COLLEGE OF ENGINEERING & APPLIED SCIENCE
UNIVERSITY OF WYOMING

WORKING FOR WYOMING & THE WORLD

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Date: 26 August 2016

To: Kate Miller, Provost and Vice President of Academic Affairs
Anne Alexander, Associate Vice President of Academic Affairs

From: Michael V. Pishko
Dean, College of Engineering & Applied Science

RE: Mechanical Engineering Program Review

As per instructions from Academic Affairs, the Mechanical Engineering Ph.D. program has been reviewed. This program is administered by the Department of Mechanical & Energy Systems Engineering. Pursuant to UW guidelines for program review, I recommend the program mentioned above be retained as mission critical. The mechanical engineering program meets basic workforce and economic development needs for the State of Wyoming, supporting industries such as mining, manufacturing, transportation, and energy production across the state. In addition, combustion engineering and carbon engineering, supported by mechanical engineering as a fundamental discipline, have been identified as key research areas by the Tier 1 Engineering Initiative as created by the Wyoming State Legislature and Governor's office. As such, the program should be retained and enhanced to support the state's economic interests.

It should be noted that the department is making a concerted effort to increase the number of students in this program.

cc: Carl Frick, Steve Barrett, Megan Barber, File

Academic Program Review
Report Template
University of Wyoming
Office of Academic Affairs
March 2016

(adapted from SDSU)

Deans and Directors who administer an authorized major or course of study approved by action of the Board of Trustees will be responsible for conducting program reviews. Four key elements should be addressed in each academic program review: (1) Program Demand, (2) Program Quality, (3) Mission Centrality, and (4) Cost.

For each program that is reviewed, a recommendation will be made by the Academic Dean to the Vice President of Academic Affairs.

Instructions: *Please provide the following information:*

Title of Program/Specialization: *ME-PhD*
Indicate whether undergraduate or graduate program/specialization: *Graduate Program*
Department and College: *Mechanical Engineering, College of Engineering and Applied Sciences*
Department Head Name and contact information (phone, email): *Carl Frick, 307.766.4068, cfrick@uwyo.edu*

Part 1 – Program Review

Instructions: *Please answer each of the following questions. Items listed under each question have been provided to help guide your response. If an item is not applicable, simply indicate "N/A".*

1. **Program Demand*:**
   (*Note: If degrees granted exceeds cutoff, delay review until next round.*)
   a. Number of graduates over 5-year period:
      We had 8 PhD students graduating in the past 5 years.
   b. Enrollment in major/specialization over 5-year period:
      We had an average of 18 PhD students over the past 5 years. The enrollment has doubled from 13 students in Fall 2011 to 26 student during Spring 2016! This is a reflection of the research success by the faculty in ME.

   * Cutoffs for "Low Demand" Designation -- *Degrees Granted*
   - Bachelor's Programs: Average – 5 per year; 5-year total: 25
   - Master's Programs: Average – 3 per year; 5-year total: 15
   - Ph.D. Programs: Average – 1 per year; 5-year total: 5

   (See APPENDIX A for the types of programs that will be excluded from review.)

2. **Program Quality: Is the program of high quality?**
   a. Program accreditation *– N/A: Graduate programs in Engineering are not typically accredited by a national organization; however, the faculty strives to ensure*

consistency and quality relative to even top-tier institutions in the nation. Our PhD program was evaluated critically by the faculty 3 years ago, resulting in a new format for our Preliminary Examination to ensure uniform rigor.

i. For programs currently accredited include:
   1. Name of accrediting body/organization
   2. Date most recently accredited
   3. Next reaccreditation date
   4. List recommendations from most recent visit and progress to date.

ii. For programs seeking accreditation include:
   1. Name of accrediting body/organization
   2. Timeline for seeking accreditation

iii. For all other programs include:
   1. Date of most recent Academic Program Review (APR)
   2. List of recommendations from the most recent APR and progress to date.

(Note: For first-time reviews, include N/A in response.)

b. Credentials of faculty

i. Include a list of all faculty by name, highest degree and discipline of highest degree. Data as of February 2016

1. *Dilpuneet S. Aidhy, Ph.D. Materials Science and Engineering*
2. *Erica L. Belmont, Ph.D. Mechanical Engineering*
3. *Jian Cai, Ph.D. Mechanical Engineering*
4. *Dennis N. Coon, Ph.D. Ceramic Science*
5. *Paul A. Dellenback, Ph.D. Mechanical Engineering*
6. *Ray S. Fertig III, Ph.D. Materials Science and Engineering*
7. *Carl P. Frick, Ph.D. Mechanical Engineering*
8. *Mark R. Garnich, Ph.D. Mechanical Engineering*
9. *Chung-Souk Han, Dr.-Ing. Civil Engineering/Computational Mechanics*
10. *Kevin Kilty, Ph.D. Geophysics*
11. *Dimitri J. Mavriplis, Ph.D. Mechanical and Aerospace Engineering*
12. *Jonathan W. Naughton, Ph.D. Mechanical Engineering*
13. *Nancy Peck (1/2 time), Ph.D. Mechanical Engineering*
14. *Michael Stoellinger, Ph.D. Mathematics*

ii. Also, include a breakdown by gender and ethnicity:
Female: 2, Male: 12
White: 12, Asian: 2

iii. Grants awarded to academic personnel:
69 grants awarded totaling $6.7M (external + internal) over the past 5 years (2010-2015). Source for iii-v: Faculty CV's submitted for performance evaluation in February 2016.

iv. Grants submitted by academic personnel*:*
92 grants submitted but not accepted in the past 5 years

v. Publications/presentations by academic personnel:
113 peer reviewed journal papers, 192 conference papers or proceedings, 171 conference presentations and invited talks over the past 5 years

vi. National/international awards:
- *Dr. Carl P. Frick, NSF CAREER Award Winner*
- *Dr. Chung-Souk Han, NSF CAREER Award Winner*

vii. Other:
- *Dimitri Mavriplis: Max Castagne Professorship, Co-author of the highly influential NASA Technical Report " NASA Vision 2030 CFD Code"*
- *Jonathan Naughton, Director of UW'S Wind Energy Research Center*
- *Dennis Coon, H.T. Person Professorship in Engineering Education in the College of Engineering and Applied Science*

c. Program reputation
   i. If program is ranked, include rank and by what organization.
   No Ranking.
   ii. Include a brief description of any other indicators of program reputation such as demand (e.g. waiting lists or over enrollment) for admission into program, employer data/feedback, etc.
   Job placement rate for graduates of our PhD program is 100% for the past 5 years.

d. Curriculum of major or specialization
   i. Include a list of courses by prefix, number, title required in the major or specialization
   The ME PhD program requires at least 72 hours of graduate coursework, at least 43 hours of which must be formal graduate coursework. ***All graduate courses are offered to MS and PhD students.*** *A total of 21 graduate courses are listed in the catalog and on average we teach 5 graduate courses per AY. There are no specifically required courses in the PhD program.*

e. Distance delivery of program/major
   i. Note if the program is offered online and/or at one of the off-campus attendance centers (e.g., UW-Casper)
   Not offered online or off-campus

f. Quality of Assessment Plan/data
   i. Include a brief description of the program assessment plan and how the data are used to inform decisions related to program quality and student learning.
   The 2015-2016 Assessment plan (Tier 2) of the ME Department is attached in the appendix.

g. Strategic Plan
   i. Include a brief description of any plans for the program or specialization that appear in the college/department strategic plan (i.e., facilities upgrades, curriculum changes, on-line or off-campus delivery, enrichment learning opportunities, etc.)
   The ME PhD program is critical to the research interests of both the college and the department. The faculty are extremely invested in this program and its continued growth.

h. Other: *None.*

3. **Mission Centrality: Does the program advance the mission of UW including institutional strategy?**
    a. Describe how the program supports the mission, vision and strategic goals of UW.
    The ME PhD program provides critical support for the mission, vision and strategic goals of UW as defined in UP4. The program caters to several of UW's "AREAS OF ACADEMIC DISTINCTION" such as Computational science and engineering, Earth and Energy Science and Engineering and Professions Critical to the State and the Region. We are an integral part of the "Engineering Initiative"to tier 1 by providing nationally and internationally recognized research in the areas of Computational Fluid Dynamics, Combustion, Material Science, and Finite Element Analysis. The ME PhD program is heavily involved with the NWSC (NCAR Wyoming Supercomputing center) as evidenced by three granted large allocations totaling 41 million core hours of computing time. The PhD program also fosters the enhancement of the "Internationalization" as expressed in UP4 - about 50% of the PhD students are foreign nationals and so are a third of the tenure track faculty.
    b. Describe how the program contributes to other programs across campus (i.e., general education courses, minor or support courses, interdisciplinary program, etc.)
    The ME Department offers several courses (ME 5045 Advanced Finite Element Analysis, ME 5440 Fluid Mechanics, ME 5446 Turbulence, ME 5461 Computational Fluid Dynamics I) that are frequently taken by graduate students from other departments (Civil Engineering, Atmospheric Sciences and Mathematics).
    c. Include placement data for graduates and indicate if graduates are working in the field or not.
    For the past 5 years all our PhD graduates are gainfully employed.
    d. Describe the uniqueness or duplication of this program across the UW.
    The PhD program in Mechanical Engineering is unique at UW.
    e. Other: *N/A*

4. **Cost: Is the program financially viable?**
    Since all faculty members teach undergraduate and graduate courses we will report total numbers (BS, MS, and PhD) in items a-b for AY 2014-15.
    a. Ratio of student credit hours per FTE: *313.2*
    b. Direct instructional expenditures
        i. Per student credit hour: *$720*
        ii. Per total degrees awarded: *$48,020*
        iii. Non-personnel expenditures per total academic FTE: *$14,121*
    c. Course enrollment
        i. Number of classes falling under University minimums:
        For AY 2014-15 and 2015-16 we had 1 graduate course (MS & PhD) falling below the enrollment limit of 5 students.
        ii. Lower-division courses falling under University minimums *N/A*
    d. Other instructional cost drivers, such as:
        i. Section fill rates *N/A*
        ii. Course completion rates:
        We can only report grade averages for our graduate courses from academic years 2010-11 to 2014-15: 3.46 (College average 3.52)
        iii. Curricular complexity:

The complexity of the PhD curriculum is very low as explained in section 2.d. All graduate courses are taught for both MS and PhD students. Since the MS program is larger than the PhD program there is no real additional cost associated with the PhD program.

iv. Faculty course load:
The standard faculty course load is 5 courses per semester, which can be reduced according to specific research and administrative metrics.

e. Research expenditures per tenured/tenure-track FTE (and other academic personnel, where appropriate): *$114,170*

f. Compare your data to national benchmarks (Delaware data)

	Dir. Instr. Expend: Per student credit hour	*Dir. Instr. Expend: Per total academic FTE*	*Research expenditures per tenured/tenure-track FTE*
Peers AY 2013	*$384*	*$10,450*	*$141,264*
UW–ME AY 2013	*$682*	*$15,602*	*$110,612*
UW–ME AY 2014	*$720*	*$17,415*	*$114,170*

g. Other:
The ME-PhD program does not require additional teaching/instructional resources beyond the ME-MS program.

Part II - Recommendations

Instructions: *After the review is completed, the Dean in consultation with the Department Head will select one of the following recommendations. In the justification, address each of the items associated with the recommendation.*

1) **Retain Due to Critical Need**
   a) A college may recommend that a degree program be retained due to its ability to fulfill a critical workforce need or shortage area for the state.

   b) Justification for retaining due to critical need must include:
      i) Explanation of why the program is important to the University/State/region
      ii) Description of specific steps (already taken and/or planned) to increase enrollment and graduate production;
      iii) Preliminary outcomes of steps taken.

2) **Retain with Further Review Required**
   a) A college may request that a program be retained for further review for those degree programs that serve a specific function central to the mission of the college or university.

   b) Justification for retain due to further review must include:
      i) Explanation for how the program is central to the university's mission and the benefit to the system;
      ii) Description of specific steps (already taken and/or planned) to increase enrollment and graduate production;
      iii) Preliminary outcomes of steps taken.

3) **Consolidate with Another Program within College**
   a) A college may request that a program be consolidated with a similar program on campus that achieves similar degree requirements.

   b) Justification to consolidate with another program on campus must include:
      i) Explanation for how the degree requirements for the two programs warrant consolidation;
      ii) Evidence that the consolidation will meet graduate production thresholds, or specific steps to increase enrollment to meet production thresholds;
      iii) Preliminary outcomes of steps taken.

4) **Consolidate with Program(s) between Colleges/campuses (e.g., UW/C)**
   a) Two or more colleges may request that similar degree programs be consolidated to maintain equivalent degree programs.

   b) Justification for retaining due to cross-college consolidation must include:
      i) Explanation for how the consolidated programs will collaborate (e.g., sharing of required courses, shared faculty, etc.) to maintain graduate

production thresholds;

ii) Evidence that multi-college collaboration will meet graduate production thresholds, or specific steps to increase enrollment if merging programs fails to meet production thresholds;
iii) Preliminary outcomes of collaboration between colleges.

5) **Terminate**
   a) A college may request that a program be terminated due to limited graduate production, lack of student interest, shifts in a given field of study, or continued declines in major enrollments.
   b) If the exigency for termination results from the program productivity review process then a brief justification to terminate a program should be included. Such a justification must include:
      i) Explanation for the decline in graduate production in the degree program;
      ii) Intended timeframe for submitting a program termination request to the Board of Trustees for their consideration;
      iii) Expected timeline to meet teach-out requirements established through the regional accrediting body.

APPENDIX A

"Low Productivity" Programs Excluded from Review Process

1) **Major Program Modifications**
   a) Degree programs that have undergone recent program modifications that adversely impact graduate production for a college.
   b) Modifications traditionally include programs that have undergone recent name changes during the reporting window that result in two equivalent degree programs.

2) **Program/Major Specializations**
   a) Degree programs that have one or more specializations which reduce the total number of graduates.
   b) The exclusion may apply only for those specializations where the combination results in graduate production that meets the establish threshold for the degree.

3) **Terminated Programs**
   a) Degree programs that have been inactivated during the reporting period, but still depict graduates that fall below the established thresholds.
   b) Terminated programs will remain on the Program Productivity Report until inactive programs have completely cycled through the established reporting period.

4) **New Programs**
   a) Degree programs that have been activated within the past 7 years resulting in limited graduate production due to program implementation.
   b) Institutional review may be requested prior to the 7th year if graduate production is not scaling to the required thresholds for the degree level.

TIER 2 ASSESSMENT OF STUDENT LEARNING OUTCOMES REPORTING FOR 2015-2016 ACADEMIC YEAR

Directions

Programs that attained Tier 2 status based on feedback from last year's annual report (2014-2015) will complete the following assessment report. This format asks departments to describe an assessment project about student learning and to provide results and analyses resulting from the project.

Report Expectations:

Completed reports should be 3 to 4 pages in length. Appendices are welcome, but not required. While the report should be concise, it should provide enough information so that external audiences understand the nature of assessment within your department.

The University Assessment Coordinators will review these reports during the summer and department heads/chairs will receive feedback by September. Please consult the rubric for the criteria used to assess this report (available on the Assessment of Student Learning website).

Why This Report is Important:

Section 10 of the annual report is the main way in which UW systematically collects information about how well the university is doing in developing and implementing effective assessment of student learning processes. As such, please recognize that UW will use these reports as part of the university's body of evidence for continued accreditation by the Higher Learning Commission (HLC). Parts or all of these reports could be read and reviewed by external audiences.

Examples, Advice, and Assistance:

The University Assessment Coordinators have posted examples of completed reports on the Assessment of Student Learning Website.

We encourage the writers of this section of the report to dedicate adequate time to the task. You will not be successful if you try to write this report a few days before the deadline! You should begin working on it during spring semester.

We also recommend that you consult your college assessment coordinator first, OR alternatively Mark Lyford as soon as possible for assistance.

Click here for your college assessment coordinator

Mark Lyford, mahler@uwyo.edu, 766-2897

Tier 2–Assessment of Student Learning Outcomes Report

Department or program name:

Name of degree/program assessed:

Program Level (check one):

_____ Undergraduate

_____ Masters

____X____ Doctorate

Submitted by: Prof. Michael Stoellinger and Prof. Carl Frick, Mechanical Engineering

Date submitted: 7/15/2016

1. **What program or department-level student learning outcome(s) did you assess this year? Please specify.**

We assessed all four of the student learning outcomes of our PhD program (see also the attached Assessment-Matrix):

SLO1: Strong Understanding of Science and Engineering

SLO2: Increase breath of knowledge base related to Mechanical Engineering

SLO3: Ability to perform independent research

SLO4: Effective, professional communication – written and oral

The reason for assessing all student learning outcomes this year is to identify issues with achieving particular SLO's so that we can focus our assessment efforts on those SLO's. We have made substantial modifications to better align SLO's and assessment strategies/metrics as discussed in more detailed in section 2 below. Assessing all SLO's for the current report will also help us establish a practical understanding for how well the metrics work.

2. Describe your program or department's assessment activities, tasks, or projects that took place this year to address the student learning outcomes. Provide sufficient detail so that people outside your department can understand your processes.

Based on the feedback on our 2015 assessment report we have significantly revised our assessment strategy. The revision of the assessment strategy and the collection of data relevant to the new strategy have been the main assessment activity in the past year. In the following, we will briefly outline the new assessment strategy and the new data is presented in section 3.

A major concern voiced in the feedback from the 2015 report was that *"It is difficult to determine if SLO 3 is really related to the metrics they examined. The report does state that 9 different metrics were used to measure SLO3"* where SLO3 was defined as ***"****Utilize ME Department's robust and contemporary learning environment to develop in-depth understanding of Mechanical Engineering"*.

To address this issue we have reformulated our student learning outcomes such that they are more specific and easier to measure. The newly formulated student learning outcomes along with the direct and indirect assessment strategies are summarized in the table 1 below.

Table 1: Student Learning outcomes and the corresponding assessments

Identifying the Learning	**Collecting Data**	
Learning Outcomes	**Assessments**	
	Direct	**Indirect**

Strong Understanding of Science and Engineering	1A) Dissertation – Science & Engineering 2) GPA-UW	6) Survey
Increase breath of knowledge base related to Mechanical Engineering	1B) Dissertation – Broader Impacts 3) Seminar attendance	5) Conference attendance 6) Survey
Ability to perform independent research	1C) Dissertation - Research	4) Publications 6) Survey
Effective, professional communication – written and oral	1D) Dissertation - Writing 1E) Dissertation - Defense Presentation	4) Publications 6) Survey

A more detailed explanation of the assessment metrics is provided in table 2. A highly relevant direct assessment strategy based on a dissertation and defense evaluation rubric that is filled out by every PhD committee member has been developed. Furthermore, an exit survey for all graduating PhD students has been developed as an indirect assessment tool that goes beyond simple counting of publications and conference presentations. Both, the dissertation defense evaluation rubric and the graduate student exit survey are attached in the Appendix at the end of the document. The new assessment strategy has been discussed and endorsed by Mark Lyford and Steven Barret.

Table 2: Direct and indirect assessment tools

Direct Assessments	Indirect Assessments
1. Dissertation/Defense Assessment by	4. Publications/conferences/presentations

all committee members A) Science & Engineering understanding: • Items 1,2,3 of the evaluation rubric B) Broader Impacts: • Item 9 of the evaluation rubric C) Research: • Items 4,5,7,8,10 of the evaluation rubric D) Writing • Item 6 (a) of the evaluation rubric E) Defense presentation • Item 6 (b) of the evaluation rubric 2. GPA of UW courses (grades of all courses taken by graduating students of program) 3. Seminar Attendance (average number of students per seminar)	A) journals B) conference proceedings C) student presentations at conferences *5.* Conference/Workshop attendance 6. Survey of graduated PhD students A) Strong understanding of science and engineering • Items 1-4 on the survey B) Ability to perform independent research • Items 5 and 6 on the survey C) Effective professional communication • Items 7-9 on the survey D) Increase breath of knowledge base related to Mechanical Engineering • Item 10 on the survey

3. Provide relevant data resulting from your department/program's assessment of student learning outcome(s). What are the key findings?

<u>SLO1: Strong Understanding of Science and Engineering</u>

Dissertation evaluation (Direct Assessment 1A): We had 3 PhD students graduate in the last year (2 in Fall 15 and 1 in Spring 16) for which we have received a total of 11 dissertation evaluation forms from the committee members. The first three items are relevant for assessing SLO1:

Evaluation/Guidance	**Needs Improvement**	**Acceptable**	**Excellent**

1. Problem Definition: Has stated the research problem clearly, providing motivation for undertaking the research	9%	64%	27%
2. Literature and Previous Work: Demonstrates sound knowledge of literature in the area, and of prior work on the specific research problem	18%	45%	37%
3. Impact of proposed research: Demonstrates the potential value of solution to the research problem in advancing knowledge within the area of study	18%	36%	46%

GPA of UW courses (Direct Assessment 2): Average GPA from graduate courses taken at UW based on the 3 PhD graduates = 3.75. Average number of graduate course hours taken at UW based on 3 PhD graduates = 20

Key findings SLO1: The average GPA of our graduating PhD students based on the courses taken at UW (ME and other Departments) is high indicating that the students are performing well in the class room. This should translate into a strong understanding of Science & Engineering in general. The average of 20 course hours (about 6 courses) taken reflects the fact that many PhD students join the program with an awarded MS degree which allows them to transfer a significant amount of coursework. Two out of the eleven committee members (18%) thought that the dissertation needs improvement regarding the discussion of "Literature and Previous Work" and of the specific impact of the solution to the research problem in advancing the knowledge in the field.

SLO2: Increase breath of knowledge base related to Mechanical Engineering

ME Seminar attendance (Direct Assessment 3): We collected data during the Spring 16 semester for 4 out of the 5 scheduled seminars. On average 24 out of 49 graduate students (MS and PhD) attended the seminars.

Dissertation evaluation – Broader Impacts (Direct Assessment 1B)

9. Broader Impact: Demonstrates awareness of broader implications of the research. Broader implications may include social, economic, technical, ethical, business, etc. aspects	27%	55%	18%

Conference attendance (Indirect Assessment 5): We have collected data from 22 out of the 26 PhD students (85%) and found that they attended an average of 2.9 conferences and workshops to date.

Key findings SLO2: The students seem to attend about half of all the seminars which should help them increase their breath of knowledge base related to Mechanical Engineering in particular in fields outside of their own research. The PhD students also attend 2.9 conferences/workshops on average which exposes them to research in and outside their specific topics. Three out of eleven (27%) of the committee members think the discussion of the broader impacts in the dissertation needs improvements.

SLO3: Ability to perform independent research

Dissertation evaluation – Research (Direct Assessment 1C)

Evaluation/Guidance	**Needs Improvement**	**Acceptable**	**Excellent**
4. Solution Plan: Has applied sound state-of-the-field research methods/tools to solve the defined problem and has described the methods/tools effectively	9%	36%	55%
5. Results: Analyzed and interpreted research results/data effectively	18%	36%	46%
7. Quality of Responses to Questions: completeness, organization of argument, subject area knowledge exhibition	18%	55%	27%
8. Critical Thinking: Has demonstrated capability for independent research in the area of study and expertise in the area	9%	55%	36%
10. Publications: Journal or conference publications have resulted from this research	0%	50%	50%

Publications/conferences/presentations (Indirect Assessment 4): We have collected data from 22 out of the 26 PhD students (85%) and found that they

- had an average of 1.3 peer reviewed journal publications
- had an average of 2.4 conference papers
- gave on average 2.7 conference presentations

Key findings SLO3: The data indicates that our students are indeed able to perform independent research. The core aspects of the dissertation including the resulting publications are rated predominantly high by the committee members. This is confirmed by the average numbers of journal and conference publications as well as by the amount of given presentations.

SLO4: Effective, professional communication – written and oral

Dissertation evaluation – Writing & Oral (Direct Assessment 1 D&E)

Evaluation/Guidance		Needs Improvement	Acceptable	Excellent
6. Quality of Written and Oral Communication: Communicates research clearly and professionally in both **a) written** and **b) oral** form	**(a)**	0%	55%	45%
	(b)	0%	64%	36%

Key findings SLO4: The quality of both, oral and written communication is rated high by the committee members. The number of published papers indirectly confirms this since poorly written papers would not get published.

4. Interpret the results as they relate to your department/program's strengths and challenges. What changes to the process, program, or curriculum are contemplated in the future, are planned, or have been made as a result of these data?

Due to the revision of our assessment process we had to collect new data during the past year and hence the small sample size of 3 graduated PhD students somehow limits the conclusions drawn from the data. In the next report we will analyze data from two years which will also be aligned with the Tier 2 report frequency and help to increase the sample size.

We believe that a core strength of the ME department is the highly recognized research work that is done by our PhD students under the guidance of our faculty members. This is reflected by the data, showing that the PhD graduates are very capable of performing independent high quality research. The student research leads to a number of publications and also conference presentations which, in turn, lead to strong written and oral communication skills of our students.

The assessment results seem to indicate that our PhD graduates struggle somewhat to put their own research work into the context of the advancement of the research field and also to articulate the broader impact of their research on the society. This is probably due to the focus on getting, analyzing, and publishing research results as required in the externally funded research groups most often found in our Department. We will discuss this finding in the first faculty meeting in Fall 16. A possible response to

improve on this issue is to have the more senior student be more involved in the writing of the broader impact statements that are required in most grant proposals.

Some changes to the assessment process will consist of a more thorough data collection regarding the attendance of the seminars such that we have separate data for PhD and MS students and also data on whether the attended seminar was in the students' research field or not. This will help us to better assess SLO1 and SLO2.

5. **What are the plans for your department/program to improve from Tier 2 to Tier 1 status? What actions or steps will your department/program take next year? (**Go to http://www.uwyo.edu/assessment/annual-reports/ for definitions of each assessment tier).

The main step for us to achieve Tier 1 is to "close the loop" in our assessment process. As a specific example we will take the finding that our PhD students' ability to formulate broader impacts of their research could be improved. We will bring this to the attention of the faculty members and also suggest involving the graduate students more in the writing of the broader impact sections for new proposals. Based on the subsequent assessment data taken over the next years, we can then measure if the taken action indeed leads to an improvement. We will report on this "loop closing" in the next assessment report.

Another step we will take next year is to diligently collect the PhD graduate student exit surveys since they are an important indirect assessment tool that will help us to get a more complete picture of the student learning outcomes.

Appendix

PhD Dissertation and Defense Outcome Assessment Rubric

Candidate Name: _____ Date: _____

Dissertation Title: _____

Evaluation/Guidance		Needs Improvement	Acceptable	Excellent
1. Problem Definition: Has stated the research problem clearly, providing motivation for undertaking the research				
2. Literature and Previous Work: Demonstrates sound knowledge of literature in the area, and of prior work on the specific research problem				
3. Impact of proposed research: Demonstrates the potential value of solution to the research problem in advancing knowledge within the area of study				
4. Solution Plan: Has applied sound state-of-the-field research methods/tools to solve the defined problem and has described the methods/tools effectively				
5. Results: Analyzed and interpreted research results/data effectively				
6. Quality of Written and Oral Communication: Communicates research clearly and professionally in both **a) written** and **b) oral** form	**(a)**			
	(b)			
7. Quality of Responses to Questions: completeness, organization of argument, subject area knowledge exhibition				
8. Critical Thinking: Has demonstrated capability for independent research in the area of study and expertise in the area				
9. Broader Impact: Demonstrates awareness of broader implications of the research. Broader implications may include social, economic, technical, ethical, business, etc. aspects				
10. Publications: Journal or conference publications have resulted from this research				

Overall Assessment: The assessment of the overall performance of the candidate based on the evidence provided in the items above.

Criteria	**Performance Ratings**		
Overall, my assessment of the candidates performance	**Needs Improvement**	**Acceptable**	**Excellent**

PhD Graduate Survey

Name: _____ Date: _____

Dissertation Title: _____

Evaluation items	**Needs Improvement**	**Acceptable**	**Excellent**
1. Please rate your understanding of science and engineering.			
2. How would you rate the quality of the courses offered in ME?			
3. How would you rate the quality of the courses offered outside of ME?			
4. Does the ME Department offer enough graduate courses?			
5. How would you rate your ability to perform independent research?			
6. Did you receive sufficient support and guidance to become an independent researcher?			
7. Do you feel confident in your scientific writing skills?			
8. Do you feel confident in your oral presentation and communication skills?			
9. How would you rate the support you have received to improve your writing and presentation skills?			
10. Do you think that the ME seminars increases the breath of your knowledge base related to Mechanical Engineering?			

Overall Assessment: How would you rank the quality of the ME Department's PhD program?

Criteria	Performance Ratings		
Overall, my evaluationof the program	**Needs Improvement**	**Acceptable**	**Excellent**

Please add any specific comments you have on the back of the form.