

Business Plan FY 06 – FY 07

GROWING OREGON'S PROSPERITY through innovation.

Driven by a passion for knowledge, the people of OSU Engineering are fully committed to developing extraordinary engineers, creating powerful new ideas from research, and fueling innovation that is truly visionary—all to build a better future for Oregon and the world.

Executive Summary

The stated mission of Oregon State University is: *“To best serve the people of Oregon, Oregon State University will be among the Top 10 land grant institutions in America.”*¹

The OSU College of Engineering supports this vision through its quest to grow prosperity through innovation by delivering the impact of the nation’s top-25 engineering programs. Measured by the composite of degrees and research expenditures, OSU Engineering now ranks 43rd and is on par with UC Irvine and Auburn University, with plans to grow to 15th, or the equivalent of Ohio State and Virginia Tech.

This focus on impact will lead to a top-25 reputation ranking and elevate OSU Engineering from its current 28th position among land grant engineering programs² to join the group of eight other land grant engineering programs that are among the nation’s top 25³.

A top-25 engineering college located in Oregon will help the state, the Pacific Northwest, and the nation remain globally competitive by delivering the world’s best engineering talent and breakthrough ideas. This talent and these ideas will help grow prosperity through innovation.

Our top-25 journey is built upon our century-long legacy as an excellent engineering institution. In the past, and today, this excellence stems from our diverse faculty and staff, specifically: 1) their passion to create opportunity for both our students and the broader community, 2) their drive to develop the best work-ready engineering talent, and 3) the power of their extraordinary collaboration in research and teaching. These three attributes have been, and will continue to be, the guideposts of our journey.

Already, the excitement and synergy of the Top-25 Drive is producing key results:

- the new 153,000-sq.-ft. Kelley Engineering Center opened in 2005
- new professors from top-tier programs are coming to OSU
- our collaborative Research Clusters are producing groundbreaking results, including more than 10 recent spin-out ideas
- nearly all of Oregon’s best engineering students are at OSU (including 13 out of the 14 AeA Scholarship winners of 2006)
- PhD enrollment is up 57% over 1999 levels
- our 2006 Mini Baja car won the world championship, and our student design teams consistently place well in national competitions
- OSU Engineering is now 19th in the nation in composite degree and research output per faculty.⁴

These results, and more, are fueling the momentum and paving our ascent to top-25.

¹ OSU Strategic Plan, <http://oregonstate.edu/leadership/strategicplan>

² U.S. News Rankings of Best Graduate Schools: Top Engineering Schools, 2006.

³ U.S. News Rankings of Best Graduate Schools: Top Engineering Schools, 2006.

⁴ OSU Innovation Capacity Metric and ASEE data. Innovation Capacity Metric = 40 x BS Degrees/Top-25 Avg + 10 x MS Degrees/Top-25 Avg + 20 x PhD Degrees/Top-25 Avg + 30 x Research Expenditures/Top-25 Avg

Our focus on excellence is increasing our capacity to deliver top talent at all levels. By Fiscal Year 2007, the College will be a top-30 producer of BS-degreed engineers (545 degrees/year) and a national leader in two critically needed areas: graduate education (226 degrees/year) and research (more than \$27M/year).

Before graduating, this new talent will have experienced our unique hands-on Platforms for Learning™, and/or an industry-sponsored internship, and/or coursework leading to a business savvy Entrepreneurship Minor. In addition, our graduates will have worked within one of our eight collaborative Research Clusters helping innovate breakthroughs that improve life. Many of these breakthroughs will have direct business impact through new company spinouts and license agreements.

From our nationally ranked Research Clusters (some ranked in the top 5) to our nationally leading learning innovations, collaboration is a critical success factor—collaboration that spans not only engineering disciplines, but also other OSU units:

- the OSU College of Business and OSU's University Housing & Dining Services in *entrepreneurship*
- the OSU School of Education in *learning innovations*
- and with almost all other OSU colleges in *research*

And this collaboration goes beyond OSU to include relationships with other universities, national labs, and our industry partners like the Oregon Nanoscience and Microtechnologies Institute (ONAMI).

OSU Engineering's track record for delivering high-impact results coupled with Oregon's need for a prosperous future recently prompted the Engineering and Technology Industry Council (ETIC) and the State Board of Higher Education to endorse doubling the number of engineering faculty at OSU over the next five years. This is precisely what is needed to grow OSU Engineering to the critical mass that will deliver the impact of a top-25 engineering program.

For 2007-2009, ETIC is requesting from the legislature a new investment in OSU Engineering of \$39M in public funds that will be matched dollar-for-dollar by private gifts. If the ETIC request is successful, this will enable the College to add 50 new professors, or nearly half of the 114 additional professors needed to reach the average faculty size of top-25 programs.

OSU Engineering's "Prosperity Through Innovation" initiative, with its goal of achieving the impact of the nation's top-25 engineering programs, has attracted substantial private investment: a total of \$85M in private gifts since its launch in 2000. And OSU Engineering's share of the University's new capital campaign launched in 2005 reached \$61M this year, or 48% of the \$128M campaign goal set for 2012.

The people of the OSU College of Engineering have extraordinary focus on creating opportunity, developing work-ready talent, and collaborating—all to help grow prosperity through innovation and to drive momentum toward the goal of reaching the top-25.

Prosperity Through Innovation

A Changing World Demands New Priorities

The nation's, and Oregon's, economic future is in peril. The world has transitioned from the Cold War, triggered by the Soviet launch of the Sputnik satellite in 1957, to a conflict of global economies based on innovation.

Oregon's—and the nation's—prosperity now depends on innovation.

And innovation is inextricably linked to engineering and science education. To compete in the global innovation economy, Oregonians must dramatically increase our commitment to engineering and science education—from kindergarten through PhD—before it's too late. While Europe and Asia are investing in education and research at staggering rates, the United States has fallen behind on several fronts, from math and science scores to the number of engineering PhD graduates. For every new engineer graduated in the United States, China and India together graduate between 6 and 10.

PhD engineers and scientists are critical to innovation. These men and women work at the cutting edge of research, creating new technologies that impact every facet of daily life: from safer hospital operating rooms and better environmental cleanup systems to faster communications networks and more sustainable sources of energy.

With these new technologies come family wage jobs—*the key to prosperity*.

A Changing Oregon Demands New Investments

In the last century, Oregon invested heavily in education and research related to agriculture and forestry. The results are the top-tier ag and forestry programs at Oregon State University that have fed and fueled the state's land-based economy.

Today, Oregon's economy is shifting to include a booming high tech sector. Engineers now play major roles in everything from wood products and agriculture to manufacturing and medicine. Although Oregon has the 4th highest per capita concentration of high tech firms in the U.S., we produce only half the national average of engineering PhDs. This is hurting our ability to compete in the innovation economy.

It's time we invest in engineering the way we have in forestry and agriculture. The result will be work-ready graduates and cutting-edge research that will feed and fuel the state's new innovation economy, and ensure prosperity for all Oregonians.

But we must act today. For Oregon. For the nation. For our children.

The New Oregon Requires More Engineering PhD Graduates

In Oregon, companies like Intel, HP, Tektronix, ESI, Pixelworks, and Xerox remain globally competitive by hiring PhDs who create new, innovative technologies. Many of these PhDs go on to launch new spin-off companies that hire from diverse populations across the state, creating greater prosperity for Oregonians.

In innovation economies like the Silicon Valley, venture capital firms invest directly in PhDs and their new research ideas because these firms understand that PhD researchers drive innovation. Here in Oregon, it's time we do the same.

By failing to invest heavily in engineering education in Oregon, we are failing to invest in Oregon's future. Young Oregonians are losing the opportunity to obtain high-level jobs at Oregon companies like Intel. Today, Intel needs more PhD engineers than ever before, but its needs go unmet by our universities. By not graduating higher numbers of

PhDs we are forcing the state's largest employer to find 90 percent of its high-end work force outside Oregon. That's not good for Oregonians. An increased investment in engineering at OSU will bring outstanding faculty to the state. These professors will attract federal research funding as well as talented PhD students. These PhD graduates will drive innovation at Oregon companies, ultimately creating new jobs and prosperity—good news for all Oregonians.

OSU Engineering's Record of Success

Recent investment in engineering education and research at OSU has produced impressive results. From 1999 through 2006, \$40 million in state funds from ETIC (the Engineering and Technology Industry Council), leveraged by \$80 million in private contributions, have produced the following dividends from the OSU College of Engineering for the citizens of Oregon:

- Constructed the new 153,000-sq.-ft. Kelley Engineering Center
- Recruited and retained professors who out-produce their peers across the nation by 30 to 40 percent
- More than doubled engineering research to \$27.5 million, establishing national leadership in multiple areas
- Spun out six prospective new companies based on research ideas
- Grew into the 22nd largest U.S. undergraduate program with 3,100 students
- Increased PhD enrollment by more than 40 percent to 220 students
- Nearly doubled number of top students choosing to study engineering at OSU
- Created educational innovations like TekBots® and expanded internships
- Co-founded the Oregon Nanoscience and Microtechnologies Institute (ONAMI) in partnership with Pacific Northwest National Laboratory in Richmond, WA, Portland State University, the University of Oregon

It is time to move the OSU College of Engineering to the next level. The right team of collaborative leaders is in place. The track record shows we can do it. With increased investment, we will help ensure economic prosperity for Oregonians.

Now is the Time to Ensure Oregon's Prosperity

A major new investment in the OSU College of Engineering will help Oregon and America prosper. Together, we can recruit top-level engineering faculty who will inspire Oregon's brightest young people to become work-ready engineers and PhD students doing innovative research that will become real jobs, at Oregon companies. By doubling the size of our engineering faculty, OSU will reach the critical mass of the world's best engineering programs. Through partnerships with OSU and industry, Oregon will become internationally competitive in a wide range of fields: computer/information systems, renewable and alternative energy, electronics and communications, sustainable infrastructure, and high technology applied to natural resources and biomedical systems.

In the end, the talent graduating from OSU will be inspired to innovate, ensuring future jobs—and prosperity—for all of us.

Vision

OSU's College of Engineering will deliver the innovative capacity and impact of the nation's top-25 engineering programs.

OSU Engineering will be a catalyst for growing Oregon's prosperity through innovation. We will deliver the engineering talent and new ideas needed to spawn innovation, allowing existing companies to grow and new companies to form.

OSU Engineering graduates will be educated by some of the world's most talented faculty, people who are passionate about engineering excellence and the critical need to develop a diverse engineering workforce. These new graduates will be able to collaborate and compete in diverse, global markets anywhere in the world.

New ideas will come from world-class faculty engaged in research with standout PhD students—research that links every sector of the economy to innovation. The resulting companies will provide family wage jobs for Oregonians and lead to prosperity.

The benefits of OSU Engineering's transformation will extend *beyond* what is traditionally viewed as the high tech sector to include medicine, agriculture, and forest products. By extending the reach of innovation to many sectors, Oregon's competitiveness will be broad as well as deep, further strengthening the state's role in the global economy.

OSU Engineering will educate the best of Oregon's high school graduates, preparing them to contribute to Oregon's economy whether they graduate with a baccalaureate or doctoral degree. Our faculty will also attract the best international students, and *all* our students will understand the power of combining invention and entrepreneurship.

We will measure ourselves against the best engineering schools in the nation and around the world, striving to achieve the degrees awarded, the research output, and the impact on prosperity of the nation's top-25 engineering colleges.

Oregon State University aspires to be a top-10 public land grant university. Because eight of the top 25 engineering colleges are located at top public land grant universities, building a top-25 college of engineering is a critical driver of Oregon State University's aspiration to become one of the nation's top-10 public land grant universities.

Values

As our mission statement implies, the core values that drive our program and guide our decision making within OSU Engineering are *People, Ideas, and Innovation*.

People.

The heart of our engineering program and the key to achieving our mission are the people of the college—our students, our administrative personnel, and our faculty. We value the contributions each of these groups make and the large reservoirs of knowledge and experience contained within and among them. We also value a working, teaching, learning, and research environment characterized by collegiality, mutual respect, appreciation of differences, and collaboration. Such an environment fosters diversity, encourages risk-taking, and draws on our collective strengths and talents to achieve our strategic goals.

Ideas.

As a diverse mix of researchers, educators, and learners, and as current and future members of the global engineering community, we value the capacities to generate, evaluate, and communicate powerful and visionary ideas. Such capacities develop most fully in the presence of:

- strong intellectual curiosity
- a broad repertoire of critical thinking, communication, and collaborative skills across a diverse population
- rigorous analytical practices
- attentiveness to alternative options and points of view
- a penchant for “thinking outside of the box”
- ongoing dialogue with interested and affirming mentors, students, and peers

Thus, our commitment at OSU Engineering is to building a diverse culture in which all of these characteristics and practices have integral roles.

Innovation.

At the OSU College of Engineering, our goal is not simply to define new possibilities. More importantly, we strive to convert these possibilities into innovative, transformative results—results that make a difference locally, regionally, and internationally. We value innovation, not as an end in itself but as a way to move creatively and responsibly into the future, a way to proactively define that future. In valuing “innovation that matters,” we also value—and actively seek to foster in ourselves and one another—ethically grounded and community-oriented solutions to the increasingly complex challenges that we face as engineers and society members.

Measurable Goals and Strategy

Measuring Our Progress

We will track our progress against the degree and research output of the top-25 colleges of engineering as reported by *U.S. News & World Report* and the American Society for Engineering Education (ASEE). These metrics include degrees by level from BS through PhD, research expenditures, and a composite Innovative Capacity Metric that combines these measures as follows:

$$\begin{aligned} \text{Innovative Capacity Metric} = & 40 \times \text{No. of BS Degrees/Top-25 Avg.} \\ & + 10 \times \text{No. of MS Degrees/Top-25 Avg.} \\ & + 20 \times \text{No. of PhD Degrees/Top-25 Avg.} \\ & + 30 \times \text{Research Expenditures/Top-25 Avg.} \end{aligned}$$

In addition, we will track our progress in helping to develop a diverse engineering workforce by measuring the relative diversity of our student population.

All of these metrics are summarized in the following table.

Measurable Goals: Attributes of a Top-25 Engineering College

METRIC	FY 1999 Baseline	FY 2006 Results	FY 2020 Goals
BS Degrees	389	592	650
MS Degrees	122	131	350
PhD Degrees	22	32	120
Research Expenditures	\$12M	\$27.5M	\$120M
Innovative Capacity Metric	36	42*	100
Innovative Capacity Metric Rank		43rd*	15th
Female B.S. Degrees	13%	14.2%	25%
Female Graduate Degrees MS / PhD	16% / 19%	17% / 19%	25% / 25%
Underrepresented Minorities BS Degrees	2.2%	5.6%	10%
Quality of New Freshmen No. of top tier	47	119	400
PhD Enrollment	132	220	570

* FY 2005 Data

The total number of OSU engineering faculty is 106, while the average number of faculty at the nation's top-25 colleges is 220. This means OSU is already 19th in innovative capacity metric per professor, and we will achieve our measurable goals by doubling the number of professors, increasing support staff, and expanding and enhancing our facilities.

Our Core Strategy

We will reach our Top-25 goal by employing a three-prong strategy that taps the passion of the people of the College, builds what the College is capable of being best at, and focuses on people—the advantage that drives the entire enterprise:

- The College will follow its passion to **create opportunity for our students and the broader community through knowledge**, developing the nation’s best engineers and innovating new knowledge that will lead to a better world.
- The College will be best at developing **work-ready engineers**, already part of our legacy, and best at building world-class **collaborative Research Clusters**, which will lead to strong academic programs, enable us to deliver our measurable goals, and ultimately lead to a top-tier ranking. Our strong culture of collaboration is already seen as a unique strength by faculty we recruit from other universities.
- The College will leverage the efforts of our **people** to grow resources and build a top-tier program. All our successes are due to extraordinary efforts of women and men associated with the college: students, staff, faculty, industry partners, and alumni.

Developing Work-Ready Engineers

Goal 2 of OSU’s Strategic Plan: *Provide an excellent teaching and learning environment and achieve student access, persistence, and success through graduation and beyond that matches the best land grant universities in the country.*

True to our legacy, the College will develop work-ready engineers who possess cutting-edge technical knowledge, hands-on experience, teamwork and communication skills, and are new-venture ready upon graduation. The key to educating work-ready engineers is faculty-student engagement in interactive learning. In support of this, we will:

- Recognize that diversity is critical to a quality engineering program and that diversity encompasses not only gender and ethnicity, but also academic discipline, cultural background, and differing styles of communication and reasoning. Success in the global workforce will require engineers who have the skills to make diversity in the workplace an advantage.
- Provide faculty and students with diversity training, including training in all aspects of collaboration, and opportunities for involvement in a variety of campus and community cultural programs.
- Promote recognized “best-practices” of engineering education, and work with the OSU Center for Teaching and Learning to provide teaching-related faculty development opportunities.
- Develop innovative peer teaching and mentoring experiences to enhance the leadership, communication, and collaborative skills of undergraduate and graduate students. Examples include: Engineering Student Ambassadors Program, peer advising, and teaching workshops for graduate students developed in partnership with the OSU Center for Teaching and Learning.

In addition, we will continue to expand learning innovations that increase the value of OSU Engineering graduates. In support of this goal we will:

- Grow MECOP/CECOP and other internship venues to achieve 80% internship rate among graduates so that new OSU engineers have broad field experience before graduation, enabling them to immediately add value to the companies and agencies where they are employed.
- Continue implementation of innovative Platforms for Learning (i.e., TekBots™, Mobile-Wireless Learning Environments, Team-based Design Competitions, etc.) across curricula to enhance experiential learning, attract top students, and build our reputation among industry as the “go-to source” of work-ready engineering talent. (These programs are funded by private dollars.)
- Continue to build entrepreneurship into the engineering curriculum through the partnership with the OSU College of Business and University Housing & Dining Services to create and deliver a best-of-class Entrepreneurship Minor in a residential college setting, enabling engineering and other students to launch business ventures before graduation or bring value-added business skills to the companies that employ them.
- Expand the partnership with the OSU College of Business to add business skills to the engineering curriculum, beyond the MBE program in Construction Engineering Management.
- Ensure that our engineering graduates are globally competitive through innovative international learning opportunities such as international global design projects utilizing virtual global teams and international internships.

Collaborative Research and Opportunities for Impact

Goal 1 of OSU’s Strategic Plan: *Provide outstanding academic programs that further strengthen our performance and pre-eminence in the following five thematic areas.*

- *Advancing the arts and sciences as the foundation for scientific discovery, social and cultural enhancement, and progress in the applied professions.*
- *Understanding the origin, dynamics, and sustainability of the Earth and its resources.*
- *Optimizing enterprise, innovation, and economic development. Oregon needs to jump-start high-tech innovations and build an entrepreneurial climate in which to move those innovations to market. OSU will develop world-class, work-ready engineers and create globally competitive high-impact ideas for products, services, and infrastructure. We will help develop tomorrow’s entrepreneurs, who will drive the success of emerging and growing organizations across the natural resource and technology sectors and build the infrastructure for 21st Century Oregon.*
- *Realizing fundamental contributions in the life sciences and optimizing the health and well-being of the public.*
- *Managing natural resources that contribute to Oregon’s quality of life, and growing and sustaining natural resources-based industries.*

The College will strategically target research investments to achieve local and national impact and global leadership. The following national research themes will drive research business development:

- **Homeland Security:** physical infrastructure; sensors; cyber infrastructure; bio, nuclear, chemical, and infrastructure threats—including incident response, first

- responder training, technical support, natural hazards recovery modeling, standards development, and public policy
- **Intelligent Information Systems:** cognitive systems; physical infrastructure self awareness / internet self awareness; fleets of vehicle self awareness; Dept. of Defense readiness; transportation systems, etc.
 - **Sustainable Physical Infrastructure:** transportation; coastal; energy; construction management; materials; etc.
 - **Human Environment Interaction:** industrial ecology; waste product recovery; water resources engineering; bioremediation; engineered landscapes
 - **Energy Independence:** alternative modes (biodiesel, wind, ocean, micro-hydro, etc.); hydrogen fuel cells and production; safer nuclear energy generation
 - **Biotechnology:** biological device development; biosensor systems; bio fuels development; metabolic engineering

Building Collaborative Research Clusters

Collaborative Research Clusters will help increase impact and bolster reputation / brand at the departmental as well as college level. These collaborations engage OSU engineering faculty with faculty in other disciplines, at other universities (including those within Oregon, across the U.S., and around the world), and with industry partners. These Research Clusters, along with their current competitive positions, goals, and strategy for impact, are summarized below.

Energy Systems

The goal of this research cluster is to develop innovative, alternative energy systems capable of providing electric power or transportation fuels using centralized or distributed energy sources, while creating new industries and family-wage jobs in Oregon. Currently OSU researchers are leading the nation in developing the technology that will harness ocean wave energy and creating passively safe nuclear power. In collaboration with other research clusters, advanced biodiesel fuels and bacteria-generated hydrogen are actively being explored for use as transportation fuels. Having generated more than \$20M in energy related research over the past 10 years, OSU is Oregon's only institution developing, constructing, and testing energy systems currently being considered by U.S. utilities for near-term deployment. The new investment will add 10 top energy researchers to the cluster to advance progress on existing concepts and to develop new energy systems. It will provide for the renovation of valuable laboratory space for collaborative research supporting 110 graduate students and providing expanded research of \$10M/year.

ONAMI @ OSU

The Oregon Nanoscience and Microtechnologies Institute is one of the signature research clusters for Oregon and involves key collaborations between OSU, UO, PSU, Pacific Northwest National Labs, HP, Intel, Xerox as well as numerous smaller companies. Oregon has been recognized nationally as being a leader in micro and nanotechnology, and ONAMI is focused on commercializing key basic research advances into products that bring economic vitality to Oregon as well as national visibility for research excellence. Initial research breakthroughs through ONAMI efforts include micro-scale biodiesel reactors and portable kidney dialysis units. ONAMI conducts \$4M/year in research at OSU and involves more than 40 graduate students. In order to leverage the growth potential in ONAMI, OSU proposes to increase the number

of faculty by 17, the number of graduate students to 130, and grow research to \$15M per year.

Biological and Environmental Systems

Biological and environmental engineering is focused on a variety of biotechnology and environmental systems; about \$1.7M/year of research is performed in areas related to bioprocessing, biomaterials, and environmental remediation. This funding comes from a variety of federal agencies including EPA, NIH, NIEH, NSF, DOE, DoD and Pacific Northwest National Lab. The cluster faculty collaborate with a variety of companies such as Bend Research, AVI, SIGA, Amgen, and Hemcon and state agencies such as ODEQ, ODOT, and ODWR. The Cluster has about 20 graduate students in chemical engineering, environmental engineering, and bioengineering. The investment in 13 additional faculty will expand capacity to allow national and international competitiveness and will increase the national stature of the program (the OSU Environmental Engineering program is currently ranked 34th in the U.S.). The proposed investment would result in: an increase in graduate student enrollments to 110 coupled with an increase in research activity to \$8M annually; an expanded capacity to provide research to serve Oregon's environmental services industry and its growing biotechnology industrial sector; creation of a graduate educational and research program in air pollution control to serve the environmental service industry, several state agencies, and a variety of companies; expansion of research on water reuse and treatment to support industrial and municipal growth in the state.

Kiewit Center for Transportation and Infrastructure

Infrastructure engineering creates and maintains the "built environment," which includes industrial sectors of construction, engineering services, and the public works portion of local, state, and federal agencies. Building and maintaining Oregon's infrastructure is nearly 10% of the state's economy. OSU's Kiewit Center for Transportation and Infrastructure conducts about \$5.4 M/year in collaborative research with universities, agencies, and companies (including ODOT, AGC, Hoffman Construction, CH2M HILL, David Evans and Associates, PSU, and UO) to provide new technologies for cost effective applications. The Kiewit Center has about 80 graduate students in structural, geotechnical, construction, water resources, and transportation engineering. The investment in 23 additional faculty will expand the program to 200 graduate students and \$30M/year in research expenditures. The impact of this investment will expand capacity, making Oregon's companies more nationally and internationally competitive and ensuring the quality of the state's infrastructure. The strategy will build on our current successes in developing nationally recognized research programs such as the Highway Bridge Testing and Evaluation Program (ODOT funding), the National Center for Accessible Transportation (Department of Education funding), NEES Tsunami Research Center (NSF funding), and the Groundwater Remediation Program (DOE funding).

Mixed-Signal Integrated Systems

RF/analog circuitry called *mixed-signal integrated systems* provides the interface between "real world signals" such as voice or temperature measurements and transforms them into digital information for processing. Oregon's leading mixed-signal concentration includes efforts at Intel, Tektronix, Maxim, Mentor Graphics, Planar, Pixelworks, Triquint, and many others. Through strong industry collaborations, OSU's mixed-signal group's research expenditures over the last four years was \$10M. Currently, the faculty advise more than 50 graduate students. In order for Oregon and the nation to remain globally competitive in mixed-signal technologies (an area China has recently targeted

as one of its top 15 engineering thrusts) OSU proposes to double the faculty in this cluster to 10 and increase the number of graduate students to 130. Two recent million-dollar research projects in sensor networks and animal tracking with the OSU Colleges of Forestry and Agriculture will lead to development of an engineering research center on environmental sensing and monitoring. This effort will grow research to \$8M/year, enhance collaborations with PSU and OHSU, and increase the impact on regional and national industry.

Intelligent Information Systems

This research cluster consists of the Northwest Alliance of Computational Science and Engineering (NACSE) led by Cherri Pancake, the Artificial Intelligence/Machine Learning Research Group led by Tom Dietterich, and the End User Software Research Group led by Margaret Burnett. NACSE recently collaborated with Civil Engineering to create full internet control of the world's largest wave basin, housed at Oregon State University. With this remote control capability, researchers from all over the world can use this facility to study tsunamis. In the AI/Machine Learning group, recent new faculty hires from Purdue and Carnegie Mellon has helped this group emerge as one of the top 10 in the nation. The End User Software research group, which started with a multi-million dollar grant from NSF, is a collaborative effort among several universities including Carnegie Mellon, Penn State, Drexel, and others. By adding 14 faculty to this cluster, research expenditures will increase to \$13M/year and graduate students will increase from 50 to 120.

Graphics and Visualization for Display Systems

Oregon has a well recognized industry cluster in display technologies, and OSU faculty have partnered with this consortium of companies. Four faculty in computer graphics and visualization hired in the last four years have initiated an NSF collaborative industry/university research center to further build these relationships. Several other universities including UC Davis will be part of this consortium. The research cluster currently includes 20 graduate students, but will add four faculty, increasing the number of graduate students to 60 and research expenditures to \$2M/year.

Autonomous Systems

Autonomous Systems is a new Research Cluster at OSU Engineering, focused on how to automate systems—from vehicles to networked sensors—for applications ranging from homeland defense to monitoring of infrastructure. Autonomous air vehicles can be used for monitoring coastal areas for tsunamis, as well as for search-and-rescue situations like Hurricane Katrina. Autonomous monitoring of highway bridges through acoustic sensing can distinguish between damage that requires immediate repairs and natural aging processes of bridges that are still safe. Oregon is home to several companies that provide key sensing and control capabilities for autonomous systems (CloudCap, Hood Technologies, and Garmin), and the Insitu Group employs Oregonians in the Hood River community at its autonomous vehicle R&D facility. OSU proposes to increase the number of faculty in this strategic area by nine and the number of graduate students to 100. Research expenditures that currently approach \$1.5M in this area can grow to \$8M with this addition of faculty.

The table below captures the strategies for growth and impact of our collaborative Research Clusters and summarizes the number of new faculty that will be recruited to achieve those results.

Goals and Strategies for Additional Faculty to be hired 2007-2011

OSU ENGINEERING RESEARCH CLUSTER	HIRES	OREGON INDUSTRY COLLABORATIONS	MEASURED RESULTS			
			Research \$M/year		Enrolled Graduate Students	
			Current	Future	Current	Future
Energy Systems Establish Energy Independence	10	PGE, Oregon DOE, EPRI, Westinghouse, BPA	2	10	25	110
ONAMI @ OSU Ensuring Oregon's Leadership in the Small Technology Industry	17	HP, Intel, Xerox, Altman- Browning, LSI Logic	4	15	40	130
Biological & Environmental Systems Ensuring a clean, healthy environment	13	Bend Research, AVI, SIGA, Amgen, ODEQ, ODOT, ODWR	1.7	8	20	110
Kiewit Center for Infrastructure & Transportation Ensuring a viable infrastructure to support economy growth	23	ODOT, AGC, Hoffman Construction, CH2M- HILL, David Evans & Associates	5.4	30	80	200
Mixed-Signal Integrated Systems Securing Oregon's leadership in the face of world competition	5	Intel, Tektronix , Maxim, Mentor Graphics, Texas Instruments, Pixelworks, Triquint, Marvell	2.5	8	50	130
Intelligent Information Systems Creating innovative solutions	14	Intel, IBM, Microsoft, HP	3.5	13	50	120
Computer Graphics and Visualization Helping innovate display systems	4	Summit, Planar, Pixelworks, InFocus	0.5	2	20	60
Autonomous Systems Creating mobile observational systems	9	Garmin, Hood Technologies, Cloudcap, ODOT, Mentor Graphics	1.5	8	40	100
Emerging Areas including Open Source (collaborative with PSU & UO)	19		2.9	26	195	140
TOTALS	114		24	120	520	1100

Achieving Our Impact Through People

We will proactively recruit the world's brightest students to study engineering at Oregon State and will recruit the world's top professors to teach those students and engage in cutting-edge research. Recruiting and retention strategies will include:

- Create and implement a PhD program for excellence that attracts the nation's best PhD students (private dollars). Implement "Opportunity Plus" with the University Honors College as a means to retain our best undergraduates as graduate students/PhD candidates.
- Create a nationally recognized women and minority program that attracts the best students to Oregon State.
- Implement a comprehensive and coordinated recruiting effort to sell the OSU Engineering advantage to high school graduates from diverse backgrounds: platforms for learning, opportunities for undergraduate research, geographic location, international programs, etc.
- Proactively identify and recruit faculty from diverse backgrounds that enhance and advance our collaborative research and education nationally.
- Enhance undergraduate student success and retention by partnering with the OSU Academic Success Center and developing coordinated quality peer mentoring and advising across the College.

Transforming Our Culture

The College will expand and enhance a culture that facilitates ongoing success of our collaborative Research Clusters. OSU Engineering is rapidly gaining an outstanding reputation for our collaborative approach to research and teaching, and we will support and expand this unique culture of collaboration by removing barriers and organizing research around Research Clusters rather than traditional departments. Among the tools we will use to enhance and expand collaborative work are:

- Keep open doors for collaborative ventures
- Build collaborative teams through new faculty hires and community-building activities
- Create social and scientific/engineering "mixers" and workshops
- Identify experts on funding sources: study OSU-accessible winning proposal examples, develop "how to succeed" rules, build a network of funding experts
- Provide offices in close proximity for lab-intensive clusters and program cluster environments into future infrastructure projects
- Make space available as needed and overcome administrative barriers
- Foster international experiences and exchanges to enhance diversity
- Implement "Second Generation Technology Transfer" methods and increase speed of intellectual property right analysis
- Balance work load as new faculty are added. OSU Engineering ranks 6th in undergraduates per faculty among research intensive engineering programs; shifting faculty work load will increase opportunities for research and collaboration.
- Create formal opportunities for enhancing faculty and graduate student collaborative, project management, and leadership skills

To fully unlock its collaborative capacity, we are organizing our degree programs and faculty around five schools. One of these schools, the School of Electrical Engineering and Computer Science, is already formed and the others are in process. This organizational change will enhance our ability to assimilate new faculty and achieve the desired growth impacts. The table below summarizes this new structure:

SCHOOL	DEGREE PROGRAMS
<i>Chemical, Biological, and Environmental Engineering</i>	Chemical Engineering Bioengineering Environmental Engineering
<i>Civil and Construction Engineering</i>	Civil Engineering Construction Engineering Management
<i>Electrical Engineering and Computer Science</i>	Electrical and Computer Engineering Computer Science
<i>Mechanical Industrial and Manufacturing Engineering Systems</i>	Mechanical Engineering Materials Science Industrial Engineering Manufacturing Engineering
<i>Nuclear Science and Engineering</i>	Nuclear Engineering Radiation Health Physics Medical Physics (new collaboration with OHSU)

The combination of schools and clusters creates a powerful community to achieve our goals and impact. It also enables us to quickly assimilate new faculty and staff. The table below shows how the schools and research clusters are linked to create this network.

SCHOOLS	COLLABORATIVE RESEARCH CLUSTERS								
	Energy Systems	ONAMI @ OSU	Biological & Environmental Systems	Kiewit Center, Infrastructure/Transportation	Mixed-Signal Integration Systems	Intelligent Information Systems	Computer Graphics & Visualization	Autonomous Systems	Emerging
Chemical, Bio, Environmental									
Civil & Construction									
Electrical & Computer Science									
Mechanical, Industrial & Manufacturing									
Nuclear Science & Engineering									

Expanding and Enhancing College Infrastructure

The following table summarizes the current and proposed infrastructure projects at the OSU College of Engineering.

OSU College of Engineering Infrastructure Transformation

PROJECT	Size (sq. ft.)	Bonds \$M	Other Funds \$M	Programs Served	Desired Start Date	Occupy Date
Kelley Engineering Center	153,000	\$20M	\$25M	Home for School of EECS	7/03	7/05
Apperson to Kearney Hall Remodel	26,342		\$10.5M	Remodel offices and class-rooms for CCEE	8/06	8/07
ONAMI Lab Phase II	40,000	\$9.5M		Home for Microproducts Breakthrough Institute	1/07	1/08
New Chem-Bio-EnvE Center <i>Proposed</i>	66,745	\$13.5M	\$13.5M	Demo W wing and remodel N wing of Merryfield Hall. Add labs, classrooms and offices to Owen Hall for ChE and BioE	6/08	6/10
Gleeson Hall Remodel <i>Proposed</i>	39,011	\$4.5M	\$4.5M	Remodel for offices and classrooms	6/10	6/11
IFIL-Radiation Center Addition <i>Proposed</i>		\$5M	\$5M	Instrumentation and Flow Imaging Lab for NE&RHP	7/03	12/04

Attracting Investment for Our Transformation

Goal 3 of OSU's Strategic Plan: *Substantially increase revenues from private fundraising, partnerships, research grants, and technology transfers while strengthening our ability to more effectively invest and allocate resources.*

Our "Prosperity Through Innovation" initiative will drive our efforts to garner the resources needed to reach our goals. Aggressive, ongoing fundraising in both the public and private sectors is essential. The Engineering and Technology Industry Council (ETIC) and other private leadership is helping us garner the public investment needed to double the OSU Engineering faculty. This public funding is significantly leveraged by private fundraising success.

Private Fundraising

During 2005, the University began the silent phase of a comprehensive capital campaign. The College of Engineering launched its "mini campaign" during 2000, raising \$85M by the end of FY06. Of the \$85M total, \$61M is included as part of the silent phase of the University campaign, and the working goal for the Engineering component of the campaign is \$128M.

Public Investment

Core funding to support doubling our faculty, increasing our staff, and expanding and enhancing our infrastructure will need to be provided by the State of Oregon in FY 2007 through FY 2013. During this period, exciting new transformational private investments in faculty, students, programs, and laboratories will match this public investment. In the future, this investment will need to be replaced with a source of recurring public funds.

The following is a summary of the operating investment needed during startup as OSU Engineering adds faculty over the next three biennia and reaches steady state under this proposal. The first phase of this investment plan and the goal to double our faculty has been endorsed by ETIC. The following estimates include inflation:

- FY 2007-FY 2009: \$43 million
- FY 2009-FY 2011: \$54 million
- FY 2011-FY 2013: \$57 million

Oregon's Return on Investment

Oregon will benefit from impacts of a top-25 engineering college including:

- Delivery of top talent, ready to contribute to Oregon's innovation economy at the highest level
- Delivery of new ideas from internationally competitive research programs that will spawn new products, new companies, and new industries
- Presence of a world class partner for collaboration with Oregon's industry
- A magnet for top talent at all levels, from new high school graduates to PhD students to professors to the leadership of innovative companies looking at Oregon as a location for their operations

Expected Results FY 06 – FY 07

During FY '06-07, OSU Engineering will:

- Sustain our powerful momentum.
- Help position ONAMI as Oregon's first nationally ranked Signature Research Center. Oregon State's Mechanical Engineering, Chemical Engineering, Bioengineering, and Industrial & Manufacturing Engineering reputations will be enhanced by this effort.
- Continue the elevation of the Mixed-Signal Integrated Systems Research Cluster from top 6 in 2003 to top 4 or 5 in 2005 to top 3 or 4 in 2007.
- Build on the positioning of the four other Research Clusters established in the 2003-05 biennium so that each moves up 1 to 3 positions in the 2005-07 biennium.
- Attract and retain the nation's best professors and deliver top work-ready engineering talent, while spinning out new technologies for Oregon industry and economic impact.

The new engineering talent graduated from OSU will be:

- The nation's best engineers, ready to build 21st Century Oregon and a better world.
- The next generation of industry and academic leaders, thanks to leadership training and experiences such as peer advising, student ambassadors, and graduate student teaching experiences.
- More diverse, thanks to a new, privately funded Women and Minorities Program.
- Ready to produce on day one, thanks to a powerful research program, privately funded and nationally leading Platforms for Learning, and internships including MECOP/CECOP.
- New-venture savvy, thanks to the optional Entrepreneurship Minor and access to the Austin Entrepreneurship Program at Weatherford Hall.

Collaborative research results will:

- Develop top R&D talent ready to help Oregon and other companies compete and succeed in the global knowledge-based economy.
- Help build a new technology industry in Oregon.
- Spin out new product or process technologies.

Investment in the development of our people will:

- Develop the faculty skills to create the ideas and nurture the talent that will result in new companies, new ideas, world class people and unique innovators.
- Develop a mentoring forum to help junior faculty identify successful paths to tenure and full professor. Have at least 50% of the untenured faculty in COE participate in two forums in FY 2006 – FY 2007. (Topic areas for forums could include effective project management skills, effective leadership skills, how to lead research clusters, how to connect with national research growth areas and

identify opportunities for funding, how to engage graduate students, and how to involve undergraduates in research.)

- In partnership with the Academic Success Center (ASC) create a student networking structure of peer advisors that is accessible to all COE students and is focused on connecting COE students to academic, social, computer, and mentoring services and support structures in the University.
- Fifty percent of all first year, full-time freshman and 75% of first year, full-time women, underrepresented minorities, and at-risk students will participate in targeted programs by end of FY 07.

We will track our progress and report results to OSU and our external leadership including ETIC. Our metrics and commitment targets are summarized in table below.

Metrics of Progress to be Reported to ETIC

METRIC	BASELINE	PROJECTED			
	AY99	AY06	AY07	AY08	AY09
Avg. SAT/ACT percentile of incoming freshmen ⁽¹⁾	76	85	85	85	85
Avg. GRE percentile of incoming grad students ⁽²⁾	57	82	82	82	82
Women graduating from ECS programs ⁽³⁾	13	17	18	19	20
Minorities graduating from ECS programs ⁽³⁾⁽⁴⁾	12 est.	14	14	15	15
ECS undergrad student credit hrs	52690	69000	69000	70000	70000
ECS bachelor degrees granted	389	545	545	545	560
ECS grad student credit hrs	12870	22800	23000	23300	23600
ECS grad degrees granted	154	218	226	232	240
Pre-college contact hrs (through extension only) ⁽⁵⁾	N/A	13225	13483	13741	14000
Total research expenditures per year ⁽⁶⁾	12.3M	23M	27M	32M	37M
National ranking of EECS ^(7a, 7b)	65-75	30-40	30-40	25-35	25-35
National ranking of ME ^(7a)	45-55	45-55	40-50	40-50	40-50
National ranking of CCEE ^(7a)	35-45	25-35	25-35	20-30	20-30
National ranking of College of Engineering ^(7a)	NA	65-75	55-65	50-60	45-65
National ranking of College of Engineering (U.S. News)	83	65-75	60-70	55-65	55-65
Licenses sold ⁽⁸⁾	5	13	13	13	14

⁽¹⁾If your applicants are required to submit SAT scores, use the percentile corresponding to the average composite SAT score of those submitting them. If they have the choice of SAT and ACT, use the average composite SAT score and the average composite ACT score, convert them to percentiles, and compute a weighted average of the two.

⁽²⁾Percentile based on the average quantitative score over those submitting such scores, ignore verbal and analytic scores.

⁽³⁾As a percent of all those graduating.

⁽⁴⁾Racial and ethnic minorities who are US citizens or permanent residents.

⁽⁵⁾Pre-college students participating in pre-college engineering, technology, computer science, math, and science programs.

⁽⁶⁾Total dollars spent by ETIC-related departments towards research during academic year.

⁽⁷⁾Forecasts for multiple programs and departments are encouraged. Each ranking should be footnoted with the ranking body or ranking methodology. ^(7a)ASEE research ranking; ^(7b)ECE and CS combined in FY03; 99 base was the same for both departments. The values for departments for '99 are rough estimates.

⁽⁸⁾Patent licenses or other royalty-generating intellectual property licenses granted to commercial entities.

Expected Fundraising Results through FY 07

We will fully engage the College Leadership in private fundraising through our partnership with the OSU Foundation. Our fundraising targets as committed to ETIC are summarized below.

Expected Private Investments FY06-FY07

Total Campaign Goal	\$128M
Campaign Total, end of FY 2005	\$46M
FY 2006 ETIC Commitment	\$10M
FY 2007 ETIC Commitment	\$10M
Campaign Total, end of FY 2007	\$66M

Revenue Forecast and Allocation

The following two tables summarize total operating revenue, including the Provost's Office allocation via the University's Budget Allocation Model (OSU E&G), student fees, indirect cost recovery (ICR), targeted state investments, private cash and endowment, research grants and contracts, and federal earmarks.

Sources and Amounts of Operating Revenue (\$1,000s)¹

	FY 06 Planned	FY 06 Actual
OSU E & G	14,207,912	14,531,792
Student Fees	3,100,000	3,180,409
ICR	867,400	1,062,389
State Targeted (ETIC & MMD)	4,830,882	4,830,882
Private Cash—Foundation	2,500,000	2,750,000
Private Endowment Earnings	1,200,000	1,500,000
Research ²	20,000,000	24,231,943
Total	43,006,194	47,837,415

¹ Operating revenue only; does not include revenue for new capital construction or funds obtained for endowment.

² Does not include matching research expenditures that are in other categories.

Total Operating Revenue in Comparison to State Funds (\$1,000s)¹

	FY 00	FY 01	FY 02	FY 03	FY 04	FY 05	FY 06
State²	8,977	9,519	12,352	12,981	13,662	14,103	14,532
Total³	30,497	34,205	41,178	42,628	45,101	47,491	47,837

¹ Operating revenue only; does not include revenue for new capital construction projects or funds obtained for endowment.

² Approximate; State General Funds through OSU plus Targeted Funds

³ Total revenue consists of State funds, Tuition and Fee Income, Indirect Cost Recovery, Private Gift Funds, Earnings from Endowments and Externally Funded Research

Investments are allocated to units consistent with strategy for growth of research clusters and degrees as shown in the following table.

Resource Allocation to Units for FY 07 (\$1,000s)¹

	COE	CCEE	ChE-BioE	EECS	IME	ME	NE-RHP
E&G Base	1,852	2,078	1,106	4,390	1,093	1,953	714
Student Fees	703	456	189	980	315	457	90
ICR	404	175	43	245	25	64	44
ETIC		934	375	2,116	229	831	108
MMD	238						
Total	3,197	3,643	1,713	7,731	1,662	3,305	956

¹ Total resources except private and external research. FY 07 relative allocation is planned to be similar.

Top-25 Drive Leadership

OSU College of Engineering Leadership Team

Ron Adams
Dean

Belinda Batten
Head, Mechanical Engineering
Interim Head, Industrial + Manufacturing Engineering

Chris Bell
Associate Dean

John P. Bolte
Head, Biological + Ecological Engineering

Bella Bose
Associate Director, School of Electrical Engineering + Computer Science

Terri Fiez
Director, School of Electrical Engineering + Computer Science

Ken Funk
Interim Associate Head, Industrial + Manufacturing Engineering

Jennifer Hall
Executive Assistant for Administration

Jim Lundy
Associate Dean

Luke Mc Ilvenny
Business Manager

Ellen Momsen
Director, Engineering Women + Minorities Program

Cherri Pancake
Director of IT

Kathy Park
Senior Director of Development

José Reyes
Head, Nuclear Engineering + Radiation Health Physics

Dave Rogge
Associate Head, Civil, Construction + Environmental Engineering

Steve Tesch
Head, Forest Engineering

Ken Williamson
Interim Head, Chemical Engineering
Head, Civil, Construction + Environmental Engineering

OSU College of Engineering Advisory Board

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President and CEO, Tripwire

Kay E. Altman
CFO, Altman Browning + Company

Fred Briggs
Executive Vice President, Verizon Communications

J. J. Cadiz
Usability Engineer, Microsoft

Mark Christensen
President, Global Capital Management, LLC

Kevin W. Clarke
Site Manager, Barco Medical Imaging Systems

Ron Dilbeck
COO, RadiSys Corporation

Dwayne Foley
*Retired—Northwest Natural Gas
OSU Alumni Association/OSU Foundation*

James A. Johnson
*Vice President, Intel Communications Group,
Intel Corporation*

Lee Kearney
Retired—Peter Kiewit Sons', Inc.

Martin N. Kelley
Retired—Peter Kiewit Sons', Inc.

Jim Lake
Associate Lab Director, Idaho National Laboratory

Mark A. Lasswell
President, OMI, Inc.

Sue Laszlo
Manager, Design Services, Port of Portland

Paul Lorenzini
Retired—PacifiCorp

Jeff Manchester
Retired—Fort James Corporation

Steve Nigro
Vice President, Hewlett Packard Co.

Jeff Peace
*Program Manager, 767 Tanker,
The Boeing Company*

Jim Poirot
Retired—CH2M HILL

Rod Quinn
*Director, Process Science + Engineering,
Pacific Northwest National Laboratory*

Hal Pritchett
*Retired—OSU
Construction Engineering Management*

Scott R. Schroeder
President/CEO, Maga Tech of Oregon

David Skillern
NetApp

Milton R. Smith
President, Smith Investments

Randall L. Smith
Vice President, CH2M HILL

Jim Street
Retired—Shell Oil Company

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President + CEO, LSI Logic Corporation

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Retired—Chevron

Mike West
VP, Technology, Pixelworks

Ted Wilson
*HP Fellow + Technology Director,
Imaging + Printing Group,
Hewlett-Packard Company*