Department of Aerospace Engineering and Mechanics
The University of Alabama
(Revised 2/19/2016)

Proposed Alternative Residency Plan for the Ph.D. in Engineering Science & Mechanics

Submitted by: Dr. Stanley E Jones, Head, AEM Department
Dr. John E Jackson, Graduate Coordinator, AEM Department, and
The AEM Departmental Faculty

Section A. Statement of Need

While the traditional residency requirements for the Doctoral degree remain viable for a subset of the potential students, financial necessities for both students and their employers make the experience very difficult for many outstanding candidates. There is a critical need for leading scholars, those who are capable of being independent contributors in their fields. In engineering we express this as the capability to perform original research. Normally, much of this capability is developed through mentorship by the faculty advisor and advisory committee, and is enhanced during a student’s period of residency.

In a technical field such as our engineering program, many of the individual contributors generated have been recruited internationally. Because of economic disparities, these students are the ones who can afford to spend years in an on-campus graduate experience. It would be very difficult indeed for the U.S. to retain leadership without these students. However, as the students’ countries of origin become increasingly competitive economically and technologically, it is becoming more difficult to attract the top students to our graduate programs. What is needed is a mechanism to increase the number of Ph.D. students domestically. An alternative residency plan tailored to domestic candidates can be successful in achieving this.

Since the early 1990s, the AEM Department has operated a highly successful distance learning Masters’ degree program. We have found the students to be, on average, at least the equivalent of the on-campus students. Many of them are superior students. Some of them would be candidates for a Ph.D. should a suitable alternative residency plan exist. For example, UA’s first (and, to date, only) astronaut was an MSAE distance student. Campuses have become not just a physical location, but are evolving into “virtual campuses” which can be every bit as effective as the geographic campus. Our department through its distance education programs has developed a thorough understanding of the circumstances and needs of the technical community and the potential domestic student base. Because of its participation in distance delivery, the department already teaches almost all of its courses with both on campus and distance education sections. In other words the graduate course work is already available to potential alternative residency Ph.D. students.

UA has offered the Ph.D. in Engineering Science & Mechanics via traditional on campus residency for many years. It is the only Ph.D. program in this field in the State. Because of mentoring requirements necessary for developing quality Ph.D. graduates, these
degrees cannot be mass produced. The number of graduates, therefore, is limited by the number of faculty. However, our program at UA is more limited by available funding than by faculty numbers. We have not discovered any alternative residency education program for a Ph.D. in Engineering Science & Mechanics offered by any organization in the United States. It appears that our proposed plan would be unique. The alternative residency plan should allow the AEM Department to double the number of its Ph.D. graduates. This will enable the number of degrees awarded to be well beyond ACHE viability standards. We have not experienced any problems with time-to-degree requirements for the distance MSAE program and, therefore, do not expect a time-to-degree problem with the proposed alternative residency Ph.D.

Section B. Value Constructs

UA Doctoral programs should fulfill the spirit of residency by featuring all of the following value constructs:

- Immersion in advanced study and inquiry
- Interaction with faculty and peers
- Access to the education resources of the university
- Interchange of knowledge with the academic community
- Broadening of educational and cultural perspectives

In defining this proposal we were guided in part by a successful alternative residency program in the State of Texas. Persons interested in an in-depth discussion of these value constructs may refer to Reference 1, “Transforming Study in Residence Based on Value Constructs”.

These value constructs were defined in the 2008 Graduate Council document inviting submittal of alternative residency proposals. Also recommended for a detailed discussion of the value constructs is the book cited in Reference 3, which was prepared by the Carnegie Foundation for the Advancement of Teaching.

In constructing this Alternative Residency Plan, we examined our current program and were careful to make sure the experiences gained by studying on-campus could be replaced by a process that was at least equal to the quality of our current procedures. The Plan we have constructed is more rigorous in creating PhD-level independent contributors than our on-campus process. Aspects of our program which were previously goals have been built into the Alternative Residency Plan as requirements. Some of these are discussed below.

Course Delivery

The question of delivering quality courses via distance education techniques was resolved in 1992 when our department began it’s highly successful MSAE distance program. Additional information on this has been included above in Section A. In the early 90’s the MSAE program was delivered to distance students via VHS videotape. Several years ago we were able to advance to recording and shipping DVDs. Beginning Spring 2010, courses are offered on the internet via video-streaming. In this format, courses are recorded “live” as they are delivered to campus students and are posted online within a
few hours for distance students. The new format will allow students to have quicker access to lecture material from anywhere in the world. Students are the real winners as they receive access to a higher quality product much quicker than in the past. Students appreciate the fact that they can view the recorded presentation multiple times, while on-campus students have only one chance to absorb material from a lecture.

**Intellectual Property Rights**

Especially in a technical field, consideration of intellectual property rights is important in a student’s professional development and should be covered during traditional on-campus residency. However, this topic is sometimes “glossed over”.

The policy stated in the following paragraph will be a part of the Alternative Residency Plan. The paragraph was written by Dr. William Gathings, Director, Office of Technology Transfer in consultation with Dr. Joe Benson, Vice-President for Research.

*It is possible that the results of dissertation research may result in new intellectual property developed by Ph.D. candidates as part of the student’s research. Prior to enrollment in AEM699 for Dissertation Research credit, the student’s employer (hereinafter “COMPANY”) and The University of Alabama (hereinafter “UA”) shall negotiate in good faith an Intellectual Property Rights Agreement (hereinafter “AGREEMENT”), the terms of which shall be consistent with both the intellectual property policy of the COMPANY and The University of Alabama Board of Trustees Rule 509 — Patent Policy. The terms of the AGREEMENT shall include, but not be limited to, disclosure and assignment obligations, ownership rights, and commercialization rights.*

The issue of publication of research results is another issue that needs to be addressed. In the last item on page 4 under the heading *Creating a “Virtual” Community of Scholars*, we state that alternative residency Ph.D. students will be required to publish, or have accepted for publication, a refereed research article in an appropriate journal. Although this is not a formal program requirement, our traditional residency students almost always accomplish this. We stated publication as a requirement for alternative residency students for two reasons. First, the alternative residency plan is new and publication provides external quality control. Secondly, it is possible that potential conflicts of interest may arise if the student’s dissertation research involves work for his/her employer. It is best to address any potential problems as a student begins his doctoral research. The University and the student have an interest in publishing research results and the employer may need to protect proprietary or classified information.

One point regarding classified research should be made at this juncture. Although certain details in a classified project, or one with proprietary interests, cannot be divulged in the open literature, it is frequently possible to publish some of the basic aspects of the research. Very often, the fabric of a research project is woven around its classified elements with basic research that can be published with impunity. However, this judgment will be made by a firm’s office of public release before a manuscript is submitted for publication.
To reconcile all of these interests, we propose to prepare a Management Plan For Potential Conflict Of Interest for each Ph.D. candidate. These Plans will be different in each case. They will be submitted for approval to the UA Office for Research Compliance. Should a potential conflict of interest arise involving a traditional residency student, research sponsor, and the University, we will follow the same process. Some details of the University’s Conflict of Interest policies are provided in the attached Appendix.

Creating a “Virtual” Community of Scholars

When beginning this exercise, we sought to ensure that alternative residency Ph.D. candidates would receive an experience as rich and as rigorous as students participating in the traditional on-campus residency program. As we formulated the procedures to ensure this, we came to understand that our existing on-campus program would be enhanced by implementing the same methodology for all students. Thus, we now propose to transform the entire AEM graduate program as described herein. As a result, there will be minimal differences between the on and off-campus residence experiences. The new AEM graduate programs will include the following features.

- Extensive use of live audiovisual conferencing for delivery of theses, dissertations, dissertation proposals, and research seminars. Although we will encourage all of our students to attend these on-campus, when that is not possible, the electronic versions will be available. (New for AEM)

- Peer interaction and interaction with faculty and external technical advisors is part of the process for creation of independent contributors. Technology now allows live, interactive audiovisual conferencing between faculty and both on- and off-campus students. We will take advantage of this capability to schedule live, interactive collaborative research discussions between groups of researchers. (New for AEM)

- Initiate an AEM Annual Research Colloquium for all graduate students and faculty. This will provide another opportunity for exchange of research ideas as a community of scholars. External graduate faculty members, typically from the student’s employer, will also be invited. The presence of these committee members at the Colloquium and their service on Advisory Committees will improve technical collaboration with industry and government. With that comes more external research funding. (New for AEM)

- Create an on-line AEM graduate database. We propose to create a module on the site for each faculty member involved with graduate students. These faculty and all of the graduate students will have access to all of the modules. The modules can be used to post Ph.D. Dissertations and Dissertation Proposals, journal and conference papers by both faculty and students, and other information thought important to a community of scholars. Both resident and non-resident students will benefit from the increased interactions. The “Blackboard” software can be used for this. (New for AEM)
• A new Doctoral student will begin his/her participation in our program by attending the Annual Colloquium. This will serve as part of the Orientation for the student. He/she will be familiarized with facilities available for research. He/she will have introductory meetings with various faculty. Very importantly, he/she will be introduced to the department’s on-campus graduate students and encouraged to participate with them in various research-related and course-related activities. Each alternative residency Doctoral student will be assigned an on-campus graduate student “partner”. We will expect regular communication between alternative residency students and their traditional residency partners. We will monitor this to ensure that it occurs. (New for AEM)

• Since the alternative residency plan is new, we did add an external quality control requirement to the off-campus plan. One characteristic a Ph.D. graduate should have is the capability to publish his/her research in peer-refereed journals. We have always encouraged our graduates to do this. However, in the Alternative Residency Plan, we take this a step further. We will require that a Ph.D. student publish, or have accepted for publication, a refereed research article in an appropriate journal. The dissertation will not be signed until this has been achieved. (New for AEM)

Distance Delivery

The interactive, “virtual department” described above is enabled by our partner in this endeavor, the Division of Academic Outreach, as described below. As technology continues to evolve, we expect to adapt and improve our programs further.

eLearning/Blackboard

The Division of Academic Outreach provides technology support to students and faculty within the distance learning eLearning/Blackboard course section. Various tools are included in this secure course management system that foster interactive communication. Students and faculty are able to interact via email, discussion board, and chat in eLearning. In addition, content can be shared and group work can be conducted online if necessary. Faculty training is available for this platform via the Division of Academic Outreach and the University’s Faculty Resource Center.

Wimba Live Classroom web conferencing tool

For optimal online interactive communication, the Division of Academic Outreach recommends using the Wimba Live Classroom platform. To access Wimba, students log into eLearning/Blackboard from their individual desktop and are able to share various applications, display content, and converse with their dissertation chair just as if they were in a physical campus environment. By using Wimba, students in geographically distant locations can deliver theses, dissertation proposals, research seminars, etc. to faculty, staff, and students in Tuscaloosa. Distance students and faculty need access to a high speed internet connection along with an appropriate headset (that includes microphone and speaker) to participate in Wimba sessions. All Wimba sessions are archived for future viewing. The Division of Academic Outreach provides training and support for this tool as it relates to distance course delivery.
The IITS videoconferencing network

IITS affords students the opportunity to have live interaction (including audio, video, and content sharing) with faculty and staff at sites throughout the state of Alabama and beyond. Students wishing to meet with instructors via IITS can schedule an appropriate meeting time and location through the IITS videoconferencing network.

The College of Continuing Studies Division of Academic Outreach supports each of these technology tools and provides technical support for all participating University of Alabama distance students and faculty.

Skype

Use of “Skype” is another communication possibility. With this software, it is possible to have audio contact via the internet. Adding a webcam adds the capability for having video contact as well.

Satisfying the Value Constructs

The table below illustrates how each of the value constructs is satisfied through the procedures we have developed to ensure a quality graduate program with this alternative residency plan. The procedures are described in more detail in section D. The nature and size of our program differs from the Texas program, but we think we have ways just as suitable for satisfying the five value constructs. The following Table shows how our proposed alternative residency procedures in Section D contribute to satisfying these value constructs.
<table>
<thead>
<tr>
<th>Table 1. Satisfaction of value constructs by the proposed alternative residency</th>
<th>Section D</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Immersion in advanced study and inquiry</strong></td>
<td>D.1-D.10 (all)</td>
</tr>
<tr>
<td>• Candidate meets on campus with his/her Advisor or Committee a minimum of once per semester.</td>
<td></td>
</tr>
<tr>
<td>• Candidate must be enrolled continuously in Doctoral Dissertation Research.</td>
<td></td>
</tr>
<tr>
<td>• A required written agreement on intellectual property rights will develop the Candidate’s understanding and appreciation for this critical issue.</td>
<td></td>
</tr>
<tr>
<td>• The Candidate shall present his/her dissertation proposal on campus.</td>
<td></td>
</tr>
<tr>
<td>• The Candidate must attend at least one Ph.D. defense prior to his/her own.</td>
<td></td>
</tr>
<tr>
<td>• Develop collaborative research relationships with industry or government partners by seeking to conduct some meetings at the Candidate’s work place.</td>
<td></td>
</tr>
<tr>
<td>• Improve collaborative research relationships by nominating qualified technical supervisors from the Candidate’s employer as temporary graduate faculty members to serve on the advisory committee.</td>
<td></td>
</tr>
<tr>
<td>• Candidate must have at least one paper accepted for publication by an appropriate archival journal before signatures are added to the Dissertation.</td>
<td></td>
</tr>
<tr>
<td>• Enrollment as a graduate student in the AEM department will automatically provide entry into an AEM departmental database web site for graduate student/faculty research collaboration.</td>
<td></td>
</tr>
<tr>
<td>• Attend an annual on-campus AEM Graduate Colloquium.</td>
<td></td>
</tr>
<tr>
<td>• Enrollment in a UA distance education course automatically provides Library resources and other benefits.</td>
<td></td>
</tr>
<tr>
<td><strong>Interaction with faculty and peers</strong></td>
<td>D.1-D.9</td>
</tr>
<tr>
<td>• All items in the box above, except the last item.</td>
<td></td>
</tr>
<tr>
<td><strong>Access to the education resources of the university</strong></td>
<td>D.2</td>
</tr>
<tr>
<td>• These are provided automatically when the Candidate is continuously enrolled in the AEM graduate program.</td>
<td></td>
</tr>
<tr>
<td><strong>Interchange of knowledge with the academic community</strong></td>
<td>D.1-D.6, D.9,D.10</td>
</tr>
<tr>
<td>• Candidate meets on campus with his/her Advisor or Committee a minimum of once per semester</td>
<td></td>
</tr>
<tr>
<td>• Candidate must be enrolled continuously in Doctoral Dissertation Research.</td>
<td></td>
</tr>
<tr>
<td>• A required written agreement on intellectual property rights will define the manner in which knowledge is shared.</td>
<td></td>
</tr>
<tr>
<td>• The Candidate shall present his/her dissertation proposal on campus.</td>
<td></td>
</tr>
<tr>
<td>• The Candidate must attend at least one Ph.D. defense prior to his/her own.</td>
<td></td>
</tr>
<tr>
<td>• Develop collaborative research relationships with industry or government partners by seeking to conduct some meetings at the Candidate’s work place.</td>
<td></td>
</tr>
<tr>
<td>• Improve collaborative research relationships by nominating qualified technical supervisors from the Candidate’s employer as additional members of the advisory committee.</td>
<td></td>
</tr>
<tr>
<td>• The Candidate must have at least one paper accepted for publication by an appropriate archival journal before signatures are added to the Dissertation.</td>
<td></td>
</tr>
<tr>
<td>• The Candidate participates in the “virtual graduate department” by enrollment in the AEM graduate program.</td>
<td></td>
</tr>
<tr>
<td>• Attend an annual on-campus AEM Graduate Colloquium.</td>
<td></td>
</tr>
<tr>
<td><strong>Broadening of educational and cultural perspectives</strong></td>
<td>D.3-D.6, D.9,D.10</td>
</tr>
<tr>
<td>• The Candidate shall present his/her dissertation proposal on campus.</td>
<td></td>
</tr>
<tr>
<td>• The Candidate must attend at least one Ph.D. defense prior to his/her own.</td>
<td></td>
</tr>
<tr>
<td>• Develop collaborative research relationships with industry or government partners by seeking to conduct some meetings at the Candidate’s work place.</td>
<td></td>
</tr>
</tbody>
</table>
• Improve collaborative research relationships by nominating qualified technical supervisors from the Candidate's employer as temporary graduate faculty members to serve on the advisory committee.
• The Candidate participates in the "virtual graduate department" by enrollment in the AEM graduate program.
• The Candidate must have at least one paper accepted for publication by an appropriate archival journal before signatures are added to the Dissertation.
• Attend an annual on-campus AEM Graduate Colloquium.

Section C. Measures of Academic Success

Assessment of the proposed alternative residency requirements will be an important and ongoing part of the program. These will include

1. Performance on Ph.D. Qualifying Examinations in comparison to that of on-campus students.
2. Publication rates of the alternative residency students in comparison to that of on-campus students.
3. Time to degree.
4. Degree completion rates.
5. Student satisfaction surveys.
6. Surveys of employer satisfaction, to the extent these are obtainable.

Section D. Details of a Proposed Alternative Residence Plan for the Ph.D. in Engineering Science & Mechanics

All requirements for the Ph.D. degree program remain the same as for on-campus students except the following.

1. The existing residency period shall be replaced by the requirement that the student Ph.D. Candidate meet on campus with his/her Advisor or Committee a minimum of once per semester. Each Advisor/Committee may require as many additional physical meetings as they deem necessary to achieve the necessary mentorship. The frequency of these meetings may be adjusted during the period of study at the discretion of the Committee/Advisor.

2. Upon successful completion of the Qualifying Exams and acceptance as a Candidate, the student must then be enrolled continuously in at least three semester hours of the UA course AEM699-921 Doctoral Dissertation Research. The location and form of each Qualifying Exam is determined by the faculty interest group for each of various subject areas.

3. In a technical field, such as engineering, consideration of intellectual property rights is important in a student’s professional development and should be covered during traditional on campus residency. Often this topic is inadequately addressed. It is possible that the results of dissertation research may result in new intellectual property developed by Ph.D. candidates as part of the student’s research. Prior to enrollment in AEM699 for Dissertation Research credit, the student’s employer (hereinafter “COMPANY”) and The University of Alabama
(hereinafter "UA") shall negotiate in good faith an Intellectual Property Rights Agreement (hereinafter "AGREEMENT"), the terms of which shall be consistent with both the intellectual property policy of the COMPANY and The University of Alabama Board of Trustees Rule 509 – Patent Policy. The terms of the AGREEMENT shall include, but not be limited to, disclosure and assignment obligations, ownership rights, and commercialization rights.

The paragraph above was written by Dr. William Gathings, Director, Office of Technology Transfer, in consultation with Dr. Joe Benson, Vice-President for Research.

4. The student shall present his/her dissertation proposal on campus.

5. The student is to attend at least one Ph.D. defense prior to his/her own. (This requirement, at the discretion of the Advisory Committee, may be met by a two-way interactive audiovisual connection.)

6. The student shall present his/her dissertation defense on campus.

7. The student’s Advisor/Committee may choose to conduct some of the meetings at the student’s work place, thus providing an opportunity to develop collaborative research relationships with industry or government partners.

8. The Advisor/Committee will seek to nominate qualified technical supervisors from the student’s employer as additional members of the advisory committee. These persons may be given temporary graduate faculty appointments. A minimum of four members of the advisory committee must be University of Alabama employees who are members of the graduate faculty.

9. The student’s Dissertation shall not be signed by the Advisor/Committee members until he/she has authored/co-authored at least one research paper related to the subject of the dissertation research. The paper must be accepted for publication by an appropriate peer-reviewed journal before signatures are added to the Dissertation.

10. Attend an annual on-campus AEM Graduate Colloquium.

Notes:
(a) Enrollment as a graduate student will automatically provide entry into an AEM departmental graduate internet database. Currently, the “Blackboard” software is used for this. We propose to create a module in the site for each faculty member involved with graduate students. These faculty and all of the AEM graduate students will have access to all of the modules. The modules can be used to post Ph.D. Dissertations and Dissertation Proposals, journal and conference papers by both faculty and students, and other information thought important to a community of scholars.
(b) Enrollment in a UA distance education course automatically provides Library resources and other benefits. See Reference 2 for details.
(c) Although a student has established residency on-campus, it is not unusual for a student doing dissertation research to meet with his advisor as infrequently as once per month. In this sense, the student pursuing a Ph.D. through alternative residency is no more disadvantaged than the on-campus student. In fact, it may be possible for the alternative residency Ph.D. students to meet more frequently with their advisors on the campus with the permission and encouragement of their employers as they near the completion of their degree requirements. The interactive features of the proposed plan will serve to keep students more actively engaged in their programs. It is reasonable to expect this to reduce the number of students who finish their education with "all but dissertation".

(d) In reviewing this proposal, it should be pointed out that this is a completely new program. As such, it should be viewed as the starting point of a process of development that may evolve as we accept students and begin working with them.

Section E. References


APPENDIX: University of Alabama Policies on Conflicts of Interest

The University of Alabama ("UA") realizes that actual or potential conflicts of interest may occur in the normal course of research and other sponsored activities. The University has developed a Policy of Conflict of Interest/Financial Disclosure in Research and Other Sponsored Programs (see http://ott.ua.edu) applicable to all UA investigators. The policy applies to all sponsored programs, including federal, state and local government; industry; or not-for-profit sponsors. The policy also covers UA intellectual property licensed to an entity in which a UA investigator owns an interest or serves as an employee, officer, consultant or member of the Board of Directors regardless of the source of funding. The policy is to be administered according to UA policy and in conjunction with laws and policies setting forth standards of conduct, including Title 42 Code of Federal Regulations (CFR) Part 50, Subpart F; Title 45 CFR Part 94; the Ethics Act of the State of Alabama; and University of Alabama Faculty Handbook, Appendix E, On Preventing Conflicts of Interest in Government-Sponsored Research at Universities.

UA understands that faculty members have the right to change the direction of their research and the assignments to their students in the normal course of research, including the supervision of a student's dissertation research. To ensure that any conflicts of interest or potential conflicts of interest are mitigated and/or managed, faculty who are committee members or supervisors of students enrolled in the Alternative Residency Plan for the Ph.D. in Engineering Science & Mechanics shall complete The University of Alabama Statement of Potential Conflict of Interest. The completed form should be submitted to the Office for Research Compliance. In the event a conflict of interest or potential conflict of interest is found, said faculty member shall work with the Office for Research Compliance to develop a Standard Management Plan for Potential Conflict of Interest.