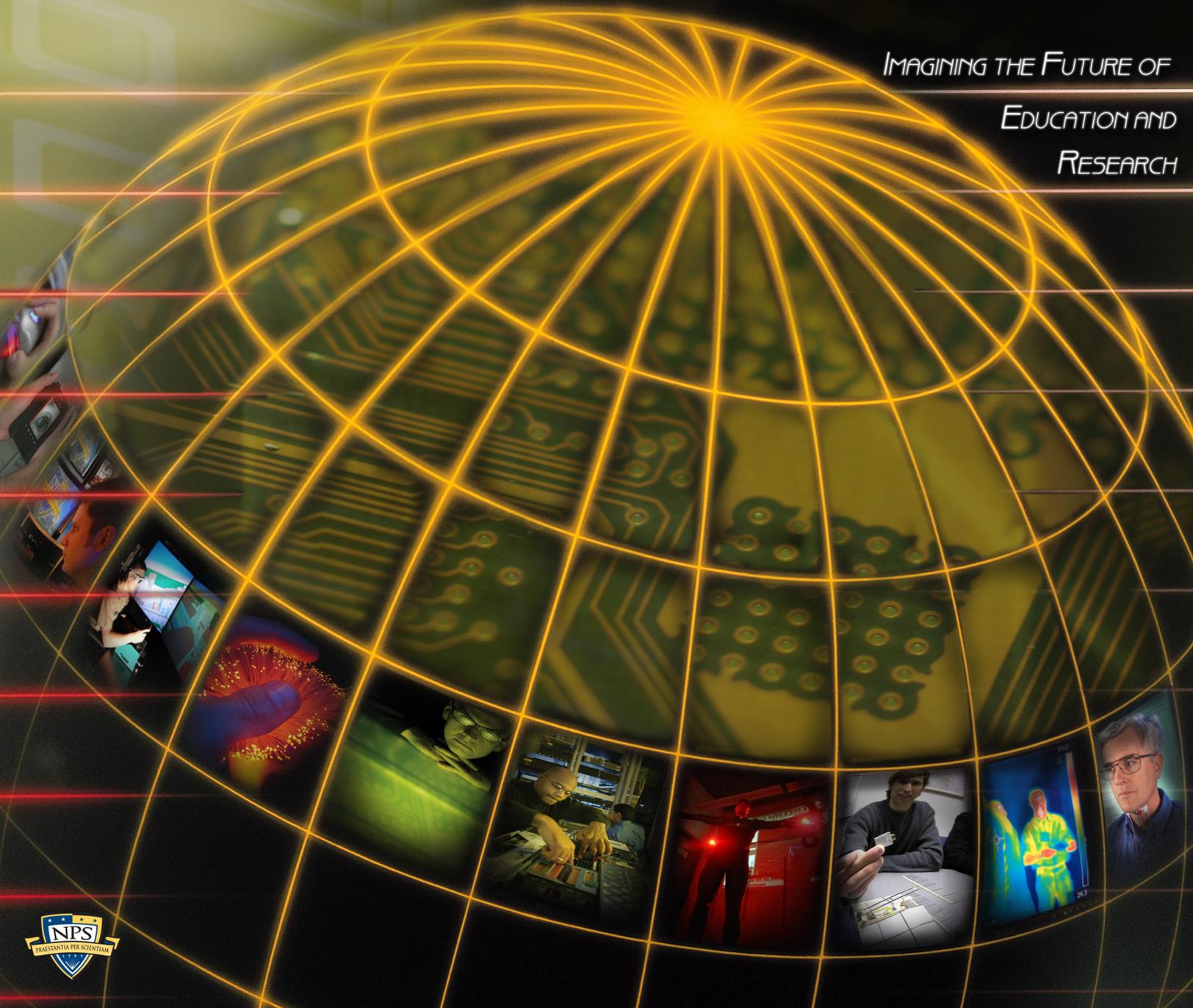


# NAVAL POSTGRADUATE SCHOOL

## IT 2009 STRATEGIC PLAN

IMAGINING THE FUTURE OF  
EDUCATION AND  
RESEARCH



# IT STRATEGIC PLAN 2009

*IMAGINING THE FUTURE OF EDUCATION AND RESEARCH*

## MISSION

The mission of ITACS is to provide technology and communications support for the NPS core mission of teaching, research, and service to the Navy and Department of Defense, and to provide voice, video, and data infrastructure as mission-crucial enablers of innovation and experimentation within the educational enterprise.



NAVAL POSTGRADUATE SCHOOL

100 YEARS OF RELEVANCE AND EXCELLENCE:  
EDUCATION AND RESEARCH SERVING NATIONAL SECURITY

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## INFORMATION TECHNOLOGY AND COMMUNICATIONS SERVICES:

### *IMAGINING THE FUTURE OF EDUCATION AND RESEARCH*

#### I. INFORMATION TECHNOLOGY AND COMMUNICATIONS SERVICES AS MISSION-CRUCIAL

The Naval Postgraduate School (NPS) Strategic Plan, *Vision for a New Century*, outlines an ambitious vision of academic excellence — defined through traditional standards of academic scholarship and peer recognition — and relevance to our nation’s priorities. The NPS plan also calls for expanded outreach efforts to the total force and to our global partners, engagement with other universities, sharing of educational resources, and the development and use of modern technologies to enrich teaching and learning experiences.

The NPS mission underscores the importance of advanced education and research for the future security of the United States and the world. Leading-edge technology is an important component of graduate-level education and research. Crucial to these initiatives is access to high-speed networks and collaborative communication tools. The mission of Information Technology and Communication Services (ITACS) is to provide technology and communications support for the NPS core mission of teaching, research, and service to the Department of the Navy and the Department of Defense, and to provide voice, video, and data infrastructure as mission-crucial enablers of innovation and experimentation within the educational enterprise.

Internet2 leadership asserts, “The research and education community increasingly relies on a comprehensive suite of advanced information technologies – including networking, computation, visualization, and collaboration tools – to accomplish its work. The term ‘cyberinfrastructure’ encompasses all of these, as well as the extensive ecology of skills and other resources needed to develop, deploy, use and support them” (<http://www.internet2.edu/ci/>).

*Vision for a New Century* calls for ensuring that NPS has “the technological resources required for superior graduate-level education and research.” The recent *Capacity and Preparatory Review Report* to the Western Association of Schools and Colleges states that technology and communications infrastructure and services continue as a priority for NPS, since future plans and goals rely on the availability and reliability of advanced networking and technological tools.

Defining Information Technology (IT) resources as strategic and essential to graduate education is appropriate. The use of IT is nearing universal proportions. The United States has one of the highest Internet usage rates in the world – 71 percent of its population uses the Internet; however, that percentage will undoubtedly increase since over 95 percent of U.S. teenagers and 20 percent of U.S. children aged 3 and 4 currently use the Internet.

**“At the Naval Postgraduate School, as with all other research universities, information technology is strategic and mission-critical. We are committed to supporting a learning environment characterized by innovation, discovery, and access. That means investing in technology and extending the reach of the university beyond its geography – to our faculty and students wherever they are in the world.”**

*Daniel T. Oliver  
President, Naval Postgraduate School*

**“Information technology is the foundation that drives our cutting-edge research and educational programs. To achieve that end, it is vital that our investment in information technology and its infrastructure remain a crucial component of the strategic plan of NPS, our nation’s premier defense and national security research university.”**

*Dr. Leonard Ferrari  
Provost, Naval Postgraduate School*

## **II. INFORMATION TECHNOLOGY AS A COMPETITIVE NECESSITY**

Graduate education depends on the intellectual enrichment of scholarship and research in order to maintain currency and academic rigor. Research university faculty members teach from existing bodies of knowledge while also creating new knowledge through inquiry and invention. This means that access to leading-edge technology tools are an integral part of the research and education process. It also means technical support for those tools must be responsive and expert.

The American Council on Education President Molly Broad maintains that “Today, a new type of strategically important infrastructure may be less publicly visible (than electrical grids or transportation networks) but is, arguably, more essential to the future success of colleges and universities: cyberinfrastructure, which refers to the array of high-speed networks and advanced computational resources, applications, and expertise that connect researchers and educators around the world in a new digital environment for discovery and education” (2008). In research universities, cyberinfrastructure must include an environment supportive of the discovery of new tools. Similarly, cyberinfrastructure is expected to provide experimental test beds for trials and evaluation.

Collaborative work, a hallmark of research for the 21st century, must be supported. Voice, video, and data tools must be available to facilitate collaboration across disciplinary, organizational, and geographic boundaries.

Outreach, for both the conventional degree programs and noncredit course offerings, is being extended. NPS covers not only a broad international, joint-service resident base, but also a growing group of students located throughout the globe, all of whom need to be effectively prepared to meet the intellectual and technical challenges of today’s world.

Indiana University President Michael McRobbie posits that:

*At the most basic level, investment in IT infrastructure is part of the cost of doing business at a research university. At the very least, an institution must provide basic IT resources and connectivity to faculty, staff, and students. But this is no longer enough to ensure that an institution is even minimally competitive. Why? Because research in nearly all academic areas requires advanced IT infrastructure to a greater or lesser degree, and because an institution’s ability to attract and retain research faculty—and increasingly, instructional faculty—now depends, in large part, on its ability to provide and support the infrastructure. Students, too, expect their IT environments to be contemporary and flexible, ready to change dramatically from one generation of students to the next — a period, on average, of only about five years (McRobbie, 2007).*

The School’s administrative systems are linked with the Department of Navy systems, which are increasingly upgraded to more current system architectures and performance standards; therefore, technology is not only essential in the

efficient and effective administrative and basic operations of the campus, but also must comply with Department of Defense regulations. Because government enterprise administrative systems are not designed to operate universities, NPS is challenged to find innovative ways in which information can be shared efficiently to support sound management practices at the campus level.

In short, every major goal of the NPS Strategic Plan, *Vision for a New Century*, relies on information technology and communication services. In addition to academic and government sectors, every economic sector relies on high-speed communications, storage and back-up, as well as data mining and warehousing capabilities. In fact, every major social institution depends on information technology for its future sustainability and growth.

### III. DEFINING THE GOALS

The IT strategic planning process included departmental meetings with every academic and major administrative section at NPS, site visits to other universities, consultation with colleagues at other universities, discussions with the Information Technology (IT) Task Force, and individual interviews with NPS deans and directors, as well as its provost and president.

To support the School's strategic plan, *Vision for a New Century*, the following goals have been defined for the IT Strategic Plan:

- Improving the information technology and communications infrastructure and services for NPS faculty, students and staff;
- Improving the learning environment through cyberinfrastructure support and services;
- Improving communications about IT as a strategic NPS priority.
- Improve security and integrity of data networks and systems.

As in the first strategic plan, the IT Task Force posed a question to focus our overall strategy by asking, "What are the factors or areas of IT that are so critical to our success that failure to accomplish any one of them puts our other goals at risk?"

Five areas were identified as a framework for specific recommendations:

#### 1. Cyberinfrastructure

The *Report of the National Science Foundation Blue-Ribbon Advisory Panel of Cyberinfrastructure*, stated "Like the physical infrastructure of roads, bridges, power grids, telephone lines and water systems that support modern society, **"cyberinfrastructure"** refers to the distributed computer, information and communication technologies combined with the personnel and integrating components that provide a long-term platform to empower the modern scientific endeavor."

**"NPS is the hidden jewel in the Federal crown of military and government education. Here is where you find cutting-edge technological research; advanced training in civil-military dynamics; the best and only master's program for government officials in Homeland Security operations; and critical real-time training exercises in peacekeeping and stabilization and reconstruction activities. Nowhere else does a single dollar of investment go so far in advancing America's agenda of peace through strength. I am proud of the work done by faculty, staff and students at this institution."**

*The Honorable Sam Farr  
Congressman, 17th District of  
California*

**“Information processes are fundamental to all our science, engineering, operations, acquisitions processes, and political arrangements. These fields rely on a first-rate IT infrastructure for their leadership. Otherwise, we are like a body without a nervous system or a society without a language.”**

*Dr. Peter Denning  
Chair, Department of Computer Science  
Director, Cebrowski Institute*

NPS cyberinfrastructure includes: The campus Intranet, data and network security, remote access, Internet access, wireless access, connectivity to high-speed national and international networks. Also includes access to data repositories, applications, and back-up capabilities, high-performance computing, visualization, computation, and collaboration tools, as well as required system support for hardware, software and network access.

2. **Academic Applications and Services:** Equipment acquisition, maintenance and replacement, technology assistance, and support of educational technology in local and distributed settings.
3. **Administrative Applications and Services:** Administrative systems that are web-enabled, intuitive and user-friendly, which provide information resources that support conventional management practices of assessment, improvement and planning.
4. **Management and Resources:** Management of IT resources, including space, staffing, professional development and training, budget, accountability reporting and equipment.
5. **Communications, Partnerships, and Outreach:** Internal communications and external visibility; leveraging partnerships with other institutions and organizations; outreach to other Department of Navy and Department of Defense partners as well as the local community and higher education constituents.

## **IV. CYBERINFRASTRUCTURE**

### **PHYSICAL INFRASTRUCTURE**

The physical network infrastructure at NPS is in the process of a major upgrade: the installation of redundant building-to-building fiber optic cable and current technology (10 gigabit) backbone and edge hardware. Capitalizing on the full capability of this infrastructure by providing gigabit connections to the desktop will require upgrades to the building infrastructure over a period of several years. The building infrastructure upgrade will also provide expanded service to the recently installed fence-to-fence wireless network and enable full utilization of this capability to the user community. The phased replacement of routers and switches per industry standards every three to four years will ensure appropriate maintenance of the network and access reliability for NPS customers.

#### **Recommendations:**

1. Develop a building infrastructure upgrade plan to enable gigabit capability to the desktop and increased wireless capability.

2. Update maps of network infrastructure conduits and relevant network electronics.

## **INTERNET ACCESS**

NPS connectivity to the rest of the world needs to be planned. The recent merger of Internet2 and the National LambdaRail provides a significant opportunity for NPS to leverage its CENIC membership and associated connection to the CalREN network for research and education.

As NPS expands its role in Internet2-NLR, the primary connection to this architecture will require an upgrade to 10 gigabits. Even more important than speed is redundancy. NPS will continue to use a redundant path to CalREN and expand the use of the secondary path for off-site storage of mission-critical backups.

### **Recommendation:**

3. Coordinate with CENIC in developing an upgrade plan for increased bandwidth availability in the high-performance research and DC CalREN connection.

## **WIRELESS**

The benefits of mobile network connectivity are many, and the campus community has welcomed every phase of the wireless build-out, deployed on the campus several years ago. However, since some buildings offer challenges to comprehensive coverage, wireless access is not yet available in every building on campus. Because of this, and because wireless technology is evolving, NPS must build into its planning the regular upgrade and refresh of its wireless networks and its wired plant.

### **Recommendations:**

4. Continue the expansion and upgrade of the existing wireless capability at NPS. Include wireless as part of network maintenance and upgrade planning.
5. Establish appropriate wireless network access controls and policies with respect to applications and network context.

## **CONVERGENCE**

Because the academic enterprise increasingly relies on an integrated voice, video, and data network, convergence of voice, video, and data requires a robust and scalable network architecture. While video-based courses are currently deployed over ISDN infrastructure, NPS is already using video over IP technology to augment, and in some cases, replace ISDN video. Infrastructure planning must include an integrated approach.

**Because the academic enterprise increasingly relies on an integrated voice, video, and data network, convergence of voice, video, and data requires a robust and scalable network architecture.**

### **Recommendation:**

6. All cyberinfrastructure planning must include voice, video, and data modalities.

### **REMOTE ACCESS**

Remote access to the NPS network is a requirement for the campus community. Faculty, students and staff need access to network resources from their residences and while traveling. Non-resident students rely on access to NPS educational resources to complete their programs. Previously, remote access was accomplished through dial-in methods, but now users require high-speed access to NPS. A few years ago, web access to email was sufficient, but today users require access to all NPS resources including, files, databases, servers, and network services (DHCP, DNS, etc).

### **Recommendations:**

7. Remote, robust and reliable access to the NPS network must be provided as part of the core network service package for the campus community.
8. Monitor tools will capture metrics on the use of remote access and be used to measure resource requirements and security capabilities. These metrics will be included as part of network performance metrics on the intranet Web site.
9. A clear policy must be established for faculty/researcher/admin server deployment which includes network services availability, firewall policy refinements, and a security policy and posture that can be flexible to balance research needs with security concerns.

### **NEXT GENERATION ENTERPRISE NETWORK (NGEN)**

The Navy and Marine Corps Intranet (NMCI) will soon be replaced with the Next Generation Enterprise Network (NGEN). Currently, NMCI is installed at NPS for the regionalized office resident (e.g. Public Works), which will likely transition to NGEN, as appropriate. In 2003, the remainder of the campus was deemed not a likely candidate for NMCI for two reasons:

- a. The academic environment is based on experimentation, testing, and the development of new operating systems, software, and middleware. This requires installation of software and equipment on the university network which would violate NMCI integrity.
- b. Academic work, fundamentally based on peer review and collaboration, requires that NPS faculty and students engage in research projects with

other universities, research centers, laboratories and accessible database and research sources, which would undermine NMCI standards.

Since the last IT strategic plan, the Chief Information Officers of NPS, the Naval War College and the U.S. Naval Academy established the Navy Higher Education IT Consortium (NHEITC), a formal organization which reviews IT requirements, policies and practices in order to share information, leverage investments, and adopt standards, where appropriate. The group meets annually in Monterey, and often includes trips to Silicon Valley to review technology futures with industry partners.

In 2008, the NHEITC completed a study, updating IT requirements for the three institutions, producing a business case analysis for the education and research network environments, and formalized a governance structure for the consortium. The study affirms the need to maintain education and research networks based on the two reasons noted above.

### **Recommendations:**

10. Provide a flexible education and research network environment which is as accessible and open as possible to enable academic work which is consistent with other research universities.
11. Continue to work with the NHEITC to ensure efficient and effective sharing of resources and the development of common standards, where appropriate.

### **SECURITY**

Security and privacy of data and the network are conventional areas of responsibility for a centralized IT department. In the last several years, much progress has been made in institutionalizing a formal security program. This process included the appointment of an Information Assurance Manager, creating and filling a Privacy Officer position, officially assigning network security staff to the Information Assurance arena, commissioning external audits to suggest improvements and to validate policies, and adopting enterprise-wide procedures and protocols.

The mission of the Information Assurance Program is to ensure availability, integrity, authentication, confidentiality, and non-repudiation of data while in transit and while stored. Further development is expected in vulnerability patch management, secure configuration, security auditing, and intrusion detections and response capabilities. Some of the future challenges include addressing emergent malicious activity, better detection of network security behavioral anomalies, and increasing the security posture of NPS' most transient systems without degrading system usability.

### **Recommendations:**

12. IT security policies and procedures must be evaluated on an ongoing basis to keep pace with new technologies and methods of penetrating existing systems, innovative safeguards, etc. The results of those evaluations will be reported in the ITACS *Annual Accountability Report*.
13. Security audits will be conducted on a regular basis.
14. A crisis response team will continue to address possible technology-based attacks.

### **GRID-CLOUD COMPUTING**

Remote access is also evolving from gigabit speed multimode, Coarse Wave Division Multiplexing (CWDM) and Dense Wave Division Multiplexing (DWDM) technologies into a networking and computing paradigm called “GRID” and “cloud computing”. The Grid-Cloud concept originated with an ambitious vision: Dr. Larry Smarr, Director of CalIT2, an advanced technology center at University of California San Diego and University of California Irvine was the first to articulate the idea of computing as a power grid. The NPS computational and data Grid should operate similarly. Through collaborations with the worldwide high-performance computer centers and research networks through CENIC, NPS plans to make this paradigm an enabler for research pursuits on the campus. This will allow the campus to collaborate more effectively by using immense computations and datasets in a significantly distributed environment. The high-speed Internet infrastructure also supports distributed virtualization applications (research, operational, administrative, educational) for redundancy, disaster recovery and load-sharing.

### **Recommendations:**

15. Evolve high-performance computer resources into a high-performance GRID portal on campus, optimizing computing, storage, and network resources. Where appropriate, use the process as a template to move into other campus network initiatives.
16. Join the Optical Networking Internet Protocol Computing Storage (Optiputer) initiative. Optiputer exploits a new world in which the central architectural element is optical networking, not computers – creating “supernetworks” for NPS faculty and students to utilize. In addition, join the Cinegrid Foundation whose mission is “to build an interdisciplinary community that is focused on the research, development, and demonstration of networked collaborative tools to enable the production, use and exchange of very high-quality digital media over photonic networks.”

17. Add a diversity of hardware/software platforms supporting cloud computing and grid initiatives to the NPS computing infrastructure.

## **AVAILABILITY OF SERVICES**

Information and systems required by NPS staff, faculty, students and other customers is made available to those users wherever they may be located, and whenever such access is needed; however, with the volume of critical research and administration data stored on the central servers, the timeliness of service restoration following a disruption may not be adequate. Additionally, off-site storage of data and redundant services is not currently available.

### **Recommendations:**

18. Using the *ITACS Disaster Recovery Plan* as a guide, develop partnerships with local Department of Defense (DoD) agencies for cooperative data and service redundancy.
19. To facilitate the above recommendation, continue to upgrade the Monterey Peninsula DoD-Net to 10 Gbps backbone and expand necessary shared network services between DoD facilities on the Monterey Peninsula.
20. Implement virtualized architectures for critical services.

## **PROFESSIONAL SERVICES**

Faculty, researchers, and administrators need professional services such as programming support and other technical expertise throughout the duration of their projects. While graduate students can frequently fill this role, a more consistent support function is required, especially in the areas of high-performance computing, web development, distance learning, and other network support operations.

### **Recommendation:**

21. Develop a professional services resource pool for programming support in a variety of research and administrative activities.

## **FUTURE TECHNOLOGIES**

Because NPS excellence is tied inextricably to its intellectual vitality, and IT excellence is based on change, innovation, experimentation, and imagination, central IT should be involved in developing, testing, and experimenting with a wide variety of technological products and processes. The IT division must support that vitality by supporting emerging technologies and expressing a willingness to pilot new technologies with faculty members. Examples of

**“Information technology is a powerful enabler. IT allows us to reach out to students and colleagues beyond our campus borders, engage students with insightful, IT-based presentations that stimulate learning and to research the unknown in ways never before possible.”**

*Dr. Jeffrey B. Knorr  
Professor and Chair, Department of  
Electrical and Computer Engineering*

emerging technologies include wireless environments, video streaming, security assessments, quality-of-service, open source products, high-performance computing research and education, visualization, voice and video over IP, virtualization, GRID-cloud computing, green data centers, OS streaming, and distance learning collaborative tools.

### **Recommendation:**

22. Central IT services at the NPS will be integrally involved in testing and evaluating emerging technologies.

## **V. ACADEMIC TECHNOLOGY**

Recent advancements in computing technology provide opportunities for NPS to meet the challenge of extending educational opportunities to the Total Force. In the last five years, the School has increased its reliance on technologies for NPS academic programs such as learning management systems, video-teleconference systems, and recorded digital content. The demand for and variety of academic software has steadily increased, as has the demand for the various operating and hardware systems required to successfully run them. The last five years have also seen the emergence of technologies such as streaming video and web-based collaboration systems which are now considered mission-critical components of distributed learning programs and resident education.

NPS forecasts a threefold increase in enrollment over the next three to five years. The NPS student body will represent increasingly diverse areas of the national and international defense communities. The vast majority of this forecasted increase will be in distributed learning programs. For these students, existing and future academic technology systems will serve as their primary access point to the NPS learning community. The availability, flexibility, reliability, and capacity of the NPS academic technology infrastructure is therefore of significant importance to the academic success of NPS students. The degree to which NPS is successful in fulfilling its academic mission in the next five years will be partially dependent on the capacity and flexibility of these academic technology systems, which are also being used for resident education and research/project collaboration. This highlights the importance of having the right licensing model and the ability to partner with technology providers to achieve campus goals.

## **LEARNING SPACES**

Advances in both learning theory and learning space design principles have opened the doors to new paradigms in teaching. Learning spaces must now be able to support more than the traditional lecture-based learning methodologies.

With the increasing mobility and power of computing devices, coupled with the increasing pervasiveness and speed of information networks, learning spaces must include learning resource centers, information commons, virtual learning spaces, conference rooms, and informal meeting spaces.

Various NPS curricula are increasingly reliant on active learning principles and the learning spaces must adapt to reflect and to support this shift, in both the unclassified and classified environments. In addition, the physical appearance of these learning spaces must reflect the status of NPS as a flagship institution.

Technology in classrooms and other learning spaces, although vital, should not be obtrusive. Classrooms should be outfitted with various software, systems, and capabilities, and when necessary, audio and video capture functionality to record class sessions, particularly as distributed learning programs expand. The various functionalities of classrooms should be simplified and standardized wherever possible to maximize efficiencies and to maintain high-quality service levels.

The growing complexity and diversity of learning resources, including software, information systems, and information networks required by the various NPS curricula demand new approaches to how those resources are delivered to NPS students. While learning resource centers will continue to have a significant presence at NPS, there will also need to be a fundamental shift in how those centers are supported. The increasing diversity and complexity of information resources may require a paradigm shift from client-centric computing to a more centralized server-client approach. This will expand the number of operating systems and software available to students and faculty and provide greater opportunity for distributed learning students to gain access to the learning resources that are available to the school's resident students.

Currently, ITACS provides central educational technology support to over one hundred campus facilities, including 74 classrooms, 17 Learning Resource Centers (LRCs), 7 conference rooms, and 5 large venue auditoriums. All facilities have multimedia presentation systems and some have complex installations for delivery of instruction by videoconferencing and web collaboration tools. These classrooms are provided direct on-site support. Quarterly, the university delivers by VTC approximately 50 classes in seven degree programs to students located at approximately 50 distant sites. Each session is streamed, recorded digitally, and archived.

The synchronous virtual classroom system, Elluminate, has been in use at NPS since the spring of 2007. Having a web-based synchronous collaboration tool as an alternative to standard video teleconferencing allows program managers and faculty more flexibility, as there are no system requirements for students to attend a live class session other than an Internet connection. In 2008, over 2,000 Elluminate class sessions were held, representing approximately 20% of distributed learning classes at NPS.

It is anticipated that the use of Elluminate will increase threefold over the next five years as both the percentage of distributed learning classes using Elluminate and the total number of distributed learning classes offered increases.

NPS educational technology is inventoried and included in a *Lifecycle Maintenance Plan* which is presented annually to the IT Task Force and to NPS leadership for their approval. In the past, funding for maintenance, upgrades, and new educational technology initiatives was not included in university-wide planning. Instead, funding was *ad hoc* and often based on year-end available resources; however, NPS leadership has emphasized recently the importance it places on educational technology by including educational technology support as a part of the campus operations budget.

### **Recommendations:**

23. Continue updates of the educational technology inventory and *Lifecycle Management Plan*.
  - a. Reinforce established contacts with the four Schools, eleven departments, and academic groups as part of the education technology maintenance and future initiative requirements analysis.
  - b. Continue informing NPS leadership and the campus as a whole about educational technology issues through web postings and presentations to user communities and to committees with influential membership such as the IT Task Force.
24. Provide dedicated funding for the development and upkeep of NPS learning spaces including classrooms, Learning Resource Centers, and informal meeting areas.
25. Provide the adequate wired and wireless network connectivity to support both formal and informal learning spaces.
26. Utilize learning space design principles that promote active learning. Solicit outside expertise from both the academic and professional communities, including NPS faculty, in support of this goal.
27. Invest in the infrastructure and research required to make learning resources more flexible and mobile.
28. For distributed learning purposes, begin integrating audio and video capture functionality into all learning spaces.

### **DISTRIBUTED LEARNING**

The meet the School's strategic vision of expanding educational opportunities

to the Total Force, distributed learning programs at NPS will be increased. If the distributed learning enrollment increases fivefold in the coming years, the majority of students will attend NPS remotely; therefore, the capacity of the distributed learning systems as well as the support for both students and faculty must be a major area of focus.

While individual distributed learning technologies will likely change and evolve, distributed learning systems should provide a virtual learning environment capable of delivering an academic experience as rich and fulfilling as a resident student experience. This should include unfettered access to a suite of both synchronous and asynchronous tools that allow instructors to choose delivery modalities based on what is most effective rather than what is available, and on providing students with easy access to learning resources, class materials, and collaborative opportunities. Learning resources should remain flexible – based on the individual situation and location of the student – and the access point should be streamlined and customized to an individual student’s needs.

The focus of the distributed learning environment should remain on providing a robust, collaborative, and interactive distributed learning environment with flexible systems that respond to emerging technologies and evolving pedagogical needs. The potential academic uses of technologies like mobile computing and virtual environments are currently being researched, and the decreasing costs of high-definition collaboration systems and accessibility of ultra-high bandwidth networks offer tremendous opportunities for advances in distributed learning capabilities. NPS must continually evaluate the potential opportunities provided by these trends to improve the effectiveness of its distributed education programs.

### **Recommendations:**

29. Provide funding to increase the capacity and storage of existing distributed systems to forecasted levels of enrollment.
30. Continue to work to remove the learning systems capability gap between resident and non-resident students.
31. Actively research and pilot emerging technologies to ascertain their potential to increase the effectiveness of distributed education programs.
32. Increase off-hours support to account for students in different time zones.
33. Create an academic technology advisory subcommittee of the IT Task Force, comprised of faculty members, ITACS staff, and students who meet regularly to discuss emerging technology and pedagogical requirements.

**“State-of-the-art IT is vital if NPS is to deliver on its dual missions of education and research. IT impacts every aspect of education at NPS, from the preparation and display of instructional materials to the scheduling of the very classrooms in which the students sit. IT also permits NPS to deliver instruction to non-traditional students, be they sailors at sea or career civil servants working in Washington. For research, IT allows NPS faculty to both perform their work and to collaborate with researchers outside of NPS. The demands on the NPS IT infrastructure are truly 24x365, and it is a testimony to the NPS IT staff that they are able to exceed the performance of our peer organizations in both academia and government.”**

*Dr. Simson Garfinkel  
Associate Professor  
Department of Computer Science*

34. Dedicate funding for short courses that focus on introducing new technologies and distributed learning systems to promote maximum benefit for NPS faculty.
35. Develop an academic portal which will deliver technologies, required software, electronic educational materials and a single sign on (SSO), to promote delivery of information and resources to the student based on curriculum and permissions.

## **FACULTY SUPPORT**

As the number and complexity of academic technology tools grows, it is imperative to maintain a clear strategy about what is available and supported by ITACS in both the unclassified and classified environments. This strategy must be informed by faculty input on what new technologies and functionalities they would like to see implemented. Similarly, the opportunity for individual faculty members to pilot new academic or research technologies with the support of ITACS must be improved. Processes for technology testing, implementation, and support requests must be streamlined to be more responsive to faculty and student requirements.

### **Recommendations:**

36. Maintain and improve the educational opportunities for NPS faculty in the areas of existing academic and research technology tools.
37. Clarify procedures for instructors to request technology support for academic technology pilots and research projects.
38. Present with faculty at national conferences to promote the solutions that NPS has deployed.

## **VI. ADMINISTRATIVE APPLICATIONS AND SERVICES**

NPS is required to use Department of Defense and Department of Navy mandated systems while providing local systems to support the day-to-day administrative work of the institution. Unfortunately, the local systems are often developed by individual departments, not updated, and do not interact with other systems. As a result, NPS has a number of stand-alone systems that require multiple data entries which then result in inconsistent results and required reconciliations of multiple databases. After numerous meetings with faculty, students, and staff, the action necessary to envision a new approach for administrative systems must include the following:

- An administrative systems environment that is committed to efficiency, effectiveness and customer service.

- A university portal with web-enabled services and applications that support faculty, students and staff in supporting the university’s mission of education, research and service.

In defining the path ahead, NPS will replace or upgrade every internal administrative system during the next five years to make them more integrated, efficient, supportable, scalable, and secure. Open source software will be strongly considered when replacing existing administrative systems so software can be updated when scheduled, and the ability to collaborate with other institutions on functionality updates and standard maintenance schedules can be developed. NPS must establish a web-based information architecture that will leverage technology to provide a robust working environment for its constituents.

The following guiding principles will be employed for the new information architecture:

- Responsive customer services
- Integrated, standard systems that comply with applicable accounting principles and internal controls
- Reliable, flexible, scalable, robust, interoperable and secure operations
- Standards-based architecture
- Stewardship accountability
- Single entry of data
- Long term sustainability
- User-friendly interfaces and navigation
- Rapid technology update capabilities
- Compliance with appropriate laws and regulations
- Single sign-on – authenticated access to multiple web-enabled resources using a single password
- Back-end data integration – across all university assets and resources pointing to authoritative data sources
- Simplicity of design
- Thorough documentation
- Availability of support, both from vendors and from user communities
- Ability to support users running on a variety of platforms (desktop/mobile/Windows/Mac/Linux/etc.)

**“For NPS to be the leader in national security graduate education and research we must have high-performance computational and communications infrastructure.**

**However, it is not sufficient for us to have state-of-the-art computer hardware and software, but we must also have services that rapidly adjust to the ever-evolving set of requirements of the students and faculty. Without all these elements, NPS will not be able to fully satisfy its critical mission.”**

*Dr. Knox Millsaps  
Chair and Professor, Mechanical and  
Aeronautical Engineering*

A NPS portal — central to the new information architecture — is under development, and will serve as the threshold to all NPS resources: people, information, tools and training. The portal will connect the campus community based on individual roles and work requirements:

- Business to faculty and staff portal (employee) – provide targeted information and tools based on one’s role within the organization, including a discovery mechanism to help members select the components that they need.
- Business to student portal (student services) – provides specific information, application and services applicable to all students, including a discovery mechanism to help members select the components that they need.
- Business to recruitment portal (new student, faculty, staff) – provides recruiting information applicable to potential faculty, students, and staff.
- Business to department portal (financial systems) – provides business portal to make current financial information readily available to managers and principal investigators across the university.

The transformation of administrative systems must include changes in other areas of the institution such as:

- a. Processes and policies: Business practices must be redesigned to take advantage of new technologies. Web integration and administrative system upgrades must include a partnership between ITACS and the functional area managers.
- b. People: To successfully use the web architecture, NPS must invest in staff resources to design and implement the new web architecture.
- c. Technology: Web-enabling campus services and applications must be used as a driver for administrative change to improve efficiencies and services within the campus community.

### **Recommendations:**

39. Prioritize administrative applications with regard to content, services, and applications for a phased web implementation over the next five years, including a new learning management system.
40. Use open source applications and standards where possible and appropriate.
41. Ensure user interfaces are intuitive and easily navigable in web-enabled business applications with back-end integration.

42. Implement the NPS portal which will convert static web pages to a data-base-driven environment.

## VII. MANAGEMENT AND RESOURCES

### MANAGEMENT PRACTICES

To serve the school's mission at the highest levels of service possible, the IT division should be managed with the highest levels of accountability and responsiveness to institutional goals, including adherence to sound disciplined management practices.

Management of IT resources includes oversight of human resources, budget, space, equipment, and contracts.

#### **Recommendations:**

43. Continue implementation of management practices that include a five-year strategic plan for ITACS; an updated organizational chart with clear reporting responsibilities; updated position titles and descriptions; a communications plan; a routine documented budget process; central compilation of all IT-related policies, and publications that describe services.
44. The IT strategic plan should support the larger academic plan of the institution and other institution-wide strategic initiatives.
45. Develop annual operational plans that align with the five-year IT strategic plan but are more specific in scope, identify immediate objectives, and tracks emerging requirements and technologies. These operational plans should have concomitant resource plans which are updated and presented to NPS leadership at appropriate times for review.
46. The IT Task Force, representing major academic and administrative areas on campus — institutionalizing faculty, student and staff input and guidance on IT-related issues — should continue to be the primary institutional body that reviews all IT-related policies and plans.
47. Feature IT prominently in macro-level planning initiatives, having IT serve as an integrator of area plans and as an institutional priority in the university-wide plan.
48. Continue to include IT leadership at the highest level institutional meetings.
49. An ITACS *Annual Accountability Report* should be continued. The report should include:
  - a. Measurement of progress on plan

**“Metcalfe’s Law tells us the value of a network is proportional to the square of the number of users. This is especially true in research-oriented environments such as the NPS. However, achieving high value requires a network that is not only extensive but is also fast and reliable. Extensive, fast, and reliable networks require considerable investments in both technology and personnel.”**

*Dr. Douglas J. Fouts  
Associate Dean of Research  
Professor of Electrical and  
Computer Engineering*

- b. Achievement of milestones
  - c. Identification of potential obstacles to next stage of implementation
  - d. Update on budget and expenditures
  - e. Information about emerging technologies that will affect NPS
  - f. Information about customer satisfaction with IT services
50. Include an IT-review of all proposals for institutional funding to realize economies of scale and to ensure that technology investments are consistent with support and maintenance policies (e.g. POM review process).
51. Encourage partnerships between IT and other NPS departments to leverage opportunities and resources (e.g. library, advancement, distance learning, secure computing, etc.).
52. Evaluate customer service through regular surveys.
53. Seek out partnerships and consortial arrangements with peer institutions to better leverage IT investments, benefit from the experience of other institutions, and become recognized national IT leaders.
54. To ensure efficient IT planning, formally include IT requirements planning in any and all plans for renovations or new construction.
55. To ensure alignment of IT plans with academic goals, ask individual schools and institutes to include IT needs and priorities in their annual reports to the Provost.

## **HUMAN RESOURCES**

The effectiveness of any IT organization is directly proportional to the talent and skill levels of the staff. As a result, the recruitment and retention of talented staff must be one of ITACS highest priorities.

IT is defined by change and innovation: staff supporting IT at a research university must be highly skilled, and interested in engaging in high-level work with sophisticated customers. They also must be involved in ongoing programs of professional development, which should include participating in professional associations and having contacts with colleagues at other institutions. These contacts can be invaluable in providing relevant and accurate benchmarking information, advice about best practices, lessons learned, etc.

The Campus Computing Project's latest report, *Campus Computing 2008*, provides the results of the annual survey of computing and information technology in U.S. higher education. Recruitment and retention of quality staff continues to be the top priorities of higher education CIOs. A recent study of

government CIOs also showed a similar priority. Investing in human resources is the most important element in the management of IT. In order to accommodate current and projected needs in all three major areas of IT service (administrative, academic and cyberinfrastructure), a number of human resources initiatives should be considered:

### **Recommendations:**

56. The need to increase the number of IT staff members is documented in the FY 2003 *Functionality Assessment Study*. Areas requiring additional support include network engineering, administrative systems, and academic services. Specific suggestions for staff increases are made in the *IT Resource Summary*.
57. The professional development program should be continued at a higher level of investment. In addition, opportunities for continuing education should be made available. These will serve as important recruitment and retention tools.
58. Continue to strive to reach the target of 79 employees, as documented in the FY 2003 *Functionality Assessment Study*.
59. Continue to take advantage of the skills and flexibility provided by assigned military.

### **SPACE**

ITACS leadership has worked hard and creatively to effectively utilize existing space and to accommodate new requirements, including adding a new data center for the Sun high-performance computing system, however providing adequate office, storage and operating space remains a significant challenge. To accommodate the growth in staff, the following recommendations are suggested:

### **Recommendations:**

60. ITACS representatives should be included in any and all space management and utilization committees and working groups established on campus.
61. ITACS representatives should be included in all discussions involving the new building for the Graduate School of Business and Public Policy (GSBPP) Business School. ITACS should be assigned any space vacated by GSBPP or the Center for Executive Education in Ingersoll Hall.

**“Information Technology is an enabler of change in increasingly ubiquitous ways — in supporting education and research and in linking the university with the rest of the world and its educational resources. In academia, the core objective is to challenge the present with the possibilities of the future — IT has a crucial role in that challenge.”**

*Dr. Christine Cermak  
Vice President, Information Resources  
and Chief Information Officer*

## CUSTOMER FOCUS

The ITACS organization has worked hard over the past five years to make customer service a priority; however, this is a difficult challenge when staffing has been reduced and customer expectations are increasing. Crisis management can quickly become the emphasis of each day's work, with little time for listening to customer priorities or requirements. It is important that ITACS does not lose the hard-won ground in customer focus. Toward this end, the following recommendation is proposed:

### **Recommendation:**

62. Since IT involves time-sensitive skill sets, it is important that the central IT organization help in developing a program of workshops, training classes, seminars and online resources for the larger NPS community. This effort should be coordinated with Human Resources.

## IT RESOURCE REQUIREMENTS

*The Information Technology (IT) Strategic Plan 2009: Imagining the Future of Education and Research* recommends significant investment in NPS IT operations to provide the technological support for the mission-critical functions of instruction research and service to Department of the Navy and the Department of Defense.

Historically underfunded (as documented in the first IT Strategic Plan: *The Information Revolution: Planning for Institutional Change*), the current central IT operation is unable to meet the rising expectations of NPS constituents: faculty, students, and staff. In order to bring NPS IT to a level comparable with peer institutions, an increase in IT support is required.

In the last year, a series of site visits were made to validate the IT budget figures reported to EDUCAUSE, the national higher education association of IT professionals. The following is a summary of central IT resources per faculty. While it is difficult to compare NPS to many other research universities – because of NPS' small size and graduate education and research mission – it was decided that considering IT expenditures per faculty was the most appropriate metric to frame the resource requirement discussion. This same metric was also used in the first IT strategic plan.

Institution I.....	\$56,492
Institution II .....	\$48,110
Institution III .....	\$43,822
Institution IV .....	\$35,538
Institution V .....	\$33,750

Institution VI.....	\$22,549
Institution VII (NPS).....	\$16,228

*(Institutions include: Massachusetts Institute of Technology (MIT), California Institute of Technology (Cal Tech), University of Southern California (USC), University of California San Diego (UCSD), University of California Santa Cruz (UCSC), Claremont Graduate University and Naval Postgraduate School.)*

Three models of IT support are presented for consideration:

**MODEL 1: STATUS QUO**

**Costs:**

**Financials:**

Operating budget.....	\$2,400K
Labor budget .....	\$6,282K
Annual IT budget.....	\$8,682K
Per faculty allotment (assumes 535 faculty) .....	\$16,228

**Other:**

Provides COA adjustments, but adds little ability to implement the IT Strategic Plan. This funding level assumes the filling of 74 positions by SEP 2009. The relatively good reputation of ITACS will erode quickly as requirements increase without resources. Campus-wide needs for IT continue to increase. Based on the growth of academic programs, the academic quality is potentially undermined at this funding level. Academic aspirations may be lowered.

**Benefits:**

- Maintain low resource requirement for central IT division
- Continue to provide current level of support

**MODEL 2: CREATING CHANGE**

*This model would provide adequate support for network, academic and administrative services and applications.*

**Costs:**

**Financials:**

Operating budget.....	\$2,991K
Labor budget .....	\$8,075K
Annual IT budget.....	\$11,066K
Per faculty allotment (assumes 535 faculty) .....	\$20,684

Two areas of investment are recommended: human and financial resources:

1. Human resources: brings total staff to 79, as recommended by the most recent FA study in operating funds.
2. Financial resources: This increase is to continue to accomplish the objectives of the NPS Strategic plan. Scaling infrastructure in support of the growing DL population and collaborative tools as well as cover increased software support and maintenance contracts.

**Benefits:**

- Maintenance of the .edu and .mil domains
- Communication and outreach
- Support of Internet2, National LambdaRail initiatives
- Investment in training and professional development of staff
- Instructional design teams to support IT and multimedia use in instruction and distance education
- Implementation of first stages of NPS Portal architecture for administrative applications and services
- Continued reliability of network infrastructure and related services
- Regular upgrade of cyberinfrastructure (including wireless, remote access, etc.) according to industry best practices and higher education conventions
- Annual security audit, crisis response team

**MODEL 3: ACCELERATING CHANGE**

*This model provides funding commensurate with delivering IT services to a research university for network, academic and administrative services and applications.*

**Costs:**

**Financials:**

Operating budget .....	\$4,838K
Labor budget .....	\$9,097K
Annual IT budget.....	\$13,936K
Per faculty allotment (assumes 535 faculty) .....	\$26,048

Two areas of investment are recommended: human and financial resources:

1. Human resources: brings staff to 89, 10 above the 79 target, as recommended in the 2003 FA study.
2. Financial resources: The increase in funds requested in this model will allow the completion of many objectives documented in the NPS Strategic Plan and the IT Strategic Plan, to cover increased capabilities to support the growth in academic programs, expanding DL student

programs, expansion of high-performance computer program support, increases in collaborative tools and outreach as well as cover the cost of development, software support and maintenance contracts.

**Benefits:**

- Improved Information Assurance posture
- Increased staff for Education Technology, Business Solutions Group, Technology Assistance Center and Network Operations Center to provide better support.
- Expanded distance learning support
- Expanded high-performance computing capabilities
- Added virtualization capability for research activities
- Establishment of a visualization facility for researchers

**RESOURCE HISTORY**

When the first IT strategic plan was written in 2003, the IT expenditures per faculty were approximately \$10,000. We have made progress since then, but so have the other institutions. Most have made even greater investments in IT in the same time period.

To address the need to increase the operating budget for IT to institutionalize a *Lifecycle Management Plan* for crucial network equipment and services, NPS submitted a POM08 proposal, and an increase of approximately \$1 million annually was awarded. However, no increase was realized in FY2008 because the institution had to reallocate those funds to other priorities. In FY2009, the ITACS budget was increased by \$500,000 – still \$500,000 short of the original POM08 allocation. If the additional \$500,000 can be allocated to the ITACS operating budget, and the staffing requirements are addressed, NPS will be able to provide IT services at a level comparable to other research universities.

Classroom technology, always separately budgeted through the lab recap process, has always shown opportunistic funding. Surplus from the lab recap process was shifted to the classrooms. As a result of a detailed annual *Classroom Technology Plan*, ITACS needs approximately \$600,000 annually to support classroom technology for NPS classrooms, Learning Resource Centers, auditoria, distance learning facilities, and publicly scheduled conference rooms. In FY2008, the IT Task Force recommended, and the Provost’s Council approved, annual funding of the *Classroom Technology Plan* at a \$500,000 level, resources permitting. Those funds have not yet been allocated for FY2009.

POM 08 also provided for \$2.5M beginning in FY 2011 to provide 24/7 Help Desk Support in the Technology Assistance Center for distance learning and on-campus students, faculty and staff. It is anticipated that a contract will be put into place to provide this coverage.

**Communications about IT issues must be frequent, timely, and accessible to all members of the NPS community.**

## VIII. COMMUNICATIONS, PARTNERSHIP AND OUTREACH

### COMMUNICATIONS

Communications about IT issues must be frequent, timely, and accessible to all members of the NPS community. External communications about IT events and news should be part of the IT communications strategy, and an integral part of the strategic plan for NPS.

#### Recommendations:

63. Continue efforts to improve communications about relevant IT issues: events, technological developments at NPS and beyond, equipment upgrades, etc. The following vehicles should continue to be used: web postings, monthly *Tech News* electronic newsletter, articles in *Update NPS* (monthly campus newspaper), *In Review* (quarterly campus magazine), meeting agendas for regular campus meetings and meetings with important campus visitors, leadership speeches and presentations, NPS reports, etc. Regular opportunities for effective communication about IT within NPS and with NPS friends and stakeholders off-campus will be identified and coordinated with the Office of Institutional Advancement.
64. Continue ITACS' commitment to consultation, information sharing, and reflective practice to better support collaboration and effective decision-making.
65. Include ITACS in the larger NPS advancement efforts. Since IT itself is a mode of communication as well as a strategic resource priority within the institution, IT services will be part of NPS larger advancement efforts. For example, website development will be defined as a priority for both IT and the Office of Institutional Advancement.
66. Develop a publication describing IT services at NPS.
67. Continue publication of the ITACS *Annual Accountability Report*, providing a summary of the year's activities, accomplishments, and challenges, a public document which also outlines ITACS goals for the coming year.

### PARTNERSHIPS AND OUTREACH

#### Recommendations:

68. Continue participation in the Navy Higher Education IT Consortium (with the CIOs of the U.S. Naval Academy and Naval War College)

which provides a formal venue for the review of best practices, common approaches to shared challenges and cooperative initiatives.

69. Continue coordination of IT-related corporate vendor relations within ITACS. Relationships with companies should be developed that go beyond transaction-based contracts. NPS leadership will be involved in initiating contacts with leaders of partner companies. Benefits include quality service, investment in the NPS academic mission, higher volume transactions resulting in lower costs, and additional advocacy for NPS priorities.
70. Continue participation in the Monterey Peninsula DoD-Net, an infrastructure made possible by the City of Monterey, for the connection of the regional DoD assets: Defense Language Institute, Naval Postgraduate School, Defense Manpower Data Center, Personnel Security Research Center (PERSEREC), Naval Research Laboratory, and Fleet Numerical Meteorology and Oceanography Center (FNMOC). This consortium is an important opportunity to share resources.
71. Continue partnership with the state higher education network, CalREN and the Corporation for Education Network Initiatives in California (CENIC). These partnerships provide access to high-speed networks both nationally and globally and provide important access to educational resources for NPS faculty and students.
72. Make outreach to local communities a part of the central IT agenda. Participation in local and regional networks (e.g. I-Net) can leverage NPS IT investments and provide increased visibility for the NPS mission.

## **IMPERATIVE FOR INVESTMENT**

Information Technology is a strategic institutional resource, and has an impact on every dimension of the school's mission. Research, education and service to the Navy and the nation are all affected by the currency, reliability, security, and services related to IT.

Over the past five years of implementing its first IT strategic plan, ITACS has demonstrated its service to the NPS mission and its ability to use institutional resources in effective and efficient ways. NPS increased its investment in ITACS and ITACS responded well.

ITACS continues to have an important responsibility to provide the tools and services necessary to support NPS mission. To meet the challenges of the next five years, the organization should be resourced to fulfill this responsibility. The imperative for investment is voiced by every constituency at NPS because of the work that is required: no class is taught without IT, no research is performed without IT, and no administrative system is managed without IT.

**The recommendations in this strategic plan are comprehensive and are designed to frame the ITACS' agenda for the next five years. The planning process will continue with annual updates, operational plans, and accountability reports.**

IT can continue to be a trigger for institutional change; however it must be resourced adequately to maintain its quality of services and to support the future of NPS.

## **NPS IT STRATEGIC PLAN**

The recommendations in this strategic plan are comprehensive and are designed to frame ITACS' agenda for the next five years. The planning process will continue with annual updates, operational plans, and accountability reports. Goals and implementation strategies have been identified for each of the major IT areas, all focused on improving IT operations and services in a way that is consistent with the NPS mission overall.

## **IMPLEMENTATION AND ACCOUNTABILITY**

Implementation will begin October 1, 2009 and will end September 30, 2014. Annual progress reports will be shared with NPS leadership and the entire NPS community, including action plans for the coming year – updated based on emerging trends and technologies – ongoing consultation and advisement by the IT Task Force, and possible new opportunities. Annual action plans will include updated cost estimates and implementation timelines.

## **OUTCOMES**

The vision for IT at NPS is to enable the school to realize its goal to become one of the top research universities in the U.S. by the year 2020. This environment will sustain a centrally coordinated IT service organization whose core mission is to provide high-level support for education and research at NPS.

The NPS IT environment will be characterized by:

- **INNOVATION** – Providing support for faculty and student leadership in the development, testing and demonstration of emerging technologies, recognizing that IT excellence is rooted in a commitment to innovation, experimentation, and imagination.
- **TALENT** – Enabling leading-edge education and research through support of sophisticated communications and computing. This means highly-skilled technical support for high-performance computing, visualizing, streaming video, digital media services, cybersecurity, wireless landscapes, etc., and talented, knowledgeable technical staff who participate in ongoing professional development programs and engage in national professional associations to maintain skill currency and contacts with colleagues at peer institutions.

- ***ACCESS TO ADVANCED TOOLS*** – Establishing ubiquitous access to a state-of-the-art communications infrastructure that integrates voice, video and data capabilities; tools and services that are renewed and upgraded at regular cycles.
- ***COMMITMENT TO SERVICE*** – Improving ITACS dedication to serving faculty, students, and staff that is visible through degree of effort, courtesy of interactions, regular seeking of constituent advice and input, and routine assessments of how well service is being provided.
- ***INTEGRATED, EFFICIENT ADMINISTRATIVE SYSTEMS*** – Enabling administrative leaders to develop maintain, and upgrade administrative systems that maximize institutional effectiveness and efficiency; working with administrative leaders to provide systems that are characterized by single point data entry, internal consistency and integration, flexibility, useful management reporting systems and customer orientation.
- ***LEADERSHIP*** – Providing leadership of IT services through strategic planning, informing the university of emerging technological directions and opportunities, managing and leading institutional change, annual reporting to the community about IT operations and services, developing of partnerships and alliances with other institutions and agencies to maximize technological currency and minimize costs, and making an articulate, persuasive case for IT resources on a regular basis.

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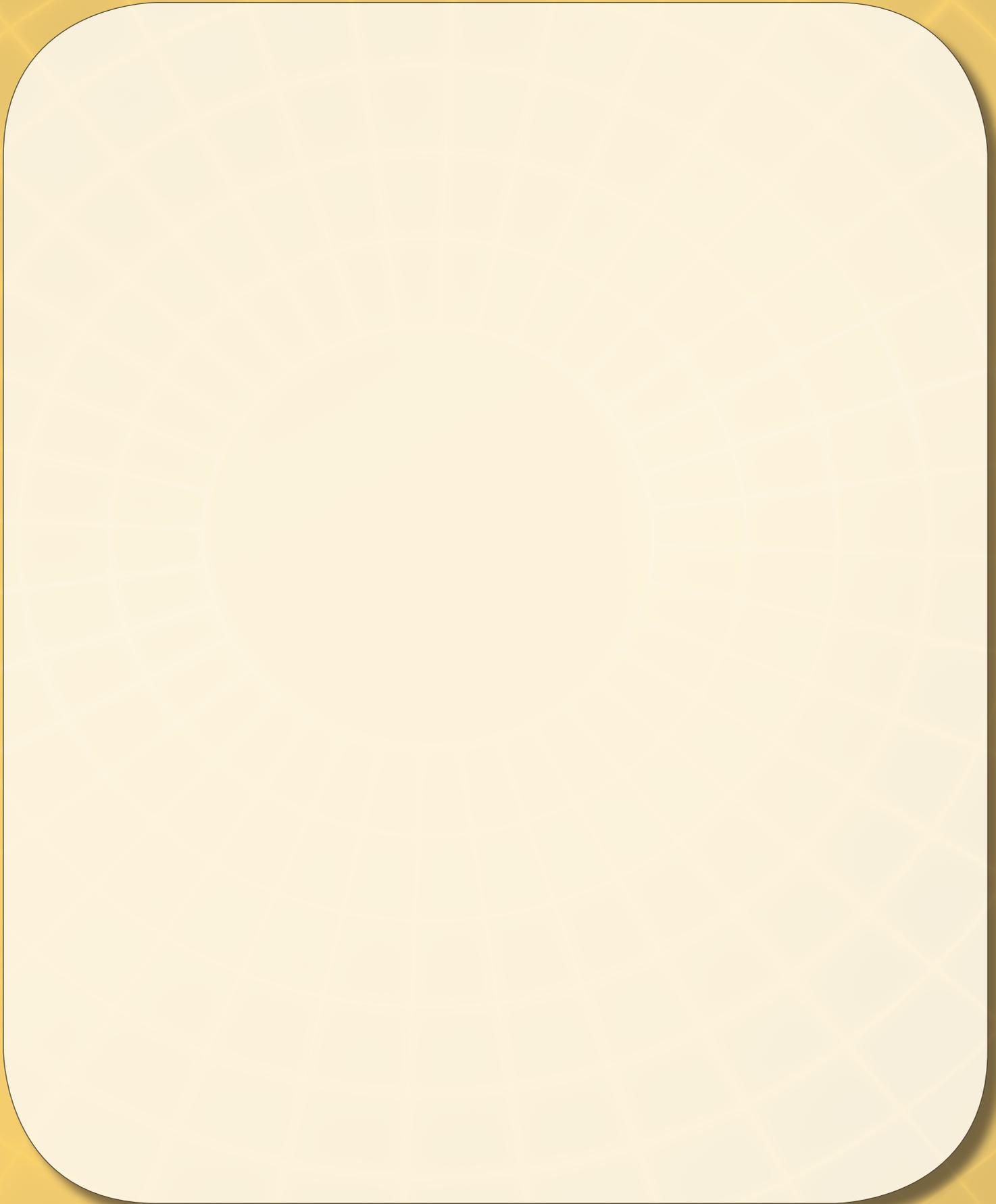
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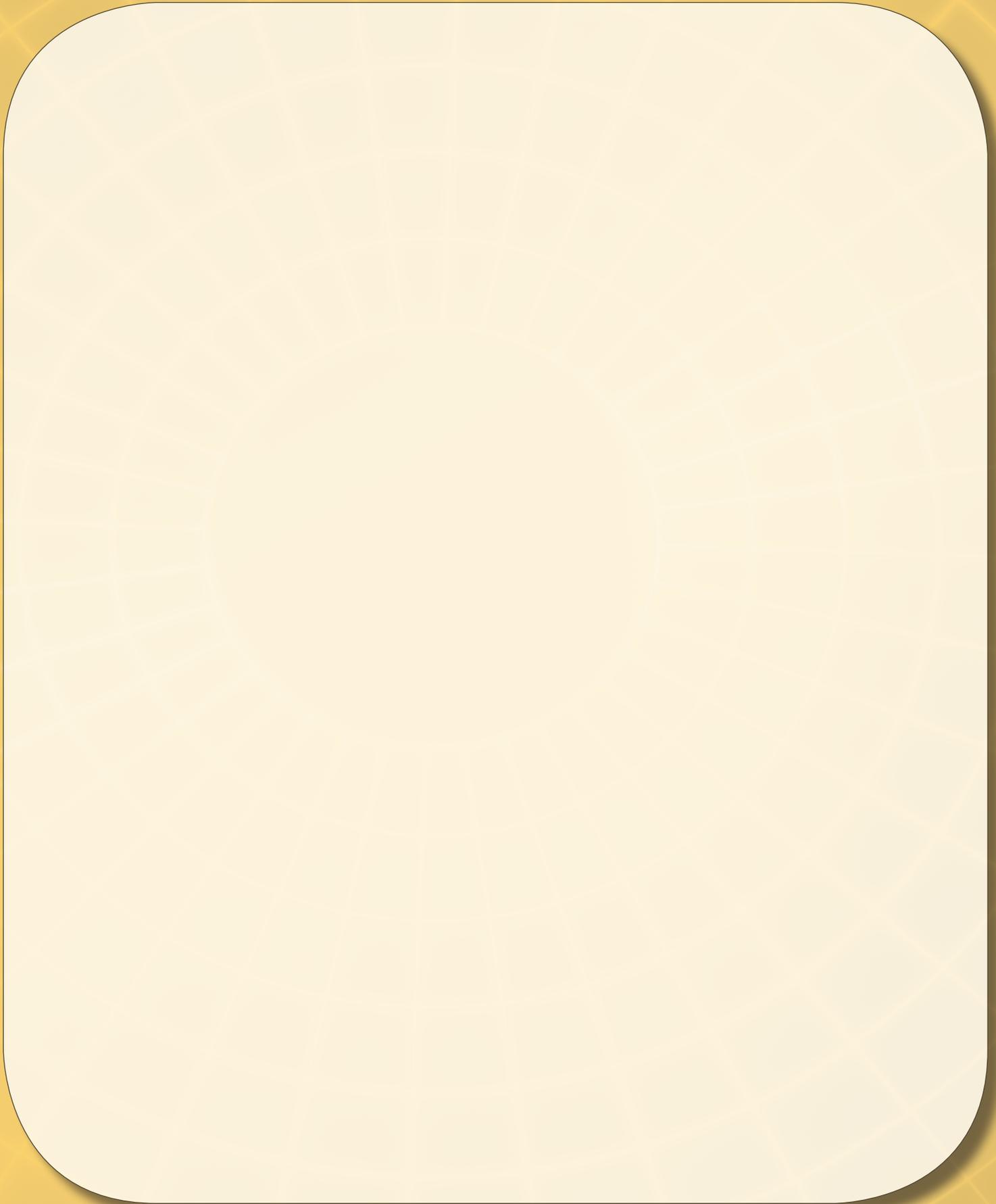
*Director, Information Professional Center of Excellence  
(IPCOE)*

# NOTES



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# NOTES





**IT** **2009**  
*STRATEGIC*  
*PLAN*