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A Strategic Plan For Computing and Telecommunications at a University

Dennis J. Huff
Nova University

A STRATEGIC PLAN FOR COMPUTING AND TELECOMMUNICATIONS AT A UNIVERSITY

DENNIS J. HUFF

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This dissertation was submitted by Dennis J. Huff under the direction of the Chairperson of the Dissertation Committee listed below. It was submitted to the Center for Computer and Information Sciences and approved in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Information Systems at Nova University.

Approved:

Feb 16, 1994
Date

John Scigliano, Ed.D.
Chairperson

George Fornshell, Ph.D.
Committee Member

Jacques Levin, Ph.D.
Committee Member

George Fornshell, Ph.D.
Program Director

Mar. 17, 1994
Date of Final Approval

Edward Lieblein, Ph.D.
Dean
Center for Computer and Information Sciences

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ABSTRACT

Embry-Riddle Aeronautical University (ERAU), a multi-campus, four-year institution of higher education specializing in aeronautic and avionic engineering, has recently made a strong commitment to integration of technology into the University environment. Due to a present lack of vision and planning, ERAU secured the services of Technology Specialists, Inc. (TSI) to mange the technology center and develop a five year plan for technology integration. The author was instrumental in the planning and development of the plan. As research has confirmed, technology planning has traditionally been lacking in higher education institutions. The author followed a method for plan development as suggested by research that includes a fourteen-step process. Plan development followed three major sections: where we are today; where we want to be in the future; and how to get from where we are to where we want to be. At this writing, the plan is under review and has yet to be formally accepted by the University. An annual schedule of review and evaluation is aided by an extensive evaluation survey developed by the author. The plan is expected to provide the University with a guideline for infusion of higher levels of technology into the institution.

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INTRODUCTION

Educational performance in the United States has suffered declines in recent times. This is a result of a mismatch between technology and education (Jacobson, 1992). The use of technology in education provides greater opportunities for students, teachers, and institutions. Online, real-time classrooms can now be extended to reach remote corners of the world (Conhaim, 1992). Education must keep pace with technology if it is to be fair to students, the workers of the future. Thus, it is incumbent upon an educational institution to provide state-of-the-art technology to its customers, the students.

Areas of concern among educational institutions - the drop in high school graduates, lower retention rates, competition for public financial support, inflation, apathy of faculty - are as critical today as they were in the 1970s and 1980s (Jacobson, 1992). The challenge to the institution and the determinant of its success can be measured by its ability to adapt to the changing external environment. The extent to which the institution can adapt is dependent upon how aggressive the institution will pursue initiating a proactive and comprehensive planning strategy. Most planning efforts by institutional personnel are designed to address small issues to increase future enrollments (Shirley & Caruthers, 1979).

Faculty, staff, and students are placing an increasing dependence upon technology. Students now expect, as they should, guaranteed access to these new technologies. Hawkins (1989, p. 3) states that "technology has matured at a rate that has far exceeded the organizational and support capacities of most universities." Richard Nolan, of Nolan Norton & Co. (Houston Community College System, March, 1991) states:

> . . . we are now in a period of 'technical discontinuity.' The world is moving from the 'DP Era' of centralized, mainframe dominated data processing to the 'Information Era,' in which flexible, fast, distributed systems are knit (sp) together with networks and ruled by business sense rather than computer science. (p. 1)

With new emerging and converging technologies being developed each day, it is apparent that evolutionary migration to such technologies can produce enhanced results if properly managed.

Statement of Problem

Recently, the Executive Vice President of Embry Riddle Aeronautical University (ERAU), Dr. Jeffery Ledewitz, requested an institutional Self-Study to assist with the application for reaffirmation of accreditation from the Commission on Colleges of the Southern Association of Colleges and Schools (SACS). The results of that study dictated the need for the University to invest resources into developing an overall administrative and academic strategic plan (Embry-Riddle Aeronautical University [ERAU], February, 1992). This plan indicated a strong desire to commit resources to investing in higher levels of technology, such as providing state-of-the-art opportunities to faculty, staff, and students. Such a commitment will additionally require a systematic approach to planning for technology investment and utilization. The key, as suggested by Sethi (1985), is to reposition technology as a strategic resource by elevating its importance within the overall institutional planning process.

Steiner (1979) offers many reasons why it is essential for an organization to strategically plan for the future. Such reasons become amplified when an organization ventures into areas previously not encountered. Technological advancement precludes the concept of impulse buying. By strategically planning for technological investments, the organization is forced into setting objectives and revealing future threats and opportunities. Educational institutions may benefit greatly from such planning, offering students the opportunities to experience state-of-the-art technology while improving their marketability for potential future employment opportunities.

There is a strong relationship between the needs of the institution and the opportunities offered by strategically planning. Strategic planning recognizes the importance of consideration of interrelationships among a number of variables, both iteratively and comprehensively (Shirley & Caruthers, 1979). Strategic planning can strike a balance between under-utilization of sophisticated technologies and over-utilization of more conventional technologies (Sullivan & Smart, 1987). Strategic planning is one of the best vehicles for improving performance and can serve as a valuable management tool. It helps to pull an organization together and instills values that result in benefits derived from a highly focused organization (Batts, 1981). In addition, a strategic plan is valuable as a means of monitoring the progress of the institution in terms of its investment and utilization of technology. Therefore, it is imperative that strategic planning for technology take place in the educational institution.

The problem facing ERAU in 1992 was that it did not have a mechanism for dealing with technology in a strategic manner. As such, it could not allocate resources effectively or measure progress against goals or objectives. These resources include personnel and time, funds available vs. funds required, and guidance with respect to the future technological direction of the University. Such guidance keeps the University from straying in its pursuit of its mission.

As an institution traditionally guided by strong military influence, ERAU has, in times past, put little emphasis on technological change. Only within the last two years, with an accompanying change in institutional leadership, has there been the desire to incorporate technology into the environment. But implementation of technology is not a direct outgrowth of such desired change. It must be planned, both tactically and strategically. A dichotomy has developed regarding the need to plan for technology integration by those inexperienced in such planning. The problem, stated succinctly, is: how will ERAU strategically and tactically plan successfully for, use, and manage the mix of technology that will benefit faculty, staff, and students?

Background of the Problem

Embry-Riddle Aeronautical University is a multi-campus, four-year institution that specializes in the field of aviation/aerospace. Established in 1926, the University has a current enrollment of approximately 30,000 students world-wide (ERAU, 1992). The University is divided into three main "campuses": residential campuses in Daytona Beach, Florida and Prescott, Arizona, and the College of Continuing Education (CCE). CCE, whose main office is located as part of the Daytona Beach campus, boasts student enrollments at remote sites across the nation as well as throughout the world. The University has attempted, as Dr. Stephen Sliwa, President of the

University (1991, p. 5) stated to provide "the ability to adapt to the greater trends of change."

Embry-Riddle Aeronautical University promotes educational opportunities to a world community of students through innovative, comprehensive programs. The University is sensitive to the needs of particular communities. ERAU is dedicated to the delivery of a spectrum of life-long educational opportunities in a manner which is most convenient to students (ERAU, 1992).

Dr. Sliwa was hired by the University in 1990 because of his innovative and fast-moving ideas. Recent downturns in enrollment can, in part, be attributed to the lack of leading-edge technology surrounding the student (Sparks, 1992). Being an aviation and aeronautical institution, it is important to provide such an environment for the student. The marketability of the institution waned as the University struggled with this technology issue. With Dr. Sliwa came an aggressive attitude toward providing the highest quality environment to the students. He has adopted the University mission to provide leading-edge technology in a hands-on environment.

The Need for a Plan

The need for a plan for technology can be illustrated through a simple but effective exercise (Wilson, 1992). Five people stand in a circle within proximity of each other. One other person, acting as the leader, gives them one ball to throw to each other around the circle in any manner preferred. This is simple and manageable. No single participant has trouble catching the ball and forwarding it to the others. Then, the leader introduces, in succession, up to four more balls to be tossed around. The group thus finds it much more difficult to concentrate and group members frequently drop the balls. Rarely do all five balls get tossed and caught without being dropped. This shows that chaos may result from introducing too many variables without some sense of management.

The exercise is then done again, this time with the leader managing the process. The leader instructs the participants to concentrate on whom they are tossing the ball to and from whom they will receive the ball. The participants are to continue to receive and toss in the same pattern. The leader again starts with one ball. As the leader introduces more balls into the circle, the pattern begins to act as a monitoring facility, and the balls are successfully tossed and received without being dropped. In the real world, this pattern takes the form of a plan that acts as a guide to managing technology while introducing, at various times, new technology. This simple exercise shows the effectiveness of management and the reason any organization should follow a plan.

Aaker (1983) stated that strategic planning "requires an external analysis of the environment" (p. 76). Dr. Sliwa saw the need to upgrade the computing environment at ERAU. In making a step in this direction, he hired Technology Specialists, Inc. (TSI), with the expectation of leading the University from a 1970s/1980s computing environment to a visionary, futuristic computing environment. TSI specializes in technology management and guiding educational institutions to higher levels of technology usage and management. TSI was specifically charged with developing a tactical and strategic plan for technology at the University. The author is employed by TSI as a Technical Manager to assist in meeting this specific charge. The author coordinated the development of the document, including: planning and developing its outline (see Appendix I), serving as user liaison between TSI and the University community, coordinating and monitoring the efforts of those who assisted in this development, served as chief writer, and edited the document as it was developed.

TSI and ERAU entered into the agreement with the expectation of setting up a "partnership" between the two principles for the purpose of facilitating the development process. That partnership is manifested by agreeing that members of TSI and the University form what is now called the Technology Management Partnership (TMP). The author acted as the chair of the TMP and utilized not more than five University employees (current Data Processing staff) for the purposes of this project (see Figure 1). Data Processing personnel membership in the TMP rotated as the need had arisen. Thus, membership number varied at any one time. Each member was assigned various tasks to assist in completing the document. The tasks assigned depended upon the particular knowledge each member holds about the targeted concern of the TMP (more will be said in Chapter 3). The author presented the plan to TSI for final approval before TSI presented the plan to the University.

Recent technological advances regarding hardware and software provide opportunities for the institution to take advantage of these resources at reasonable costs. When using these resources, the University may

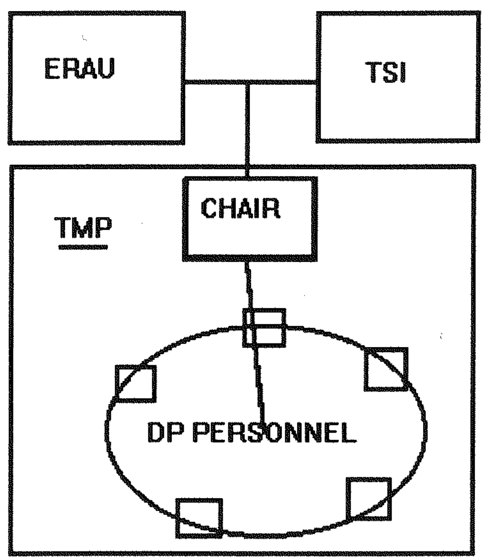

FIGURE 1: TMP Organization

enhance the decision-making process. In addition, improvements may be seen in the quality of academic programs, faculty awareness, knowledge, productivity, administrative processing, and increased levels of effectiveness regarding students' educational environment. With the existing vision of extended use of computing technology, the University can expect to produce a better prepared student.

Organizational Changes

Leontief (1985) estimates that 20 million fewer workers will be needed in the year 2000 than was needed a decade earlier. Rapid change in technology many times results in higher turnover and reduction of information managers - largely because change in technology requires new and fresh management ideology. Many times information managers have a difficult time changing to meet the challenge of new technology. "This resistance implies that the rate of technology transfer is directly related to the ability of the agents of change to gain acceptance from their users" (Bouldin, 1989, p. 2). Many managers suffer from misperceptions of the users whom they serve. If it seems to keep the user happy, then that manager is comfortable in his job. Managers who act only as a result of immediate users' needs cannot help the institution progress into the future. Burrows (1986, p. 80) states, "It could be argued that it is information technology which is changing society so the planner should be planning it." Thus, it was imperative to plan to weather the change in management. Embry-Riddle has operated with obsolescent technology in their computer center for many years. The line of computing equipment serving the University (see Appendix A) has been less than state-of-the-art , and the computing center organization reflected a 1970s environment (see Appendix B).

New technology introduced in an environment that has experienced little in the way of exposure to such technology requires purposeful leadership. "Leadership shares with power the central function of achieving purpose" (Burns, 1978, p. 18). To achieve goals and objectives set forth by an institution, the organization must rely upon individuals both experienced and disciplined in technology implementation. Alder and Rodman (1982), Wright (1986), and Yip (1985) agree that leadership involving computing technology requires a self-understanding of one's strengths and weaknesses. In addition, one must make appropriate changes to meet the changing technological environment.

Cleese (1992) suggests that planning in and of itself is worthless if not properly managed. Technology management requires leadership regarding integration to help solve problems (Zaleznik, 1983). This means realizing that a change in technology may require a change in management style to make effective use of the new technology. "The role of the computing center director is evolving from one of data processing to one of providing information services" (Hess, 1991, p. 85). Lynch and Preston (1990) suggest that the infrastructure of the information society is well established. Users have become more sophisticated, demanding less attention from data processing personnel while requiring more access to information. McIntyre (1990) agrees that organizational structures must change to meet the changing requirements demanded by technological advancement. He further suggests flatter structures with more point-to-point relationships to support such changes. Thus, the organization of the computing department that is charged with responsibility for implementation of the technology promoted in the plan must be adaptable to the future.

In addition to the organizational infrastructure of the computing department, the University must also provide an adaptable infrastructure. The University of Miami has formed a "partnership" among administrative offices to take advantage of the changing computing environment. This enterprise-wide infrastructure lends itself to cooperative processing and promotes a client/server environment (Olson, 1992).

Computing management at ERAU reflected a philosophy that was inconsistent with the vision of technology utilization within the institution.. Realizing the need for a fresh management approach, ERAU officials recently appointed two TSI employees (the author included) to manage the computing services department. In doing so, University officials have proven their commitment to the improvement of computing services. TSI's specific charge was to leapfrog the University from their current environment to a position of technology leader, thereby strengthening the institution's aeronautical educational market. In realizing TSI's challenge, the need for a strategic and tactical plan increasingly became apparent.

Beginning in June of 1992, the author developed two documents to further the charge to bring state-of-the-art technology to the University: a Request For Information (RFI) to upgrade the University's Student Administrative System software and request bids from software vendors; and the Strategic and Tactical Plan for Computing and Telecommunications at Embry-Riddle Aeronautical University.

Purpose of Plan

Just as it takes delicate workmanship to shape a mound of clay into a finely crafted work of art, so too, does it require the same detail and dedication to shape the direction of an institution into a highly technologically advanced organization. It takes precise planning to bring an institution from where it presently resides on the technology spectrum to where it prefers to be. Without a strategic direction, the University may not reach its potential. This undermines the strategy to provide better services for the students that better equips them for the technologically advanced workplace (Huff, 1991). The purpose of this plan, or blueprint (as it serves the same purpose) is to provide guidance in a logical and structured manner, assisting in the educational process. It was the author's intention through this plan to address every aspect of the University community regarding use of technology. Therefore, the plan presents solutions and action plans to assist Embry-Riddle Aeronautical University in achieving a higher level of information and technology effectiveness.

"Planning for computing and communications should be an ongoing exercise, regardless of current level of technology used" (Penrod & West, 1982, p. 121). As the recent problems at IBM can attest (Schneidawind, 1992), it is imperative to plan so that unexpected negative influences may minimally impact the organization.

The plan is a dynamic document, one that can be easily maintained, monitored, and changed to meet the changing technological environment. As a living, breathing document, the blueprint serves as the basis for both administrative and academic strategies for present and future goals. Its design prevents it from becoming a stagnant reminder of what was once a vision of the University. The plan is an ever-changing reference of how University technology usage has evolved as well as what new opportunities lie in the future. Therefore, as new technology emerges, its implementation and usage, where and when appropriate, will be included in future revisions of the plan.

Whether or not Embry-Riddle takes advantage of technology is influenced not only by economic standards, but by the quality of education required as a product of the University. The investment in technology requires a commitment by the University - a commitment to the faculty, a commitment to the staff, and most important, a commitment to the students. Every level within the University community must become dedicated to providing the highest quality educational environment. By making strategic use of technology resources, the University is positioning itself to meet the challenge of high-quality information demand in the '90s and beyond.

Purpose of Study

Having stated the purpose of and need for the blueprint, there must be a reason for developing the study for the plan. The purpose of the study is to present the steps taken to design and develop the plan, provide results of the efforts to implement many of the action events targeted throughout the plan, and explain the various factors that must be accommodated in making the development process a high-quality operation (Scigliano, 1993). The study helps define the requirements to leapfrog the University into state-of-the-art technology utilization. It provides background information that serves as a basis for comparison and initiation of strategic events. The study serves as a guide for development of future University plans or addenda to the plan focused in this study. It also provides a guide for evaluating the success and progress of events targeted in the plan.

Assumptions and Limitations

Several assumptions and specific limitations are made in this study that concern the timeline selected, the training of the staff, and the commitment to implementation. The assumptions are presented below, followed by the limitations.

Assumptions:

1). It is assumed that the Strategic and Tactical Five Year Plan for Computing and Telecommunications at Embry-Riddle Aeronautical University will adequately cover the needs of the University for a five-year period. It may be that five years is too long a period for which to plan due to the short life-cycle of computing equipment (Skarulis, 1989). However, it is assumed that five years is adequate for the needs of the University and this study. Technological advancements and funding issues may require a new direction any time during the period covered by the plan. Therefore, the plan is designed to be monitored at the end of each year so that adjustments can be made accordingly.

2). It is further assumed that the information gathered is sufficient to define the desires and needs of University faculty, staff, and administrators. Although many University personnel are keenly aware of the changing technological environment, just as many are uninformed about technology and the benefits it presents. It is for this very reason that Technology Specialists, Inc. was hired. Thus, during the process of development of the plan, the author and other TSI personnel intended to educate the University community regarding the opportunities that new technology can afford the institution.

3). The plan requires a timeline that may be realistic if followed to the minute detail. The timeline, in reality, is a guideline as to when, in a suggested order, one may implement the action event suggested by the plan. The timeline is expected to move the University to action. Thus, it is assumed that the timeline is as realistic as the University desires it to be.

4). The final assumption is that the plan will become more than a shelf document. The "existence of formal information systems plans is insufficient. The plans must be implemented" (Lederer & Mendelow, 1986, p. 245). The University must commit to implementing the technologies and ideas projected by the plan. If constant monitoring is not done, the action events, in the suggested order they should be completed, fall behind schedule. Once behind schedule, it will then be difficult to implement the suggestions quickly, and the University will stray off the course laid out by the plan.

Limitations:

1). The first limitation involves the results of the plan. The success of the entities identified and implemented will not be realized without the complete commitment of the University community. Top-level management has confirmed its commitment to technological enhancements to the University by its commitment to the development of the document. Each member of the University community must make a commitment to implementing the events required to result in successful migration to a higher level of technology usage.

2). A second limitation concerns the extent to which the implementation of the plan may intrude upon the comfort levels associated with daily operational functions. It requires the evaluation and assessment of operational processes that may require reallocation of resources and priorities. Extra time and effort are required if the plan is to be implemented on schedule while current processing continues.

3). There must be a commitment regarding dollar investments. As new technology emerges, the user community must ultimately pay the costs of research and development. Costs decrease as time passes, and sometimes the specific technology targeted may be less expensive than the costs of processing using technology currently available within the University. The rewards to be gained far outweigh the costs involved. No rewards will be realized unless there is displayed commitment to costs, resources, priorities, and attitudes regarding the investment required to enhance the University community using higher levels of technology.

Hax and Majluf (1984) warn of potential additional limitations that could destroy the effectiveness of a plan for technology. Such limitations include (limitations quoted from pp. 67-70, comments are editorials by the author):

1) *Risk of excess bureaucratization.* Commitment to events described in the plan for technology may wane if the plan formalizes conditions that impose a bureaucratic burden upon the institution. Such apathy would render the plan useless and thus become a "shelf document." In addition, future planning would be seen as wasted effort due to the lack of commitment to the current plan for technology. One way to prevent this situation is to selectively identify higher-priority planning units each year to help avoid spending unnecessary efforts to less important issues. The danger with this approach is in defining the priority attached to each issue. Consensus must be made when defining priorities.

2) *Lack of integration with other formal management systems.* Planning cannot be an isolated activity. It must envelope the entire institution. Most institutions do not employ professional planners, thus planning is done by line executives that tend to put emphasis in areas specific to their own concerns. This can be avoided by inclusion of representation of the entire organization in the planning process, even if it means participation in self-studies and climate surveys. This participation will provide a global perspective of the organization and lend balance to the development process.

3) *Grand design versus logical incrementalism.* Managers employ a series of incremental processes which provide strategies at disparate levels and integrate such processes in steps. This lacks vision and global thinking required of strategic planning. In such incremental strategies, later implementations may impact early implementations of strategic events without such impacts having been considered. The danger in this is obvious. The institution may thus be committing resources to later implementation events they had previously not planned to use.

4) *Formal planning versus opportunistic planning.* If the plan relies solely on formal, structured planning, potential opportunities that come with technological advancement may be missed. The table on the next page (Steiner, 1984, p. 69) provides a comparison of what is meant by formal versus opportunistic planning.

FACTORS	FORMAL PLANNING	OPPORTUNISTIC PLANNING
TIMING	Systematic process that follows a prescribed calendar	Responses to unexpected emergencies of opportunities and threats
SCOPE	Corporate-wide	Usually concentrated on a segment of the corporation
PURPOSE	Attempts to develop a coordinated and proactive adaptation to the external environment, while seeking internal effectiveness and efficiency	It is based on existing capabilities that permit slack and flexibility to respond to unplanned events

TABLE 1: Characteristics of Formal and Opportunistic Planning

The Strategic and Tactical Plan for Computing and Telecommunications at Embry-Riddle Aeronautical University attempts to take such limitations into consideration with providing proper timing of events. In addition, this study provides proper evaluation techniques that will prevent the plan from becoming a "shelf document." If Embry-Riddle Aeronautical University is truly committed to ***Leading The World in Aviation and Aerospace Education*** (ERAU, 1992), technology will play a major role in Embry-Riddle's future. Given this

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Conceptual Framework

The focus of this paper is centered around technology infusion in the University. Technology may not be the solution to every problem, but because the University has chosen to pursue greater levels of technology usage, every reference to planning pertains to such technology infusion. Thus, the conceptual framework for this paper restricts its focus to technology-related issues.

The organization of this paper is based on the conceptual idea that planning is a cyclical process. Steiner (1979) provides four conceptual models that together support such an idea. Problem areas are defined, potential solutions are identified, other institutions with similar problems are researched, a framework for solution implementation is developed, the solutions are implemented, evaluation of the results is done, then new problems are identified and the cycle begins again. All these factors provide the building blocks upon which a cohesive and practical strategic plan may be constructed (see Figures 2 and 3).

Having identified problem areas within Embry-Riddle, the Review of Literature is focused around the following issues:

1) Technology as a viable solution;

2) Reasons to plan;

3) What is planning?; and

4) Practical planning models.

After ensuring that the need for planning has been identified, the paper then defines the methodology for developing the planning document. Chapter 3, Methodology and Procedures, is the most important section of text in the document as it will define for the reader the exact methods upon which to develop a strategic plan. This section will offer more literature regarding plan development methodology. Once completed, the plan must be implemented and evaluated to identify satisfaction of defined problem areas. As each year passes, new problems will be identified, thus possibly requiring new research of potential technological solutions. This facilitates the need to plan for possible implementation of more technology to meet that defined problem area. The cycle continues each year indefinitely.

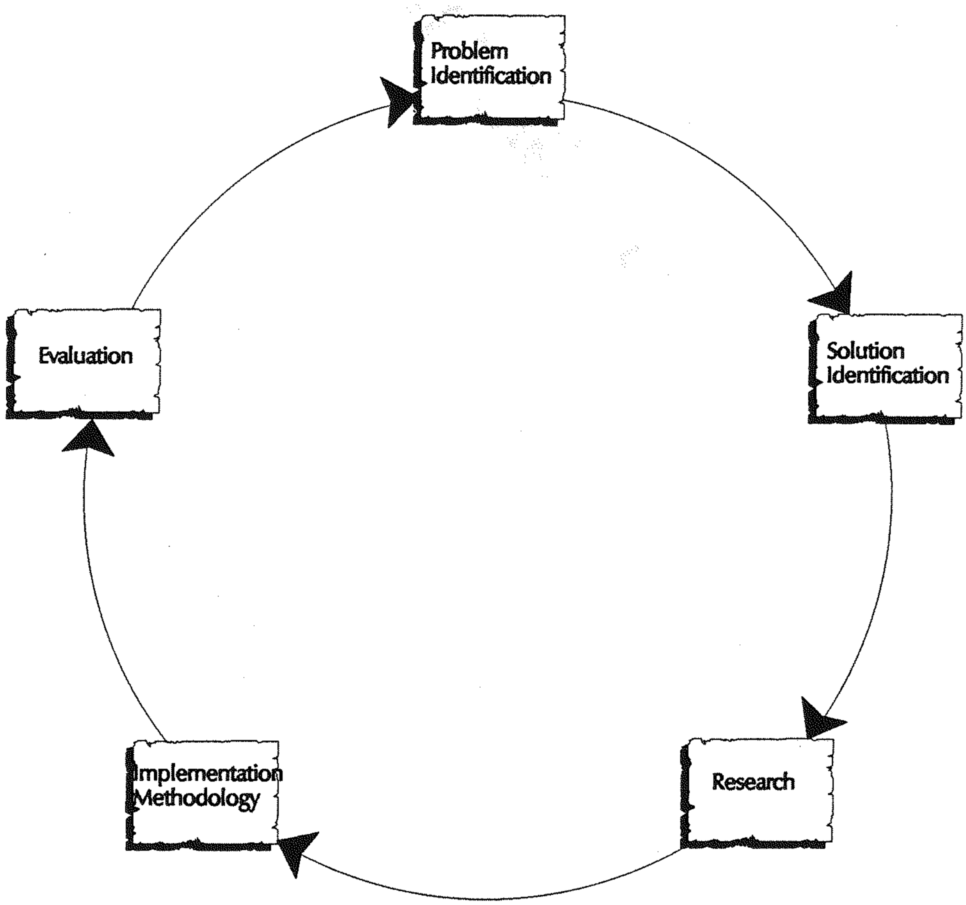

FIGURE 2: Conceptual Framework

FIGURE 3: Plan built from conceptual framework

Definition of Terms

Unless signified with a page number, the definitions were gleaned from general information referenced in the source cited. The author provides some definitions based upon his general knowledge base.

Academic and Administrative Computing Advisory Committee: Computing governing committees at Virginia State University formed to serve as the decision-making body regarding technology issues within the University environment (Virginia State University, 1990)..

Algorithm: A finite set of well-defined rules for the solution of a problem in a finite number of steps (Rosenberg, 1987, p. 15).

Alto: First personal computer, developed by Xerox (Twigg, 1991).

Artificial Intelligence: The capability of a device to perform functions that are normally associated with human intelligence, such as reasoning, learning, and self-improvement (Rosenberg, 1987 p. 28).

ATM: Automatic Teller Machine - An unmanned, secured computer that allows the user to deposit or withdraw funds from his bank account (Twigg, 1991).

ATM: Asynchronous Transfer Mode - A high speed packet and signalling technology for transmitting voice, video, and data that runs over fiber optic cable or twisted pair copper wiring (Chernicoff, 1993).

Attiliasm: A philosophy attributed to Atilla the Hun regarding setting unattainable goals (Roberts, 1985).

Blueprint: Another reference to the strategic plan proposed by the author.

CD-ROM: An acronym for compact disc read-only memory. This stores large amounts of data that, once written, can then only be retrieved (Mueller, 1992).

Cellular Phones: Mobile telephones that transmit over airwaves in specific geographic "cells" (or districts). Each cell has a transmission receiver and sender that allows the transmission to go from geographic cell to cell (Vaught, 1989).

CIPP: Context, Input, Process, and Product evaluation. A method for evaluating the organizational environment (Guba & Stufflebaum, 1970).

Client/Server: The technology allows a single database residing in a central location to serve many remote locations without the need for redundant data (Mace, 1990).

Compatibility: The ability of two or more entities to work in harmony. This may refer to software products or hardware products (Vaught, 1989).

Computer Server: A computer that may act to serve other devices, either to store data, execute programs, route information, or any combination thereof (Lopez, 1992).

Computing Governance Committee (CGC): The highest governing authority regarding technology utilization and procurement within the institution (ERAU, 1992).

Concurrency: The ability to stay current regarding technology utilization (Boissel, 1991).

Cooperative Applications: Compatible application software that complements each other (Freedman & York, 1991).

Critical Success Factors (CSF): Functional activities that must occur to guarantee successful achievement of specified goals (Scigliano, 1993).

CUMREC: College and University Computer Users Conference - Held annually at different sites around the nation that provides discussion and information pertaining to technology issues from a higher education perspective (Block, 1992).

Data Banks: A comprehensive collection of libraries of data. For example, one line of an invoice may form a record, a complete set of such records may form a file, the collection of inventory files may form a library, and the libraries used by an organization are known as its data bank (Rosenberg, 1987, p. 144).

Database: A collection of data fundamental to a system (Rosenberg, 1987, p. 144).

Data Storage: The use of any medium for storing data (Rosenberg, 1987, p. 155).

DBMS: Database Management System - A software system facilitating the creation and maintenance of a database and the execution of computer programs using the database (Rosenberg, 1987, p. 145).

Decentralization: Two or more sets of information processed by the same enterprise without any implied cooperation among the sets (Bernbom & Brenner, 1991).

Demographics: Basic information about a data entity (CARS, 1992)..

Desktop Publishing: Sophisticated technology used to produce presentation documents (Saffo, 1988).

Disparate Information and Processing Capabilities: Dissimilar information and processing within a single campus-wide network (CARS, 1992).

Distributed Database: Processing data that resides in different nodes on a network that allows advantages such as more efficient operations and more manageable data monitoring (McLachlan, 1993).

Distributed Processing: A technique for implementing a set of information processing functions within multiple physically separated physical devices (Rosenberg, 1987, p. 184).

Document Imaging: Storing images of documents digitally. The image can be retrieved and printed (Edelstein, 1992).

Downsizing: The process of economizing the organization through staff reduction, automation, or a combination of the two (Bernbom & Brenner, 1991).

EDUCOM: A national conference for educators introducing new technologies and providing sessions that offer ways to integrate technology into the institutional environment (Coughlin, 1986).

Electronic Data Interchange: The exchange of data via electronic means (Supply Tech, Inc., 1992).

Emerging Technologies: New technologies (Davis and Davidson, 1991).

Fax Machine: A system for the transmission of images (Rosenberg, 1987, p. 227).

Fiber Optics: The technology of guiding and projecting light for use as a communications medium using hair thin glass fibers (Rosenberg, 1987, p. 232).

Fishbone Diagram: A diagram that represents the relationships between some effect and all the possible causes (GOAL/QPC, 1992).

Force Field Analysis: A strategic tool designed to identify the driving and restraining forces behind an event (Goal/QPC, 1992).

Formative Evaluation: Evaluation designed to help in the development of the plan (Anderson, Ball, Murphy, & Associates, 1975).

Fully Configured: A computer system that includes all necessary software ad hardware (Detweiler, 1989).

Graphical User Interface (GUI): A user-friendly, graphics-oriented interface into an operating or application software system (Boissel, 1991).

GroupSystems: A PC group decision-making software product that assists in setting priorities for targeted issues (ERAU, 1993c).

High-definition Television: A television set with very high quality resolution (Elliott, 1992).

High-speed Data Transmission: The transfer of data over media that is designed for fast transmission (Supply Tech, Inc., 1992).

Hypertext: Electronically indexed text (The, 1992).

Imaging: Processing of images using computer techniques (Rosenberg, 1987, p. 282).

Implementation: Installing a new piece of hardware or software (Rosenberg, 1987, p. 283).

Infostructure: The blending of all forms of information into a single architecture (Davis & Davidson, 1991).

Infrastructure: The organizational structure of an institution (Lopez, 1992).

Integration: The sharing of commands and the flow of information from one program to another (Rosenberg, 1987, p. 302).

Internet: A national network specifically for the use of educational or government institutions. It allows access to a variety of information and services, including educational libraries and informational discussion groups (Nelson, 1991, June).

Interoperability: Compatible operating systems or portable application software (Unidata, 1993).

ISDN: Integrated Services Digital Network - The world's telephone companies' operations enabling any telephone line to carry a simultaneous mix of voice, computer, and video signals (Rosenberg, 1987, p. 301).

Intrapreneural: The term given to a philosophy of promoting an entrepreneurial attitude within an organization. This benefits the organization by encouraging creativity to develop new ideas (Pinchot III, 1985).

LAN: Local Area Network - A system linking together computers, word processors, and other electronic office machines to create an inter-office, or inter-site network (Rosenberg, 1987, p. 342).

Mainframe: Deprecated term for processing unit and processor. A computer system that is larger, more costly, and often less powerful than minicomputers (Rosenberg, 1987, p. 364).

Medium: The material in or on which data may be represented (Rosenberg, 1987, p. 151).

Meta-analysis: A form of artificial intelligence (Caudill, Machover, & Marcus, 1992).

Minicomputer: A computer that does not need the closely controlled environment of mainframe computers. Minicomputers are usually smaller than mainframes and more powerful (Rosenberg, 1987, p. 387).

Mission Statement: Identifies the underlying design, aim, or thrust of a company (Steiner, 1979, p. 155).

Multimedia: Mixing various types of media such as graphics, sound, and text, to expand processing and presentation capabilities (Daniel, Dec. 20, 1990).

Natural Input/Output Technologies: User-friendly, non-technical mechanism for input and output, such as Graphical User Interface (GUI) (Caudill, Machover, & Marcus, 1992).

Network: An interconnected group of nodes (Rosenberg, 1987, p. 409).

Nominal Group Technique (NGT): A structured method of group decision-making (Goal/QPC, 1991).

Node: In a network, a point where one or more functional units interconnect transmission lines (Rosenberg, 1987, p. 413).

NREN: National Research and Education Network - Sponsor of the Internet (Nelson, 1991, June).

Online: Pertaining to a user's ability to interact with a computer (Rosenberg, 1987, p. 431).

Operating System: Software that controls the execution of a computer program and that may provide scheduling, debugging, input/output control, accounting, compilation, storage assignment, data management, and related services (Rosenburg, 1987, p. 434).

Optical Character Recognition: A means of encoding information on paper that requires special equipment to scan the paper and recognize the encoded information. It allows for fast data entry by machine rather than by human interaction (Chenkin, 1993).

Paradigm: A pattern or model (Wordperfect Online Thesaurus).

Pareto Diagram: A graphical analysis of the relationship between an operational variable and its impact on profit. It is based upon Pareto's Law that states that in a group of elements the most important ones are a small proportion of the total (Steiner, 1979).

Participation Decision-Making: Involving employees from all levels in the decision-making process (Redding, 1972).

Personal Computer (PC): A relatively inexpensive, general-use computer created for a single user in an office or home. PCs are now an integral part of a networked environment (Rosenberg, 1987, p. 462).

PERT: Program Evaluation and Review Technique - An extensive study of an overall program to list all individual activities (Rosenberg, 1987, p. 463).

Plan-to-Plan: A document developed to assist in the process of Strategic Plan development (Scigliano, 1993).

Portable Computers: A computer that can easily be hand-carried and which has similar dimensions to a typewriter (Rosenberg, 1987, p. 472).

Punched-card Technology: Old technology requiring cards to provide different patterns of holes that define different instructions (Head, 1982).

Realtime: Pertaining to the processing of data by a computer in connection with another process outside the computer according to time requirements imposed by the outside printing in conversational mode and processes that can be influenced by human intervention while they are in progress (Rosenberg, 1987, p. 516).

Remote Access: Pertaining to communication with a data processing facility through a data link (Rosenberg, 1987, p. 530).

SACS: Southern Association of Colleges and Schools - The governing body that performs assessments at various institutions of higher education for the purposes of determining whether the institutions should be accredited and worthy of offering learning programs (Osborne, 1993).

Self-perpetuating Bureaucracy: Causing oneself to sustain bureaucratic processes (Lenz, 1987).

Speech Synthesizers: Units that produce speech sounds from input in another form (Rosenberg, 1987, p. 594).

Spreadsheet: A screen-oriented, interactive program enabling a terminal user to lay out financial or other numeric data on the screen (Rosenberg, 1987, p. 595).

State-of-the-art: The most current research and up-to-date technology in a specific field of endeavor (Rosenberg, 1987, p. 601).

Statement of Purpose: See Mission Statement.

Strategic Plan: A comprehensive master plan stating what and how decisions should be made and implemented to achieve stated goals and objectives (Rowe, Mason, & Dickel, 1986).

Summative Evaluation: A type of evaluation method designed to determine the overall effectiveness of the plan (Anderson, Ball, Murphy, & Associates, 1975).

TCP/IP: Transmission Control Protocol/Internet Protocol - A very popular software package that controls the transmission of data (Sandler & Badgett, 1990).

Tactical Plan: A short-term plan of actions designed to benefit long-term, strategic planning (Steiner, 1979).

Technology Management Partnership (TMP): A partnership between TSI and Embry-Riddle designed specifically to utilize the talents of both TSI and ERAU employees to assist in the development of the plan (TSI, March 31, 1992).

Technology Specialists, Inc. (TSI): Higher education specialists in technology consultation and implementation (TSI, March 31, 1992).

Telecommunication Links: Physical media along which data is transmitted (Sandler & Badgett, 1990).

Total Quality Management (TQM): A systematic approach for setting and meeting quality goals throughout the company (Juran, 1989, p. 176).

Unix: A powerful operating system program making it possible for application programs that perform specific tasks to be transferred easily from one brand of system to another (Hewlett-Packard, 1992).

User Liaison: A systems analyst with a high degree of user orientation (TSI, 1992).

Vaught's Pyramid: A graphical diagram displaying the relationship of information flow within an organization (Vaught, 1989).

Video-teleconferencing:

Virtual Reality: Technology that allows one to experience two dimensional images from a three dimensional perspective, as if one were actually inside the image (Davis & Davidson, 1991).

WOTS-UP: Weaknesses, Opportunities, Threats, Solutions - A method of analyzing the environment of an organization (Rowe, Mason, & Dickel, 1986, p. 62).

Summary of Chapter 1

The lack of technology may receive the blame for recent educational performance decline in the United States (Jacobson, 1992). That may be directly attributable to the fact that institutions of higher education lack technological concurrency. This is due, in part, to a tradition of poor planning efforts regarding technology utilization. Embry-Riddle Aeronautical University, when faced with reaffirmation of accreditation from the governing body for accreditation (SACS), realized it needed to improve the technical support now required to provide a proper learning environment for students. Thus, an effort was made to begin planning for higher levels of technology utilization.

As earlier plans had failed to produce the type of technical expertise desired, the University procured the services of Technology Specialists, Inc. to coordinate and assist in the development of an overall strategic and tactical plan for computing and telecommunications at the University. TSI and ERAU pooled resources to form a partnership (the Technology Management Partnership) to develop the strategic plan.

The previous computing services unit had a management style that did not fit well with the management requirements of today's changing technology. Thus, the University secured the services of TSI to manage and direct the computer services department. This led to further organizational changes in the environment to better service the needs of the user community by offering a more user-oriented environment. The TSI influence should help to educate

ERAU employees on technology utilization as well as assist in its use. Part of the education process included the development of the plan. The purpose of the plan was to serve as the guide to introduce and integrate higher levels of technology into the University environment. The plan is a dynamic document that can be easily maintained, monitored, and changed to meet the changing technological environment. Prior attempts to develop a computing plan failed as the developers lacked the vision and structure to create a realistic plan that can be followed to ensure high level integration of technology.

The purpose of the study is to present the steps taken to design and develop the plan, provide results of the efforts to implement many of the action events targeted throughout the plan, and explain the various factors that must be accommodated in making the development process a high-quality operation. Limitations exist that may impact potential results of the plan or its implementation. Such limitations include: the potential for lack of commitment from top-level management; the existing comfort levels of the employees and their possible aversion to change; the lack of availability of required funds; and the potential for planning for unattainable goals.

CHAPTER 2

REVIEW OF THE LITERATURE

The Review of Literature identifies four areas that support two parts of the conceptual framework: potential solutions to problem areas and practical models identified through research. The four areas include:

1) Technology as a viable solution;
2) Reasons to plan;
3) What is planning?; and
4) Practical planning models.

These four areas may not represent the full spectrum of issues that may be reviewed pertaining to the planning process. The author attempted to organize the literature into the most parsimonious scheme possible, keeping in mind that technology is the main focus of discussion and the chosen solution by the University for its problem areas. The author attempted to restrict research to planning pertaining to technology-related issues.

Viable Technology Solutions

President Sliwa has chosen to infuse technology into the curriculum as well as into the administration of business for the University (ERAU, 1991). Thus, it is appropriate that investigation into available technology takes place. This section of the literature search focuses on technology trends in education as well as what technology is available in general. The reader is cautioned that technology, in some cases, may not be an appropriate solution. Technology is appropriate when it satisfies a need. It is appropriate to be aware of what technology can offer so that an appropriate solution may be addressed once a problem is identified.

"The coming year in computers is destined to make this one look like a stroll through the virtual park" (Welch, 1992, p. 59). "Computers will soon be as ubiquitous as automobiles" (Block, 1991, p. 116). Research literature suggests that technology advancements will force obsolescence of older technology, requiring vocational organizations to investigate the purpose and usefulness of such new advancements. It suggests that such organizations should make the effort to maintain technology concurrency, lest imposing greater levels of constraints when finally relinquishing to such concurrency. Such technological advancements as: data banks and meta-analysis; hypertext; and natural input/output technologies, such as interactive graphic user interfaces (GUI), will enable information at the touch of a finger (Boissel, 1991; The, 1992; Caudill, Machover, & Marcus, 1992).

Over the next several years, educational institutions will encounter the need to take advantage of technology. One way is to integrate into a single campus-wide network that provides disparate information and processing capabilities (CARS, 1992). Such a seamless environment will allow faculty, staff, and students to move effortlessly from one computer environment to another, bringing together administrative and academic computing (Skarulis, 1989). Improvements in high-speed data transmission capabilities increase the potential for instant information access. Standards such as Transmission Control Protocol/Internet Protocol (TCP/IP) for data transmission and Integrated Services Digital Network (ISDN) have become important in education in the last eight years. ISDN provides the avenue to mix voice, video, text, and image on a single communications line. Video-teleconferencing, available over a high-speed, wide-bandwidth medium, will allow the University to hold interactive meetings and instruction at remote sites. Electronic Data Interchange (EDI) is becoming more prevalent in educational institutions because it offers a faster way of transmitting documents and quicker turnaround on approvals (Supply Tech, Inc., 1992).

Image document processing has become a popular technology in academia today. It offers the institution the ability to capture, store, process, display, and retrieve document information electronically online, resulting in significant savings in time and effort (Sharp, 1991). With the increasing need to archive paper and retrieve for later reference, such as for government requirements, document imaging offers particular advantages to the educational institution. Edelstein (1992, p. 46) warns "Without careful planning, what seemed like a simple change to a DBMS can be a formula for disaster." The document, once scanned, cannot be mishandled and mutilated while providing opportunity to minimize data-entry requirements. The documents can be protected with electronic security and stored in less space than that required of physical paper documents.

Bernbom and Brenner (1991) believe academic trends can be summarized as, what they term in an article appearing in the Winter issue of CAUSE/EFFECT, the three D's: decentralization, downsizing, and distribution. Business functions no longer require one central processing area. The appearance of distributed processing allows for remote registration and matriculation. Distance learning improvements allow students to "attend" classes without setting foot on the central campus.

As costs decrease while power increases, educational institutions are investigating the usefulness of moving mainframe applications to workstations. Workstations and network technology allow for the physical distribution of information. This benefits administrative as well as academic needs by incorporating personal computing graphics and applications with mainframe applications. This means that information sharing is more immediate and more in the control of the user.

One of the most exciting technological advancements involves "virtual reality." Such a concept allows one to create a reaction on a device simply by the movement of one's hand (Davis & Davidson, 1991; Elliott, 1992). Used in concert with high-definition television, the impact is long-lasting and irrevocable. Teaching courses (i.e., Computer-Aided Design (CAD)) with this type of multimedia means that the 20th Century institution may offer 21st Century opportunities. At Comdex in the Fall of 1990, multimedia computing was proclaimed as the next era of computing (Daniel, Dec. 20, 1990).

One popular and useful trend for information access involves distributed processing in a client/server environment (Mace, 1990). Originating from tiered and centralized computing architecture, the technology allows a single database residing in a central location to serve many remote locations without the need for redundant data. No standards have yet been set for definition of true client/server computing. Client/server (Lopez, 1992, p. 145) "is a distributed processing technology that defines:

- A client as a requestor of service.
- A server as the provider of services requested by clients."

Olson (1992, p. 158) defines distributed computing as:

> The strategic allocation of information systems resources and their management to the primary provider of the application services supported, with the concomitant

> responsibility, accountability, and authority for their successful utilization.

Olson goes on to quote Freedman and York from the Spring, 1991 issue of CAUSE/EFFECT, stating:

> Client/Server computing is as important to the 1990's as the time-sharing model was to the 1980's. It will initially cause confusion but will ultimately lead to systems that are highly functional, easy to use, and affordable. The technology to implement effective client/server systems is now emerging, but key standards, tools, and skills necessary to construct them are only nominally available. Hence the transition to this new environment will not take place overnight; rather it will emerge gradually in the coming decade. (p. 159)

Distributed processing and client/server are complementary terms. Lopez offers three critical elements to the functionality provided by a client/server system: seamless access to the applications and resources within the infrastructure; cooperative applications; and a support infrastructure. Cooperative applications distribute functions across multiple systems. Client/server environments usually involve desktop workstations as the clients requesting services from the host mainframe or minicomputer through a networked access medium. Thus, the cooperative manner is very important to

> responsibility, accountability, and authority for their successful utilization.

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Other trends include: enterprise-wide cooperative processing across multiple hardware platforms (interoperability); high speed Local Area Network (LAN) connections; hybrid, multi-vendor systems; enhancements in desktop technology regarding speech synthesizers, voice input, and graphics animation; and artificial intelligence to improve student reasoning and logic cognitive processes. The role of the Computer Center is being minimized due to the high regard for user interaction and user-friendly devices. Computing and communication resources are being distributed to users from management to clerks.

Reasons for Planning

This section of the review is designed to demonstrate that technology is not something that may be implemented without much forethought. Technology usage cannot be taken for granted. Reviewing the past 90 years, from a technology perspective, reveals certain truths about its evolution. Technology advancement, although not yet taken for granted, has become more accepted as a way of life. Telephones are almost as common in cars as sophisticated radios. Fax machines have added a new form of communication to personal computing as well as to the business world. Technologies initially intended to render paper obsolete have automated its generation, e.g., desktop publishing (Saffo, 1988). Technology is moving at a rapid pace, as Head (1982) evidences by specific examples shown in Figure 4.

It took approximately eighty years to migrate the key-driven calculator to solid-state technology (Event A). As we became more knowledgeable about technology, we began to develop tools much quicker. It took approximately forty years to then develop punched-card technology (Event B). It took half as long to then develop fast and reliable general purpose computers (Event C).

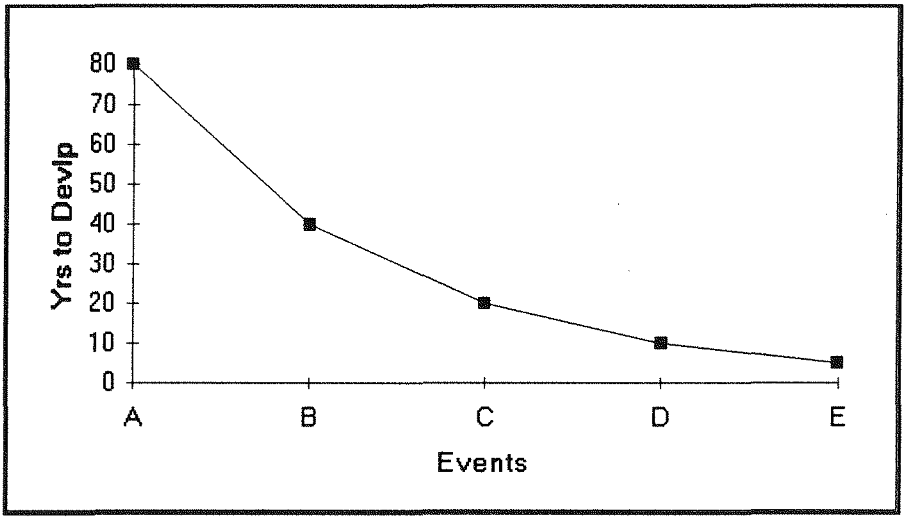

FIGURE 4: Technology Developments

Again, in half that amount of time, communication-based online systems were developed (Event D). Minicomputers took even half that amount of time, being developed for functional usage in about five years (Event E). With technology advancing at such a rapid pace, it is difficult to keep pace without first planning for its use and, what is more important, for adaptability to future enhancements and their potential usage.

In the past four years mainframes have doubled in speed. During the same period, microcomputers have also made significant improvements in speed and service. Most computer server speeds of 1988 are considered too slow in the 1990's instant information society (Editors of Corporate Computing, 1992). Emerging technologies have restructured our way of doing business. Today, every form of information, due to telecommunication links, may blend into a single architecture that Davis and Davidson (1991) termed an "infostructure." This architecture will promote integration of data and text in computers as well as sound and image in telephone and television. Soon telephones, computers, and television may be virtually the same medium.

Personal computers and workstations are bringing the power of traditional mainframe computers and minicomputers to the desktop. Dissimilar computing devices may communicate via networks using means that are transparent to the user. Remote access is becoming more important each day. The reality of instant access is facilitated by the arrival of cellular telephones, faxes, and portable computers. Equipment costs are decreasing every day due to increases in competition and more efficient means of development. The Unix operating system is being considered the de facto standard among the major hardware vendors. Unix allows vendors to subscribe to an open environment while offering slight variations that require only minor modification for compatibility purposes. This interoperability permits the economic development of many new systems while offering customers vendor independence (Vaught, 1989).

Education may greatly benefit from such new advances in technology. Information executives are beginning to form partnerships with nearby college or universities that have information departments. This is to take advantage of training with the latest in technology while permitting students to experience the business world. Businesses may help guide and shape information systems to fit future needs. Technology plays a major role in this alliance. It allows the business to take advantage of the added resource while the student gains a better understanding of the business environment.

Institutions offering distance learning and multimedia in education are taking advantage of technology. Such services and offerings are possible via use of satellites, computer software, computer networks, compact discs (CD ROM), fiber optics, radio, and telephone (Brock, 1990). Networking and telecommunications are fast becoming the foundations upon which plans are designed regarding any use of technology. There are now specific agencies, such as the National Research and Education Network (NREN) whose sole mission is to define ways to incorporate network and telecommunications into specific vocations. NREN works primarily with education to bind together vast educational activities (Nelson, June 1991).

Embry-Riddle (1992b) identified many trends that were specified particularly for Aviation/Aerospace higher education. The trends identified include: global economic development, training and education, greater competition in fund raising, greater competition for students in higher education, changing demographics, changing demand for pilots (shortage in the 1990s), maintenance technology requirements reflect a current shortage of skills, airline consolidation resulting in fewer powerful airplanes, military reduction, institutional effectiveness requiring a commitment to Total Quality Management methodology, and retention considerations. Each instance may be influenced by technology and the planning, or lack thereof, for technology integration throughout the University.

Technology is infiltrating educational institutions at a tremendous pace. Coughlin (1986) quotes former chief executive officer of EDUCOM John McCredie below:

> Whether or not information technologies are unique, the demands they place on academic institutions are clearly proliferating at a quickening pace. Therefore, <u>the argument as to why higher education must create new strategies for information processing</u>

> activities in the next decade is, in part, a very practical one [emphasis supplied]. Such strategies are central to the convergence of several related campus activities that use new technologies (i.e., video discs, graphics, broadband cables, etc.) in instructions, research, administration, telecommunications, mail, printing, institutional planning, and library services...Most institutions have made plans to react to the strategies to face the inevitable technological changes on the horizon. If these changes are not planned for, the opportunity to higher education will be very large. (pp. 7-8)

Coughlin (1986) offers nine specific major trends that would affect computing in higher education over the next few years. Declining costs in computer hardware (1), coupled with the attraction to an open systems environment (2) allows for more effective and economical solutions based upon computing resources (3). Increased demand of additional computing resources (4), decentralized processing (5), and higher forms of communications between platforms (6) has influenced computing resource needs. The shortage in professional computing resources (7) implies the need for definitive strategic (8) as well as tactical (9) planning requirements. Yet, he "has found no information outlining the nature of strategic models for academic and administrative computing within the parameters of financial support allocated to centrally-provided computer services" (p. 10).

"The influx of technology has had a profound influence on campus" (Hawkins, 1989, p. 1). Whereas Hawkins thinks technology is a positive influence upon education, Glick is skeptical that the influence is nothing more than "marginal at best" (Twigg, 1991, p. 55). Glick's skepticism is because most educational organizations try to apply the old paradigm to solve new problems. Thus, applying old management techniques to new technology results in less than positive influence on the organization. The skills required in the future and how they are managed will be critical to ensuring the success of

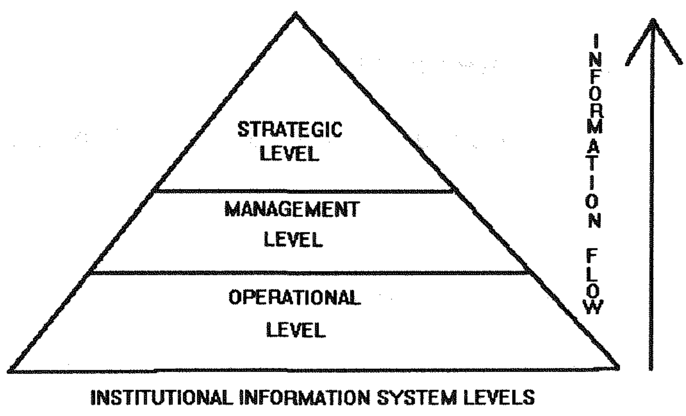

FIGURE 5: Vaught's Pyramid (1989, p. 153)

technology has forced attention toward strategic planning in the campus environment.

Yet, "true strategic planning is all too uncommon in our campuses today" (Hawkins, 1989, p. 9). Even in the short time since Hawkins' suggestion, the institution (Thurow, June 1991). There is a need for greater emphasis placed upon the planning process - particularly strategic and tactical planning.

Vaught's pyramid (Figure 5) graphically demonstrates how information flows through an organization. Traditionally, institutions have focused on only the broad operational systems levels at the bottom of the triangle. This level provides the raw data used by the systems higher in the triangle. This level unconsciously screens the information that should go to decision makers. This traditional infrastructure prevents the organization from including unabridged information in the planning process. Vaught suggests that information should originate from additional areas, including management. The second level of the pyramid provides data summary systems used to describe various aspects of the university. Both sets of information flow to the top level and serve as the basis for strategic and tactical planning. Thus, it is important to understand that strategic planning is not peculiar to executive-level management. Strategic and tactical planning must begin at the lower levels, thus involving the entire enterprise.

<u>Strategic and Tactical Planning</u>

This section of the review is to identify the origins of the planning process as well as define what a plan should be. Temares and Zastrocky

(1992) report on a survey they conducted of colleges and universities in preparation to present a paper at CUMREC 92. The survey was specifically designed to define technology issues confronting higher education in the 1990s. The issues offered by the Temares and Zastrocky survey focuses on what the authors feel are the main issues for higher educational institutions. The issues include: reengineering, networking, staff development, aging systems, effectively coping with limited resources, developing an IS strategic plan, integrating information systems, determining the value of IS, software productivity and reliability, and integrating computing into the curriculum. The overwhelming issue of concern was that of networking implementation (see Appendix D for reproduction of graphical representation). Oddly enough, developing a strategic plan was neither high nor low priority. Thus, the need for strategic planning is a relatively new notion to higher education. These technology needs would normally become apparent when proper strategic planning is done. The implementation of technology will follow, but only after laying out the blueprints for its use and implementation.

"A plan is a predetermined course of action" (Davis & Olson, 1985, p. 300) representing goals and objectives of the organization. The courses of action represent the pathways to achieving the goals. Informal planning is usually inconsistent and less comprehensive than formal, strategic planning. Informal planning may lead to goal-setting that is superficial and unrealistic. Atilla the Hun, long portrayed as barbaric, yet now becoming considered a metaphor for leadership, offered "Superficial goals lead to superficial results" (Roberts, 1985, p. 106). Although suggested centuries ago, this "Attilaism" is just as true today when applied to the planning process. It is easy to suggest goals so out-of-tune with reality that reasonable expectation of their achievement suffers. To suggest such goals would invalidate the plan itself.

Head (1982) believes strategic and tactical planning originated in the military. Strategy was borrowed from the military to project importance and planning connotes a process for exercising favorable influence upon future activities. Strategic planning consists of the overall guidance of large-scale operations while tactical planning concentrates on more immediate problems. For example, maneuvering military units in the field to achieve certain objectives are tactical moves that contribute to larger, strategic objectives.

Business has followed the idea that strategic and tactical planning may apply to its specific needs. For example, strategic planning reflects the concern of top management with the future direction of the organization, including profitability. This will ensure that the company is in the best possible position to take advantage of emerging and converging technologies, satisfying particular future needs developed during the planning period. Tactical planning then addresses the day-to-day concerns of operations, ensuring the proper distribution of resources to support immediate and current computing needs of the organization. Strategic plans may be implemented with the aid of tactical planning (Davis & Olson, 1985).

Penrod and West (1989) extend the idea of strategic planning, stating that "strategic planning aims to exploit the new and different opportunities of tomorrow while minimizing any negative aspects of the unexpected challenges that will surely occur" (p. 118). They offer six benefits that may result from strategically and tactically planning: 1) communication of a strategic vision; 2) clear articulation of the vision; 3) an increased certainty it brings to the lives of the organizational members; 4) a context for allocation and reallocation of resources on campus; 5) it improves the image of the institution; and 6) it builds expertise and teamwork within the organization.

Communication is imperative in any organization. It not only informs but serves to unite and influence. Communicating the vision will inspire organization members to accept a higher order of challenges. The vision will present such challenges while offering realistic levels of aspiration for the institution. The clear articulation of such a vision facilitates support from funding agencies. In addition, it increases the certainty among employees of the commitment by the institution to the future welfare and service for faculty, staff, and students. New technology obsoletes certain job functions while creating others. Proper planning may eliminate the need to "downsize" in exchange for reallocating resources, providing more effective service while enhancing the work skills of the resource involved (Penrod & West, 1989).

Temares, De Torres, and Cook (1992) offer three benefits from external effects by strategically planning for technology in an institution of higher education: image, revenues, and market share. The image of the institution, especially the educational institution, will greatly improve by planning for technology. If planned properly, technology may be used not only to enhance effectiveness of job functions, but will serve to better position the institution in terms of marketing. If potential students understand and can witness effective use of technology, particularly when used in the classroom, the institution will benefit from increased enrollment. Such increased enrollment will serve to facilitate funding and afford higher morale within the educational community. Proper strategic planning will facilitate teamwork, forcing information managers, senior executives, faculty, and staff to work together while following the plan.

Higher education institutions are adopting management techniques such as Deming's Total Quality Management (TQM), designed to allow for better management of the changing environment (Plice, 1991). "TQM is a management-driven philosophy that encourages everyone in the organization to know the organizational mission and to adopt a quality philosophy to continuously improve on how the work is done to meet the satisfaction of the customer" (Cornesky & McCool, 1992, p. v). TQM helps to minimize obstacles for adaptation to technology enhancements and makes their use especially applicable in higher education. Incorporation of TQM into the University may begin with its incorporation into the plan itself.

In order for the plan to truly be visionary, it must make some assumptions about the future. Such assumptions are based on experience and education: image, revenues, and market share. The image of the institution, especially the educational institution, will greatly improve by planning for technology. If planned properly, technology may be used not only to enhance effectiveness of job functions, but will serve to better position the institution in terms of marketing. If potential students understand and can witness effective use of technology, particularly when used in the classroom, the institution will benefit from increased enrollment. Such increased enrollment will serve to facilitate funding and afford higher morale within the educational community. Proper strategic planning will facilitate teamwork, forcing information managers, senior executives, faculty, and staff to work together while following the plan.

Higher education institutions are adopting management techniques such as Deming's Total Quality Management (TQM), designed to allow for better management of the changing environment (Plice, 1991). "TQM is a management-driven philosophy that encourages everyone in the organization to know the organizational mission and to adopt a quality philosophy to continuously improve on how the work is done to meet the satisfaction of the customer" (Cornesky & McCool, 1992, p. v). TQM helps to minimize obstacles for adaptation to technology enhancements and makes their use especially applicable in higher education. Incorporation of TQM into the University may begin with its incorporation into the plan itself.

In order for the plan to truly be visionary, it must make some assumptions about the future. Such assumptions are based on experience and research. A plan for technology also must rely on human creativity. Mendell (1983) displays much faith in human creativity and the effects it has on the future. Given the opportunity, people will find constructive ways to use their extra time. Pinchot III (1985) offers many instances where human ingenuity has provided a beneficial service. He cites specific "intrapreneural" examples, such as events that happened within 3M Corporation, Du Pont, Hewlett-Packard, Master Charge (MasterCard), and Pontiac, among others. Twigg (1991) cites examples where human creativity and analysis resulted in success that has revolutionized the banking industry. The first ATM (Automatic Teller Machine) was installed inside a bank and could be used only during banking hours. Such an arrangement promised no significant increase of service to the bank patron. The innovation occurred when the ATM was placed outside the bank. Thus, 24-hour banking was born.

Humans, by nature, are inimical to change. Most people feel overworked and behind schedule. Thus, when new technology, theories, methodologies, and tools are introduced, there is a tendency to resist whatever change is being offered (Bouldin, 1989). There is stress, or what Lenz and Lyles (1986, p. 60) refer to as "cognitive strain," involved when one faces change. Thus, there is a need for creativity in the planning process to take this stress and adversity to change into consideration. One cannot assume that by introducing a new advancement in technology that everyone will accept it as the way things ought to be. It requires a nurturing of attitudes. This implies the need for creative thinking. The plan should include not only the advancements in technology, if so desired, but also an explanation of how that technology is to be used. In addition, the plan should describe how one may migrate from the "old" way of doing things to the "new, improved" way in a painless manner.

"Most strategic planning processes do not facilitate the self-reflective learning that is necessary for competitive conditions. Instead, they become self-perpetuating bureaucratic mechanisms that limit strategic vision" (Lenz, 1987, p. 30). The information contained within the document should stimulate research and learning. This allows managers to keep abreast of the latest advancements in technology and to relate such advancements to the goals and objectives (and vision) planned throughout the blueprint itself. The document should allow for easy maintenance and allow for frequent review or else its contents will become obsolete and ineffective. Thus, the plan becomes nothing more than a shelf-document, which renders the time and effort of those developing such a document useless and costly. Future attempts at developing a plan, if so challenged, will lead to more "self-perpetuating bureaucracy" unless one learns from his mistakes.

Technology transforms the way we do things as human beings. Most "profound results of technology are unpredictable and unintentional" (Johnson, 1989, p. 71). Thus, integrating technology into the educational environment requires clear intentions with what technology may do for the institution and a plan for integration. Yet, the "key to the successful integration of technology into an educational environment lies not with technology but with people" (Detweiler, 1989, p. 42). The paradigm shift caused by technological change requires that people shift to adapt to the new environment (Twigg, 1991; Plice, 1991). The fear of change can be the largest obstacle for an institution to overcome when attempting to integrate technology into the organization. The director of technology, in essence, becomes the agent for change (Bouldin, 1989; Hess, 1991; McGovern, 1991). It is his leadership that will influence the success of the plan.

Practical Technology Models

This section of the review provides examples of planning processes and results in other institutions. There has been much written about strategic planning and the procedures to follow to ensure success. White (cited in Burgelman & Maidique, 1988) defines many areas that one may follow as a guide to developing a strategic plan. He views it from a corporate perspective, but these are offered so that any plan developer, such as within an educational environment, may use them.

Had Xerox done a better job of planning, they would have seen the future implications of personal computing and acted to aggressively market their Alto personal computer. The Alto was the first personal computer, developed at the Palo Alto Research Center in Palo Alto, California by Xerox.

Instead, Xerox scrapped the Alto, seeing no future in the product. This failure to plan resulted in what Baker (cited in Twigg, 1991) termed the "paradigm effect." Simply stated, this means that the assumptions one makes about the world may affect his vision , allowing one's own beliefs to impact the information he sees. In many ways, a solid and analytical strategic plan can act as the eyes to the future.

InteCom Inc. (1986) employed the idea of describing what technology currently is available to the company regarding. InteCom's analysis included the current employment of computing technology, what the desired results of the plan would be, and the migration path needed to get from the current to the desired environments. This method of analysis is consistent with that employed by the author in this study.

In 1988 (Block, 1992), Parkland College of Champaign, IL report on a comprehensive study of the information processing environment at the college. Assessing the college's current environment and requirements for the future resulted in a visionary plan for the establishment of an enterprise-wide computer-integrated environment. Parkland was then able to focus on certain issues of technology that would lead them to their visionary future. They discovered a need to implement electronic mail as a standard means of communication. They also discovered that computer literacy could be acquired through incorporating technology into standard, non-computer specific courses, such as English.

Houston Community College System (1990) employed a strategic model developed by Dr. Robert Shirley of California State University at Los Angeles. This model employs a brainstorming session that "relates external environmental opportunities and challenges with internal needs and opportunities" (p. 3). The plan incorporates technology trends, planning objectives, and critical success factors into an analysis framework that reviews each area from both external as well as internal environmental perspectives. As of this writing, the plan, although not yet formally approved, has been accepted. The first outgrowth of the plan was the successful installation of a new campus and student computer lab.

The University of Miami employed a seven-year Long Range Information Systems Plan in 1984. Implementation of the plan was completed in less than seven years while coming in under budget (Temares, De Torres, & Cook, 1992). By strategically managing the process for implementation of an information system, the whole institution benefitted from the plan regarding goals and objectives of the University.

Stanford University recognized and identified basic trends in higher education in the early 1980s regarding technology that still apply today and must be planned for: costs are declining regarding data storage and computer terminals; printers are maturing such that higher quality is being produced much faster than before; networking and telecommunications are improving between computers with local area networks (LAN) permitting high transmission speeds; and software development tools are reducing the needs for specialists within the institutional computing environment (Sandelin, 1981). Today Stanford is recognized as a leader in education, due in part to the technology it offers.

Coughlin (1986) cites what he considers the seminal literary work regarding technology strategies, EDUCOM's Campus Computing Strategies. This was a study, involving ten institutions, conducted by EDUCOM to find out how, if at all, colleges and universities are organized to take advantage of technological changes. The results yielded many common strategies that have many implications for Embry-Riddle Aeronautical University today, such as the introduction of Library automation, upgrades in personal computers, re-organization of the infrastructure, and a process of decentralization (see Appendix G).

As early as 1983, Drew University decided to provide every entering freshman with a computer package, including: a fully configured personal computing system, printer, and software, including WordPerfect, a spreadsheet, a database, and telecommunications. This could only be done after much early planning and research to see if personal computing could be used as a pervasive tool within an educational environment. The decision to implement what the University termed the Computer Initiative was made by Drew officials upon being convinced that the proper research was given due diligence (Detweiler, 1989).

Virginia State University (VSU) realized the need to "achieve optimal utilization of technology in teaching, learning, and research" (Virginia State University, 1990, p. 4). VSU officials set out to develop a plan that would strategically incorporate such objectives and lay a foundation for what President McClure termed the "New University." Like Embry-Riddle Aeronautical University, VSU also contracted with Technology Specialists, Inc. to help with development of their five-year plan for technology. Short-term tactical activities included: reorganizing the Data Processing Center under the management of TSI as well as providing training for staff, improving immediate user services, establishing advisory committees (the Academic Computing Advisory Committee and the Administrative Computing Advisory Committee), and a budget planning strategy designed to maximize financial resources for enhanced delivery of services. The VSU blueprint provided work plans for both academic and administrative areas and suggested the need to reorganize the data processing center to adapt to the changing technological environment. This reorganization has resulted in consolidation of functions, provided new services, and improved the effectiveness and efficiency of operations.

Brown University (Beeman, 1989) is an example of the need for a dynamic and pedagogical document to guide the integration of technology within an educational institution. Brown found that, due to increased sophistication of students and rapid technological advancements, a constant monitoring of the environment must be done. Brown promotes a regular self-study program to benefit fully from technology while ensuring that technology usage is "in accord with people's real scholarly needs" (p. 25).

Indiana University (Bernbom & Brenner, 1991) found that the strategic plan and the strategic planning process serves four purposes:

1) Communication is improved as ideas are being translated into realities. Committing goals and objectives to writing after specifying them provides a "concrete understanding of what will happen (the objectives) and the reasons why (the goals);" (p. 100)

2) The computing organization listens to its users and advisory groups. The plan provides a formal opportunity to seek out the user and understand his needs. Such needs may then be incorporated into the activities proposed by the plan;

3) The plan establishes a formal decision process for the computing organization that may be adopted by others in the institution. Priorities may be set according to the resources available; and

4) The plan may identify and allocate resources to the computing organization's highest priority objectives. Often critical objectives are postponed (and eventually never addressed) while small, short-term, more immediate

objectives are tackled. In doing so, the resources (people, funds) are not available when it is time to address the high priority items.

These stated purposes are consistent with the reasons for this study. Users have had little involvement in technology decisions at ERAU. The plans developed for the University have shown no vision and communication among University employees has been marginal, at best.

Summary of Chapter 2

Technology is rapidly changing, with networking and telecommunications leading the charge. Literature confirms that computers are becoming as ubiquitous as cars (Block, 1991). Institutions of higher education are beginning to understand that technology must become an integral part of the university environment (CARS, 1992; Skarulis, 1989). New infusion of technology requires new styles of management. Planning for infusion of technology in educational institutions has waned (Temares & Zastrocky, 1992). Many schools are embracing TQM as a basic philosophy. TQM helps to minimize obstacles to adaptation to technology enhancements and their use especially applicable in higher education.

The combination of new styles of management and a philosophy of TQM will provide for a smooth transition of technology integration in both the administrative and academic environments. Administrative technology may be in the form of client/server and distributed processing while academia may incorporate CAD, multimedia, distance learning, and virtual reality (Davis & Davidson, 1991; Daniel, 1990).

Information flows upward through the organization (Vaught, 1989). It is imperative to plan for technology and to communicate accordingly. Strategic planning is known to originate with the military (Head, 1982). Strategic planning involves the overall guidance of large-scale operations while tactical planning concentrates on more immediate problems. Many authors have volunteered methods of planning, desiring to result in improved image, higher revenues, and greater market share for educational institutions (Temares, De Torres, & Cook, 1992).

There are many success stories regarding utilization of planning to integrate technology into the environment, such as Parkland College of Champaign, Il and the University of Miami. There are also examples of failure when technology integration was improperly planned, such as Xerox. Indiana University, a successful integrator of technology, provides four purposes of the planning process: Communication; Group input; Decision process structuring; and improved resource allocation.

People are key to technology integration (Detweiler, 1989). This presents a dichotomous situation as people are traditionally adverse to change, which is what technology integration is entirely about. But people should not be underestimated. Given the opportunity, people will find constructive ways to use their extra time (Mendell, 1983). The information within the formal plan should stimulate learning and research. Thus, management may stay abreast of emerging technologies and will be ready for its integration when needed.

CHAPTER 3

METHODOLOGY AND PROCEDURES

To successfully develop and implement the plan for technology at Embry-Riddle Aeronautical University, structured methodology should be employed. This chapter will define and illustrate the methodology employed by the author to develop and implement the strategic and tactical plan for technology at ERAU. The author employed a 14-step procedure that resulted in a quality document and an aggressive, yet achievable timeline for implementation.

There is a considerable body of literature about the strategic planning process (Steiner, 1979; Goal/QPC, 1992; King, 1992; Guba & Stufflebaum, 1970; Head, 1982). Although there is a surfeit of authors proposing numerous ideas, there is a consistent pattern concerning what the major steps in the planning process are. Rowe, Mason, and Dickel (1986) succinctly offer the following four steps that summarize the ideas of most planning literature. They group the planning process into four components:

1) Define the strengths and weaknesses of the company;
2) Define the desired future scope of the company;
3) Define the competitive advantage and market niche of the company;

4) Develop a statement of purpose, goals, and objectives; and

5) Define the allocation of resources needed to implement and execute the plan.

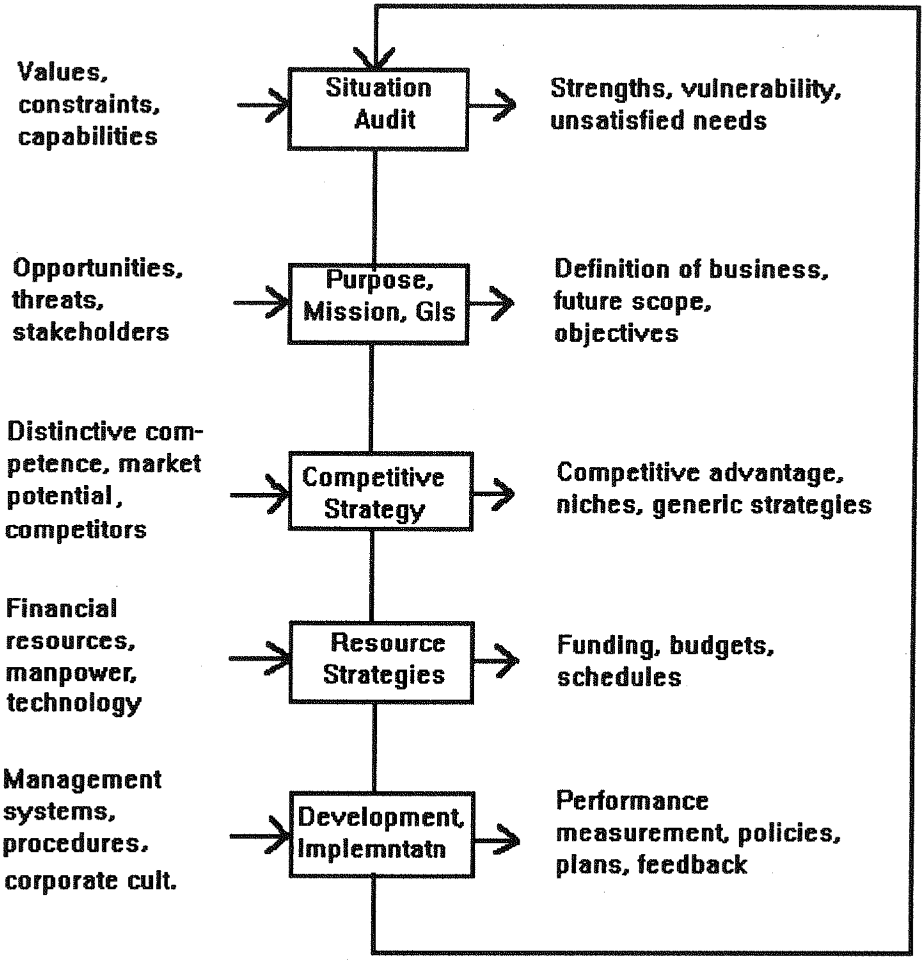

FIGURE 6:

Diagram of strategic planning process - Rowe, Mason, and Dickel (1986, p. 32).

Figure 6 graphically describes the manifestation of the five components.

Plan-to-Plan

As a way of initiating the entire planning process as displayed above, it is suggested that a plan-to-plan (PTP) be developed that may serve as a stepping stone to development of the plan itself (Scigliano, 1993). The plan-to-plan incorporates information about present institutional planning with suggestions about whether more or different planning should follow. The PTP is the initiation point of the formal strategic plan as well as the focus for continual monitoring, evaluation, and modification of the plan. It provides the methodology and evaluation tools to be applied to every facet of the strategic planning process.

Steiner (1979) suggests that the plan-to-plan should include "a strong statement of the chief executive officer's commitment to effective formal planning as an essential managerial need, especially for the first planning cycle; a glossary of key terms; a specification of data required from the planning system; a specification of who is to supply what data..." (p. 59). "The PTP provides definitions, examples, schedules, charts, and checklists that are uses in designing these plans" (Nova University, July 1, 1992). The PTP employed by the author includes endorsement statements by University officials, critical success factors, University goals and objectives, information gathering tools, information pertaining to the University self-study Climate Surveys, describes evaluation methodology (such as quarterly reports) and tools, and provides the steps to developing the strategic plan as defined in the following sections. Appendix K displays the PTP.

Procedures: (Plan Development)

The following set of procedures identify the milestones necessary to identify the key plan components and stages in the development of the plan. The steps in developing and implementing the Strategic and Tactical Plan for Computing and Telecommunications at Embry-Riddle Aeronautical University include the following:

1. Conduct the Needs Assessment
2. Complete the WOTS-UP Analysis
3. Identify Participants
4. TQM - Define Critical Success Factors
5. Define Goals and Objectives
6. Identify Competitive Strategy
7. Identify Resource Strategy
8. Define the Scope of the Plan
9. Gather Information
10. Formulate the Plan Outline
11. Write the Document
12. Validate the Plan and Receive Approval

13. Implement the Plan

14. Evaluate the Plan

TABLE 2: Timeline of Plan Development

ACTION	DURATION	START	END
Conduct Needs Assess	2.00 w	03-Aug-92	14-Aug-92
Develop PTP	2.00 m	03-Aug-92	02-Oct-92
Complete WOTS-UP	2.00 w	17-Aug-92	28-Aug-92
Identify Participants	2.00 w	03-Aug-92	14-Aug-92
Define CSFs	2.00 m	31-Aug-92	30-Oct-92
Define Goals/Objectives	2.00 w	30-Oct-92	16-Nov-92

continued on next page

ACTION	DURATION	START	END
Identify Compet Strat	2.00 w	16-Nov-92	01-Dec-92
Identify Resource Strat	2.00 w	16-Nov-92	01-Dec-92
Define Scope of Plan	2.00 w	16-Nov-92	01-Dec-92
Gather Information	4.00 m	03-Aug-92	04-Dec-92
Formulate Plan Outline	2.00 w	04-Dec-92	18-Dec-92
Write Plan	4.00 m	18-Dec-92	30-Apr-93
Validate and Approve	3.00 m	30-Apr-93	30-Jul-93
Implement Plan	12.00 m	30-Jul-93	30-Jul-94
Evaluate the Plan	2.00 w	30-Jul-94	30-Aug-94

1. Conduct the Needs Assessment

TSI was contracted to do a needs analysis prior to being hired fully by the University to develop the plan and manage the data processing center. That document serves as a crucial piece of information. The process begins by identifying goals and objectives, and then designing the information gathering process. The needs analysis document (needs assessment), serves as the starting point for the information gathered. It provides the "environmental scanning" that Rowe, Mason, and Dickel (1986, p. 100) offer as essential to identifying the threats and opportunities the institution faces. The needs assessment contributes to the WOTS-UP analysis. Appendix H describes the needs assessment process used by TSI for Embry-Riddle.

2. Complete the WOTS-UP Analysis

The second step is to complete a WOTS-UP Analysis. This is an appropriate tool for helping to analyze the potential for maximizing technology investment is offered by Rowe, Mason, and Dickel (1986). They call the tool WOTS-UP analysis whereas Fowler (1987) labels it SWOT. WOTS-UP, or SWOT "helps determine whether the organization is able to deal with its environment" (Rowe, Mason, & Dickel, 1986, p. 60). WOTS-UP is an acronym for Weaknesses, Opportunities, Threats, and Strengths. Weaknesses are limitations, faults, or defects in the organization "that will keep it from achieving its objectives" (Rowe, et al., p. 62). "An opportunity is any favorable situation in the organization's environment" (Rowe, et al., p. 60). A situation that can be damaging to the organization and its strategy is considered a threat. Strengths are resources that can be effectively used by the organization to achieve its goals.

The identification of each of the factors within an organization may act as a guideline for developing goals and objectives that serve as the foundation of the planning process. The WOTS-UP tool is designed so that the organization may learn what it does particularly well and what niche it has in the marketplace. Having that resolved, WOTS-UP may then help to match what the organization does well with what it does best socially and economically. Educational institutions have specific clientele to satisfy. Most institutions employ similar techniques as far as administering daily operations. Thus, the marketability of the institution is defined by the niche it satisfies to the educational community. Once the niche is identified, focused efforts toward fulfilling that role depends upon the method the institution employs. At Embry-Riddle the plan is the focal point in defining the success of the University in fulfilling its niche. As with most educational institutions, success is measured by the increase or decrease of enrollment.

3. Identify Participants

In step three, the participants were identified. Since information gathering is a critical part of developing any plan for technology, it is defined by the people involved in the project. Thus, it is imperative that the right personnel participate in the process. According to Drucker (1988), there is a strong tendency for businesses to use team decision-making processes. The idea is that productivity and effectiveness are enhanced and a feeling of contribution by participants may lead to increased efficiency and morale. It is desirable to staff the task force with people that have different backgrounds. In addition to staff members that have experience in policy and strategy formulation, it is important to consider those with technical skills and those knowledgeable about the status of technology within the institution and its future requirements (Head, 1982). The absence of these skills may lead to unrealistic goals.

Selecting the proper personnel to support and participate in the process ensures that the process progresses quickly toward the proper path. Scotto (1989) suggests that a skills inventory matrix be created to identify the skills required and compare them to the potential participants in the project. However, there are some general requirements to define from the outset. The participants should possess: a keen knowledge of interview methodology, experience in the planning process, familiarity with the environment they will survey, professional presence, and verbal and written communication skills.

4. TQM - Define Critical Success Factors (CFSs)

A key step in the procedures is the identification of critical success factors. By identifying the CFSs for the institution, the internal environment is better defined and goals and objectives may be developed. Normally key executives participate in the development of these critical success factors. It requires a great degree of intelligence, experience, and knowledge about the internal environment. A member of the President's Cabinet was chosen to represent the University for the purposes of identifying CFSs. This person is highly qualified for such representation as she represents the University at a number of functions and is champion of the University's integration of Total Quality Management (TQM) into its environment. This person is the leading University researcher in terms of self-study and SACS accreditation requirements. In this instance, the Director of the Office of Information Research and Effectiveness (OIRE) was enlisted to help lead the process of identifying the CFSs. She was asked a basic question offered by Martin (1982):

> "In running your organization there are a small number of aspects of paramount importance - factors that must be done well if the operation is to succeed. Can you describe the factors that are most critical for success?" (p. 31)

CFSs relate to the conduct of key areas where performance is necessary and offer measures that are necessary in a controlled system. The CFSs pipeline into development of goals and objectives. As CFSs may vary greatly from time to time, periodic review will be made during the process of plan implementation.

Embry-Riddle has adopted the concept of Total Quality Management (TQM) as the basis for planning and decision-making for the institution. Juran (1989) has termed this approach Strategic Quality Management (SQM) and defines it as a "systematic approach for setting and meeting quality goals throughout the company" (p. 176). Figure 7 displays the relation of SQM to enterprise-wide quality management.

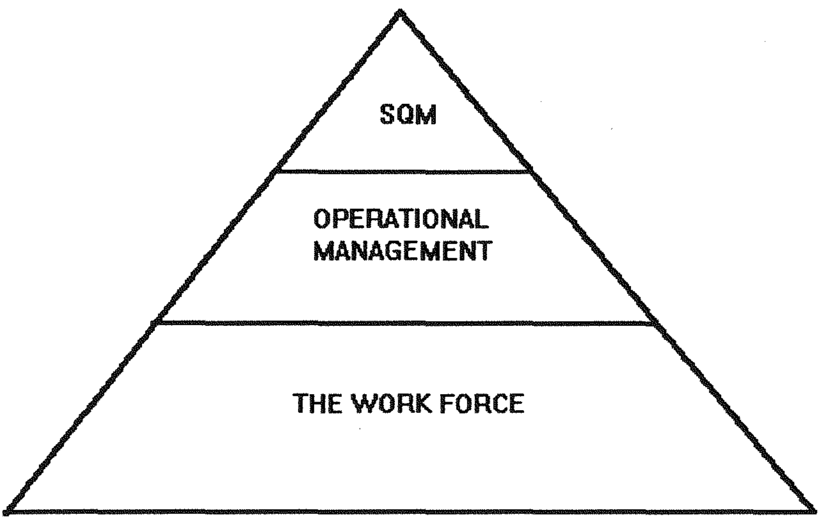

FIGURE 7: Relation of SQM to Quality Management

SQM (TQM) involves procedures where one is continually examining the way things are done and offering ways to improve potential dysfunctional processes. SQM normally is applied at the executive level, but may be employed at the middle management and operational levels. SQM involves continual efforts toward providing a customer-oriented focus and improving services and processes while employing the efforts of the organization's work force (Nova University, August 1992). Upper managers' involvement in SQM is essential because they participate in policy formulation, goal setting and deployment, and can provide needed resources to carry out the list of tasks during the deployment process. SQM starts as a top-down method of information analysis that involves other levels of the organization at some point.

SQM, or Total Quality Improvement (TQI), as Cornesky and McCool (1992) define it, employs tools that help identify problems that inhibit quality that may not readily be apparent. Such tools include: Affinity Diagrams, Cause and Effect Diagrams, Flow Charts, Force Field Analysis, Histograms, Nominal Group Process (further defined in the section regarding plan evaluation), Pareto Diagram (pipelined from NGT - also used for plan evaluation), Relations Diagram, and Systematic Diagrams. One of the techniques for identifying specific information that leads to quality improvement is definition of the Critical Success Factors that are essential to purpose of the organization.

Rowe, Mason, and Dickel (1986) refer to John Rockart, who has developed a three-step procedure for determining the factors that will meet organizational goals. Rockart feels that determining the factors that lead to success will help define the goals and objectives of the organization. Nova University has embraced this philosophy, as evidenced in their 1992-1997 Plan-to-Plan (Nova University, 1992). Critical success factors are those issues, items, or areas that must be provided in order for the vision of the plan to flourish (Nova University, 1992). CFSs are specific controllable actions that may be used to evaluate the success of the intended objectives of the plan. CFSs "are, to a large extent, controllable by the firm. They correspond, primarily, to functional activities which have to be deployed to guarantee a successful competitive standing..." (Hax & Majluf, 1984, p. 157).

5. Define Goals and Objectives

Germane to the process is the definition of basic goals and objectives. Each group member is requested to identify particular goals and objectives. Such goals and objectives can be derived from: information gathered by TSI their needs analysis process; personal experience of each member; particular knowledge about the University, especially from the University employees; literature research; interviews with ERAU personnel; and Embry-Riddle documents, such as the University strategic plan.

The standard against which every decision and input regarding the plan for technology is measured is the Embry-Riddle Aeronautical University Statement of Purpose. This Statement represents the official posture and practice of the University. From this Statement, the official description of the University is provided in the University catalog and other University documents. See Appendix E for the full Embry-Riddle Statement of Purpose.

Without a measurement standard, the process could stray from its intended purpose, jeopardizing the result while producing potentially invalid policies and procedures. Periodic monitoring of the information gathered and positioned as input to the plan presents a proactive method of ensuring the process does not stray from its intended purpose. Thus, it is through the guidance of the Statement of Purpose that the entire process gets its validity. This Statement precedes the need for a plan, but demands the development of the plan. Every goal and objective bases its origin upon the Statement.

Head (1982) offers that there is a slight difference between goals and objectives, mainly in scope. Goals are enduring statements of purpose that are "non-quantitative in nature, not referencing specific resources required for implementation or specific timetables for realization. Objectives are subordinate to goals, narrower in scope, shorter in range and usually attainable" (p. 6). The data contained within the blueprint represent an overview of the current technological functionality at the University. In addition, it describes work plans (tactical actions) to support ERAU's efforts to move to the next technological plateau.

6. Identify Competitive Strategy

Steiner (1979) offers a checklist of questions that can be used to identify the institution's competitive position. The author, using this as a boilerplate example, developed a similar checklist as part of the PTP (Appendix M displays a sample checklist). This is intended to be distributed to identified members of the University executive staff to complete as well as to members of the TMP for research.

The ancient Chinese philosopher, Sun Tsu, once suggested that if you know the enemy and know yourself, you need not fear the result of a hundred battles (Clavell, 1983). We live in a competitive environment, given the economic portfolio of the country. Each institution of higher education must invest time and resources into identifying what it has to offer as well as what the competition has to offer in order to attract the potential student population. This means that the institution must provide some niche that can strategically position it above the competition. Technology utilization may provide the difference regarding market attractiveness when compared to the competition. This especially holds true if the institution cannot boast of employing honored faculty members (i.e.: Noble Laureates, Pulitzer Prize winners, etc.) or is not known for high quality, society-benefitting research (i.e.: MIT, Harvard, etc). Such characteristics may attract quality students based on reputation alone.

The hypothesis is that ERAU provides a service that enjoys limited competition. As an Aviation and Aeronautical University, Embry-Riddle is in a unique position of providing a service that is provided elsewhere by a limited population of competitors. Thus, ERAU may not need to dwell on what limited competition can provide. Rather, the University can invest in identifying areas within the institution that can be improved that may result in producing higher quality students. The measure of the success of the University is in the quality of individual graduated (his market value in the work world). The University implements an annual self-study program (for a sample page from the Climate Survey - see Appendix L) designed to measure internal satisfaction regarding University administration and resources. From that, statistical algorithms identify particular areas in which to give attention that will provide a higher quality environment and produce a higher quality student. Higher quality students will then be of more value to the business world and increased employment among recent graduates can be expected.

7. Identify Resource Strategy

"Poor quality isn't the result of ineffective workers, but of ineffective systems" (CareerTrack, 1993, p. 5). In accordance with TQM philosophy, the development of a tool such as a strategic and tactical plan for technology can be more effective when involving key individuals. The author, charged by TSI and Embry-Riddle to coordinate the development of the plan, helped form the TMP (see Introduction section of this paper) to help in the development of the plan. Such a "partnership" provides one of the essentials of TQM techniques - employee involvement. Properly directed, the University employees offered valuable information and creative ideas that are essential to a worthwhile plan.

8. Define the Scope of the Plan

The scope of the plan, or blueprint, for technology at Embry-Riddle Aeronautical University consists of the **definition** and **implementation** strategy of the University's administrative and academic technology environments. Virtually every application in support of University administration, instruction, and student affairs fall under this umbrella. The technology environment encompasses a comprehensive platform of hardware, communications networks, and software.

Definition of the technology environment spans from the "optimum" (ideal) to the "target" (specific) strategies. Interviews and requests for information center on "optimum" opinions, and consider both immediate and long-term objectives. A "target" strategy may be defined as the "best" environment for Embry-Riddle, derived from the optimum, while considering all circumstantial factors. These factors include University strategic plans, product availability, risk potential, and finances.

Implementation strategies define the resources, work plans, critical paths, and evaluation criteria necessary to realize the "target" administrative and academic technology environments. This facilitates the transition to specific, concurrent projects and tactical objectives.

If properly planned, the chances are minimized that critical issues will be ignored. Although there are no limitations regarding how far one may think, there are limitations as to how far one may pursue a specific set of goals. The strategic plan, when properly pursued, is designed such that the developing organization may know both itself and the technology of which it is to use and conquer. It would be easy to develop a plan that encompasses as many far-reaching ideas and concepts as the medium upon which it is written allows. However, the document would be fictional because the ideas are not attainable within a reasonable period of time, if at all. Therefore, this plan for technology has set practical limitations on the concepts it suggests. Although providing for future growth, the plan considers resource availability and costs and provides guidance to proven concepts for technological utilization.

Davis and Olson (1985) offered three sources of planning: internal data organized and processed for planning; external data sources; and environmental scanning. The author directed the efforts to investigate such sources and a comprehensive and justifiable plan has resulted. Defining the scope identifies the focus of the plan.

9. Gather Information

Gathering the information that will lead to the development of the plan is as important a step as writing the document itself. Prior steps in the process devoted little time to communicating with the users. It is important to communicate with those who will be most immediately and directly impacted by the decisions that come about due to the plan. However, up to this point there had been no real opportunity to listen to the users (save the needs assessment). This step in the procedures required that participants in the plan development team ask the users for their views and listen intently to what they have to say. The users dwelled on the problems they were having while they identified areas they saw needed improvement.

Here, again, listening is an important skill that team members must possess. "Too often, when others are speaking we are framing our next sentences or daydreaming about something totally different from the subject at hand." (Bouldin, 1989, p. 65) Our minds leap ahead, processing faster than anyone could speak. Thus, a certain discipline was required of the plan development team member.

Brainstorming is one of the fastest ways to reach an objective (Bouldin, 1989). Gathering a group of people together to define solutions to problems has its advantages. When managed properly, brainstorming can be very productive. The idea is that one person's thought triggers another's, which then triggers another's. In this way, the process may be exhaustive and complete. This exercise helps to synthesize a course of direction. Adler and Rodman (1982) offer that extensive research suggests that groups are one of the most effective ways of decision-making and handling tasks. Groups normally possess a greater collection of resources than do most individuals. There is also increased likelihood that the information will be accurate due to peer monitoring. In addition, there is a feeling that, due to this participatory method, each member plays a part in the process. This means that the participants are likely to have a strong commitment to the project, a principle that Redding (1972) termed "participation decision making." This idea, where the people who must live with the plan help develop it, fosters such commitment. Although TSI was hired to develop the plan, we take care in identifying the ERAU resources needed to participate in the process. The author participated in small brainstorming session with the select members of the Technology Management Partnership (TMP) team to discuss interview results and to help formulate the information within the plan.

In addition to the information that each member brought with him to the process (i.e., expertise, experience, environmental knowledge-base, etc.), much of the information was collected using existing documents. Such documents included: the needs assessment, the University-wide Embry-Riddle Aeronautical University Five-Year Strategic Plan (not the technology plan to which this study applies), and other research.

Steiner (1979) believes that a solid manner of information gathering is through doing a situation audit. The situation audit provides information regarding analysis of data representing the past, present, and future of the organization. Rowe, Mason, and Dickel (1986) agree that a situation audit will provide needed information regarding the state of technology in the current environment. The outline of the plan itself provides a situation audit (see Appendix I). The author designed a series of surveys specifically to gather information regarding the current state of technology at Embry-Riddle (see Appendix J). In conjunction with the WOTS-UP and needs analysis previously conducted, the information provides the situation audit information within the plan itself.

There are four components of the surveys conducted in this study: Academic Computing, Administrative Computing, Computer Center, and Computer Center Inventory. The surveys were designed to act as an inventory of sorts, with the Computer Center Inventory as the only listing of actual technology in use at the University. The other surveys address subjective information about such things as the amount of technology usage each respondent experiences, the comfort of each respondent regarding such technology usage (or lack thereof), and the comfort with and support from the Computer Center and its personnel. The surveys were planned to be distributed to each department head or department chair to distribute to select employees that represent the attitudes of the department for which they work.

10. Formulate the Plan Outline

Shirley (1982) offers four basic criteria that strategic issues or decisions should address: 1) define the institution's relationship to its environment; 2) generally take the whole organization as a unit of analysis; 3) depend on inputs from a variety of functional areas; and 4) provide direction for and constraints on every administrative and operational activity throughout the institution. The process at ERAU simplifies, while not straying from, these suggestions by offering the following objectives:

A) where is the institution now in terms of technology usage;

B) where does the institution desire to go; and

C) how does the institution get from where they are to where they would like to be?

Cleese (1992) furthered this idea, stating: "The first step in successfully managing any change is analyzing the gap between the present situation and your intended goal" (p. 224). This process subscribes to literature that suggests the plan should help to: realistically evaluate the present situation, clarify future direction, and focus on how to move from one point to the other (Bryson, 1988; Wallace, 1986). Simply stated, the plan describes: where we are today, where we want to be in the future, and how to get from where we are to where we want to be, but does so in discrete steps for manageability.

This plan for technology progresses logically: starting with basic technological needs for effective and quality functionalities, to analyzing the current environment that promotes those needs, to defining requirements to provide solutions to those needs, to work plans that may be implemented to satisfy those needs. The primary tasks for strategic management are to: understand the environment, define organizational goals, identify those goals, identify options, make and implement decisions, and follow-up with actual performance evaluations (Morrison & Renfro, 1984).

This methodology is consistent with that adopted and implemented by Indiana University (IU). IU identified four chief inputs: user plans and recommendations; evaluation of the environment, organizationally and technically; evaluation of prior- year performance; and participation of the institution's entire management team in establishing the final plan (Bernbom & Brenner, 1991).

The needs assessment and interview information, along with the intimate knowledge of particular plan development participants, identifies the current state of technology within the University. A University document known as the "Vision of ERAU Environment by the Year 2000" (Appendix F) was developed to help identify where the University aspires to be in the future. The combination of experience, research, and TSI resource personnel also help to identify how the University may leapfrog from their current state of technology to the desired future state.

11. Write the Document

Based on the previous procedures, the plan was written and properly documented. It hen serves as a dynamic volume. It will be rewritten, reworked, and often reviewed to meet the changing needs of the University as technology changes. It is important that the document was modularly developed for easy modification. Even the binding within which the document is placed must allow for ease of modification and review. Five years is a generation in terms of technological change. It must be expected that the plan will evolve with technology and should be monitored accordingly.

The information contained within the plan must be informative without being complex. The plan should be described in tangible terms, free of technological jargon (Scotto, 1989). Because the plan covers what, in technological terms, may be considered a lifetime, the chance is great that personnel will change. Thus, personnel implementing the plan are likely to change before the completion of the plan timeframe. Thus, it is important that the plan be easily understood by those who are responsible for its implementation in the future. Too much attention to detailed explanation may usurp the intention of the document itself - that of transitioning the University to a technology leader within the higher education community.

12. Validate the Plan and Receive Approval

Once the document was written, it was reviewed and critiqued by those for whom it is written. Embry-Riddle recently formed a technology advisory committee called the Computing Governance Committee (CGC). The charge of this committee is to monitor every aspect of technology within the University. The CGC is divided into three functional areas (Figure 8): Administrative; Academic; and Network and Telecommunications.

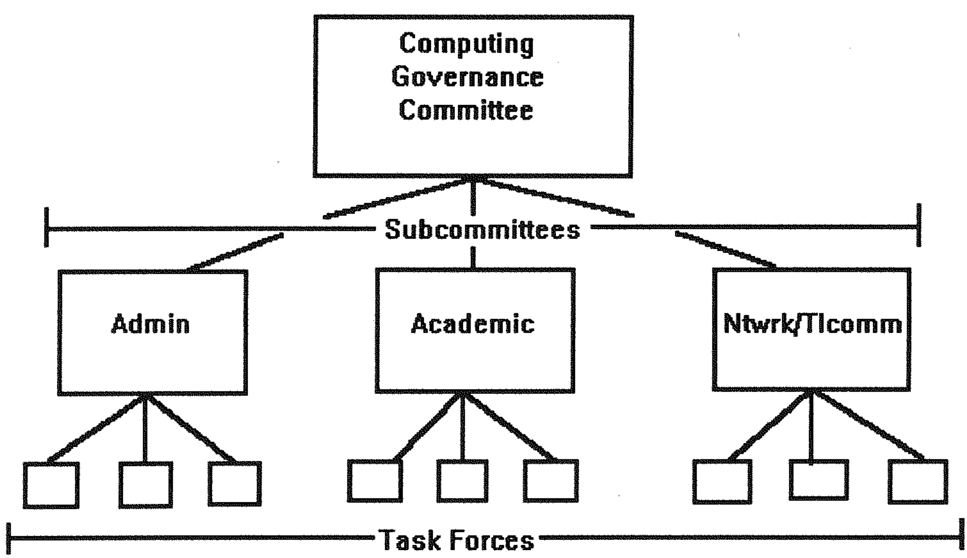

FIGURE 8: Computing Governance Structure

Each of the three subcommittees is charged with review and validation of specific sections of the plan related to their areas. Each subcommittee consists of various task forces that will do the detailed review and report back to the subcommittees. Once the subcommittees have reviewed and validated the plan, which may mean many modifications to the plan, it will then be passed to the CGC for final approval.

<u>13. Implement the Plan</u>

"It is easier to develop a new business strategy than it is to implement one" (Marx, 1991, p. 19-1). The pivotal point of the entire process is the implementation of the plan. At this point in time the plan will have been prepared. Subsequent tasks will consist of potentially monotonous chores dedicated to follow-up, and then the process will start again as each new year arrives. "Strategy implementation is the process of putting strategies and policies into action through the development of programs, budgets, and procedures" (Wheelen & Hunger, 1983, p. 10). The implementation of the plan will bridge the gap between where the institution is in terms of technology utilization and where it aspires to be. It will bring to reality the unfamiliar ground that was seemingly only a wish before the process began. The implementation of the plan requires almost the same attention to details that were required of the development of the plan itself.

Implementations are procedurally oriented. This means that it is important to follow specific steps to properly installing and implementing a plan. Not every implementation process follows the same steps. It takes the experience of those who have done such implementations to know how to adapt a basic implementation process to the specific organization that requires that process. Experience helps in defining how to measure the success of the process.

The implementation of the strategic plan depends upon: the priorities set, the defined goals, the complexity of the planned event, the resources available (both in terms of personnel as well as funds), the timeline of events, and the commitment of the institution. To avoid the pitfall of optimal strategic goals, Head (1982) suggests that the implementor(s) take small steps rapidly. This will allow economic benefits of each event to set in place, instead of trying to implement too many ideas at once. The potential problem with global implementation is that many events may never be completed due to shortage of resources and/or funds. The plan should clearly consider future resource availability. It cannot always be accurate because of the changes that may be outside the control of the institution, such as the economy. It is also not wise to implement seemingly smaller, more achievable tasks. By straying from the ordered sequence of events, the integrity of the plan may be compromised.

Because the implementation of the plan may cause a cultural change in the daily lives of the institution's personnel, one may expect some resistance from those whose areas will be affected either totally or partially. Therefore, management that commissioned the strategic plan is obliged to display that commitment to the personnel directly enduring the change. Technology transfer and enhancement is an entire enterprise endeavor, yet there are certain factions that will show more opposition to the change than others. Without upper management commitment, the buy-in process that is so important to the success of the implementation may be jeopardized.

Presently, Embry-Riddle Aeronautical University is investing significant "person-power" and resources in planning for the University's entry into the 21st Century. A "vision" is being developed and articulated to the many constituencies comprising the Embry-Riddle community. While the "vision" will identify many goals and objectives, several commitments will be directly related to a significant enhancement in the utilization of technology at the University.

Resource commitments for academic, research, and business requirements confirm the necessity to integrate technology into the University environment and curriculum. Technology may serve as a catalyst to attract prospective ERAU students and help to better position the University in today's competitive educational marketplace.

The decision to take advantage of technology is influenced not by economic standards only, but by the quality of education required as a product of the University. The investment in technology requires a commitment by the

University - a commitment to the faculty, a commitment to the staff, and what is more important, a commitment to the students.

Wheelen and Hunger (1983) suggest that an organization must consider three questions regarding strategic plan implementation: Who will carry out the plan?; What must be done?; and How are they going to do what is needed? The final plan will consider the last two questions while the first question is dependent upon resource availability and the particular task or action to be considered at any one particular time. The last two questions will become part of the action plans laid out in the final plan that provides a path between where the University currently is regarding technology usage and where they plan to go.

The author has developed a plan for implementation (PFI) of the Strategic and Tactical Plan. Based on Lebreton's (1961) suggested steps for implementation, the PFI serves as a guideline for anyone who is charged with implementation of the plan. This PFI may also serve as a guideline for implementation of other plans, such as the University's overall Strategic Plan (encompassing more than just technology) and plans for improvement in academics.

Lebreton's suggested PFI leads the implementor to consider many issues prior to and during implementation. The PFI suggests specific dimensions, such as: complexity, significance, magnitude, comprehensiveness, frequency, duration, uniqueness, authorization, flexibility, time availability, the plan's confidential nature, the clearness of the plan, and the formality, specificity, completeness, accuracy, and stability of the plan. See Appendix O for the PFI Table of Contents.

Those who implement the strategy will include some who developed the plan as well as those who did not. Motivation will come from middle to executive management, if, in fact, the plan will be carried out. The evaluation plan will help promote the execution of the plan. What must be done to carry out the plan will include a program statement regarding each action event planned that will identify steps required to execute the action plan. Identified procedures will provide techniques to perform a particular task or job. These action plans and accompanying steps will be developed as the plan solution sets are developed.

Implementation of the plan will require changes among the University community. The most visible change targeted is within the computing services. "The social change process is an effective means for introducing new directions, however, its success often depends on the manager's decision style" (Rowe, Mason, & Dickel, 1986, p. 268). As noted in the Introduction, prior management style was inconsistent with changes required in the plan. Thus, an organizational change regarding technology management has recently been implemented, with the author installed as Manager of Academic/Institutional Computing Support Services (this is partial outsourcing, as the author is still employed by TSI as Technical Manager). The directorship of the office has also changed, along with a change in name. The department is now known as Computing and Telecommunications Services (CTS) and the new Director (to whom the author reports) is a fellow TSI employee. Both changes are designed to provide a different, more user-oriented management style and to enhance the utilization of technology within the University. The Director of CTS is responsible for the coordination of implementation of each of the sections of the plan. He is an experienced TSI employee who has implemented plans in the past. In addition, TSI provides a pool of resources that will assist in implementing the plan, if needed. This is the first step to implementing the plan.

The implementation of a specific and comprehensive strategic plan for technology provides the measurement required of the institution regarding positioning in the competitive marketplace. At the end of the specified time period, the University should be able to assess its success in using higher levels of technology. A timeline of events will be included in the final plan from which to measure.

The plan is a living document that requires monitoring to stay current and focused on the intended objectives. New technology advancements will render some objectives obsolete. Thus, new objectives will replace old objectives just as new technology will be targeted to replace old technology. The plan will provide a path that, if followed to conclusion, will result in the following influences: increased productivity, increased knowledge, increased morale, increased effectiveness of financial planning, and reduced costs. Embry-Riddle may then enjoy increased interest by prospective future students.

Each department must formulate their own strategy for implementation. The plan for implementation should consider programs, budgets, and procedures (Wheelan & Hunger, 1983). Programs are statements of activities needed to accomplish the action described in the plan for that particular department. They are action-oriented. For example, to introduce higher levels of technology utilization, such as high quality computers, an academic department must first identify the desired end-results to be accomplished as well as design the integration into the curriculum.

A budget is a statement of the organization's programs in terms of available dollars. Thus, the academic department must define technology utilization in terms of what they can afford. Procedures are a system of sequential steps that describe how to perform a task. For example, the academic department may need to create a team of academicians to design integration of technology into the curriculum together as a team. Such strategies will depend upon who is implementing the action plan. Consultation will be available from CTS for the purposes of providing advise t the various departments when considering implementation.

It is important that plan implementation strategy carry a proactive philosophy. Such a proactive concept may still provide reactive procedures, if reacting to a current problematic environment (Desai, 1987). The Strategic and Tactical Plan for Computing and Telecommunications at Embry-Riddle Aeronautical University will include tactical strategies for implementation. These will be included in the Solutions section of the plan. Appendix N shows an example of a strategic implementation solution plan, known as an action plan.

All levels of the University community should be focused and dedicated toward providing the highest quality educational environment. By taking strategic initiative of resources available, the University is positioning itself to meet the challenge of high quality information access in the '90s.

14. Evaluate the Plan

The only way expectations for the plan can be judged is through a rigorous evaluation design. At specified times, the status of the environment must be studied to determine how effective the action plans from the strategic plan have been (Best & Kahn, 1993). Determining the exact time of such evaluation is dependent upon what has been implemented as well as when it has been implemented.

Evaluation may be categorized as either formative or summative evaluation. Formative evaluation is designed to specifically help in the development of the plan while summative evaluation is designed to determine the overall effectiveness of the plan (Anderson, Ball, Murphy, & Associates, 1975). Tools such as WOTS-UP, the Nominal Group Technique (NGT), and survey questionnaires may serve as both formative and summative evaluation instruments. In almost every case, summative evaluators must consider effectiveness in light of the defined goals and objectives.

In this study, an established evaluation model will be used. Guba and Stufflebaum (1970) offer four types of decision making upon which the evaluation topology can be based. Context, Input, Process, and Product (CIPP) evaluation can serve as a guide of activities to evaluating the effectiveness of the plan (Anderson, Ball, Murphy, & Associates, 1975; Stufflebaum, Foley, Gephart, Guba, Hammond, Merriman, & Provus, 1971).

Context evaluation, diagnostic in nature, attempts to discover any discrepancies between the plan's goals and objectives and the plan's actual impact, so that planning decisions may be made or changed to produce greater correlescence between the intended and actual outcomes. Survey questionnaires, as yet defined for this plan (contingent upon approval of all or parts of the plan and what changes may occur during the approval process) may serve as context evaluation tools.

As suggested in the literature (Beeman, 1989), Brown University promotes a periodic self-study program to help control and evaluate the use of technology as a result of their strategic planning process. Embry-Riddle also promotes a self-study program the evaluate program utilization throughout the

University for the purposes of SACS accreditation (ERAU, February 23, 1993). Known as the "Climate Survey," this self-study program provides information on a yearly basis that is quantified and used to promote University enhancement programs on a variety of subjects. This is designed to provide a snapshot of the environment at specified periods of time. Appendix L displays a sample page of the ERAU Climate Survey.

Input evaluation provides information about the means necessary and available to reach the plan's goals. Process evaluation provides daily feedback (i.e.: interpersonal relationships, logistics, and adequacy of staff performance) to aid managers in monitoring the implementation of the action events defined in the plan. Effective input evaluation tools include Program Evaluation and Review Technique (PERT) and brainstorming, such as Delphi or Nominal Group Technique (NGT). Embry Riddle has experienced the use of the NGT model. This will be a main process for identifying the success of problem solution implementation. The process will be performed after the first year and on an annual basis to determine if the same problems continue to exist after implementation of the first year's planning events. The results will indicate that either the strategies implemented are ineffective or the problems have yet to be addressed. In the case of the latter, the next year's phase of the plan may require adjustment to include attention to the identified problem areas. Appendix P provides information that will be distributed to members of the

Computing Governance Committee for the purposes of performing the NGT process.

NGT may lead to the use of Force Field Analysis as a way to identify the driving forces that cause problems and the restraining forces that may prevent positive change (Goal/QPC, 1991). This can be helpful to thinking and a strategic tool for change. Appendix Q provides an example of Force Field Analysis.

Process evaluation provides the information required for day-to-day decision-making needs to carry out an action event. Staff meetings, PERT charts, and progress reports provide the means of information exchange regarding process evaluation. *Product evaluation* measures and interprets the extent to which goals have been attained. This is a form of Quality Control. Annual NGT sessions will provide such information. Appendix R provides a questionnaire that may be offered to the CGC to help determine whether the planned events have made a positive difference at ERAU. The instrument will be administered annually.

Summary of Chapter 3

There are many different methods of planning. Most planning is consistently categorized into four components in some fashion (Rowe, Mason, & Dickel, 1986): Define the future scope of the organization; Define competitive advantage and market niche; Develop a statement of purpose; and Define the allocation of resources. These components are integrated into the planning process, which usually starts with a plan-to-plan. The author employed a plan-to-plan to initiate and assist in the development of the formal plan.

The following identifies the step of the development of the formal plan:

1. Conduct the Needs Assessment
2. Complete the WOTS-UP Analysis
3. Identify Participants
4. TQM - Define Critical Success Factors
5. Define Goals and Objectives
6. Identify Competitive Strategy
7. Identify Resource Strategy
8. Define the Scope of the Plan
9. Gather Information
10. Formulate the Plan Outline
11. Write the Document
12. Validate the Plan and Receive Approval

13. Implement the Plan

14. Evaluate the Plan

Development of the plan incorporated assistance from Embry-Riddle employees as well as resources from TSI. Information was gathered from the pre-plan needs assessment, WOTS-UP, survey questionnaires, and employee knowledge and experience. Validation of the plan must be made by approval of the Administrative Subcommittee of the Computer Governance Committee. Once the plan is approved and implemented, it must be evaluated to determine its success. Evaluation will take form as surveys and group discussion (such as using the Nominal Group Technique). The entire planning development process of the plan will take approximately one year with evaluation of the plan to take place annually.

CHAPTER 4

RESULTS

The Strategic and Tactical Plan for Embry-Riddle Aeronautical University has been completed in final draft form and is under review from the Computer Governance Committee (CGC). The CGC has disbursed the plan to its three subcommittees to do a detailed review of the content and make suggestions as to its accuracy and direction. The early feedback reflects a positive attitude regarding both the accuracy and direction, although, as yet, there has been no official word of acceptance from the CGC.

The plan follows the format of identifying the current technological environment of the institution, then defining the perceived requirements, and finally specifying the solution sets that will allow the University to migrate from the current to the desired level of technology usage. This offers a natural flow between sections of the plan, with the solutions set using the requirements as its reference base. The requirements sections uses the current environment as its reference base (Ferrante, Hayman, Carlson, & Phillips, 1989). Appendix I offers an outline of the plan.

There is an extensive appendix section to the plan. It describes, among other items, hardware and software used in the institution, network structure, documents pertaining to decision-making involved in choosing a new student information system, discussion about current development projects underway, and the organizational changes planned. The appendix is not yet complete.

The format of this chapter follows the format of the procedures in Chapter 3. The concept is that by presenting the results in relatively the same order as those procedures proposed in the previous chapter, a logical comparison can be made between the expectation of the planning process and what actually happened. The procedures that were followed did result in a completed plan, but the quality of the plan may have suffered due to the variation in the procedures. Resolution to the problem originally stated was accomplished, but future evaluations and adjustments of the plan will indicate the degree of quality of the completed plan.

Plan-to-Plan

No organization, no matter how large, can examine thoroughly all of the elements that may conceivably be included in a plan. However, the organization of the planning process has a definite and long-lasting effect on the resulting plan. The plan-to-plan is an instrument that greatly enhances the planning process. It helps provide the institution with the understanding of the environment and the desired objectives of executive management (Steiner, 1979). Appendix K provides the plan-to-plan.

The plan-to-plan may be used as a training tool for future planning. Once the annual review is made of the plan, the plan-to-plan may again be looked upon as a guide to help define the information that needs to be considered, especially if the resulting plan needs significant changes. It may be used as a model for other areas of planning within the University. The plan-to-plan may also be used as an instrument of measurement. After each year, the goals and objectives stated may be compared to the environment to see if they were achieved. New goals may need to be defined if earlier goals were achieved or are no longer applicable.

In developing the Strategic Plan for Computing and Telecommunications, most of the steps described in Chapter 3 of this document were followed. There were some procedures that were not followed due to various constraints outside the author's control. The following describes the manner in which those steps were followed and identifies the associated impacts during the process. It also describes the rationale behind employing the people involved in the process and what effect they had on the process and development of the plan. Rationale is provided in those areas where the procedures were not followed.

Conduct the Needs Assessment

Technology Specialists, Inc. (TSI) sent a survey team to the University early in 1992 to conduct the needs assessment. The purpose was to "perform an analysis of Administrative Data Processing and Records and Registration functions" (ERAU, February 28, 1992, p. 1) and provide an environmental scan of the institution. TSI's team consisted of the president of the company, two vice presidents, three regional directors, and a networking specialist. This team provided the institution with experienced, knowledgeable professional and the stature of the participants suggested that ERAU was very important to TSI. ERAU participants represented administrative and academic departments, meeting individually with the TSI staffers as well as in group settings. Extensive interviews were conducted with the President, Vice Presidents, Provosts, key administrative personnel, academic technology users, and computing services staff to provide the information to the needs assessment. The assessment lasted three days. The interviewers had no prepared questions, preferring to conduct an informal interview session to offer a more relaxed setting.

Once the interviews were concluded, the TSI staff met with ERAU management to discuss, in an overview session, their findings. ERAU management included the Vice President of Administration, the Dean of the College of Continuing Education, the Vice President of Student Affairs, the Director of Data Processing, the Director of Academic Computing Services, the Controller, the Director of the Office of Institutional Research and Effectiveness, the Provost, and a faculty representative from the Prescott campus. The findings were then formalized in the Needs Assessment document and presented in a formal session to ERAU management.

The following provides some of the findings (TSI, March 31, 1992, p. I-1):

- inadequate return on the computing investment;
- need for establishment of policies related to technology;
- inappropriate (an antiquated) style of technology delivery;
- poor access to information in almost all areas and levels of institution management;
- incomplete administrative systems;
- unnecessarily costly hardware direction;
- deficient productivity of technical staff and the user staff they support;
- deficient technology methodologies; and
- lack of administrative computing center management and vision.

WOTS-UP Analysis

The following (Table 2) is a composite of the results identified through use of the WOTS-UP analysis applied to the department of Data Processing, combining both the previous organization (Data Processing) and looking ahead to the Office of Information Technology (explained later in the section labeled Organization and Staffing Requirements). The information was gleaned from a self-study conducted within the Computing Services Department. Each manager was asked to identify areas of concern and to respond to the Director of Computing and Telecommunications Services (CTS). CTS chose to use WOTS-UP analysis because it easily identifies, in list form, the particular areas needing attention. Its list format provides useful information, even at quick glance. Each manager could identify areas that he felt would fall under each of the analysis categories. The author was asked to interpret the information and format it into a WOTS-UP analysis form. The information was then used to help develop departmental goals and subgoals to supply the Office of Institutional Research and Effectiveness with information to include in their assessment analysis. The information was also used as additional information to the needs assessment to identify the environment and the opportunities within.

Table 2: WOTS-UP Analysis Results

OPPORTUNITIES

O-1. New Leadership✓

O-2. New Technological Innovations✓

O-3. New Sources of Funding✓

O-4. Eagerness of University to Make Changes

continued on next page

O-5. Distance Learning✓

O-6. Multi-Campus Environment

O-7. External Leveraging✓

O-8. New Hardware and Software Platforms

O-9. Client/Server Technology

O-10. User Information Access and Control✓

O-11. The Internet and Information Exchange

O-12. Online Library

O-13. Help Desk

O-14. Decreasing Hardware and Software Costs

O-15. Cooperative Partnerships

O-16. Higher Computer Literacy

THREATS

T-1. Poor Technology Policies✓

T-2. Inappropriate Style of Technology Delivery✓

T-3. Incomplete Administrative Computing System

T-4. Costly Hardware Direction

T-5. No Prior Strategic Computing Plan✓

T-6. No University-wide Network✓

T-7. Resistance to Change by Some University Factions

continued on next page

T-8. Inadequate Technology Usage✓

T-9. Rapidly Advancing Information Technology

T-10. Lack of Computing Standards✓

WEAKNESSES

W-1. Inadequate Return on Computing Investment✓

W-2. Deficient Productivity of Staff

W-3. Recent Reorganization Deflated Morale

W-4. No Formal Training Plan

W-5. Current Systems Require High Degree of Overtime Work

W-6. Deficient Technology Methodologies✓

W-7. Poor Information Access

W-8. Prior Lack of Computing Management and Vision✓

W-9. Antiquated Computing Technology✓

W-10. Poor Retention Potentially Related to Student System

W-11. Downturn in Enrollments✓

W-12. Poor Capital Planning and Expenditure Management✓

W-13. Inadequate Planning/Training for Integration of Technology

STRENGTHS

S-1. Computing Governance Committee✓

continued on next page

<u>S-2. New Leadership✓</u>

<u>S-3. New Visions✓</u>

<u>S-4. New Goals✓</u>

<u>S-5. Acceptance of New Technologies</u>

<u>S-6. External Leverages✓</u>

<u>S-7. New Management Methodologies✓</u>

<u>S-8. High Desire to Integrate New Technologies</u>

<u>S-9. New Student Administrative System</u>

<u>S-10. New Hardware Platform</u>

<u>S-12. Skilled, Knowledgeable Employees</u>

<u>S-13. University Recognition of Importance of Technology✓</u>

<u>S-14. New Service-oriented Philosophy</u>

✓ = Critical

It was clear that the Data Processing organization needed improvement in areas of user orientation and productivity management. The existent policies required evaluation to determine their effectiveness. In addition, the policies had not been communicated effectively so that the user community could understand the proper procedures regarding technology utilization. The Data Processing (DP) department controlled all facets of computing services and support, leaving the University to rely totally upon the DP department for any purchases, advice, or authorization of technology utilization within their own departments. This caused a high degree of inefficiency and unnecessary paperwork regarding such policies, and this provided less effective services to the user community.

The hardware platform was saturated and reflected that prior planning was insufficient to ensure adequate support the current environment, causing less effective services to the users. For example, there were not enough ports available to provide all users with access to the computer. During peak times, such as registration, some services were offloaded from the computer to provide a minimally acceptable level of response time. Proper monitoring and resultant action would have provided for a plan that called for a higher level of investment in the computing environment before the danger level of saturation was approached.

The strengths of the department were derived on the evidence that computing operations are currently taking a different organizational shape and philosophy (see Organization and Staffing Requirements below). There is a new philosophy toward transitioning into a true service department rather than one steeped in development. This new philosophy will offer computing staff the opportunity to learn new technologies to enhance skill levels. It will also benefit the user community by allowing user liaisons from the computing staff to work directly with the users to set strategies to improve the working environment. This may manifest itself in many ways, including the analysis of current department procedures and ergonomic design and structure of the respective departments. It also offers the departments additional resources that they previously did not have. Opportunities are being explored to promote cooperative partnerships with community and national businesses. This will help identify potential additional sources of funding as well as provide better employment opportunities for ERAU graduates.

Participants and Resource Strategy

TSI and ERAU entered into an agreement to establish a Technology Management Partnership (TMP). Coined within the agreement, the TMP included personnel from both parties to work in concert to provide an enhanced mode of support for the University. The TMP had two basic responsibilities: 1) support current systems and 2) support the vision of the future. TSI was charged with directing the efforts to infuse technology into the institution while ERAU personnel was to support the current environment. As a unit, TMP was charged with assisting in development of the plan.

TSI personnel included the Director of Future Technologies, one regional vice president, the technical manager (the author's position at the time), and various other specialists in the company from a general resource pool. The resource pool was used on an as-needed basis. The TSI personnel provided valuable experience in higher education on varying levels. The regional vice president established rapport with upper level management, the Director of Future Technologies had recently been Computing Center Director at another four-year institution and provided experience in developing similar plans. The technical manager provided technical experience in higher education and could analyze the environment and develop portions of the plan from a technical sense. TSI personnel provided the information regarding future opportunities in technology.

ERAU personnel included the Computing Center Director to liaise between ERAU and TSI personnel, two Computing Center programmer/analysts to provide insight into the environment from a technical perspective, and a small ERAU resource pool to provide assistance when necessary. ERAU personnel provided information about current systems and functionality. In addition, their established rapport with the user community provided a natural link to understanding the functional environment.

Critical Success Factors and Goals and Objectives

Gathering information from various resources, such as the internal University Self-Study and the Needs Analysis done by TSI, the author developed Critical Success Factors. The CSFs were developed under the premise that these are the most important entities to be in place in order for the University to be successful. Success is defined by the author as increased levels of retention and increased enrollment on an annual basis. These CFSs can be evaluated for success each year against WOTS-UP analysis. WOTS-UP will provide specific areas that are deemed strengths and weaknesses. If areas determined as critical to the success of the University fall into the weaknesses of the WOTS-UP analysis, a strategy must be determined to address such issues. The WOTS-UP results include only those items pertaining to Computing and Telecommunications, and thus cannot all be directly linked to the full compliment of CFSs.

The CSFs were provided to the Office of Information Research and Effectiveness (OIRE). The OIRE is responsible for providing statistical information that can be used by the University as input to planning. These CFS's (Table 3) provide an overall picture of the factors that must be performed well and are viewed as critical to the success of the University (Martin, 1982; ERAU, February 23, 1993; ERAU, February 3, 1992):

TABLE 3: Critical Success Factors

CRITICAL SUCCESS FACTOR	RESPONSIBLE PARTIES	WOTS-UP LINK (See WOTS-UP List)
1. Avoid decreases in enrollment	Director of Admissions, Faculty	W-10; W-12; W-13
2. Maintain technical concurrency	Director of Computing and Telecommunications Services (CTS)	O-1; O-2; O-3; O-7; O-8; O-9; O-11; T-1; T-5; T-6; T-8; W-4; W-8; W-13; S-1; S-2; S-3; S-4; S-7; S-13
3. Provide information access at one's fingertips, including network capabilities	CTS	O-2; O-3; O-4; O-8; O-9; O-10; O-11; O-12; O-13; O-16; T-3; T-5; T-6; T-7; T-8; T-10; W-4; W-5; W-6; W-8; W-9; W-10; W-13; S-1; S-2; S-3; S-4; S-7; S-8; S-9; S-10; S-11; S-12; S-13

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CRITICAL SUCCESS FACTOR	RESPONSIBLE PARTIES	WOTS-UP LINK (See WOTS-UP List)
4. Provide information access to remote sites	CTS, CCE	O-2; O-3; O-4; O-8; O-9; O-10; O-11; O-12; O-13; O-16; T-3; T-5; T-6; T-7; T-8; T-10; W-4; W-5; W-6; W-8; W-9; W-10; W-13; S-1; S-2; S-3; S-4; S-7; S-8; S-9; S-10; S-11; S-12; S-13
5. Provide technology training for University	CTS	O-5; O-8; O-9; O-15; T-5; T-6; T-7; T-9; T-10; W-4; W-6; W-9; W-13; S-2; S-5; S-7; S-11; S-12; S-13
6. Provide more terminally degreed faculty	Faculty Senate	Not Applicable
7. Provide more computer-based instruction	Faculty Senate, CTS	O-1; O-2; O-5; O-10; O-11; O-12; O-13; O-16; T-2; T-3; T-5; T-6; T-7; T-8; T-9; T-10; W-4; W-6; W-7; W-8; W-9; W-13; S-1; S-2; S-3; S-5; S-8; S-11; S-12
8. Provide more teaching and athletic facilities space	University Management, Board of Trustees	Not Applicable

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CRITICAL SUCCESS FACTOR	RESPONSIBLE PARTIES	WOTS-UP LINK (See WOTS-UP List)
9. Increase Library holdings and databases	Daytona Beach and Prescott libraries	Not Applicable
10. Maintain a Long-range Financial Plan and an Educational Master Plan	University Management	Not Applicable
11. Continue SACS accreditation	Institutional Research	Not Applicable

The critical success factors for which CTS is responsible (CSF #'s 2, 3, 4, 5, and 7) have direct ties to the goals stated below. The associated WOTS-UP entities have an impact on attainment of the CFSs. Each year the WOTS-UP analysis will identify weaknesses within CTS that may have an impact on the CFSs. The University may focus on any one CFS and determine what entities impact its achievement. Strategies may developed to provide a path for solutions to negative impacts on University CFSs. The WOTS-UP entities specific to CTS will impact various CFSs, thus the Strategic and Tactical Plan for Computing and Telecommunications will have a direct influence on the success of the University. New goals and objectives will be defined at each annual review.

The plan contains provisions for technology enhancements that will directly affect the environment and provide answers to the CSF's. There are specific work solutions in the Solution Sets Section of the plan that address the issues that will ensure the consideration of CSF items. For example, The new student system will provide better and more access to information. The new system will allow the users to control much of their data inputs and outputs. The timeline refers to the new system in Work Program II.A.1 (see appendices T and V). Other suggestions that address issues pertaining to the critical success factors include provisions for: executive management and University staff computing literacy programs; decision support and executive information systems; more service-oriented organizational considerations; net work and telecommunications plans; faculty training for CAI and CMI course offerings; multimedia labs and associated training; increased levels of computing equipment investments; analysis of Library needs and increased use of CD-ROM databases; and increased use of office automation equipment and training.

As part of the University's commitment to Total Quality Management, the Office of Institutional Research and Effectiveness (OIRE) has recently promoted the planning process through an Assessment Workshop. The purpose of the workshop was to introduce to and educate departmental managers about planning instruments. The objective was to persuade managers to use these tools to define objectives for their respective departments and then identify the solutions to achieving those objectives.

The tools suggested at the Assessment Workshop included WOTS-UP analysis, Brainstorming, Nominal Group Technique, Force Field Analysis

(Appendix Q), Process Flows, Pareto Charts (Appendix X), Fishbone Diagram (Cause/Effect) (Appendix X). The tool chosen was left to the discretion of the individual departments. The expectation of OIRE was that by providing the tools to the various departments and identifying their use, the process of identifying goals would be easier. The tools should help improve the processes within the University and minimize mistakes. The philosophy was to improve quality by improving the process. "Improvement is a process, and quality is the result. Quality cannot be improved directly; it is the result of improving the process used to produce the product or service" (ERAU, 1993, p. 16). The author did not confer with other departments to identify what tools each would use.

Information resulting from the Assessment Workshop was used as a guideline for completing departmental goals and objectives (mentioned above under the heading WOTS-UP Analysis). These were included in the overall University strategic plan. WOTS-UP analysis is used to define the weaknesses, opportunities, threats, and strengths that may suggest strategies that may be tested against the University's mission and goals. The Office of Institutional Research and Effectiveness required a list of goals from each department.

Early in 1992, the identified institutional goals for ERAU. Personnel from many parts of the University participated in goal development. The Computing Governance Committee determined the vision of computing and charged CTS with defining departmental goals. This was consistent with other departments who had the same charge.

The goals defined by Computing and Telecommunications Services provided input into the assessment plan for the University as well as the strategic plan for computing. The format of the assessment that each department was asked to perform is as follows:

University Goal (N.N): A goal statement of the University that could be applied departmentally. (N.N) is the number assigned to the University Goal statement;

Subgoal (N): A possible subgoal that could be used to support the University goal statement;

Objective N(:) An objective that supports each subgoal;

Assessment Measures: The way the department will measure whether or not they have achieved the desired goal.

This format closely follows that offered by Hoc (1988). By decomposing goals into subgoals, basic operations may be better identified and lead to specific actions. The subgoals can be carried out in parallel corresponding to the satisfaction of preconditions (other subgoals, each being the precondition for the next). Each subgoal is decomposed to objectives and must be measured for success against the assessment measures.

The goals and objectives for technology were defined as part of the brainstorming strategy. The principals (TMP and TSI officials) identified these goals based upon previously identified goals of the University in combination with TSI's experience and knowledge of technology trends (see Chapter 2 Literature Review). The format stated above provided not only for the statement of the goals, but also the required assessment tactics for measurement. The Director of Computing and Telecommunications gathered all the information identified by the principals and formatted them into the required format. The final goals, objectives, and assessment measurements identified what was feasible, the types of data to collect, how the data would be analyzed, and the expectations for improvements (another TQM principle). The goals would then be implemented as a part of the planning process.

The implementation of the new Student Information System is one example of the link between the plan, WOTS-UP analysis, and CFSs. The new system should provide greater information access in a much less costly fashion. By doing so, the information access Critical Success Factor may be attained in a systematic manner.

The following list contains the prime objectives of the technology improvement plan (Technology Specialists, Inc., 1992, pp. EXEC-7, I-5,I-6). These were later reformatted into the Goal/Subgoal format.

- Establishment of the University's technology improvement goals for the next five years;
- Definition of existing University technology deficiencies and proposed solution sets for meeting such problem areas;

- Provision of alternative technology platform solutions with applicable cost/benefit analysis;
- Presentation of related priorities, checkpoints, schedules and costs for implementing suggested solutions;
- Provision of necessary data to aid in the determination of future equipment needs, space and staffing requirements, and budgetary implications; and
- Establishment of a management tool to be utilized in tracking and assessing the progress of appropriate University technology service providers in meeting the needs of the served community.

Beyond functionally-oriented objectives, specific technological principles are aggressively pursued as shown below:

- *Integration*: An intelligent database foundation is critical for promotion of true integration and elimination of redundant, inefficient practices. Relational concepts, data dictionaries, data administration, history techniques, data consistency, and audit and security issues all are ingredients.
- *Flexibility*: The technology platform must not hinder Embry-Riddle's unique situations and growth. Regarding hardware, ERAU strives to be positioned to take advantage of emerging technologies. Considerations may include: a UNIX platform, client-server environments, E-mail, voice mail for staff and

students, Computer-Aided Instruction (CAI), automated administration, distance learning, multimedia capabilities, and distributed communications principles in general.

With regard to application software, considerations include: user-friendly environments, user-defined criteria, unlimited record capacities, and extensive reporting capabilities. Other considerations include the following:

- *User interface*: Human factors and consistency are very important for end-user acceptance. Consistent techniques and procedures ease the on-going training burden. A new Student Information System has been chosen by University officials that will enhance the user interfaces. The current system was written in-house and uses intrinsics from the proprietary operating system, but cannot take advantage of an open environment. The new system will run under the Unix operating system, allowing for portability. The new system will also offer a commercially developed application that uses VT320 graphic capabilities. It uses function keys to allow for a more user-friendly environment.

The University is investing in more Windows applications. Training for the users has been planned and all users with personal computers will be charged to use the Windows interface. Faculty is investigating multimedia and is developing a plan for its use.

- *Adaptability*: Interface bridges combining the functionalities of hardware, software, and networking must be supported and straight forward. The ability to interface with specific internal as well as external applications must be easily accomplished. The new networking plan provides a strategy to network the entire University (Daytona Beach campus) within the next year. It will serve as a tool for instruction, research, and University support. Access to the Internet will enhance communication and access to a nationwide network.
- *Return on Investment*: An investment of resources is measured by its return. The investment in technology must support the purpose of the University. The University is in the process of streamlining operations. The plan is the first step in that process. An example of how the University will see greater return for its investment in technology will be displayed after the implementation of the new student system is complete. The number of employees supporting the system is planned to decrease from a high of fourteen to an optimum number (projected at 4). This will provide the University with a more cost-effective operation. The network will also allow for more streamlined operations by reducing the costs of software.

A commitment to Embry-Riddle's philosophy has been and remains a constant influence. Such a commitment includes:

- Providing, within realistic constraints, a baseline level of computing and information support for the needs of the educational community in the areas of instruction, administration, and public service;
- Improving the performance, quality, and effectiveness of students and faculty through applied knowledge relating to computing tools and techniques;
- Incorporating modern technology into the University curricula to advance the level of academic excellence;
- Improving administrative productivity and efficiency to better serve the student and staff communities;
- Enhancing support for University management, allowing for more informed avenues of decision-making; and
- Offering unlimited access to the world of students via enhanced distance learning capabilities, thereby becoming a "university without walls."

Competitive Strategy

The instrument, designed by the author to generate a competitive strategy, has yet to be implemented. Because Embry-Riddle is an aviation and engineering institution, it provides unique programs in niche markets with limited competition. The author continues to work with the ERAU staff to identify the competition and expects to use it in the future planning work.

Scope of the Plan

TSI does not offer a boilerplate format for definition of the plan scope. This is a joint effort based upon the needs of the institution. The scope of the plan was identified by TSI and ERAU management personnel. The idea was to create a plan that would identify strategies and solution sets to arrive at specific goals and requirements defined throughout the process. Both parties identified a planning time period of five years. The scope included defining the current technology environment as well as identifying the best environment for ERAU. Once identified, the plan was to include strategic and tactical action events designed to implement the strategies defined.

Information Gathering

Much of the information included in the plan was gathered from the users. They were given the opportunity to participate in the process by completing assessment surveys (see appendix L), interviews, and brainstorming sessions. Other information sources included existing documents, such as previous planning documents. The surveys were input into Lotus 123 spreadsheets and tallied.

As an example of some of the information gathered, one survey identified that the perceived skill level of the faculty is less than optimal. In the Graduating Student Survey (See Figure 9 on next page) administered on the Daytona Beach Campus in April 1991 (ERAU, 1991, p. 10), 35.4% of the respondents rated faculty computer skills as very inadequate or inadequate. This reflects a less than effective learning environment. Faculty unfamiliar with state-of-the-art equipment cannot adequately prepare students who will enter a working environment using state-of-the-art equipment. The results of this survey were used as input to identifying needs of faculty. The resulting solution defined within the plan provided for an increase in the computing equipment and training for faculty over the next five years.

This is a clear indication that there is a need for technology infusion into the curriculum. The plan has a section specifically targeted toward higher levels of use of technology in the classroom.

At present, higher quality personal computers and workstations are being installed in the student labs as well as in the faculty offices. This will allow greater accessibility to information while forcing faculty training to result in higher levels of faculty computer literacy (Marks, 1989). This will provide opportunity to investigate ways of introducing computing tools to aid in instruction.

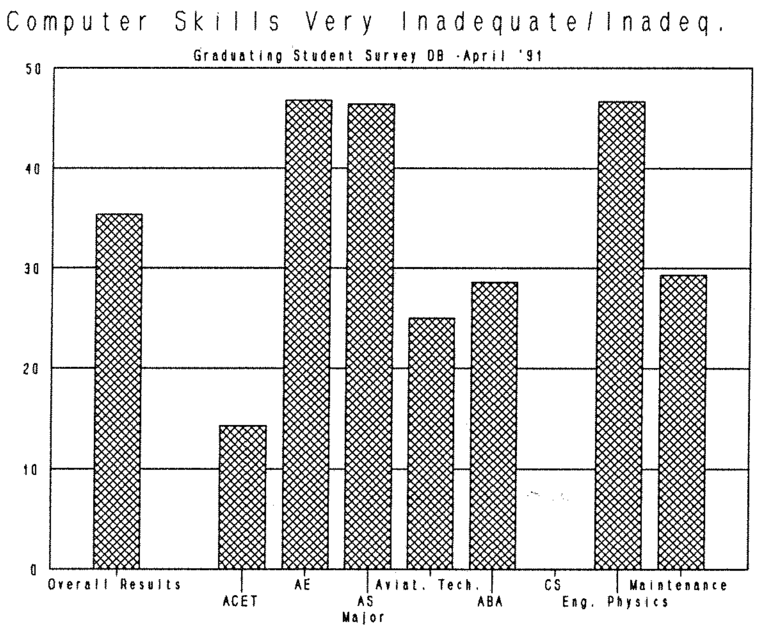

Figure 9: Faculty Skill Level

Plan Outline

TSI officials offered a standard format for planning documents. The format follows the same objectives suggested by Shirley (1982) and Cleese (1992).

The author used this standard format and developed the final plan outline as described in appendix I. TSI suggested the same outline that the author proposed in Chapter 3 of this document. The outline was approved by TSI officials as well as by ERAU officials.

Draft Plan

The draft of the plan was written in phases by the author and those he requested and appointed to assist. All participants in the writing of the document were not resident at ERAU. Two of the writers lived in other states and transferred the information via electronic mail. The document was written using a number of PC tools, including: WordPerfect's Master Document utility to break up the size of the document to manageable proportions; Timeline by Symantec to develop the project management document; Quattro and Excel spreadsheets; and Windows' Paintbrush as an intermediate facility to convert spreadsheet graphics to WordPerfect graphics.

The plan is in final draft form, but it took a number of iterations to get it to the point where it could be presented to the staff of the University. TSI officials had approved the final of the plan before they presented it to the University officials. The draft of the plan is permanently bound, but the final accepted version of the plan will be included in three-ring binders so that it can be modified. As each year ends, changes for that year will be put in a separate section of the plan, and each subsequent year will become one year more current, and a new fifth year will be developed.

Plan Validation and Approval

The plan was presented to the Computing Governance Committee. The CGC distributed the document to each subcommittee, including the Administrative Subcommittee of the CGC, the Academic Subcommittee, and the Network and Telecommunications Subcommittee (Figure 8 in Chapter 3 provides a graphical description of the CGC and its subcommittees). Each subcommittee was charged with reviewing specific sections of the plan that was related to the purpose of each subcommittee. The subcommittees will continue to provide the author with potential changes that may result from shifts in the environment, changes in University direction, or fluctuations in the economy at the time of the review. No specific date has been set for completion of the review.

Implementation and Plan Evaluation

Sections of the plan have already been implemented. Even though it has yet to be formally accepted, there was a need to begin implementing portions of the plan to which the University had already committed. The implementation of these sections of the plan did not follow the implementation schedule since University officials opted for some implementation prior to the completion of the Plan for Implementation (PFI) document. Once the plan has been officially approved, the Director of Computing and Telecommunications Services expects to use the PFI as a guide for implementation of solutions provided within the plan, including the responsible parties. The PFI will be adjusted annually to reflect external changes. Appendix O contains the Plan for Implementation for the first year.

The remainder of this chapter describes the major sections of the plan in detail. "Where we are" provides results of data gathered that describes the current technological environment of the University. The following section, labeled "Where we want to be" identifies results of investigation of the state of technology and how it can be applied to the University environment. The last section, "How do we get from here to there" contains data resulting from the Solutions Sets section of the plan (TSI, 1992).

The reader must be aware that the information within this document, as well as that within the plan, will become obsolete as time passes. The institutional environment will change based upon variables such as enrollment, the economy, and infusion of technology. This may, in turn, change other requirements. As technology is introduced, it precipitates changes in the planning process regarding future investments. Thus, the annual review and evaluation of the plan may cause a complete re-write of the requirements and solutions sets of the plan.

Where We Are!

The following three main sections describe results of information gathered about the current environment, the desires of the University, and how it can get to its desired results. "Where we are" defines the current technological environment and identifies some of its weakness. "Where we want to be" identifies the some of the technology that the University would like to infuse into its business and instruction. "How do we get from here to there" identifies action events that lead to the implementation of the suggested solutions in the plan.

Based upon the findings of the Needs Assessment provided by TSI (TSI, March 31, 1992), Embry-Riddle Aeronautical University is currently working at what could be considered the low-end of the technology spectrum. The University management understands that large investments in technology are required to improve utilization within the University. The following goals and objectives affirm the commitment to technology integration on the part of the University.

The resulting plan focuses on areas within the University that must be addressed to bring the utilization of technology to a level that will make future infusion of technology easier to occur. The information gathered in this study for the purposes of plan development revealed that the University must upgrade technology in the following areas: Administrative Computing, Academic Computing, Network and Telecommunications, Office Automation, Library Resources, and Organization and Staffing of the Data Processing Center. The concerns were addressed by identifying information regarding the current environment, requirements for the future, and the path that leads to greater technology utilization.

Administrative Computing

While the functionality of the financial systems (Human Resources and General Ledger) meet current needs, the present student administrative information system is inadequate. Developed in-house, the system suffers inadequacies regarding system and database design (TSI, 1992, March 31). In-house expertise lacked global vision and the product was developed as a reaction to problems rather than in a proactive, visionary manner. Poor design methodology resulted in segmented, multiple databases. System integration was an after thought. This segmented design caused inefficient and less effective data access, resulting in less than optimal services to the students.

The system requires a large resource investment to maintain and operate. Because the system is batch-oriented, much of the processing is done at night, requiring 24-hour monitoring. Operators are required to input critical job parameters, even though they are unaware of the purpose or what the parameters do. This results many times in processing errors, requiring programmers to be on-call at night. In addition, because the database structure is so complex and disjointed, each programmer has become a specialist with one particular portion of the system, such as Admissions. If there is a problem with the Admissions module and the programmer is not available, the problem goes unresolved until that programmer becomes available. This causes user services to be less effective.

Integration of the student information system exists only as much as was developed through ancillary programming efforts. The basic modules of the system are autonomous in nature and were developed and implemented as reactions to separate problems. There is no evidence that suggests a global perspective when developing solutions to autonomous problems. The student system is minimally functional at best.

The current hardware under which the student systems operate is outdated and its capacities are over-extended. Performance charts (see Appendix S) show that at heavy times, memory management exceeds the recommended limits for Central Processing Unit (CPU) consumption. Operation procedures dictate that batch jobs run during the day, competing with interactive jobs for CPU time. This results in system degradation, causing inefficient operations by administrative offices.

With the University choosing to invest in a new student information system, the opportunity arose to investigate expanding the hardware platform. The new student system would be the primary determinant of hardware requirements. The chosen student system would run on many different platforms, including Digital Equipment, IBM, Hewlett-Packard, Unisys, and Prime. Investigation by TSI, commissioned by ERAU to do hardware analysis, resulted in a decision to purchase either an IBM Risc system or an HP Unix system. Due to the heavy investment in HP equipment already in place within the institution, and because the power estimates for both HP and IBM rated the same, TSI's recommendation was to purchase a HP 9000 Series computer. This computer runs HP's hybrid (System V and Berkley) Unix operating system. This provides the open environment sought by the University.

Academic Computing

Computing Services is responsible for maintaining over 300 personal computers on the Daytona campus, including those in student labs, departmental labs, and various faculty offices. Approximately 210 faculty offices have computer equipment, with more than half of those outdated. As part of the Strategic and Tactical plan, a strategy has been developed to implement a capital improvement program that requires an upgrade of faculty computer equipment every two years. With each new purchase of a more powerful machine, the replaced machine will be handed to the party with the oldest technology. As PC technology is moving at a rapid pace, with new PCs being outdated within a year's time (Boudette, 1993), this will ensure that faculty are working with the most up-to-date equipment that institutional funding will allow.

In the past, any developments in Academic computing at ERAU has been reactive. Until recently, the Computing Services concerned itself mostly with administrative computing needs and paid little attention to academic computing needs. In the past, the department provided minimal support for faculty interested in instructional computing applications. The Academic Computing plan, as part of the Strategic and Tactical plan, will provide a proactive stimulant for internal and external funding for computer purchases.

Library Resources

The Hunt Memorial Library at the Daytona campus of ERAU has a collection comprised of over 200,000 books, periodicals, documents, newspapers, and media programs. The Prescott Library collection comprises over 150,000 of the same type of materials, most focusing on aeronautics, math, computer science, and engineering.

In Daytona, the library computer system provides an online catalog with boolean search capabilities, circulation, and acquisitions. A link is maintained to facilitate the connection of over 6,000 libraries for shared cataloging and inter-library loans. Online search and retrieval to over 200 databases is provided by a service called DIALOG. Access is available to documents, reports, conference proceedings, journal articles, dissertations, etc. Several CD-ROM workstations provide access to Periodical Abstracts Ondisc, ABI/Inform, Aerospace Database, Newsbank, and Business Newsbank.

The Prescott Library at the ERAU campus in Prescott, AZ., participates in the Yavapai Library Network Consortium. Membership is six libraries/agencies within Yavapai County. Access is available to the Internet and international databases. Both Daytona and Prescott libraries seek a more automated environment. Prescott Library staff have developed a strategic plan that will incorporate more computer technology into their environment over the next five years.

Office Automation

Office Automation at ERAU is minimal, consisting of placement of computer equipment into offices to reduce manual labor, costs, and paper flow. Such equipment includes: personal computers, faxes, shared printers, Desktop Publishing, scanners, electronic mail, optical mark readers (OCR), electronic bulletin boards, and one envelope printer.

There are indications of automated offices throughout the University, but none can be described as fully automated. Some departments have invested in equipment unilaterally, without consideration given to a global University perspective. This has led to an excess in expenditures where departments duplicated purchases without knowing what equipment exists. There is a lack of office automation awareness that can only be satisfied through focused training. The plan calls for investigation into imaging. Currently TSI is conducting investigation into the utilization of imaging within the University.

The University uses spreadsheet (Excel and Lotus), wordprocessing (WordPerfect and AmiPro), and statistical packages (SPSS, MAPLE mathematical software) to assist in daily operations. Various other PC software is used for special purposes, such as Ontarget project management software, Lotus Organizer for appointment scheduling (CTS is networked with Workgroups for Windows and can use it as a networkable scheduler), and Lotus Freelance and IBM's Presentations for multimedia presentations. ERAU is exploring the use of CD-ROM as database storage and retrieval for postal information and research within the Library. Physical data storage space is becoming limited as each new year passes. With large volumes of data stored within various departments, physical data security and access has become a critical issue. The University is investigating the impacts of document imaging (see the section on "Where we want to be" below).

Organization and Staffing

The staff of the Data Processing Services Department, as of the time TSI arrived on campus, was mired in traditionalist thinking. Even the name "Data Processing" signifies a philosophy that can only be categorized as old and obsolete. The staff have been given specific responsibilities that potentially can result in ineffective services for the user community.

Figure 10 shows what happens when a user calls the Data Processing Department. In this example, the user, a student accounts receivables staff member, calls the appropriate programmer to seek help for a particular problem. If the programmer is out of town or unavailable, the user must either seek an alternate solution from a processing perspective, or wait until the programmer is available.

The inefficiency of the student system (poor database design) has resulted in an excess number of programming personnel. The staff has been working in a reactive mode, rather than a proactive role, to support the current application system. In concert with enhancement needs and other types of user support, the workload sometimes gets too large. When that happens, standard procedures has been for the data processing management to hire new programmers. Morale among data processing staff is low. As discussed in the next major section ("Where we want to be"), a new organization oriented to user services and a new, more efficient student

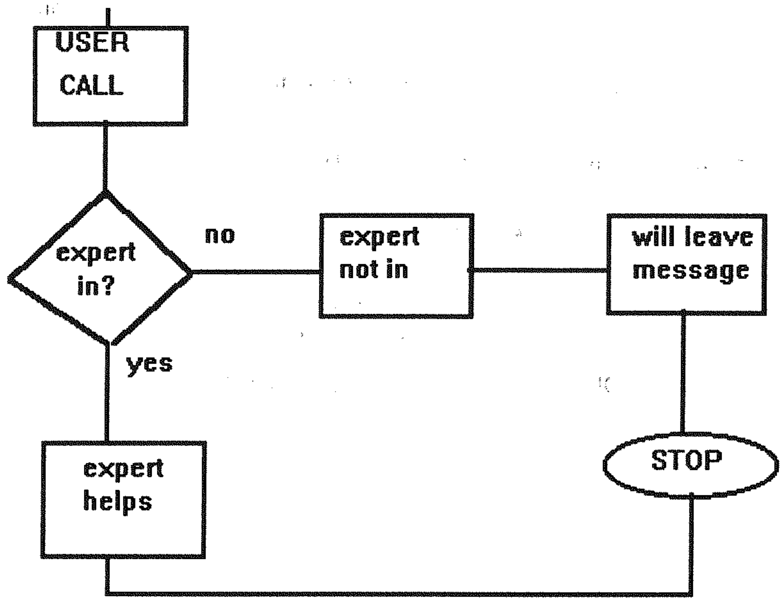

Figure 10: Service call process flow

system, will give the staff the opportunity to expand their skills sets. They will not need to sit behind a desk and program every day, all day. They will be able to meet with users on a more regular basis, thus relieving them of the monotonous and tedious work involved in programming.

The department has a number of projects presently in progress. In addition to continual support of the applications systems, the department is developing an application unique to the University. The Flight (actual name) system provides information about Flight students that cannot be maintained and supported by the present application systems. Other systems have been developed in-house, requiring constant attention to enhance as well as resolve programmatic problems. The in-house development philosophy is labor-intensive and lessens the amount of attention paid to the user community.

Academic Computing has been given little attention. Academic Computing has relied upon one person to provide all the support and assistance required by the academic community. Thus, the introduction and utilization of technology by the academic community has been ineffective.

As the figure above shows, a user many times may not be serviced until an "expert" in their area is available. In addition, the confidence level in the computing department to be able to complete work effectively and timely is less than desired (as identified during the interview process).

Where We Want To Be!

The purpose of a plan is to identify the requirements that will provide the University with the highest level of technology utilization. The second section in the plan is dedicated to identifying and defining such requirements. These requirements indicated a disparity between the present status of technology utilization throughout the University and the desired level.

The requirements for the Strategic and Tactical Plan for Computing and Telecommunications at Embry-Riddle Aeronautical University dictate the direction that must be pursued to provide a proper foundation for technology utilization at the University. The timeline for implementation of the plan serves as a guide and reminder for introduction and maintenance of technology within the University. For example, Appendix T provides an example of some of the events that must take place to achieve the desired objective within certain areas of the plan. The timeline displays a major heading, such as Academic Computing. The steps following are the steps needed to achieve the desired goals in Academic Computing. It is in Gantt Chart form for easy determination when a step (or task) starts and its expected end date, as well as the status of that task at a quick glance. At any time, one should be able to tell if a project is on target, ahead of schedule, or behind schedule.

The following sections describe the areas of importance to the University in their pursuit of achieving higher levels of technology usage. Because the University is attempting to transition to more effective use of technology, it is appropriate to discuss how the new technology will be monitored, maintained, procured, and administered. This requires a set of policies and procedures, currently missing within the department. The major headings of the previous section are then discussed to describe the difference between where the institution is as opposed to where it wants to be.

Policies and Procedures

The need to manage new technology justifies a Computing Technology Policies and Procedures manual. The manual will serve as a guide for the introduction and disbursement of computing technology throughout the University. As agents of technology, the Data Processing Center, or Office of Information Technology (see later in this section), must develop and maintain such policies and procedures in document form and distribute so that all may be informed as to how to address an issue involving technology at ERAU. The manual will include information that will assist in monitoring all aspects of computing under the responsibility of CTS. It will describe the role of CTS in technology management and advice. It describes the mission and organization of CTS, the hardware and software acquisition procedures, defines security of both data and the physical equipment, and provides procedures pertaining to disaster recovery. Appendix U identifies an example of a Table of Contents for a Policies and Procedures Manual.

Administrative Computing

The current student administrative system is inadequate to support the administrative environment effectively. TSI has prepared, distributed, and received feedback from a Request for Information (RFI) describing the requirements for a new student information system (SIS). Being a private institution, ERAU is not required to perform a search for the lowest bid for a system as would be required of a public institution. However, the University wanted to pursue the search for a student system as if it were out to bid, without the constraints of conforming to a Request for Purchase (RFP). By issuing a RFI, the selection committee could then choose a system without having to conform to exact specifications of the RFI. This alleviated the responsibility of the University to choose the lowest bidder based solely on the RFI, as would happen with a RFP process.

A selection committee, identified by University officials, was presented with the information from the needs analysis done by the TMP during the information gathering process. The committee reviewed all proposal by the vendors and selected four semi-finalists to demonstrate their products. The on-site demonstration provided enough information to reduce the number to two finalists. The selection committee then requested that the two finalists perform a detailed demonstration to both the Daytona Beach and Prescott campuses. An evaluation questionnaire, developed by one of the TMP members and formatted similar to the information presented within the RFI, was sent to various ERAU demo participants to rate the various components of the each vendor's product (see Appendix Y). TMP members tallied the results and provided the information to the author. The author developed a recommendation document based upon information from the evaluation results as well as research into the various products themselves, including telephone calls to vendor clients.The recommendation document was presented to the selection committee, who then made a decision to choose the system that conformed the best to the following basic requirements (the RFI is attached as an appendix in the plan itself.):

1. The system must be integrated with all modules. A module is a component of the system that provides specific functionality. The student system will provide functionality for storing, retrieving, and modifying student records data, financial aid data, accounts receivables data, admissions data, student housing data, etc. Each component will be integrated into a single database for more consistency, easy data retrieval, and more efficient procedures for modifying data;
2. It must be state-of-the-art, including the potential to run under the Unix operating system. As previously stated, the institution desires a system that can provide a compatible environment. This means that the application can run on many different platforms requiring minimal modification. An application written to run on the Unix operating system will provide such an environment as Unix is offered on almost every hardware platform. This means the application is

consistent with standards set for the Unix operating system and can run on other platforms;

3. It must include the potential to service a complex multi-campus environment. The ERAU environment includes many remote sites. Each site must be accountable and each site runs there operation differently. The student system must be flexible enough to provide functionality for the residential campuses as well as each individual campus interfacing to a single database;

4. It must have the potential to allow users to request and develop their own user reports. The University would like to empower its users with responsibilities for initiating data retrieval. This would help reduce costs associated with a large data processing environment and would allow faster turnaround for reports and other information that previously has been dependent upon data processing resource availability; and

5. It must have the potential to provide for the use of electronic media, such as optical character recognition (OCR), voice response, and imaging (storing of imaged documents). The new system must allow for better methods of data storage and retrieval. Scanning

information into the system reduces costs associated with data entry. Registration can be done by telephone if the system allows for voice response. This would allow the student to verbally request to register into particular classes and have the system update student records as a result of the telephone conversation.

The new student system requires a new hardware platform. The current platform is inadequate to support the varied needs of the users and has been a source of concern regarding performance for the last two years (see Figure 11). "When response time is important, individual resources should generally not be pressed beyond the 80% level" (Hewlett-Packard, 1992b, p. 6). Once beyond the point of 80% saturation, response times tend to become erratic. ERAU's CPU utilization was consistently, on a daily basis, above the 80% saturation level. This resulted in slower response times, causing less effective services to the students, particularly during peak times, such as registration.

The plan calls for an upgrade in hardware. The new student system is the driving force behind the acquisition of a new hardware platform. One of the requirements defined in the RFI is a system that fits into an open environment. The system must be portable between platforms. Thus, a Unix platform was chosen as the operating system that most closely provides for an open environment (McLachlan, 1992). This hardware platform must provide a

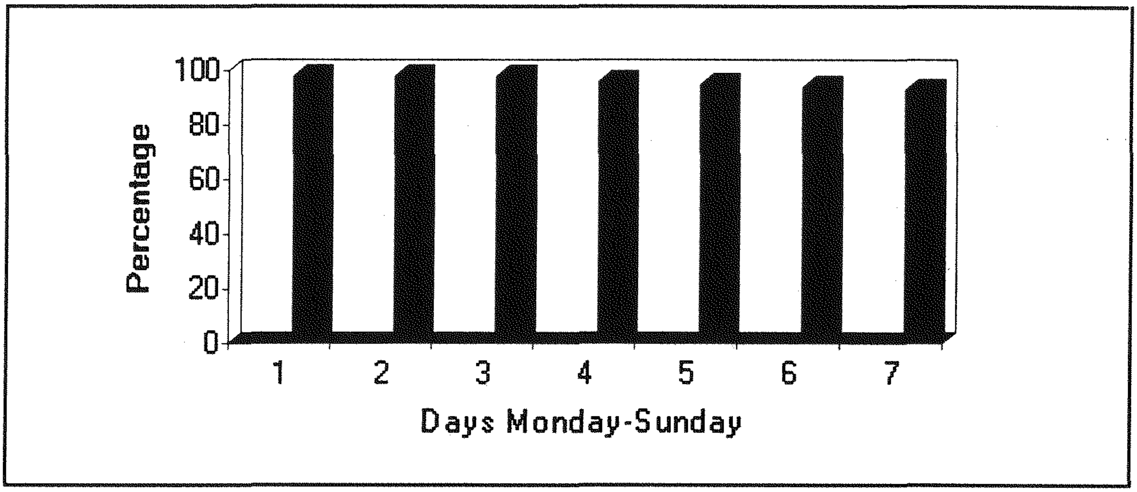

Figure 11: CPU Utilization

(HP, 1992, p. 6)

Unix operating system (see previous explanation of Unix) while providing enough power to support a large and growing number of users. Based on information offered within the plan, the University, through the advice of TSI, has procured a powerful, Unix-based hardware platform from Hewlett-Packard, an HP 9000/H50 Series system. The HP machine "has added functionality on top of Unix, including data journaling, supplementary security features, fault-resiliency, automatic fault recovery, disk mirroring, multi-processor support, performance tools, high-speed back-up utilities, remote systems network management, easy-to-use systems administration interfaces, and NewWave Office -- MS-Windows-based office automation" (Aberdeen Group, 1992, p. 3). HP is the leader in Unix-based sales (Aberdeen Group, 1992). The new hardware platform will be used initially to house the new student information system. As more ERAU systems migrate to Unix, they will also reside on the Unix machine. The current HP 960 system will eventually be sold.

Financial Resources (General Ledger) and Human Resources (Payroll, Personnel) systems will be evaluated in future years due to the implementation schedule of the student information system. The Financial Resources system administers the accounting process. It houses the general ledger's chart of accounts. It provides the functions needed to store, access, and modify data regarding financials, such as fixed assets, inventory, purchasing, accounts receivables, and budgets. The system will allow for proper audit trails, such as date- and time-stamped information. This will provide information to internal and external auditors. The Human Resources system provides information pertaining to institution employees. It will account for pay rate, job position, benefit information, as well as storing and updating payroll information. The Human Resources system will provide the processing of pay checks throughout the year as well as W-2 processing at the end of the year.

Academic Computing

Until recently, ERAU faculty have had little access to computing equipment. There was a lack of computer technology integration into instruction. Faculty concentrated on what they were teaching rather than how they were teaching. Thus, there was no need for a high degree of computer literacy. A survey prepared and administered by Academic Computing Services in 1991 revealed a low level of computer literacy among faculty members. The low level of computer literacy justified an increase in technology throughout the academic community. Another survey administered to the students that same year revealed a desire to improve access to computing equipment. At that time, the student labs provided inadequate computing access. Most technology throughout the institution was concentrated in the administrative areas. The faculty has expressed a desire to access computer resources and information services both on and off campus (ERAU, 1991). Because Academic Computing had been neglected in the past, there is a concerted effort to improve technology utilization throughout the academic user community, including investments in computing equipment, training, and introduction of technology into the curriculum and instruction.

The Academic Computing Subcommittee of the Computing Governance Committee developed plan sections for the Strategic and Tactical Plan for Computing and Telecommunication. Members of the subcommittee used a unique format to assist in developing their plans. Each academic department already had a number of projects identified, but had to set priorities. Although they had a series of brainstorming meetings, they couldn't agree on the order of the projects. They decided to use a software package designed to provide order to the priority setting process. GroupSystems, by Ventana Corporation in

Tucson, AZ. is "networked software which can be used to make meetings and group-based decision-making more efficient" (ERAU, 1993c, p. 3). GroupSystems is an "automated Delphi" (ERAU, 1993c, p. 3) technology that collects and documents different viewpoints to reach quick conclusions without peer influence.

The Academic Subcommittee met in an academic student lab where the software was installed on IBM-compatible personal computers. The lab was wired in a token-ring network topology. Some faculty members in Prescott participated via a modem. GroupSystems requires no direct verbal communication between participants. All communication is done through the software. Each member voted on a list of tasks and the software provided statistical analysis that result in an ordered list. What ordinarily would take many meetings to achieve the desired results through brainstorming, this new software provided within an hour. The results were submitted to the CGC as recommendations. The CGC approved all ordered items that fell within the specified range of the funds.

A series of projects will be required over the next five years for the specific purpose of increasing technology utilization within the Academic Computing community. The projects will result in:

1) ERAU implementing a planning/governance process that allows for the acquisition and support of the required resources;

2) Faculty developing the necessary skills to use these resources in their teaching; and

3) The creation of advanced facilities for using technology to support the instructional process.

Network and Telecommunications

The Telecommunications Subcommittee of the Computing Governance Committee was charged by the Computing Governance Committee to prepare a network plan for the University. This plan was developed as an addendum to the Strategic and Tactical Plan for Computing and Telecommunications.

The Subcommittee was charged with developing a vision of a University network. It was further charged to plan for its implementation and ensure its implementation and incorporation into the University. The following vision was developed by the Telecommunications Subcommittee (TSI, 1993, p. 2):

"The ERAU network should allow any person or computing resource access to any information or computing resource on the network (e.g. electronic mail, campus information, library resources, student information system, student labs, distance learning environments, the Internet):

- to/from anywhere within the University and its external global concerns (e.g. Internet / NREN resources) via access to a common environment;

- to be available to, shared by, and utilized by all members of the ERAU community;
- including information in all of its forms (e.g. multimedia: text, data, voice, video);
- ensuring that the methods, media and means used to get information and computing resources to the end user are transparent to the end user and utilize a standard interface wherever feasible;
- providing for the appropriate security; and
- adhering to accepted international standards for connectivity (e.g. IEEE, OSI, ARPA, ANSI, etc)."

This vision took about one month to develop after review and revision. The Network Subcommittee limited network vendors to the campus and analyzed their technology offerings. The Subcommittee decided, after research by some members, that the technology offered (Asynchronous Transmission Mode - ATM) was inappropriate for the present, but would be appropriate for the future. They decided to proceed now and identify the costs needed to invest in such technology.

The subcommittee called upon TSI to provide network expertise to help develop a network plan within a short period of time. The original charge by the CGC was to develop the plan within a specified period of time as the President (Chair of the CGC) was about to embark on a fund-raising campaign to Washington, D.C. The idea was to develop a boilerplate document that the Subcommittee, with local (ERAU) expertise, could design to fit the environment. Local ERAU expertise defined the infrastructure around which to fit the plan. The Director of Computing and Telecommunications Services (a Telecommunications Subcommittee member) was then asked to develop a cohesive document based upon information from the network resources. The document was reviewed by the Subcommittee and ordered into phases. The CGC then approved the plan and work is now underway to implement the plan.

Appendix X provides the outline included in the network plan. Functions provided within the network plan include:

1) File sharing. This means that each PC on the network, contingent upon security, could access and exchange files with other PCs, workstations, or minicomputers (individually referred to as a node) on the network. It also would allow for particular entities on the network to act as a file server to other entities. The University could reduce software costs by buying one version of network software that all could share.;

2) Printer sharing. The network would allow multiple nodes to share a single printer. For example, one department may purchase a color laser printer to which other departments may direct output.

3) Electronic mail. Electronic data exchange over a network, known as electronic mail, provides a quick and easy method for

communicating. Depending upon the sophistication of the electronic mail product, the user can develop correspondence, send messages to primary receivers, copy messages to other users, reply to messages, forward messages, store information in files or temporary folders, edit messages, and print messages;

4) Interactive remote logins. Allow logins from other machines to interact with any node on the network. Dependent upon network security, this would allow a user to directly access information residing on any node on the network; and

5) Client/Server functions. With empowerment of individual departments and because of the multi-campus environment, the University is investigating the benefits of distributing data and processing away from the central computer in CTS. This client/server environment would provide access to common workgroup or institution data and applications (Mace, 1990).

Library Resources

The libraries in both Daytona Beach and Prescott will increase their use of technology by investing in higher quality services and equipment. The libraries developed their own plans and submitted them for inclusion in the Strategic and Tactical Plan. Both will enhance student research capabilities by enhancing the network connectivity. The network will allow access to the

Internet. Access to the Internet means that students will be able to search other libraries online for research material. In addition, CD-ROM databases on the network will allow the student to access all library catalog information as well as purchased research databases from the same desktop.

A major goal of each library is to provide access to a national electronic library, accessible on the campus-wide network. One such system, Carnegie Mellon's Mercury software, will provide a large corp of electronic information that researchers may use in the field (Carnegie Mellon, 1992). Mercury provides text and bit-mapped images of documents that may be displayed on a terminal or PC and can be transmitted by electronic mail. It uses a Motif or VT100 user interface. Current available information includes: Carnegie Mellon Library Catalog; CMU journal list; bibliographic records for pictures and drawings of more than 3,000 modern buildings, selected from books in the CMU libraries' collection; CMU directory; American Heritage Dictionary; periodical abstracts beginning with the year 1986; newspaper abstracts from the year 1986; CD-ROM databases; and selective book reviews on scholarly and popular books in all academic subject areas.

ProjectJANUS, by the Columbia Law School, offers a small database with approximately 2,000 volumes from part of the Columbia card catalog, NAFTA and European Community treaty documents, and other sources. It displays text and bitmapped images. The Naval Research Laboratory offers its Optical Disk Project. It is a collection of 125,000 government agency reports in an optical disk jukebox. Other topics include physics and chemistry (Krumenaker, 1993). As yet, the University has not purchased any of these systems.

The Prescott Library is a member of the Yavapai County Library Consortium that provides a network within the six college membership. The network plan includes networking the Prescott campus, thus providing for local access to the consortia materials. Networking the campus means that students, faculty, and staff will be able to access library materials from their own desktops, regardless of their geographic locations. Fiber optic lines, a reliable physical media for data transportation, will be laid between buildings to provide the physical link necessary to network the campus. Thus, a student in the student lab will then be able to access the library, other nodes on the network, information at the other institutions of the consortium, or the Internet from the same PC.

Office Automation

The opportunity for office automation at ERAU focuses on end-user functional work environments and establishes a philosophy of technology synergism that promotes self-sufficiency. A better term might be end-user functional technology because technology should not be constrained by the boundaries of an office, department, organization chart, or any other system. The plan considers this aspect of technology and suggests the enhanced use of personal microcomputers, networks, bulletin board systems, and software tools that will increase awareness and improve effectiveness of each user.

As with any new technology, each iteration of technology enhancement within the user community must be accompanied by training. The timeline, although it doesn't specifically spell out training pertaining to office automation itself, does provide for generic training that may include office automation equipment and tools. CTS employs a full-time training coordinator who will develop, prepare, and teach classes regarding word processing, statistical packages, spreadsheets, and host system application software. Training will be provided from an elementary perspective to the advanced level. The training will be done at the CTS conference room, which is equipped with eight 386 PCs running DOS and the software packages described above. A CTS newsletter publishes proposed training dates and University personnel must reserve a spot in the training class with the training coordinator.

TSI is preparing a document providing information regarding document imaging. Such a system would upgrade the level of office automation throughout the University and provide enhanced data storage and retrieval capabilities TSI, 1993, August). Documents stored within a document imaging management system (DIMS) represent a digital image of the physical copy of data. The copy can be accessed and reproduced with little effort. An Optical Character Recognition (OCR) scanner will scan a document and convert them to an ASCII file format to be stored digitally (Edelstein, 1992). This will allow all aspects of document processing to be performed at the desktop. There will no longer be the fear of documents being destroyed, damaged, or lost and they can be electronically delivered to any remote location. Physical space will be reduced as the data will be stored on a desktop computer or network server.

Organization and Staffing

Users are beginning to perform many of the functions that used to be the responsibility of the computing staff. This means that the traditional organization of a data processing department, one that was oriented to controlling all aspects of computing power, is no longer needed. With software becoming easier to manage from a user perspective, the traditional programming position is slowly becoming obsolete. The current data processing staff is under-going a change to a more user-oriented approach to programming and user support.

As suggested by the strategic plan, a new concept has been introduced and is being implemented. The concept of an Office of Information Technology (OIT) that emphasizes a strong commitment to user services. The OIT's objective is one of unifying academic and administrative delivery of computing and telecommunications support in a growing, more technologically sophisticated and demanding campus environment. The OIT is responsible for supplying management expertise and technical support to the academic, library, and administrative computing services environments as well as telephone and network services.

The OIT is divided into primarily three areas: user services, technical services, and programming services. There is no segregation between academic and administrative computing support. Figure 12 graphically shows the new OIT concept.

The University has employed the services of TSI to manage and direct the new OIT. As such, the OIT employs two managers under the guidance of the Director. The two managers are responsible for: 1) Academic and Administrative User Support Services and 2) Networking and Telecommunications Services.

User Support Services includes programming staff in Administrative Computing and specific user-oriented liaisons for both Academic and Administrative Computing. Liaisons will dedicate most of their time to addressing specific user needs, spending considerable time in direct contact with the user community. Liaisons will analyze user procedures and technology use and assist in improving the user environment based upon those analyses.

These are systems analysts who no longer need to spend their time sitting behind a computer terminal writing code to support users. The new student administrative system and other tools planned for investment will allow users to access much of their information directly. Thus, there is more time available for computing staff to spend time directly with the users. The

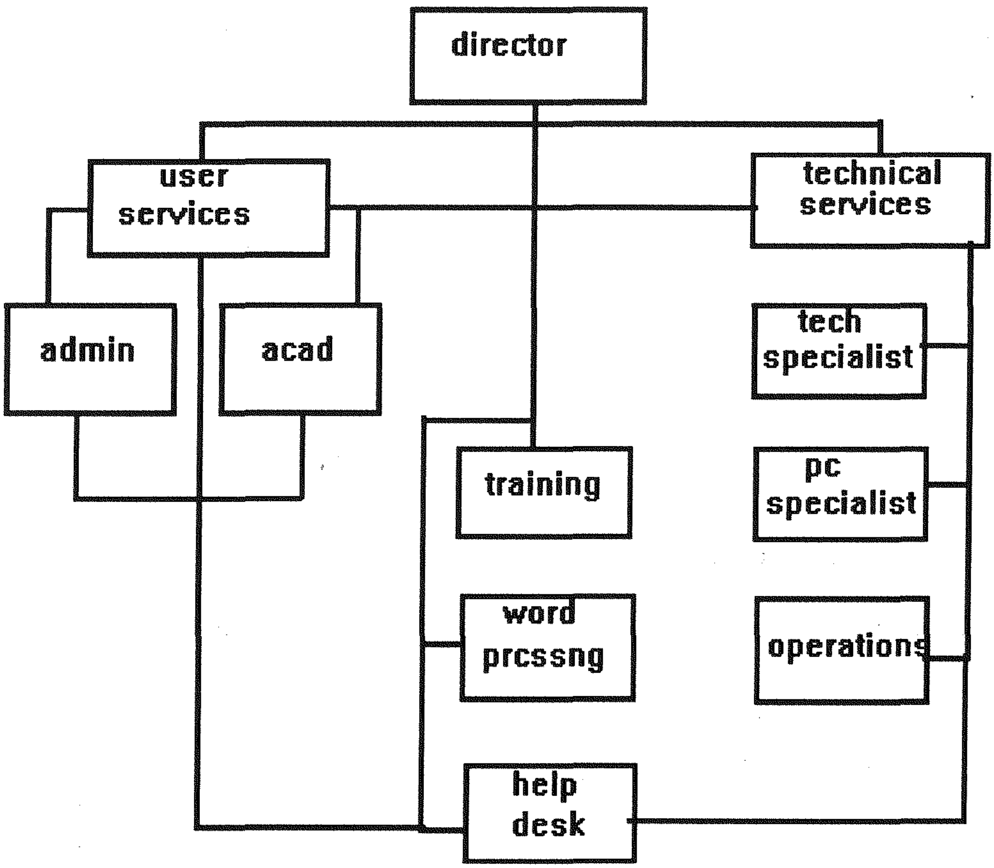

Figure 12: OIT Organization

programming staff will continue to maintain and support systems that require extensive assistance.

There now exists a strong commitment to support academic needs. Academic specialists are working directly with faculty and students to improve their work environments. Additionally, there is a strong commitment to providing a structured format for training faculty and staff to ensure effectiveness in learning. A help desk facility will provide better services to faculty, staff, and students who inquire and request assistance and support from the OIT. This will enhance turnaround on requests as well as provide an audit trail to track work in progress.

Technical services will provide support concerning any hardware and system difficulties. Specific specialists are committed to keeping up-to-date on emerging technologies and providing adequate support. The tools provided to this staff will help them monitor system performance. This will ensure that the staff can take a proactive perspective that will prevent saturation of the system. In addition, these personal computing specialists provide on-site (in office) support and advice regarding microcomputing to the users.

Implementation of the re-organization is underway. The transition to a fully user-oriented structure will be slow due to the number of concurrent projects within the organization (new student system, new hardware and operating system platform, network plan implementation).

How Do We Get From Here To There?

The path to upgrade the University in technology utilization requires a set of solutions to the requirements. Such solutions will help the staff gain control of existing systems, implement new systems, and plan for the future use of technology in a broad organizational perspective. The plan provides a section dealing with solution sets (suggested tasks) that will help guide the University to an increased use of technology.

As new initiatives are implemented as an outgrowth of the plan itself, some critical issues must be addressed that cannot wait for full implementation of all long-term, strategic plans. The solution set offers tactical support in addition to strategic initiatives. The solution sets provide action events that must take place to achieve the desired level of technology usage. Such action events take the form of work programs. The work programs describe a general action event from which more detailed, task-oriented, manageable sets of discrete actions may be developed as implementation of each specific action event takes place.

The work programs address four questions for the stages of actions deliverables that may be asked, such as (ERAU, August 28, 1992, p. IV-9):

- *What* area of concern is the action event designed to satisfy? Every event in the timeline has specific reasons for its inclusion. Taking a holistic perspective, all events lead to a higher level of technology usage;

- *When* will the event take place. This is a strategic issue that, if not thoughtfully and carefully planned, may impact functional processing;
- *Who* will be primarily impacted by the action event. If there are no benefactors, there may be no need to pursue the action; and
- *How much* will the event cost in terms of dollars and human resources?

The Solution Set Action Programs offer tactical information to provide guidance for implementation of specific tasks. Potential difficulties in planning may be overcome by using a set of guidelines that describe the action required to realize desired outcomes. The Solution Set Action Programs are designed to provide that guidance. A standard layout is used to provide a synopsis of each major solution deliverable (see Appendix V).

Summary of Chapter 4

The plan has been completed in draft form but has yet to be formally accepted. The various Computing Governance Subcommittees are reviewing the plan for the purpose of making minor adjustments to better fit the plan into the environment as well as any adjustments needed due to the period of time between the completion of the draft plan and the present. The author followed most of the proposed steps for the plan's development, review, evaluation, and implementation. One step, identification of competitors, could not be followed due to external constraints outside the control of the author, such as the lack of available personnel and time to complete the instrument. The plan-to-plan and the plan to implement will be used in the future, even if not completely followed during this process.

Results showed that there is a strong need for greater levels of technology infusion into the University. Solutions defined included: a new Help Desk facility; more computing equipment available to faculty; a new, integrated student system database based on an open environment platform; new mainframe hardware; a user-oriented service re-organization of the data processing department; a total University-wide network; proactive approaches to investments in computer aided training and computer based learning environments;; more investments in CD-ROM databases for library research; and a stronger emphasis on technology training throughout the institution.

CHAPTER 5

IMPLICATIONS, RECOMMENDATIONS, AND CONCLUSIONS

Review of Problem

The purpose of the study was to present a methodology that the reader can follow to ensure that a quality strategic plan can be developed. The steps provided in this document have provided the author with the methodology that has resulted in a quality strategic plan for computing for Embry-Riddle Aeronautical University. By using the instruments described within the document, the author has coordinated and developed a quality plan and has provided the University with the necessary guidelines to pursue its implementation. In addition, the author has created a model that can be followed by both ERAU and TSI for future use.

There is a firm commitment at the University to invest in technology. Whereas previously all elements of technology infusion have not been in place (i.e. funding, knowledge, guidance, commitment, etc.), presently the University is proceeding with such infusion, guided by the plan. The President of Embry-Riddle Aeronautical University has secured an $11 million bond fund. The purpose of this bond is two-fold: to construct learning structures on both the Daytona Beach and Prescott campuses; and to provide for investment into technology, including a campus-wide network. Although not yet formally accepted, the plan has served as a catalyst for change and the solution sets offered have been followed to the point of actual investments taking place.

Based upon the information in the plan, certain changes have begun to take place: a new computing governance structure has been implemented; a reorganization with a new user-oriented philosophy has been installed in the computer services area; a new student information system has been purchased; a networking plan has been developed and is being implemented; a Help Desk is being investigated for both Academic and Administrative Computing; the University is investigating the infusion of image processing; a computing newsletter has been developed and distributed on a regular basis; a partnership with a commercial vendor has developed to complete and enhance the in-house Flight system; teleconferencing equipment has been purchased, implemented, and is being used; investigation into distance learning has begun; a new mini-computer with the Unix operating system has been installed; and a University-wide upgrade in computing equipment has begun.

It would not be possible to implement so much in such a short period of time without a plan to guide the process. The plan is being reviewed and will be edited to fit the present environment. Based upon funding and timing of needs, some investment in technology has already taken place in a faster timeframe than offered by the plan. The plan will be adjusted to reflect these changes. Although not yet formally accepted, the plan has been in existence for about one year and has been referred to for guidance.

Goals and Objectives Revisited

The real measure of the effectiveness of a plan is in comparison to the goals and objectives that were defined during its development. The following describes objectives identified in the University Plan. Accompanying the objectives is the identified effects the plan is to have for each objective. The plan gives Embry-Riddle a systematic mechanism to achieve or target those goals:

- *Establishment of the University's technology improvement goals for the next five years* - The plan is designed for a five-year period of time. Each year is designed to provide improvement on an annual basis. The environment is already showing signs improvement regarding an upgrade in skill-sets, improved mechanisms of communication, and improved means of accessibility to information.
- *Definition of existing University technology deficiencies and proposed solution sets for meeting such problem areas* - The plan provides the definition of existing deficiencies in its Current Environment section and provides solution sets in its Solution Sets section. This confirms the understanding of what problems exist and what solution may address those problem areas.
- *Provision of alternative technology platform solutions with applicable cost/benefit analysis* - The plan calls for computing in

an open environment. Until this year, the University has operated on a minicomputer running a proprietary operating system (HP 3000 Series running MPE). Recently the University, with the help of TSI, selected a more powerful host computer (HP 9000 Series) running Unix. This positions the University for more compatible software products, effectively providing for an economy of scales operation. This also provides the opportunity for the University to expand its computing power without constraint of particular software and hardware requirements.

- *Presentation of related priorities, checkpoints, schedules and costs for implementing suggested solutions* - The plan provides a cohesive guideline for implementation of related activities. The solution set timeline was designed to provide a step-wise, flowing process of events that capitalizes on cost efficiency by suggesting specific times to implement particular events, many related in nature.
- *Provision of necessary data to aid in the determination of future equipment needs, space and staffing requirements, and budgetary implications* - The plan calls for the development of standards, policies, and procedures. These are specifically designed to provide appropriate information for investigation and procurement of future equipment and human resource needs.

- *Establishment of a management tool to be utilized in tracking and assessing the progress of appropriate University technology service providers in meeting the needs of the served community* - The Computing and Telecommunications Services department is investigating specific management tools, including project management tools, Help Desk tools, and technology inventory monitoring tools.

Implications

Although Embry-Riddle has yet to accept the plan officially, the University has begun implementing portions of the plan. The focus of the current implementations is on a new Student Information System and a thrust toward greater levels of network and telecommunications. The new technology will provide better and more efficient use of sources of information to University staff as well as faculty. The faculty is targeting enhanced methods of instruction by focusing on technology a tool. Recently the University has established a Distance Education Committee. Distance education is an area that the University did not investigate before development of the plan because it was previously unprepared for such an endeavor. The plan has provided a phased approach to technology infusion that allows the institution to expand its vision of the future and begin taking action toward achieving it.

The plan is used as a guide for implementation. The solution set action events point to areas to consider when implementing portions of the plan. By following such solution sets, the University is in position to infuse technology into the institution with a strategy in place. Dr. Jefferey Ledewitz, Vice President of Student Affairs, believes that ERAU now can approach a new marketing strategy due to opportunities afforded to prospective students (1993). He believes opportunities such as the planned Campus-wide Information System will attract more students. The University is already seeing increases in new student enrollment (Gans, 1993).

The University staff has a potential of falling into the same planning mode that it has previously experienced. They must complete the review of the plan and formally accept it. At the time of this writing, the plan has been in draft form for one year. Although there has been progress toward technology infusion (based upon the draft of the plan), the entire plan has not been fully addressed.

The appropriate subcommittees have vowed to make appropriate adjustments and give formal approval to the plan (Mead, 1993). The exact deadline for formal acceptance has not yet been chosen. The subcommittees feel that the plan will provide a foundation for long-range as well as short-term planning for technology. Over the past year, the University has implemented or begun implementing: new information systems, including the student systems, voice-mail, video-conferencing; two local area networks and wiring for more networks; upgrades in computing equipment, including more high-level personal computers and a new minicomputer running Unix; and computer-based learning software, such as Lotus 123 CBT.

The strategic plan is providing vision and guidance toward raising the level of the University's computing support. There is a new commitment to high-quality user services. The new president has procured funds that will allow the University to invest in appropriate computing resources. In addition, TSI has provided leverage to external contract negotiations and has also provided resource expertise in a number of technological areas. The University is investing in new hardware and software dedicated to enhancing user services as well as planning for a complete network to provide information access to the University.

Student Information System

At the time of this writing, the student system has been chosen and is being implemented. The current system is not easy to maintain. The new system will reduce the amount of maintenance required to support end users. This will result in lower operational costs due to a reduction in staffing requirements. The new system is designed to provide information to all internal and some external University constituencies that had previously not been served.

The current system was written in-house, the new system has been purchased from a commercial vendor. This implies that the new system will have the advantage of proper design by professionals who are in that particular business. The new system is in operation in many institutions throughout the United States. This gives ERAU the opportunity to communicate with others who have worked with the system, potentially providing solutions to possible future problems in getting the system to fit exactly the needs of the University.

The new system will offer many other benefits when compared to the current system. These advantages include: better access to more information on a more timely basis; higher levels of security; quicker processing and report turnaround; more cost effective operations; less maintenance overhead; and more effective use of computing resources.

The University departments have reduced their staffing levels based on the functionality of the current system. This has taken place after many years of modifying the system to fit the functionality that satisfies the users. While the modifications allow the users comfort with system interaction, the current system is not cost effective in terms of necessary human resources and computing power. Although the initial implementation of the new system may seem to lose some functionality, the new system will offer the opportunity for each department to review their current procedures and possibly define ways to enhance them. Once the staff in the departments get comfortable with the new system, they will customize their own procedures and resource needs based upon the new system. It is expected that the new system will provide more efficient and effective more of departmental operations.

Recommendations

The first and most obvious recommendation is for the University to complete their review of the plan. The plan has become a shelf document and is ineffective because it has not been accepted officially. Questions can be raised as to the commitment of the University to infusing higher levels of technology into the institution. The University is implementing many things suggested in the plan, yet has not used the plan for guidance as to timing of the implementations. This could impact other suggestions defined in the plan. Due to the implementations that are happening, the frequency that the Administrative Subcommittee meets has lessened. This means that completion of the review of the plan is less likely to happen in a timely manner. The author has tried, and will continue to try to suggest meetings to re-address the plan.

The second recommendation is that the University look to the plan for guidance on implementation tactics. Even though the plan has not been accepted, it can still provide guidance for those things that are being implemented. There is nothing currently being implemented that has not been addressed in the plan. The plan provides an ordered and systematic tactic for implementation.

The third recommendation is that ERAU should review and evaluate the results of the plan solution set on a regular basis. This longitudinal evaluation will assist in determining changes in attitudes and literacy over the life of the planning period. The author conferred with both the Office of Institutional Research and Effectiveness as well as the ERAU Director of Assessments regarding questionnaire design. The Director of Assessments for the University is a member of the travelling party for assessments for the Southern Association of College Systems (SACS) for Florida, who are charged with evaluating accreditation criteria for Florida higher educational institutions. It is SACS' responsibility to incorporate tools such as the one suggested here to assist in the evaluation of the institutions. The OIRE is responsible for providing statistical information to federal agencies on behalf of the University.

The evaluation can be done in the following manner:

1. On a quarterly basis, each department will submit to the CGC a Board Quarterly Report (see Appendix K) that can be compared with the plan's timeline of events. This will indicate how much progress is being made toward achieving specific actions suggested by the plan. This is one valuable way of determining the effectiveness of the plan and how well the institution follows it as a guide. If necessary, the CGC will determine whether action

is necessary to ensure that the departments will meet timeline deadlines. Such actions may include: resource re-allocation; additional equipment; analysis of process flows to identify unnecessary procedures; or recommendations for adjustments to the timeline.

2. A questionnaire was developed by the author to identify the effectiveness of the plan. On an annual basis, the CGC will administer, to respective departments, the sections of the questionnaire (Appendix Z is an example of the contents of the questionnaire - the actual questionnaire is in scannable form) that have meaning for each respective area. The questionnaire will allow the University community to provide input regarding technology usage in their respective departments. It will also give them an opportunity to participate in the planning process because the results will be analyzed and adjustments made accordingly. The questionnaire, formatted for the Likert Rating Scale (Suskie, 1992) follows the major sections of the plan and asks questions specifically about each respective section. The instrument provides a cross-reference to the identified goals and objectives for technology. This will indicate whether the plan is achieving the goals of the University.

3. The University has standardized on the SPSS as a statistical package. The results of the questionnaire will be codified on a scale of 1 to 5, with 5 corresponding to the "Strongly Agree" Likert rating, and entered in to the SPSS software on an IBM-compatible PC. The Office of Institutional Research and Effectiveness has suggested that a spreadsheet in Lotus or Excel be developed to allow for quick and easy data entry. Either spreadsheet can then be imported into SPSS for statistical analysis. The OIRE will be tasked with responsibility for entering data into the spreadsheet, importing it into SPSS, and performing the calculations. The questionnaire will be scanned and the resulting file will be imported into Lotus 123, then into SPSS.

4. In order to keep the analysis simple, yet effective, frequency data will be analyzed. Kolmogorov-Smirnov Z (Suskie, 1992; Norusis, 1988) analysis can also be used to identify the difference between expected distribution of data with the cumulative distribution. SPSS provides this type of analysis data.

5. The CGC must take the results and determine the numerical index for comparison to identify what questions warrant further attention. For example, results may show that only 28% of the respondents have confidence in the effectiveness of the CGC. The CGC may have determined that any question with a

frequency rating below 50% must be addressed. Thus, concern for the effectiveness of the CGC must be considered for further analysis.

6. The identified problem areas would be synthesized into a list. The CGC would conduct a meeting using GroupSystems to identify the areas needing the most immediate attention. GroupSystems is a networked decision-making set of software products from Ventana Corporation, located in Tucson, AZ. (ERAU, 1993c).

7. The CGC will then conduct another meeting specifically to address the results of the GroupSystems session. Using a Fishbone diagram (GOAL/QPC, 1992) will help determine the cause and effect of each area of concern.

8. Using the Nominal Group Technique, or any other group decision-making method, the CGC must determine appropriate action to remedy the situation.

The format of the questionnaire was designed to be easy to complete. A simple rating instrument is efficient because much information can be provided quickly and compactly (Suskie, 1992). Likert scales successfully measure attitudes and opinions. Yet, no method of evaluation is perfect. Each has its limitations. The disadvantages of using a questionnaire such as this is that there is no substantial factual information. The information must be subjectively interpreted. This can lead to incorrect analysis. Care was taken to confer with those familiar with evaluation methods, such as OIRE.

Perhaps the most value the questionnaire can offer is its indication of communication, or lack thereof. For example, assume that statistics prove that the new hardware platform runs more efficiently than the old. If the user community thinks it runs less efficiently, chances are that communication of such statistical information was ineffective. The questionnaire will indicate areas where more effective communication is necessary. The OIRE will assist the CGC in interpreting the information so that proper corrective action can take place.

Conclusions

This project has provided more than just a strategic plan. It has provided a methodology for developing planning documents. In addition, it has provided a model for practical usage of planning tools. Finally, it confirms that the methods, procedures, and tools used for development of the plan can work effectively to produce a high level document for planning.

The University had the desire to incorporate higher levels of technology into the environment to provide a higher level of learning for the students, hoping that it would attract more students. A self-study to determine the readiness for re-accreditation of the institution indicated the need for the

University to invest in technology. The problem was that the institution had no strategic direction for implementing technology into the environment. Even though the desire was present by University officials, there was no formal or informal mechanism in place to guide technology infusion into the institution. Thus, the University secured the services of Technology Specialists, Inc. to identify methodology for such technology infusion. After analysis, TSI determined the need for a strategic and tactical plan for computing and telecommunications.

The University depended on the expertise of TSI to develop such a plan. Table 2 indicated weakness within the University that prevented University personnel from developing an effective document. Such weaknesses included:

1. Poor technology policies - the style of management present pointed toward a 1970s mentality, preventing the University from a futuristic vision for technology and relying on current technology until a vision could be determined;
2. Current hardware was costly - the expenses of operating with the current hardware was higher than it should have been. The proprietary operating system required add-on products to make it operate more efficiently;
3. The current student information system was cost-ineffective - it also required add-on products to help it operate more effectively.

It also offered opportunity for disaster as it required operators to input critical job parameters to critical jobs;

4. There was no strategic plan in place - Because there was insufficient vision, there was no need to strategically plan. This led to inefficiencies in operations;

5. The skill sets of the computing staff was deficient - the University could not depend on computing staff to offer vision as they were content to operate in the current environment. Computing management philosophy prevented a schedule of regular training to upgrade the skill sets of the staff.

6. A downturn in enrollment - this dictated a need for downsizing the staff and prevented yearly pay raises. This led to low morale among University personnel and gave the staff a defeatist attitude toward learning and implementing new technology.

The plan developed by TSI and the author provides specific steps toward improving the environment. Improvement is one of the basic principles of TQM, along with satisfying the customers and advancing the organization (Zultner, 1993). As a result of the plan development process, the computing staff will be reorganized. A change in management philosophy will result because TSI has been offered the opportunity to manage the department. This change in management philosophy will allow the University to realize greater return on investment by directing efforts to improve services to the users. Empowerment of the user is the basis for procuring a new student information system, giving the user departments more control over their data. This will allow computing personnel to dedicate more time directly with the users to improve their environment as well as upgrade their skill sets via research of technology and regular training schedules.

Securing the bond money will allow the University to invest in higher levels of technology. The new hardware platform and network implementation are areas where this is proving true. The new HP Unix machine provides the University with an open environment, offering a compatible platform and opportunity for client/server processing. This was previously unattainable. The new network provides access to the Internet. The Internet greatly increases research opportunities by its access to libraries and other information sources throughout the world. By following the guidance provided in the plan, the University will be able to offer existing and potential students a higher quality of instruction. The institution cannot rely upon uniqueness of curriculum alone to attract students. This strategy for infusion of technology should offer an attractive environment for future students, resulting in an increase in enrollment. The Solution Sets offer the action events that must be taken to achieve desired results.

The document cannot be effective unless it is approved and implemented. By waiting so long to approve the plan, portions of the plan will be obsolete or outdated. Designed to be dynamically edited on an annual basis, the plan is due for review as if the first year had been followed. As it is, adjustments must be made, reviewed, and approved to reflect the atmosphere of the current year. The University has yet to invest most of the bond money, so suggested investments and procedures offered in the plan for the first year can still be implemented. Although the University has suggested commitment to providing higher levels of technology, it is failing to prove such commitment by failing to approve the plan. It is recommended that the plan again be given priority by the Computing Governance Committee for evaluation and approval.

This plan for technology will provide the guidance that the University has needed for the present and the future. Although not yet formally accepted, the plan already has proven to be a useful document. The real advantage in the exercise is that these plans can and will be followed for future planning processes. The experience gained by the staff in writing the document will have a significant impact on Embry-Riddle. In addition, a prototype has been developed that will be used by the author in future planning processes. This prototype will be a valuable asset to Technology Specialists Inc. in exploring future business opportunities.

Summary of Chapter 5

The plan has yet to be formally accepted but has already contributed to substantial improvements at ERAU. The President has secured funds for the majority of technology investment suggested by the plan. The plan has helped the staff meet overall University goals and objectives. A commitment exists to invest in more state-of-the-art computing equipment for faculty that will require extensive training.

The focus of the current implementations is on a new Student Information System. The new technology will provide better and more efficient use of sources of information to University staff as well as faculty. The faculty is targeting enhanced methods of instruction by focusing on technology a tool. The plan has provided a phased approach to technology infusion. The solution set action events point to areas to consider when implementing portions of the plan.

The University has implemented or begun implementing many new instruments of technology, even though the plan has not yet been accepted. It is used as a guide for implementation. The ERAU president has procured funds that will allow the University to invest in appropriate computing resources. TSI has provided leverage to external contract negotiations and has also provided resource expertise in a number of technological areas. The University is investing in new hardware and software dedicated to enhancing user services as well as planning for a complete network to provide information access to the University.

The procurement and implementation of the new student information system addressed in the plan will provide greater information access and more effective management. This new information accessibility will allow faculty and staff the opportunities to provide greater levels of service to the students, either directly (instruction) or indirectly (higher levels of services).

It is recommended that the University complete review and approval of the plan so that it does not become a shelf document. Its value is in its implementation. It is further recommended that ERAU follow a practice of regular review and evaluation of the plan. The author has proposed an evaluation instrument (Appendix Z).

The ERAU president has procured funds that will allow the University to invest in appropriate computing resources. In addition, TSI has provided leverage to external contract negotiations and has also provided resource expertise in a number of technological areas. The University is investing in new hardware and software dedicated to enhancing user services as well as planning for a complete network to provide information access to the University.

This project has provided more than just a strategic plan. It has provided a methodology for developing planning documents. In addition, it has provided a model for practical usage of planning tools. Finally, it confirms that the methods, procedures, and tools used for development of the plan can work effectively to produce a high level document for planning.

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APPENDICES

Appendix A: Computing Equipment at Embry-Riddle Aeronautical University

The University currently operates a networked pair of Hewlett-Packard 3000 Series supermini computers, a 960 and a 947, as the primary platform for administrative computing. The computers are located in the Data Processing building on the Daytona Beach campus and serves as the central hub for administrative processing activities today. Access to the processors is confined to a broad, asynchronous network running throughout the campus and connected between sites by an extensive backbone of 100/140 micron fiber optic cabling.

A variety of devices are used to convey the asynchronous signals from building to building. Most widely used are 8 channel fiber optic multiplexors, followed by T1 fiber optic multiplexors and modems. Currently, no device attached to any of these units exceeds a serial speed of 9600 baud. Plans call for increasing the maximum speed to 19,200 baud in the near future. Prescott also has access to the administrative system via a similar though smaller asynchronous network established on that campus and connected to Daytona Beach via a 56 kilobit digital link.

The Hewlett-Packard platform supports a variety of communications protocols, including Ethernet and ARPA services (TCP/IP, FTP, etc.). The computers can also operate as Novell Netware servers and can run the UNIX operating system.

A bulletin board system has been established in Data Processing for use by the University's remote campus centers. The centers are small satellites of Embry-Riddle and operate primarily at Air Force and Army bases both in the United States and abroad. The system is accessible via both direct dial-in and an X.25 link.

The administrative computing area in Daytona Beach also operates one local area network which is used by three departments on campus. It is based on Token Ring running Novell 3.11 and runs Preventive Maintenance and Citation Tracking applications for the Physical Plant and Safety/Security departments. A networked version of the Q&A database software is also used by the Career Center. The LAN is completely stand-alone and does not connect to any other networks. The server is located in the Data Processing building and is attached to network segments at two other sites via fiber optic repeaters. A similar LAN has been established on the Prescott campus solely for handling the aforementioned Preventive Maintenance system. It, too, is stand-alone.

Some of the services offered on the Administrative network include processing of student related data (Admissions, Registration, Grading, Student Accounting, etc.), General Ledger, Personnel/Payroll, and Development.

These resources are of great interest to many non-administrative departments, such as Academic computing. The Remote Center bulletin board system and the link to Prescott are likewise desirable services to other segments of the University.

The campus extension to the General Electric Complex, two miles away, has brought about the installation of an ethernet terminal server network with a gateway to support asynchronous requirements.

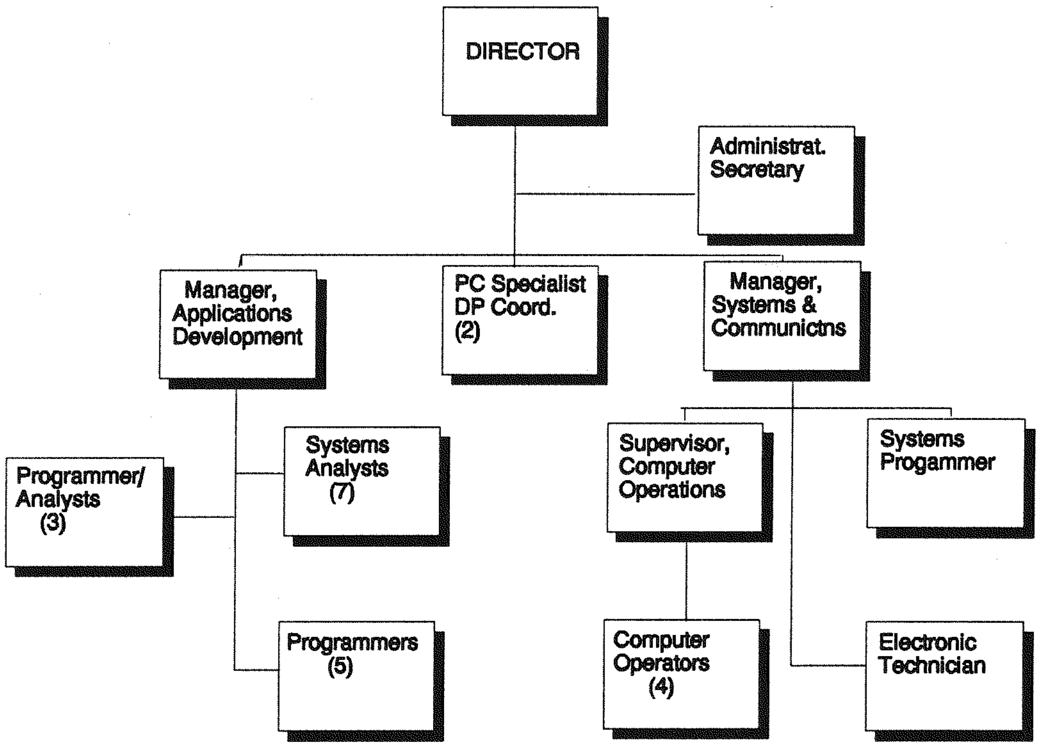
Hewlett-Packard 3000 SERIES HARDWARE

	model 960	model 947	model 917
CPU (TPS): (transactions/sec.)	44	41	41
MEMORY:	150 mb	128 mb	24 mb
DISC CAPACITY:	8.49 gb	4.0 gb	1.3 gb
PORTS (users):	144	60	8
PRINTERS:	2 - 1200 lpm 1 - 20 ppm laser W/Signature Fonts	840 lpm	420 lpm
TAPE:	2 - ½" drives, (1 compressed) DAT	DAT	DAT

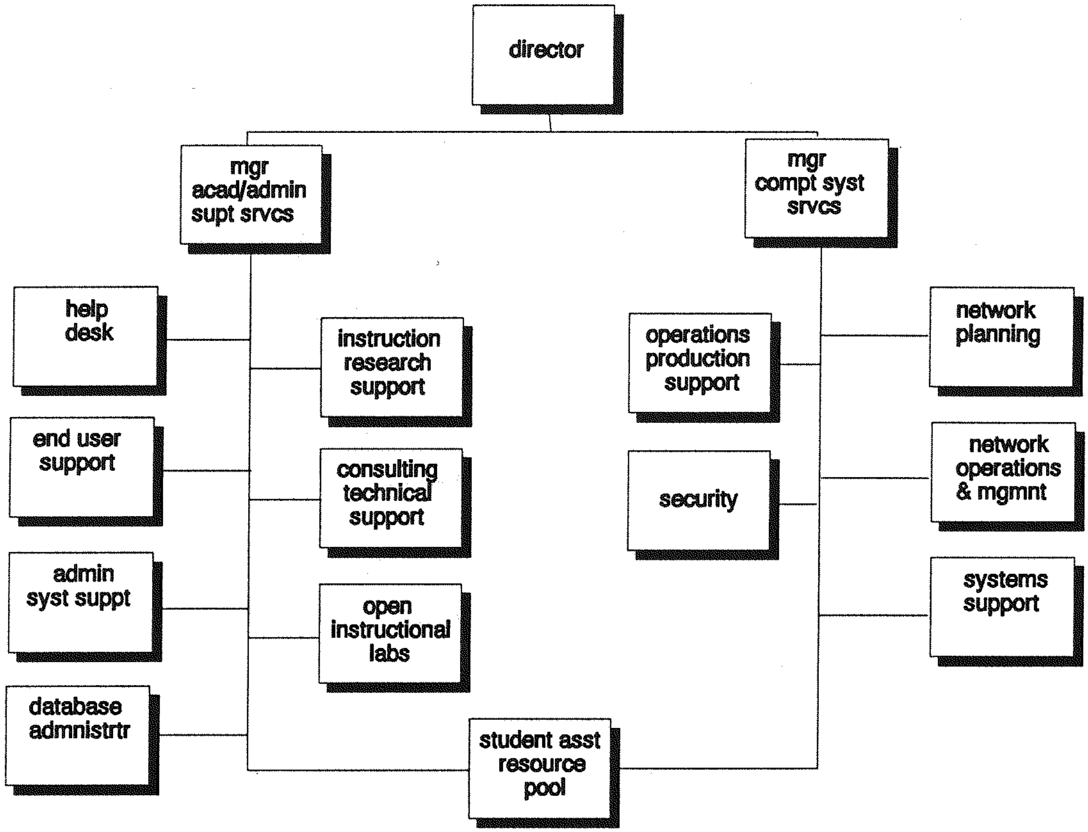
continued on next page

	model 960	model 947	model 917
COMMUNICATNS	EQUINOX DATA SWITCH NS 960/947 LAN	EQUINOX DATA SWITCH NS 960/947 LAN	EQUINOX DATA SWITCH

Appendix B: Pre-TSI Data Processing Center Organization



Appendix C: Post-TSI Data Processing Center Organization

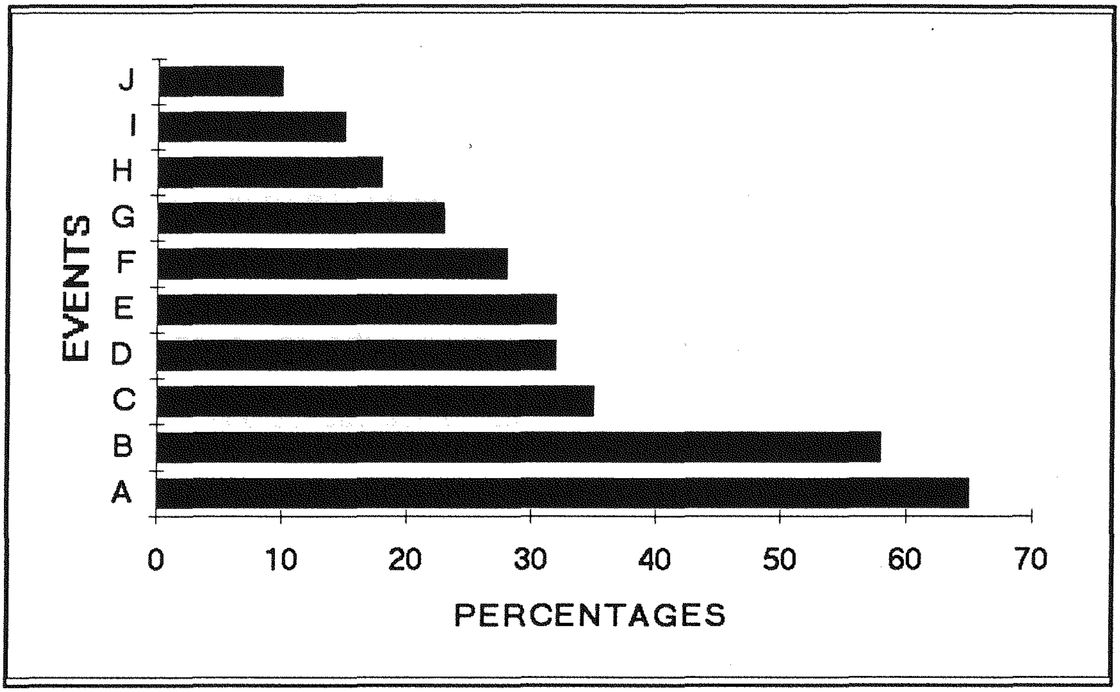


Computing and Telecommunications Services

A Department of the Office of Information Technology

Appendix D: Percentage of Issues Ranked By CUMREC Participants

Taken from paper presented at CUMREC 92 by Temares and Zastrocky (1992, p. 365).



LEGEND

Event A = Networking
Event B = Effectively coping with limited resources
Event C = Integrating information systems
Event D = Integrating computing into the curriculum
Event E = Developing an IS strategic plan
Event F = Staff Development
Event G = Aging Systems
Event H = Reengineering
Event I = Software productivity and reliability
Event J - Determining the value of IS

Appendix E: Embry-Riddle Statement of Purpose

From Embry-Riddle (1992b, p. 4)

Embry-Riddle Aeronautical University is an independent, nonsectarian, not-for-profit, coeducational university with a history dating back to the early days of aviation. The University serves culturally diverse students motivated toward careers in aviation and aerospace. Residential campuses in Daytona Beach, Florida and Prescott, Arizona provide education in a traditional setting and an extensive network of continuing education centers throughout the United States and abroad serves civilian and military working adults.

It is the purpose of Embry-Riddle Aeronautical University to provide a comprehensive education to prepare graduates for productive careers and responsible citizenship to support the needs of aviation, aerospace, engineering and related fields. To achieve this purpose, the University is dedicated to the following:

A) To offer undergraduate and graduate degree programs which prepare students for immediate productivity and career growth while providing a broad education with emphasis on communication and analytical skills.

B) To emphasize academic excellence in the teaching of all courses and programs; to recruit and develop excellent faculty and staff; and to pursue research and creative activities that maintain and extend knowledge in aviation, aerospace and related disciplines.

C) To develop mature, responsible graduates capable of examining, evaluating and appreciating the economic, political, cultural, moral and technological aspects of humankind and society, and to foster a better understanding of the working of the free enterprise system and its social and economic benefits, and of the profit motive, as vital forces to the potential of individuals and of groups. To promote ethical and responsible behavior among its students and graduates in the local, national and international aviation and aerospace communities and in the community at large.

D) To develop and effectively deliver educational programs for the adult student and professional at the undergraduate and graduate level, including off-campus degree programmed, short course, independent study, non-credit programs, seminars, workshops and conferences.

E) To support each student's personal development by encouraging participation in programs and services which offer opportunities for enhanced physical, psychological, social and spiritual growth; and, by complementing the academic experience, contribute to the development of a well-rounded individual prepared for personal and professional success.

F) To engage in research, consulting services, and related activities that address needs of the aviation, aerospace, and related industries.

Appendix F: Vision of the ERAU Environment by the Year 2000

1. We will have 100-150 CCE Centers. (College of Continuing Education remote sites).
2. Distance learning will be a larger product line than resident campus learning.
3. Registration will take place electronically during the advisement process, or from anywhere.
4. Students, faculty, staff, and Alumni will have access to computers 24 hours/day.
5. A decision support system will be available to all decision makers.
6. An image processing system will be available to all decision makers.
7. All students, faculty, and staff will each have one university card for monetary transactions and access control.
8. Industry will have access to ERAU Career Centers and vice versa.
9. Students, faculty, staff, and Alumni will have electronic access to ERAU libraries.
10. Electronic Data Interchange (EDI) capability with a charge function will be available.
11. High schools and individual students will have electronic access to ERAU admissions information.

12. Automated transcript and pre-requisite checking systems will be used.

13. We will use one electronic mail system for faculty, staff, Alumni, and students throughout the university.

14. The systems will be integrated rather than interfaced.

15. On-line responses will be available within 5 seconds of each request.

16. All data will undergo reasonable quality control procedures to ensure reliable data in our databases.

Appendix G: Common Strategies Identified by EDUCOM's 1980 Survey

Taken from Coughlin (1986, p. 35).

Organizational Structure. Eight of the institutions had a single administrative office or one individual to coordinate information-processing related issues. Of the remaining two, one was actively considering the creation of such a position.

Decentralization. All of the organizations were moving to a more decentralized information-processing environment. This trend does not necessarily imply that centralized facilities will cease to exist, or even get smaller, but that an increased amount of this processing activity will occur outside of the centralized facility.

Personal Computers. All of the organizations had, or were formulating, plans related to the growing potential of personal workstations for students, scholars, and administrators.

Networking. All ten campuses were involved with both local and national networking activities...Many faced major investments in telephone systems and were seeking to make sure investments would serve more than one purpose.

Library Automation. Once again, all of the schools had plans to deal with the convergence of computing and communications to help provide access to library resources.

Information Processing Literacy. Groups or task forces in each of the colleges and universities were studying what level of literacy for computing and communications activities is required of a well educated graduate in the 1980s...

Text Processing. In all ten institutions, text processing services were seen as important to academic computer literacy and to administrative support...

Electronic Mail. Several of the campuses had extensive electronic mail systems in operation, and most were actively considering how to provide this service in the future...

Appendix H: Needs Analysis Process

From Technology Specialists, Inc. (March 31, 1992)

DEFINITION OF A NEEDS ANALYSIS:

A Needs Analysis is the tool used to determine what hardware and software are required to perform an activity of the University. The needs analysis must be prepared in all cases where the University aggregated investment will exceed $100.00 or where the requested activity requires a non-standard software product.

INITIATION OF A NEEDS ANALYSIS:

The Needs Analysis must begin with Statements of User Requirements. The Needs Analysis will be submitted in written format using a standard University form. It will contain a written summation of the problem which requires a solution. The statement should document the problem and give some indications of why the change is needed. Once the problem is stated and analyzed by the Data Processing Department it is returned to the originator with an outline of what hardware and software is required.

As stated above, the needs analysis begins with a summary statement of the problem or situation that requires a solution. This summary statement should contain sufficient information to both outline the problem and state some of the users global or overall product output. An example of a statement summarizing a system or task related problem might be "This activity maintains records of student materials using a manual system. As the number of students vary and the amount of equipment and materials change, we are having a difficulty maintaining our records. We desire to move to some automated system over the next 6 months."

Notice, the statement addressed the problem and did not state what actual procedure should be used to solve the problem. Do not use statements such as "Requests that a Q and A Database system be installed at this location for the purpose of tracking student materials inventory." A correctly formulated statement explains the problem and states the need, it does not address specific hardware or software.

RESPONSIBILITIES:

DIRECTOR, DATA PROCESSING DEPARTMENT - Once a request for a needs analysis reaches the Data Processing Department, the Director will review the problem. After review, the Director will forward the request to the Manager, Applications Development or to a Micro-Computer Specialist for further processing. Upon completion of the Needs Analysis, the Director will review and approve/reject the recommendations of the analyst. If approved, he will forward the approved Needs analysis requisition for final execution.

MANAGER, APPLICATIONS DEVELOPMENT - Upon receipt of the request, the Manager, Applications Development will assign the project to one of the analysis staff for evaluation. The Manager will determine which staff member is to perform the evaluation. The Manager will discuss the problem with the assigned analyst and provide basic guidance in arriving at a solution. The final date for submission of the evaluation to the Department Director will be agreed on between the Manager, Applications Development and the evaluator.

ANALYST/MICRO-COMPUTER SPECIALIST - The analyst assigned the Needs Analysis for review and solution determination will contact the Department submitting the request and make an appointment to visit the client. The analyst will discuss all of the needs and will evaluate the scope of the project. If the solution requires the action of several Data Processing staff members, it will be the responsibility of the Analyst to provide such coordination and discussion. All reports will be prepared in a memo format. Hardware requirements will be documented using the attached form.

DISPOSITION: After final review by the Director, Data Processing Department, the finalized Needs Analysis will be returned to the requestor. The final report will detail the recommendations of the Data Processing review and will provide recommendations as to follow-on actions to be taken by both the requestor and the Data Processing Department.

Appendix I: Foundational Outline of Strategic Plan

EXECUTIVE SUMMARY

I. INTRODUCTION

II. ERAU...THE CURRENT ENVIRONMENT
This section describes the environment at particular points in time. As requirements are revised and as requirements are implemented, it is expected that this section will be revised to reflect the state of the environment.

III ERAU...THE REQUIREMENTS
This section is dynamic and will change as other requirements are implemented. It will change as new requirements are defined. Once implemented, these requirements may pipeline to the Current Environment section.

IV. ERAU...THE SOLUTION
This section defines the actions required to implement the requirements that take the University from the Current Environment to the desired level of technology utilization. This too will be changed as the requirements change.

V. GLOSSARY OF TERMS

VI. APPENDICES

Appendix J: Technology Surveys

ACADEMIC COMPUTING SURVEY

NAME: **POSITION:**

NAME OF SUPERVISOR: **DEPARTMENT:**

DATE:

PERSONAL DATA

I. Please list your responsibilities.

II. Please list any skills you possess with regard to computing technology.

Please list the courses you teach and use of computing technology for each. Instruction means you use the computer as an aid in teaching or

Continued on next page

the class teaches the use of computers. Administration means you use the computer to do faculty administrative work such as grading, electronic communication, etc. Please indicate the number of lab hours the course requires.

COURSE		USE OF COMPUTERS			
Name	# Students (this year)	# Students (next year)	Instr.	Admin	Lab Hours

Please use the next two pages to describe how computer technology integrates into your coursework and administrative work.

COMPUTER SERVICES SUPPORT

Please circle the level of support you feel you are receiving from Computer Services.

		LEVEL OF SUPPORT				
		EXCEED	MEET	BELOW	UNACCEPT	NOT AP
A.	Promptness in responding to requests	A	B	C	D	E
B.	Courteousness	A	B	C	D	E
C.	Cooperation	A	B	C	D	E
D.	Problem solving abilities	A	B	C	D	E
E.	Openness to new ideas	A	B	C	D	E
F.	Effort to understand	A	B	C	D	E
G.	Well organized	A	B	C	D	E
H.	Openness to criticism	A	B	C	D	E
I.	Adjustment to request changes	A	B	C	D	E
J.	Provides policies and procedures regarding user requests	A	B	C	D	E

Continued on next page

K.	Follows policies/proced.	A	B	C	D
L.	Produces desired results	A	B	C	D
M.	Exhibits knowledge and skills of job	A	B	C	D
N.	Timeliness in producing results	A	B	C	D
O.	Good decision-making skills	A	B	C	D
P.	Willingness to accept new or additional requests	A	B	C	D
Q.	Good communication skills	A	B	C	D
R.	Availability of computer staff	A	B	C	D
S.	Overall appraisal of services	A	B	C	D

Please use space below to comment further on above support table or on anything else regarding level of support.

Please describe below the procedure for addressing problems due to hardware or software failures.

COMPUTER TECHNOLOGY USAGE

Please indicate the level that best applies to your usage of computing technology at ERAU.

		LEVEL OF SUPPORT				
		EXCEED	MEET	BELOW	UNACCEPT	NOT A
A.	Comfort with use of computers	A	B	C	D	I
B.	Use computers in instruction	A	B	C	D	I
C.	Use computers in administrative work	A	B	C	D	E
D.	Knowledge of personal computers	A	B	C	D	E
E.	Knowledge of mainframe computers	A	B	C	D	E
F.	Network knowledge	A	B	C	D	E
G.	Use electronic mail	A	B	C	D	E
H.	Trained in use of computers	A	B	C	D	E
I.	Knowledge of software/ hardware available at ERAU.	A	B	C	D	E

J.	Willingness to try new applications of software/ hardware	A	B	C	D
K.	Installation and repair of microcomputers	A	B	C	D
L.	Skill in programming microcomputers	A	B	C	D
M.	Skill in programming mainframe computers	A	B	C	D
N.	Familiar with BITNET/ INTERNET	A	B	C	D
O.	Computer accessibility for you (courseware develop/demo)	A	B	C	D
P.	Computer accessibility for student (lab work)	A	B	C	D

COMPUTER TECHNOLOGY SUPPORT

Please circle the most appropriate level of support you feel you need to help you make better use of computers.

		LEVEL OF SUPPORT				
		EXCEED	MEET	BELOW	UNACCEPT	NOT A
A.	Computer training	A	B	C	D	E
B.	Information of what is available at ERAU and how to use it	A	B	C	D	E
C.	Personal consulting on the use of hardware/software	A	B	C	D	E
D.	Identification of new applications/evaluations hardware/software	A	B	C	D	E
E.	Integration of technology into instruction	A	B	C	D	E
F.	Written instruction on how to use hardware/software	A	B	C	D	E

G.	Demonstration of newly acquired hardware/software	A	B	C	D
H.	Installation/repair of microcomputers	A	B	C	D
I.	Computer programming	A	B	C	D
J.	Network training	A	B	C	D
K.	Access to computers	A	B	C	D

COMPUTER HARDWARE/SOFTWARE

Please list the hardware you currently use and its accompanying software. This may include use for instruction or personal administrative use. Please indicate the number of machines, disk space of machines, memory, graphics cards, microchip, peripherals (modem, mouse), and printers and their brands and models.

HARDWARE	SOFTWARE

GENERAL COMMENTS

Please use the space below to make any other comments you may have regarding the use of computer technology at ERAU.

ADMINISTRATIVE COMPUTING SURVEY

NAME: **POSITION:**

NAME OF SUPERVISOR: **DEPARTMENT:**

DATE:

PERSONAL DATA

I. Please list your responsibilities.

____

____

____

II. Please list any skills you possess with regard to computing technology.

____

____

____

____

COMPUTER SERVICES SUPPORT

Please circle the level of support you feel you are receiving from Computer Services.

		LEVEL OF SUPPORT				
		EXCEED	**MEET**	**BELOW**	**UNACCEPT**	**NOT A**
A.	Promptness in responding to requests	A	B	C	D	E
B.	Courteousness	A	B	C	D	E
C.	Cooperation	A	B	C	D	E
D.	Problem solving abilities	A	B	C	D	E
E.	Openness to new ideas	A	B	C	D	E
F.	Effort to understand	A	B	C	D	E
G.	Well organized	A	B	C	D	E
H.	Openness to criticism	A	B	C	D	E
I.	Adjustment to request changes	A	B	C	D	E
J.	Provides policies and procedures regarding user requests	A	B	C	D	E
K.	Follows policies/proced.	A	B	C	D	E
L.	Produces desired results	A	B	C	D	E

M.	Exhibits knowledge and skills of job	A	B	C	D
N.	Timeliness in producing results	A	B	C	D
O.	Good decision-making skills	A	B	C	D
P.	Willingness to accept new or additional requests	A	B	C	D
Q.	Good communication skills	A	B	C	D
R.	Availability of computer staff	A	B	C	D
S.	Overall appraisal of services	A	B	C	D

Please use space below to comment further on above support table or on anything else regarding level of support.

Please describe below the procedure for addressing problems due to hardware or software failures.

SYSTEM SUPPORT

Please circle the letter that best fits the level of expectancy of the application software that you use in your job position.

		LEVEL OF SUPPORT				
		EXCEED	MEET	BELOW	UNACCEPT	NOT AP
A.	Quick online system response time	A	B	C	D	E
B.	User-friendliness of application system	A	B	C	D	E
C.	Application system provides needed reports	A	B	C	D	E
D.	Application system provides needed information	A	B	C	D	E
E.	Adequate help facility of application system	A	B	C	D	E
F.	Data integrity adequately upheld due to system security	A	B	C	D	E
G.	Good system response during peak time usage	A	B	C	D	E

Continued on next page

H.	Application system provides adequate regulatory enhancements	A	B	C	D	E
I.	System in place to allow user easy request of ad hoc reports	A	B	C	D	E
J.	Easy navigation of application system	A	B	C	D	E
K.	System down-time minimal	A	B	C	D	E

Please use space below to comment further on above support table or on anything else regarding level of support.

COMPUTER TECHNOLOGY USAGE

Please indicate the level that best applies to your usage of computing technology at ERAU.

		LEVEL OF SUPPORT				
		EXCEED	MEET	BELOW	UNACCEPT	NOT APP
A.	Comfort with use of computers	A	B	C	D	E
B.	Use computers in instruction	A	B	C	D	E
C.	Use computers in administrative work	A	B	C	D	E
D.	Knowledge of personal computers	A	B	C	D	E
E.	Knowledge of mainframe computers	A	B	C	D	E
F.	Network knowledge	A	B	C	D	E
G.	Use electronic mail	A	B	C	D	E
H.	Trained in use of computers	A	B	C	D	E
I.	Knowledge of software/ hardware available at ERAU	A	B	C	D	E

J.	Willingness to try new applications of software/ hardware	A	B	C	D	E
K.	Installation and repair of microcomputers	A	B	C	D	E
L.	Skill in programming microcomputers	A	B	C	D	E
M.	Skill in programming mainframe computers	A	B	C	D	E
N.	Familiar with BITNET/ INTERNET	A	B	C	D	E

Continued on next page

COMPUTER TECHNOLOGY SUPPORT

Please circle the most appropriate level of support you feel you need to help you make better use of computers.

		LEVEL OF SUPPORT				
		EXCEED	MEET	BELOW	UNACCEPT	N A
A.	Computer training	A	B	C	D	
B.	Information of what is available at ERAU and how to use it	A	B	C	D	
C.	Personal consulting on the use of hardware/software	A	B	C	D	
D.	Identification of new applications/evaluations hardware/software	A	B	C	D	
E.	Integration of technology into instruction	A	B	C	D	
F.	Written instruction on how to use hardware/software	A	B	C	D	
G.	Demonstration of newly acquired hardware/software	A	B	C	D	
H.	Installation/repair of microcomputers	A	B	C	D	
I.	Computer programming	A	B	C	D	
J.	Network training	A	B	C	D	
K.	Access to computers	A	B	C	D	

Continued on next page

COMPUTER HARDWARE/SOFTWARE

Please list the hardware you currently use and its accompanying software. This may include use for instruction or personal administrative use. Please indicate the number of machines, disk space of machines, memory, graphics cards, microchip, peripherals (modem, mouse), and printers and their brands and models.

HARDWARE	SOFTWARE

Continued on next page

GENERAL COMMENTS

Please use the space below to make any other comments you may have regarding the use of computer technology at ERAU.

COMPUTER CENTER SURVEY

NAME: **POSITION:**

NAME OF SUPERVISOR:

DATE:

PERSONAL DATA:

I. Please list your responsibilities.

____

____

____

____

____

II. Is your primary responsibility in:

___ Administrative ___ Academic ___System Mgt ___ Other

III. Are you cross-trained on any other system (hardware, software, or application)? Please list.

____

____

____

____

____

Continued on next page

IV. When were you hired to work at the ERAU Computer Center?

____

V. Please list your academic achievements (degrees, honors, etc.).

____

____

VI. Please list the training you have received since your hire at the ERAU Computer Center.

____

____

____

VII. Please list what you regard as your strengths.

____

____

____

VIII. Please list what you regard as your weaknesses.

____

____

Continued on next page

IX. Please list your hardware experience.

X. Please list your software experience.

XI. What hardware are your primarily responsible for or use most frequently?

Continued on next page

XII. The following questions pertain to the area of your primary responsibility. Please answer as best you can.

A. Number of records ____________________

B. Amount of disk space required ____________________

C. Percentage of disk space available ____________________

D. Approx. percentage of growth in disk space usage per month ____________________

E. Number of batch jobs required by your application system ____________________

F. Approx. number of programs required by your application system ____________________

G. Approx. number of files required by your application system ____________________

H. Programming language of your application system ____________________

I. Avg. number of special programming requests per month ____________________

J. Avg. number of application or system bugs requiring fixes per month ____________________

Continued on next page

K. Time of day considered peak usage ______________________

L. Time of month of peak usage ______________________

M. Time of year of peak usage ______________________

N. Avg. number of concurrent users at peak times (I/O) ______________________

O. Avg. number of meetings you attend per month ______________________

P. Avg. amount of time spent on phone with users each month ______________________

Q. Current number of outstanding job requests ______________________

R. Avg. number of overtime hours per month ______________________

S. Avg. number of hours personally spent with end-users per month ______________________

T. Estimate of current percentage of used capacity of computer system ______________________

Continued on next page

ERAU COMPUTER CENTER ENVIRONMENT

Please circle the answer that best describes the working environment at the ERAU Computer Center.

H=high, M=moderate, L=low, N=none, N/A=does not apply

A.	Computer training	H	M	L	N	N/A
B.	New employee orientation	H	M	L	N	N/A
C.	Policies and Procedures	H	M	L	N	N/A
D.	Communication with superiors	H	M	L	N	N/A
E.	Communication with peers	H	M	L	N	N/A
F.	Intra-college communication	H	M	L	N	N/A
G.	Trade publications availability	H	M	L	N	N/A
H.	Intra-data center morale	H	M	L	N	N/A
I.	Attitude towards change	H	M	L	N	N/A

Continued on next page

J.	Comfort with knowledge-level of computing technology	H	M	L	N	N/A
K.	User-level support	H	M	L	N	N/A
M.	Satisfaction with currency of equipment for your work	H	M	L	N	N/A
N.	Satisfaction with currency of software tools	H	M	L	N	N/A
O.	Responsiveness of field service	H	M	L	N	N/A

Continued on next page

GENERAL COMMENTS

Please use this page to describe the strengths and weaknesses of the ERAU Computer Center.

COMPUTER CENTER INVENTORY

Please complete the following survey. It will serve as a current inventory of computer equipment now either being used or stored at the ERAU Computer Center. The survey is divided into five sections: mainframes and minis; micros, workstations, and terminals; peripherals; maintenance agreements; and network. Use the following as a guide to completing the survey.

- **Mainframes and minis:**
  - **Software** is the application or programming language that resides on the machine.
  - **Machine** is make and type of computer where the aforementioned software resides.
  - **Operating System** is the OS residing on that machine.
  - **Memory Required** means how much memory does that software take up on the machine.
  - **Disk Space Required** is the amount of disk space required to reside by that software on that machine.

- **Micros, workstations, and terminals:**
  - **Number** refers to the number of PC, workstations, or terminals.
  - **Type** refers to the brand (IBM, MacIntosh, etc.).
  - **Model** refers to the brand's model (e.g. IBM PS/2).
  - **Microchip** refers to the chip residing on the machine (e.g. Intel 386DX).
  - **Memory** refers to the amount of memory available on the machine.
  - **Graphics** refers to the graphics card (e.g. VGA).
  - **Software** refers to the applications residing on the machines (e.g. Lotus 123, WordPerfect, etc.).

- **Peripherals and other:**
  - **Peripheral** refers to the peripheral or other device attached to the machines.
  - **Attached to** refers to the equipment on which that peripheral is attached.
  - **Used for** requests the use of the device (e.g. scanner for image processing).

- **Maintenance agreements:**
  - **Company** refers to the name of the company that has been contracted.
  - **Service provided** refers to the type of service the contracted company has agreed to (repair, replace, etc.).

Continued on next page

- **Equipment** refers to the equipment the contracted company will service under the agreement (PCs, printers, network, etc.).
- **Software** refers to agreements with software if other than equipment.
- **Turnaround** refers to the amount of response and turnaround time of service agree to.
- An attached page offers the opportunity to describe any maintenance done outside of maintenance contracts. Please include the procedure when any equipment or software failure occurs (including requests for maintenance from users).

- **Network:**
  - **Network software** refers to the software running on the network.
  - **Resides on** refers to the machine on which the software resides.
  - **Memory required** refers to the amount of memory required by this software to run effectively and efficiently.
  - **Disk space required** refers to the amount of disk spaces this network software requires.
  - **Server?** asks whether the software resides on a server (implying that **Resides on** machine is a server).

Please put a check mark by the computer equipment that is not currently being used (such as old micros that are working, but are in storage). When complete, please date and sign at the bottom of this sheet. This is only to help define what **current** means for purposes of the Computer Technology Inventory.

Continued on next page

MAINFRAMES AND MINIS

SOFTWARE (Application)	MACHINE	OPERATING SYSTEM	MEMORY REQUIRED	DISK SPACE REQUIRED

MAINFRAMES AND MINIS (cont.)

SOFTWARE (Application)	MACHINE	OPERATING SYSTEM	MEMORY REQUIRED	DISK SPACE REQUIRED

MICROS, WORKSTATIONS, AND TERMINALS

NUMBER	TYPE (IBM, Apple)	MODEL	MICRO CHIP	MEMORY	GRAPHICS	SOFTWARE (Applications)

PERIPHERALS AND OTHER

PERIPHERAL	ATTACHED TO	USED FOR

Continued on next page

MAINTENANCE AGREEMENTS

COMPANY	SERVICE PROVIDED	EQUIPMENT	TURNAROUND

MAINTENANCE AGREEMENTS (cont.)

Please describe any maintenance done by the Computer Center that is not included in a contracted maintenance agreement. Please also describe the procedure for addressing requests from users regarding hardware or software failure.

Continued on next page

NETWORK

NETWORK SOFTWARE	RESIDES ON	MEMORY REQUIRED	DISK SPACE REQUIRED	SERVER? (Y/N)

Continued on next page

MISCELLANEOUS NETWORK

Please use this page to describe how the network is currently being used. Include the architectures, layout, bridging, gatewaying, communication usage, speed, physical media, etc.

Continued on next page

Appendix K: Plan-to-Plan

INTRODUCTION

This plan-to-plan was developed to assist executive management and administrative and academic staff at Embry-Riddle Aeronautical University in the development of documents designed to aid in the planning process. This document will provide structured methodology that employs useful tools to facilitate the planning process. Current plans under development, such as the Strategic and Tactical Plan for Computing and Telecommunications as well as the institutional network plan, may use this document as a guide to developing future plans.

The University officials have adopted a vision for the furture for the institution. It is believed that this vision will provide the incentive to infuse technology into the environment and will be the basis for campaigns for future funds. If achieved, the vision will provide the University with a competitive advantage and an attractiveness that should promote higher levels of enrollment into the 21st Century.

VISION STATEMENT

1. We will have 100-150 CCE Centers. (College of Continuing Education remote sites).
2. Distance learning will be a larger product line than resident campus learning.
3. Registration will take place electronically during the advisement process, or from anywhere.
4. Students, faculty, staff, and Alumni will have access to computers 24 hours/day.
5. A decision support system will be available to all decision makers.
6. An image processing system will be available to all decision makers.
7. All students, faculty, and staff will each have one university card for monetary transactions and access control.
8. Industry will have access to ERAU Career Centers and vice versa.
9. Students, faculty, staff, and Alumni will have electronic access to ERAU libraries.
10. Electronic Data Interchange (EDI) capability with a charge function will be available.
11. High schools and individual students will have electronic access to ERAU admissions information.
12. Automated transcript and pre-requisite checking systems will be used.
13. We will use one electronic mail system for faculty, staff, Alumni, and students throughout the university.
14. The systems will be integrated rather than interfaced.

15. On-line responses will be available within 5 seconds of each request.
16. All data will undergo reasonable quality control procedures to ensure reliable data in our databases.

GOALS AND OBJECTIVES

With the development og goals ans objectives comes the opportunity for developers to shape the control system to fit their needs. It is important to set goals that are realistic. Goals that are too high or too low are not motivating. If they are too low they lose their effectiveness. If they are too high, there is little obligation toward achieving them as they are seen as unachievable. The best mix is to set goals that are a little aggressive but achievable. The following identifies the prime objectives of the technology improvement plan (Technology Specialists, Inc., 1992, pp. EXEC-7, I-5,I-6):

- Establishment of the University's technology improvement goals for the next five years;
- Definition of existing University technology deficiencies and proposed solution sets for meeting such problem areas;
- Provision of alternative technology platform solutions with applicable cost/benefit analysis;
- Presentation of related priorities, checkpoints, schedules and costs for implementing suggested solutions;
- Provision of necessary data to aid in the determination of future equipment needs, space and staffing requirements, and budgetary implications; and
- Establishment of a management tool to be utilized in tracking and assessing the progress of appropriate University technology service providers in meeting the needs of the served community.

Beyond functionally-oriented objectives, specific technology principles are aggressively pursued:

- *Integration*: An intelligent database foundation is critical for promotion of true integration and elimination of redundant, inefficient practices. Relational concepts, data dictionaries, data administration, history techniques, data consistency, and audit and security issues all are ingredients.

- *Flexibility*: The technology platform must not hinder Embry-Riddle's unique situations and growth. Regarding hardware, ERAU strives to be positioned to take advantage of emerging technologies. Considerations may include: a UNIX platform, client-server environments, E-mail, voice mail for staff and students, Computer-Aided Instruction (CAI), automated administration, distance learning, multimedia capabilities, and distributed communications principles in general.

With regard to application software, considerations include: user-friendly environments, user-defined criteria, unlimited record capacities, and limitless reporting capabilities. In addition:

- *User interface*: Human factors and consistency are very important for end-user acceptance. Consistent techniques and procedures ease the on-going training burden.

- *Adaptability*: Interface bridges combining the functionalities of hardware, software, and networking must be supported and straight forward. The ability to interface with specific internal as well as external applications must be easily accomplished.

- *Return on Investment*: An investment of resources is measured by its return. The investment in technology must support the purpose of the University.

A commitment to Embry-Riddle's philosophy has been and remains a constant influence. Such a commitment includes:

- Providing, within realistic constraints, a baseline level of computing and information support for the needs of the educational community in the areas of instruction, administration, and public service;

- Improving the performance, quality, and effectiveness of students and faculty through applied knowledge relating to computing tools and techniques;

- Incorporating modern technology into the University curricula to advance the level of academic excellence;

- Improving administrative productivity and efficiency to better serve the student and staff communities;

- Enhancing support for University management, allowing for more informed avenues of decision-making; and

- Offering unlimited access to the world of students via enhanced distance learning capabilities, thereby becoming a "university without walls."

This plan-to-plan provides a variety of tools, such as surveys, critical success factors, Board Quarterly Report guidelines, and other tools such as WOTS-UP to identify areas of the University that need attention to better service the students. The PTP will help make the planning process more effective.

This plan-to-plan targets three major documents being developed at the University: the annual Climate Survey, the Startegic and Tactical Plan for Computing and Telecommunications; and the Network Analysis and Plan. The PTP is organized into five parts:

PART 1: Preparation of the Climate Survey;

PART 2: Preparation of the Strategic and Tactical Plan for Computing and Telecommunications;

PART 3: Guidelines for development of the Board Quarterly Reports; and

PART 4: Planning Tools.

PART 1: CLIMATE SURVEY

The Climate Survey is performed annually as a responsibilitiy of ERAU's Office of Institutional Research and Effectiveness (OIRE). Its purpose is to determine the attitudes of the faculty and staff toward the administration of business by executive management. By targeting the environment and evaluating the leadership capabilities of the executive management, anticipated improvements in the administrative environment should become reality. In addition, attitudes are examined regarding student services. Strengths and weaknesses can be generically determined. If feedback consistently indicates lack of leadership regarding student services, a process specifically targeted to improve the student services will be developed and implemented. This process will be determined by an appointed committee. The Climate Surveys are adjusted each year, depending upon the previous year's outcomes. Subsequent annual Climate Surveys will evaluate the success of the previous processes.

Various result presentations are performed to the many different factions of the ERAU community, including those at the Prescott campus. In addition, the results are presented at the annual Conference for the College of Continuing Education. The results are taken into consideration for inclusion as input into the University-wide strategic planning and assessment that takes place shortly after the close of the fiscal year.

The survey is distributed in the Fall each year to faculty, staff, and students. The survey is also distributed to Prescott as well as to all CCE Centers. The surveys are expected to be completed and returned within one month. Analysis is then done by the Office of Institutional Research and Effectiveness (OIRE), gathering statistics using SPSS for the final results. The results are formally presented to the participants in the months of March and April. The presentation of the results present opportunities of the audience to brainstorm and suggest strategy to management to address the problem areas. The results of the surveys and the brainstorming session will provide information for future strategic plans.

A sample of the survey is presented below.

EMBRY-RIDDLE AERONAUTICAL UNIVERSITY
STAFF CLIMATE SURVEY
FALL 1992 ADMINISTRATION

This Staff Climate Survey is designed to collect information about your perception of the University environment as it involves the following areas:

Overall University Leadership;
Departmental Leadership;
Working Environment;
Satisfaction;
Performance Evaluations; and
Communication and Cooperation.

The information you provide will help the University leadership to better plan for University needs in the areas surveyed. The results will be compiled for the entire University community and by campus.

DIRECTIONS FOR COMPLETING THE SURVEY FOLLOW:

FOR EACH STATEMENT ON THE FOLLOWING PAGES, INDICATE YOUR LEVEL OF AGREEMENT BY SHADING THE BUBBLE CORRESPONDING TO THE FOLLOWING CODES:

SA	I STRONGLY AGREE WITH THE STATEMENT.
A	I AGREE WITH THE STATEMENT.
D	I DISAGREE WITH THE STATEMENT.
SD	I STRONGLY DISAGREE WITH THE STATEMENT.
DNA/DK	THE STATEMENT DOES NOT APPLY TO ME OR I DON'T KNOW ENOUGH ABOUT THE STATEMENT TO PROVIDE MY PERCEPTION.

For the results to be meaningful, it is important that you complete the survey completely and honestly. Individual identification is not included on the survey to preserve anonymity. On the first page of the survey, please bubble in the response beside the campus where you are physically located and the Vice President responsible for your department/area.

EMBRY-RIDDLE AERONAUTICAL UNIVERSITY
STAFF CLIMATE SURVEY
FALL 1992 ADMINISTRATION

Campus	Vice President Responsible for my Area
CCE ---------------> O	Academics ----------------> O
Daytona ---------> O	Administration ----------> O
Prescott ---------> O	Flight ----------------------> O
	Special Projects ----------> O
	Student Life --------------> O
	None of Above ----------> O

OVERALL UNIVERSITY LEADERSHIP:	SA	A	D	SD	DK / DNA

1. I have the confidence in the overall leadership at ERAU.	O	O	O	O	O
2. I have confidence in the leadership of the President.	O	O	O	O	O
3. I have confidence in the leadership of the Vice President of Academics.	O	O	O	O	O
4. I have confidence in the leadership of the Vice President of Student Life.	O	O	O	O	O
5. I have confidence in the leadership of the Vice President of Administration.	O	O	O	O	O
6. I have confidence in the leadership of the Board of Trustees.	O	O	O	O	O
7. ERAU has a work environment of mutual respect and trust.	O	O	O	O	O
8. My chain of command to the President works well: My ideas are communicated to the President, and his decisions are shared promptly with me.	O	O	O	O	O
9. The Vice President responsible for my dept. emphasizes teamwork within my division as well as cooperation among divisions to achieve the University Visions. (Note: If your dept. reports directly to the President, respond DK/DNA).	O	O	O	O	O
10. The President is successful in dealing with issues external to the University environment.	O	O	O	O	O
11. The President devotes sufficient attention to the CCE concerns.	O	O	O	O	O
12. The president devotes sufficient attention to Prescott concerns.	O	O	O	O	O
13. The President devotes sufficient attention to Daytona concerns.	O	O	O	O	O
14. The President devotes sufficient attention to University-level concerns.	O	O	O	O	O
15. I understand where the University wants to be within the next five years.	O	O	O	O	O
16. The President's Cabinet minutes are distributed to staff at my level.	O	O	O	O	O

PART 2: STRATEGIC AND TACTICAL PLAN FOR TECHNOLOGY

There is a considerable body of literature about the strategic planning process (Steiner, 1979; Goal/QPC, 1992; King, 1992; Guba & Stufflebaum, 1970; Head, 1982). Although there is a surfeit of authors proposing numerous ideas, there is a consistent pattern concerning what the major steps in the planning process are. Rowe, Mason, and Dickel (1986) succinctly offer the following five steps that summarize the ideas of most planning literature. They group the planning process into four components:

1) Define the strengths and weaknesses of the company - this can be accomplished by using WOTS-UP analysis described in the Tools section of this document. This gives the University a picture of areas upon which it should capitalize (strengths) and areas it should try to change (weaknesses);
2) Define the desired future scope of the company - define what is the vision of the University. This sets a goal and all planning efforts should be directed toward attaining that goal;
3) Define the competitive advantage and market niche of the company - identify what the marketing advantage/disadvantage is for the University compared with its competitors. The Tools section defines an evaluation instrument for this purpose;
4) Develop a statement of purpose, goals, and objectives - identify the Mission Statement of the University and ensure the goals and objectives are in line with that statement. This is similar to number 2 above; and
5) Define the allocation of resources needed to implement and execute the plan - make sure that appropriate resources are assigned to carry out the action plans suggested in the plan.

The plan must be reviewed and evaluated on an annual basis. This will serve as a checkpoint for progress (see next section). This will allow the University to make adjustments to the plan depending on available resources or funds. Reviewing on an annual basis rather than a longer period of time means that the adjustments that must be made can be smaller in nature and possibly requiring less effort and resources.

Each plan developed in the University, if following the guidelines set forth by a plan-to-plan document, such as this, will offer consistency in the resulting plan. It is the purpose of this plan-to-plan document to serve as a guide for the modifications that must be made to the Strategic Plan. The Strategic and Tactical Plan for Technology at Embry-Riddle Aeronautical University is the responsibility of the Computing Governance Committee (CGC) to ensure its development, acceptance, implementation, and evaluation. The CGC has the authority to deligate responsibility for any part of the plan to whomever it deems appropriate. The Computing and Telecommunications Services department, managed by Technology Specialists, Inc. (TSI) has been charged with original development and implementation of the plan.

Without a strategic direction, the University may not maximize functional processing that leads to better services for the students which, in turn, better equips them for the technologically advanced workplace. The purpose of this plan is to provide that guidance in a logical and structured manner and to assist in the educational process. It is the intention of this document to address every aspect of the University community regarding use of technology. Therefore, this plan will provide solutions and action plans that will lead Embry-Riddle Aeronautical University to a higher level of information access.

This plan for technology progresses logically, starting with basic technological needs for effective and quality functionalities, to analyzing the current environment that promotes those needs, to defining requirements to provide solutions to those needs, to work plans that may be implemented to satisfy those needs.

As a living document, the blueprint will serve as the basis for both administrative and academic strategies for present and future goals. It is not designed to become a stagnant reminder of what was once a vision of the University. It is designed to be an ever-changing reference of how the University has revolved as well as what new opportunities lie in the future. Therefore, as new technology avails itself, it will be included in future revisions of the plan. The Strategic Plan may be used as a paradigm for other planning processes.

Outline of the Strategic Planning Process

Components of the strategic plan must be identified prior to its development. The path to developing the plan may follow many different routes. Therefore, it is as important to identify how to develop the plan as it is to identify what the plan will encompass. The following outline may be used as a template for development of the strategic plan:

1. **Conduct the Needs Assessment** - The needs analysis document (needs assessment), serves as the starting point for the information gathered. It provides the "environmental scanning" that Rowe, Mason, and Dickel (1986, p. 100) offer as essential to identifying the threats and opportunities the institution faces. The needs assessment contributes to the WOTS-UP analysis.

2. **Complete the WOTS-UP Analysis** - WOTS-UP is an acronym for Weaknesses, Opportunities, Threats, and Strengths. Weaknesses are limitations, faults, or defects in the organization "that will keep it from achieving its objectives" (Rowe, et al., p. 62). "An opportunity is any favorable situation in the organization's environment" (Rowe, et al., p. 60). A situation that can be damaging to the organization and its strategy is considered a threat. Strengths are resources that can be effectively used by the organization to achieve its goals. WOTS-UP is described in the Tools Section of this document.
3. **Identify Participants** - It is imperative that the right personnel participate in the process. According to Drucker (1988), there is a strong tendency for businesses to use team decision-making processes. The idea is that productivity and effectiveness are enhanced and a feeling of contribution by participants may lead to increased efficiency and morale. It is desirable to staff the task force with people that have different backgrounds. In addition to staff members that have experience in policy and strategy formulation, it is important to consider those with technical skills and those knowledgeable about the status of technology within the institution and its future requirements (Head, 1982). The absence of these skills may lead to unrealistic goals. Selecting the proper personnel to support and participate in the proce
4. **TQM - Define Critical Success Factors** - A key step in the procedures is the identification of critical success factors. By identifying the CFSs for the institution, the internal environment is better defined and goals and objectives may be developed. Normally key executives participate in the development of these critical success factors. It requires a great degree of intelligence, experience, and knowledge about the internal environment. CFSs may be identified by asking the question: "In running your organization there are a small number of aspects of paramount importance - factors that must be done well if the operation is to succeed. Can you describe the factors that are most critical for success?" (Martin, 1982, p. 31). Defining CFSs helps to follow Total Qulaity Management philosophy of idenifying areas to target for improvement, resulting in improvement of the whole institution.
5. **Define Goals and Objectives** - Head (1982) offers that there is a slight difference between goals and objectives, mainly in scope. Goals are enduring statements of purpose that are "non-quantitative in nature, not referencing specific resources required for implementation or specific timetables for realization. Objectives are subordinate to goals, narrower in scope, shorter in range and usually attainable" (p. 6). The golas and objectives will help focus the plan.
6. **Identify Competitive Strategy** - The ancient Chinese philosopher, Sun Tsu, once suggested that if you know the enemy and know yourself, you need not fear the result of a hundred battles (Clavell, 1983). We live in a

competitive environment, given the economic portfolio of the country. Each institution of higher education must invest time and resources into identifying what it has to offer as well as what the competition has to offer in order to attract the potential student population. This means that the institution must provide some niche that can strategically position it above the competition. Steiner (1979) offers a checklist of questions that can be used to identify the institution's competitive position. The Tools Section displays an example of the checklist.

7. **Identify Resource Strategy** - "Poor quality isn't the result of ineffective workers, but of ineffective systems" (CareerTrack, 1993, p. 5). In accordance with TQM philosophy, the development of a tool such as a strategic and tactical plan for technology can be more effective when involving key individuals.
8. **Define the Scope of the Plan** - A "target" strategy may be defined as the "best" environment for Embry-Riddle, derived from the optimum, while considering all circumstantial factors. Implementation strategies define the resources, work plans, critical paths, and evaluation criteria necessary to realize the "target" administrative and academic technology environments. This facilitates the transition to specific, concurrent projects and tactical objectives. The scope of the plan should include not only information regarding desires of the institution, but what action events to take to realize such desires and how best to implement the plan.
9. **Gather Information** - Gathering the information that will lead to the development of the plan is as important a step as writing the document itself. It is important to communicate with those who will be most immediately and directly impacted by the decisions that come about due to the plan. See the Tools Section to identify what tools are available to help gather information.
10. **Formulate the Plan Outline** - Shirley (1982) offers four basic criteria that strategic issues or decisions should address: 1) define the institution's relationship to its environment; 2) generally take the whole organization as a unit of analysis; 3) depend on inputs from a variety of functional areas; and 4) provide direction for and constraints on every administrative and operational activity throughout the institution. One way of incorporating these criteria are:

    A) where is the institution now in terms of technology usage;
    B) where does the institution desire to go; and
    C) how does the institution get from where they are to where they would like to be?

tangible terms, free of technological jargon (Scotto, 1989). It will be rewritten, reworked, and often reviewed to meet the changing needs of the University as technology changes. It is important that the document is modularly developed for easy modification. Even the binding within which the document is placed must allow for ease of modification and review. Just five years is a generation in terms of technological change. It must be expected that the plan will evolve with technology and should be monitored accordingly.

12. **Validate the Plan and Receive Approval** - Once the document is written, it must go through review, evaluation, possible re-writing, and finally approval. The plan must be approved by those charged within the University to approve technology vision. At ERAU, the Computing Governance Committee should approve the plan.

13. **Implement the Plan** - "It is easier to develop a new business strategy than it is to implement one" (Marx, 1991, p. 19-1). The pivotal point of the entire process is the implementation of the plan. At this point in time the plan will have been prepared. Subsequent tasks will consist of potentially monotonous chores dedicated to follow-up, and then the process will start again as each new year arrives. "Strategy implementation is the process of putting strategies and policies into action through the development of programs, budgets, and procedures" (Wheelen & Hunger, 1983, p. 10). Implementations are procedurally oriented. This means that it is important to follow specific steps to properly installing and implementing a plan. Not every implementation process follows the same steps. It takes the experience of those who have done such implementations to know how to adapt a basic implementation process to the specific organization that requires that process. Experience helps in defining how to measure the success of the process. The implementation of the strategic plan depends upon: the priorities set, the defined goals, the complexity of the planned event, the resources available (both in terms of personnel as well as funds), the timeline of events, and the commitment of the institution.

14. **Evaluate the Plan** - The only way expectations for the plan can be judged is through a rigorous evaluation design. The Tools Section identifies one method of evaluation - CIPP.

PART 3: PREPARATION OF THE BOARD QUARTERLY REPORTS

The Board Quarterly Reports offer reviews of the progress of each area within the University toward achievement of goals and objectives. Nova University provides their BQRs in four distinct reports: Academic Center performance for the fiscal year, facilities and equipment, programs and innovations, and faculty and personnel. Each area within the University should identify the progress toward goals and objectives that impact their areas. In addition, identification of obstacles to achieving the goals are included in the BQRs. Priorities of the goals are identified and links to the Critical Success Factors is made. This will define how important it is to find soltuion for problems toward achieving goals as well as identify whether progress is being made toward goal achievement.

The following is a copy of the outline of the Faculty and Personnel BQR of of Nova University (1992, p. i). The areas under review supply any documents they have developed that will help display information pertaining to progress toward the goals and objectives of the institution.

- Executive Summary
- Structure of the Report
- Overview of Progress
- Enhance Administrtaion and Faculty (Goal 4)
- Provide Skills in Technological Fluency (Goal 6)
- Expansion of Full-time Faculty (CSF 8)
- Human Resources Development - Self-paced Learning (CSF 12.A)
- Human Resources Development - Technology (CSF 12.B)
- Human Resources Development - Capital Attraction (CSF 12.C)
- Appendices
    - Synthesis of BQRs
    - Priority of Critical Success Factors
    - Institutional Goals
    - Format of Structure for Center Reporting

The preceding is one example of how to develop a BQR for the University. For the purposes of planning for the Strategic and Tactical Blueprint fot Computing and Networking at ERAU, the BQRs should be developed with computing and telecommunications in mind. The golas should be identified prior to developing the BQRs.

PART 4: PLANNING TOOLS

The following describes some of the tools available to gather information for the purposes of planning and evaluating the plan for technology. Although not an exhaustive list, it provides some guidance to those charged with gathering information. Brainstorming, Nominal Group Technique, GroupSystems decision making, Force Field Analysis, Pareto Chart, and Flowcharting will be described below. After those descriptions, examples of the Competitor Checklist, a project management tool, and WOTS-UP analysis follow.

BRAINSTORMING - Brainstorming helps a group of people create many ideas in a short period of time. It can be used in either structured or unstructured ways. A strucutred brainstorming session allows each member to provide input as their turn arises. It sometimes forces shy people to participate. Unstructured sessions allow members to provide input as they think of it. It creates a relaxed atmosphere, but risks domination by vocal members (GOAL/QPC, 1992).

NOMINAL GROUP TECHNIQUE - NGT involves the participation of a number of people in a group setting. It was designed to provide each member of the group an equal voice in problem selection without the influence of others in the group. The following describes the process of NGT (GOAL/QPC, 1992):

1. A chairman is chosen to monitor and record the process.
2. The chairman focuses the group on the particular goal or set of goals to be addressed by transcribing the goals(s) on a flip chart. The chairman then asks the members to identify areas the each feels is most important to achieving the goals(s).
3. The chairman records the group input on the flip chart.
4. Each member has the opportunity to clarify (not defend) the item they offered.
5. Each member lists the five most important items on a piece of paper, ranking them in order with 1 the lowest and 5 the highest.
6. The chairman asks each member to list their items so he can record them on the flip chart. After going around the room and listing the most important items, the corresponding numbers are added to determine a rank order of priority. This would identify the priority of issues to address to achieve the desired goal(s).

GROUPSYSTEMS - This is an automated prioritizing tool. It allows the group members to gather numerical or prioritizing data quickly froma group and in immediately usable form. Designed for silent decision-making, it requires PCs to run on a network. The chairman provides a list of items to be prioritized. These usually are items identified as needing attention to accomplish a goal. This can be the next step after NGT. Each member casts his vote for the item needing the most attention. The system automatically calculates a priority depending upon the weights given to the issues to be addressed. The results are presented wither online or can be printed (ERAU, 1993c).

FORCE FIELD ANALYSIS - This tool helps to identify how change can occur. One approach is to view change as a result of a struggle between forces that are seeking to upset the status quo. Driving forces move a situation toward change while restraining forces move it away from change. When there is no change, the opposing forces are equal. Consider the example on the next page (GOAL/QPC, 1992, p. 73):

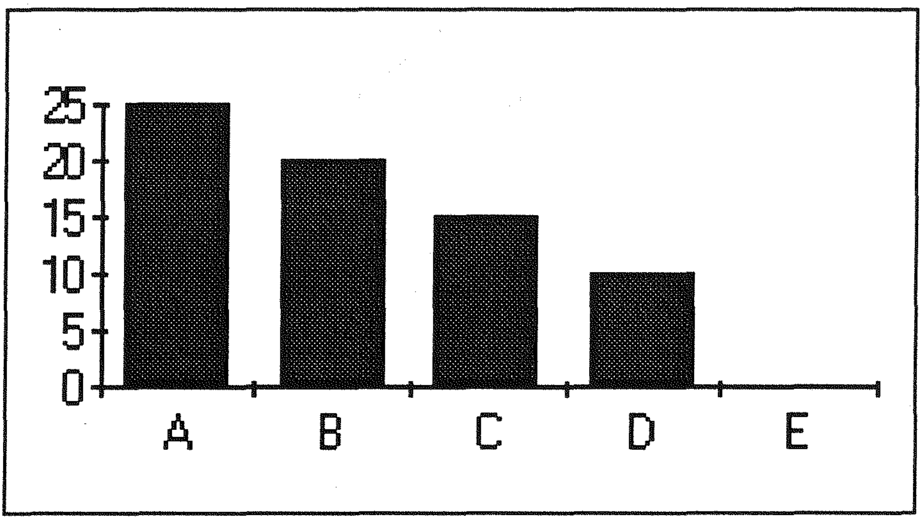
Consider the question "Why TQM for Education?

DRIVING FORCES	RESTRAINING FORCES
$$$$$$	Training for faculty
People are committed to doing their best	Parents' perceptions Politics
Commitment to students	Tradition Fear of change
Students have changed	Buy-in from top administration
Lack of structure	$$$$$$
Reputation of TQM Pride in work	Inability to agree on "who is our customer"
Competition Less fear	Staff's fear of additional responsibility
	Lack of time

If restraining forces are stronger than the driving forces, the desired change will not happen. Conversely, some change can be expected to occur if driving forces are greater than restraining forces. Force field analysis forces people to think together about all facets of a desired change. It encourages people to agree about the relative priority of restraining factors vs. driving forces. It provides a strating point for action by either strengthening the driving forces or reducing the restraining forces.

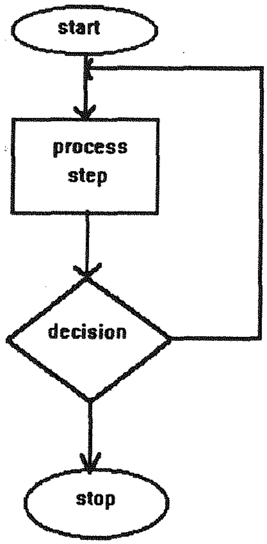
PARETO CHART - A Pareto Chart is a vertical bar graph that helps determine the relative importance of all problems to choose a starting point for problem solving. It helps to direct work efforts toward the most important issue first. The steps include (GOAL/QPC, 1992):

1. Select the problems to be compared and ranked;
2. Select a common unit of measurement, such as annual cost or frequency;
3. Select a time period to be studied;
4. Gather information;
5. Compare the frequency or cost against all other categories (e.g. Problem A occurred 75 times, Problem B occurred 100 times);
6. List the categories from left to right on a horizontal axis, smallest to the extreme right;
7. Draw a rectangle above each category whose height represents the frequency or cost.



Pareto Chart example: Problem A has highest frequency.

FLOWCHARTING - A flowchart is a pictorial representation of all the steps wihin a process. It uses easily recognizable symbols to represent the type of processing being performed (see example next page).



The basic steps of the flowchart are to identify: the starting and ending points of the process; the action steps of the process; and what decisions that result in either yes or no answers are made to proceed. A flowchart can be used in two ways: what the actual steps of a process are; and what the steps of the process should be. The two charts, if drawn for the same process, can be compared to see where the processes (actual and desired) differ. Appropriate action can then be taken to correct the process (GOAL/QPC, 1992).

Competitor Checklist

	COMPETITORS			
ITEM	**A**	**B**	**C**	**D**
Name				
Geographic Location of Main campus				
School Costs				
Specialty (Niche)				
Number of Sites				
Estimated Number of Students				
Terminal Degrees?				
Technology Utilization*				
Relative Valuation				
Growth or Decline? By How Much?				

* Evaluate on the following scale: 1 = high; 2 = above average; 3 = average; 4 = below average; 5 = low.

Example of WOTS-UP Analysis

OPPORTUNITIES

O-1. New Leadership✓
O-2. New Technological Innovations✓
O-3. New Sources of Funding✓
O-4. Eagerness of University to Make Changes
O-5. Distance Learning✓
O-6. Multi-Campus Environment
O-7. External Leveraging✓
O-8. New Hardware and Software Platforms
O-9. Client/Server Technology
O-10. User Information Access and Control✓
O-11. The Internet and Information Exchange
O-12. Online Library
O-13. Help Desk
O-14. Decreasing Hardware and Software Costs
O-15. Cooperative Partnerships
O-16. Higher Computer Literacy

THREATS

T-1. Poor Technology Policies✓
T-2. Inappropriate Style of Technology Delivery✓
T-3. Incomplete Administrative Computing System
T-4. Costly Hardware Direction
T-5. No Prior Strategic Computing Plan✓
T-6. No University-wide Network✓
T-7. Resistance to Change by Some University Factions
T-8. Inadequate Technology Usage✓
T-9. Rapidly Advancing Information Technology
T-10. Lack of Computing Standards✓

WEAKNESSES

W-1. Inadequate Return on Computing Investment✓
W-2. Deficient Productivity of Staff
W-3. Recent Reorganization Deflated Morale
W-4. No Formal Training Plan
W-5. Current Systems Require High Degree of Overtime Work
W-6. Deficient Technology Methodologies✓
W-7. Poor Information Access
W-8. Prior Lack of Computing Management and Vision✓
W-9. Antiquated Computing Technology✓

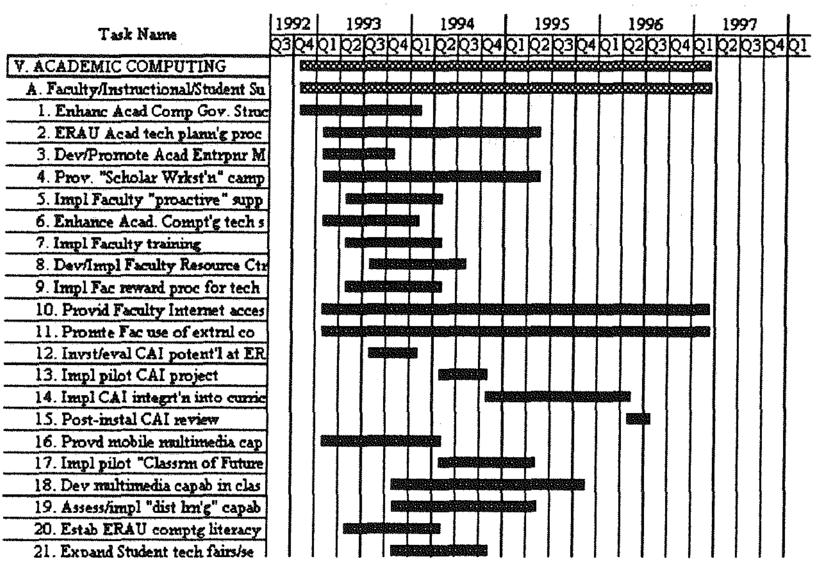
W-10. Poor Retention Potentially Related to Student System
W-11. Downturn in Enrollments✓
W-12. Poor Capital Planning and Expenditure Management✓
W-13. Inadequate Planning/Training for Integration of Technology

STRENGTHS
S-1. Computing Governance Committee✓
S-2. New Leadership✓
S-3. New Visions✓
S-4. New Goals✓
S-5. Acceptance of New Technologies
S-6. External Leverages✓
S-7. New Management Methodologies✓
S-8. High Desire to Integrate New Technologies
S-9. New Student Administrative System
S-10. New Hardware Platform
S-12. Skilled, Knowledgeable Employees
S-13. University Recognition of Importance of Technology✓
S-14. New Service-oriented Philosophy

✓ = Critical

TIMELINE Project Management Tool

To assist in the management of the plan development process as well as to provide a timeline of events within the plan, a tool such as TIMELINE, by Symantic, or a similar tool, is recommended. This will provide an easily manageable sequential timing of events. The tool provides for the ordering of events, can tie events to other events for dependency, allows resource allocation and cost monitoring, and summarization of like-events. It displays the timeline of events using PERT and Gantt Charts, Pie Charts, and Histograms. The following is an example of a Gantt Chart of events:



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Appendix L: Climate Survey Sample Page

EMBRY-RIDDLE AERONAUTICAL UNIVERSITY
STAFF CLIMATE SURVEY
FALL 1992 ADMINISTRATION

This Staff Climate Survey is designed to collect information about your perception of the University environment as it involves the following areas:

- Overall University Leadership;
- Departmental Leadership;
- Working Environment;
- Satisfaction;
- Performance Evaluations; and
- Communication and Cooperation.

The information you provide will help the University leadership to better plan for University needs in the areas surveyed. The results will be compiled for the entire University community and by campus.

DIRECTIONS FOR COMPLETING THE SURVEY FOLLOW:

FOR EACH STATEMENT ON THE FOLLOWING PAGES, INDICATE YOUR LEVEL OF AGREEMENT BY SHADING THE BUBBLE CORRESPONDING TO THE FOLLOWING CODES:

SA	I STRONGLY AGREE WITH THE STATEMENT.
A	I AGREE WITH THE STATEMENT.
D	I DISAGREE WITH THE STATEMENT.
SD	I STRONGLY DISAGREE WITH THE STATEMENT.
DNA/DK	THE STATEMENT DOES NOT APPLY TO ME OR I DON'T KNOW ENOUGH ABOUT THE STATEMENT TO PROVIDE MY PERCEPTION.

For the results to be meaningful, it is important that you complete the survey completely and honestly. Individual identification is not included on the survey to preserve anonymity. On the first page of the survey, please bubble in the response beside the campus where you are physically located and the Vice President responsible for your department/area.

EMBRY-RIDDLE AERONAUTICAL UNIVERSITY
STAFF CLIMATE SURVEY
FALL 1992 ADMINISTRATION

Campus	Vice President Responsible for my Area
CCE ------------------> O	Academics -------------------------> O
Daytona -----------> O	Administration ------------------> O
Prescott ------------> O	Flight ------------------------------> O
	Special Projects -----------------> O
	Student Life ----------------------> O
	None of Above ------------------> O

Climate Survey continues on next page!

OVERALL UNIVERSITY LEADERSHIP:	SA	A	D	SD	DK/ DNA

1. I have the confidence in the overall leadership at ERAU.	O	O	O	O	O
2. I have confidence in the leadership of the President.	O	O	O	O	O
3. I have confidence in the leadership of he Vice President of Academics.	O	O	O	O	O
4. I have confidence in the leadership of the Vice President of Student Life.	O	O	O	O	O
5. I have confidence in the leadership of the Vice President of Administration.	O	O	O	O	O
6. I have confidence in the leadership of the Board of Trustees.	O	O	O	O	O
7. ERAU has a work environment of mutual respect and trust.	O	O	O	O	O
8. My chain of command to the President works well: My ideas are communicated to the President, and his decisions are shared promptly with me.	O	O	O	O	O
9. The Vice President responsible for my dept. emphasizes teamwork within my division as well as cooperation among divisions to achieve	O	O	O	O	O

Appendix M: Competitor Checklist

	COMPETITORS			
ITEM	**A**	**B**	**C**	**D**
Name				
Geographic Location of Main campus				
School Costs				
Specialty (Niche)				
Number of Sites				
Estimated Number of Students				
Terminal Degrees?				
Technology Utilization*				
Relative Valuation				
Growth or Decline? By How Much?				

* Evaluate on the following scale: 1 = high; 2 = above average; 3 = average; 4 = below average; 5 = low.

Appendix N: Sample Action Plan

A major function of a long-range plan is to provide guidance and direction for actions that must take place in order to achieve desired outcomes regarding computing technology upgrades. It takes much planning to build a strong infrastructure of technology, yet planning alone does not build that infrastructure. It takes action to bring a vision to fruition.

There are perception-related difficulties involved in planning for technology that are overcome by using a set of guides that describes the action required to realize desired outcomes. Such action events are described in this section of the document as "Work Programs." The work programs may be thought of as "place holders" for events that must happen in order to integrate technology into the current environment. The work program timeline identifies many general tasks that must be addressed in order to bring ERAU to a higher level of technology usage. The work programs describe a general action event from which more detailed, task-oriented, manageable sets of discrete actions may be developed as implementation of each specific action event takes place.

The work programs address four questions for the stages of action deliverables that may be asked:

- *What* area of concern is the action event designed to satisfy? Every event in the timeline has specific reasons for its inclusion. Taking a holistic perspective, all events lead to a higher level of technology usage;

- *When* will the event take place. This is a strategic issue that, if not thoughtfully and carefully planned, may impact functional processing;

- *Who* will be primarily impacted by the action event. If there are no benefactors, there may be no need to pursue the action; and

- *How much* will the event cost in terms of dollars and human resources. This is probably the most conspicuous item of concern.

Responsibility for the action varies due to resource availability and expertise. The detailed tasks defined in the discrete action events identify responsible parties and provide greater detail regarding the timing of such events.

Work Program Action Event Form Explanation

A standard layout is used to provide a synopsis of each major solution deliverable. Following is a brief explanation of the different headings:

Work Program - The Blueprint Solution section is divided into several logical groupings, called work programs. These work programs correspond to various disciplines associated with the overall technology strategy. Work programs are made up of projects.

Project Name - The project name is representative of a specific deliverable.

Timeline X-Ref - The cross reference number provides a link between a given project and the Long Range Time Line of Events. Some project will incorporate multiple events; hence, multiple reference numbers.

Primary Impact - This describes the areas of the University that will be impacted by the action event, either as a benefit or as the largest area of work concentration for the event to happen.

Description - The description provides a project scope summary.

Status - The status presents the current level of progress.

Work Effort - The work effort denotes the estimate of person labor, not elapsed time.

Schedule - The schedule provides calendar start and completion estimates.

Project Cost - The project cost reflects hardware, software, and other capital estimates.

The work programs are defined in the following pages.

MANAGEMENT/"NEW DIRECTIONS" INITIATIVE

WORK PROGRAM: Planning

PROJECT NAME: Develop Technical Mission Statement

TIMELINE X-REF: I.A.2

PRIMARY IMPACT: ERAU Management

DESCRIPTION: Development of Mission Statement as the guide for future strategic direction of ERAU regarding computing technology. Must be based upon Statement of Purpose in the ERAU Strategic Management Plan.

STATUS: Ready to begin investigation and information gathering. Will be meeting with Executive Management for information and final approval.

WORK EFFORT:

SCHEDULE: Start - quarter 3, FY 92/93
End - quarter 4, FY 92/93

PROJECT COST: nn person months @ $$$/per = $$$

Appendix O: Plan for Implementation Table of Contents

PLAN TO IMPLEMENT THE STRATEGIC PLAN

"A strategy that is not implemented is no strategy at all" (Rowe, Mason, & Dickel, 1986, p. 262). Plans do not implement themselves. It requires the activities of individuals to direct actions toward the achievement of the University's goals, guided partly by implementation technique. There are certain tasks or steps that must be identified and followed to ensure proper implementation of the Plan. There must be consideration of (Steiner, 1979):

1) Resources - both human and physical;
2) Motivation and incentive systems;
3) Coordination of effort and guidance of individual activities;
4) Budgets;
5) Training programs to improve managerial and worker capabilities; and
6) Control techniques to consider all of the above.

Control comes in three basic types:

1) Steering controls to detect deviations from standards and to permit corrective action before operations are completed - Standards must be defined before implementation takes place. Management must identify what needs to be measured, focusing on key activities that should be monitored closely. As Pareto's law describes, in a group of elements, the most important ones are a small proportion of the total. The more concrete the standard is, the easier it will be to measure performance against. Therefore, the implementors must define what standards should be in place prior to implementing any system. The standards may be used after implementation as a measurement of performance. Variation from the standard must be identified to identify a reason for taking corrective action. A solid reporting mechanism can assist in identifying variation for standards.

2) Yes/no controls that require authoritative approval before attempting another succeeding step - One way to control the implementation of any plan is to require authorization of particular portions of the plan. This can be purposely designed to prevent unauthorized implementation. By requiring signature sign-off, management can be assured that portions of the plan are not implemented without authorization to do so.

3) Postaction controls to measure results after action is completed - This is where Gantt charts and other evaluation tools can be employed. They will give quantitative measurements for comparison against expectations that have been previously defined.

Management control systems in themselves are ineffective. People must control the process. Change is usually accompanied by factions of resistance. Employees enjoy the comfort of familiar systems. When that comfort is threatened, the result is resistance to the new process or system. People must be motivated to accept change. This is where top level management can be most effective. Specific benefits must be identified to prove the value and worth of the particular change. Motivation may come in the form of allowing participation in decision-making, or simply by expressing what new levels of comfort can be expected. The mix of strategies employed by management for the purposes of ensuring successful implementation may be determined after the identifying and knowing the personalities involved. Sun Tsu offered that if you know the enemy, you will be assured of winning a hundred battles. Knowing the participants involved can assist in development of motivational strategies.

Resistance to change is usually due to a lack of full knowledge of the system; factions attempting to exert pressure to keep the status quo; a mis-perception of the system as being disfunctional; inconvenient timing of the implementation; of mistrust in the attempted change (Rowe, Mason, & Dickel, 1986). The manager must identify the cause of resistance and then identify the neutralizing factors that will leverage the resource to motivated participation. Such factors as friendships, loyalties, habits, and shared beliefs may be used to motivate the participant to a greater level of support.

Rowe, Mason, and Dickel (1986, pp. 263, 661) offer a specific tool (a worksheet - see attachment) to identify the level of participation expected from participants in the implementation process. Once participants' expected level of participation is identified, management may identify those whom he can reasonably expect to offer the greatest level of participation to ensure a successful implementation.

Each participant is assigned a weight in the range of 0 to 10, subjectively indicating the relative importance of that participant in the implementation strategy. If the plan cannot be reasonably implemented without that particular participant, he should be given a weight of 10. If the plan can be implemented without a particular participant, he shall be given a weight of 0. The attitude of the participant is then determined. The authors suggest the following scale to identify attitudes (next page):

BEHAVIOR	SCORE
Active resistance	-2
Passive resistance	-1
Indiffernce	0
Cooperation	1
Enthusiastic support	2

The importance weights are multiplied by the attitude score, resulting in the significance of each participant in the implementation process. Those who actively resist implementation must be neutralized by motivational tactics or separation from the process. Participants with little importance can be ignored while whose with strong support should be reinforced. The weighted scores of all participants will provide a disposition of the implementation process.

IMPLEMENTATION PROCESS
Lebreton (Scigliano, 1993) offers specific steps to implementing a strategic plan. One should be able to implement a completed plan by following the guidelines set below:

1. **Receipt of approved plan**. The plan must be approved before one can reasonably expect that portions of it are implemented. Approval should be made within a reasonable period of time after its completion. Waiting too long to approve may result in having to make adjustments to the plan prior to the implmenetiaon of the first targeted action plan.

2. **Obtaining an understanding of the technical components of the plan**. The plan should not be implemented without the complete understanding its technical components by thoise who are implementing the plan. Without proper understanding, potential errors may occur that could result in higher implementation costs. The plan developer should prepare some accompanying documentation for each of the action events in the plan. Additional training may be required, depending on the complexity of the action event. The plan developer may need to schdule a formal training session.

3. **Interpretation of ramification of the plan**. The plan implementors should have a good appreciation of the implications of the plan. This will help ensure that care is

taken during the implementation process. This can be accomplished in a formal discussion session with the implementors, directed by the plan developer. Many times, during the acceptance process of the plan, questions regarding such significance will be made that make known potential implications. However, it should not be assumed that everyone knows such implications.

4. **Determination of the role of implementor**. To provide an orderly implementation of the plan, the participants should be given specific tasks to perform that they are capable of performing and that they understand fully the complexities and implications of implementing such actions. Thus, care should be taken by those charged with coordinating the implementaiton to select the proper personnel for implementation of the particular action events.

5. **Organizing implementation staff and assigning responsibility**. As mentioned above, involving the right personnel can be one of the most critical decsions that can be made regarding implementing the plan. The first qualification that a participant needs is that of buy-in. The persons implementing the plan must feel confident and believe in the plan. They must loook at change objectively and be willing to accept the change as a benefit to the institution. If one tries to implement a plan that he does not fully accept and believe in, his heart will not be in it and there is a good chance that it will not be implemented properly.

The participant must be self-disciplined and be able to take initiative when appropriate. Giving one responsibility depends on the work ethic of the individual. If he need constant supervision, it could take up precious time from others who are responsible for other parts of the implementation. Finally, the participant must be able to manage his time appropriately. Implementing a plan usually increases the workload of those involved. The manage should be willing to prioritize responsibilities to allow for a managable project.

6. **Preparation of an implementation plan**. Even though the plan includes a timeline of events, each action event must be planned in advance of its implementation. This plan to implement serves in that capacity.

7. **Taking action and making necessary commitments**. Once an action is planned, it must be acted upon. This proves commitment. All necessary preparation, including equipment and resource costs, must be considered. Costs should be known prior to implementation, thus those investments must be made. If one is unwilling to make the investments necessary, the entire plan is an exercise in futility. Things do change between development of the plan and its implementation, yet necessary adjustments should be made to ensure implementation of the plan.

8. **Notifying organization members of the new program**. Communication is the most important aspect of an implementation process. It allows others to be aware of

the status and other information, as appropriate, such as up-to-the-minute costs. Communication may also help with program buy-in. Without the proper buy-in, implementation can become difficult as those who do not see its benefits may cause the process to slow. Communication may come in the form of newsletters, electronic mail, and meetings.

9. Interpretation of operational plans to subordinates. It is important that those who are tasked to carry out action events fully understand what they are to do. This is comparable to programmers fully understanding program specifications prior to coding programs to perform desired tasks. The implementation project manager should take the time to explain the task to the subordinate and provide them with an expactation level to which they can target their efforts. The manager should go line-by-line, if appropriate, to ensure that the subordinate understands the task. An agreed upon level of acceptance should be developed as a measurement.

10. Instruction of subordinates in their control assignments. Milestones should be developed to help focus the subordinate to the required task as well as provide the measurement needed to control the process. These milestones should be identified within the timeline and reviewed at the appropriate times. Adjustments may be made at the milestone dates if necessary.

11. Gathering data on progress of plan. This is one of the most important steps in developing a plan. Infomration can be either valuable or valueless. It is valuable when it has appplication to the topic. It can be of little or no value if it does not relate to the subject. A plan to gather information is just as important as the information itself. There are a number of sources that can provide information, such as human resources, library databases, national electronic databases (such as the Internet), trade magazines, and conference proceedings. The planner should carefully consider potential sources and define how to approach the information gathering process. It is very important to decifer information that has application versus information for information's sake.

12. Review and evaluation of plan. The plan should follow a regular review schedule to allow for adjusments due to changes in the economy, human resources, institution funding, or philosophy. The planner should define how the evaluation should be made and by whom. A questionnaire that follows the objectives of the plan is one appropriate tool for evaluation. Other tools include group decision-making sessions and outside review. Lebreton (Scigliano, 1993) suggests seventeen areas to ensure the plan has value: complexity, significance, scope or magnitude, comprehensiveness, frequency, duration, uniqueness, authorization, flexibility, available time, confidential nature, clearness, formality, specificity, completeness, accuracy, and stability

13. Taking corrective action when necessary. Once it is determined that adjustments should be made to the plan, it is necessary to identify how and by whom the adjustments should be made. The adjustments should not stray from the vision and goals of the institution, unless the vision and golas have changed. In that case, it is appropriate to start the planning process from the beginning.

14. Report of progress to authorized personnel. During the planning process, it is important to report project status to the appropriate authority. By doing this, there will be no question as to how far along the project is, compared to where it should be. The proper authority can also help to provide the necessary resources if there is an indication that the project is falling behind for one reason or another.

References

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Appendix P: Nominal Group Technique
(Goal/QPC, 1992)

Nominal Group Technique

The following describes the process that will be followed to identify problem areas at the University. The problems will be ranked to provide order of importance. The results will provide input into the strategic planning for Computing and Telecommunications Services process on a yearly basis. Once problem areas are identified in order of importance, solution events may be developed, with an emphasis on incorporating technological tools into the solution process.

I. The NGT leader will provide a question that will prompt thought towards areas within their department and within the University that require improvement.

II. 3X5 cards are distributed and the members are asked to identify 5 problem areas.

III. After a specified period of time (approx. 15 min), the leader will go around the room and the members will provide the leader with their identified problems. The process calls for the first member to respond with his first problem area. The next member will respond with his first problem areas. Once all members have responded with their first problem areas, the process is followed again, this time with the second problem areas identified. This process continues until all five areas are identified by each member. No discussion of the problem takes place at this time. The leader will list the problems on a flip chart.

IV. A short discussion period follows to clarify any unclear items. This is only for clarification and should not be a debate. This will last approximately 5-15 minutes.

V. The team members will then mark the back of their cards with numbers from 1 to 5, leaving space to write a problem area next to each number.

VI. Each member will then rank the problem areas from the list, marking the most important with the number 5, the least important with the number 1.

VII. After approximately 5-10 minutes, the leader will go around the room in the same fashion as previously followed to list numbers on the flip chart next to the problem areas.

VIII. After all problem area rankings are complete, the list is tallied to identify the most important problems to be addressed. Those with the highest scores are the most critical areas to address.

IX. The leader will provide the Computing Governance Committee with the ranked order for their follow-up.

Appendix Q: Force Field Analysis
(Goal/QPC, 1992, p. 73)

"Why TQM for Education?"

DRIVING FORCES	RESTRAINING FORCES
$$$$$ People are committed to doing their best	Training for faculty Parent's perceptions
Commitment to students	Tradition Fear of change
Students have changed	Buy-in from top administration
Lack of structure	$$$$$
Reputation of TQM	Inability to agree on "who is our customer"
Pride in work	Staff's fear of additional responsibility
Competition	Lack of time
Less fear	

Appendix R: Post-implementation plan questionnaire
(Steiner, 1979, pp. 301-303)

Post-implementation plan questionnaire

Rate each question from 1 to 5, 1 as not effective, 5 as very effective. The system referred to here equates to the infusion of new technologies.

Statement	Rating
A. Overall Managerial Perceived Value	
1. President Sliwa believes the system helps him to discharge better his responsibilities.	
2. Other major line managers think the system is useful to them.	
3. Overall, the benefits of the strategic planning are perceived to be greater than the costs.	
4. Are major changes needed in our strategic planning system?	
B. Does our strategic planning system produce the "right" substantive answers and results?	
5. Developing basic ERAU missions.	
6. Foreseeing future major opportunities.	
7. Foreseeing future major threats.	
8. Properly appraising ERAU strengths.	
9. Properly appraising ERAU weaknesses.	
10. Developing realistic current information about competitors.	
11. Clarifying priorities.	
12. Developing useful long-range objectives.	
13. Developing useful long-range program strategies.	

14. Developing creditable medium- and short-range plans to implement strategies so as to achieve goals.

15. Preventing unpleasant surprises.

16. Our major financial indicators have been better after introducing planning than before:

C. Does our planning system yield valuable ancillary benefits?

17. The system has improved the quality of management.

18. The system is a unifying, coordinating force in ERAU operations.

19. The system facilitates communications and collaboration throughout the University.

D. The design of the planning system.

20. Top management has accepted the idea that strategic planning is its major responsibility.

21. Our system fits the management style of ERAU.

22. The system fits the reality of our strategic decision-making processes.

23. The planning committee structure is appropriate.

E. Are the planning processes effective?

24. Top management spends and appropriate amount of time on strategic planning.

25. There is too much foot-dragging about planning. It is given lip-service but too many line managers really do not accept it.

26. Line managers generally spend an appropriate amount of time with other line managers and/or staff in developing strategic plans.

27. The system proceeds on the basis of an acceptable set of procedures.

28. The planning procedures are well understood at ERAU.

29. The work requirement to complete the plans is acceptable to our managers and staff.

30. The process is effective in inducing in-depth thinking.

31. Too much attention is paid to putting numbers in boxes. The process is too proceduralized, too routine, too inflexible.

32. New ideas are generally welcomed.

33. Too many managers are not willing to face up to ERAU weaknesses in devising plans.

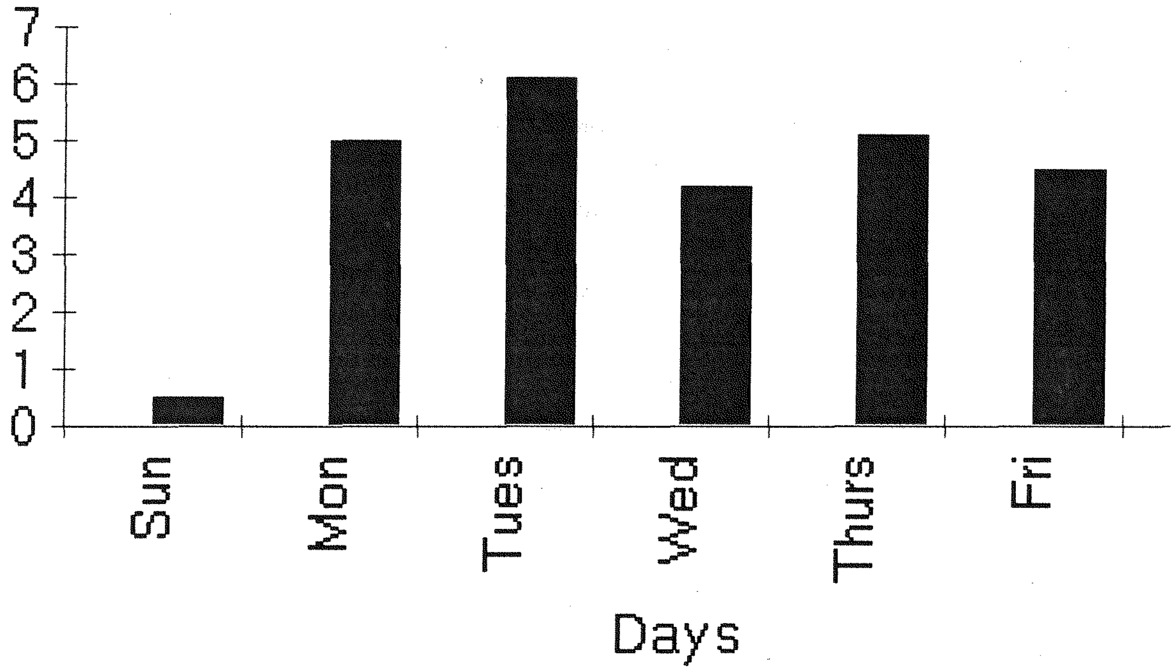
34. Departments do not get sufficient guidance from top management for effective planning.

35. Departments are too much restrained by top management for effective planning.

36. The ability of managers to do effective strategic planning is taken into consideration in a proper manner when they are measured for overall performance.

Appendix S: Memory and Disk Utilization (HP, 1992, pp. 16, 18)

The part of the operating system that manages memory is called the memory manager. Its job is to keep track of which parts of memory are in use and which parts are available. This figure represents peak CPU time spent on memory management. CPU utilization greater than 5% typically indicates the system needs additional memory.



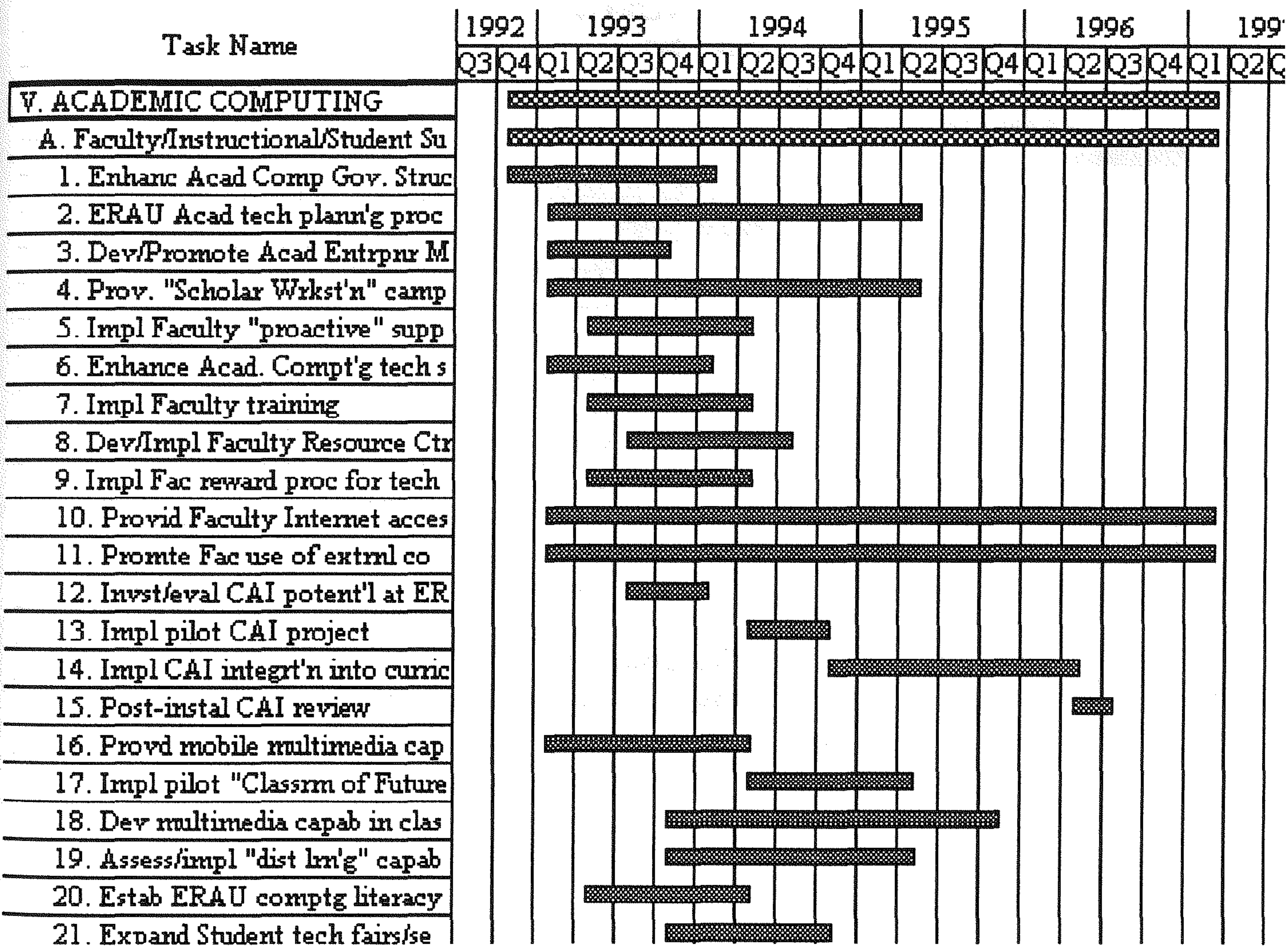
Disk I/O is comprised of three components:

Seek time -The time required to move the disk heads from their current location to the desired cylinder. 20 milliseconds is typical;

> **Latency** - The rotational delay for the desired sector to revolve to a point where it is under the disk heads. Most HP disk drives do half a revolution in 8.3 ms;
>
> **Control & transfer** - The time required to issue commands to the disk controller and receive the requested data back over the channel. Usually 2-4 ms is required.

Most disk drives can complete an average of 30 operations per second. The ERAU disk drives are over-burdened such that the drives cannot complete the operations within an acceptable timeframe.

Appendix T: Example Timeline of Solution Events



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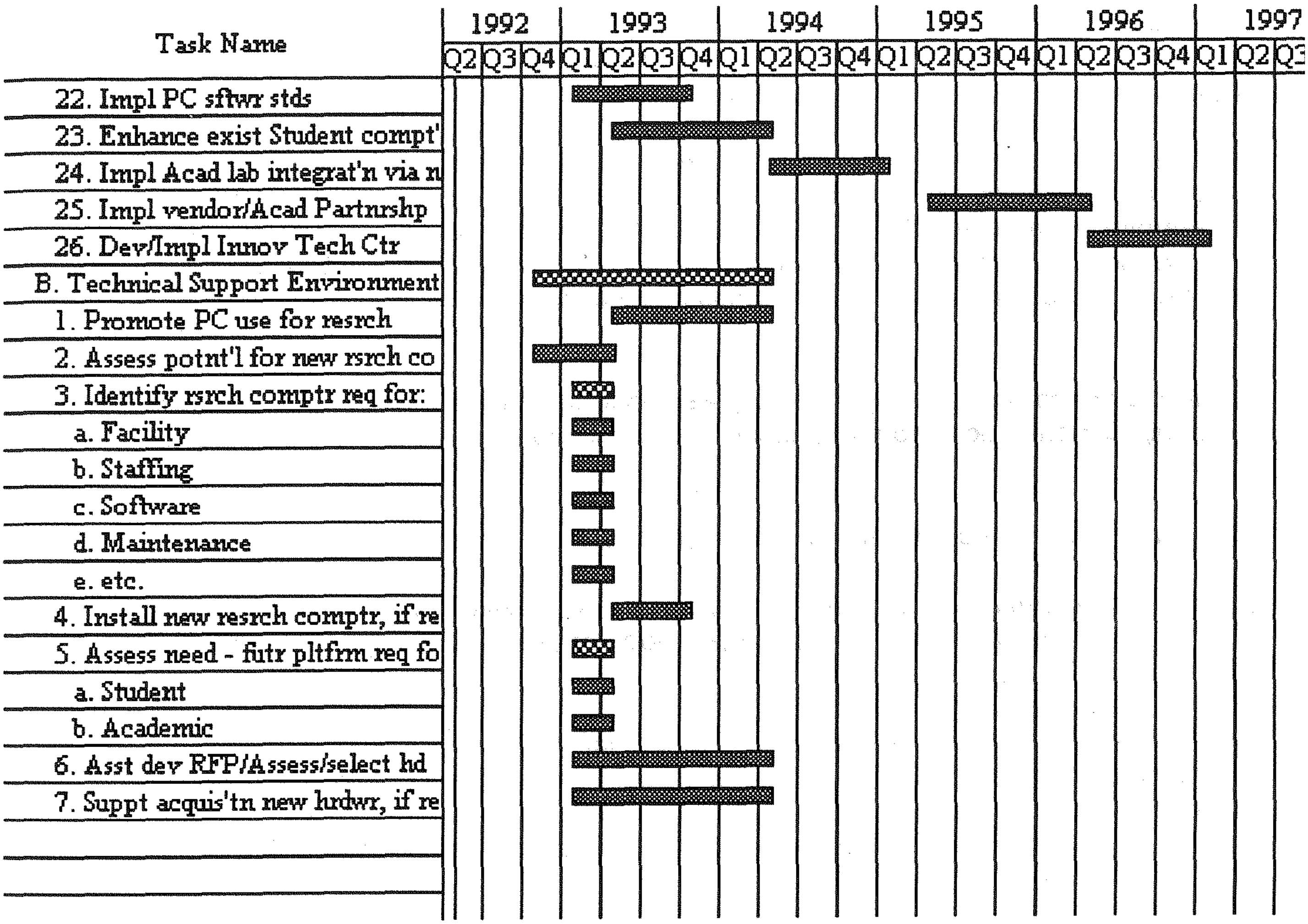

Task Name
1992
1993
1994
1995
1996
1997
Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2 Q3 Q4 Q1 Q2
22. Impl PC sftwr stds
23. Enhance exist Student compt'
24. Impl Acad lab integrat'n via n
25. Impl vendor/Acad Partnrshp
26. Dev/Impl Innov Tech Ctr
B. Technical Support Environment
1. Promote PC use for resrch
2. Assess potnt'l for new rsrch co
3. Identify rsrch comptr req for:
a. Facility
b. Staffing
c. Software
d. Maintenance
e. etc.
4. Install new resrch comptr, if re
5. Assess need - futr pltfrm req fo
a. Student
b. Academic
6. Asst dev RFP/Assess/select hd
7. Suppt acquis'tn new hrdwr, if re

Appendix U: Sample Policies and Procedures

A. Policies and Procedures

In order to function at maximum effectiveness, guidelines should be developed and communicated to the University community. Such guidelines, known as Policies and Procedures, describe the actions that must take place regarding every issue involving technology that will impact Embry-Riddle Aeronautical University. As technology agents, the Data Processing Center, or what it should more appropriately be called, the Office of Information Technology (OIT), must develop and maintain such policies and procedures in document form and distribute it such that all may be informed as to how to address an issue involving technology at Embry-Riddle Aeronautical University. The following describes basic components of a Policies and Procedures manual.

POLICY: is a broad statement of principles, goals, objectives, and courses of action adopted by the University to govern issues relating to technology and managed by the Office of Information Technology.

PROCEDURES: are the methods of proceeding in a definite pattern and manner to accomplish particular goals and objectives that may be described by an accompanying policy. Absence of specific procedures requires users and staff to use their best judgment in following the policies, standards, or guidelines.

EVALUATION STANDARD: is a specific rule, principle, or criteria established by the technology authority (either the Computing Governance Committee or the OIT) to ensure a minimum level of performance. Review of OIT performance is directly related to the Standards in this manual and is used for annual management audits. Users expect a minimum service level consistent with the standards.

GUIDELINES: are suggested methods for a course of action needed to obtain desired results. These are not as specific as standards and usually require judgment decisions. Users expect OIT to follow the guidelines, but there may be exceptions based on management judgment. Guidelines may be stated to assist in determining various alternatives and possible courses of action.

EXCEPTION: Normal policies and procedures do not cover all alternatives. An EXCEPTION statement and procedures includes those cases where, based on management judgments, a clear exception must be addressed.

INTERIM: information is information not yet officially approved by the governance structures. During the development of new items in the manual, the information will initially be entered as "interim". Policies and procedures approved by the governing structure may become "Official" and their adherence will be strictly enforced.

INTERIM POLICY, INTERIM STANDARD, INTERIM GUIDELINES, AND INTERIM PROCEDURES are items requiring immediate attention and documentation while the approval process is being considered. Interim status is considered University policy, standard, guideline, and procedure until approved or disapproved and does not exempt users or staff from full compliance.

The intent is to maintain a Policies and Procedures Manual online for access by University staff and users with printed copies only being used for reference or produced by special requests.

The following two pages suggest possible information that could be addressed by a standard technology Policies and Procedures Manual.

EXAMPLE

I. GENERAL DESCRIPTION

1. *Table of Contents*
2. *Description of Manual*
3. *Definitions*
4. *Mission Statement*
5. *Organization*
6. *Governance Structure*
7. *Hardware and Software Description*
8. *User Support Services and Software*

II. COMPUTING SERVICES ADMINISTRATION

1. *Organization*
2. *Personnel Administration*
3. *Office of Information Technology Services Plan*
4. *Hardware Acquisition*
5. *Software Acquisition*
6. *Information Center*
7. *University Reporting and Communications*
8. *Computing Resource Accounting*
9. *Maintenance*
10. *User Requests for Service*

III. ACADEMIC COMPUTING SERVICES

1. *Resources Description*
2. *Software and Hardware Guidelines*
3. *Office of Information Technology Services Support*

IV. ADMINISTRATIVE SYSTEMS AND PROGRAMMING

1. *Resources Description*
2. *Software and Hardware Guidelines*
3. *Office of Information Technology Services Support*

EXAMPLE con't

V. MICROCOMPUTING SYSTEMS AND PROGRAMMING

1. *Resources Description*
2. *Software and Hardware Guidelines*
3. *Office of Information Technology Services Support*

VI. SYSTEMS AND PROGRAMMING

1. *User Project Requests*
2. *Project Teams*
3. *Programming Standards*
4. *Documentation Standards*

VII. COMPUTER OPERATIONS

1. *Operational Acceptance*
2. *Physical Facilities Security*
3. *System Security*
4. *Data Security*
5. *Disaster Plans*
6. *Supplies Management*
7. *Operations Scheduling*
8. *Job Preparation and Distribution*
9. *Job Documentation*

VIII. REFERENCE MATERIALS

1. *Proprietary Software Documentation*
2. *Other University Documents*
3. *Contracts and Agreements*

APPENDICES

The following is an **example** of one issue and how it *could* be described using the above-mentioned format. **It should not be construed as an official or interim policy and procedure for the University.**

EMBRY-RIDDLE AERONAUTICAL UNIVERSITY
OFFICE OF INFORMATION TECHNOLOGY
(OIT)
POLICY AND PROCEDURES MANUAL

MAINTENANCE

POLICY

OIT is dedicated to servicing the needs of the Embry-Riddle Aeronautical University in the most efficient and timely manner. To this end, OIT will maintain all computer hardware and software as described in section I.7 of this manual.

"Maintenance" includes assuring that all hardware is kept in proper operating condition, all software meets the needs of the users and is the most current version available as budgetary policy and licensing agreements allow.

Because of the maintenance agreements, no computer hardware will be moved without the approval of OIT. Movement of such equipment will be done by OIT or Physical Plant under the guidance of OIT. This is necessary to keep the inventory database current. OIT maintains cost of maintenance in the OIT budget.

OIT will ensure proper maintenance of all approved equipment by entering into a maintenance agreement with a third-party maintenance company.

OIT will periodically (probably on a monthly basis) schedule downtime for the mainframe computers (approx. 2 hours) to do preventative maintenance.

Microcomputers will be placed on a rotating preventative schedule.

PROCEDURES

OIT will accept no less than three (3) bids from third-party maintenance companies for hardware maintenance.

OIT will recommend one (1) company to the University approval committee.

All maintenance will be administered by the third-party maintenance company under the guidance of OIT.

Users with hardware problems must complete the Hardware Failure Form (HFF) either in hardcopy or via the Electronic Hardware and Software Failure Logging System (EHSFLS) and submit to OIT for investigation. Emergency problems (emergency problems are defined in the appendix, section B) warrant direct contact to designated OIT personnel by telephone (designated personnel have not yet been identified and approved).

OIT will investigate and determine if maintenance company should be contacted. If maintenance company is not contacted, OIT will address the maintenance problem. If maintenance company must be contacted, OIT will contact the maintenance company who will then respond in a contracted and agreed upon timely manner.

All maintenance calls will be logged online via the EHSFLS and monitored and updated to allow users to check status of their calls.

EVALUATION STANDARD

OIT maintains copies of maintenance agreements.
OIT maintains a database of all operable versions of software.
OIT maintains a database of hardware and software and their current locations.
See Hardware and Software Description Section I.7.
See Hardware Acquisition Section II.4.
See Hardware Software Acquisition Section II.5.

EXCEPTION

Because of the variety of computer equipment and software throughout the University that was obtained before standards were set, the third-party maintenance agreement may not cover those items. In such cases, OIT will ensure, to the best of their ability, proper maintenance.

Appendix V: Solution Set Terms

Work Program - The Blueprint Solution section is divided into several logical groupings, called work programs. These work programs correspond to various disciplines associated with the overall technology strategy. Work programs are made up of projects.

Project Name - The project name is representative of a specific deliverable.

Timeline X-Ref - The cross reference number provides a link between a given project and the Long Range Time Line of Events. Some project will incorporate multiple events; hence, multiple reference numbers. The numbers reference the graphic timeline of events that follow all the work programs in this section.

Primary Impact - This describes the areas of the University that will be impacted by the action event, either as a benefit or as the largest area of work concentration for the event to happen.

Description - The description provides a project scope summary.

Status - The status presents the current level of progress.

Work Effort - The work effort denotes the estimate of person labor, not elapsed time.

Schedule - The schedule provides calendar start and completion estimates.

Project Cost - The project cost reflects hardware, software, and other capital estimates.

Appendix W: Network Plan Outline

(TSI, 1993).

Section 1. Introduction.

Section 2. Current Technology and ERAU - includes policies, current network infrastructure, management and administration, and hardware and software.

Section 3. Network Design - includes network service design and intrabuilding connectivity.

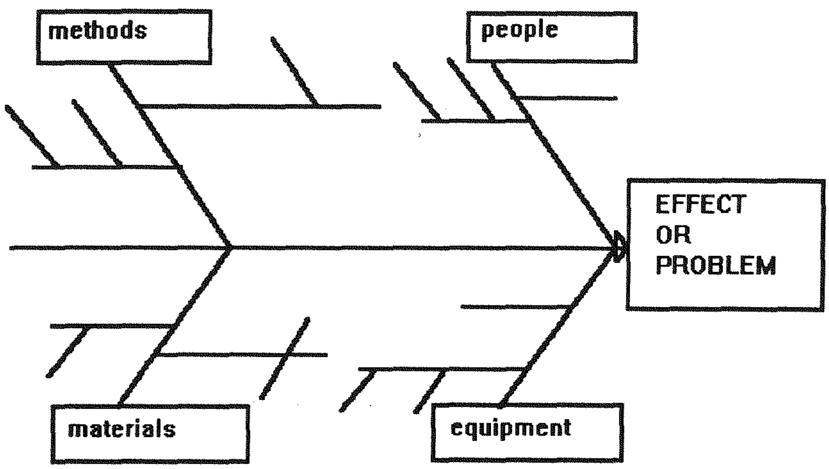
Section 4. Network Specifics - includes phases of implementation, wiring design, personnel requirements, and task lists.

Phase 1. Budget.

Addendum.

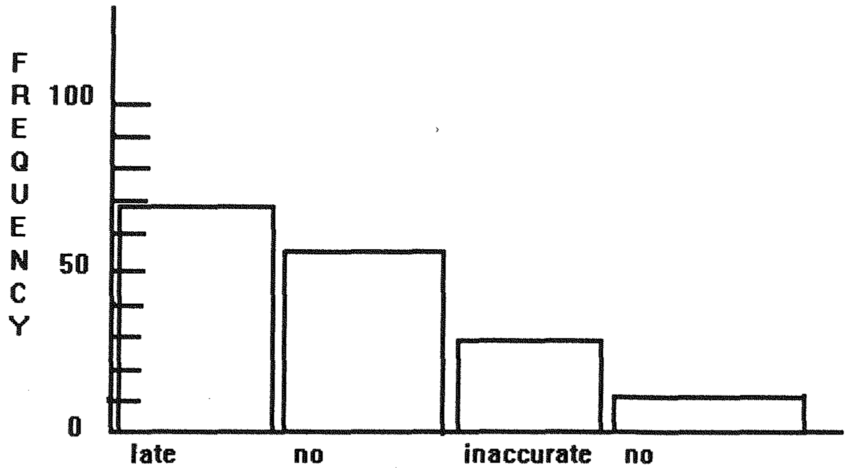
Appendix X: Assessment Tools

(ERAU, 1993).



Cause and Effect Diagram (Fishbone) - This tool shows the relationship between and effect or problem and its causes. It helps enumerate possible causes for an effect as well as serves as an aid in analyzing complex problems. Categories, such as those in the diagram above, are defined for a particular problem or set of problems, and the causes related to those categories serve as the "fishbones" that contribute to the overall effect.

Appendix X - Tools continued.



Pareto Chart - In a group of elements, the most important one is a small proportion of the total. The apreto Chart displays the relative importance of problems, the order of priority, and helps define a starting point for problem-solving. The above shows the Help Desk scenario. When users request help, the most frequent response has been late. The smallest percentage of responses provide no information at all. Even though late responses are not ideal, they are preferred to those responses where there is no information given at all.

Appendix Y: Student System Evaluation Questionnaire

Student Administrative System

Evaluation Criteria

I. INTRODUCTION

In mid-August, 1992, a request for information was distributed to known vendors who provide university software packages, and indicated a willingness to present their solution to Embry-Riddles's requirements for a Student Administrative System. The purpose of this document is to define the model by which respondents will be evaluated.

A. Evaluation Process

Evaluation will be conducted in a two phase process. Each phase is designed to narrow the list of potential candidates, leading to identification of the best choice. A typical scenario based on 6 responses might be: The Phase I technical and general evaluation will eliminate 2 to 3 respondents, leaving 3 to 4 candidates; The Phase II functional evaluation will eliminate all but 1 candidate, with 1 alternate. Evaluation Criteria Charts (contained in section II of this document) will be used to rate respondents.

Numerical scores will be accumulated by each respondent and a ranking formulated at each phase. However, this is not to be considered the exclusive vehicle to "pick the winner". It is a tool which will be used by Technology Management Partnership (TMP) to recommend the best potential solution/alternatives. Other circumstantial factors will be applied during any phase, at the discretion of Embry-Riddle and Technology Specialists.

Phase I

Phase I will focus on technical composition and general characteristics that transcend all functional applications. Criteria in Evaluation Chart A will be applied towards technical design, which covers: Integration, Security, Data Structure, Audit Trails/Recovery, Electronic Media, and Limitations/Constraints. Criteria in Evaluation Chart B will be applied towards general features, which covers: Help Facility, Reporting, Multi Campus, User Interface, Documentation, Training, and Maintenance and Support.

The Technology Management Partnership (TMP) Team is responsible for Phase I evaluation. They will examine the technical platform offered by each respondent. This evaluation will be concerned with architectural principles and practices as the foundation for long term technology strategies. Without a sound and flexible technical foundation, functionality will eventually become constrained and costly to upgrade.

Evaluation of general characteristics will be concerned with global features and vendor services that will be of major importance to ongoing success of the software solution. These same general features will be applied in the next phase as well, for end-user perspective.

Phase II

Phase II will be a meticulous functional evaluation of the respondents who pass Phase I. Criteria in Evaluation Charts C through I will be used for this phase, which cover: Admissions/Recruitment, Alumni/Development, Billing/Receivables/Cashiering, Financial Aid, Student Records, Advising/Degree Audit, and Housing. In addition, general characteristics contained in Evaluation Chart B will be evaluated from the end-user perspective, with emphasis on human factors.

Key Users from each Campus will be the primary evaluators. This evaluation will be an in-depth review of end-user application functionality. It will occur as part of vendor demos and presentations, with hands-on opportunities. Participants in this analysis should be representative of those who will be using the system at the operational level, covering the different application areas identified in the preceding paragraph.

B. Ranking Scheme

Each item for evaluation will be given an importance weight factor of 1 to 3, as follows:

1 = nice to have;

2 = important to have; or

3 = critical to have.

The respondent's ability to satisfy each item for evaluation will be a rating, as follows:

0 = not satisfied (rating factor 0);

1 = partially satisfied (rating factor 4);

2 = mostly satisfied (rating factor 8);

3 = fully satisfied (rating factor 12); or

4 = fully satisfied with significant value added (rating factor 13).

All ratings that fall below fully satisfied may have a potential factor, as follows:

0 = impractical to attain fully satisfied status within 6 calendar months;

1 = internal resources can provide alternate/full solution, major effort;

2 = internal resources can provide alternate/full solution, minor effort; or

3 = vendor will provide fully satisfied solution within 6 calendar months.

Finally, respondent composite score will be the total of rating factor plus potential factor. This model causes existing capability (rating) to be ranked higher than potential, but still places value on potential. This will result in an overall score of:

13 = fully satisfied with significant value added;

12 = fully satisfied;

11 = mostly satisfied, full vendor solution within 6 calendar months;

10 = mostly satisfied, full solution with minor internal effort;

9 = mostly satisfied, full solution with major internal effort;

8 = mostly satisfied, no practical full solution;

7 = partially satisfied, full vendor solution within 6 calendar months;

6 = partially satisfied, full solution with minor internal effort;

5 = partially satisfied, full solution with major internal effort;

4 = partially satisfied, no practical full solution;

3 = not satisfied, full vendor solution with 6 calendar months;

2 = not satisfied, full solution with minor internal effort;

1 = not satisfied, full solution with major internal effort; or

0 = not satisfied, no practical full solution.

Respondent ranking of composite scores will be summarized by raw importance factor and weighted total. Following are examples:

Respondent # 1

Importance	Raw Score	Weight	Weighted Score
Nice To Have:	375	x1	375
Important:	625	x2	1,250
Critical:	890	x3	2,670
	1,890		4,295

Respondent # 2

Importance	Raw Score	Weight	Weighted Score
Nice To Have:	660	x1	660
Important:	725	x2	1450
Critical:	720	x3	2,160
	2,105		4,270

In the above examples, respondent 2 recorded a higher total raw score than respondent 1. This signifies that respondent 2 ranked higher on more evaluation items. However, respondent 1 recorded a higher weighted score than respondent 2. The weighted score values critical items greater than important, and important items greater than nice to have. Respondent 1 satisfied more critical items, therefore achieving a higher total weighted score. Respondent 2 did better on both important and nice to have items, which is reflected in the closeness of total weighted scores. Scores may be too close to call in some cases, requiring additional management decision criteria for final respondent ranking.

C. Sequence of Events

The following steps overview implementation of the evaluation process:

1. Define the people who will be conducting each evaluation phase, as described earlier under the Evaluation Process topic. Initial procedures for coordinating Phase II should be identified by this time.

2. Create a cover memo to distribute the Evaluation Criteria Charts, to the above audience, for establishment of importance weight factors. The memo should open the door for substantive feedback on missed or undiscernible criteria items. It should discourage comments of wording or style. The memo should stress the significance of the three levels of importance. The value of the model will be compromised if all items are set as critical.

3. Distribute the Evaluation Criteria Charts for establishment of importance weight factors. These charts are organized by evaluation phase, as described earlier under the Evaluation Process topic. Importance weight factors should be set by those who will be participating in the relevant evaluation phase. Those responsible for supplying importance factors will be asked to identify people who they recommended for evaluators.

People designated responsible for establishing importance factors will be supplied with charts for all functional areas, but should focus on their area of responsibility. They will be encouraged to review the other functional charts and supply a factor for any item that is directly important to the success of their own operation. They should not set factors for how they think other functional areas should view their area of responsibility.

4. Create Lotus Ranking Tables as described in section III of this document. Table size will be dependent on the mix of evaluators defined in step 1 above. These tables will hold all factors and ratings which will be used to calculate respondent scores.

5. TMP will receive back the Evaluation Criteria Charts distributed in step 3 above. Any necessary modifications to criteria items will be made at the discretion of TMP. Changes will be kept to a minimum, if at all, so as to avoid the possibility of having to re-distribute charts.

6. Importance weight factors will be entered into the appropriate Lotus Ranking Tables. There will be only 1 importance weight factor per criteria item. Where different campuses may have set different factors, the highest will be chosen as the University standard.

7. Phase I evaluations will take place, controlled by TMP. Rating results will be entered in the appropriate Lotus Ranking Tables, for permanent record keeping.

8. Create a cover memo to explain the Phase II evaluation procedures. Phase II evaluation charts should be distributed in advance of vendor demos. This will allow evaluators to familiarize themselves with the evaluation criteria, as vendors will not be presenting their packages in the same order as our charts.

9. Phase II evaluations will take place, one respondent at a time, coordinated by TMP, according to the procedures defined by step 1 above. It is quite possible that some vendor responses may surface criteria that had been overlooked in original charts. For such reasons, new criteria may be added at any time during the evaluation process and applied against all other responses.

   People designated responsible for evaluating respondents will be supplied with rating charts for all functional areas, but should focus on their area of responsibility. They will be encouraged to consider other functional requirements and supply a rating for any item that is directly related to the success of their own operation. They should not supply ratings for how they think other functional areas should evaluate their area of responsibility.

10. Phase II evaluation ratings will be entered into the appropriate Lotus Ranking Tables. Initial findings may be produced before consideration of potential factors.

11. TMP will coordinate review and establishment of potential factors for criteria items that fall short of "fully satisfied". This may not be done for all items ranking below fully satisfied. Items of critical importance will be researched, especially where respondent scores come out very close. Potential factors will be entered into appropriate Lotus Ranking Tables.

12. Final respondent scores will be produced from the Phase II Lotus Ranking Tables. Any additional summaries and groupings will be produced as required, dependent on the number of respondents and the closeness of individual scores.

13. At this point in time, the statistical evaluation process is concluded. A recommendation will be made to the Computing Governance Committee based on results of this analysis and any other relevant data.

II. EVALUATION CRITERIA CHARTS

Evaluation criteria for the Student Administrative System will be separated into several components. These components are organized to be compatible with the Functional Considerations, Request For Information (RFI) and may not match any respondent's modular structure. Regardless, this format will be used for all evaluations. Any necessary clarifications will be explained in the Respondent Synopsis section of this document, (eg: 3 different modules from a particular vendor are combined under the Student Records evaluation).

Copies of the following charts, A through I, will be used to establish importance weight factors. They will be distributed as described under the Sequence of Events topic, listed on previous pages of this document.

Copies of the same charts, A through I, will be used to record respondent ratings during actual evaluations. The I.F. (importance factor) column will be eliminated and replaced with 3 or 4 rating columns, dependent on the number of candidates being evaluated in Phase II. This will allow side-by-side comparisons to foster consistency in the rating process. A rating chart sample may be found at the end of this document.

A. Technical Requirements

TECHNICAL REQUIREMENTS		
ITEM	**I.F.**	
Integration		
A001		The most important feature of the new student administrative system is integration. Each module in the system must be consistent with and interface to all other system modules. Current system make-up includes much redundant data. A fully integrated system will not only negate the need for redundant data, but will allow for consistent data access. Screen access from one function or module to another must not require the user to exit from the current function and initiate the next.
Security		

TECHNICAL REQUIREMENTS		
ITEM¦ I.F. ¦		
A002		The system should provide a sophisticated user-defined security access mechanism for multiple levels of access. Based on a hierarchical architecture of data access, the security mechanism must support such function schemes as: Read only - unlimited; Update/inquire - limited; Update/inquire - unlimited; System-sensitivity; Context-sensitivity; Screen-sensitivity; Element (field)-sensitivity.
A003		Data integrity requirements dictate the need for a terminal ID, operator (user) ID, transaction (function), date, and time tracking mechanism. Audit trails, check points, and journaling for easy data recovery is required.
A004		The system entry must be user-friendly while providing a logically secured environment.
Data Structure		

TECHNICAL REQUIREMENTS

ITEM	I.F.	
A005		ERAU requires the new system to be structured around a single database concept. Such a concept may be realized via use of a relational database management system (RDBMS) as the platform for development and operations. As defined by authors Gardarin, Date, Codd, and Ullman, a relational database system includes the following components: data definition; data manipulation; semantic data control; transaction management; additional tools; distributed database management.
A006		This means, at a minimum, the platform should be able to address such capabilities as: security and data integrity; reliability; audit trails; maintainability; user as well as programmer tools; a data dictionary; a query language; consistent update capabilities; table-driven values; and ease of data retrieval.
A007		Examples of table-driven values include: grade types and values; tuition, fees, and charges; terms; degrees; programs; majors; etc. Table-value validation and editing must be included as part of the system.

TECHNICAL REQUIREMENTS

ITEM	I.F.	
A008		Any alternative proposal to a RDBMS must be capable of addressing the requirements as stated with regard to a true RDBMS. Such capabilities must be readily apparent.
A009		The data dictionary will allow for coded rules to define how the system will process each module; it will provide records that contain display information; and it will provide parameters that may be used to define ERAU-peculiar characteristics that are easily modifiable.
A010		The system must provide a variety of processing codes and flags. In addition, the system must be flexible enough to support user-defined codes, flags, parameters, and other elements for the purpose of tailoring the system for future institutional functions.
A011		The system must be able to provide an automated online, real-time editing and validation mechanism.
A012		Consistent data access requires the system to provide a mechanism of synchronization with regard to ID number changes throughout the integrated databases.

TECHNICAL REQUIREMENTS		
ITEM	**I.F.**	
A013		It is desirable that the proposed system include a mechanism for element/screen cross-referencing.
A014		"Tickler" files must be available in every module of the proposed system. Tickler files provide for free-form comments.
A015		The proposed system must provide the availability of many addressing schemes and multiple addresses. A centralized concept for an address facility would eliminate redundancy. Due to new federal postal capabilities, the zip code fields must include the capability of providing for the five-digit zip code plus four-digits plus 2 more digits (zip+4+2).
Audit Trail/Data Recovery, Purging		

TECHNICAL REQUIREMENTS

ITEM	I.F.	
A016		The current student system allows for logging (monitoring) of every transaction that enters the system. The proposed system must provide the same type of mechanism. ERAU would like to track such information as who made a change to the system's information of any kind, what that change was, and when that change was made. To expand this capability further, the identification of the who, the what, and the when of any request (such as transcript requests) should be available.
A017		Using this concept should provide for easy data recovery in case of critical data corruption. An automated recovery process of this data should be provided in case of data corruption. This process would allow for accurate and effective data recovery. Such an audit trail would allow for recovery of data up to the corrupted data, thus affording the opportunity to edit the corrupted data, and continue with the recovery process from that point.

TECHNICAL REQUIREMENTS

ITEM	I.F.	
A018		A purging mechanism initiated by user-defined parameters and dates must accompany the student administrative system. Such areas of consideration for purging include: Admissions inquiry records; Accounts Receivables detail; Student records; Financial Aid applications and closed accounts; Alumni Development detail.
A019		The purging process must include hardcopy reports of purged accounts printed by option. The purged records must be archived to other storage media, such as magnetic or streaming tape, microfilm (or fiche), or CD-ROM. The purge function must provide a recovery mechanism.
A020		Future capability would include the opportunity to provide for data imaging and storage.

Electronic Media - The respondents are encouraged to provide information regarding access or interfaces to electronic media and processing. This is regarded as "value added" criteria. Such an environment, if not part of the vendor solution, must be adaptable for the future. Such processing may include, but is not limited to the following:

TECHNICAL REQUIREMENTS		
ITEM	**I.F.**	
A021		*imaging capabilities* - tracking of paper and data storage may be enhanced with the advent of image processing.
A022		*optical mark reading (scanners)* - tracking and reporting may be made simpler using optical mark readers. The grading process may be enhanced using OMR scanners.
A023		*voice response* - time required for registration processing and advising may be minimized with this capability.
A024		*CD-ROM capabilities* - data storage and access may be enhanced via this capability.
A025		*debit card* - a single student card approach may simplify complex processing, such as meal plans, fees, bookstore and library charges, enrollment tracking, even registration.
Limitations/Constraints		
A026		The proposed technology platform (software, hardware, network) should not constrain nor limit evolution towards Embry-Riddle and higher education visions, strategic goals, and trends.

TECHNICAL REQUIREMENTS

ITEM	I.F.	
A027		The proposed technology platform (software, hardware, network) should not constrain nor limit evolution towards emerging computer industry trends and standards. This would include: open architecture, client-server, distributed, centralized, de-centralized , and telecommunications capabilities.

B. General Requirements

GENERAL REQUIREMENTS		
ITEM	**I.F.**	
Help Facility		
B001		The student administrative system must include the capabilities of a standard help facility. The help facility must be accessed via both hardcopy as well as online. The facility must include system, screen, and field (element) level help. The help facility must also include indexing capabilities to request topic assistance. In addition, the user must be able to define and install institution-specific information, such as policies and procedures.
Reporting		

GENERAL REQUIREMENTS		
ITEM	**I.F.**	
B002		The new student administrative system must provide the capability for users to develop and generate ad hoc reports. This requires access to a report writing tool, such as 4GL. The front-end screen interface and report generation syntax must be user-friendly to encourage its use.
B003		The report writing tool must also be sophisticated enough to allow for simple and complex selection and sort criteria. Ease of use for functional users should not prevent meaningful usage by the institution's professional programming staff. A user-friendly mechanism for report requests is a strict requirement.
B004		The report writing and generation capability must provide selection of any data field in the system. It is desirable to be able to set up related data system views for easy data retrieval. This is a normal report generator capability and must be addressed by the proposed systems.

GENERAL REQUIREMENTS

ITEM	I.F.	
B005		The proposed student administrative system must provide the capability for an executive management support facility process, including statistical analysis, trend analysis and summary reporting.
B006		Online report previewing capabilities are required.
B007		Reporting to disk must include conversion to ASCII files for downloading to PC packages.
B008		The reporting capability must include flexible formatting availability, including bar graph, labels (see below), 8 1/2 x 11, and special forms (mailers, 3 x 5 cards, envelopes, etc.).
B009		Flexible label generation (1-up, 2-up, 3-up, etc.) is required.
B010		The reporting facility must be capable of offering full boolean logic and exclusion criteria.

GENERAL REQUIREMENTS

ITEM¦ I.F. ¦

B011		Institutional Research requirements: It is important that the proposed system provides for reporting capabilities that will enhance the effectiveness of OIRE. The following reporting requirements must be addressed by the proposed system: IPEDS, Integrated Postsecondary Education Data System; SBICU, State Board of Independent Colleges and Universities; SACS Institutional Profile, Profile for accrediting agency; ABET, Accrediting agency for specific programs; Surveys (Peterson's Guide, Publication; Barron's Education Series, Profiles of American Colleges; US News and World Report, Publication); University Fact Book. In addition, the new student administrative system must provide for other OIRE analysis reporting, including: Post-graduate tracking to determine success of the programs; Faculty data for EEO-5 and EEO-6 reporting; Dollars generated by program.

Multi-campus

GENERAL REQUIREMENTS		
ITEM	**I.F.**	
B012		The new system must be capable of processing and reporting ERAU's multiple campus environment, both for the current as well as for the future. Individual campus and total university information reporting must be available. This includes the need to set up user-defined parameters and codes specific to particular individual campuses.
B013		The system must have the capability of providing for either a decentralized or centralized processing environment, depending on the wishes of the institution. In addition, there are multiple locations within the CCE campus setting that must have the capability to be addressed and reported on by location.
B014		The system should accommodate the inter-campus registrations, e.g.: where a student is registered concurrently at two different campuses within ERAU.
User interface		
B015		The proposed system must include a user-friendly menuing system. The system must avoid complex screen-access methodology and provide simple sign-on, sign-off procedures.

GENERAL REQUIREMENTS		
ITEM	**I.F.**	
B016		The system should provide across-the-board consistency, such as data entry syntax (e.g. name format is consistent in every module).
B017		Consistency regarding screen access - Moving from one screen to another must be consistent and user-friendly.
B018		Access to student accounts must include options via ID, name lookup, and partial name lookup.
B019		Single functional screens would expedite certain processes, such as registration. A single registration screen housing information pertinent to the registration process would minimize the necessity of navigating through several screens. Other single screen areas include admissions for inquiry, cashiering, financial aid, and transcript inquiries.
B020		Input screens must have proper edit and validation routines, to the field level, to manage the input process.

GENERAL REQUIREMENTS		
ITEM¦	I.F. ¦	
B021		Screen formatting must include menu selection and field identification techniques, such as highlighting and cursor positioning. Formatting of screens and screen access mechanisms must be consistent throughout the system.
B022		The proposed system must provide for variable data entry through real-time terminal access as well as data collection capabilities and flexible online query options.
B023		A system needs a flexible facility of cross-referencing. Such areas as element/screen and former name cross-referencing are examples.
B024		The system must provide a mechanism for screen generation.
B025		The system must have provision for word processor interfaces for all modules.
Documentation		

GENERAL REQUIREMENTS		
ITEM	**I.F.**	
B026		Full and complete documentation must accompany the proposed student administrative system. Such documentation will include element and screen cross-referencing, element definition, process definition, database or application system processing and functions, report definition and processing, file structure definition, data flow and processing diagrams, etc.
B027		The documentation must be available online as well as in hardcopy. The online version will have a user-friendly, indexed keyword accessing scheme.
Training		

GENERAL REQUIREMENTS		
ITEM	**I.F.**	
B028		ERAU will consider all responses that provide for complete and extensive training of users and programming staff. The training must be conducted such that distinction is easily made between functions of a technical nature and those of the users. The preferred location of training is on-campus. In addition, the respondent will provide evidence of a plan for *migration* to and *implementation* of the student system. This will serve as a guide to ensure the proper sequence of events may be followed regarding that implementation.
Maintenance and Support		

GENERAL REQUIREMENTS		
ITEM¦ I.F. ¦		
B029		With the complexity of some of the system processing and requirements of regulatory agencies, in-house maintenance should be kept at a minimum. The ideal system would minimize in-house modifications as well as offer ease of upgrade implementation. Changes by regulatory agencies must be an inherent part of the maintenance agreement. Ongoing support effectiveness is an important consideration. Two categories of support will be evaluated: a) information support would include "how do I..." or "what if I..." questions; and b) problem support would include program aborts, program logic errors, and data recovery.
B030		ERAU excpects prompt and rapid response to the probelm situations. A commitment to customer service is paramount. Therefore, it is mandatory that the proposed system(s) be accompanied by flexible options regarding vendor-provided maintenance and support of the product. Responsible customer support and contingency procedures must be demonstrated.

GENERAL REQUIREMENTS		
ITEM	**I.F.**	
B031		ERAU desires information regarding possible users' group participation. A strong, non-vendor controlled, User Group should be in existence or establishment underway.
B032		Vendor reputation should be rated high among the industry and customer base.

C. Admissions/Recruitment

ADMISSIONS/RECRUITMENT		
ITEM	**I.F.**	
General		
C001		Full **integration** with Student Records, Financial Aid, Alumni Development, etc.
C002		Processing from recruiting to application to final acceptance and have the capability to include processing from the **College of Continuing Education (CCE)** and **Independent Studies** as well as the traditional residence campuses at **Daytona Beach** and **Prescott**.
C003		**Conditional admission**, e.g.: students in the graduate program in CCE are admitted as conditional until they have completed 12 hours with no less than a 3.0 GPA.
C004		**Automatic "roll"** to student accounts after admission acceptance.

ADMISSIONS/RECRUITMENT		
ITEM	**I.F.**	
C005		Provide processing for **current and future terms concurrently**.
C006		Provide for and distinguish between **multiple inquiries** by the same individual. In addition, the system should **track the source and location** of inquiry for marketing purposes.
C007		A **trend analysis** mechanism providing such prospect and applicant information as geographic, economic data must be available.
C008		A mechanism for **automatic status upgrades** should be available based on receipt of required documents and completed financial aid information (requires direct access to financial aid module, if possible).
C009		System flexibility to afford information such as **referral data and applicant/relative identification.**
C010		Provide for **flexibility in address definition**, such as permanent, parent/guardian, and work addresses.

ADMISSIONS/RECRUITMENT		
ITEM	**I.F.**	
C011		As mentioned under general requirements, admissions would benefit from **single screen functionality**. Such functions as data collection and inquiries pertaining to demographic, educational, and financial information requires minimal keystrokes.
C012		The admissions function relies heavily on **mass mailings** (sometimes up to 10,000 letters in a single run), thus it must include the capability to sort and select on group as well as individual criteria and merge into a mail listing file.
C013		Provision for **flexible applicant transcript** processing.
C014		Provide a **purging option defined by the user**. The purging process must have the capability for manual as well as automatic initiation.
C015		Automatically **generate the necessary student and receivables records** (either physically and/or logically) upon acceptance into the institution.

ADMISSIONS/RECRUITMENT ITEM ¦ I.F. ¦		
C016		Process those students who are accepted, register, but are **no-show** to classes. Such students are currently un-registered and placed back into the admissions database. The new system should provide a workable solution to this process.
C017		Provide the capability to **generate meaningful ID numbers** for those who do not provide such identification with their applications. There should be a mechanism to allow ID changes to take place. When this happens, depending on the status of the applicant, the ID change process must be automated and allow for **consistency throughout all subsequent records**.
C018		Provision for **automatic assignment of advisors** based on user-defined criteria.
C019		Online **applicant profiles** selected and sorted by user-defined criteria.
C020		Provide for the capturing at time of admission of **parent/student relationship data** that may be used for future University Relations (Alumni Development) processing.

ADMISSIONS/RECRUITMENT **ITEM¦ I.F. ¦**		
C021		**Interactive reviews of applicant information** against University-defined criteria.
Marketing/Applicant		
C022		Support of ETS **High School and College mailing lists**.
C023		Entrance requirements processing includes tape-handling for test scores, such as SAT, ACT, GRE, GMAT, and others. The new admissions module must provide for **multiple standardized test score tracking** (re-testing history). The system should allow for duplication identification for those applicants on tape.
C024		Provide for acceptance criteria and **automatic migration to student records** and registration. Provide for user-defined applicant verification criteria.
C025		Provide information pertaining to **high school or transfer honors** and rank and other related data.
C026		Provision for applicant's **expected term of entrance**.
C027		Provision for automated **scanning of applications**. One alternative may be voice response inquiry and application.

ADMISSIONS/RECRUITMENT		
ITEM	**I.F.**	
C028		Provide for **special applicant information** such as interests, intentions, class rank, etc.
C029		Support **differing marketing plans** for user-defined criteria.
Tracking		
C030		The availability of user-defined codes and selection criteria for particular **prospect and applicant tracking requirements**. There is a need to track based on date of last activity.
C031		Provide **location tracking** and supply information about and tracking of high school prospects.
C032		Monitoring of **contacts and publication mailings**.
C033		Capability of sort/selection criteria to allow for group and individual document generation. Included in this function is the ability to automatically **generate letters and documents** to facilitate the tracking mechanism. Therefore, **document tracking** is required as well. The system should also provide the ability to make easy modification to **document text**.

ADMISSIONS/RECRUITMENT		
ITEM	**I.F.**	
C034		**Applicant status tracking** must be available. User-defined criteria would allow for various methods of tracking.
Reporting		
C035		Automatic generation of **follow-up letters**.
C036		Automatic generation of **user-defined mailings**.
C037		Various **user-defined sort/selection reporting**.

D. Alumni/Development

ALUMNI/DEVELOPMENT		
ITEM	**I.F.**	
Integration		
D001		Ability for **students to evolve to alumnus status** without redundant record keeping.

ALUMNI/DEVELOPMENT		
ITEM	**I.F.**	
D002		Ability to **interface** gift financial data to the **General Ledger system**.
D003		Ability to **interface payroll deductions** from the Payroll system.
Biographic/Demographic Information		
D004		Ability to identify **constituent types**: alumni, friend, parent, sponsor, trustee, faculty, staff, corporation, trust, foundation, organization, and other user-defined categories.
D005		Ability to maintain a **history of communications** to/from constituents.
D006		Ability to identify an **alumnus who is also a student**, pursuing a second or graduate degree. Consider that the student may be in an independent studies program. This should be a criteria during solicitation processes.
D007		Availability of flexible **user-defined attributes**, such as: education history, occupation and job history, ratings and certifications, activities, achievements, tickler and comment details, parent and relationship specifics.

ALUMNI/DEVELOPMENT		
ITEM	**I.F.**	
D008		Provide flexible, unlimited, user-defined, **addresses and contact information**. User-defined criteria for **choosing the right address** at the right time. Be in compliance with necessary **postal regulations**.
D009		Ability for multiple people to **share the same address**, eliminate redundant maintenance (e.g.: husband and wife alumni, parent and student living at home).
D010		Ability to track and retain name and **address changes**.
D011		Ability to track user-defined **event registration and attendance** (e.g.: alumni chapter memberships, parent associations, presidential receptions, homecoming).
D012		Flexible **status definitions**, e.g.: ability to assign a student who does not graduate to alumnus status.
D013		Ability to establish a user-defined algorithm to move **inactive constituents** to a history or hold place (e.g.: no communications for x years, deceased, past parent).
Relationships Development		

ALUMNI/DEVELOPMENT

ITEM	I.F.	
D014		Ability to establish user-defined **validation of bio/demo information**, including logic checks (e.g.; zip code to state logic check).
D015		Ability to maintain unlimited, user-defined, **relationships among constituents and students** (e.g.: mother-son, step father-daughter, sponsor-student, husband-wife, company-employee, constituent-volunteer, constituent-ERAU contact).
D016		Identify **primary donor/sponsor** and combined mailing situations. Be able to automatically change relationships upon specific events (e.g.: parent-applicant changes to parent-student upon matriculation, parent-student changes to parent-alumnus upon graduation, parent-student is broken upon drop out).
D017		Ability to establish unique **corporation relationships** (e.g.: a particular company being a subsidiary of a parent corporation, a particular military base belonging to a branch of the military). This information should be considered in employer/employee processes.
D018		Flexible, user-defined **fund codes**.

ALUMNI/DEVELOPMENT		
ITEM	**I.F.**	
Soliciting		
D019		Ability to schedule **pre-defined communications** based on user-defined criteria (**cultivation**). This includes relationships (e.g.: associates, family members).
D020		Ability to **extract for mailings** based on user-defined selection criteria (e.g.: certain occupations, and certain graduation years, excluding certain activities and excluding those who contributed within the past x months, and including those who are related to enrolled students).
D021		Ability to "**mail merge**" specific constituent data with skeleton personalized letters (download for Wordperfect mail merge).
D022		Ability to create **mailing lists in a variety of formats**. (e.g.: label creation, envelop printing, mag tape creation for outside services, download files for microcomputer applications).
D023		Ability to produce customized **phonathon cards**.
Gifts		

ALUMNI/DEVELOPMENT		
ITEM	**I.F.**	
D024		Ability to **post cash** (check, charge card), **stocks** and **securities, gift-in-kind.**
D025		Ability to **assign gifts to campaigns/drives, funds, purposes**, CFAE categories.
D026		Ability to designate and track **matching gifts**.
D027		Ability to designate and track gifts that are **credited to different constituents**.
D028		Ability to **manage pledges**, including employee payroll deductions. Assign to specific campaigns/drives, funds and purposes. Ability to produce **pledge reminders**.
D029		Ensure that **payroll deduction gifts** do not hit the general ledger twice (coordinate with payroll system).
D030		Ability to maintain **deferred gifts** (e.g.: wills, trusts).
D031		Provide **receipts and thank you letters**. Ability to define different acknowledgement letters based upon the constituent and/or gift amount.

ALUMNI/DEVELOPMENT		
ITEM	**I.F.**	
D032		Maintain **gift history by fiscal year**, and retain for immediate access for x (user-defined) years after no further giving.
D033		Ability to **correct previously entered gifts**, with appropriate accounting, receipt and constituent audit trails.
D034		Extensive **audit and control** features in support of gift processing and maintenance, daily balance and reconciliation.
Reporting		
D035		Various **management reporting**, e.g.: campaign/drive, pledge, LYBUNT (Last Year But Unfortunately Not This), SYBUNT (Some Year But Unfortunately Not This),. Allow for **summaries or detail**.
D036		Ability to produce **CFAE reports**.
D037		Ability to produce **trend management reports**, (e.g.: drive/campaign and fund over x years).
D038		Ability to provide **statistical analysis** reports of gifts by user-defined categories (e.g.: constituent type, drive/campaign, giving club, region, fund, purpose).

ALUMNI/DEVELOPMENT		
ITEM¦ I.F. ¦		
D039		Ability to maintain and report on user-defined **giving categories** (e.g.: major donor, giving club).
D040		Routine **tickler** set up and reporting (e.g.: follow-up phone call, visit set up, anniversary).
Miscellaneous		
D041		Ability to **track update activity** to constituent records.
D042		Ability to facilitate **remote access to the system** (e.g.: during an alumni chapter meeting off site).

E. Billing, Receivables, Cashiering

BILLING, RECEIVABLES, CASHIERING		
ITEM¦ I.F. ¦		
Integration - The following **integration/interface** points should be accommodated:		
E001		**Flight** - charges, credits;

BILLING, RECEIVABLES, CASHIERING		
ITEM	**I.F.**	
E002		**Financial Assistance** - financial aid awards, estimated aid, 3rd-party fiscal agents;
E003		**Registration (and mid term activity)** - tuition, housing, meal plan, insurance, and other user-defined charges;
E004		**Parking** - vehicle permits, citation fines;
E005		**Library** - fines;
E006		**Admissions** - charges, credits, deposits;
E007		**CEFIS** - interface from the decentralized CCE system;
E008		**General Ledger** - interface to the G/L of all subsidiary entries.
Cashier functions		
E009		**Efficiency, accuracy and control**, are important goals of this function. Student satisfaction becomes an issue when the process takes too long, waiting lines build, and accuracy becomes suspect.

BILLING, RECEIVABLES, CASHIERING		
ITEM	**I.F.**	
E010		Flexible, user-defined **transaction tables** with tie into chart of accounts. Ability to define unique transactions for each campus. Flexibility regarding **required/not required receipts**.
E011		Ability to process **student and non-student** (miscellaneous university) activities.
E012		**Receipt generation**, and re-printing with system controlled receipt numbers.
E013		Ability to **apply payments to specific charges** with user-defined default methodology.
E014		Ability to apply/proportion payments to **3rd-party fiscal agents**.
E015		Ability to post **deposits** against any user-defined future charges.
E016		Ability to accept **payments** in cash, check, credit card, or voucher.
E017		Complete audit and **cash drawer reconciliation** capability, online and hard copy.
E018		Dynamic **balance facilities** by cashier, activity, receipt, or combination.

BILLING, RECEIVABLES, CASHIERING		
ITEM	**I.F.**	
E019		Ability to **correct transactions** with appropriate audit trails and receipt reconciliation.
Billing/Receivables		
E020		Allow for **open item or balance forward** methods.
E021		**Registration** should result in all appropriate charges and fees posted to student accounts, according to user-defined structures.
E022		Any **mid-term academic or administrative activities** that affect financials should result in proper posting to student accounts. This would include courses being added or dropped, flight activities, housing changes, transcript fees and other user-defined charges or credits.
E023		Ability to process and reconcile **student refunds**. In addition, there should be the capabilities for special refund processing, such as user-defined criteria.
E024		Ability to administer student **temporary/emergency loans**.

BILLING, RECEIVABLES, CASHIERING		
ITEM	**I.F.**	
E025		User-defined criteria to establish when specific **charges and loans are due** (Flight charges due in x days), along with resulting actions (late fees, personalized dunning letters, grade hold flags).
E026		Ability to establish **deferred payment plans** with user-defined finance charges.
E027		Ability to produce user-defined formatted **invoices** as a result of registration. Produce preliminary or final invoice along **with initial schedule** during registration, and final invoice on demand.
E028		Produce **invoice mailers** (instead of folding and stuffing).
E029		Ability to produce periodic **statements** with capability to customize format and messages. Ability to show **aging**. Ability to combine **academic schedule** with associated charges.
E030		User-defined **aging categories**.

BILLING, RECEIVABLES, CASHIERING		
ITEM	**I.F.**	
E031		Ability to administer **collection activities** for tuition and associated fees, through the bad debt write-off process. Trigger activity upon student **withdrawal**. Support collections activities in a centralized fashion for all 3 campuses.
E032		Ability to administer **3rd-party fiscal agents** with the students they support. User-defined **responsibility criteria** (i.e: x% of tuition, flat dollar amount, x% of all expenses, not to exceed x dollar amount). User-defined qualifications (i.e: GPA above x.x, a least x credit hours, no repeat courses). Ability to identify contract **expiration dates**.
Reporting		
E033		Ability to produce **summary reports for CCE** campus locations.
E034		Ability to **purge transaction activity**, consistent with open item or balance forward methods based on user-defined criteria.
E035		Ability to produce **ad hoc reporting** and download files for micro computer applications.

BILLING, RECEIVABLES, CASHIERING		
ITEM¦ I.F. ¦		
E036		Ability to **access all student records** via ID, name, partial name lookup, or soundx.
Miscellaneous		
E037		Ability to identify **foreign students** and establish unique rules (i.e: foreign students must have insurance, which may be provided by a 3rd-party fiscal agent).
E038		Ability to manage **transfer students** across campus boundaries without duplicating student entities.

F. Financial Aid

FINANCIAL AID
ITEM¦ I.F. ¦
General

F001		The system must be highly **integrated** with other system modules, such as **admissions, student records, payroll (work-study), and accounts receivables.** The system must provide automatic transaction generation for linkage to students receivables upon disbursement. In addition, a similar linkage to payroll for work study purposes must be displayed.
F002		Flexibility regarding **application requirements** definitions. When a student applies for financial aid, the system should be able to produce and track a **user-defined set of documents** required in the awarding process.
F003		Automatic **roll of applicant information** from previous applications when re-applying in a new term or year.
F004		Provide for **electronic media** processing for the purposes of information transfer to and from **federal agencies** as well as **loan agents**.
F005		Allow for student **validation of enrollment** at time of application.
F006		Ability to handle **VA, Perkins, GSL, and Pell** financial aid activities.
F007		Unlimited **fund codes** availability.

F008		Flexibility regarding **user-defined table parameters**, including fund sources, packaging, awarding, checking fund availability, and management reporting.
F009		Provide for **financial aid transcript** processing on demand, including hardcopy as well as look-up capabilities.
F010		**Electronic Funds Transfer** and capability to allow for future needs.
F011		ERAU is investigating the capabilities of imaging. The system should either provide **imaging capabilities** to reduce paper flow or allow for such capabilities via interfacing.
F012		Ability to offer unlimited **budget types**.
F013		A user-defined **criteria for purging** must be supplied. In addition, ERAU will entertain suggestions for electronic media for data storage. Ideally the respondent will be able to supply such capabilities.
F014		Automatic verification against **aid limitations**.
F015		There is a need to identify **independent study courses**. Students taking these courses are eligible for less financial aid. This further suggests the integration to other modules and systems.

F016		The system must offer **user-defined code** availability, such as **residency and special funds** codes.
F017		Capability to **assign a major** if no major has been defined for the student.
F018		Flexible and user-defined **eligibility parameter** mechanism.
F019		Provide capabilities for automatic **loan processing**, including: encumbrances (pending funds); funds accruals; lender tracking; lender notification upon withdrawl; automated deferments; enrollment verification.
F020		Provide **financial aid history** information for each individual applicant, both in summary and in detail.
Needs Analysis/Packaging		
F021		Ability to perform **needs analysis** calculations based on federal guidelines. Essential to this requirement is the availability of student and family contribution information and student budgeting. In addition, automatic recalculation initiated by adjustments is desirable.

F022		**Award packaging** is a central requirement of the module. Flexible user-defined packaging criteria needs to accommodate the policy currently in existence that dictates that the need is based on family contribution (see current Financial Aid write-up). **Award distribution** over multiple terms is considered part of the award packaging function.
F023		Capability to process and **validate needs analysis data** either manually or from CSS, USA Funds, and other tapes.
F024		Provide a mechanism to define and review complete **"what if" scenarios** regarding needs analysis and budgets calculations.
F025		Provide for automatic **prior-year budget rollover**.
Tracking		
F026		Ability to record and **track aid disbursements** on predefined disbursement schedules related to specific enrollment periods and automatically forward this to **accounts receivables**.
F027		Capability to **track student loan applications** from the point of receptions through disbursement.

F028		The need to keep **track of Financial Aid-specific academic status** based on F.A.-defined criteria and monitoring of satisfactory progress should be available.
Reporting - The module must be capable of handling such outputs and processes as:		
F029		**FISAP** statistics;
F030		**Statement of Funds**;
F031		**Frequency** distributions;
F032		**Cash flow** analysis;
F033		**Pell** recipients;
F034		**Package** documents;
F035		Compliance to **Office of Education and NACUBO**;
F036		**Ad hoc** reports.
F037		Provide **flexibility in reporting**, such as online reporting of unduplicated head count, unduplicated monies, and summary of information by disbursing agencies.
F038		Provide for **automatic generation of documents** based on activity and dates.

F039		Provide automatic **summary report disbursements to fund agencies**.
F040		Provide for **multiple letter (document) generation** based on user-defined criteria. Document text must be user-modifiable.
F041		The Financial Aid department must **maintain record documentation** to justify monies given to the students. Records must be maintained in active status for 5-6 years and, due to federal regulations, an additional 5 years as inactive. This creates a large database of records. The new system must be able to address this problem by offering **archiving solutions and alternatives**.

G. Student Records

STUDENT RECORDS
ITEM¦ I.F. ¦
General

STUDENT RECORDS		
ITEM	**I.F.**	
G001		The Student Records must be highly **integrated** with other modules and systems, such as: **Admissions, Flight, Continuing Education Field Information System (CEFIS), Student Billing, Financial Aid, and Student Housing**.
G002		The student information system should allow the user flexibility and control to tailor the environment, supporting **multiple campuses, multiple sites, and multiple terms**.
G003		Ability to handle **concurrent enrollment** of students across campus boundaries.
G004		Ability to track the academic progress for students enrolled in **multiple degree programs** encompassing several minors, specialties, options, etc.
G005		Capability to track individual **graduate and undergraduate academic data**.
Terms / Sessions		

STUDENT RECORDS		
ITEM	**I.F.**	
G006		Flexible **user-defined academic terms and sessions**; e.g.: CCE terms have variable start dates, residential campuses have 4-5 terms per year. Definition of concurrent terms must be available.
G007		**User-defined ongoing registration processing**, e.g.: the independent studies program starts a new "term" every week, 52 times a year. This implies the capability to offer OE/OE (open entry/open exit) course design.
G008		Ability to define and process **multiple, concurrent, and future terms**, e.g.: **pre-registration** permits registering for the Summer A, Summer B, and Fall terms at one time.
Course Scheduling		
G009		Facility for creating a **master course plan** using data from a degree audit/vertical outlines module.
G010		Provision for user-defined **course section limitations** and detection.
G011		Online maintenance of **course descriptions**.

STUDENT RECORDS		
ITEM	**I.F.**	
G012		Ability to **roll course offerings forward** to a future term/session.
G013		User definition of **course lengths** within a term, e.g.: short courses or independent study courses.
G014		**Validation of course sections** against course master.
G015		User-defined **course start and stop dates** by campus, site, term and section.
G016		**Multiple instructors** per course section.
G017		User-defined format for printing **term schedule books.**
Course Cataloging		
G018		Flexibility would ensure that **items significant to each campus**, **site, term, and course** would be retained on the student's academic record. This may be a subsystem or an integral part of a degree audit module. Thus, many functions may describe a direct degree audit function.
G019		Define **degree programs** online.

STUDENT RECORDS		
ITEM	**I.F.**	
G020		User-defined **multiple sections**. Items that may delineate sections may include one or more components: campus, site, section 1,2,3, independent study, weekend class, directed study, seminar, special topic etc.
G021		User-defined **calculations for units attempted, units completed, units graded** etc, e.g.: remedial courses do not count for college credit, some courses award a certificate etc.
G022		ERAU allows students to **repeat courses**. There are specific calculations regarding GPA depending on how many times a course is repeated and the grade achieved in each repeated course. The new system should address this function.
G023		Initiate student receivables **special fees** processing, e.g.: student may be required to purchase software, computer rental etc.
G024		User-defined **transcript codes** to indicate how the course should be noted on a transcript (transferred course, wavier, substitution)
Classroom Scheduling		

STUDENT RECORDS

ITEM	I.F.	
G025		**Multiple campus room scheduling** capability.
G026		**Room forecasting** facilities.
G027		Optimization of **classroom vs. enrollment.**
G028		**Pre-allocation of specific classrooms** to academic departments.
G029		User-defined **attributes and their priorities** specific to each classroom.
G030		User-defined schedule for specific **class sizes.**
G031		Ability to **schedule rooms by time of day**. In addition, the system must allow for **restriction** of classroom usage.
G032		**"What if" scheduling** scenarios.
G033		Report **unattended rooms** by day/hour.
G034		User-defined **cancel and re-assign** on demand.
G035		User-defined **room reservations** by special request.
G036		Usage **restrictions flag**, based on entity/group requesting space.

STUDENT RECORDS **ITEM** | **I.F.** |		
G037		Ability to **schedule exams**.
Student Statuses		
G038		User-defined **criteria for continuing student status** (e.g.: CCE operates on a two year basis vs consecutive spring/fall terms for the residential campuses).
G039		User-defined indication for **full/part time enrollment** status. e.g.: Full/part time enrollment on the residential campus is based on hours attempted for one term, ie: spring, summer a/b, fall. CCE enrollment is based on three (monthly) terms within a spring, summer, fall, winter term designator. They also **track graduation term** completion within one of the four graduation classes.
G040		User-defined criteria determining the **academic status**. e.g.: CCE statuses are calculated based on when each student completes a block of twelve hours vs standard term basis for the residential campuses.
Student Record Criteria		

STUDENT RECORDS		
ITEM	**I.F.**	
G041		User-defined academic standards for **athletic eligibility**.
G042		User-defined **activities code**.
Advisor Assignments - Ability to **assign advisors programmatically** to include one or more of these user-criteria:		
G043		in the **"approved" phase** of the admissions process;
G044		by the **"type" of applicant**, e.g.: transfer, foreign;
G045		by **major**;
G046		by **campus**;
G047		by **expected entry term**.
G048		Allow **maintenance of advisors** on active student and approved applicant records.
G049		Track the number of assigned **applicants and students by advisor**.
G050		Provide audit reporting of **advisement changes**.
Registration Processing		

STUDENT RECORDS		
ITEM	**I.F.**	
G051		Provision for online, **interactive registration**.
G052		Capability for **touch-tone and voice registration**. In addition, **unattended terminal registration** may be considered in the future. Evidence of this type of functional processing is desirable.
G053		Automated **appointment scheduling**.
G054		Ability to allow **dual program enrollments** as well as **multiple minors**.
G055		User-defined **closed section wait list**.
G056		Provision for automatic checking of **restriction flags** during registration.
G057		Capability to **create a course section at the time of registration** (CCE). E.g.: CCE will allow the system to build a course section before determining the number of students needing that course.
G058		Notification to student of **drop status** based on restrictions.

STUDENT RECORDS		
ITEM	**I.F.**	
G059		Ability to **transfer groups of students** from one course section to another (CCE).
G060		Automatic initiation of posting of **charges and/or refunds during the registration process,** e.g.: with regard to the refund percentage defined for each course, term and campus.
G061		Automated **drop process** for non-payments, non-activations/no-shows, and canceled sections with an automatic adjustment to student schedule.
Grade Processing		
G062		Real time **recalculation of GPA's, academic statuses, and enrollment statuses** when grades are posted.
G063		**Distributed grade posting/processing** ability with audit facilities by site and/or section.
G064		**Hold flag restriction** availability for transcripts.
G065		Support of **mid-term and final grading**.

STUDENT RECORDS ITEM¦ I.F. ¦		
G066		Ability to **post grades** by student, course section, or site; from batch files **via scan forms**; and for courses that end **prior to the current term** (such as AMT short courses).
G067		User-defined criteria **selecting those students for midterm grading**, (i.g; freshman level only).
G068		User-defined **grade types and weights**. Must be able to distinguish grades that are valid to include in GPA, transfer grades that are valid to include in graduation, honors calculations (e.g.: grades from transfer credit are only accepted for use in determining honors at time of graduation), grades that are valid repeat grades (e.g.: grades of "P", "W", "S" are not valid within the repeat policy).
G069		Complete grade posting for a student to **initiate academic status letters** processing and generation (CCE).
G070		Provide user **printing options**, including: Labels vs. Mailers vs. Envelopes, class lists, etc.
Academic Evaluations		

STUDENT RECORDS		
ITEM¦	**I.F. ¦**	
G071		Ability to monitor **course substitutions** (how many, for what courses?, degree programs?, approved or not?, etc).
G072		Facility to track the **status of evaluation requests/processing**.
G073		Ability to **detect duplicate credit**.
Graduation Evaluations		
G074		Ability to create **online catalogs** and perform degree audit processing.
G075		Automated process to determine students for **graduation processing**.
G076		Ability to produce **commencement list**.
G077		Online access specific to auditing **credit applicable to degree program**.
G078		Ability to compute **academic equivalent GPA's** on demand.
G079		Ability to **compute honors**, including transfer credit grades, class rank and standing.

STUDENT RECORDS		
ITEM	**I.F.**	
G080		Ability to track **applications for Degree Completion** with user-defined reporting capabilities.
G081		Automatic change of **student status** once the degree is posted.
Transcript Processing		
G082		Transcripts should reflect **student academic history** for multiple programs / minors and degree levels (graduate / undergraduate). Flexibility in **transcript design** is desirable. For example, the transcript should not reflect the graduate courses enrolled in by undergrads and vice versa.
G083		Provide **online viewing of transcripts**.
G084		Ability to produce **official and unofficial transcripts** on demand by individual student or other user-defined selection criteria.
G085		Provision for **honors and awards notations**.
G086		Initiate **receipts for transcripts**.
G087		Facility to retain **multiple transcript addresses**.

STUDENT RECORDS		
ITEM¦ I.F. ¦		
G088		Report record **summary or detailed transfer credit and advance standing**.
G089		Report record of **miscellaneous academic credit**.
History		
G090		Ability to define **criteria for inactive records** with access to activate a history record promptly.
Reporting		
G091		All reporting should be able to run for **multiple campuses, sites, and terms**.

H. Advising/Degree Audit

ADVISING/DEGREE AUDIT		
ITEM	**I.F.**	
General		
H001		**Pre- and Co-requisite checking** during the registration process.
H002		Display **alternate course sections** available if the current section selected is filled.
H003		Ability to enter course **equivalency transfer credit**.
H004		Online access to **pre-defined course equivalency records** (articulation database).
H005		Provide the ability to retain **multiple college catalogs and student vertical outlines**. These catalogs must be able to support graduation requirements in reference to curriculum definitions comprised of specific majors, minors, or any items that would make up a program of study.

ADVISING/DEGREE AUDIT		
ITEM	**I.F.**	
H006		All catalogs must be retained to allow the advisor to evaluate a student's course work under **alternate catalogs within the same curriculum**.
H007		Catalogs must provide for **descriptive/instructional text** regarding the requirements defined in addition to the "rules" (courses and events needed to complete a degree).
H008		Ability to edit a current catalog and or functional outline and **roll that information forward to create a new catalog/outline year**.
H009		Define the **requirements for a degree program** in a simple, uncomplicated manner while at the same time providing enough flexibility to accommodate complex programs.
H010		Ability to optionally include **currently enrolled course work**, with the assumption that the credit will be earned.
H011		Evaluate **multiple majors and minors** per student.
H012		Provide for **waivers and substitutions** globally or by individual student.
H013		Account for any restrictions for **marginally passing credit**.

ADVISING/DEGREE AUDIT		
ITEM	**I.F.**	
H014		Provide online and batch mode **evaluation processing**.
H015		Allow for **"what if" plan change** capability.
H016		Allow user to specify if a course is associated with major(s) to enable the calculation of **GPA's within programs.**
H017		User-defined **course equivalences at the student level.**
H018		Allow user to define additional **parallel courses**; e.g.: labs.
H019		User-defined **processing and selection options**.
H020		Provide the ability for the advisor to create and maintain a **customized vertical outline** for each student under advisement.
H021		Facility to **modify the academic plan** by indicating the student's minor, area of concentration or any other designation that may significantly **alter the basic functional outline**.
H022		**Functional outlines should be interactive with the student's course history**. Any course work that has been graded should be shown on the outline. Transfer or advance standing granted should be indicated on the outline as well.

ADVISING/DEGREE AUDIT		
ITEM	**I.F.**	
H023		User-defined **curriculum requirements**.
H024		Allow definition of general **academic and elected major requirements**.
H025		Allow for specific **course requirements** or a list of courses from which a **minimum number of credits or courses** should be completed.
H026		Allow for the use of a **wildcard value**, e.g.: MA 2@@ equals any '200 level' math course, in order to include or exclude any classification of required disciplines, course-id's, or suffixes.
H027		Ability to define **additional parameters, specific to the course level**, will also be required. Some examples are: minimum number of courses acceptable grade; minimum credit hours pass/fail grade; minimum gpa maximum credits for transfer credit; advance standing or marginally passed courses.

ADVISING/DEGREE AUDIT

ITEM	I.F.	
H028		Ability to **join courses** in various combinations will be necessary so the student may select the best avenue to fulfill the degree requirements, e.g.: this may be from a relatively simple combination of course requirements, such as : Nine credits from at least three of the four defined course areas OR twelve credits of Avionics Electives.
H029		**Global requirements** may need to be specified for all options defined within a degree program. The system should allow the implementation of requirements definitions for general studies or any areas of study that may be appropriate. An example may be: be: minimum grade point average; maximum number of minimal grades; maximum transfer credit limit.

ADVISING/DEGREE AUDIT

ITEM	I.F.	
H030		Provide the ability to identify individual **student "exception" information** which may be the result of academic actions or existing data found on the student record. These "exceptions" should be noted in the student's functional outline. Examples of exceptions: an alternate record identifier (course substitution) may be assigned; individual course characteristics may be changed, such as a pass/fail course may be modified to a standard grade course to meet a specific requirement.
H031		Restriction flag override capability to **"force" courses** into the plan.
H032		Ability to create **course "exceptions"**, e.g.: course waivers and completed requirements for accepted work.
H033		Identify **"non-course" items** such as Cooperative Education Credit.
Repeated Courses		

ADVISING/DEGREE AUDIT		
ITEM	**I.F.**	
H034		The system will need to handle **course work that has been repeated or taken as an audit**. In addition, there is a need to flag a required course as being allowed as a repeat course and apply credit accordingly.
H035		User-defined number of **repeats allowed** for a course.
H036		Ability to define how many **repeated courses will be included in the grade point average** for a degree requirement.
H037		Ability to define **any grade as the minimum acceptable** for a repeated course to be included in the grade point average.
H038		User-defined **number of times the course is forgiven**, e.g.: how often it may be retaken without penalty.
Processing and Reporting		
H039		**Batch and/or online operation** is a requirement of the audit/advisement processing.
H040		**Ad hoc reporting** capability with flexible sort and selection .
H041		**Descriptive or instructive comment** availability.

ADVISING/DEGREE AUDIT

ITEM¦ I.F. ¦

H042		An **unmet requirements** report to summarize the course work to be completed for graduation by class. This report can be used to project the demand for future course offerings.

I. Housing

HOUSING		
ITEM	**I.F.**	
Integration		
I001		**Student billing** and receivables system.
I002		**MAPCON physical plant** system for building, room, and damage (work order) information.
I003		**Student records and/or admissions** systems.
General		
I004		**User-defined charges** (e.g.: housing, phone, lost key fee, damages). For Prescott, allow for access by outside services (e.g.: meal plans and parking decal charges).
I005		User-defined criteria for establishing **application priorities**.
I006		**Room forecasting**.

HOUSING		
ITEM	**I.F.**	
I007		User-defined **facility/room attributes** (e.g.: available for clusters/zones, smoking, unavailable for summer B, reserved for special purpose).
I008		Ability to **assign rooms** by application priority, facility attributes and user-defined applicant attributes (e.g.: gender, age, major, club/association, ROTC, physical limitations). Allow for "what if" runs.
I009		**Advance deposit** processing.
I010		Ability to assign rooms by requested roommate via **roommate matching** and lookup.
I011		Ability to **override room assignments and re-assign** at any time. Allow for pro-rated charges/credits.
I012		Ability to manage **overflow waiting lists**.
I013		Ability to maintain **history of applicants and room assignments**.
I014		Ability to track **occupancy and roster information**.
I015		Ability to support a **calendar of events** (e.g.: club meetings, social events, skyfest, VIP guests).

HOUSING

ITEM	I.F.	
I016		Provide an information/referral service for **off-campus housing**.
I017		Provide support for **emergency information**.

III. RESPONDENT RATING SYNOPSIS

A. Ranking Explanation

Each evaluator will be provided with appropriate Evaluation Criteria Charts (from section II of this document) to record perceived ratings. Any criteria item not evaluated should be left blank, which will be ignored in the averaging process. Ratings from individual evaluator charts will be entered into a campus specific Ranking Table. Automatic Lotus functions will calculate an average evaluation rating, and compute composite and weighted scores. Any items that fall short of a "fully satisfied" rating may be researched for potential compliance within 6 calendar months. Subsequent entry of a potential factor will influence composite score calculations. Respondent rankings will be determined from the total weighted score.

Lotus spreadsheet Ranking Tables, with importance weight factors, will be established in advance of actual evaluations. The next page of this document shows samples of the Ranking Tables that will exist for each respondent.

B. Rating Table Explanation

ITEM= Item reference number (cross-reference to the Evaluation Criteria Charts).

IF = Importance weight Factor.

E1-E5 Individual Evaluator ratings (may be more or less than 5, dependent on the number of evaluators).

AE = Average Evaluation rating (of E1-E5).

PF = Potential Factor.

CS = Composite Score (average evaluation rating + potential factor).

WS = Weighted Score (composite score x importance weight factor).

C. Sample Vendor Rating Tables

Respondent: Vendor # 1

DAYTONA										
ITEM	**IF**	**E1**	**E2**	**E3**	**E4**	**E5**	**AE**	**PF**	**CS**	**WS**

PRESCOTT										
ITEM	**IF**	**E1**	**E2**	**E3**	**E4**	**E5**	**AE**	**PF**	**CS**	**WS**

CCE										
ITEM	**IF**	**E1**	**E2**	**E3**	**E4**	**E5**	**AE**	**PF**	**CS**	**WS**

CCE										

UNIVERSITY					
ITEM	IF	DAYTONA WS	PRESCOTT WS	CCE WS	ERAU AVERAGE

IV. SAMPLE EVALUATION RATING CHART

Following is a sample of a respondent rating chart, implying that three vendors will be evaluated (V1, V2, and V3). Charts used for establishment of importance factors will be reformatted in this fashion, including the appropriate number of rating columns.

ALUMNI/DEVELOPMENT				
ITEM¦ V1¦ V2¦ V3¦				
Integration				
D001				Ability for **students to evolve to alumnus** status without redundant record keeping;
D002				Ability to interface gift financial data to the **General Ledger system**;
D003				Ability to interface **payroll deductions** from the Payroll system;
Biographic/Demographic Information				
D004				Ability to identify **constituent types**: alumni, friend, parent, sponsor, trustee, faculty, staff, corporation, trust, foundation, organization, and other user-defined categories.

ALUMNI/DEVELOPMENT ITEM¦ V1¦ V2¦ V3¦				
D005				Ability to maintain a **history of communications** to/from constituents.
D006				Ability to identify an **alumnus who is also a student**, pursuing a second or graduate degree. Consider that the student may be in an independent studies program. This should be a criteria during solicitation processes.
D007				Availability of flexible **user-defined attributes**, such as: education history, occupation and job history, ratings and certifications, activities, achievements, tickler and comment details, parent and relationship specifics.
D008				Provide flexible, unlimited, user-defined, **addresses and contact information.** User-defined criteria for choosing the right address at the right time. Be in compliance with necessary postal regulations.

ALUMNI/DEVELOPMENT				
ITEM¦	**V1¦**	**V2¦**	**V3¦**	
D009				Ability for multiple people to **share the same address**, eliminate redundant maintenance (e.g.: husband and wife alumni, parent and student living at home).
D010				Ability to track and retain **name and address changes**.

Appendix Z: Strategic Plan Evaluation Questionnaire

Strategic Plan Evaluation

VP = very poor; P = poor; A = adequate; G = good; E = excellent; NA = not applicable

I. MANAGEMENT "NEW" INITIATIVES

A. Planning

1. The Mission Statement reflects the mission of the University
2. Plan assesses current technical environment
3. Long range plan reflects vision of the University
4. Short term plan reflects immediate needs of the University
5. Plan is clear and reasonable
6. Plan reflects goals and objectives of University
7. Confidence in plan for disaster recovery

B. Governance

1. Confidence in governance structure
2. Effective Computing Governance Committee
3. Effective technology budgets

C. Communications

1. Adequacy of computing newsletter frequency

2. Informative computing newsletter context
3. Adequate representation in professional organizations
4. Adequate participation in technology presentations
5. Adequate use of local area network
6. Adequate use of electronic mail
7. Effective overall communciation

D. Computing Literacy

1. Satisfactory comfort with personal computers
2. Satisfactory comfort with Windows
3. Satisfactory comfort with DOS
4. Satisfactory comfort with Macs
5. Satisfactory understanding of mainframe vs. PCs
6. Satisfactory understanding of networking
7. Adequate frequency of training
8. Satisfactory comfort with training topics
9. Satisfactory comfort with electronic mail
10. Satisfactory understanding of University computing standards
11. Satisfactory understanding of multimedia
12. Satisfactory participation with the Internet

II. ADMINISTRATIVE SUPPORT SOFTWARE

A. Administrative Systems

1. Student

a. Satisfactory access to system

(1) Daytime

(2) Nighttime

b. System contains necessary information

c. Adequate user interface

d. Adequate training

e. Improved functionality over prior system

f. Effective implementation

g. Positive impact on student services

h. Meets functional needs

i. Allows for future technological expansion

j. Fully integrated and complete

k. Adequate interfaces to existing systems

l. Adequate departmental staffing to operate

m. Effective computing support

n. Effective system security

2. Financial

a. Satisfactory access to system

(1) Daytime

(2) Nighttime

b. System contains necessary information

c. Adequate user interface

d. Adequate training

e. Improved functionality over prior system

f. Effective implementation

g. Positive impact on student services

h. Meets functional needs

i. Allows for future technological expansion

j. Fully integrated and complete

k. Adequate interfaces to existing systems

l. Adequate departmental staffing to operate

m. Effective computing support

n. Effective system security

3. Human Resources

a. Satisfactory access to system

(1) Daytime

(2) Nighttime

b. System contains necessary information

c. Adequate user interface

d. Adequate training

e. Improved functionality over prior system

f. Effective implementation

g. Positive impact on employee services

h. Meets functional needs

i. Allows for future technological expansion

j. Fully integrated and complete

k. Adequate interfaces to existing systems

l. Adequate departmental staffing to operate

m. Effective computing support

n. Effective system security

4. Decision Support Systems

a. System contains necessary information

b. Adequate user interface

c. Adequate training

d. Effective implementation

e. Positive impact on information access

f. Allows for future technological expansion

g. Adequate departmental staffing to operate

h. Effective computing support

i. Effective system security

5. Other Support Systems (auxilliary systems)

a. Systems contain necessary information

b. Adequate user interfaces

c. Adequate training

d. Positive impact on student services

e. Meets functional needs

f. Allows for future technological expansion

g. Fully integrated and complete

h. Adequate interfaces to existing systems

i. Adequate departmental staffing to operate

j. Effective CTS support

k. Effective system security

B. Computing Literacy

1. Satisfactory understanding of Unix

2. Satisfactory understanding of MPE

3. Satisfactory understanding of terminal emulation

4. Satisfactory understanding of networking

5. Satisfactory frequency of training

6. Satisfactory comfort with training topics
7. Satisfactory understanding of University computing standards
8. Effective new employee orientation

C. Policies/Procedures

1. Clear and understandable
2. Complete
3. Accessible
4. Flexible to change with technology
5. Evaluation effectiveness
    a. Adequate frequency of review
    b. Satisfactory level of University participation

D. Documentation Support

1. Clear and understandable
2. Complete
3. Accessible
4. Flexible to change with technology

III. ADMINISTRATIVE TECHNICAL PLATFORM

A. Hardware

1. State-of-art
2. Flexible to change with technology

3. Meets University vision

4. Effective upgradability

5. Satisfactory level of cost effectiveness

6. Local accessibility

7. Satisfactory level of infrequency of downtime

8. Adequate safety from interruption of service

9. Effective maintainability

10. Effective CTS support

11. System supports "open" environment

    a. Supports Unix

    b. Interfaces to existing system

    c. Interfaces to disparate platforms

    d. Supports network/telecommunications

12. Satisfactory life expectancy

13. Effective system security

B. Resource Facility

1. Adequate housing of hardware

2. Accessible to system

3. Satisfactory level of cost effectiveness of housing environment

4. Satisfactory physical security of environment

5. Satisfactory frequency of preventative maintenance

6. Capable of handling system(s) expansion

C. Operations

1. Satisfactory level of cost effectiveness

2. Adequacy of user support

   a. Adequate level of quality of work

   b. Adequate level of access to personnel

   c. Personnel are courteous

3. Quick Report/Request turnaround

4. Adequate level of confidence in personnel skill set

5. Adequate level of trust of personnel (security)

6. Effective skills-upgrade training schedule

D. Technical/Programming Support

1. Satisfactory level of cost effectiveness

2. Adequacy of user support

   a. Adequate level of quality of work

   b. Adequate level of access to personnel

   c. Personnel are courteous

3. Quick Report/Request turnaround

4. Adequate level of confidence in personnel skill set

5. Adequate level of trust of personnel (security)

6. Effective skills-upgrade training schedule

IV. NETWORK/TELECOMMUNICATIONS

A. Management/Planning/Direction

1. Charter is clear and defined

2. Network Plan

a. Plan fits vision of University

b. Plan is complete

c. Plan is flexible for changes in technology

d. Review methodology is clear and defined

3. Adequate level of confidence in management direction

4. Adequate level of confidence in management style/decisions

B. Service Expansion/Enhancement

1. Imaging

a. Adequate level of use

b. Easy to learn

c. Satisfactory understanding of use

2. Video Conferencing

a. Easy to use

b. Available

c. Satisfactory level of cost effectiveness

d. Downtime infrequent

3. Adminstrative office network availability

a. Accessible

b. Satisfactory level of information availability

4. Faculty network availabilty

a. Accessible

b. Satisfactory level of information availability

5. Library access on network

a. Accessible

b. Satisfactory level of information availability

V. ACADEMIC COMPUTING

A. Faculty/Instructional/Student Support

1. Charter fits vision of University

2. Adequate introduction of emerging technologies

3. Adequate training of emerging technologies

4. Satisfactory understanding of multimedia

5. Satisfactory level of multimedia usage

6. Adequate level of technology equipment accessibility

7. Adequately equipped student labs

8. Adequate student lab accessibility

9. Students able to access the Internet

10. Students understand purpose of the Internet

11. Faculty innovation adequately rewarded

12. Faculty Resource Center adequately equipped

13. Classrooms adequately equipped for technology instruction

B. Technical Support Environment

1. Adequately staffed student labs

2. Student labs adequated equipped

VI. LIBRARY SYSTEMS SUPPORT

A. Evaluation/Enhancements of Current Systems

1. Support staff computer literate

2. Library staff helpful

3. Library adequately equipped

a. CD-ROM databases

b. Automated Card Catalog

4. Library holding easily accessible

5. Adequate research materials available

6. Material procured on timely basis

B. Future Library System Requirements

1. Library adequately networked

2. Need to consolidate Prescott and Daytona databases

3. Adequate training schedules

VII. OFFICE AUTOMATION

A. Administrative Users

1. Fax machine accessible

2. Scanner accessible

3. Office adequately equipped with PCs

4. Adequate training

5. Postscript printer available

6. Laser printer available

7. Color print available

8. Office adequately equipped with PCs

9. Adequate PC software

a. Spreadsheet

b. Wordprocessing

c. Window environment

B. Academic/Faculty

1. Fax machine accessible

2. Scanner accessible

3. Office adequately equipped with PCs

4. Adequate training

5. Postscript printer available

6. Laser printer available

7. Color print available

8. Office adequately equipped with PCs

9. Multimedia equipment available

10. Adequate PC software

    a. Spreadsheet

    b. Wordprocessing

    c. Window environment

VIII. ORGANIZATION AND STAFFING

A. Management

1. Has vision of future

2. Is technologically current

3. Communicates mission effectively

4. Pursues mission effectively

5. Allocates resources effectively

B. Technology Leadership Role

1. Understands technology role

2. Recommends appropriate technologies

3. Ensures staff technologically current

4. Understands new technologies

C. Office of Information Technology

1. Appropriately structured to achieve vision

2. Appropriately staffed

3. Adequately services institution

4. Follows TQM philosophy