Action Plan for the
MATERIALS SCIENCE GRADUATE
DEGREE PROGRAM
Oregon State University
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REVIEW COMMITTEE OVERVIEW:

The committee was impressed with the overall quality of the Materials Science Program. Over the past two years, the Program has begun to regenerate itself with new leadership under Bill Warnes, new core faculty in Mechanical Engineering, enthusiastic support from the Department Head of Mechanical Engineering (Belinda Batten), faculty who want to participate in the Program, and a strong cadre of graduate students who identify themselves as being in the Department of Materials Science. The Deans of the Colleges of Engineering, Forestry, and Science all said the Program is strategic for their colleges, and for OSU. Materials Science is poised to benefit from the rebirth of the shared instrumentation facility OSUMI (Oregon State University Materials Institute) and the nanoscale science initiative ONAMI (Oregon Nanoscience and Microtechnologies Institute).

This review committee unanimously recommends the Program continue. Today the indicators for the Program generally point in the positive direction. This report outlines the Program’s strengths, enumerates what we perceive to be the challenges the Program faces, and makes specific recommendations we believe will strengthen the Program to keep the indicators positive in the future. We believe the Program can continue to improve, but if it is to become a strong, truly cross-college interdisciplinary Program, important issues need to be addressed and resolved. Some of these can be solved at the Program level, but others are systemic to interdisciplinary programs and can only be resolved at the College and Graduate School levels.

GRADUATE COUNCIL ADDENDUM:

At the June 7 Graduate Council meeting, a motion was made and seconded to approve the Materials Science Graduate Council Review Report with a three part addendum, that added:

- A recommendation that the directorship be increased to at least .25 FTE.
- Recognition that the decision whether or not to move the program to the Graduate School remains with the program faculty.
- A recommendation that alternative business models be explored
ADDRESSING THE SPECIFIC RECOMMENDATIONS:

1. **An administrative staff person should be assigned to the Program.**

   **Response:** Materials Science shares administrative staff with the School of Mechanical, Industrial, and Manufacturing Engineering in the College of Engineering. Given the small number of graduate students in the Materials Science graduate program, this is unlikely to change. We will develop a clear set of contacts for graduate students for dealing with administrative issues and have these posted on our website.

2.a. **The Program faculty members are encouraged to hold a series of retreats to discuss the issues of administration, developing a committee structure for the Program, and examining the new curriculum.**

2.b. **The Program faculty members should begin to meet regularly.**

   **Action Taken:** The Materials Science faculty held a faculty meeting on May 29, 2007 to discuss the Graduate Program Review and vote on a new curriculum. The meeting was held over lunch and attended by 14 of the 35 faculty members with all three Colleges represented. The principal result was the adoption of a new graduate curriculum plan that has been in development over the past two years. The faculty voted to have the new curriculum apply to the incoming students (Fall 2007). We have also decided to meet once each term as a faculty in addition to several social events including both faculty and graduate students.

3. **Students should be included on some Program committees to get their input.**

   **Response:** As the committee structure develops, graduate student input will be sought for all relevant issues. This is informally done now, and we will develop a formal process for inclusion of graduate students in critical discussions.

4. **The Materials Science Program’s self-study omitted important assessments of student experience that are expected by the OSU graduate council. The Program should complete the required survey of current students and present an analysis of the data, along with a plan for on-going programmatic assessment as part of the required two-year Program Review follow-up.**

   **Response:** The Program Director accepts responsibility for not completing this part of the review. It will be completed in the review follow-up.
5. *The Program should create a series of required courses that is part of the first year curriculum and is taught by Materials Science faculty members from each of the three colleges. The goals of this series of courses are to introduce the students to the breadth and perspective of materials science in Engineering, Science, and Forestry, to create a unique experience that defines materials science, and to have a forum to discuss critical issues as research methodology and ethics.*

**Action Taken:** The newly approved graduate curriculum addresses all of these issues and is in place starting Fall term 2007.

6.a. *The Program should be moved so it is under the direction of the Graduate School.*

6.b. *Addendum: Recognition that the decision of whether or not to move the program to the Graduate School remains with the program faculty.*

6.c. *Addendum: A recommendation that alternative business models be explored.*

**Response:** This question of how to administer the graduate program will be addressed this year (2007-08) in the first two of our planned faculty meetings. There are several models for inter-disciplinary degree programs on campus, and other examples around the country, each with it’s own set of advantages and disadvantages. The Materials Science Faculty will work to determine the best course of action for the program. Now that the curriculum is in place, this is the highest priority action item for the faculty.

7.a. *The Program should have a Director and two co-Directors, one from each college, so each director can advocate for the Program in their home college.*

7.b. *Addendum: A recommendation that the directorship be increased to at least 0.25 FTE.*

**Response:** Historically, only ME faculty have been given teaching release or support for taking on the role of program director. This has typically been at the level of one course release per year. The Materials Science faculty support the spirit of the recommendation, and in the present climate of higher education funding, anticipate significant difficulty in achieving these goals. A request will be made for co-directors from the colleges of Science and Forestry during our first faculty meetings.

8. *OSU should examine its current model for allocating GTA funds. The current model, which is ubiquitous in the US, has the unfortunate effect of making students in interdisciplinary programs like Materials Science second class citizens when they compete for GTAs. The underlying issues that need to be*
addressed are whether the Oregon state funds used for GTA positions “belong” to each individual department and if these funds can be earmarked exclusively for a department’s graduate students. Or do departments need to advertise their GTA positions and hire the OSU student who is most qualified for a specific GTA independent of the student’s home department or program?

**Response:** The faculty in the program agree with this analysis of the difficulty in funding GTA’s for interdisciplinary programs, and are working to develop solutions to student funding. Ultimately the GTA appointments will be controlled by the departments offering the courses, and will therefore be out of the direct control of the Materials Science program.

**CHALLENGES:**

The challenges are presented progressing from those for the smallest unit – the Program – to the largest unit – the University – and ending with the students. Often the challenges are at multiple levels, in which case they are first mentioned in the smallest unit. The rationale for categorizing the challenges this way is to attempt to identify the level where they need to be addressed.

**The Program**

9. As previously mentioned, a strength of the Program is the close proximity of the core Mechanical Engineering faculty offices, labs, and students. These core faculty members see each other almost daily and meet informally on a regular basis to discuss Materials Science issues. Although this has been very positive in reinvigorating the Program, it creates a challenge for faculty outside the core to feel enfranchised in the Program, particularly when all the faculty members in the Program have not met formally for several years. The challenge is to make faculty outside Mechanical Engineering feel enfranchised and want to actively participate in the Program.

**Action Taken:** The Materials Science faculty held a faculty meeting on May 29, 2007 to discuss the Graduate Program Review and vote on a new curriculum. The meeting was held over lunch and attended by 14 of the 35 faculty members with all three Colleges represented. We have decided to meet once each term as a faculty in addition to several social events including both faculty and graduate students. A research seminar course has been organized during the past two years to bring faculty from across campus and outside of campus to meet with all the Materials Science graduate students. This has been a very successful and positive addition to the program, and has been formalized as a 1 credit course offering for graduate students. Attendance by faculty outside of ME has been good and will continue to grow. We also expect the materials science website will act as a “home” for faculty, with secure pages for information, schedule pages,
10. **The self study indicated the Program is perceived as belonging to Mechanical Engineering. This is due to the core faculty being in ME and identifying themselves with Materials Science, the center of gravity (offices and labs) of the Program being in an ME building, ME providing some administrative staff support for the Program, ME providing some TA support for Program students, and the Program’s core courses being mainly ME courses taught by ME faculty, and Program students being recruited through Engineering’s recruiting event. The challenge is to make this a truly interdisciplinary program with cross-college support.**

**Response:** This is possibly the biggest impediment for the program for continued growth. The history of the program shows that the domination of the program by ME faculty and students has diminished significantly over the past 15 years, but the perception of the program being an ME program continues. We are committed to making the program as interdisciplinary as possible. Several actions we have planned that will help with this issue are:

- Identifying students as belonging to the College of their major professor. At present, all Materials Science students are coded as College of Engineering students, even though their support and major professor may come from the College of Science or Forestry;
- Continuing to develop cross-disciplinary “Focus Tracks” as part of the graduate curriculum. Presently we have one such track in polymeric materials, which was developed largely by the faculty in the Wood Science and Engineering Department (College of Forestry), and the Chemical Engineering Department (College of Engineering). A new focus track in nano-scale materials involving the Colleges of Science and Engineering is planned for this academic year;
- Improving the review process for applicants to the program to provide faculty outside ME with better access to the applicant files will help broaden the recruiting and funding opportunities for potential students and improve the perception of program within OSU;
- Developing additional coursework within the core courses that will be taught by faculty outside ME. At present, we offer a graduate laboratory course (ME555: Experimental Techniques in Materials Science) which is designed to be team-taught by faculty from all disciplines and provide exposure to a broad variety of experimental facilities on the OSU campus.

11. **There is little in the Program that brings all the students together and sets them apart academically as Materials Science students. The challenge is to identify what defines the Materials Science Program and to orient the students about the various aspects of Materials Science across the campus.**
**Action Taken:** The new graduate curriculum addresses this in several ways. Firstly, the core courses will provide a uniform introductory course experience for all entering students. This common core in the first year will help students establish a sense of community and develop contacts within the University. Secondly, the research seminar provides a weekly meeting point for students and faculty with a principle focus on the materials research occurring at OSU; and finally, the graduate laboratory course will provide access to experimental facilities at OSU from a variety of departments across campus.

12. *The Program’s curriculum is currently in a state of significant transition.* The Program has developed a new core curriculum, but approving then implementing all the courses associated with the new graduate curriculum is still a long way off. The challenge is to make sure that all Program faculty have had input into the new curriculum and to make it happen.

**Action Taken:** The new graduate curriculum was approved by all Materials Science faculty and is in place for students entering the program in Fall term 2007.

13. *The Program takes in students from a wide range of disciplines and has a common set of core courses to give them the same background materials. However, it has individualized preliminary exams that do not specifically test the core material. The challenge is to create a standard metric for competency on the core material.*

**Response:** This is a critical issue for students to have a uniform experience in the Materials Science program. It will be the subject of our first faculty meeting of 2007-08, and a solution will be sought during this next academic year. It is, of course, a somewhat knotty problem because of the differences in the philosophy of participating faculty and departments as regards the utility and purpose of the preliminary and qualifying exams.

14. *The Program’s curriculum encompasses a large number of 400/500 (“slash”) courses. The challenge is to define what constitutes a graduate education.*

**Action Taken:** The new graduate curriculum does not have this difficulty as all the core courses are now graduate level only.

15. *Information about the Program is very difficult to find on the web. The challenge is to develop a web presence that is easy to find and navigate, and that gives as much information as possible about the Program.*
**Action Taken:** A web site has been developed and put on-line in the spring of 2007. The site will continue to expand and include more information about the program. We have requested all University and Departmental websites provide links to this website as appropriate. The address for the program website is:

**matsci.oregonstate.edu**

16. *The Program has a goal of increasing its “diversity and interdisciplinary participation of students and faculty in the education and research missions of Materials Science”. The challenge is to make this happen.*

**Response:** Because our numbers of students are small, drawing conclusions from them is a little dubious. Over the five years of the Graduate Review (2002-2007) 25% of the admitted students were female (from a pool of applicants that was 20% female). We have not done a similar analysis based on ethnic background. While we clearly need to work on attracting more underrepresented applicants to our pool, we have been active in bringing those who do apply to the degree program. The bigger question of increasing the interdisciplinarity of the program will continue to be a focus of faculty discussions, probably indefinitely.

**Departments**

17. *Do the Program students “belong” to ME where most of the graduate courses are currently taught? Or do the Program students “belong” to the department in which they are conducting their thesis work? The problems are:*

- Some faculty outside ME were concerned that their department does not give them credit for advising and supporting Program students.
- Some departments outside Engineering were concerned that they would not get credit from their college for Program students working with their faculty members.

*The challenge is to give the faculty members and departments as much credit as possible for educating graduate students.*

**Response:** At present, all students are automatically designated as belonging to the College of Engineering when they are accepted into the Materials Science graduate program. This has several disadvantages;

- some Colleges allocate budget resources based (partly) on the number of graduate students in the degree program. This provides a disincentive for some faculty to participate in the program by supporting students getting a Material Science degree;
- College of Engineering students pay a large resource fee each term, even if their major professor and laboratory work are conducted in another College. This provides a financial disincentive for students outside the College of Engineering to become Materials Science students.
We have begun conversations with the Graduate School and the Admissions office to have students in the program identified as “belonging” to the College of their major professor. This will help to clarify where the student support is generated and will help to engage more faculty and students in the program, but it is not yet clear how this can be done without individually changing each student record by hand.

18. Courses are created at the department level and instructors for the courses are assigned by the department in which the course is taught. This creates problems because:
   • New faculty have brought new areas of research interest, new or upgraded laboratory facilities, and expanded scientific expertise. Over time, they will want to develop new courses in these areas. Currently, any new course is created by a faculty member within a department. As such, it is difficult to develop a course specifically for the Program, as the course has to satisfy the academic needs of students in the department as well as those of the Program students for whom it is being created.
   • Courses in one department are typically taught by faculty members within that same department. Cross department teaching is not common, which makes it difficult for faculty outside ME to teach core courses.

The challenge is developing a mechanism to create new courses for the Program and to have faculty from one department teach courses in another department.

Response: This is a concern common to any interdisciplinary program, and it is unlikely to be solved without large additional resources for instructional support. However, the very interdisciplinary nature of the Materials Sciences provides the context for additional learning and connections that is possible when taking a course in another discipline. Examining the new curriculum shows that courses from all member departments are welcome components of the graduate program of study. In particular, the development of a “Focus Track” to emphasize the specialized coursework needed for a student’s research. We have so far refrained from cross listing courses so that the Departments originating the course will accrue the Student Credit Hours as a small incentive for making courses germane to the Materials Science program.

19. A college gives GTA funding to specific department and that department preferentially gives the GTA positions to that department’s graduate students. Program students working with a faculty member outside ME are almost always second in line behind the department’s own graduate students for departmental GTA support. The challenge is to find a mechanism whereby Program students are not “second class” citizens with respect to GTA support.

Response: This is unlikely to be changed without substantial additional funding for GTA’s across the campus.
Colleges

20. None of the three colleges provide direct support to the Program. All the support at the college level is indirect, as described below. Engineering provides the most support, which it does indirectly through Mechanical Engineering. ME has chosen to provide support to reduce the Program director’s teaching load by 1 course per year – from 5 to 4 courses per year - and by providing some administrative support. Engineering also provides indirect support for the Program because many of the Program’s core and other courses are taught by engineering faculty members. Science and Forestry both provide a small amount of indirect support through courses Science and Forestry faculty teach that are taken by Program students. The challenge is to get all colleges associated with the Program to contribute direct support to the Program.

Response: See remarks above (comment 7).

21. Previously we noted that not all faculty members are rewarded by their department (or colleges) for participating in the Program. This translates to their department and college missing an opportunity to publicize that they have greater breadth because of having a faculty member who participates in the Program. The challenge is for departments and colleges to augment their academic reputation from having faculty participate in the Program.

Response: We believe this will change as the program becomes more successful and faculty are vocal in their support of it.

22. Students in the Program are confused where they needed to go for academic and administrative issues, so they go to their advisor. The Program students need staff support for academic and financial issues. The challenge is to make administrative portion of graduate school as painless as possible for the graduate students.

Response: We are working on a more streamlined and clear process for graduate students, which will include an improved web presence and better separation of the graduate process from that of the ME Department.

University (including the Graduate School)

23. The University needs to learn how to manage cross-college interdisciplinary programs. The challenge is to broaden compartmentalized issues inherent in a college/department structure to serve programs such as Materials Science that flourish across traditional department and college boundaries.
Response: Many of the faculty in the Materials Science program are anxious and willing to take on these broader issues for the University about interdisciplinary programs at OSU. We would certainly be interested in helping to determine the University’s role in supporting cross discipline programs.

Students

24. Many students have limited funding and if their advisor is outside ME, they are often not in the top tier to be considered for GTA funding by their advisor’s home department. This was mentioned previously, but is such an important factor in attracting and retaining students that our concern is reiterated here. The challenge is to find a mechanism that allows Program students to be eligible for GTA positions.

Response: This issue will ultimately be determined by the major professor and the Department to which the major professor belongs. Outside of developing additional fellowship and scholarship funding specifically for Materials Science students, there is little the program can do to affect this point of view.

25. One department (Wood Science) encouraged students to do a double major. This appears to have been due to OSU’s earlier budget allocation model in which departments benefit by the number of students enrolled in the graduate program offered by the department rather than in interdisciplinary programs. The challenge is minimizing the time to graduation while maximizing the student’s mastery of their chosen field.

Response: This isn’t a unique situation to Wood Science and Engineering. We believe that this situation has been changing, but must be solved by the faculty in the Wood Science and Engineering Department and their administration.

26. As previously mentioned, the students are sometimes confused who they should see about administrative and financial issues. Currently they go to their advisors. The challenge is to provide an administrative structure that Program students can readily identify as being there to help and guide them.

Response: See remarks above (comment 22).

27. As mentioned above, there is little in the Program that brings all the students together and sets them apart as Materials Science students. The challenge is to provide students who have a wide variety of backgrounds and will work for faculty members in at least three colleges with a unifying experience in their first year in the Program.

Response: See previous remarks (comments 11, 12, 13).

-END-