

Massachusetts Institute of Technology

# The Doctoral Program

in

# Aeronautics and Astronautics

March 2020

Based on modifications to the doctoral program  
approved by the faculty of Aeronautics & Astronautics in March 2020

Changes in this version from February 2018 include:

- Changes to the doctoral qualifying process in AeroAstro

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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 (Graduate Committee). All questions regarding application of policy and procedures of the Department's Doctoral Program must be resolved and approved by the Graduate Committee. 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 Graduate Committee 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 resources:

- a. *Thesis Specifications Booklet*: <http://libraries.mit.edu/archives/thesis-specs/>
- b. *ODGE Graduate Policies and Procedures*: <http://odge.mit.edu/gpp/>

### 3.1 English Evaluation Test

All incoming graduate students who were required to submit TOEFL and/or IELTS test scores for admission 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 AeroAstro 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 Graduate Writing Exam**

The department requires that all entering graduate students demonstrate satisfactory technical English writing ability by taking the Graduate Writing Exam offered online early each summer 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 AeroAstro 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 AeroAstro Graduate Committee.

Students can only take the exam once and must score 80 or above to fulfill the requirement. Examinees who score 75 and below are required to take a writing workshop during their first January Independent Activities Period (IAP), for a letter grade. This must be done during the first IAP period.

### **3.3 Admission to the Doctoral Program**

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

1. Admission to the department's Graduate Program
2. Passing performance on the Field Exam (FE)
3. Completion of an SM degree
4. 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 in the RPC. Note: Often, a student will take the FE prior to completing his/her SM. In this case, admission to the Doctoral Program will be conditionally granted pending successful completion of an SM.

The FE format is discussed in detail in Section 4.

### **3.4 Research and 16.THG Requirement**

Given the integral role of research in graduate studies and importance of feedback to the student, the department requires that:

- All graduate students must register for 16.THG every semester. The number of credit hours of 16.THG should be appropriate to the student's situation and should be agreed upon by the student and advisor upon registration each semester.
- For the Fall and Spring semesters, a formal research progress evaluation will be conducted between the student and advisor in the process of assigning a grade for 16.THG. This progress evaluation is administered through a web-based system maintained by the department's academic programs office.

Additional information on the 16.THG requirement including advice on determining an appropriate number of credit hours is given in documentation on the department's website.

### 3.5 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, including a first meeting with the Thesis Committee, should be taken within one year of admission to the Doctoral Program (see Section 3.3).

#### 3.5.1 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. Monitoring and suggesting modifications to drafts of the candidate's thesis prior to formation of the ad hoc Thesis Defense Committee.
7. 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 quality of the research is the sole responsibility of the candidate, and is the essential measure by which the faculty judges performance in the doctoral program.

#### 3.5.2 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 member<sup>1</sup>, emeritus faculty member, Professor of the Practice<sup>2</sup>, or Senior Research Scientist/Engineer/Associate<sup>3</sup> 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*<sup>4</sup>.

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

<sup>2</sup> *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."

<sup>3</sup> 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."

<sup>4</sup> A Deputy, Associate, or Assistant Head would also be able to sign off for this.

### 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.

### **3.5.3 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 Graduate Committee must be recorded in the *Doctoral Program Record 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 33-202.

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**.

### **3.5.4 The Doctoral Stipend Rate**

Students admitted to the Doctoral Program (as described in Section 3.3) become eligible for the doctoral stipend rate. Note: Students conditionally admitted to the Doctoral Program prior to completion of an SM must complete the SM to become eligible for the doctoral stipend rate.

### **3.6 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.

### **3.7 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, the student proposes a minor program with a set of subjects that is sufficiently different from the major field.

### **3.8 The Graduate Mathematics Requirement**

The purpose of the Graduate Mathematics Requirement is to give students exposure to advanced mathematical concepts at the graduate level. Although mathematics is an integral part of all engineering curricula, it is our experience that additional math subjects can add significantly to the student's problem solving capabilities. A detailed description of this requirement is available on the department's website or by contacting the Academic Program staff.

### **3.9 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 that 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 on the thesis proposal and proposal defense are given in Section 6.

### **3.10 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 that reflects the degree of success that a candidate achieves in the Doctoral Program. The Thesis Defense is discussed in Section 7.

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 Doctoral Field Evaluation (FE)**

All graduate students registered in the Department of Aeronautics and Astronautics (AeroAstro) must complete the "FE Requirement" within 4 semesters after their enrollment in the AeroAstro Graduate Program for admission to the Doctoral Program.

The FE Requirement is fulfilled by satisfying both of the following:

1. Complete the "FE Coursework" or pass the "FE Exam,"
2. Identify an eligible "Thesis Advisor" willing to supervise the student's doctoral thesis.

Guidance on individuals who are eligible to be doctoral Thesis Advisors can be found in Section 3.5.2 of this document.

This section describes the FE Course Work (Section 4.1) and the FE Exam (Section 4.2) requirements. Both sections separately describe the process of reporting the Thesis Advisor.

#### 4.1. FE Coursework

In order to fulfill the FE Coursework requirement, graduate students must do both of the following:

1. Choose a “Field of Study” and choose 3 subjects from the “FE Subject List” for that field, before the registration day of their 3<sup>rd</sup> semester in the Graduate Program.
2. Complete the chosen 3 subjects with at least two A grades and one B grade or better, by the end of their 3<sup>rd</sup> semester in the Graduate Program.

**Fields of Study:** The AeroAstro Department has 13 “Fields of Study”:

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

Each field is described in the AeroAstro Department website.

**Field Evaluation (FE) Subject Lists:** For each Field of Study, an FE Subject List is announced on the AeroAstro Department website. The FE Subject Lists may also include certain structure, for instance, requiring all students take a core subject.

**Chosen Field of Study and Chosen FE Subjects:** Before the registration day of their 3<sup>rd</sup> semester after their enrollment to the Graduate Program, each student will

- i. Declare a Field of Study, which is called the “Chosen Field of Study”;
- ii. Choose 3 FE subjects, which is called the “Chosen FE Subjects,” from the list of FE Subjects in their Chosen Field of Study.

The students report their Chosen Field of Study and their Chosen FE Subjects with “**Field Evaluation Initiation Form.**” The form can be found the AeroAstro Department website. Graduate students must fill out the Field Evaluation Initiation Form and submit it to the Graduate Program Administrator before the registration of their 3<sup>rd</sup> semester in the Graduate Program.

**Completing FE Coursework and the Thesis Advisor:** To complete the FE Coursework Requirement, graduate students must complete all 3 of their Chosen FE Subject with two A grades and B grade or better. In addition, the graduate students must have at least 4.4 cumulative graduate GPA.

After completing the subjects, graduate students report the grades of their 3 Chosen FE Subjects and their cumulative graduate GPA by submitting a “**Field Evaluation Completion Form**” before the grades deadline of their 3<sup>rd</sup> semester in the Graduate Program. The form also requires the signature of an eligible MIT Faculty Member, called the “Thesis Advisor,” who is willing to supervise the student’s doctoral thesis.

By signing the form, the Thesis Advisor makes a commitment to supervise the student’s doctoral thesis until the student leaves the doctoral program, either by graduation or withdrawal. However, neither the Thesis Advisor nor the Department makes a commitment of funding by signing this form. Graduate students arrange research assistantships and/or teaching assistantships separately during their graduate studies.

Also, the form does not bind the graduate student to the Thesis Advisor. A graduate student may switch to another eligible Thesis Advisor at any time during their graduate studies, if this new Thesis Advisor commits to supervising the student's thesis.

**Graduate Students who complete the FE Coursework and identify an eligible Thesis Advisor fulfill the field evaluation.**

## **2. FE Exam**

**Admission:** Graduate students who do not complete the FE Course Work Requirement by the end of their third semester may take the FE Exam in their fourth semester, hereafter called the “Exam Semester,” to complete the Field Evaluation.

All students who are taking the exam must have at least 4.4 cumulative graduate GPA and identify an MIT faculty member, the “Thesis Advisor,” who agrees to advise the student’s doctoral thesis should the student pass the FE Exam.

Graduate students who would like to take the FE Exam must report their cumulative GPA and their Thesis Advisor by submitting an “**FE Exam Initiation Form**” before the grades deadline of their 3<sup>rd</sup> semester in the Graduate Program. In addition, the thesis advisor must submit an Endorsement Letter to the Graduate Program Administrator before the same deadline.

**Scheduling:** The FE exam is scheduled and the exam date and time is announced on the registration day of the Exam Semester.

**Administration:** The FE Exam consists of two parts: The FE Written Exam and the FE Oral Exam.

The FE Written Exam questions will cover the material described in the 3 Chosen FE Subjects. The graduate student has 75 minutes to provide written answers to these questions. The FE Written Exam is closed books and closed notes.

The FE Oral Exam is immediately after the FE Written Exam. For the FE Oral Exam, the graduate student meets with a panel of five faculty members, called the “FE Exam Panel,” chosen by the Graduate Program Committee. The Graduate Program Committee identifies one faculty member as the “FE Exam Panel Chair,” who guides the FE Oral Exam process. The FE Oral Exam will focus on the questions given to the candidate in the written exam. It may include any other questions that are

covered in the 3 Chosen FE Subjects. The FE Oral Exam will last for 60 minutes. The graduate students can use the written answers to the FE Written Exam as a reference during FE Oral Exam.

After the completion of the FE Oral Exam, the graduate student must hand in the written answers to the FE Written Exam to the FE Exam Panel Chair.

**Passing the FE Exam:** The panel of five faculty will evaluate the result of the FE Written Exam, the FE Oral Exam, and the Endorsement Letter. The evaluation period is 10 business days. The panel will then determine the result of the FE Exam with a majority vote of the FE Exam Panel. The Thesis Advisor will inform the graduate student of the final result (pass/fail) of the FE Exam.

Graduate students who fail the FE Exam are required to withdraw from the program after completing their SM thesis. The SM thesis must be completed no later than two semesters following the Exam Semester.

**Graduate students who could *not* complete the FE Coursework, but were able to pass the FE Exam and identify an eligible Thesis Advisor complete the Field Evaluation.**

## **5. Research Process & Communication (RPC) Subject**

Students who are admitted to the doctoral program via the faculty review following the FE will become eligible to take new AeroAstro subject on *research process and communication* (RPC). This subject will be offered for the first time in the Spring 2017 semester, and is expected to be offered regularly (either every spring term *or* every fall/spring term) after that.

Beginning with the cohort of students taking the FE in January 2017, every AeroAstro doctoral candidate will be required to pass the RPC with a grade of A or B **before proceeding to the thesis proposal defense**. (Note also the timeline for the thesis proposal defense, described in Section 6.2.) A student may retake the course if his/her performance is not sufficient.

The learning objectives of the RPC subject will center on the critical thinking and communication skills necessary for research: understanding relevant literature, posing a meaningful research question, putting one's research contributions in context, clearly communicating the core of one's technical results and their impact, critically examining the limitations of one's work and the work of others. To pass the course, a student will have to demonstrate competence in each of these areas at a level that shows promise for doctoral-level research. The subject will thus draw upon each student's ongoing research, incorporating short practice presentations and providing frequent opportunities for feedback and iteration.

## 6. 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.

### 6.1 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 as listed above (including a bibliography of cited references).

Examples of thesis proposals are available on the department's website.

### 6.2 Scheduling the Thesis Proposal Defense

The Thesis Proposal and Thesis Proposal Defense are evaluated by the student's Thesis Committee and one additional member (external to the committee, generally from faculty or senior research staff) whose recognized professional interests and achievements qualify him/her to judge the quality and merits of the proposed research. It is advisable that the candidate seek and recommend to the Thesis Committee and to the Chair of the Graduate Committee one or more persons who would serve in this capacity, with expertise in the student's research. The Academic Programs Office will also designate a representative from the faculty in the department; this department representative will chair the Thesis Proposal Defense. The department representative may be a member of the Thesis Committee. Thus, the following people comprise the evaluation committee and must participate in the Thesis Proposal Defense:

1. the designated Department Representative,
2. the candidate's Thesis Committee, and
3. an external evaluator with expertise in the student's research topic.

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

The thesis proposal and proposal defense should be successfully completed **at most three regular terms (a regular term is a Fall or Spring term) after being admitted to the doctoral program. 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 submit a Thesis Proposal Defense Application and provide a copy of the thesis proposal to his/her Thesis Committee, the external evaluator, and the Academic Programs Office staff (note: ten business days is equivalent to **two calendar weeks** unless there are MIT holidays during this time, e.g., Thanksgiving).

### **6.3 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.

Examples of presentations from previous thesis proposal defenses are available on the department's website (under Academics->Graduate Program->Doctoral Degree).

### **6.4 Results of the Thesis Proposal and Proposal Defense**

If the candidate has successfully demonstrated criteria (a)–(d) given in Section 6.0, 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 re-defend 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 re-defend his/her Thesis Proposal should be the same as the first attempt including the Chair of the Graduate Committee (or designated

representative). In the event that this is not possible, the Graduate Committee 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.

## 7. 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.

### 7.1 The MIT Degree Application Form

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

### 7.2 The Thesis Defense Committee

It is required that the *ad hoc* Thesis Defense Committee include five members selected as follows: three members of the candidate's Thesis Committee including the Chair and two individuals (generally 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. The chair of the candidate's thesis committee will also act as department representative and be responsible for running the defense, including moderating questions and taking notes in the official record book.

### 7.3 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 five 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 five 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.

### 7.4 Scheduling the Thesis Defense

For a thesis defense to be scheduled, the candidate must obtain the approval of the Thesis Defense Committee before working with the Graduate Administrator and the Academic Programs Office. 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 (or multiple drafts) of the complete thesis, upon which the candidate is prepared to have his/her research work judged. The Thesis Defense Committee may then **give the candidate permission** to proceed with planning of the thesis defense.
2. No later than **20 business days** (4 calendar weeks) before the thesis defense, the candidate must notify the Graduate Administrator of the proposed date of the defense and the

composition of his/her Thesis Defense Committee (including the two readers). This notification must include telephone and email contact information for all members of the Thesis Defense Committee. The Graduate Administrator will then confirm with the Committee Chair that the student is cleared to proceed.

3. No later than **ten business days** (2 calendar weeks) before the thesis defense, the candidate must submit an electronic PDF copy of a proposed final draft of the thesis for distribution, to the following parties:

- each member of the Thesis Committee,
- every other faculty member or guest invited to participate in the *ad hoc* Thesis Defense Committee, and
- the Academic Programs Office, for posting on the faculty wiki, which is available to all AeroAstro faculty members

Furthermore, the candidate will submit the following electronically to the Academic Programs Office at least **ten business days** (2 calendar weeks) before the defense, to be included in the thesis defense announcement:

- the thesis abstract and title
- the finalized time and location of the defense

Within the guidelines outlined above, the Chair of the Graduate Committee is empowered to deal with all matters that arise from unforeseen absences at the scheduled time of thesis presentation. Moreover, while the formal timeline above begins 20 business days (4 calendar weeks) before the defense, we expect that the process of deciding whether the student is ready to schedule his/her defense should involve coordination and communication between the student and the Committee (e.g., iteration on thesis drafts) *well before* the start of the formal timeline.

**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. In any case, the thesis committee should provide a frank assessment to the candidate of the adequacy of the research prior to agreeing to schedule a thesis seminar.

### **7.5 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 that may arise at the closed faculty meeting, which follows the open presentation.

### **7.6 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 Graduate

Committee, 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.

### **7.7 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.

### **7.8 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 final grade is obtained from the Thesis Chair and submitted to the Registrar's Office. At this point, a student will not be permitted to make changes to the thesis. The Chair of the Department Graduate Committee signs on behalf of the faculty of the department and both copies of the thesis document are delivered to the Archives Office.

**APPENDIX A**  
**Doctoral Program Checklist**

Note: timings in this checklist are given in number of *terms* and refers only to regular fall and spring terms (i.e. not including summer terms)

- \_\_\_ English Evaluation Test (for non-native English speakers) **(at entrance)**
- \_\_\_ Graduate Writing Exam **(at entrance)**
- \_\_\_ A minimum cumulative grade point average of 4.4
- \_\_\_ Faculty endorsement for the Field Exam (FE)
- \_\_\_ Field Exam **(within first three terms)**
- \_\_\_ Admission to the doctoral program
- \_\_\_ Formation of and first meeting with Thesis Committee **(within two terms of admission to doctoral program)**
- \_\_\_ Regular meetings with Thesis Committee **(at least twice per year)**
- \_\_\_ Update *Doctoral Program Record Form* **(after every Thesis Committee meeting and requirement satisfaction)**
- \_\_\_ Major program selection
- \_\_\_ Minor program selection
- \_\_\_ Successful completion of the Research Process & Communication (RPC) subject **(before the thesis proposal is defended)**
- \_\_\_ Thesis Proposal and Proposal Defense **(within three terms of admission to doctoral program, and following successful completion of the RPC)**
- \_\_\_ Satisfactory performance in the minor field
- \_\_\_ Satisfactory performance in the major field
- \_\_\_ Completion of Graduate Mathematics Requirement
- \_\_\_ Institute Residency Requirements
- \_\_\_ MIT Degree Application Form
- \_\_\_ A defense of the thesis **(within four terms of completion of thesis proposal and defense)**
- \_\_\_ A satisfactory thesis **(within four terms of completion of thesis proposal and defense)**

## **APPENDIX B**

### **Doctoral Student Warning Policy**

The Department's Graduate Committee meets at the end of each academic term to monitor student progress throughout the graduate academic program. At this end-of-term meeting, the Graduate Committee will authorize the Committee Chair to notify students by letter if they are not making appropriate progress. In addition, a warning from the Dean of Graduate Education can be requested that could eventually lead to a denial of registration. The following are the most common reasons for warnings or other actions:

- "U" grade on 16.THG
- GPA falling below 4.4
- Has not had first Thesis Committee meeting within two regular terms of admission to the doctoral program
- Has not successfully completed the thesis proposal and proposal defense within two regular terms of admission to the doctoral program
- Has not successfully defended thesis within four regular terms of passing the proposal defense

For most problems except a "U" grade: For a first occurrence, a warning letter from the department's Graduate Committee will request the student improve his/her performance, provide a program completion plan, or follow up with the Graduate Committee in an appropriate manner. For a second occurrence from either a continued or new problem, the department will issue a second departmental warning letter. In addition, the department will generally request a warning letter from the Dean of Graduate Education. On a third occurrence, the department will generally make a request to the Dean that the student not be allowed to continue his/her studies in the Department of Aeronautics and Astronautics.

For a "U" grade on 16.THG: For a first occurrence, a warning letter from the department's Graduate Committee will request the student improve his/her performance, provide a program completion plan, or follow up with the Graduate Committee in an appropriate manner. In addition, the department will generally request a warning letter from the Dean of Graduate Education. On a second occurrence, the department will generally make a request to the Dean that the student not be allowed to continue his/her studies in the Department of Aeronautics and Astronautics.

While the general policies for responding to students with insufficient progress are described above, individual circumstances will be accounted for in the application of these policies. Furthermore, students are encouraged to seek the assistance of their advisor(s), the Academic Program staff, or the Graduate Committee to help resolve any problems that are hindering their progress.