May 11, 2015

To: Dean Van Galen, Chancellor  
116 North Hall  
University of Wisconsin-River Falls

From: David P. Rainville, Chair  
Faculty Senate  
University of Wisconsin-River Falls

Re: UWRF Faculty Senate Motion 2014-15/91

At the May 6, 2015 meeting of the University of Wisconsin-River Falls Faculty Senate, motion 2014-15/91 was passed and is effective immediately. The motion is forwarded to you for your action.

A motion from the Academic Policy and Program Committee (James Zimmerman, Chair) to approve a new program in Agricultural Engineering (New Program). See attached. When this agenda was prepared, this program had not yet been approved by AP&P, but should have been approved on Monday, May 4, 2015.

Approved  
Disapproved  

Approved  
Disapproved  

Dean Van Galen, Chancellor  
Date  
5/14/15
University of Wisconsin-River Falls

Proposed Agricultural and Environmental Engineering Programs

Submitted to the University of Wisconsin System
by
Chancellor Dean Van Galen and Provost Fernando Delgado

December 29, 2014
Introduction
UWRF Engineering Program Priority/Institutional Fit

UW-River Falls (hereafter UWRF) has sought and received entitlements to plan both a Bachelor of Science in Agricultural Engineering and a Bachelor of Science in Environmental Engineering. The university sees the two programs as twinned and parallel programs that draw from the institution's academic strengths and from the strategic direction the university, particularly its College of Agriculture, Food and Environmental Sciences, is taking in building 21st century academic programs that develop student talent, address workforce needs, and create opportunities for industry-university partnerships that drive the region's economy.

The faculty from the existing Agricultural Engineering Technology [AET] program have consulted with colleagues across their college (and in particular with an eye toward those faculty members teaching in the Environmental Science and Land Use Planning programs) and with those faculty members who have had a long history of working within UWRF's existing 3+2 baccalaureate programs in physics/engineering. UWRF has a range of applied science programs in its College of Agriculture, Food and Environmental Sciences that have considerable reputational strength in and beyond the state of Wisconsin. In addition, other STEM programs—Biology, Chemistry, and Physics—have won UW System teaching awards, been identified as centers of excellence, and are among the top producers for baccalaureate degrees among UW comprehensive institutions.

In developing the engineering entitlement proposals UWRF has contracted with Hanover Research to do a number of studies exploring demand and need in engineering. Some reports, such as those for Mechanical and Systems/Industrial engineering, have
encouraged UWR to reprioritize the institution's approach to engineering programs and defer to regional partners (such as UW-Eau Claire and UW-Stout). However, the umbrella study on Biosystems Engineering encouraged the university look at the three sub-areas identified by Hanover Research: agricultural engineering, environmental engineering, and biomedical engineering. After looking at the near term need and ability/positioning of the university to respond quickly, the UWR faculty and administration identified Agricultural Engineering and then Environmental Engineering as the two key programs with which to begin. Both would draw on considerable existing curricular strengths, facilities, and faculty resources and align well with the existing and successful Bachelor of Science in Agricultural Engineering Technology as well as strong cognate programs such as Physics, Environmental Science, and Chemistry.

The preference of UWR is to move forward on both Agricultural Engineering and Environmental Engineering. If pushed, UWR would prefer to lead with Agricultural Engineering but strongly urges that both come forward as they work well together and emanate from the same programmatic base. The operating assumptions for one or both of these additions would be that it/they are embedded within the AET department, which currently is home to four engineers. The department has plans to hire a fifth engineer in a complementary area (pending Regents approval for one or both programs) in the next year, with additional hires projected as engineering programs are approved and enrollment develops. Current AET faculty members have engineering backgrounds in agricultural/water resources; mechanical engineering; agricultural/civil; and food process engineering. In addition, the university's existing resource base for pre-engineering components is in place and serving UWR students (almost exclusively as Physics majors)
who then move on to other institutions to complete the final two years of study and graduate with a UWRF Physics degree and a degree in Engineering from the relevant school, typically a high caliber research university (e.g. University of Wisconsin-Madison, University of Minnesota-Twin Cities, Washington University) that is out of state or region.

**Resource Allocation and Reallocations**

In terms of the programmatic budget, the below table shows where the AET department is presently and projects a revised budget if including the addition of Agricultural Engineering and Environmental Engineering for the 2015-16 academic year (as an example).

<table>
<thead>
<tr>
<th>Programs</th>
<th>2014 Enrollment</th>
<th>2014 S&amp;E Budget</th>
<th>2015 Enrollment</th>
<th>2015 S&amp;E Budget</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ag. Eng. Technology Enrollment</td>
<td>74</td>
<td>$26,236</td>
<td>76</td>
<td>$26,500</td>
</tr>
<tr>
<td>Agricultural Engineering major</td>
<td>0</td>
<td>0</td>
<td>15 (proposed)</td>
<td>$36,000</td>
</tr>
<tr>
<td>Environmental Engineering major</td>
<td>0</td>
<td>0</td>
<td>15 (proposed)</td>
<td>$36,000</td>
</tr>
</tbody>
</table>

As the new engineering programs grow and evolve, particularly into the upper division courses, UWRF is aware that there will be additional reallocations to supplies and equipment budgets. Table 2 below shows the incremental additions from the current state through to the addition of students projected to be served by the two engineering programs and the associated faculty, facilities, supplies, and equipment reallocations and investments needed. What the table does not show are the collateral assets (such as the Physics department instrumentation and laboratory spaces and those of the dairy/food
processing pilot plants) that support a number of programs, including the proposed engineering programs. These spaces are already part of the array of physical assets that UWRF has at its disposal and, in the case of engineering, are sufficient enough for UWRF to send many of its students through consortia programs such as the aforementioned 3/2 Physics/Engineering degrees (primarily in the areas of mechanical and electrical).

Table 2: Increased Expenses Related to Agricultural Engineering and Environmental Engineering

<table>
<thead>
<tr>
<th>Expense</th>
<th>Existing</th>
<th>Increment Projected</th>
<th>Total</th>
<th>Funding Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tenure Track Faculty, Current</td>
<td>4</td>
<td></td>
<td>4</td>
<td>Currently GPR funded</td>
</tr>
<tr>
<td>Agricultural Engineering added</td>
<td>2</td>
<td></td>
<td>6</td>
<td>Institutional reallocation</td>
</tr>
<tr>
<td>Environmental Engineering added</td>
<td>1</td>
<td></td>
<td>7</td>
<td>Institutional Reallocation</td>
</tr>
<tr>
<td>Student Enrollment</td>
<td>74 AET Majors</td>
<td>40 Ag. Engineering 40 Env. Engineering</td>
<td>80 students</td>
<td>Based on standard Wisconsin tuition and fees= $620,139.20 (excluding any course, lab, or program fees)</td>
</tr>
<tr>
<td>Supplies and Equipment</td>
<td>$26,236</td>
<td>$91,826</td>
<td>$113,062</td>
<td>Institutional reallocation, course fees, philanthropy</td>
</tr>
<tr>
<td>Space/Facilities</td>
<td>13,000 square feet of lab, production, &amp; class space for existing AET program</td>
<td>$1.2 million for instrumentation, lab, and production space</td>
<td>$1.5 million (includes philanthropic gifts)</td>
<td>Institutional planned reserves, ISIP proposal, philanthropy</td>
</tr>
</tbody>
</table>
Transmittal for Undergraduate Programs:
Request for Agricultural Engineering

Narrative:

The purpose of this proposal is to create a new Agricultural Engineering undergraduate program. The proposed program is the result of a Fall 2012 Ideas and Innovation Incubator (I3) Strategic Plan initiative. This group was given the task to investigate the potential for developing engineering programs at UWRF. Currently, engineering programs in the state are available primarily at UW-Madison, UW-Platteville and UW-Milwaukee with limited engineering options available in western and northern Wisconsin. Developing Engineering programs at UWRF was considered to be a bold idea, with the potential to increase enrollment and produce engineering graduates serving industry in the region and the state.

The proposed Agricultural Engineering program is designed to complement, not replace, the existing Agricultural Engineering Technology program. Engineering and Engineering Technology programs are separate but closely related professional programs. Engineering programs are more theoretical and focus on conceptual design requiring higher level mathematics and calculus-based theoretical sciences while Engineering Technology programs are more practical and focus on applied engineering. Graduates of an accredited Engineering Program are eligible to become licensed Professional Engineers (PE) while Engineering Technology graduates are less likely (but not impossible) to become eligible for licensure. Most engineering programs across the nation offer both engineering and engineering technology programs to serve a broader range of students.

The career paths of Engineering and Engineering Technology graduates often intersect in related, but different capacities. Many engineering applications employ both engineering and engineering technology professionals working on the same project. For example, engineers may design the next generation of tractors to be marketed by Case-IH while engineering technologists could be employed as test engineers during the development and testing phase of the same product. Similar interactions and overlap exist in most engineering related fields.

History of Engineering Proposal

In Fall 2013, UW-River Falls sought entitlements to plan for an Agricultural Engineering major and an Environmental Engineering major (see attached UWRF Engineering Entitlement document). These two majors were chosen because they are a close fit with resources available in CAFES. The Agricultural Engineering Technology department has much of the expertise and laboratory space needed to offer an Agricultural Engineering program; while the Laboratory Farms and courses offered by the Plant and Earth Science department complement an Environmental Engineering program.
This request for entitlement, along with requests from UW-Stout and UW-Eau Claire generated significant discussion related to the need and expense of developing new engineering programs. In general, UW-Madison, UW-Milwaukee and UW-Platteville opposed the development of new engineering programs in the state while UW-River Falls, UW-Stout and UW-Eau Claire stressed the need for engineering programs in western and northern Wisconsin. This argument was supported by numerous industry representatives in western Wisconsin.

In response to these discussions, the Northwest Engineering Consortium was developed as a joint effort between UW-River Falls, UW-Stout and UW-Eau Claire to offer a variety of engineering programs in Western Wisconsin. UW-River Falls submitted a comprehensive analysis describing how the campus would develop an engineering program utilizing existing resources (See attached response) while UW-Stout and UW-Eau Claire submitted similar analyses. One condition of this proposal was each campus was to identify the top choice for program development; UW-River Falls chose Agricultural Engineering.

An Agricultural Engineering major at UW-River Falls has the potential to attract a new pool of students to our campus. Traditional Agricultural Engineering programs, including a Power and Machinery option was established at The University of Minnesota in 1930. However, the U of M Agricultural Engineering department has evolved over time. Agricultural Engineering Technology was discontinued in 1985, the department was renamed Biosystems and Agricultural Engineering in 1995, and merged with the Bio-Based Products program in 2006 and renamed the Department of Bioproducts and Biosystems Engineering. Today, the University of Minnesota does not offer an Agricultural Engineering program with a Power and Machinery option. The nearest similar programs are UW-Madison, North Dakota State University, South Dakota State University and Iowa State University.

The Board of Regents recently acted (February, 2015) on this proposal and UW-River Falls was granted pre-authorization to plan an Agricultural Engineering program (See attached authorization). Similarly, UW-Stout was granted Mechanical Engineering, while UW-Eau Claire was granted a Materials Science and Engineering program.

**Current Status of Agricultural Engineering**

UW-River Falls chose Agricultural Engineering with a Power and Machinery option as the top choice for program development because of the close alignment with current resources and expertise, and the strong demand for engineers in this field. The laboratory farms, existing lab facilities in the Agricultural Engineering Annex and the Case-IH agreement all support the curriculum needed for this option.

The curricula and 4-year plan of study for the proposed Agricultural Engineering major with a Power and Machinery option is attached. The courses proposed for this major are mainly existing courses in Math, Physics and Agricultural Engineering Technology, along with the creation of 7
new courses (18 credits) designed specifically for the major, and significant changes to 3 existing courses (9 credits) to serve both Agricultural Engineering and Agricultural Engineering Technology.

The proposed curriculum (130 credits) was modeled after similar programs such as UW-Madison (125 credits), Iowa State University (128 credits) and North Dakota State University (133 credits), and was designed to meet accreditation requirements outlined by the Accreditation Board for Engineering and Technology (ABET). See attached ABET Accreditation criteria for more information.
Curriculum for proposed Agricultural Engineering Major

University Requirements
Global Perspectives 3
American Cultural Diversity 3

General Education
COMS 116, MATH 166, CHEM 121, PHYS 131 (Possible double count) 36-39

Engineering Major: Core Courses (36 Credits)
* AET 251 Introduction to Instrumentation 3
AET 325 Alternative Energy Systems 3
AET 350 Applied Electricity 3
** AET 361 Farm Machinery Management 3
AGEN 440 Soil and Water Conservation 4
AGEN 352 Food and Process Engineering 3
GENG 121 Engineering Drawing 3
* GENG 135 Introduction to Engineering 2
* GENG 316 Engineering Thermodynamics 3
* GENG 336 Engineering Fluid Mechanics 3
GENG 450 Engineering Project Management 3
ENGL 367 Technical Writing 3

Support Courses: (33 credits)
CSIS 161 Programming I 3
SOIL 120 Introduction to Soil Science 3
MATH 167 Calculus II 4
MATH 266 Calculus III 3
MATH 331 Differential Equations 3
MATH Directed Elective: Statistics, Numerical Analysis, or Modeling 3
PHYS 132 Calculus Based Physics II 5
PHYS 250 Statics 3
PHYS 252 Dynamics 3
PHYS 254 Mechanics of Materials 3

Power and Machinery Option: (19 credits)
** AET 320 Internal Combustion Engines 3
** AGEN 451 Systems Instrumentation 3
* AGEN 461 Off-Road Vehicle Engineering 3
AGEN 465 Fluid Power Systems 3
* GENG 305 Machine Design Lab 1
** GENG 345 Machine Design I 3
* GENG 346 Machine Design II 3

Total Credits 130

*Denotes New Course  ** Denotes Significant Changes to existing course
<table>
<thead>
<tr>
<th>Course</th>
<th>Credits</th>
<th>Course</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>GENG 135 Introduction to Engineering</td>
<td>2</td>
<td>CSIS 161 Programming I</td>
<td>3</td>
</tr>
<tr>
<td>GENG 121 Engineering Drawing</td>
<td>3</td>
<td>MATH 167 Calculus II</td>
<td>4</td>
</tr>
<tr>
<td>MATH 166 Calculus I</td>
<td>4</td>
<td>PHYS 132 Physics II</td>
<td>5</td>
</tr>
<tr>
<td>PHYS 131 Physics I</td>
<td>5</td>
<td>COMS 116 Business Communication</td>
<td>3</td>
</tr>
<tr>
<td>ENGL 100 Academic Read and Write</td>
<td>3</td>
<td>PED 108 PED 108</td>
<td></td>
</tr>
<tr>
<td>Semester Total</td>
<td>17</td>
<td></td>
<td>16</td>
</tr>
<tr>
<td>AET 320 Internal Combustion Engines</td>
<td>3</td>
<td>AET 251 Intro. to Instrumentation</td>
<td>3</td>
</tr>
<tr>
<td>MATH 266 Calculus III</td>
<td>3</td>
<td>MATH 331 Differential Equations</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 121 Gen Chemistry I</td>
<td>5</td>
<td>PHYS 252 Dynamics</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 250 Statics</td>
<td>3</td>
<td>ENGL 200 English II</td>
<td>3</td>
</tr>
<tr>
<td>General Education Humanities</td>
<td>3</td>
<td>General Education Social and Behavioral Sci</td>
<td>3</td>
</tr>
<tr>
<td>Semester Total</td>
<td>17</td>
<td></td>
<td>15</td>
</tr>
<tr>
<td>AET 350 Electricity</td>
<td>3</td>
<td>GENG 450 Engineering Project Management</td>
<td>3</td>
</tr>
<tr>
<td>AET 361 Farm Machinery Management</td>
<td>3</td>
<td>AET 325 Alternate Energy Systems</td>
<td>3</td>
</tr>
<tr>
<td>PHYS 254 Mechanics of Materials</td>
<td>3</td>
<td>GENG 345 Machine Design</td>
<td>3</td>
</tr>
<tr>
<td>GENG 310 Engineering Thermodynamics</td>
<td>3</td>
<td>GENG 336 Engineering Fluid Mechanics</td>
<td>3</td>
</tr>
<tr>
<td>MATH Elective (Modeling, Stats.)</td>
<td>3</td>
<td>GENG 300 Machine Design Lab</td>
<td>1</td>
</tr>
<tr>
<td>SOIL 120 Introduction to Soil Science</td>
<td>3</td>
<td>General Education Social/Global Persp</td>
<td>3</td>
</tr>
<tr>
<td>Semester Total</td>
<td>18</td>
<td></td>
<td>16</td>
</tr>
<tr>
<td>GENG 346 Machine Design II</td>
<td>3</td>
<td>AGEN 451 Instrumentation Systems</td>
<td>3</td>
</tr>
<tr>
<td>AGEN 461 Off Road Vehicle Engineering</td>
<td>3</td>
<td>AGEN 352 Food and Process Engineering</td>
<td>3</td>
</tr>
<tr>
<td>AGEN 440 Soil and Water Conservation</td>
<td>4</td>
<td>AGEN 465 Fluid Power Systems</td>
<td>3</td>
</tr>
<tr>
<td>University Req American Cult Div</td>
<td>3</td>
<td>ENGL 367 Technical Writing</td>
<td>3</td>
</tr>
<tr>
<td>General Education Humanities</td>
<td>3</td>
<td>General Education Ethical Citizenship</td>
<td>3</td>
</tr>
<tr>
<td>Semester Total</td>
<td>16</td>
<td></td>
<td>15</td>
</tr>
</tbody>
</table>

Total Credits 130 credits
UWRF is projecting that the two proposed engineering programs combined will provide equivalent enrollments to that of the AET program (roughly 80 additional students split between the two engineering programs) and necessitate, when fully mature, yet another tenure track or full-time faculty member within the department (bringing the complement to seven FTE if and when both programs are authorized) and some additional instructional academic staff (preferably with industry experience) to provide curricular support and teaching capacity (roughly $40,000 to cover ten sections over the course of the academic year). UWRF expects that additional hires would bring expertise in basic/general engineering, agricultural/mechanical, and systems/precision. At the same time the university projects that the ongoing S&E budget would be multiplied by a factor of 2.5 yielding an additional $65,000 in S&E by year three of implementation and upwards of 3.5 yielding nearly an additional $92,000 to the department’s operating budget by the fifth year (this is exclusive of capital equipment purchases, which get handled through a centralized budgeting process at UWRF). However, it should be noted that the most current and conservative pricing structure would yield more than $610,000/annum in Wisconsin tuition/fees and exclusive of any lab/course/program fees for up to 80 additional students distributed between Agricultural Engineering and Environmental Engineering.

The relative incremental increase is based on the presence of some existing curricular resources, four existing faculty members, and existing facilities (albeit with need for renovation and upgrading—the university has already identified $1.2 million for this facility and renovation upgrade to the 13,000 square feet of lab and production space within the Agricultural Engineering Annex associated with UWRF’s Agricultural Science building and a separate, largely privately funded, upgrade to the university pilot plants).
The $1.2 million allocation was noted in the university's 2014 fund balance report to UW System Administration. The existing facilities to be renovated would be, in part, necessary to sustain the existing high quality Agricultural Engineering Technology major and would include enhancements to house a clean/test engineering and fabrication lab, a design studio, and an upgraded testing, instrumentation, and fabrication space. Because of the existing AET program the current faculty can also leverage existing lower-division courses in engineering technology. The Agricultural Engineering curriculum plan delivers a major that runs to about 133 semester credits. However, there are plans to modify the scale and structure of the university's general education curriculum independent of the discussions regarding engineering programs at UWRF.

The AET faculty, despite a formal UW System moratorium on program development, has continued to assess the state of its curriculum and to address how courses would need to be developed, redesigned, and pedagogically rethought in order to deliver a high quality program that would enhance the current offering (the AET major) and provide a platform to assure that the programs could secure ABET (Accreditation Board for Engineering and Technology) accreditation and, equally important, create a learning environment that would provide an appropriate intellectual and professional platform for UWRF undergraduate students interested in engineering. The AET faculty members have consulted with campus colleagues and examined how a responsive and rigorous curriculum can be deployed at UWRF in the near term and Table 3 provides an indication of the existing, developing, and to be developed courses to support the Agricultural Engineering major.
Table 3: Agricultural Engineering: Machinery emphasis
(Color coding refers to courses in development [blue]; redesign [green]; or need to be developed [grey])

<table>
<thead>
<tr>
<th>Semester 1</th>
<th>Semester 2</th>
<th>Semester 3</th>
<th>Semester 4</th>
<th>Semester 5</th>
<th>Semester 6</th>
<th>Semester 7</th>
<th>Semester 8</th>
</tr>
</thead>
<tbody>
<tr>
<td>17 cr</td>
<td>17 cr</td>
<td>16 cr</td>
<td>17 cr</td>
<td>17 cr</td>
<td>16 cr</td>
<td>18 cr</td>
<td>15 cr</td>
</tr>
<tr>
<td>Math 166 Calc 1 4 cr</td>
<td>Math 167 Calc 2 4 cr</td>
<td>Math 266 Calc 3 3 cr</td>
<td>Math 366 Adv. Calc 3 cr</td>
<td>Math 331 Diff Eq 5 cr</td>
<td>Physics 361 Math of Physics 1 3 cr</td>
<td>ENGR 15 Senior Design 2 3 cr</td>
<td></td>
</tr>
<tr>
<td>Physics 161 Gen Physics 1 4 cr</td>
<td>Physics 162 Gen Physics 1 4 cr</td>
<td>Math 226 Statistics 3 cr</td>
<td>ENGR 3 Engineering Thermodynamics 1 3 cr</td>
<td>Physics 361 Math of Physics 1 3 cr</td>
<td>ENGR 5 Heat Transfer 1 3 cr</td>
<td>GENG 450 Project Management 3 cr</td>
<td></td>
</tr>
<tr>
<td>Physics 166 Gen Physics Lab 1 1 cr</td>
<td>Physics 167 Gen Physics 1 1 cr</td>
<td>Physics 311 Electronic Circuits 4 cr</td>
<td>ENGR 12 Finite Element Analysis and Computational Fluid Dynamics 3 cr</td>
<td>ENGR 6 Heat Transfer 1 3 cr</td>
<td>ENGR 7 Thermofluid Measurements Lab 2 cr</td>
<td>GENG 32D IC Engines 3 cr</td>
<td></td>
</tr>
<tr>
<td>ENGR 121 Engr Drawing 3 cr</td>
<td>GENG 265 Engr Drawing 3cr</td>
<td>Soils 120 Intro to Soils 3cr</td>
<td>ENGR 2 Programming for Engineers 2cr</td>
<td>ENGR 5 Machine Design 1 3 cr</td>
<td>ENGR 10 Ethics &amp; Citizenship for Engineers 2 cr</td>
<td>GEN-ED Elective 3 cr</td>
<td></td>
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<tr>
<td></td>
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<td></td>
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<td></td>
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</tr>
</tbody>
</table>

Total projected faculty resources, existing and new, to support the current Agricultural Engineering Technology degree and the proposed degree in Agricultural Engineering (and Environmental Engineering) would therefore be seven tenure-track faculty members (calculated at an average of $75,000/faculty) and one full-time Instructional Academic Staff (or equivalent thereof) for implementation of the Agricultural Engineering program (by year five). The instructional cost is therefore projected at $500,000/annum by year five of implementation. The additional faculty member(s) necessary to sustain an Environmental Engineering degree, with the associated incremental increase in new courses needed for the major, are captured in the additional tenure track faculty member listed in Table 2. In addition UWRF would expect to add more
courses/sections led by instructional academic staff as needed. Under current projections the ratio of existing AET majors plus the addition of 40 students for each of the two engineering programs divided by the tenure track faculty members would be 22/1, considerably better than many of the university's existing major/faculty ratios.

**Partnerships and Consortium Relationships**

Beyond the university, UWRF has connected its engineering efforts, through the Northwest Wisconsin Engineering Consortium, with those of UW-Stout and UW-Eau Claire to assure collaboration, cooperation, and a rational approach to developing engineering programs in this region of Wisconsin. All three universities are very focused on engineering as means toward enhanced workforce and regional economic development. UWRF has proposed its engineering degree options as part of the Northwest Wisconsin Engineering Consortium (NWEC), which is described in the accompanying document previously distributed to UW System Administration and members of the Board of Regents. The consortium currently comprises three UW comprehensive institutions that are also pursuing collaborations with appropriate technical colleges and UW colleges. Each of the institutions has ongoing relationships with regional high schools and collectively have delineated the ways in which the three schools can share curricular resources (when appropriate), open facilities to each partner institution, engage in student recruitment and advising, connect with employers on internships and cooperative learning, and leverage focused job fairs. The intention and direction of the NWEC collaboration, as specified in previous documents submitted to UW System Administration, is to have an ongoing collaboration involving UW-Eau Claire, UWRF, and UW-Stout to promote, manage, and develop engineering options and connections in the Northwest region of Wisconsin.
Within the collaboration UWRF would contribute its brand strength and relevancy to the region and state's agricultural industries. The Agricultural Engineering Technology department has had longstanding connections with various regional industry partners—Cargill Kitchen Solutions, Oxbo, Case IH, Toro Machinery, Parker Hannifin—that have received UWRF interns and hired UWRF graduates of the existing Agricultural Engineering Technology program and are keen to extend their partnership with a fully developed engineering program (that would seek ABET accreditation). These strengths in agriculture are part of the university's historical mission and identity and thus serve as a complement to the program array and missions of UW-Eau Claire and UW-Stout and their proposed engineering programs. By continuing to partner with the agriculture and agricultural machinery industries, UWRF is well positioned to offer a valuable, albeit relatively small, Agricultural Engineering (and if also approved, Environmental Engineering) program that is responsive to industry and attracts talented student and faculty who would work with industry to build a viable workforce and partner on research and development projects.

Attracting Student Talent

UWRF has a strong regional appeal. The university draws more than 70% of its students from within a 100-mile radius of the River Falls campus. The UWRF unit that is an exception is the College of Agriculture, Food and Environmental Sciences—because of its program array, accessibility, size, and reputation—which attracts students from every corner of Wisconsin (and beyond). UWRF prides itself on providing access to many first-generation, non-traditional, and low-income students. UWRF is intentional in its efforts to attract additional highly academically qualified students through an enhanced Honors program and scholarship programs such as Falcon Scholars. The university has strong
TRANSMITTAL for UNDERGRADUATE PROGRAMS:
Changes or Proposals

I. INFORMATION:

1. Program Title: Agricultural Engineering

2. Department(s): Agricultural Engineering Technology

3. College(s): CAHES

4. Proposal prepared by: D. Olson, J. Shkal, J. Peterson Date: 8/13/15

5. Check all that apply
   - [ ] New program
   - [ ] Existing program
   - [ ] Change in course name
   - [ ] Change in number of credits
   - [ ] Change in major
   - [ ] Change in minor
   - [ ] Change in course content
   - [ ] Change in emphasis/option

6. Other Programs/Departments Consulted (Requires letters of comment from all Departments or Programs substantially affected):
   a) [ ] Math
   b) [ ] Physics
   c) [ ] [ ]
   d) [ ] [ ]

7. Catalog year (and semester) of implementation: Semester Fall Year 2016

8. Have all courses in this program been approved? Yes [ ] No [ ]
   If “No” which courses have not been approved?

9. Attach Request Narrative
   Include in narrative on attached pages a rationale for the requested changes or creation of program.
   Include clarification concerning any courses that have not yet been approved. If requesting a
   program change also include a listing of course array for both the current and proposed program?

10. UNIT APPROVALS: Requires signatures of all Department Chairs and Deans whose programs will
    be substantially affected by the changes or proposal. Signature lines for the affected Departments and
    Colleges (noted in “6” above), are on the addendum to this form. These signatures should be obtained
    prior to review by all other shared governance levels.

Department Curriculum Committee Chair (optional)

Department/Program Chair [Signature] [Date]

College Curriculum Committee Chair [Signature] [Date]

Dean of College [Signature] [Date]

University Curriculum Cmtt. Chair [Signature] [Date]

Academic Policy & Program Cmtt. Chair

Faculty Senate Chair

Provost / Vice Chancellor [Signature] [Date]

Chancellor [Signature] [Date]

*NOTE: The master copy of this transmittal & accompanying documents must be filed in the Provost’s office upon
final approval. The Provost’s office will notify all appropriate administrative offices [Registrar, Dean(s), Department
Chair(s)] of approvals & necessary actions to implement changes.

Revised December 2012
Courses not yet approved for the proposed Agricultural Engineering Program

1. AET 251 Introduction to Instrumentation
2. AET 361 Farm Machinery Management
3. AGEN 451 Instrumentation Systems in Agricultural Engineering
4. AGEN 461 Off-Road Vehicle Engineering
5. GENG 135 Introduction to Engineering
6. GENG 305 Machine Design Laboratory
7. GENG 316 Engineering Thermodynamics
8. GENG 336 Engineering Fluid Mechanics
9. GENG 345 Machine Design I
10. GENG 346 Machine Design II

These 10 courses (7 new courses and 3 existing courses with significant changes) have been reviewed by the CAFES curriculum committee and submitted to University Curriculum Committee. Also, the AET designation creation proposal was submitted to the Academic Program and Policy (AP&P) committee and is on the Monday April 20, 2015 agenda.

The Agricultural Engineering Technology faculty recognizes these proposals represent a significant workload for University Committees during a busy time of the year. However, we are working on a compressed timeline as we were granted pre-authorization to plan the Agricultural Engineering program in February 15, 2015 and are working to achieve Chancellor Van Galen’s goal to submit this proposal to the Board of Regents in the near future, possibly as early as the July 2015 Board of Regents meeting. We are not asking for special consideration; we are only asking for due diligence as we try to meet this deadline.
Agricultural Engineering Technology Meeting Minutes
January 30, 2015

Attending: Dean Olson, Joe Shakal, Joel Peterson, Youngmi Kim

Purpose of this meeting was to discuss the proposed creation of an Agricultural Engineering program at UWRF. We received word from the Provost that approval of Agricultural Engineering was likely to pass at the February 2015 Regents meeting and were given permission to prepare course proposals and documentation to Create an Agricultural Engineering program for submittal to Curriculum Committees and Academic Program and Policy Committee. Since the forthcoming pre-authorization to plan will be limited to a single major (Agricultural Engineering), faculty members decided to fully develop an Agricultural Engineering major with a Power and Machinery option.

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(Shakal/Peterson second)

Motion passed by unanimous vote.

We then worked to draft a potential 4 year plan of study that would maximize use of existing courses while still meeting the requirements for accreditation by ABET. After a workable 4 year plan was developed, it was agreed that we would work together to prepare various course proposals and submit the proposals to the curriculum committee as soon as possible.

Motion 2: Move to adjourn.

Motion passed by unanimous vote.
programs in STEM fields. For example, in the current year the ACT math composite for UWRF Physics majors is at 26.29 and 26.26 for ACT science. Across Math, Chemistry, and Computer Science the Math and Science ACT composites are between 23 and 24. For the existing Agriculture Engineering Technology major the ACT composites are between 22 and 23 for Math and Science.

In addition to embracing its identity as an institution of opportunity, UWRF can attract quality students to rigorous and attractive majors (such as engineering or the forthcoming Data Science degree) and the ACT composite scores for high school students in the region are among the highest in the state of Wisconsin. Beyond, the discussion around engineering has already encouraged very positive dialogues between the university and regional high schools (such as River Falls, Hudson, Somerset, Osceola, etc.) that have a keen interest in promoting STEM education and careers. Moreover, the university can target particular high schools in Minnesota (especially in the Twin Cities metropolitan area), a state with the highest ACT scores in the nation for 2013.

The three UW comprehensive universities that are part of the Northwest Wisconsin Engineering Consortium can partner with schools in the region with enviable ACT profiles (such as Eau Claire Memorial at 24.2; Hudson 23.8; New Richmond at 23.6) that place them in the top 60 high schools in the state according to Milwaukee Sentinel-Journal (Aug 20, 2014) and the opportunity to recruit (as a consortium) in other regions (such as the Northeastern part of the state) where NCHEMS has identified engineering as a need. In fact, each of the school districts in the region most directly served by the consortium partners (Chippewa Falls, Eau Claire Area, Hudson, Menomonie, and River Falls) performed better on the ACT math exam than the Wisconsin statewide average in 2012-13. Beyond these
immediate schools there are talented students in smaller and more rural school districts that UWRF plans to deepen already existing relationships (particularly connected to the university's College of Agriculture, Food and Environmental Sciences) to focus on engineering programs and careers in Northwest Wisconsin.

The consortium members welcome the opportunity to work with UW two-year institutions and recognize that the proximity of UW-Barron County and its pre-engineering sequence could be a valuable ally in the recruitment of students to engineering fields. Further, other UW colleges' campuses (including Waukesha) have indicated an interest in partnering on engineering pathways to the baccalaureate degree and UWRF will continue to cultivate such relationships with technical, tribal, and two-year colleges across the northern tier of Wisconsin.

**Summary and Benefits**

Over the past several years each UW institution has been charged with developing activities that connect to economic development; to emphasize degree programs and curricular reform that ensure workforce development and encourage educational partnerships; and to develop talent and create jobs. UWRF, as one member of the Northwest Wisconsin Engineering Consortium, has looked toward engineering degrees as an important academic route to all of the above mandates from UW System Administration and the UW Board of Regents. Evidence of the potential regional impact of engineering programs offered by UWRF (and its consortium partners) is suggested by the various letters in support of the consortium that have come from industry, K-12, and economic development partners.

UWRF perceives that it is in a strong position given its current array of academic
programs, facilities, and location in one of the fastest growing and economically dynamic regions in the state of Wisconsin. UWRF, like its consortium partners at Stout and Eau Claire, has heard the industry needs for a talented and stable workforce—one that is attracted to the small and midsize communities east of the St. Croix River. There is little doubt that STEM disciplines, particularly engineering, can be catalysts for profound regional economic development. Evidence of this is found in dense university clusters with various and overlapping engineering programs in such states as California, Texas, and Massachusetts. UWRF, as well as UW-Eau Claire and UW-Stout, seeks to provide high quality engineering programs that are academically rigorous and responsive to industry needs.
DATE: February 12, 2015

TO: Fernando Delgado, Provost and Vice Chancellor for Academic Affairs
    UW-River Falls

FROM: Stephen H. Kolison, Jr.  
    Associate Vice President for Academic, Faculty, and Global Programs

RE: Pre-Authorization for a B.S. in Agricultural Engineering

On October 15, 2013, you invited all UW System institutions and the Office of Academic, Faculty, and Global Programs to comment on your proposal to plan a B.S. in Agricultural Engineering. Subsequently, substantive concerns were expressed by other UW institutions regarding the demand for new engineering programs given the high resource commitment required to establish them. Other concerns expressed were related to duplication and the supply-demand ratio in specific engineering fields. These concerns, among other array management considerations, led to discussions among the UW institutions, as well as a demand study commissioned by UWSA from the National Center for Higher Education Management Systems.

After carefully considering different data sets, including the systemwide array, regional needs, employer testimonials, and the perspectives of institutions within the UW System, Interim Senior Vice President David J. Ward recommended to the Board of Regents and the President of the UW System that four of the proposed eight new engineering programs submitted to UW System Administration for review be granted a pre-authorization to plan.

On Friday, February 6, 2015, the Education Committee of the Board of Regents discussed the need for new engineering degrees in the UW System and endorsed Interim Senior Vice President Ward’s recommendation for the planning of four new baccalaureate engineering degrees. The B.S. in Agricultural Engineering proposed by your institution was among the four programs granted pre-authorization to plan. Congratulations!

It is our understanding that this program will be offered face-to-face. Also, as articulated by Interim Senior Vice President Ward at the Board meeting, among the conditions for authorization are the demonstration of clear demand supported by conclusive data, a confirmation that no new resources are needed to develop and implement the program, a precise analysis of the overall cost of implementation, a consortial element to reduce cost, mission congruence, demonstration of non-duplication, pursuit of ABET accreditation, and Higher Learning Commission approval, if applicable.
After you have had a chance to review and endorse the authorization document and financial statement that the Board of Regents will review, please submit them along with your Letter of Commitment electronically to afgp@uwst.edu. When you submit these documents, please also indicate the tuition and fees that will be charged to students who enroll in this program.

This pre-authorization will expire five years after the date of this memo if this program has not been authorized by the Board of Regents prior to that date.

Please contact Laura Anderson at 608.265.6921 or landerson@uwst.edu if you would like assistance with the development of the authorization documents.

Again, congratulations to you and your faculty for gaining the pre-authorization to plan this program. We appreciate the opportunity to work with you in this endeavor.

cc: Raymond C. Cross, President
    David J. Ward, Interim Senior Vice President, Academic and Student Affairs
    Dean Van Galen, Chancellor, UW-River Falls
    Provosts and Vice Chancellors
    UWSA Program Planning Team
    Institution Program Planning & Review Liaisons
October 15, 2013

Dr. Mark Nook, Senior Vice President for Academic and Student Affairs
UW System Administration
1730 Van Hise Hall
1200 Linden Dr.
Madison, WI 53706-1525

Dear Dr. Nook,

This letter accompanies our document requesting entitlement to plan two engineering programs—one program in Agricultural Engineering (with two distinct tracks) and the second in Environmental Engineering (which has no distinct tracks but which emphasizes other institutional resources/strengths, particularly within the College of Agricultural, Food, and Environmental Sciences [CAFES]). The two programs grow out of the natural interest of the engineers who are part of our Agricultural Engineering Technology department. Further, the initiatives have been spurred by conversations within CAFES and those at the institutional level triggered by our strategic plan (Pathways to Distinction). These conversations have been abetted by program/demand analyses and reports provided to the university by Hanover Research and discussions we have had with external stakeholders at the department and university levels.

As the Provost, I am convinced that leveraging engineering programs is key to our future relevance to the region and a natural outgrowth of the strengths of the CAFES’ programs as well as those in Physics, Biology, Chemistry, and Mathematics in UWRF’s College of Arts and Sciences. The two engineering options we seek authorization for are natural next steps for CAFES given the strengths in Agricultural Engineering Technology, the presence of pilot plants for processing, the investments in infrastructure we have made thus far to support the department as well as programs in Crops and Social Sciences, Conservation, and Land Use Planning/Geographic Information Systems. In addition, we have already begun searching for two additional engineers to supplement and extend the intellectual and professional reach of the department and would anticipate both adding additional lines as necessary but also to seek out industry partners to assist in the instruction and professional development of our majors.

This is a bold but logical next step of program development for the College of Agricultural, Food, and Environmental Sciences and our expectation is that we would have the support of our System colleagues and be able to successfully move forward with the entitlement and program building process to accept students beginning Fall 2015.

Thank you for your attention to the matter and we look forward to working with UW System Administration personnel on the program development.

Sincerely,

Fernando Delgado
Provost and Vice Chancellor for Academic Affairs
UWRF Entitlement for Agricultural Engineering and Environmental Engineering

INTRODUCTION

UW-River Falls seeks entitlement to develop and offer baccalaureate degrees in Agricultural Engineering and Environmental Engineering.

The degree in Agricultural Engineering is proposed to contain two emphases of study: (1) Power and Machinery and (2) Food and Process Engineering. The proposed degree in Environmental Engineering will contain no additional sub-areas or tracks (though given what the department and college already teach and collaborate with external stakeholders on, the subjects of water resources, pollution control and management, and sustainable environmental management would be important elements to the program).

OVERVIEW

The Agricultural Engineering Technology program has been a long-standing and strong program for UW-River Falls. During the course of its history it has had focal areas in Agricultural Engineering Technology; Environmental Engineering Technology; and Mechanized Systems Management. With stable enrollments that have grown steadily over the past 7 years, high retention and graduation rates, and enviable job placement rates, discussions with the department have evolved to the current state: consideration of moving toward and adding engineering degrees that are consonant with the strengths of the department and appropriate for the mission of the College of Agricultural, Food, and Environmental Sciences and the university.

In pursuing this entitlement the department and the university seek to leverage the following components:

1) Faculty in the Agricultural Engineering department that have academic and professional training as engineers;
2) Strong collateral programs such as those in Biology, Chemistry, Environmental Science, and Physics;
3) Unique facilities on the university's two working farms as well as pilot plants used to process dairy, meat, and fruits/vegetables;
4) A recently approved position in Food and Process Engineering (who would provide support to our minor in Food Processing Technology and support the university's response to the recent WEDC study and identification of industry sectors that are economic drivers);
5) The university's existing partnerships and relationships, such as those with Case IH, Cargill Kitchen Solutions division of Cargill Inc., The Toro Company, and Oxbo International Corp.;
6) The potential for further collaborations with technical colleges in Wisconsin.
7) The potential of the Midwest Higher Education Consortium to pull more students from Illinois, Michigan, and other Midwestern states into Wisconsin for formal education and professional internships.

Further, the university has received two positive external studies conducted by Hanover Research that examine opportunities in areas related to engineering, specifically those options that are relevant to the context of the College of Agriculture, Food, and Environmental Sciences.
UWRF Entitlement for Agricultural Engineering and Environmental Engineering

PURPOSE

UW-River Falls is uniquely positioned to take advantage of its proximity to a major metropolitan area and its attendant diversity of manufacturing, high tech, and research and innovation opportunities in the agricultural and environmental sectors. However, in addition to these elements within a 45-minute drive of the UWRF campus, the department proposes to work with small and mid-size companies in Wisconsin and our service region. The Agricultural Engineering Technology degree already produces graduates who go work for such smaller companies and family firms in Wisconsin and the surrounding area. The program’s history of attracting and graduating students who come from rural Wisconsin (and who wish to return to such areas) suggests that the proposed degree program can accelerate the ability of UW-River Falls to secure multiple partnerships that fuel economic development, job growth, and research activities in our region.

NEEDED PROGRAM SUPPORT

UW-River Falls anticipates the need to continue to redirect internal resources to support the evolving program. For example, the university anticipates identifying additional engineering positions as needed to support the program (likely in Mechanical or Environmental Engineering). In terms of facilities, the university is already beginning the process to renovate pilot plants and has authorized the investment in new equipment that would enhance the current Engineering Technology Program and serve the proposed engineering programs.

The development of the program could also spur conversations with academically qualified professional engineers who would also serve as important adjuncts to the program, bringing the professional and technical expertise to supplement the expertise of the tenure-track faculty.

The university anticipates that this would be a campus-based, largely face-to-face program.

PRESUMED OUTCOME OF RECEIVING THE ENTITLEMENT

UWRF will continue to work with Hanover Research to ensure that there is student demand for the program and internship and job opportunities available for students. The college and department will continue to work with economic development, advisory boards, and partners to assure that the proposed degree programs are a suitable fit and produce engineers of the caliber and focus that serve our external partners well. Finally, the university will pursue ABET accreditation once the program is approved and we have admitted students.

Assuming that this entitlement process is successful, the Agricultural Engineering Technology department will begin to formalize the curriculum and course design required to navigate the university’s governance process. The expectation is that UW System Administration and the Board of Regents will receive our proposal in time for consideration at the April, 2014 Board of Regents meeting to be hosted by UW-River Falls and the university would seek to deploy the program for the Fall of 2015.
TRANSMITTAL for UNDERGRADUATE PROGRAMS:
Changes or Proposals

I. INFORMATION:

1. Program Title: Agricultural Engineering
2. Department(s): Agricultural Engineering Technology
3. College(s): CAFES
5. Check all that apply
   - [ ] New program
   - [ ] Existing program
   - [ ] Change in course name
   - [ ] Change in number of credits
   - [ ] Change in major
   - [ ] Change in minor
   - [ ] Change in course content
   - [ ] Change in emphasis/option
6. Other Programs/Departments Consulted (Requires letters of comment from all Departments or Programs substantially affected):
   a) Math
   b) Physics
   c) 
   d) 
7. Catalog year (and semester) of Implementation: Semester [ ] Fall [ ] Year 2016
8. Have all courses in this program been approved? Yes [ ] No [ ]
   If “No” which courses have not been approved?
9. Attach Request Narrative
   Include in narrative on attached pages a rationale for the requested changes or creation of program.
   Include clarification concerning any courses that have not yet been approved. If requesting a program change also include a listing of course array for both the current and proposed program?
10. UNIT APPROVALS: Requires signatures of all Department Chairs and Deans whose programs will be substantially affected by the changes or proposal. Signature lines for the affected Departments and Colleges (noted in “6” above), are on the addendum to this form. These signatures should be obtained prior to review by all other shared governance levels.

Signature Date

Department Curriculum Committee Chair (optional)

Department/Program Chair

College Curriculum Committee Chair

Dean of College

University Curriculum Cmtt. Chair

Academic Policy & Program Cmtt. Chair

Faculty Senate Chair

Provost / Vice Chancellor

Chancellor

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Motion 2: Move to adjourn.

Motion passed by unanimous vote.
Transmittal for Undergraduate Programs:
Request for Agricultural Engineering

Narrative:

The purpose of this proposal is to create a new Agricultural Engineering undergraduate program. The proposed program is the result of a Fall 2012 Ideas and Innovation Incubator (I3) Strategic Plan initiative. This group was given the task to investigate the potential for developing engineering programs at UWRF. Currently, engineering programs in the state are available primarily at UW-Madison, UW-Platteville and UW-Milwaukee with limited engineering options available in western and northern Wisconsin. Developing Engineering programs at UWRF was considered to be a bold idea, with the potential to increase enrollment and produce engineering graduates serving industry in the region and the state.

The proposed Agricultural Engineering program is designed to complement, not replace, the existing Agricultural Engineering Technology program. Engineering and Engineering Technology programs are separate but closely related professional programs. Engineering programs are more theoretical and focus on conceptual design requiring higher level mathematics and calculus-based theoretical sciences while Engineering Technology programs are more practical and focus on applied engineering. Graduates of an accredited Engineering Program are eligible to become licensed Professional Engineers (PE) while Engineering Technology graduates are less likely (but not impossible) to become eligible for licensure. Most engineering programs across the nation offer both engineering and engineering technology programs to serve a broader range of students.

The career paths of Engineering and Engineering Technology graduates often intersect in related, but different capacities. Many engineering applications employ both engineering and engineering technology professionals working on the same project. For example, engineers may design the next generation of tractors to be marketed by Case-IH while engineering technologists could be employed as test engineers during the development and testing phase of the same product. Similar interactions and overlap exist in most engineering related fields.

History of Engineering Proposal

In Fall 2013, UW-River Falls sought entitlements to plan for an Agricultural Engineering major and an Environmental Engineering major (see attached UWRF Engineering Entitlement document). These two majors were chosen because they are a close fit with resources available in CAFES. The Agricultural Engineering Technology department has much of the expertise and laboratory space needed to offer an Agricultural Engineering program; while the Laboratory Farms and courses offered by the Plant and Earth Science department complement an Environmental Engineering program.
This request for entitlement, along with requests from UW-Stout and UW-Eau Claire generated significant discussion related to the need and expense of developing new engineering programs. In general, UW-Madison, UW-Milwaukee and UW-Platteville opposed the development of new engineering programs in the state while UW-River Falls, UW-Stout and UW-Eau Claire stressed the need for engineering programs in western and northern Wisconsin. This argument was supported by numerous industry representatives in western Wisconsin.

In response to these discussions, the Northwest Engineering Consortium was developed as a joint effort between UW-River Falls, UW-Stout and UW-Eau Claire to offer a variety of engineering programs in Western Wisconsin. UW-River Falls submitted a comprehensive analysis describing how the campus would develop an engineering program utilizing existing resources (See attached response) while UW-Stout and UW-Eau Claire submitted similar analyses. One condition of this proposal was each campus was to identify the top choice for program development; UW-River Falls chose Agricultural Engineering.

An Agricultural Engineering major at UW-River Falls has the potential to attract a new pool of students to our campus. Traditional Agricultural Engineering programs, including a Power and Machinery option was established at The University of Minnesota in 1930. However, the U of M Agricultural Engineering department has evolved over time. Agricultural Engineering Technology was discontinued in 1985, the department was renamed Biosystems and Agricultural Engineering in 1995, and merged with the Bio-Based Products program in 2006 and renamed the Department of Bioproducts and Biosystems Engineering. Today, the University of Minnesota does not offer an Agricultural Engineering program with a Power and Machinery option. The nearest similar programs are UW-Madison, North Dakota State University, South Dakota State University and Iowa State University.

The Board of Regents recently acted (February, 2015) on this proposal and UW-River Falls was granted pre-authorization to plan an Agricultural Engineering program (See attached authorization). Similarly, UW-Stout was granted Mechanical Engineering, while UW-Eau Claire was granted a Materials Science and Engineering program.

**Current Status of Agricultural Engineering**

UW-River Falls chose Agricultural Engineering with a Power and Machinery option as the top choice for program development because of the close alignment with current resources and expertise, and the strong demand for engineers in this field. The laboratory farms, existing lab facilities in the Agricultural Engineering Annex and the Case-IH agreement all support the curriculum needed for this option.

The curricula and 4-year plan of study for the proposed Agricultural Engineering major with a Power and Machinery option is attached. The courses proposed for this major are mainly existing courses in Math, Physics and Agricultural Engineering Technology, along with the creation of 7
new courses (18 credits) designed specifically for the major, and significant changes to 3 existing courses (9 credits) to serve both Agricultural Engineering and Agricultural Engineering Technology.

The proposed curriculum (130 credits) was modeled after similar programs such as UW-Madison (125 credits), Iowa State University (128 credits) and North Dakota State University (133 credits), and was designed to meet accreditation requirements outlined by the Accreditation Board for Engineering and Technology (ABET). See attached ABET Accreditation criteria for more information.
Curriculum for proposed Agricultural Engineering Major

**University Requirements**
- Global Perspectives 3
- American Cultural Diversity 3

**General Education**
- COMS 116, MATH 166, CHEM 121, PHYS 131 (Possible double count) 36-39

**Engineering Major: Core Courses (36 Credits)**
- AET 251 Introduction to Instrumentation 3
- AET 325 Alternative Energy Systems 3
- AET 350 Applied Electricity 3
- **AET 361 Farm Machinery Management** 3
- AGEN 440 Soil and Water Conservation 4
- AGEN 352 Food and Process Engineering 3
- GENG 121 Engineering Drawing 3
- **GENG 135 Introduction to Engineering** 2
- **GENG 316 Engineering Thermodynamics** 3
- **GENG 336 Engineering Fluid Mechanics** 3
- GENG 450 Engineering Project Management 3
- ENGL 367 Technical Writing 3

**Support Courses: (33 credits)**
- CSIS 161 Programming I 3
- SOIL 120 Introduction to Soil Science 3
- MATH 167 Calculus II 4
- MATH 266 Calculus III 3
- MATH 331 Differential Equations 3
- **MATH Directed Elective: Statistics, Numerical Analysis, or Modeling** 3
- PHYS 132 Calculus Based Physics II 5
- PHYS 250 Statics 3
- PHYS 252 Dynamics 3
- PHYS 254 Mechanics of Materials 3

**Power and Machinery Option: (19 credits)**
- AET 320 Internal Combustion Engines 3
- **AGEN 451 Systems Instrumentation** 3
- **AGEN 461 Off-Road Vehicle Engineering** 3
- AGEN 465 Fluid Power Systems 3
- **GENG 305 Machine Design Lab** 1
- **GENG 345 Machine Design I** 3
- **GENG 346 Machine Design II** 3

**Total Credits** 130

*Denotes New Course  ** Denotes Significant Changes to existing course
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<td>University Req American Cult Div</td>
<td>3</td>
<td>ENGL 367 Technical Writing</td>
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<td></td>
<td>General Education Humanities</td>
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<td>General Education Ethical Citizenship</td>
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<tr>
<td></td>
<td><strong>Semester Total</strong></td>
<td><strong>16</strong></td>
<td><strong>Semester Total</strong></td>
<td><strong>15</strong></td>
</tr>
</tbody>
</table>

Total Credits: 130 credits
October 15, 2013

Dr. Mark Nook, Senior Vice President for Academic and Student Affairs
UW System Administration
1730 Van Hise Hall
1200 Linden Dr.
Madison, WI 53706-1525

Dear Dr. Nook,

This letter accompanies our document requesting entitlement to plan two engineering programs—one program in Agricultural Engineering (with two distinct tracks) and the second in Environmental Engineering (which has no distinct tracks but which emphasizes other institutional resources/strengths, particularly within the College of Agricultural, Food, and Environmental Sciences [CAFES]). The two programs grow out of the natural interest of the engineers who are part of our Agricultural Engineering Technology department. Further, the initiatives have been spurred by conversations within CAFES and those at the institutional level triggered by our strategic plan (Pathways to Distinction). These conversations have been abetted by program/demand analyses and reports provided to the university by Hanover Research and discussions we have had with external stakeholders at the department and university levels.

As the Provost, I am convinced that leveraging engineering programs is key to our future relevance to the region and a natural outgrowth of the strengths of the CAFES’ programs as well as those in Physics, Biology, Chemistry, and Mathematics in UWRF’s College of Arts and Sciences. The two engineering options we seek authorization for are natural next steps for CAFES given the strengths in Agricultural Engineering Technology, the presence of pilot plants for processing, the investments in infrastructure we have made thus far to support the department as well as programs in Crops and Social Sciences, Conservation, and Land Use Planning/Geographic Information Systems. In addition, we have already begun searching for two additional engineers to supplement and extend the intellectual and professional reach of the department and would anticipate both adding additional lines as necessary but also to seek out industry partners to assist in the instruction and professional development of our majors.

This is a bold but logical next step of program development for the College of Agricultural, Food, and Environmental Sciences and our expectation is that we would have the support of our System colleagues and be able to successfully move forward with the entitlement and program building process to accept students beginning Fall 2015.

Thank you for your attention to the matter and we look forward to working with UW System Administration personnel on the program development.

Sincerely,

Fernando Delgado
Provost and Vice Chancellor for Academic Affairs
UWRF Entitlement for Agricultural Engineering and Environmental Engineering

INTRODUCTION

UW-River Falls seeks entitlement to develop and offer baccalaureate degrees in Agricultural Engineering and Environmental Engineering.

The degree in Agricultural Engineering is proposed to contain two emphases of study: (1) Power and Machinery and (2) Food and Process Engineering. The proposed degree in Environmental Engineering will contain no additional sub-areas or tracks (though given what the department and college already teach and collaborate with external stakeholders on, the subjects of water resources, pollution control and management, and sustainable environmental management would be important elements to the program).

OVERVIEW

The Agricultural Engineering Technology program has been a long-standing and strong program for UW-River Falls. During the course of its history it has had focal areas in Agricultural Engineering Technology; Environmental Engineering Technology; and Mechanized Systems Management. With stable enrollments that have grown steadily over the past 7 years, high retention and graduation rates, and enviable job placement rates, discussions with the department have evolved to the current state: consideration of moving toward and adding engineering degrees that are consonant with the strengths of the department and appropriate for the mission of the College of Agricultural, Food, and Environmental Sciences and the university.

In pursuing this entitlement the department and the university seek to leverage the following components:

1) Faculty in the Agricultural Engineering department that have academic and professional training as engineers;
2) Strong collateral programs such as those in Biology, Chemistry, Environmental Science, and Physics;
3) Unique facilities on the university’s two working farms as well as pilot plants used to process dairy, meat, and fruits/vegetables;
4) A recently approved position in Food and Process Engineering (who would provide support to our minor in Food Processing Technology and support the university’s response to the recent WEDC study and identification of industry sectors that are economic drivers);
5) The university’s existing partnerships and relationships, such as those with Case IH, Cargill Kitchen Solutions division of Cargill Inc., The Toro Company, and Oxbo International Corp.;
6) The potential for further collaborations with technical colleges in Wisconsin.
7) The potential of the Midwest Higher Education Consortium to pull more students from Illinois, Michigan, and other Midwestern states into Wisconsin for formal education and professional internships.

Further, the university has received two positive external studies conducted by Hanover Research that examine opportunities in areas related to engineering, specifically those options that are relevant to the context of the College of Agriculture, Food, and Environmental Sciences.
UWRF Entitlement for Agricultural Engineering and Environmental Engineering

PURPOSE

UW-River Falls is uniquely positioned to take advantage of its proximity to a major metropolitan area and its attendant diversity of manufacturing, high tech, and research and innovation opportunities in the agricultural and environmental sectors. However, in addition to these elements within a 45-minute drive of the UWRF campus, the department proposes to work with small and mid-size companies in Wisconsin and our service region. The Agricultural Engineering Technology degree already produces graduates who go work for such smaller companies and family firms in Wisconsin and the surrounding area. The program's history of attracting and graduating students who come from rural Wisconsin (and who wish to return to such areas) suggests that the proposed degree program can accelerate the ability of UW-River Falls to secure multiple partnerships that fuel economic development, job growth, and research activities in our region.

NEEDED PROGRAM SUPPORT

UW-River Falls anticipates the need to continue to redirect internal resources to support the evolving program. For example, the university anticipates identifying additional engineering positions as needed to support the program (likely in Mechanical or Environmental Engineering). In terms of facilities, the university is already beginning the process to renovate pilot plants and has authorized the investment in new equipment that would enhance the current Engineering Technology Program and serve the proposed engineering programs.

The development of the program could also spur conversations with academically qualified professional engineers who would also serve as important adjuncts to the program, bringing the professional and technical expertise to supplement the expertise of the tenure-track faculty.

The university anticipates that this would be a campus-based, largely face-to-face program.

PRESUMED OUTCOME OF RECEIVING THE ENTITLEMENT

UWRF will continue to work with Hanover Research to ensure that there is student demand for the program and internship and job opportunities available for students. The college and department will continue to work with economic development, advisory boards, and partners to assure that the proposed degree programs are a suitable fit and produce engineers of the caliber and focus that serve our external partners well. Finally, the university will pursue ABET accreditation once the program is approved and we have admitted students.

Assuming that this entitlement process is successful, the Agricultural Engineering Technology department will begin to formalize the curriculum and course design required to navigate the university's governance process. The expectation is that UW System Administration and the Board of Regents will receive our proposal in time for consideration at the April, 2014 Board of Regents meeting to be hosted by UW-River Falls and the university would seek to deploy the program for the Fall of 2015.
University of Wisconsin-River Falls

Proposed Agricultural and Environmental Engineering Programs

Submitted to the University of Wisconsin System
by
Chancellor Dean Van Galen and Provost Fernando Delgado

December 29, 2014
Introduction
UWRF Engineering Program Priority/Institutional Fit

UW-River Falls (hereafter UWRF) has sought and received entitlements to plan both a Bachelor of Science in Agricultural Engineering and a Bachelor of Science in Environmental Engineering. The university sees the two programs as twinned and parallel programs that draw from the institution's academic strengths and from the strategic direction the university, particularly its College of Agriculture, Food and Environmental Sciences, is taking in building 21st century academic programs that develop student talent, address workforce needs, and create opportunities for industry-university partnerships that drive the region's economy.

The faculty from the existing Agricultural Engineering Technology [AET] program have consulted with colleagues across their college (and in particular with an eye toward those faculty members teaching in the Environmental Science and Land Use Planning programs) and with those faculty members who have had a long history of working within UWRF's existing 3+2 baccalaureate programs in physics/engineering. UWRF has a range of applied science programs in its College of Agriculture, Food and Environmental Sciences that have considerable reputational strength in and beyond the state of Wisconsin. In addition, other STEM programs—Biology, Chemistry, and Physics—have won UW System teaching awards, been identified as centers of excellence, and are among the top producers for baccalaureate degrees among UW comprehensive institutions.

In developing the engineering entitlement proposals UWRF has contracted with Hanover Research to do a number of studies exploring demand and need in engineering. Some reports, such as those for Mechanical and Systems/Industrial engineering, have
encouraged UWRF to reprioritize the institution’s approach to engineering programs and defer to regional partners (such as UW-Eau Claire and UW-Stout). However, the umbrella study on Biosystems Engineering encouraged the university look at the three sub-areas identified by Hanover Research: agricultural engineering, environmental engineering, and biomedical engineering. After looking at the near term need and ability/positioning of the university to respond quickly, the UWRF faculty and administration identified Agricultural Engineering and then Environmental Engineering as the two key programs with which to begin. Both would draw on considerable existing curricular strengths, facilities, and faculty resources and align well with the existing and successful Bachelor of Science in Agricultural Engineering Technology as well as strong cognate programs such as Physics, Environmental Science, and Chemistry.

The preference of UWRF is to move forward on both Agricultural Engineering and Environmental Engineering. If pushed, UWRF would prefer to lead with Agricultural Engineering but strongly urges that both come forward as they work well together and emanate from the same programmatic base. The operating assumptions for one or both of these additions would be that it/they are embedded within the AET department, which currently is home to four engineers. The department has plans to hire a fifth engineer in a complementary area (pending Regents approval for one or both programs) in the next year, with additional hires projected as engineering programs are approved and enrollment develops. Current AET faculty members have engineering backgrounds in agricultural/water resources; mechanical engineering; agricultural/civil; and food process engineering. In addition, the university’s existing resource base for pre-engineering components is in place and serving UWRF students (almost exclusively as Physics majors)
who then move on to other institutions to complete the final two years of study and
graduate with a UWRF Physics degree and a degree in Engineering from the relevant
school, typically a high caliber research university (e.g. University of Wisconsin-Madison,
University of Minnesota-Twin Cities, Washington University) that is out of state or region.

**Resource Allocation and Reallocations**

In terms of the programmatic budget, the below table shows where the AET
department is presently and projects a revised budget if including the addition of
Agricultural Engineering and Environmental Engineering for the 2015-16 academic year
(as an example).

<table>
<thead>
<tr>
<th>Programs</th>
<th>2014 Enrollment</th>
<th>2014 S&amp;E Budget</th>
<th>2015 Enrollment</th>
<th>2015 S&amp;E Budget</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ag. Eng. Technology Enrollment</td>
<td>74</td>
<td>$26,236</td>
<td>76</td>
<td>$26,500</td>
</tr>
<tr>
<td>Agricultural Engineering major</td>
<td>0</td>
<td>0</td>
<td>15 (proposed)</td>
<td>$36,000</td>
</tr>
<tr>
<td>Environmental Engineering major</td>
<td>0</td>
<td>0</td>
<td>15 (proposed)</td>
<td>$36,000</td>
</tr>
</tbody>
</table>

As the new engineering programs grow and evolve, particularly into the upper division
courses, UWRF is aware that there will be additional reallocations to supplies and
equipment budgets. Table 2 below shows the incremental additions from the current state
through to the addition of students projected to be served by the two engineering
programs and the associated faculty, facilities, supplies, and equipment reallocations and
investments needed. What the table does not show are the collateral assets (such as the
Physics department instrumentation and laboratory spaces and those of the dairy/food
processing pilot plants) that support a number of programs, including the proposed engineering programs. These spaces are already part of the array of physical assets that UWRF has at its disposal and, in the case of engineering, are sufficient enough for UWRF to send many of its students through consortia programs such as the aforementioned 3/2 Physics/Engineering degrees (primarily in the areas of mechanical and electrical).

Table 2: Increased Expenses Related to Agricultural Engineering and Environmental Engineering
Year 5 Snapshot

<table>
<thead>
<tr>
<th>Expense</th>
<th>Existing</th>
<th>Increment Projected</th>
<th>Total</th>
<th>Funding Source</th>
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<tr>
<td>Tenure Track Faculty, Current</td>
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<td></td>
<td>4</td>
<td>Currently GPR funded</td>
</tr>
<tr>
<td>Agricultural Engineering added</td>
<td></td>
<td>2</td>
<td>6</td>
<td>Institutional reallocation</td>
</tr>
<tr>
<td>Environmental Engineering added</td>
<td></td>
<td>1</td>
<td>7</td>
<td>Institutional Reallocation</td>
</tr>
<tr>
<td>Student Enrollment</td>
<td>74 AET Majors</td>
<td>40 Ag. Engineering 40 Env. Engineering</td>
<td>80 students</td>
<td>Based on standard Wisconsin tuition and fees= $620,139.20 (excluding any course, lab, or program fees)</td>
</tr>
<tr>
<td>Supplies and Equipment</td>
<td>$26,236</td>
<td>$91,826</td>
<td>$113,062</td>
<td>Institutional reallocation, course fees, philanthropy</td>
</tr>
<tr>
<td>Space/Facilities</td>
<td>13,000 square feet of lab, production, &amp; class space for existing AET program</td>
<td>$1.2 million for instrumentation, lab, and production space</td>
<td>$1.5 million (includes philanthropic gifts)</td>
<td>Institutional planned reserves, ISIP proposal, philanthropy</td>
</tr>
</tbody>
</table>
UWRF is projecting that the two proposed engineering programs combined will provide equivalent enrollments to that of the AET program (roughly 80 additional students split between the two engineering programs) and necessitate, when fully mature, yet another tenure track or full-time faculty member within the department (bringing the complement to seven FTE if and when both programs are authorized) and some additional instructional academic staff (preferably with industry experience) to provide curricular support and teaching capacity (roughly $40,000 to cover ten sections over the course of the academic year). UWRF expects that additional hires would bring expertise in basic/general engineering, agricultural/mechanical, and systems/precision. At the same time the university projects that the ongoing S&E budget would be multiplied by a factor of 2.5 yielding an additional $65,000 in S&E by year three of implementation and upwards of 3.5 yielding nearly an additional $92,000 to the department’s operating budget by the fifth year (this is exclusive of capital equipment purchases, which get handled through a centralized budgeting process at UWRF). However, it should be noted that the most current and conservative pricing structure would yield more than $610,000/annum in Wisconsin tuition/fees and exclusive of any lab/course/program fees for up to 80 additional students distributed between Agricultural Engineering and Environmental Engineering.

The relative incremental increase is based on the presence of some existing curricular resources, four existing faculty members, and existing facilities (albeit with need for renovation and upgrading—the university has already identified $1.2 million for this facility and renovation upgrade to the 13,000 square feet of lab and production space within the Agricultural Engineering Annex associated with UWRF’s Agricultural Science building and a separate, largely privately funded, upgrade to the university pilot plants).
The $1.2 million allocation was noted in the university's 2014 fund balance report to UW System Administration. The existing facilities to be renovated would be, in part, necessary to sustain the existing high quality Agricultural Engineering Technology major and would include enhancements to house a clean/test engineering and fabrication lab, a design studio, and an upgraded testing, instrumentation, and fabrication space. Because of the existing AET program the current faculty can also leverage existing lower-division courses in engineering technology. The Agricultural Engineering curriculum plan delivers a major that runs to about 133 semester credits. However, there are plans to modify the scale and structure of the university's general education curriculum independent of the discussions regarding engineering programs at UWRF.

The AET faculty, despite a formal UW System moratorium on program development, has continued to assess the state of its curriculum and to address how courses would need to be developed, redesigned, and pedagogically rethought in order to deliver a high quality program that would enhance the current offering (the AET major) and provide a platform to assure that the programs could secure ABET (Accreditation Board for Engineering and Technology) accreditation and, equally important, create a learning environment that would provide an appropriate intellectual and professional platform for UWRF undergraduate students interested in engineering. The AET faculty members have consulted with campus colleagues and examined how a responsive and rigorous curriculum can be deployed at UWRF in the near term and Table 3 provides an indication of the existing, developing, and to be developed courses to support the Agricultural Engineering major.
Table 3: Agricultural Engineering: Machinery emphasis
(Color coding refers to courses in development [blue]; redesign [green]; or need to be developed [grey])

| Semester 1 | Math 166 Calc I 4 cr | Physics 161 Gen Physics 1 4 cr | Physics 166 Gen Physics Lab 1 1 cr | Engl 367 Tech Writing 3 cr | GEN 121 Engr Drawing 3 cr | ENGR 1 Introduction to Engineering 2 cr |
| Semester 2 | Math 167 Calc II 4 cr | Physics 162 Gen Physics 1 4 cr | Physics 167 Gen Physics 1 1 cr | COMS 116 Business & Professional Comm 3 cr | GEN 265 Engr Drawing 3 cr | ENGR 2 Programming for Engineers 2 cr |
| Semester 3 | Math 266 Calc III 3 cr | Math 226 Statistics 3 cr | Physics 311 Electronic Circuits 4 cr | Physics 250/GENG 251 Statics 3 cr | Soils 120 Intro to Soils 3 cr | X |
| Semester 5 | Math 331 Diff Eq 3 cr | ENGR 3 Engineering Thermodynamics 1 3 cr | ENGR 6 Heat Transfer 1 3 cr | ENGR 7 Thermo-fluid Measurements Lab 2 cr | ENGR 8 Machine Design 2 3 cr | GEN-ED Elective 3 cr |
| Semester 6 | Physics 361 Math of Physics & Engineering 1 3 cr | ENGR 12 Finite Element Analysis and Computational Fluid Dynamics 3 cr | ENGR 361 Power & Machinery 3 cr | AGEN 465 Intro to Fluid Power 3 cr | ENGR 9 Off-Road Machinery Design 3 cr | ENGR 10 Ethics & Citizenship for Engineers 2 cr |
| Semester 7 | ENGR 11 Senior Design 1 3 cr | GEN 450 Project Management 3 cr | AGEN 320 IC Engines 3 cr | ENGR 14 Instrumentation Systems in Ag. Machinery 3 cr | GEN-ED Elective 3 cr | GEN-ED Elective 3 cr |
| Semester 8 | ENGR 15 Senior Design 2 3 cr | AGEN 320 IC Engines 3 cr | GEN-ED Elective 3 cr | GEN-ED Elective 3 cr | GEN-ED Elective 3 cr | GEN-ED Elective 3 cr |

Total projected faculty resources, existing and new, to support the current Agricultural Engineering Technology degree and the proposed degree in Agricultural Engineering (and Environmental Engineering) would therefore be seven tenure-track faculty members (calculated at an average of $75,000/faculty) and one full-time Instructional Academic Staff (or equivalent thereof) for implementation of the Agricultural Engineering program (by year five). The instructional cost is therefore projected at $500,000/annum by year five of implementation. The additional faculty member(s) necessary to sustain an Environmental Engineering degree, with the associated incremental increase in new courses needed for the major, are captured in the additional tenure track faculty member listed in Table 2. In addition UWRF would expect to add more
courses/sections led by instructional academic staff as needed. Under current projections
the ratio of existing AET majors plus the addition of 40 students for each of the two
engineering programs divided by the tenure track faculty members would be 22/1,
considerably better than many of the university’s existing major/faculty ratios.

**Partnerships and Consortium Relationships**

Beyond the university, UWRF has connected its engineering efforts, through the
Northwest Wisconsin Engineering Consortium, with those of UW-Stout and UW-Eau Claire
to assure collaboration, cooperation, and a rational approach to developing engineering
programs in this region of Wisconsin. All three universities are very focused on engineering
as means toward enhanced workforce and regional economic development. UWRF has
proposed its engineering degree options as part of the Northwest Wisconsin Engineering
Consortium (NWEC), which is described in the accompanying document previously
distributed to UW System Administration and members of the Board of Regents. The
consortium currently comprises three UW comprehensive institutions that are also
pursuing collaborations with appropriate technical colleges and UW colleges. Each of the
institutions has ongoing relationships with regional high schools and collectively have
delineated the ways in which the three schools can share curricular resources (when
appropriate), open facilities to each partner institution, engage in student recruitment and
advising, connect with employers on internships and cooperative learning, and leverage
focused job fairs. The intention and direction of the NWEC collaboration, as specified in
previous documents submitted to UW System Administration, is to have an ongoing
collaboration involving UW-Eau Claire, UWRF, and UW-Stout to promote, manage, and
develop engineering options and connections in the Northwest region of Wisconsin.
Within the collaboration UWRF would contribute its brand strength and relevancy to the region and state's agricultural industries. The Agricultural Engineering Technology department has had longstanding connections with various regional industry partners—Cargill Kitchen Solutions, Oxbo, Case IH, Toro Machinery, Parker Hannifin—that have received UWRF interns and hired UWRF graduates of the existing Agricultural Engineering Technology program and are keen to extend their partnership with a fully developed engineering program (that would seek ABET accreditation). These strengths in agriculture are part of the university's historical mission and identity and thus serve as a complement to the program array and missions of UW-Eau Claire and UW-Stout and their proposed engineering programs. By continuing to partner with the agriculture and agricultural machinery industries, UWRF is well positioned to offer a valuable, albeit relatively small, Agricultural Engineering (and if also approved, Environmental Engineering) program that is responsive to industry and attracts talented student and faculty who would work with industry to build a viable workforce and partner on research and development projects.

Attracting Student Talent

UWRF has a strong regional appeal. The university draws more than 70% of its students from within a 100-mile radius of the River Falls campus. The UWRF unit that is an exception is the College of Agriculture, Food and Environmental Sciences—because of its program array, accessibility, size, and reputation—which attracts students from every corner of Wisconsin (and beyond). UWRF prides itself on providing access to many first-generation, non-traditional, and low-income students. UWRF is intentional in its efforts to attract additional highly academically qualified students through an enhanced Honors program and scholarship programs such as Falcon Scholars. The university has strong
programs in STEM fields. For example, in the current year the ACT math composite for UWRF Physics majors is at 26.29 and 26.26 for ACT science. Across Math, Chemistry, and Computer Science the Math and Science ACT composites are between 23 and 24. For the existing Agriculture Engineering Technology major the ACT composites are between 22 and 23 for Math and Science.

In addition to embracing its identity as an institution of opportunity, UWRF can attract quality students to rigorous and attractive majors (such as engineering or the forthcoming Data Science degree) and the ACT composite scores for high school students in the region are among the highest in the state of Wisconsin. Beyond, the discussion around engineering has already encouraged very positive dialogues between the university and regional high schools (such as River Falls, Hudson, Somerset, Osceola, etc.) that have a keen interest in promoting STEM education and careers. Moreover, the university can target particular high schools in Minnesota (especially in the Twin Cities metropolitan area), a state with the highest ACT scores in the nation for 2013.

The three UW comprehensive universities that are part of the Northwest Wisconsin Engineering Consortium can partner with schools in the region with enviable ACT profiles (such as Eau Claire Memorial at 24.2; Hudson 23.8; New Richmond at 23.6) that place them in the top 60 high schools in the state according to Milwaukee Sentinel-Journal (Aug 20, 2014) and the opportunity to recruit (as a consortium) in other regions (such as the Northeastern part of the state) where NCHEMS has identified engineering as a need. In fact, each of the school districts in the region most directly served by the consortium partners (Chippewa Falls, Eau Claire Area, Hudson, Menomonie, and River Falls) performed better on the ACT math exam than the Wisconsin statewide average in 2012-13. Beyond these
immediate schools there are talented students in smaller and more rural school districts that UWRF plans to deepen already existing relationships (particularly connected to the university's College of Agriculture, Food and Environmental Sciences) to focus on engineering programs and careers in Northwest Wisconsin.

The consortium members welcome the opportunity to work with UW two-year institutions and recognize that the proximity of UW-Barron County and its pre-engineering sequence could be a valuable ally in the recruitment of students to engineering fields. Further, other UW colleges’ campuses (including Waukesha) have indicated an interest in partnering on engineering pathways to the baccalaureate degree and UWRF will continue to cultivate such relationships with technical, tribal, and two-year colleges across the northern tier of Wisconsin.

Summary and Benefits

Over the past several years each UW institution has been charged with developing activities that connect to economic development; to emphasize degree programs and curricular reform that ensure workforce development and encourage educational partnerships; and to develop talent and create jobs. UWRF, as one member of the Northwest Wisconsin Engineering Consortium, has looked toward engineering degrees as an important academic route to all of the above mandates from UW System Administration and the UW Board of Regents. Evidence of the potential regional impact of engineering programs offered by UWRF (and its consortium partners) is suggested by the various letters in support of the consortium that have come from industry, K-12, and economic development partners.

UWRF perceives that it is in a strong position given its current array of academic
programs, facilities, and location in one of the fastest growing and economically dynamic regions in the state of Wisconsin. UWRF, like its consortium partners at Stout and Eau Claire, has heard the industry needs for a talented and stable workforce—one that is attracted to the small and midsize communities east of the St. Croix River. There is little doubt that STEM disciplines, particularly engineering, can be catalysts for profound regional economic development. Evidence of this is found in dense university clusters with various and overlapping engineering programs in such states as California, Texas, and Massachusetts. UWRF, as well as UW-Eau Claire and UW-Stout, seeks to provide high quality engineering programs that are academically rigorous and responsive to industry needs.
DATE: February 12, 2015

TO: Fernando Delgado, Provost and Vice Chancellor for Academic Affairs
    UW-River Falls

FROM: Stephen H. Kolison, Jr.  
      Associate Vice President for Academic, Faculty, and Global Programs

RE: Pre-Authorization for a B.S. in Agricultural Engineering

On October 15, 2013, you invited all UW System institutions and the Office of Academic, Faculty, and Global Programs to comment on your proposal to plan a B.S. in Agricultural Engineering. Subsequently, substantive concerns were expressed by other UW institutions regarding the demand for new engineering programs given the high resource commitment required to establish them. Other concerns expressed were related to duplication and the supply-demand ratio in specific engineering fields. These concerns, among other array management considerations, led to discussions among the UW institutions, as well as a demand study commissioned by UWSA from the National Center for Higher Education Management Systems.

After carefully considering different data sets, including the systemwide array, regional needs, employer testimonials, and the perspectives of institutions within the UW System, Interim Senior Vice President David J. Ward recommended to the Board of Regents and the President of the UW System that four of the proposed eight new engineering programs submitted to UW System Administration for review be granted a pre-authorization to plan.

On Friday, February 6, 2015, the Education Committee of the Board of Regents discussed the need for new engineering degrees in the UW System and endorsed Interim Senior Vice President Ward’s recommendation for the planning of four new baccalaureate engineering degrees. The B.S. in Agricultural Engineering proposed by your institution was among the four programs granted pre-authorization to plan. Congratulations!

It is our understanding that this program will be offered face-to-face. Also, as articulated by Interim Senior Vice President Ward at the Board meeting, among the conditions for authorization are the demonstration of clear demand supported by conclusive data, a confirmation that no new resources are needed to develop and implement the program, a precise analysis of the overall cost of implementation, a consortial element to reduce cost, mission congruence, demonstration of non-duplication, pursuit of ABET accreditation, and Higher Learning Commission approval, if applicable.
After you have had a chance to review and endorse the authorization document and financial statement that the Board of Regents will review, please submit them along with your Letter of Commitment electronically to afgp@uwsa.edu. When you submit these documents, please also indicate the tuition and fees that will be charged to students who enroll in this program.

This pre-authorization will expire five years after the date of this memo if this program has not been authorized by the Board of Regents prior to that date.

Please contact Laura Anderson at 608.265.6921 or landerson@uwsa.edu if you would like assistance with the development of the authorization documents.

Again, congratulations to you and your faculty for gaining the pre-authorization to plan this program. We appreciate the opportunity to work with you in this endeavor.

cc: Raymond C. Cross, President
    David J. Ward, Interim Senior Vice President, Academic and Student Affairs
    Dean Van Galen, Chancellor, UW-River Falls
    Provosts and Vice Chancellors
    UWSA Program Planning Team
    Institution Program Planning & Review Liaisons
CRITERIA FOR ACCREDITING ENGINEERING PROGRAMS

Effective for Reviews During the 2015-2016 Accreditation Cycle

Incorporates all changes approved by the ABET Board of Directors as of November 1, 2014

ABET
Engineering Accreditation Commission
ABET
415 N. Charles Street
Baltimore, MD 21201

Telephone: 410-347-7700
Fax: 443-552-3644
E-mail: accreditation@abet.org
Website: www.abet.org
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<td>3</td>
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<td>Program Educational Objectives</td>
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<tr>
<td>Student Outcomes</td>
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<td>Continuous Improvement</td>
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<td>Curriculum</td>
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<td>GENERAL CRITERIA FOR MASTERS LEVEL PROGRAMS</td>
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Criteria for Accrediting Engineering Programs
Effective for Reviews during the 2015-2016 Accreditation Cycle

Definitions

While ABET recognizes and supports the prerogative of institutions to adopt and use the terminology of their choice, it is necessary for ABET volunteers and staff to have a consistent understanding of terminology. With that purpose in mind, the Commissions will use the following basic definitions:

Program Educational Objectives – Program educational objectives are broad statements that describe what graduates are expected to attain within a few years of graduation. Program educational objectives are based on the needs of the program’s constituencies.

Student Outcomes – Student outcomes describe what students are expected to know and be able to do by the time of graduation. These relate to the skills, knowledge, and behaviors that students acquire as they progress through the program.

Assessment – Assessment is one or more processes that identify, collect, and prepare data to evaluate the attainment of student outcomes. Effective assessment uses relevant direct, indirect, quantitative and qualitative measures as appropriate to the outcome being measured. Appropriate sampling methods may be used as part of an assessment process.

Evaluation – Evaluation is one or more processes for interpreting the data and evidence accumulated through assessment processes. Evaluation determines the extent to which student outcomes are being attained. Evaluation results in decisions and actions regarding program improvement.

This document contains three sections:

The first section includes important definitions used by all ABET commissions.

The second section contains the General Criteria for Baccalaureate Level Programs that must be satisfied by all programs accredited by the Engineering Accreditation Commission of ABET and the General Criteria for Masters Level Programs that must be satisfied by those programs seeking advanced level accreditation.

The third section contains the Program Criteria that must be satisfied by certain programs. The applicable Program Criteria are determined by the technical specialties indicated by the title of the program. Overlapping requirements need to be satisfied only once.

These criteria are intended to assure quality and to foster the systematic pursuit of improvement in the quality of engineering education that satisfies the needs of constituencies in a dynamic and competitive environment. It is the responsibility of the institution seeking accreditation of an engineering program to demonstrate clearly that the program meets the following criteria.

I. GENERAL CRITERIA FOR BACCALAUREATE LEVEL PROGRAMS

All programs seeking accreditation from the Engineering Accreditation Commission of ABET must demonstrate that they satisfy all of the following General Criteria for Baccalaureate Level Programs.

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Criterion 1. Students

Student performance must be evaluated. Student progress must be monitored to foster success in attaining student outcomes, thereby enabling graduates to attain program educational objectives. Students must be advised regarding curriculum and career matters.

The program must have and enforce policies for accepting both new and transfer students, awarding appropriate academic credit for courses taken at other institutions, and awarding appropriate academic credit for work in lieu of courses taken at the institution. The program must have and enforce procedures to ensure and document that students who graduate meet all graduation requirements.

Criterion 2. Program Educational Objectives

The program must have published program educational objectives that are consistent with the mission of the institution, the needs of the program's various constituencies, and these criteria. There must be a documented, systematically utilized, and effective process, involving program constituencies, for the periodic review of these program educational objectives that ensures they remain consistent with the institutional mission, the program's constituents’ needs, and these criteria.

Criterion 3. Student Outcomes

The program must have documented student outcomes that prepare graduates to attain the program educational objectives.

Student outcomes are outcomes (a) through (k) plus any additional outcomes that may be articulated by the program.

(a) an ability to apply knowledge of mathematics, science, and engineering
(b) an ability to design and conduct experiments, as well as to analyze and interpret data
(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
(d) an ability to function on multidisciplinary teams
(e) an ability to identify, formulate, and solve engineering problems
(f) an understanding of professional and ethical responsibility
(g) an ability to communicate effectively
(h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
(i) a recognition of the need for, and an ability to engage in life-long learning
(j) a knowledge of contemporary issues
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
Criterion 4. Continuous Improvement

The program must regularly use appropriate, documented processes for assessing and evaluating the extent to which the student outcomes are being attained. The results of these evaluations must be systematically utilized as input for the continuous improvement of the program. Other available information may also be used to assist in the continuous improvement of the program.

Criterion 5. Curriculum

The curriculum requirements specify subject areas appropriate to engineering but do not prescribe specific courses. The faculty must ensure that the program curriculum devotes adequate attention and time to each component, consistent with the outcomes and objectives of the program and institution. The professional component must include:

(a) one year of a combination of college level mathematics and basic sciences (some with experimental experience) appropriate to the discipline. Basic sciences are defined as biological, chemical, and physical sciences.

(b) one and one-half years of engineering topics, consisting of engineering sciences and engineering design appropriate to the student's field of study. The engineering sciences have their roots in mathematics and basic sciences but carry knowledge further toward creative application. These studies provide a bridge between mathematics and basic sciences on the one hand and engineering practice on the other. Engineering design is the process of devising a system, component, or process to meet desired needs. It is a decision-making process (often iterative), in which the basic sciences, mathematics, and the engineering sciences are applied to convert resources optimally to meet these stated needs.

(c) a general education component that complements the technical content of the curriculum and is consistent with the program and institution objectives.

Students must be prepared for engineering practice through a curriculum culminating in a major design experience based on the knowledge and skills acquired in earlier course work and incorporating appropriate engineering standards and multiple realistic constraints.

One year is the lesser of 32 semester hours (or equivalent) or one-fourth of the total credits required for graduation.

Criterion 6. Faculty

The program must demonstrate that the faculty members are of sufficient number and they have the competencies to cover all of the curricular areas of the program. There must be sufficient faculty to accommodate adequate levels of student-faculty interaction, student advising and counseling, university service activities, professional development, and interactions with industrial and professional practitioners, as well as employers of students.
The program faculty must have appropriate qualifications and must have and demonstrate sufficient authority to ensure the proper guidance of the program and to develop and implement processes for the evaluation, assessment, and continuing improvement of the program. The overall competence of the faculty may be judged by such factors as education, diversity of backgrounds, engineering experience, teaching effectiveness and experience, ability to communicate, enthusiasm for developing more effective programs, level of scholarship, participation in professional societies, and licensure as Professional Engineers.

Criterion 7. Facilities

Classrooms, offices, laboratories, and associated equipment must be adequate to support attainment of the student outcomes and to provide an atmosphere conducive to learning. Modern tools, equipment, computing resources, and laboratories appropriate to the program must be available, accessible, and systematically maintained and upgraded to enable students to attain the student outcomes and to support program needs. Students must be provided appropriate guidance regarding the use of the tools, equipment, computing resources, and laboratories available to the program.

The library services and the computing and information infrastructure must be adequate to support the scholarly and professional activities of the students and faculty.

Criterion 8. Institutional Support

Institutional support and leadership must be adequate to ensure the quality and continuity of the program.

Resources including institutional services, financial support, and staff (both administrative and technical) provided to the program must be adequate to meet program needs. The resources available to the program must be sufficient to attract, retain, and provide for the continued professional development of a qualified faculty. The resources available to the program must be sufficient to acquire, maintain, and operate infrastructures, facilities, and equipment appropriate for the program, and to provide an environment in which student outcomes can be attained.

II. GENERAL CRITERIA FOR MASTERS LEVEL PROGRAMS

Masters level programs must develop, publish, and periodically review, educational objectives and student outcomes. The criteria for masters level programs are fulfillment of the baccalaureate level general criteria, fulfillment of program criteria appropriate to the masters level specialization area, and one academic year of study beyond the baccalaureate level. The program must demonstrate that graduates have an ability to apply masters level knowledge in a specialized area of engineering related to the program area.
III. PROGRAM CRITERIA
Each program must satisfy applicable Program Criteria (if any). Program Criteria provide the specificity needed for interpretation of the baccalaureate level criteria as applicable to a given discipline. Requirements stipulated in the Program Criteria are limited to the areas of curricular topics and faculty qualifications. If a program, by virtue of its title, becomes subject to two or more sets of Program Criteria, then that program must satisfy each set of Program Criteria; however, overlapping requirements need to be satisfied only once.

PROGRAM CRITERIA FOR
AEROSPACE
AND SIMILARLY NAMED ENGINEERING PROGRAMS
Lead Society: American Institute of Aeronautics and Astronautics

These program criteria apply to engineering programs that include "aerospace," "aeronautical," "astronautical," or similar modifiers in their titles.

1. Curriculum
Aeronautical engineering programs must prepare graduates to have a knowledge of aerodynamics, aerospace materials, structures, propulsion, flight mechanics, and stability and control. Astronautical engineering programs must prepare graduates to have a knowledge of orbital mechanics, space environment, attitude determination and control, telecommunications, space structures, and rocket propulsion. Aerospace engineering programs or other engineering programs combining aeronautical engineering and astronautical engineering, must prepare graduates to have knowledge covering one of the areas -- aeronautical engineering or astronautical engineering as described above -- and, in addition, knowledge of some topics from the area not emphasized. Programs must also prepare graduates to have design competence that includes integration of aeronautical or astronautical topics.

2. Faculty
Program faculty must have responsibility and sufficient authority to define, revise, implement, and achieve program objectives. The program must demonstrate that faculty teaching upper-division courses have an understanding of current professional practice in the aerospace industry.

PROGRAM CRITERIA FOR
AGRICULTURAL
AND SIMILARLY NAMED ENGINEERING PROGRAMS
Lead Society: American Society of Agricultural and Biological Engineers

These program criteria apply to engineering programs that include “agricultural,” “forest,” or similar modifiers in their titles.
1. Curriculum
The curriculum must include mathematics through differential equations and biological and engineering sciences consistent with the program educational objectives. The curriculum must prepare graduates to apply engineering to agriculture, aquaculture, forestry, human, or natural resources.

2. Faculty
The program shall demonstrate that those faculty members teaching courses that are primarily design in content are qualified to teach the subject matter by virtue of education and experience or professional licensure.

PROGRAM CRITERIA FOR
ARCHITECTURAL
AND SIMILARLY NAMED ENGINEERING PROGRAMS
Lead Society: American Society of Civil Engineers
Cooperating Society: American Society of Heating, Refrigerating, and Air-Conditioning Engineers

These program criteria apply to engineering programs that include "architectural" or similar modifiers in their titles.

1. Curriculum
The program must demonstrate that graduates can apply mathematics through differential equations, calculus-based physics, and chemistry. The four basic architectural engineering curriculum areas are building structures, building mechanical systems, building electrical systems, and construction/construction management. Graduates are expected to reach the synthesis (design) level in one of these areas, the application level in a second area, and the comprehension level in the remaining two areas. The engineering topics required by the general criteria shall support the engineering fundamentals of each of these four areas at the specified level. Graduates are expected to discuss the basic concepts of architecture in a context of architectural design and history.

The design level must be in a context that:
   a. Considers the systems or processes from other architectural engineering curricular areas,
   b. Works within the overall architectural design,
   c. Includes communication and collaboration with other design or construction team members,
   d. Includes computer-based technology and considers applicable codes and standards, and
   e. Considers fundamental attributes of building performance and sustainability.

2. Faculty
The program must demonstrate that faculty teaching courses that are primarily engineering design in content are qualified to teach the subject matter by virtue of professional licensure, or by education and design experience. It must also demonstrate that the majority of the faculty members teaching architectural design courses are qualified to teach the subject matter by virtue of professional licensure, or by education and design experience.
PROGRAM CRITERIA FOR
BIOENGINEERING, BIOMEDICAL,
AND SIMILARLY NAMED ENGINEERING PROGRAMS
Lead Society: Biomedical Engineering Society
Cooperating Societies: American Ceramic Society, American Institute of Chemical Engineers,
American Society of Agricultural and Biological Engineers,
American Society of Mechanical Engineers, and
Institute of Electrical and Electronics Engineers

These program criteria apply to engineering programs that include “bioengineering,” “biomedical,” or
similar modifiers in their titles.

1. Curriculum
The structure of the curriculum must provide both breadth and depth across the range of engineering and
science topics consistent with the program educational objectives and student outcomes. The curriculum
must prepare graduates with experience in:

- Applying principles of engineering, biology, human physiology, chemistry, calculus-based
  physics, mathematics (through differential equations) and statistics;
- Solving bio/biomedical engineering problems, including those associated with the interaction
  between living and non-living systems;
- Analyzing, modeling, designing, and realizing bio/biomedical engineering devices, systems,
  components, or processes; and
- Making measurements on and interpreting data from living systems.

PROGRAM CRITERIA FOR
BIOLOGICAL
AND SIMILARLY NAMED ENGINEERING PROGRAMS
Lead Society: American Society of Agricultural and Biological Engineers
Cooperating Societies: American Academy of Environmental Engineers and Scientists,
American Ceramic Society,
American Institute of Chemical Engineers, American Society of Civil Engineers,
American Society of Mechanical Engineers, Biomedical Engineering Society,
CSAB, Institute of Electrical and Electronics Engineers,
Institute of Industrial Engineers, and Minerals, Metals, and Materials Society

These program criteria apply to engineering programs that include “biological,” “biological systems,”
“food,” or similar modifiers in their titles with the exception of bioengineering and biomedical
engineering programs.

1. Curriculum
The curriculum must include mathematics through differential equations, a thorough grounding in
chemistry and biology and a working knowledge of advanced biological sciences consistent with the
program educational objectives. The curriculum must prepare graduates to apply engineering to
biological systems.
2. Faculty
The program shall demonstrate that those faculty members teaching courses that are primarily design in content are qualified to teach the subject matter by virtue of education and experience or professional licensure.

PROGRAM CRITERIA FOR
CHEMICAL, BIOCHEMICAL, BIOMOLECULAR,
AND SIMILARLY NAMED ENGINEERING PROGRAMS
Lead Society: American Institute of Chemical Engineers

These program criteria apply to engineering programs that include "chemical," "biochemical," "biomolecular," or similar modifiers in their titles.

1. Curriculum
The curriculum must provide a thorough grounding in the basic sciences including chemistry, physics, and/or biology, with some content at an advanced level, as appropriate to the objectives of the program. The curriculum must include the engineering application of these basic sciences to the design, analysis, and control of chemical, physical, and/or biological processes, including the hazards associated with these processes.

PROGRAM CRITERIA FOR
CIVIL
AND SIMILARLY NAMED ENGINEERING PROGRAMS
Lead Society: American Society of Civil Engineers

These program criteria apply to engineering programs that include "civil" or similar modifiers in their titles.

1. Curriculum
The program must prepare graduates to apply knowledge of mathematics through differential equations, calculus-based physics, chemistry, and at least one additional area of basic science, consistent with the program educational objectives; apply knowledge of four technical areas appropriate to civil engineering; conduct civil engineering experiments and analyze and interpret the resulting data; design a system, component, or process in more than one civil engineering context; explain basic concepts in management, business, public policy, and leadership; and explain the importance of professional licensure.

2. Faculty
The program must demonstrate that faculty teaching courses that are primarily design in content are qualified to teach the subject matter by virtue of professional licensure, or by education and design experience. The program must demonstrate that it is not critically dependent on one individual.
PROGRAM CRITERIA FOR
CONSTRUCTION
AND SIMILARLY NAMED ENGINEERING PROGRAMS
Lead Society: American Society of Civil Engineers

These program criteria apply to engineering programs that include "construction" or similar modifiers in their titles.

1. Curriculum
The program must prepare graduates to apply knowledge of mathematics through differential and integral calculus, probability and statistics, general chemistry, and calculus-based physics; to analyze and design construction processes and systems in a construction engineering specialty field, applying knowledge of methods, materials, equipment, planning, scheduling, safety, and cost analysis; to explain basic legal and ethical concepts and the importance of professional engineering licensure in the construction industry; to explain basic concepts of management topics such as economics, business, accounting, communications, leadership, decision and optimization methods, engineering economics, engineering management, and cost control.

2. Faculty
The program must demonstrate that the majority of faculty teaching courses that are primarily design in content are qualified to teach the subject matter by virtue of professional licensure, or by education and design experience. The faculty must include at least one member who has had full-time experience and decision-making responsibilities in the construction industry.

PROGRAM CRITERIA FOR
ELECTRICAL, COMPUTER, COMMUNICATIONS, TELECOMMUNICATION(S)
AND SIMILARLY NAMED ENGINEERING PROGRAMS
Lead Society: Institute of Electrical and Electronics Engineers
Cooperating Society for Computer Engineering Programs: CSAB

These program criteria apply to engineering programs that include “electrical,” “electronic(s),” “computer,” “communication(s),” telecommunication(s), or similar modifiers in their titles.

1. Curriculum
The structure of the curriculum must provide both breadth and depth across the range of engineering topics implied by the title of the program.

The curriculum must include probability and statistics, including applications appropriate to the program name; mathematics through differential and integral calculus; sciences (defined as biological, chemical, or physical science); and engineering topics (including computing science) necessary to analyze and design complex electrical and electronic devices, software, and systems containing hardware and software components.
The curriculum for programs containing the modifier “electrical,” “electronic(s),” “communication(s),” or “telecommunication(s)” in the title must include advanced mathematics, such as differential equations, linear algebra, complex variables, and discrete mathematics.

The curriculum for programs containing the modifier “computer” in the title must include discrete mathematics.

The curriculum for programs containing the modifier “communication(s)” or “telecommunication(s)” in the title must include topics in communication theory and systems.

The curriculum for programs containing the modifier “telecommunication(s)” must include design and operation of telecommunication networks for services such as voice, data, image, and video transport.

PROGRAM CRITERIA FOR
ENGINEERING, GENERAL ENGINEERING,
ENGINEERING PHYSICS, ENGINEERING SCIENCE,
AND SIMILARLY NAMED ENGINEERING PROGRAMS
Lead Society: American Society for Engineering Education

These program criteria apply to engineering programs that include “engineering (without modifiers),” “general engineering,” “engineering physics,” or “engineering science(s),” in their titles.

There are no program-specific criteria beyond the General Criteria.

PROGRAM CRITERIA FOR
ENGINEERING MANAGEMENT
AND SIMILARLY NAMED ENGINEERING PROGRAMS
Lead Society: Institute of Industrial Engineers
Cooperating Societies: American Institute of Chemical Engineers, American Society of Civil Engineers, American Society of Mechanical Engineers, Institute of Electrical and Electronics Engineers, Society of Manufacturing Engineers, and Society of Petroleum Engineers

These program criteria apply to engineering programs that include “management” or similar modifiers in their titles.

1. Curriculum
The curriculum must prepare graduates to understand the engineering relationships between the management tasks of planning, organization, leadership, control, and the human element in production, research, and service organizations; to understand and deal with the stochastic nature of management systems. The curriculum must also prepare graduates to integrate management systems into a series of different technological environments.
2. Faculty
The major professional competence of the faculty must be in engineering, and the faculty should be experienced in the management of engineering and/or technical activities.

PROGRAM CRITERIA FOR
ENGINEERING MECHANICS
AND SIMILARLY NAMED ENGINEERING PROGRAMS
Lead Society: American Society of Mechanical Engineers

These program criteria apply to engineering programs that include “mechanics” or similar modifiers in their titles.

1. Curriculum
The program curriculum must require students to use mathematical and computational techniques to analyze, model, and design physical systems consisting of solid and fluid components under steady state and transient conditions.

2. Faculty
The program must demonstrate that faculty members responsible for the upper-level professional program are maintaining currency in their specialty area.

PROGRAM CRITERIA FOR
ENVIRONMENTAL
AND SIMILARLY NAMED ENGINEERING PROGRAMS
Lead Society: American Academy of Environmental Engineers and Scientists
Cooperating Societies: American Institute of Chemical Engineers,
American Society of Agricultural and Biological Engineers, American Society of Civil Engineers,
American Society of Heating, Refrigerating and Air-Conditioning Engineers,
American Society of Mechanical Engineers, SAE International,
and Society for Mining, Metallurgy, and Exploration

These program criteria apply to engineering programs that include "environmental," "sanitary," or similar modifiers in their titles.

1. Curriculum
The curriculum must prepare graduates to apply knowledge of mathematics through differential equations, probability and statistics, calculus-based physics, chemistry (including stoichiometry, equilibrium, and kinetics), an earth science, a biological science, and fluid mechanics. The curriculum must prepare graduates to formulate material and energy balances, and analyze the fate and transport of substances in and between air, water, and soil phases; conduct laboratory experiments, and analyze and interpret the resulting data in more than one major environmental engineering focus area, e.g., air, water, land, environmental health; design environmental engineering systems that include considerations of risk, uncertainty, sustainability, life-cycle principles, and environmental impacts; and apply advanced principles and practice relevant to the program objectives. The curriculum must prepare graduates to
understand concepts of professional practice, project management, and the roles and responsibilities of public institutions and private organizations pertaining to environmental policy and regulations.

2. Faculty
The program must demonstrate that a majority of those faculty teaching courses that are primarily design in content are qualified to teach the subject matter by virtue of professional licensure, board certification in environmental engineering, or by education and equivalent design experience.

PROGRAM CRITERIA FOR
FIRE PROTECTION
AND SIMILARLY NAMED ENGINEERING PROGRAMS
Lead Society: Society for Fire Protection Engineers

These program criteria apply to engineering programs that include “fire protection” or similar modifiers in their title.

1. Curriculum
The program must prepare graduates to have proficiency in the application of science and engineering to protect the health, safety, and welfare of the public from the impacts of fire. This includes the ability to apply and incorporate an understanding of the fire dynamics that affect the life safety of occupants and emergency responders and the protection of property; the hazards associated with processes and building designs; the design of fire protection products, systems, and equipment; the human response and behavior in fire emergencies; and the prevention, control, and extinguishment of fire.

2. Faculty
The program must demonstrate that faculty members maintain currency in fire protection engineering practice.

PROGRAM CRITERIA FOR
GEOLOGICAL
AND SIMILARLY NAMED ENGINEERING PROGRAMS
Lead Society: Society for Mining, Metallurgy, and Exploration

These program criteria apply to engineering programs that include "geological" or similar modifiers in their titles.

1. Curriculum
The program must prepare graduates to have:
(1) the ability to apply mathematics including differential equations, calculus-based physics, and chemistry, to geological engineering problems;
(2) proficiency in geological science topics that emphasize geologic processes and the identification of minerals and rocks;
(3) the ability to visualize and solve geological problems in three and four dimensions;
(4) proficiency in the engineering sciences including statics, properties/strength of materials, and geomechanics;
(5) the ability to apply principles of geology, elements of geophysics, geological and engineering field methods; and
(6) engineering knowledge to design solutions to geological engineering problems, which will include one or more of the following considerations: the distribution of physical and chemical properties of earth materials, including surface water, ground water (hydrogeology), and fluid hydrocarbons; the effects of surface and near-surface natural processes; the impacts of construction projects; the impacts of exploration, development, and extraction of natural resources, and consequent remediation; disposal of wastes; and other activities of society on these materials and processes, as appropriate to the program objectives.

2. Faculty
Evidence must be provided that the program’s faculty members understand professional engineering practice and maintain currency in their respective professional areas. The program’s faculty must have responsibility and authority to define, revise, implement, and achieve program objectives.

PROGRAM CRITERIA FOR
INDUSTRIAL
AND SIMILARLY NAMED ENGINEERING PROGRAMS
Lead Society: Institute of Industrial Engineers

These program criteria apply to engineering programs that include “industrial” or similar modifiers in their titles.

1. Curriculum
The curriculum must prepare graduates to design, develop, implement, and improve integrated systems that include people, materials, information, equipment and energy. The curriculum must include in-depth instruction to accomplish the integration of systems using appropriate analytical, computational, and experimental practices.

2. Faculty
Evidence must be provided that the program faculty understand professional practice and maintain currency in their respective professional areas. Program faculty must have responsibility and sufficient authority to define, revise, implement, and achieve program objectives.

PROGRAM CRITERIA FOR
MANUFACTURING
AND SIMILARLY NAMED ENGINEERING PROGRAMS
Lead Society: Society of Manufacturing Engineers

These program criteria apply to engineering programs that include "manufacturing" and similar modifiers in their titles.
1. Curriculum
The program must prepare graduates to have proficiency in (a) materials and manufacturing processes: ability to design manufacturing processes that result in products that meet specific material and other requirements; (b) process, assembly and product engineering: ability to design products and the equipment, tooling, and environment necessary for their manufacture; (c) manufacturing competitiveness: ability to create competitive advantage through manufacturing planning, strategy, quality, and control; (d) manufacturing systems design: ability to analyze, synthesize, and control manufacturing operations using statistical methods; and (e) manufacturing laboratory or facility experience: ability to measure manufacturing process variables and develop technical inferences about the process.

2. Faculty
The program must demonstrate that faculty members maintain currency in manufacturing engineering practice.

PROGRAM CRITERIA FOR
MATERIALS (1), METALLURGICAL (2), CERAMICS (3)
AND SIMILARLY NAMED ENGINEERING PROGRAMS

(1,2) Lead Society for Materials and Metallurgical Engineering Programs: The Minerals, Metals & Materials Society

(3) Lead Society for Ceramics Engineering Programs: American Ceramic Society

(1) Cooperating Societies for Materials Engineering Programs: American Ceramic Society, American Institute of Chemical Engineers, and American Society of Mechanical Engineers

(2) Cooperating Society for Metallurgical Engineering Programs: Society for Mining, Metallurgy, and Exploration

(3) Cooperating Society for Ceramics Engineering Programs: The Minerals, Metals & Materials Society

These program criteria apply to engineering programs including "materials," "metallurgical," "ceramics," "glass", "polymer," "biomaterials," and similar modifiers in their titles.

1. Curriculum
The curriculum must prepare graduates to apply advanced science (such as chemistry, biology and physics), computational techniques and engineering principles to materials systems implied by the program modifier, e.g., ceramics, metals, polymers, biomaterials, composite materials; to integrate the understanding of the scientific and engineering principles underlying the four major elements of the field: structure, properties, processing, and performance related to material systems appropriate to the field; to apply and integrate knowledge from each of the above four elements of the field using experimental, computational and statistical methods to solve materials problems including selection and design consistent with the program educational objectives.

2. Faculty
The faculty expertise for the professional area must encompass the four major elements of the field.
PROGRAM CRITERIA FOR
MECHANICAL
AND SIMILARLY NAMED ENGINEERING PROGRAMS
Lead Society: American Society of Mechanical Engineers

These program criteria will apply to all engineering programs that include "mechanical" or similar modifiers in their titles.

1. Curriculum
The curriculum must require students to apply principles of engineering, basic science, and mathematics (including multivariate calculus and differential equations); to model, analyze, design, and realize physical systems, components or processes; and prepare students to work professionally in either thermal or mechanical systems while requiring topics in each area.

2. Faculty
The program must demonstrate that faculty members responsible for the upper-level professional program are maintaining currency in their specialty area.

PROGRAM CRITERIA FOR
MINING
AND SIMILARLY NAMED ENGINEERING PROGRAMS
Lead Society: Society for Mining, Metallurgy, and Exploration

These program criteria apply to engineering programs that include "mining" or similar modifiers in their titles.

1. Curriculum
The program must prepare graduates to apply mathematics through differential equations, calculus-based physics, general chemistry, and probability and statistics as applied to mining engineering problem applications; to have fundamental knowledge in the geological sciences including characterization of mineral deposits, physical geology, structural or engineering geology, and mineral and rock identification and properties; to be proficient in statics, dynamics, strength of materials, fluid mechanics, thermodynamics, and electrical circuits; to be proficient in engineering topics related to both surface and underground mining, including: mining methods, planning and design, ground control and rock mechanics, health and safety, environmental issues, and ventilation; to be proficient in additional engineering topics such as rock fragmentation, materials handling, mineral or coal processing, mine surveying, and valuation and resource/reserve estimation as appropriate to the program objectives. The laboratory experience must prepare graduates to be proficient in geologic concepts, rock mechanics, mine ventilation, and other topics appropriate to the program objectives.

2. Faculty
Evidence must be provided that the program faculty understand professional engineering practice and maintain currency in their respective professional areas. Program faculty must have responsibility and authority to define, revise, implement, and achieve program objectives.
PROGRAM CRITERIA FOR
NAVAL ARCHITECTURE, MARINE ENGINEERING,
AND SIMILARLY NAMED ENGINEERING PROGRAMS
Lead Society: Society of Naval Architects and Marine Engineers

These program criteria apply to engineering programs that include “naval architecture” and/or “marine engineering” or similar modifiers in their titles.

1. Curriculum
The program must prepare graduates to apply probability and statistical methods to naval architecture and marine engineering problems; to have basic knowledge of fluid mechanics, dynamics, structural mechanics, materials properties, hydrostatics, and energy/propulsion systems in the context of marine vehicles and; to have familiarity with instrumentation appropriate to naval architecture and/or marine engineering.

2. Faculty
Program faculty must have sufficient curricular and administrative control to accomplish the program objectives. Program faculty must have responsibility and sufficient authority to define, revise, implement and achieve the program objectives.

PROGRAM CRITERIA FOR
NUCLEAR, RADIOLOGICAL,
AND SIMILARLY NAMED ENGINEERING PROGRAMS
Lead Society: American Nuclear Society

These program criteria apply to engineering programs that include “nuclear,” “radiological,” or similar modifiers in their titles.

1. Curriculum
The program must prepare the students to apply advanced mathematics, science, and engineering science, including atomic and nuclear physics, and the transport and interaction of radiation with matter, to nuclear and radiological systems and processes; to perform nuclear engineering design; to measure nuclear and radiation processes; to work professionally in one or more of the nuclear or radiological fields of specialization identified by the program.

2. Faculty
The program must demonstrate that faculty members primarily committed to the program have current knowledge of nuclear or radiological engineering by education or experience.
PROGRAM CRITERIA FOR
OCEAN
AND SIMILARLY NAMED ENGINEERING PROGRAMS
Lead Society: Society of Naval Architects and Marine Engineers
Cooperating Societies: American Society of Civil Engineers
and Institute of Electrical and Electronics Engineers

These program criteria apply to engineering programs that include “ocean” or similar modifiers in their titles.

1. Curriculum
The curriculum must prepare graduates to have the knowledge and the skills to apply the principles of fluid and solid mechanics, dynamics, hydrostatics, probability and applied statistics, oceanography, water waves, and underwater acoustics to engineering problems and to work in groups to perform engineering design at the system level, integrating multiple technical areas and addressing design optimization.

2. Faculty
Program faculty must have responsibility and sufficient authority to define, revise, implement, and achieve the program objectives.

PROGRAM CRITERIA FOR
OPTICAL, PHOTONIC,
AND SIMILARLY NAMED ENGINEERING PROGRAMS

Co-Lead Societies: SPIE, the International Society for Optical Engineering
or Institute of Electrical and Electronic Engineers

These program criteria apply to all engineering programs that include "optical," "photonic," or similar modifiers in their titles.

1. Curriculum
The structure of the curriculum must provide both breadth and depth across the range of engineering topics implied by the title of the program. The curriculum must prepare students to have knowledge of and appropriate laboratory experience in: geometrical optics, physical optics, optical materials, and optical and/or photonic devices and systems.

The curriculum must prepare students to apply principles of engineering, basic sciences, mathematics (such as multivariable calculus, differential equations, linear algebra, complex variables, and probability and statistics) to modeling, analyzing, designing, and realizing optical and/or photonic devices and systems.

2. Faculty
Faculty members who teach courses with significant design content must be qualified by virtue of design experience as well as subject matter knowledge.
PROGRAM CRITERIA FOR
PETROLEUM
AND SIMILARLY NAMED ENGINEERING PROGRAMS
Lead Society: Society of Petroleum Engineers

These program criteria apply to engineering programs that include "petroleum," "natural gas," or similar modifiers in their titles.

1. Curriculum
The program must prepare graduates to be proficient in mathematics through differential equations, probability and statistics, fluid mechanics, strength of materials, and thermodynamics; design and analysis of well systems and procedures for drilling and completing wells; characterization and evaluation of subsurface geological formations and their resources using geoscientific and engineering methods; design and analysis of systems for producing, injecting, and handling fluids; application of reservoir engineering principles and practices for optimizing resource development and management; the use of project economics and resource valuation methods for design and decision making under conditions of risk and uncertainty.

PROGRAM CRITERIA FOR
SOFTWARE
AND SIMILARLY NAMED ENGINEERING PROGRAMS
Lead Society: CSAB
Cooperating Society: Institute of Electrical and Electronics Engineers

These program criteria apply to engineering programs that include "software" or similar modifiers in their titles.

1. Curriculum
The curriculum must provide both breadth and depth across the range of engineering and computer science topics implied by the title and objectives of the program.

The curriculum must prepare graduates to analyze, design, verify, validate, implement, apply, and maintain software systems; to appropriately apply discrete mathematics, probability and statistics, and relevant topics in computer science and supporting disciplines to complex software systems; to work in one or more significant application domains; and to manage the development of software systems.

PROGRAM CRITERIA FOR
SURVEYING
AND SIMILARLY NAMED ENGINEERING PROGRAMS
Lead Society: National Society for Professional Surveyors
Cooperating Society: American Society of Civil Engineers

These program criteria apply to engineering programs that include "surveying" or similar modifiers in their titles.
1. Curriculum
The curriculum must prepare graduates to work competently in one or more of the following areas: boundary and/or land surveying, geographic and/or land information systems, photogrammetry, mapping, geodesy, remote sensing, and other related areas.

2. Faculty
Programs must demonstrate that faculty members teaching courses that are primarily design in content are qualified to teach the subject matter by virtue of professional licensure or by educational and design experience.

PROGRAM CRITERIA FOR
SYSTEMS
AND SIMILARLY NAMED ENGINEERING PROGRAMS
Co-Lead Societies: American Society of Mechanical Engineers, CSAB,
Institute of Electrical and Electronics Engineers, Institute of Industrial Engineers,
ISA, International Council on Systems Engineering, or
SAE International

These program criteria apply to engineering programs that include “systems (without other modifiers)” in their title.

There are no program- specific criteria beyond the General Criteria.
PROPOSED CHANGES TO THE CRITERIA

The following section presents proposed changes to these criteria as approved by the ABET Board of Directors on November 1, 2014, for a one-year first reading review and comment period. Comments will be considered until June 15, 2015. The ABET Board of Directors will determine, based on the comments received and on the advice of the EAC, the content of the adopted criteria. The adopted criteria will then become effective following the ABET Board of Directors Meeting in the fall of 2015 and will first be applied by the EAC for accreditation reviews during the 2016-17 academic year.

Comments relative to the proposed criteria changes should be addressed to: Senior Director for Accreditation Operations, ABET, 415 N. Charles Street, Baltimore, MD 21201 or to accreditation@abet.org.
II. GENERAL CRITERIA FOR MASTER’S LEVEL AND INTEGRATED BACCALAUREATE-MASTER’S LEVEL ENGINEERING PROGRAMS

Programs seeking accreditation at the master’s level from the Engineering Accreditation Commission of ABET must demonstrate that they satisfy the following criteria, including all of the aspects relevant to integrated baccalaureate-master’s programs or stand-alone master’s programs, as appropriate.

Criteria Applicable to Integrated Baccalaureate-Master’s Level Engineering Programs

Engineering programs that offer integrated baccalaureate-master’s programs must meet all of the General Criteria for Baccalaureate Level Programs and the Program Criteria applicable to the program name, regardless of whether students in these programs receive both baccalaureate and master’s degrees or only master’s degrees during their programs of study. In addition, these programs must meet all of the following criteria. If any students are admitted into the master’s portion of the combined program without having completed the integrated baccalaureate portion, they must meet the criteria given below.

Criteria Applicable to all Engineering Programs Awarding Degrees at the Master’s Level

Students and Curriculum

The master’s program must have and enforce procedures for verifying that each student has completed a set of post-secondary educational and professional experiences that:

- Supports the attainment of student outcomes of criterion 3 of the general criteria for baccalaureate level engineering programs, and
- Includes at least one year of math and basic science (basic science includes the biological, chemical, and physical sciences), as well as at least one-and-one-half years of engineering topics and a major design experience that meets the requirements of criterion 5 of the general criteria for baccalaureate level engineering programs.

If the student has graduated from an EAC of ABET accredited baccalaureate program, the presumption is that items (a) and (b) above have been satisfied.

The master’s level engineering program must have and enforce policies and procedures ensuring that a program of study with specific educational goals is developed for each student. Student performance and progress toward completion of their programs of study must be monitored and evaluated. The program must have and enforce procedures to ensure and document that students who graduate meet all graduation requirements.

The master’s level engineering program must require each student to demonstrate a mastery of a specific field of study or area of professional practice consistent with the master’s program name and at a level beyond the minimum requirements of baccalaureate level programs.
The master’s level engineering program of study must require the completion of one academic year of full-time study (equivalent to at least 30 semester hours) beyond the baccalaureate program.

Each student’s overall program of post-secondary study must satisfy the curricular components of the baccalaureate level program criteria relevant to the master’s level program name.

**Program Quality**

The master’s level engineering program must have a documented and operational process for assessing, maintaining and enhancing the quality of the program.

**Faculty**

The master’s level engineering program must demonstrate that the faculty members are of sufficient number and that they have the competencies to cover all of the curricular areas of the program. Faculty teaching graduate level courses must have appropriate educational qualifications by education or experience. The program must have sufficient faculty to accommodate adequate levels of student-faculty interaction, student advising and counseling, university service activities, professional development, and interactions with industrial and professional practitioners, as well as employers of students.

The master’s level engineering program faculty must have appropriate qualifications and must have and demonstrate sufficient authority to ensure the proper guidance of the program. The overall competence of the faculty may be judged by such factors as education, diversity of backgrounds, engineering experience, teaching effectiveness and experience, ability to communicate, level of scholarship, participation in professional societies, and licensure.

**Facilities**

Means of communication with students, and student access to laboratory and other facilities, must be adequate to support student success in the program, and to provide an atmosphere conducive to learning. These resources and facilities must be representative of current professional practice in the discipline. Students must have access to appropriate training regarding the use of the resources available to them.

The library and information services, computing and laboratory infrastructure, and equipment and supplies must be available and adequate to support the education of the students and the scholarly and professional activities of the faculty.

Remote or virtual access to laboratories and other resources may be employed in place of physical access when such access enables accomplishment of the program’s educational activities.

**Institutional Support**

Institutional support and leadership must be adequate to ensure the quality and continuity of the program. Resources including institutional services, financial support, and staff (both administrative and technical) provided to the program must be adequate to meet program needs. The resources available to the program must be sufficient to attract, retain, and provide for the continued professional development of a qualified faculty. The resources available to the program must be sufficient to acquire, maintain, and operate infrastructure, facilities, and equipment appropriate for the program, and to provide an environment in which student learning outcomes can be attained.
PROPOSED REVISIONS TO THE PROGRAM CRITERIA FOR CIVIL AND SIMILARLY NAMED ENGINEERING PROGRAMS
Lead Society: American Society of Civil Engineers

These program criteria apply to engineering programs that include "civil" or similar modifiers in their titles.

1. Curriculum

The curriculum program must prepare graduates to apply knowledge of mathematics through differential equations, calculus-based physics, chemistry, and at least one additional area of basic science, consistent with the program educational objectives; apply probability and statistics to address uncertainty; apply knowledge of analyze and solve problems in at least four technical areas appropriate to civil engineering; conduct civil engineering experiments in at least two technical areas of civil engineering and analyze and interpret the resulting data; design a system, component, or process in at least two more than one civil engineering contexts; include principles of sustainability in design; explain basic concepts in project management, business, public policy, and leadership; analyze issues in professional ethics; and explain the importance of professional licensure.

2. Faculty

The program must demonstrate that faculty teaching courses that are primarily design in content are qualified to teach the subject matter by virtue of professional licensure, or by education and design experience. The program must demonstrate that it is not critically dependent on one individual.

PROPOSED REVISIONS TO THE PROGRAM CRITERIA FOR SOFTWARE AND SIMILARLY NAMED ENGINEERING PROGRAMS
Lead Society: CSAB
Cooperating Society: Institute of Electrical and Electronics Engineers

These program criteria apply to engineering programs that include “software” or similar modifiers in their titles.

1. Curriculum

The curriculum must provide both breadth and depth across the range of engineering and computer science topics implied by the title and objectives of the program. The curriculum must prepare graduates to analyze, design, verify, validate, implement, apply, and maintain software systems; to appropriately apply discrete mathematics, probability and statistics, and
relevant topics in computer science and supporting disciplines to complex software systems; to work in one or more significant application domains; and to manage the development of software systems. Include computing fundamentals, software design and construction, requirements analysis, security, verification, and validation; software engineering processes and tools appropriate for the development of complex software systems; and discrete mathematics, probability, and statistics, with applications appropriate to software engineering.

2. Faculty

The program must demonstrate that faculty members teaching core software engineering topics have an understanding of professional practice in software engineering and maintain currency in their areas of professional or scholarly specialization.