VirginiaTech
Invent the Future

Invent the Future: Quality, Innovation, Results:
The 2006 - 2012 Strategic Plan Update

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Executive Summary

Invent the Future: Quality, Innovation, Results

The 2006 - 2012 Strategic Plan Update reaffirms Virginia Tech's commitment to achieving excellence as a comprehensive land-grant university that makes innovative contributions in learning, discovery, and engagement to the Commonwealth of Virginia, the nation, and the world. The priorities expressed in the 2006 - 2012 Strategic Plan Update demonstrate Virginia Tech's ongoing commitment to transform itself as a 21st century university capable of responding effectively to opportunities presented in a dynamic and diverse domestic and global environment.

The process during 2005 –2006 of updating the plan confirmed the university's commitments to its mission and core values. Virginia Tech values the educational contributions made by a high quality and diverse student body, faculty, and staff who contribute to the robust exchange of ideas. The updated plan introduces the terms *learning, discovery, and engagement* to articulate an updated understanding of the complexities of the university's integrated and multi-disciplinary Scholarship Domain areas. An important component of the plan is the commitment to link strategic goals to financial planning and outcomes in order to increase Virginia Tech's accountability to a variety of important stakeholders.

The 2006 – 2012 Strategic Plan Update is comprised of three Scholarship Domains and three Foundation Strategies that serve to achieve Virginia Tech's mission and core values.

The Scholarship Domains: Learning, Discovery, Engagement

Learning

Virginia Tech is committed to total enrollments of 28,954 in 2012. Within that number, graduate enrollments will include 2,600 Ph.D. and 3,900 master's students. Undergraduate enrollments will total 22,500, including 3,000 who enter as transfer students.

The strategic priorities in these areas are

- ***Undergraduate Education*.** A key element in the learning domain is a commitment to enrich the academic experience of a diverse undergraduate student body by expanding research and capstone experiences within the new VT Pathways for Learning model. VT Pathways integrates liberal education throughout the curriculum and provides students with a robust academic experience, including expanded foreign language opportunities.

- ***Graduate and Professional Education***. The Transformative Graduate Education initiative integrates the university's strengths in research, technology, and teaching to prepare graduate students as the next generation of scientists, educators, scholars, engineers, artists, professionals, and global citizens. Virginia Tech's graduate education will align with National Research Council quality benchmarks aimed at growing and strengthening Ph.D. production.

- ***eLearning and Information Systems***. Priority is given to strengthening the university's commitment to distance and distributed eLearning and the use of advanced learning technologies by faculty and students within and outside the classroom. The University Libraries will be strengthened to support university missions.

- ***Educating the Whole Student***. Virginia Tech strives to provide undergraduate and graduate students with environments, programs, and services that support the curricular and co-curricular experiences of a diverse student body. Goals include building multicultural and international competencies and supporting students through improved living and learning environments.

Discovery

The Discovery Scholarship Domain outlines the university's commitments to research and creative scholarship in strategically important areas that draw upon established strengths and forecast Virginia Tech's ability to capture opportunities

to produce quality research. A specific goal is to expand annual research expenditures to $540 million by 2012 primarily through research growth in Blacksburg and the National Capital Region. Strategic partnerships will be a key component of the growth strategy. The strategic priorities in the Discovery Scholarship Domain are

- ***Energy, Materials, and Environment.*** These areas of scholarship are interwoven and require focused and multidisciplinary research activities. Energy, in particular, promises to be an area for innovative research in sustainable energy supplies. Materials research is a strength upon which collaborations and multidisciplinary efforts can be built within and outside the university. Water quality and environmental health are signature areas for environmental research.

- ***Social and Individual Transformation****.* The dynamics of economic, social, political, technological, environmental, and cultural change are at the heart of this area of research and creative scholarship, which has application in domestic and international aspects of community life.

- ***Health, Food, and Nutrition****.* Two areas of focus are the strategic priorities for this research initiative. The infectious disease initiatives are focused on the prevention, diagnosis, treatment, and management of naturally or purposely introduced emerging and re-emerging infectious diseases. A comprehensive approach to the prevention and treatment of obesity is the second key area of emphasis.

- ***Innovative Technologies and Complex Systems.*** Powering progress in all areas of discovery are cutting-edge technologies and the development of systems to solve complex problems. Advancements will be achieved by strategically investing in nanotechnology, bioinformatics, biotechnology, high performance computing, power electronics and robotics, wireless technologies, and geographic information systems.

Engagement

Virginia Tech is the commonwealth's senior land-grant university and is committed to engaging its intellectual assets to address economic and social needs of communities around the commonwealth, the nation, and the world. Strategic priorities in the Engagement Scholarship Domain include

- ***Economic Vitality*****.** Virginia Tech will connect innovations in the scholarship of learning, discovery, and engagement to the economic well-being of individuals, families, businesses, and communities. Central to this goal are entrepreneurial initiatives advancing technology transfer, intellectual property, and the transfer of knowledge in domestic and international partnerships.

- ***International Education and Research.*** At the heart of this goal is the implementation of the Virginia Tech International Strategic Plan reaffirming the commitment to fostering communities that value all cultures, languages, lands, and people. International collaborations will include the establishment of research and education centers and the expansion of study abroad.

- ***PK-12 Education in Science, Technology, Engineering, and Mathematics (STEM).*** This goal is achieved through multi-disciplinary research partnerships, teacher preparation, professional development opportunities for PK-12 educators, and programs connecting PK-12 to STEM undergraduate programs.

- ***Student Engagement.*** Undergraduate and graduate students will have opportunities to engage in service learning and civic activities. These opportunities will amplify student learning and build professional skills to strengthen student academic careers and professional development.

The Foundation Strategies: Organizational Development; Campus Infrastructure; Resource Development, Allocation, and Management

Organizational Development:
Fostering a High Quality Diverse and Inclusive Academic Environment

Human resource and work/life strategies support the achievement of the university's missions by attracting and retaining the best instructional, research, and administrative/professional faculty and staff, investing in their development, and supporting them by providing a high quality of work life. Analyses indicate that the salaries of teaching and research faculty will achieve the 60th percentile over the six-year planning period with 4 percent annual increases; however, the university must continue to evaluate trends in faculty salaries to ensure that steady progress is made in providing competitive compensation.

Without attention to staff compensation as well, the university will not be able to continue to recruit and retain the caliber of staff members needed.

With projected retirements resulting in the loss of approximately 12 percent of our faculty and staff over the next six years, enhanced faculty and staff recruitment and development programs will provide the foundation for succession planning and knowledge transfer.

The university must foster a diverse and inclusive community that supports mutual respect. Efforts to diversify the university by increasing the number of women and underrepresented minorities hired and promoted into faculty and staff ranks must continue to be a priority.

Virginia Tech has been considered one of the region's employers of choice for many years. However, to sustain this position, the university must continue to promote the health and welfare of the university community through family-friendly policies and a competitive benefits package.

Additionally, competition for resources requires that the administrative operations continue to look creatively at developing new strategies for gained efficiencies.

Investment in the Campus Infrastructure

As the university continues to grow at a rapid pace, several key choices must be addressed to ensure the most effective management of the university's learning, living, and work spaces. The development of a comprehensive space management system will enable the university to manage space in such a manner to fully meet the academic and research needs of the university community while ensuring that the maximum amount of indirect costs can be recovered on sponsored projects.

Consistent with the Campus Master Plan, a goal of the university is to maintain the pedestrian nature of campus and to continue to implement safety measures. With Virginia Tech's emerging participation in the biological and medical fields also comes the need for higher security. The university must enhance health, safety, and security operations to support its discovery, learning, and engagement endeavors. The development of university-wide emergency preparedness and hazard mitigation plans will help the university plan for major emergencies that threaten the health, safety, and security of the campus community.

Emphasis must also be placed on promoting robust and integrated information technology strategies that advance Virginia Tech's excellence. The university has been a leader in the information technology arena and is poised to continue to remain on the cutting edge of technology.

Finally, the university must advance and implement initiatives to improve operational efficiencies and enhance customer service. The Higher Education Restructuring Act will provide the university with greater authority over financial and administrative operations and will provide the opportunity for staff to begin to streamline administrative processes and policies.

Effective Resource Development, Allocation, and Management

The university has five major sources of funds to manage operations: state appropriations, tuition and fees, grants and contracts, auxiliary enterprises, and gifts and investments. Staff members must continue to work with the governor, legislators, General Assembly staff, and the State Council of Higher Education

for Virginia to increase state funding. Likewise, private fundraising will be critical to achieving the university's goals. Other opportunities to enhance university revenue sources, such as more effective use of the university's real-estate portfolio and a more aggressive approach to marketing intellectual property and service, may yield additional revenue.

Additionally, the university is working to develop a comprehensive Debt and Risk Management Policy for both the university and the Virginia Tech Foundation and is expected to demonstrate management competency as evidenced by either a bond rating in the "AA" range or a two-year history of competency in the areas of finance and capital outlay.

As part of its land-grant mission, the university has historically maintained affordable tuition and fees to ensure access to all. Increasing student access and affordability to the institution is at the heart of Virginia Tech's new "Funds for the Future" program, which increases the level of institutional funding of student financial aid. The university is committed to continuing programs that will ensure accessibility.

Vision for the Future
by President Charles W. Steger

Institutions such as universities are not readily changed. To embark on a process of transformation requires considerable persistence and determination. But most importantly, the vision for the future must be clearly articulated.

The expression of the vision takes many forms because the university has many constituencies, each frequently requiring a different form of communication or "language" if the message is to be delivered effectively. The vision is not changed as plans are updated, though strategies and tactics may well be modified. The vision that was articulated in 2000 and captured in the Strategic Plan now being updated will require a transformation of the university, one that will evolve but also alter the institution in fundamental ways.

There is a history of such transformational experience at Virginia Tech. After its founding in 1872, progress was uneven and not always in the most positive direction. Perhaps the first critical transformation occurred during the presidency

of John McBryde, 1891-1907. He set upon establishing a statewide presence and reputation for the then-college that included the creation of both the substance and symbols of a proper institution of higher education.

Julian Burruss, president 1919-1945, expanded what Dr. McBryde had set in motion. The collegiate Gothic style of architecture was fully embraced, curricula were expanded, and Virginia Polytechnic Institute, as we were popularly and finally officially called then, went on to establish significant technical expertise in agriculture and engineering. Through the work of many to follow, considerable progress was made along this path.

A second stage of transformation occurred during the presidency of T. Marshall Hahn, 1962- 1974. Dr. Hahn guided a dramatic change in both scope and scale that set the institute on a new path. During this period, enrollment tripled, the College of Arts and Sciences and the College of Architecture and Urban Studies were created, and Virginia Tech moved from being a polytechnic institute to a university.

The changes under way today are very different in character but no less profound. These changes are brought about by the dynamic environment in which today's universities must operate and by opportunities to enhance the contribution to the Commonwealth of Virginia, as well as society at large, that may be available to Virginia Tech.

Global Communications Revolution:
A New Standard of Quality

Intellectual capital has been given wings by the advent of the Internet. Individuals, industries, and governments can access information and expertise from virtually any point on the globe. As a result, a new competitive quality standard has emerged. The successful organization will be defined by its capacity to deliver world-class quality in its core strategic functions. A presumption in our plan is that quality will ultimately be the sustaining measure of success.

The Exponential Growth of Investments Required
to Enter New Fields of Research

Investments required to deploy competitive programs have grown exponentially because of 1) the necessity of interdisciplinary research, 2) the need for increasingly sophisticated instrumentation, and 3) the demand for high-performance computing.

It is not uncommon for the start-up equipment package for a new faculty member in a science field to range from $500,000 to $1million. The investments necessary to recruit interdisciplinary research teams, which are the current trend, can be many times these amounts. Any university that cannot assemble the critical mass of financial resources and necessary intellectual capital cannot

ultimately compete on the national and international scene. This is one of the reasons why Virginia Tech must increase its resources substantially in terms of both intellectual capital and financial strength.

Trends of Consolidation and Differentiation in Higher Education

A structural revolution is under way in higher education. It has characteristics similar to the changes that have been occurring in business for the past decade. Just as banks and airlines have consolidated to seek economies of scale and gain market share, universities are in the early stages of a somewhat similar process. Within the hierarchy of higher education, the strong institutions are growing stronger at an accelerating rate. To illustrate, the top 40 universities in the National Science Foundation (NSF) rankings now account for 50 percent of all university-based research expenditures.

Further, there is an emerging pattern of global strategic partnerships. For example, Stanford and Cambridge universities are expanding their shared program offerings. Tokyo University may soon be a partner. Virginia Tech is in the process of establishing such a relationship with the Technische Universität Darmstadt whereby the names of both universities might appear on the diploma.

Ultimately, a small set of global strategic partnerships in areas such as bioinformatics and nanotechnology will be the dominant players and recipients of significant funding. These resources will be accompanied by the flow of the best faculty and graduate students, combining to make these entities key centers of innovation and research.

Virginia Tech has responded to these trends by choosing key areas in science and technology for strategic investments. However, this focus must be balanced with our broader mission of producing graduates who are holistically educated and who can assume leadership roles in a democratic society.

From these dual commitments comes our intent to remain a comprehensive university. Comprehensiveness and diversity of offerings have a very practical application. The path of research is not easily predicted. As new areas emerge that draw upon a wide variety of disciplines, the ability to adapt is reduced if comprehensive offerings are not present. The ecological principle of “stability through diversity” aptly applies here.

Virginia Tech in the next decade will

1. Double its research expenditures to exceed $540 million dollars per year.
2. Continue to strengthen the quality of its programs as indicated by the achievements of its students (for example, through nationally competitive scholarships), recognition of the faculty (for example, by memberships in national academies), and other indicators.

3. Sustain an entrepreneurial culture characterized by public/private strategic partnerships to diversify sources of income for the university and increase organizational responsiveness to a changing environment.
4. Expand its national and international presence through alliances that create opportunities for advanced research and study for faculty and students.
5. Foster an organizational culture that nurtures the next generation of leadership, enhances diversity, and sustains a positive momentum geared to a successful future.
6. Continue to enjoy strong and enthusiastic support from alumni and the various public constituencies that the university represents.

Virginia Polytechnic Institute and State University
Mission Statement

Virginia Polytechnic Institute and State University (Virginia Tech) is a public land-grant university serving the Commonwealth of Virginia, the nation, and the world community. The discovery and dissemination of new knowledge are central to its mission. Through its focus on teaching and learning, research and discovery, and outreach and engagement, the university creates, conveys, and applies knowledge to expand personal growth and opportunity, advance social and community development, foster economic competitiveness, and improve the quality of life.

2001 Mission Statement adapted in 2006
Virginia Tech Board of Visitors

Virginia Tech Core Values

*Freedom of inquiry
*Mutual respect
*Lifelong learning
*A commitment to diverse and inclusive communities
*_Ut Prosim_ (That I May Serve)
*Personal and institutional integrity
*A culture of continuous improvement

Freedom of inquiry. Fundamental to the creation and transmission of knowledge is a commitment to nurture and protect freedom of inquiry. Intellectual freedom is the foundation of academic excellence and is vital to sustaining environments in which sound and rigorous learning, discovery, and engagement occur.

Mutual respect. At the center of the educational enterprise is the commitment to the exchange of ideas and information. Respect for varied points of view and the

diverse backgrounds upon which they may be based is essential to the continued growth and advancement of all members of the university community.

Lifelong learning. A commitment to lifelong learning and inquiry within and outside the university community guarantees continued growth and secures for society the benefits of ever advancing knowledge.

A commitment to diverse and inclusive communities. In carrying out its mission, Virginia Tech values the educational benefits of diverse ideas, peoples, and cultures. Articulated in the Virginia Tech Principles of Community, adopted by the board of visitors in 2005, diversity enlivens the exchange of ideas, broadens scholarship, and contributes to just engagement in all the world's communities.

Ut Prosim. (That I May Serve) is Virginia Tech's motto. This attribute distinguishes Virginia Tech from all but a few of the nation's institutions. As a community of scholars and reflective of our land-grant mission, Virginia Tech is committed to service to individuals and society in all its forms.

Personal and institutional integrity. Integrity demands that all members of the university community and the university itself engage in continual civil discourse and ethical behaviors that advance learning, discovery, and engagement, supported by the administration. Integrity demands maintaining standards of personal and professional behavior of the highest order.

A culture of continuous improvement. Through benchmarking, assessment, evaluation of academic and administrative goals, and a commitment to process improvement and change, Virginia Tech will achieve greater national and international prominence.

Learning Scholarship Domain

Undergraduate Education

***2012 Profile of the Undergraduate Student body*.**
Over the 2006-2012 planning period, the profile of the undergraduate student body will remain relatively constant in total size while steadily improving in quality. Most of the 5,000 freshmen entering Virginia Tech each year will be full-time residential, traditionally aged students; about 30 percent will be from outside Virginia.

Total undergraduate enrollment is expected to reach 22,500, about 1,000 more undergraduates than were enrolled in fall 2005. The increase is expected to come from additional transfer students, primarily from the Virginia community

colleges, part of Virginia Tech's commitment to the state to help address the growing number of students seeking college enrollment in the commonwealth.

Commitment to a diverse and inclusive student community.
This plan emphatically reaffirms the university's long-standing commitment to increase access and inclusion of students from underrepresented groups, particularly underrepresented racial and ethnic minorities and first-generation, low-income students. There were 1,600 African American, Hispanic, and Native American undergraduates on campus in fall 2005. (Nearly 2,000 additional students chose not to report their racial or ethnic identity, a number that has dramatically increased since 2001.)

The goal is to work toward doubling the number of students from these underrepresented groups by the end of the planning period. Vigilant attention to the recruitment and retention of students from underrepresented groups and from international backgrounds will change the profile of the student body over time and help create a community in which the educational benefits of diversity can be realized for all undergraduates.

Undergraduate learning goals.
Education of the whole person, disciplinary competence, and responsible citizenship form the core values of the undergraduate learning experience. A broad set of opportunities for domestic and international learning, involvement in research and discovery, and active engagement both in and outside the classroom are critical aspects of educational excellence.

Education of the whole person is achieved through the rigor of the university's undergraduate curriculum and the delivery of curricular choices provided by VT Pathways for Learning and the educational benefits of a culturally diverse student body. VT Pathways for Learning reflects Virginia Tech's renewed commitment to liberal education through strong advising, multiple majors, integrated course sequences, and purposeful selection of liberal education courses across different disciplines. Virginia Tech graduates will be prepared for interdisciplinary and creative problem solving and lifelong learning in a variety of contexts, including emerging global communities.

Disciplinary competence is achieved within major programs of study that are linked and integrated with the foundation of liberal education. Integrated coursework, research experiences, and capstone projects or seminars provide opportunities for developing disciplinary competence.

Responsible citizenship emphasizes ethical and civil behavior with an understanding of the importance of cultural and economic awareness and an appreciation of the workings of local and global communities, as well as one's role in them.

Goal I. Increase student involvement in discovery and engagement by creating more opportunities for undergraduates to be involved in research, capstone experiences, education abroad, and experiential learning.

Strategies:

- Increase opportunities and participation in undergraduate research and independent and field study to enhance critical thinking skills and the ability to learn independently and to encourage close involvement with faculty members.
- Align theme-based learning pathways with university research initiatives to create synergies between the university's learning and discovery missions.
- Expand opportunities for students to integrate and apply classroom learning through education abroad, capstone courses, service learning, internships and co-ops, and other experiential and engagement learning activities.
- Develop rich reflection/assessment strategies, such as e-portfolios, to enhance and document learning and personal growth from these special experiences.

Goal II. Strengthen and integrate all aspects of the undergraduate academic experience, including the academic experience for transfer students.

Strategies:

- Implement VT Pathways for Learning to integrate learning across the entire curriculum.
- Develop holistic advising strategies at all levels (including course-of-study planner and quality academic and career advising).
- Develop a first-year transition and support program for new transfer students.
- Increase support for programs serving new undergraduates, such as programs for teachers of first-year students, first-year experiences, learning communities, convocation, and the common book.
- Redefine the formative role of academic assessment and curriculum review as effective tools for continuous quality improvement and as essential elements of public accountability for institutional effectiveness.

Goal III. Significantly increase the diversity of the student body and provide educational experiences that will enhance students' multicultural competence.

Strategies:

- Increase the proportion of women and students from underrepresented racial and ethnic groups and assure the continued participation of students from low-income and first-generation families so that Virginia Tech more appropriately reflects and serves diverse populations in the commonwealth.
- Increase the number of students enrolled in expanded coursework offerings and academic experiences, including foreign language instruction, that enhance their understanding of multicultural and international issues and increase their ability to contribute in a global society.
- Encourage the incorporation of diverse perspectives in coursework and adoption of effective classroom learning strategies through faculty development programs.

Goal IV. Invest in departmental and university-level support for undergraduate education.

Strategies:

- Increase instructional support for academic departments based on student credit hours, program quality, number of majors, and demonstrated need.
- Fully implement the new University Center for Undergraduate Education to facilitate, coordinate, and support integrative learning strategies, fund innovative curricular changes, and advance VT Pathways efforts.
- Strengthen programs, such as the Honors Program, and support for the highest academic achievers.
- Expand articulation agreements with community colleges to attract and retain transfer students.
- Strengthen existing and initiate new programs that support the unique needs of new transfer students.
- Dramatically increase the opportunities for summer-session enrollment using on-line courses and flexible summer scheduling.
- Strengthen commitment to faculty development, assessment, curricular improvement, and innovation.

Performance Measures:

- Evidence of increased student engagement in learning initiatives as measured by responses to the National Survey of Student Engagement, including involvement in undergraduate research, foreign language study, study abroad, practicum, internships, and other related experiences.
- Increased satisfaction of graduates with advising as reported on the alumni survey.
- Increased satisfaction of graduates with opportunities to improve multicultural competencies as reported on the alumni survey.
- Increase by 50 percent the number of undergraduates from underrepresented racial and ethnic groups to 2,400 by 2012.

- Complete articulation agreements with Virginia community colleges for all academic colleges at Virginia Tech.
- Increase on-line and residential summer session enrollments by 10 percent annually.
- Double the number of undergraduates in study abroad and other international experiences.
- Increase by 65 percent the number of undergraduates in service learning and related outreach activities (using 2005 as a base year).

Graduate and Professional Education

Graduate and professional education is important to Virginia Tech's quest to be identified among the top research universities. Advanced education contributes to the three missions of a land-grant institution: learning, discovery, and engagement. Goals were developed with the understanding that Virginia Tech is one university geographically located throughout the commonwealth, the nation, and the world.

Nearly 6,000 graduate students (1,990 doctoral and 3,942 master's students) were enrolled in fall 2004, representing 17 percent of the total student population. The goals and strategic foci for graduate and professional education are shaped by Virginia Tech's core values and embrace a commitment to achieving the qualities, characteristics, and established standards of nationally recognized research universities.

In its pursuit of excellence in graduate education, Virginia Tech has embraced Transformative Graduate Education (TGE) as a university-wide initiative led by the Graduate School. TGE draws upon Virginia Tech's strengths in graduate education and its expertise in new and original technology. TGE is designed to foster a significant change in how the university prepares its graduate students as the next generation of scientists, educators, scholars, engineers, artists, and professionals. TGE provides opportunities for doctoral and master's students to explore connections between their roles and responsibilities as faculty members and professional practitioners, their pedagogical approaches and construction of teaching and learning paradigms, and their development of research-in-practice as citizen-scholars.

In addition, TGE, unlike other programs, collaborates with multiple university units to integrate a critically engaged understanding and use of technology throughout the process. While many universities offer some professional development training or workshops, none provide all of the components of TGE, and none offer such opportunities as part of an integrated whole, making Tech's program unique in the nation.

Graduate and professional education at Virginia Tech is defined by two overarching and overlapping goals that are intentionally comprehensive and

broad. The first goal is to *enhance quality graduate and professional education*, and the second goal is to *establish a graduate education portfolio reflective of a 21st century research university*.

Three areas of strategic focus assist in achieving these goals:

- Align with National Research Council (NRC) quality benchmarks.
- Successfully implement Transformative Graduate Education initiative.
- Enhance graduate and professional degree value through national/international partnerships and joint degrees.

Goal I. Enhance quality graduate and professional education.

Strategies:

- Implement and expand Transformative Graduate Education (TGE) initiatives:
    - Preparing the Future Professoriate (courses, certificates, teaching assistant (TA) training, teaching opportunities);
    - Preparing the Future Career Professional (course, certificate, internship);
    - Graduate Education Development Institute (GEDI) (critical pedagogy, technology, graduate teaching assistant (GTA) training); and
    - Citizen-scholar engagement (courses, certificate, Virginia Tech Citizen Scholars).
- Provide quality graduate and professional education offerings: doctoral and master's degrees and certificates.
- Develop national and international partnerships for global graduate degrees.
- Enter into national partnerships that enhance professional graduate degree value and/or offer joint degrees, e.g., Doctor of Veterinary Medicine (D.V.M.)/Master of Public Health (M.P.H.).
- Continue to implement Graduate Program Review.
- Enhance graduate and professional education through technology.
- Build and sustain graduate community (Graduate Life Center).
- Foster an environment that helps recruit, retain, and graduate outstanding graduate students of diverse backgrounds, including international students.
- Provide meaningful and relevant disciplinary and interdisciplinary graduate offerings.
- Embrace the successful elements of the National Science Foundation (NSF) Integrative Graduate Education and Research Traineeship (IGERT) program in most graduate programs.
- Enhance the quality of life for graduate students (family housing, accessible and affordable child care, work-life balance, competitive multiyear stipends, and health insurance premium coverage).

- Implement effective and efficient operations, meaningful policies, and procedures.
- Provide teaching opportunities for graduate students, especially doctoral students.

Goal II. Establish a graduate education portfolio reflective of a 21st century university.

Strategies:

- Increase the number of graduate students to 20 percent of the total enrollment.
- Maintain the viability of master's degree programs, artistic master's degree (Master of Fine Arts), and students with need and interest – consider bachelor's/master's degrees and professional science master's (P.S.M.) degrees.
- Prioritize new and extended degrees through the Institutional Plan for Graduate Degrees (IPGD) (contextualized in concert with Strategic Plan Update and research foci areas).
- Expand existing graduate degree offerings to the portfolio of a 21st century university:
    - "Right" size, program/priority, critical mass of students and faculty;
    - Ph.D. degrees in social sciences/humanities;
    - Interdisciplinary graduate programs;
    - Science, technology, engineering, and mathematics (STEM) focus;
    - Unique graduate opportunities (degrees, certificates, courses) throughout the commonwealth (extended campuses and National Capital Region);
    - Establishment of partnerships and collaborations with U.S. institutions and universities around the world.
- Strengthen research/scholarship efforts and initiatives.
- Compete for federal funds for D.V.M./M.P.H. education and research.
- Increase competitiveness and sustained support for graduate students, including stipends, health insurance, multiyear funding, tuition remissions, and bridge funding.
- Increase enrollments of graduate students of diverse backgrounds (domestic and international).
- Increase the international experience for graduate students, including study abroad and foreign language training.

Performance Measures:

A number of metrics could be used to measure success in meeting our two goals. Many of these would track with the National Research Council (NRC) assessment of doctoral programs. Other measures include satisfaction of graduates and future employers.

At a minimum, the following benchmarks should be considered:

- Increase Ph.D. enrollment by 900 to a total of 2,600 by the year 2010.
- Increase the production of Ph.D.s to 320 annually.
- Increase the number of courses (seven plus) and programs offered through the Transformative Graduate Education (TGE) initiative and increase the number of students who participate annually (from 250 to 400).
- Continue to successfully implement the Institutional Plan for Graduate Degrees (IPGD).
- Complete program review for one-third of the graduate degrees offered, with the remainder scheduled for completion by 2012, according to the schedule for Graduate Program Review.
- Increase the number of nationally ranked graduate programs.
- Provide professional education programs that meet or exceed accreditation requirements.
- Develop and implement a plan for ongoing data collection and analysis of the metrics identified in the NRC assessment of research-doctorate programs.
- Increase the number of distinguished fellowships to 15 NSF fellowships; increase the number of distinguished fellowships to 10 percent of all Ph.D. students with partial or full fellowships.

eLearning and Information Systems

Advanced technologies, used in distance and distributed eLearning; integrated learning technologies used to enhance learning; and information systems, such as the libraries, provide the infrastructure necessary for meeting the university's goals in learning, discovery, and engagement. Technologies will support advancements in educational access, course management, and collaborative learning systems, computer-integrated classrooms, electronic tutorials and portfolios, and research software systems that, in concert with the print and electronic collections maintained by the university library, will support excellence in activities in learning, discovery, and engagement across the entire university community.

eLearning, advanced learning technologies, and the University Libraries will broaden and deepen Virginia Tech's learning, discovery, and engagement activities through

- an awareness of students' approaches to meeting their learning needs and of what technologies are available to assist in meeting identified learning outcomes, including access to new knowledge for the global community.
- professional development so that everyone has the skills needed to implement change.
- the integration of pedagogy, learning-space design, technology, support, and policies to enable successful learning.

Goal I. Strengthen the role of distance and distributed eLearning in achieving the university's goals in learning, discovery, and engagement.

Strategies:

- Continue to lead, manage, coordinate, and support the provision of quality distance and distributed learning opportunities for domestic and international learners through a holistic approach to eLearning.
- Continue to meet the goals outlined for distance learning in the Code of Virginia to expand access to education in the commonwealth, improve quality, and minimize the cost of education to Virginia's citizens.

Performance Measure:

- Increase from 85 percent to 95 percent the number of academic departments engaged in developing and delivering eLearning courses.
- Expand the number of distance and distributed eLearning course offerings to at least 800 per year and the percentage of students indicating satisfaction with their eLearning experience to 90 percent or better; increase the value-of-investment (VOI) by an average of 10 percent per year.

Goal II. Develop and integrate advanced technology and information systems applications that assist collaboration, reflection, assessment, and sharing among faculty members, students, and staff members.

Strategies:

- Continue to lead, develop, implement, and assess technology-integration efforts aimed at increasing the information technology fluency of faculty, staff, and students in learning, discovery, and engagement activities.
- Develop, implement, and manage integrated learning and collaboration tools to enable course, non-course related, e-portfolio, and Web publishing activities to be engaged through a common framework.
- Update established classroom functionality and equipment standards, regularly review and upgrade processes, and support a comprehensive structure for routine maintenance.
- Re-establish funding options to support integrating technology in learning activities in strategically targeted curricular areas.

Performance Measures:

- Provide faculty development opportunities in learning technologies for 95 percent of faculty on a three-year cycle through the Faculty Development Institute.

- Provide educational development opportunities for credit for all students entering graduate programs in partnership with the Graduate School through the Graduate Education Development Institute.
- Establish infrastructure and expertise to make available testing services, digital repositories, e-portfolios, accessibility technologies, and Web-hosting services for personal and institutional purposes, integrated with course management systems where appropriate.

Goal III. Strengthen the ability of the library systems to acquire, preserve, and manage research-level collections and user services that advance Virginia Tech's research capabilities.

Strategies:

- Develop and preserve print and electronic collections within the university library system that support faculty and student research needs.
- Provide programs that develop information literacy skills.
- Re-purpose physical spaces to meet user needs through renovations.

Performance Measures:

- Adjust library funding to at least the 30th percentile level of the average funding associated with peers.
- Use annual surveys of customers to determine the quality of services delivered by the library.

Educating the Whole Student

The Division of Student Affairs and the Graduate School support the mission of Virginia Tech through the development of campus environments, programs, and services that complement the university's learning, discovery, and engagement foci and its mission to expand personal growth and opportunity, advance social and community development, foster economic competitiveness, and improve the quality of life.

Many co-curricular programs specifically support the academic mission of the university and address four university core values: the enhancement of mutual respect; a commitment to diverse and inclusive communities; the development of personal and institutional integrity; and the realization of the university's motto, *Ut Prosim* (That I May Serve). To these ends, campus environments are created 1) that help to recruit, retain, and graduate students of diverse backgrounds; 2) that are welcoming to all; 3) that promote supportive and inclusive communities; and 4) that contribute to a just and caring campus.

The programs designed to address the whole student affirm the university's commitment to assist all students to develop personal and professional standards of ethical and civil behavior and good citizenship. In developing

students who embody the service orientation expressed in the university motto, opportunities are provided for both undergraduate and graduate students to engage in leadership and experiential learning opportunities. In educating the whole person, comprehensive programs are developed that enhance the quality of life for all students and encourage productive, healthy lifestyles.

Goal I. Contribute to the holistic and transformative educational experiences of Virginia Tech undergraduate and graduate students.

Strategies:

- Create a comprehensive First-Year Experience Program for undergraduate students.
- Provide Transformative Graduate Education (TGE) experiences that foster the professional development of graduate students for the type of careers they will pursue.
- Provide, through the Graduate Life Center, a unique, integrated center that includes graduate housing, graduate life activities, and the Graduate School offices.
- Partner with academic units and external communities to offer leadership, service, and experiential learning opportunities for students that focus on multicultural and international competencies, ethics, and excellence.
- Strengthen the academic, professional, and personal development of students through partnerships between academic departments, university support services, and external stakeholders such as community constituents, parents, alumni, employers, and international partners.
- Partner with academic advising and other departments to provide transitional support to entering transfer students.

Goal II. Promote the development of international and multicultural competencies in Virginia Tech students.

Strategies:

- Create environments that are welcoming, accessible, comfortable, and representative of a diverse and inclusive campus community and that address the needs of students from a wide variety of backgrounds to reflect and stimulate diversity of thought and encourage meaningful participation and dialog.
- Improve campus climate, creating an environment of civility, sensitivity, and mutual respect that offers opportunities that encourage students to have productive and positive interactions with different cultures.

Goal III. Support the university's commitment to continuous improvement by assessing student learning outcomes in co-curricular programs.

Strategies:

- Articulate student learning outcomes that connect co-curricular experiences to the education of students in a developmentally appropriate manner.
- Track student wellness behaviors to evaluate and develop programs that support the education of students by enhancing their health, safety, and wellness.

Goal IV. Improve the capital assets that underpin student learning and support programs.

Strategies:

- Renovate and/or build contemporary residential living and fitness facilities, dining and student union facilities, and medical and mental health services facilities that are accessible to people with disabilities and will attract top-tier domestic and international students.
- Continue renovations and development of the Graduate Life Center and facilities for graduate housing.

Performance Measures:

- Increase the number of undergraduate students participating in residential and co-curricular first-year experiences.
- Increase the percentage of undergraduate and graduate students who engage in leadership programs and experiential learning opportunities.
- Assess and enhance the multicultural and international competencies of the Virginia Tech student community.
- Assess and enhance reporting mechanisms, programming, and interventions to positively impact the campus climate and civility.
- By 2012, complete construction of a new residence hall and an addition to McComas Hall as well as renovate selected undergraduate and graduate facilities such as residence halls, dining facilities, and student unions.

Discovery Scholarship Domain

Introduction

As a land-grant university, Virginia Tech embraces the intrinsic value of research and creative scholarship. In the broader context of "discovery," cutting-edge research and innovative and creative scholarship define the university's role as a forward-looking institution. The discovery mission infuses learning and engagement with a sense of direction, fostering collaborative learning and motivating engagement with the broader community. Discovery enables Virginia Tech to invent a new and better future; it leads to progress in the material sense and to economic development and increased investments. Discovery results in a

purposeful, self-reflexive enlightenment, one that takes into account the needs and perspectives of others.

Economic engines fuel the need for a focused approach to discovery at Virginia Tech, the commonwealth, the nation, and the world. A fundamental restructuring of how state-sponsored universities are funded is under way. Coupled with potential cutbacks in federal research funding associated with budget deficit reduction efforts, these changes in funding bring an enhanced sense of urgency to maximize the effective and efficient use of both current and new resources in order to reach Virginia Tech's expenditure target of $540 million per year by 2012.

The pace of change in publicly supported research funding has quickened, and expectations for return on investment have increased. It is important to develop approaches that allow needed adjustments to be made and to continue the support of core values of a major land-grant university.

The goal of $540 million in National Science Foundation (NSF)-measured research expenditures has been established in parallel to emulating Association of American University (AAU) institutions. To obtain $540 million in NSF-measured research requires externally sponsored research of $375 million in expenses by 2012, yielding a growth rate of 13.5 percent per year. (The 2012 balance, $165 million in NSF expenditures, will come from internally generated expenditures from research-related activities.)

To achieve these objectives, Virginia Tech must enhance its research portfolio with interdisciplinary, multi-college/department efforts fostered by the largest university institutes, in contrast to the single primary investigator (PI) model that has been the most prevalent form of past research. Research expansion will be strategically catalyzed by the growth of new research activities in the National Capital Region and by the continued exploration of partnerships with other institutions.

Success in all missions of the university is dependent upon the caliber and effectiveness of the faculty, but it is especially critical for success in the area of discovery. Recognizing the highly competitive nature of today's research environment, it is essential that areas of research focus be identified that show significant growth potential and build upon existing faculty strengths. It is also essential that we contextualize new discoveries, bearing in mind the global and sociopolitical landscape of the 21st century. The strengths of Virginia Tech's research capabilities include the ability of the university's largest institutes to leverage intellectual and resource capital to achieve these ambitious goals.

The university's institutes include the

- Institute for Critical Technology and Applied Science (ICTAS),
- Institute for Biomedical and Public Health Sciences (IBPHS),

- Virginia Bioinformatics Institute (VBI),
- Virginia Tech Transportation Institute (VTTI), and
- (proposed) Institute for Society, Culture, and Environment.

Within this institutional context, four discovery areas of immediate strategic focus within the broad array of programs consistent with the university's comprehensive mission have been identified for emphasis during the current planning period:

- Energy, materials, and environment;
- Social and individual transformation;
- Health, food, and nutrition; and
- Innovative technologies and complex systems.

These areas take advantage of the existing strengths of the Virginia Tech faculty, including the significant contributions of the university's research faculty, post-doctoral students, and graduate students, while addressing some of the most significant issues confronting global society. There are significant overlaps at the interfaces of these four areas, and they provide a wealth of opportunities for those willing to work collectively across traditional boundaries imposed by disciplines and institutional history. In fact, the most significant opportunities will probably occur at the interfaces, with the innovative technologies and complex systems area viewed as a central, common catalyst for change. Institutions that can marshal the essential resources from a variety of sources and maintain the necessary focus will be those that will continue to progress in a highly competitive world.

Catalyzed by the goal of advancing Virginia Tech to be among the top research universities, a major strategic element of the current plan, significant effort has been expended at the college and university levels to identify and define these four areas of investment and to begin to develop the resources and individual programs needed to successfully bring these areas to maturity. During this strategic planning period, total research expenditures, as reported to the National Science Foundation, are expected to grow to $540 million per year.

This ambitious target will require disciplined investments, responsive and aggressive pursuit of funding opportunities, and streamlined internal operations designed to remove barriers to success. The research agenda requires substantial investments in new and improved facilities, sophisticated equipment, and people.

Energy, Materials, and Environment

Much of the technical knowledge that will transform our society by advancing our understanding of complex systems and by developing technologies that promote an improved quality of life resides in the fields of *energy, materials, and environment.*

These three fields are inherently interwoven in a way that requires both intensively focused and broadly multidisciplinary research activities. This multifaceted research approach can be initiated by building on the strong technical base that already exists at Virginia Tech and that will be expanded by providing mechanisms to allow researchers to converge into multidisciplinary groups to tackle the challenges associated with complex systems within the university and in the National Capital Region (NCR).

The institutes at Virginia Tech will provide this mechanism for multidisciplinary collaboration; e.g., several of the research projects supported by the Institute for Critical Technology and Applied Science (ICTAS) have their roots in the fields of energy, materials, and environment.

Many of the recent and planned investments in equipment and research facilities and the clustered faculty searches have been aligned with the university's priorities within these fields. Continued efforts will be made to maintain this research foundation; to establish new, internationally recognized research programs within these fields; and to apply this technical expertise to fashion a sustainable future both nationally and globally.

Energy

In 2006, 40 percent of the U.S. energy needs are petroleum-derived, with more than 60 percent of the oil imported. With fossil fuels contributing 85 percent of our energy, combustion by-products generate significant pollution problems. Of greatest concern are greenhouse gases that have contributed to record global temperatures and the threat of climate change.

As international pressure on the U.S. mounts and with increasing awareness of the environmental costs associated with the global buildup of these pollutants, demand is growing for environmentally friendly sources of energy. Fossil fuels are also finite resources, and except for coal, economically retrievable fossil fuels will rapidly decline in this century. Remaining large oil reserves are concentrated in politically unstable parts of the world, contributing to price volatility and international tensions to assure access to these resources. Hence, efforts are needed to increase energy conversion efficiency, to reliably and securely distribute energy to meet industrial and consumer needs, and to reduce demand through the design of energy-efficient systems.

Building upon existing faculty expertise to form an energy research consortium, Virginia Tech is poised to become a national leader on energy supply, distribution, and utilization in clean coal, fuel cell, bio-renewable fuels, solar, wind, and nuclear energy. The research consortium has the potential to eventually lead the nation's research efforts on energy sources yet to be envisioned.

Although coal is a carbon-based fuel, we must rely on it for years to come, and Virginia Tech is already a national leader in clean-coal technologies and emerging research in sequestration.

There is also renewed interest both nationally and in Virginia in nuclear energy, where Virginia Tech can play a substantive role in developing safe and reliable nuclear power.

Virginia Tech has leading national expertise in the College of Natural Resources and the College of Agriculture and Life Sciences in forest, fiber, and agricultural systems and the utilization of these renewable resources.

Additionally, the university benefits from significant expertise in the College of Engineering and College of Architecture and Urban Studies, with the Myers-Lawson School of Construction, in designing and constructing efficient “green” buildings, vehicles, power systems, processes, communities, and public policies.

Potential directions for research include building virtual environments to understand energy and environmental problems, e.g., a virtual nuclear reactor, energy grid, mixed energy supply logistics, building design and construction practices, emerging energy technologies, identification and sequestration of pollutants, and mineral processing and geological issues.

Transportation issues remain a major challenge to mobility and safety throughout the U.S. and abroad. Within the U.S. we are experiencing increased congestion on roadways and within the air transportation system. In addition, the U.S. is experiencing rising fuel costs and higher numbers of crashes on our highways, resulting in an increased need for efficient and cost-effective mass-transit systems. Challenges exist related to technical issues, policy matters, and societal impacts.

Virginia Tech is a major contributor to the development of solutions for these issues. The Virginia Tech Transportation Institute (VTTI), the largest university-level research center at Virginia Tech, focuses on solving major transportation problems related to the use of technology to improve transportation safety, diminish traffic congestion, and reduce transportation infrastructure costs.

Likewise, faculty in departments across the university are addressing technical and policy matters that provide improved safety for passengers, more efficient systems for the transport of goods throughout society, and advances in technologies that will produce safer and more fuel-efficient means of transportation.

Materials

Virginia Tech has long enjoyed an international reputation in materials research with strengths in polymeric, ceramic, metallic, composite, electronic, optical, computational, and biological materials. With the *MicrON* clean room renovation, the hiring of advanced materials and nanomaterials faculty in the College of Engineering and the College of Science, and the Advanced Materials Characterization Facility in ICTAS**,** Virginia Tech is prepared to establish a research presence in inorganic nanomaterials, which complements its well

earned reputation in organic nanomaterials, and to address the field of active materials.

Active materials, which encompass smart materials (such as those studied within the Center for Intelligent Material Systems and Structures) that sense and adapt to their environment, is a developing research area that Virginia Tech is uniquely positioned to fill. Applying similar techniques to biomaterials will be an important step in preventive and regenerative medicine that is critically needed for NASA's flight to Mars and for improved medical care on the battlefield.

Virginia Tech's role in the National Institute of Aerospace consortium of universities and NASA Langley Research Center will be used to broaden and support our research progress in these areas. One can envision a distributed network of nanoprobes that relay sensory data to one another, carry out data analysis to form decisions, and initiate appropriate actions – for example, an *in-vivo* nanosensor array designed to seek out and destroy cancerous cells without interfering with an individual's quality of life.

To achieve this and more, Virginia Tech has continued its research in computational materials with System X and the CAVE and other high performance computational systems available across campus in intelligent material design, fabrication, characterization, and manufacturing and in its cross-disciplinary/cross-college research on materials applications.

Environment

Environmental research at Virginia Tech is broadly based in that it spans multiple scales and is evident in every college and focus area of this strategic plan. As a result, this section targets additional areas of environmental research that are particular strengths and growth areas.

First, Virginia Tech has a core strength in water quality-related research from engineered treatment technologies to watershed-scale and geospatial-scale investigations. Our efforts have historically mimicked federal funding efforts, which are largely focused on short-term problems with decentralized and uncoordinated funding agendas. A recent National Research Council report, *Confronting the Nation's Water Problems: The Role of Research*, 2004, has begun to influence the funding agenda for water.

At the same time, Virginia Tech has the potential to merge many existing and new efforts focused on water quality research to meet the growing funding trends in this area. For example, the proposed establishment of a Center for Metropolitan Watersheds, a coordinated effort across five colleges, the Virginia Water Resources Research Center, and the National Capital Region, is an example of how Virginia Tech can position itself to be a leader in water quality research.

Similarly, environmental research in the atmospheric sciences has traditionally been very segregated, despite obvious overlaps between the sub-disciplines that comprise atmospheric science research. This is a growth area for Virginia Tech,

and an effort is under way to develop programs and to integrate cross-disciplinary research in this area.

A substantial priority for the future is environmental health. The National Institute for Environmental Health Sciences (NIEHS) has a strong focus on environmental health, particularly through its various center efforts. Virginia Tech has a strong environmental research infrastructure and, through the School for Biomedical Engineering and Science and its collaborations with the Virginia College of Osteopathic Medicine and the Wake Forest University School of Medicine, is uniquely positioned to coordinate efforts with a focus on environmental health sciences. This focus will include a range of existing health and environment research efforts, including the developing fields of nanotoxicity and environmentally mediated neurotoxicological pathways.

Goal I. Strengthen research activities, with a focus on energy.

Strategies:

- Initiate an energy research consortium focused on energy supply (clean-coal, fuel cell, bio-renewable fuels, solar, wind, and nuclear), distribution, and utilization.
- Explore research opportunities in clean coal technologies and the emerging area of research in sequestration.
- Investigate research possibilities with a focus on nuclear energy.
- Explore the research areas of forest and fiber systems and the utilization of these renewable feedstocks.
- Collaborate on efforts that involve the designing and constructing of efficient “green” buildings, vehicles, power systems, processes, communities, and public policies.
- Develop cross-disciplinary directions for research efforts that include building virtual environments to understand energy and environmental problems, e.g., a virtual nuclear reactor; energy grid; mixed energy supply logistics; building design and construction practices; emerging energy technologies including bio-renewable fuels, identification and sequestration of pollutants, and mineral processing; and geological issues.
- Continue to address technical and policy matters that provide improved safety for passengers, more efficient systems for the transport of goods throughout society, and advances in technologies that will produce safer and more fuel-efficient means of transportation.

Goal II. Strengthen research activities with a focus on materials.

Strategies:

- Establish research initiatives in polymeric, ceramic, metallic, composite, electronic, optical, computational, and biological materials.
- Capitalize on the recently renovated *MicrON* clean room.
- Capitalize on the Advanced Materials Characterization Facility in ICTAS.

- Continue aggressive research in high-performance computational systems.
- Establish research initiatives in intelligent material design, fabrication, characterization, and manufacturing.

Goal III. Strengthen research activities with a focus on the environment.

Strategies:

- Strengthen research partnerships designed to examine water quality.
- Establish a Center for Metropolitan Watersheds.
- Establish and strengthen research initiatives in atmospheric sciences.
- Strengthen multidisciplinary research partnerships focused on environmental health, including the areas of
  - nanotoxicity and
  - environmentally mediated neurotoxicological pathways.

Performance Measures:

Achieve recognition as one of the top three research institutions that focuses on cross-disciplinary and interdisciplinary research as it relates to the discovery of new technologies that lead the United States to a robust, independent, and sustainable energy supply (traditional and renewable sources) in an environment with clean air and a safe and secure water supply.

Strengthen existing expertise and build research capacity in both inorganic and organic nanomaterials in support of the above.

Leverage the resources, facilities, and cross-disciplinary working environment of the Institute for Critical Technology and Applied Science for the discovery of new technologies and for the shaping of emerging policy in support of the above, both in Blacksburg and the National Capital Region.

Social and Individual Transformation

The Social and Individual Transformation component of the Discovery Scholarship Domain is central to Virginia Tech's mission as a land-grant university. The dynamics of economic, social, political, technological, environmental, and cultural change are at the heart of this area of research and creative scholarship, which has application in domestic and international public policy and all aspects of community life.

Building on strengths and accomplishments, faculty members across multiple colleges are poised to contribute in substantial ways to understanding and affecting social and individual transformation. With a strong commitment to inter- and multi-disciplinary approaches; with the use of Virginia Tech's strength in technical areas to leverage creative scholarship, research, and innovation in the humanities, arts, and social sciences; with the creation of a sharper research

focus; and with the strategic investment of new and reallocated resources, the prognosis for success is high.

In today's fast-moving and highly interdependent world, the foundations of social well-being and the quality of individual and community life — employment, health, housing, education, income, security, mobility, environmental quality, and cultural expression and vitality — are more dependent than ever on the complex interactions between the flows and permanencies among capital, ideas, technology, and people.

Scholarship in this area will focus on the causes and consequences of the increased interdependence of economic, social, political, and institutional systems. Research based in social and individual transformation touches both societal and individual life, extending from public policy to personal identity and including explorations of the constructions of race, ethnicity, class, and gender. The results will assist in understanding and addressing critical and emerging issues at the societal and individual levels and contribute toward planning for a sustainable future.

Research at the intersections of individual and society requires innovative and creative thinking from multiple viewpoints and garnering the strengths of multiple disciplines. Examples of these intersections include research in cognition, brain, and behavior; the analysis of democratic systems; the transformative effects of technology on society; new media and communication technologies; language and symbolic systems; the quantitative study of society; literature, and information technology; and the interface between the humanities and sciences in the study of symbolic thinking and practical environments.

Creative scholarship and research in these and related areas require university structures that promote innovation and reward collaboration across disciplines. Making sense of and anticipating the effects of cultural, economic, and sociopolitical shifts are essential for survival and prosperity. Discovery that enables people and communities to interpret, assess, critique, create, and influence the social, economic, political, and cultural will make a difference.

Virginia Tech has a distinguished record of research in many aspects of social and individual well-being and the quality of community life and is committed to strengthening the capacity of the university to address social and individual transformation within the commonwealth and the nation as we move into an increasingly globalized, post-9/11, neoliberal era. Virginia Tech will develop cross-disciplinary and interdisciplinary approaches that are both theoretical and applied and that are of relevance at every scale, from the human body and the individual to the local community, the region, the state, the nation, and the world.

A proposed Institute for Society, Culture, and Environment (ISCE) will be organized as a university-level comprehensive research institute to foster a

creative, interactive, and multidisciplinary environment for intellectually important research and creative effort in the social sciences, humanities, and arts. ISCE can build a diverse portfolio of projects in the Social and Individual Transformation area of strategic focus. This institute also will serve as the main nexus for externally funded interdisciplinary research and creative artistic endeavors.

The principal foci of applied research on social and individual transformation will capture primary concentrations of existing scholarly strength with the potential to engage in multi- and cross-disciplinary efforts to address the implications of globalization for individuals, communities, and regions. These foci are

- governance and globalization;
- community arts, built environments, and urban formations;
- human development and behavioral health;
- rhetoric, representation, and public humanities; and
- social complexity and individual risk.

The proposed institute's activities are projected to cover the Blacksburg campus and to deploy a significant fraction of its efforts in the National Capital Region (NCR). The institute will amalgamate existing strengths in the colleges to form a cohesive program, addressing critical emerging issues in society. An area of focus will be an institute in global issues, and others will be identified in an ongoing implementation process.

The Virginia Tech Alliance of Social, Political, Ethical, and Cultural Thought (ASPECT), a graduate program implemented in 2005, contributes to the development of overarching theoretical aspects of social transformation, including, for example, comparative perspectives on relationships between technology, science and democracy; theories and practices of civil society; analysis of cultural forms of neo-liberalism; migration and citizenship; class, race, gender, nationality, and ethnicity; bio-ethics and bio-power; and media and representation.

Cultural vitality is a critical component of social well-being, creative expression, and quality of life, and Virginia Tech's contributions will be focused on the local and regional scales. The construction of a new Performing and Visual Arts Center will be catalytic in developing the arts. The arts are a clear and direct expression of cultures and global interconnectedness, providing a means of access to societal and individual diversity through multiple artistic vocabularies. Theatre, music, visual art, new media, and dance are valuable tools in opening difficult conversations in societies by exploring values, self-interests, and concerns of the community.

The Virginia Tech Collaborative for Creative Technologies in the Arts and Design (CCTAD) is committed to the transformative power of the arts and to exploring the intersection between human creativity and technology, focusing on digital and

interactive art. CCTAD will work closely with the Art Museum of Western Virginia to establish the New River Valley and Roanoke region as a setting for innovative, world-class art and artists.

Public education, from preschool through college, represents an essential element of social transformation. Virginia Tech is positioned well to be a national leader in developing solutions to a particularly pressing problem: enhancing teaching and learning in science, technology, engineering, and mathematics (STEM). Working with public and private partners, the strengths of the university in STEM areas are increasingly being brought to bear on issues such as improvement of curriculum and pedagogy, examination of socio-cultural factors related to student success, career choice and access to curriculum, and development of best practices in the preparation of personnel as leaders and change agents.

Goal I. Establish the *proposed* Institute for Society, Culture, and Environment to foster collaboration and creative efforts in the arts, humanities, sciences, and the university's other major institutes.

Strategies:

- This proposed university institute will form the nexus for interdisciplinary research efforts addressing critical emerging issues in society and will serve as a complement to the existing major university institutes on problems of mutual interest. An overarching theme in these research areas is an integration of multi-disciplinary skill sets to address crucial aspects of global and regional interdependence. While a number of existing institutes concentrate in some of these areas, the proposed institute will actively integrate researchers in the humanities, social sciences, and science.

Goal II. Strengthen the Virginia Tech Alliance of Social, Political, Ethical, and Cultural Thought (ASPECT).

Strategies:

- Explore research areas that encompass comparative perspectives on relationships between technology, science, and democracy.
- Engage faculty members and graduate students in examining theories and practices of civil society.
- Provide opportunities for the analysis of cultural forms of neo-liberalism, market institutions, migration and citizenship, bio-ethics and bio-power, and media and representation.

Goal III. Expand the Metropolitan Institute in the National Capital Region.

Strategies:

- Create opportunities to produce research on the impacts of advanced Geographic Information Systems on the economic and demographic dimensions of urban development.
- Support research in the areas of suburbanization and quality of life.
- Create research collaboration that examines “green,” “brown,” and “sustainable” models and practices of interlinked urban and rural development and fair growth and housing affordability.

Goal IV. Establish the Virginia Tech Performing and Visual Arts Center.

Strategies:

- Construct a new Performing and Visual Arts Center that will be catalytic in developing the arts. The arts are a clear and direct expression of cultures and global interconnectedness, providing a means of access to societal and individual diversity through multiple artistic vocabularies. Theatre, music, visual art, new media, and dance are valuable tools in opening difficult conversations in societies by exploring values, self-interests, and concerns of the community.
- Continue the commitment of the Virginia Tech Collaborative for Creative Technologies in the Arts and Design (CCTAD) to the transformative power of the arts and to exploring the intersection between human creativity and technology, focusing on digital and interactive art.

Goal V. Initiate PK-12 enhancements in science, technology, engineering, and mathematics (STEM).

Strategies:

- Work with public and private partners to improve curriculum and pedagogy**.**
- Examine socio-cultural factors related to student success, career choice, and access to curriculum.
- Develop best practices in the preparation of personnel as leaders and change agents.

Action Items:

- Invest in social science and humanities programs to address the university’s mission in supporting cultural vitality and creativity.
- Invest in cross-disciplinary graduate programs that address theories and processes of economic, social, and political change and the interdependencies between science and society.
- Invest in research capacity in the National Capital Region and Blacksburg campus in energy (focus on the policy, design, and environmental

dimensions of international energy supply and demand); world economic system integration (focus on interdependencies of financial and intellectual capital and policy in creating new development regimes); and culture and development (focus on the dimensions and consequences of globalization on culture conflict and social transformation).

Health, Food, and Nutrition

Virginia Tech established the Institute for Biomedical and Public Health Sciences (IBPHS) in August 2003 to emphasize and expand collaborative, interdisciplinary research related to biomedical and health issues affecting humans and animals. This new institute complements and extends the capabilities of the Virginia Bioinformatics Institute (VBI).

The mission of IBPHS is to enhance the quality and quantity of research in the biomedical and public health sciences and to develop innovative cross-disciplinary research efforts in the areas that foster the development of new knowledge. This strategy aligns with the NIH Roadmap that describes major future funding to interdisciplinary research teams rather than to single investigators examining a fraction of a problem. IBPHS is currently focusing on two primary areas that build on current research strengths:

> The *infectious disease* area concentrates on the prevention, diagnosis, treatment, and management of naturally or purposely introduced emerging and re-emerging infectious diseases.
>
> *Health, food, and nutrition* areas concentrate on the prevention and treatment of obesity, with a unique comprehensive approach from development and evaluation of new functional foods through behavior change by the consumer.

Three additional areas of interest in IBPHS are *Molecular and Cellular Regulation, Genomic Science, and Neuroscience,* areas that will be more fully developed and expanded over time.

Infectious Disease

Colleges are partnering to cluster-hire faculty in the areas of infectious disease and health, food, and nutrition. These faculty members will focus on similar biomedical problems from different and complementary disciplines. The faculty clusters will share space and equipment; develop multidisciplinary graduate programs; and establish partnerships with the Virginia Bioinformatics Institute (VBI), industry, medical institutions, and other academic institutions that will assist IBPHS to achieve its goals.

Partnerships will also be developed with the Virginia Tech-Wake Forest School of Biomedical Engineering and Sciences (SBES), Carilion Health Systems/Carilion

Biomedical Institute, and the Institute for Critical Technology and Applied Science (ICTAS) to build on current strengths in biomechanics, tissue engineering, imaging, and medical physics.

The first programmatic focus of IBPHS is in research on *host-pathogen-environment interaction (HPEI)-infectious disease*. Virginia has an opportunity to be a leader, both nationally and world-wide, in this important discovery area. In 2004, the commonwealth asked members of the National Academy of Sciences to evaluate a proposal to expand an evolving collaborative program for HPEI research at Virginia Tech. Following their recommendations, Virginia Tech has developed and implemented the multidisciplinary approaches that are essential for anticipating conditions under which new infectious diseases will emerge and old ones will re-emerge. Academy members rated the proposal as having a very high potential for developing nationally and internationally recognized research programs, building upon the demonstrated success of VBI as a potential world leader in bioinformatics and systems biology.

Infectious diseases, including those transmitted through wildlife vectors, pose a serious threat to local, state, and national societal welfare, including risks of tuberculosis, avian influenza, and plant diseases such as soybean rust and sudden death syndrome in oaks. Infectious diseases kill millions of people each year and contribute to the deaths of many more. The impact on biological and social systems is substantial. Public health delivery and response, national economies, and ecosystems are affected by the emergence of new diseases and by the persistence of others. These concerns will be addressed by expanding our existing research programs, including a summary-level approach to solving disease problems (see HPEI research chart) that simultaneously grows university research and spurs economic growth.

Existing expertise and infrastructure in geographic information systems and high-performance computing will contribute greatly to the modeling activities needed to predict and extrapolate disease outbreaks and risks. Achieving the HPEI research objectives and associated benefits will be returned many times over through extramurally funded research, application of findings, and resultant economic growth. World-class educational programs in microbiology must be further developed at the undergraduate and graduate levels to support these efforts.

Health, Food, and Nutrition

The second programmatic focus of IBPHS – *Health, Food, and Nutrition* – promotes and protects the public's health through scientific discovery and information dissemination. This mission will be accomplished using advanced technologies from the development of new functional foods, improved nutrition and food safety, and the adoption of health-promoting behaviors to prevent illness and reduce health costs.

A focus within this mission relates to *prevention and management of obesity.* This is one of the most pressing global public health problems, and Virginia Tech has current research strengths in this area. More than 60 percent of U.S. adults are overweight and more than 30 percent are obese. Obesity is a significant and growing cause of spiraling health costs totaling $69–117 billion per year at the national level in 2003, representing approximately 15 percent of the nation's gross domestic product. Obesity dramatically increases the risk of most chronic diseases including cardiovascular disease, diabetes, hypertension, and some cancers. Obesity and being overweight, which have rapidly increased across the past decade, are approaching smoking as the number one preventable cause of premature death and disease.

The National Institutes of Health (NIH) is developing a strategic plan for obesity research that highlights such research as a key part of its future funding agenda. IBPHS is seeking to enhance development of research initiatives in areas of the greatest scientific opportunity and challenge, including the prevention and treatment of obesity through dietary, medical, and lifestyle interventions. NIH recognizes that effectively addressing the obesity epidemic requires a research approach that *integrates* the study of behavioral causes of obesity and the study of the biological/physiological causes and has expended approximately $1 billion of its total $28 billion of funding for nutrition-related projects in 2003. The Health, Food, and Nutrition research initiative proposes an innovative approach to building research teams designed to address NIH-supported research goals.

The Health, Food, and Nutrition research program is an integrated and multidisciplinary approach that builds on and leverages the existing and developing research strengths of Virginia Tech's colleges and institutes in partnership with other academic institutions and the biomedical industry. Collaborating scientists are developing and evaluating new and more nutritious plant and animal foods, evaluating the science-based impacts of the new foods and lifestyles in preventing obesity and related chronic diseases, and analyzing the economic issues and impact of new foodstuffs and lifestyles.

The focus of the research investigates the biological mechanisms responsible for obesity and its co-morbidities including such chronic diseases as Type-II diabetes and cardiovascular disease. Investigation of causative mechanisms of obesity and their health consequences will facilitate development of foodstuffs and lifestyle intervention strategies to prevent and manage the clinically overweight and obese. Scientists working together in networks that encourage collaboration, such as that proposed for this initial focus in the Health, Food, and Nutrition program, will be needed to solve these complex issues.

Goal I. Establish research strengths in the study of infectious disease.

Strategy:

Strengthen and establish significant research initiatives in host-pathogen-environment interaction (HPEI)-infectious disease prevention, diagnosis, treatment, and management of naturally or purposely introduced emerging and re-emerging infectious diseases.

Goal II. Establish research strengths in the study of health, food, and nutrition.

Strategy:

Establish research programs that explore the prevention and treatment of obesity with a unique comprehensive approach from development and evaluation of new functional foods through behavior change by the consumer.

Performance Measures:

Maintain recruitment and hiring emphasis on interdisciplinary research teams rather than single investigators to address problems.

Continue to develop both facility and faculty strength in HEPI – infectious diseases.

Leverage partnerships with Virginia Tech-Wake Forest School of Biomedical Engineering and Sciences (SBES), Carilion Health Systems/Carilion Biomedical Institute, Virginia Bioinformatics Institute (VBI), the University of Maryland-Baltimore Public Health School, the Institute for Critical Technology and Applied Science, and the Virginia College of Osteopathic Medicine (VCOM) to build on current strengths in biomechanics, tissue engineering, imaging, medical physics, and public health.

Develop and evaluate functional foods in combination with consumer behavioral change as a means to prevent and manage obesity.

Innovative Technologies and Complex Systems

In its conception, Innovative Technologies and Complex Systems is placed at the center of the other three discovery research areas, with an implied role of powering progress in these areas through the use of cutting-edge technologies and the development of systems to solve complex problems.

Innovative Technologies

Innovative technologies have encompassed different specificities through time. In the past, microelectronics and advances in silicon technologies would fall within this description. At present, Virginia Tech is among the leaders in innovative technologies such as geographic information systems (GIS), wireless technologies, high performance computing (especially as it relates to grid computing), power electronics and robotics, biotechnology, and materials research. Progress in these technologies will continue to be of critical importance over the upcoming six-year planning period.

A more recent manifestation of innovative technologies is nanoscale science and engineering (nanotechnology). Nanoscience is a scientific frontier where molecular and cellular dynamics are critical and an area in which breakthroughs in discovery will take place in the years to come. Nanotechnology is a defining tool for progress if Virginia Tech aspires to scientific and technological leadership in the near future.

The importance of nanotechnology as an indispensable tool for high-impact discoveries has been recognized by funding agencies at federal and state levels. For the 2006-07 fiscal year, the National Nanotechnology Initiative (NNI), which coordinates research activities across several agencies, is requesting over $1 billion to support research. NNI estimates that resultant new technologies and products will reach $1 trillion by 2015. The Commonwealth of Virginia is considering a one-time research expenditure of $255 million for fiscal year 2006, a significant portion of which targets nanotechnology.

Industry interest in nanotechnology is growing and pervades several areas. Among these areas are the pharmaceutical industry, where drug delivery and therapies based upon cellular responses are reaching critical attention; the biomedical and biotechnology industries, where biomaterials based upon nanotechnology are on a steep growth curve; the energy industry, where fuel cells and other alternative energy sources depend upon advanced materials; and the critical technologies sector, where nanotechnology has given rise to sensing and imaging devices that enable real-time studies of cellular functions and materials characterization.

One of Virginia Tech's greatest competitive advantages is in the area of advanced computing. The development of the System X supercomputer and the continuing effort to achieve petascale computing capabilities provides researchers with the technologies to address the important issues in emerging areas of design and discovery.

Complex Systems

In broad terms, a complex system refers to any aggregate that includes self-regulation, with feedback or adaptation in its dynamics. Biological systems provide many examples of complex systems, and sophisticated computers and sensors are examples of intentionally designed complex systems. Complex systems have been studied and exploited intensely for many years. The realization that complex systems have common underlying structures despite their apparent differences has spawned the inclusion of this area in the Discovery Scholarship Domain.

The ecosystem, weather, financial systems, disease surveillance, epidemic simulation, transportation, and rocket and satellite guidance systems are examples of complex systems. As miniature sensors are developed and placed

in the environment, advances in understanding the complexity of abiotic and biotic factors within a very complex ecosystem will greatly increase.

Virginia Tech has many existing strengths in complex systems. Among these are a strong program in macromolecules and interfaces; in materials research at the nanoscale level; in fabrication; in imaging and sensing; and, most important of all, in its strengths in bioinformatics, systems biology, computational science, engineering, and transportation. Strength in these areas has been significantly augmented since 2004 through a coordinated multi-disciplinary faculty recruitment effort across several colleges.

Relationships put in place recently with Wake Forest University (through the School for Biomedical Engineering and Sciences), Georgetown University, Carilion Health Systems/Carilion Biomedical Institute, the Virginia College of Osteopathic Medicine, The Institute for Genomic Research, and the University of Maryland-Baltimore County afford access to medical facilities and related resources ideal for complementary research.

An expanded view of complex systems builds on the successes of the Virginia Bioinformatics Institute (VBI) in systems biology and bioinformatics and leverages strengths to achieve leadership in this important area of research. The emergence of new areas of achievement within VBI in modeling and simulation of populations provides a key area for growth in the National Capital Region in alignment with defense and homeland security initiatives.

Virginia Tech has invested significantly in several institutes to nurture the activities within the area of Innovative Technologies and Complex Systems. Four of these institutes have prominence within the university and are already contributing to the production of knowledge and research in innovative technologies and complex systems. ICTAS, IBPHS, VBI, and VTTI are making significant contributions. ICTAS and VBI are securing developments in innovative technologies including nanotechnology, advanced information technology, high performance computing, and bioinformatics. IBPHS is tackling critical issues in that quintessential complex system, the health and well-being of humans and animals. VTTI continues to be a national leader in addressing transportation-related issues. The proposed institute within social and individual transformation is targeted to research broad-reaching and complex systems that impact the entire globe.

Each of Virginia Tech's eight colleges is investing in innovative technologies and complex systems. Recent cluster hires of faculty members have resulted in the addition of almost 100 new faculty members interested in enhancing the use of technology and advanced science for the purposes of expanding and understanding complex systems.

Nanoscience and nanotechnology are approaching a maturity that raises the issue of disciplinary recognition through the awarding of academic degrees.

Institutions elsewhere have put in place such undergraduate and graduate degree programs. ICTAS and IBPHS are the appropriate entities to supply the coordination of the research infrastructure for Virginia Tech to reach its goals. The implementation of academic degree programs could be achieved through creation of a School for Nanotechnology.

Virginia Tech's existing research strengths and recent hiring decisions position the university to foster vibrant programs at the nexus of innovative technologies and complex systems. The other three Discovery foci: energy, materials, and environment; social and individual transformation; and health, food, and nutrition will benefit from a pervasive, strategic commitment to innovative technologies and complex systems. Virginia Tech is poised to take a leadership role in each key area and to achieve the ultimate goal of being among the elite institutions of higher education in the world.

Goal I and Strategy. Achieve research strength in the areas of innovative technologies and complex systems through the strategic integration and support of critical research areas:

- **Nanotechnology**
- **Bioinformatics**
- **Biotechnology**
- **High performance computing**
- **Power electronics and robotics**
- **Wireless and optical technologies**
- **Geographic information systems (GIS).**

Performance Measures:

Power developments in the complex systems represented by the three other discovery domains using the technology made possible by discoveries in the sciences and engineering.

Provide the context for activities for all five of the major research institutes within Virginia Tech and the attendant academic programs for students across all colleges.

Focus specifically and immediately on nanotechnology, culminating in a proposed School for Nanotechnology that brings together these elements in a cohesive whole.

Position Virginia Tech to be competitive in securing the significant comprehensive grants and procurements to lead the university to the level of prominence that is the ultimate aim of the Strategic Plan.

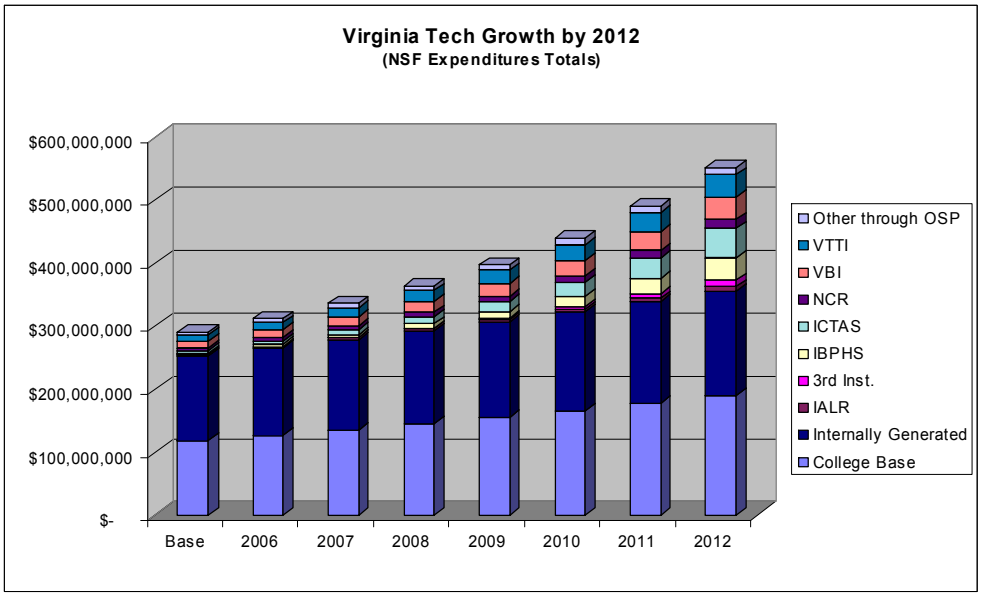
Leverage research strength to expand research presence in the National Capital Region.

University Level Benchmarks:
Goals, Proposed Metrics, and Assessment Procedures

Projected Outcomes:

- Reaching $540 million in university research expenditures by 2012.
- Expenditure growth in both individual college base and college research supported by institutes and centers.
- Twenty-seven affiliated National Academy members by 2012.
- Growth in faculty awards and post-doctoral appointees.

Roadmap to $540 M in Expenditures



Indicators of Performance:

- Using American Association of Universities (AAU) criteria, measurements of the following:
  - Proposals submitted (count and dollar value)
  - Proposals awarded (count and dollar value)
  - Research expenditures
  - National Academy members
  - Faculty awards
  - Postdoctoral appointees

Note: Institute contributions will be linked back to colleges and their faculty.

Annual Performance Goals:

	Current	***2006***	***2007***	***2008***	***2009***	***2010***	***2011***	***2012***
1) College direct ($M)	117.8	125.1	132.8	141.0	149.7	159.0	168.8	179.2
2) Institute	37.7	46.2	57.5	71.8	90.8	116.5	151.9	196.1

related ($M)								
3) Internally generated ($M)	135.0	139.1	143.2	147.5	151.9	156.5	161.2	166.0
4) Total NSF expenditures ($M)	290.5	310.4	333.5	360.3	392.4	432.0	481.9	541.3
5) National Academy members	13	14	16	18	21	22	24	27
6) Faculty awards	13	15	24	31	29	48	57	68
7) Postdoctoral appointees	278	336	368	424	469	512	551	594

Discovery Domain Assessment Procedures:

Evaluation:

- Monthly reports on research proposals, awards, and expenditures by Office of Vice President for Research.
- Biannual reports on academy members, faculty awards, and post-doctoral appointees.
- Annual reviews of college research performance.
- Annual reviews of the contributions of centers and institutes to increased scholarship.

- **Planning:**
  - Annual reassessment of university and college goals and strategies to reach those goals.
  - Annual review of performance and planning with board of visitors Committee on Research.

- **Implementation:**
  - Evaluation and planning outcomes inform annual budget process.

Engagement Scholarship Domain

As Virginia's senior land-grant university, Virginia Tech is committed to engaging its intellectual assets to address the economic and social needs of communities around the commonwealth, the nation, and the world. This commitment is based on the university's motto *Ut Prosim* (That I May Serve) and is founded on principles of an engaged university:

- Engagement cuts across and is embedded in all missions.
- All disciplines of the university are expected to participate.
- Faculty involvement and rewards are tied directly to scholarship and quality outcomes.

- Relationships with communities and partners are defined as being
  - bi-directional and reciprocal;
  - partnership-based, i.e., parties make investments in and get benefits from specific projects; and
  - mutually respectful of the strengths and needs of all parties and involved in a regular, healthy exchange of ideas.

Overarching goal of the Engagement Scholarship Domain: Engage in strategic partnerships that enhance the economic and social well-being of individuals, families, businesses, and communities around the commonwealth, the nation, and the world, and enrich and strengthen the university's discovery and learning missions.

Goal I: Connect the university's discovery, learning, and engagement assets through partnerships with both the public and private sectors to advance the economic vitality of the commonwealth and the quality of life of its citizens.

Our society is shifting to an innovation-based economy. As such, the sustainable competitive advantage of the U.S. will be in higher-value products and services versus low-wage labor. This trend has led federal, state, and local government officials; representatives from businesses and communities; and individuals to look to institutions like Virginia Tech to enhance their economic competitiveness and long-term success. The outcomes these stakeholders are expecting from knowledge generated through discovery in a robust research program include new jobs, better paying jobs, increases in wealth, and an improved quality of life.

Virginia Tech's mission states: "The university creates, conveys, and applies knowledge to expand personal growth and opportunity, *advance social and community development, foster economic competitiveness, and improve the quality of life*" (italics added). Virginia Tech is committed to its leadership role and contribution to the economic vitality of the local region, the Commonwealth of Virginia, and the world.

The university is one of the region's largest employers with thousands of faculty and staff. The purchases by employees and students are a major driver of local commerce. Additionally, Virginia Tech's many campus-based athletic, cultural, and professional education events annually bring to the region hundreds of thousands of visitors who pump millions of dollars into the local economy.

The direct and residual contribution of the university's $270 million in sponsored research stimulates significant job growth. For example, each $1 million investment in research generates approximately 31 new jobs. The transfer of faculty-created technology to the marketplace manifests itself in the creation of

spin-off companies, licensing to existing companies, additional research and technical assistance projects, and public/private partnerships.

To nurture this increased emphasis on commercialization, the university has invested heavily in additional personnel to assist faculty in these new ventures.

Also, through the Virginia Tech Foundation, the university has provided leadership to the development and growth of the nationally recognized Corporate Research Center (CRC). As a showcase of entrepreneurial enterprises, the CRC currently has more than 120 companies and 1,800 employees and significant expansion is anticipated over the next six years.

In addition, the Virginia-Maryland Regional College of Veterinary Medicine engages in translational research and medical services contributing to the economic vitality of the region.

As Virginia's senior land-grant university, Virginia Tech is uniquely positioned to be a significant partner in the commonwealth's economic strategy. The university annually produces thousands of technology-savvy graduates, most of whom enter the workforce, and the state's largest number of doctoral degree holders. Continuing and professional education programs annually reach more than 50,000 professionals through short courses, conferences, seminars, and workshops. Thousands of other working adults receive graduate credit courses and degree programs at the six Commonwealth Campus Centers and through distance and distributed learning programs. Additionally, faculty members provide technical assistance, consulting, applied research, and service learning activities with students to improve businesses and communities across the state.

Virginia Cooperative Extension continues to be a vital contributor to the competitiveness of the agricultural, health, and life-sciences sectors of Virginia's economy. Through its extensive network of 107 local Extension offices, six 4-H educational centers, and 13 Agricultural Research and Extension Centers across the state, Virginia Cooperative Extension provides research-based information and technologies that contribute to the well-being of individuals, families, and communities across the commonwealth.

In the economically distressed Southside region of the commonwealth, the university helped create and supports the Institute for Advanced Learning and Research (IALR) in Danville. IALR currently has over $20 million in four sponsored research foci, each with a commercial dimension, to transform the economy of Southside.

The university is working with state and local leaders to establish regional research and development centers in four other distressed communities in Virginia, each focusing on a major existing business cluster. The university continues to support the Southside Business Technology Center in Martinsville

that provides strategic planning and business development services to businesses in Southside, Virginia's Philpott Manufacturing Extension Partnership, and other agencies and organizations that contribute to the state's overall economic program.

With the National Capital Region becoming increasingly important to the economies of both the state and the nation, the university will leverage and grow its presence there to better access the unique opportunities and assets that exist in the region. Program ventures include expanded research programs targeted at key sectors of the federal agenda; high-end professional education programs for business, the technology sector, and government; and new collaborations with non-government and international organizations.

In today's world, the full success of the university's economic vitality commitment is contingent upon connections to an ever-emerging global marketplace. The university's international strategic plan articulates a bold vision that includes existing or planned programs in Switzerland, Asia (India and China), Dominican Republic, Egypt, Mexico, and Africa.

Additionally, the university will leverage its position as the third largest university recipient of funds from USAID to expand and enhance programs that address the economic health of impoverished regions of the world, as well as connect opportunities in these regions with Virginia interests.

Strategies:

- Increase commercialization activities emanating from faculty research, including the number of public/private partnerships initiated, patents filed, spin-off companies created, licensing income generated, and research and technical assistance projects completed with businesses located in the Corporate Research Center and across the commonwealth.
- Increase research, education, and outreach interactions with international organizations and businesses with commercial interests in Virginia.
- Increase enrollments in Extension, continuing education, and lifelong learning programs that educate, train, retain, and retrain the workforce in targeted fields with skills necessary to contribute to a strong economy.
- Establish regional research, development, and innovation centers.
- Lead economic and community development efforts in targeted regions such as Roanoke/New River Valleys, Southside, and Southwest Virginia.
- Create and leverage partnerships with local, national, and international organizations uniquely accessible in the National Capital Region.

Performance Measures:

Number of patents filed by faculty, staff, and students.
Number of companies created from faculty research activities.
Number of participants in Extension and professional and continuing education programs.

Number of regional research, development, and innovation centers developed and implemented.

Goal II. Foster communities that value all cultures, languages, lands, and people by strengthening the international and multicultural expertise of students, faculty, staff, alumni, and constituents.

The university's commitment to enhanced international and cross-cultural awareness and understanding is based on the recognition that its graduates live and work in a world that is culturally diverse, interdependent, and interconnected economically. The university must educate students to contribute and thrive in this global environment. The success and societal contributions of Virginia Tech graduates depend upon their familiarity with the world beyond the borders of the U.S.

To be competitive domestically, Virginia Tech must be competitive internationally. The university recognizes that international research and scholarship contribute tangibly to the university's competitiveness and provide opportunities for faculty members to make important contributions to the economic well-being and quality of life of people around the world.

Breakthrough innovation frequently involves international collaborations, making the increasingly global character of university engagement valuable to the university's mission. Virginia Tech must have effective practices for internationalization and diversity in order to compete with highly regarded peer institutions around the world. Investments comparable to other world-class universities are necessary to attract the best students and facilitate internationally acclaimed research and scholarship.

Virginia Tech will invest in transformative institutional change to strengthen its position as a world-class university of scholarly innovation, instruction, and outreach. The university will advance its international position by enhancing program activities at the Center for European Studies and Architecture and through the development of new international venues. By 2012, the university will have at least five international initiatives that will serve as hubs for program expansion in key regions of the world. The initiatives may involve facilities and services to support regular faculty and student exchanges, research and teaching collaborations, and new engagement ventures that address global issues

Woven into the strategy is a participatory process that involves all stakeholders who are key partners with the university's work and contributors to the following mission and vision for the university's international position:

Virginia Tech's International Mission
Virginia Tech fosters a community that values all cultures, languages, lands, and people. The university seeks to enrich its international competence and to enhance the quality of life throughout the world with scholarly engagement in education, research, and outreach.

Virginia Tech is committed to applying its core values to its international programs and activities. The following values have special significance for the university's international mission:

- *Cross-cultural understanding* that recognizes the dignity of all people.
- *Critical reflection* that seeks alternative perspectives to illuminate and challenge our own.
- *Rigorous engagement in the learning process* that measures our scholarly activities against international standards of excellence.

Through its international efforts, the university will develop and nurture the following competencies:

- Language skills, which facilitate communication with partners from across the globe in learning and scholarship and which enable a nuanced understanding of ideas from various cultures.
- Personal cross-cultural experiences, which provide a working knowledge of the ideas and customs of the world's societies.
- Understanding, respect, and appreciation of various cultures and traditions, which provide a foundation for cooperation and engagement with people from around the world.
- Scholarly engagement that creates knowledge with which lives are improved.

Strategies:

- Fully implement the Virginia Tech International Strategic Plan to lead to the following major outcomes:
    - An increase in the number of students participating in education abroad programs and foreign language courses**.**
    - An increase in the number of faculty members engaged in international and multicultural research, education, and outreach**.**
    - An increase in the number of language offerings for students, faculty, and staff**.**
    - Enhanced international and cross-cultural content of the curriculum.
- Develop and implement an international competency certificate as part of the undergraduate experience.
- Develop five international regional program centers.
- Launch a comprehensive program in a new Visual and Performing Arts Center that contributes to enhanced engagement in cultural and international education throughout the university.

Performance Measures:

- Number of students participating in education abroad and foreign language courses.
- Number faculty/staff engaged in international and multicultural research, education, and outreach.
- Creation of an international competency certificate at the undergraduate level.
- Number of regional program centers.
- Number of participants in international/cultural programs in the Visual and Performing Arts Center.

VT-STEM

Education in science, technology, engineering, and math (STEM) is at the forefront of our nation's agenda. National and global development and sustainability are contingent upon fostering discovery and development in the STEM disciplines. Learning STEM concepts and skills not only prepares students to enter the workforce and develop productive careers, but it also gives learners skills to make informed decisions. Strong partnerships among schools with grades PK-12 and universities are necessary to ensure that STEM education efforts have the potential to meet these needs and enhance the scientific and technological literacy of our nation's workforce. Schools require equitable access to research-based STEM content and education resources. Additionally, there is a growing need for STEM teacher preparation, pre-service education, induction, and in-service professional development. As the commonwealth's senior land-grant university with special expertise in STEM fields, Virginia Tech is uniquely positioned to provide statewide and national leadership in transferring STEM research discoveries to PK-12 classrooms.

In addition, science learners of all ages, from kindergarten through graduate school, need to understand scientific inquiry, or the process of science. Scientists and engineers are trained to problem-solve by critically evaluating data, carefully considering others' ideas, and making informed choices about what experiments to conduct. Teaching students the skills of scientific inquiry and problem solving helps them to evaluate information in the newspaper and on television, carefully consider physicians' recommendations about their healthcare, and make informed choices as consumers.

Pre-college science education reform has focused on integrating scientific inquiry into all science learning experiences. Steps are being taken at the undergraduate level to emphasize design, discovery, and real-world problems rather than lecture-based information delivery. Graduate education in the sciences requires students to *do* science, from designing experiments to analyzing data to communicating findings.

Virginia Tech is committed to fostering exchanges of scientific and pedagogical expertise between PK-12 and university communities. One of several mechanisms for enabling this dialogue is the Graduate School's Citizen Scholar Experience, through which graduate students in STEM fields share their skills and knowledge with PK-12 communities. The ultimate goal of such discourse is the creation of a STEM teaching and learning continuum from pre-kindergarten through graduate education.

The School of Education is bringing greater focus on STEM education through the recruitment of a senior scholar, who will lead a new interdisciplinary program in STEM teaching and learning research. Faculty and staff across the disciplines are engaged in strategic partnerships with PK-12 STEM education programs through Virginia Tech's Science, Technology, Engineering, and Mathematics K-12 Education Outreach Initiative (VT-STEM). VT-STEM serves as a bridge between PK-12 schools and the university by facilitating quality PK-12 STEM educational experiences; collaborating with the PK-12 community to enhance teacher preparation and professional development; and supporting Virginia Tech students and faculty in developing, implementing, and sustaining PK-12 STEM programming. The university will leverage its assets across the commonwealth, represented by 4-H and other education programs, to directly involve youth in STEM education programs.

Anticipated outcomes of these endeavors are PK-12 students who are better prepared for advanced education in STEM disciplines and PK-12 teachers who have easy access to STEM expertise. In addition, these efforts will result in university faculty who are champions for PK-12 education and model good teaching practices for future science and math teachers.

Goal III. Enhance PK-12 education and its continuity with undergraduate and graduate education, especially in the key disciplines of science, technology, engineering, and mathematics (STEM).

Strategies:

- Implement and expand PK-12 STEM teacher preparation.
- Implement and expand STEM partnerships and collaborations between the university and PK-12 schools.
- Provide quality STEM professional development for PK-12 teachers and other educators.
- Develop and implement a continuum of recruitment, from PK-12 to STEM undergraduate programs to STEM education graduate programs (teacher licensure, specialist degrees, etc.).

- Strengthen research and scholarship efforts related to PK-12 STEM education.

Performance Measures:

- Number of graduates prepared to take STEM teaching positions in PK-12 schools and STEM specialist positions in PK-12 school divisions.
- Number of PK-12 teachers and students in the commonwealth served through the university's educational support programming (graduate courses, continuing education programs, advanced certificate programs).
- Number of PK-12 students who successfully matriculate into and complete post-secondary education in STEM fields.
- Number of STEM undergraduates who successfully matriculate into and complete graduate programs in STEM education.
- Number of youths participating in non-formal and informal STEM-related projects.

Service Learning

Top universities across the nation are committed to empowering students and enhancing the student experience at the undergraduate and graduate levels with service-, civic-, and business-based educational opportunities that extend beyond the classroom. Students who participate in service-learning and student engagement activities contribute to our local, national, and international communities via curricular and co-curricular activities with community partners. Students relate their engagement activities with domestic and international partners to their studies and other university-based experiences, allowing for real-world application of their learning and the development of personal, professional, leadership, and citizenship skills.

Integrating civic engagement with academic learning enriches the outcomes for the student and for society. The pedagogy of service learning and civic engagement links disciplinary study and community service with structured reflection. Civic engagement results in improved academic performance that deepens the learning experiences of the student and enhances the transfer of knowledge. Cooperative education, internships, externship experiences, and jobs in business and industry provide students with opportunities to expand their curricular and co-curricular knowledge and skill base.

Goal IV. Engage students, at the undergraduate and graduate levels, in opportunities for service learning and experiential education that prepare them to serve a diverse and complex marketplace and society while building the capacity of communities.

Strategies:

Broaden the array of service-learning and student engagement experiences through curricular change such as a) the development of capstone activities; b) the integration of additional components of service, community-based research, and civics into the curriculum; and c) internationalization of the service-learning and engagement curricula.
Provide professional development activities, tools, and resources to support the involvement of faculty, staff, community partners, and students.
Increase the institutional capacity for documentation, assessment, and evaluation of service-learning and student engagement activities.

Performance Measures:

Number of academic courses that integrate service learning.
Number of graduate students participating in the Citizen Scholars program.
Number of established partnerships with businesses/agencies that host service learning and experiential education opportunities for students.
Number of students participating in service learning and experiential education programs.

Foundation Strategies

Organizational Development: Fostering a High Quality Diverse and Inclusive Academic Community

Human resource and work/life strategies support the achievement of the university's missions by attracting and retaining the best instructional, research, and administrative/professional (A/P) faculty and staff; investing in their development; and supporting them by providing a high quality of work life. The university is faced with several key choices that will impact our ability to continue to recruit, retain, and develop an excellent and diverse faculty and staff. The objectives in this section are intended to foster and further develop a sense of community such that our faculty and staff work in an environment that supports their efforts in an atmosphere of mutual respect.

Goal I. Provide competitive compensation based on market data.

Faculty commitment to the multiple missions of the university emphasizes the need for new policies that reward achievements in strategic activities. Base compensation and incentive strategies must be considered, including strategies to shift base salaries to grants and contracts. Analyses indicate that the salaries of teaching and research faculty will achieve the 60^{th} percentile over the six-year planning period with 4 percent annual increases; however, the university must continue to evaluate trends in faculty compensation to ensure that steady progress is made in providing competitive compensation.

Without attention to staff compensation, the university will not be able to continue to recruit and retain the caliber of staff needed.

An analysis of (A/P) faculty compensation, while more difficult given the limitations on appropriate market data and an undefined job structure, is also necessary.

Strategies:

- Make annual investments in faculty compensation to achieve the 60th percentile of instructional faculty salaries for Virginia Tech's peer institutions by 2012.
- Implement a specific compensation strategy for staff, research faculty, and A/P faculty that addresses the university's goals relative to appropriate market data and available benchmarks.
- Make annual investments in the compensation of staff and A/P faculty to ensure that competitive market compensation is achieved.
- Implement incentive programs that meet institutional and unit goals.

Goal II. Enhance current programs and establish new programs to recruit, retain, and develop the best faculty and staff.

With retirements projected at an annual rate of 12 percent of the workforce over the next six years, the recruitment of new and development of currently employed instructional, research, and administrative/professional faculty and staff will provide the foundation for succession planning and knowledge transfer. Further, increasing efforts to diversify by increasing the number of women and underrepresented minorities hired into faculty and staff ranks must continue. Faculty development and mentoring programs are in place and will provide opportunities for faculty members to obtain focused training and experience in international research, diversity, laboratory management, fiscal skills, and other areas relevant to leadership. Some staff development programs are also in place, including programs that foster networking, mentoring, and training. Through the collaborative efforts of several university offices, new faculty and staff programs have been proposed that will further enhance programs already in place as well as initiate new programming opportunities.

Strategies:

- Develop workforce plans and strategies that seek to recruit, promote, and retain a qualified, diverse, and engaged workforce.
- Continue efforts to recruit and retain women and underrepresented minorities in staff positions and in instructional, research, and A/P faculty ranks.
- Design and implement a comprehensive Leadership, Management, and Supervisory Development Program for faculty and staff.
- Ensure that necessary accommodations and support services are provided for faculty, staff, and students with disabilities.

Provide a professional development program that nurtures leadership, addresses programs related to succession management and mentoring, and provides other avenues where information can be exchanged among peers in similar positions/roles.

Continue current recognition programs for accomplishments and develop new opportunities for recognition.

Goal III. Promote the health and welfare of the university community.

Virginia Tech has been considered one of the region's employers of choice for many years, primarily due to the benefits package and work/life policies that have been provided to employees. Over the past several years, however, the university has not kept pace with industry standards in these areas. The university's Employee Benefits Committee identified the gap in income protection for short-term disability as the most urgent benefits issue for research faculty. Options should be explored to address this deficiency. The establishment of the dual career coordinator is having a positive impact, and further investment is needed to address additional requests. Availability of quality childcare for employees as well as graduate students continues to be an issue of concern. Virginia Tech is among the major universities looking at family-friendly policies. There is no doubt that future competitiveness requires attention to these issues.

Strategies:

Establish programs that address critical gaps in benefits coverage and employee services.

Establish family/work-life policies that are comparable to the programs at other major public universities.

Continue to promote and provide preventive services (i.e., vaccinations and health screenings) to the university community.

Continue to make investments in graduate student health insurance.

Goal IV. Establish comprehensive and responsive human resources programs and services.

To fully support the growing needs of our staff, Human Resources (HR) must become a strategic partner with colleges and administrative units. This will require a greater focus on services aligned with the needs of the units and require a different level of HR expertise and new service delivery models. The restructuring act will provide greater flexibility over a number of HR program areas while creating greater complexity with the administration of two systems for non-faculty employees. Workplace issues have become more complex and sensitive as the university faces changes in leadership at all levels, workload pressures, and a more diverse community. Additional resources are needed to facilitate more effective management and coaching, to conduct workplace/climate

assessments, and to design interventions to promote a healthy and productive workplace.

Strategies:

- Enhance employee relations services and coaching to improve successful movement into management positions.
- Ensure consistent and effective application of faculty and staff performance evaluation processes.
- Facilitate the use of technology and continuous improvement methods to streamline university programs and processes.

Goal V. Foster a diverse and inclusive community that supports mutual respect.

With adoption of the Principles of Community, the university articulated its commitment to create a truly diverse and inclusive community and provided a guide for improving the university climate for all people. Virginia Tech will draw on the collaborative efforts of many offices, including Multicultural Affairs, Equal Opportunity, Provost, Student Affairs, and Human Resources, in building the capacity to recognize and value differences, to sustain the positive momentum that we have experienced, and to continue supporting positive interactions among diverse populations.

Strategies:

- Establish and support programs that enhance campus/workplace climate, safety, and community.
- Implement sexual harassment and non-discriminatory training for all faculty and staff.
- Increase diversity training opportunities to continue to improve cultural awareness and foster a welcoming university climate for all visitors and members of the university community.
- Engage in partnerships with alumni, emeriti faculty, business, and government partners that advance the opportunities for learning and working in collaboration with diverse and cross-cultural communities.

Goal VI. Continue to promote an efficient administrative culture that promotes a commitment to quality and service.

Competing resources require that administrative operations continue to look creatively at developing new strategies for gained efficiencies. Further, as technological advancements are enhanced, processes should be streamlined. Attention to all customers, whether they are students, campus visitors, faculty, or staff, are a priority, and improved customer service should be incorporated into enhancements as they are made.

Strategy:

Promote innovative administrative processes that initiate and take action on suggestions and proposals for enhancing quality, improving cost effectiveness, streamlining operations, and/or improving customer service.

Performance Metrics per the Higher Education Restructuring Act

Percentage of turnover as an indicator of staff stability and staff satisfaction compared to the average percentage turnover rate trend with College and University Personnel Association (CUPA) – Human Resources (HR).

Internal transfers/promotions as a percentage of total number of hires as a measure of the extent to which the institution hires or promotes from within compared to the percentage rate with CUPA-HR benchmark.

Average number of days to classify new positions or reclassify a staff position as a measure of effectiveness of the classification process compared to the percentage rate with CUPA-HR benchmark.

Average number of days to hire staff, from recruitment posting to the candidate's acceptance, compared to trend data against baseline average in 2005-2006 or average over past three years.

Compliance with restructuring act election provisions.

Performance Metrics per the University's Affirmative Action Plan

Faculty by race/ethnicity and gender

Staff by race/ethnicity and gender

Investment in Campus Infrastructure

In order to adequately support the learning, engagement, and discovery missions of the university, there must be adequate infrastructure in facilities and administrative operations. With the approval of the restructuring act, the university will gain greater authority over many of its administrative processes, which will allow for more effective management of the university as a whole, as well as over the areas of facilities, information technology, and business services. As the university continues to grow at a rapid pace, several key choices must be addressed to ensure the most effective management of the university's infrastructure and physical environment. The objectives in this section are consistent with the Campus Master Plan and are intended to enable the university to respond to requirements necessary to become a top research university.

Goal I. Effectively manage the university's space and land resources for learning, living, and work.

With the substantial amount of research growth, existing facilities are either at capacity or outdated and in need of renovation to meet basic academic and

research space needs. More and better quality classrooms are needed to enhance undergraduate education. Structurally, many of the older buildings do not support the economical installation of leading advancements that are essential for safe and operable laboratories. The university has become more dependent upon the Virginia Tech Corporate Research Center (CRC) to provide overflow research space. A comprehensive space management system is needed to merge all current systems related to infrastructure and to track both on- and off-campus space. This system will allow the university to better manage space and land as the campus grows, as well as provide a mechanism to ensure that the maximum amount of indirect costs can be recovered on sponsored projects. In conjunction with the development of the Campus Master Plan, the university needs to work to maintain the pedestrian nature of campus and to continue to implement safety measures. Parking structures will need to be constructed in the near future. With the expansion of campus and the relocation of some programs to the CRC, the need for adequate transportation is heightened.

Strategies:

- Create flexible, high quality accessible spaces for learning, living, and working that address the changing needs of the university.
- Identify a formal system to provide administrators with the necessary tools to effectively manage university facilities and space.
- Build on the opportunities offered through university-related corporations, strategic collaborations, and partnerships in the growth of state-of-the-art research facilities that are a “bridge” between industry and the academic environment.
- Continue to upgrade the physical environment to ensure that ADA accommodations and OSHA regulations are addressed.
- Integrate the scholarship domains by developing campus facilities in a manner that fosters collaboration along the lines of “quadrants” for our community of scholars and researchers.
- Identify and implement transportation and parking solutions that maintain the pedestrian nature of the campus while providing adequate access to integral sites adjacent to campus and perimeter campus routes to reduce inner campus congestion.
- Renovate residential and student spaces to provide students with facilities that are conducive to quality learning and social interaction.

Goal II. Enhance health, safety, and security operations to support the university’s discovery, learning, and engagement endeavors.

With the university’s emerging participation in the biological and medical fields comes the need for higher security. Currently, the university has stand-alone security systems that are hard to manage centrally. A comprehensive security system for all areas that addresses varying levels of security is necessary. A

committee was established in fall 2005, and work is under way to develop a university-wide Emergency Preparedness Plan outlining the university's procedures for managing major emergencies that may threaten the health, safety, and security of the campus community or disrupt its programs and activities. A budgeting plan to address the priorities and strategies outlined in the university's Hazard Mitigation Plan must also to be developed. Further, as the university constructs additional buildings and conducts significant renovations of existing structures, security and safety measures need to be incorporated into each aspect of the infrastructure.

Strategies:

- Develop programs, policies, and procedures that allow for the successful management of major emergencies that may threaten the health, safety, and security of the campus community and of the continuity of operations.
- Construct facilities and processes to more safely contain and manage hazardous waste materials.
- Increase the number of security personnel based on levels appropriate for the size of the campus and population served.

Goal III. Promote robust and integrated information technology strategies that advance Virginia Tech's excellence.

The university's emphasis on greater levels of research has generated several information technology initiatives: maintaining a secure environment is essential for a healthy and productive university network; allowing faculty to be exposed to and to incorporate new forms of technology into instruction has a direct relationship on the effectiveness and efficiency of learning; upgrades to the university communications infrastructure, both on campus and regionally, will provide the computing power needed to support learning, discovery, and engagement; enhancements to data access and distributing data files are important elements of increased efficiency, relieving faculty and staff from tedious and time-consuming processes; and advancements in high-performance computing will support faculty discovery. The university has been a leader in the information technology arena, and with investments in the following objectives, the university will be poised to continue to remain on the cutting edge.

Strategies:

- Provide information technologies combining new modes of computing and communication to enhance the educational experience of students on-site and on-line.
- Increase data storage, application platforms, and messaging services that advance instructional and research-related computing and communication, as well as enhance the programmatic content of the student learning experience.

- Organize an aggressive program to acquire and leverage infrastructure assets and industry partnerships to create and exploit technological advancements that provide the university community with competitive advantages throughout the commonwealth, the nation, and the world (e.g., National LambdaRail).
- Implement and maintain information systems that are secure and protect the confidentiality of university data while also ensuring full replication of all mission-critical information, utilizing resources both on and beyond the Blacksburg campus.
- Implement information technologies that enhance the educational experience of students, including the development of a technologically advanced library system and interactive learning centers, employing the latest technologies.

Goal IV. Advance and implement initiatives to improve operational efficiencies and enhance customer service.

The restructuring act will provide the university with greater authority over financial and administrative operations. Competing resources require that administrative operations continue to look creatively at developing new strategies for gained efficiencies. Further, as technological advancements are enhanced, processes should be streamlined. Attention to all customers, whether they are students, campus visitors, faculty, or staff, is a priority, and improved customer service should be incorporated into enhancements as they are made.

Strategies:

- Streamline administrative processes and policies with the goal of removing unnecessary barriers to campus operations.
- Decentralize routine processes to improve efficiency while ensuring appropriate accountability through post audit measurement and evaluation.
- Invest in process redesign to streamline internal approvals, eliminate current paper-based processes, and create administrative efficiencies.
- Develop and implement best practices for strong internal controls and improved workflow management.
- Promote and reward innovative administrative processes that initiate and take action on suggestions and proposals for enhancing quality, improving cost effectiveness, streamlining operations, and/or improving customer service.

Performance Metrics per the Higher Education Restructuring Act

- Number of days on average for the institution to process change orders locally.
- Number of days saved by board of visitors approval of NGF projects compared to state approval.
- Average number of days for the institution to approve a lease.

Major information technology projects completed on time and within budget at a rate that matches industry standards.
Percentage of all courses that utilize technically up-to-date course management systems.
Evidence of collaboration among institutions, such as the Higher Education Virginia Alliance for Security Computing and Networking (VA SCAN), of leveraging of collective expertise to save money and help strengthen security programs.
Results of external and internal audits indicating compliance with policies for the procurement of information technology goods and services, including professional services, that are consistent with the requirements of § 23.38.110 of the Restructured Higher Education Financial and Administrative Operations Act and that include provisions addressing cooperative arrangements for such procurement as described in § 23.38.110.
Status relative to goals established in the plan submitted to the state under current law for small, woman-owned, and minority-owned procurement.
Dollar volume of purchases handled through electronic procurement.
Volume of cooperative procurements.
Vendor protests with a legal basis for the protest.

Effective Resource Development, Allocation, and Management

The university has five major sources of funds to manage its operations: state appropriations, tuition and fees, grants and contracts, auxiliary enterprises, and gifts and investments. During 2002-04, the university experienced a decrease in state General Fund appropriations of 26 percent, or $72 million, due to statewide budget reductions. Although the university experienced a brief slippage in some areas due to accelerated retirements of some senior faculty, it managed to keep growing its overall research expenditures, in stark contrast to what happened during the budget reductions of the mid-1990s. Further, the market decline in early 2000 affected the endowment performance, but significant improvements have been experienced over the past two years.

Goal I. Work with the governor, legislators, General Assembly staff, and SCHEV to increase state funding.

The Appropriation Act states that it is the intent of the General Assembly to fund 67 percent of the cost of educating Virginia residents; however, Virginia Tech is currently funded at 55 percent (2005-2006). Further, the current funding proposal for the next biennium would continue this percentage at 55 percent through 2007-08. The commonwealth's Joint Subcommittee on Higher Education Funding Policies developed the Base Budget Adequacy Model. The funding shortfall for Virginia Tech as computed by the State Council of Higher Education for Virginia (SCHEV) utilizing the joint subcommittee's model is $25 million for 2005-06, and

the shortfall is projected to increase to $30 million during 2006-08. This translates into 2,200 unfunded in-state students. In addition to the Base Budget Adequacy support, the university continues to emphasize increased support for its Agricultural Experiment Station and Cooperative Extension Service as well as additional capital project support.

Strategies:

Continue to seek full funding of the Base Budget Adequacy Model.
Increase support for Cooperative Extension Service and Agricultural Experiment Stations.
Increase support for capital projects.

Goal II. Increase funding from private and other fund sources.

The university previously adopted the goal to significantly grow its endowment by 2013. Based on current projections, the ongoing capital campaign will add about $240 million to that objective. While it is recognized that private fundraising will be critical to achieving the university's goals, other opportunities to enhance university revenue sources, such as more effective use of the university's real estate portfolio and a more aggressive approach to marketing intellectual property and service, may yield additional revenue.

Virginia Tech has fared relatively well in recent years in attracting additional federal research funding. For example, federal grants and contracts increased from $71.1 million in 2000 to $112.4 million in 2005. However, all indications are that the competition for federal funds is going to become even more intense for the foreseeable future. The budget proposed by President Bush for fiscal year 2007 gives a strong indication of what is in store for the next few years at least. A primary reason for this outlook, of course, is the large federal deficit. As noted in *The Chronicle of Higher Education,* "Education and research programs continue to be part of the only section of the federal budget really up for debate. Roughly 84 cents of every dollar the government spends is eaten up by interest on the federal debt, defense and homeland security, and entitlement programs like Social Security."

Strategies:

Initiate public phase of capital campaign.
Enhance foundation and corporate relations initiatives.
Strengthen governmental relations and federal relations support to generate additional growth in research support.
Expand and diversify university funding sources.
Engage and cultivate more alumni through on- and off-campus programs offered by the Alumni Association, colleges, and other constituencies.

Goal III. Establish affordable tuition and fees to ensure accessibility.

As part of its land-grant mission, the university has historically maintained affordable tuition and fees to ensure access to all. The average cost of instruction increased from $7,457 in 1989-90 to $11,826 in 2005-06 at an annual rate of increase of less than 3 percent. In 2005-06, in-state undergraduate students paid 45 percent ($5,297) of the cost of instruction through tuition and mandatory fees; out-of-state undergraduate students paid 141 percent ($16,636) of the cost of instruction. The cost of higher education as a percentage of family income has risen nationally over the past decade, especially for low-income families.

Among public institutions in Virginia, the university provides the lowest total cost, including tuition, mandatory fees, and room and board, for in-state undergraduate students. The in-state student total cost for 2005-06 was $10,834, and the out-of-state total cost was $22,293. Using the same data set, the university is ranked sixth for its total out-of-state undergraduate cost, offering a lower total package cost than the University of Virginia, the College of William and Mary, Virginia Commonwealth University, and George Mason University. The university also provides affordable rates for its graduate students and is ranked fourth for the in-state graduate student total cost and tenth for the out-of-state graduate student total cost.

Increasing student access and affordability to the institution is at the heart of Virginia Tech's “Funds for the Future” program. Virginia Tech’s endowment is currently at $408 million; however, only a relatively small portion of the endowment is directed to the support of unrestricted student financial aid programs. As a result, the “Funds for the Future” program obtains a significant portion of its incremental resources through new state General Fund financial aid allocations, assessing higher tuition rates to all students, redirecting a portion of the resulting revenue to students demonstrating financial need, and using other non-state fund sources. This strategy places increasing pressure on tuition and fees for all students without contributing to the overall quality of the instructional and research programs. Increasing private support for financial aid programs is a significant issue for Virginia Tech.

Strategies:

- Set tuition and fee rates that are competitive relative to other Virginia institutions and Virginia Tech’s peers.
- Continue to support the “Funds for the Future” financial aid program for students.
- Encourage private giving to support financial aid.
- Effectively manage institutional enrollment plans.

Goal IV. Ensure effective debt management.

In order to maintain its Management Agreement Level status (under the Higher Education Restructuring Act), the university is expected to demonstrate management competency as evidenced by either a bond rating in the “AA” range or a two-year history of competency in the areas of finance and capital outlay. At some point in the future, these two goals may become conflicting goals as the issuance of too much debt would result in a lower bond rating. The university’s current Moody’s bond rating is Aa3, with the next lower rating being an A1, which is below the “AA” range.

Strategies:

- Initiate a review of the debt capacity for both the university and the Virginia Tech Foundation.
- Maintain or enhance the university’s double-A bond rating.
- Develop a comprehensive Debt and Risk Management Policy for both the university and the Virginia Tech Foundation.

Performance Metrics per the Higher Education Restructuring Act

- Stability of tuition and fee increases over time that measures the percentage of increases from 1990-2005 compared to percentage increases over the six-year planning period.
- Bond rating from rating agencies of double-A or better.
- Annualized investment returns earned on operating cash balances invested by the institution over a rolling three-year period.
- University debt burden ratio that is equal to or less than 7 percent.
- Write-off of bad debts from tuition, fees, room, and board charges that is less than or equal to 1 percent of prior year’s operating revenues over a three-year rolling period.
- Percentage of recovery of delinquent accounts receivable sent to outside collection agencies or litigation that is less than or equal to 10 percent of dollar value of the accounts referred to collection agencies averaged over the past three years.
- Amount of need-based financial aid for undergraduate Virginia students with the trend data being calculated against a 2005-06 baseline.
- Amount of need-based grants for undergraduate Virginia students with the trend data being calculated against a 2005-06 baseline.