Form 1

<div align="center">

COVER SHEET
NEW DEGREE PROGRAM PLANNING NOTIFICATION OF INTENT
(PLANNING NOI)

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Program Information

Program Name: Industrial & Systems Engineering

Institution Name: University of Washington

Degree Granting Unit: College of Engineering
<div align="center">*(e.g. College of Arts & Sciences)*</div>

Degree: Master of Industrial and Systems Engineering   Level: Masters   Type: Engineering
              (e.g. B.S. Chemistry)   *(e.g. Bachelor)*   *(e.g. Science)*

Major: Industrial and Systems Engineering (ISE)   CIP Code: 14.3501
              (e.g. Chemistry)

Minor:
              (if required for major)

Concentration(s):   N/A
                          (if applicable)

Proposed Start Date: Autumn Quarter 2012

Projected Enrollment (FTE) in Year One: 12   At Full Enrollment by Year: 2016 ; 20
                                                  (#FTE)   *(# FTE)*

Proposed New Funding: $488,700

Funding Source: ☐   State FTE   ☒ Self Support   ☐   Other

Mode of Delivery / Locations

☒ Campus Delivery   Blended program—Seattle Campus
                                          (enter locations)

☐ Off-site
                          (enter location(s))

☒   Distance Learning   Blended program—UWEO/Edge
                                          (enter formats)

Substantive Statement of Need

Attach sheet

Contact Information (Academic Department Representative)
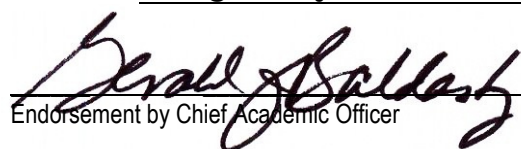
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_____   November 14, 2011
Endorsement by Chief Academic Officer   Date

Planning Notice of Intent for
Master of Industrial and Systems Engineering (MISE)

"….with the growing interdependence between technology and the economic and social foundations of modern society, there will be an increasing number of opportunities for engineers to exercise their potential as leaders." National Academy of Engineering 2010

Overview and Rationale

While certain basics of engineering will not change, the way engineers work will change. To be successful, the future engineer must have an enhanced skill set beyond their core body of knowledge. Engineers must also have the capacity to lead and innovate within an environment of complex global change. The most sought after engineering professional today has both technical and leadership credentials. Employers seek engineers who can lead the process of change and have the ability to complement technical knowledge with non-traditional engineering skills such as systems engineering and technical management and leadership.

The forecasted growth in market demand for masters-level engineers, who combine core and non-traditional skills cast in the context of global change, will spawn a corresponding increase in the number and variety of masters programs that seek to satisfy these needs. Those prospective master's degree students are engineers, scientists, and mathematicians (i.e. professionals in STEM fields) who already have professional jobs, and who want to pursue a master's program without leaving their employment. To that end, it is our goal to provide a *distance-based, part-time terminal graduate engineering degree*, a Master of Industrial and Systems Engineering, which emphasizes leading-edge engineering skills by providing a spectrum of courses, concentrations and certificate options. Taken together, a graduate of the program will gain

- inter-disciplinary skills that enable them to work successfully within and outside technical departments,
- systems-based approaches that can be used in any complex application,
- enhanced decision-making, leadership and management capabilities, and
- experience with multidisciplinary and virtual teams doing project-based work.

Attributes of the 2020 Engineer:
- Strong analytical skills
- Practical ingenuity
- Creative
- Good communicator
- Knowledge of business & management
- Leadership ability
- Professional
- Ethical
- Flexible
- Lifelong learner

Source: National Academy of Engineering Report, *Educating the Engineer of 2020*

These outcomes for the MISE degree align well with the attributes necessary for future engineers (see box). The knowledge gained from this program will enhance a student's technical skill set so that they can work seamlessly across disciplines in their organization. The proposed degree differs from the ISE department's current Master of Science in Industrial Engineering (MSIE) which is a 41-credit hour program intended for students pursuing full-time education on their way to earning a PhD. The proposed MISE degree has different admission requirements, graduation requirements, academic emphasis, and audiences.

Program Description

The MISE program has two primary goals: 1) to develop systems engineering skills, and 2) to build strategic management skills, particularly those associated with technical leadership in an increasingly complex manufacturing and service system environments.

The program is anchored around systems engineering, because the systems engineer has become a valued position. Companies and organizations around the world rely on systems engineers for their ability to look at the larger picture and take into account how factors such as technology, the environment, engineering, management, risk, quality and research contribute to the overall success or failure of a product or service. The systems engineer has both the expertise of selecting the right technical solution within a project's cost and schedule constraints and an understanding of the system and its technical complexity. Systems engineering is a valuable discipline for master's level study because engineers from all fields will typically find themselves deeply involved in designing and implementing complex systems at some point in their career. Master's level study in this area can support their career goals and give them tools for continued improvement of professional skills. The curriculum blends a systems engineering approach with business fundamentals and quantitative methods in a practical, problem solving framework.

Our target student population will be engineers with at least 2 years of work experience in a technical environment who are seeking an advanced degree to further their employment opportunities. A series of UWEO certificate-based concentrations are currently offered (or in development), and these programs will be used as a mechanism to attract students to the MISE. Proposed concentrations include:

- Global Integrated Systems Engineering (established)
- Engineering Leadership (established)
- Engineering Entrepreneurship (future, Spring 2012)
- Health Systems and Public Policy (future, Fall 2012)
- Six Sigma Methodology (future)

The proposed Master of Industrial and Systems Engineering program is 39 credit hours and will follow the UW academic schedule. Courses will have both distance and campus students enrolled and be delivered over the Internet via live streaming video (classes are archived online for review and easy access). To earn the degree, a student must complete (see the table below for the specific courses that satisfy these requirements):

- One applied math course,
- One management course,
- One capstone course,
- 21 additional graded course credits in INDE courses (500 level or above), and
- 9 graded course credits of approved technical electives. An approved elective list is maintained by the academic advisor.

The electives may be used to pursue areas that are of interest to the student. For example, once admitted to the MISE program, a student may not earn a UWEO certificate. However, a student may take the courses in that concentration to gain that body of knowledge (and those credits would apply toward their degree). Existing and planned courses that meet the above graduation requirements include:

Course [Prefix: INDE] (credits)	Applied Math	Management	Capstone
595 GISE (13)		X	X
581 Navigating the Business Environment (3)		X	
582 Technical Leadership (3)		X	
583 Decision Analysis in Engineering (3)	X		
584 Project Performance (3)		X	
599 Tech Entrepreneurial Enterprise (3)		X	
5XX Management Science in Health Care I	X		
5XX Management Science in Health Care II	X		
5XX Health Systems Project			X
5XX Applied Regression Analysis	X		
521 Quality Control (3)	X		
524 Design of Experiments (3)	X		
5XX 6σ Methodology	X		
5XX 6σ Project			X
599 Intro to Optimization Models (3)	X		

In addition, ISE will regularly offer other courses via Edge that would apply toward the degree. An aggressive plan of study to complete the degree in 2.5 years is:

Year	Autumn	Winter	Spring	Summer
1	INDE 595-GISE (6)	INDE 595-GISE (4)	INDE 595-GISE (3)	INDE 584-Proj Perf (3)
2	INDE 581-Nav Bus (3)	INDE 582-Tech Ldr (3)	INDE 583-DA (3)	
	Elective (3)	INDE 521-Qual (3)	INDE 599-Entrep I (3)	
3	INDE 599-Opt Mod(3)			
	INDE 524-DOE (3)			

Related Masters Degrees

At the UW, the department's MSIE (briefly described above) is the most closely related degree. There are no other 'pure' Master's degrees in either systems engineering or engineering management (as in other academic institutions). Besides the MSIE, the most similar option is the pursuit of an MBA which lacks the systems engineering context of the proposed MISE, focuses on advanced management skills and can be cost prohibitive. As stated above, the proposed degree program is for students who are looking for a distance-based, part-time terminal graduate ISE degree that emphasizes systems engineering and technical leadership. Unlike a traditional MBA, this program teaches relevant managerial skills than enhance a students' technical skills. In addition, compared to a traditional research-based graduate degree in industrial and systems engineering, the proposed degree offers practical business perspective needed by systems engineers and engineering managers.

After a close examination of the universities within the state of Washington, we have determined that there is no equivalent degree program at either the undergraduate or graduate level at any other Washington state college or university.

UW Industrial & Systems Engineering offers degrees for both undergraduates and graduates, with robust programs for B.S.I.E., M.S.I.E., and Ph.D. degrees to prepare students for successful careers in the field. ISE graduates from UW are in high demand from local, state, national and international sources, at all three degree levels The graduate program stands 23rd among industrial engineering programs offering a doctoral degree in the 2008 *US News and World Report* rankings.   The M.S.I.E. program has strong demand from both students and employers. The local entrepreneurial culture combined with Seattle's location on the Pacific Rim, makes UW IE uniquely poised to continue taking advantage of global initiatives and opportunities.

The demand for graduates from the department reflects the breadth of interests of IEs. The manufacturing sector, including large and small companies, continues to recruit and hire ISE's graduates. This includes companies like Boeing, Intel, Philips and Fluke. However, an equal demand is in service industries and companies like UPS, Microsoft, T-Mobile, and Starbucks, which also hire ISE's graduates. There is also a continuing demand for ISE graduates in consulting firms that specialize in process improvement activities, such as Accenture. Additionally, IE graduates are beginning to be recruited for both small entrepreneurial firms and in the emerging healthcare industry.

There are online systems engineering degrees at other top schools including Penn State, Georgia Tech, Cornell, and the University of Southern California.   There are online engineering management degrees at Purdue, Northwestern, Penn State, and John Hopkins. However, we did not find one professionally-oriented master's degree that combined both systems engineering and engineering leadership & management in one degree.

Need for the Degree

In 2008, the National Council on Competitiveness outlined an agenda for the U.S. that included not just producing more engineers and scientists, but the need to foster and develop the "entrepreneurial, creative, and interdisciplinary talent" of students in these programs. As manufacturing becomes more integrative and global, industrial and systems engineers are focused more on the service industry. "The service sector requires workers with a more complex and creative skill set – including problem solving, communications, entrepreneurship, computational analysis, collaboration and team work." More companies are striving to maintain an edge by continuous innovation and effective management. Companies want people with technical depth and business breadth with the ability to speak both languages.

The U.S. Department of Labor projects that over the next decade the demand for industrial and systems engineers will rise 14%, faster than average for all occupations. In 2008, ISEs were the third highest employed engineers behind only civil and mechanical engineers.

Washington State has one of the best educated workforces in the nation. But according to the *2011 Key Facts about Higher Education in Washington* report by the Higher Education Coordinating Board, "Washington is importing college-educated workers to meet demand. The number of graduate and professional degree holders from outside the state actually exceeded the number of earned degrees at Washington institutions." The report goes on to state that, "Washington's reliance on out-of-state-

workers may be due in part to a scarcity of educational opportunities for native Washingtonians to earn degrees in the state within key employment disciplines." (pg. 82)

In 2009, Washington continued to see the largest gaps between employer demand and graduate degrees granted in "science, technology, engineering, and mathematics (STEM) disciplines, and in health sciences including engineers, computer science, and medical professions." (*A Skilled Workforce*, HEC Board, page 12). "In relative terms, the largest gaps for supply and demand are found for industrial, environmental, civil, and aerospace engineers, where current production is less than half of forecast demand." (pg. 19)

According to *U.S. News and World Report*, Engineering Management (embodied in the degree) is a "smart choice" where students gain "technical know-how plus management skills in this discipline, which is rapidly gaining popularity among business-savvy engineers who want a shot at consulting or administrative positions." (http://www.usnews.com/education/articles/2010/04/15/engineering-schools-tips-and-stats?goback=.anh_1963273).

Based on a unique "blended learning" format that combines traditional teaching with group learning, and distance education, the new degree will fill a significant gap in the higher education offerings for working engineers. The format will appeal to practicing engineers because it fits how they work. Students will progress through the degree at their own pace.

Earning a graduate degree in Industrial and Systems engineering that emphasizes engineering leadership & management and systems engineering will make an engineer even more valuable. Feedback from the ISE industrial advisory board bears this out:

- "The proposed degree really draws on a niche market without a lot of other opportunities."
- "The program allows you to pace yourself, take classes when they fit in your schedule, and work your way through based on time and the funds you have available."
- "Everyone here at UPS loves the certificate programs and how they can lead to a degree."
- "The MBA program doesn't offer part-time programs or distance learning and the focus isn't business within an engineering environment."

Finally, the ISE department believes that the proposed degree will enable us to capture the demand that our current MSIE does not. ISE has offered the Global Integrated Systems Engineering (GISE) certificate program 4 times and had an average enrollment of 21 students (~90% fee-based, 10% state-based) per year. We have offered the Technical Leadership certificate program twice and had an average enrollment of 17 students per year.

Preliminary Budget

The budget projections are based on an annual offering of 13 courses per 9-month period. Most courses are 3 credits with the exception of GISE. Twelve students per course are projected. The program will be self-supported through tuition revenue. As such, a master's degree would cost $31,800 (at $795/credit). This is highly competitive with similar programs at peer institutions which charge $39,720 to $49,320. Our total annual tuition income would range from $488,700 to $908,000.

Major program expenses include teaching faculty, program administration, teaching assistants, UW/UWEO overhead costs, and scholarships. The courses in the program will be taught by current

faculty and affiliates. Of the distance courses offered in the last two years, half were taught by affiliates and the rest by department faculty. The draft budget is balanced and flexible in that it can be adjusted to meet the differing needs of the participating academic units. Revenue would be used to improve the program and surplus revenue would be returned to the ISE department. For year 1, this is projected to be $81,700; by year 5, the surplus is projected to be $280,000.