The purpose of this paper is to share with the reader experiences successfully contracting for the installation of our campus-wide voice, video, and data network, from start to finish -- including obtaining a management consultant for the design, writing the bid specifications, evaluating the proposals, awarding the contract, and managing the installation and implementation. It took fifteen months from construction through implementation, including trenching, construction, cabling, and systems implementation. There are important issues and people to be considered in all phases of such a project.
TURNKEY CAMPUS NETWORK INSTALLATION:
VOICE, VIDEO, AND DATA

In the mid-1980's, the term “network” started to become an important characteristic of a college or university. For example, whenever Virginia Tech was mentioned, someone would always add that “they are installing a huge network there, you know.” Further discussion would lead to how difficult it is to manage and connect networks. It took many engineers and senior computer personnel to operate the network. From the perspective of a small liberal arts college, I was concerned whether Mary Washington College could ever have such a monstrosity because of our lack of highly technical personnel. But as time went on, smaller institutions installed networks as the technology began to stabilize and the network operating systems matured, lessening the demand for professional (engineer) administration. I began to foresee a time when Mary Washington College might be networked. Many new exciting applications were emerging which greatly enhanced communications, such as electronic mail, access to computer resources throughout the campus, and sharing of files. Our President, having an understanding of systems and networking, began to realize that installing a network would offer a competitive edge in attracting new students and retaining those currently enrolled. I began working on a Request for Proposals for management consulting services for the design of our campus network. For this paper, I am breaking the project into six phases: Management Consultant Services, Analysis and Design Document, Network Request for Proposals (RFP), Evaluation and Award, Installation and Implementation, and finally, Lessons Learned.

Management Consultant Services: In order to write specifications for management consultant services for the analysis and design of the Mary Washington College network, I performed some background work by requesting copies of similar documents from various sources, and attending a few telecommunications conferences and seminars, where valuable information about consultant specifications were presented. One key recommendation I followed was to require the design consultant to play a major role in the writing of the RFP, assist in proposal evaluation, perform project management functions for the College, and insure that all aspects of the project were acceptable. Of course, each of the components of the consulting contract after the design was optional as determined by the College. In order to ensure accountability on the part of the designer, and a practical design, the consultant could be retained to implement his design. The bids for consulting services ranged from seventy thousand to seven hundred thousand, with a wide variety of approaches. It is extremely important that the chosen contractor have many years of expertise in all fields of technology and supporting subsystems. (Experience became a major selection criteria in the evaluation and award process.) You should, after all, incorporate as many cabling and electronic subsystems in this project as budgetarily possible. The whole idea of hiring an expert is to be made aware of options and a direction that you might not have developed yourself. Just prior to issuing the RFP for consulting services, the College formed a core project team to not only discuss the proposals submitted, but also to solicit information from others to share with the team members. This core team would meet periodically during the life of the project.

The analysis and production of a design document took about nine months. The contractor and I initially met with key administrative personnel to determine the broad scope of what the College wanted from the project. Interviews were later set up with every administrative and academic department to apprise them of the project and extract any information or “wish lists” they might have -- without regard to perceived limitations. We might be a small liberal arts college, but our
faculty and staff want everything any large university would offer. As expected, the more technically gifted faculty and staff requested capabilities requiring huge amounts of bandwidth, the ability to exchange information in any format, and network resident software. This interview exercise was one of the most interesting tasks in the early phases, as some really progressive ideas came from disciplines not necessarily considered “technical.” One example, is the Drama Department wanting computerized queuing of lights, sound, and music in the theater for their plays. The most tedious part of the analysis was determining where every type of “drop” should be located. A drop is an outlet which might consist of voice, data, video, fiber, or in any combination thereof. Some standards started to evolve during this activity as to what should be in every dormitory room, classroom, lab, office, and also laundry rooms and lounges. If you plan on reselling long distance services to help pay for the project, you need lots of available telephone lines.

**Analysis and Design Document:** The consultant will compile all the information, and after several discussion sessions with the core project team, produce a final design document. This document includes a description of the current environment, discussion of the needs analysis, recommendations for data, voice, and video systems, and recommendations for personnel and training for support. The document also includes a voice system comparison between Centrex and PBX, and an approximate cost of each major component of the network for budgetary purposes. It is very important to have such a document from which to build the RFP, and for audit and planning purposes. A formal, independently produced document will carry more credibility than an in-house technical report. Later, to satisfy State requirements, the design document could be the supporting documentation to show that in-depth planning was performed, and contain much of the justification and benefits needed to proceed with the project.

Once the design document is complete and a formal presentation made to the administrators, the next step is to determine how to obtain the funding. In most cases today, this step will be the most challenging. Successfully requesting several millions for a network in the next fiscal allocation is highly unlikely. But there are ways! This is the point where the top fiscal officers and president are practically the only ones who could develop a methodology. At Mary Washington College, we analyzed various methods including using vendor financing, selling revenue bonds, requesting a limited amount from the general assembly, and redirecting retired debt to the project. In fact, we used every one of these methods, including setting a reasonable technology fee to be billed with tuition. At this point, we knew we could fund the project, and RFP development for the campus network proceeded.

**RFP for Campus Voice, Video, and Data Network:** The RFP production took longer than I had anticipated and required quite a bit of scrutiny by the core project team. The final four-hundred page document included comprehensive sections on construction, voice system, video facilities, campus data network, associated systems, training, implementation and acceptance. After approval from State-level procurement, the RFP was advertised in several publications and released in July 1993. A mandatory pre-proposal conference was held in August, with bids due in late November. An important requirement was that the College wanted a prime contractor relationship for all aspects of the project. Such a specification will add some prime contractor overhead to the bottom line, but it insures total ownership by the prime, eliminates finger pointing in times of conflict, enables the tight coordination between vendors and suppliers needed to meet deadlines, and facilitates the necessary “partnership” between the institution and the prime
contractor. The RFP should require that the contractor include all costs associated with every aspect of the project in order to eliminate any surprise costs during installation, such as bonds, permit fees, and service orders.

The specifications were stated as functional requirements. Adherence to standards, guidelines, and operational specifications were required and referenced. Some of the standards referenced included National Electric Codes (NEC), Building Industry Consultants Service International (BICSI), Commercial Building Standard for Telecommunications Pathways and Spaces EIA/TIA-569, Commercial Building Wiring Standard EIA/TIA-568, Virginia Uniform Statewide Building Code (VUSBC), and various video specifications. There may be standards and guidelines in place at your institution or mandated by State code. Check with the facility manager and include any institutional requirements in the RFP to prevent non-compliance problems surfacing during the project.

The following nine paragraphs include highlights of the major sections of the RFP.

1. Distribution Systems -- This section includes the outside and inside cabling, conduit, and construction. It is important to stress the sensitive environment of the institution. Students will be walking around twenty-four hours a day and need access to the facilities even during construction. Look for responses which depict an understanding and, even better, experience in working under these conditions. Consider requiring conduit encased in concrete. There are several good reasons for this, including elimination of conduit joint movement or separation during cable pulling, reduced fear of future digging damaging cables, and reduced soil sinkage after installation. Be sure to require modular cable connections and avoid “punch down” methods except when absolutely necessary. The staff that will inherit the cable system maintenance will provide service more efficiently using modular connections. It is a good idea to have the contractor supply adequate spare patch cables and other parts prior to acceptance. When estimating the number of connections, increase it by 30 percent, even if you have included every single room on campus. Don’t rely solely on a list of rooms. Oftentimes lists do not contain special use rooms. Plan for installing “no dial tone” lines for future use. Do not forget any off-campus locations which are considered part of the institution. You must consider how will you include them on the network.

2. Voice System -- The voice system section of our RFP is very unusual in that the requirements did not specify either a Centrex or PBX solution, but required that the bidder offer either solution as long as the functional requirements were met. What better way to obtain a true comparison between the two technologies? One of the two finalists proposed enhanced Centrex and the other proposed a PBX. There were many debates during the evaluation of this section, and we were able to clearly understand both the financial and personnel impacts of each solution. We were interested in reliable service, telephone line configuration control, and provision of more features than are available with analog lines. Include in the RFP, that the vendor should take responsibility for the payment of any fees to replace the current voice system which could be service order fees, line features, etc. You must determine the ownership of the existing cable system. There may be costs involved in retiring old cabling.

3. Campus Data Network -- The data network section is by far the most complicated. We required a Fiber Distributed Data Interface (FDDI) backbone, and Ethernet within each building, with the capability to migrate to emerging technologies such as fast Ethernet or Asynchronous Transfer
Mode (ATM). The unusual part of our request was for the vendor to also offer, as an alternative, a solution which takes advantage of some of the newer technologies. These alternatives would not change the functionalities required, but encourage creative thinking for solutions which would best match the capabilities of a small support staff. The prime contractor would submit one proposal which included all subsystems, and with the global knowledge of all requirements, be able to optimize and combine similar requirements and installation. The result is a more efficient total system at a reduced cost. We knew that at least a year would pass after the contract award before beginning the installation of the data portion of the project. This would allow enough time for new technologies and products to be available. In this way, we became the largest ATM installation to date. In the data network section, we required the offeror to include all electronic equipment, software, software and hardware configuration, information loading, electronic mail, server virus protection, uninterruptable power supplies (UPS), and a network-based suite of office software in his bid. The contractor had to install and load the equipment and software before handing control over to the College. An innovative solution offered by the successful contractor was the use of three centralized superservers in lieu of seventy servers spread all over campus. This offer provided the advantage of centralized network administration and backup. We included the requirement for a fifty-line communications server to provide the same capabilities for off-campus access as is experienced on-campus. We found that encouraging the vendors to be creative in their offer allowed them to draw expertise from their most talented employees and partners, and added a level of excitement to the project. The successful installation of the ATM hubs and backbone equipment was very important to the vendor, for future reference and publicity. As such, the vendor provided their senior technical personnel to do the installation and testing. You should consider what would be required for a major upgrade, and try to build in scalability. We installed higher capacity hubs in all buildings to enable upgrading from Ethernet to ATM with just a “board swap.” We can easily provide ATM to all buildings, in addition to deployment in the backbone, at minimum cost.

4. Video Facilities -- The video facilities section includes the provision of television stations to all residence hall rooms, six closed circuit channels for College distribution, installation of a high-tech classroom integrated with the campus data and video networks, and upgrade of the head end facilities. The cable television service in student rooms did not include any premium or pay-per-view stations. The students may contract directly with the local cable provider for these services. The high-tech classroom has a touch control podium for the instructor -- no technician is needed to operate any of the devices. But we did add a second control center in the control booth for instances when it is desired to have “back room” control. This is another section where we did not specify that the television signal must come from a cable television provider and we received one bid which offered two satellite dishes and a subscription service for video programming, while the other offered service from a local provider. Consideration must be given to personnel requirements and maintenance, as well as initial and ongoing costs.

5. Associated Systems -- This section includes requirements for an electronic telephone directory; voice mail for students, faculty, and staff; residential paging system; electronic card access and door control system; surveillance camera system; and information kiosks. These are the types of components that emerge from initial campus meetings when performing a needs analysis. There are normally many people on campus who, when given the opportunity, know what improvements in their areas would enhance the way they do business, which usually benefits the
students. Other projects which might be considered for new cabling are the campus clocks and all alarm systems.

6. **Warranty, Maintenance, and Support** -- This section requires two years of maintenance after acceptance. We ended up reducing this requirement to one year as every proposal charged dearly for the second year. Our initial thought was that an offeror might “throw in” the second year to win the bid -- wrong. The winning offeror included a ten-year warranty on the cable plant which should probably be a requirement. It is very important to require maintenance costs, as part of the submission, for cost evaluation over the designated life cycle. You must also require a detailed description of the level of support for each component and make sure that they will meet your business needs. For instance, if the voice mail system is down for four hours, you will probably not suffer any great loss, but if the data network were down that long, productivity and research could be lost. The maintenance should match the risk of loss of service.

7. **Training** -- This section insures that appropriate personnel are trained and, what is more important, that funds are allocated for training purposes. We also included a requirement that the contractor provide training tapes for the voice system and data network to be distributed over one of the College cable channels. The RFP required the contractor to produce instruction books on many features of the system, but we chose not to implement this requirement and diverted the time and funds to additional formal training. Our final training needs really emerged once the systems were in place. This was especially true in the data area. The RFP must provide as much flexibility as possible in this section.

8. **Implementation and Acceptance** -- This section reiterates the overall responsibility of the contractor to fully install and prove operational the voice system, campus data network, video system, associated systems, and distribution systems in accordance with the terms of the RFP. The offeror must also prepare implementation plans of each component, test and acceptance plans, and documentation. The contractor must submit to the College as-built building and outside plant drawings using AutoCAD, and the cable plant records in electronic form. Part of the construction work in buildings included penetrating walls and floors for conduit installation. The Fire Marshall will need to inspect the fire stoppage materials and methods prior to building acceptance. It is a good idea to have a meeting with the Fire Marshall to discuss requirements, and have an inspection when the first building is complete to insure that the requirements are met and that the contractor is clear on what needs to be done.

9. **Facility Management** -- The facility management section describes the assistance the College requires in order to keep the new systems operational while the staff attends training sessions and gains experience with the new technologies. The first year was included in the cost of the proposal, with optional, additional years available if we determined such services were required. Reselling long distance services to students is included as a requirement in this section and we were able to offer this service as each building was cut over to the new telephone system -- the students love it. The subcontractor was required to generate the student bills for the first two years of service.

**Evaluation and Award:** The evaluation phase is taxing to say the least. One helpful requirement is to specify that the vendors’ proposals restate the RFP requirement followed immediately with their response. We supplied all interested parties with copies of the RFP on a diskette for this
purpose. Reading and evaluating from one book is far easier than reading the requirement from one book and the corresponding response from another. Two weeks following the proposal deadline, each potential prime contractor was assigned a two-hour time period to give a formal presentation of their offer to the evaluation committee. With the small number of bids, we were able to schedule all the presentations in the same day. The presentations saved the evaluation team an enormous amount of time in that the prime contractors made formal presentations to the team describing overall strategies and methodologies supporting their approach and solution to the project. Minute details of equipment, software, etc. were excluded, however the major products, protocols, and systems were presented to the evaluation team. Since the interested bidders were given some freedom to propose solutions based on required functionality, all submitted proposals could be, and were, different. The presentations to the evaluation team provided a means for the potential contractor to deliver the company’s philosophy toward education, and what this type of project would mean to them. Following the presentations, the evaluation team had a good “feel” for each offer which eased the proposal reading and understanding processes immensely.

To facilitate the evaluation, each offeror had to submit product specification sheets with the proposal, and we researched and compiled product comparison sheets from various sources. We requested customer site visits for the evaluation team to obtain first-hand information on the products being offered and services they had performed. We spent two and a half days with each finalist traveling to nearby customer sites and found the experience very helpful not only in evaluating the product or service, but also for future contacts.

The evaluation criteria included cost as a factor, but also included experience, references, methodology (approach to the project), and minority business utilization. Cost is always a concern, but the soundness and creativity of the offer, and past experiences in project management of the offeror are paramount to a successful installation. The prime contractor should approach such a project with the attitude that this project is a partnership with the institution. If the project goes well, and both sides are willing to give and take, everyone wins.

**Installation and Implementation:** The scariest moment in this whole project was the day we posted the award. The realization suddenly set in that this project, for which I am responsible, would disrupt every person and building on campus during the installation. The award was made on April 15, 1994, and within one month, the contractor was on campus (even before he could arrange for a double-wide trailer to be installed for office space), three weeks after the residence halls were vacated. It was imperative to start construction in the empty residence halls as soon as possible.

All institutions are sensitive to keeping their campuses as neat and attractive as possible. Therefore, finding a suitable location for a construction yard (with back hoes and a myriad of other equipment and supplies) and several construction trailers, was a difficult task. Other considerations include taking over parking lots or areas around residence halls, and making the construction area accessible to large delivery trucks. The site must accommodate the large supply of conduit, concrete manholes, sand, bricks, spools of cable, and other construction materials for transport to the area under construction. We ended up using a residence hall parking lot at a corner of the campus and designating the majority of spaces in a nearby commuter lot for the residence hall students. The next concern for that residence hall was the time of day that construction crews generally start (compare that time with the time a student wants to wake up and you see that they
are very different times.) We restricted the crews to starting no earlier than 7am, and still received some complaints about construction noise.

Another construction consideration is making sure that all workers are aware of the rules of parking, wearing identification badges, trash removal (lunch as well as construction), use of restroom facilities, and looking at students. We made it the Contractor’s responsibility to inform their employees of the policies and enforce them according to College guidelines. The number of permanent and temporary workers required, and the lack of troublesome instances, made it quite clear that the construction team was top notch.

Approximately one third of the cost of this project was construction. I really thought that the ability to start construction at one end of campus and move across to the other end in a smooth and non disruptive manner would be only a dream, but the Contractor was able to attack construction in that way. The single biggest surprise in the project happened in the first two weeks of class when the construction contractor had completed “rough-in” work in the ninth building prior to the students returning, and wanted to reenter the building to pull and connect the cable when the students were settled. The students were so excited about the possibility of having telephone service in their rooms that they readily agreed to allow completion. The next building to be cabled was a small house and those students also opted for construction to be performed during the day. The telephone service was the key! It became apparent that, with the students cooperation, the remaining residence halls could be cabled during the academic year. We hired hourly guards from a local company to knock on doors, and generally watch the workers. The uniformed guards continually milled around and provided a feeling of safety to students, the contractor, and the College. We essentially had around-the-clock construction for the entire academic year. Work in residence halls was conducted from 8am through 6pm, and in academic and administrative buildings from 6pm until 6am. The faculty and staff were informed ahead of time when their building would be wired and advised to remove any item they considered valuable from sight. There were no incidents. We did receive a complaint the morning after the rat lab in the psychology department had conduits run through the plaster ceiling, that the rats were sneezing from the dust. After any complaint, no matter how trivial, the contractor always sent someone to follow up and talk with the person who submitted the complaint. Most of the time, I also visited the site with the Bell Atlantic project manager. This type of response lets everyone know that you are concerned and want any problems rectified.

The new telephone service was the first system completed. The faculty and staff were given Integrated Systems Digital Service (ISDN) telephones in order to provide many features which were not available with the previous analog telephones. The telephone installation was very complex with numerous steps, procedures, and service groups involved. Fortunately, with Bell Atlantic as the prime contractor, the telephone system installation was seamless. We always learned something from every type of installation, whether it was the analog telephone service for students or the ISDN for faculty and staff. We developed and revised procedures after every phase. The basic steps in providing ISDN in a building included notification of cabling (including times and duration); review of departmental telephone use; training on the new features; service order preparation and scheduling; cable termination and connection; station review with users for final features (can be altered later); labeling the ISDN face plates; delivery of sets with face plates; and hands-on user training.
Some additional considerations in the telephone world included determining if the user needs the old analog line for modem dial-up until the data network is complete, and if there are plans for facsimile machines -- include that cable now! If the old analog number was retained for modem use, the user normally kept the old voice mail feature to inform callers of the new telephone number. How do you inform the outside world about the new numbers? As a policy, only published, departmental lines were forwarded to the new number as there is a hefty charge for this feature, and there is no charge for the “State Interrupt” to obtain a new number.

There are two other components of the voice system: voice mail, and long distance capturing and billing. The voice mail system was installed and used by all on the new system as they were cut over. After having the local telephone company manage voice mail, and paying dearly every month for it, I can confidently recommend having your own system. We have full management capabilities including partitioning (creating sub-mail boxes), initializing, reinitializing, setting mail box limitations, granting privileges, creating message boards, reporting statistics, etc. The other component of the voice system is capturing and billing for long distance calls. The proposals included two years of management of these services. As soon as a residence hall was cabled and telephone lines activated, the students had voice mail and the capability of signing up for discounted long distance service -- which 95 percent did. The system logs long distance calls and generates bills monthly. The College is using the commission from these calls to help pay for the telecommunications network project and hold down tuition costs.

The data network could not be provisioned in a “one building at a time” fashion as the telephone system. The major backbone components had to be installed and configured and thousands of connections in the building telecommunications closets had to be completed. The first building to begin use of the network and software was my building, where the major components of the system reside. We plugged in everyone in this building and asked them to be the guinea pigs for software use, network trials, and network reliability. On more than one occasion, the network controllers had to be restarted or reconfigured and the users lost some data -- most of the time they were very cooperative, but as time marched on they were more reliant upon network resources and became less understanding of disruption.

We were extremely tight on time to meet the deadline for having the network up and running by the beginning of the Fall 1995 semester, even for faculty and staff. There were some glitches in the remote half of the network which caused that end to be painfully slow. It was so sluggish that we abandoned the massive loading of faculty and staff computers until the problem was resolved. The ATM backbone to Ethernet network on our campus was the largest site with that configuration in the country. There was limited expertise in debugging and resolution, but the prime contractor, major hardware vendor, and key College personnel worked diligently to meet the deadline. Some of the key equipment components of our unique network were not even announced as products until after we had completed the major network installation. If the vendor had not been fully committed to supplying the appropriate expertise at our location when we needed it, this paper might be entirely different!

The next hurdle was to distribute the information necessary for students to connect to the network. We included recommendations on minimum computer configurations and what network interface cards (NIC) to purchase with several student mailings originating from various offices. We produced a separate student mailing from our office with their login names and passwords. Many
students brought the recommended computer and NIC when they returned, but many others
brought what was represented to them as “compatible.” Oftentimes a NIC touted as compatible
will not work on a Novell network because there are no drivers for that NIC card. The most time
consuming problems we experienced were trying to create drivers for these cards. Successfully
connecting to, and using, a network can be much more complicated than running other
applications. The computer, software, and network components generally have very stringent
requirements to adhere to particular specifications based on the network technology deployed.
Consequently, our department spent a frustrating three to four weeks trying to assist those students
having trouble connecting to the network. The first few weeks were the most difficult, but as we
were learning more about the types of problems students were having, and students were assisting
other students, our work days became tolerable. I was surprised that students appeared all during
the semester to obtain their login name, password, and instructions for connecting and
downloading, as I thought after the first month there would be few new users.

The network-resident software we are initially providing to faculty, staff, and in labs is Microsoft
Office (MS Word, Excel, PowerPoint, and Access), Word Perfect, virus protection, GroupWise,
and LAN WorkPlace. As new versions become available, they are upgraded on the server and the
user is automatically prompted to install the new version upon his next login to the network. If a
virus is detected on the user’s computer, he is notified about the virus and not allowed to login.
This procedure can be inconvenient for the user, but has been well received -- there have been bad
experiences and a lot of publicity about viruses. Users are very aware today of the potential
damages from viruses.

The last major component of the data network is upgrading the Internet connection and installing a
security firewall. The original 56kb Internet connection was inadequate for the number of users on
the new network. Also, the original connection was not considered secure from hackers on the
Internet. The upgrade was not part of the original contract for the telecommunications project, but I
substituted Internet security for server-based microcomputer security. The prime contractor
configured the Internet security firewall and installed several other components for the connection.
The T-1 line (upgraded Internet connection) and a router were purchased and installed through a
State contract. The firewall requires authentication of users for access to our new network. When
a student, faculty, or staff member is away from campus, they have full access to their files, but
unauthorized users are not able to move past the firewall. The World Wide Web server, Gopher,
List server, etc. remain outside the firewall as we want Internet users to access the information on
these servers.

Lessons Learned:

Be sure you have the support of the administration and governing board before beginning a project
of this scope. They will be the recipients of complaints about parking, a line item on the tuition bill
for services not yet available, and other questions, and need to defend the inconveniences with the
promise of capabilities the system will bring to the campus.

Unless you have exceptional expertise on your campus, hire a consultant to perform the network
analysis, produce the design document, and finally write the Request for Proposals. These tasks
are best performed by those with the technical resources available and previous experience
producing such documents. It will be well worth the cost in terms of completeness of
requirements and in professionally presented documents. The institutional representative will spend most of his or her time working with the consultant during all phases. The bid prices we received for such consultation and documents varied dramatically based on the level of architectural work to be performed by the consultant.

You must be absolutely sure that the construction company understands the campus environment with its continuous population and limited ability to interrupt campus scheduling. Another factor to consider of the construction company is their experience with telecommunications. Changes in cabling routes will require analysis of cable requirements against all the standards. These changes will most likely occur “on the job” and probably at night when the most knowledgeable engineers are not on campus. All foremen must know the effects on cable route changes.

It is imperative that the construction company has regular and continual communications with the prime contractor and institution project manager. Daily status reports, at least verbal, should be required and any deviations in plans must be discussed and documented.

You should have standing, regularly scheduled project meetings. The attendees should include the prime contractor project manager, construction project manager, construction foreman (maybe several representatives depending on needs), telephone company representatives, physical plant employees assigned to the project, project inspector, your staff members assigned to the project, your supervisor, and yourself. My supervisor is in a senior position in the administration and while he did not have detailed knowledge of the technical aspects of the project, he provided a wealth of information about the campus, buildings, and schedules, and assisted greatly in many difficult decisions. By attending almost every meeting, my supervisor stayed up to date on the project, relayed the progress and problems at senior his staff meetings, and supported the project with knowledge gained from the meetings.

You must thoroughly understand the budget for the project. There will be changes that require budgetary consideration and you must know how to “rob Peter to pay Paul.” I would also suggest regular budget reviews with the budget officer at your institution.

The data portion of the project is the most complicated. Investigate the credentials of the individuals and organization proposed to configure and implement the campus data network. They must have a working knowledge of the electronic equipment and software proposed, and be willing to work closely with the equipment engineers. By specifying, in the RFP, the functional requirements instead of name brands, the prime contractor will propose the brand of equipment and software with which the data engineers are most experienced. Most of the major manufacturers of electronic equipment for large networks are very competitive while offering similar capabilities.

Take into account the time frame of when the data network will be available and work with the contractor to install the latest models at installation time -- not necessarily what is available at bid time. We were able to install an ATM backbone which was not on the market at bid response time a year earlier. If you are able to take a chance on new technology, you will receive extra attention and assistance during implementation as the manufacturer will want a good reference for the new products.
Assign as many members of your staff as possible to the project. I am not suggesting they do no other work, just that they regularly attend meetings, visit some of the buildings and telecommunications closets during construction, and have an opportunity to contribute their ideas to the project.

Be prepared to make demands of the prime contractor to change anything that you feel is not properly installed, that does not meet the requirements in the RFP, or appears to not suit the aesthetics of your institution. It is nearly impossible to have every detail completely described in the RFP, which means that some on-the-spot decisions will be made by the contractor, he may just install something before discussing it with you. Some of these working decisions are great. Some are not.

Finding the time for staff training on the new technologies, equipment, and software is difficult to schedule as everyone is so busy keeping the old systems going, attending meetings, and learning bits and pieces of the new systems. Training times should coincide with the implementation of each system. Your staff will not have to initially configure the systems, but they will need to understand the configurations and be able to maintain and eventually enhance the systems. Training is very effective when it follows a period of system observation.

It is very likely that many members of the faculty and staff will have computers that are inadequate for accessing the campus network. Identify the inadequacies as soon as possible and present your findings and recommendations to the administration -- along with the projected cost. Our network was completed prior to the targeted completion date which left some faculty and staff without access to the network because new computers were not budgeted. The users who previously used only word processing on their computers are not necessarily content to wait for six months before accessing the campus network! I have found that almost every faculty and staff employee is very excited and enthusiastic about the capabilities of the network and want to be a participant.

Get students involved in assisting other students. Hire student aides, as many as you can, to assist users in loading software, installing new computers, installing network interface cards, troubleshooting problems, and training other students. My department is not adequately staffed to support 3,800 students using the network. You must be creative in this area. We contacted several computer companies in the area to anticipate calls from students for installation of computers and network interface cards, and provided a list of companies for students to call for assistance. We are still brainstorming as to the most efficient way to assist students in accessing the network.

Where Do We Go From Here?

I began this project with the expectation that interest in, and use of, the network would evolve gradually. I was entirely wrong. We already have professors giving assignments using the network resident software, requesting special software to be loaded on the network for designated classes, requesting the purchase of site licenses for software packages, using the Internet access to resources in assignments, and communicating by electronic mail with their students and colleagues.
We have loaded a limited site license of a statistical software package for a designated number of concurrent users which is much less expensive than the purchase of stand alone versions. We have formed an academic resource committee to evaluate requests for network resident software and either provide or recommend funding, depending on the amount.

Training for product support staff and end users will be regularly scheduled. The network versions of software need to be utilized. People must be trained in their use. Our institution has been lax in training prior to the network installation. We encourage faculty and staff to attend training, offer the sessions often, and solicit feedback. Many of the training sessions are available to students. We established and staffed a department strictly devoted to training, with a large room equipped with networked multimedia computers and video display devices. This department will be expanded in the near future to accommodate development of course materials using available electronics and software. The department is also responsible for training faculty and staff in the use of various peripheral equipment, such as visualizers, CD-ROMs, laser disks, and other instructional devices.

There are numerous policies and procedures we must develop in order to maintain some sense of order to our network and its capabilities. These policies and procedures will not only address fraudulent activities and consequences, but also loading and updating software from the network, posting information on servers, creating Web pages, highlighting computer courtesy issues, delineating responsibilities for information, reporting problems, and so on.

One very large project utilizing the new network is that of replacing all administrative software. During the year of network installation and implementation, we released an RFP for integrated student and financial software. The contract commenced in January 1996 with loading the software, training development staff, and implementation of several modules. The project completion date is December 1997. The new software is very “user friendly,” allows for end users to create their own reports and queries, and provides electronic movement of information through the network. Without campus-wide access, the software replacement project would benefit only a fraction of our faculty and staff.

The network expansion we are anticipating in two years, will consist of redesigning a couple classrooms in each academic building into high-tech laboratory style and lecture style classrooms. The use of computing and electronics in the classroom will continue to grow over the next few years, even in liberal arts institutions. The laboratory style classroom will provide hands on experience for students with instructor control. The lecture style classroom will allow for instant feedback from students through small devices at each seat, and provide viewing from large monitors of electronically produced and projected materials from a variety of peripherals.

Of course, the fastest growing interest in technology today is accessing the Internet. Mary Washington College is in an enviable position to take advantage of new Internet developments with its ubiquitous network, state of the art backbone, all new cabling, and campus enthusiasm. If this enthusiasm remains steady, there is no doubt that the connectivity the network provides, both on- and off-campus, will offer limitless opportunities and capabilities for years to come.