

Massachusetts Institute of Technology

The Doctoral Program

in

Aeronautics and Astronautics

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1. General Description

The Doctoral Program of the Department of Aeronautics and Astronautics offers opportunities for advanced graduate study and research in the disciplines of aeronautics and astronautics. In recognition of creative and independent accomplishment at a high level of excellence, the Department awards either the Doctor of Philosophy (PhD) or the Doctor of Science (ScD) degree. There is no substantive difference between the two degrees, and the choice of degree name is that of the individual recipient.

The two major components of the Doctoral Program are course work and research. Together these are intended to stimulate intellectual growth and develop powers of objective understanding of the physical world. The course work focuses on a program of study in the student's chosen major and minor fields of specialization. Its purpose is to broaden the student's command of basic scientific principles, encourage the imaginative application of science and technology for the productive and economic uses of mankind, and foster the ability to express and communicate ideas in the English language. The research involves an original investigation of an advanced problem, the results of which are summarized in a written thesis and reported in a thesis seminar.

2. Administration of the Doctoral Program

The Doctoral Program is administered by the Department Graduate Committee (GradComm). All questions regarding application of policy and procedures of the Department's Doctoral Program must be resolved and approved by the GradComm. This includes the scheduling of examinations and of thesis presentations, and the certification that requirements have been satisfactorily completed. Students are advised to keep the Chair of the GradComm informed of their plans and progress through the Graduate Program administrator.

3. Doctoral Program Requirements

A checklist of all Doctoral Program requirements is in Appendix A. They are detailed in subsequent sections. Students should also refer to the following documents:

- a. *Thesis Specifications Booklet* - <http://libraries.mit.edu/archives/thesis-specs/>.
- b. *Graduate Student Education Manual* – <http://web.mit.edu/gso/gpp/index.html>.

3.1 English Evaluation Test

All incoming graduate students whose native language is not English are required by Institute rules to take the Department of Humanities English Evaluation Test (EET) offered at the end of January and August. Results of the exam are given directly to the student by the EET staff and a copy forwarded to the Aero/Astro Graduate Administrator. This test is a proficiency examination designed to indicate areas where deficiencies may still exist and recommend specific language subjects available at MIT.

3.2 Diagnostic Test in Technical Writing

The department requires that all entering graduate students demonstrate satisfactory English writing ability by taking the Writing Diagnostic examination offered in early September by the Program in Writing and Humanistic Studies. Students admitted in February must take the examination with those admitted in September. Students admitted into an interdisciplinary program through

Aero/Astro will also be required to take the Writing exam. The Writing exam will be waived for students in interdisciplinary programs that require a technical writing class approved by the Aero/Astro GradComm.

Students can only take the exam once and must score 75 or above to fulfill the requirement. Examinees whose score falls between 60 and 75 are required to take a two-unit writing workshop (21W.794) during their first Independent Activities Period (IAP). Students who score below 60 on the Writing exam are required to take a writing subject recommended by the Writing faculty. The remedial work must be done in the Spring term of the student's first academic year in the graduate program.

3.3 Qualifying as a Doctoral Candidate

Admission to the Doctoral Program in this department is a three step process:

1. Passing performance on the Field Exam (FE)
2. Passing performance on the Research Evaluation (RE)
3. Granting of admission to the Doctoral Program through a faculty review consisting of an examination of the student's achievements including an assessment of the quality of the past research work and evaluation of the student's academic record in light of the performance on the FE and RE.

The FE and RE formats are discussed in detail in Section 4.

3.4 The Thesis Committee

The candidate forms the Thesis Committee by visiting members of the faculty and research staff whose research interests are similar to the candidate's own interests, discussing plans and objectives with them and verifying their willingness to serve. This action should be taken within one year of admission to the Doctoral Program (see Section 3.3).

3.4.1 Roles of the Thesis Committee

1. Advising and supervising the candidate's research work
2. Approving a major program of study
3. Development of a minor program of study
4. Conducting the thesis proposal defense
5. Monitoring the quality of the candidate's academic performance in all subjects, and ensuring at all stages of the program that the candidate is making satisfactory progress towards the degree.
6. Participating in the ad hoc Thesis Defense Committee.

The Thesis Committee does not assume responsibility for the quality of the research performed by the candidate--its role in the process is to evaluate critically the progress reported by the candidate, and offer suggestions and advice which might help the candidate in the pursuit of the research goals. The process of conducting research is the sole responsibility of the candidate, and is the essential measure by which the faculty judges performance in the doctoral program.

3.4.2 Membership of the Thesis Committee*

Thesis Committee Chair

The Thesis Committee Chair plays a role as department academic representative on the committee. The role is a management function in addition to an intellectual one. The Thesis Committee Chair *must* be a faculty member¹, emeritus faculty member, Professor of the Practice², or Senior Research Scientist/Engineer/Associate³ in the department. Note: The Thesis Committee Chair will frequently also be the Thesis Advisor. These two roles are not exclusive.

Thesis Advisor

The Thesis Advisor is the main intellectual advisor for the thesis research. Faculty members, emeriti faculty, Professors of the Practice, and Senior Research Scientist/Engineer/Associates are eligible to be Thesis Advisors. Principal Research Scientist/Engineer/Associates are also eligible *providing they have the written permission of the Department Head or Deputy Department Head*⁴.

Current Principal Researchers who are Thesis Advisors of students at the time this policy is put into effect (February 2005) are grandfathered for those specific students only. For any additional doctoral students the written permission must be in place.

Thesis Committee Member

The Thesis Committee must have at least three members. *Two of these must be MIT faculty members, including emeriti faculty, or Professors of the Practice in the major field, i.e., two faculty who are familiar with the field and are expected to contribute to the research.* The other committee members may be MIT faculty, MIT research staff, or individuals who are familiar with the field from industry, government, or another university. The advisor for the minor field (the so-called "minor advisor" as formerly denoted) does not count as one of the two faculty members needed for the committee.

3.4.3 Thesis Committee Meeting Record and Frequency

The formal log of Thesis Committee meetings is the *Doctoral Program Record Form*. The form includes the names of the members of the Thesis Committee, a list of major and minor subjects, which the student must complete, and a record of important dates and milestones in the candidate's progress toward the degree. All important decisions and recommendations of the Thesis Committee, dates of completion of each requirement of the doctoral program and of requirements made by the thesis committee or the department GradComm must be recorded in the *Doctoral Program Record*

* The policies and procedures governing the make-up of the Thesis Committee are in effect for *all* students who enter the doctoral program in February 2005 or later.

¹ Faculty members, as defined in *Policies and Procedures*, include only Professors, Associate Professors, and Assistant Professors

² *Policies and Procedures* emphasizes the connection of Professors of the Practice with education in the statement that they "demonstrate a deep commitment to teaching and research".

³ Senior S/E/A are academic staff, a different category from other research appointments. Specifically, as stated in *Policies and Procedures*, "Senior Research Scientist, Senior Research Engineer, and Senior Research Associate are the senior positions in the campus research staff structure and for that reason have been designated academic staff positions with special status and prerogatives."

⁴ An Associate or Assistant Head, as has been the case in the past, would also be able to sign off for this.

Form in the Academic Programs Office. It is the responsibility of the candidate to ensure that recommendations for future action are recorded in the *Doctoral Program Record Form* by the Thesis Committee Chair, and to return the form to the Academic Programs Office, Room 33-208.

It is also the responsibility of the candidate to undertake any course of action recommended by the Thesis Committee. Finally, the candidate must keep the Thesis Committee informed of plans and progress by calling a meeting of the Thesis Committee **at least once each term**.

3.4.4 The Doctoral Stipend Rate

Students who have been admitted to the Doctoral Program become eligible for the doctoral stipend rate after the first meeting of their Thesis Committee.

3.5 The Major Program of Study

The student should propose to the Thesis Committee for its approval a specific set of subjects that will constitute the major program of study for the degree. At a minimum, this program will include at least five graduate subjects in the major field. Subjects taken in the SM program can be counted toward this requirement.

Doctoral candidates are normally expected to take their major subjects at the Institute.

3.6 The Minor Program of Study

The Minor Program must consist of a coherent set of related graduate subjects adding up to at least 30 units (typically three courses) in a field of study related to Aeronautics and Astronautics, which is not in the candidate's primary field of study. The aim of the Minor requirement is to broaden the candidate's knowledge and perspective of fields that support the candidate's capabilities as an aerospace engineer. In consultation with his/her Thesis Committee and a Minor Field Advisor, the student proposes a minor field and set of subjects. The proposed minor field and set of subjects must then be approved by the department's Doctoral Committee.

3.6.1 The Minor Field Advisor

The Minor Advisor can be any active MIT faculty member. The purpose of the Minor Advisor is to ensure that the Minor courses form a coherent whole. Only G or H-level courses are acceptable for this requirement and there must be agreement by the Thesis Committee that the minor field is sufficiently different from the major field. The minor advisor will typically not be a member of the Thesis Committee unless he/she can also advise in the major field of study.

3.6.2 The Minor Proposal Form

The student submits the *Minor Proposal Form* to the department's Graduate Committee via the department's Academic Program staff. This form must be signed by the Minor Advisor signifying that the subjects proposed by the student form a coherent set in the Minor Field. The form must also be signed by the Thesis Committee Chair signifying that the Minor Field is related to aerospace engineering and is outside of the student's Major Field. The student's minor proposal will then be approved by the department's Graduate Committee.

3.6.3 Satisfactory Performance in the Minor Field

Satisfactory completion of the Minor program of study is certified by the Minor Advisor. The Minor Advisor has the responsibility of determining what constitutes satisfactory performance in the Minor program.

3.7 The Thesis Proposal and Proposal Defense

The purpose of the thesis proposal and proposal defense is to ensure that the student has (a) performed an adequate literature search, (b) a deep understanding of their research field, (c) identified a problem that could produce a doctoral-quality contribution(s), and (d) a reasonable plan for how to proceed. The student prepares a thesis proposal document which is then distributed to an evaluation committee which includes the student's Thesis Committee. The student then defends this proposal to the evaluation committee. Based on the proposal and the proposal defense, the evaluation committee may recommend actions to improve the student's proposal and his/her understanding of their research field. Details of the thesis proposal and proposal defense are given in Section 5.

3.8 The Doctoral Thesis and Thesis Defense

A major specific objective of the Doctoral Program is the successful completion of a research program and its summary in a doctoral thesis. Ultimately, it is the quality of the research and of the summary in the thesis which reflects the degree of success which a candidate achieves in the Doctoral Program. The Thesis Defense is discussed in Section 6.

An essential requirement in writing a thesis is to ensure that the document conveys information to the technically qualified reader. The style of presentation should be consistent with the style of technical reports found in the professional literature. Structurally, the thesis should begin with a clear introduction to the problem, its history, and importance. It should contain a description of the technical approach, a summary and discussion of results, the conclusions drawn from the results, and recommendations on research that might be undertaken in the future in the light of the results. If the thesis relies on experimental data found nowhere else, such data must be included in the document.

4. Rules of the Field Examination (FE) and Research Evaluation (RE)

4.1 Admission to the FE and RE

Only graduate students registered in the Department of Aeronautics and Astronautics may take the FE/RE. However, persons not yet registered as regular graduate students in the Department may petition to take the FE/RE.

Persons registered in the Department of Aeronautics and Astronautics must receive the written endorsement of one member of the department faculty in order to take the FE/RE. The faculty endorser must also provide the following input:

- 1) length of time and the capacity in which the faculty has known the student, if the faculty member has limited knowledge of the student, an interview should be held; and
- 2) specific strengths and weaknesses of the applicant that may bear on the success of the student as a doctoral candidate.

The faculty member is expected to make a presentation of the candidate's academic achievements at the faculty review following the FE/RE, as an advocate of the candidate.

In order to be admitted to the FE/RE, the student must attain a minimum cumulative grade point average of 4.4 in technical subjects as a graduate student at MIT.

4.2 Scheduling of the FE/RE

The FE/RE is offered once each academic year, usually during the January Independent Activities Period (IAP).

All graduate students who are admitted to this department (with or without a prior SM degree) and who wish to be selected as doctoral candidates must take the FE/RE no later than the IAP which occurs between the third and fourth term following their initial registration as graduate students in the department. (Students who first register in February must take the FE/RE between the second and third term following their registration.)

A candidate for the SM degree who does not take the FE/RE during the time interval specified above must re-apply for graduate admission. A student who decides to take a leave of absence after having passed the FE/RE may defer the start of their doctoral program for up to 2½ years. For example, if a student passes the FE/RE in January 2008, he/she may start the doctoral program any time between then and September 2010. If a student does not return to continue their academic program by the end of the 2½ year period, he/she will also have to reapply to the graduate program and retake the FE/RE. A request to go on leave must be submitted to the Graduate Committee through the Department's Academic Programs Office.

4.3 Field Examination Structure

The FE is solely an oral examination. Each student selects a single field for the FE based upon his/her research interests. The current set of fields is:

1. Aerospace Computational Engineering
2. Air-Breathing Propulsion
3. Aircraft Systems Engineering
4. Air Transportation Systems
5. Autonomous Systems
6. Communications and Networks
7. Controls
8. Humans in Aerospace
9. Materials and Structures
10. Space Propulsion
11. Space Systems

The content of the FE is specific to each field and is equivalent to two-to-four H-level graduate subjects in the field. The specific content for each FE is available through the department's Academic Programs Office on the department's webpage.

Prior to the oral examination, students will be given questions in a written form and allowed to prepare for 60 minutes. While the written questions will be the basis for most of the FE, additional topics may also be covered. Following the preparation period, the oral examination will then be conducted for a period of 45 minutes.

The standard for passing the FE is the demonstration of superior intellectual ability through skillful use of concepts, including synthesis of multiple concepts, in foundational, graduate-level material in a field of aerospace engineering. NOTE: this wording borrows heavily from the MIT Letter Grade description for an A.

4.4 Research Evaluation Structure

While the FE is focused on intellectual ability as demonstrated on foundational subjects in a field of aerospace engineering, the RE is direct assessment of the student's ability to perform research. The RE will consist of a 20 minute presentation by the student **on research they have performed** followed by 25 minutes of questions.

The standard for passing the RE is the demonstration of a superior ability to solve research-oriented problems with guidance in a field relevant to aerospace engineering. The phrase "with guidance" is included to recognize that a student at this stage in his/her pursuit of a doctorate degree is not expected to conduct research without supervision; rather the expectation is that given guidance on the research problem including possible approaches, the student has a superior ability to solve research-oriented problems.

In preparing for the RE presentation, the student is encouraged to seek the advice of others including his/her advisor(s). The intent is that the student's preparation for the Research Evaluation presentation is consistent with the best practices for preparing a research presentation for other purposes (such as a conference or seminar). In addition, the department will provide students with a Research Presentation Practicum opportunity to help prepare for the RE.

While a clear and concise presentation is important, **the major factor in the RE assessment is the student's ability to respond to questions from the examiners.** In particular, the student will be assessed on their critical thinking skills, their understanding of the technical material, and their ability to put their research into the context of the field as a whole. Additional information on the RE process is available in Appendix B.

4.5 The Faculty Review

After the examination process has been completed, the department faculty is expected to meet and assess each student's performance on the Written and Oral Examinations.

The faculty will review the performance on the FE, RE, and also the academic achievements of the student. The quality of the research work in progress, and all additional evidence which attests to the student's potential to conduct original research at the doctoral level successfully will also be considered. Following this review, the faculty will vote to decide on one of these three outcomes:

1. **Pass**
2. **No Pass**, but option to--
 - a) retake the FE and RE
 - b) retake the FE only
 - c) retake RE only
3. **Fail**, with no option to retake

A student who has failed the FE/RE will not be admitted to the Doctoral Program.

4.6 Retake Policies and Procedures

1. Students who have passed the FE and been given the opportunity to retake the RE (outcome 2c above), may do so in April/May or the following January. All other students must do the retake the following January, subject to the usual FE/RE entrance rules.
2. For any FE/RE retake, the faculty endorser may submit an amended written assessment of the student.
3. The only possible outcomes for any retake are **Pass** or **Fail**.

5. The Thesis Proposal and Proposal Defense

The purpose of the thesis proposal and proposal defense is to ensure that the student has (a) performed an adequate literature search, (b) a deep understanding of their research field, (c) identified a problem that could produce a doctoral-quality contribution(s), and (d) a reasonable plan for how to proceed.

5.1 Thesis Proposal Requirements

The candidate must prepare a thesis proposal consisting of:

- A clear, specific statement of the technical problem and the objectives of the proposed research
- A thorough, adequately referenced, summary of previous work done on the problem
- A plan for the initial approach to the problem, an outline of the major foreseeable steps to a solution of the problem, an estimate of the time that might be required, and a list of the facilities needed.

The purpose of the proposal is two-fold: the work leading to the proposal helps the candidate define the research problem and plan the initial phases of the research, while the proposal itself helps the faculty to determine whether the problem and research path are indeed of doctoral research caliber, and whether the candidate understands both sufficiently to begin exploration. Formally, it should include:

- A separate title page, including a proposed thesis title, the candidate's name, the date, and a list of the members of the candidate's Thesis Committee,
- An abstract contained on a single sheet,
- The proposal which must address all elements of the proposal as listed above (including a bibliography of cited references).

5.2 Scheduling the Thesis Proposal Defense

The Thesis Proposal and Thesis Proposal Defense are evaluated by the student's Thesis Committee and one additional faculty member (external to the committee) with expertise in the student's research. The Thesis Proposal Defense is chaired by the Chair of the Department GradComm (or his/her designated faculty representative). Thus, the following people form the evaluation committee and must participate in the Thesis Proposal Defense:

1. the Chair of the GradComm or a designated representative,
2. the candidate's Thesis Committee, and
3. an external evaluator: i.e. a member of the faculty external to the Thesis Committee with expertise in the student's research topic.

In addition, any member of the faculty may attend and participate in the Thesis Proposal Defense.

The thesis proposal and proposal defense should be successfully completed at most 2 years after being admitted to the doctoral program through the Candidate Review. **It is the responsibility of the candidate to bring to the attention of the Thesis Committee, at some stage within this time period, the need to schedule the Thesis Proposal Defense.** Once the Thesis Committee has agreed that the Thesis Proposal Defense should be scheduled, it is the responsibility of the candidate **to schedule a mutually convenient date with his/her Thesis Committee** and external evaluator, and to coordinate with the Academic Programs Office staff who will schedule a department representative.

At least ten business days prior to the Thesis Proposal Defense, the student must provide a copy of the thesis proposal to his/her Thesis Committee, the external evaluator, and the Academic Programs Office staff.

5.3 The Structure of the Thesis Proposal Defense

The typical process for the Thesis Proposal Defense is:

1. The Thesis Proposal Defense begins once the candidate and all members of the evaluation committee are present.
2. The candidate will then be asked to leave the room so that the evaluation committee can discuss the candidate's thesis proposal. The purpose of this discussion is to determine if the written thesis proposal is adequate to proceed with the thesis proposal defense; if the thesis proposal requires major revisions, the proposal defense presentation will not be made and feedback will be given to the candidate on the written document. If the proposal needs minor revisions, the evaluating committee may still proceed with the thesis proposal defense.
3. The student presents his/her thesis proposal. This presentation should not exceed thirty minutes. Questioning during the presentation should be only for clarification purposes.
4. The evaluation committee will then question the student on his/her thesis proposal and, more generally, his/her proposed research field.
5. Once all questioning is complete, the candidate will leave the room and the evaluation committee will discuss the candidate's performance. Upon reaching a recommendation, the members of the evaluation committee will discuss the results with the candidate.

The Thesis Proposal Defense is expected to be completed in 1.5 hours.

5.4 Results of the Thesis Proposal and Proposal Defense

If the candidate has successfully demonstrated criteria (a)-(d), the Thesis Proposal and Defense will be found adequate. Otherwise, the student's proposal, defense, or both will have been found inadequate. In these situations, the student must revise and/or redefend the proposal in accordance with the findings of his/her evaluation committee. Furthermore, the evaluation committee may make specific recommendations to help the student improve his/her performance including, but not limited to, additional academic subjects to take.

The evaluation committee for a candidate that must revise or redefend his/her Thesis Proposal should be the same as the first attempt including the chair of the Grad Comm (or designated representative). In the event that this is not possible, the Grad Comm is empowered to handle exceptions. A candidate who does not successfully write or defend his/her Thesis Proposal upon a second attempt will be required to withdraw from the doctoral program. Furthermore, the student must successfully complete the proposal and defense within at most 6 months of the first attempt or be withdrawn from the doctoral program.

6. The Thesis Defense

Formally it is the responsibility of the Department faculty as a whole to accept or reject a thesis, and to recommend to the Institute faculty that a candidate be granted a degree. Accordingly, the candidate is required to present and defend the thesis orally, at a thesis seminar, to members of an *ad hoc* Thesis Defense Committee convened for this purpose, as well as other faculty members who wish to attend.

6.1 The MIT Degree Application Form

This form must be completed before the Thesis Defense can take place, and is subject to MIT deadlines.

6.2 The Thesis Defense Committee

It is required that the *ad hoc* Thesis Defense Committee include six members selected as follows: three members of the candidate's Thesis Committee including the Chair; the Chair of the Department GradComm, or a designated representative; and two individuals (generally, but not necessarily, from faculty or senior research staff) whose recognized professional interests and achievements qualify them to judge the quality and merits of the thesis being presented. It is advisable that the candidate seek and recommend to the Thesis Committee and to the Chair of the GradComm the persons who would serve in this capacity.

6.3 The Presentation of the Thesis to the Faculty

The procedure for the presentation, oral defense, and faculty assessment of the doctoral thesis consists of two parts: an appropriately scheduled thesis seminar, and a meeting of the six members of the Thesis Defense Committee and all other faculty present at the seminar to consider accepting or rejecting the thesis, or requiring that it be modified. The thesis seminar is open to all members of the academic community who wish to attend. The faculty meeting convened for the purpose of judging the merit of the thesis is open only to the six members of the *ad hoc* Thesis Defense Committee, who constitute the quorum, and to all other faculty members who were present at the oral defense and wish to participate in the discussion and vote.

6.4 Scheduling the Thesis Defense

For a thesis defense to be scheduled, the candidate must obtain the formal approval of the committee by their signatures on the form titled, "*Authorization to Proceed with Thesis Defense*". Specifically, the following process must be followed leading up to the candidate's thesis defense:

1. The candidate gives to his/her Thesis Defense Committee a draft of the thesis which, in the candidate's opinion, is complete, and upon which the candidate is prepared to have the research work judged by the faculty.
2. The candidate notifies the Academic Programs Office staff that a thesis draft has been given to his/her Thesis Defense Committee with the intent of obtaining approval to proceed with the Thesis Defense. This notification must include telephone and email contact information for all members of his/her Thesis Defense Committee.
3. The Academic Programs Office will contact all members of the candidate's Thesis Defense Committee to confirm (1) that they have received the thesis draft and (2) that, within **ten working days**, they must judge whether it is appropriate to schedule a thesis seminar (see Note below). Furthermore, the earliest date that the candidate's thesis defense can occur is **thirty working days** after the Academic Programs Office has sent this confirmation.

4. The candidate must submit the (signed) form to the Academic Programs Office staff at least **twenty working days** prior to the defense date.
5. No later than **ten working days** before the thesis defense, the candidate must submit at least seven copies of a proposed final draft of the thesis for distribution, as follows:
 - one copy for each member of the Thesis Committee,
 - one copy for every other faculty member or guest invited to participate in the *ad hoc* Thesis Defense Committee, and
 - one copy to the Department library reserve shelf.Furthermore, the candidate will send the thesis abstract to the Academic Program Office at least **ten working days** before the defense. This will be sent with the thesis defense announcement made by the Academic Programs Office.

Within the guidelines outlined above, the Chair of the GradComm is empowered to deal with all matters which arise from unforeseen absences at the scheduled time of thesis presentation.

Note: A candidate should not assume that once a thesis committee agrees to schedule a thesis seminar, the Committee considers the research and thesis satisfactory. In some cases, while a great amount of effort may have been expended, and an accomplishment of some form may be identified, the Thesis Committee may question the quality and importance of the results and may agree to schedule a thesis seminar in order to seek the counsel of the faculty-at-large whether the thesis is acceptable as a department document.

6.5 The Thesis Seminar

In the thesis seminar the candidate discusses, in a period of not more than 60 minutes, the motivation, methodology, results, and conclusions of the research. Afterwards the candidate is expected to defend the thesis in response to questions by the faculty and guests. The candidate is also expected to be available to answer questions which may arise at the closed faculty meeting which follows the open presentation.

6.6 Evaluation of the Thesis

At the faculty meeting following the thesis defense, any member of the *ad hoc* Thesis Defense Committee and of the faculty in general may object to accepting the thesis. If the faculty present cannot agree on the merit of the thesis, the matter will be referred to the Department GradComm, who may choose to resolve the issue itself, or may appoint a special review committee which does not include members of the candidate's original Thesis Defense Committee.

There is seldom a question of acceptance when a clearly recognizable advance has been achieved and which has been presented in a definitive, explicitly technical report. In such a case, the professional performance of the competent research worker will be evident to the technically trained colleague, even if the colleague is not a specialist in the field.

It may happen that a significant contribution has been made, but is so poorly presented in the thesis document as to be nearly unintelligible without an inordinate effort on the reader's part. Such a document is not acceptable; it is the candidate's obligation to prepare a written document and present an oral report that make the achievements clear to a reasonably well qualified, but inhomogeneous audience such as the department faculty. The candidate will not be recommended

for the degree and the candidate's name will be withheld from the degree list until a satisfactorily completed document has been presented. The Thesis Committee is responsible for judgment on this point.

6.7 Modification of the Thesis and the Manuscript Prepared for Publication

The faculty will decide, at the meeting following the thesis defense, whether the thesis is acceptable as presented or whether it must be modified. If modifications are required, the faculty will specify whether it considers these modifications to be "major" or "minor."

Minor modifications may involve correction of typing errors, alterations of structure or style of presentation in order to conform to format standards set by the Institute Archives, and changes in content or emphasis which do not substantially alter the candidate's analysis, results, or conclusions.

Revisions associated with errors in analysis, with misinterpretation of the results, or with unwarranted conclusions will require "major" modifications. In such cases, the faculty may require another thesis presentation based on the revised thesis draft, to be scheduled for a later date in accordance with the rules for scheduling a thesis seminar.

6.8 Submitting the Thesis

After a thesis has been accepted by the faculty, all members of the Thesis Committee indicate their endorsement by placing their signatures on the title page of the original copy of the thesis document.

After these signatures have been obtained, the candidate submits the original and one copy of the thesis to the Academic Programs Office. Both loosely bound copies of the thesis document must be on archival bond paper. A member of the staff in the Academic Programs office verifies that these copies satisfy the requirements set by the Institute on style and format. If the document satisfies all requirements, the candidate receives a department receipt for the thesis and a *Special Report Sheet* is sent to the Registrar, stating that the candidate has satisfied the thesis requirements. At this point, a student will not be permitted to make changes to the thesis. The Chair of the Department GradComm signs on behalf of the faculty of the department and both copies of the thesis document are delivered to the Archives Office. The Archives Office keeps one copy and sends the second copy to the Aero/Astro Library.

APPENDIX A**Doctoral Program Checklist**

- ___ English Evaluation Test (for non-native English speakers) **(at entrance)**
- ___ Diagnostic Test in technical writing **(first term)**
- ___ A minimum cumulative grade point average of 4.4
- ___ Faculty endorsement for the Field Exam/Research Evaluation (FE/RE)
- ___ Field Exam/Research Evaluation **(within first three terms)**
- ___ Admission to the doctoral program
- ___ Formation of a Thesis Committee **(within one year of admission to doctoral program)**
- ___ *Doctoral Program Record Form*
- ___ Major program selection
- ___ Minor program selection
- ___ *Minor Proposal Form*
- ___ Thesis Proposal & Proposal Defense **(within two years of admission to doctoral program)**
- ___ Satisfactory performance in the minor field
- ___ Institute Residency Requirements
- ___ A satisfactory thesis
- ___ MIT Degree Application Form
- ___ A defense of the thesis

APPENDIX B

Research Evaluation (RE) Presentation Guidelines for Students and Examiners

The RE is a direct assessment of the student's ability to perform research. The RE will consist of a 20 minute presentation by the student **on research they have performed** followed by 25 minutes of questions.

The standard for passing the RE is the demonstration of a superior ability to solve research-oriented problems with guidance in a field relevant to aerospace engineering. The phrase "with guidance" is included to recognize that a student at this stage in his/her pursuit of a doctorate degree is not expected to conduct research without supervision; rather the expectation is that given guidance on the research problem including possible approaches, the student has a superior ability to solve research-oriented problems.

While a clear and concise presentation is important, **the major factor in the RE assessment is the student's ability to respond to questions from the examiners.**

In the research presentation itself, the student is expected to:

- Give motivation for the research, citing previous work as appropriate
- Present the material in a clear and concise manner
- Summarize the main conclusions of the research

The presentation should not be interrupted by the examiners, except for points of clarification. The time needed to address any such interruptions will not count against the student's allotted time, but will be considered part of the Q&A.

In the follow-up Q&A, the student is expected to:

- Show a thorough understanding of the research
- Understand how the research advances or enhances previous work
- Understand any shortcomings of the research
- Suggest any appropriate follow-on work which might be indicated
- Be able to examine the topic from alternative viewpoints

The research advisor(s) for the work presented in the RE may be present for the presentation and Q&A, however, they may not speak (including asking questions during the Q&A). Furthermore, the advisor cannot participate in the assessment of the student's RE performance and must leave the room following the Q&A.