**University of Southern California**
**Department of Astronautical Engineering**
**Handbook for Astronautical Engineering Ph.D. Students**

DISCLAIMER

This handbook is produced by the Department of Astronautical Engineering as a guide to Ph.D studies in astronautical engineering. The source for much of the information in this booklet is the USC Catalogue, the document of authority for all students of the University of Southern California. Degree requirements listed in the USC Catalogue supersede any information which may be contained in any bulletin of any school or department. The USC Catalogue is updated and published annually by the University of Southern California.

Although the University of Southern California and the Viterbi School of Engineering have many resources to help each student achieve his/her desired education and training goals, it is ultimately the student's responsibility to see that all requirements for graduation are satisfied.

"Students are expected to be familiar with university policies and to monitor their own academic progress. They should keep all records of official grades earned, degree requirements met, transfer credits accepted and actions taken on requests for substitutions or exceptions to university policies and regulations."

--USC Catalogue

## 1. Introduction

This handbook provides information about the Astronautical Engineering Ph.D program offered by the Astronautical Engineering Department at USC, including admission requirements; general degree requirements; screening exam; qualifying exam; pre-defense; defense; dissertation advisor and dissertation committee; performance review; timeline and time limit; and special circumstances.

## 2. Admission Requirements

The Ph.D program application at USC is a separate process from the MS program application. The Astronautical Engineering Ph.D program admits both students directly after the undergraduate program ("direct Ph.D students") and students after having completed a Master's degree ("Ph.D students with a MS").

Students who are interested in the Ph.D program should apply directly to the Ph.D program through https://viterbigradadmission.usc.edu/. The application deadline is Dec.15, every year. The minimum admission requirements for the Ph.D. in Astronautical Engineering are:

- GRE: mid 150s in both the verbal and quantitative sections.
- Undergraduate GPA: 3.3 on a 4.0 scale.

Applicants must supply transcripts, GRE score reports, three recommendation letters, and a personal statement with the application form. An application fee is required, but is waived for USC alumni.

Other than academic qualifications, the alignment of the research interests between student and dissertation advisor is a key requirement for admission. Potential applicants are encouraged to contact individual faculty members about their research expertise and ongoing research activities during the application. An applicant is admitted only if an aste faculty member is available to be the student's dissertation advisor.

## 3. General Degree Requirements

The general degree requirements for the Ph.D degree are listed. in the USC Catalogue. To obtain the Ph.D student, a student must successfully complete the required course work and the Ph.D dissertation. The astronautical engineering Ph.D. student is expected to meet the following minimum requirements:

### 3.1 Course Work

A minimum of 60 units of course work beyond the baccalaureate is required for the PhD degree, including research courses and four units of 794ab Doctoral Dissertation. No more than 8 units of 794 may be received or applied toward the degree.

A minimum of 36 units of course work beyond the first graduate degree, exclusive of 794 Doctoral Dissertation, is required for doctoral degree students admitted with Advanced Standing. Additional course work may be required if deemed necessary by the student's faculty.

a minimum of 24 units applicable toward the degree, exclusive of 794 Doctoral Dissertation, must be completed at the University Park campus.

Students pursuing a Ph.D. must maintain an overall cumulative grade point average of at least 3.5. If a student's cumulative GPA falls below 3.5 at the end of any semester, the overall average must be raised to at least 3.5 by the end of the following semester; otherwise the student will be dismissed from the program.

## 3.2 Approval of Course Work Selection

While there is no formal course requirement in the Ph.D program, a student's selection of course work must be approved by the student's advisor to ensure its relevance as well as a timely progress towards degree completion.

At the beginning of semester, a written approval from the research advisor is required on the courses the student is planning to take before course registration. If the research advisor is absent, the approval will be given by the department chair.

## 3.3 Dissertation

A dissertation is an original contribution to current knowledge and a demonstration that the PhD candidate has achieved sufficient mastery in the field to pursue independent research and scholarship. A dissertation represents the individual candidate's research and writing.

The student is expected to be enrolled in 794 Doctoral Dissertation each semester, except summer sessions, after admission to candidacy until all degree requirements are completed. Registration for 794 for the two semesters (excluding summer sessions) immediately following admission to candidacy is the minimum requirement entitling the candidate to dissertation supervision by the dissertation committee. Enrollment in 794 prior to admission to candidacy is not permitted and such registration is invalid. If the dissertation is not completed and accepted within two semesters the candidate must continue to register for 794 each semester thereafter until the dissertation has been approved and the approval of the Ph.D. dissertation has been signed by the dissertation committee. Students are expected to complete and defend their dissertation before they have enrolled in no more than five semesters of 794.

## 3.4 Approval of Dissertation Subject Selection, Dissertation Scope, Dissertation Content

While a student is encouraged to explore different research areas during the first year of study, the selection of a dissertation research direction should be an early priority. The dissertation subject should be finalized before the student's qualifying exam. If a student's dissertation direction changes significantly after passing the qualifying exam, the result of the previous qualifying exam will be invalided and the student must retake the qualifying exam.

The dissertation subject must be in the general area of astronautical engineering and space science. The subject must also be related to the dissertation advisor's research expertise. If a student's dissertation subject is outside the research expertise of all current ASTE faculty members, an outside expert on the subject must be brought in as an external member of the dissertation committee.

The student's dissertation advisor has the final approval of the dissertation subject selected. An approval from the advisor on the dissertation subject is required before the qualifying exam.

An approval from the advisor on the dissertation scope is required before the dissertation pre-defense. The dissertation committee has the final approval of the scope of the dissertation research at or after the pre-defense. The dissertation committee has the final approval of the dissertation content at or after the dissertation defense.

### 3.5 Publication of Dissertation Research

The quality of the dissertation research must meet that for research published at leading peer reviewed journals in the field. All relevant research results from the dissertation need to be disseminated in a timely manner before completion of all degree requirements.

It is expected that all major results of the dissertation will have been submitted for journal publication by the time of dissertation pre-defense (Section 6) and will have been accepted for publication by the time of dissertation defense (Section 7).

The dissertation advisor determines the publication venue, the number of publications, and the content of each publication. The dissertation advisor is the corresponding author on all publications related to the dissertation research.

### 3.6 Exams and Milestones

All students begin their PhD studies with the status of "admitted to the PhD program". Continuation in the ASTE PhD program requires that the student successfully pass the following exams and milestones

- Ph.D screening exam
- Ph.D qualifying exam (admission to Ph.D candidacy)
- Ph.D dissertation pre-defense
- Ph.D dissertation defense

## 4. ASTE Ph.D Screening Exam

All students in the ASTE Ph.D program are required to pass a written Ph.D screening exam in order to continue in the Ph.D program. A screening examination is to be administered before the student has taken more than 24 units (including research courses). Passing this procedure is prerequisite to continuation in the doctoral program. Students who fail the screening procedure will be advised that they are not recommended to continue in the PhD program and that any additional work may not be counted toward the degree. Failure to undertake the screening procedure before completion of 24 units of course work may jeopardize additional units.

The ASTE Ph.D Screening Exam is offered once a year. The screening exam typically takes place on the third or fourth Friday of January every year. Students will have two chances to pass the screening exam. Those students who failed their first attempt must take the screening exam again the next year.

4.1 Timeline for Ph.D Screening Exam

- Students who are continuing into the Ph.D program after earning a MS degree from the ASTE master's program are required to take the 1st attempt of the screening exam within ONE year of entering into the Ph.D program. (Example: if you already have a MS from USC ASTE dept. and entered into the Ph.D program either in Jan. or Aug. 2018, you must take the screening exam in Jan. 2019. )
- All other students are required to take the 1st attempt of the screening exam within TWO years of entering into the Ph.D program. (Example: if you entered into the Ph.D program either in Jan. or Aug. 2018, you must take the screening exam no later than Jan. 2020.)

4.2 Screening Exam Content and Format

- The screening exam is a closed book written exam. It has two sections.

- Section I will test a student's general knowledge in astronautics and related fields such as mathematics and physics. Section I contains relatively short questions. Most of these questions can be answered with an undergraduate education in engineering or physical science. Students will be expected to answer as many Section I questions as he/she can.

- Section II will test a student's in-depth knowledge in any two of the following subject areas.

- Plasmas and Gas Physics (recommended preparation: ASTE 505a Plasma Dynamics)
- Orbital and Spacecraft Dynamics (recommended preparation: ASTE580 Orbital Mechanics)
- Space Propulsion (recommended preparation: ASTE470 Spacecraft Propulsion)
- Space Environment and Spacecraft Interactions (recommended preparation: ASTE535 Space Environments and Spacecraft Interactions)
- Space Systems (recommended preparation: ASTE520 Spacecraft System Design)

- Students are required to answer TWO section II questions, one from each of the two students' chosen areas.

## 5. ASTE Ph.D Qualifying Exam

All students in the ASTE Ph.D program are required to pass the Ph.D qualifying exam in order to continue in the Ph.D program. Students have two chances to pass the qualifying exam.

The examination qualifying a student for candidacy for the PhD degree is designed to test the student's fitness to undertake independent research. Prior to taking the qualifying examination, the student must have met all of the university's and program's requirements for the Ph.D. degree, except the dissertation and successful qualifying exam. The student must have a GPA of at least 3.0 on all USC course work available for graduate credit and the approval of his or her qualifying exam committee to proceed to the exam.

The qualifying exam committee is composed of five members. The committee chair and at least two additional members must have an appointment in the astronautical engineering program. The committee chair and at least two additional members must be affiliated with the astronautical engineering program. Faculty eligible to serve as committee chairs and members include tenured and tenure-track faculty, and non-tenure-track faculty of outstanding stature who have a documented record of exceptional expertise and superior achievement in a field relevant to the exam and have been approved by the dean of the school. At least three members of the committee must be tenured or tenure track. Visiting faculty may not serve on qualifying exam committees.

5.1 Timeline for Ph.D Qualifying Exam

All full-time students are required to take the qualifying exam (i.e. the 1st attempt) within TWO years of passing the screening exam.

For part time students: exception to the timing of your qualifying exam can be made pending the request from your advisor and the approval from the Ph.D program director and the dept. chair.

Students who failed their first attempt must take the qualifying exam again within 6 months.

5.2 Qualifying exam Content and Format

The astronautical qualifying exam is an oral exam. It consists of a short presentation by the student on his/her intended dissertation research and an oral examination by the qualifying committee on questions specifically related to student's presentation, and oral examinations by the qualifying committee in the general area of the student's research.

The qualifying document must be submitted to the qualifying exam committee ***at least*** one week prior to the exam. Failing to do so will lead to automatic cancellation of the qualifying exam.

## 6. Dissertation Pre-Defense

At least one semester prior to the scheduled Ph.D dissertation defense, all ASTE Ph.D candidates are required to pass a dissertation pre-defense administrated by the dissertation committee. The candidate is expected to have already completed the majority of his/her dissertation research at the time of pre-defense.

At the pre-defense, the committee will either approve the scope and major results of a student's dissertation and allow the dissertation to be scheduled or require the student to carry out further dissertation work and return for another pre-defense.

The pre-defense document must be submitted to the dissertation committee ***at least*** one week prior to the exam. Failing to do so will lead to automatic cancellation of the pre-defense. The pre-defense generally takes about one hour.

## 7. Dissertation Defense

An ASTE Ph.D candidate may schedule the dissertation defense after passing the pre-defense.

The completed dissertation must be submitted to the exam committee ***at least*** two weeks prior to the defense. Failing to do so will lead to automatic cancellation of the defense. The defense presentation by the candidate generally takes about one to two hours.

## 8. Dissertation Advisor and Dissertation Committee

### 8.1 Dissertation (Research) Advisor

Upon admission to the program, the student will be assigned a dissertation advisor, a research active member of the astronautical engineering faculty. The dissertation advisor will help the student select courses and develop the research plan for dissertation. It is typical for the dissertation advisor to serves as the student's qualifying exam committee chair and dissertation committee chair.

The dissertation advisor approves the student's course selection each semester and the student's dissertation subject selection before the qualifying exam. The dissertation advisor evaluates the student's performance progress each semester and provides the evaluation to the graduate school. The dissertation advisor approves the scope/results of the dissertation before the pre-defense, and the dissertation before the defense. The dissertation advisor approves the content, venue, and authorship related to the publication of dissertation research.

### 8.2 Dissertation Committee

The dissertation committee is appointed as soon as possible after the qualifying examination has been passed and a dissertation topic approved. The committee should be appointed at least one month before the dissertation pre-defense. The Appointment or Change of Qualifying Exam or Dissertation Committee form, available on the Graduate School Website, is used to establish the dissertation committee. The form requires the signatures of each member of the committee, the department chair or program director, and dean or dean's designate. The completed form is filed in the student's home department or program.

The dissertation committee is composed of at least three and no more than five members. The committee chair and at least one additional member must have an appointment in the student's program. Two committee members must be from the home program, at least one of whom must be tenured. Faculty eligible to serve as committee chairs and members include tenured and tenure track faculty, and non-tenure track faculty of outstanding stature who have a documented record of exceptional expertise and superior achievement in a field relevant to the dissertation and have been approved by the dean of the school. At least two members of the committee must be tenured or tenure track. Visiting faculty may not serve on dissertation committees. The vice provost for graduate programs is an ex officio member of all dissertation committees.

## 9. Time Limit

It is expected that all the key milestones are completed in a timely fashion (see previous sections). Under normal circumstances, the time-to-degree for the PhD is expected to be 5 years or less for students entering with a Master's degree and 6 years or less for direct PhD students. Students whose programs extend beyond the cited times are subject to progress reviews and an

overall program time limit approved by the department chair. Failing to meet the overall time limit may lead to dismissal from the program.

Under special circumstances, a student may request to take a temporary leave from the program. The temporary leave request will need to be approved by the department chair.

**10. Progress Review**

The graduate school has an established procedure to review all Ph.D students in the program. A progress review will be carried out every semester by the advisor and the department committee following the procedure. The progress review will typically cover your course work, research progress, and whether you have met the program milestones (see Sec. 3.6) and the expectations of your research (dissertation) advisor (see Sec. 11). Failing the progress review will lead to dismissal from the program.

**11. Expectations on Ph.D Students**

A Ph.D study entails both formal education and research training under the supervision of faculty members. A positive mentoring relationship between Ph.D students and their research advisors involves certain expectations from the research (dissertation) advisors and requires certain commitments from the students. To help you understand such expectations/commitments, we compiled the following based on typically adopted compacts between graduate students and their advisors (e.g. "AAMC Compact between graduate students and their research advisors", etc). All ASTE Ph.D students are required to meet the following expectations.

As a Ph.D student at USC Astronautical Engineering Department,

• I acknowledge that I have the primary responsibility for the successful completion of my degree. I will be committed to my graduate education and will demonstrate this by my efforts in the classroom and in the research laboratory. I will maintain a high level of professionalism, self-motivation, initiative, engagement, scientific curiosity, and ethical standards.

• I will maintain detailed, organized, and accurate research records. With respect to research/data ownership, I acknowledge that original notebooks, computer codes, digital files, and tangible research materials belong to the institution and will remain in the lab when I finish my dissertation so that other individuals can reproduce and carry on related research, in accordance with institutional policy. Only with the explicit approval from my research advisor and in accordance with institutional policy may I make copies of my notebooks and digital files and have access to tangible research materials that I helped to generate during my graduate training.

• I will meet regularly with my research advisor to provide updates on the progress and results of my course work, research, and professional and career development activities.

• I will work with my research advisor to develop a dissertation project and establish a timeline for my work. I will keep engaged with the work, discuss findings and any pitfalls, and meet the established goals and deadlines. I will be responsive to the advice, suggestion, and constructive criticism on my dissertation project from my advisor.

• I will work with my research advisor to select a dissertation committee. I will meet with this committee according to program guidelines, discuss my progress to date, and be responsive to the advice and constructive criticism from my committee.

• I will work with my research advisor to disseminate all relevant research results in a timely manner before completion of all degree requirements. I will abide by the policies established by my advisor and institution on publication and authorship, and the instructions of my advisor on publication content and venue.

• I will abide by the policies on work hours from my graduate program and research advisor. I will consult with my advisor in advance of any planned absences and apprise my advisor of any unexpected absences due to illness or other issues.

• I will actively participate in laboratory meetings, seminars, and journal clubs that are part of my educational program.

• I will be a good research lab citizen and take part in shared laboratory responsibilities. I will use laboratory resources carefully and frugally. I will be respectful of, tolerant of, and work collegially with all laboratory personnel. I will be an active contributing member to all team efforts and collaborations and will respect individual contributions. I will contribute to an environment that is safe, equitable, and free of harassment.

• I will abide by all relevant institutional policies and procedures, and meet the requirements from the department, graduate school, and university.