

Engineering and Technology Industry Council Campus Investment Proposal Biennium from July 1, 2009 to June 30, 2011

Campus: University of Oregon

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Date of Revised Submission: 7 April 2008

Summary of Proposal:

The Graduate Internship Program at the University of Oregon builds on the strengths of Oregon's existing and growing industry clusters. The University of Oregon requested \$10,800,000 in strategic funding to

- expand the existing graduate internship programs in materials science,
- expand federally funded graduate, K-12 outreach, community college partnership programs,
- start a new biotechnology internship track, and
- assess opportunities in Oregon's growing energy, water and biomedical clusters for expansion and begin an additional track in Oregon's nationally unique graduate internship program.

The requested funding will be leveraged by federal grant funds exceeding \$11,000,000 in addition to over \$33,000,000 in private matching funds.

Vision Statement:

The Materials Science Institute at the University of Oregon is a strategic asset for Oregon's economy and Oregon residents providing:

- nationally unique and rapidly growing graduate internship degree programs tailored to meet the needs of existing and growing Oregon industry clusters;
- K-12 educational outreach programs that yield continual returns from strategic infrastructure and teacher training investments;
- bridge programs that connect the UO and community colleges in Oregon;
- nationally and internationally respected research faculty and programs that attract both research funds and human talent to Oregon from throughout the world; and
- world class instrumentation and staff running Oregon's high tech extension service – CAMCOR - that provide Oregon businesses a competitive economic advantage by producing key information in a timely manner.

The Materials Science Institute has led a cultural change at the University of Oregon, expanding partnerships with industry and other stakeholders in Oregon. The requested funding focused on expanding this entrepreneurial approach to other science and applied science fields while continuing the growth of existing programs.

Aspirational Peers

In Materials Science, our aspirational peers are:

University of California, Santa Barbara - Interdisciplinary success

University of Wisconsin - Integration of research/education

University of Minnesota - Industry partnerships

The Materials Science programs at these three Universities are national leaders and excel in the areas indicated above. We are strongly motivated to attain the levels of achievement of these outstanding programs. We have made remarkable progress over the last ten years in attracting outstanding faculty (another NSF career award in 2007) and graduate students, increasing competitive research funding, and building nationally unique programs that can reach and exceed the levels attained by our aspirational peers. The requested funding from ETIC is crucial to continuing to accelerate this progress and impact.

Long-term Goals

The aggressive goals in Materials Science by 2020 are to have:

- expanded the Graduate internship program to over 100 MS students per year and achieved the number one ranking in the nation in awarding chemistry masters degrees by a factor of two,
- doubled the number of Ph.D. degrees awarded per year compared to 1999,
- increased the amount of externally funded research compared to 1999 by a factor of five,
- developed an undergraduate materials chemistry program granting 20 BS degrees a year,
- expanded the Graduate Internship program to other Oregon economic clusters (such as energy, sustainability, biotechnology, and information technology),
- increased the number of patent disclosures five-fold compared to 1999,
- increased annual licensing revenue ten-fold compared to 1999,
- expanded the number of our industrial partners to over 100, and
- increase the usage of CAMCOR by outside industrial users to over \$1,000,000 annually.

Investment Description

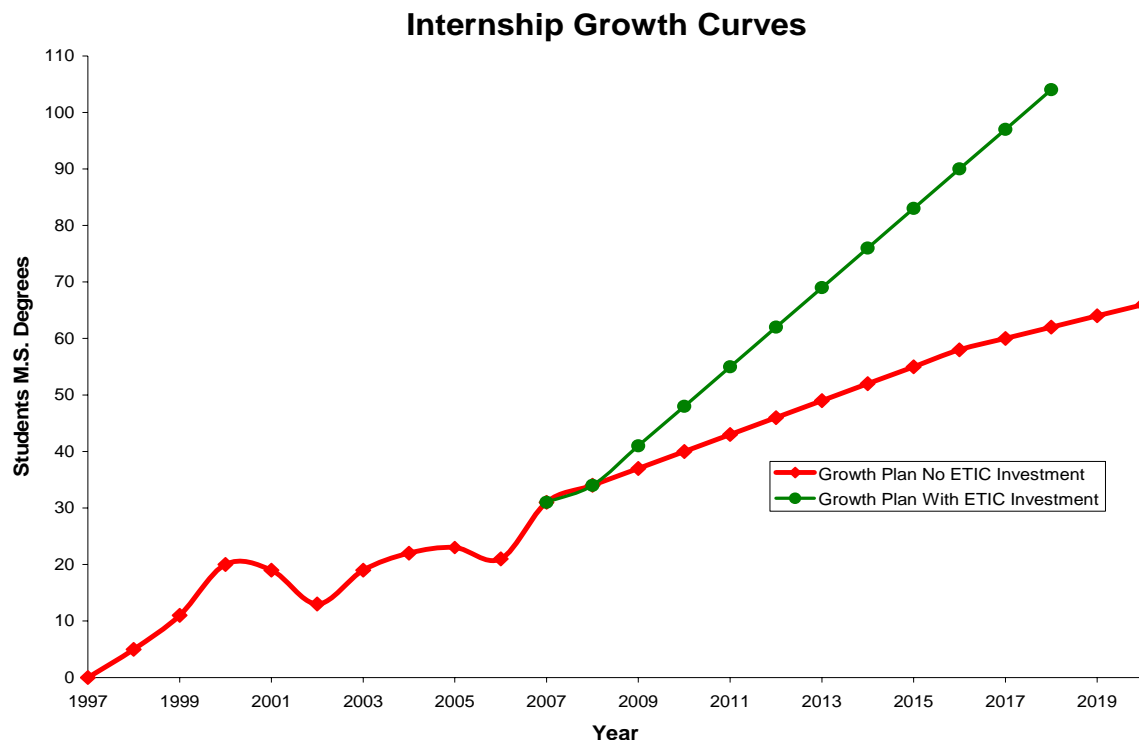
Proposed Investments and Rational.

The University of Oregon's 2009-2011 biennium request targets capital and manpower investments aimed at accelerating the growth of the Graduate Internship program with a goal of being the number one masters program in the country by 2012 in chemistry and to graduate twice as many masters as the nearest competitor by 2020. The requested investment:

- expands program staffing to increase student recruitment, strengthen our corporate relationships, increase our marketing efforts, and maintain virtually 100% student placement in internships and retention,
- adds two faculty positions to support the increasing workloads generated by expanding enrollments, increases the research enterprise within the Institute and continues the "cultural" changes on the Oregon campus spearheaded by the internship program,
- adds laboratory equipment to the internship laboratories to expand teaching capacity,
- provides matching funds for federal proposals aimed at accelerating the growth of our Ph.D. program and increasing the amount of federally awarded grant dollars per faculty member, and

- provides matching funds that will expand our federally funded IGERT, GAANN, GK-12 and STEP programs that build partnerships with Oregon industry, Oregon’s K-12 schools, and Oregon community colleges, respectively.

This investment during the 2009-2011 biennium will greatly accelerate growth of our nationally unique graduate internship program toward our 2020 goals, getting us there decades earlier than if we receive no ETIC investment, as shown below.



In the 2011-2013 biennium we anticipate requesting additional faculty positions and funding for major space renovations that will enable the polymer science, organic synthesis and biotechnology tracks to expand and create the laboratory space for an undergraduate program in materials chemistry. The program staffing and the laboratory upkeep costs will be funded by the increased enrollments in the graduate internship program after the requested biennium of funding. The faculty positions will be supported via a combination of new and existing resources within the departments and college.

Partnerships with Oregon Industry:

The Graduate Internship program is built on collaboration and partnerships with Oregon companies, PSU, OSU, OIT, SOU, and other Oregon institutions of higher education including community colleges, and with many public and private institutions outside of Oregon. We currently partner with over 60 companies in the graduate internship program and CAMCOR and this list continues to increase on a monthly basis. Our partners include:

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|---------------------------------------|----------------------|-----------------|
| Albany Molecular Research, Inc | AVI Biopharma | Bend Research |
| Invitrogen/Molecular Probes | Chemica Technologies | Hewlett Packard |
| Pacific Northwest National Laboratory | Organic Consultants | Marker Gene |
| Hexion (Borden Chemical) | Synthetech Inc. | TCI America |
| Entek International | Akzo Nobel | CW Group |
| Materials Modification Inc | Forrest Paint | Dynea Resins |
| Meggitt Silicone Products | Novellus | Nanosolar |

Specialty Polymers	Nike	Sipix Imaging
Willamette Valley Company	Ventana Research Corp	FEI Company
Hynix Semiconductor	Microsemi	Intel
Microchip Technology	Network Elements	Micron Boise
ON Semiconductor	Planar	SanDisk
Electro Scientific Industries (ESI)	Sawtek	Triquint
Deep Photonics	MLD Technologies	nLIGHT
Intel	Maxtek	PSC Inc.
Tektronix	Timbercon	Vistakon
Johnson and Johnson	Cordis	Hayes and Associates
Radiation Monitoring Devices	AISthesis	Voxtel
Crystal Clear Technology	Texas Instruments	Chemcraft
W. Tom Haswell Consulting	Dune Sciences	Lacamas Laboratories
JHS Natural Products	Catalytica Energy	Oregon Organics

The vast majority of these companies are based in Oregon. Over 90 percent of the internships for the graduate internship program have been in Oregon and a very large percentage of these students accept permanent positions with an Oregon company.

Partnerships with Universities, Community Colleges and K-12 schools:

The graduate internship program partners with faculty and programs on many of the OUS campuses. Faculty from OSU (Doug Keszler, Dave McIntyre, Skip Rochefort, Sundar Atre), PSU (Robert Daasch) and faculty from other campuses Richard Chartoff (University of Dayton, polymer expert) have taught in the intensive summer courses. We seek to optimize instruction by utilizing experts in fields and topics of interest to our corporate partners. Many of the students in the Graduate Internship program finish their course work at our partnering institutions. This occurs most frequently at PSU, but a significant number of graduate classes are taken at OSU and other universities geographically located near our corporate partners. Working with the University of Oregon Graduate School, we have worked closely with SOU and OIT to develop the formal structure of a 4+1 BS+MS program. We anticipate that formal agreements will be in place before the 2009-11 biennium. This will permit our partners to use UO engagement as a recruiting tool to assist in attracting talented undergraduates to their campuses.

CAMCOR has been a regional asset to over 30 colleges and Universities within the Pacific Northwest which have used the facilities within the past biennium. Oregon State faculty in particular have taken advantage of the open door policy and low user rates available to all faculty from any institution to further their research programs.

MSI has successfully obtained a four-year \$2,000,000 grant from NSF focusing on building partnerships and pathways between our programs and Oregon community colleges. We are currently working with our science department colleagues at Portland Community College Sylvania, Portland Community College Rock Creek, Chemeketa Community College, Mount Hood Community College, Lane Community College, and Central Oregon Community College. The grant funds 30 community college students while they conduct research during the summer in MSI research groups and pays the community college students while they are peer tutors during the academic year. The goal of this program is to increase the number of community college students who transfer to 4-year schools to complete their degrees in science or engineering.

MSI has also obtained over \$5,000,000 in federal funding in the last 5 years focused on providing embedded professional development on the use of inquiry-based science curricula to K-8 teachers in rural Oregon schools. Our graduate students have:

- worked in over 35 schools in 15 school districts,
- trained over 150 teachers on the content in and the use of science kits in the classroom, and
- taught inquiry-based science to over 6000 students.

The new five-year \$3,000,000 NSF GK-12 grant that started January 1, and begins in the classroom in September 2008, will enable us to train the teachers in over 50 schools (mainly in Eastern Oregon) impacting over 7500 students. We will be seeking a second GK-12 grant during the next biennium and have requested ETIC funds to pilot and match this request. The GK-12 funds are augmented by a three-year ~\$330,000 GAANN grant from the Department of Education that started in September 2007.

Feasibility Issues for Proposed Growth Plan:

Our proposed growth plan requires:

- a continued growth of our relationships with Oregon companies to provide the core element of our new educational paradigm - internships for the graduate students and
- a continued growth in the number and quality of the student applicants for the program.

Success of these two requirements is critical, and we have asked for ETIC support to hire appropriate staff to ensure success. The increased enrollments will enhance class sizes, creating a need for more equipment for the laboratories, also a key part of our ETIC request detailed below.

Our proposed plan has a modest increase of two faculty positions over the 2009-2011 biennium and we believe that space will be available on campus to meet these needs. We have asked ETIC for funding of the start-up packages for these faculty positions – a critical need. MSI continues to have great success in hiring young “star” faculty. We just received notice that our latest MSI hire (Raghu Parthasarathy) has received the NSF CAREER award. This makes 14 of the last 16 MSI assistant professors that have received a national young investigator award. Competitive start-up packages are critical to get the best young faculty to locate in Oregon and ETIC funding has played a crucial role in MSI’s success.

As discussed above, MSI has developed a long-term strategy of building relationships with academic partners at all levels to recruit the top students to our programs and we request assistance from ETIC to redouble these efforts. During the past year, as for the last ten years, MSI faculty visited over 60 undergraduate institutions recruiting graduate students and building relationships with the faculty at these institutions. We have begun building partnerships with our community college colleagues to increase the number of undergraduate students that are interested in science and engineering careers by making community college students aware of the career possibilities. On a longer time scale, our GK-12 efforts to K-12 schools will result in more Oregon students pursuing careers in science and engineering.

The graduate internship program has an enviable record of retention. We have had only 3 out of 180 students not obtain internships. Our graduation rate for the 2005 and 2006 cohorts was 100%. This reflects the high quality of the students that apply and are admitted to the program, as well as the counseling and support offered by the Graduate Internship Program Director, Chris Larson. As the program grows, maintaining this support is critical and is part of our proposed ETIC request for staffing.

Strengths, Weaknesses, Opportunities and Threats:

The strength of Oregon's Graduate Internship Program is the partnerships it has forged with the collaborating companies and the unique educational model that focuses on students learning how to obtain information on their own, organizing and processing the information to solve problems, and creating and carrying out the plan in collaborative teams. The skills that the students develop during the intense summer immersion programs make them outstanding employees and/or exceptional Ph.D. candidates.

The weakness of our program is that it is potentially duplicated if faculty members at other institutions realize the advantages of an outwardly focused graduate program. Fortunately for us, most faculty and departments want "students chained to the bench" in their laboratories and do not see the tremendous opportunities both for their students and their own research that can be realized through true partnerships with industry.

This creates an exceptional opportunity to carve out a unique new niche in graduate education that focuses on preparing graduate students for a diverse set of career opportunities. Our goal with the proposed marketing investment is to stake out this idea as Oregon's and then capitalize on this in recruiting more companies, more outstanding graduate students and more award winning faculty. The proposed ETIC marketing investment will provide us with a lead over our competition and it will be our responsibility to extend this advantage.

The biggest threat to our program is that one of the more wealthy institutions will realize what we have accomplished and find our "secret sauce" – partnerships with industry and an outwardly focused graduate program that prepares its graduates to excel in a spectrum of potential careers. We have seen how difficult it is to change a campus culture, even when the data and success are apparent every day. The culture change at the University of Oregon is unique in that it is being led by faculty, with the support of key elements of the top administration. This is an unusual and very successful partnership.

Tract Record versus Promised Results:

The Graduate Internship Program has continually met or exceeded its goals. We have created the only self-sustaining program using ETIC funding as capital investments to enhance growth. MSI's research program has grown from expenditures of \$1,300,000 in 1999 to over \$9,900,000 in expenditures in 2007. The number of students in the Graduate Internship Program has been steadily increasing, exceeding its goals for the number of internships and degrees granted. The one concept that MSI has not been able to fully deliver is an undergraduate materials chemistry degree program. We have established a summer program with NSF support and a renewal is pending. With an upcoming change in department leadership, we anticipate the formation of this program during the 2009-2011 biennium. This program will be started with resources from the Graduate Internship program – fulfilling MSI's commitment made during the 2005-2007 biennium.

The impact of the Graduate Internship Program on the Ph.D. program in MSI-associated departments has been extraordinarily positive. For example, the chemistry applicant pool is truly outstanding for the materials and related inorganic and organic areas. This has resulted in significant attention and scrutiny from other departments and divisions who aim to strengthen their application pools. The proposed biotechnology program reflects the desire of faculty in molecular biology to copy/partner to achieve the same success. The benefit to ETIC and MSI is the recruitment of existing faculty into a vision for academic success in Oregon that is based on unique programs that provide immediate and distinct returns for both the graduate students and the partnering companies. ETIC funding of the investments proposed below will accelerate the necessary changes on campus, multiplying the returns from both current and prior investments. We appreciate the support, council, and challenges provided by ETIC and look forward to continuing to excel via our partnership.

Proposed Investments:

PROGRAM STAFFING AND MARKETING:

\$800,000.

Our challenge is to grow both the company base and the student base for the Graduate Internship Program while also exploring for potential economic areas where new programs would aid economic growth in Oregon. We ask for funds to be used to cover a maximum of 75% of the costs of:

- a dedicated graduate student recruiter,
- a program coordinator to work with the Director, Chris Larson, in managing the relationships with the 60 plus and growing base of company partners, arranging the growing number of student internships, and ensuring the retention of the students in the program, and
- an administrative assistant.

Approximately half of the requested funds will be used to fund the development and implementation of a marketing campaign for the graduate internship program aimed both at prospective graduate students and prospective corporate partners. The recurring costs of these positions will be funded after this biennium by the growth in the program.

TWO FACULTY POSITIONS:

\$2,400,000.

We request funds for a faculty position each year of the 2009-2011 biennium. These funds will be used to partially cover the cost of start-up funds (currently averaging ~\$800,000 for starting physical scientists), laboratory renovations (typical cost at the UO ~\$400,000 per laboratory in Klamath), and bridging funds for salary. New faculty have been critical to the success of the MSI and we aim to continue our track record of recruiting and retaining outstanding young faculty. These positions are critical to the continued growth of the Ph.D. program, the continued growth of external research funding, and the continuing advancements in the sciences at the University of Oregon. The University of Oregon will endeavor to cover the recurring costs of these faculty positions after this one-time investment.

VISITING FACULTY SCHOLAR PROGRAM:

\$120,000.

Crucial to the continued growth of the Graduate Internship Program is the advice given to prospective graduate students by the faculty at their undergraduate institutions. We have found that when faculty from regional undergraduate institutions spend a portion of their sabbatical doing research at the UO they return to their institution recommending to their graduate students that they attend the University of Oregon. We request funds that will create sabbatical research positions in the Materials Science Institute for faculty at regional undergraduate institutions without the limitations inherent to external grant funding. It will also permit the visiting professors to focus on building a research program, learning from their host labs and using the facilities in CAMCOR.

LABORATORY CAPACITY EXPANSION:

SEMICONDUCTOR PROCESSING PROGRAM:

\$730,000.

The semiconductor processing program is moving into new, expanded facilities in the Integrative Sciences Phase 1 building in time for the summer 2008 program. These expanded facilities were funded in part by a generous donation by Lorry Lokey. Approximately 20% of the ~\$15,000,000 new facility is laboratory space dedicated to the semiconductor processing and characterization program. This provides the space required to double the number of students (30 per summer) taught each summer. The requested funds from ETIC will be used to expand the laboratory equipment base to what is required to teach this number of students per summer. The University of Oregon, through CAMCOR, will provide a staff member responsible for the upkeep and efficient operation of this facility throughout the year.

OPTICAL MATERIALS AND DEVICES PROGRAM: \$430,000.

The optical materials and devices program is moving into the space to be vacated by the semiconductor program in time for the summer 2008 program. This laboratory is three times the size of the facility used during last summer's pilot program and will permit an enrollment of up to 20 students per summer. The requested ETIC funds, to be matched by donations from the participating optics companies, will be used to expand the laboratory equipment base to that required to teach this number of students per summer. The University of Oregon will provide a staff member responsible for the upkeep and efficient operation of this facility throughout the year.

ORGANIC PROGRAM: \$195,000.

The organic synthesis program has doubled its enrollment in the past 4 years and, as it looks to again double its size, needs the requested investment to expand the number of high pressure liquid chromatography columns, other synthesis equipment, and glassware. The requested funds from ETIC will permit us to teach this laboratory-based program to up to 15 graduate students each summer.

POLYMER PROGRAM: \$295,000.

Working with its industry partners, the polymer program has expanded its scope to include coating science and the emphasis has shifted away from synthesis to include more polymer processing such as extrusion and spin coating, polymer blend design, and the use of physical characterization techniques such as thermal analysis to guide product design. The requested ETIC investment will be used to add, update and expand the polymer processing and physical characterization facilities in the polymer laboratory. The requested funds from ETIC will permit us to teach this laboratory-based program to up to 20 graduate students each summer.

BIOTECHNOLOGY PROGRAM START-UP: \$1,150,000.

Working with its industry partners, the faculty members spearheading the Graduate Biotechnology Internship track are developing a training program for students wishing to embark on a career using molecular biology and biochemistry in a commercial setting. Discussions with Bend Research (interested in RNA interference and drug targeting), Illumina (maker of equipment for sequencing genomes) and Invitrogen/Probes (makers of dyes for staining biological samples and kits for molecular biology) to develop the curriculum for the planned intensive summer program are already underway. In addition to "hands on" technical skills, it is apparent that team skills, problem solving and resourcefulness are considered critical for success. This is leading to a challenging projects-oriented laboratory aimed at forcing the class to work as a team to accomplish their goals. The requested ETIC funds will be used to equip a state-of-the-art training lab expected to contain an Illumina Genome Analyzer capable of sequencing 1.5 billion bases per run and an associated data analysis center, a lab equipped for RNA interference and other experiments, a small molecule cell culture screening facility, a flow cytometer to sort cells based on the response to RNAi knockdown or small molecule exposure, and a phosphorimager that is used to characterize protein-nucleic acid, protein-protein and nucleic acid-nucleic acid interactions using chemiluminescent, fluorescent and radioisotope labels.

NEW PROGRAM START: \$300,000.

During the coming biennium the Program Coordinator will be working with Oregon companies to identify opportunities for an additional track for the graduate internship program and assessing the business plan for each of the opportunities. Preliminary discussions have identified the energy sector (photovoltaics), sustainability, biotechnology, water and information technology as opportunities that will be evaluated. We anticipate making a decision on the track with the most upside potential late in 2009 and beginning the program in 2010. The

requested funds from ETIC will fund the development of a pilot curriculum and support the required investment in laboratory equipment.

TARGETED FUNDS TO MATCH FEDERAL PROPOSALS:

MATCH FOR GK-12 GRANT AND EDUCATIONAL OUTREACH: \$720,000.

MSI staff and faculty have been very successful partnering with K-8 schools to implement a nationally developed and evaluated inquiry-based science curriculum. We work with a school district, providing them background on science curricula and the evaluation reports of student testing from school districts that have adopted this approach. If the school district decides to adopt the curricula, we provide imbedded professional development for teachers by placing graduate students in the schools for six weeks of the school year. The graduate student fellows work with all of the teachers in the school, developing their knowledge and confidence in the science content. Last biennium's seed investment led to a five-year, \$3,000,000 grant from NSF to extend the ETIC pilot to an additional 13 eastern Oregon schools per year in either the High Desert or the Umatilla-Morrow Educational Service Districts. Both of these ESD's are setting up kit restocking facilities to serve the schools that adopt this curriculum.

The requested funds are to further expand this program, taking advantage of growing relationships with either additional ESD's or Native American tribal leaders. The goal will be to leverage this ETIC investment to get a second five-year, \$3,000,000 grant from NSF. The requested funds will support an additional eight graduate students on Fellowships for each year of the biennium. The requested ETIC funding alone will impact 12-16 additional schools, between 150 and 200 teachers, and approximately 5000 students in the biennium.

MATCH FOR IGERT GRANTS: \$480,000.

MSI faculty members have led two inter-institutional IGERT proposals in the last three years. The first of these was funded starting in September of 2006. The second proposal is currently pending at NSF, having survived the long odds at the pre-proposal stage, with a 50% chance of funding. Both IGERT grants involved faculty from PSU, OSU and the UO and are aimed at increasing the research level at all campuses via collaboration. The funded proposal revolves around research related to the semiconductor processing, optical materials and devices and polymer graduate internship tracks. The pending proposal has a blend of nanoscience and biotechnology research thrusts. The requested ETIC funds will be used to solve the institutional challenges posed by these inter-institutional programs. The major challenge is that NSF mandates that the IGERT fellowship holders be supported by stipends. This results in many challenges at each institution (out of state tuition charges, health plan issues, etc.). MSI firmly believes that it is worth working through these challenges, as collaboration will make us more successful and the rules need to be changed to encourage partnerships, not discourage them. Some of the ETIC requested funds will be used to promote the enrollment of underrepresented groups in our graduate internship program.

MATCH FOR STEP GRANT: \$180,000.

MSI has successfully obtained a four-year \$2,000,000 grant from NSF focusing on building partnerships and pathways between our undergraduate and graduate programs and Oregon community colleges. We are currently working with our science department colleagues at Portland Community College Sylvania, Portland Community College Rock Creek, Chemeketa Community College, Mount Hood Community College, Lane Community College, and Central Oregon Community College. The grant funds 30 community college students while they conduct research during the summer in MSI research groups and pays the community college students while they are peer tutors during the academic year. The goal of this program is to increase the number of community college students who transfer to four-year schools to complete their degrees in science or engineering.

The requested ETIC funds will be used to expand this program to additional community colleges, focusing on eastern or southern Oregon institutions, laying the foundation for a second proposal.

MATCH FOR CAMCOR EQUIPMENT PROPOSALS:

\$3,000,000.

The University of Oregon has just completed the construction of the first building of the Integrative Science Complex. The Lorry Lokey Laboratories houses CAMCOR – the State of Oregon’s high tech extension service. This facility is the “quietest” building in the United States with a factor of two less vibrational energy at all frequencies than the new NIST facility in Maryland. This creates tremendous opportunities for the state, as the performance of many high-resolution instruments are limited by background vibrational amplitudes. The requested funding from ETIC is to assist in the purchase of signature instruments - the latest aberration corrected transmission electron microscope or a nano – SIMS (secondary ion mass spectrometer) - that will have unmatched performance in this new building. The funds will be used to match federal and foundation proposals, as these signature instruments are beyond the funding range of a single granting agency, approaching \$4,000,000 per instrument. The University of Oregon is leveraging this requested funding with a Presidential Endowed Chair position focusing on a senior faculty member with expertise in green nanoscience and/or nanocharacterization.

Private Support

The private support required to match this ETIC request is significantly higher than MSI has achieved in past biennia. Commitments for a large part of the required matching funds are already in hand via pledges for the second building in the Integrative Science Complex, and the recent donation from Lorry Lokey in support of graduate education. Integrative Science Phase II is very significant for the programs proposed here. While the planning process is still underway, the building of an additional 100,000 sq. ft. of science research space will help facilitate some additional expansion space for MSI collaborations, research partnerships and research groups. We anticipate that at least one floor of this new complex will be devoted to materials science. We anticipate additional significant square footage of contiguous vacated space in the existing science complex may be used to create a signature physical sciences teaching facility that will serve the Graduate Internship Program during the summer, thus permitting additional growth of the organic, polymer and biotechnology programs. The donation by Mr. Lokey for excellence in graduate education and science contains several components that directly support MSI faculty including an endowed chair in Green Materials Chemistry and support for graduate fellowships in the sciences. We anticipate additional private support will continue to come from companies in the form of internships, equipment donations, scholarships and graduate fellowships. We will continue to pursue funding from private foundations to accelerate the growth of our proposed programs. Several private donors have expressed interest in MSI’s educational outreach programs to the K-12 community, and we hope that one or more of these will result in a significant pool of additional undergraduate scholarships for science majors and an endowment for graduate fellowships in K-12 outreach.

Results and Benefits

SHORT-TERM

The requested funding from ETIC addresses the immediate needs to rapidly accelerate the growth of the graduate internship program. We are asking for an investment and will not be asking ETIC for ongoing support for the salaries of the requested staff and faculty positions. We anticipate that the University of Oregon will be the number one program in the nation in terms of the number of chemistry masters degrees awarded per year by the end of the 2009-2011 biennium. We expect to see continued increases in federal funding as upcoming young

faculty members become established and as more existing faculty members become partners with the Graduate Internship Program.

The requested faculty positions will be in either chemistry or physics, depending on negotiations with the new Dean of the College of Arts and Sciences. Since we have needs and there are significant opportunities in both fields, this uncertainty is not an issue for our program. The faculty positions will be aligned with one of Oregon's existing or emerging economic clusters. Significantly, we are already seeing departments make offers to new faculty members whose research interests align with the Graduate Internship Program. For example, the Chemistry Department is currently in the process of making an offer to an outstanding young polymer chemist who was identified as the top candidate in a broad application pool. He specifically stated during his interview that the Graduate Internship Program and its partnerships with companies were critical factors that encouraged him apply to Oregon. Hires such as this one are helping to broaden the range of successful integrative models for the sciences at the University of Oregon and leveraging ETIC investments.

We have requested significant funds for the expansion of our existing programs, the establishment of a new proposed biotechnology program and a new program start in the 2009-11 biennium. The requested funds will almost exclusively be used for purchasing equipment for the laboratories – expanding our ability to teach more students in each of the individual programs. The requested investment in equipment for the graduate internship laboratories will also help to increase federal funding of research, as researchers from all three campuses and the private sector utilize this equipment when it is not dedicated to teaching laboratory functions. The equipment that will be purchased considers the input of our corporate partners and targets existing or emerging Oregon industry clusters.

We have also requested significant funds that will be used to match federal proposals and leverage existing grants. Two of the programs targeted in this manner are focused on building partnerships with community colleges and the K-12 schools. We expect to increase both the quality and impact of science taught in Oregon schools as a crucial element for increasing the competitiveness of Oregon industry. As always, we will seek to leverage these matching funds with proposals to federal agencies and private foundations. The final category of matching funds is for *signature equipment* for the new Lokey Laboratories. The unprecedented performance of this facility makes us competitive for major state of the art transmission electron microscopes, ion microscopes and other vibrationally sensitive equipment with price tags above the funding levels at NSF and other federal agencies. The requested ETIC funds will be used, along with funding from private donors, foundations and companies, to bring these facilities to Oregon. The equipment will be part of CAMCOR, which is open for business as Oregon's "high tech extension service" and will help make Oregon competitive when recruiting companies. Having this equipment in CAMCOR will make faculty at all of our Universities more competitive for federal funding.

MEDIUM-TERM

The graph on the second page of this proposal extrapolates the proposed growth of the program with ETIC support to the year 2020. In addition to the funding requested this biennium, it assumes major funding for "signature teaching laboratories" from ETIC in the 2011-2013 biennium. These teaching laboratories will be used for the Graduate Internship Program and the undergraduate science programs at the UO. The requested ETIC funding will enable:

- a rise in national rankings for masters degrees in chemistry,
 - 1999 - not in top 50
 - 2005 - 7th in chemistry masters degrees

- 2007 - ~5th in chemistry masters degrees
 - 2013 – 1st in chemistry masters degrees
 - 2020 - 2x - 1st in chemistry masters degrees by a factor of two
- growth in graduate degrees and externally funded research by the year 2020,
 - 100 MS degrees per year (**29x** or a 2900% increase relative to 1999)
 - 20 Ph.D. degrees per year (**2x** or a 200% increase relative to 1999)
 - \$18,000,000 in externally funded research (**5x** or a 500% increase relative to 1999)
 - growing partnerships with Oregon companies and a growing role as Oregon’s “high tech extension service,”
 - 100 participating company partners
 - greater than \$1,000,000/year in CAMCOR revenue from industrial use
 - an increase Oregon’s competitiveness and in the diversity of our graduate population through outreach programs that will
 - train ~750 K-8 teachers in inquiry based science in 2008-2011
 - teach ~19,000 K-8 students inquiry based science in 2008-2011
 - inspire ~ 150 community college students to pursue science based careers

We have picked the leading institutions in the country in each of three areas as our aspirational peers as they have set the standard in each of their indicated areas. Our goal is to be like our aspirational peers, not by copying what they have done, but by developing unique and innovative new models for graduate education that are tailored to Oregon’s needs and opportunities. We believe that if we reach the goals outlined above, these and other institutions will be seeking the secret of the Oregon model, asking how they can be more like us.

Future Plan & Resources

The ETIC requests for the 2009-2011 biennium aimed at removing current growth limitations in the Graduate Internship Program resulting from the lack of available capital required to hire additional program staffing and purchase necessary laboratory equipment. At level 0 funding, we would anticipate requesting ETIC funds to replace the proposed cuts in the 2011-13 biennium, especially if we are able to meet our program goals at the reduced funding levels. We also anticipate requesting ETIC for funding in the 2011-2013 biennium to help renovate ~25,000 sq. ft. of contiguous space to create a signature teaching facility that will be used in the summer by the internship program and in the academic year by the undergraduate physical sciences programs at the University of Oregon. These renovation funds are necessary to remove laboratory space limits on the growth of the Polymer, Biotechnology and Organic programs. It is anticipated that these renovations would double the capacity of each of these programs to ~25-30 students per year. We also anticipate requesting two additional faculty positions and additional funds for new tracks of the graduate internship program related to Oregon’s growing economic clusters in the 2011-2013 biennium.

As has always been the policy of the Materials Science Institute, we are seeking investment capital from ETIC. The recurring costs of the staff positions will be covered by increases in tuition revenue from the Graduate Internship Program. ETIC funding is enabling us to hire these staff positions ~2-4 years earlier than we would otherwise be able to afford. The recurring costs of the faculty positions will be covered by a combination of resources including reallocation of existing resources and increases in tuition

revenue. ETIC funding is crucial to provide the start-up funds and remodeling resources required to attract the top young faculty in the materials area. The increases in research funding will be used to grow the number of graduate students in the Ph.D. program, producing a larger and more diverse stream of talent for Oregon companies.

Proposed Investment and Private Support Forecast (\$M)

		Level 0 Base Budget	Level 1 Policy Option	Level 2 Policy Option
1	Sources of funds			
2	Base budget for ETIC-related programs -- all sources except ETIC	21	25	\$ 27.0
3	Proposed allocation from ETIC budget (\$M) (3)	3.096	9.096	\$ 10.8
4	Expected private support (\$M) (4)	10	27.3	\$ 33.0
5	Total (\$M)	34.096	61.396	\$ 70.8
6	Personnel supported (FTE) (5)			
7	Existing faculty (1)			0.0
8	New faculty(2)	1	2	2.0
9	Existing staff (1)			0.0
10	New staff(2)	2	3	3.0
11	Total	3	5	5.0
12	New positions created (6)			
13	Faculty (2)	1	2	2.0
14	Staff (2)	2	3	3.0
15	Total	3	5	5.0
16	Uses of ETIC funds in line 3			
17	New facilities			\$ -
18	Improvements to facilities (7)			\$ -
19	Laboratory equipment (7)	0.816	2.8	\$ 2.8
20	Other equipment (7)	0.3	1.82	\$ 3.0
21	Other one-time expenses			\$ -
22	Existing faculty salaries & benefits (1)	0	0	\$ -
23	New faculty salaries & benefits (2)	0.2	0.4	\$ 0.4
24	Existing staff salaries & benefits (1)	0	0	\$ -
25	New staff salaries & benefits (2)	0.3	0.4	\$ 0.4
26	Services & supplies			\$ -
27	Other	1.48	3.676	\$ 4.2
28	Total (8)	3.096	9.096	\$ 10.8
	Instructions. (Replace with your own notes in the document you submit.)			
	(1) Hired through June 2009 that will be supported by ETIC funds during 2009-11			
	(2) To be hired with ETIC funds during 2009-2011 biennium.			
	(3) Include any Certificates of Participation to be issued during 2009-2011 biennium.			
	(4) Consistent with ETIC Private Support Policy dated 1-23-02.			
	(5) FTE expressed as percent of full time over 2 years of biennium. For instance, a new full-time faculty member hired on 7/1/10 would be counted as 0.5 because he/she joined half way through the biennium.			
	(6) FTE on an ongoing basis. For instance, if a new half-time position is created but not expected to be filled until the last month of the biennium, it would still be counted as 0.5.			
	(7) Include improvements and equipment to be purchased with ETIC funds and any Certificates of Participation to be issued during the biennium.			
	(8) Totals on line 3 and line 28 should match.			

Metrics Forecast (for programs/departments receiving ETIC funding):

Level 0 Base Level Funding

	Actuals (1)		Projected (2)		
	AY 99	AY07	AY11	AY13	AY20
Undergraduate student credit hours	0	0	0	0	500
Graduate student credit hours	190	1584	2500	3000	4000
Graduation rate, 6-year (3)	100%	95%	95%	95%	95%
Bachelor's degrees granted	0	0	0	0	5
Master's degrees granted	2	18	40	45	60
PhD degrees granted	9	17	15	15	15
Women graduating (4)	30%	32%	35%	40%	40%
Minorities graduating (5)	0%	32%	20%	20%	20%
Externally-funded research expenditures (6)	\$2,880,000	\$9,900,000	10,500,000	\$12,000,000	13,000,000
Invention disclosures (7)	3	11	10	12	13
License/options (8)	0	1	2	3	3
License income received (9)	\$4,500	\$538	5,000	\$7,500	\$10,000
Spin-off Companies (10)	0	1	1	1	1
National ranking of Chemistry					
Department Masters program (11)	less than 50	7th in 05	1st	1st	1st
(12)					
Notes/instructions. (Delete these notes and replace with your own in the document you submit.)					
(1) Actuals for 12-month period ending in June of the year shown.					
(2) Forecast for the 12-month period ending in June of the year shown.					
degree.					
(4) From engineering, computer science, and other programs directly benefiting from ETIC funding, stated as of all those graduating.					
(5) Racial and ethnic minorities who are US citizens or permanent residents, stated percent of US citizens or permanent residents graduating.					
(6) Total external dollars spent by ETIC-related departments towards research during academic year.					
(7) See Association of University Technology Managers (AUTM) survey definitions.					
(8) Number of license or option agreements executed during the year. See AUTM survey definitions.					
(9) License issue fees, payments under options, annual minimums, running royalties, termination payments, the amount of equity received when cashed in, and software end-user license fees equal to \$1000 or more, but not research funding, patent expense reimbursement, valuation of equity not cashed-in, or end-user license fees less than \$1000. See AUTM survey definitions.					
(10) New companies that were dependent on the licensing of your program's technology for their initiation. See survey definitions.					
(11) Ranking based on data on the number of masters degrees awarded from the American Chemical Society published annually in Chemistry and Engineering News.					
(12) Add additional metrics as appropriate.					

Impact of Proposed Level 0 Funding:

The proposed level 0 funding increases the growth rate of the Graduate Internship Program by fifty percent relative to the growth plan without an ETIC investment. This level of investment, however, does not provide the capital investment necessary to continue this growth rate, as the lack of laboratory equipment and space will cap the enrollment at approximately 60 graduate students per year which will be reached in the 2011-13 biennium. Below we highlight the areas of proposed investment and detail the impact on the Graduate Internship Program.

- ***Proposed Program Staffing Investment:*** The proposed level 0 funding will be used to increase program staffing by 50%, focused on increasing student recruitment, strengthening our corporate relationships, increasing our marketing efforts, and maintaining virtually 100% student placement in internships and retention towards graduation. We project that this funding level will enable approximately a twenty percent growth rate until the capacity of the laboratory sections is reached.
- ***Proposed Investment in New Faculty Positions:*** The proposed level 0 funding will add one faculty member to the physical sciences in the biennium. The on-going support of this faculty position will be the responsibility of the University of Oregon. This addition will add to the growth of the research enterprise within the Institute and continue the “cultural” changes on the Oregon campus spearheaded by the internship program.
- ***Proposed Laboratory Expansion Investment:*** The proposed level 0 funding provides significant resources to increase capacity of the laboratories associated with the five focused tracks of the Graduate Internship program. This investment will expand the capacity of the Photovoltaic and Semiconductor Processing track and the Optical Materials and Devices track, add new experiments to the Polymer Science and Organic tracks, and initiate the Biotechnology track. Significant additional funding will be required in the 2011-13 biennium, when capacity limits are reached.
- ***Proposed Federal Matching Funds Investment:*** The proposed level 0 funding provides resources to match existing federally funded IGERT, GAANN and GK-12, and STEP programs that build partnerships with Oregon industry, Oregon’s K-12 schools, and Oregon community colleges, respectively. ETIC support has been crucial in seeding these programs and in showing state support for Federal proposals. The level 0 support continues the existing programs but does not provide the resources necessary to expand the federal funding of these programs.

Metrics Forecast (for programs/departments receiving ETIC funding):

Level 1 POP Funding

	Actuals (1)		Projected (2)		
	AY 09	AY07	AY11	AY13	AY20
Undergraduate student credit hours	0	0	0	0	1000
Graduate student credit hours	190	1584	2700	3400	4500
Graduation rate, 6-year (3)	100%	95%	95%	95%	95%
Bachelor's degrees granted	0	0	0	0	20
Master's degrees granted	2	18	45	55	75
PhD degrees granted	9	17	20	20	20
Women graduating (4)	30%	32%	35%	40%	40%
Minorities graduating (5)	0%	32%	20%	20%	20%
Externally-funded research expenditures (6)	\$2,880,000	\$9,900,000	11,000,000	\$13,000,000	15,000,000
Invention disclosures (7)	3	11	10	12	20
License/options (8)	0	1	4	5	6
License income received (9)	\$4,500	\$538	10,000	\$15,000	\$20,000
Spin-off Companies (10)	0	1	1	1	1
National ranking of Chemistry					
Department Masters program (11)	less than 50	7th in 05	1st	1st	1st
(12)					
Notes/instructions. (Delete these notes and replace with your own in the document you submit.)					
(1) Actuals for 12-month period ending in June of the year shown.					
(2) Forecast for the 12-month period ending in June of the year shown.					
degree.					
(4) From engineering, computer science, and other programs directly benefiting from ETIC funding, stated as of all those graduating.					
(5) Racial and ethnic minorities who are US citizens or permanent residents, stated percent of US citizens or permanent residents graduating.					
(6) Total external dollars spent by ETIC-related departments towards research during academic year.					
(7) See Association of University Technology Managers (AUTM) survey definitions.					
(8) Number of license or option agreements executed during the year. See AUTM survey definitions.					
(9) License issue fees, payments under options, annual minimums, running royalties, termination payments, the amount of equity received when cashed in, and software end-user license fees equal to \$1000 or more, but not research funding, patent expense reimbursement, valuation of equity not cashed-in, or end-user license fees less than \$1000. See AUTM survey definitions.					
(10) New companies that were dependent on the licensing of your program's technology for their initiation. See survey definitions.					
(11) Ranking based on data on the number of masters degrees awarded from the American Chemical Society published annually in Chemistry and Engineering News.					
(12) Add additional metrics as appropriate.					

Impact of Proposed Level 1 Funding:

The proposed level 1 funding enables a significantly more aggressive growth plan for the Graduate Internship Program that will propel it to national prominence as the top graduate masters program in the country.

- **Proposed Program Staffing Investment:** The proposed level 1 funding enables an additional staff member to be added to the program who is envisioned to work closely with OECED to recruit companies to Oregon, retain companies in Oregon and encourage growth of companies in Oregon through workforce enhancement by graduates of the Graduate Internship program and through expansion of CAMCOR (the Center for Advanced Materials Characterization in OREGON), Oregon's "High Tech." extension service. The addition of this additional staff person, combined with the other supported activities at level 1 funding will enable us to double the growth rate of the program.
- **Proposed Investment in New Faculty Positions:** The proposed level 1 funding enables the addition of two new faculty positions to the physical sciences which has major impacts on the growth of the research enterprise within the Materials Science Institute and significantly increases the rate of the "cultural" changes on the Oregon campus spearheaded by the internship program. Relative to the "ETIC will pay forever" position of the other campuses with regard to the addition of new faculty, the University of Oregon has committed to the ongoing funding of the proposed faculty positions after the initial ETIC investment in start-up funds, laboratory renovations and salary. This support of faculty salaries by the University of Oregon is worth millions of dollars over the lifetime of the proposed tenure track position.
- **Proposed Laboratory Expansion Investment:** The proposed level 1 funding enables each of the Graduate Internship Program tracks to increase capacity by the acquisition of key laboratory equipment requested by our company partners to enhance the training of the graduate student participants. This funding level enables enrollment to more than double in the programs before the physical size of the laboratories precludes additional students due to safety concerns.
- **Proposed Federal Matching Funds Investment:** The proposed level 1 funding provides resources to match and expand existing federally funded IGERT, GAANN and GK-12, and STEP programs that build partnerships with Oregon industry, Oregon's K-12 schools, and Oregon community colleges, respectively. ETIC support has been crucial in seeding these programs and in showing state support for Federal proposals. The level 1 provides the matching fund resources necessary to submit additional proposals to expand the federal funding of these programs leading to the growth of the Ph.D. programs in the sciences at the University of Oregon through the graduate stipends provided. The proposed funding also provides resources to obtain "signature" analytical tools in CAMCOR, Oregon's high tech extension service. This will have an impact on our ability to recruit graduate students and potential new faculty members. ETIC support has been crucial in providing matching funds for federal equipment proposals, and is absolutely crucial for CAMCOR to obtain "signature analytical tools" that can cost from \$2-5,000,000 each. (Federal equipment grants typically have limits of ~\$1,000,000.)

Metrics Forecast (for programs/departments receiving ETIC funding):

Level 2 POP Funding

	Actuals (1)		Projected (2)		
	AY 99	AY07	AY11	AY13	AY20
Undergraduate student credit hours	0	0	0	0	1000
Graduate student credit hours	190	1584	3000	4000	6000
Graduation rate, 6-year (3)	100%	95%	95%	95%	95%
Bachelor's degrees granted	0	0	0	0	20
Master's degrees granted	2	18	50	65	100
PhD degrees granted	9	17	20	20	20
Women graduating (4)	30%	32%	35%	40%	40%
Minorities graduating (5)	0%	32%	20%	20%	20%
Externally-funded research expenditures (6)	\$2,880,000	\$9,900,000	11,000,000	\$13,000,000	18,000,000
Invention disclosures (7)	3	11	12	14	20
License/options (8)	0	1	4	5	6
License income received (9)	\$4,500	\$538	10,000	\$15,000	\$20,000
Spin-off Companies (10)	0	1	1	1	1
National ranking of Chemistry					
Department Masters program (11)	less than 50	7th in 05	1st	1st	1st
(12)					
Notes/instructions. (Delete these notes and replace with your own in the document you submit.)					
(1) Actuals for 12-month period ending in June of the year shown.					
(2) Forecast for the 12-month period ending in June of the year shown.					
degree.					
(4) From engineering, computer science, and other programs directly benefiting from ETIC funding, stated as of all those graduating.					
(5) Racial and ethnic minorities who are US citizens or permanent residents, stated percent of US citizens or permanent residents graduating.					
(6) Total external dollars spent by ETIC-related departments towards research during academic year.					
(7) See Association of University Technology Managers (AUTM) survey definitions.					
(8) Number of license or option agreements executed during the year. See AUTM survey definitions.					
(9) License issue fees, payments under options, annual minimums, running royalties, termination payments, the amount of equity received when cashed in, and software end-user license fees equal to \$1000 or more, but not research funding, patent expense reimbursement, valuation of equity not cashed-in, or end-user license fees less than \$1000. See AUTM survey definitions.					
(10) New companies that were dependent on the licensing of your program's technology for their initiation. See survey definitions.					
(11) Ranking based on data on the number of masters degrees awarded from the American Chemical Society published annually in Chemistry and Engineering News.					
(12) Add additional metrics as appropriate.					