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I. Summary

This year has been yet another characterized by a mixture of steady progress and notable events. Corporate relationships were enhanced with firms such as AT&T, Hyperion (now Adelphia Business Solutions), Bell Atlantic, Lucent, FORE, and others, while new relationships were cultivated with films such as Telebeam, 3COM, and TCI, the latter focused upon the pending introduction of higher speed network access within the State College area. The concept of a Metropolitan Internet Exchange was developed, with activity underway to finalize contractual and technical issues with those initially engaged in its creation.

Several other strategically important activities were undertaken, which culminated in arrangements:

- With Bell Atlantic for continued provision of phone services, as progress is made to move to a "Voice over Internet Protocol (VoIP)" environment,
- With Hyperion for provision of additional lines to serve dial in modem needs at University Park
- With AT&T for higher-speed Internet2 connections to the Pittsburgh "gigapop," and
- With a yet-to-be-selected vendor for provision of next-generation equipment for the integrated backbone.

A proposal to redefine the manner in which OTC is funded—in order to ease the impact of decreased future voice revenue, as well as to alleviate related internal funding difficulties—by converting certain cost-recovered amounts to central funding—was presented to executives. They, in turn, redirected the effort toward developing a funding plan dependent upon a higher percentage of cost-recovered revenue for services. A proposal of how fees might be defined and established to accommodate this new direction is now being developed.

Progress was made in terms of improving quality of various services, clarifying billing, continuing to improve information infrastructure (especially that funded by the $ 15.8M DOS program, including completion of room 108 Wartik), disseminating information about the services offered or being planned by OTC, and preparing for a smooth transition of services into Year 2000. Substantial effort was expended upon assuring continued basic voice services, categorized as second only to power as being most critical to the operation of the University. Plans were also conceived for undertaking an updated strategic planning effort during 2000.

II. CQI

OTC Web site

As part of an ongoing effort to improve access to Web-based information, a major re-design of the OTC Web site was implemented at the beginning of spring 1999. The site has been simplified, with an emphasis placed on reflecting the user's view. Major improvements to the site include a streamlined, no-scroll, front-end page, re-organization and implementation of a tailored "catalogue" of products and services based on whether the user is faculty, staff, or student, and enhancements to help the user navigate through the site more easily. A search engine is available from the "Home Page" to help the user find what they're looking for in an even more direct manner. A list of OTC services is included in Appendix A, with further detail available at the OTC Regularly Provided Services Web site.

Integrated Telecommunications Management System

An integrated telecommunications management system, “Mysoft”, from Compco Inc., was implemented to manage OTC internal processes, including Telecommunications Service Requisitions (TSR), trouble tickets, assignment and tracking of cable pairs, installed inventory and stockroom inventory, and billing. The system was put into production use in August 1998, and provides integration of information between separate functional areas that were previously isolated. The new system is Year 2000 (Y2K)
ready and replaces systems that were not Y2K ready. Further details about the new system are in Appendix B.

Review of Bills
Beginning late spring 1999, OTC began a program to review and explain the telecommunications bills at all non-University Park locations. For each, a team from OTC travels to the campus to meet with the Director of Business Services and staff to review both the OTC billing statement as well as any statements that the campus receives directly from telecommunications vendors (e.g. Bell Atlantic). So far to date, 3 campuses and 1 other site has gained an improved understanding in how to read and interpret their billing statements. OTC plans to offer an audit service for University Park departments/colleges in the near future.

Call-Handling Data Reports
To help departments better manage incoming call flow, a more structured approach to producing reports outlining call-handing data was implemented. Reports for departments using Uniform Call Distribution (UCD), a method used for distributing many incoming calls uniformly among a group of people, are now able to be updated on an hourly basis, and are available through a Web-based interface. The timeliness and readability of the new report now enables departments to immediately analyze their call flows make prompt adjustments to compensate for fluctuating call volumes. Web versions of additional call handling reports are under development.

Voice Mail Script Changes
In order to reduce the number of errors incurred during the process by which University Park voice mail users change their security codes some script changes to simplify the process were implemented in November 1998. Evidence gathered during a normally busy month (February) indicates that significantly fewer trouble calls were reported to OTC's Help Desk related to voice mail password resetting.

Network Operations Center Help Desk
The Network Operations Center (NOC) Help Desk provided support for over 13,000 trouble calls during the reporting period. Over 7,000 trouble tickets were issued while the NOC staff evaluated and resolved over 6,000 problems over the phone. Questions and inquiries ranged from restoring simple dial tone service to solving complex network connectivity problems. The recent addition of extra staff at the NOC to answer and handle trouble calls improved service.

III. Notable Corporate Endeavors and Alliances
AT&T Alliance
The AT&T Alliance was formally initiated in 1994. Although there is no precise length specified for the Alliance to continue, the long distance contracts which are a cornerstone are for ten year terms. This reporting period marks the halfway point and a useful point to highlight changes and new directions. Since 1994, AT&T has changed significantly through recent leadership changes, mergers and acquisitions. Penn State has also changed with increasing emphasis on the use of Information Technology to support the educational research missions. Long distance service has dramatically changed, with more competition and lowered costs. Traditional calling methods using calling cards and 1+ dialing are slowly decreasing as a result of e-mail (which is replacing telephone/voice utilization) and of voice mail (reducing the length of calls).

With the acquisition of Vanguard Cellular Services and TCI, AT&T could provide improved national programs to the University, including nationwide cellular services and higher-speed network access to our off-campus students, faculty, and staff. Through its fiber construction projects, AT&T could also offer
higher-bandwidth services to most campus locations. At an Alliance meeting in early June, these ideas were presented and will be explored, along with others, over the next few months.

Bell Atlantic
The University has entered into a contract extension with Bell Atlantic for telephone service at the University Park Campus. This contract will provide a reliable source of telephone service while a technology change to providing voice over IP (VoIP) occurs. VoIP will provide further integration of communications types over a single network using the Internet Protocol (IP).

Part of this contract extension, which was made through a formal RFP process, will include trials between the University and Bell Atlantic. Bell Atlantic will help fund trials of VoIP equipment installed and maintained by the University, and will work with the University to conduct trials of this equipment with Bell Atlantic's network.

Adelphia Business Solutions
Adelphia Business Solutions, formerly called Allegheny-Hyperion Telecommunications, is a relatively new company that competes with Bell Atlantic and other incumbent local exchange companies. The name change to Adelphia Business Solutions reflects the relationship with Adelphia - a large cable TV multiple system operator, and the majority owner of Hyperion.

Adelphia Business Solutions provides a variety of services to the University. At a few campuses, it provides the external hunk connections from the campus telephone system to the public switched network. At University Park, acting as a sub-contractor to AT&T, Adelphia Business Solutions provides the State College-Altoona portion of our Internet2 connection. Also at University Park, Adelphia Business Solutions provides the digital communications from the public switched network to the Penn State modem pool.

During the past year, Adelphia, via AT&T has implemented the high-bandwidth "OC-3" connection used for Internet2 service between University Park and the Pittsburgh "gigapop." Adelphia has also been selected to provide additional lines to support University Park-based dial-up modem services, and has taken residency in the Penn State Research Park. They, along with Lucent Technologies, also arranged for participation by Penn State's Vice Provost for Information Technology on a discussion panel at Supercom's international conference in Atlanta.

Lucent Technologies
Penn State has developed a much closer relationship with Lucent Technologies (Lucent) over the past year. Among areas that continue to be explored with Lucent are next generation routers, coarse and dense wave division multiplexing, voice over IP developments, wireless networking, and methods to lower the cost of high-bandwidth services. Discussions with Lucent will continue over the next several months, seeking opportunities to continue and enhance this relationship.

Vanguard Cellular Services
The growth in digital cellular service at University Park continues. A significant change in our service provider relationship occurred this spring, when the acquisition of Vanguard by AT&T was completed. Although the Vanguard Cellular One name will continue to be used for some period of time, it will eventually be replaced with the AT&T name. The current cellular services and programs are expected to remain unchanged at least through fall 1999. Since AT&T has a much larger geographic coverage area than Vanguard, we hope that improved national programs can be developed, while still retaining the attractive local rates and structure developed under the Vanguard program.
TeleBeam Inc.
Efforts continue to implement the Metropolitan Internet Exchange (MIX), as well as to utilize Telebeam's services for provision of fiber optic transport to the Swan Building in CATO Park, to meet the needs of ARL, and look for further opportunities to enhance the relationship. The final legal review of the contract for the MIX is reportedly imminent, as is completion of the fiber optic path to the MIX, which is located in a Telebeam facility on South Allen Street in State College, PA. A deal has been struck to utilize funding from within OTC to augment that available from ARL to complete a reasonably sized fiber path to CATO park, and execution of the necessary paperwork with Telebeam is imminent.

FORE Systems
Penn State's corporate relationship with FORE Systems Inc. continues to be productive and beneficial to the University. For example, a FORE closet switch was recently selected to be OTC's new standard device for connecting user work stations to the University's Integrated Backbone. The FORE switch will be the basis for many new OTC support services such as video, voice, and mobility as well as potential security services. FORE worked with University personnel on modifications needed to the switch to enable it to meet Penn State's requirements and is selling the switch to Penn State at greatly reduced prices.

3COM
Stimulated somewhat by the potential use of 3COM equipment by local service providers such as Bell Atlantic and TCI, as well as a close personal relationship with 3COM personnel, numerous avenues of mutual interest were investigated, including focus upon Palm computing, standards-based cable modem services, wireless products, and other technological areas in which 3COM is involved. Plans were made for a meeting early next quarter to review mutually promising areas of interest.

Compaq
In meetings with Compaq executives, information was exchanged about strategies for the future, and mutual interest in Web-based networking models. While no specific directions were established, it was agreed to maintain awareness of progress, and continue to search for mutually interesting endeavors.

Dell/Intel
Insight was gained through non-disclosure discussions with Dell and Intel representatives regarding future microcomputer developments and plans, especially for a networking viewpoint. As closer relationships are developed with these companies, it is likely that more interactions will be warranted in terms of networking aspects.

IV. University Wide Activities
Internet2
The circuit used to connect Penn State to the Pittsburgh "gigapop" for Internet2 traffic was upgraded in October from a DS-3 (45Mbps) to an OC-3 (155Mbps). This capacity increase was used initially for additional traffic to the vBNS (and then to the growing number of institutions connected to the Internet2 backbone). However, the Pittsburgh "gigapop" will be connected to the second Internet2 national backbone, Abilene, early in the next reporting year, so the new oe-3 circuit will provide capacity to both Internet2 backbones.

OTC staff are involved in CIC and Internet2 digital video development activities and as part of this project were part of the digital video demonstrations for the fall Internet2 member meeting. The demonstration involved taking a live television feed, converting it to a compressed digital stream, encapsulating it in the IP Internet protocol, and broadcasting it to all end stations on Internet2. OTC will continue to pursue this particular type of digital video as well as some of the other video technologies
that were demonstrated during the meeting. One of these is a higher performance technique for use in interactive conference rooms and classrooms with Internet2 style network connections. Less compression and less end-to-end latency will both be welcomed enhancements to group interactive situations.

Year 2000 Readiness
OTC continues its support of the University-wide Year 2000 (Y2K) effort. A team of 6 OTC staff has been working to identify services and products which may need upgrades. Extensive lists of products are being examined one-by-one for vulnerabilities. A list of vendors is being developed to identify those who supply critical telecommunications services to the University, and a test plan is being developed to test systems for Y2K-compliance. These Y2K preparations are documented on OTC’s Y2K Web page.

Open House
OTC held an Open House in its University Support Building 2 location on November 5, 1998 from 10 a.m. to 3 p.m. Close to 200 University faculty and staff members attended, several from campuses other than University Park. OTC showcased emerging and established technologies supporting voice, data, and video services, and offered tours of the Call Center and other areas of interest.

Access Modem Project/Internet Access Services
OTC, in conjunction with the Center for Academic Computing (CAC), upgraded the dial-up capabilities and modem counts in place at many campuses. These upgrades allow faster access, and decrease the possibility of getting a busy signal. Where possible, campuses were provided digital dial-up capability, using ISDN lines, while the size and speed of modem pools were upgraded at numerous campuses.

In order to support dial-up modems, an additional 14 ISDN PRI lines were added at University Park campus for a total of 24, prior to the beginning of fall 1998. An additional set of 24 ISDN PRI lines were added in the early part of spring 1999.

In order to encourage students living in residence halls to take advantage of their 10 Mbps EtherNet connections, as well as to ensure that the campus access modem pools are reserved for users for which dial-up is the only option (i.e. those who live off campus), the following campuses implemented call blocking from residence hall rooms to their modem pools effective with the beginning of fall 1998 semester: Beaver, Behrend, Berks, Hazleton, and Mont Alto. (Altoona campus was the first campus to implement call blocking with the beginning of the spring 1998).

The table in Appendix C lists the current counts and speeds of access modem pools at Penn State campus locations and outlines the changes that were made at these campuses.

Penn State Call Center
In addition to providing all types of information, scheduling use of interactive video services, handling emergencies and other duties, the Call Center handled over 600,000 requests for directory assistance during this reporting period. This averages of approximately 3.5 calls per minute - a call roughly every 20 seconds - to request telephone numbers, fax numbers, e-mail addresses, and other information about Penn State or its faculty, staff, students, and endeavors.

The Call Center arranges Audio Conference Calling services ("Meet Me" and Operator Assisted Conference Calling), and OTC Videoconferencing services. OTC-scheduled Videoconference rooms (106 and 120 University Support Building 2) and the Penn State Video Bridge continue to be heavily utilized by staff and faculty. The two conference rooms average approximately 4 videoconferencing events per week, while video events in these rooms and others requiring use of a video bridge an average of
approximately 13 times per week. The charts in Appendix Q. illustrate the utilization of the Audio Conferencing and OTC Videoconferencing services.

A new Message Service, part of the Can Center Services, was introduced in fall 1998. This service allows calls to be forwarded to a Call Center Operator for message coverage over the lunch hour, during holidays, or on other occasions when the need may arise. The service works by having the departmental phone number forwarded to a special Can Center Message Service phone number. A Call Center Operator will answer all calls and have messages forwarded hourly to departments by electronic mail. Special arrangements can also be made with the Call Center to handle urgent or emergency calls, such that high priority messages will get to the designated departmental contact as soon as possible. To date, several departments have used the new message service. They are:

- The College of Engineering ran a program called "Spend an Engineering Day" for which attendees needed to RSVP. The published RSVP number was an 800 number that was forwarded to the Call Center Message Service. The Message Service handled a total of 140 RSVP's, which was well over the amount that the College was expecting to receive by phone.
- The Research, Instruction, & Information Technology department in the Smeal College and the "Better Kid Care Program" of the Agricultural Economics and Rural Sociology Department are taking advantage of the "CHAMPS" services.

In addition to traditional message service support, the Call Center also provides Outcalling and Call Forwarding services as part of the "CHAMPS" (Call Handling and Message Phone Service) offerings.

In addition, an agreement was also established with the Undergraduate Admissions Office to evaluate a new service within the Call Center's "CHAMPS" services that involves the Call Center taking calls from prospective students who are requesting Admissions applications and informational brochures. The Call Center's assistance will greatly improve turn-around time on such requests, and will allow the prospective student to speak with a live operator rather than leaving a recorded message. The trial consists of two phases and began in December 1998.

To better support these services in a quality manner, an RFP for an integrated console/directory product was distributed to various vendors in June 1999. If affordable, it is intended that the new system will replace the current 15-year-old propriety consoles and paper directories with an on-line PC-based solution.

V. Student-Focused Services

Residence Hall Internet Services

The project to install electronics on all non-University. Park residence hall ports (one per pillow) was completed. With this, OTC, in collaboration with Housing and Foods Services, has fully populated traditional residence halls (at campuses that have on-campus housing) with data connection ports. This has reduced the time necessary to activate service the student requests it. All Penn State students housed within these traditional residence halls (approximately 17,000) now have high-speed access to the Penn State, network and global Internet. Few, if any, other institutions, especially of Penn State's size, offer this combination of highly secure, yet quickly available, Internet connection.

Other activities related to residence hall services include:

- 64 residence hall connections enabled at Dickinson.
- 216 residence hall connections enabled at Schuylkill.
- Completion of the connection of all residence hall ports at Berks, Behrend, and Altoona campuses.
• 86 additional ports installed at University Park's East Halls to accommodate temporary housing needs.
• Harrisburg temporarily removed from residence hall database while new residence areas are being constructed.

To further minimize the time to activate these services, an on-line “Student Internet Connection Request Form” has been developed and is available on off of the Internet Connection for Penn State Residence Hall Students Web site. With this Web-based form, students can apply for a residence hall Internet connection and have it activated almost immediately. Other options, such as student inquiries, moves, changes, and disconnections are also available on this site.

At the end of spring semester, over 9,000 residence hall Internet connections were activated in Penn State residence halls. This is a 37.5% growth in connections compared to the previous year. Additionally, over 3,500 advance requests for residence hall connections have been received for fall 1999. The advance request ensures that the students' Internet connections will be ready the day they return to campus in the fall. The charts in Appendix E illustrate the growth in use of residence hall connections.

VI. General Support Services
   A. Overall Activities

Voice Mail
The demand for voice mail service continues to increase. The chart in Appendix F illustrates the installation of voice mailboxes at University Park at the average rate of one per day since 1990 - this was the first year after the introduction of the voice mail service at University Park. Currently, the Voice Mail system handles approximately 10,000 calls per day with approximately 1/3 of those calls being forwarded to the recipient's mailbox greeting as a result of a busy signal. During this reporting period, a special voice mailbox was configured for the Ritenour Pharmacy at University Park. The special voice mailbox is made up of several mailboxes that allow the caller to hear a "menu" of various recordings by choice. The mailbox plays a recording describing the Pharmacy hours, allows patients to leave messages requesting prescription refills, and routes calls appropriately within the Pharmacy.

Local Area Networks (LAN)
Over one hundred LAN designs were completed during this year. Of those, 10 LANs were installed, bringing the total number of OTC-installed LANs to 142, and the total number of OTC-supported LANs to 184. The chart in Appendix G illustrates the continued growth trend for requests for OTC-LAN installation. A strategy of all LAN designs using only newer-technology switch-based components was also adopted during this reporting year. This strategy will ensure that all Penn State LANs used by students, and faculty and staff members will be able to the handle the higher speeds and new protocols supported by the Integrated Backbone.

Integrated Backbone (IB)
Over Eighty IE designs were completed during this reporting period. The number of Penn State Integrated Data Backbone connections and hosts has been charted in Appendix H. These illustrations represent an eight-year growth trend.

A new, much more accurate, network based time source is nearing production. The new source is roughly 100,000 times more accurate than the existing time source, as it uses the Global Positioning System as its reference. This means that any network based application, such as
distributed processing or distributed databases, that needs to accurately synchronize events, can now do so with greatly enhanced precision.

Training
Penn State faculty and staff continued to take advantage of the no-fee telecommunications training services offered by OTC during this reporting period. Over 100 people attended the Telephone, Voice Mail, and Videoconferencing Workshops that were offered in October. As evidenced in the chart in Appendix I, a total of 1,026 people received training on Merlin, Centrex/Meridian Business Sets (MBS), Voice Mail, Videoconferencing, and/or new DEFINITY systems.

B. University Park Activities

$15.8M Telecommunication Infrastructure Project ($15.8M Project)
Construction of the second portion of Phase A (Phase A2) of the multi-year Telecommunications Infrastructure Project at University Park was completed in January 1999 (phase A has been divided into 3 separate portions i.e. AI, A2, A3). This portion of the $15.8M project provided telecommunication wiring in 12 buildings and added approximately 3,300 category 5 outlets to these buildings. An outlet consists of multiple jacks (minimum of 2) located on a single face plate, in addition to category 5 wiring from each jack back to the telecommunications closet and CATV jacks as required. As a result, 524 computers can now be networked to the Integrated Backbone and 172 Mobil Ports have been made available at University Park. (A Mobil Port is an access point to the Penn State Integrated Backbone for users with laptop computers who frequently travel between several buildings and wish to have network access at each site).

In addition to internal building wiring, phase A2 also included the first phase of the telecommunication closet security system. This system provides card access security systems to 64 buildings and creates a central campus monitoring system that is located in the Eisenhower Parking Deck office of Police Services. The system, which is administered and monitored by Police Services, began operations in spring 1999.

Also completed in phase A2 was the installation of a redundant single mode fiber path between each of the hubs (excluding Research Park and Rider I hubs), offering increased reliability and more efficient traffic flow for the Integrated Backbone.

Construction and purchase of building electronics, interactive video equipment, hub upgrade equipment, and other items associated with Phase B of the $15.8M Telecommunications Infrastructure project at University Park are underway. As scheduled, the design was completed, reviewed and approved by DGS on July 6, 1998. Request for release of funds was submitted to the Commonwealth on July 27, 1998 and funds were released for construction in November 1998. The project was bid and on January 7, 1999 bids were received. The low bids were within the estimated and allocated amount, and contracts were awarded to the successful bidders with a notice to proceed issued on March 8, 1999. Phase B will provide services within approximately 25 additional buildings, adding approximately 5,200 new outlets in these buildings. The total cost of the wiring portion of Phase B is approximately $3 million.

Designs are 50% completed for Phases C and D of the project. The designs are scheduled for completion in October 1999 with the release of funds expected in December 1999. Bidding on phases C & D is scheduled to start in January 2000 with the start of construction in March of 2000. All aspects are currently on schedule.
Project updates and highlights are outlined in Appendix J. More information on the Project is also located on the $15.8M Web site.

**Interactive Video Rooms Funded by the $15.8M Project**
A major initiative of the $15.8M Project is to provide interactive video facilities for both classroom and conference room environments over the life of the Project. The first of these was the design and installation of a large interactive technology classroom located in 108 Wartik building. The full room characteristics of this classroom, and others, are outlined on OTC's Web site. Specific interactive video room activities during the reporting period are outlined in Appendix K.

**Cable TV System**
The head-ends for the two Cable TV (CATV) systems (Campus Cable and Housing and Foods Cable) were merged and key portions of the distribution system were upgraded. This step resulted in a single, common channel line-up through both systems, and new services for administrative and classroom buildings. Additional work will be completed during the summer semester 1999 leading to a single distribution system with equal capabilities. See University Park Cable TV System for more information.

**Paging System**
The University Park Paging System, which is currently servicing 855 pagers, is nearing the end of its serviceable life. To address this matter, a project team has been designated and charged with evaluating the paging requirements at University Park and specifying a new paging system.

**Planned Integrated Backbone Upgrade**
As a result of the anticipated increased load on the Integrated Backbone, (due primarily to new applications made possible by Internet2), planning has started on a major upgrade to the Integrated Backbone at University Park. It is expected that the projected load placed on the University Park routers will necessitate their replacement during fall 1999, with routers that have a performance level (OC-12 interfaces) that is only now becoming commercially available. In order to support these new routers, the University Park ATM network will also need to have a corresponding capacity increase.

**West Campus**
Work is nearing completion on two new academic buildings, infrastructure upgrades and a central Chiller Plant building on the West campus. The new Chiller Plant building will house a new Integrated Backbone hub to serve the West campus buildings. The infrastructure upgrades include single and multi-mode fiber optic cable for data and CATV services, and copper pairs for telephone service. Also included in this work are provisions for connection to TeleBeam, Inc. to provide for participation in the Metropolitan IntereXchange (MIX) within State College.

**School of Information Science and Technology**
A representative from OTC participated in the program development for the new School of Information Sciences and Technology Building. The program development work was started in summer 1998 and was completed and submitted to Provost Brighton in January 1999.

**Additional Telecommunications Projects**
OTC has been actively involved in planning design and construction of the telecommunication systems for many projects underway at University Park, some of these include:
• The new Alumni Center,
• Pattee Library,
• HUB Renovation and Addition and,
• Beaver Stadium Expansion.

In addition to these projects, instruction upgrades have been on-going to provide for these new facilities and the increased demands for Integrated Backbone connections in existing buildings.

**Additional Telecommunication Projects underway at University Park**
Planning, design and construction of:

• A new home for the Schreyer Honors College (to be located at Atherton Hall)
• Complete renovations and fiber extension to the old Air National Guard building – now occupied by Purchasing Services.
• Renovation and expansion of the Greensburg Sports Complex (now called Lasch building which holds the new football training facility).
• The Noll Lab addition
• The Shields building renovations

**C. Non-University Park Activities**

**Switch Enhancements**

OTC spearheaded the activities involved with the Mont Alto and York campuses' telephone switch upgrade and their addition of new Lucent Intuity voice mail systems. OTC also assisted Mont Alto, Worthington Scranton, and Hazleton campuses with the installation of new ISDN-PRI service into their telephone systems. These campuses have converted to a totally digital trunking arrangement for telecommunication services.

**Inter-campus Bandwidth Upgrade**

The inter-campus upgrade was completed during this reporting period. This upgrade increased the bandwidth to each campus to a minimum of 3Mbps, added ATM to manage the multiple circuits used to each campus and some measure of Quality of Service, added an on-demand, dial-up, backup capability for all but one campus, and upgraded each campus's router. Another upgrade to the inter-campus system provided each campus (with the exception of Lehigh Valley, where the carrier technology used is cost prohibitive) with a redundant path to University Park. The redundancy system provides each campus with 0.5Mbps of bandwidth, in case of a failure to all the primary circuits and is sized to support five campuses concurrently.

**Additional Telecommunication Projects**

OTC has also been actively involved in planning, design and construction of the telecommunication systems for 5 projects underway at Non-University Park locations, including:

• The new Classroom Building at Delaware Campus,
• The Safeguard Scientific Building at Great Valley,
• Construction of a new residence hall (Ohio Hall), a new Multi-Purpose Building design and Nick Building Phase II design at Behrend campus location. In addition, a number of infrastructure upgrades have been accomplished including expansion of the campus switch room and PBX system, and new underground distribution systems to the north side of that campus.
• Completion of major underground cable maintenance, assistance in the planning of a Department of General Services (DGS) project to move all remaining overhead services
(telecommunications and electrical) underground at the Capital campus. Capital also has a new Library under construction and an addition to the Science and Technology Building at that campus, which included complete rewiring of the existing building. Work has also begun on the design and infrastructure required to support the proposed new residence halls at that campus. Completion of the new interactive video classroom in Lecture Room D of the Capital campus was timed to coincide with the new interactive video classroom in 108 Wartik at University Park Classes began on January 11, 1999.

Additional Telecommunications Projects
Underway at Non-University Park locations:

The planning, design and construction of telecommunications systems for:

- Schuylkill residence halls.
- Abington - Lares Renovations.
- Philadelphia Recruitment Center expansion.
- Berks - switch room upgrades and new residence hall construction, expansion at the Perkins Student Center and Information Commons at Thun Library, complete rewiring of the Maintenance Facility.
- Mont Alto - upgrade of the Chambersburg Mall Recruitment Center and campus PBX, distribution of satellite video feeds to campus buildings, an addition to the Chapel, and renovations at the General Studies Building.
- Hazleton - installation of link to the local school district to provide shared instructional services.
- Completion of several projects which included new distribution in the Annex Building, and computer labs in Tricket Hall (residence hall) at the Dickinson School of Law.

VII. Special Projects and Investigations into Potential New Services
Single Mode Fiber Deployment
To control costs and technological risk, Penn State's inter-building cabling infrastructure has focused primarily upon the use of "multi-mode" fiber optic cabling. However, as demands for higher speed connections to the integrated backbone continue to grow, and support of more advanced applications such as those associated with Internet2 is needed, broader use of a type of fiber known as "single mode" is wan-anted. To help address this need, a group of 25 Penn State buildings will have single mode fiber installed by the end of summer, doubling the number of those that have received the service to date. Installation of the fiber will allow connection speeds to the integrated backbone up to four times as fast as the 155Mbps service, and will eventually make much higher speeds possible. It will also enable continued expansion of the Cable TV system upgrade, which will ultimately support additional digital video channels.

Work began on several potential new services and continued on several others already in the development cycle.

Potential new services include:

- **Web-based "Barker" Channel**
The service would entail a control system for "barker" channels on Cable TV (CATV) systems. A "barker" channel is a channel akin to a CATV information channel that provides news, events, weather reports, and etc. such as TCI's channel 4 on the State College, P A system. The "barker" channel is a channel dedicated to broadcasting textual and graphical information on a repetitive basis. The system under investigation uses the Integrated Backbone to centrally control remote
"barker servers" that connect locally to the CATV system. Besides giving considerably more flexibility than existing systems it offers a wider variety of information presentation.

- **Merging of Components**  
  Work continues on merging the capabilities of OTC's standard closet EtherNet switch service with the authentication capabilities of the components used to support mobile ports (i.e. Mobile Computing service). If it is possible to combine the two services into a single device, the cost of deploying OTC-designed local networks will be significantly reduced and network security improved. This project is nearly completed, with some of the new components already being deployed.

- **Digital Video over Internet2**  
  Much of the effort related to digital video is intended to duplicate the existing video application capabilities, such as videoconferencing (which is currently only available through the public switched network), onto Internet2. Once all of the basic capabilities are available, then video-based applications can become fully integrated with other Internet2 applications. Many aspects related to digital video over Internet2 include desktop video, digital video bridging, ISDN to digital video gateways, analog conference room system to digital video gateways, and more advanced digital video CODECS.

- **Quality of Service (QoS)**  
  In an effort to meet OTC's goal of deploying controlled network performance, (often referred to as Quality of Service, or QoS), to selected applications, a set of activities that touch the Integrated Backbone, the Inter-campus network, and the local networking components deployed by OTC, will be ongoing. Even though the techniques used to achieve the QoS goal are still under development, OTC and other Internet2 sites consider this capability critical for deploying future Internet2 applications and are working with together, along with various vendors, on an early deployment of the technologies that can support QoS.

**VITI. Community Initiatives and Awards**  
*Take Our Daughters to Work*  
OTC participated in the University-sponsored Take Our Daughters to Work program this year by hosting girls in grade 6 through 12 and their mentors. The theme, "The New Workplace...Welcome to the Future!" prevailed as young women and their mentors experienced how today's businesses and individuals use modern video tools to conduct meetings and to work collaboratively with people in other parts of the world. The sessions featured video conferences with Acadia University in Canada and with Puebla University in Mexico. Girls also experimented with a collaborative Internet tool to solve a puzzle.

*Awards*  
For the third consecutive year, OTC received Loral Skynet's Bronze-level "Uplinker of the Year" award. This hard-earned award is given to uplink sites that achieve 50-250 completely error-free accesses using Loral Skynet satellite transponders.

OTC also received a "Certificate of Appreciation" in recognition of outstanding participation in the "Opportunity Network for Employment (ONE)" program. The ONE program is an initiative of the Office of Human Resources which serves individuals with disabilities who are seeking employment at Penn State.
IX. Internal Activities

Funding and Budget Changes

Driven by external forces - regulatory, legislative and technical - traditional sources of revenue to OTC will change significantly over the next few years. In anticipation of these changes a multi-year review of the cost recovered budget is underway. While specific results are not yet known, it is likely that some centrally funded services may be cost-recovered, and many existing telecommunications rates will change, and new rates introduced, over the next few years.

Team Building

Several members of the Client Services and Business Office staffs spent a day at Stone Valley working on team building and brainstorming ideas for process improvements. Several improvements have been implemented and others are in process.

Utilization of Web-based Services

Significant progress has been made over the past year to utilize Web-based services to help make record drawing information more accessible to OTC staff, provide a convenient and easy to use format for initiating infrastructure projects, and to make standards information more readily available.

A "Special Projects Design Request Form" went into production during this reporting year. The form is used by OTC staff to initiate all infrastructure projects, both inter and intra-building wiring. In addition, the form is utilized by The Office of Physical Plant (OPP) for renovation and new construction projects. This Web form has proven to be extremely useful in increasing coordination between OTC and OPP for all projects.

A Web accessible AutoCAD drawing and standards information access system was established over the past reporting year. The system, which is accessible only to OTC staff, provides and easy point-and-click method to obtain OTC electronic drawing and jack matrix files. The drawings are organized by campus in both text and drawing format, and include outside plant (inter-building) and building files.

25-Year Chair Recipients

Two OTC employees celebrated their 25 years of service at Penn State. They are:

- Teny Corl, Manager, Client Services
- Connie Putnam, Senior Communications Analyst

The Pennsylvania State University