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# Office of Telecommunications

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2000-2001

Annual Report

July 1, 2000 to June 30, 2001

## **Acknowledgments:**

This report was produced by the Office of Telecommunications,  
The Pennsylvania State University, University Support Building 2,  
University Park, PA 16802

A copy is available at <http://www.otc.psu.edu>, under "About OTC"

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*At a Glance... Some of the Years' Highlights and Numbers*

**Integrated Backbone (IB)**

PSU.EDU Registered Hosts	100,758 (Peak) 90,259 (as of June 30)
Contracted Commodity Internet Bandwidth	80 Mbps
Contracted VBNS/Internet2 Bandwidth	155Mbps
Total IB connections	493
OTC Connections Designed - 00/01	215
OTC Connections Installed - 00/01	107

**Local Area Networks**

Total LANs	Over 450
OTC LANs Installed – 00/01	106
Total OTC-Installed & Supported LANs	336

**Residence Hall Activated Ports**

UP	10,388
Non-UP	3,808
Total	14,196

**Penn State Call Center**

Total Calls Handled	457,554
C.H.A.M.P.S. (Call Handling and Message Phone Service)	42
Operator Assisted Conference Calls	772
Meet-Me Conference Calls	1,435

**UP Voice Mailboxes** 4,922

**\$15.8M Program at UP**

Projected Final Number of Outlets	17,500
Projected Quantity of Category 5 Cabling	2000 Miles
Projected Quantity of UP Buildings Affected	105

## I. Summary

This report summarizes the achievements, activities, and ongoing projects of the Office of Telecommunications (OTC) for the fiscal year period covering July 1, 2000, to June 30, 2001.

With the support and focus of the President and Provost, and diligent work through the year by a committee comprised of Deans and other senior leaders, a new financial model was developed for funding of Telecommunications, and for Computer and Network Security, services. The steps taken to revise the manner in which these services are financially supported removed a large degree of uncertainty and concern about future sources of revenue for these critical areas of information technology. The committee developed a series of guiding principles, and adopted them in the context of "Common Good" and "Individual Good" services. The new budget model lowers rates on certain services such as dial-tone and long distance and holds annual cost increases to a modest 1.5%. It is funded through a combination of budget transfers, new student IT fees, and new faculty and staff per-person fees.

Other notable accomplishments included steady progress toward completion of the multi-year DGS-funded \$15.8M "Information Infrastructure Upgrade" program at University Park Campus, enhancement of the quality of OTC services as a result of a customer survey during Fall 2000, and further integration of various aspects of voice-based services with those viewed as data or video. Specific achievements included accommodation of the needs of the National Governor's Association meeting, evaluation of strategically important technologies such as "Voice-over-IP" and "high-speed wireless", development of processes to address issues stemming from "Napster" and from reporting of "network" problems, and expansion of service level and bandwidth among the campuses, and between the University and Internet/Internet2.

## II. CQI

### Customer Satisfaction Survey

A survey was conducted to assess the overall performance of OTC and to identify possible areas in which to improve the quality of services offered by OTC. Survey data was obtained from a target group of Penn State personnel having the most direct interaction with OTC. In general, responses were very favorable, with approximately 80% of the respondents being satisfied or very satisfied with a variety of criteria, including OTC's services, responsiveness, quality of problem resolution, accuracy of information, competency, and quality of work. The [survey results](#) are available at <http://www.otc.psu.edu> under "News and Alerts." They are based upon data as compiled by the designer of the survey, and distillation of over 100 written comments offered by the 293 respondents.

### Process Improvements

Partially guided by the survey, OTC has implemented a variety of internal process improvements to promote greater efficiency and effectiveness in the office environment. These improvements have not only saved time and money, but have also enhanced the quality of service provided to the Penn State Community. Included among them are:

- **Web distribution of monthly billing statements** which enables faster distribution and access to statements, and allows money and staff time involved in the paper billing process to be reallocated to more pressing needs.
- **Creation of on-line forms** to streamline the process for requesting telecommunications products and services.
- **Implementation of a service that provides for Web-based access to the detail behind Verizon's bill.** The service, "Business@Once", enables OTC to have more efficient access to telephone bills and Customer Service Requisitions.

#### New Budget Model

Changes in technology and regulation are raising Information Technology (IT) funding issues for all colleges and universities, and particularly for large research universities. As traditional telephone technologies change, many are finding the methods that have been used to help fund IT needs are no longer sufficient. A committee of Deans and other senior leaders reviewed the current budget model used for services provided by two Computer and Information Systems (CIS) organizations: the Office of Telecommunications, and Computer and Network Security. The Committee determined that in order for Penn State to continue to have a reliable, secure and robust core network yet at the same time provide for individual units to invest in local networking capabilities as they deem best for their own needs, a new budget model was needed. A target was set to achieve both of these goals over a five-year period. Principles guiding the formation of the new budget model were announced and led to the creation of two broad service categorizations: "Common Good" and Individual Good." Common Good services will be funded centrally, while Individual Good services will be charged to the individual units opting to use them. Senior management of the University has approved the Committee's recommendations; the new budget model is being implemented on July 1, 2001.

#### Billing Improvements

The program to initiate review and to further clarify the contents of telecommunications bills at non-University Park locations continued. The program has helped customers to gain an improved understanding about how to interpret billing statements. A similar service was made available for University Park areas, to be provided upon request of the department/college.

Recent enhancements to billing statements have further clarified service and equipment descriptions, and expanded the text lines to allow for fuller, line-wrapped descriptions of services and equipment. In addition, an asterisk (\*) symbol has been added to the billing statement to highlight recurring charges that are appearing for the first time. These enhancements appear to have been well-received.

#### Network Operations Center

The staff of full-time technicians at the Network Management Center (NMC), now renamed the Network Operations Center (NOC), provide support for trouble calls related to the University's telecommunications services. This staff also works to continually monitor and maintain the University's voice, video, and data networks to ensure that problems are identified and resolved quickly. A new application that uses e-mail to track "trouble" calls was implemented during this reporting year. As a result, all service interruptions or other problems with telecommunications services that are reported to the NOC are given a case number that is used as a tracking method for the reported call. An e-mail notice is sent to the person initially making the report, referencing the case number, when it is rectified. During this year, the NOC received over 15,000 calls, with 1/3 of those being evaluated and rectified over the phone by the NOC staff and the remainder being escalated to the proper technical staff and/or vendor for troubleshooting and resolution.

## Reorganization of Communications Analyst Group

OTC Communications Analysts (CA's) assist Penn State colleges, departments and campuses in reviewing their telecommunications capabilities; they serve as the first point of contact for services offered by OTC. Each CA is responsible for numerous colleges, campuses, and administrative units. In an effort to improve CA accessibility and responsiveness to customer inquiries—even during a CA's absence from the office due to vacation, illness or business travel—the CA group was reorganized into three teams, each led by a Lead Analyst. This structure allows team members to have a better understanding of each other's assigned areas, and improves coverage during such periods. In addition, all CA's have the "zero-out" option activated on their voice mail, which enables callers to speak to another OTC representative.

### III. Notable Events

#### National Governors Association (NGA)

OTC and the Center for Academic Computing (CAC) worked together to serve the diverse computing and communications needs of the NGA 2000 conference, held in July 2000 at University Park. OTC provided Internet connectivity and network services by providing routing and domain name service, installing network switching equipment, and installing network cabling to the meeting rooms. In addition, OTC also provided 400 cellular phones, more than 200 dial tone lines (in support of telephones, fax machines and dial-out modems), 75 two-way radios, 50 pagers (in support of immediate communication needs), and two video connections (in support of satellite uplink and Webcasting services). The host staff from both the University and from the NGA relied upon these services for critical communications, document preparation, and coordination and scheduling of event activities. The support team encountered no significant problems during the conference, and thus their work quietly made a major contribution to the success of NGA 2000.

### IV. University Wide Activities

#### Inter-campus Bandwidth (Circuit) Upgrade

In order to meet the University's increasing demand for telecommunications service at campuses other than University Park, the inter-campus circuit capacity (circuits that connect each campus to University Park) was increased, with 17 of 22 campus locations currently upgraded to a DS-3 (45 Mbps) circuit. This upgrade will yield an approximately 10-fold increase in effective bandwidth available at each campus, with only a modest increase in central cost. Upgrades to the remaining 5 campuses will be accomplished prior to the fall 2001 semester.

#### Access Modem Project/Internet Access Services

The installation in May of new modems at the Lancaster Continuing Education Center has completed the upgrade to digital modem technology at all Penn State sites thus supported by OTC. (Approximately 40% of the University's roughly 3,500 digital modems are at non-University Park locations, and managed by OTC). As a result of the upgrade, campus locations have received new digital dial-up capability in the form of ISDN (Integrated Services Digital Network) lines. The ISDN connection supports both ISDN dial-up (at speeds up to 128Kbps) and analog dial-up (at speeds up to 56Kbps). The upgrade enables faster access speeds, as well as decreases the possibility of encountering a busy tone. OTC continues to review campus modem usage statistics in order to

formulate recommendations for upgrades and further expansion of campus modem pools. [Penn State modem information](#), including modem and speeds, is available at <http://www.otc.psu.edu>, under “Products and Services – Networking Services,” and “Remote Access.”

## V. Student-Focused Services

### Residence Hall Internet Services

The number of students using residence hall Internet connections reached a peak during this reporting period. At the end of spring 2001 semester, over 14,000 Internet connections were activated in Penn State residence halls (10,388 at University Park, 3,808 elsewhere). This represents a 22% increase compared to the previous record of 11,900 set at the end of spring 2000 semester.

### Bandwidth Issues

Demand for Internet bandwidth from computers located in Penn State's residence halls grew to a record level during the spring semester. As a result, despite aggressive increases in bandwidth to the Internet and to Internet2, individual bandwidth metering controls had to be implemented. These limit the total bandwidth that can be used by any individual residence hall computer. The largely manual, labor-intensive, process involved measuring and ranking the weekly bandwidth utilization for every computer located in the residence halls. A maximum amount of weekly bandwidth consumption was designated. This limit, and the consequences of exceeding it, was communicated through Housing to the residence hall residents. If the limit was exceeded, controls were activated within the network that significantly reduced the maximum bandwidth available to the offending computer at any point in time. The expected result—a significantly lower demand on Penn State Internet bandwidth—was achieved. Although this process was terminated at the end of the spring semester, an automated replacement system is being prepared for deployment at the beginning of fall semester.

### General Purpose Classrooms

A General Purpose Classroom (GPC) is a room used for general academic instruction (as opposed to departmental classrooms, which are scheduled for courses offered primarily by the department or college unit). To date, 90% of the GPC's at University Park have been equipped with:

- at least one laptop Internet access port;
- at least one permanently assigned Internet access ports for instructor podiums and multimedia technology carts;
- a telephone connection; and
- a connection to the University Park Basic Cable TV service.

These connections provide an opportunity for innovative use of technology by faculty, and permit students to learn in a multimedia classroom environment. The installations have been made possible as part of the \$15.8M Telecommunications Infrastructure Project at University Park and will be completed by the end of that project in August 2002. A list of GPC profiles at University Park is maintained at <http://www.psu.edu/registrar/>.

## VI. Support Services

### A. General Activities

#### Integrated Backbone (IB) Services

During this reporting year, Penn State's Integrated Backbone (IB) has supported interconnectivity of over 450 Local Area Networks and over 100,000 hosts at Penn State, as well as providing access to other computer resources and information available via the Internet. A record 215 IB connections were designed, and 107 IB connections were activated, bringing the total number of backbone connections to 493.

An Asynchronous Transfer Mode (ATM) architecture, used to transmit data within Penn State's IB, currently enables the University to keep pace with the ever-growing demands for increased network capacity and capabilities. Due to the frequent changes required to maintain service levels in conjunction with information technology advancements, ATM was adopted 5 years ago and is the fourth type of network transport technology used within Penn State's network in the past 12 years. Due to the continued exponential growth of traffic carried on the University's network, yet another upgrade to the University Park portion of the IB—to its fifth technological generation—began in the latter half of this reporting year. In addition to providing for growth, this upgrade is also needed to support new connection methods to the IB and to eventually enable new services, such as support for new, Internet2-compatible, methods to implement "Quality of Service" (QoS). This upgrade, to be completed during fiscal year 2001/2002, will increase both the capacity and the capability of the core network, as well as prepare it for the replacement of the ATM architecture.

As with many changes in technology, this upgrade is also causing the discontinuation of currently supported connection methods and services. These multi-year phase-outs are available in detail on the [Service Options of the Integrated Backbone](http://www.otc.psu.edu) Web page at <http://www.otc.psu.edu> under "Products and Services – Integrated Backbone Services."

#### Local Area Network (LAN) Services

During this reporting period, 106 LANs were installed, bringing the total number of OTC-designed, installed and supported LANs to 336. All are serviced through an IB connection.

To ensure that all OTC-designed Penn State LANs used by students, faculty and staff members will be able to handle the higher speeds and new services and protocols supported by Penn State's Integrated Backbone, a newer-technology, switch-based approach, called "Ethernet Switching," is now exclusively being used in all designs to connect local area networks.

#### Laptop Access Ports

To help accommodate the growing number of laptop computer users at Penn State, OTC has been aggressively increasing the amount of laptop computer access ports at the University's campuses. These ports enable students, faculty, and staff with laptop computers to connect to Penn State's Integrated Backbone, to obtain access to Penn State computing resources and the Internet from different areas on campus. Most of the over-2000 access ports, now available at Behrend, Berks, DuBois, Harrisburg, Hazleton, Lehigh Valley, McKeesport Shenango, Worthington Scranton, York, and University Park, with over two-thirds in Library Facilities, have been installed and are being managed by OTC. These ports are available to anyone who has a Penn State Access Account. They enable laptop access to virtually all Penn State Internet resources (such as e-mail and the World Wide Web), as well as use of any software already loaded on the laptop. A listing of [Penn](#)

[State public "wired" laptop computer access port locations](http://www.otc.psu.edu/) is available at <http://www.otc.psu.edu/> under "Products and Services – Networking Services."

#### Penn State Call Center Services

The Penn State Information Operators now use the latest technology, to handle roughly 1,200 calls per day. In addition to providing all manner of general University information, scheduling use of interactive video services, and accommodating other call management services, the Penn State Call Center handled over 450,000 requests for directory assistance during this reporting year. For many, a call answered by the Call Center represents their first verbal communications with Penn State. In order to better support the services provided, the Call Center identified and implemented an electronic directory finally able to meet Penn State's expectations. The new integrated computer-based console/directory system provides access to more timely and accurate listings, since it is based on official University records, downloaded on a daily basis.

Use of the Call Center's Call Handling and Message Phone Service ("C.H.A.M.P.S") has grown over 5-fold since its introduction in 1998, with 10 departments utilizing the service for a total of 42 events. The service provides departmental message coverage during the lunch hour, holidays, or other occasions when such need may arise, by having the departmental phone number forwarded to a special Call Center Message Service phone number. The Call Center's Audio Conferencing services, "Meet Me" and "Operator Assisted" Conference Calling, also continued to be heavily utilized. During this reporting period, the Call Center handled over 1,400 "Meet-Me" conference calls and 772 "Operator Assisted" conference calls.

#### Voice Mail Services

The number of voice mailboxes at University Park has grown to over 4,900. Currently, the University Park Voice Mail system handles roughly 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.

A customized voice mail application that enables callers to select choices from a "menu" of recorded messages is called a Single Digit Menu (SDM). SDMs enable quick and efficient call processing for departments that experience heavy call volumes and/or have limited staff, but which need to maintain constant call coverage. The Enrollment Services department of the University Registrar's Office was able to efficiently route approximately 30,000 of the over-100,000 calls to that Office's main number, by using an SMD custom-designed by OTC. By directing callers to selected Registrar voice mailboxes such as transcripts, enrollment verification, grade reporting, registration and graduation, the SDM brought about a 27% reduction in the amount of calls requiring the attention of a "live" person.

University Park departmental contacts are now able to access weekly voice mail report data, such as call processing statistics for heavily called SDMs (such as in the Admissions, and the Registrar's Office), through a password protected Web-based format. Previously, the reports had to be captured in real time by OTC's System Administrator, saved manually, and distributed via a-mail. The output is now captured in the data directory, which is then put into an HTML format and posted on-line.

#### Videoconferencing Initiatives

In concert with the Intercampus circuit upgrade, a project to expand Penn State's videoconferencing capability, from an ISDN-only environment, to utilization of an IP (Internet Protocol) network for videoconferencing events, was undertaken. As part of a comprehensive multi-year plan to enhance Penn State's video-related services, all public Penn State videoconference rooms (excluding Penn College's) will be upgraded. The upgrade relies on the use of the emerging "IP transport option" and

its use within the University's statewide IP-based "Integrated Backbone" network. The availability of Video-over-IP service marks a significant step toward the integration of voice, data, and video traffic at Penn State over a common internal network and enables sites to take advantage of Internet2 capabilities. Usage costs for Video-over-IP services may also be significantly less than those of ISDN for like bandwidth connections, without sacrificing video quality. A list of [Penn State Videoconference rooms that have IP video capability](#) is available at <http://www.otc.psu.edu> under "Products and Services – Video/Cable TV Services."

Newly expanded conference mode options were made available on the Penn State Video Bridge. (Video bridges are required to enable three or more sites to participate in a videoconference). In addition to the standard "Voice Activated" conference mode option, the new "continuous presence" conference mode options allow for the simultaneous display of multiple participants during a bridged videoconference. "Continuous presence" helps to enhance the multi-point videoconference experience by providing constant display of views with multiple sites. OTC's bridging service is offered as an alternative to higher-priced commercial video bridging services, and is available to all Penn State departments. The new options are available at no additional charge to all users of the Penn State Video Bridge, however, they must be selected when the Penn State Video Bridge conference is scheduled. More information on the [Penn State Video Bridge](#) is available at <http://www.otc.psu.edu> under "Products and Services – Video/Cable TV Services."

## Training

Penn State faculty and staff continued to take advantage of the no-fee telecommunications training services offered by OTC. A total of 1,334 people received hands-on training on key systems, Centrex/Meridian Business Sets, Voice Mail, and Videoconferencing systems during this reporting period. Included in that total are 135 people who attended the Fall Telephone, Voice Mail, and Videoconferencing Workshops that were offered. To make it even easier for people to sign up for these Workshops, a Web-based form was implemented for the workshop registration.

## B. University Park Activities

### Telecommunications Infrastructure Project (\$15.8M Program)

Construction and purchase of building electronics, interactive video equipment, hub upgrade equipment, and other items associated with Phases C & D, (the third and fourth phases of the five-phase \$15.8M Telecommunications Infrastructure program at University Park) began in June 2001. Phases C and D were combined into a single bid package to save on administrative costs and time. This phase of the project, which is expected to be completed by September 2001, will provide telecommunications wiring and over 3,300 new outlets within 33 Penn State buildings.

Design and installation of 5 interactive videoconference rooms will be completed under phases C & D and will complete the interactive video efforts funded by the \$15.8M program. In addition, phases C & D will also include the installation of both single and multi-mode fiber paths to designated buildings throughout campus. The fiber will provide Integrated Backbone services to a large number of buildings previously not able to have access. Phases C & D will also provide a fully integrated (universal) wiring concept, where select buildings will have fully integrated telecommunication jacks that can be used for either voice or data services.

Funding approval for the final \$2,268,886 for phase E, the final phase of the Program, has been received, and design was completed. Phase E will involve infrastructure upgrades in 25 buildings. Construction of phase E will begin in August, with completion scheduled for August 2002. The Project will by then have added a total of more than 17,500 telecommunications outlets, and more than 2000 miles of "Category 5" wire, in 105 buildings at the University Park campus.

Comprehensive information on the [Telecommunications Information Infrastructure Upgrade program](#), as well as a [color-coded map](#) of the buildings involved in the Program is available at <http://www.otc.psu.edu/> under "Special Projects."

### Telecommunications Projects

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

- New fiber installations at 9 campus buildings.
- New Chemistry Building.
- New Information Sciences and Technology Building.
- New MBNA Career Services Building.
- New Heintz Alumni Center.
- Beaver Stadium expansion and new Beaver Stadium Score Boards.
- Telecommunications Building and University Support Building renovations (see below).

**Additional Telecommunications Projects underway at University Park Locations:**

- Thomas Building addition: All 724 seats in the Addition's General Purpose Classroom have been wired as preparation for Internet access
- White Building addition and renovations.
- Executive Education Center rewiring

Due to the increasing needs and growth of Penn State's telecommunications infrastructure, OTC undertook a multi-phase project to provide for more equipment, fiber optic and copper cabling distribution, and "frame room" space within the Telecommunications Building during this reporting period. In order to make room for the additional copper and fiber facilities needed in the frame room, renovations were made in University Support Building 2, in order to relocate certain OTC staff and equipment previously housed in the Telecommunications Building. Additional renovations were made in the Telecommunications Building to provide more space for the Network Operations Center staff and monitoring equipment, as well as for the accommodation of equipment to satisfy increased requests for telephone, Internet, Internet2, and campus connection circuit services.

### C. Non-University Park Activities

#### Telecommunications Projects

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

- The completion of the new student housing at Berks campus.
- The rewiring of one of the largest Penn State-owned buildings, the Olmstead Building at the Harrisburg campus location, which encompasses over 206,000 square feet.
- The design of the new Student Union Center at McKeesport campus.
- The comprehensive survey and documentation of the underground telecommunications distribution system at Hazleton campus.
- The OTC-funded rewiring of the Academic Building at Lehigh Valley campus.

**Additional Telecommunications Projects underway at Non-University Park Locations:**

- Behrend: Smith Chapel renovations, Erie Hall addition, and new Multi Purpose Student Center
- York: Library addition and Classroom Building construction
- Mont Alto: Food Service Building addition and renovations, Chapel addition, and General Studies Building renovations.

- The design for the new Administration Building at Beaver campus. The design includes the encapsulation of the existing campus-wide switch room that resides in the underground basement of the existing Administration Building, so that when the old building is demolished around it, the switch room will remain intact.

## VII. Investigations into Potential New Services

### High-Speed Wireless Networking Services

A team comprised of OTC, CAC, and CETS (Center for Education Technology Services) personnel worked to develop a University-wide production-quality high-speed wireless service, meeting general needs for scalability, security, and ease-of-use. Significant efforts were expended to assess various paper-based designs, and to fully evaluate one vendor's product holding the most promise for long-term use. Despite substantial progress in working with the vendor to address a number of issues that were uncovered upon actual deployment of the product within the University's environment, limitations of that product thwarted its adoption as a suitable solution. Alternative approaches were again considered, and information shared with those organizations within Penn State unable to delay further activation of some form of this service, despite systems based upon current technology failing to adequately meet the general needs cited above. An interim approach, utilizing a different architecture, is being evaluated as a next step in the team's trial. To make information on this subject readily accessible to students, faculty, and staff, as well as departments in the process of implementing the new technology, [wireless considerations and recommendations](#) were made available to the Penn State community at <http://www.otc.psu.edu> under "News and Alerts."

### Voice-over-IP Services

Additional emphasis was placed upon the further integration of treatment of voice services—especially network planning and system integration aspects—in a manner similar to those of data and video-oriented services. To further the progress to integrate various aspects of voice-based services with those of a data and video nature, a second "VoIP" (Voice over Internet Protocol) trial has been completed, and OTC has begun preparing for the production deployment of this technology to support voice services at University Park. The second trial used "best available" VoIP desktop sets and a "near production" LAN and Integrated Backbone to provide voice services for 50 OTC staff. Among the results of this trial were refinements to the lower level network that will be used to support the production deployment of VoIP, and the confidence that the production deployment will meet Penn State's expectations. In addition, reassignment of positions and duties involving various personnel, development, revision, and refinement of internal processes, and other steps, were taken to continue the progress already made toward convergence of these areas. A Request for Proposal has been released for many of the VoIP components that will be used in the production system.

## VIII. Community Initiatives

### Take-Our-Daughters-to-Work Program

For the third year in a row, OTC participated in the University-sponsored *Take Our Daughters to Work* program. Participants experienced how staff members use modern telecommunications tools, such as cellular telephone technology, and resources such as e-mail, voice mail, and the Internet to

communicate and collaborate with each other. Participants also experienced an interactive videoconference, and took a tour of the Penn State Call Center.

#### Holiday Gift Drive

Employees of OTC helped to make the holidays special for those in need by sponsoring a needy family. Working from the family's "wish list," employees donated funds or contributed items such as children's clothes, toys, and gift certificates. In addition to sponsoring a needy family, employees also held a food drive to collect non-perishable items for donation to the local area food bank.

## IX. Appendices

**Appendix A** Penn State Student Residence Hall Internet Connection Statistics

**Appendix B** Penn State Call Center Statistics

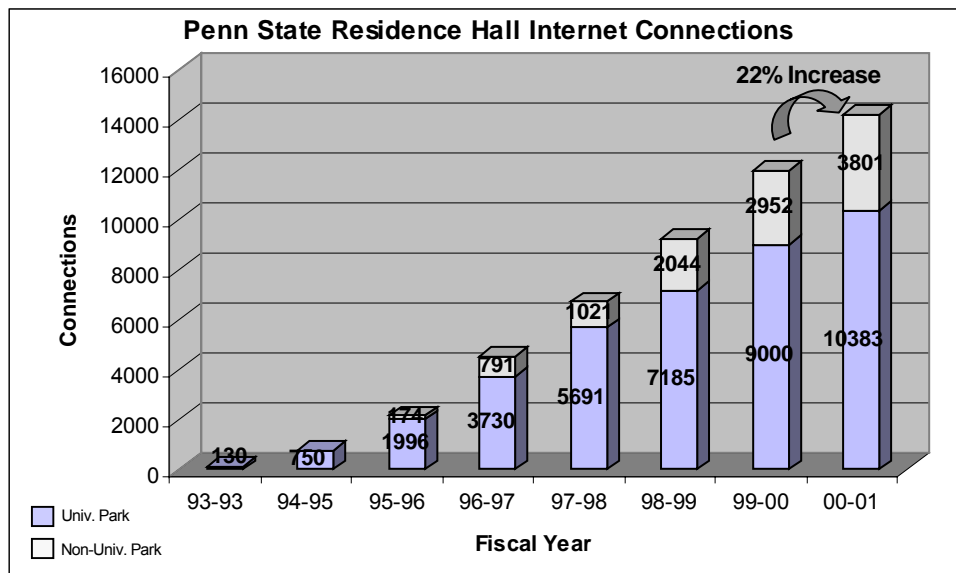
**Appendix C** University Park Voice Mail Statistics

**Appendix D** Penn State OTC-Installed Local Area Networks (LANs)

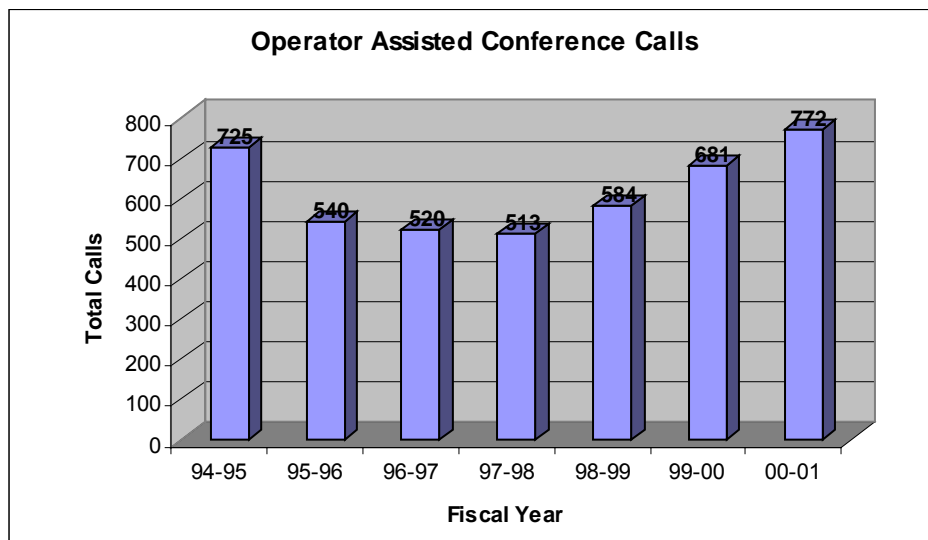
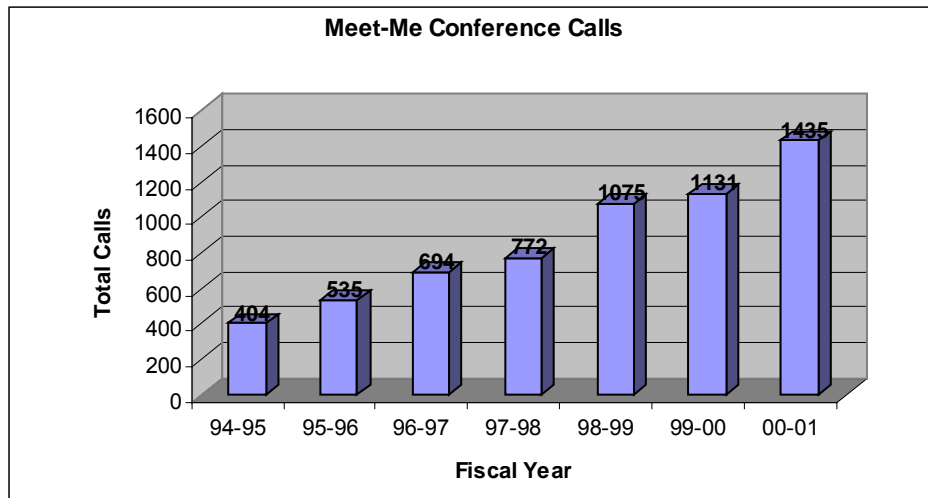
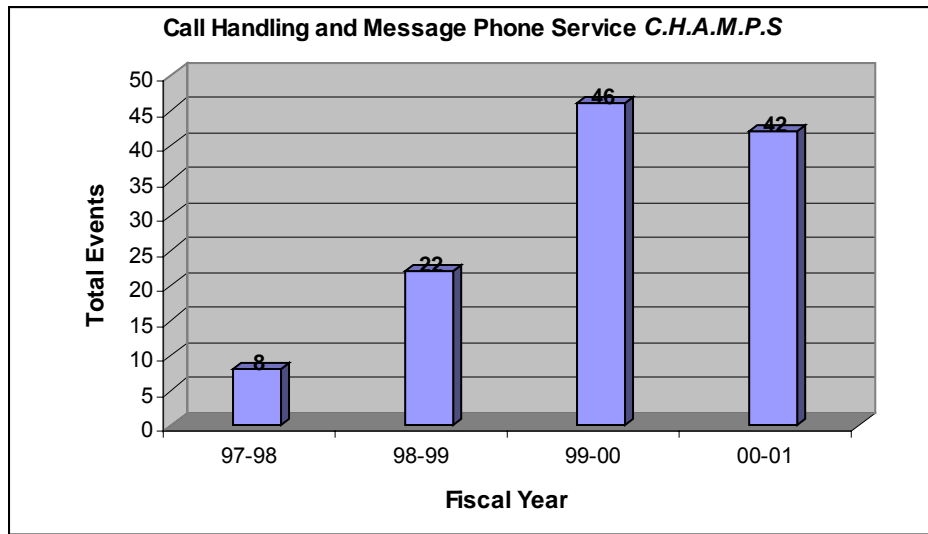
**Appendix E** Penn State Integrated Backbone Statistics

**Appendix F** Penn State Training Summary

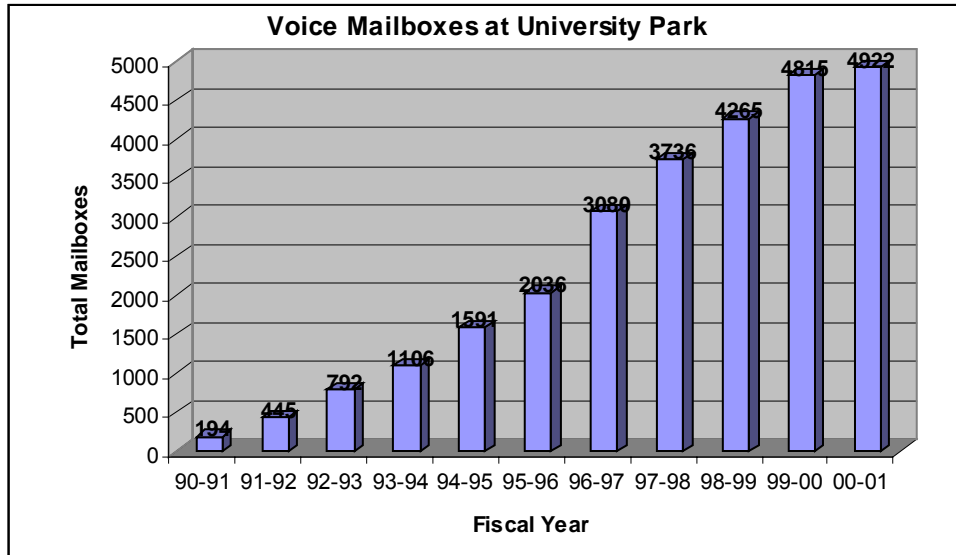
**APPENDIX A**  
**Penn State Residence Hall Internet Connection Statistics**



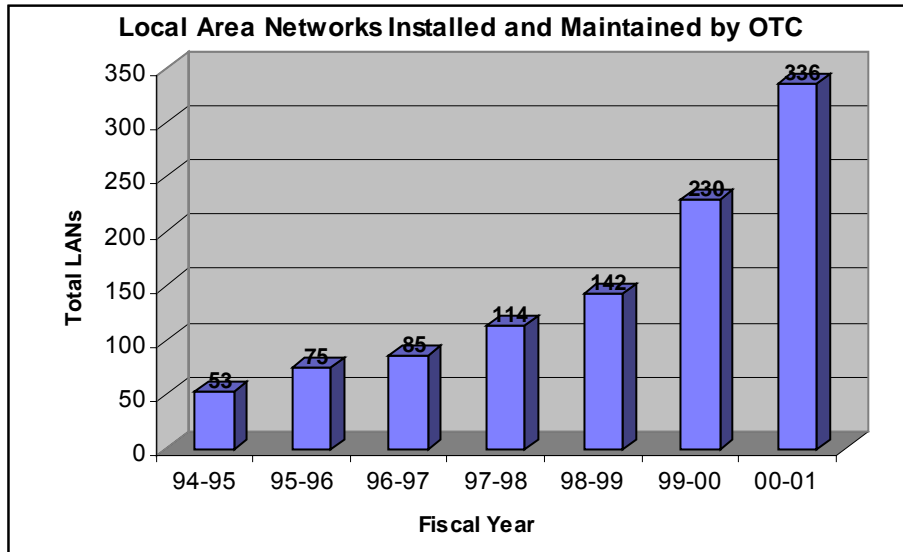
**APPENDIX B  
Penn State Call Center Statistics**



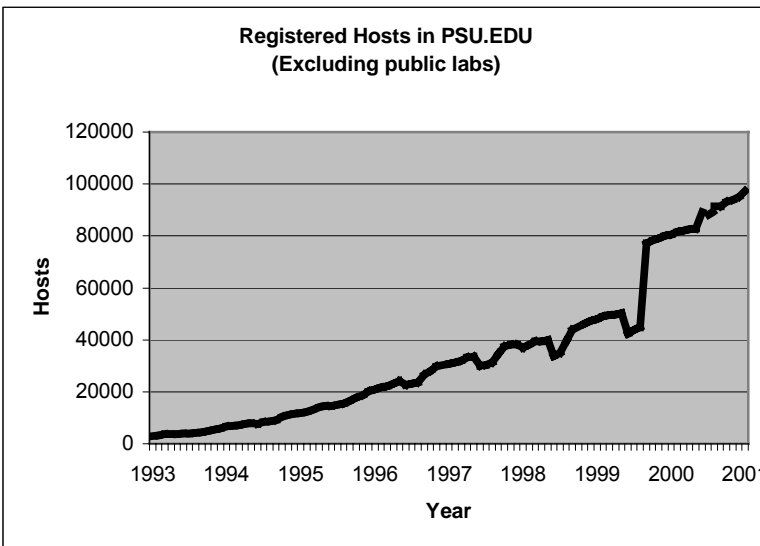
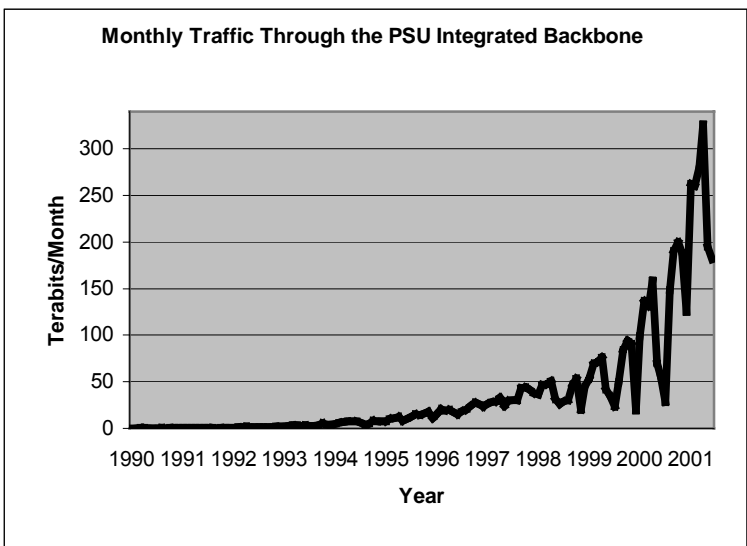
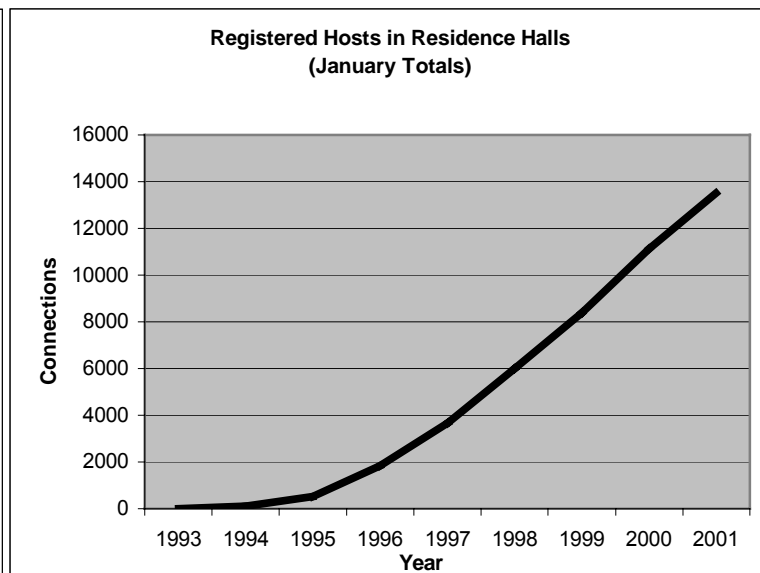
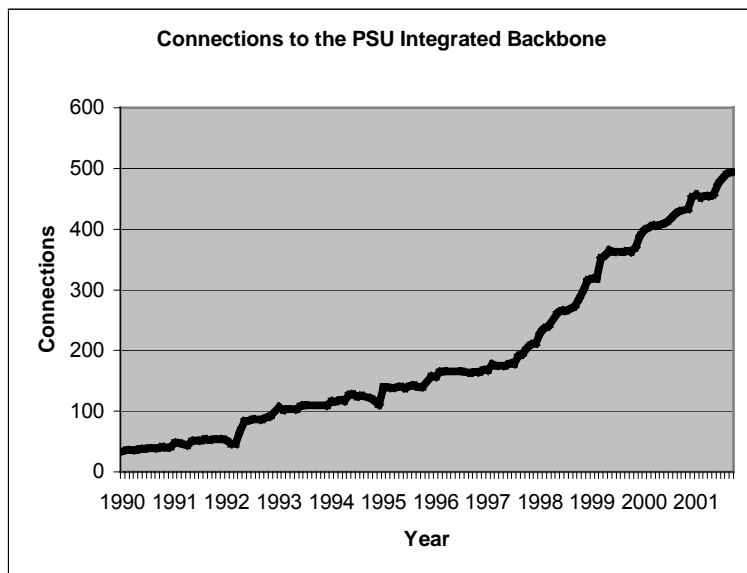
**APPENDIX C**  
**University Park Voice Mail Statistics**



**APPENDIX D**  
**Penn State OTC-Installed Local Area Networks (LANs)**



## APPENDIX E Penn State Integrated Backbone Statistics



**APPENDIX F**  
**Penn State Training Summary**

