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SUBJECT

Proposal for the Complete College Idaho Plan

REFERENCE

August 12, 2010	Board established the goal that 60% of young Idahoans age 25-34 will have a degree or credential of value by the year 2020.
August 10, 2011	Board reviewed data regarding Idaho's status in meeting the 60% goal by 2020, and heard strategies to meet the goal.
October 19, 2011	Board identified four areas that wanted to focus on as part of the 60% goal. Those areas include: Dual Credit, Remediation, Retention, and Financial Efficiency.

BACKGROUND/DISCUSSION

In August 2010, the Idaho State Board of Education ("Board") set an ambitious goal that 60% of young Idahoans age 25-34 will have a degree or credential of value by 2020. This goal mirrors the national goal and the subsequent organizational goals of which the Board is a part, including Complete College America (CCA), which is a national non-profit organization working to significantly increase the number of Americans with a college degree or credential of value and to close attainment gaps for traditionally underrepresented populations. By joining the CCA Alliance of States, the Board has partnered with 28 other states to reach the "60% goal."

In October 2011, a team of individuals that consisted of Idaho legislators, Governor's office staff, institutional VPs/Provosts, a member of the Board, a representative from the business community, and Board office staff attended the CCA Annual Convening and Completion Academy in Austin, Texas. The purpose of Idaho's participation in such an Academy was to draft a proposed statewide plan to move the state closer to its education goal.

The Board has been working toward this end for over a year and has completed the following steps: 1) has become a member of the CCA Alliance of States, 2) has asked institutions of higher education to provide strategies on how they will each contribute to advancing the 60% goal, and 3) has participated in the CCA Completion Academy, garnering key public and private input toward developing a proposed statewide plan, the result of which was a completion plan entitled, A Plan for Growing Talent to Fuel Innovation and Economic Growth in the Gem State.

IMPACT

This Complete College Idaho Plan proposes focus on improving educational attainment in a way that is responsive to the needs of business and those who will hire the workforce of the future. Increasing the educational attainment of Idahoans will better prepare them for future job requirements. It has the potential to attract out-of-state businesses to Idaho, thus positively impacting Idaho's future economic development.

From this plan we can build a system in which our students graduate with the knowledge and skills that maximize their potential for success in the workforce while providing business with the necessary talent needed to thrive. The proposed strategies in this plan will aid in meeting the goal that 60% of Idahoans 25-34 have a college degree or credential of value by 2020.

ATTACHMNETS

Attachment 1 – Complete College Idaho: A Plan for Growing Talent to Fuel Innovation and Economic Growth in the Gem State — Page 3

STAFF COMMENTS AND RECOMMENDATIONS

Staff recommends the Board approve the Complete College Idaho plan and, with the timeline proposed in the plan, and obtain feedback from key stakeholders as outlined.

BOARD ACTION

I move to approve the framework for Complete College Idaho: A Plan for Growing Talent to Fuel Innovation and Economic Growth in the Gem State, direct staff to obtain stakeholder feedback and buy-in, and bring back the plan for approval at the June 2012 Board meeting.

Moved by _____ Seconded by _____ Carried Yes _____ No _____

Complete College Idaho

A Plan for Growing Talent to Fuel Innovation and Economic Growth in the Gem State

December 2011

Complete College Idaho

A Plan for Growing Talent to Fuel Innovation and Economic Growth in the Gem State

EXECUTIVE SUMMARY

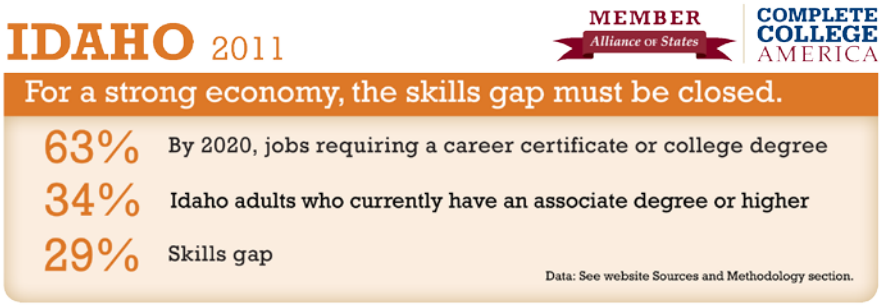
Idaho is at the crossroads. The choices we make today are the foundation that will shape the future for our children and grandchildren. College access without success is an empty promise, and a missed opportunity with economic consequences. It is time to tie access to completion for the benefit of our students. The choices are not easy, but *doing nothing is not an option*.

We must grow talent in our state to fuel innovation and compete economically.

THE FACTS

Basic facts about economic success in the 21st century economy should drive our decisions. We know that postsecondary education enhances personal income. Those with some college have a median income 23% higher over their lifetimes, those with an associate degree 28% higher, and those with a baccalaureate degree 61% higher. The rate of unemployment for individuals 25 and older without a college degree is 10.3% compared to 4.6% for those with a 4-year degree.

Just as our society has shifted from an industrial to a service economy so too must our educational and career planning mechanisms adjust. We are mismatched between our current workers and the workers that employers in our state need both now and in the future.



While the skills gap phenomenon is a national one, it is particularly problematic in Idaho. A recent study issued by the International Monetary Fund[1] showed that Idaho is in the most critical quartile of all states relative to the skills mismatch. And that challenge isn't going away. Georgetown University's Center for Education and the Workforce recently estimated that by 2018 61%[2] of Idaho jobs will require some form of postsecondary credential, and that by 2020 63% will require a certificate or degree by the year 2018. Complete College of America has identified that 34% of Idahoans have an associate degree or higher. Focusing on the Board's goal that 60% of Idahoans, 25-34 have a degree or credential of value by 2020; currently, only 31.4% of our target population have a certificate or degree.

Idaho must focus on improving educational attainment in a way that is responsive to the needs of business and those who will hire the workforce of the future. Our students must graduate

[1] http://www.imf.org/external/pubs/ft/wp/2011/wp11105.pdf
[2] Georgetown University Center on Education and the Workforce: http://cew.georgetown.edu/jobs2018/

with the knowledge and skills that maximize their potential for success in the workforce and that provide business with the necessary talent needed to thrive.

We want to send a signal to business in neighboring states and across the world that Idaho has the talent, innovation, and economy to support their success.

TALENT AND INNOVATION FOR IDAHO'S FUTURE

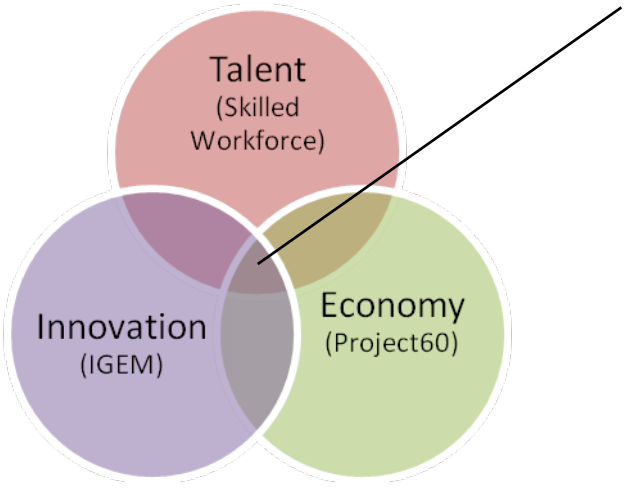
So what will it take to ensure a prosperous future for Idaho? Committing to the bold agenda necessary to transform our talent base is key to success. Knowledge is the driver of economic prosperity. It is imperative that we make a commitment to efficiently and effectively increase the number of citizens with postsecondary certificates and degrees of value in the marketplace.

To meet this commitment, in the October 2011 a team of individuals consisting of Idaho legislators, Governor's office staff, institutional provosts, a member of the State Board of Education (SBOE), a representative from the business community, and SBOE staff attended the Complete College America Completion Academy. The sole purpose of Idaho's participation in the Academy was to draft a proposed statewide plan to move the state closer to its education goal, the result of which was a completion plan entitled:

Complete College Idaho:
A Plan for Growing Talent to Fuel Innovation and Economic Growth in the Gem State

Idaho will be internationally recognized for the quality of talent, knowledge and skills of its workforce, and the ability of its higher education system to prepare citizens to meet and exceed the needs of business, industry, and society.

This proposed plan mirrors Governor Otter's commitment to unified job creation and growth strategy, which has resulted in a focused vision for Idaho and its educational system.



COMPLETE COLLEGE IDAHO

1. STRENGTHEN THE PIPELINE
2. TRANSFORM REMEDIATION
3. DEMYSTIFY COLLEGE
4. STRUCTURE FOR SUCCESS
5. REWARD PROGRESS & COMPLETION

Idaho's public colleges and universities currently produce on average 9,518 degrees and certificates annually. To remain competitive nationally and globally, the public system of higher education in **Idaho has committed to increase the number of degrees and certificates by 13% each year; which is an increase of 3,461 more degrees and certificates each year. We have set an aggressive goal that 60% of Idahoan's 25-34 have a degree or credential of value by 2020.**

The key strategies to help attain this goal:

1 STRENGTHEN THE PIPELINE	• Develop intentional advising along the K-20 continuum. • Prepare students prior to exiting high school. • Support accelerated HS – PS pathways.

2 TRANSFORM REMEDIATION	Develop a statewide framework for transformational models of remedial placement and support. The statewide framework will:
	• Determine common statewide placement levels, and align assessments and data for placement decision-making.
	• Establish common elements for remedial support programs, but leave room for local innovation.
	  o Be based upon learning outcomes
	  o Embrace emerging best practice models such as co-requisite, emporium or embedded support linked to and through gateway courses.
	• Require institutions justify alternate and/or modified approaches with data and evidence.
	• Require institutions include a remediation transformation plan with goals and benchmarks in their annual strategic plans to the SBOE.

3 DEMYSTYSIFY COLLEGE	• Implement systemic advising that links education and careers. • Create a state-level Student Success Web-Portal with clearly articulated pathways to certificates and degrees. • Communicate strong, clear, and guaranteed statewide articulation & transfer options to students and families.
4 STRUCTURE FOR SUCCESS	• Package certificate and degree programs for accelerated completion. • Default Program/Curriculum Options • Adult Reintegration/Near Completers Options • Create a cost effective delivery option for students in Eastern Idaho. • Engage faculty as the leaders of course quality and continuous improvement.

5 REWARD PROGRESS & COMPLETION	Establish metrics and accountability tied to institutional mission for measuring state and institution progress toward completion goals. • Use data to drive statewide and institution level investment choices. • Recognize and reward progress and completion through performance funding.

OUR COMMITMENT

The Idaho State Board of Education, institution presidents, and other leaders in Idaho stand united with Governor Otter in growing the economy through innovation and talent, creating the foundation for Idaho's future success. Idaho joined the *Complete College America (CCA) Alliance of States* and the National Governors Association *Complete to Compete*, to become a recognized leader in talent creation.

TIMELINE FOR ACTION

Due	Action	Person Responsible
December 2011	Present Complete College Idaho Plan to the State Board of Education for their approval and request to solicit stakeholders' support.	Mike Rush, Selena Grace
January – June 2012	Solicit stakeholder support and buy-in (i.e., ISBA, IASA, Legislators, IBCEE, etc.)	Board Members, Mike Rush, Matt Freeman, Selena Grace, Tracie Bent
January – June 2012	Use the 2012 Legislative Session to ensure key players are part of the whole strategy. • 60% Goal • 5 Key Strategies	Mike Rush, Matt Freeman, Selena Grace, Tracie Bent
Late Winter/ Early Spring 2012	Governor's Call to Action	Governor Otter, Roger Brown
May 2012	Full Complete College Idaho Plan created and vetted	Mike Rush, Selena Grace
June/July 2012	SBOE approval	
August 2012	SBOE approve any necessary legislation	Mike Rush, Tracie Bent

Due	Action	Person Responsible
September 2012	Prep for 2013 Legislative Session	Mike Rush, Matt Freeman, Selena Grace, Tracie Bent
November 2012	DFM approve any necessary legislation	Mike Rush, Tracie Bent
January 2013	Any necessary legislation ready for session.	Mike Rush, Tracie Bent

THE STRATEGIES

1 STRENGTHEN THE PIPELINE

We know there are multiple broken points in the pipeline. Strengthening the pipeline is a critical first step to meeting the 60% goal. One area that could provide a significant impact to students is the high school counselor. High school counselors carry a lofty responsibility of promoting college aspirations, ensuring that students enroll in the academic classes necessary to be ready for college, guiding students through the admission and financial aid processes, and helping students build the social skills necessary to succeed. This service is especially vital for first generation college students and for students from low-income families. In Idaho, a high school counselor's ability to meet this role is hindered by the fact that student to counselor ratios average 443:1[3]. With waning resources and a disproportionate workload, professional development opportunities are limited at best. Counselors are lucky if they can spend ¼ of their time helping students with postsecondary admissions counseling.

Two models Idaho has initiated through the College Access Challenge Grant funds are the Comprehensive Counselor Training Initiative and the Near-Peer Mentor Program. In an effort to keep counselors abreast of current resources available to them with regard to college access, Idaho has taken advantage of the work done by other states to create a customized online professional development course focused on college access information for secondary school counselors, college admissions counselors, financial-aid administrators, teachers as advisors, and principals. Near-Peers are recent college graduates and their mission is to increase the number of students who enter and complete postsecondary education in their respective school districts, with an emphasis on low-income and first generation populations. Mentors seek out and work with students who typically "fall through the cracks" and help them plan for some kind of education and training beyond high school. They *complement* the work of counselors and advisors, making sure the needs of all students are addressed and served.

The following is a breakdown of the five proposed *strategies*[4]. Within the strategy to STRENGTHEN THE PIPELINE we propose to focus on the following *initiatives*[5], and *activities*[6] outlined in the tables below. We recognize these initiatives and activities are not exhaustive.

[3] College Board – The College Completion Agenda: http://completionagenda.collegeboard.org/state-performance/state/idaho
[4] Strategies are the overarching themes that are easy to remember and identify.
[5] Initiatives are more prescriptive descriptions of a Strategy's focus areas.
[6] Activities are actual tasks to be accomplished in order to move the needle toward the 60% goal.

DEVELOP INTENTIONAL ADVISING ALONG THEK-20 CONTINUUM.

Activity	**Location in the continuum**	**Implemented/Proposed**
Comprehensive Counselor Training Initiative	Middle & Secondary	Implemented
Career Information Systems	K-12, Postsecondary, Workforce	Implemented
Reduce Student-Counselor Ratios	Middle & Secondary	Proposed
Near-Peer Mentoring Program	Secondary	Pilot currently taking place at two high schools. Proposed to be implemented in all high schools.
Mandatory Campus Advising	Postsecondary	Implemented on some campuses. Proposed to be implemented on all campuses.
Advising that includes students, parents, and teachers as partners in the planning.	Secondary & Postsecondary	Proposed. There is a good model in GEAR-UP, but only happening in a limited number of schools.

PREPARE STUDENTS PRIOR TO EXITING HIGH SCHOOL.

Activity	**Location in the continuum**	**Implemented/Proposed**
Increased High School Graduation Requirements	Secondary	Goes into effect for the 2013 graduating class.
Common Core State Standards	Secondary & Postsecondary	Professional development begins this year, continues through 2012-13. In 2013-14 they will be taught. In 2014-15 new common assessments based on the common core state standards will be delivered.
College Entrance Exam	Secondary	Goes into effect for the 2013 graduating class.

SUPPORT ACCELERATED HS – PS PATHWAYS.

Activity	Location in the continuum	Implemented/Proposed
Dual Credit/Advance Placement/ Tech-Prep	Secondary & Postsecondary	Implemented. Funding for students participating in Dual Credit should be supported by the State.
2+2 Degree Options	Secondary & Postsecondary	Proposed. Examples of this opportunity exist between ISU and the Meridian School District.

2 TRANSFORM REMEDIATION

We know that remediation in its current form is ineffective. Students too often fail before they even start. A one size fits all approach to remedial instruction, where students must enroll in one or more semesters of remedial instruction, has not proven to be effective. Research from the Community College Research Center has found that most students who require remedial education do not complete their remedial education sequence within one year. Many do not even enroll in a single remedial course. In Idaho, on average, 41% of all first-time, full-time freshman required remedial services in 2009. There are demonstrated key policy levers that can significantly increase the effectiveness of remedial education programs and the role they can play as part of our effort to increase college attainment. These levers include the use of data to drive policy formation and continuous improvement, assessment and placement policies that prescribe appropriate intervention for students, and instructional deliveries that ensure students address their academic needs as effectively and efficiently as possible. Successful efforts to transform remediation focus on three key strategies: 1) pre-test guidance, 2) select the right math, and 3) provide options such as a co-requisite model, accelerated model, or an embedded model.

Within the strategy to TRANSFORM REMEDIATION we propose to focus on the following *initiative*[7] and associated *activities*[8]. We recognize these initiatives and activities are not exhaustive.

[7] Initiatives are more prescriptive descriptions of a Strategy's focus areas.
[8] Activities are actual tasks to be accomplished in order to move the needle toward the 60% goal.

DEVELOP A STATEWIDE FRAMEWORK FOR TRANSFORMATIONAL MODELS OF REMEDIAL PLACEMENT AND SUPPORT. THE STATEWIDE FRAMEWORK WILL:

Activity	**Location in the continuum**	**Implemented/Proposed**
Determine common statewide placement levels, and align assessments and data for placement decision-making	Secondary & Postsecondary	Proposed
Establish common elements for remedial support programs, but leave room for local innovation	Postsecondary	Proposed
Be based upon learning outcomes	Postsecondary	Proposed
Embrace emerging best practice models such as co-requisite, emporium or embedded support, and be linked to and through gateway courses	Postsecondary	Proposed
Require institutions justify alternate and/or modified approaches with data and evidence	Postsecondary	Proposed
Require institutions include a remediation transformation plan with goals and benchmarks in their annual strategic plans to the SBOE	Postsecondary	Proposed

We specifically did not address remediation at the high school level, rather the work of the Common Core State Standards seeks to address the misalignment of the K–12 education system with international standards and college admission expectations, so that all students are prepared for future opportunities in education, work and life. Content standards outline the knowledge and skills students should attain at each level of their education across different subjects. These standards serve as the foundation of every other component of raising student achievement.

In 2009, the Board signed on to participate in the Common Core State Standards. In 2010, the Board approved English and Math Common Core Content standards. The Standards are aligned with college and workforce expectations; are clear, understandable, and consistent; include rigorous content and application of knowledge through high-order skills; build upon strengths and lessons of current state standards; are informed by standards in other top performing countries, so that all students are prepared to succeed in a global economy; and are evidence-based.

3 DEMYSTIFY COLLEGE

We know that poverty is a significant barrier to education. Completion rates by income show a stark reality: young people from high income families complete college at a 60% rate; those from low income families complete at a 7% rate. We know this disparity is not because young people from higher income families are smarter or more talented – they are simply afforded more opportunities. Why is this so significant? Because the primary source of new students is from families with low income. Low income and first generation college students, in particular could reap significant benefits from systematic advising that links education and careers. Many young adults understand the value of college but many lack a clear understanding of the link between education and careers.

We also know that students need access to web-based resources where they can learn about the available transfer options. At a time where a significant number of students attend one or more institution before they earn a degree, the benefits of a single, centralized source of transfer information where students can identify and plan their options provides significant benefit. A portal could provide transparency of institutional agreements, transfer guides, course equivalency information, and institutional participation. A portal is a way to demonstrate greater levels of coordination, accountability, and transparency.

The Board's Articulation and Associate Degree policy is intended not only to assist students as they transfer between Idaho public institutions, but to act as a guide for institutions to ensure the ease of credit transfer from one Idaho institution to another. This policy has not been updated since 1997 and allows for broad interpretation. The current policy simply provides a minimum credit requirement and subject matter standard for a general education core. The policy does not preclude an institution from creating a general education core above and beyond the minimum core defined by the State Board of Education. Over time, the four-year institutions have modified their general education core to include additional course requirements and have revised their lower division general education core to incorporate appropriate learning outcomes, develop systemic approaches to program assessment, and increase interdisciplinarity. These modifications have created a gap between the general education core at the two-year and the four-year levels. The policy needs to be revised and updated.

Within the strategy to DEMYSTIFY COLLEGE we propose to focus on the following *initiatives*[9] and associated *activities*[10]. We recognize these initiatives and activities are not exhaustive.

[9] Initiatives are more prescriptive descriptions of a Strategy's focus areas.
[10] Activities are actual tasks to be accomplished in order to move the needle toward the 60% goal.

IMPLEMENT SYSTEMIC ADVISING THAT LINKS EDUCATION AND CAREERS.

Activity	Location in the continuum	Implemented/Proposed
Mandatory advising and career planning	Secondary & Postsecondary	Proposed
Mandatory academic advising and degree planning	Postsecondary	Proposed system-wide, but exists in several institutions.

CREATE A STUDENT SUCCESS WEB-PORTAL WITH CLEARLY ARTICULATED PATHWAYS TO CERTIFICATES AND DEGREES.

Activity	Location in the continuum	Implemented/Proposed
Identify all institutional agreements	Postsecondary	Proposed
Identify and create a course equivalency guide	Postsecondary	Proposed
Develop a web-portal	Postsecondary	Proposed

COMMUNICATE STRONG, CLEAR, AND GUARANTEED STATEWIDE ARTICULATION & TRANSFER OPTIONS TO STUDENTS AND FAMILIES.

Activity	Location in the continuum	Implemented/Proposed
Identify how the Association of American Colleges and Universities LEAP1 standards might influence general education core reform in Idaho	Postsecondary	Proposed
Update and revise Board policy III.V.	Postsecondary	Proposed

4 STRUCTURE FOR SUCCESS

We must restructure the delivery of education for today's students. Among students in four-year schools, 45% work more than 20 hours a week, and among those attending community colleges, 6 in 10 work more than 20 hours a week, more than a quarter work more than 35 hours a week[11], and 23% of all college students have children[12]. We know that one of every two students who enter a four-year college does not finish.

[11] U .S. Department of Education, 2007–2008 National Postsecondary Student Aid Study; in Viany Orozco and Nancy K. Cauthen, "Work Less, Study More & Succeed: How Financial Supports Can Improve Postsecondary Success," Demos, 2009.

There is also a pressing need to focus more attention and resources on adult learners. Close to 2/3 of the projected workforce of 2020 are already out of elementary and secondary education and following current trends this nation will fall an expected one million short of the college graduates needed in the workforce by 2025. There is no single group of adult learners, as they vary widely in age and level of academic readiness, and they come from different social and economic circumstances.

Within the strategy for STRUCTURE FOR SUCCESS we propose to focus on the following *initiatives*[13] and associated *activities*[14]. We recognize these initiatives and activities are not exhaustive.

PACKAGE CERTIFICATE AND DEGREE PROGRAMS FOR ACCELERATED COMPLETION.

Activity	**Location in the continuum**	**Implemented/Proposed**
Review certificate and degree requirements with incentives for institutions to reduce the number of credits required. Create policy to reduce the number of credits required for certificate and degree programs	Postsecondary	Proposed
Create a "no-frills" degree option that takes less time and uses less campus-based resources. Could be an entirely on-line degree.	Postsecondary	Proposed
Articulate more of the professional-technical courses into baccalaureate degree requirements. Examples include engineering degrees and health science degrees. Could accelerate completion, and also have the effect of encouraging them to "go on" to a bachelor's degree	Postsecondary	Proposed

[12] U .S. Department of Education, National Center for Education Statistics, 2008, National Postsecondary Student Aid Study.
[13] Initiatives are more prescriptive descriptions of a Strategy's focus areas.
[14] Activities are actual tasks to be accomplished in order to move the needle toward the 60% goal.

Offer a General Associates Degree for Bachelor seekers	Postsecondary	Proposed
Link with employers to offer course schedules compatible with work schedules	Postsecondary	Proposed

DEFAULT PROGRAM/CURRICULUM OPTIONS

Activity	**Location in the continuum**	**Implemented/Proposed**
Degree-seeking students are automatically signed up for classes based upon their program. If they want to take classes outside of their program they must apply	Postsecondary	Proposed

ADULT REINTEGRATION/NEAR COMPLETERS OPTIONS

Activity	**Location in the continuum**	**Implemented/Proposed**
Systematic and state-wide acceptance of work experience (or non-academic setting learning) or other learning opportunities. Recognize learning that happens beyond our institutions. For near-completers who still need to complete general education core requirements, use software/technology packages and a state-wide acceptance of that work if done in conjunction with work experience	Postsecondary & Workforce	Proposed
Diversify course delivery methods (f2f, synchronous, asynchronous) in more of the curricula to increase options for students	Postsecondary	Proposed
Contact students who have left an institution and offer degree	Postsecondary	Proposed

audits, counseling, and advising		
Identify targeted sectors of industry/business with high need and provide workers with information about the benefits of a certificate/degree	Postsecondary & Workforce	Proposed
Implement a near completer notification system.	Postsecondary	Proposed

CREATE A COST EFFECTIVE DELIVERY OPTION FOR STUDENTS IN EASTERN IDAHO.

Activity	**Location in the continuum**	**Implemented/Proposed**
Expand the availability of general education core classes at community college tuition rates	Postsecondary	Implemented on a limited bases.
Expand collaborative programs	Postsecondary	Proposed

ENGAGE FACULTY AS THE LEADERS OF COURSE QUALITY AND CONTINUOUS IMPROVEMENT.

Activity	**Location in the continuum**	**Implemented/Proposed**
Bring high school and college instructors together to discuss and align curriculum requirements and standards.	Secondary & Postsecondary	Proposed
Create advisory committees made up of business and industry representative that assist in program development and monitoring of program success	Postsecondary & Workforce	Implemented on a limited bases.
Develop a system of incentives that reward quality/innovation in course development and improvement.	Postsecondary	Proposed
Include course quality/ assessment as a component of faculty evaluation	Postsecondary	Proposed

5 REWARD PROGRESS AND COMPLETION

Idaho's investment in four-year public higher education has gone from $285.1M in FY2009 to $209.8M in FY2012. At the same time, the demand for postsecondary education is strong; and the need for postsecondary education in today's global knowledge economy is essential if we wish to remain competitive among industrialized nations. The reality of this situation requires that we use every dollar to maximize operational efficiencies. Performance-based funding can be used as a strategic incentive for innovation and creativity in resource allocation to improve desired campus outcomes. Specifically, linking a portion of state funding for higher education to performance outcomes could prioritize and focus the use of institutional resources on student success. It is a generally accepted best practice for performance measures to be developed through negotiation and consensus between the governing board and the institutions.

Within the strategy to REWARD PROGRESS AND COMPLETION we propose to focus on the following *initiative*[15], and to support this initiative and associated *activities*[16]. We recognize these initiatives and activities are not exhaustive.

ESTABLISH METRICS AND ACCOUNTABILITY TIED TO INSTITUTIONAL MISSION FOR MEASURING STATE AND INSTITUTION PROGRESS TOWARD COMPLETION GOALS.

Activity	Location in the continuum	Implemented/Proposed
Use data to drive statewide and institution level investment choices	Postsecondary	Proposed
Recognize and reward progress and completion through performance funding	Postsecondary	Proposed

SUMMARY

We are at risk of this generation being the first in our country's history to be less educated than their parents. We have an ever growing population of non-traditional, first generation, and low-income students who are forced to work more hours than students of prior generations. They are underprepared for college and forced into remedial courses that slow their progress, force them into deeper debt where most lose momentum and simply give up. Students are overwhelmed by too many choices with little structure, leading to wasted semesters and years. We have a skills gap caused by too few trained workers for the potential number of high-skill jobs.

This Complete College Idaho Plan proposes focus on improving educational attainment in a way that is responsive to the needs of business and those who will hire the workforce of the future.

[15] Initiatives are more prescriptive descriptions of a Strategy's focus areas.
[16] Activities are actual tasks to be accomplished in order to move the needle toward the 60% goal.

From this plan we can build a system in which our students graduate with the knowledge and skills that maximize their potential for success in the workforce while providing business with the necessary talent needed to thrive. The proposed strategies in this plan will aid in meeting the goal that 60% of Idahoans 25-34 have a college degree or credential of value by 2020. We are proposing that Idaho will be internationally recognized for the quality of talent, knowledge and skills of its workforce, and by the ability of its higher education system to prepare citizens to meet and exceed the needs of business, industry, and society.

BOISE STATE UNIVERSITY

SUBJECT

Approval of Full Proposal – Doctor of Philosophy (Ph.D.) in Materials Science and Engineering

APPLICABLE STATUTE, RULE, OR POLICY

Idaho State Board of Education Governing Policies & Procedures, Section III.G.4. and 5.

BACKGROUND/DISCUSSION

BSU proposes a new doctoral program in Material Science and Engineering (MSE). The proposed program will be offered by the Department of Materials Science and Engineering in the College of Engineering.

The MSE department at BSU has grown rapidly since its creation in 2004 into one of the largest departments in the Pacific Northwest with approximately 110 students and $4 million in annual research expenditures. The MSE faculty members are nationally and internationally recognized experts in their fields. Faculty research strengths are in the following areas:

- Semiconductor Device Reliability
- Microelectronic Packaging
- Shape Memory Alloys
- Nanoscale Devices
- DNA and Bio-Machinery
- Materials for Energy Applications
- Environmental Degradation
- Materials for Extreme Environments
- Biomaterials and Bio-Machinery
- Solid State and Soft Matter Physics
- Materials Characterization
- Materials Modeling
- Magnetic Materials
- Polymer Chemistry

The proposed program will provide substantial economic benefit to the region, the state, and the nation. The global materials industry is worth an estimated $550 billion, conservatively. The market for biocompatible materials has grown to $60 billion in the past decade. Market size is growing for materials in emerging areas such as photonic materials, electronic and dielectric materials, functional coatings, and green materials. Due to the highly interdisciplinary nature of Materials Science & Engineering, students who graduate from MSE programs are recruited into a wide range of disciplines. Materials Science & Engineering has synergy with all the engineering fields as well as many of the sciences,

particularly chemistry, biology, and physics. Ph.D.s in MSE are well suited for positions at national laboratories, such as INL, managerial and senior scientist or engineering professions in industry, and as teachers, researchers, and faculty in academia.

The Idaho Department of Commerce has identified 1) novel materials, 2) biological sciences, and 3) nanotechnology as central to the future of Idaho's economy. The Treasure Valley area of Idaho has the largest concentration of advanced materials-related manufacturing companies in the state, including Micron Technology and Hewlett-Packard. The continued success and growth of a regional high-technology economy, and the ability to attract other major companies, requires a research and development base and availability of a highly skilled technical workforce.

The 2004 Report of the Idaho Governor's Science and Technology Advisory Panel identified the following as critical elements necessary to support the growth of a vibrant, knowledge-based economy in Idaho:

- A research and development base
- Highly skilled technical workforce
- Entrepreneurial culture
- Knowledge transfer mechanism
- Technology infrastructure
- Risk capital
- Attractive quality of life

Advanced graduate education and research programs, such as the proposed Ph.D. in MSE, play a central role in addressing the majority of these critical elements. There is significant science- and technology-based economic growth occurring in the greater Boise metropolitan area, therefore, Boise State University is attempting to meet the growing need for delivery of advanced graduate degree programs in high technology disciplines.

The proposed program builds on an existing interdisciplinary graduate program (M.S. and M.Engr.) in MSE, which presently has approximately 30 students enrolled. The Department of Materials Science & Engineering has the organizational structures, policies and procedures already in place to manage graduate programs successfully.

Existing undergraduate and graduate programs in the department will experience synergistic benefits from the addition of the proposed new Ph.D. program. The presence of advanced graduate students and their dissertation research fosters student-to-student mentoring and creates more opportunities for hands-on participation by undergraduates in advanced, applied research, as has been found with national studies of the potential benefits of research-intensive

graduate programs on undergraduate education (e.g., Boyer Commission on Educating Undergraduates, 1998; NRC Committee on Undergraduate Science Education, 1999).

The University of Idaho offers a Ph.D. in Materials Science and Engineering through its Chemical and Materials Engineering Department. In general, no two programs are alike due to the highly interdisciplinary nature of Materials Science & Engineering, and, consequently, the various emphases of the departments are quite different. For example, a significant emphasis of the MSE program at BSU has been and will continue to be focused on nanoscale fabrication and materials for semiconductor device processing. By contrast, the program at University of Idaho grew out of the field of hydrometallurgy and mining and consequently has historically been strong in metallurgy, including extractive metallurgy. They currently have MSE faculty with expertise in nuclear materials, electronic materials, and metallurgy. Materials Science & Engineering faculty at UI and BSU have several strong research collaborations with extramural support between the two institutions in excess of $1M. The creation of the Ph.D. program at BSU is expected to strengthen these collaborations as well as collaborations with Physics, Chemistry, and Nuclear Engineering programs at both UI and ISU.

With the exception of Wyoming, each of the states bordering Idaho offer at least one MSE PhD; most have two or more universities offering such degrees.

The proposed program was reviewed by an external team comprised of Dr. Hussein Zbib (Washington State University, Professor in the School of Materials and Mechanical Engineering), and Dr. Wayne Hubner (Missouri University of Science and Technology, Dept. Chair and Professor of Ceramic Engineering, Past Associate Provost). Each wrote a separate report.

In his report, Dr. Zbib summarized as follows:

"This proposal is very well designed and lays the ground for a high-quality interdisciplinary PhD program in MSE. The proposal is very timely and addresses an important regional and national need for PhDs in this area of research. The new program will build on existing interdisciplinary strength in materials science and engineering, physics and chemistry, and will be supported by local industry. In general, the requested resources are adequate and consist with the projected size of the program. The input received during our various meetings with faculty from engineering, physics and chemistry, university administrators, and students indicated very strong support for the program."

In his report, Dr. Hubner summarized, in part, as follows:

"Boise State University (BSU) is proposing to establish a Doctor of Philosophy (PhD) degree program in Materials Science & Engineering (MSE). A decision to approve this request can only be warranted if a careful analysis reveals that the

investment is in the best interest of the students and citizens of the State of Idaho. As an external reviewer I am happy to conclude that this proposal builds upon the considerable strengths of the faculty, students and facilities of the MSE program at BSU, and clearly fills a need for industry in the region and state. Indeed, it is quite the testimonial that Micron would invest $13M to fully fund the proposed PhD program the first three years of its existence. Equally impressive is the support I witnessed from all levels of the administration; future funding past year 3 will come from re-allocation within the university. We all know what that means in terms of scrutiny from the departments who will lose positions. Yet I believe history will show that making this investment now in the MSE department will nucleate a change in culture at BSU towards a balanced research university. A campus where scholarly activity and the pursuit of external funding is the norm, yet never done at the expense of the undergraduates. This is the culture within MSE right now."

Boise State University has a strategy in place for funding recurring costs of the proposed MSE program, which will be similar to that used for BSU's Ph.D. in Electrical and Computer Engineering. During the first three years of the program, BSU will accrue the needed reallocation of appropriated funding through a combination of salary savings derived from the replacement of retired senior faculty with new junior faculty and fee revenues that result from increased enrollment. BSU's primary focus will be on replacing the grant funding for faculty members and staff members with appropriated funding. We anticipate that some portion of the remaining required funding will be derived from overhead costs from grants as well as other sources.

IMPACT

Boise State University received a donation from the Micron Foundation in the amount of $12,910,000 that will support the development of a new Ph.D., in Materials Science and Engineering (MSE). The gift from the Micron Foundation, however, is contingent upon the Board formally approving the establishment of the proposed MSE program.

Attachment 1 depicts new funding for the proposed Ph.D. program. Table 1 differs from the budget table in the full proposal in that Table 1 spreads the Micron donation over four years instead of three, and it depicts the budget for five years instead of three. The "University Total" in FY16 represents the ongoing funding that the university will need to allocate to the new program.

Table 2 depicts the planned disbursements of the gift from Micron. Note that the disbursements occur over three years in amounts greater than expenditures attributed to the Micron gift. The resulting funds will be carried forward until in FY2015 they total $3,063,667. That amount of expenditures is attributed in FY15 to the Micron gift.

IRSA

Nine new tenured/tenured track faculty members will join the department between fall 2011 and fall 2013 (three each year). The number of required faculty was determined following a year long process of benchmarking against peer institutions, and an assessment of teaching and research demands expected of faculty in the program. The program will also require new staff in order to support the significant expansion of research and course offerings such as two additional office administrators and a business manager. The proposal also includes 4 FTE of permanent funding to support the growth in MSE research lab operations and the BSCMC. The program would also add 18 new graduate assistantships ($27,000K stipend per academic year plus fee waiver phased in over three years (six per year).

ATTACHMENTS

STAFF COMMENTS AND RECOMMENDATIONS

Boise State University (BSU) proposes to create a new Doctor of Philosophy in Materials Science and Engineering to be offered at BSU's main campus. Students in the program are expected to be full-time students with one-third to one-half being graduates from their existing B.S. and M.S. programs in-state or region. The program will matriculate approximately 6-12 new Ph.D. students per year reaching a steady state enrollment of approximately 50 students by the 6th year.

Consistent with Board Policy III.G., BSU's proposed MSE program was reviewed by an external review panel. While positive and supportive reviews were provided there were some comments cited with regard to space that the Board should be aware of. Approximately 19,000 ft^2 of new space will be needed to accommodate new faculty and students. Reviewers indicate that "spreading faculty and students out amongst separate buildings and departments is a serious detriment to their future." The reviewers further state that "every effort should be made to ensure that space is identified and made available very soon." BSU has a plan in place that would accommodate the MSE program. This includes strategically reorganizing their existing administrative units involved in the MSE program into close proximity. BSU also has plans for infrastructure enhancements, which is being funded by a National Science Foundation Academic Research Infrastructure grant and also plans to incorporate facility requirements for the new MSE program in the 2004 College of Engineering Facilities Master Plan.

Pursuant to III.Z there is not an engineering Statewide Program Responsibility assigned to any of the universities, therefore it would fall under the category of Boise State's Regional Program Responsibility. There is a Primary Emphasis in engineering assigned to Boise State University and the University of Idaho, but not in the specific area of Materials Science and Engineering. Currently, the

University of Idaho (UI) offers a Ph.D. and a Master of Science in Materials Science and Engineering at their main campus and at their Idaho Falls campus. In accordance with the University of Idaho, there are College of Engineering and College of Science faculty who conduct research in the area of nanotechnology.

BSU has garnered support from private and public industry such as Idaho National Laboratory, Micron – Member of BSU's Industrial Advisory Board, Office of the Mayor of Boise, NanoSteel Co. in Idaho Falls, Premier Technology, Inc., Blackfoot, Washington State University-Pullman, WA, and Ceramatec, Inc.

BSU's program is consistent with their Regional Eight-Year Plan for delivery of academic programs in the Southwest Region. It's important to note that institutions are currently working on their Five-Year Plans pursuant to the recently clarified Board Policy III.Z. The Five-Year Plans are scheduled to be presented to the Board at their August 2012 Board meeting.

BOARD ACTION

A motion to approve the request by Boise State University to offer a Doctor of Philosophy in Biomolecular Sciences.

Moved by _____ Seconded by _____ Carried Yes _____ No _____

Attachment 1

Table 1.

	#	Micron	Univ	Dept/ College	#	Micron	Univ	Dept/ College	#	Micron	Univ	Dept/ College	#	Micron	Univ	Dept/ College	#	Micron	Univ	Dept/ College
	FY12				FY13				FY 14				FY15				FY16			
Personnel																				
Faculty	1	123,500	0	0	4	510,000	0	0	7	933,333	0	0	9	768,667	467,333	0	9	0	1,273,080	$0
GA Positions/Fees	3	129,000	0	0	9	387,000	0	0	12	516,000	0	0	15	516,000	148,350	0	18	0	821,137	$0
Other Personnel	6	309,500	0	100,000	11	626,000	0	0	11	652,000	0	0	11	294500	377,060	0	11	0	691,706	$0
Operating																				
OE/Travel	1	75,000	0	0	1	150,000	0	0	1	150,000	0	0	1	75,000	79,500	0	1	0	159,135	$0
Library	1	25,000	0	0	1	50,000	0	0	1	50,000	0	0	1	25,000	26,500	0	1	0	53,045	$0
Capital																				
Faculty Start Up	1	250,000	0	0	3	750,000	0	50,000	3	750,000	0	50,000	2	500,000	0	0	0	0	0	$0
Equipment	1	500,000	0	0	1	1,500,000	0	0	1	1,500,000	0	0	1	884,500	0	0	0	0	0	$0
Micron Total		**1,412,000**				**3,973,000**				**4,551,333**				**3,063,667**				**0**		
University Total			**0**				**0**				**0**				**1,098,743**				**2,998,103**	
Dept/ College Total				**100,000**				**50,000**				**50,000**				**0**				**$0**

Table 2.

	FY12		FY13		FY14			FY15
Micron Planned Disbursements	**3,682,500**		**4,357,000**		**4,960,500**			**0**
Expenditures	**1,412,000**		**3,973,000**		**4,551,333**			**3,063,667**
Carry Forward	**2,270,500**		**384,000**		**409,167**			
Total Carried Forward to FY15	↘→		↘→		↘→		→	**3,063,667**

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Institution Tracking No. FP 10-34

IDAHO STATE BOARD OF EDUCATION
ACADEMIC/PROFESSIONAL-TECHNICAL EDUCATION
FULL PROPOSAL

Submitted by:

Boise State University

INSTITUTION SUBMITTING PROPOSAL

College of Engineering

Name of College, School, or Division

Materials Science & Engineering

Name of Department(s) or Area(s)

A New, Expanded, or Off-Campus Instructional Program Leading to:

Doctor of Philosophy in Materials Science & Engineering
(CIP Code: 14.1801)

Degree/Certificate & 2010 CIP

Program Change, Off-Campus Component

Fall 2012

PROPOSED STARTING DATE

This proposal has been reviewed and approved by:

College Dean (Institution) — Date 6/3/11

Chief Fiscal Officer (Institution) — Date 6/6/11

Chief Academic Officer (Institution) — Date 6/3/11

President — Date 6-3-11

VP Research and/or Graduate Dean — Date John R Pelton 6/2/11

Chief Academic Officer (OSBE) — Date

SBOE/OSBE Approval — Date

1. NATURE OF THE REQUEST

Describe the nature of the request. For example, is this a request for a new on-campus program? Is this request for the expansion or extension of an existing program, or a new cooperative effort with another institution or business/industry or a contracted program costing greater than $150,000 per year? Is this program to be delivered off-campus or at a new branch campus? Attach any formal agreements established for cooperative efforts, including those with contracting party(ies). Is this request a substantive change as defined by the NWASC criteria?

Boise State University (BSU) proposes a new on-campus graduate program leading to the degree of **Doctor of Philosophy (PhD) in Materials Science & Engineering (MSE)**. The program will require a minimum of 68 credits, representing advanced courses, independent research, a comprehensive exam (which serves as a qualifying exam for admission to candidacy), and a dissertation constituting an original and significant contribution to the discipline.

The proposed program builds on an existing interdisciplinary graduate program (M.S. and M.Engr.) in Materials Science & Engineering and faculty research strengths in the following areas:

- Semiconductor Device Reliability
- Microelectronic Packaging
- Shape Memory Alloys
- Nanoscale Devices
- DNA and Bio-Machinery
- Materials for Energy Applications
- Environmental Degradation
- Materials for Extreme Environments
- Biomaterials and Bio-Machinery
- Solid State and Soft Matter Physics
- Materials Characterization
- Materials Modeling
- Magnetic Materials
- Polymer Chemistry

Faculty participants will work together on student recruitment, admissions recommendations, participation on Supervisory Committees, design of comprehensive examinations, and the generation of financial support and research opportunities for students.

The University will correspond with our regional accrediting agency, the NWCCU, regarding the proposed PhD program.

2. QUALITY

This section must clearly describe how this institution will ensure a high quality program. It is significant that the accrediting agencies and learned societies which would be concerned with the particular program herein proposed be named. Provide the basic criteria for accreditation and how your program has been developed in accordance with these criteria. Attach a copy of the current accreditation standards published by the accrediting agency.

Further, if this new program is a doctoral, professional, or research, it must have been reviewed by an external peer-review panel (see page 7, "Guidelines for Program Review and Approval). A copy of their report/recommendations must be attached.

The MSE department at BSU has grown rapidly since its creation in 2004 into one of the largest departments in the Pacific Northwest with approximately 110 students and $4M in annual research expenditures. The MSE faculty members are nationally and internationally recognized experts in their fields. Evidence of the quality of the program is supported in the confidence given by Micron

Technology, Inc. in its $13M contribution to help develop the PhD and in the letters of support provided in Appendix F.

Boise State is committed to excellence in the delivery of all its educational programs, including the growing suite of PhD programs. A number of programmatic controls and quality assurance activities are part of the management plan for the anticipated PhD in Materials Science & Engineering. These are highlighted and described in more detail below. In accordance with SBOE guidelines, the proposed program and its context at Boise State have been evaluated by an independent, objective review team composed of national experts in Materials Science & Engineering, including pertinent research areas and graduate education. The Report of the External Review Committee along with the Boise State response is included in Appendix A.

Regional Institutional Accreditation: Boise State University is regionally accredited by the Northwest Commission on Colleges and Universities (NWCCU). Regional accreditation of the university has been continuous since initial accreditation was conferred in 1941. Boise State University is currently accredited at all degree levels (A, B, M, D). Accreditation was reaffirmed by NWCCU in 2010.

Specialized Accreditation: The Boise State University undergraduate engineering programs in Civil, Electrical, and Mechanical Engineering have been accredited by ABET, Inc. since 1999. PhD programs in Materials Science & Engineering are not directly accredited by ABET. The Materials Science & Engineering Department successfully underwent its inaugural ABET accreditation visit in October 2006. Engineering disciplines are normally only accredited by ABET at the undergraduate level. The four Engineering programs underwent successful reaccreditation visits in fall 2010, and anticipate being reaccredited through 2017.

Internal Program Evaluations: Internal program evaluations will take place every five years as part of the normal departmental review process conducted by the Office of the Provost. This process requires a detailed self-study (including outcome assessments) and a comprehensive review and site visit by external evaluators. In addition, the program will receive feedback from the existing Materials Science & Engineering Advisory Board comprised of representatives from local businesses, government laboratories, and universities.

University and Graduate College Oversight: The program will adhere to all policies and procedures of the Graduate College, which is assigned broad institutional oversight of all graduate degree and certificate programs.

Materials Science & Engineering Departmental Oversight: The proposed PhD in Materials Science & Engineering will build on a foundation of experience within the department of managing graduate programs successfully. Existing graduate programs include the interdisciplinary Master of Science (M.S.) and Master of Engineering (M.Engr.) degrees in Materials Science & Engineering. The graduate student community of the department currently includes approximately 30 master's level students. The majority of MS students graduate within 2-1/2 years after initial matriculation. Thus, the Department of Materials Science & Engineering has the organizational structures, policies and procedures already in place to manage graduate programs successfully and to ensure that students receive the individual mentoring, guidance, and professional development needed to progress through their programs in a timely manner.

In addition, the MSE department is committed to undergraduate education and research. It is an objective of the department that existing graduate and undergraduate programs in the department will experience synergistic benefits from the addition of the proposed new PhD program, further

strengthening these programs and adding to the value of these degrees. The presence of advanced graduate students and their dissertation research in the department creates an environment that fosters student-to-student mentoring and creates more opportunities for hands-on participation in advanced, applied research. We have seen this outcome in the last few years as a byproduct of BSU's existing PhDs in Geophysics, Geosciences, and Electrical & Computer Engineering, and it is consistent with national studies of the potential benefits of research-intensive graduate programs on undergraduate education (e.g., Boyer Commission on Educating Undergraduates, 1998; NRC Committee on Undergraduate Science Education, 1999).

Key aspects and quality control measures associated with the MSE Department's planned PhD program are described below.

Student Mentoring and Program Assessment: On-going program evaluation and assessment at the department level will provide essential information to help ensure the long-term quality of the program. Assessment activities will allow monitoring of individual student progress in the program so challenges can be recognized early and managed effectively. Integrated and evaluated over time, this feedback will also be used to fine-tune and adjust the overall program design, as needed, to ensure student success. Components of the student mentoring and outcomes assessment plan include:

Appointment of a Major Advisor who has the primary responsibility for day-to-day mentoring and professional development of their students – Identification of the advisor is a prerequisite for admission to the program. Outstanding students may be admitted to the program with a temporary advisor (typically one of the graduate program coordinators), but must identify a permanent research advisor within one year of admission to the program. The advisor will be responsible for funding the research of the student, typically through grants or fellowships. All students entering the program will be supported financially.

Required registration of all new graduate students in MSE 601 Graduate Orientation – This class is designed to facilitate the transition of students into the department; introduce them to lab safety, record keeping, and research ethics; help them understand the processes and procedures associated with the completion of a degree, including the process of developing a dissertation proposal.

Planning of academic course work – Students work with their advisor to complete a Program Development Form (PDF) in the first year, which identifies the calendar of course work necessary for students to complete their degree requirements. Each student's PDF is updated on an annual basis, providing an opportunity for the advisor and student to review the plan and make periodic adjustments that might be necessary. Completed PDFs are placed in each student's departmental file.

Progress and competency in graded coursework – How students perform in the classroom will provide a direct metric of progress and achievement – particularly in the early portion of the program when much of the required course work is typically completed. A student must maintain a GPA of at least a 3.0 every semester in order to remain in the program. Students whose GPA drops below a 3.0 in any semester will be put on academic notice and may be subject to removal from the program according to guidelines stipulated by the Graduate College.

The Comprehensive Examination - As discussed below, the Comprehensive Exam represents a significant milestone and assessment tool for monitoring how well students have assimilated information from various sources and integrated it into a comprehensive knowledge of Materials Science & Engineering. Details of the exam format will be described in detail in the Graduate

Student Handbook for the program and will be posted on the MSE website, including exam dates and study guidelines.

Evaluation of the dissertation proposal – Students must present to their Supervisory Committee a dissertation proposal describing in detail the proposed scope of work, anticipated scientific impact, timeline, and a plan for obtaining and utilizing the resources necessary to complete the research. The presentation typically will occur at anytime in the first two years of admission to the graduate program, but must be approved by the Supervisory Committee no less than 6 months after satisfactory completion of the Comprehensive Exam. Guidelines for the proposal will be provided in the Graduate Student Handbook.

Annual meeting with Supervisory Committee and progress report - Although students will interact with members of their Supervisory Committee individually and informally on a daily or weekly basis in classes or working on their research, the entire Supervisory Committee will meet formally with a student at least once each year to receive a progress report from the student, provide feedback, and discuss future plans. The student or committee may choose to invite external members to observe and offer input to the research direction and methods. Notes from the meeting and the progress report of the student become part of the student's departmental file. It is the responsibility of the student to schedule these meetings annually.

Dissertation defense – the preparation and public defense of a dissertation constitutes the culminating activity of the program (discussed in more detail below).

Exit interview – Exit interviews will be conducted with students completing their degree as well as students who fail to complete the degree requirements in order to evaluate their experiences in the program, determine if their expectations were met, and obtain specific suggestions for ways to improve the program.

Two-year post-graduation follow-up interview with alumni – The department will contact and interview alumni approximately two years after graduation to assess whether or not the program was effective in giving the students the practical skills and knowledge necessary to achieve success in their careers. Feedback from the alumni will be factored into decisions about restructuring coursework or other aspects of the program (as needed).

Graduate Program Committee: The Graduate Program Committee (GPC) of the Department of Materials Science & Engineering will consist of the graduate Program Coordinators, plus the chair of the Department or a faculty delegate. The department currently has two Graduate Program coordinators, and it is anticipated that a third coordinator will be identified when the PhD program is initiated. One of the responsibilities of the Graduate Program committee will be to ensure that program monitoring and outcomes assessment are conducted fairly, effectively and consistently. In addition, the Graduate Program Committee will develop recommendations for admission of prospective graduate students, make decisions on transfer credits and required background courses, make decisions on the award of departmental graduate assistantships, facilitate the identification of advisors, coordinate the Comprehensive Exam, and provide departmental approval of Supervisory Committees for graduate students.

Supervisory Committee: The Supervisory Committee is charged with the general guidance of the doctoral student, including design and approval of the program of study, supervision of the dissertation research, and participation at the dissertation defense. The Supervisory Committee is composed of members of the graduate faculty who are appointed to the committee by the Graduate College and are able to contribute to the student's dissertation research. The student will work in consultation with his/her major advisor to identify committee members and to submit a

Request to Appoint a Supervisory Committee form to the Graduate College. The committee is to consist of the major advisor, who serves as chair, plus at least three but no more than four additional members. The major advisor is the primary mentor for the student and must be a member of the graduate faculty and a full-time, joint, or university affiliate faculty member in the MSE department. At least one additional member must be part of the full-time MSE faculty. In addition, there must be at least one committee member who is external to the MSE department and is a member of the university's graduate faculty.

- **Application and Admission Requirements:** Applicants to the PhD program in MSE will be required to have a Bachelor's and/or a Master's degree in Materials Science & Engineering or a related discipline from an accredited college or university. Admission will be highly competitive and will be based on the applicant's transcripts, professional references, scores on the Graduate Record Examination (GRE) general test, and a statement of purpose. The statement of purpose should describe the applicant's research motivation, aptitudes, professional interests, and plans for the future. Students whose native language is not English must also pass the Test of English as a Foreign Language (TOEFL) with a minimum score as dictated by the College of Engineering. Admission to candidacy includes the requirement that the student passes the Comprehensive Exam (MSE 600) with a score of 80% or better. Students holding a Master of Science degree and who have evidence of conducting independent research, for example, through peer-reviewed publications, are encouraged to take the Comprehensive Exam within the first year of enrollment.

2A. CURRICULUM

Describe the listing of new course(s), current course(s), credit hours per semester, and total credits to be included in the proposed program.

The curriculum design is consistent with the nominal requirements found in the broad spectrum of Materials Science & Engineering programs at the doctoral level in the United States. The curriculum is more focused on regional needs and is consistent with the areas of specialization described in section 5A. Learning goals of the PhD include:

a. Understand processing-structure-properties relationships as it relates to Dissertation work,
b. Understand and independently implement robust experimental procedures for Dissertation work,
c. Demonstrate sound data collection/analysis/interpretation for Dissertation work
d. Possess ability to independently acquire and implement new knowledge via scientific inquiry, literature review, and self-study
e. Possess the ability to transfer acquired technical knowledge via written and verbal communication
f. Understand and demonstrate the importance of Dissertation work in a larger context of technological and/or societal importance.

Table 1 shows the requirements of the proposed program, followed by more detailed descriptions of non-credit requirements like the comprehensive examination and dissertation defense. The degree requirements, as shown in Table 1, will be included in the Graduate Catalog description of the program, with possible revisions determined by the Graduate College. The following curriculum has

been approved by the University Graduate Committee for inclusion in the fall 2012 catalogue pending further approvals of the program.

Table 1: Degree Requirements

Doctor of Philosophy in Materials Science & Engineering	
Course Number and Title	**Min. Credits**
Required Core Courses MSE 605 Bonding and Structure of Materials ..... 4 MSE 608 Solid State Thermodynamics ..... 4 MSE 618 Phase Transformations and Kinetics 4	12
Required Core Emphasis Course Choose at least one course from the following: PHYS 515 Solid State Physics ..... 3 MSE 510 Electrical, Optical, and Dielectric Materials ..... 3 MSE 512 Mechanical Behavior of Materials I 3	3
Required Characterization Course Choose at least 3 credits from the following (or alternative characterization course(s) approved by the GPC) PHYS 523 Physical Methods of Materials Characterization ..... 3 MSE 521 Introduction to Electron Microscopy ..... 3 MSE 522 Advanced Transmission Electron Microscopy ..... 2 MSE 525 Surface Analysis ..... 3 CHEM 522 Spectroscopy ..... 3 CHEM 540 Spectroscopic Identification ..... 3 CHEM 560 Introduction to NMR Spectroscopy 3	3
Required Processing Course Choose at least 3 credits from the following (or alternative processing course(s) approved by the GPC) MSE 540 Advanced Processing ..... 3 MSE 542 Ceramic Processing ..... 3 MSE 545 Nanoscale Processing ..... 3 ECE 540 Intro to Integrated Circuit Processing ..... 3 ECE 540L Introduction to Integrated Circuit Processing Lab ..... 1 ECE 541 Advanced Topics in Silicon Technology ..... 3 ECE 542 Photolithography ..... 3 ECE 543 Introduction to MEMS 3	3
Other Graduate Courses Additional elective courses in Materials Science & Engineering or related fields as approved by the Supervisory Committee and by the coordinator of the Materials Science & Engineering Doctoral program.	15
MSE 601 Graduate Student Orientation	1
MSE 600 Assessment [Comprehensive Examination]	1
Subtotal	**38**
MSE 693 Dissertation (Pass/Fail)	30
TOTAL	**68**

General Information: The Doctor of Philosophy in Materials Science & Engineering degree requires completion of a prescribed course of study, satisfactory performance on a comprehensive exam, and completion of independent research that results in a publicly defended dissertation that contributes to the broad field of materials science and engineering. The MSE Graduate Student Handbook provides details on procedures and requirements for admission to the graduate program, admission to candidacy, and other procedural matters related to the PhD.

Credit Requirements: Courses applied to meet the 68-credit minimum requirement must be taken for a letter grade (A-F), except MSE 600 Assessment, MSE 601 Graduate Student Orientation, and MSE 693 Dissertation. MSE 600 will be graded P (Pass) or F (Fail), and MSE 693 Dissertation will initially be graded IP (In Progress) and later graded P or F depending on the outcome of the dissertation defense. MSE 601 is also graded P (Pass) or F (Fail) and must be taken during the first year a student is admitted to the MSE graduate program. All electives must be graduate courses in Materials Science & Engineering (MSE) or approved graduate or upper level undergraduate courses in other disciplines. On-campus graduate students are required to enroll for MSE 598 Seminar each and every semester, but MSE 598 may not be applied to meet the elective requirement. Students are expected to present their research in MSE 598 at least once during their graduate student tenure. With GPC approval, applicants admitted with an MS degree in Materials Science & Engineering or related discipline from an accredited college or university may transfer up to 22 credits of previous graduate course work toward the required credit total.

Comprehensive Examination: The objective of the comprehensive examination (MSE 600) is to judge depth and breadth of knowledge in Materials Science & Engineering. The examination is to be developed and administered by Comprehensive Exam Committee. A student should take the comprehensive examination prior to the end of their fourth semester. The outcome of the examination is determined by the Comprehensive Exam Committee, and must be one of the following: pass or fail. If a student fails the initial examination, the committee has the option of allowing a student to repeat the examination one time. If a repeat examination is granted by the Comprehensive Exam Committee, it must occur within 3 months of the initial examination. Failure of the Comprehensive Examination a second time results in dismissal from the PhD program.

Teaching Requirement: Doctoral students are not required to teach. However, working with a faculty mentor and the Center for Teaching and Learning (CTL), students in the PhD program may develop and deliver as the principal lecturer one 3-credit course at the undergraduate level. The teaching experience will usually occur in the later part of their program, following the Comprehensive Examination and prior to Dissertation Defense. Students must be recommended in writing to the Department Chair for teaching by the student's major advisor. Approval is highly selective and is granted through a departmental (3/4 majority) vote of tenured and tenure track faculty. Students approved to teach will register for MSE 650 Teaching Experience, and will work with their assigned mentor and the CTL to develop both the course structure and a scholarly experience in teaching.

Dissertation Requirements: The dissertation must be the result of independent and original research by the student and must constitute a significant contribution to Materials Science & Engineering knowledge equivalent to multiple, archival, peer-reviewed publications. The style and format of the dissertation are to conform to the standards of the Department of Materials Science & Engineering and the Graduate College.

Dissertation Defense: The final oral examination for a PhD student (the defense) must consist of three sequential parts in which the student presents and defends the dissertation research: 1) a public presentation, 2) a public question and answer session, and 3) a private question and answer session with a committee of experts known as the Defense Committee. The Defense Committee must include the entire Supervisory Committee plus a nonvoting graduate faculty representative (GFR) appointed by the Dean of the Graduate College. The GFR must be a member of the graduate faculty from a college not represented on the Supervisory Committee. The GFR conducts all three

parts of the final oral examination according to procedures established by the Graduate College. The outcome of the final oral examination can only be pass or fail and is determined by a majority vote of the Supervisory Committee (a tied vote is considered a failure). A student who fails the defense may be permitted to try again according to the rules established in the Graduate Catalog, but a second failure results in dismissal from the program.

Final Approval of the Dissertation: If the defense is completed with a result of pass, the Supervisory Committee prepares a statement describing final requirements such as additions or modifications to the dissertation and any additional requirements such as archiving of data. When these requirements have been met to the satisfaction of the Supervisory Committee, the final reading approval page of the dissertation is signed by the major advisor.

Graduate Materials Science & Engineering Courses: Catalog descriptions of existing and proposed graduate classes offered through the Department of Materials Science & Engineering are given in Appendix B. The current graduate curriculum will be augmented by the additions of nine new tenure-track faculty members who will join the program between 2011 and 2013 (three each year). The new faculty members will develop additional new graduate courses in the areas of their specialization, and contribute to the delivery of the undergraduate curriculum as appropriate.

2B. FACULTY

Include the names of full-time faculty as well as adjunct/affiliate faculty involved in the program. Also, give the names, highest degree, rank and specialty. In addition, indicate what percent of an FTE position each faculty will be assigned to the program. Are new faculty required? If so, explain the rationale including qualifications.

The Department of Materials Science & Engineering currently includes 8 full-time tenured and tenure-track (T/TT) faculty, 6 research faculty, and 12 affiliate faculty shown in the tables below. Curriculum Vitae for MSE tenured and tenure-track faculty, lecturers and research faculty are included in Appendix C. For comparison, Appendix D lists the number of tenure track and research faculty in MSE departments regionally where available from the National Science Foundation. In order to offer a sufficiently broad curriculum and to develop a research portfolio to support a PhD program with over 50 graduate students, a total of nine new T/TT faculty members will join the department between fall 2011 and fall 2013 (three each year). The number of required faculty was determined following a year long process of bench marking against peer institutions, and an assessment of teaching and research demands expected of faculty in the program. The assessment of needs was conducted by a committee of faculty from the Materials Science & Engineering, Physics, and Chemistry Departments and was presented to the faculty at two retreats for revisions and final concurrence. The curriculum and staffing requirements plan subsequently was reviewed and approved by the Department's Industrial Advisory Board (IAB). The new hires will be expected to have PhD degrees in Materials Science & Engineering or a related field. They will be expected to contribute to the department by teaching courses at both the graduate and undergraduate level, mentoring students, and establishing an externally funded research program that fits within the emphasis areas of the department. The Program FTE figures provided in the table below represent faculty effort at the end of year 3. All new hire T/TT faculty in the MSE department will be expected to increase their contribution to 0.2 FTE by the end of year 6.

Tenure-Track Faculty in the Department of Materials Science & Engineering (17)			
Name	***Rank***	***Specialty***	***Program FTE***
D. Butt	Professor, Chair	Materials for Extreme Environments, Inorganic Materials Processing, Surfaces and Interfaces	0.05
J. Callahan	Professor, Assoc. Dean	Biomaterials	0.02
M. Frary	Associate Professor	Processing-structure-properties relationship in metals and ceramics	0.2
W. Hughes	Assistant Professor	Biomaterials and DNA nanotechnology	0.2
B. Knowlton	Professor	Gate oxides, biomaterials, electronic materials, nanophotonics, through-wafer interconnects	0.2
A. Moll	Professor, Interim Dean	Microelectronic packaging and ceramic microfluidic and micro analytical systems	0.02
P. Müllner	Professor	Formation and characterization of microstructures	0.2
R. Ubic	Associate Professor	Materials characterization, ceramics and dielectric materials	0.2
New Hire I	Assistant, Associate, or Full Professor Depending on Candidate Pool	Emphasis area consistent with departmental focus areas described in sections 1 and 5A.	0.15
New Hire II	Assistant, Associate, or Full Professor Depending on Candidate Pool	Emphasis area consistent with departmental focus areas described in sections 1 and 5A.	0.15
New Hire III	Assistant, Associate, or Full Professor Depending on Candidate Pool	Emphasis area consistent with departmental focus areas described in sections 1 and 5A.	0.15
New Hire IV	Assistant, Associate, or Full Professor Depending on Candidate Pool	Emphasis area consistent with departmental focus areas described in sections 1 and 5A.	0.05
New Hire V	Assistant, Associate, or Full Professor Depending on Candidate Pool	Emphasis area consistent with departmental focus areas described in sections 1 and 5A.	0.05
New Hire VI	Jointly Appointed Assistant, Associate, or Full Professor Depending on Candidate Pool	Emphasis area consistent with departmental focus areas described in sections 1 and 5A.	0.02
New Hire VII	Assistant, Associate, or Full Professor Depending on Candidate Pool	Emphasis area consistent with departmental focus areas described in sections 1 and 5A.	0.05
New Hire VIII	Assistant, Associate, or Full Professor Depending on Candidate Pool	Emphasis area consistent with departmental focus areas described in sections 1 and 5A.	0.05
New Hire IX	Jointly Appointed Assistant, Associate, or Full Professor Depending on Candidate Pool	Emphasis area consistent with departmental focus areas described in sections 1 and 5A.	0.02

Affiliate Faculty (12)			
Faculty	***Rank and Department***	***Specialty***	***Program FTE***
K. Campbell	Associate Professor, Electrical & Computer Engineering	Glass-based devices and electronic memories	0.02
C. Hanna	Chair, Professor, Physics	Theory, computation, and modeling	0.02
B. Kim	Associate Professor, Physics	Biophysics and condensed-matter	0.02
W. Kuang	Assistant Professor, Electrical & Computer Engineering	Nanophotonics, photonic bandgap material, Parallel computing	0.02
J. Lee	Assistant Professor, Chemistry and Biochemistry	Synthesis, fabrication, and properties of nanomaterials	0.02
M. Mitkova	Assistant Professor, Electrical & Computer Engineering	Nano-ionic conductive bridge non-volatile memory, amorphous semiconductors	0.02
J. Oxford	Professor, Biological Sciences	Function of extracellular matrix molecules in craniofacial and skeletal development	0.02
D. Plumlee	Assistant Professor, Mechanical & Biomedical Engineering	Ceramic-based micro-electrical mechanical systems, micro-fluidics, micro-propulsion	0.02
A. Punnoose	Professor, Physics	Condensed-matter and materials experimentation	0.02
P. Raghani	Assistant Professor, Physics	Computational physics of nanomaterials	0.02
D. Russell	Professor, Chemistry and Biochemistry	Electroanalytical chemistry	0.02
D. Tenne	Assistant Professor, Physics	Condensed-matter physics	0.02

Lecturers, Research Faculty, and Key Research Staff in Materials Science & Engineering (12)		
Faculty	***Rank***	***Specialty***
K. Allahar	Research Associate Professor	Electrochemistry and Corrosion
J. Burns	Research Associate	Microstructural characterization in metals and alloys
K. Chinnathambi	Post-doctoral Researcher	Irradiation effects on graphite
S. Donovan	Lecturer	Process engineering
E. Graugnard	Research Assistant Professor	DNA and biomachinery, bio-physics
M. Hurley	Research Assistant Professor	Corrosion and environmental degradation of materials
B. Jaques	Research Associate	Ceramic processing and microstructural studies
D. Leu	Postdoctoral Researcher	Structural characterization of functional materials and electronic thin film materials and devices
P. Lindquist	Research Assistant Professor	Electrochemical deposition of thin films, magneto-mechanical materials and MEMS devices.

C. Watson	Research Associate	Atomic force microscopy, mechanical properties
J. Youngsman	Research Assistant Professor	Materials and structures for renewable energy
B. Yurke	Research Professor	DNA-nanotechnology, biomimetic materials and systems, soft condensed matter

The tenured and tenure track faculty, including affiliate faculty within the university, will teach the majority of courses in MSE and will serve as research advisors. Research Faculty will provide occasional topical courses in areas of their specialization at either the graduate or advanced undergraduate level by appointment to the Adjunct Faculty rank and will serve occasionally on Supervisory Committees. Supporting course work in other disciplines (Physics, Chemistry, Math, Biological Sciences, Electrical & Computer Engineering, Mechanical & Biomechanical Engineering, etc.) is available through existing graduate programs in other departments and is taught by faculty in those departments. It is anticipated that two to three of the new hires will have joint appointments in synergistic departments outside of MSE where outstanding candidates are identified.

2C. STUDENTS

Briefly describe the students who would be matriculating into this program.

This program will attract students from the state and region as well as from across the nation and internationally. Applicants will have Bachelor's and/or Master's degrees in MSE or a related discipline. They will typically plan to establish careers in basic or applied materials research and development in industry, academia, government agencies or national laboratories. The Chair of the MSE Department will continue to serve on the University Materials Council and the Department of Materials Science & Engineering will maintain membership in this organization. The Council gathers data each year on prospective graduate students from undergraduate programs in the United States and provides these data to Council members. Typically, the list includes the names of approximately 300 students, most of whom are planning to pursue PhD degrees. These students will serve as a base for program recruiting efforts. In addition, fliers and other promotional materials, and university visits will be used to recruit undergraduates from MSE and related programs across the U.S. Faculty members from MSE are frequently asked to deliver invited presentations at universities with undergraduate MSE programs; these presentations serve as an excellent mechanism for recruiting graduate students.

2D. INFRASTRUCTURE SUPPORT

Clearly document the staff support, teaching assistance, graduate students, library, equipment, and instruments employed to ensure program success.

Administrative Staff Support:

The Department of Materials Science& Engineering administrative staff currently includes personnel that are shared with the Departments of Electrical & Computer Engineering (ECE) and Computer Science (CS). Combined, the three departments currently manage more than 90% of the College of Engineering research funds and approximately one-third of the research funds of the University. Creation of the PhD in MSE will require new staff in order to support the significant expansion of research and course offerings. Currently, the MSE department has only one appropriated line for staff. The other 4 staff members, shared with ECE and CS, are supported either through funds appropriated to those departments or through soft money (i.e., short term—usually 1-3 years—

funds obtained by faculty through grants and other extramural sources) obtained through returned overhead or specific projects. The current administrative staff includes:

(1) Management Assistant (1.0 FTE funded by an appropriated line attached to the Electrical and Computer Engineering Department) who manages administrative services and business activities for the three departments described above as well as supports assessment, curriculum and catalog updates, course scheduling, and a number of other maintenance items.
(2) Administrative Assistant Level 2 (1.0 FTE funded by an appropriated line attached to the Materials Science & Engineering Department) who supports all purchasing and travel functions for the three departments noted above.
(3) Administrative Assistant 1 (1.0 FTE funded by an appropriated line attached to the Computer Science Department) who serves as a student support specialist and human resource liaison for the three departments. This position is responsible for initiating, tracking, and renewing employment contracts; processing graduate admission applications; maintaining student files; and supporting searches for new faculty and professional staff.
(4) Technical Records Specialist 1 (1.0 FTE funded by an appropriated line attached to the Electrical and Computer Engineering Department) who provides support related to finances, including budget forecasting, account reconciliation, grant maintenance, p-card reconciliation.
(5) Temporary Office Specialist 2 (0.80 FTE funded by soft funds from the Materials Science & Engineering Department) who assists with all aspects of travel and purchasing.

The program growth would necessitate hiring two additional office administrators (for a total of three office administrators dedicated to the MSE department) and a business manager as outlined in the budget tables below.

Research Staff Support:
Excluding research faculty and postdoctoral researchers, the department research staff currently includes the following:

1) Director of the Boise State Center for Materials Characterization (BSCMC) (0.1 FTE soft money), who oversees day-to-day operations of the Center. This proposal includes 0.1 FTE of support to permanently fund the additional duties of the BSCMC Director.
2) Research Staff (3.5 FTE soft money), who conduct hands on research, machining, and direct supervision and training of students.

As described in the budget section, this proposal includes 4 FTE of permanent funding to support the growth in MSE research lab operations and the BSCMC.

Graduate Student Teaching Assistantships:
The department currently has two Graduate Assistantships ($24,000 stipend per academic year, plus fee waiver) used primarily to support the MS degree programs. The proposed PhD program would add 18 new Graduate Assistantships ($27,000 stipend per academic year, plus fee waiver) phased in over three years (six per year). Each assistantship will employ a student for 20 hours/week during the 9-month academic year and 40 hours per week between semesters, and would be in the form of either a Teaching Assistantship (TA) that will aid curriculum delivery or Research Assistantship (RA) that will support research laboratories and facilities. The TAs provide T/TT faculty the student assistance necessary to support the teaching of MSE labs and upper division courses in the undergraduate curriculum. They play a critical role in the delivery of the undergraduate curriculum as well as provide real-world teaching experiences for graduate students – an important part of the

professional development of the graduate students, particularly at the PhD level. In addition, it is expected that individual faculty will have additional GA lines through sponsored research. It is estimated that the total number of GA positions for the department will average approximately 50 by 2016. As long as satisfactory performance is maintained, all students conducting research will be supported through stipends and tuition waivers to the point of completion of their research.

Library Facilities:
The current library facilities are sufficient to initiate the new graduate program, but will need to be augmented over time to include more electronic journal subscriptions and an increased spectrum of journal availability. These upgrades are part of the planned growth of the Library facilities and are needed to support a wide range of new research and graduate academic programs. All departments have access to serials titles through packages such as Elsevier ScienceDirect, Springer/Kluwer, and Wiley. As discussed below, the PhD program will augment library resources with an additional $50k per year to cover additional texts, journal subscriptions and electronic resources that are required.

Collection Statistics:

Books	566,822
Bound Periodicals	93,865
Total periodicals, newspapers, and serials available - all sources	88,182
Online Databases	272
Microforms	1,442,989
Non-print Materials	44,809
Maps	101,394
Manuscripts (linear feet)	6,769
U.S. Documents	182,751
Textbooks, e-Books, Curriculum Resource Books, Browsing Books	25,214

Library Facilities:

Net Assignable Square Feet (estimate)	200,000
Seats	1,008
Public Terminals	113

Library Staff:

Librarians	20.92 (FTE)
Professional Staff	5.00 (FTE)
Other Staff	37.61 (FTE)
Student Assistants in 60-70 student positions	14.24 (FTE)
Total Staff	77.77 (FTE)

Materials Science & Engineering information systems and search engines:
Web of Science
Compendex and INSPEC
SciFinder Scholar

Laboratories, Equipment, and Instrumentation:
The Department of Materials Science &Engineering currently houses a number of research laboratories that will form the analytical foundation of the PhD program, and more are currently under construction or planned for the near future. For example, a new biomaterials laboratory is

currently under construction, and $4.5M in new capital investments have been made available through the Micron, Inc. contribution.

Appendix E summarizes the specific equipment currently available to the program. The following briefly summarizes the major laboratories that house the equipment summarized in Appendix E.

1. Boise State Center for Materials Characterization (BSCMC)
2. Idaho Microfabrication Laboratory(IML)
3. MSE Surface Analysis Laboratory
4. Semiconductor Test Facility
5. Semiconductor Fabrication Cleanrooms
6. SPM/AFM Systems and Nanofabrication Laboratory
7. MSE Magnetic Materials Laboratory
8. MSE Mechanical Testing Laboratory
9. MSE Advanced Materials Laboratory
10. MSE Teaching Laboratory
11. MBE Low Temperature Co-Fired Ceramic Research Laboratory
12. Computer Laboratories
13. High Bay Teaching Laboratories
14. Machine Shop

2E. Future Plans

Discuss plans for the expansion or off-campus delivery of the proposed program.

No plans currently exist to expand the program or deliver it off-campus. Some of the graduate classes offered through the department are expected to become available to students in other parts of the state or region via access-grid teleconference technology. There are currently strong collaborations with the University of Idaho, Idaho State University, and the Center for Advanced Energy Studies, and it is expected that these collaborations will be strengthened through the course offerings as well as research opportunities that will be created through the proposed PhD program.

3. DUPLICATION

If this program is unique to the state system of higher education, a statement to that fact is needed. However, if the program is a duplication of an existing program in the system, documentation supporting the initiation of such a program must be clearly stated along with evidence of the reason(s) for the necessary duplication. Describe the extent to which similar programs are offered in Idaho, the Pacific Northwest and states bordering Idaho. How similar or dissimilar are these programs to the program herein proposed?

The proposed PhD program does not duplicate any program offered by the Idaho public system of higher education in the southwest Idaho service region, the primary service region of BSU. There are three universities within a six-hour drive of Boise with PhD programs in Materials Science & Engineering: University of Utah (340 miles), Washington State University (370 miles), and the University of Idaho (380 miles). The program at the University of Idaho resides in the Chemical and Materials Engineering Department. With the exception of Wyoming, the States bordering Idaho offer at least one MSE PhD; most have two or more universities offering such degrees. As is true of materials science programs in general, no two programs are alike due to the highly interdisciplinary nature of Materials Science & Engineering, and, consequently, the various emphases of the

departments are quite different. For example, a significant emphasis of the MSE program at BSU has been and will continue to be focused on nanoscale fabrication and materials for semiconductor device processing. By contrast, the program at University of Idaho grew out of the field of hydrometallurgy and mining and consequently has historically been strong in metallurgy, including extractive metallurgy. As noted above, the department at UI was recently merged with Chemical Engineering. They currently have MSE faculty with expertise in nuclear materials, electronic materials, and metallurgy. *Materials Science & Engineering faculty at UI and BSU have several strong research collaborations with extramural support between the two institutions in excess of $1M. The creation of the PhD program at BSU is expected to strengthen these collaborations as well as collaborations with Physics, Chemistry, and Nuclear Engineering programs at both UI and ISU.*

The Chair of Materials Science & Engineering has discussed the proposed PhD with faculty and Department Chairs at the University of Utah, Washington State University, and the University of Idaho, as well as other departments that could benefit from the new PhD, such as the Nuclear Engineering programs at University of Idaho and Idaho State University, and the Aerospace Engineering program at Utah State University. All three neighboring schools with MSE PhD programs are supportive of the proposed program and have expressed a strong desire to collaborate or continue to collaborate through both research and distance learning. The synergy of such collaborations and cooperation would attract more students to both BSU and the other campuses, and will raise the reputation and quality of programs across the state. The establishment of a PhD program at BSU would support the growing need of local industries such as Micron, as well as more distant organizations such as the Idaho National Laboratory, with technical leaders and high level scientists and engineers in various fields of materials. The proposed PhD program would reside in a location within 20 miles or less of approximately half of the state's population, central to the technology core of the state.

4. CENTRALITY

Documentation ensuring that program is consistent with the Board's policy on role and mission is required. In addition, describe how the proposed program relates to the Board's current Statewide Plan for Higher Education as well as the institution's long-range plan.

The following excerpts are from the current role and mission statement formulated by the State Board of Education (SBOE). The excerpts indicate that the proposed program is consistent with the SBOE intentions for Boise State University.

Boise State University "offers a variety of masters and ***select doctoral degrees***" and "conducts coordinated and ***externally funded research studies***."

"Boise State University is a comprehensive, urban university serving a diverse population through undergraduate and ***graduate programs***, ***research***, and state and regional public service."

"Boise State University will formulate its academic plan and generate programs with primary emphasis on business and economics, ***Engineering***, the social sciences, public affairs, the performing arts, and teacher preparation. Boise State University will give continuing emphasis in the areas of the health professions, the physical and biological sciences, and education and will maintain basic strengths in the liberal arts and sciences, which provide the core curriculum or general education portion of the curriculum."

5. DEMAND

Address student, regional and statewide needs.

5A. Summarize the needs assessment that was conducted to justify the proposal. The needs assessment should address the following: statement of the problem/concern; the assessment team/the assessment plan (goals, strategies, timelines); planning data collection; implementing date collection; dissemination of assessment results; program design and on-going assessment. (See the Board policy III.X., Outcomes Assessment)

Statement of the Problem and Overall Needs Assessment

This proposal for an interdisciplinary PhD program in Materials Science & Engineering is the result of many factors, including: (1) increasing demand from local employers, (2) expressed interest from science and engineering students, (3) a national demand for MSE PhDs, (4) several strong, collaborative research programs between faculty in Materials Science & Engineering, Physics, and other departments, and (5) the rapid growth of the B.S. and M.S. programs in MSE at BSU. The PhD program will generate a significant number of qualified graduate students with extensive training in the key areas of the state's high-tech economy including semiconductor science, nanotechnology, and energy materials. The PhD in MSE is driven not only by surveys and observations of the Department, College and Departmental Industrial Advisory Boards, and the University, but also by the business community of Idaho.

The needs assessment that lead to the proposal of a new PhD program in MSE included a synthesis of information gathered during the last five years from: (1) direct inquiries to the department and its faculty from potential students expressing their need to complete a PhD in MSE and desire to do so at Boise State; (2) conversations with the MSE Industrial Advisory Board, local industry, state and federal agency personnel in Idaho who have a need and interest in both the intellectual property and value created by a PhD in MSE and the student products that it would create; (3) discussions with research directors and program managers at the Idaho National Laboratory; and (4) analysis of job advertisements in national publications and recruitment centers seeking applicants with a PhD in MSE.

The direct student inquiries are discussed further in the next section as part of the description of likely sources of students. Attached letters of support are representative of the input obtained from prospective employers of MSE graduate students. Classified advertisements placed in the leading national publications and websites through MSE professional societies including TMS, the Materials Research Society, and the American Ceramic Society illustrate the employment opportunities for MSE PhD positions. The Materials Research Society, for example, currently has 83 positions posted requiring a PhD in MSE or closely related discipline, demonstrating the demand for doctoral students nationally.

National Demand for PhDs in Materials Science and Engineering

The global materials industry is worth an estimated $550 billion, conservatively. Materials revolutionize our lives by offering advanced performance and new possibilities for design and usage. For example, the market for biocompatible materials has grown from a few to $60B in the past decade. Market size is growing for materials in emerging areas such photonic materials, electronic and dielectric materials, functional coatings, and green materials. Due to the highly interdisciplinary nature of Materials Science & Engineering, students who graduate from MSE programs are recruited

into a wide range of disciplines. Materials Science & Engineering has synergy with all the engineering fields as well as many of the sciences, particularly chemistry, biology, and physics. PhDs in MSE are well suited for positions at national laboratories, such as INL, managerial and senior scientist or engineering professions in industry, and as teachers, researchers and faculty in academia.

Because of the interdisciplinary and research-intensive nature of Materials Science & Engineering, the PhD (rather than the B.S. or M.S.) is arguably the terminal degree for most careers in the field. Consequently, a majority of students entering into Materials Science & Engineering graduate programs hope to obtain their PhD and view the MS as an intermediate step to that degree. A few examples illustrating the ratio of PhD to MS students include the University of Florida (180 PhD students, 6 MS students), Georgia Institute of Technology (270 PhD students, 40 MS students), and Drexel University (52 PhD students, 20 MS students).

Regional Demand for PhDs in Materials Science and Engineering

Idaho's Treasure Valley currently supports semiconductor manufacturing, electronic products, software publishing, and engineering services. According to the US Small Business Administration (SBA), Idahoans start new businesses at three times the national average. In addition, technology accounts for more than 70% of all exports and 18% of all wages in Idaho. Although the entrepreneurial spirit of Idaho cannot be denied, neither can the influence of highly specialized manufacturers on the local economy. For example, the Hewlett-Packard Company and Micron Technology represent "surrogate" universities, helping bootstrap the Treasure Valley with world-class talent, intellectual capital, financial investment, and technological innovation. Idaho has been ranked first among the 50 U.S. states in patents and manufacturing investment per capita according to the Idaho Department of Commerce, a significant fraction of which are related to innovations in the use and design of materials.

In order to preserve the industrial vitality of Idaho, the state and community are investing in forward-thinking ideas and technology, supporting local industry via home-grown innovation, differentiating themselves from existing competitive markets, diversifying the current industrial portfolio to include nano/biotechnology, and transitioning from a manufacturing to a knowledge-based economy. As a consequence, *the Idaho Department of Commerce has identified 1) novel materials, 2) biological sciences, and 3) nanotechnology as central to the future of Idaho's economy. At the forefront of this effort is Boise State University with the Department of Materials Science & Engineering conducting research in all three areas through its interdisciplinary program. Recognizing the need for a stronger foundation in materials science in the region, Micron Technology, Inc. has generously donated $13M, the largest donation in BSU history, to start the new MSE PhD at Boise State.* The following is a quote (see Appendix F for full letter) that emphasizes this point:

"To maintain the core value of the company, we have to enhance research and development to generate better product ideas. One of the requirements to fulfill this task is the need of highly trained engineers. These qualified engineers should normally have PhD training with solid background in at least one or two disciplines in Engineering… Materials Science and Engineering is one of these disciplines and will become more and more important in the near future."
-Dr. Du Li, TEM Laboratory Manager, Micron Technology, Inc.

Despite the recent financial challenges in the U.S., Idaho has maintained a fast-growing science and technology based economic sector, currently accounting for more than 25% of the gross state

product. The potential for economic expansion in this area is significant - however, based on the national census of 2000, Idaho was tied for 40th place among all states with only 6.8% of its population over the age of 25 holding a graduate degree (Bauman and Graf, 2003). In 2003, Idaho ranked 43rd in the production of doctorates in sciences and engineering (Burrelli, 2004). Data from the 2010 Census are not available for comparison at this time.

Because modern industry and its associated diverse economic activity depend on the availability of a skilled workforce in science and engineering, Idaho needs to augment graduate education in these areas to remain economically competitive on a regional and national basis. This perspective was reinforced by the Governor's Science and Technology Advisory Council in 2000, and the 2004 Reports of the Idaho Governor's Science and Technology Advisory Panel which identified several critical elements necessary to support the growth of a vibrant, knowledge-based economy in Idaho:

1) A research and development base
2) Highly skilled technical workforce
3) Entrepreneurial culture
4) Knowledge transfer mechanism
5) Technology infrastructure
6) Risk capital
7) Attractive quality of life

Advanced graduate education and research programs in science play a central role in addressing the majority of these individual points. Because much of the science and technology based economic growth in Idaho is occurring in the greater Boise metropolitan area, Boise State University has an important responsibility and role to play in meeting the growing need for delivery of advanced graduate degree programs in Idaho, particularly in high technology disciplines.

The Treasure Valley area of Idaho has the largest concentration of advanced materials-related manufacturing companies in the state, including Micron Technology and Hewlett-Packard. The continued success and growth of a regional high-technology economy, and the ability to attract other major companies, requires a research and development base and availability of a highly skilled technical workforce. Although 80% of Idaho residents are high-school graduates (as compared to 75% nationwide), the state ranks near the bottom in the production of new science and engineering doctoral degrees. For example, Idaho ranked 45th out of 50 states based on a survey conducted during 1998-2001. This is also reflected in the employment patterns of the major semiconductor companies in Idaho. For example, the pool of qualified science and engineering graduates in Idaho could only fill less than 30% of the scientist/engineer positions at the major semiconductor companies in Idaho based on the hiring data during 2002-2004. As a result of these disparities, Boise State University is expanding its offerings of undergraduate and graduate programs in science and engineering disciplines. Although there is unemployment among Treasure Valley residents, a large fraction of the high-tech job opportunities available within the state go to well qualified graduates from other states. Therefore, if more Idaho residents were qualified, local employers would be interested in hiring them.

To begin addressing the disparity in the numbers of technically educated Idahoans, BSU introduced an interdisciplinary Materials Science & Engineering masters degree (M.S.) program in 2002 by developing graduate courses with faculty from Physics, Electrical Engineering, and Mechanical Engineering departments along with the support of faculty from several other departments. The

program grew to 18 graduate students by the fall of 2006 and currently has approximately 30 students. According to a recent survey of the University Materials Council, Boise State is now one of the top masters degree producing MSE programs in the U.S. (Note: the survey includes responses from approximately 60% of the departments in the U.S.) The early growth of the masters programs in MSE encouraged the Micron Technology Foundation (Boise, ID) to donate $2 million in 2004 to create a department of Materials Science & Engineering and to start an undergraduate (B.S.) program. The B.S. program grew to 50 undergraduate students in two years and currently stands at approximately 85 students. Figure 1 below depicts the student growth in the department since the inception of each program.

As discussed above, the PhD is considered by many employers as the terminal degree in Materials Science & Engineering. Consequently, recruiting graduate students or retaining the best students in the MSE program at BSU is difficult due to the absence of a PhD program. *A significant number of students that inquire about graduate studies in MSE at BSU are interested in a PhD and ultimately choose to go elsewhere when they discover that the option is not available. Consequently, the University and the state of Idaho are losing talented individuals to other states.*

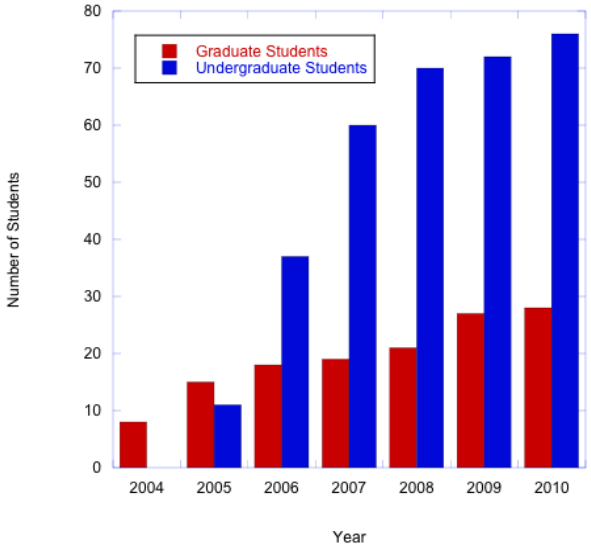

Figure 1. Growth of Boise State's bachelor's and master's degree programs since the department's inception in 2004

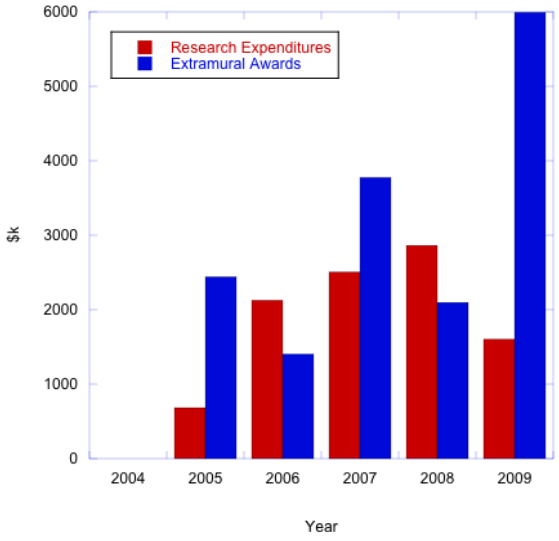

Figure 2. Research activity of Boise State's MSE faculty since the department's inception in 2004. ($k = $1000, multiply y-axis by 1000 to get values in actual dollars.)

The contributions of the Micron Foundation allowed the MSE department at BSU to recruit and retain a collection of outstanding faculty who have been highly successful at obtaining extramural support for research. In fact, the total research expenditures per tenure track-faculty member in the department ranks among the highest in the nation. In 2010, new grants in the department constituted approximately 18% of the University's total new research budget. As shown in Figure 2, since 2007, the department has had research expenditures near $2 to $3M per year and this number is projected to increase in the coming years. *Current projections for FY2011 indicate expenditures will exceed $4M. Much of this research is conducted with a mix of graduate and undergraduate students. While the current approach has allowed BSU to develop one of the top undergraduate programs in the region with highly sought after students, many of these students leave Boise to*

pursue graduate studies in other states. For examples, MSE graduates are currently or will be pursuing PhDs at Penn State, University of California-Santa Barbara, Cal Tech, Colorado School of Mines, Carnegie Mellon University, University of Texas, Washington State University, Arizona State University, and Oregon State University. At this date, we have no statistics on what happens to those students after receiving their doctorates, but it is expected that many may not return to the region having found positions through their graduate institutions. Having a PhD program in Boise will allow us to retain a greater percentage of Idaho's top engineering and science students.

As stated above, the department has a broad spectrum of specializations, including semiconductor device reliability, microelectronic packaging, shape memory alloys, nanotechnology, DNA machinery, materials for energy applications, environmental degradation, materials for extreme environments, biomaterials and bio-machinery, materials characterization, and materials modeling. In addition, the department has considerable interest and activities in Science, Technology, Engineering, and Math (STEM) education and outreach. These areas of research are highly synergistic with local industries, including Micron Technology, Hewlett Packard, and Idaho National Laboratory (INL). Through this new PhD, the department intends to recruit faculty that are complimentary to these research and educational areas as well as fill gaps in needs for local industry.

The MSE department at BSU has gained a strong national and international reputation. Bringing this department to the status of a PhD program will not only improve workforce skills for the local industry, but will also provide opportunities for creating new intellectual property (IP) and businesses in the region, as well as attract industry to the region that can leverage the department's expertise.

5B. Students

Explain the most likely source of students who will be expected to enroll (full-time, part-time, outreach, etc.). Document student demand by providing information you have about student interest in the proposed program from inside and outside the institution.

Differentiate between the projected enrollment of new students and those expected to shift from other program(s) within the institution.

Students in the program are expected to be full-time students in residence, conducting their coursework and dissertation research for approximately 4 - 5 years. It is expected that approximately one-third to one-half of these students will be graduates of B.S. and M.S. programs in the state or region, and we expect the balance of students to come from high-quality science and engineering programs across the U.S. or from respected international programs. This expectation is based on the current graduate program composition and inquiries received by faculty members in the MSE Department about the possibility of working on a PhD under their supervision.

Another source of student interest comes from graduates of our existing B.S and M.S. programs; some of the strongest students coming out of our existing programs have expressed the desire to continue their education and pursue a PhD in MSE at Boise State, but the lack of a program prevents them from doing so. Some of these students have stopped their education short of achieving the terminal degree and are currently waiting for the PhD to be created at BSU. Among those that have gone on to pursue a PhD, all but one have chosen to leave the state in search of a program that suits their specific interests. The single exception is a student pursuing a PhD in Nuclear Engineering at Idaho State University. As noted above, other graduates are attending universities such as Penn State, University of California-Santa Barbara, Cal Tech, Colorado School of Mines, Carnegie Mellon University, University of Texas, Washington State University, Arizona State University, and Oregon

State University. Of those students that have left the state to pursue a PhD, only one, a Washington State University doctoral recipient, has returned to Idaho to date.

The MSE graduate programs are interdisciplinary in nature. Consequently, students in the PhD program are expected to come from a variety other disciplines including Physics, Chemistry, Biology, Mechanical Engineering, and Electrical and Computer Engineering. These studies will come from a variety of institutions in the region including regional liberal arts colleges like Northwest Nazarene University and the College of Idaho. It is expected that students will enter the MSE PhD program as BS or MS students and will not shift from other PhD programs within the institution. Therefore, the PhD program would not compete with other programs but would provide an additional higher education option to students in other departments that might go elsewhere for an advanced degree.

As discussed above, there are excellent job opportunities for students holding PhDs in MSE. For example, more than 80 ads are currently open on the MRS jobs web site specifically for PhD holding MSE graduates. The MSE Department at BSU has a jobs website that currently lists 150 prospective employers, a majority of which are within Idaho: (https://sites.google.com/a/boisestate.edu/mse_connections/).

Currently, Micron is advertising for 21 positions that call for a degree in Materials Science and Engineering, and at least 35 other positions are being advertised for in Idaho jobs listings for materials science related positions, including six manufacturing engineers, nine quality engineers, and twenty process engineers.

5C. Expansion or Extension

If the program is an expansion or extension of an existing program, describe the nature of that expansion or extension. If the program is to be delivered off-campus, summarize the rationale and needs assessment.

Not applicable to the proposed program. No expansion is anticipated.

6. RESOURCES

Fiscal impact and budget

On this form, indicate the planned FTE enrollment, estimated expenditures, and projected revenues for the first three fiscal years (FY) of the program. Include both the reallocation of existing resources and anticipated or requested new resources. Second and third year estimates should be in constant dollars. Amounts should reflect explanations of subsequent pages. If the program is a contract related, explain the fiscal sources and the year-to-year commitment from the contracting agency(ies) or party(ies).

I. PLANNED STUDENT ENROLLMENT

The program will matriculate approximately 6 to 12 new PhD students per year, reaching a steady-state enrollment of approximately 50 students by the sixth year. Students will be funded by a combination of appropriated and grant-funded assistantships. For purposes of projecting the first three years, we have assumed matriculation of ten new doctoral eligible students in the first year of the program, ten in the second year, and five in the third year. This is based on the assumption that there is an immediate demand that will lead to a number of early applicants in 2012-13. Following

the initial demand and influx of students, the number of accepted applicants will grow steadily to a steady state level that equates to approximately 2-5 PhD students per T/TT faculty, or an average of 50 students overall. The proposed program will begin in FY13 (fall 2012). However, initial investments, hires, and recruiting will begin in FY12.

	FY 12		FY 13		FY 14	
	FTE	Headcount	FTE	Headcount	FTE	Headcount
A. New enrollments	10	10	20	20	25	25
B. Shifting enrollments	0	0	0	0	0	0

II. EXPENDITURES

A. Personnel Costs

	FY 12		FY 13		FY 14	
	FTE	Cost	FTE	Cost	FTE	Cost
1. Faculty	3	$300,000	6	$603,461	9	$938,077
2. Administrators						
3. Adjunct faculty						
4. Graduate/instructional assistants	6	$180,000	12	$360,000	18	$540,000
5. Research personnel						
6. Support personnel	10	$429,028	10	$445,496	10	$446,458
7. Fringe benefits		$275,472		$402,044		$537,466
8a. Other: Faculty Startup		$750,000		$750,000		$750,000
8b. Other: Graduate Fees		$48,000		$96,000		$144,000
Total FTE Personnel and Costs	19	$1,982,499	28	$2,657,001	37	$3,376,000

B. Operating Expenditures

	FY 12	FY 13	FY 14
1. Travel	$30,000	$30,000	$30,000
2. Professional services			
3. Other services			
4. Communications	$15,000	$15,000	$15,000
5. Utilities			
6. Materials & supplies	$25,000	$25,000	$25,000
7. Rentals			
8. Repairs & maintenance	$75,000	$75,000	$75,000
9. Materials & goods for manufacture & resale			
10. Miscellaneous	$5,000	$5,000	$5,000
Total Operating Expenditures	$150,000	$150,000	$150,000

C. Capital Outlay

	FY 12	FY 13	FY 14
1. Library Resources	$50,000	$50,000	$50,000
2. Equipment	$1,500,000	$1,500,000	$1,384,500
Total Capital Outlay	$1,550,000	$1,550,000	$1,434,500

D. Total Physical Facilities or Major Renovation

	FY 12	FY 13	FY 14
Total Physical Facilities or Major Renovation			

Facility expansions or renovations are not included in the above budget; however, new space will be required to accommodate program growth supporting the proposed PhD program. It is estimated that to accommodate office and laboratory needs for new faculty, staff and students, approximately 19,200 ft^2 will be required. All efforts will be made to satisfy these requirements within the existing facilities of the home departments of the new faculty members, however, it is expected that additional new or renovated space will be required to accommodate the full six year projected growth.

E. Indirect Costs (overhead)

	FY 12	FY 13	FY 14
Total Indirect Costs (overhead)	-	-	-

GRAND TOTAL EXPENDITURES

	FY 12	FY 13	FY 14
Grand Total Expenditures	$3,682,499	$4,357,001	$4,960,500

III. REVENUES

A. Source of Funds

	FY 12	FY 13	FY 14
1. Appropriated funds – reallocation -- MCO			
2. Appropriated funds – new – above MCO			
3. Federal funds			
4. Other grants			
5. Fees			
6. Other (Micron Technology)	$3,682,499	$4,357,001	$4,960,500
Grand Total Revenues	$3,682,499	$4,357,001	$4,960,500

B. Nature of Funds

	FY 12	FY 13	FY 14
1. Recurring*	$1,432,499	$2,107,001	$2,826,000
2. Non-recurring**	$2,250,000	$2,250,000	$2,134,500
Grand Total Revenues	$3,682,499	$4,357,001	$4,960,500

* Recurring is defined as ongoing operating budget for the program which will become part of the base.
** Non-recurring is defined as one-time funding in a fiscal year and not part of the base.

a. Faculty and Staff Expenditures

Project for the first three years of the program, the credit hours to be generated by each faculty member (full-time and part-time), graduate assistant, and other instructional personnel. Also indicate salaries. After total student credit hours, convert to an FTE student basis. Please provide totals for each of the three years presented. Salaries and FTE students should reflect amounts shown on budget schedule.

The tables below illustrate the anticipated student credit hour production and the Faculty salary costs associated with credit hour production for the first three years of the program. Estimated FTE assignment to the program is based on considering distribution of effort in each of the three principal areas of activity for tenure-track faculty – teaching, research, and service – and the following assumptions: (1) the steady state graduate student population in the department will be composed of approximately two-thirds PhD students and one-third MS students; (2) teaching loads for tenure-track faculty involved in mentoring PhD students will be approximately two 3-credit classes per academic year; (3) for most tenure-track graduate faculty, at least one of the classes will be at the graduate level (some may be cross listed as upper division undergraduate classes); and (4) MSE faculty will offer one class per year that is relevant to students in the PhD program.

FY 12 Faculty Expenditures

Name, Position, and Rank	Annual Salary Rate	% FTE Assignment to this Program	Program Salary Dollars	Projected Student Credit Hours	FTE Students
D. Butt, Chair, Professor	$120,459	5%	$6,023	8	0.33
J. Callahan, Assoc. Dean, Professor	$154,336	2%	$3,087	3	0.13
B. Knowlton, Professor	$98,448	30%	$29,534	48	2.0
A. Moll, Interim Dean, Professor	$98,447	2%	$1,969	3	0.13
P. Mullner, Professor	$97,927	30%	$29,378	48	2.0
M. Frary, Assoc. Professor	$87,298	15%	$13,095	24	1.0
W. Hughes, Asst. Professor	$74,007	15%	$11,101	24	1.0
R. Ubic, Assoc. Professor	$93,000	13%	$12,090	22	1.0
New Hire I	$95,000	5%	$4,750	8	0.33
New Hire II	$95,000	5%	$4,750	8	0.33
New Hire III	$95,000	5%	$4,750	8	0.33
C. Hanna, Chair, Professor, Physics	$83,824	2%	$1,676	3	0.13
J. Oxford, Professor, Biology	$102,733	2%	$2,055	3	0.13
A. Punnoose, Professor, Physics	$75,255	2%	$1,505	3	0.13
D. Russell, Professor, Chemistry	$66,560	2%	$1,331	3	0.13
K. Campbell, Assoc. Professor, Electrical Engr.	$92,248	2%	$1,845	3	0.13
B. Kim, Assoc. Professor, Physics	$61,319	2%	$1,226	3	0.13
M. Mitkova, Asst. Professor, Electrical Engr.	$88,463	2%	$1,769	3	0.13
W. Kuang, Asst. Professor, Electrical Engr.	$80,642	2%	$1,613	3	0.13
J. Lee, Asst. Professor, Chemistry	$52,000	2%	$1,040	3	0.13
D. Plumlee, Asst. Professor, Mechanical Engr.	$74,173	2%	$1,483	3	0.13
P. Raghani, Asst. Professor, Physics	$56,015	2%	$1,120	3	0.13
D. Tenne, Asst. Professor, Physics	$56,597	2%	$1,132	3	0.13
Total			$138,323	240	10

FY 12 Assumptions:

- Typical faculty will provide 6 credits per semester of graduate level lecture/dissertation credits.
- 30 workload units/year are required of each faculty member.
- Therefore, generating graduate credits is 20% of average annual effort.
- Year 1 graduate student enrollment projected increase is 10 students.
- One FTE graduate student will enroll in 24 credits per year.
- Year 1 credit hours generated will be 10 students x 24 credit hours/student = 240 credit hours.
- New hire faculty will not assume full 20% graduate effort in first year.

FY 13 Faculty Expenditures

Name, Position, and Rank	Annual Salary Rate	% FTE Assignment to this Program	Program Salary Dollars	Projected Student Credit Hours	FTE Students
D. Butt, Chair, Professor	$124,073	5%	$6,204	14	0.6
J. Callahan, Assoc. Dean, Professor	$158,966	2%	$3,179	6	0.2
B. Knowlton, Professor	sabbatical	-	-	-	-
A. Moll, Interim Dean, Professor	$101,400	2%	$2,028	6	0.2
P. Mullner, Professor	$100,865	20%	$ 20,173	56	2.3
M. Frary, Assoc. Professor	$89,917	20%	$17,983	56	2.3
W. Hughes, Asst. Professor	$76,227	20%	$15,245	56	2.3
R. Ubic, Assoc. Professor	$95,790	20%	$19,158	56	2.3
New Hire I	$98,077	15%	$14,712	42	2.0
New Hire II	$98,077	15%	$14,712	42	2.0
New Hire III	$98,077	15%	$14,712	42	2.0
New Hire IV	$98,077	5%	$4,904	16	0.6
New Hire V	$98,077	5%	$4,904	16	0.6
New Hire VI (Affiliate)	$98,077	2%	$1,962	6	0.2
C. Hanna, Chair, Professor, Physics	sabbatical	-	-	-	-
J. Oxford, Professor, Biology	$105,815	2%	$2,116	6	0.2
A. Punnoose, Professor, Physics	$77,513	2%	$1,550	6	0.2
D. Russell, Professor, Chemistry	$68,557	2%	$1,371	6	0.2
K. Campbell, Assoc. Professor, Electrical Engr.	$95,015	2%	$1,900	6	0.2
B. Kim, Assoc. Professor, Physics	$63,159	2%	$1,263	6	0.2
M. Mitkova, Asst. Professor, Electrical Engr.	$91,117	2%	$1,822	6	0.2
W. Kuang, Asst. Professor, Electrical Engr.	$83,061	2%	$1,661	6	0.2
J. Lee, Asst. Professor, Chemistry	$53,560	2%	$1,071	6	0.2
D. Plumlee, Asst. Professor, Mechanical Engr.	$76,398	2%	$1,528	6	0.2
P. Raghani, Asst. Professor, Physics	$57,695	2%	$1,154	6	0.2
D. Tenne, Asst. Professor, Physics	$58,295	2%	$1,166	6	0.2
Total			$156,478	480	20

FY 13 Assumptions:

- Typical faculty will provide 6 credits per semester of graduate level lecture/dissertation credits.
- 30 workload units/year are required of each faculty member.
- Therefore, generating graduate credits is 20% of average annual effort.
- Year 2 graduate student enrollment projected increase is 10 students.
- One FTE graduate student will enroll in 24 credits per year.
- Year 2 credit hours generated will be 20 students x 24 credit hours/student = 480 credit hours.

- New hire faculty will not assume full 20% graduate effort in first year.
- Assume one sabbatical leave in MSE faculty and one sabbatical leave in affiliate faculty
- New Hire VI will be in affiliate department

FY 14 Faculty Expenditures

Name, Position, and Rank	Annual Salary Rate	% FTE Assignment to this Program	Program Salary Dollars	Projected Student Credit Hours	FTE Students
D. Butt, Chair, Professor	$127,795	5%	$6,390	16	0.7
J. Callahan, Assoc. Dean, Professor	$163,735	2%	$3,275	7	0.3
B. Knowlton, Professor	$104,443	20%	$20,889	67	2.7
A. Moll, Interim Dean, Professor	$104,442	2%	$2,089	7	0.3
P. Mullner, Professor	sabbatical	-	-	-	-
M. Frary, Assoc. Professor	$92,614	20%	$18,523	67	2.7
W. Hughes, Asst. Professor	$78,514	20%	$15,703	67	2.7
R. Ubic, Assoc. Professor	$98,664	20%	$19,733	67	2.7
New Hire I	$102,564	15%	$15,385	49	2.0
New Hire II	$102,564	15%	$15,385	49	2.0
New Hire III	$102,564	15%	$15,385	49	2.0
New Hire IV	$102,564	5%	$5,128	16	0.7
New Hire V	$102,564	5%	$5,128	16	0.7
New Hire VI (Affiliate)	$102,564	2%	$2,051	7	0.3
New Hire VII	$102,564	5%	$5,128	16	0.7
New Hire VIII	$102,564	5%	$5,128	16	0.7
New Hire IX (Affiliate)	$102,564	2%	$2,051	7	0.3
C. Hanna, Chair, Professor, Physics	$88,929	2%	$1,779	7	0.3
J. Oxford, Professor, Biology	sabbatical	-	-	-	-
A. Punnoose, Professor, Physics	$79,838	2%	$1,597	7	0.3
D. Russell, Professor, Chemistry	$70,614	2%	$1,412	7	0.3
K. Campbell, Assoc. Professor, Electrical Engr.	$97,866	2%	$1,957	7	0.3
B. Kim, Assoc. Professor, Physics	$65,053	2%	$1,301	7	0.3
M. Mitkova, Asst. Professor, Electrical Engr.	$93,850	2%	$1,877	7	0.3
W. Kuang, Asst. Professor, Electrical Engr.	$85,553	2%	$1,711	7	0.3
J. Lee, Asst. Professor, Chemistry	$55,167	2%	$1,103	7	0.3
D. Plumlee, Asst. Professor, Mechanical Engr.	$78,690	2%	$1,574	7	0.3
P. Raghani, Asst. Professor, Physics	$59,426	2%	$1,189	7	0.3
D. Tenne, Asst. Professor, Physics	$60,044	2%	$1,201	7	0.3
Total			$174,070	600	25

FY 14 Assumptions:

- Typical faculty will provide 6 credits per semester of graduate level lecture/dissertation credits.
- 30 workload units/year are required of each faculty member.
- Therefore, generating graduate credits is 20% of average annual effort.
- Year 3 graduate student enrollment projected increase is 5 students.
- One FTE graduate student will enroll in 24 credits per year.
- Year 3 credit hours generated will be 25 students x 24 credit hours/student = 600 credit hours.
- New hire faculty will not assume full 20% graduate effort in first year.
- Assume one sabbatical leave in MSE faculty and one sabbatical leave in affiliate faculty
- New Hire IX will be in affiliate department

The program is anticipated to reach steady-state enrollment after five or six years, with a total student FTE between 40 and 60.

Project the need and cost for support personnel and any other personnel expenditures for the first three years of the program.

Anticipated costs and revenues to support Administrative Staff, Research Staff, and Other Staff associated with the PhD program in the first three years are shown in the tables below:

FY 12 Staff Expenditures

Position	Annual Salary Rate	FTE Assignment to this Program	Program Salary Dollars	Percent of Salary Dollars to Program
Business Manager	$60,150	1.0	$60,150	100%
Admin Support	$27,397	2.0	$54,795	100%
Technical Support	$51,481	4.0	$205,926	100%
IT Support	$52,985	1.0	$52,985	100%
Professional Advising	$27,586	2.0	$55,172	100%

FY 13 Staff Expenditures

Name, Position, and Rank	Annual Salary Rate	FTE Assignment to this Program	Program Salary Dollars	Percent of Salary Dollars to Program
Business Manager	$62,500	1.0	$62,500	100%
Admin Support	$28,253	2.0	$56,507	100%
Technical Support	$53,333	4.0	$213,334	100%
IT Support	$55,224	1.0	$55,224	100%
Professional Advising	$28,965	2.0	$57,931	100%

FY 14 Staff Expenditures

Name, Position, and Rank	Annual Salary Rate	FTE Assignment to this Program	Program Salary Dollars	Percent of Salary Dollars to Program
Business Manager	$64,394	1.0	$64,394	100%
Admin Support	$29,109	2.0	$58,219	100%
Technical Support	$55,970	4.0	$223,881	100%
IT Support	$57,895	1.0	$57,895	100%
Professional Advising	$31,034	2.0	$62,069	100%

The following are job descriptions for the required additional Technical Support Staff:

Skilled Mechanic/Machinist:
The skilled mechanic will upgrade existing experimental apparatus and develop new research instruments for the MSE Department. This individual will work closely with faculty and graduate students during all stages of instrument development projects including planning, design, fabrication, and installation.

BSCMC Characterization Staff Engineer:
This individual will have technical and engineering skills and have responsibilities in three areas for the department. The first area concerns service and maintenance of sample-preparation and materials characterization instruments housed in the Boise State Center for Materials Characterization (BSCMC), and contact to the vendors of instruments and laboratory supply. The second task is to provide training and characterization services for graduate students and senior users at characterization and sample preparation instruments. A third group of tasks consists in repairing and upgrading instruments and in developing new characterization capabilities.

Nanoscience & Technology Characterization and Professional Development Staff Engineer:
This individual will have technical and engineering skills in and provide characterization support for nanoscience and bionanotechnology in the department by maintaining and developing surface science characterization methodologies such as surface probe microscopy techniques, upgrading instrumentation, and contacting vendors of instruments and laboratory supplies. Additionally, the individual will train users such as undergraduate and graduate students and facilitate student research by working closely with the students to educate them and teach them the skills they need to perform their own research. Furthermore, the individual will maintain inventory and purchase consumables, equipment and chemicals and ensure that appropriate safety procedures are in place and that all users are trained and operate the equipment and perform experiments safely. In addition, the individual will provide reports where appropriate on research conducted in the surface probe microscopy laboratory and assist in disseminating the results of research. Lastly, the individual will train senior undergraduates in professional development via senior projects that interface students with technology-based industry and research groups. Professional development includes project and time management, acquiring and organization of current technology information, technical writing, design of experiments, team work, and performing extended experiments, analysis of data and professional presentation of findings.

Electromechanical Technician:
The person shall have a background as an electrical and mechanical engineer and provide support for faculty including designing, building, and maintaining instrumentation/equipment in research and

teaching labs. The person will also support classroom demonstrations and outreach opportunities for the Department of Materials Science & Engineering.

The Department of Materials Science & Engineering currently funds a single full-time administrative assistant (AAII) but would augment administrative personnel to include the following positions:

Business Manager:
Provides support to research administration, reporting, and research proposal preparation. Provides leadership in delegating administrative responsibilities to staff.

Administrative Assistant 2:
Supports academic activities such as assessment, curriculum changes, catalog updates, and course scheduling. Also provides some amount of student support related to graduate applications, assistantships, and forms.

Administrative Assistant 2:
Provides purchasing support, coordinates textbook adoption, facilitates meetings and events, and manages user support requests such as those related to facilities, operations, and maintenance.

Administrative Assistant 2:
Provides travel support including estimates, travel authorizations, reservations, and post-travel reimbursement.

It is expected that recruitment for the two new administrative positions would begin in June 2011 so as to finalize hiring in early 2011. There will be a period of transition during which existing administrative support personnel cross-train with new administrative personnel to create a smooth transition for all three departments currently supported by the existing administrative support team.

In addition, because the scope, complexity, and overall demands placed on the staff will exceed the capacity of the three administrative support positions above, two to three staff persons supported on soft money will be brought on during the first two years of the program. Given the volume of research and academic activity supported by the support staff, the Department will need an office manager with increased responsibility and decision-making authority. Thus, one of the administrative positions will likely be upgraded to the title of Administrative Services Supervisor.

b. Administrative Expenditures

Describe the proposed administrative structure necessary to ensure program success and the cost of that support. Include a statement concerning the involvement of other departments, colleges, or other institutions and the estimated cost of their involvement in the proposed program

See preceding section for a description of the department administrative staff necessary to ensure program success. Regarding involvement of other departments, colleges or institutions, students in the program will utilize graduate course work available in a few other departments on a case-by-case basis (primarily Physics, Chemistry, Biology, Mechanical Engineering, Electrical and Computer Engineering, and Geosciences), and may invite participation of faculty in other departments on their

Supervisor Committee depending on their individual dissertation research topics. However, the amount of administrative expenditures or other costs to supporting departments, colleges or institutions is anticipated to be negligible and is not reflected quantitatively in the analysis of program impacts presented here.

c. Operating Expenditures (travel, professional services, etc.)

Briefly explain the need and cost for operating expenditures.

- Travel – during the first three years of the program there will be travel expenses associated with recruiting trips for prospective candidates.
- Communications – general administrative expense associated with new hires.
- Materials & supplies – general administrative expense plus an increased requirement to produce materials to promote the new degree program and recruit students to participate in the program.
- Repairs & maintenance – expenses associated with service contracts and maintenance of laboratory instrumentation. Estimate based on 15% per year of acquisition cost for new instrumentation plus existing service contracts.
- Miscellaneous – general administrative expense increase with additional headcount.

d. Capital Outlay

(1) Library resources

(a) Evaluate library resources, including personnel and space. Are they adequate for the operation of the present program? If not, explain the action necessary to ensure program success.

The Department of Materials Science & Engineering is working closely with the Library Liaison and Associate Dean of Libraries to identify and review information sources needed for the new program. In addition, a line item ($50k/year) for supplemental library funding has been incorporated into the proposed program budget that will assist the library in the procurement of materials science-specific journals and other relevant library information sources. These funds will be permanent and allocated directly to the library.

The following additional resources identified by the current MSE faculty members will be added to the library collection as budgeted in the sections above (the costs listed for journals represent annual subscription fees):

Resources identified by current Materials Science and Engineering faculty

Journal of Bionanoscience	$ 1,630
Inorganic Crystal Structure Database	$ 2,501
Nature Materials	$ 3,224
Nature Nanotechnology	$ 3,224
Nature Biotechnology	$ 3,110
Nature Chemistry	$ 4,244

Nature Physics	$ 3,394
Phase Equilibria Diagrams	$ 1,695
Small	$ 3,242
Springer Materials - The Landolt-Bornstein Database	$11,336
Resources identified by library liaison Beth Brin and other faculty	
Alloy Diagram Center Online	$ 2,100
Thermophysical Properties of Matter Database	$ 5,000
Web Thermo Tables - Professional Edition	$ 2,300
Additional Monograph and Serials Support	
Additional annual funds for monograph purchases	$ 3000
TOTAL	**$50,000**

(b) Indicate the costs for the proposed program including personnel, space, equipment, monographs, journals, and materials required for the program.

Both the monograph and serials budgets for Materials Science & Engineering will be expanded over time to include more electronic journal subscriptions and an increased spectrum of journal availability. The Library resource base for the PhD program will continue to sustain the other MS and BS programs in the department as well, because a library sufficient to support PhD research in Materials Science & Engineering is also capable of supporting the other programs at little additional cost.

(c) For off-campus programs, clearly indicate how the library resources are to be provided.

Not Applicable.

(2) Equipment/Instruments

Describe he need for any laboratory instruments, computer(s), or other equipment. List equipment, which is presently available and any equipment (and cost) which must be obtained to support the proposed program.

Appendix E provides a detailed list of existing equipment in MSE and other departments that are accessible to the PhD program. In addition, the department will receive $1.5M/year for three years from the industrial donation that will help fund the necessary infrastructure to support the PhD program. An additional $750k/year in start up funds for new faculty will be used to provide specific instrumentation and equipment needs for each individual.

e. Revenue Sources

(1) If funding is to come from the reallocation of existing state appropriated funds, please indicate the sources of the reallocation. What impact will the reallocation of funds in support of the program have on other programs?

As is depicted in Section 6.a. of this proposal, the proposed program will be supported for its first three years (FY12, 13, 14) by a pending donation of approximately $13 million from Micron Technology, Inc. Of that amount, a total of $,6,365,500 (over 3 years) will fund recurring needs such as personnel and operating expenses. The remainder will fund non-recurring needs such as equipment. The final year's budget provides a reasonable approximation of the recurring funding needed to sustain the program; that amount totals $2,826,000 per year. That sustained funding would pay for 9 faculty members, 18 graduate assistants, 10 support staff, $150,000 of operating expenditures, and $50,000 of library expenditures.

Our strategy for funding recurring costs of the proposed program will be similar to that used to fund our relatively new PhD in Electrical and Computer Engineering. During the first three years of the program we will accrue the needed reallocation of appropriated funding through a combination of salary savings derived from the replacement of retired senior faculty with new junior faculty and fee revenues that result from increased enrollment. Our primary focus will be on replacing the grant funding for faculty members and staff members with appropriated funding. We anticipate that some portion of the remaining required funding will be derived from overhead costs from grants as well as other sources.

(2) If an above Maintenance of Current Operations (MCO) appropriation is required to fund the program, indicate when the institution plans to include the program in the legislative budget request.

There is not a plan to request MCO funds as part of a legislative appropriation.

(3) Describe the federal grant, other grant(s), special fee arrangements, or contract(s) to fund the program. What does the institution propose to do with the program upon termination of those funds?

Please see section (1) above for discussion of the means by which Boise State University will sustain the program after the initial three years that will be funded by a donation from Micron Techology, Inc.

It should be noted that over the long term, dissertation research activities, new research equipment purchases, and on-going maintenance or replacement of existing research equipment will be funded primarily from proposals submitted by the Materials Science & Engineering faculty to federal agencies that fund materials-related research, instrumentation, and facilities (e.g., National Science Foundation, DoE, EPA). Extramural grant activity in the Department of Materials Science & Engineering is currently at approximately $4 million per year, and has increased an average of 50% per year in the last five years.

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APPENDIX A1:

Doctor of Philosophy in Materials Science & Engineering
Boise State University
External Program Review Report

Site Visit Report

Reviewing the proposal for
Doctor of Philosophy (PhD) in Materials Science and Engineering (MSE)
College of Engineering, Department Materials Science and Engineering
Boise, Idaho

Hussein Zbib, Washington State University

Summary: This proposal is very well designed and lays the ground for a high-quality interdisciplinary PhD program in MSE. The proposal is very timely and addresses an important regional and national need for PhDs in this area of research. The new program will build on existing interdisciplinary strength in materials science and engineering, physics and chemistry, and will be supported by local industry. In general, the requested resources are adequate and consist with the projected size of the program. The input received during our various meetings with faculty from engineering, physics and chemistry, university administrators, and students indicated very strong support for the program. Below I offer several observations and recommendations.

1. Nature of the Request

The MSE faculty recognizes the need to offer an interdisciplinary PhD as the terminal degree for MSE students. The national and regional needs for PhD in MSE are well discussed and recognized in the proposal. It is indicated that the proposed program will build on existing strength in various areas of research, and new faculty hires will be in these areas of research. While this is a reasonable approach, it might be wise to hire strategically to create critical mass in one or two areas of expertise, with the goal of becoming recognized as the national leaders in those areas. With the addition of nine new faculty members and the projected enrollment in the PhD program, the MSE at BSU will become the largest MSE department in the northwest, providing a unique opportunity to lead the region in key areas of research.

Recommendation: Hire strategically to create critical mass in one or two areas of expertise, with the goal of becoming recognized as the national leaders in those areas.

2. Quality

There is no doubt that the MSE faculty is committed to a high quality program. In a very short period of time since the creation of the MSE department at BSU in 2004, the undergraduate has become one of the largest programs in the northwest. Their undergraduate program has been accredited successfully by ABET in 2006, and underwent successful re-accreditation visit in fall 2010 and anticipate being accredited through 2017. Furthermore, the MSE professors are highly respected and visible in the research community nationally and internationally.

The above indicate that the MSE faculty maintains a high quality program and will develop a highly visible and respectable PhD program. Although there is no formal and specialized accreditation for the PhD program such as ABET for undergraduate programs, there are plans in the proposal for program evaluations every five years which will include internal as well as external evaluations.

The MSE department has policies and procedures to manage graduate programs successfully and to ensure that the students receive mentoring, guidance, and professional development.

The MSE department is very much commended for emphasizing its strong commitment to the undergraduate program. They recognize that the undergraduate program can benefit from the proposed PhD program, providing opportunities to the undergraduate students to participate in research and to interact with PhD students and researchers. This also provides the PhD students with opportunities to mentor undergraduate students and develop teaching skills.

Curriculum: The curriculum for the proposed new PhD degree has been successfully approved by the University Graduate Committee. The curriculum requires a total of 68 credit hours which includes course work and research. The minimum required graded course work is 36 credit hours which seem to be very high. Given the interdisciplinary nature of the PhD in MSE, and the current trend in other similar programs in the country, this requirement may put the new program at a disadvantage. The current trend in many universities for the requirements for interdisciplinary PhD degrees is to reduce the number of the required graded courses to a minimum, to allow flexibility for each individual student and faculty advisor to tailor the course work around the needs of the student's area of research.

Recommendation: Substantially reduce the number of the minimum required graded course work (this reviewer would argue to reduce it to 12 credit hours of graduate course work, i.e. the required Core Courses). Let the individual student advisor and the

graduate committee decides on the curriculum, beyond the required minimum, for each individual student.

Faculty: Nine new faculty lines are requested in this proposal. When added to the existing 8 faculty members, the size of the MSE department will be at par with the average MSE program in the country and will make it the largest program in the Northwest. This goal is very reasonable and logical, and it makes much sense to build a new program so that it is competitive with its peers in the country.

It is indicated that the new hires would be hired in any of the 14 research areas listed in Section 1 of the proposal, and at any of the three academic ranks (assistant, associate, or full professor).

Recommendations: As discussed above, it is recommended to focus the new hires to two or three key research areas to be decided by the department, and to hire in each area at least one senior faculty member with established national and international reputation. This will ensure an immediate impact and visibility of the new PhD program, attract top quality junior faculty members, help in recruiting PhD students, and will ensure having enough support to mentor new assistant professor.

Students: The new program plans to attract students from the state, the region, the nation and internationally. The MSE faculty at BSU recognizes that attracting domestic students into PhD programs is a challenge for most universities with existing programs, and will be even more challenging for the new program. They plan to have a variety of recruiting mechanisms to help in attracting students into the new PhD program. Also the new faculty hires will have a significant impact in attracting PhD students.

Infrastructure support: With this new program, the size of the MSE department will almost double, making essential to add new staff support at the level requested in the proposal.

The proposed new program would add 18 new Graduate Assistantships, at $27,000 stipend per academic year. This level of support would provide a significant and immediate boost to the new program. This will make it even more feasible to attract high quality students into this new program, and to provide the existing and new faculty with an immediate resource to begin building the program and have an immediate impact in the research community. This resource can be used effectively to increase in the future the number of the PhD students in the new program, by targeting the way the GAs are allocated.

Recommendation: The GAs can be used as a resource to leverage and boost the productivity of active research professors who have externally funded research grants. The GAs can be used as a mechanism to support new students for their first and second years of study while working for an advisor on a research project, and then they should support them on research grants for the remainder of their studies.

The new program will require additional support for the Library. The program budget includes sufficient support to expand holdings and services to the doctoral program.

The MSE department has an adequate number of research laboratories and facilities and they collaborate very closely with labs and facility in physics and chemistry. The main concern is that many of the facilities are located in difference buildings which may not provide the best environment for research.

3. Duplication

The new proposed program is unique to the state of Idaho. Currently, many students from Idaho who wish to pursue PhD in MSE do not have this option in Idaho and they end up attending universities outside the state. In fact this new program may even attract students from neighboring states. For example, many undergraduate MSE students at WSU wish to remain in the northwest for PhD studies but at the same time want to go to a different school to gain new experience, and a PhD in MSE at BSU will be an attractive option for many of them.

4. Centrality

The proposed new program is consistent with the SBOE intentions for Boise State University. It will provide a selected and high-quality doctoral program which supports local industry, the region and the nation, and it will provide unique opportunity and service to people of the state.

5. Demand

There is no doubt that there is a very high demand for PhDs in MSE. There is a strong evidence of regional and national demand, and there are various national studies and initiatives which support this conclusion (e.g. the most recent Materials Genome Initiative). One clear indication is the existing undergraduate and MS programs in MSE at BSU which demonstrated outstanding success in a short period of time. The programs are now one of the largest in the Northwest. Given the fact that in the

materials science and engineering field many students pursues PhD studies in their field most of these students would want to continue in the PhD program. This is very well documented and discussed in the proposal.

6. Resources

The resources requested are adequate for the proposed expansion in terms of new faculty hires, graduates students, staff support and facilities. The level of the faculty startup is excellent and will help in developing new research activities and attract high quality new professors. The main concern is the availability of space for the new faculty, graduates students and laboratory space for new activities. It is indicated in the proposal that approximately 19,200 ft^2 of space is needed which is an adequate approximation. But there it is not clear where this space will come from other than to indicate that it will be made available form existing facilities. There are two problems with this proposition. 1) Space is a very precious and well protected commodity in universities, and it normally takes lots of effort with many challenges to move things around. 2) This may result in labs and offices for new this program being dispersed in various buildings, and thus negatively affecting the effectiveness of the collaborative nature of the program.

Recommendation: An effort should be made to ensure that space is identified and be made available very soon. All effort should be made to make sure that the labs and offices are located in the proximity of the current MSE facilities. In the long term, an effort should be made for a new building to house all the activities related to MSE.

Summary of major recommendations:

- *Hire strategically to create critical mass in one or two areas of expertise, with the goal of becoming recognized as the national leaders in those areas.*
- *Hire in each key area at least one senior faculty member with established national and international reputation.*
- *Substantially reduce the number of the minimum required graded course work.*
- *Use the GAs as a resource to leverage and boost the productivity of active research professors who have externally funded research grants.*
- *An effort should be made to ensure that space is identified and be made available very soon. All effort should be made to make sure that the labs and offices are located in the proximity of the current MSE facilities.*
- *In the long term, an effort should be made for a new building to house all the activities related to MSE.*

Site Visit Report

Reviewing the proposal to the Idaho State Board of Education to establish a:

Doctor of Philosophy in Materials Science and Engineering

College of Engineering
Boise State University
Boise, Idaho

Site visited occurred September 6-7th, 2011

Dr. Wayne Huebner
Chairman, Materials Science and Engineering
Missouri University of Science and Technology

FINAL REPORT

September 7th, 2011

Executive Summary

Boise State University (BSU) is proposing to establish a Doctor of Philosophy (PhD) degree program in Materials Science & Engineering (MSE). A decision to approve this request can only be warranted if a careful analysis reveals that the investment is in the best interest of the students and citizens of the State of Idaho. As an external reviewer I am happy to conclude that this proposal builds upon the considerable strengths of the faculty, students and facilities of the MSE program at BSU, and clearly fills a need for industry in the region and state. Indeed, it is quite the testimonial that Micron would invest $13M to fully fund the proposed PhD program the first three years of its existence. Equally impressive is the support I witnessed from all levels of the administration; future funding past year 3 will come from re-allocation within the university. We all know what that means in terms of scrutiny from the departments who will lose positions. Yet I believe history will show that making this investment now in the MSE department will nucleate a change in culture at BSU towards a balanced research university. A campus where scholarly activity and the pursuit of external funding is the norm, yet never done at the expense of the undergraduates. This is the culture within MSE right now.

Throughout this report I pose questions and comments regarding the approach being taken towards establishing the PhD program, but all of these are minor details that stem from decades of experience as a faculty member, and sometimes Chairman too, of a vibrant MSE department.

I can summarize the proposal quite simply. **If this program is approved and budgeted as requested, then I am certain the only limit to the productivity of the MSE PhD students and faculty will be their own hard work and creativity.** That type of environment will be the magnet that draws the world's best faculty and students to BSU.

I have only one concern, and that's related to space. This could be the Achilles heel for the long-range success of the proposed PhD program and growth in the MSE department. The proposal notes that ≈19,000 ft^2 of new space will be needed to accommodate the new faculty and students, and that efforts will be made to satisfy that need within existing departments. Spreading faculty and students out amongst separate buildings and departments is a serious detriment to their future. Most highly successful MSE programs have a building dedicated to materials research. Without a doubt the synergy that is created by co-located researchers, the savings in terms of centralized analytical services, and the ability to showcase the premier research program on campus are all facilitated by having a world-class building. You can fully expect that the Chairman of MSE will be aggressive in his pursuit of that reality. Importantly, this is not a reason not to proceed, but the anticipated success will be create a future space problem, a good one to have.

This report is organized into sections corresponding exactly to those contained in the proposal to the Idaho State Board of Education. Items bulleted with a red diamond (♦) are comments that are recommended for consideration.

1.0 Nature of the Request

Boise State University (BSU) is proposing to establish a Doctor of Philosophy (PhD) degree program in Materials Science & Engineering (MSE). This proposed program builds on an existing interdisciplinary graduate program (M.S. and M.Engr.) in MSE, and represents a natural outgrowth of a vibrant, ABET-accredited undergraduate MSE degree program. Similar to many campuses around the country and region, existing materials research at BSU cuts across many academic disciplines including Mechanical Engineering, Electrical Engineering, Chemistry, and Physics. Establishing an MSE Ph.D. program would serve many purposes, perhaps most importantly creating opportunities for students and faculty, and building the research stature of BSU.

2.0 Quality

The proposal describes five primary mechanisms at various university and departmental levels that will support and administer the proposed Ph.D. program, and ensure its quality and sustainability.

NWCCU Accreditation: BSU's accreditation was re-affirmed in 2010; this is a 10-year review cycle. Graduate programs are also assessed as part of NWCCU accreditation

- No mention is made in the proposal if BSU has a campus-wide committee that is in charge of assessing learning outcomes for NWCCU at the graduate level. Typically data is collected at the comprehensive exam and dissertation defense points in a student's progression. If such a committee exists, mention of what data will be provided to the assessment committee should be included.

Specialized Accreditation: The undergraduate B.S. in MSE was ABET-accredited in 2006. This is a good sign that assessment is part of the MSE culture, and lends credence that the proposed mechanisms to ensure quality of the Ph.D. program will be executed.

Internal Program Evaluations: The Provost's Office at BSU conducts 5-year reviews of all academic departments; the proposed Ph.D. program would be included as part of this requirement. The existence of an MSE Advisory Board is mentioned, although this should be categorized as an external program evaluation.

- No mention is made of how the BSU administration uses the information gathered by the 5-year reviews.
- Provide the names and affiliations of the existing Advisory Board Members, the criteria by which they were selected, and the meeting periodicity.

University and Graduate College Oversight: The proposal notes it will follow all the policies and procedures of the Graduate College. During the site visit, the Provost, Dr. Martin Schimpf, Dean of the Graduate College, Dr. Jack Pelton, Vice President for Research, Dr. Mark Rudin, the Vice Provost for Academic Planning, Dr. Jim Munger, and the Interim Dean of Engineering, Dr. Amy Moll, were all particularly impressive with their knowledge and support of the proposed Ph.D. program, and their articulation of the potential impact the new program would have on the graduate mission and stature of the university. Having the enthusiastic support of all of these

administrators will be a key to success, and of course will provide the "weight over MSE's head" to provide incentive to succeed.

- Does a graduate catalog or website exist that contains all of the policies and procedures? If so, please refer to it or provide the website address.

MSE Department Oversight: The proposed program builds upon a highly successful existing M.S. graduate program built upon dedication to student success. Clearly the culture of mentoring, advising and supporting graduate students at the M.S. level will naturally extend into the Ph.D. program.

Student Mentoring and Program Assessment: A normal and complete array of steps is proposed to support and monitor a student's progression through the Ph.D. program, including appointment of the major advisor, taking an orientation class, developing the planned coursework, monitoring progression through the coursework with grades, taking a comprehensive exam, developing a Ph.D. proposal, periodic meetings with the Ph.D. committee, and successfully defending the dissertation. Additional and noteworthy items included are an exit interview and two-year post-graduation interview to assess the Ph.D. program. In general all of these steps reflect that the Ph.D. program is well designed, and will provide the oversight necessary to ensure a high quality program. A few comments regarding this section:

- Will a minimum score on the GRE general test or TOEFL exam be required?
- State that "all students entering the program will be supported financially" includes paying for the tuition and fees. This is significant, and will help attract the best students.
- The proposed Graduate Orientation course, MSE 601, is a great idea. Semester-long? Offered once a year?
- Only limited details regarding the format and mechanism by which the Comprehensive exam will be administered and evaluated were included in the proposal. During the site visit it was clear that some details had been worked out, but was still a "work in progress." That is acceptable at this juncture, but it is recommended that in the proposal that the process will be completed prior to August 2012 .
- Mention is made of a "Graduate Student Handbook" – does this exist?
- The "dissertation proposal" is a good idea. How will the student develop a plan for "obtaining and utilizing the resources necessary to complete the research"? Does this simply refer to non-financial aspects?

Graduate Program Committee: The MSE department has two graduate coordinators who oversee the many details related to admissions, exams, forms, etc.. This number is appropriate for the scale of the proposed Ph.D. program.

- Do the graduate coordinators receive any compensation (e.g. summer salary or teaching release) for the performance of their duties?
- Eighteen GA's are proposed to support this program, and the graduate coordinators are in charge of making decisions on awarding them. What process will they use to make this important decision?

Supervisory Committee: The proposed process to assign a supervisory committee and their responsibilities are normal and should work well.

- Mention is made that the major advisor must be a member of the graduate faculty. Provide information on how that membership is established and reviewed. Is this coordinated through the Graduate College?

Two items in particular display the level of certainty other have that this program is designed to succeed: 1) a $13M gift from Micron to fully fund the first 3 years, and 2) the existing and future support of the BSU administration to invest in the MSE program.

2A. Curriculum

The proposed Ph.D. curriculum is similar to those at most MSE programs around the country in terms of total required hours and the course content. Regarding specifics:

Credit requirements: The total number of credit hours necessary (68) is normal, as well as details regarding the grading and criteria by which the courses are selected. The array of processing and characterization courses that are available is impressive. The presence of a weekly seminar series is noteworthy, as well as the requirement that all graduate students present their research work in a seminar.

- The number of required courses, 38 credit hours, is higher compared to most MSE programs. This is not noted as a suggestion to reduce the number, just an observation.
- Only four of the proposed new courses in MSE are included in the required courses. Which of the new courses will by necessity be taught by the proposed new faculty members?
- During the interview with the current MSE MS graduate students it was noted that the current graduate-level courses are too similar in terms of content and depth to their undergraduate counterparts. This is undoubtedly a matter of available time for existing faculty to develop the new courses to their full potential.

Comprehensive Exam: The purpose and general format of the comprehensive exam are provided in the proposal. During the site visit additional details regarding the exam were provided, including that the exam has both written and oral components, and would cover five general subject areas. This is good. From experience this exam needs to be carefully designed and administered to make certain the process is totally objective and fair. It is unknown whether or not additional detail is needed for this proposal, but in general I would note the following from 25 years of experience:

- All MSE faculty should be <u>required</u> to submit questions for sections of the exams pertinent to their expertise. These can be collected up over time into a large pool of questions.
- The exam committee should select which questions are used for a particular cycle, along who grades the exam questions.
- What length of time is given for the written exam? Students should be assigned numbers to put on their exam sheets, not names, in order to ensure objectivity by the graders. All questions and answers should be shredded afterwards.
- How long after the written exam is the oral exam given? What is the length of the oral exam? Who will be the examiners? It is recommended that the main advisor be present during the oral exam, but that he/she may not speak whatsoever.

- Can a student pass sections of the exam, and only be required to retake failed sections?
- Repeating an exam within three months seems like a large burden on the exam committee. Administering the exam twice a year should suffice.
- A rubric for measuring the performance on the comprehensive exam should be developed, and data used for assessing the exam process.

Teaching Requirement: An excellent idea.

Dissertation Requirements/ Final Approval of the Dissertation: The proposed process is well defined and robust.

2B. Faculty

Currently the MSE department includes 8 full-time tenured and tenure-track (T/TT) faculty, 6 research faculty, and 12 affiliate faculty. All of the T/TT faculty were available during the site visit. In general the faculty are highly productive, experts in their field, well-published, and importantly, passionate about their teaching and research. This was expounded upon numerous times by the graduate students – the words "caring," "accessible" and "approachable" were used many times. The productivity level as measured by research expenditures and publications record is particularly impressive, and on par with the best MSE programs in the country. It is proposed that nine additional faculty (hired over three years) are needed to offer the curriculum and develop a research portfolio commensurate with a PhD program with over 50 graduate students. The new hires will be expected to have PhD degrees in MSE or a related field, and all will be expected to contribute to the department by teaching courses at both the graduate and undergraduate level, mentoring students, and establishing an externally funded research program that fits within the emphasis areas of the department.

I concur with this analysis, and offer the following comments:

- What is the workload model (e.g. teaching/research expectations) for the MSE faculty, taking into account the expected number of undergraduate and graduate students? Does the campus have a workload model? Later it is stated that 30 workload units/year are required for each faculty member. What does this mean?
- Several of the new hires will have joint appointments with other departments. Does BSU have a policy regarding joint appointments that addresses issues affiliated with the % of the appointment, split teaching duties, annual reviews, shared space, etc.? Untenured faculty should not have joint appointments, i.e. two bosses.
- Hiring three new faculty a year is a tremendous task. No mention is made about how the new faculty will be mentored. Does BSU offer any "new faculty" programs?

2C. Students

The existing M.S. program is already attracting students from the state and region as well as from across the nation and internationally, a reflection of the equality of the faculty and the recruiting efforts. Hence recruiting high quality Ph.D. students will simply build upon this success. The proposed budget does include funding to bring Ph.D. candidates to campus, which is a great idea.

2D. Infrastructure Support

Administrative Staff Support: Currently the MSE department is understaffed, and relies heavily upon other departments to receive the support necessary to run the department. Frankly I am surprised they have been able to do it. With the proposed growth affiliated with the new Ph.D. program, two additional office administrators and a business manager are proposed. The duties and responsibilities of each position are described in detail, and the positions are warranted.

Research Staff Support: Four additional staff members are budgeted with duties and responsibilities affiliated with the maintenance and operation of the sophisticated research equipment (SEM, TEM, thermal analysis, AFM, XPS, XRD etc.), training students to use the equipment, machining, and performing some research. These staff positions are a necessity in order to free up faculty time for the pursuit of research funding, and advising the graduate students.

Graduate Student Teaching Assistantships: Eighteen new GAs (six per year) are budgeted as part of this new degree program. This level of support would allow the new MSE program to hit the ground running, and immediately make a large impact on the research mission. It would be a key enabler for the new faculty to immediately attract the best and brightest graduate students. The level of the stipend ($27K) and covering the tuition and fees is attractive, and would rank BSU amongst the best.

- Who would make the decision regarding which faculty serve as the main advisor for the GA positions? What criteria would be used? How would the ability to support the research (i.e. analytical services fees, supplies and materials, travel etc.) be guaranteed?

Laboratories, Equipment and Instrumentation: The proposal describes an impressive array of research laboratories that form the analytical foundation of the PhD program, and many were visited during the site review. In general I was highly impressed – at least one of almost every conceivable high-end analytical pieces of equipment existed.

- A major issue is the fact that the key pieces of analytical equipment necessary to support the MSE Ph.D. program is contained in multiple buildings, multiple departments and multiple faculty labs. **A key need of the new MSE Ph.D. program will be a new Materials Building -** a single location where the students, staff and faculty are co-located, along with the equipment and facilities necessary to do their research. This will save a great deal of time and money. From the site review I did not see how nine new faculty and 50 Ph.D. students will be accommodated in terms of space. The plan seems to be putting them “here and there”, but this is a particular disservice to new assistant professors and their students.

- An appendix documenting the space that is administered by MSE would have been helpful.

2E. Future Plans

No plans currently exist to expand the program or deliver it off-campus. Bill Hughes, Director of the CAES at the INL was present for lunch during the site review. It is clear that establishing the

Ph.D. program will significantly grow collaborations with the CAES, as well as other universities in the region, notably the University of Idaho and Idaho State University.

3.0 Duplication

The proposal describes the other MSE programs within driving distance, and how the proposed program is differentiated in terms of research focus and constituency served. The Chairman of MSE at BSU visited each of these universities and discussed how the establishment of a new Ph.D. program would result in greater collaborations and would also attract more students to both BSU and the other campuses. Also, the establishment of a PhD program at BSU would support the growing need of local industries such as Micron (who will donate $13M to launch the program), and the INL.

I find the analysis compelling and a new program warranted.

4.0 Centrality

The proposal readily documents how the proposed PhD program is consistent with the Idaho State Board of Education's policies on the role and mission of the public universities.

5.0 Demand

5A. Needs assessment

Directly from the proposal:

> *"This proposal for an interdisciplinary PhD program in Materials Science & Engineering is the result of many factors, including: (1) increasing demand from local employers, (2) expressed interest from science and engineering students, (3) a national demand for MSE PhDs, (4) several strong, collaborative research programs between faculty in Materials Science & Engineering, Physics, and other departments, and (5) the rapid growth of the B.S. and M.S. programs in MSE at BSU. The PhD program will generate a significant number of qualified graduate students with extensive training in the key areas of the state's high-tech economy including semiconductor science, nanotechnology, and energy materials. The PhD in MSE is driven not only by surveys and observations of the Department, College and Departmental Industrial Advisory Boards, and the University, but also by the business community of Idaho."*

The proposal contains a detailed analysis for each of these five factors, and as Chairman of MSE at Missouri S&T I can verify that the analysis is well thought out, an accurate reflection of regional and national needs, and builds upon existing strengths in MSE at BSU. Indeed, I am highly impressed by the level of productivity that has been achieved in such a short time. It is clearly a reflection of the quality of the faculty, staff and students, and the support of an

administration that understands what a vibrant, research-active department can do for the stature of the university at all scale levels.

5B. Students

The proposal contains an analysis of where the new Ph.D. students are expected to come from, and where they may be employed upon graduation. This analysis is an accurate reflection of reality. From experience it will be the national recognition of the faculty and department that will attract the best and brightest students. New faculty must be encouraged to take leadership roles within their professional organizations, and publish widely. The existing faculty have done just that, and the demographics of the current MS program reflect positively on their ability to recruit from the best undergraduate programs nationally and internationally.

5C. Expansion/Extension

N/A

6.0 Resources

I. Planned Student Enrollment

Plans for the equilibrium number of PhD students enrolled in the program are aggressive, but achievable in consideration of the research activity of the faculty and the proposed budget. 50 Ph.D. students is equivalent to ≈3/FTE faculty member, which would result in 0.75 PhDs graduating/year/FTE. This would rank BSU amongst the most productive MSE PhD programs in the country.

II. Expenditures

A&B. Faculty/Staff/Administrative Costs

The budget affiliated with the proposed faculty and staff positions is on par with the S&W levels at Missouri S&T. The $250K/faculty member start-up package is highly competitive, particularly since BSU already has an array of the best analytical tools needed to perform state-of-the-art materials research.

- Will a mix of assistant/associate/full professors be hired? If so, provide an estimated breakdown of the number of each.
- Note what the start-up funds can be used for (e.g. equipment, renovations, GA support, summer salary etc..)

C. Operating Expenditures

The annual E&E of $150K is adequate to support the new PhD program.

- What is the current annual cost of the maintenance agreements for the analytical equipment? How does that compare to the $75K budgeted?

D. Capital Outlay

(1) Library resources

$50K/year is budgeted, and justified in detail.

(2) Equipment/Instruments

The proposal budgets $1.5M/year for the first three years for equipment purchases, and each new faculty member will receive $250K as a start-up package that could also be used for equipment if deemed necessary.

- With the level of detail provided in the proposal and from the site review I do not have adequate information to ascertain if the equipment budget is adequate to meet the anticipated needs. From my experience I would say yes. It would be nice if a "shopping list" of equipment needs were provided as a means to warrant the level of the budget.

D. Total Physical Facilities or Major Renovation

This could be the Achilles tendon for the long-range success of the proposed PhD program and growth in the MSE department. The proposal notes that ≈19,000 ft^2 of new space will be needed to accommodate the new faculty and students, and that efforts will be made to satisfy that need within existing departments. **Don't do that. Spreading faculty and students out amongst separate buildings and departments is a serious detriment to their future. Most highly successful MSE programs have a building dedicated to materials research**. Without a doubt the synergy that is created by having researchers together, the savings in terms of having co-located analytical services, and the ability to showcase the premier research program on campus are all facilitated by having a world-class building.

- As noted earlier, what is the current space MSE occupies, and what is the breakdown in terms of utilization?
- How was the 19,000 ft^2 determined?

E. Revenue Sources

(1) Re-allocation

The proposed expenditures for the first three years of this program are being totally funded by a $13M donation from Micron. As noted earlier and described in great detail in the proposal, this funding will be used for a variety of recurring and non-recurring needs. At year 4, the recurring

budget provided by BSU amounts to ≈$2.8M/year. It is noted that these funds will be found through "savings derived from the replacement of retired senior faculty and fee revenues that result from increased enrollment" as well as "derived from overhead costs from grants as well as other sources."

- Considering that none of the current MSE faculty will be retiring in the near-term, it is certain then that the growth in MSE faculty numbers will occur at the expense of other departments on campus. **I applaud the administration for having the courage to do this type of re-allocation.** From what I have learned about all aspects of the MSE department, this is a wise decision that will reap great rewards in changing the culture at BSU, and raising the bar for expectations of what it takes to be a balanced, world class department that expires to excellence amongst their peers around the world. The recurring budget represents "doing it right" – a standard that can be used for other departments on campus who also aspire to excellence.

APPENDIX A2:

Doctor of Philosophy in Materials Science & Engineering
Boise State University
External Program Review Report

Response to the External Review
conducted September 6 and 7, 2011 of
the Proposed PhD in Materials Science and Engineering at Boise State University

Review conducted by Dr. Hussein Zbib, Washington State University, and
Dr. Wayne Huebner, Missouri University of Science and Technology

The proposed PhD in Materials Science and Engineering (MSE) at Boise State University underwent an external review September 6 and 7, 2011 by Prof. Hussein Zbib of Washington State University and Prof. Wayne Huebner of Missouri University of Science and Technology. Professors Zbib and Huebner are well recognized in the field of Materials Science and Engineering and have held administrative positions at their respective comprehensive universities including the position of Department Chair. Both are very familiar with the field of MSE and the challenges of operating a department with both undergraduate and graduate programs, including PhD programs.

Each reviewer provided extensive, independent assessments of the proposed PhD in MSE. The reviews are positive and very supportive of the proposed program. Each review offers recommendations, poses questions, and cites concerns that deserve a written response by the department. We focus in this response on those elements that are critical to the success of the program, and organize them below by major theme. Recommendations and questions associated with the technical details of program execution, such as assessment practices, admission requirements, and student orientation, are not addressed in this document because these are procedural matters that are well understood and capably handled by the faculty participants.

Hiring and Faculty Members

- *Hire strategically to create critical mass in one or two areas of expertise, with the goal of becoming recognized as the national leaders in those areas. (Zbib)*
- *Hire in each key area at least one senior faculty member with established national and international reputation. (Zbib)*
- *Hiring three new faculty a year is a tremendous task. No mention is made about how the new faculty will be mentored. Does BSU offer any "new faculty" programs? (Huebner)*
- *Several of the new hires will have joint appointments with other departments. Does BSU have a policy regarding joint appointments that addresses issues affiliated with the % of the appointment, split teaching duties, annual reviews, shared space, etc.? Untenured faculty should*

not have joint appointments, i.e. two bosses. (Huebner)

- *What is the workload model (e.g. teaching/research expectations) for the MSE faculty, taking into account the expected number of undergraduate and graduate students? Does the campus have a workload model? Later it is stated that 30 workload units/year are required for each faculty member. What does this mean? (Huebner)*

  The PhD proposal calls for hiring of nine new faculty members. Successful hiring and integration of the new faculty members is critical to the success of the department and of the program. The program faculty recently met for a full day to discuss the PhD program and to discuss hiring strategies. The department will hire faculty in such a way as to result in strategic growth in several areas. These areas were chosen to support current research where significant expertise is already established and to support research interests and economic development of local industry as outlined in the proposal.

  The department currently has several nationally and internationally known faculty members in key areas. These individuals are directly responsible for the tremendous growth in our research capabilities and reputation and have been important in the success and growth of the program. Because of the strength of the existing faculty members, we feel confident that hiring primarily at the assistant and associate level is appropriate. Strategic hires will be made in these key areas in order to build our reputation and offer a quality experience to our students.

  Our senior faculty members serve in the important role of mentors to less experienced faculty and will continue to do this with new hires. Our formal process for this is a three faculty member committee which meets annually with each new faculty member to evaluate their progress towards tenure and promotion and provide advice and support to ensure the success of the faculty member. Informal mentoring also occurs regularly and results in collaboration on research projects, advice on teaching, and suggestions on professional development. In addition, the University has a formal mentoring program for new faculty members, which is run out of the Provost's office. New faculty members are encouraged to enroll and often participate for two years. Plans are also in place to develop a new faculty orientation program within the department. The orientation program will help the new faculty members understand the business systems and processes of the university such as how to recruit and hire graduates students, safety procedures, grant submission process, etc. Directing this program will be one of the responsibilities of the Business Functions Manager that will be hired in 2012.

  Boise State does not have a policy on joint appointments. Currently, faculty members with joint appointments reside fully in a home department (e.g., Physics or MSE) but have responsibilities outside of their home department (e.g., teaching and research). The relationships that exist between departments in the MSE interdisciplinary program are formalized only in the offer letter and job descriptions associated with each faculty member. Based on this suggestion, we will elevate this discussion to the Faculty Senate and university administration for further consideration.

The department manages the workload of each faculty member using the university workload policy is described in BSU Policy 4560: (http://policy.boisestate.edu/academic-affairs-faculty-administration/). This workload model is intentionally flexible so that the university can match the assignments of each faculty member to their individual strengths across teaching, research, and professional service.

Curriculum and Students

- *Substantially reduce the number of the minimum required graded course work. (Zbib)*
- *Use the GA's (graduate assistants) as a resource to leverage and boost the productivity of active research professors who have externally funded research grants. (Zbib)*

Our students are the key to the success of this program. The funding for graduate assistants will be carefully leveraged to ensure the quality of the program. Funding will be used to recruit the best possible students to the program. The GA's will also be distributed to support the research of all of the faculty members in the program. The work of the students – both coursework and research work-- will be carefully reviewed and assessed on a regular basis to ensure the quality of the program and the appropriate use of funds.

Although the required number of courses for the proposed PhD appears high to those outside of Boise State, it is low compared to other PhDs in Idaho. The faculty concur that reducing the number of required credits and empowering PhD candidates and their advisors to design their course schedule is desirable and would make our program more competitive. However, as a young and relatively unknown program, it is critical that our students receive a high quality education with a strong foundation in the fundamentals of MSE so that they can successfully compete for positions and careers with students from well-established programs. Solid, high-quality coursework is one way to ensure our students have the knowledge necessary to compete for positions. As we build our reputation, we will re-evaluate coursework requirements and benchmark our program with the top-ranked programs in the nation.

Space

- *An effort should be made to ensure that space is identified and be made available very soon. All effort should be made to make sure that the labs and offices are located in the proximity of the current MSE facilities. (Zbib)*
- *In the long term, an effort should be made for a new building to house all the activities related to MSE. (Zbib)*
- *A major issue is the fact that the key pieces of analytical equipment necessary to support the MSE Ph.D. program is contained in multiple buildings, multiple departments and multiple faculty labs. A key need of the new MSE Ph.D. program will be a new Materials Building - a single location where the students, staff and faculty are co-located, along with the equipment and facilities necessary to do their research. This will save a great deal of time and money. From the*

site review I did not see how nine new faculty and 50 Ph.D. students will be accommodated in terms of space. The plan seems to be putting them "here and there", but this is a particular disservice to new assistant professors and their students. … what is the current space MSE occupies, and what is the breakdown in terms of utilization? How was the 19,000 ft^2 determined? (Huebner)

Materials Science and Engineering is an inherently multi-disciplinary field and the program primarily involves faculty members from Materials Science and Engineering, Chemistry, Physics, Electrical Engineering, and Mechanical Engineering. Faculty members in Biology, Geosciences, and Kinesiology also collaborate on research projects in Materials Science. The faculty members in the MSE department currently occupy research and office space in four buildings that are located adjacent to one another. These four building currently house the majority of all College of Engineering activities. However, the faculty in other departments, such as those in Chemistry and Physics, reside on the opposite side of campus, which is not ideal. The department concurs that housing all activities in a single building, or at least a single area of campus would be optimal to encourage intra-program collaborations, providing that the MSE program does not become isolated from other departments on campus.

In the long term, the Campus Master Plan includes the eventual construction of three additional buildings in the same area of campus as the present engineering facilities. Those buildings will house science and engineering departments, and will therefore provide the opportunity for us to bring the departments involved in the MSE program into close proximity.

In the short term, we will be able to accommodate the initial growth of the MSE program in current buildings because of investments we are making in infrastructure (investments that were identified and prioritized through planning efforts), in the remodeling and repurposing of existing space, and as a result of newly-created space in our new Environmental Research Building.

Infrastructure enhancements are being funded largely by a recently received National Science Foundation Academic Research Infrastructure (NSF-ARI) grant that has a focus on research infrastructure upgrades in the Micron Engineering Center (MEC; pictured above). The MEC building is a four story 69,000 gross square foot facility constructed in 1999. The building was designed to accommodate research growth in the College of Engineering programs and to provide office space for faculty and students. The initial design of MEC anticipated research predominantly focused on design and characterization of electronic devices. With growth in the

college programs and establishment of a vibrant program in MSE, an emerging emphasis has been placed on materials processing, fabrication, and characterization. This growth has created a significant demand for research laboratories to support "wet lab" activities. To meet this need, the University has systematically upgraded individual labs in MEC to provide wet lab capabilities. The NSF-ARI grant (approx. $1.8 million) will allow the University to upgrade the primary infrastructure systems servicing the building, and allow for expansion of wet lab functionality to additional labs in the building. Upgrades to the building will include:

- Additional fume hood capacity
- Sinks and safety showers in all new wet labs
- De-ionized water upgrades and distribution
- Increased electrical distribution
- Chilled water upgrades and distribution
- Utility racks provided in labs

Repurposing and remodeling of space for research laboratories often relies on infrastructure improvements, and NSF-ARI project has allowed the college to reassign six rooms in the MEC building to support the Materials Science & Engineering PhD program, four to become research labs and two to become instrumentation labs (see table below). Of the six labs shown, only MEC 416 currently has the wet lab capability needed for the MSE program. The NSF-ARI project will provide this capability to the remaining five labs.

Room Number	Square Footage	Purpose
MEC 104	943	Instrumentation Lab
MEC 105 North	536	Instrumentation Lab
MEC 311	1,213	Research Lab
MEC 312	584	Research Lab
MEC 313	1,186	Research Lab
MEC 416	1,093	Research Lab
Total	**5,555**	

Five additional research labs will be accommodated in the Environmental Research Building, which was occupied in summer of 2011. At the time we planned that building, we included additional research lab capability to accommodate needs such as those of the new PhD in MSE.

The MSE PhD program will also require additional office space for faculty, staff, and graduate students. Faculty and staff will be accommodated in space vacated in the MEC building by the move of the Department of Civil Engineering to the Environmental Research Building and by the repurposing and remodel of the Extended Studies Building (the Division of Extended Studies moved to the Yanke Family Research Park Complex). Sufficient graduate student space is very important to the program because of its importance in the development of the student culture of the program. The development of a positive culture is dependent of the quality of space provide for the graduate students, allowing them to work in a collaborative and supportive environment. Graduate students may be housed in the vacated Extended Studies building, in the Environmental Research Building, and in spaces that will be vacated upon completion of the new building housing the College of Business and Economics.

The SBOE recently approved our request to hire a consultant to update the 2004 College of Engineering Facilities Master Plan, with particular attention to the requirements of the new MSE PhD program. It will be the goal of that planning effort to ensure that we have fully considered the long-term space implications of a successful and vibrant new PhD in MSE in addition to the needs of other College of Engineering programs.

Budget

- *With the level of detail provided in the proposal and from the site review I do not have adequate information to ascertain if the equipment budget is adequate to meet the anticipated needs. From my experience I would say yes. It would be nice if a "shopping list" of equipment needs were provided as a means to warrant the level of the budget. (Huebner)*

- *The equipment budget will be used in part to provide matching funds to NSF MRI grants. The MSE and Physics Departments have a history of success in obtaining MRI grants for major equipment purchases through NSF (e.g., more than $2M in grants for a TEM, XRD, and XPS). (Huebner)*

  The MSE department maintains a list of equipment and instrumentation needs that is regularly updated by the department chair. The list is constantly revised to reflect instruments procured through grants and new needs that arise from new research. The Materials Science and Engineering program has been remarkably successful at obtaining Major Research Instrumentation (MRI) awards from the National Science Foundation. These grants have been important in acquiring many of the instruments used for materials research in many departments across campus. Matching funds improve the probability of obtaining an MRI. Consequently, the capital funds in the budget will be used in large part as matching funds to obtain major analytical equipment. We anticipate that the $4.5M in equipment funds will enable us to procure more than double that level of support from NSF and other agencies to grow the capabilities in Idaho.

APPENDIX B:
Catalog Descriptions of Existing Graduate Courses in Materials Science & Engineering

The following list of courses includes existing courses and proposed new courses that MSE PhD students may take in order to satisfy the requirements for the PhD in MSE. Also, included at the end of this list are proposed course changes to the MSE program which includes changes in course numbers, prerequisites, semester offerings, and descriptions. These additions and changes to the curriculum have been submitted to and approved by the University Graduate Committee for implementation in fall 2012, contingent on full approval of this proposal. As with any new program, as new faculty are hired, they will likely develop new courses, which will be added to the curriculum over time.

CHEM — CHEMISTRY

CHEM 501 ADVANCED INORGANIC CHEMISTRY (3-0-3)(F). Atomic structure, molecular structure using valence bond and molecular orbital theories, elementary group theory, transition metal coordination chemistry, acids and bases, descriptive transition and nontransition metal chemistry. PREREQ: CHEM 322 or PERM/INST.

CHEM 509 INTRODUCTION TO POLYMER CHEMISTRY (3-0-3)(F) (Alternate years). An introduction to the concepts of polymer synthesis, characterization, structure, properties, and basic fabrication processes. Emphasis is on practical polymer preparation, on the fundamental kinetics and mechanisms of polymerization, and on structure-property relationship. PREREQ: CHEM 309 or PERM/INST.

CHEM 510 ORGANIC POLYMER SYNTHESIS (3-0-3)(S)(Alternate years). A study of the synthesis and reactions of polymers. Emphasis is on practical polymer preparation and on the fundamental kinetics and mechanisms of polymerization reactions. Topics include relationship of synthesis and structure, characterization of polymer structure, step-growth polymerization, chain-growth polymerization via radical, ionic and coordination intermediates, copolymerization. PREREQ: CHEM 309 or PERM/ INST.

CHEM 522 SPECTROSCOPY (3-0-3)(F)(Alternate years). Concepts and practical usage of modern chemical spectroscopic techniques, including electronic absorption, infrared/Raman, X-Ray/EXAFS, magnetic resonance and magnetic circular dichroism. Emphasis will be placed on the application of these techniques to the structure/function characterization of chemical and biochemical systems. PREREQ: CHEM 521 or PERM/INST.

CHEM 540 SPECTROMETRIC IDENTIFICATION (3-0-3)(S). Identification of compounds using modern spectrometric techniques. PREREQ: CHEM 309 and CHEM 321.

CHEM 560 INTRODUCTION TO NMR SPECTROSCOPY (1-3-2)(On demand). This course will instruct students on the theory and practice of one- and two-dimensional NMR spectroscopy. Emphasis will be placed on using the NMR spectrometer to solve a variety of chemical and biological problems. PREREQ: CHEM 322, or PHYS 309 and PHYS 432, or PERM/INST.

ECE — ELECTRICAL AND COMPUTER ENGINEERING

ECE 540 INTRO TO INTEGRATED CIRCUIT AND MEMS PROCESSING (3-0-3)(F). Fundamentals of integrated circuit and micro electromechanical systems (MEMS) fabrication technology; semiconductor substrates; theory of unit processes such as diffusion, oxidation, ion implantation, rapid thermal processing, photolithography, wet etching and cleaning, dry etching, thin-film deposition; chemical mechanical polishing; process integration; metrology; statistical process control; TCAD. COREQ: ECE 540L. PREREQ: ECE 323 or PERM/INST.

ECE 540L INTRO TO INTEGRATED CIRCUIT AND MEMSPROCESSING LAB (0-3-1)(F). Semiconductor cleanroom practices; heavy lab safety; students will fabricate and test simple structures in lab; application of TCAD to practical problems. COREQ: ECE 540.

ECE 541 ADVANCED TOPICS IN SILICON TECHNOLOGY (3-0-3)(S). Advanced models for unit processes such as diffusion, oxidation, ion implantation, thin film deposition, etching, rapid thermal processing, chemical mechanical polishing, lithography. CMOS, bipolar, and micro electro mechanical systems (MEMS) process integration. Process and device modeling using TCAD. PREREQ: ECE 440/540.

ECE 542 PHOTOLITHOGRAPHY (3-0-3)(F/S). Principles of optics, diffraction, interference, superposition of waves, imaging systems, fundamentals of microlithography, resolution, contact and projection lithography, photoresist processing, metrology. Phase shift masks, antireflective coatings, deep-ultraviolet lithography, off-axis annular illumination. Use of TCAD lithography simulation software. COREQ: ECE 442.

ECE 542L PHOTOLITHOGRAPHY LAB (0-3-1)(F/S). Cleanroom lab experience accompany ECE 542, utilizing a projection-printing wafer stepper, photoresist wafer track, SEM, and optical metrology equipment. Use of TCAD lithography simulation software. PREREQ: ECE 342. COREQ: ECE 542.

ECE 543 INTRODUCTION TO MEMS (3-0-3)(F/S). Overview of MEMS; MEMS device physics including beam theory, electrostatic actuation, capacitive and piezoresistive sensing, thermal sensors and actuators; basic MEMS fabrication techniques; MEMS technologies: bulk micromachining, surface micromachining, and LIGA; MEMS design and modeling; case studies in various MEMS systems. PREREQ: ECE 440/540, or PERM/INST.

ME — MECHANICAL ENGINEERING

ME 556 INTRODUCTION TO SOLID BIOMECHANICS (3-0-3)(S). Students will learn to apply the principles of engineering mechanics to the human musculoskeletal system. Topics covered include functional anatomy, human motion analysis, mechanical properties of biological tissues, and modeling of the human body. PREREQ: ENGR 220 or PERM/INST.

ME 577 (BIOL 577)(MSE 577) BIOMATERIALS (3-0-3)(F/S). Theory of biomaterials science. Medical and biological materials and their applications. Selection, properties, characterization, design and testing of materials used by or in living systems. May be taken for BIOL, ME, or MSE credit, but not from more than department. PREREQ: ENGR 245 or CHEM 112.

ME 578 DESIGN AND ANALYSIS OF MECHATRONIC SYSTEMS (3-0-3) (F/S). Design and analysis of engineering systems containing mechanical, electro-mechanical and embedded computer elements. The course provides an overview of basic electronics, digital logic, signal processing and electromechanical devices. Fundamentals of event-driven programming will also be covered. PREREQ: ENGR 240.

MSE — MATERIALS SCIENCE & ENGINEERING

MSE 501 SURVEY OF MATERIALS SCIENCE (3-0-3)(F/S)(On demand). Application of the principles of chemistry and physics to the Engineering properties of materials. Development of an in-depth understanding of the relationship between structure, properties, processing and performance for all classes of materials. PREREQ: PERM/INST.

MSE 505 BONDING AND STRUCTURE OF MATERIALS (3-0-3)(F/S). Bonding, atomic arrangements and crystal structures of metals, ceramics, electronic materials and polymers; electronic structure of solids; physical properties of solids; defects in solids; relationship between processing, microstructure and properties of materials, PREREQ: ENGR 245.

MSE 508 SOLID STATE THERMODYNAMICS (4-0-4)(S). The laws of thermodynamics are applied to multicomponent, multiphase reacting systems, and other thermodynamic systems. These concepts are used to discuss and mathematically compute equilibrium phase diagrams. The energy effects due to the geometry of solid surfaces are discussed in regards to capillarity effects. Classical thermodynamics is related to atom-level distributions using statistical thermodynamics and the partition function. Electrochemical thermodynamics is discussed in the context of two phase interfacial reactions. PREREQ: MATH 333, CHEM 322 or ENGR 320 or MSE

308 or PHYS 432.

MSE 510 ELECTRICAL, OPTICAL, AND MAGNETIC PROPERTIES OF MATERIALS (3-0-3)(F/S). Introduction to the physical principles underlying the electric, optical and magnetic properties of modern solids. Crystalline and energy band structure of materials, thermal properties and electrical conduction in semiconductors and metals, optical and magnetic properties of solids are covered. PREREQ: ENGR 245.

MSE 511 SEMICONDUCTOR MATERIALS (3-0-3)(F/S). Examination of the physical properties of semiconductors including electronic structure, freecarrier statistics, optical properties, crystallography, and defects. Study of thermodynamic properties as related to lattice vibrations and diffusion. PREREQ: ENGR 245.

MSE 512 MECHANICAL PROPERTIES OF MATERIALS (3-0-3)(F/S). Study of deformation and fracture in Engineering materials, including elasticand plastic deformations; dislocation theory; alloy hardening and creep deformation; fracture mechanisms; linear elastic and nonlinear elastic fracture mechanics; toughening of metals, ceramics, and composites; environmentally assisted failure. PREREQ: ENGR 245.

MSE 518 PHASE TRANSFORMATIONS AND KINETICS (3-0-3)(F). Kinetics of phase transformations, nucleation, crystallization, decomposition, chemical reactions, and atomic and molecular diffusion. Surface and interface phenomenon, nanoparticle-matrix interactions, sintering, grain growth, recovery and recrystallization. PREREQ: MSE 308 or MSE 508.

MSE 519 INTERFACIAL KINETICS AND TRANSPORT PROCESSES (3-0-3) (S) (Even years) Reaction kinetics and mass transport phenomena at materials interfaces important in materials processing and performance, including gas-solid, liquid-solid, and electrochemical processes. Emphasis is placed on understanding fundamental mechanisms that control rates of reactions and mass transport. PREREQ: MSE 508.

MSE 521 INTRODUCTION TO ELECTRON MICROSCOPY (2-2-3)(S). Theory and practice of scanning electron microscopy (SEM) and transmission electron microscopy (TEM), including electron optics, contrast mechanisms, diffraction theory, chemical analysis techniques, and sample preparation. Some understanding of crystallography is recommended. Applications of SEM and TEM in Materials Science & Engineering will be covered. PREREQ: MSE 305 or MSE 505.

MSE 522 ADVANCED TRANSMISSION ELECTRON MICROSCOPY (1-3-2)(F). In-depth understanding of the transmission electron microscope(TEM), electron diffraction, imaging techniques, analytical techniques, and high-resolution electron microscopy (HREM). Students are required to have an approved project that utilizes the TEM. PREREQ: MSE 421 or MSE 521.

MSE 523 INTRODUCTION TO X-RAY DIFFRACTION (1-2-1) (S) This course presents a practical introduction to x-ray diffraction and the optimal use of an x-ray diffractometer for crystalline materials in the form of bulk materials, powders, or films. Students are required to have a planned project that utilizes x-ray diffraction and the approval of their research advisor to enroll in this course. PREREQ: Instructor consent and MSE 305 or MSE 505.

MSE 528 INTERFACES AND DISLOCATION BEHAVIOR (3-0-3)(S)(Odd years). Structure of interfaces as groups of line defects including dislocations, disconnections, and disclinations; application of general concepts to special situations including epitaxial interfaces, twin boundaries and phase transformations. PREREQ: MSE 305 or MSE 505.

MSE 549 ADVANCED TOPICS IN MATERIALS SCIENCE & ENGINEERING (3-0-3)(F/S)(On demand). Selected advanced topics from current research in Materials Science & Engineering such as defects in solids, physics of thin films, nanomaterials, optoelectronics, computational materials science, corrosion, reliability physics. PREREQ: ENGR 245.

MSE 561 MICROELECTRONIC PACKAGING MATERIALS (3-0-3)(F/S). Engineering analysis of electronic packaging materials and their affect on electrical design, assembly, reliability, and thermal management. Selection process for packaging materials, manufacturing and assembly, single and multi-chip packaging. PREREQ: ENGR 245.

MSE 565 APPLICATIONS OF MATHEMATICA FOR MATERIALS SCIENCE & ENGINEERING (1-0-1)(F/S). The basics of using Mathematica software to solve problems in Materials Science & Engineering. PREREQ: ENGR 245 and MATH 175.

MSE 577 (BIOL 577)(ME 577) BIOMATERIALS (3-0-3)(F/S). Theory of biomaterials science. Medical and biological materials and their applications. Selection, properties, characterization, design and testing of materials used by or in living systems. May be taken for BIOL, ME or MSE credit, but only from one department. PREREQ: ENGR 245 or CHEM 112.

MSE 588 BIOCOMPATIBILITY AND ENVIRONMENTAL DEGRADATION (3-0-3)(F/S). Theory of environmental degradation of metals, ceramics, polymers and biomaterials. The scientific principles of materials degradation with emphasis on material interactions within a living organism (in vivo). PREREQ: CHEM 112 or ENGR 245.

PHYS — PHYSICS

PHYS 512 INTRODUCTORY QUANTUM MECHANICS (3-0-3)(F/S). Introduction to fundamentals of quantum mechanics, including Schroedinger equation, energy levels, angular momentum, electron spin, perturbations, and scattering. Applications, such as tunneling, orbitals, magnetic resonance, and nanoscale effects. PREREQ: PHYS 309.

PHYS 515 SOLID STATE PHYSICS (3-0-3)(F/S). Quantum physics applied to understanding the properties of materials, including semiconductors, metals, superconductors, and magnetic systems. PREREQ: PHYS 309.

PHYS 523 PHYSICAL METHODS OF MATERIALS CHARACTERIZATION (3-0-3)(S). Physical principles and practical methods used in determining the structural, electronic optical, and magnetic properties of materials. Course topics will include optical, electron, and scanning microscopies, diffraction, surface analysis, optical spectroscopy, electrical transport, and magnetometry. Individual projects will focus on the application of an analytical technique to solve a specific problem. PREREQ: PHYS 309 or PERM/INST.

PHYS 530 OPTICS (3-0-3). Geometrical and physical optics, including lenses, fiber optics, Fourier optics, polarization, interference, diffraction, lasers, and holography. PREREQ: PHYS 212, MATH 333. COREQ: PHYS 534.

PHYS 532 THERMAL PHYSICS (3-0-3)(S). Discussion of temperature, work, specific heat, and entropy. The laws of thermodynamics are discussed and applied to physical problems. Ideal gases, statistics, Gibbs free energy, and cryogenics. Work on heat transfer of lattice vibrations and phonons will be required. PREREQ: Graduate standing or PERM/INST.

PHYS 534 OPTICS LABORATORY (0-3-1). Laboratory to be taken concurrently with PHYS 530. Experiments in optics, including optical systems, thick lenses, interference, diffraction, Fourier optics, image processing, and holography. COREQ: PHYS 530.

PHYS 536 SOFT MATTER (3-0-3)(S)(Even years). Introduction to the physical principles underlying the properties and behaviors of soft matter, including polymers, gels, colloids, and liquid crystals. Examples of soft matter include glues, paints, soaps, rubber, foams, gelatin, milk, and most materials of biological origin. (Recommended preparation: PHYS 309.) PREREQ:MATH 275, PHYS 212, and CHEM 322 or MSE 308 or PHYS 432

Proposed New Courses, FY12-14

MSE 513 MECHANICAL BEHAVIOR OF MATERIALS II (3-0-3)(F/S). Topics include fracture in different materials classes, time-dependent deformation behavior, mechanical behavior of polymers and other soft materials, deformation of natural materials and cellular solids, or mechanical behavior at the nanoscale.

MSE 514 MAGNETISM AND MAGNETIC MATERIALS (3-0-3)(F/S). Introduction to the phenomenon of magnetism. Basic magnetic properties of solid matter. Unit systems in magnetism. Magnetic anisotropy, magnetic domains, magnetic hysteresis, permeability, coercivity, and magnetostriction. Examples of magnetic materials.

MSE 525 SURFACE ANALYSIS (3-0-3)(F/S). Fundamentals and techniques associated with a range of surface analysis methods including LEED/RHEED, SPM, SIMS, XPS, Auger, RBS or NAA.

MSE 527 POINT DEFECTS (3-0-3)(F/S). Point defects in materials, particularly focused on defect chemistry, notation, ionic/electronic disorder, mass/charge balance, and the influence of point defects on materials properties.

MSE 540 ADVANCED PROCESSING (3-0-3)(F/S). Science and engineering of processes used in the manufacture of advanced ceramics, metals, polymers and composites.

MSE 542 CERAMIC PROCESSING (3-0-3)(F/S). Science and engineering of fabricating ceramic materials primarily from powders. Fundamental principles of colloid chemistry, thermodynamics of curved surfaces, and sintering kinetics models, and processing techniques.

MSE 545 NANOSCALE PROCESSING (3-0-3)(F/S). Fundamental and applied aspects of current approaches to fabrication of nanoscale (<100nm) features, materials, and devices including chemical, physical, and biological methodologies.

MSE 564 COMPUTATIONAL MATERIALS SCIENCE (3-0-3)(F/S). Theory and application of atomistic computer simulations to model, understand, and predict the properties of real materials. Energy models, density functional theory, thermodynamic ensembles, Monte Carlo methods, molecular dynamics and mesoscale modeling.

MSE 570 PHYSICAL METALLURGY (3-0-3)(F/S). Structure-property relationships with a focus on the formation of microstructures of alloys and the resulting mechanical properties. Fundamentals of annealing, spinodal decomposition, nucleation, growth, and coarsening. Role of defects in the formation of microstructures.

MSE 571 PHYSICAL CERAMICS AND GLASSES(3-0-3)(F/S). Structure-property and processing-property relations in crystalline and amorphous ceramic materials at the atomistic and microscopic levels.

MSE 578 SCIENTIFIC COMMUNICATION IN MATERIALS SCIENCE AND ENGINEERING (1-0-1)(F/S). Communication of research findings. Organization and composition of scientific research papers. PREREQ: PERM/INST

MSE 601 GRADUATE STUDENT ORIENTATION (1-0-1)(F/S). Orientation to the graduate student experience, requirements for the doctoral degree, and research practices including ethics, safety, research methods, and intellectual property. (P/F).

MSE 650 TEACHING EXPERIENCE (3-0-3)(F/S). Under the guidance of a faculty member, Doctoral candidates develop and teach an undergraduate course in Materials Science & Engineering. PREREQ: PERM/INST.

Proposed Modified Courses, FY12-14

MSE 602 SURVEY OF MATERIALS SCIENCE (3-0-3)(F/S) Application of the principles of chemistry and physics to the engineering properties of materials. Development of an in-depth understanding of the relationship between structure, properties, processing, and performance for all classes of materials.

MSE 605 BONDING AND STRUCTURE OF MATERIALS (4-0-4)(F/S). Bonding, atomic arrangements and crystal structures of metals, ceramics, electronic materials and polymers; electronic structure of solids; physical properties of solids; defects in solids; relationship between processing, microstructure and properties of materials.

MSE 608 SOLID STATE THERMODYNAMICS (4-0-4)(F/S). The laws of thermodynamics are applied to multicomponent, multiphase reacting systems, and other thermodynamic systems. These concepts are used to discuss and mathematically compute equilibrium phase diagrams. The energy effects due to the geometry of solid surfaces are discussed in regards to capillarity effects. Classical thermodynamics is related to atom-level distributions using statistical thermodynamics and the partition function. Electrochemical thermodynamics is discussed in the context of two-phase interfacial reactions.

MSE 510 ELECTRICAL, OPTICAL, AND DIELECTRIC MATERIALS (3-0-3)(F/S). Physical principles underlying the electrical, dielectric and optical properties of modern solids. Crystalline and energy band structure of materials, thermal properties and electrical conduction in semiconductors and metals, dielectric response and optical behavior of solids are covered.

MSE 511 SEMICONDUCTOR MATERIALS (3-0-3)(F/S). Examination of the physical properties of semiconductors including electronic structure, free carrier statistics, optical properties, crystallography, and defects. Study of thermodynamic properties as related to lattice vibrations and diffusion.

MSE 512 MECHANICAL BEHAVIOR OF MATERIALS I (3-0-3)(F/S). Study of deformation and fracture in engineering materials, including elastic and plastic deformations; dislocation theory; alloy hardening and creep deformation; fracture mechanisms; linear elastic fracture mechanics; toughening of metals, ceramics, and composites; environmentally assisted failure.

MSE 618 PHASE TRANSFORMATIONS AND KINETICS (4-0-4)(F/S). Kinetics of phase transformations, nucleation, crystallization, decomposition, chemical reactions, and atomic and molecular diffusion. Surface and interface phenomenon, nanoparticle-matrix interactions, sintering, grain growth, recovery and recrystallization.

MSE 521 INTRODUCTION TO ELECTRON MICROSCOPY (2-2-3)(F/S). Theory and practice of scanning electron microscopy and transmission electron microscopy, including electron optics, contrast mechanisms, diffraction theory, chemical analysis techniques, and sample preparation.

MSE 522 ADVANCED TRANSMISSION ELECTRON MICROSCOPY (1-3-2)(F/S). In-depth understanding of the transmission electron microscope, electron diffraction, and imaging and analytical techniques. Students are required to have an approved project. PREREQ: PERM/INST.

MSE 523 INTRODUCTION TO X-RAY DIFFRACTION (1-2-1) (F/S) A practical introduction to the apparatus and technique of x-ray diffraction for crystalline materials in the form of bulk materials, powders, or films. Students are required to have an approved project. PREREQ: PERM/INST.

MSE 528 INTERFACES AND DISLOCATION BEHAVIOR (3-0-3)(F/S). Structure of interfaces as groups of line defects including dislocations, disconnections, and disclinations; application of general concepts to special situations including epitaxial interfaces, twin boundaries and phase transformations.

Delete and Remove **MSE 549 ADVANCED TOPICS IN MATERIALS SCIENCE & ENGINEERING**

MSE 561 MICROELECTRONIC PACKAGING MATERIALS (3-0-3)(F/S). Engineering analysis of electronic packaging materials and their effect on electrical design, assembly, reliability, and thermal management. Selection process for packaging materials, manufacturing and assembly, single and multi-chip packaging.

MSE 565 APPLICATIONS OF MATHEMATICA (1-0-1)(F/S). The basics of using Mathematica software to solve problems in materials science and engineering.

MSE 588 BIOCOMPATIBILITY AND ENVIRONMENTAL DEGRADATION (3-0-3)(F/S). Theory of environmental degradation of metals, ceramics, polymers and biomaterials. The scientific principles of materials degradation with emphasis on material interactions within a living organism.

APPENDIX C:
Curriculum Vita of Materials Science & Engineering Faculty

NAME: **Darryl P. Butt**

ACADEMIC RANK: **Professor**

EDUCATION:

Degree	*Major*	*Institution*	*Year*
BS	Materials Science & Engineering, Technical Writing Minor	Pennsylvania State University	1984
PhD	Materials Science & Engineering	Pennsylvania State University	1991

NUMBER OF YEARS OF SERVICE ON THIS FACULTY: **5**

DATE OF ORIGINAL APPOINTMENT: **July 2005**

DATE OF ADVANCEMENT IN RANK: **July 2005**

OTHER RELATED EXPERIENCE:

Department Chair (2008-present), Professor (2005-present), Materials Science &Engineering, Boise State University

Associate Professor (2000-05) Materials Science &Engineering, University of Florida

Senior Scientist (1999-2000), Ceramatec, Salt Lake City, UT

Lead Project Leader (1998-99), Non-Proliferation and International Security Division, Los Alamos National Laboratory

Team Leader (1993-98) Materials Science and Technology Division, Los Alamos National Laboratory

Technical Staff Member (1992-93), Nuclear Mtrls Technology and Materials Science & Technology, Los Alamos Ntnl Lab

CONSULTING, PATENTS, AND RELATED ACTIVITIES:

D.P. Butt, R.A. Cutler, S.W. Rynders, & M.F. Carolan, "Method of Forming a Joint", U.S. Patent No. 7094301 (2006).

D.P. Butt, R.A. Cutler, S.W. Rynders, M.F. Carolan, "Method of Joining Ion Transport Membrane Materials Using a Partially of Fully-Transient Liquid Phase", U.S. Patent No 7011898, (2006).

D.P. Butt, M.F. Carolan, P.N. Dyer, R.M.P.H. Van Doorn, R.A. Cuter, & K.D. Gourley, "Mixed Conducting Membranes for Syngas Production", Australian Patent 2001295502, (2005)

R.E. Ressler, D.J. Pysher, P.M. Benson, and D.P. Butt, “Fiber Tester” U.S. Patent No. 6112589 (2000)

D.L. Shelleman, D.P. Butt, J.J. Mecholsky, J.R. Hellman, & R.E. Ressler, “High Temperature Tube Burst Test Apparatus”, U.S. Patent No 5220824 (1994)

PRINCIPAL PUBLICATIONS OF LAST FIVE YEARS:

P. Periasamy, M. F. Hurley, B. M. Marx, M. F. Simpson and D. P. Butt, “Compatibility of ZrN and HfN with Molten LiCl-KCl-NaCl-UCl3,” J. Nucl. Mater., 405, 286-273 (2010).

P.G. Callahan, B.J. Jaques, B. M. Marx, A.S. Hamdy, D.D. Osterberg, D. P. Butt, “Synthesis of Dysprosium and Cerium Nitrides by a Mechanically Induced Gas-Solid Reaction”, *Journal of Nuclear Materials***392**, 121 (2009)

B.J. Jaques, B. M. Marx, A.S. Hamdy, D. P. Butt, “Synthesis of Uranium Nitride by a Mechanically Induced Gas-Solid Phase Reaction”, *Journal of Nuclear Materials***381**, 309 (2008)

K.B. Gibbard, K. N. Allahar, D. Kolman, D. P. Butt, “High Temperature Synthesis of Cerium Sulfides and Kinetics Modeling*”, Journal of Nuclear Materials***378**, 291 (2008)

J. Payapilla, Butt, D. P. (2007). "Kinetics of Hydrothermally Induced Transformation of Yttria Partially Stabilized Zirconia" Journal of Nuclear Materials, **360**, 92 (2007).

A.C. Lawson, D.P. Butt, J.W. Richardson, Jr., "Thermal Expansion and Atomic Vibrations of ZrC to 1600K ", *Philosophical Magazine*, **87**, 2507 (2007).

A.S. Hamdy, D.P. Butt, A.A. Ismail, "Electrochemical Impedance Studies of Sol-gel Based Ceramic coatings Systems in 3.5% NaCl Solution", *Electrochimica Acta,***52**, 3310 (2007)

A.S. Hamdy, D.P. Butt, "Novel Anti-Corrosion Nano-sized Vanadia-based Thin Films Prepared by Sol-gel Method for Aluminum Alloys*", Journal of Materials Processing Technology*, **181**, 76 (2007).

A.S. Hamdy, D.P. Butt, "Envrionmentally Compliant Silica Conversion Coatings Prepared by Sol-gel Method for Aluminum Alloys", Surface & Coatings Technology, **201**, 410 (2006).

A.S. Hamdy, D.P. Butt, "Corrosion Protection Performance of Nano-particles Thin-films containing Vanadium Ions Formed on Aluminum Alloys", *Anti-Corrosion Methods and Materials*, **53**, 240 (2006).

E. Pabit, K. Siebein, D.P. Butt, H. Heinrich, D. Ray, S. Kaur, R.M. Flinders, R.A. Cutler, "Grain Boundary Chemistry of SiC-based armor", *Ceramic Engineering and Science Proceedings*, **27**, 69 (2006)

K.N. Allahar, D.P. Butt, M.E. Orazem, H.A. Chin, G. Danko, W. Ogden, R.E. Yungk, "Impedance of Steels in New and Degraded Ester Based Lubricating Oil", *Electrochimica Acta*, **51**, 1497 (2006).

SCIENTIFIC AND PROFESSIONAL SOCIETIES:

The American Ceramic Society

The Materials Research Society

The American Society for Engineering Education

The Materials Research Council

HONORS AND AWARDS:

Outstanding Contributor Award, Center for Advanced Energy Studies, 2010

Professor of the Year, Boise State University, College of Engineering, Teaching, 2008.

Triple Point Award for Undergraduate Teaching, University of Florida, MSE Department, Teaching, 2005

Robert L. Coble Award for Young Scholars, American Ceramic Society, 1997

Distinguished Performance Award, Los Alamos National Laboratory, 1994

INSTITUTIONAL AND PROFESSIONAL SERVICE IN PAST FIVE YEARS:

Department Chair (2008 – present)
University Finances Committee member (2009 – present)
Associate Director of the Center for Advanced Energy Studies (2008-present)
Graduate Student Coordinator, MSE, Boise State (2005-2008)
College of Engineering Graduate Committee, Boise State (2005-2008)
College of Engineering Safety Committee, Boise State (2006-2008)
Associate Editor, Journal of the American Ceramic Society (1996-present)
Editorial Board, *Pacific Northwest Journal of Undergraduate Research and Education*, 2010-present
National Academy of Engineering ROCSE Committee
Faculty Financial Affairs Committee, Boise State University, 2008-present
Fellowships Committee member DOE National Nuclear Security Agency 2006-present
Committee Member, SSGF Fellowships, DOE National Nuclear Security Administration, 2006-present
Steering Committee Member, for SSGF Fellowships, DOE NNSA, 2009-present
Executive Committee Member, Los Alamos National Laboratory MaRIE Program, 2009-2010
Member, VHTR Technology Development Office Materials Technical Coordination Team, 2010-present

NAME: **Janet M. Callahan**

ACADEMIC RANK: **Professor**

EDUCATION:

Degree	*Major*	*Institution*	*Year*
BS	Chemical Engineering	University of Connecticut at Storrs	1983
MS	Metallurgy	University of Connecticut at Storrs	1986
PhD	Materials Science	University of Connecticut at Storrs	1990

NUMBER OF YEARS OF SERVICE ON THIS FACULTY: **6**

DATE OF ORIGINAL APPOINTMENT: **July 2004**

DATE OF ADVANCEMENT IN RANK: **July 2004**

OTHER RELATED EXPERIENCE:

Associate Dean for Academic Affairs (2005-present), College of Engineering, Boise State University.

Professor(2004 – present), Materials Science & Engineering, Boise State University

Associate Professor (1999-2004), Materials Science & Engineering, Georgia Institute of Technology

Director of Reseearch (1998-2001), RadioVascular Systems, Inc. Atlanta, GA

Assistant Professor (1992-1999) Materials Science & Engineering, Georgia Institute of Technology

Visiting Scientist (1990-1992) Commonwealth Scientific and Industrial Research Organization, Materials Science & Technology

CONSULTING, PATENTS, AND RELATED ACTIVITIES:

.J.M. Hampikian and N.A. Scott, "Radioactive Coating Solutions Methods and Substrates", U.S. Patent No. 6475644 (2002).

J.M. Hampikian and E.M. Hunt, "A Method for Ion Implantation Induced Embedded Particle Formation via Reduction", U.S. Patent No. 6294223 (2001).

PRINCIPAL PUBLICATIONS OF LAST FIVE YEARS:

L. Nadelson, J.M. Callahan, P.A. Pyke, C.B. Schrader, "A Systemic Solution: Elementary Teacher Preparation in STEM Expertise and Engineering Awareness", American Society for Engineering Education Annual Conference and Expo, **2009-939** (2009)

S.Y. Chyung, J.M. Callahan, D. Bullock, K. Bridges, J. Guild, C.B. Schrader, C. B. "Improving Students' Learning in Precalculus with E-Learning Activities and Through Analyses of Student Learning Styles and Motivational Characteristics", American Society for Engineering Education Annual Conference and Expo, **2009-1873** (2009).

D. Bullock, J.M. Callahan, Y. Ban, A. Ahlgren, C.B. Schrader, "The Implementation of an Online Mathematics Placement Exam and its Effects on Student Success in Precalculus and Calculus", American Society for Engineering Education Annual Conference and Expo, **2009-1783** (2009).

S. Miller, P. Pyke, A. Moll, M. Wintrow, C. Schrader, J. Callahan, "Successes of an Engineering Residential College Program Within an Emerging Residential Culture," American Society for Engineering Education Annual Conference & Expo, **2009-1113** (2009).

S.Y. Chyung, A.J. Moll, B. Marx, M. Frary, J.M. Callahan, "Improving Engineering students' cognitive and affective preparedness with a pre-instructional e-learning strategy", *Advances in Engineering Education*, **2**, 1 (2010).

M. Gerritsen, J.T. Oxford, M. Frary, J. Henderson, J.M. Hampikian, "Immuno-SEM Characterization of Developing Bovine Cartilage" *Materials Science & Engineering C*, **28**, 341 (2008).

J.C. Guarino, J. M. Callahan, S.Y. Chyung, R. Walters, W. Clement, "Developing and Assessing Engineering-Based Modules for a Freshman Engineering Class", American Society for Engineering Education Annual Conference and Expo. **2008-1128** (2008).

J.M. Callahan, S.Y. Chyung, J. Guild, W. Clement, J.C. Guarino, D. Bullock, C.B. Schrader, "Enhancing Precalculus Curricula with E-Learning: Implementation and Assessment", American Society for Engineering Education Annual Conference and Expo, **2008-1703** (2008).

L. McClain, C.B. Schrader, J.M. Callahan, "ImprovingCampus Climate for Faculty from Underrepresented Groups", American Society for Engineering Education Annual Conference and Expo, **2008-2106** (2008).

J.F. Gardner, P.A. Pyke, C.B. Schrader, J.M. Callahan, A.J. Moll, "The Party's Over, Sustaining Support Programs When the Funding is Done" American Society for Engineering Education Annual Conference & Expo, **2008-2786** (2008).

K. Moeller, J. Besecker, G. Hampikian, A. Moll, D. Plumlee, J. Youngsman and J.M. Hampikian, "A Prototype Continuous Flow Polymerase Chain Reaction LTCC Device," Materials Science Forum, **539-543,** 523 (2007).

V. Siva Kumar, G. Kelekanjeri, W.B. Carter and J.M. Hampikian, "Deposition of alpha-alumina via combustion chemical vapor deposition," Thin Solid Films **515**, 1905 (2006)/

J.F. Gardner, P.A. Pyke, M.J. Belcheir, J.M. Hampikian, A.J. Moll, C.B. Schrader, "An Innovative Method to Realistically Track Engineering Student Retention and Academic Progress," American Society for Engineering Education Annual Conference & Expo, **2007-1266** (2007)

J.M. Hampikian, J. Guarino, Y. Chyung, A. Moll, P. Pyke, J. Gardner, C. Schrader, "Assessing a Retention Program for Pre-Freshman Engineering Students", American Society for Engineering Education Annual Conference & Expo, **2007-1998** (2007).

SCIENTIFIC AND PROFESSIONAL SOCIETIES:

American Institute of Chemical Engineers,

American Society for Engineering Education

Tau Beta Pi

The Minerals, Metals & Materials Society

ASM International.

American Ceramic Society

Society for Women Engineers

HONORS AND AWARDS:

Idaho Women Making Herstory, 2009

University of Connecticut Academy of Distinguished Engineers, 2004

National Science Foundation CAREER Award 1996-2003

Student Choice Award, College of Engineering, 2010

Provost's Excellence in Advising Award, 2006

Georgia Tech Foundation Teaching Fellow 1993-94

INSTITUTIONAL AND PROFESSIONAL SERVICE IN PAST FIVE YEARS:

Associate Dean for Academic Affairs

Chair, COEN Accreditation Committee

COEN Engineering Science Coordinator

University Gender Studies Advisory Board

ABET Evaluator, Materials Science & Engineering, Chemical Engineering, Ceramic Engineering

PROFESSIONAL DEVELOPMENT ACTIVITIES IN PAST FIVE YEARS:

"Writing & Citing: Helping Students Use Source Material and Avoid Plagiarism", Center of Teaching and Learning (2007)

Faculty Advising Institute, Boise State University (2006)

NAME: **Sean Donovon**

ACADEMIC RANK: **Special Lecturer**

EDUCATION:

Degree	*Major*	*Institution*	*Year*
BS	Materials Science &Engineering	University of Florida	1992
PhD	Materials Science &Engineering	University of Florida	1999

NUMBER OF YEARS OF SERVICE ON THIS FACULTY: **5**

DATE OF ORIGINAL APPOINTMENT: **October 2003**

DATE OF ADVANCEMENT IN RANK: **July 2004**

OTHER RELATED EXPERIENCE:

Special Lecturer (2004 - Present), Materials Science & Engineering Boise State University.

Research Assistant Professor (2003-2004), Materials Science & Engineering, Boise State University

Process Engineer (2001), Novalux, Santa Clara, CA

Process Engineer (2000), SDL/JDS Uniphase, San Jose, CA

PRINCIPAL PUBLICATIONS OF LAST FIVE YEARS:

T.E. Lawrence, S.M. Donovan, W.B. Knowlton, J. Rush-Byers, A.J. Moll, "Electrical Characterization of Through Wafer Interconnects", IEEE Workshop on Microelectronics and Electron Devices, pp 99-102 (2004).

SCIENTIFIC AND PROFESSIONAL SOCIETIES:

Materials Research Society

INSTITUTIONAL AND PROFESSIONAL SERVICE IN PAST FIVE YEARS:

College of Engineering Web Committee

Faculty Advisor, Materials Science & Engineering Student Club, Boise State

Undergraduate Advisor

NAME: **Megan E. Frary**

ACADEMIC RANK: **Associate Professor**

EDUCATION:

Degree	*Major*	*Institution*	*Year*
BS	Materials Science &Engineering	Northwestern University	1999
MS	Materials Science &Engineering	Northwestern University	2001
PhD	Materials Science &Engineering	Massachusetts Institute of Technology	2005

NUMBER OF YEARS OF SERVICE ON THIS FACULTY: **5**

DATE OF ORIGINAL APPOINTMENT: **August 2005**

DATE OF ADVANCEMENT IN RANK: **July 2010**

OTHER RELATED EXPERIENCE:

Associate Professor (2010 – present), Materials Science & Engineering, Boise State University.

Assistant Professor (2005-2010), Materials Science & Engineering, Boise State University.

Research Engineer (2001-2002), Caterpillar, Peoria, Illinois

CONSULTING, PATENTS, AND RELATED ACTIVITIES:

Independent Consulting, Failure Analysis Project (2010).

PROFESSIONAL REGISTRATION: N/A

PRINCIPAL PUBLICATIONS OF LAST FIVE YEARS:

L. Bonfrisco, M. Frary, "Effects of Crystallographic Orientation on the Early Stages of Oxidation Behavior in Nickel and Chromium," *Journal of Materials Science*, **45**, 1663 (2010).

P.J. Andersen, M.N. Bentancur, A.J. Moll, M. Frary, "Microstructural Effects During Chemical Mechanical Planarization," *Journal of the Electrochemical Society*, **157**, H120 (2010).

M. Frary, S.M. Schlegel, S. Hopkins, E. Young*, J. Cole, T. Lillo, "Analysis of Precipitate Redistribution in Inconel 617 Using Integrated Electron Backscatter Diffraction and Energy Dispersive Spectroscopy," *Microscopy and Microanalysis*, **15**, 24 (2009).

T. Lillo, J. Cole, M. Frary, S. M. Schlegel, "Influence of Grain Boundary Character on Creep Void Formation of Alloy 617," *Metallurgical and Materials Transactions*, **40**, 2803 (2009).

S. M. Schlegel, S. Hopkins, E. Young, T. Lillo, J. Cole, M. Frary, "Precipitate Redistribution during Creep of Alloy 617," *Metallurgical and Materials Transactions*, **40**, 2812 (2009).

S. M. Schlegel, S. Hopkins, M. Frary, "Effects of Grain Boundary Engineering on Microstructural Stability during Annealing," *Scripta Materialia*, **61**, 88 (2009).

S.Y. Chyung, A.J. Moll, B. Marx, M. Frary, J.M. Callahan, "Improving Engineering students' cognitive and affective preparedness with a pre-instructional e-learning strategy", *Advances in Engineering Education*, **2**, 1 (2010).

M. Gerritsen, J.T. Oxford, M. Frary, J. Henderson*, J.M. Hampikian, "Immuno-SEM Characterization of Developing Bovine Cartilage," *Materials Science & Engineering C*, **28,** 341 (2008).

M. Frary, C.A. Schuh, "Correlation-Space Description of the Percolation Transition in Composite Microstructures," *Physical Review E,***76**, 041108 (2007).

M. Frary, "Determination of Three-Dimensional Grain Boundary Connectivity from Two-Dimensional Microstructures," *Scripta Materialia*, **57**, 205 (2007).

M. Demkowicz, A. S. Argon, D. Farkas, M. Frary, "Simulation of Plasticity in Nanocrystalline Silicon," *Philosophical Magazine*, **87**, 4253 (2007).

C.A. Schuh, M. Frary, "Correlations beyond the Nearest-Neighbor Level in Grain Boundary Networks," *Scripta Materialia*, **54**, 1023 (2006).

SCIENTIFIC AND PROFESSIONAL SOCIETIES:

American Society for Engineering Education

ASM International

Materials Research Society

The Minerals, Metals, and Materials Society

HONORS AND AWARDS:

Bradley Stoughton Award for Young Teachers, ASM International. (2008).

NSF Career Award, National Science Foundation. (2007).

INSTITUTIONAL AND PROFESSIONAL SERVICE IN PAST FIVE YEARS:

Undergraduate Coordinator, Materials Science & Engineering, Boise State University

Faculty Advisor, Materials Science Club, Boise State University

ABET Accreditation Committee, Materials Science & Engineering, Boise State

College of Engineering Outreach Committee

Affiliate, Center for Advanced Energy Studies Consortium.

Materials Research Society Public Outreach Committee

Marcus A. Grossman Young Author Award and Henry Marion How Medal Selection Committee, Committee Member

TMS Women in Materials Science Committee

Board of Review for Metallurgical and Materials Transactions A

NSF Reviewer, various panels and Division of Materials Research

PROFESSIONAL DEVELOPMENT ACTIVITIES IN PAST FIVE YEARS:

"Course Design Summer Institute", Center for Teaching and Learning (2010).

"Investigating Student Learning as a Strategy for Optimizing our Teaching Practice", Center for Teaching and Learning (2010).

"Pedagogical Podcasting: Beyond the Recorded Lecture" Center for Teaching and Learning (2009)

"Helping Students Become Better Writers in Your Discipline", Center for Teaching and Learning (2009)

"Designing Courses for Significant Learning", Center for Teaching and Learning (2008).

"Graduate Mentoring: From Good to Great", Center for Teaching and Learning (2008).

"Engaging Students in Large Classes with Active and Cooperative Learning", Center for Teaching and Learning (2008).

"From Lab Reports to Scientific Articles: Helping Students Write Science", Center for Teaching and Learning (2008).

"Why Don't They Look Beyond Wikipedia", Center for Teaching and Learning (2008).

NAME: **William L. Hughes**

ACADEMIC RANK: **Assistant Professor**

EDUCATION:

Degree	*Major*	*Institution*	*Year*
BS	Materials Science & Engineering	Virginia Polytechnic Institute and State University	2001
PhD	Materials Science & Engineering	Georgia Institute of Technology	2006

NUMBER OF YEARS OF SERVICE ON THIS FACULTY: **2**

DATE OF ORIGINAL APPOINTMENT: **August 2008**

DATE OF ADVANCEMENT IN RANK:

OTHER RELATED EXPERIENCE:

Assistant Professor (2008-present), Materials Science & Engineering, Boise State University.

Adjunct Professor (2008-present, Materials Engineering, California Polytechnic State University

Affiliate Member (2010-present), St. Luke's Mountain States Tumor and Medical Research Institute, Boise, ID.

Assistant Professor (2006-08) Materials Engineering, California Polytechnic State University.

Post-Doctoral Fellow (2006-07) National Academy of Engineering.

CONSULTING, PATENTS, AND RELATED ACTIVITIES:

W.L. Hughes, Z.L. Wang, B.A. Buchine, "Probe Tips and Methods of Making Same", U.S. Patent No. 7,408,366, (2008).

Z.L. Wang, W.L. Hughes, B.A. Buchine, "Probe Sensor with Multidimensional Optical Grating, U.S. Patent No. 7,705,999 (2010).

PRINCIPAL PUBLICATIONS OF LAST FIVE YEARS:

E. Graugnard, A. Cox, J. Lee, C. Jorcyk, B Yurke, W.L. Hughes, W. L. "Point-of-Contact, DNA-Based Amplifier for Detecting Cancer-Related Micro-RNA in Blood Serum", *IEEE Transactions on Nanotechnology*. (2009)

L. Bollschweiler, A. English, R.J. Baker, W. Kuang, Z.-C. Chang, M.-H. Shih, W.B. Knowlton, W.L. Hughes, J. Lee, B. Yurke, N.S. Cockerham, V.C. Tyree, "Chip-Scale Nanophotonic Chemical and Biological Sensors using CMOS Process," *52nd IEEE Midwest Symposium on Circuits and Systems (MWSCAS) 2009 Conference,* Proceedings., pp. 413-416, 2009.

L. Vanasupa, K.C. Chen, J. Stolk, R. Savage, T. Harding, B. London, W.L. Hughes, "Converting Traditional Labs to Project-Based Learning Experiences: Aiding Students' Development of Higher-Order Cognitive Skills," *Journal of Materials Engineering*, **30**, 281 (2008).

L. Vanasupa, T. Harding, W.L. Hughes, "The Four-Domain Development Diagram: A tool for designing development-centered teaching," *American Society of Engineering Education*, **AC2008-1347** (2008).

D.C. Miller, W.L. Hughes, Z.L. Wang, K. Gall, C.R. Stoldt, "Mechanical Effects of Galvanic Corrosion on Structural Polysilicon," *Journal of MEMS*, **16**, 87 (2007).

B.A. Buchine, W.L. Hughes, F.L. Degertekin, Z.L. Wang, "Bulk Acoustic Resonator Based on Piezoelectric ZnO Belts," *Nano Letters*, **6**, 1155 (2006).

J. Zhou, C.S. Lao, P.X. Gao, W.J. Mai, W.L. Hughes, S.Z. Deng, N.S. Xu, Z.L. Wang, "Nanowire as pico-gram balance at workplace atmosphere," *Solid State Communications*,**139**, 222 (2006).

A.G. Onaran, M. Balantekin, W. Lee, W.L. Hughes, B.A. Buchine, R.O. Guldiken, Z. Parlak, C.F. Quate, and F.L. Degertekin, "A new atomic force microscope probe with force sensing integrated readout and active tip," *Review of Scientific Instruments*, **77**, 023501 (2006).

A.G. Onaran, M. Balantekin, W. Lee, W.L. Hughes, B.A. Buchine, R.O. Guldiken, Z. Parlak, C.F. Quate, F.L. Degertekin, "A new atomic force microscope probe with force sensing integrated readout and active tip," *Virtual Journal of Nanoscale Science and Technology*, **13**, No. 7, (2006).

SCIENTIFIC AND PROFESSIONAL SOCIETIES:

Society for Biomaterials

Society of Women Engineers

American Society for Engineering Education

International Society for Nanoscale Science, Computation and Engineering

HONORS AND AWARDS:

President's Community Service Award (2008)

Inaugural Paul Bonderson Materials Fellowship (2007)

Research Scholarship, Center for the Advancement of Scholarship on Engineering Education, National Academy of Engineering (2006)

Eugene P. Wigner Fellowship, International Finalist(2006)

Tools and Techniques in Nanoscience Fellowship (2006)

INSTITUTIONAL AND PROFESSIONAL SERVICE IN PAST FIVE YEARS:

University Professional Standars Committee (2009-10)

INBRE Summer Fellowship Review Committee (2009 - Present).

COEN Teaching and Learning (2008 - 2009).

Materials Research Society, MRS, Cal Poly Student Chapter Faculty Advisor (2007).

PROFESSIONAL DEVELOPMENT ACTIVITIES IN PAST FIVE YEARS:

Continuing Education Program, "Journal Club", Department of Biological Sciences, Boise State University (2008-09)

"INBRE Nevada: Write Winning Grants", Grant Writers' Seminar and Workshops (2009).

"Ten Before Tenure", Center for Teaching and Learning, (2008-09).

"How to implement service learning into freshman and senior level courses", ASEE Brownbag on Service Learning (2008).

"Promoting intellectual and personality diversity during service learning" (2008).

"The Rhythms of Stone Course", Augustana College (2007).

"Introduction and Overview of the NSF Proposal Process", ASEE Conference (2007).

NAME: **Michael Hurley**

ACADEMIC RANK: **Research Assistant Professor**

EDUCATION:

Degree	*Major*	*Institution*	*Year*
BS	Engineering Science	University of Virginia	1999
MS	Materials Science &Engineering	University of Virginia	2002
PhD	Materials Science &Engineering	University of Virginia	2007

NUMBER OF YEARS OF SERVICE ON THIS FACULTY: **3**

DATE OF ORIGINAL APPOINTMENT: **April 2007**

DATE OF ADVANCEMENT IN RANK: **August 2008**

OTHER RELATED EXPERIENCE:

Research Assistant Professor (2008-present), Materials Science & Engineering, Boise State University.

Post Doctoral Research Scientist (2007-08) Materials Science & Engineering, Boise State University.

Post Doctoral Research Scientist (2007), Center for Electrochemical Science and Engineering, University of Virginia.

PRINCIPAL PUBLICATIONS OF LAST FIVE YEARS:

P. Periasamy, M. F. Hurley, B. M. Marx, M. F. Simpson, D. P. Butt, "Compatibility Assessment of ZrN and HfN with Molten Salts of LiCl-KCl-NaCl-UCl3." Submitted to *J of Nuclear. Materials* (2009).

H. Cong, F. Bocher, N.D. Budiansky, M.F. Hurley, and J.R. Scully "Use of Coupled Multi-Electrode Arrays to Advance the Understanding of Selected Corrosion Phenomena." *Journal of ASTM International*, **4** No. 10 (2008).

M.F. Hurley, J. R. Scully. "Corrosion Propagation Behavior of New Metallic Rebar Materials in Simulated Concrete Environments and Engineering Implications" *ECS Trans*. **3**, 53 (2007).

N.D. Budiansky, F. Bocher, H. Cong, M.F. Hurley, and J.R. Scully, "Use of Coupled Multi-Electrode Arrays to Advance the Understanding of Selected Corrosion Phenomena" *Corrosion***63**, 537, (2007).

M.F. Hurley and J.R. Scully, "Threshold Chloride Concentrations of Selected Corrosion Resistant Rebar Materials Compared to Carbon Steel," *Corrosion*, Vol. 62. No. 10 (2006).

M.F. Hurley, J. R. Scully. "Candidate Corrosion Resistant Reinforcement Materials for Concrete Structures: Corrosion Propagation Behavior," CORROSION/2006, paper no. 06340, San Diego, CA: NACE International (2006).

N. D. Budiansky, F. Bocher, H. Cong, M. F. Hurley, and J. R. Scully. "Use of Coupled Multi-Electrode Arrays to Advance the Understanding of Selected Corrosion Phenomena," CORROSION/2006, paper no. 06677, San Diego, CA: NACE International (2006).

SCIENTIFIC AND PROFESSIONAL SOCIETIES:

National Association of Corrosion Engineers, NACE.

The Electrochemical Society.

PROFESSIONAL DEVELOPMENT ACTIVITIES IN PAST FIVE YEARS:

"Writing Objectives for Problem-Based Learning", Center of Teaching and Learning, Boise (2009).

"I just want to be whelmed: Maintaining a Vibrant and Productive Work Life", Center of Teaching and Learning (2009).

"Designing Courses for Significant Learning, Part I: Learning Outcomes", Center of Teaching and Learning (2008).

"From Lab Reports to Scientific Articles: Helping Students Write Science", Center of Teaching and Learning (2008)

NAME: **Brian Jaques**

ACADEMIC RANK: **Research Engineer**

EDUCATION:

Degree	*Major*	*Institution*	*Year*
BS	Mechanical Engineering	Boise State University	2006
MS	Materials Science & Engineering	Boise State University	2008

NUMBER OF YEARS OF SERVICE ON THIS FACULTY: **2**

DATE OF ORIGINAL APPOINTMENT: **May 2008**

DATE OF ADVANCEMENT IN RANK: **N/A**

OTHER RELATED EXPERIENCE:

Research Engineer (2008-present), Materials Science &Engineering, Boise State University

PRINCIPAL PUBLICATIONS OF LAST FIVE YEARS:

P.G. Callahan, B.J. Jaques, B.M. Marx, A.S. Hamdy, D.D. Osterberg, and D.P. Butt, "Synthesis of Dysprosium and Cerium Nitrides by a Mechanically Induced Gas-Solid Reaction*." Journal of Nuclear Materials*. **392**, 121-124 (2009).

B.J. Jaques, D.D. Osterberg, B.M. Marx, A.S. Hamdy, P.G. Callahan, and D. P. Butt, "New Routes to Lanthanide and Actinide Nitrides." Global 2009: The Nuclear Fuel Cycle: Sustainable Options & Industrial Perspectives, Paris, France. September 6-11, 2009.

B. Jaques, B. M. Marx, G. Balfour, A. S. Hamdy, and D. P. Butt, "Synthesis of Uranium Nitride by a Mechanically Induced Gas-Solid Reaction," J. Nuclear Materials, **381** [3] 309-311 (2008).

B.J. Jaques, B., H. Weston, D.G. Plumlee and A. J. Moll, "Advanced Fabrication Techniques for an Ion Mobility Spectrometer in Low-Temperature Co-Fired Ceramics." Proceedings of the IMAPS/ACerS 2nd International Conference and Exhibition on Ceramic Interconnect and Ceramic Microsystems Technologies, International Microelectronics and Packaging Society and the American Ceramics Society, April 25-27, 2006, Denver, CO (2006).

SCIENTIFIC AND PROFESSIONAL SOCIETIES:

American Ceramic Society

TMS

HONORS AND AWARDS:

Advanced Fuel Cycle Initiative, Generation IV Fellowship (2006-08)

Tau Beta Pi

Engineer in Training Certification (2006)

Outstanding Mechanical Engineering Student (2006)

National Science Foundation Scholar (2004-06)

NAME: **William B. Knowlton**

ACADEMIC RANK: **Professor**

EDUCATION:

Degree	*Major*	*Institution*	*Year*
A.A.	Math, Science &Engineering	Sacramento City College	1990
BS	Materials Science & Engineering	University of California, Berkeley	1992
MS	Materials Science & Engineering	University of California, Berkeley	1995
PhD	Materials Science & Engineering	University of California, Berkeley	1998

NUMBER OF YEARS OF SERVICE ON THIS FACULTY: **10**

DATE OF ORIGINAL APPOINTMENT: **August 2000**

DATE OF ADVANCEMENT IN RANK: **July 2010**

OTHER RELATED EXPERIENCE:

Professor (2010-present), Electrical and Computer Engineering, Boise State University.

Professor (2010-present,) Materials Science & Engineering, Boise State University.

Affiliate Member (2005-present), St. Luke's Mountain States Tumor and Medical Research Institute, Boise, ID.

Associate Professor (2004-10) Electrical and Computer Engineering, Boise State University.

Associate Professor (2004-10), Materials Science & Engineering, Boise State University.

Affiliate Faculty (2004 – present), Materials Science & Engineering, Academic, University of Idaho.

Assistant Professor (200-04), Electrical and Computer Engineering, Boise State University.

Assistant Professor (2000-04), Materials Science & Engineering, Boise State University

Member of Technical Staff (1998-2000), Insight Analytical Labs, Colorado Springs, CO

Research Intern (1997-98), Hewlett Packard Laboratories, Palo Alto, CA

CONSULTING, PATENTS, AND RELATED ACTIVITIES:

P. Mullner and W.B. Knowlton*, Multi-state memory and multifunctional device based on magnetic shape-memory alloys*, U.S. Patent No. 7,710,766 (2010).

William B. Knowlton and Dale Russell, *Electrochemical Deposition Method Utilizing Microdoplets of Solution*, U.S. Patent No. 7,628,902 (2009).

PRINCIPAL PUBLICATIONS OF LAST FIVE YEARS: (partial list)

R.G. Southwick III, J.C. Reed, C. Buu, R. Butler, G. Bersuker, and W. B. Knowlton, *Limitations of Poole-Frenkel Conduction in Bilayer HfO_2/SiO_2 MOS Devices*, IEEE Transactions on Device and Materials Reliability– in press (2010).

M. Reinhold*, D. Kiener, W.B. Knowlton, G. Dehm, and P. Müllner, *Deformation twinning in Ni-Mn-Ga micropillars with 10M martensite*, Journal of Applied Physics **106**, (2009) pp. 053906 (1-6)

S Yingst, K. Bloxham, L. Warner, R. Brown, J. Cole, L. Kenoyer, W.B. Knowlton, J. T. Oxford, *Characterization of Collagenous Matrix Assembly in a Chondrocyte Model System*, Journal of Biomedical Materials Research Part A,**90A** (2009) pp. 247-255.

D. Estrada*, M. L. Ogas*, R. G. Southwick III*, P. M. Price*, R. J. Baker, W. B. Knowlton, *Impact of Single pMOSFET Dielectric Degradation on NAND Circuit Performance*, Microelectronics Reliability,**48**(3) (2008) p. 354–363.

J. Jozwiak, R. G. Southwick III*, V. N. Johnson*, W. B. Knowlton, and A. J. Moll, *Integrating through-wafer interconnects with active devices and circuits*, IEEE Transactions on Advanced Packaging, **31**(1) (2008) p. 4-13.

P. Müllner, Z. Clark*, L. Kenoyer, W. B. Knowlton, and G. Kostorz, *Nanomechanics of orthorhombic Ni-Mn-Ga martensite*, Materials Science & Engineering A, **481–482** (2008) p. 66–72.

K. M. Reddy, R. Benson*, Z. Clark*, R. Hansen*, J. Hays*, A. Thurber*, M. H. Engelhard, V. Shutthanandan, S. Thevuthasan, W. B. Knowlton and A. Punnoose, *On the Room Temperature Ferromagnetism of $Zn_{1-x}Cr_xO$ Thin films Deposited by Reactive Co-sputtering*, Solar Energy Materials & Solar Cells, **91**, (2007) pp. 1496–1502.

R.G. Southwick III*, and W. B. Knowlton, *Stacked Dual Oxide MOS Energy Band Diagram Visual Representation Program*, IEEE Transactions on Device and Materials Reliability, **6**(2) (2006) p. 136-145.

P. M. Lenahan, B. Knowlton; J.F. Conley, B. Tonti, J. Suehle, and T. Grasser., *Introduction to the Special Issue on the 2007 International Integrated Reliability Workshop*, IEEE Transactions on Device and Materials Reliability, **8**(3) (2008) p. 490.

SCIENTIFIC AND PROFESSIONAL SOCIETIES:

Materials Research Society (MRS); Institute of Electrical and Electronics Engineers (IEEE); American Physical Society (APS); American Society of Engineering Education (ASEE)

HONORS AND AWARDS:

IEEE Senior Member (2009)

Honored Faculty Member - Boise State University Top Ten Scholar/Alumni Association (2004 & 2008)

College of Engineering - Professor of the Year (2007)

Boise State University Rising Star (2004)

Electrical and Computer Engineering Professor of the Year–Boise State University IEEE Student Chapter (2004)

1st Boise State University Presidential Research and Scholarship Award (2004)

INSTITUTIONAL AND PROFESSIONAL SERVICE IN PAST FIVE YEARS:

Graduate Program Co-Coordinator, Materials Science & Engineering (2003-present);

Member, Boise State University NIH INBRE Summer Fellows Selection Committee (2004-2008);

Co-PI and Member, Biomedical Research Center [BRC SBOE Center] (2004-present);

Chair (Faculty Research Council (2007-Present);

Member, College of Engineering Graduate Committee (2004-present)

Co-Chair, Vice President of Research Search Committee (2005-2007);

Member, University Strategic Planning Committee (2005-2007);

Program Committee Member, International Semiconductor Device Research Symposium (ISDRS) 2009;

Guest Editor, Special Edition of IEEE Transactions on Device and Materials Reliability – Sept. 2008 Edition;

Management Committee Member, IEEE International Integrated Reliability Workshop 2002 – 2005 & 2008 – present; Technical Committee Member, IEEE International Integrated Reliability Workshop 2002 – Present;

Guest Editor, Special Edition of IEEE Transactions on Device and Materials Reliability – June 2006 Edition;

Mentor, 2006 McNair Summer Research Fellowship Program;

PROFESSIONAL DEVELOPMENT ACTIVITIES IN PAST FIVE YEARS:

"Enhancing the Learning Environment", NSF Workshop (2005)

"NBTI – Why won't this go away" National Institutes of Standards and Technology (2009)

"Measurement Issues for High-k Technology including NBTI", Stanford University (2008)

NAME: **Paul Lindquist**

ACADEMIC RANK: **Assistant Research Professor**

EDUCATION:

Degree	*Major*	*Institution*	*Year*
B.S.	Ceramic Engineering	University of Illinois	1978
Ph.D.	Materials Science & Engineering	University of Illinois	1988

NUMBER OF YEARS OF SERVICE ON THIS FACULTY: **1**

DATE OF ORIGINAL APPOINTMENT: **December 2009**

DATE OF ADVANCEMENT IN RANK:

OTHER RELATED EXPERIENCE:

Research Assistant Professor (2009-present), Materials Science & Engineering, Boise State University.

Process Development Engineer, (2004–2007), Micron Technology Inc., Boise ID.

Member of the Technical Staff, Process Technologist, (2000-2004), NuTool Inc., Milpitas CA.

Member of the Technical Staff, Manager Enabling Technologies, (1993-1998), SCP Global Technology, Boise ID.

Advisory Engineer, (1988-1993), IBM Microelectronics, E. Fishkill NY,

Research Engineer, (1979-1983), Reed RockBit Co., Baker-Hughes, Houston TX.

CONSULTING, PATENTS, AND RELATED ACTIVITIES:

Patents: 6,413,403; 6,821,409; 6,802,946; 4,556,424; 6,878,213; 5,882,598;

NAME: **Amy J. Moll**

ACADEMIC RANK: **Professor**

EDUCATION:

Degree	*Major*	*Institution*	*Year*
BS	Ceramic Engineering	University of Illinois, Urbana	1987
MS	Materials Science & Engineering	University of California, Berkeley	1992
PhD	Materials Science & Engineering	University of California, Berkeley	1994

NUMBER OF YEARS OF SERVICE ON THIS FACULTY: **10**

DATE OF ORIGINAL APPOINTMENT: **August 2000**

DATE OF ADVANCEMENT IN RANK: **July 2010**

OTHER RELATED EXPERIENCE:

Professor (2010 – present), Materials Science & Engineering, Boise State University

Chair, (2005-08), Materials Science & Engineering, Boise State University

Associate Professor (2004-10), Materials Science & Engineering, Boise State University

Affiliate Faculty (2003-present), Materials Science & Engineering, University of Idaho

Assistant Professor (2000-04), Mechanical Engineering, Boise State University

Project Manager (1999-2000), Strategic Commodities, Agilent Technologies, Colorado Springs, CO

Process Engineering Manager (1998-99), Colorado Springs Technology Center, Hewlett Packard

Production Manager (1996-98), Optoelectronics Division, Hewlett Packard, San Jose, CA

Research & Development Engineer (1994-96), Optoelectronics Division, Hewlett Packard, San Jose, CA

PRINCIPAL PUBLICATIONS OF LAST FIVE YEARS:

P.J. Andersen, M.N. Bentancur, A.J. Moll, and M.E. Frary, "Microstructural Effects during Chemical Mechanical Planarization of Copper", Journal of the Electrochemical Society, **157**, H120 (2010).

S.Y. Chyung, A.J. Moll, J. Callahan, M. Frary and B. Marx, "Improving Engineering Students' Cognitive and Affective Preparedness with a Pre-Instructional E-Learning Strategy," Advances in Engineering Education, **10** (1) 22-37 (2010).

D.L. Kellis, A.J. Moll and D.G. Plumlee, "Effects of silver paste application on embedded channels in low temperature co-fired ceramics", Journal of Microelectronics and Electronic Packaging, **6**, (1), 54 (2009).

J. Jozwiak, R.G. Southwick III, V.N. Johnson, W.B. Knowlton, and A.J. Moll, *"Integrating Through-Wafer Interconnects with Active Device and Circuits,"* IEEE Transactions on Advanced Packaging, **31** (1) 4-13 (2008).

D. Plumlee, J. Steciak, and A. Moll, "Development and Simulation of an Embedded Hydrogen Peroxide Catlayst Chamber in Low Temperature Co-fired Ceramics," International Journal of Applied Ceramic Technology, **4** (5) 406-414 (2007).

J. Youngsman, B. M. Marx, S. Wolter, J. Glass, A.J. Moll *"Miniature Multi-electrode Electrochemical Cell in LTCC,"* Journal of Microelectronics and Electronic Packaging, **4** (1) 31-36 (2007).

A.J. Moll, W.B. Knowlton, R. Oxford, "Through wafer interconnects for 3-D Packaging", Enabling Technologies for 3-D Integration Symposium, p163-9 (2007).

K. Moeller, J. Besecker, G. Hampikian, A. Moll, D. Plumlee, J. Youngsman and J.M.Hampikian, *"A prototype continuous flow polymerase chain reaction LTCC device,"* Materials Science Forum, 2007, Vols. **539-543**, 523-528.

P.A. Miranda, J. Imonigie, and A.J. Moll, "Through-Wafer Interconnect CMP: An Investigation of Slurry Interaction Effects using a Design of Experiments Approach," Journal of the Electrochemical Society, 153 (3) G211-G217 (2006)

S. Miller, P. Pyke, A. Moll, M. Wintrow, C. Schrader, J. Callahan, "Successes of an Engineering Residential College Program Within an Emerging Residential Culture," American Society for Engineering Education Annual Conference & Expo, **2009-1113** (2009).

J.F. Gardner, P.A. Pyke, C.B. Schrader, J.M. Callahan, A.J. Moll, "The Party's Over, Sustaining Support Programs When the Funding is Done" American Society for Engineering Education Annual Conference & Expo, **2008-2786** (2008).

J.F. Gardner, P.A. Pyke, M.J. Belcheir, J.M. Hampikian, A.J. Moll, C.B. Schrader, "An Innovative Method to Realistically Track Engineering Student Retention and Academic Progress," American Society for Engineering Education Annual Conference & Expo, **2007-1266** (2007)

J.M. Hampikian, J. Guarino, Y. Chyung, A. Moll, P. Pyke, J. Gardner, C. Schrader, "Assessing a Retention Program for Pre-Freshman Engineering Students", American Society for Engineering Education Annual Conference & Expo, **2007-1998** (2007).

SCIENTIFIC AND PROFESSIONAL SOCIETIES:

American Society for Engineering Education

International Microelectronic and Packaging Society

Materials Research Society

Women in Engineering Program Advocates Network, WEPAN

Society of Women Engineers

HONORS AND AWARDS:

Golden Apple Award, Associated Student of Boise State, 2007

Honoree, Women Making Herstory, 2006

Best Poster, UGIM Conference, 2003

Hewlett Packard Ovations, 1998

INSTITUTIONAL AND PROFESSIONAL SERVICE IN PAST FIVE YEARS:

Undergraduate Coordinator, Materials Science & Engineering

Accreditation Committee, College of Engineering

Scholarship Committee, College of Engineering

Co-Chair, Core Reform Task Force, Boise State University

Core Curriculum Committee, Boise State University

Technical Chair and General Chair, Ceramic Interconnect and Ceramic Microsystems Conference, 2008-11

Chair, Public Outreach Committee, Materials Research Society,

Chair, NOVA series "Stuff" Committee, Materials Research Society

Host, Nano-Days, NISE Network

Associate Editor, Journal of Applied Ceramic Technology, 2007-08

PROFESSIONAL DEVELOPMENT ACTIVITIES IN PAST FIVE YEARS:

"How to use You-Tube in the Classroom," Center for Teaching and Learning (2010)

"Publish and Flourish: Become a Prolific Scholar", Center of Teaching and Learning (2007)

"Writing & Citing: Helping Students Use Source Material and Avoid Plagiarism", Center of Teaching and Learning (2006)

NAME: **Peter Müllner**

ACADEMIC RANK: **Professor**

EDUCATION:

Degree	*Major*	*Institution*	*Year*
MS	Materials Engineering	ETH Zurich, Swiss Federal Institute of Technology	1991
PhD	Materials Engineering	ETH Zurich, Swiss Federal Institute of Technology	1994

NUMBER OF YEARS OF SERVICE ON THIS FACULTY: **6**

DATE OF ORIGINAL APPOINTMENT: **July 2004**

DATE OF ADVANCEMENT IN RANK: **July 2009**

OTHER RELATED EXPERIENCE:

Professor (2009-present), Materials Science & Engineering, Boise State University.

Director (2006-present) Boise State Center for Materials Characterization, Boise State University

Associate Professor (2004-09), Materials Science & Engineering, Boise State University.

Senior Researcher (1998-2004), Institute of Applied Physics, ETH Zurich, Switzerland

Research Associate (1996-98), Max Planck Institute fur Metallforsch, Stuttgart, Germany

Post Doctoral Researcher (1995), University of Illinois, Urbana, Illinois.

CONSULTING, PATENTS, AND RELATED ACTIVITIES:

Peter Mullner and William B. Knowlton, "Multi-state memory and multifunctional device based on magnetic shape-memory alloys," U.S. Patent No. 7,710,766 (2010).

PRINCIPAL PUBLICATIONS OF LAST FIVE YEARS:

D. C. Dunand, and P. Müllner, "Size effects on magnetic actuation in Ni-Mn-Ga shape-memory alloys", Advanced Matertials 23 (2011) 216-232.

M. Chmielus, C. Witherspoon, R. Wimpory, A. Paulke, A. Hilger, X. X. Zhang, D. C. Dunand, and P. Müllner, "Magnetic-field-induced recovery strain in polycrystalline Ni-Mn-Ga foam", Journal of Applied Physics 108 (2010) 123526.

P. Müllner and A. King, "Deformation of hierarchically twinned martensite", Acta Materialia 58 (2010) 5242-5261.

M. Reinhold, C. Watson, W. B. Knowlton, and P. Müllner, "Transformation twinning of Ni-Mn-Ga characterized with temperature-controlled atomic force microscopy", Journal of Applied Physics 107 (2010) 113501.

M. Chmielus, K. Rolfs, R. Wimpory, W. Reimers, P. Müllner, and R. Schneider, "Effects of surface roughness and training on the twinning stress of Ni-Mn-Ga magnetic shape memory alloys", Acta Materialia 58 (2010) 3952-3962.

J. Guldbakke, M. Chmielus, K. Rolfs, R. Schneider, P. Müllner, and A. Raatz, "Magnetic, mechanical, and fatigue properties of a Ni45.4,Mn29.1Ga21.6Fe3.9 single crystal", Scripta Materialia 62 (2010) 875-878.

K. Rolfs, M. Chmielus, R. C. Wimpory, A. Mecklenburg, P. Müllner, and R. Schneider "Double twinning in Ni-Mn-Ga-co", Acta Materialia 58 (2010) 2646-2651.

V. A. Chernenko, M. Chmielus, and P. Müllner, "Large magnetic-field-induced strains in Ni-Mn-Ga non-modulated martensite", Applied Physics Letters 95 (2009) 103104.

M. Chmielus, X. X. Zhang, C. Witherspoon, D. C. Dunand, and P. Müllner, "Giant magnetic-field-induced strains in polycrystalline Ni-Mn-Ga foams", Nature Materials 8/11 (2009) 863-866.

M. Reinhold, D. Kiener, W. B. Knowlton, G. Dehm, and P. Müllner, "Deformation twinning in Ni-Mn-Ga micropillars with 10M martensite", Journal of Applied Physics 106 (2009) 053906.

V. A. Chernenko, K. Oikawa, M. Chmielus, S. Besseghini, E. Villa, F. Albertini, L. Righi, A. Paoluzi, P. Müllner, R. Kainuma, and K Ishida, "Properties of Co-alloyed Ni-Fe-Ga ferromagnetic shape memory alloys", Journal of Materials Engineering and Performance 18/5 (2009) 548-553.

V. Golub, K. M. Reddy, V. A. Chernenko, P. Müllner, A. Punnoose, and M. Ohtuska, "Ferromagnetic resonance properties and anisotropy of Ni-Mn-Ga thin films of different thicknesses deposited on Si substrates", Journal of Applied Physics 105 (2009) 07A942.

V. A. Chernenko, S. Besseghini, M. Hagler, P. Müllner, M. Ohtuska, and F. Stortiero, "Properties of sputter-deposited Ni-Mn-Ga thin films", Mater. Science and Engineering A 481-482 (2008) 271-274.

P. Müllner, Z. Clark, L. Kenoyer, W. B. Knowlton, and G. Kostorz, "Nano-mechanics and magnetic structure of orthorhombic Ni-Mn-Ga martensite", Mater. Science and Engineering A 481-482 (2008) 66-72.

Y. Boonyongmaneerat, M. Chmielus, P. Müllner, D. Dunand, "Increasing magnetoplasticity in polycrystalline Ni-Mn-Ga by reducing internal constraints through porosity", Physics Review Letters 99 (2007) 247201.

V. A. Chernenko, S. Doyle, M. Kohl, P. Müllner, S. Besseghini, and M. Ohtsuka, "Texture of submicron Ni-Mn-Ga thin films studied by x-ray beam line of synchrotron source", Z.f. Kristallog. 26 (2007) 229-234.

V. A. Chernenko, S. Besseghini, P. Müllner, G. Kostorz, J. Schreuer, and M. Krupa, "Ferromagnetic shape memory materials: underlying physics and practical importance", Sensor Letters 5 (2007) 229-233.

V. A. Chernenko, M. Hagler, P. Müllner, V. A. Kniazkyi, V. A. L'vov, M. Ohtuska, S. Besseghini, "Magnetic susceptibility of martensitic Ni-Mn-Ga film", Journal of Applied Physics 101 (2007) 053909.

SCIENTIFIC AND PROFESSIONAL SOCIETIES:

American Society for Engineering Education.

ETH Zurich Alumni Association.

Materials Research Society.

Sigma Xi, The Scientific Research Society.

The Mineral, Metals & Materials Society.

HONORS AND AWARDS:

ETH Silver Medal for outstanding Diploma Thesis (1994)

INSTITUTIONAL AND PROFESSIONAL SERVICE IN PAST FIVE YEARS:

Scholarly Activities and Research Committee, College of Engineering

Director, Boise State Center for Materials Characterization

Co-organizer, International Workshop on Magnetic Shape memory Alloys

Co-organizer, MRS Symposium "Materials Structures-The Nabarro Legacy", 2008.

Patent Committee, Boise State University

Graduate Program Coordinator, Materials Science & Engineering, 2008

Guest Editor for *Progress in Materials Science*, 2009.

PROFESSIONAL DEVELOPMENT ACTIVITIES IN PAST FIVE YEARS:

"Grade Conversation", Center of Teaching and Learning, Boise (2010)

"A Peer Assessment System to Improve Student Team Experiences", Center of Teaching and Learning (2010).

"Scholarly Approaches to Teaching: Getting Started with Action Research", Center of Teaching and Learning (2008)

"Active Learning: Creating Excitement in the Classroom", Center of Teaching and Learning (2006)

NAME: **Rick Ubic**

ACADEMIC RANK: **Research Associate Professor**

EDUCATION:

Degree	*Major*	*Institution*	*Year*
BS	Materials Science & Engineering	Case Western Reserve University	1993
MS	Materials Science & Engineering	Case Western Reserve University	1994
PhD	Engineering Materials	University of Sheffield	1998

NUMBER OF YEARS OF SERVICE ON THIS FACULTY: **3**

DATE OF ORIGINAL APPOINTMENT: **February 2007**

DATE OF ADVANCEMENT IN RANK: **October 2009**

OTHER RELATED EXPERIENCE:

Research Associate Professor (2009-present), Materials Science & Engineering, Boise State University. (2009 - Present).

Research Assistant Professor (2007-09), Materials Science & Engineering, Boise State University.

Senior Lecturer(2005-07), Department of Materials, Queen Mary, University of London, England.

Director/Liaison (2002-07), Electron Microscopy and Microanalysis Suite, Queen Mary, University of London, England.

Director of Undergraduate Admissions (2001 - 07), Department of Materials, Queen Mary, University of London, England.

Lecturer (1999 - 2005), Department of Materials, Queen Mary, University of London, England.

Post Doctoral Research Associate (1998-99), Engineering Materials, University of Sheffield, England.

PRINCIPAL PUBLICATIONS OF LAST FIVE YEARS:

T. Joseph, P.S. Anjana, S. Letourneau, R.Ubic, S. van Smaalen, and M.T. Sebastian, "Structure and microwave dielectric properties of $Ca_5A_4TiO_{17}$ (A = Nb, Ta) ceramics," *Materials Chemistry and Physics*, in press.

J.J. Bian, L.L. Yuan, and R. Ubic, "New perovskite oxides of the type $(M_{¼}Ln_{¾})(Mg_{¼}Ti_{¾})O_3$ (M = Na, Li; Ln = La, Nd, Sm): Crystal structure and microwave dielectric properties," Ceramic Transactions, in press.

R. Ubic and G. Subodh, *"The prediction of lattice constants in orthorhombic perovskites,"Journal of Alloys and Compounds,* **488** 374-379 (2010).

R. Ubic, G. Subodh, M.T. Sebastian, D. Gout, and T. Proffen, "Structure of $Sr_{0.4}Ce_{0.4}TiO_3$," *Chemistry of Materials,***21** 4706-4710 (2009).

R. Ubic, G. Subodh, M.T. Sebastian, D. Gout, and T. Proffen, "Effective size of vacancies in the $Sr_{1-3x/2}Ce_xTiO_3$ superstructure,"*Ceramic Transactions*, **204** 177-185 (2009).

X. Lu, Y. Lee, S. Yang, Y. Hao, R. Ubic, J.R.G. Evans, and C.G. Parini, "Fabrication of millimeter-wave electromagnetic bandgap crystals using microwave dielectric powders, *" Journal of the American Ceramic Society*, 92 [2] 371-378 (2009).

R. Ubic, G. Subodh, M.T. Sebastian, D. Gout, and T. Proffen, "Structure of compounds in the Sr1-3x/2CexTiO3 Homologous Series," *Chemistry of Materials*, **20** [9] 3127-3133 (2008).

R. Ubic, I. Abrahams, and Y. Hu, "Oxide Ion Disorder in $Nd_2Hf_2O_7$", *Journal of the American Ceramic Society*, **91** [1] 235–239 (2008).

Y.J. Lee, X.S. Lu, Y. Hao, S.F. Yang, R. Ubic, J.R.G. Evans, and C.G. Parini, "Rapid prototyping of cerami millimeterwave metamaterials: Simulations and experiments," *Microwave and Optical Technology Letters*, **49** [9] 2090-2093 (2007).

J.J. Bian, K. Yan, and R. Ubic, "Structure and Microwave Dielectric Properties of Sm(2-x)/3LixTiO3," *Journal of Electroceramics*, **18** 283-288 (2007).

R. Ubic, "Revised Method for the Prediction of Lattice Constants in Cubic and Pseudocubic Pervoskits*" Journal of the American Ceramic Society*, **90** [10] 3326-3330 (2007).

Y. Lee, X. Lu, Y. Hao, S. Yang, R. Ubi**c**, J.R.G. Evans, and C.G. Parini, "Directive Millimetre-Wave Antenna Based on Freeformed Woodpile EBG Structure," *Electronics Letters*, **43** 195 (2007).

R. Ubic, Y. Hu, and I. Abrahams, "Neutron and Electron Diffraction Studies of $La(Zn_{½}Ti_{½})O_3$ Perovskite" *Acta Crystallographica,* **B62** 521-529 (2006).

H. Yan, H. Zhang, R. Ubic, M.J. Reece, J. Liu, Z. Shen, "Orientation Dependence of Dielectric and Relaxor Behaviour in Aurivillius Phase $BaBi_2Nb_2O_9$ Ceramics Prepared by Spark Plasma Sintering," *Journal of Materials Science: Materials in Electronics*, **17** [9] 657-661 (2006).

H. Yan, H. Zhang, Z. Zhang, R. Ubic, and M.J. Reece, "B-Site Donor and Acceptor Doped Aurivillius Phase Bi_3NbTiO_9 Ceramics," *Journal of the European Ceramic Society,* **26** 2785-2792 (2006).

R. Ubic, Y. Hu, K. Khamoushi, and I. Abrahams, "Structure and Properties of $La(Zn_{½}Ti_{½})O_3$," *Journal of the European Ceramic Society*, **26** 1787-1790 (2006).

SCIENTIFIC AND PROFESSIONAL SOCIETIES:

Institute of Physics, Electron Microscopy and Analysis Group

American Ceramic Society

HONORS AND AWARDS:

Edgar Andrews Best Journal Article, QMUL Department of Materials. (2006)

Robert L. Coble Award for Young Scholars, American Ceramic Society (2004)

Edward C. Henry Best Paper Award, American Ceramic Society (2003)

Berthold Eichler Memorial Prize, G.R. Stein Refractories (1998)

INSTITUTIONAL AND PROFESSIONAL SERVICE IN PAST FIVE YEARS:

Materials Research Bulletin, Associate Editor. (2007 - Present).

Web Committee, College of Engineering, Boise State University

Thesis Committee, Master of Health Science, Boise State University

External Examiner, PhD Defense, University of Sydney, Australia and Jozef Stefan International School, Slovenia

Symposium Organizer, Dielectric Ceramic Materials, MS&T (2010)

Reviewer, Innovation and Technology Commission of Hong Kong

PROFESSIONAL DEVELOPMENT ACTIVITIES IN PAST FIVE YEARS:

"Using the Scholarship of Teaching and Learning to Enhance Your Teaching" Center for Teaching and Learning (2009)

"I Just Want to be Whelmed: Maintaining a Vibrant and Productive Work Life", Center of Teaching and Learning (2009)

"Bungling the Burglars Who Steal Your Time, Attention, Energy and (Really) Your Life: For Those Who Want to Take a Stand Against this Crime!", Center of Teaching and Learning (2009)

Certificate for Professional Development in "Integrating Research and Teaching" (2009)

"Graduate Mentoring: From Good to Great!", Center of Teaching and Learning (2008)

"Scholarly Approaches to Teaching: Getting Started with Action Research ", Center of Teaching and Learning (2008)

NAME: **Chad Watson**

ACADEMIC RANK: **Research Associate**

EDUCATION:

Degree	*Major*	*Institution*	*Year*
BS	Materials Engineering	New Mexico Institute of Mining and Technology	1999
MS	Materials Engineering	New Mexico Institute of Mining and Technology	2001

NUMBER OF YEARS OF SERVICE ON THIS FACULTY: **3**

DATE OF ORIGINAL APPOINTMENT: **October 2007**

DATE OF ADVANCEMENT IN RANK:

OTHER RELATED EXPERIENCE:

Instructor (2008-present), Materials Science & Engineering, Boise State University.

Research Associate (2007-present), Materials Science & Engineering, Boise State University.

Member of Technical Staff (2004-07), Sandia National Laboratories, Albuquerque, NM.

PRINCIPAL PUBLICATIONS OF LAST FIVE YEARS:

T.F. Juliano, T.E. Buchheit, S.V. Kalinin, C Watson, Y.G. Gogotsi, J. Shin, A.P. Baddorf, "Detection of Indentation Induced FE-to-AFE Phase Transformation in Lead Zirconate Titanate." *Journal of the American Ceramic Society,* **89**(11), 3557-3559 (2006).

C. Watson, P Yang, "Effects of Lead Stoichiometry on the Microstructure and Mechanical Properties of PZT 95/5" *Ceramic Transactions,* **167**, 89-98 (2005).

C. Watson, "Strength and Reliability of Lead Zirconate Titanate Ceramics" *Fracture Mechanics of Ceramics,* **14**, 485-498 (2005).

HONORS AND AWARDS:

Employee Recognition Award, Sandia: Glass-to-Metal Team. (2006).

PROFESSIONAL DEVELOPMENT ACTIVITIES IN PAST FIVE YEARS:

National Capstone Design Conference, NSF and ASEE, University of Colorado (2010)

"Failure Analysis of Brittle Materials Summer Course", University of New Mexico. (2006).

"MiniTab Basic Statistics and Statistical Process Control Short Course". (2006).

"Glass Science & Technology Short Course", Elan Technologies. (2005).

"Process & Measurements Assurance Program short course". (2005).

APPENDIX D:
Data tables

Materials Science and Engineering — Tenure-Track and Research Faculty			
	Tenure Track	*Research*	*Total*
Idaho	**10.0**	**17.0**	**27.0**
University of Idaho	3.0	0.0	3.0
Idaho State University	NA	NA	NA
Boise State University	8.0	16.0	24.0
Colorado	**20.0**	**17.0**	**37.0**
Colorado School of Mines	20.0	17.0	37.0
Montana	**4.0**	**0.0**	**4.0**
University of Montana	4.0	0.0	4.0
Wyoming	**0.0**	**0.0**	**0.0**
University of Wyoming	NA	NA	NA
Utah	**17.0**	**24.0**	**41.0**
University of Utah	17.0	24.0	41.0
Utah State	NA	NA	NA
Nevada	NA	NA	NA
University of Nevada-Reno	9.0	4.0	13.0
University of Nevada-Las Vegas	NA	NA	NA
Oregon	NA	NA	NA
University of Oregon	NA	NA	NA
Oregon State	NA	NA	NA
Washington	**11.0**	**18.0**	**29.0**
University of Washington	11.0	18.0	29.0
Washington State University	NA	NA	NA
Regional Averages	**7.8**	**9.5**	**17.3**

PhD Production[1]

	2009	2008	2007	*Average*
Idaho	**0.0**	**3.0**	**0.0**	**1.0**
University of Idaho	0.0	3.0	0.0	*1.0*
Idaho State University	0.0	0.0	0.0	*0.0*
Boise State University	0.0	0.0	0.0	*0.0*
Colorado	**6.0**	**2.0**	**10.0**	**6.0**
Colorado School of Mines	5.0	2.0	10.0	*5.7*
Colorado State University	0.0	0.0	0.0	*0.0*
University of Colorado	1.0	0.0	0.0	*0.3*
Montana	**0.0**	**0.0**	**0.0**	**0.0**
Montana State	0.0	0.0	0.0	*0.0*
University of Montana	0.0	0.0	0.0	*0.0*
Wyoming	**0.0**	**0.0**	**0.0**	**0.0**
University of Wyoming	0.0	0.0	0.0	*0.0*
Utah	**2.0**	**8.0**	**0.0**	**3.3**
University of Utah	2.0	8.0	0.0	*3.3*
Utah State	0.0	0.0	0.0	*0.0*
Nevada	**5.0**	**5.0**	**1.0**	**3.7**
University of Nevada-Reno	4.0	3.0	1.0	*2.7*
University of Nevada-Las Vegas	1.0	2.0	0.0	*1.0*
Oregon	**3.0**	**4.0**	**1.0**	**2.7**
University of Oregon	0.0	0.0	0.0	*0.0*
Oregon State	3.0	4.0	1.0	*2.7*
Washington	**13.0**	**10.0**	**18.0**	**13.7**
University of Washington	10.0	7.0	11.0	*9.3*
Washington State University	3.0	3.0	7.0	*4.3*
Regional Averages	3.6	4.0	3.8	3.8

[1] Source: National Science Foundation/Division of Science Resource Statistics, Survey of Earned Doctorates, 2009-2007

Appendix E:
Facilities Detail

The following is a list of the major equipment items in the instructional and research laboratories of the College of Engineering segregated by building and room. Areas such as classroom and teaching labs that perform a direct academic function are also listed. In addition, a list of computer laboratories and software is also included. The list includes equipment owned by other departments including ECE and MBE because these facilities are often shared through collaborations and joint research projects.

ET 104	MSE Surface Science Research Lab
ET 104	Triboscope TS-70
ET 104	Conductive AFM Module
ET 104	Diamond Indenter Tip for AFM, Qty 2
ET 104	FEI 800-03103-03 SEM microscope
ET 104	Herzan TS-140 Desktop Active V
ET 104	Herzan VA-2 3-axis Vibration Sensor
ET 104	Hysitron Temperature Controller
ET 104	Multimode Scanning Probe
ET 104	Novascan UltraViolet Surface
ET 104	SCM Scanning Capacitance Microscope
ET 104	SPC Special Nano TAC-2 heater/cooler
ET 104	TMC 63-531 Vibration Isolation
ET 104	Veeco DHMX microscopy package
ET 104	Veeco Nanoscope IV Scanning Probe
ET 104	Veeco V, Upgrade to NanoScope V Station

ET 104A	ECE Optical Research Lab
ET 104A	Quantum Energy Max Sensor
ET 104A	Opotek LD 355 II laser system
ET 104A	Princeton ProEM 512 EMCCD Camera System, Qty 2

ET 105	ECE & MSE IML Semiconductor Test Facility
ET 105	CHA 600 Thermal Evaporator
ET 105	Philtec 2015E Signatone Groover
ET 105	CALIBRATION KIT/STRASBAUGH
ET 105	Advanced Energy Ejmdx500 Power Supply:
ET 105	Neslab HX-150 chiller
ET 105	Stereozoom Microscope: Stemi 2
ET 105	Vacuum Pump: Pfeiffer TCP300
ET 105	Alcatel 2063 Vacuum Pump
ET 105	Model 310A Lasair II Airborne
ET 105	Nikon Opiphot66 Microscope with Camera
ET 105	220261 4" Gimbal Carrier
ET 105	West Bond 747677E-79 Wedge Bonder
ET 105	Afpp 500S Probe Computer Sys

ET 105	Veeco Ion Mill
ET 105	Rapid Thermal Annealing System RTP-6005
ET 105	AJA ATC Orion 5-HV Sputtering Syst
ET 105	CMP UNIT
ET 105	Plasmalab System 100 Icp 180
ET 105A	Carbon Dioxide Unit

ET 106	**ECE & MSE IML Metrology Lab**
ET 106	HD17095 broad band amplifier
ET 106	HP E4420B RF Generator
ET 106	HP Esa-L 9Khz-1.5Ghz Spectrum Analyzer
ET 106	Rf Signal Generator 250K-2Ghz
ET 106	Varian 979 Turbo Pump Leak Detector
ET 106	Veeco WYKO NT-1100 profiling system
ET 106	Dektak V200 Profile System

ET 107	**ECE & MSE Lab IML Semicond. Fab Cleanroom**
ET 107	Semitool ST-460 Spin Rinser Dryer
ET 107	SCP Elipsometer: Gaertner Klinger
ET 107	Nikon Opiphot66 Microscope with Camera
ET 107	Nano Metrics Nano Spec
ET 107	4000AMS4 Controller
ET 107	Headway PWM32-PS-R790 Manual Ph
ET 107	Branson Etcher
ET 107	Basic Hydraulic Test Bench
ET 107	Inspection System: Kla Wafer
ET 107	Nano-Master SWC-2000 Megasonic
ET 107	Basic Hydraulic Test Bench
ET 107	Quintel Q4000-6TI
ET 107	Sogevac Vacuum Pump
ET 107	Neslab CFT-300 chiller
ET 107	Acid Tank

ET 108	**ECE & MSE IML SEM Lab**
ET 108	Leo 1430Vp SEM
ET 108	Hitachi S-4500 SEM

ET 109	**ECE&MSE SPM/AFM Systems & Nanofab. Lab**
ET 109	Low-noise Voltage Preamplifier
ET 109	34U Cabinet
ET 109	TMC 63-531 Vibration Isolation
ET 109	Edmund Industries Camera System
ET 109	Silicon photomultiplier
ET 109	Keithley 590 C-V analyzer
ET 109	Mastercycler Personal #E533200
ET 109	Eppendorf NA BioPhotometer
ET 109	Agilent DSO5014A Oscilloscope

ET 109	Excellence Level Balance
ET 109	Stanford Research SR830 Amplifier
ET 109	fluorescence Illumination Syst
ET 109	Switching Matrix Mainframe 707A
ET 109	Oscilloscope Infiniium 1 Gsa/S
ET 109	Eppendorf Microcentrifuge 5430R
ET 109	Agilent Pulse Generator
ET 109	E5250A Low Leakage Switch Main
ET 109	Agilent 4284A LCR Meter, Qty 2
ET 109	Oscilloscope Infiniium 1 Gsa/S
ET 109	81110A -165/330 Mhz Pulse/Patt
ET 109	Microscope Leitz
ET 109	JM Micromanipulator 6200 Analytic
ET 109	Micromanipulator 6700-MZ6
ET 109	RF Network Analyzer: 1.3 Ghz
ET 109	Tunable light source as per quote
ET 109	Agilent 54832D Oscilloscope
ET 109	Micromanipulator Probe Station
ET 109	Switching Matrix Mainframe Ke
ET 109	Oscilloscope Infiniium 1 Gsa/S
ET 109	Keithly 4200-SCS/F Semiconductor Char.
ET 109	Veeco TUNA Tunneling AFM Application
ET 109	Agilent 4156C
ET 109	Alpha Innotech FlourChem Q system
ET 109	Microscope Head
ET 109	Keithly Semiconductor Characterization
ET 109	Variable Temperature Probe Station

ET 212	**Computer Lab**
ET 212	Dell Optiplex 380 Workstations and Monitors, Qty 38

ET 213-4	**Linux Computer Lab**
ET 213-4	Dell T3400 Precision Workstations and Monitors, Qty 32

ET 237	**Computer Lab**
ET 237	Computers and Monitors, Qty 24

ET 238	**CAD Classroom**
ET 238C	LCD Monitor 30"
ET 238C	Pnc Sign Maker
ET 238C	Roland Digital Pnc
ET 238C	Roland Digital Pnc
ET 238	Dell Optiplex 380 Workstations and Monitors, Qty 30
ET 240	**CS, ECE & MSE Dept Offices**
ET 240A	AOR AR5000A +3B wideband receiver
ET 240A	HP Esa-L 9Khz-1.5Ghz Spectrum Analyzer

ET 240A	Agilent 81130A pulse pattern generator
ET 240A	Agilent Pulse Pattern Generator
ET 240A	HP Infiniium Oscilloscope 1Gsa/S 4 Channel
ET 240A	HP 89410A Signal Analyzer
ET 240A	Agilent 89600S vector signal analyzer
ET 240C	U-Shape Kimball Workstation

ET 335	**ECE MOS-FET Research Lab**
ET 335	PolyCom Video Conferencing System
ET 335	Agilent MS07104A Oscilloscope

HML 102	**HML High Bay Teaching Lab Area (Shared)**
HML 102	Solar Water Heater/Instrument.
HML 102	Trainer Scott Air Conditioning 9086
HML 102	RF Power Supply 1200 watt 13.5
HML 102	Power Supply 3kw: 13.56mhz
HML 102	Reaction Frame
HML 102	CONSOLIDATION APPARATUS
HML 102	Ach401607032
HML 102	Hydraulic Universal Test Machine
HML 102	Thermal Technologies 10165 Hot Press
HML 102	SHB BH Looper

HML103	**MSE Magnetic Materials Research Lab**
HML 103	Ntron OA-1 Oxygen Analyzer
HML 103	Struers LaboPol-5 Grinding/Polishing Machine
HML 103	Allied High Tech 5-5100 TechCut 4 Low Speed Saw
HML 103	GSL1500X tube furnance
HML 103	Infinity x21C 21 camera
HML 103	HiCube 80 Eco Turbo Pump
HML 103	Fume Hood Assembly: Labconco
HML 103	Princeton Scientific WS22 High
HML 103	Xantrex XDC 80-150 12kW power supply
HML 103	REITEL Feinwerktechnik Induret 33802 Casting Unit
HML 103	Despatch Magnetic Oven
HML 103	Complete kSA Multi-beam Optica
HML 103	Single Crystal Growth Furnace
HML 103	Annealing Box Furnace
HML 103	Laboratory Scale
HML 103	Hot Plate
HML 103	Precision Scale
HML 103	ADE Model 10 VSM Magnetometer
HML 103	Dynamical Magneto-Mechanical Testbench with Rotating Magnet
HML 103	Dynamical Magneto-Mechanical Testbench with Linear Actuation
HML 113	ENA Series Network Analyzer
HML 102	AMS Truck Mounted Power Probe

HML 114	Machine Shop
HML 114	Rong Fu Lobo Milling/Drilling Machine 20"
HML 114	Monarch 15 x 60 lathe
HML 114	Welding System Rfq Lq99-140Rev
HML 114	Lathe Tida #1240E Bench Lathe
HML 114	Wilton Bandsaw Heavy Duty Cut-Off
HML 114	Sharp Vertical Milling Machine
HML 114	CM-01S Cuttermaster Select Too
HML 114	Band Saw: Contour 2013-V
HML 114	618M Surface Grinder
HML 114	Sharp LMV-50 Mill W/Table Power Feed
HML 114	Lathe: South Bend G-26 Geared
HML 114	Haas TM-1 Milling Machine

MEC 113	MSE BSU Center for Mat'ls Charact. Research Lab
MEC 113	Leica Microsystems Inc.Vibration Isolation Table
MEC 113	Ion Beam Thinner w/HP computer XLA/2000
MEC 113	Struers LaboPol-5 Grinding/Polishing Machine, Qty 2
MEC 113	Buehler 11-1280-160 Low Speed Saw
MEC 113	GKM: RMC Glass Knife Maker
MEC 113	D500i Dimpler
MEC 113	Gatan 656 Dimple Grinder
MEC 113	Buehler Versamet 3 Inverted Optical Microscope
MEC 113	High Precision Balance
MEC 113	Turbo Carbon Evaporator
MEC 113	Gatan 691 Ion Beam Thinner
MEC 113	Leica EM UC6b Ultramicrotome
MEC 113	JEOL TEM Ion Slicer
MEC 113	Bruker D8 Discover diffraction system
MEC 113A	Turbo Pumping station as peer
MEC 113A	TEM microscope

MEC 117	MSE Mechanical Test Research Lab
MEC 117	Dynamic Force Transducer
MEC 117	Ewald Thermocouple Welder Package 7007
MEC 117	MTS Servohydraulic Mechanical Syst

MEC 208	ECE Shared Research Lab
MEC 208	HP 3325A Synthesizer/Function Generator
MEC 208	Drytel 100 Vacuum
MEC 208	Power Ten Model P63C-30110
MEC 208	100 MHz: 4 channel Oscilloscop
MEC 208	Agilent DSO5014A Oscilloscope
MEC 208	Purair Polypropylene Fume Hood
MEC 208	Agilent1131-A Probe Amplifier, Qty 4
MEC 208	HP E4420B RF Generator
MEC 208	Glassman Model PS/LT005R400-22

MEC 208	BSU-1 vacuum system
MEC 208	Kensington Inspection Station: Air Table
MEC 208	Air Table Tm
MEC 208	Training Aid Infinium O-Scope
MEC 208	Ip-02 Inverted Pendulum Sys
MEC 208	HP 4279 LCN Meter
MEC 208	Spectrum Analyzer
MEC 208	HP 4275A LCR Meter
MEC 208	Bausch and Lomb Microscope 4" & Probe Station
MEC 208	HP 4155A Parametric Semiconductor Analyzer
MEC 208	E4438C ESG Vector Signal Gener
MEC 208	308R Dual Source Evaporation

MEC 210	**MSE Teaching Lab**
MEC 210	Grinder Labopol-5 Single Wheel
MEC 210	Micros MCX1700 Inverted Microscope, Qty 6
MEC 210	Allied High Tech 5-5100 TechCut 4 Low Speed Saw
MEC 210	Nikon Opiphot66 Microscope with Camera
MEC 210	Nikon Opiphot66 Microscope with Camera
MEC 210	United Sfm-30 Smart1 Test Machine
MEC 210	JEOL JCM-5000 Benchtop Microscope

MEC 212	**MSE Materials Research Lab**
MEC 212	Durston DRM F130 SSP Flat Rolling Mill
MEC 212	Lesker Trs2Fsa Torus 2 Sputter Source
MEC 212	Quartz Tube Furnace OTF-1200X
MEC 212	Buehler EcoMet 3000 grinder/polisher
MEC 212	Buehler 67-1635-160 VIBROMET 2
MEC 212	Buehler EcoMet 3000 grinder/polisher
MEC 212	Carl Zeiss Microscope Inverted Stage Opt

MEC 213	**MSE Advanced Materials Research Lab**
MEC 213	Cycle Dyne MK-20
MEC 213	Scientech Weight Scale SM128D
MEC 213	12Ton Manual Press w/13 mm Die
MEC 213	Ntron Oxygen OA-1 Analyzer, Qty 2
MEC 213	Manual Pellet Press
MEC 213	Thermolyne Box Furnace
MEC 213	Carver Heated Plated Press
MEC 213	Mistler Table Top TAPE Casting
MEC 213	Digital Viscometer
MEC 213	Radiation Detector and Counter
MEC 213	SFM-2 Desktop vertical Mixer/B
MEC 213	Allied High Tech 5-5100 TechCut 4 Low Speed Saw
MEC 213	AMETEK 303B Moisture Monitor
MEC 213	Fully Articulating 3-point Fixture
MEC 213	Leybold Turbo Pump TW 300H
MEC 213	Thermolyne Tube Furnace 59300

MEC 213	Automatic Mounting Press
MEC 213	Quantachrome 02029-1 Multipycnometer
MEC 213	PLAS-LABS CLOSED LOOP CONTANIM
MEC 213	AMETEKThermox CG1000 Port. Oxygen Analyzer
MEC 213	Deltech Furnace DT 31 R505 E2404
MEC 213	NetzschThermo Gravimetric Analyzer
MEC 213	Planetary Ball Mill
MEC 213	RETSCH PM100 Planetary ball mill
MEC 213	Olmpus BX51 microscope
MEC 213	SDT 2960 Simultaneous DSC-TGA
MEC 213	Retsch Inc. 22.782.0004 PM Gri
MEC 213	Fundamental Electrochemistry S
MEC 213	Oscilloscope Infiniium 1 Gsa/S
MEC 213	Quantachrome 02090-2AG-1 Gas Analyzer
MEC 213	Chemical Fume Hood
MEC 213	Chemical Fume Hood
MEC 213	Micromanipulator Probe Station 6000
MEC 213	CM High Temperature Furnace 1730-12 HTF
MEC 213	HORIBA LA-950SD Multi Waveleng
n/a	Spark Plasma Sintering System- located in CAES, Idaho Falls, ID

MEC 312	**ECE Microprocessor Work Area**
MEC 312	Tektronix Logic Analyzer
MEC 312	Photoresist Pump Cabinet
MEC 312	Oscilloscope Infiniium 1 Gsa/S
MEC 312	Logic Analyzer W/Floppy
MEC 312	HP 54645D Oscilloscope
MEC 312	HP 54645D Oscilloscope
MEC 312	Tektronix 318S1 Logic Analyzer

MEC 413	**MBE New Product Development Lab**
MEC 413	Sensable Technologies Amplifier Box 1.5
MEC 413	Ramco Equip. Model MK30CSS/TPM
MEC 413	PCNC 1100 3-Axis CNC Milling Machine
MEC 413	Sensable Technologies Phanton Premium 1.5A
MEC 413	Direct Writing System
MEC 413	Viper si2 3D Stereolithography System

MEC 414	**MBE/MSE Low Temp Co-fired Ceramic Research Lab**
MEC 414	Stereo Olympus Microscope
MEC 414	Allied High Tech 5-5100 TechCut 4 Low Speed Saw
MEC 414	Jandel Universal 4 Point Probe
MEC 414	Remanufactured MPM Corp. model
MEC 414	CNC Milling Machine
MEC 414	Universal Laser System M-300
MEC 414	Infared Camera System

APPENDIX F:
Letters of Support

Idaho National Laboratory INL

January 18, 2011 CCN 223099

Dr. Darryl P. Butt, Ph.D
Professor and Chair
Department of Materials Science and Engineering
1910 University Drive
Boise State University
Boise, ID 83725-2075

SUBJECT: Letter of Support

Dear Darryl:

Speaking on behalf of the three Idaho public universities and INL (with respect to their association at CAES), I fully and enthusiastically support the proposed PhD program in Materials Science at Boise State University. CAES and INL see this program as an enormous benefit not only to BSU and the Treasure Valley Region, but the entire state of Idaho and its academic institutions and research and industrial communities.

As you know, the Center for Advanced Energy Studies is a public/private partnership comprised of Boise State University, Idaho State University, University of Idaho, private industry, and the Idaho National Laboratory. The partnership integrates resources, capabilities and expertise to create new research capabilities, expand researcher-to-researcher collaborations, and enhance energy-related educational opportunities. Materials science is an essential component of the CAES research agenda, today and tomorrow.

The PhD program will provide value on several fronts at BSU as well as across the state of Idaho. The quality of faculty and students in the Materials Science and Engineering Department is already outstanding as evidenced by its impressive portfolio of competitively won research. The faculty at BSU has demonstrated a strong emphasis on collaboration which has resulted in many joint research programs within Idaho – the PhD program will add to this collaboration and ability to win competitive research grants. Clearly this success suggests that a PhD program is essential as well as a natural progression in its quest to become a world class Materials Science program. Further, the program will enhance the ability of Idaho's industrial and research communities to fill their human capital pipelines with top notch people. Finally, BSU's continued involvement in CAES would be strengthened through a PhD program, and CAES in turn would certainly make continued contributions to the department through access to research opportunities and its world class research facilities.

P.O. Box 1625 • 2525 North Fremont Ave. • Idaho Falls, Idaho 83415 • 208-526-0111 • www.inl.gov
Battelle Energy Alliance, LLC

CAES is confident that the PhD program is a win-win-win for BSU, CAES and most importantly the education, research, and industrial communities across the state of Idaho. We fully support BSU's proposal and their commitment to provide solutions to the education and research challenges of Idaho and the nation.

Sincerely,

Oren V. Hester, Deputy Director
Center for Advanced Energy Studies

DCW

Micron Technology, Inc.
8000 S. Federal Way
P.O. Box 6
Boise, ID 83707-0006
208.368.4000

January 24, 2011

Dr. Darryl P. Butt, Ph.D.
Professor and Chair
Department of Materials Science and Engineering
1910 University Drive
Boise State University
Boise, ID 83725-2075

Subject: Letter of Support to start PhD Program in BSU, MSE Department

Dear Darryl,

As a member of your Industrial Advisory Board, I am pleased to provide you with this letter of support, endorsing the creation of a PhD in Materials Science and Engineering (MSE). To start a PhD program is an essential step towards building a strong MSE program in Boise metro-area. Considering the success of undergraduate and M.S. degree programs in the last few years in the department, the development of a PhD program is a nature progression for the MSE department. The proposed PhD program is not only for the development of the MSE department, but also for the benefits of local industries.

As we all know, more and more manufacture jobs are moving to lower labor cost region outside the US as the results of the globalization. To maintain the core value of the company, we have to enhance research and development to generate better product designs. One of the requirements to fulfill this task is the need of highly trained engineers. These qualified engineers should normally have PhD training with solid background in at least one or two disciplines in Engineering so that they can face the challenges of increasing difficulties in the day-to-day work. Materials Science and Engineering is one of these disciplines and will become more and more important in the near future. These highly trained engineers are in shortage in the job market, particularly at the PhD level. For example, I now have had hard time to fill two such openings in my Lab, which is not an isolate case in Micron. Therefore, I fully support the proposed PhD program in BSU/MSE department.

Sincerely,

D. Li

Du Li, Ph.D., MBA
TEM Lab Manager
Micron Technology, Inc.

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Mayor

City Council

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January 26, 2011

Dr. Darryl P. Butt, Ph.D
Professor and Chair
Department of Materials Science & Engineering
1910 University Drive
Boise State University
Boise, ID 83725-2075

SUBJECT: Letter of Support

Dear Dr. Butt:

On behalf of the people of Boise, I'm pleased to offer my support the proposed doctoral program in Materials Science at Boise State University. The City of Boise sees this program as a strong addition to the University, as well as to the economy of the Treasure Valley and the State of Idaho. By producing more materials science engineers who possess doctorate degrees and the robust skills developed through that education, we will provide employers across the Valley the ability to fulfill their hiring needs right here in Idaho.

The amount of research dollars that the faculty and students in the Materials Science & Engineering Department bring to the University is impressive, and the PhD program will only add to their ability to win competitive research grants. These grants provide necessary funds to assist Boise State in its quest to become a Research University of Distinction, and further assist the economy of the entire State.

I am confident that the PhD program is a win for Boise State and for the education, research, and business communities across Idaho. I fully support Boise State's proposal and its commitment to provide solutions to the education and research challenges of Idaho and the nation.

Sincerely,

David H. Bieter
Mayor

January 28th, 2011
Mary Givens
Director Office of Technology Transfer / Division of Research
Boise State University
1910 University Drive,
Boise, ID 83725-1135

Dear Director Givens,

I am writing this letter to wholeheartedly support the establishment of a PhD program in the Department of Materials Science & Engineering (MSE) at Boise State University.

Materials Science is a unique specialized field of science which can be enabling for a multitude of industries contributing greatly to the economic and technological strength of a region, state, and nation. A US Committee on Science, Engineering, and Public Policy (COSEPUP) report from the National Academy Press (ISBN 030906893 2000) states; "To be leaders in industrial growth and to maintain a vibrant economy, it is critical that the United States lead the world in materials science and engineering innovations. Materials have been central to economic growth and societal advancement since the dawn of history. With the ever strengthening fundamental underpinnings of the fields and the growing interdependence of materials with other emerging technologies, these societal and economic contributions of the field are accelerating". One measure of the influence of material science can be seen from the total number of R&D 100 Award winning technologies from 1963 to 2010. In all possible categories, Materials Science represents the second highest category and represents over 11% of the most technologically significant new products developed worldwide.

While founder and Chief Technical Officer or The NanoSteel Company, I also currently serve as an Industrial Advisory Board Member for the Material Science and Engineering (MSE) Department at Iowa State University which is one of largest materials programs in the nation. While ISU's MS&E Department is much bigger, I have been impressed by the faculty members at BSU that I have met and worked with and also with the high quality of the research that is currently going on. Additionally, at the NanoSteel Company, we currently utilize key equipment in the Boise State Center for Materials Characterization (BSCMC) to complement our existing research in advanced nanomaterials. We have found that the materials characterization equipment is world class and the ability to utilize this advanced equipment at the BSCMC has significantly helped our nanomaterial research effort.

I have seen and know that that the current National rankings of the MS&E Department are low (not deserved) and partially arise from the young age of the department which was only formed in 2004. I believe that the establishment of a PhD program would greatly help to support these rankings. As undoubtedly, students and faculty at BSU can attest with the success of the nationally recognized football program, national rankings do matter and raising these rankings for the MS&E Department will ultimately allow the attraction of the best and brightest faculty, students, and alumni enabling additional research dollars and ensuring future growth.

Sincerely,

Daniel James Branagan, PhD
Chief Technical Officer
The NanoSteel Company,
505 Lindsay Boulevard, Idaho Falls, Idaho, 83402
tel: (208)-552-5226 / fax: (208)-552-2923
e-mail: dbranagan@nanosteelco.com

PREMIER Technology, Inc.

Fax: (208) 782-9005

February 2, 2011

Dr. Darryl P. Butt
Professor and Chair
Dept. of Materials Science and Engineering
1910 University Dr.
Boise State University
Boise, ID 83725-2075

Dear Professor Butt,

I would like to offer my support for the creation of a PhD in Materials Science and Engineering (MSE). This program is essential to the future of a successful PhD MSE program at BSU in order to provide the professionals we will need for the future workforce in the energy fields. If we can thrust our education system into the future, Idaho will continue to lead our country in innovation and technology.

I am working with ISU on several projects to unite our universities and if this program were offered at BSU and available to the other universities, they could be coupled together and increase the learning opportunities and locations for students. Increasing the number of graduates in this program will springboard our universities into a higher academic level nationally. Please accept my endorsement in support of the PhD for Materials Science and Engineering.

Best regards,

Douglas A. Sayer
President & CEO
Premier Technology, Inc.

Corporate Office and Manufacturing Facility: 1858 W. Bridge St. * Blackfoot, Idaho 83221 * 208-785-2274

WASHINGTON STATE UNIVERSITY

Research and Graduate Programs
College of Engineering and Architecture

April 13, 2011

Professor Darryl P. Butt
Department of Materials Science and Engineering
1910 University Drive
Boise State University
Boise ID 83725-2075

Dear Darryl:

Re: Proposed PhD Program in Materials Science and Engineering

I strongly support the proposed PhD program in Materials Science and Engineering (MSE) at Boise State University. As a member of your Industrial Advisory Board I have watched the growth of the MSE department since its inception. What has been achieved is truly remarkable and the next logical step in the development of the department is the formation of a doctoral program. Such a program is critical as it is only programs that offer a PhD that can achieve national ranking and prominence. I believe the time is right to start a PhD program as Boise State University has an outstanding group of faculty with phenomenal research support, which should be directed towards doctoral education and training. With the proposed growth in faculty numbers and using past performance as a measure of future success it is clear that Boise State University will be the top materials program in Idaho and could certainly become the preeminent MSE program in the entire northwest if it is able to offer a PhD in the field.

As a faculty member and administrator at Washington State University I look forward to seeing Boise State University offer a PhD in MSE. This proposed addition to the existing strong PhD programs at University of Washington and Washington State University will enhance the overall level of materials-related research and education programs in the Pacific Northwest and hopefully allow synergies between these program to be developed that leads to significant student exchange and increase opportunities for large programmatic funding.

Yours sincerely

M. Grant Norton
Professor and Associate Dean

PO Box 642714, Pullman, WA 99164-2714
509-335-8730 • Fax: 509-335-9608 • www.cea.wsu.edu

2425 South 900 West
Salt Lake City
Utah 84119

April 28, 2011

Dr. Darryl. P Butt
Professor and Chair
Department of Materials Science & Engineering
Boise State University
1910 University Drive
Boise, ID 83725

Dear Darryl,

I am writing as a representative of regional industry to express my support for the proposed PhD program in Materials Science at Boise State University. My employer, Ceramatec, provides benefits to our region through commercialization of innovative technologies, such as fuel cells, batteries, membrane technologies, components for energy efficient fuel conversion processes, etc.. We rely heavily on staff with advanced degrees, including PhD degrees, and support regional hiring. After serving on the Industrial Advisory Board for the Department of Materials Science, at Boise State University, and recently reviewing a summary of your plans to initiate a PhD program, I am thoroughly convinced that this program would be a huge asset in the economic development of the region. Furthermore, I feel that a PhD program will be an additional incentive to retain and attract quality faculty members and that this will further benefit undergraduate and Master's degree students, who will be able to contribute significantly to the region's welfare also. Therefore, it is without hesitation that I offer my support for your proposal and sincere wishes for its success.

If I can be of any further assistance, please don't hesitate to contact me.

best regards,

Charles Lewinsohn

Project Manager, ITM Oxygen
Ceramatec, Inc.
Salt Lake City, UT 84119

SUBJECT

Higher Education Research Council Appointments

REFERENCE

August 2010	Board appointed Michael J. Scott and Haven Baker to the Higher Education Research Council for three (3) year terms.

APPLICABLE STATUTE, RULE, OR POLICY

Idaho State Board of Education Governing Policies and Procedures, Section III.W., Higher Education Research Council Policy

BACKGROUND/DISCUSSION

The Higher Education Research Council (HERC) is responsible for implementing the Board's research policy and provides guidance to Idaho's four-year public institutions for a statewide collaborative effort to accomplish goals and objectives set forth in Policy. HERC also provides direction for and oversees the use of research funding provided by the Legislature to promote research activities that will have a beneficial effect on the quality of education and the economy of the State. HERC's annual budget has averaged approximately $1.4 million over the past ten years.

HERC consists of the Vice Presidents of Research from Boise State University, Idaho State University, and the University of Idaho and a representative of Lewis-Clark State College; a representative of the Idaho National Laboratory; and three (3) non-institutional representatives, with consideration of geographic, private industry involvement and other representation characteristics. Terms are for three years

HERC met on November 16th, 2011 to consider recommendations to the Board for the vacant position. At this time HERC is submitting Peter M. Midgley's name to fill the vacant industry representative position.

ATTACHMENTS

STAFF COMMENTS AND RECOMMENDATIONS

The previous term for the non-institutional position expired in December of 2010. Due to the pending changes to Board Policy III. W. Higher Education Research, the appointment of the vacant position was held open. The Board approved the second reading of Board Policy III.W. at the October 2011 Board meeting.

Members of the council solicited names for the position and is forwarding Peter Midgley's name to the Board for consideration. Mr. Midgley would serve a three year term effective immediately. Staff recommends approval.

BOARD ACTION

I move to appoint Peter Midgley to the Higher Education Research Council for a three-year term, effective immediately, expiring December 2014.

Moved by_____ Seconded by_____ Carried Yes_____ No_____

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960 Broadway Avenue
Suite 250
Boise, ID 83706
Telephone 208.562.4900
Facsimile 208.562.4901

Peter M. Midgley

Direct Dial
(208) 562-4904
E-Mail
PMidgley@parsonsbehle.com

November 17, 2011

VIA U.S. MAIL & EMAIL

Tracie Bent
Chief Planning and Policy Officer
Idaho State Board of Education
P.O. Box 83720
Boise, ID 83720-0037
Tracie.Bent@osbe.idaho.gov

Re: Idaho State Board of Education - Higher Education Research Council

Dear Tracie:

Thank you for approaching me regarding the opportunity to serve on the Higher Education Research Council. I am honored to be considered for a position on the Council, and I will be delighted to serve on the Council if invited to do so.

I am enclosing a copy of my bio for your reference. Should you require any additional information, please do not hesitate to contact me. I look forward to hearing back from you, and to the prospect of working with you on the Council.

Sincerely,

Peter M. Midgley

PMM/rg

Enclosure

4813-7104-0270.1

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Peter Midgley is a registered patent attorney practicing primarily in the areas of patent prosecution, licensing and litigation. He has a degree in electrical and computer engineering, and specializes in matters involving technologies such as telecommunications, semiconductor processing, medical devices, and computer hardware and software. He counsels clients ranging from small startup ventures to large multinational corporations on a variety of intellectual property issues, with an emphasis on building value through the acquisition, maintenance, and enforcement of patent portfolios. Mr. Midgley is licensed to practice in the states of Idaho and California.

Professional Highlights

- Chairperson, *J. Reuben Clark Law Society*, Boise Chapter (2008-09)
- Chairperson, Intellectual Property Law Section, Idaho State Bar (2007-08)
- Member, *American Intellectual Property Law Association* (1999-present)
- Member, *The Federalist Society* (2000-present)

Areas of Practice:

Patent Prosecution
Patent Licensing
Patent Litigation and Appeals
IP Strategic Counseling
IP Portfolio Management

Bar Admissions:

Idaho
California
U.S. Patent and Trademark Office
U.S. Court of Appeals Federal Circuit

Education:

George Washington University Law School, Washington, District of Columbia, 1999
J.D.

Brigham Young University, 1996
B.S.
Major: Electrical & Computer Engineering

HIGHER EDUCATION RESEARCH COUNCIL

NOVEMBER 2011

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SUBJECT

Statewide Strategic Plan for Higher Education Research

REFERENCE

April 2010	The Board was provided with a summary of the Statewide Strategic Plan for Higher Education Research
October 2010	The Board was provided with an update of the progress made toward the development of the Statewide Strategic Plan for Higher Education Research

APPLICABLE STATUTE, RULE, OR POLICY

Idaho State Board of Education Governing Policies and Procedures, Section III.W., Higher Education Research

BACKGROUND/DISCUSSION

Board Policy III.W Higher Education Research recognizes the significant role science, technology and other research play in statewide economic development as well as the need for collaboration and accountability in publicly funded research, to this end, the Higher Education Research Council(HERC) is assigned the responsibility of directing and overseeing the development, implementation, and monitoring of a statewide strategic plan for research. The Statewide Strategic Plan for research will assist in the identification of general research areas that will enhance the economy of Idaho through the collaboration of academia, industry, and/or government.

In an effort to accomplish this objective, the Vice Presidents for Research of the University of Idaho, Boise State University and Idaho State University were charged with developing a Statewide Strategic Plan for Research. The Research Plan has been completed and was submitted to HERC for review and approval at their November 16th, 2011 meeting. HERC has accepted the Statewide Strategic Plan for Higher Education Research and is presenting it to the Board for approval.

The plan represents the role Idaho's research universities will play in driving innovation, economic development, and enhancing quality of life in Idaho through national and internationally lauded research programs in strategic areas. The plan identifies areas of strength among Idaho's research universities; identifies research challenges and barriers facing universities; includes research opportunities Idaho should capitalize upon to further build its research base, and includes steps for achieving the research vision for Idaho's universities.

IMPACT

Investing in the state's unique research expertise and strengths could lead to new advances and opportunities for economic growth and enhance Idaho's reputation as a national and international leader in excellence and innovation.

ATTACHMENTS

Attachment 1 - Statewide Strategic Plan for Higher Education Research — Page 3

STAFF COMMENTS AND RECOMMENDATIONS

The plan will be monitored annually and updated as needed. The Higher Education Research Council will report to the Board annually on the progress made toward meeting the plans goals and objectives.

Board staff have reviewed the plan and recommend approval.

BOARD ACTION

I move to approve the Statewide Strategic Plan for Higher Education Research as submitted.

Moved by _____ Seconded by _____ Carried Yes_____ No_____

Five Year STRATEGIC RESEARCH PLAN FOR IDAHO HIGHER EDUCATION (2012-2016)

Richard Jacobsen
Executive Director of Research and Technology Transfer
(Interim Vice President for Research)
Idaho State University

John K. McIver
Vice President for Research and Economic Development
University of Idaho

Mark J. Rudin
Vice President for Research
Boise State University

EXECUTIVE SUMMARY

Research is being increasingly acknowledged by industry, government and education as a key factor in the future economic vitality of Idaho. The universities and colleges of Idaho's system of higher education understand the need for greater collaboration in order to be competitive in today's global environment. The vice presidents of research also recognize the need to focus on and emphasize existing strengths and opportunities in Idaho's research community. They developed the following statewide strategic plan for research to ensure the greatest potential for achieving a vital and sustainable research base for Idaho. The strategic plan identifies the key research areas that will become the focal points for research and economic development through partnering among academia, industry, and government in both science and technology.

Research is fundamental to the mission of a university due to its role in knowledge discovery and in providing new ideas for technology commercialization via patents, copyright, licenses, and startup companies. University faculty who engage in research and creative activity are at the leading edge of their respective fields. Research also enhances the national reputation of the faculty and the universities. These faculty and their vibrant research programs attract the best graduate and undergraduate students by providing unique, cutting-edge learning experiences in their research laboratories, studios, field sites, and classrooms. On the most basic level, research strengthens a university's primary product -- innovative, well-educated students ready to enter a competitive workforce.

Research is the foundation of a university's economic development role. The influx of research dollars from external grants and contracts creates new jobs at the university, along with the attendant purchases of supplies, services, materials and equipment. The results of the research are new knowledge, new ideas, and new processes, which lead to patents, startup companies and more efficient businesses.

Idaho's research universities have strengths and opportunities for economic development in 1) Energy, 2) Natural Resource Utilization and Conservation, 3) Biosciences, 4) Novel Materials and 5) Software Development. By focusing collaborative efforts in these areas, the research universities will expand research success, public-private partnerships and the overall economic development of the State. Specifically, this collaboration:

- will increase the focus among Idaho universities and colleges on areas of strengths and opportunities;
- create research and development opportunities that build the relationship between the universities and the private sector;
- contribute to the economic development of the State of Idaho;
- enhance learning and professional development through research and scholarly activity; and
- build and improve the research infrastructure of the Idaho universities to meet current and future research needs.

This Statewide Strategic Research Plan for Idaho Higher Education is a tool for identifying and attaining quantifiable goals for research and economic growth and success in Idaho. The plan will be reviewed and updated annually as needed amid the fast-changing pace of research discovery.

VISION

Idaho's public universities will be a catalyst and engine to spur the creation of new knowledge, technologies, products and industries that lead to advances and opportunities for economic growth and enhance the quality of life of citizens of Idaho and the nation.

MISSION

The research mission for Idaho's universities is to develop a sustainable resource base by:

- identifying, recruiting and retaining top faculty with expertise in key research areas;
- building research infrastructure including facilities, instrumentation, connectivity and database systems to support an expanding statewide and national research platform;
- attracting top-tier students to Idaho universities at the undergraduate and graduate levels, and providing outstanding education and research opportunities that will prepare them to excel in future careers;
- raising awareness among state, national and international constituencies about the research excellence and capabilities of Idaho's universities by developing and implementing targeted outreach, programs and policies; and
- collaborating with external public, private, state, and national entities to further the shared research agenda for the state, thereby promoting economic and workforce development and addressing the needs and challenges of the state, region and nation.

GOALS

1. Goal - Increase research collaboration among Idaho universities and colleges to advance the areas of research strengths and opportunities.
   a. Objective – Ensure the growth and sustainability of the Center for Advanced Energy Studies (CAES).
      i. PM – Amount of ongoing state funding received annually at each of the universities to support CAES activities.
      ii. PM –Number of graduate degrees resulting from CAES-related activities each year.
      iii. PM – Annual expenditures derived from external funds on CAES activities.

b. Objective – Expand joint research ventures among the state universities, including EPSCoR and Institutional Development Award (IDeA) related programs.
   i. PM – Number of collaborative, sponsored proposals submitted.
   ii. PM – Number of collaborative, sponsored projects awarded.

c. Objective – Create joint and coordinated hires (faculty, staff, and graduate students) among the state universities.
   PM – Number of joint hires.

2. Goal – Create research and development opportunities that strengthen the relationship between the state universities and the private sector.
   a. Objective – Leverage facility use between the state universities and private sector.
      PM – Number of university/private sector facility use agreements (in both directions).

   b. Objective – Increase the number of sponsored research projects involving the private sector.
      i. PM – Number of proposed sponsored projects with private sector.
      ii. PM – Number of awarded sponsored projects with private sector.

   c. Objective – Encourage the exchange of ideas between the universities and the private sector.
      i. PM – Number of student internships.
      ii. PM – Number of faculty conducting research in external facilities.
      iii. PM – Number of private sector personnel conducting research in residence at university facilities.
      iv. PM – Number of joint university/industry workshops.

3. Goal – Contribute to the economic development of the State of Idaho.
   a. Objective – Increase the amount of university-generated intellectual property introduced into the marketplace.
      i. PM – Number of technology transfer agreements.
      ii. PM – Number of invention disclosures.
      iii. PM – Number of non-disclosure agreements.
      iv. PM – Number of patent filings.
      v. PM – Number of issued patents.
      vi. PM – Amount of licensing revenues

   b. Objective – Increase the number of university start-up companies.
      i. PM – Number of start-up companies
      ii. PM – Number of jobs created by startup companies

4. Goal – Enhance learning and professional development through research and scholarly activity.
   a. Objective – Increase the number of university and college students and staff involved in sponsored project activities.
      i. PM – Number of undergraduate students supported by sponsored projects

   ii. PM – Number of graduate students supported by sponsored projects
   iii. PM – Number of faculty and staff involved in sponsored projects
b. Objective – Increase the dissemination of research findings.
   i. PM – Number of peer-reviewed publications (students and faculty).
   ii. PM – Number of theses and dissertations.
c. Objective – Increase the number of K-12 students involved in STEM education.
   i. PM – Number of STEM events promoting research-related activities.
   ii. PM – Number of K-12 students involved in research presentations and instruction.

5. Goal – Enhance the research infrastructure of the Idaho universities to meet current and future research needs.
   a. Objective – Increase the infrastructure necessary to enhance research and collaboration.
      i. PM – Number of proposals targeted for research equipment, facilities, and services.
      ii. PM – Number of awards for research equipment, facilities, and services.
      iii. PM – Amount of space dedicated to research
   b. Objective – Coordinate and create efficiencies in university research administration across the state.
      i. PM – Number of efficiencies identified.
      ii. PM – Number of efficiencies implemented.

RESEARCH OPPORTUNITIES

Idaho's research universities have developed statewide strengths in strategic research areas that have great potential to drive future economic growth and success. The criteria used to select these areas include: number of faculty and qualifications; peer-reviewed publications and impact; infrastructure (facilities, equipment, information technology, staff); external grant and contract funding; academic programs; student involvement; potential benefit to the State; and technology transfer activity, including patents, licenses, and startup companies. By *focusing* collective research efforts and resources in these areas, the universities will be on the most efficient and effective route to research success and state-wide economic development. These high impact areas include 1) Energy, 2) Natural Resource Utilization and Conservation, 3) Biosciences, 4) Novel Materials, and 5) Information Management and Software Development.

Energy: Energy is a critical driver of any economy. The projected increases in the population of the world and increases in the standard of living will produce severe strains on the ability to meet the demands of the next few decades. In addition, finite reserves of fossil fuels and pollution from their combustion requires that alternative sources of energy production be developed. The combination of natural resources in Idaho and presence of the Idaho National Laboratory makes energy a natural area of emphasis. Indeed, the three universities with research capabilities already have extensive research projects in this area. The Center for Advanced Energy Studies is an example of the significant investment the three universities and the Idaho National

Laboratory have made to develop expertise in nuclear engineering and safety, biofuel production from dairy waste, geothermal exploration, carbon sequestration, energy policy, and energy efficient structures. Intellectual property has already been generated from these products and is licensed. Further growth in these areas not only takes advantage of the strong base but strongly supports economic development through new markets for new product development

Natural Resource Utilization and Conservation: In the broad field of natural resource utilization and conservation, Idaho's universities have expertise in water resources, agriculture, forestry, recreation, and geophysics and geochemical detection and monitoring of groundwater pollutants. For example, university geologists, ecologists, and policy experts are collaborating on broad-ranging research projects that examine and predict the impact of climate change on Idaho's water resources. As water is essential to agriculture, recreation, the ecosystem, and human health, the universities have research strength in an area of tremendous societal and economic impact. Agriculture remains an important part of the economy of Idaho. Development of new plant varieties with improved resistance to disease and climate change remain an area of importance as does the development of new feeds for domestic fish production. The often competing demands for preservation and exploitation put on the environment require understanding of the various ecosystems in the state and region as well as societal and economic impacts of policy decisions. The future economic success of the state will rely on a deep understanding of these processes.

Biosciences: Idaho universities have established research programs in several areas of the biosciences. These include selected areas of cell signaling and bioinformatics. While these areas of expertise contribute to the basic understanding of processes in living systems, they are applied to a wide range of living systems—extending from humans through wild and domestic animals and fish to plants. Human health is an important element of these programs, with research occurring in cancer as well as genetic and pathogenic diseases. Research on non-human living systems involves animal disease, improving food production and methods for mitigating climate variability. These studies address many of the challenges facing humanity not just in Idaho but also in the nation and the world. Results can lead to new treatments for human diseases, increased food production and safety, and preservation of the natural environment.

Novel Materials: The global materials industry is worth an estimated $550 billion, conservatively. Materials revolutionize our lives by offering advanced performance and new possibilities for design and usage. For example, the market for biocompatible materials has grown from a few to $60 billion in the past decade. Market size is growing for materials in emerging areas such photonic materials, electronic and dielectric materials, functional coatings, and green materials. Materials research in Idaho is conducted by a wide range of scientists in diverse fields. Current materials researchers in Idaho cover a broad spectrum of specializations, including semiconductor device reliability, microelectronic packaging, shape memory alloys, DNA machinery, environmental degradation, materials for extreme environments, biomaterials and bio-

machinery, materials characterization, and materials modeling. Nanoscale materials and devices, functional materials and their uses and materials for energy applications are a focus of research throughout the state. These areas of research are highly synergistic with local industries and the Idaho National Laboratory (INL). Access to materials characterization equipment and processing laboratories has resulted in collaborations with small businesses and start-up companies.

Information Management and Software Development: Device control and information management are an essential part of 21st century life and, therefore, are an important part of educational requirements. For instance, large amounts of sensitive data are collected, processed, and stored electronically but must be accessed and moved in order to have any impact. In fact, many systems are computer controlled through networks. These include such things as the electric transmission grid and transportation in major cities. The universities are beginning to develop research expertise in software development and data management lifecycle design and operations and secure and dependable system design and operations. This area provides a significant area of opportunity for economic development in Idaho as well as for improving the global competitiveness of the United States. There are already a significant number of firms in Idaho whose interests are in software development for device control, information management and processing. In addition, many of the major research projects being undertaken in the region by various state and federal agencies as well as the universities require the handling of significant amounts of data in a secure and dependable fashion. Each university has some expertise in this area but not a critical mass. Currently, research funding in the universities from private and governmental sources is limited by the number of qualified personnel. In addition, within Idaho there is a high demand for graduates at all levels in computer science.

EXTERNAL FACTORS: IDAHO RESEARCH ADVANTAGES AND CHALLENGES

Research Advantages

The Idaho National Laboratory (INL) and the Center for Advanced Energy Studies (CAES): Idaho is fortunate to be home to the Idaho National Laboratory, one of only 20 national laboratories in the U.S. The INL's unique history and expertise in nuclear energy, environmental sciences and engineering, alternative forms of energy, and biological and geological sciences and related fields provides an excellent opportunity for research collaboration with Idaho's university faculty in the sciences, engineering, business and other fields.

CAES established at the request of the U.S. Department of Energy, is a public-private partnership that includes Idaho's research universities–Boise State University, Idaho State University, and the University of Idaho–and the Battelle Energy Alliance (BEA), which manages the INL. The CAES partners work together to create unique educational and research opportunities that blend the talents and capabilities of Idaho's universities and the INL. A 55,000 square-foot research facility in Idaho Falls supports

the CAES energy mission with laboratory space and equipment for students, faculty, and INL staff in collaborative research projects. The State of Idaho invested $3.2M in direct support of the three Idaho research universities during FY09 and FY10. During these first two years, the CAES partners won $24M in external support for CAES research that has contributed to both scientific advances and economic development in the state and region.

Natural Resources: Idaho's beautiful natural resources are well known to fishermen, hunters, skiers, and other outdoor enthusiasts. Through its rivers, forests, wildlife, geological formations, and rangelands, Idaho itself is a unique natural laboratory for geological, ecological, and forestry studies. Idaho is home to some of the largest tracts of remote wilderness in the lower 48 states. In addition, the proximity of Yellowstone National Park and the Great Salt Lake provide additional one of a kind opportunities for ecology and geology research.

Intrastate Networks: The existing networks within the state, including agricultural extension services and rural health networks, provide a foundation for collecting research data from across the state, and rapidly implementing new policies and practices as a result of research discoveries.

Coordination Among Universities In Advancing Research and Economic Development (technology transfer): By and large the research universities continue to coordinate and share their technology transfer and economic development activities. This not only increases each university's competitiveness at the national and state level but also decreases the costs for achieving a particular goal.

Research Challenges

Economy: The current economic recession is the most severe downturn most of us have seen in our lifetimes. The immediate effects of this recession on university research are state-wide budget cuts, with results that include hiring freezes, loss of university faculty and staff, higher teaching loads for faculty (with correspondingly less time for research), and delayed improvements in research infrastructure, including major equipment.

However, it is not only the current recession which threatens Idaho university research. Idaho has relatively few industries, and seems to attract fewer new companies and industries than other states. When one major sector suffers, as agriculture is at the present time, the entire state suffers. As state institutions, the research universities suffer. Over time, a relatively slow state economy leads to at least two problems: 1) recruitment and retention of faculty, who go to institutions offering higher salaries, more startup money, and better infrastructure; and 2) aging infrastructure, keeping Idaho researchers behind their national peers in terms of having the most up-to-date facilities and equipment. Without proper infrastructure, Idaho research faculty is at a distinct disadvantage in competing with peers across the nation for federal grants.

Competition from Other Universities: In research, university faculty competes nationally for grant funds from federal agencies such as the National Science Foundation, Department of Energy, and the National Institutes of Health. Many other universities are well ahead of Idaho's universities in terms of state funding per student, patent royalty income, endowments, etc., and are able to move ahead at a faster pace, leaving Idaho universities further behind as time goes on.

University Culture: Each of Idaho's research universities aspires to greater levels of achievement in research and creative activity, and to emphasize economic development outcomes along with success in basic and applied sciences, engineering and other scholarly pursuits. It is expected in the future that faculty at each of the universities will be rewarded in annual performance reviews for invention disclosure, entrepreneurial engagement, outreach activities and interdisciplinary research along with the traditional value placed on archival publication and external research funding. There is world-class research in Idaho that is recognized on national and international levels in selected fields of endeavor. This is increasing with new research-active faculty hires at each institution. There are some cultural differences among faculty manifested by discomfort with change aimed at increasing research volume making Idaho's universities more nationally competitive. These concerns often lessen as faculty from the various universities, private sector professionals and national laboratory staff work together in collaborative research and related instruction in state-of-the-art activities.

Vastness of State and Distances Between Schools: Although the distances between the research universities is not much different from those in other western states, the topography of Idaho increases the time and cost required for travel well beyond those experienced in other states. This fact discourages collaborations between faculty members and administrators at the different research universities as well as between universities and other entities within Idaho. Although video conferencing can alleviate this problem, there is limited capability at each university. There is also the continuing problem of finding funds to pay for the necessary connectivity between the universities as well as to the world outside of Idaho.

Data Issues: There is very little long-term, quality data available on the research enterprise or economic development. The data that exists are scattered among various entities in a variety of formats thus make it hard to centralize and use. Furthermore, there is no one entity responsible for collecting, analyzing and dispersing it. This is also true for many of the sectors that will strongly influence the future economic impact of Idaho. While there are large amounts of data that have been collected on watersheds, forests and agricultural operations and the environment—to name a few—they are distributed across a number of agencies and individuals within those agencies. Worse yet, much of this information is lost every time a researcher retires.

Private Sector Support: Idaho has very little high-technology industry within its borders. This reduces the potential for developing an applied research initiative within the universities that, in many states, provides one important arm of economic

development and technology transfer. This also means that it is much harder to develop those private/public partnerships that provide the universities with additional capital to construct research are technology transfer facilities. Idaho's relatively small population of 1.6 million people limits the potential tax revenue for support public institutions, but improves participation in research surveys and hearings for establishing public opinion.

Fragmented Economic Development Initiatives: There are seemingly too many economic development initiatives in Idaho and they are not well coordinated. It is imperative that state, university, and community initiatives work together toward common and agreed to goals. As it is, little progress is being made towards developing an economic strategy for the state that includes the research universities and little money has been secured to drive the economic development process. In fact, it is not uncommon to find that different entities in Idaho are competing against each other.

National and International Recognition: While each Idaho research university has faculty members that can successfully compete on the national and international scene for research funds, no one university has the necessary reputation, breadth of faculty expertise or facilities to compete for the large projects that are necessary to establish a national or international reputation and substantially grow its research funding.

Lack of Diversity: The population of faculty, staff and students at each of the three research universities, like that of the State, is fairly homogeneous. This lack of diversity—be it cultural, socio-economic or ethnic—hurts the universities and surrounding communities in several different ways. First, it makes recruitment of students, faculty and staff from under-represented groups more difficult. Second, it is noted on accreditation reports and, as such, is a negative reflection on the institution. Finally, it limits the competitiveness of the university in several federal agencies where plans for including under-represented groups in the program are a key element of the proposal.

ON-LINE CONTENT AND CURRICULUM GOVERNANCE

SUBJECT

On-line Course Governance as it relates to Idaho Education Network (IEN), and Idaho Digital Learning Academy (IDLA).

APPLICABLE STATUTE, RULE, OR POLICY

Section 67-5745D, 67-5745E Idaho Code
Sections 33-5504, 33-5505, Idaho Code
Section 33-1627, Idaho Code
Section 33-107, Idaho Code

BACKGROUND/DISCUSSION

The Idaho Legislature established the Idaho Education Network (IEN) as a means to provide better bandwidth to public schools and coordinate a statewide telecommunication distribution system for distance learning for public schools which would include two-way interactive video, data, Internet access, and other telecommunications services for providing distance learning. The IEN would also coordinate connections to each institution of higher education and other locations as necessary to facilitate distance education, teacher training and other related services (§67-5745D(2)).

Oversight for IEN is provided by the IEN Program and Resource Advising Council (IPRAC) made up of 13 members including; chairman, superintendent of public instruction; vice chairman, director of the department of administration; chief executive officer of Idaho Digital Learning Academy (IDLA); two individuals representing public and higher education appointed by the superintendent of public instruction; two individuals representing the private sector appointed by the superintendent of public instruction; the chairman of the Senate education committee; chairman of the House of Representatives education committee; and four member from the joint finance-appropriations committee (§67-5745E(1)).

Section 67-5745E(4), Idaho code states IPRAC will implement a three (3) phase plan that will connect each public high school with scalable, high-bandwidth connection, including connections to each institution of higher education and the Idaho Digital Learning Academy in phase one (1). Provide each public high school with high bandwidth connectivity, Internet access and equipment with at least one two-way video classroom in phase two (2). Evaluate and make recommendations to the legislature for connectivity to each elementary and middle school, additional libraries, and the migration of state agency locations from current technology and services in phase three (3).

Section 33-5502, Idaho Code created the Idaho Digital Learning Academy in 2002. Section 33-5505, Idaho Code defines IDLA as an on-line educational program organized as a fully accredited school with statewide capabilities for

delivering accredited courses to Idaho resident students at no cost to the student unless the student enrolls in additional courses beyond fulltime enrollment. Services are provided to students through their respective local school district or directly if there is not current public school affiliation. IDLA provides high-quality public school education, aligned with state achievement standards and standard based student-centered training and professional development for students and teachers statewide.

Section 33-1627, Idaho code allows for, beginning with the 2012-2013 school year, parents and guardians of secondary students to enroll their student, with or without permission of the school district, in on-line courses provided that the on-line course provider is accredited by an organization that accredits Idaho high schools, or is recognized by an organization that accredits Idaho high schools; the State Department of Education (SDE) has verified that the teacher is certificated by Idaho and is qualified to teach the course; SDE or IDLA has verified that the course meets state content standards; and the parent or guardian registers the student for the course through the school that will be transcribing the credit. Those courses that are taken outside of the school's normal schedule are the responsibility of the parent or guardian to pay for while those that are taken as part of the student's normal school schedule will be paid for by the school district as outlined in section 33-1002A, Idaho code.

Additionally, at the November 3, 2011, Special Board Meeting the Board approved the pending rule requiring students who will be graduating in 2016 to take two on-line learning credits. One of which must be an on-line, asynchronous course, the second credit may be either an on-line course or hybrid course. On-line courses must meet the state content standards, approved by the Board, and be taught by a teacher with an appropriate Idaho certificate.

Given the anticipated influx of on-line courses in the k-12 system and the growing number of on-line courses in the postsecondary system and the large number of entities involved in on-line courses there is opportunity for a statewide systematic approach to assure quality and accountability for on-line courses provided to students within Idaho's K-20 educational system. As the entity responsible for the general supervision, governance and control of all state education institutions and the public school system, the Board is positioned as the lead agency in this endeavor.

During the Instruction, Research, and Student Affairs (IRSA) Committee Meeting held November 17, 2011, the matter was discussed and IRSA tasked the Executive Director to form a taskforce or committee to determine the appropriate parties and bring back a recommendation to the Board regarding the best process for assuring coordination of the entities involved and for quality and accountability for on-line courses.

STAFF COMMENTS AND RECOMMENDATIONS

IEN was charged by the legislature to build an infrastructure within the state for telecommunications, distance learning, two-way interactive video, data and Internet access. While IDLA is only one possible provider for on-line courses within the state, they are a governmental entity accountable to the state with a proven track record of providing quality, standard based, on-line courses to students within the state. In addition to IDLA, school districts may develop their own on-line courses or use private providers to provide on-line courses to their students. Given the growing number of courses that are likely to be taken from a variety of sources over both the IEN or locally provided Internet access, as well as the growth of dual credit offerings it would seem prudent at this time to discuss the need for coordination.

Many of the conversations regarding on-line courses have also included dual credit courses or the possibility of our public postsecondary institutions providing secondary on-line courses. It is important to note that while some on-line courses are also dual credit courses the majority of the dual credit courses taken by students within the state are not on-line courses. In order for postsecondary instructors to be eligible to teach (non-dual credit) classes at public schools, whether on-line or in person, they must obtain a postsecondary specialist certificate as outlined in IDAPA 08.02.02.032. A postsecondary instructor teaching postsecondary courses (dual credit), on-line or in person, does not need to be certificated to teach secondary students.

BOARD ACTION

This item is for informational purposes only. Any action will be at the Board's discretion.

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