STRATEGIC PLAN

August 19, 2011

Strategic Vision 2011:
Empowering People to Create a Better Future
SEAS STRATEGIC PLAN

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INTRODUCTION

SEAS History

The School of Engineering and Applied Science at the University of Virginia got its start as the School of Civil Engineering in 1836. It was the first engineering school in the South and the fourth university-level engineering school in the nation.

The Engineering School was initiated by Charles Bonnycastle and William Barton Rogers, who in 1864 would become founding president of the Massachusetts Institute of Technology. The School struggled and became dormant for a time until the post-Civil War era brought renewed interest in engineering to Virginia.

Among the post-Civil War students was William Mynn Thornton, who worked for 50 years to lay the groundwork for what has become today’s Engineering School.

SEAS Today

The University of Virginia School of Engineering and Applied Science, or SEAS, combines research and educational opportunities at the undergraduate and graduate levels in nine academic departments. They include biomedical engineering; chemical engineering; civil and environmental engineering; computer science; electrical and computer engineering; materials science and engineering; mechanical and aerospace engineering; science, technology and society; and systems and information engineering.

Within the undergraduate programs, courses in engineering, ethics, mathematics, the sciences and the humanities are available to build a strong foundation for careers in engineering and other professions. The School’s abundant research opportunities complement the curriculum and educate young men and women to become thoughtful leaders in technology and society. In addition, the Engineering Business Minor, offered in collaboration with the McIntire School of Commerce, is the School’s most popular minor. The newly initiated entrepreneurship program is receiving great student attention.

With a distinguished faculty of 140 tenure-track and 46 non-tenure-track, 100 research professionals, a professional staff of 110, a student body of 2,300 undergraduates and 616 graduate students, the Engineering School offers an array of engineering disciplines, including cutting-edge research programs with expenditures of $56 million annually. At the graduate and faculty level, the Engineering School collaborates with the University’s highly ranked medical and business schools on interdisciplinary research projects and entrepreneurial initiatives.

The Engineering School is ranked by U.S. News & World Report in the top 40 among engineering schools in the U.S. overall and in the top 25 among engineering schools within public institutions.

While progress has been made, the School must regain momentum in its transition to become a premier research-intensive institution while continuing to provide an outstanding undergraduate experience.
On the positive side, the demand for science, technology, engineering and math (STEM) education remains strong and many of the challenges of the world will require engineering research and solutions. This should provide a positive impetus for engineering education and research. However, the recent economic environment has not been conducive to increased investment and support.

Over the past several years, the Engineering School has conducted two external reviews: one by a group of deans of peer engineering schools, and another by an outside consulting firm. Both reviews reached similar conclusions regarding the state of SEAS: The reports noted the strength and distinctiveness of the undergraduate program relative to peer institutions. They also highlighted the need to strengthen the School’s research and graduate education programs to bring both to a level consistent with peers, and noted the low level of state and institutional support relative to peer engineering schools. These findings are echoed in the internal review conducted during the most recent strategic planning process.

Both the Commonwealth of Virginia and University have acknowledged that investment in engineering education and research at U.Va. has not kept pace with the School’s peers over the past two decades. So while the School continues to work with the University and Commonwealth to ensure sufficient funding, SEAS must make hard decisions, focus its available resources on strategic priorities, and continue to identify new partners and collaborators as well as new sources of revenue.

Faculty and staff surveys show the pride that people have in being part of SEAS and the University. However, those surveys have also shown frustration with bureaucracy, the leadership of SEAS at all levels, and several years without state or University salary increases. These challenges create the risk that SEAS’ best and brightest will seek other opportunities. This plan is designed to encourage faculty initiative to produce the desired SEAS of tomorrow.

No strategy, no matter how well intentioned, can succeed without excellent people and the additional aspect of a strong organizational foundation. This strategy not only presents a vision for the future of teaching and research at SEAS but also lays out a strategy to build a more effective organization, ready to meet the challenges ahead.

The SEAS Strategic Planning Process

The planning project was initiated in January 2010 when Dean James H. Aylor asked members of the SEAS Trustees to help design a project plan that would be effective in developing a strategy for the School. The SEAS Trustees put together an initial proposal that was further developed and refined in a series of meetings with input from the leadership of the School (Dean’s Office and department chairs).

From these meetings it was agreed that the plan should be developed with a strong “bottom-up” engagement of the faculty and staff of SEAS. The principles included the following:

- Adhering to an inclusive and transparent a process as practical.
- Promoting ownership by administration, dean, chairs, faculty and staff.
- Ensuring the plan was impactful for all stakeholders.
- Creating an implementable plan.
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- Using a data-driven and fact-based research process.
- Maintaining a balance of both “hard” and “soft” elements – including an examination of the current SEAS culture.
- Using timely and effective research and recommendation reporting processes.

A Project Management Office (PMO) was established to facilitate the overall coordination and development of the plan, and a Steering Committee was created for overall governance and approval of key milestones. The Steering Committee was designed to include perspectives outside SEAS and included members of the SEAS Trustees, the U.Va. Vice President for Research, and senior officers from the College and Graduate School of Arts & Sciences and the School of Medicine.

The work was divided into module teams focused on the following:

- Undergraduate programs.
- Graduate programs.
- Research distinctiveness.
- Finance.
- Organizational alignment.

Module team leadership and membership were selected to ensure diversity and practical representation of departments within SEAS. The module teams followed a common process of gathering data and ideas from key stakeholders from internal and external organizations, and evaluating strengths and opportunities for improvement. The teams made their final recommendations by evaluating ideas against selection criteria and each idea’s ability to achieve excellence and to distinguish SEAS and U.Va. At key milestones, the teams made presentations to the Steering Committee to ensure alignment with University-wide strategies and agreement among University leadership.

Over the next year there was extensive activity by the module teams as they completed their tasks. This involved intensive data gathering and analysis of internal and external data from peer and aspirational engineering schools; multiple workshops with key stakeholders (department chairs, faculty, undergraduate and graduate students, staff and SEAS Trustees); surveys (1,000 alumni and 260 faculty and staff); as well as multiple integration meetings with other module teams and the Steering Committee. Communication among and engagement of faculty and staff were encouraged through a strategic planning web site, online newsletter, email communications, faculty/staff meeting presentations, departmental meetings, department chair meetings, individual interviews and “open house” poster sessions.

After the module teams completed their work and received approval from the Steering Committee, the module leads worked together as a team to select and integrate the various ideas and recommendations into a comprehensive plan for the School. The selection criteria included the following:

- Ensuring consistency with the vision and culture for SEAS and U.Va.
- Ensuring consistency with SEAS values.
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- Considering other strategic initiatives, key initiatives and constraints.
- Striking the proper balance between efforts in academic, research and service areas.
- Creating an implementable plan with achievable goals.
- Aligning with opportunities to attract resources and funding.

Module leads prioritized and sequenced their recommendations to facilitate implementation of the overall plan. The plan also includes key metrics to measure progress toward the School’s goals.
SEAS MISSION, VISION AND CORE VALUES

In the future, SEAS will be larger, more productive and significantly more impactful. Over the next decade, SEAS envisions that faculty size (both tenure and non-tenure-track) and productivity will increase to offer larger, more effective educational programs at both the undergraduate and graduate levels. SEAS will also expand collaborative research programs of significant benefit to society.

SEAS Mission

Through the creation and transfer of knowledge, SEAS educates leaders in the application and development of engineering and scientific solutions that benefit the world.

SEAS Vision “Empowering people to create a better future”

SEAS will be a premier engineering research school offering a personalized, high-impact student education, leadership development and a dedication to service.

SEAS will do the following:

- Provide student-focused educational programs within a thriving research environment.
- Emphasize leadership and service.
- Provide engineering technical rigor and a broad educational experience across U.Va.
- Connect our undergraduate and graduate educational and research programs.
- Live by our core values every day.
- Empower faculty, staff and students to succeed.

SEAS Core Values

SEAS is committed to the following:

- The value it places on students in a thriving research environment.
- Development of its faculty and staff.
- A culture of mutual respect for all members of the SEAS community.
- Appreciation of diversity in all its aspects.
- Leadership for the public good.
- Honor and ethics.
- Innovation and collaboration in the pursuit of knowledge.
SEAS GOALS AND STRATEGIES

The School of Engineering and Applied Science Strategic Plan was developed to guide the School in the coming years as it transitions from a primarily education-focused school to a major research institution.

Recognizing that resources are always limited, SEAS cannot launch every conceivable new initiative in every inviting field at one time. So the strategy is to invest strategically, funding selected new efforts that leverage current and emerging strengths to further distinguish the School in education and scholarship. To maximize its investments, SEAS will strengthen its foundation, focusing on initiatives that increase its operating effectiveness, expand its external partnerships, and develop and reward its people. SEAS will create a culture that removes barriers and rewards innovation and collaboration.

The strategy is divided into six interrelated goals. The first three describe the School’s goals and key actions for expanding and enhancing its education and research mission. The last three describe its goals and key actions to strengthen the organizational foundation of SEAS, enabling it to achieve its first three goals.

Goals to Advance the SEAS Mission
- Graduates prepared for leadership
- Research with impact
- Extension of SEAS Reach

Goals to Strengthen the SEAS Foundation
- Faculty and staff success
- Operational excellence
- Resources for the future
Goal: Graduates Prepared for Leadership

It is clear that the economic development and well-being of those in the Commonwealth and beyond will increasingly rely on the contributions of SEAS graduates. To address this need, SEAS will increase both the size and the effectiveness of its graduate and undergraduate programs. Undergraduate enrollment is expected to increase from 2,300 to more than 2,700 in the next five years and graduate enrollment from 600 to 900 over 10 years. Taking the following actions will enable SEAS to continue to provide an outstanding student experience and effectively prepare its graduates to lead in their chosen fields.

Key Actions

- **Increase impact of the graduate program**
  Increasing the size and impact of the graduate program is central to SEAS’ strategy. For its graduate students to lead in their chosen field whether in academia or industry, SEAS must provide a thriving, competitive environment that values and encourages internationally recognized scholarship. The environment should stimulate connections across SEAS, U.Va. and beyond. A larger, better connected, more productive graduate student body will increase the School’s research and scholarly productivity, provide support for its undergraduate program and enhance the visibility and reputation of the School. This growth strategy includes the following components:

- **Increase enrollment**
  To build critical density in the graduate student population, SEAS will increase graduate student enrollment from the current level of 4.3 students per faculty, to 5.5 students per faculty, primarily through growth in Ph.D. programs. With the expected increase in faculty resulting from the planned undergraduate enrollment increase, SEAS’ goal is to increase overall graduate student enrollment to 900 in the next 10 years, while enhancing the diversity of the graduate student population.

- **Increase internal funding for graduate students**
  One of the principal barriers to admitting highly qualified graduate students has been the lack of a buffer to “smooth out” fluctuations in research funding. Admitting graduate students inevitably incurs risk, because the decision to admit them to the Engineering School involves a commitment of support. Currently, this risk is assumed fully by the individual faculty member, thereby discouraging faculty from taking on additional students. To address this issue, SEAS will more than double institutional support for graduate students from the current level of 9 percent student support to 20 percent. This will allow the Engineering School to spread the risk of admission across the School, and will make it much easier for faculty to take on the students needed to support their research. In addition, this increase will provide the necessary teaching assistant support for SEAS’ growing undergraduate program.

- **Create student community-building opportunities to stimulate innovation, collaboration and personal development**
  Expanded enrollment alone will not achieve the School’s goal of creating a thriving graduate program. SEAS will also increase and enhance the opportunities for interaction among students and faculty within and beyond SEAS.
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- **Consolidate SEAS-wide educational programs**
  SEAS will create a new department that brings together the existing Science, Technology, and Society (STS) department and the programs in Applied Math, Experiential Learning, Distance Learning, Rodman Scholars, International Studies, and business and entrepreneurship. Students gain a discrete advantage in the marketplace by participating in these programs, but they are currently administered by disparate faculty members with little coordination among the programs. By consolidating these educational programs, which add significant value and cross all departments, SEAS will strategically integrate the educational experience, support high-impact practices and realize significant efficiencies in course delivery.

- **Ensure efficient, effective delivery of SEAS educational programs**
  SEAS will continuously review its curriculum for both undergraduate and graduate programs to ensure that it is providing the highest quality educational outcomes. SEAS must ensure that both its content and its method of delivery maximizes the impact of its educational program while properly using faculty and staff resources. Low-value-added courses and areas of duplication should be eliminated or revised to use SEAS resources effectively. In particular, SEAS will undertake a review of the first-year program, including common courses such as ENGR 1620 and CS 1110.

- **Provide every undergraduate with a sustained, high-impact educational experience**
  High-impact practices are sustained, purposeful, experiential learning interactions among faculty and students. They follow many themes, including:
  
  - Undergraduate research.
  - Engineering practice.
  - Service learning.
  - Entrepreneurship.
  - International study.

  High-impact practices have been shown to improve student performance, persistence and success. Moreover, high-impact practices allow the Engineering School to directly align faculty interests with student passions. Better alignment will reduce undergraduate student churn, tap into the latent intellectual capacity of the SEAS’ undergraduate student population, and further empower students to take ownership of their learning experience. When faculty align with one or more high-impact practice themes, they gain access to students who are passionate about that theme, and can create relationships of deep educational benefit for the student and professional benefit for the faculty member.

  To coordinate development of and access to high impact educational experiences for its students, SEAS will seek funding to create the Center for High Impact Practices.

- **Strengthen rigor in technical courses while ensuring broad educational opportunities across U.Va.**
  The Engineering School must continue to challenge its most ambitious and talented students with rigorous curricular and experiential learning opportunities in all disciplines. It is incumbent upon the faculty to create experiences that tap the intellectual capacity, leadership potential and creativity of these high-achieving students. Our curricula must meet the needs of all students, but we will raise the general level of rigor in the technical experience and demand more intellectual curiosity, collaboration and teamwork from each of our students.
• **Engage alumni in educational programs**
  Many SEAS alumni hold great affection for SEAS and the University and seek ways to sustain their connection to SEAS. The School envisions its alumni as career mentors for students, partners in the education process (for example, as guest speakers), connections to employment opportunities, conduits to research experiences and partners in realizing its goals. Engaging alumni in the SEAS educational mission requires the following:

  • Continuously connecting alumni to the School, beginning immediately upon graduation and evolving into different roles and responsibilities.
  • Providing the SEAS undergraduate students with trusted career counseling, a connection to the broader U.Va. network and “real world” advice.
  • Allowing faculty to engage with its alumni in support of a variety of relationships: education, research, Capstone projects, sabbaticals, etc.

**Key Metrics**

Key metrics to measure success are the following:

- The quality of SEAS incoming students (SAT’s, GRE’s).
- The value added to the SEAS educational program (number of publications, number of undergraduate students participating in high impact experiences, etc.).
- The diversity of the SEAS student body.
- The ratio of graduate students to faculty from current 4.3 to 5.5 and the graduate student to undergraduate ratio to 1:3 from current 1:4, primarily through growth in Ph.D. programs.
- The success rate of SEAS students (initial placement rates, long-term longitudinal studies)
- Number of alumni engaged in SEAS educational programs.
Goal: Research with Impact

SEAS has been transitioning from a primarily undergraduate education-focused institution to a more research-intensive school over the past 25 years. Completing the transition, while maintaining SEAS excellence in undergraduate education, requires a culture that values the contributions of both teaching and research to the SEAS/U.Va. mission. The research environment in SEAS must encourage and enable innovative, collaborative research and must value both high quality scholarship and contributions to the education of students via research.

Part of the strategic planning process was a critical evaluation of the current research strengths of the School. The analysis involved not only gathering information from department chairs and faculty but also a quantitative assessment of these research areas using a suite of generally accepted metrics (number of Ph.D. advisees, scholarly publications, invited lectures, awards and honors, and research expenditures) averaged over the last three years. It is important to note that the list of strengths below is a snapshot of current strengths and will no doubt change over time.

Identifying current research strengths will do the following:
- Provides information to allow SEAS to better project itself upwards and outwards.
- Facilitates new collaborations inside and outside SEAS.
- Identifies development and publicity opportunities.
- Helps guide strategic faculty hiring decisions.

The analysis demonstrated that SEAS has numerous current and emerging research strengths that are being applied to solve critical societal needs. The School also has important strengths in the fundamental engineering disciplines, enabling research that supports these needs. Four societal challenges capture much of the research strength within SEAS:

- **Creating a sustainable future** – There is a need to better manage our natural resources while providing sufficient energy for improved life.
- **Engineering improved health** – Technology and quantitative understanding of living systems can be used to enhance the diagnosis and treatment of disease and to improve the human condition.
- **Advancing the cyber and physical infrastructure** – Although the current cyber and physical infrastructure allows society to function in ways that would have been unknown in the not-too-distant past, there are many challenges to reinvigorating and expanding the reach of this field.
- **Providing personal and societal security** – The need for advances in protecting personal privacy and societal security have become increasingly important as more personal and societal functions rely on technology.
Although these challenges are not inclusive of all cutting-edge research in SEAS, the following table illustrates how the current identified research strengths of SEAS map to the four societal needs. It is clear that there is substantial work involving SEAS in each of the four societal needs. Much of this work involves collaboration across SEAS, with others at U.Va., and with colleagues around the world. Future research opportunities will allow even greater contribution to these four societal challenges. (For a more detailed overview of SEAS research strengths, please see Appendix A, page 23.)

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Key Actions

- **Increase faculty and graduate student scholarly productivity**
  Faculty and graduate students are the engine of SEAS scholarly production. To broaden participation in research and increase scholarly productivity, SEAS will undertake a comprehensive revision of existing policies and incentive programs. The key aspect of this will be a relentless focus on making better use of faculty time. Greater flexibility in the allocation of effort will allow faculty to better specialize and use processes that are more efficient. Increased staff and teaching assistant support will free additional faculty time for research. These changes will enable departments to set ambitious goals for scholarly productivity and provide them with the tools and flexibility to achieve their goals. Faculty will be provided with any strategic mentoring, partnerships, and collaborative environments that may be needed to stimulate the desired level of SEAS activity overall.

- **Increase opportunities for internal and external collaboration**
  While individual researchers continue to expand the frontiers of knowledge, discoveries are increasingly made through collaboration across departments and schools. To encourage greater collaboration within SEAS and beyond, the School will expand its own programs to bring researchers together, invest in tools to increase awareness of faculty activities and actively participate in University-wide efforts to build the “innovation ecosystem.”

- **Recruit faculty that will leverage and enhance SEAS research strengths**
  The faculty hiring process is one of SEAS’ principal tools to grow research. Through this process, SEAS will hire to enhance the diversity of SEAS faculty, connect areas of research strength and leverage established strengths to expand into emerging areas. Over the next 10 years, SEAS will grow its tenure-track faculty from 140 to 170. A parallel increase in the technical support staff will enable SEAS to pursue even more challenging research topics.

- **Develop a fund to provide seed and matching funding for collaborative research**
  SEAS will create a fund to provide seed and matching funding to support new research collaborations. Each $50,000 award will support a graduate student and will come through an annual call for proposals. Results of the awards will be presented to the SEAS faculty annually.

- **Optimize impact and effectiveness of research centers**
  SEAS will initiate a project to assess and benchmark the current SEAS-wide research centers within the School (Applied Research Institute, NanoQuest, Commonwealth Center for Advanced Manufacturing, Commonwealth Center for Aerospace Propulsion, etc.), against other highly successful research centers to see if there are additional recommendations which, if implemented, might enhance a center’s role and effectiveness in support of Engineering School research programs in terms of improved infrastructure or collaboration opportunities.

- **Increase undergraduate student participation in research**
  While SEAS works to increase the scale of its research enterprise, the School will find new ways to bring that research into the undergraduate experience. Undergraduate student research is an important example of a high-impact practice for undergraduates. By more closely integrating its research, graduate and undergraduate programs, the School will become a model for research-based education.
Key Metrics
Key metrics to measure success are the following:

- Scholarly productivity as measured by Ph.D./faculty, publications/faculty, citations/faculty, awards/faculty, patents, invited lectures and other output metrics.
- Percentage of research-active faculty.
- Total number of tenured and tenure-track faculty from 140 to 170.
- Diversity of SEAS faculty.
- Research expenditures (target: $80 million in the next five yrs.).
- ROI of seed investments (target: 4:1 direct cost increase to investment).
- Number of proposals submitted/won as collaborative proposals.
- Number of large-scale proposals (> $1 million/year) submitted/won.
Goal: Extension of SEAS Reach

The future success of SEAS will increasingly depend on initiatives to develop, maintain and optimize relationships with external partners locally and globally. This includes building multi-faceted partnerships with those organizations that hire graduates of the School, provide educational opportunities for its students, and/or collaborate on common interests in research and development. A key element of this strategy will be to work together within SEAS and across Grounds to build productive external relationships with companies, foundations, government agencies and peer institutions. Of specific interest is building and strengthening the School’s relationships with organizations in the Charlottesville, Central and Northern Virginia areas. Examples of these organizations include Rolls-Royce, the National Ground Intelligence Center, and the U.S. Defense Intelligence Agency. SEAS will also consider collaborating with organizations in emerging economies where we have common goals and objectives.

Key Actions

- **Establish a strategic relationship management capability**
  Effectively managing external relationships will require SEAS to align its career placement services, educational, research and development activities. The School will evaluate its existing relationships to see that the needs of our partners are being met. It will work across the University to develop the tools necessary to increase opportunities for innovation and collaboration.

- **Increase SEAS community outreach efforts**
  Community outreach efforts expand the impact of SEAS both locally and globally, yet too often such efforts occur in isolation. By understanding and sharing its current outreach activities across SEAS, and by providing support for coordinating future outreach, SEAS can maximize the impact of its efforts for the communities it serves.

- **Increase SEAS presence near strategic partners**
  In partnership with other parts of the University, SEAS will consider establishing satellite locations near strategic partners to develop, enhance and retain the School’s important relationships. One potential location is Northern Virginia.

- **Establish or enhance use of existing research centers to strengthen our relationships**
  SEAS will look to leverage existing (Commonwealth Center for Advanced Manufacturing, Applied Research Institute, Commonwealth Center for Aerospace Propulsion, etc.) or establish new research centers where there is a common strategic interest that will further expand and strengthen our external relationships.

- **Establish a SEAS Advocacy Council to increase alumni engagement**
  Establishing a SEAS Advocacy Council will provide an organized structure for authentic engagement of alumni and friends including: current students and a broad spectrum of alumni, parents, and SEAS faculty and staff. This will strengthen the School’s ability to connect with a more diverse population that makes up the SEAS community.
Key Metrics
Key metrics to measure success are the following:

- Accountability for external relationship management by 2012.
- Identification of 10 pilot partners and implementation of a relationship management system.
- Development of a long-range external relationship management plan (expand beyond Central and Northern Virginia).
- Number of community outreach initiatives.
Goal: Faculty and Staff Success

Ultimately, SEAS success depends largely on the creativity and energy of its people. SEAS faculty and staff have weathered repeated budget cuts while continuing to provide an outstanding educational experience for students and push the frontiers of knowledge. SEAS will look to develop the best possible group of people to maximize their potential and advance the SEAS mission.

Key Actions

- **Provide clarity of SEAS vision, mission and core values**
  A key goal for this plan is to provide a roadmap for SEAS activities in the coming years. SEAS will weave the mission, vision, values and strategies identified in this plan into the operation of the Dean’s Office and each academic department, and into individual objectives for faculty and staff. In this way, SEAS will align efforts to meet its goals. SEAS leaders will make future decisions that are consistent with strategic objectives and values.

- **Ensure that SEAS policies and incentives encourage a culture of excellence**
  To maximize the contributions of faculty and staff within SEAS, policies and incentives must recognize, encourage and reward excellence. SEAS will assign accountability for the review of each policy to an individual or committee, who will conduct a comprehensive review of the policies to ensure that they align with the desired outcomes. Policies that are no longer required or inconsistent with the School’s strategic objectives will be modified or eliminated (for example the SEAS P&T Guidelines for Non-Tenure Track Faculty).

- **Clarify roles and responsibilities and implement transparent decision-making processes**
  The lack of clear, transparent decision-making processes limits SEAS’ ability to act strategically. In conjunction with other SEAS organization changes, SEAS will develop principles and decision-making processes that clarify roles and responsibilities and provide for effective and transparent decision-making.

- **Expand leadership development and professional-development programs for SEAS faculty and staff**
  Changes within the University and within SEAS will increasingly devolve responsibility and authority to schools and departments. Fully realizing the benefits of these changes will require current and future leaders in SEAS to develop effective management and leadership skills. To strengthen the School’s current leaders, and build a pipeline of future leaders, SEAS will develop clear expectations for the competencies required for leaders and will work with University Human Resources and the Provost’s Office, to provide leadership and professional development programs (including 360-degree feedback programs) for its faculty and staff to prepare them for evolving responsibilities.

- **Develop and fully utilize an integrated performance management system aligned with compensation and reward system**
  Faculty and staff performance is optimized when performance expectations are clear, meaningful and timely feedback is provided, and individuals are recognized and rewarded for excellence in meeting expectations. Current performance management systems are inconsistent across departments and within the Dean’s Office for faculty and administrators; and existing systems for
staff are not effectively or uniformly implemented. To address this need, SEAS will develop a consistent performance management process for faculty that sets clear performance expectations, provides flexibility to departments in distributing faculty efforts, and provides a more performance-based reward system. SEAS will increase training and educational opportunities for staff and supervisors, and will integrate incentive programs to recognize and reward top performers.

- **Develop effective support staff capabilities for administrative, technical and research activities**
  The current SEAS staff-to-faculty ratio is significantly lower than those of its peer institutions. Insufficient staffing of administrative and technical endeavors increases the burden on current staff and faculty, reduces the teaching and scholarly productivity of faculty, and hinders SEAS overall effectiveness and productivity. SEAS is committed to providing the human resources necessary to meet its mission. SEAS will examine the distribution of staff functions in order to make better use of economies of scale where appropriate, and will hire staff where necessary to support implementation of the strategic plan. SEAS will identify areas where better tools or training might improve staff functions and where cross training might provide improvements in efficiency.

**Key Metrics**

Key metrics to measure success are the following:

- Implementation of faculty performance management system for year 2012.
- Scholarly productivity as measured by Ph.D./faculty, publications/faculty, citations/faculty, awards/faculty, patents, invited lectures and other output metrics.
- Improved utilization and effectiveness by staff of the **Lead@UVa** performance system and alignment with Rewards and Recognition Program.
- Increased faculty/staff participation in leadership and development opportunities.
- Staff: faculty ratio.
- Improvement in periodic faculty/staff surveys.
Goal: Operational Excellence

SEAS business and management operations must continue to evolve as SEAS enrollment increases and research opportunities continue to grow. SEAS business and administrative functions must support and enable the educational and research missions, and must provide SEAS the information and ability to make informed, strategic decisions.

Key Actions

- **Revise SEAS organizational structure to align administrative and academic functions**
  SEAS will revise its organizational structure to reflect the distribution of academic and administrative responsibilities and will identify the individuals and units accountable for ensuring that these responsibilities are realized. SEAS will move to provide those who are held accountable with the appropriate authority to perform their jobs.

- **Implement an Activity-Based-Budgeting (ABB) financial model in SEAS that aligns accountability and authority, and that provides incentives for departments to achieve SEAS and departmental goals**
  The University’s transition to an ABB model will have a profound impact on SEAS. To maximize the benefits of the new model, SEAS will adapt and modify this model for use within SEAS. Implementing a modified ABB financial model will create incentives for enrolling students and for new endeavors. An effective ABB model should allow SEAS departments to maintain budget stability with respect to fluctuations in enrollment and research funding, while creating meaningful incentives to strengthen current research and academic programs, and to create new ones.

- **Maximize SEAS productivity**
  Effective use of SEAS’ limited resources is critical for building a stable foundation for growth. As part of SEAS’ strategy, the School will begin an initiative to evaluate and improve business processes across the School, with an emphasis on areas including research administration, graduate funding and budgeting. Where possible, SEAS will look to eliminate low value-added activities to free up resources for priority areas. With the expected increase in student, staff and faculty in the coming years, SEAS will look to improve the year-round utilization of facilities and equipment.

Key Metrics

Key metrics to measure success are the following:

- Implementation of new structure for Dean’s Office and academic departments.
- Utilization rate of facilities.
- Reduction in manual data entry and paper-based business processes.
Goal: Resources for the Future

While SEAS continues to look for ways to improve how the School uses its current resources, achieving its goals will require new resources. To address the gap in funding between SEAS and peer engineering schools, SEAS will seek to increase current sources while identifying new opportunities.

The implementation of a new budget model, increased undergraduate enrollment and the initiatives described in this plan provide SEAS with the opportunity to grow its faculty and strengthen its graduate and research programs. Challenges to the successful implementation of this plan include the cost of faculty startup packages as well as additional funding for graduate student fellowships. SEAS will generate these resources through internal allocation, enhanced external revenue opportunities and development activities.

Key Actions

• Proactively engage in the implementation of an ABB-based financial system
  Implementation of the new budgeting model within the University will dramatically change the way schools are funded. SEAS administrators will work closely with the University administration and other schools to ensure that this system is successfully implemented.

• Secure Differential Tuition/Enrollment Growth /Institutional Investment
  SEAS will continue to advocate for differential tuition for the School as a way to mitigate the disproportionately high cost of engineering education and research. SEAS is committed to increasing undergraduate and graduate enrollment during the coming years in support of University and Commonwealth goals. SEAS will secure a commensurate increase in institutional support for this growth.

• Grow research
  SEAS will increase scholarly productivity and the volume of sponsored research within SEAS in order to grow the graduate student population, to support research opportunities for faculty and students, and to increase both the overall value of research, and the financial return to the School. Through research growth, and improvements in resource allocation, the School can support additional graduate students and enhance its undergraduate programs. This research growth will be supported by an outreach effort to increase the quantity and quality of SEAS strategic partnerships.

• Enhance development
  With a new development team and strategy in place, SEAS will increase fundraising support to a level consistent with its peer institutions. Additional new funds will be used to invest in some of the goals identified in the strategic planning process and in promising new initiatives. This development effort will be supported by the SEAS outreach effort to increase the quantity and quality of the School’s strategic external partnerships.
• **Explore new revenue-generating academic programs**
  Implementation of the new budget model within the University, combined with increased flexibility for departments, will enable SEAS to identify new programs that are consistent with its educational and research mission and that provide new sources of revenue. SEAS will reevaluate current academic programs and will explore new programs that align with the School’s academic mission and that will provide additional resources to support its educational and research goals.

**Key Metrics**

Key metrics to measure success are the following:

- Development (20 percent increase in Annual Fund by 2013; 5x increase in major gift prospects by 2013), increased funding/endowment of strategic initiatives.
- Differential tuition by 2012.
- Growth of graduate students to 900 in 10 years (supported by increased research and graduate student endowment), Undergraduate students from 2,300 to 2,700 in five years.
- Increase in external revenue.
IMPLEMENTING THE SEAS STRATEGY

This plan sets ambitious goals, and lays out a roadmap for moving the School forward. Developing the plan took many months of effort by many members of the SEAS community, yet the hard part is just beginning. SEAS has already completed several of the initiatives highlighted in this plan, and more are underway. However, implementation of this plan will take years, and will require active leadership, disciplined management and participation across the School. To guide this process, SEAS is developing an implementation plan that includes the following:

- Prioritizes the key initiatives to maximize the benefit to SEAS, while minimizing the disruption to its teaching and research activities.
- Identifies specific champions, as well as individuals or committees responsible for each initiative.
- Lays out a timeline for completing the initiatives.
- Provides a process for evaluating and reporting its success.
- Provides a framework for ongoing strategy management, reviews and updates.
- Supports ongoing, transparent communications; and helps SEAS adapt to the changes.
- Encourages long-term commitment by the SEAS community in new ways of doing business.

The success of this strategy will depend on the active, long-term involvement of the dean, associate deans, department chairs, SEAS faculty and staff, and its alumni. Implementing the plan will require new ways of doing business, continuous communications, proactively managing change, ownership and accountability for completing these initiatives, and dogged persistence.
APPENDIX A: Overview of SEAS Research Strengths

**Biomechanics** – Researchers at U.Va. apply mechanical principles to a wide range of biological systems, such as humans, animals, organs and cells. One application is the field of injury biomechanics, which has resulted in improved automobile designs, occupant restraints, child restraints, helmet designs and personal protective devices. In addition, active research is underway on movement disorders, musculoskeletal modeling and simulation and morphing functional structures that mimic animals.

**Biomolecular Design** – Research addresses a wide range of applications in which the understanding and use of biotechnology can assist in the creation of biorenewable fuels, improved batteries, water remediation and rational drug design and production, as well as protein and viral engineering.

**Catalysis and Surface Reactivity** – Research enables new relationships between catalyst structure and chemical reactivity to be discovered for a wide range of chemical reactions used in chemical synthesis, fuel cells, chemical conversion and magnetic materials for memory device fabrication. State-of-the-art computational methods and experimental probes are used.

**Corrosion and Electrochemistry** – Electrochemical science and engineering impacts public safety, next-generation energy systems and national defense. Most societal grand challenges in engineering require advances in electrochemical science and engineering. SEAS researchers are working on projects that address a range of issues including those that affect renewable energy, long-lived infrastructure and national security.

**Cryptography** – SEAS research seeks to create systems that can be trusted even in the presence of malicious attackers and that empower individuals to control how their data is used.

**Dependable Systems** – This research focuses on issues related to software and architectures in high-value systems – computing systems of extreme importance to society whose failure would have a severe negative impact whether measured in terms of time, money or loss of life. Dependability of a computing system is the ability to deliver reliable, available, safe services that can justifiably be trusted. Such systems include medical devices, avionics, weapons systems; critical infrastructures such as financial networks, transportation systems, and power systems; and grid computing systems that increasingly play a strategically vital role in such diverse industries as finance, health care, pharmaceuticals and aerospace.

**Ethics in Emerging Technologies** – Technology affects society, but society also affects technology. Advances in our technological capabilities bring with them new ethical questions that must be addressed. Examples of active interest at U.Va. include questions concerning the effects of climate change, nanotechnology risks and distribution of advanced health care.

**Graphics** – Computer graphics is used for data visualization and simulating the appearance of virtual scenes, all of which are important components in many software systems and a wide range of applications in which accurate rendering of 3D objects is critical such architecture, manufacturing plants, security systems, entertainment and medicine.

**Human Computer Interaction** – Human computer interaction research at U.Va. focuses on modeling human judgment and decision-making, data visualization, computer-based training, haptics and computational neuroscience in the domains of health care, air transportation, meteorology,
bioinformatics, and process control to inform system requirements, procedures, display designs and training. One example is the design and analysis of medical simulators to ensure that health practitioners' hands-on skills are systematically trained, time-effective and highly accurate.

**Medical Imaging** – Biomedical imaging is a dominant approach for discovery, diagnosis and therapy in today's biological and medical world. At U.Va., an established biomedical imaging community has produced a remarkable string of innovations in magnetic resonance imaging, ultrasound imaging and cellular imaging – including the fastest MR pulse sequences for abdominal and cardiac imaging, the smallest ultrasound devices and the highest resolution 4-D imaging of the living cell cytoskeleton. This research activity aims to improve the practice of medicine by introducing new technological capabilities that provide increasing amounts of functional information regarding the molecular and cellular determinants of disease, as well as more cost-effective diagnosis of anatomical pathologies such as small breast tumors. In cellular imaging, new optical advancements allow discovery of the fundamental molecular systems controlling cell behaviors such as adhesion, migration and proliferation that play a central role in diseases ranging from cancer to atherosclerosis.

**Nanoelectronics** – SEAS researchers are leading the search for new materials and nanostructures for logic and memory applications beyond the current technology used in integrated circuits. The new materials and structures (spintronics and phase transition materials) will require much smaller switching energies, without compromising performance.

**Next-Generation Aerospace Science** – SEAS is developing the next generation of jet engines that may one day enable people to fly around the world in high-speed aircraft or to fly into space using technology that is more reliable, safer and cheaper than the space shuttle, for example. These engines are called scramjets and they could potentially transport people and goods at speeds of more than 10,000 mph. At this speed one could fly anywhere in the world in about 1.25 hours. These engines could also be used to fly into space at a cost per pound of payload that is one to two orders of magnitude cheaper than today's cost using conventional rocket technology.

**Optimization and Control** – Many applications require high-fidelity modeling tools that allow improvement of system performance by active control of important parameters. Examples include analysis of electricity markets, control algorithms for an artificial pancreas and cyber security related to wireless networks.

**Pervasive Computing** – Computing has seemingly permeated all aspects of modern life, but challenges remain in the areas of real-time computing, cyber physical systems, and ad hoc wireless sensor networks. Such networks are being applied to saving energy in both residential and commercial buildings as well as for ad hoc networks for first responders to disasters.

**Risk Management of Engineering Systems** – SEAS research builds on the risk assessment process by seeking answers to a set of three questions: What can be done and what options are available? What are the associated trade-offs in terms of all costs, benefits and risks? And what are the impacts of current management decisions on future options? To be effective and meaningful, risk management must be an integral part of the overall management of a system. This is particularly important in the management of technological systems, where the failure of the system can be caused by the failure of the hardware, the software, the organization or the human element. Some of SEAS' applications include critical infrastructure protection, infrastructure interdependencies, dependence of defense infrastructure on civilian infrastructure, continuity of operations planning, transportation systems,
environmental impact, water resources, civil infrastructure, software acquisition, aircraft and space
systems, information management, ground transportation and highway vehicle safety.

**Scalable, Efficient and Reliable Circuits, Architectures and Systems** – Society increasingly relies on
information technology — especially the ability to analyze massive amounts of data and simulate
complex systems — to improve quality of life and advance scientific understanding. This in turn requires
continuing advances in raw computing performance, as well as advances in energy-efficiency and
reliability as system sizes and complexities reach unprecedented scales. This work focuses on reliable,
energy efficient circuit design for applications ranging from high-performance servers to portable
electronics to wearable body sensors.

**Software Engineering, Programming Languages and Compilers** – The overall goal of this research effort
is to develop innovative techniques that enable the deployment of secure, robust and resilient cyber-
infrastructures, even in the presence of cyber attacks, bugs in software, and run-time variations and
wear-out of hardware.

**Sustainable Infrastructure Systems** - The coming century will put unprecedented demands on our
natural and engineering infrastructure that will require novel engineering approaches. To provide basic
amenities to the developed and developing world equally, SEAS researchers are seeking to make
significant advances in terms of resilient and adaptive infrastructure, understanding the nexus between
water and energy systems, hydrogeochemical cycling, ecosystem restoration, water reuse, carbon
cycling, contaminants of emerging concern, and related areas.

**Systems Biology and Cell Signaling** – Approaches from engineering and physics are used to examine
how complex biological functions emerge from the network of interactions between proteins,
metabolites and cells. SEAS researchers develop quantitative experimental approaches to take system-
wide measurements of how biological systems respond to genetic perturbations or changes in their
environment. They use computational approaches to integrate these data and develop predictive
models that help us explain biological complexity and design therapeutic strategies for cancer,
cardiovascular disease and infectious disease.

**Terahertz Science and Engineering** – The terahertz region of the spectrum is critical for radio astronomy
because it encompasses spectral information concerning the makeup of the interstellar medium,
distribution of cosmic background radiation and formation of new galaxies. It also includes information
on the molecular transitions that are crucial to our understanding and monitoring of global ozone
depletion over the polar regions. Recently, engineers have recognized the advantages of the terahertz
region for applications ranging from high-resolution imaging for navigation and security to spectral
identification of chemical and biological materials, and high-bandwidth communications. The terahertz
science and technology research carried out at the University of Virginia focuses on the development of
solid-state circuit components for state-of-the-art receivers, sources and instrumentation operating
from 100 GHz to 3 THz.

**Transportation Studies** – This research activity focuses on developing and applying technology to make
transportation safer, more efficient and more reliable. SEAS researchers are known as leaders in
harnessing advances in information technology to improve the operation of traffic signal systems,
creating better information for travelers, enabling enhanced public transportation services and allowing
for improved maintenance of the extensive transportation system. They also focus on improving how
we design, build, monitor and maintain the physical infrastructure underpinning the system — including pavements, structures and storm water management.

**Wireless Health** — Wireless health is an emerging field that seeks to infuse wireless technologies into health care and medical research with the goals of improving patient care and quality of life while reducing health care costs. Efforts in this field are necessarily interdisciplinary, bringing engineers together with doctors, nurses, psychologists, medical researchers, caretakers, family members and patients themselves. Ongoing SEAS projects include: in-home sensors for identifying signs of depression, body-worn sensors for fall risk assessment and an artificial pancreas that combines blood glucose sensing and insulin pumping for Type I diabetics.
APPENDIX B: Strategic Planning Team Members

Undergraduate Module
Ed Berger (Lead), Associate Dean for Undergraduate Programs
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Archie Holmes, Electrical and Computer Engineering
Will Guilford, Biomedical Engineering
Bill Scherer, Systems and Information Engineering

Graduate Module
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Roseanne Ford, Chemical Engineering
Scott Acton, Electrical and Computer Engineering
Jack Stankovic, Computer Science
Craig Meyer, Biomedical Engineering

Research Module
Rob Kelly (Lead), Materials Science and Engineering
Pam Norris, Mechanical and Aerospace Engineering
Kevin Skadron, Computer Science
John Lach, Electrical and Computer Engineering
Andres Clarens, Civil and Environmental Engineering

Finance Module
Bill Johnson (Co-Lead), Materials Science and Engineering
Lloyd Harriott (Co-Lead), Electrical and Computer Engineering
Bill Thurneck, Associate Dean for Administrative and Academic Services
Jean Reese, Materials Science and Engineering
David Green, Chemical Engineering

Organizational Alignment Module
Eric Coleman (Co-Lead), Senior Organization/Leadership Development Consultant – Human Resources
Michael King (Co-Lead), Science, Technology and Society
Bob Bremer, Associate Dean for Management and Finance
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