



December 30, 2019

Daniel A. Reed  
Senior Vice President for Academic Affairs  
205 Park Bldg.  
Campus

RE: Graduate Council Review  
Department of Materials Science and Engineering

Dear Vice President Reed:

Enclosed is the Graduate Council's review of the Department of Materials Science and Engineering. Included in this review packet are the report prepared by the Graduate Council, the Department Profile, and the Memorandum of Understanding resulting from the review wrap-up meeting.

After your approval, please forward this packet to President Ruth Watkins for her review. It will then be sent to the Academic Senate to be placed on the information calendar for the next Senate meeting.

Sincerely,

David B. Kieda  
Dean, The Graduate School

Encl.

XC: Michael S. Simpson, Chair, Department of Materials Science and Engineering  
Richard B. Brown, Dean, College of Engineering  
Darryl P. Butt, Dean, College of Mines and Earth Sciences

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## **Department of Materials Science and Engineering**

A unique collaboration between the College of Engineering and the College of Mines and Earth Sciences has addressed a central constraint raised in the review of the Department of Materials Science and Engineering (MSE). By merging with the Department of Metallurgical Engineering, they have created a department with more complete disciplinary breadth and a larger core faculty. This is now an opportunity to spread best practices across this new department and to build further on current research strengths. MSE was particularly commended for their success in the recruitment, involvement, and satisfaction of their undergraduates.

**The Graduate School - The University of Utah**

**GRADUATE COUNCIL REPORT TO THE SENIOR VICE PRESIDENT  
FOR ACADEMIC AFFAIRS AND THE ACADEMIC SENATE**

*February 25, 2019*

The Graduate Council has completed its review of the **Department of Materials Science and Engineering**. The External Review Committee included:

Katherine T. Faber, PhD  
Simon Ramo Professor of Materials Science  
Department of Applied Physics and Materials Science  
California Institute of Technology

Leonard Feldman, PhD  
Distinguished Professor  
Department of Materials Science and Engineering  
Rutgers University

Xiaoqing Pan, PhD  
Professor and Henry Samueli Endowed Chair in Engineering  
Department of Chemical Engineering and Materials Science  
University of California, Irvine

The Internal Review Committee of the University of Utah included:

Lyda Bigelow, PhD  
Associate Professor  
Department of Entrepreneurship & Strategy

Ryan Smith, M.Arch  
Former Associate Professor  
School of Architecture

Scott L. Anderson, PhD  
Distinguished Professor  
Department of Chemistry

This report of the Graduate Council is based on the self-study submitted by the Department of Materials Science and Engineering, the reports of the external and internal review committees, and joint responses to the external and internal reports from the Chair of the Materials Science and Engineering Department and Dean of the College of Engineering.

## **DEPARTMENT PROFILE**

### **Program Overview**

The Materials Science and Engineering (MSE) program at the University of Utah was accredited in 1971-1972, first as a division within Mechanical Engineering, then gaining independent departmental status in 1974-1975. Its mission statement is centered on “student learning through teaching, research, and service within the University of Utah and the community,” also emphasizing the cultivation of critical thinking, community skills, and a desire for life-long learning.

Materials science and engineering is by its nature interdisciplinary, bridging traditional disciplines of physics, chemistry, and engineering. The field impacts numerous key technologies connected with computers, medicine, and manufacturing. External reviewers note that the importance of the materials science field and its natural connections with other technical disciplines situate MSE ideally to fulfill its education, research, and service responsibilities to the community. They suggest that MSE “can serve as the center pin of large projects and large multi-PI grants and stimulate the creation of new enterprises and businesses.”

The MSE Department offers programs of study toward BS, BS/MS, MS, and PhD degrees. It has a growing presence in the Honors program and is promoting undergraduate research through the Undergraduate Research Opportunities Program. Successful recruiting efforts have led to significant recent growth in the undergraduate program. The trajectory of the graduate program is less encouraging, however.

A long-standing issue with the MSE Department, noted by all reviewers, is its relatively small size. While the field of materials science is growing, MSE at Utah has remained constrained, in part due to an unusual institutional structure that has separated it from Metallurgical Engineering, a closely connected discipline that for historical reasons is in the College of Mines and Earth Sciences at Utah. This circumstance underlies the most substantive concerns of the reviewers. Major recommendations center on bringing MSE and Metallurgical Engineering closer together, either through merger of the departments or other initiatives that will create a more unified and robust graduate admissions and training program.

### **Faculty**

The MSE Department currently has 11 tenure-line faculty members, eight of whom have full-time appointments in the Department, while two hold joint appointments with other departments (Chemistry and Electrical and Computer Engineering) and another is in phased retirement. Additional faculty members include three auxiliary faculty who contribute to the Department’s teaching and outreach missions, particularly in core courses, and a fourth career-line faculty member who contributes to the development of the research mission of the Department. The present faculty composition reflects a number of changes since the last review, including three tenure-line hires (two full-time in the Department and a 0.5 FTE joint appointment),

and two career-line hires. The Department has just one Assistant Professor, and the average age of the tenure-line faculty is 55, a demographic that prompted the external reviewers to suggest that the Department should make strategic plans for hiring younger faculty while considering the benefits of incentives for faculty retirement.

Both internal and external reviewers praise the overall quality of the faculty, lauding the several MSE faculty members who are research-active, well-funded, and exhibiting leadership in their fields. Notably, two members of this small Department are members of the National Academy of Engineering. Recent trends in research support are less encouraging, however. Internal reviewers note that some senior faculty have low research activity; external reviewers note the recent loss of the NSF-supported Materials Research Science and Engineering Center. By the reckoning of the internal reviewers, the net effect has been a reduction of research funding from ~3.6M/year to ~2.4M/year. Because research funding is presently the only source of support for PhD students, a necessary consequence has been a significant reduction in the size of the MSE graduate program, detailed below.

Internal reviewers express serious concerns over recent decreases in research support and the accompanying shrinkage in the PhD program. They fear that the stature of the Department is at risk, and that with further erosion of the Department's reputation it will become difficult to recruit strong faculty. They suggest that rebuilding should commence immediately, possibly through a process of borrowing faculty lines from other departments in the college, rather than waiting to hire only into positions vacated by retirement. In the letter responding to the internal reviewers, the Chair and Dean appear to respond positively to this suggestion, though specific commitments are not made. Internal reviewers suggest that another useful step toward strengthening materials science research would be to merge the Department with Metallurgical Engineering, a theme repeated throughout both reports.

The Department's self-study states that the normal teaching load for research-active faculty should be one course per semester and that junior faculty generally receive lighter teaching assignments. Both internal and external reviewers note that a disproportionate amount of teaching is in fact being done by one career-line Assistant Professor and the sole tenure-track Assistant Professor in the Department. A prior review recommended that tenured faculty increase their contributions to the core courses. Internal reviews indicate that this has had the unintended effect of decreasing the rigor of certain courses, necessitating intervention by junior faculty (who thereby take on an increased load).

The current faculty of 11 includes only one woman (0.5 FTE joint appointment) and no underrepresented minorities (URM). According to the Survey of Earned Doctorates, national norms in materials science engineering (percent of awarded PhDs) are ~25% female and ~15% URM (African-American, Hispanic/Latino and two or more races). External reviewers suggest that the Department needs to make stronger efforts to improve the diversity of its faculty. In the letter of response, the Chair and Dean noted that they will keep diversity in mind in future faculty hiring but that the main problem has been with the small number of hires they have been able to make; specific plans for improvement in this area were not described.

## **Students**

Undergraduate students. The number of MSE undergraduates has grown substantially in the period since the last review, increasing from 48 in AY2010-11 to 88 in AY2016-17. Growth has resulted from concerted recruiting efforts by the Department, and particularly an outreach campaign spearheaded by undergraduate students who have made many visits to local high schools and prospective student events. The Department has placed greater emphasis on the BS/MS program in recent years. Students drawn to research are pleased to have the opportunity to finish both degrees in five years, and those recruited into the Department by this avenue are enthusiastic about the major.

Students express a high degree of satisfaction with the major overall. They are attracted to and proud of the high degree of rigor, the bridging of disciplines, and the ability to put their knowledge to practical use (internal reviewers). Students also value the accessibility of most faculty members and the excellent faculty/student interactions, as well as the opportunities for undergraduate research (external reviewers). The Department implements a thoughtful scheme for student advisement, and the undergraduate advisor, Marcie Leek, was praised for her knowledge of the curriculum and skill in assisting students as they navigate the curriculum.

With the growth of the undergraduate student population in MSE has come an increase in student diversity. Among currently enrolled undergraduates, approximately 25% are female, and 11% Hispanic/Latino, as described in the self-study. Both percentages are in line with national norms for this discipline.

Graduate students. Enrollment in the MSE PhD program has declined since the last review, from an average of about 33 (2011-2013) to a present enrollment of around 20. The size of the program does not appear to be restricted by a shortage of qualified applicants; acceptance rates have been in the 10%-20% range (self-study Table 3.4), and academic qualifications of the applicant pool appear comparable to those of the admitted students. The reduction in size seems linked to the decrease in research funding. Although students are required to serve as Grading Assistants for one semester, the Department budget does not include support for TAs. For the past 10 years, admittance into the program depended upon an offer of support from an MSE faculty member.

Students in the PhD program generally expressed satisfaction with the program (external review), and many appreciated the open-door policy of the faculty (internal review). Some students expressed frustration with the shortage of research-active faculty to mentor and support PhD students (internal review). In connection with this, external reviewers noted that graduate recruiting might benefit from graduate admissions being coupled with Metallurgical Engineering. Although generally satisfied, students voiced a number of specific concerns with both the facilities and the curriculum, detailed in sections below.

In terms of diversity, females constitute 38% of the current group of graduate students, a significant increase from the previous review (11%) and above the national norms of ~25%. Notably, the majority of female students in the program (7/8 in 2017) are nonresident aliens, whereas the reverse is true for the male students (2/13 nonresident alien). Only one student self-identified as a member of an underrepresented ethnicity (internal review).

## **Curriculum**

Undergraduate program. The BS in Materials Science is a demanding course of study that includes significant components of chemistry, physics, math, and chemical, mechanical and electrical engineering in addition to an array of MSE courses. While students regard it as one of the most demanding majors in the College, those interviewed are “extremely satisfied with and enthusiastic about the major” (internal review) and “very proud of the department” (external review). Some would invite increased rigor, suggesting that admissions standards to the program could be raised further (external review).

Students expressed concern with what they viewed as inconsistent rigor in some of the core courses (both internal and external reviews) and suggest that some might benefit from the use of more up-to-date textbooks (external review). These concerns are connected with the inordinately heavy teaching load that has fallen on junior faculty, a situation described by the review panels as disturbing and surprising. Further concerns were noted with a relative shortage of polymer/soft materials courses (external review) and with perceived redundancy in some course material, specifically the double coverage of some topics in statistics (internal review). Also, although metallurgy is a necessary component in a materials science degree, it is not offered in the Department and must be taken through the College of Mines and Earth Sciences. External reviewers state that “duplication of courses in materials science and engineering and metallurgy is troubling and unnecessary” and suggest that an effort be made to develop a set of core courses that can accommodate students from both programs. In response to this recommendation, members of the two departments have met to discuss possible pathways to greater efficiency (see Chair and Dean’s letter of response to external review).

Graduate programs. In addition to 14 hours of thesis research, PhD students in MSE must complete at least 36 hours of coursework and 4 hours of graduate seminar, suggesting a rigorous course of study. Students expressed some dissatisfaction with the high number of required electives, indicating that the topics were sometimes not germane to their research area and that the time might be better spent working on their thesis research (internal review). It was further suggested that the graduate curriculum offers too few choices beyond the core (external review). The Department has already undertaken moves that should ameliorate this problem, implementing a new teaching rotation that has increased the number and diversity of technical electives. Notwithstanding this enlarged menu of electives, internal reviewers suggest that the Department reconsider the number required.

All reviewers drew attention to issues with the graduate seminar program, which many students regard as no more than a drain on their time. The seminar is unfunded and relies on visitors who are visiting campus for other reasons, with many of the slots filled by graduate students. Both internal and external reviewers agree that the graduate seminar is an important component of the curriculum and is in need of attention. There is reason to hope that this situation will improve very soon; in their response to the internal reviewers, the Chair and Dean describe a concrete plan for improving the seminar program.

In response to recommendations of a previous review, the Department has put in place (since AY2015-16) a new procedure for the qualifying exam. The new exam consists of a written component taken in the morning followed by a one-on-one oral examination by the faculty members who set the questions. Although it is too early to fully evaluate the new format, the procedures and expectations have been set out clearly, likely increasing its chances for success.

The Department is making an effort to increase enrollments in the MS and BS/MS programs (self-study 3.3). External reviewers note that the increased emphasis on the BS/MS can provide a relatively inexpensive way to expand the graduate program.

### **Program Effectiveness and Outcomes Assessment**

Undergraduate program. Assessment criteria for BS students, as described in the self-study, are detailed and thorough. A thoughtfully organized sequence of advising meetings ensures that students joining the major are prepared to take advanced engineering courses and are set on an appropriate trajectory of coursework. During the last semester, student progress is assessed with an End of Program Review, which begins with the completion and presentation of a Senior Design Project at an annual banquet and presentation held in April. The project includes a written component due at the end of the semester. Graduating seniors also complete an exit survey in which they provide information on prospective employment. An Industrial Advisory Committee, in existence since AY2008-09, interacts with faculty on an annual basis to provide feedback on the preparation of recent graduates for meeting the engineering requirements of their employment in local companies. On the advice of this committee, the Department is planning to develop social media as a means of maintaining contact with students after graduation, and an alumni contact page as a means for connecting with alumni in industry.

An additional data point, noted by all reviewers, is the success of the program in recruiting increasing numbers of high-quality undergraduate students. By this measure, the program is doing very well.

Graduate program. Curricular requirements for PhD students are spelled out clearly in the self-study. External reviewers expressed some concern with the lack of assessment of graduate-student progress, suggesting that some means of recording graduate-student trajectories should be developed. On the positive side, the qualifying exam—a key milestone toward the PhD—has received needed attention and should provide a better-standardized readout on student progress to that stage. Retention rate in the years since the last review appears in line with other PhD programs (with roughly 25% of students dropping out before completion of the degree). The self-study states that “for graduate students, retention is an issue that is controlled by the individual faculty advisors of the graduate students and is based on completion of required courses and continued research as outlined and required by the graduate student’s faculty advisor.” The Graduate Council was concerned that this description did not incorporate the role of the thesis committee, as this is critical to avoid inconsistency in standards and to ensure appropriate balance of power in guiding the student through the milestones of the program. The external committee was also concerned that, as part of graduate program outcomes, “critical assessment associated with research, beyond statistics, received little attention in the self-study and almost no discussion in the actual visit.”

### **Facilities and Resources**

The MSE Department is housed on the second and third floors of the Civil and Materials Engineering Building (CME), in space that includes offices for 10 faculty members, an administrative center, conference rooms, and a student study room with a small kitchen. While external reviewers regard the space as “adequate,” the internal review panel expressed concerns, noting that the space cannot accommodate growth

in the faculty or faculty visitors from other universities. The Department does not have space dedicated to classroom teaching, relying on spaces in Warnock and Merrill arranged through the University teaching office.

Teaching laboratories are described by both panels as adequate for present purposes but unlikely to meet the demand as the undergraduate program grows. External reviewers expressed concern with the age of some instrumentation in the teaching and characterization labs and urged the Department to devise a roadmap for upgrading these facilities. Nanofabrication facilities, as well as facilities for electron microscopy and ion beam systems, are regarded as first-rate resources for the Department.

A serious facilities issue, raised by the internal review panel, concerns spaces for graduate students. Presently, some students must occupy desks inside laboratories, with inappropriate proximity to instruments and in some cases without adequate temperature control. Students and faculty state that these space concerns present an obstacle to the recruitment of overseas graduate students who might otherwise come to the Department fully funded by their home governments. Internal reviewers noted that the existing research space does not have wet lab capabilities needed for emerging research in bioengineering and chemistry. They link these facilities concerns with the shrinkage in external grant funding, stating that the Department will be at risk if it does not secure increased funding, more graduate students, and updated spaces soon. Reviewers (both internal and external) suggest that these issues might be addressed by a merger with Metallurgical Engineering.

The MSE Department employs one full-time administrative officer, one full-time academic advisor, and a full-time clerk. The self-study states that existing staff support is sufficient for the Department's needs, but reviewers (external) suggest that the Department is short of administrative staff to support research proposal development and grant administration, and that the Department is short of staff to run the teaching laboratories, as it presently relies on student interns.

## **COMMENDATIONS**

1. The Department has responded constructively to the previous review by instituting a new qualifying exam procedure and a new teaching rotation that allows for additional technical-elective course offerings.
2. The Department has made strong hires in the period since the last review, and new faculty are on the way to establishing strong research programs and teaching portfolios.
3. Since the last review, both the size and diversity of the undergraduate MSE program have increased significantly. The Department has fostered development of a strong undergraduate SAC that has built community and contributed substantively to recruitment efforts.
4. The Department has substantially increased its participation in both the Honors program and in UROP-sponsored undergraduate research.
5. Department staff are doing an excellent job in supporting the activities of the Department. Undergraduate student advising garnered special praise.

## RECOMMENDATIONS

1. The Department should formulate a strategic plan that gives urgent priority to rebuilding its research strengths. To support this plan, the Department should explore specific tactics such as creating a shared training environment with Metallurgy, possibly through a merger with Metallurgy, and planning for multi-PI grants that involve collaborations beyond the Department.
2. The Department's strategic plan should include aggressive actions to enhance faculty diversity, including specific steps to address recruitment, hiring, mentoring, and retention of diverse faculty members.
3. The Department should follow through on plans to upgrade the graduate seminar and to decrease course overlap/redundancy.
4. The Department should take steps to address the problem of non-uniform rigor in the graduate and undergraduate curricula, while minimizing inequities in teaching loads, particularly for junior faculty. The Department should also seek to develop more effective methods for assessing graduate-student progress and for tracking its graduates.
5. The Department's strategic plan should include a process to identify the most critical space and facilities needs, in order to meet anticipated demands for teaching laboratory space, research space for graduate students, and growth of the faculty.

Submitted by the Ad Hoc Committee of the Graduate Council:

David F. Blair (Chair)  
Professor, Department of Biology

Anthea Letsou  
Professor, Department of Human Genetics

Joanna Bettman Schaefer  
Professor, College of Social Work

Monisha Pasupathi (Undergraduate Council Representative)  
Professor, Department of Psychology

College Name  
All

Department Name  
Materials Science & Engineering

Program  
All

## Faculty Headcount

		2011-2012	2012-2013	2013-2014	2014-2015	2015-2016	2016-2017	2017-2018
<b>With Doctoral Degrees Including MFA and Other Terminal Degrees</b>	Full-Time Tenured Faculty	6	5	5	6	6	6	5
	Full-Time Tenure Track	2	1	3	2	2	2	2
	Full-Time Career Line/Adjunct Faculty	1	2	1	1	2	4	1
	Part-Time Tenure/Tenure Track	1	0	0	0	0	0	1
	Part-Time Career Line/Adjunct Faculty	3	3	1	1	1	2	3
	<b>Total</b>	13	11	10	10	11	14	12
<b>With Masters Degrees</b>	Full-Time Tenured Faculty							
	Full-Time Tenure Track							
	Full-Time Career Line/Adjunct Faculty	1	0	0	0	0	0	0
	Part-Time Tenure/Tenure Track							
	Part-Time Career Line/Adjunct Faculty	0	1	0	0	0	0	0
	<b>Total</b>	1	1	0	0	0	0	0
<b>With Bachelor Degrees</b>	Full-Time Tenured Faculty							
	Full-Time Tenure Track							
	Full-Time Career Line/Adjunct Faculty							
	Part-Time Tenure/Tenure Track							
	Part-Time Career Line/Adjunct Faculty							
	<b>Total</b>							
<b>Total Headcount Faculty</b>	Full-Time Tenured Faculty	6	5	5	6	6	6	5
	Full-Time Tenure Track	2	1	3	2	2	2	2
	Full-Time Career Line/Adjunct Faculty	2	2	1	1	2	4	1
	Part-Time Tenure/Tenure Track	1	0	0	0	0	0	1
	Part-Time Career Line/Adjunct Faculty	3	4	1	1	1	2	3
	<b>Total</b>	14	12	10	10	11	14	12

## Cost Study

	2011-2012	2012-2013	2013-2014	2014-2015	2015-2016	2016-2017	2017-2018
<b>Direct Instructional Expenditures</b>	1,712,766	1,527,662	1,857,814	1,634,587	1,841,091	1,816,997	1,918,319
<b>Cost Per Student FTE</b>	23,380	21,936	25,029	20,329	22,664	22,201	22,835

## FTE from Cost Study

	2011-2012	2012-2013	2013-2014	2014-2015	2015-2016	2016-2017	2017-2018
<b>Full-Time</b>	14	12	16	15	11	12	10
<b>Part-Time</b>	1	2	1	0	0	0	2
<b>Teaching Assistants</b>	0	1	1	0	0	0	0

## Funding

	2011-2012	2012-2013	2013-2014	2014-2015	2015-2016	2016-2017	2017-2018
<b>Total Grants</b>	3,623,534	3,696,779	2,761,863	2,802,742	2,553,824	2,430,902	1,613,448
<b>State Appropriated Funds</b>	1,509,823	1,421,326	1,532,520	1,589,433	1,612,525	1,755,980	1,771,895
<b>Teaching Grants</b>	14,350	1,845	1,580	6,311	0	0	0
<b>Special Legislative Appropriation</b>							

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**Differential Tuition**

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**Student Credit Hours and FTE**

		2011-2012	2012-2013	2013-2014	2014-2015	2015-2016	2016-2017	2017-2018
<b>SCH</b>	Lower Division	435	626	603	611	693	749	738
	Upper Division	675	596	822	950	922	1,049	1,055
	Basic Graduate	345	140	221	284	248	205	281
	Advanced Graduate	381	439	314	284	301	234	205
<b>FTE</b>	Lower Division	14	21	20	20	23	25	25
	Upper Division	23	20	27	32	31	35	35
	Basic Graduate	17	7	11	14	12	10	14
	Advanced Graduate	19	22	16	14	15	12	10
<b>FTE/FTE</b>	LD FTE per Total Faculty FTE	1	1	1	1	2	2	2
	UD FTE per Total Faculty FTE	2	1	2	2	3	3	3
	BG FTE per Total Faculty FTE	1	0	1	1	1	1	1
	AG FTE per Total Faculty FTE	1	1	1	1	1	1	1

**Enrolled Majors**

	2011-2012	2012-2013	2013-2014	2014-2015	2015-2016	2016-2017	2017-2018
<b>Undergraduate Pre-Majors</b>	29	37	24	24	25	24	45
<b>Undergraduate Majors</b>	37	51	53	60	66	64	54
<b>Enrolled in Masters Program</b>	9	3	1	4	7	6	4
<b>Enrolled in Doctoral Program</b>	33	33	31	30	26	22	19
<b>Enrolled in First-Professional Program</b>							

**Degrees Awarded**

	2011-2012	2012-2013	2013-2014	2014-2015	2015-2016	2016-2017	2017-2018
<b>Undergraduate Certificate</b>							
<b>Graduate Certificate</b>							
<b>Bachelors</b>	13	12	13	13	20	12	19
<b>Masters</b>	10	3	2	0	3	5	3
<b>Doctorate</b>	7	5	5	10	4	6	1
<b>First-Professional</b>							



## **Memorandum of Understanding Department of Materials Science and Engineering Graduate Council Review 2017-18**

This memorandum of understanding is a summary of decisions reached at a wrap-up meeting on September 27, 2019, and concludes the Graduate Council Review of the Department of Materials Science and Engineering. Daniel A. Reed, Senior Vice President for Academic Affairs; Richard B. Brown, Dean of the College of Engineering; Darryl P. Butt, Dean of the College of Mines and Earth Sciences; Michael F. Simpson, Chair of the Materials Science and Engineering Department; Feng Liu, Former Chair of the Materials Science and Engineering Department; David B. Kieda, Dean of the Graduate School; and Katharine S. Ullman, Associate Dean of the Graduate School, were present.

The discussion centered on but was not limited to the recommendations contained in the review summary report presented to the Graduate Council on February 25, 2019. The working group agreed to endorse the following actions:

**Recommendation 1: The Department should formulate a strategic plan that gives urgent priority to rebuilding its research strengths. To support this plan, the Department should explore specific tactics such as creating a shared training environment with Metallurgy, possibly through a merger with Metallurgy, and planning for multi-PI grants that involve collaborations beyond the Department.**

Since the Graduate Council report was completed, the Department of Materials Science and Engineering (MSE) merged with the Department of Metallurgical Engineering. While the name of the department remains Materials Science and Engineering, it now houses metallurgy, which is integral to the materials science discipline. This merger reflects a unique collaboration between two colleges and is a significant accomplishment that addresses a central concern expressed by reviewers of both departments. These changes are still fresh and several administrative steps remain to be completed, including filing paperwork for a new department and aligning faculty appointments with this department. Moreover, while an MOU was created to outline the unique governance structure of MSE, a more comprehensive operational plan needs to be laid out to support uniform practices in a longer-term manner. This plan should provide clarity and stability, yet it is a living document and even the process of how to amend it needs to be delineated. These steps forward are clearly strategic ones, but with this strong unified foundation in place, it will be important to create a more comprehensive strategic plan that builds on the vision of this new department and is consistent with strategic plans of both the College of Engineering and the College of Mines and Earth Sciences. The department's strategic plan should seek to capitalize on their unique position at the intersection of these two colleges. Relevant recommendations in this MOU, as well as that of Metallurgical Engineering, should be taken into account, and further ideas can be found in reviewer reports from these recent reviews.

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Along the lines of long-term strategic planning, we discussed the advantages of looking more broadly across campus for faculty involved in related research. Having more faculty associated with the graduate program through adjunct or joint appointments offers several advantages, including more disciplinary coverage (such as polymer research) and a larger array of available courses (cross-listed through multiple units), which in turn enhances the graduate program and attracts quality students. Creating these broader connections will also help efforts to bolster multi-PI collaborations, which was noted as an area where there have been recent successes and where there is great potential to further grow.

**Recommendation 2: The Department's strategic plan should include aggressive actions to enhance faculty diversity, including specific steps to address recruitment, hiring, mentoring, and retention of diverse faculty members.**

The Department acknowledges the high-level importance of increasing diversity among its faculty. In their current search, they have taken care to place advertisements where they will reach a diverse audience and they intentionally chose to focus their search on sub-specialties in which female graduates are more prevalent. Just as important as increasing diversity among the applicant pool will be designing campus visits that highlight the inclusive, supportive culture. Dean Brown emphasized that the Department has seen impressive increases in the diversity of its undergraduate population; exposing faculty candidates to undergraduates who represent this full cross-section would be one way to underscore the community the Department supports. It would also be good to highlight the strong chapter of the Society of Women Engineers fostered by the College of Engineering. Another tactic would be to involve diverse faculty from other departments who have disciplinary connections to meet with candidates to illustrate the potential for a wider network of peers. Underlying these recruiting efforts, a Diversity Action Plan that supports an inclusive culture in the new department and ensures that practices are broadly in place to support mentoring and retention is important. Dean Kieda pointed out that an immediate and simple step supporting an inclusive community is to be deliberate in seeking diversity of external speakers in the graduate seminar series. Finally, with respect to longer term plans to enhance faculty diversity, the Department could build on its success at the undergraduate level by increasing their mentorship and encouragement to pursue academic careers. This pipeline would benefit the field and may even ultimately provide connections to alumni who are promising faculty candidates with an affinity to the University of Utah.

**Recommendation 3: The Department should follow through on plans to upgrade the graduate seminar and to decrease course overlap/redundancy.**

The recent merger has already spurred actions in these areas, as the graduate seminar and a review of courses for redundancy were immediate priorities. With regard to the graduate seminar, the merger also helps by creating a bigger built-in audience for outside speakers. With resources now budgeted for outside guests, the graduate seminar has been organized around a combination of internal and external speakers.

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Commendably, this is also now used as a forum for graduate students to learn about communication skills and to receive written feedback. For this departmental activity to be robust, faculty must regularly attend as well, and the group discussed how to promote this expectation. Beyond simply articulating this message, practical ideas include having the seminar at a set time that people learn to reserve and sending out calendar appointments as an additional reminder. With regard to course overlap/redundancy, the merger prompted elimination of several classes that were overlapping. Continuing to review coursework is likely to uncover additional areas to streamline. Looking particularly for overlap in BS/MS course content is one area to focus on and brought up the possibility of allowing more flexibility in curriculum -- for instance, allowing students to cross-over to particular courses offered across the College of Engineering, or in other colleges across campus.

**Recommendation 4: The Department should take steps to address the problem of non-uniform rigor in the graduate and undergraduate curricula, while minimizing inequities in teaching loads, particularly for junior faculty. The Department should also seek to develop more effective methods for assessing graduate-student progress and for tracking its graduates.**

The first step in creating equity in teaching loads is to develop a departmental teaching load policy, consistent with those that exist at the college level. All present were supportive of this and, indeed, felt it was imperative in order to make expectations clear and proceed fairly. Given the importance of agreement on a policy, Dean Kieda requested an update on this in one year. Faculty also need to be aware that there are university policies that govern requirements for substitute teaching. If there are faculty who are at a point in their careers where teaching is no longer a priority because their focus is primarily research, shifting to a research track position should be considered a viable alternative. Of course, it is important not just to teach, but to teach effectively, and assessment methods must be in place to ensure uniform rigor and quality in the undergraduate and graduate curricula. There is now an Administrative Manager tasked with administering both Materials Science and Metallurgical Engineering graduate degrees. With input from the Graduate Program Committee and Chair Simpson, a tracking system will be implemented, and student progress will be reviewed every semester with concerns brought back to the Graduate Program Committee. In future progress reports, the Department should include an evaluation of this system and how well students are keeping up with milestones and progression to degree.

**Recommendation 5: The Department's strategic plan should include a process to identify the most critical space and facilities needs, in order to meet anticipated demands for teaching laboratory space, research space for graduate students, and growth of the faculty.**

Given that space was also an issue brought up in the review of Metallurgical Engineering (Rec. #2), it is clearly critical both to find shorter-term ways to find adequate space and to develop a process that helps prioritize the needs across the Department. Toward the former, many initiatives were cited, including reorganizing space in the Crus Renewable Energy Research Center (WBB 208, 213, 214), as well as installing new equipment there for lab classes and remodeling labs in HEDCO. Architectural design plans

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have been made for remodeling WBB-422. In the longer term, SVP Reed said that talks are underway about space shortages in both colleges and a broader space planning effort has been initiated.

At the conclusion of the meeting, SVP Reed congratulated Chair Simpson, Dean Butt, and Dean Brown, commenting that a lot of progress had been made on integrating departments. Generally, this unique model has strengthened both units and, building on the past accomplishments of both departments, this newly integrated department is on an exciting forward trajectory.

This memorandum of understanding is to be followed by regular letters of progress, upon request of the Graduate School, from the Chair of the Materials Science and Engineering Department. Letters will be submitted until all of the actions described in the preceding paragraphs have been completed. In addition, a follow-up meeting may be scheduled during AY 2021-22 to discuss progress made in addressing the review recommendations.

Daniel A. Reed  
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Darryl P. Butt  
Michael F. Simpson  
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David B. Kieda  
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David B. Kieda  
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December 30, 2019