

Handbook for Students & Faculty

MIT/WHOI Joint Program in Applied Ocean Science and Engineering

1. Overview

The Joint Program is organized within five disciplinary areas, each administered by a Joint Committee consisting of MIT and WHOI faculty: Biological Oceanography, Chemical Oceanography, Marine Geology and Geophysics, Physical Oceanography, and Applied Ocean Science and Engineering (AOSE). The Joint Committee associated with each discipline provides guidance as to the course of study for incoming students who have strong interests in that focal area. The MIT/WHOI Joint Program in Applied Ocean Science and Engineering (JPAOSE) combines basic research on a wide range of oceanic processes with applied research and engineering. Students are given the chance to select individual paths combining skills from mathematics, physics, and engineering disciplines with oceanography.

Faculty members from four MIT engineering departments — Aeronautics and Astronautics (AeroAstro), Civil and Environmental Engineering (CEE), Electrical Engineering and Computer Science (EECS), and Mechanical Engineering (ME)— and any one of the five WHOI departments combine to make up the Joint Program discipline of AOSE. Students entering the JPAOSE are enrolled at MIT through one of the four engineering departments, called the “home” MIT department, which is chosen by the student during the application process. Regardless of which MIT department is the home department, the primary research advisor can be in any one of the five WHOI departments or any one of the four MIT engineering departments.

Unlike the other four disciplines that make up the Joint Program, **students in AOSE must satisfy all the degree requirements of their home MIT department, as well some additional Joint Program requirements.** Most students enter the JPAOSE with a Ph.D. (or Sc.D., which differ only in name) as their ultimate goal. Depending on the home MIT engineering department, the Master of Engineering, Master of Science, or Engineer degree may also be obtained. In fact, students admitted through the AeroAstro and EECS departments must first complete all requirements for a master’s degree, from MIT or another institution, before being formally admitted to the doctoral program in those departments. The JPAOSE also houses some of the Navy students in the Navy Master’s program.

The exact requirements for the doctoral program depend on the “home” MIT department, but typically the doctoral program in AOSE is made up of approximately two years of graduate-level course work, mostly comprised of classes offered at MIT. Most students in AOSE spend their first 3-4 full semesters (not counting summers) based at MIT to complete their course work. The MIT engineering departments require that doctoral students take a general or qualifying examination, typically by the end of 3-5 full semesters, depending on the department. The

forms of the examination may also differ among the MIT departments, and some departments adjust their policies for JP students. For instance, the ME department considers *Acoustics* and *Robotics* as Core Subjects for JP students' qualifying exam subject choices. These examinations test a student's preparation to go forward with thesis research. After the exam is passed, the student then presents a proposal for thesis research, normally about six months after their qualifying exam, and typically before the end of their third academic year in the program. The timeline could be slightly different in MIT departments that require students to complete a Master's thesis. After passing the research proposal, the student will formally transition to a PhD candidate. Students then focus on their thesis research, which requires another two to three years. Typically, upon completion of the qualifying examination, AOSE students are based at the institution where their primary research advisor is based.

2. Advisors and Committees

As students in JPAOSE proceed toward their degree, they will interact principally with their research advisor, their academic advisor, the AOSE Education Coordinator, and with two committees, their Thesis Committee and the Joint Committee on Applied Ocean Science and Engineering (JCAOSE).

Research Advisor

Research advisors, also referred to as thesis advisors, are given broad responsibilities concerning the overall academic and research progress of students. Their primary responsibilities include guiding the student's academic program, securing financial support for the student, helping to define the student's research, and acting as the student's advocate. Generally, a student is matched with a research advisor (or advisors) prior to their arrival in the Joint Program. Any MIT faculty member in any of the MIT engineering departments participating in the MIT/WHOI Joint Program (AeroAstro, CEE, EECS and MechE) or any member of the WHOI faculty (see definition at the end of this handbook) can serve as a primary research advisor for a student in AOSE. Many MIT departments also allow Senior Research Scientists/Engineers/Associates (S/E/A) to advise students. Faculty from outside of WHOI or MIT can serve as a research advisor only under exceptional circumstances, with permission from JCAOSE and the home MIT department, and with an MIT and/or WHOI co-advisor.

Upon arrival in the JP, every student and advisor should meet and review the student/advisor expectations and responsibilities guidelines provided on the JP web site. All students are expected to attend and participate in lab meetings and research seminars of the research groups to which they belong. Students and advisors are expected to set up a schedule for regular interaction. Student progress should be reported as requested by the AOSE joint committee and the home MIT department, including annual submission of the student/advisor report on student progress. Results of meetings and examinations where decisions are made affecting the student's graduate career, as well as any documents/forms required by the student's home MIT department, should be documented in writing and sent to JCAOSE chair, the AOSE Education Coordinator, the MIT Joint Program Office, and the WHOI Academic

Programs Office. The contact information can be found on the Joint Program website (mit.who.edu).

Switching Research Advisors

A student or the student's advisor may recommend a change of advisor for a variety of reasons, such as the departure of the advisor to another institution, a shift in research interests, or an ineffective student/advisor relationship. JCAOSE supports switching advisors when it becomes necessary, and urges the student, original advisor, and new advisor to work on the transition in a transparent and constructive manner. Switching advisors should involve discussion with the Education Coordinator, who can facilitate discussions with the original advisor, help the student to identify a new advisor, and provide guidance toward developing a transition plan. The MIT home department should also be included in the discussion. The WHOI Dean and/or MIT JP Director (Associate Directors when necessary) should be consulted in development of a transition plan, and in cases where advising shifts between WHOI and MIT, it is necessary to notify both the WHOI Dean and the MIT JP Director. The transition plan will consider how best to wrap up research with the original advisor, as well as the timing of the move to working with the new advisor, including any additional classes to be taken, timeline for taking qualifying exams, forming/reforming the thesis committee, and completing research.

Requests for switching research advisors should be submitted with the transition plan to JCAOSE for approval. If necessary, JCAOSE will work with the student and new advisor to adjust the student's timeline. For students who have advanced to candidacy, JCAOSE will consult with the student and advisor and will determine whether the change will result in a substantial shift in research focus. If so, the student would need to prepare and defend a new thesis proposal.

Academic Advisor

Every JPAOSE student will be assigned an MIT academic advisor in their home MIT department, distinct from their research advisor(s). The academic advisor will sign registration forms each semester and will check that the student is aware of and is meeting milestones such as taking qualifying exams and fulfilling MIT departmental course requirements. In addition, the MIT academic advisor may be a valuable resource for helping a student with course selection. Students may identify their own academic advisors or request academic advisors by writing to the Education Coordinator. The MIT academic advisor should be identified and then approved by JCAOSE prior to the start of the first full semester at MIT. If the academic advisor changes for any reason, the student is responsible for requesting approval from JCAOSE by writing to the chair of JCAOSE in a timely fashion. The duties of the academic advisor transfer to the research advisor and thesis committee once the thesis committee is formed.

The Joint Committee for Applied Ocean Science and Engineering (JCAOSE)

JCAOSE is responsible for overseeing all aspects of the AOSE graduate program, including:

- Approving academic advisors.
- Reviewing student progress annually, and more frequently if required.
- Approving proposed thesis committees and thesis defense chairs.

- Recommending to the deans of the Joint Program, on the basis of the thesis defense, whether the doctoral degree should be conferred on the student.
- Reviewing petitions and otherwise deciding on the student's continued enrollment and financial support in the Joint Program based upon the student's demonstrated progress.

Members of JCAOSE are appointed from the MIT and the WHOI faculty, and include the Education Coordinator. Every attempt is made to have at least one faculty member from each of the MIT engineering departments involved in the Joint Program. Appointments are made by the Director of the Joint Program at MIT upon recommendation of the Department Head for faculty of the appropriate MIT department, and by the Vice President for Academic Programs and Dean at WHOI for members of the WHOI faculty, upon the recommendation of the WHOI department chair(s). The chair of the JCAOSE serves a three-year term, and the chair position typically alternates between an MIT and WHOI faculty member. The chair of JCAOSE has executive authority on all decisions, requests, and petitions, at his or her discretion, after considering advice from the entire JCAOSE committee.

Students are encouraged to consult JCAOSE on academic questions or issues related to the Joint Program by contacting the Education Coordinator, the chair of JCAOSE, or other members of JCAOSE. Their contact information could be found the Joint Program website (mit.who.edu). Any petition to or request for approval by the JCAOSE shall be sent to the chair of JCAOSE in writing (for instance, emails would be sufficient).

Thesis Committee

Every AOSE student must form a thesis committee after the student passes the general/qualifying exam, which typically occurs before the end of the third year in the Joint Program. Different MIT departments have slightly different rules regarding the makeup of the thesis committee. However, the following guidelines incorporate both MIT and Joint Program requirements, and should be adhered to by all JCAOSE students:

1. There must be a minimum of three members on a thesis committee, and members of the thesis committee should be selected by the student in consultation with the student's research advisor. The student's research advisor is one of the members of the thesis committee.
2. Many thesis committees have five or six members. However, thesis committees with more than six members can become unwieldy and committee meetings difficult to arrange, and are discouraged.
3. Every thesis committee should have at least one member from the WHOI faculty.
4. Every thesis committee should have at least one member from the home MIT department faculty.
5. Married couples can both serve on a thesis committee. However, they count as only *one* person toward the membership requirements.
6. In addition:
 - a. MIT AeroAstro requires that two members of every thesis committee be MIT faculty (not necessarily AeroAstro), including *emeriti faculty*, or *Professors of the Practice* in the major field.

- b. MIT CEE requires that two members of every thesis committee be CEE faculty members.
 - c. MIT EECS requires that two members of every thesis committee be EECS faculty members.
 - d. MIT ME typically requires that there be three MIT faculty members on every thesis committee, including two ME faculty members. However, ME typically waves this requirement for JPAOSE students. A JPAOSE student can have one ME faculty and two WHOI scientists on the thesis committee, and no petition is required.
7. The proposed thesis committee must have a chair identified, and guidelines vary by MIT department:
 - a. MIT AeroAstro: The chair of the thesis committee must be an AeroAstro faculty member. The chair of the thesis committee is often the research advisor (if the research advisor is in AeroAstro), but does not have to be.
 - b. MIT CEE: The chair of the thesis committee must be a CEE faculty member. The chair of the thesis committee must be distinct from the research advisor.
 - c. MIT EECS and ME: The chair of the thesis committee is typically the research advisor, but does not have to be. The chair of the thesis committee can be either a WHOI faculty member or MIT faculty member from the home MIT department.
 8. The academic advisor (an MIT faculty member from the home MIT department) can be a member of the thesis committee and can be the chair of the thesis committee, if it does not conflict with the above requirements.
 9. In all cases, the proposed thesis committee must be approved by JCAOSE and the home MIT department. Any subsequent changes in membership of the thesis committee must be approved by JCAOSE and by the home MIT department.
 10. In the event that a student needs longer than three years before forming a thesis committee, the student must petition JCAOSE, in a timely fashion, for approval to remain in the Joint Program until a thesis committee is formed. The petition must contain a timeline for forming the thesis committee and must be endorsed by the thesis/research advisor.

3. Requirements for the Doctoral Degree in AOSE

1. Satisfy the requirements for the home MIT department. Students should consult the MIT on-line handbook for their home MIT department, which can be found on their website.
2. Read this handbook and comply with all reporting requirements for both the home MIT department and the JCAOSE (see details below).
3. Complete one summer, fall or spring term of research at WHOI within the first five years in the program. Students should obtain course credit through the appropriate course number for the home MIT department. The first summer at WHOI, prior to the official start of the first academic year, can serve to fulfill the research semester at WHOI requirement.
4. Complete the course 2.688 *Principles of Oceanographic Instrumentation*. This course requirement must be completed by the end of the fourth academic year. This requirement may, under some circumstances, be substituted by an equivalent experience or course by petitioning JCAOSE for approval. This petition must be received by JCAOSE by the beginning

of the fourth academic year. Students should make a plan to meet this requirement at the beginning of their Ph.D. study, so that this course can be counted against the course requirements of their home MIT department.

5. Complete a graduate-level 12-credit-unit *Oceanography or Oceanographic Engineering* breadth class. This class must be in area outside of the student's chosen research area. Approved classes are listed below. This requirement must be completed by the end of the fourth academic year. Other equivalent classes may potentially be substituted by petitioning the JCAOSE for approval by the beginning of the fourth academic year. Students should make a plan to meet this requirement at the beginning of their Ph.D. study, so that this course can be counted against the course requirements of their home MIT department.

Approved Classes:

- a. 1.69 Introduction to Coastal Engineering
 - b. 2.681 Environmental Ocean Acoustics
 - c. 2.682 Acoustical Oceanography
 - d. 7.470 Biological Oceanography
 - e. 12.742 Marine Chemistry
 - f. 12.710 Geological Oceanography
 - g. 12.712 Marine Seismology
 - h. 12.800 Fluid Dynamics of the Atmosphere and Ocean
 - i. 12.808 Introduction to Observational Physical Oceanography
 - j. 12.862 Coastal Physical Oceanography
6. Maintain an "A" or "B" grade in the required AOSE classes.
 7. Participate annually in the AOSE student seminar and annual review process.
 8. Complete and defend in public a doctoral dissertation with direct application to the ocean.
 9. Present a seminar at either WHOI or MIT during the same semester as the thesis defense, at the institution where the thesis defense will not be held. Ideally, this seminar will take place about 1-3 weeks in advance of the thesis defense, as it is an important mechanism for practicing the thesis defense.

Timeline and Reporting Requirements

1. Students must comply with all reporting requirements for the home MIT department, and provide a copy of all documentation to WHOI APO and the Education Coordinator.
2. Students must notify WHOI APO and the Education Coordinator on the outcomes of their general/qualifying exams and the thesis proposal defense in a timely fashion.
3. Students must submit an annual report and brief presentation of their research for the annual AOSE student seminar and annual review process, typically held in mid-summer (first Wednesday in August) at WHOI. The exact date and location are announced in late spring every year. Advisors must submit an annual evaluation of the student for this review.
4. Students must form a thesis committee and successfully defend a Ph.D. thesis proposal before the end of the third year in the Joint Program. The thesis proposal shall contain a timeline for completion of the student's Ph.D. program and must be submitted to JCAOSE for final approval. In the event that a student needs longer than three years before forming a thesis committee or defending a thesis proposal, the student must petition JCAOSE, in a timely fashion, for approval to remain in the Joint Program until a thesis committee is

formed and the thesis proposal is completed and accepted. The petition must contain a timeline for forming the thesis committee and completing the thesis proposal and must be endorsed by the research/thesis advisor.

5. Starting with the summer closest to the end of a student's fourth year in the Joint Program and continuing for each summer after that, the student must submit to the JCAOSE a detailed timeline for the remainder of his or her time in the Joint Program. The timeline shall include major research or thesis milestones and expected dates of completion of all remaining degree requirements and shall be signed by the student's thesis advisor and all members of the thesis committee. The timeline will be reviewed by JCAOSE as part of the annual review of student progress and determination of each student's academic standing. JCAOSE shall be notified promptly of any major changes to the timeline.
6. Students are strongly encouraged to complete a doctoral degree in five years. This five year "clock" begins when the student initially enters graduate school at either MIT or the MIT/WHOI joint program. For students transferring to the JP doctoral program from a MIT/JP master's program, the time spent pursuing a master's degree counts in the five-year time limit, without exception.
7. If a student expects to require more than five years in the AOSE Joint Program to complete the Ph.D. degree requirements, then six months prior to the end of the student's fifth year in the program, he or she must submit to the JCAOSE a request for permission to stay in the program past five years. The request shall be signed by the research advisor. It shall include a detailed schedule for completing the remaining items necessary for the Ph.D. and a listing of the source(s) of funding for the student.
8. A student will be allowed to continue past the end of the sixth year in the Joint Program only in exceptional circumstances. For this to happen, the student must submit to JCAOSE, at least six months before the end of the sixth year in the program, a written request for this approval. The request shall include items listed in (7) as well as an explanation of the reason for the need for the continuation. The request must have the explicit endorsement of each member of the student's thesis committee and thesis advisor. If the request is approved, then JCAOSE will establish additional timeline and reporting requirements to be adhered to by the student and the student's thesis advisor and committee. A similar request must be submitted at the end of each subsequent term (summer, fall, and spring) for the remainder of the student's time in the Joint Program.
9. If at any time the JCAOSE determines that a student is no longer in good academic standing, the student may be required to leave the Joint Program.
10. For any publication resulting from a student's research in the MIT-WHOI Joint Program, the student shall include the MIT-WHOI Joint Program in his/her affiliations.

Financial Support

The Joint Program is committed to ensuring that each student is funded for their first five years in the program as long as the student maintains good academic standing as determined by the JCAOSE and student's home department at MIT. After the fifth year, financial support for students is not guaranteed and will depend on a number of factors. Financial support beyond the sixth year requires extraordinary circumstances. Students are able to receive funding from other sources including external fellowships and appointments such as Research and Teaching

Assistants after the end of their fifth year in the program as long as they remain in good academic standing. Guidelines for student obligations and benefits supported by research and teaching assistantships can be found from the MIT Graduate Student's Office at <http://web.mit.edu/gso/>.

4. Requirements for the AOSE Navy Master of Science Program in Mechanical Engineering

The Joint Program has been offering a Master's degree program for U.S. Naval Officers since 1970. The Joint Program recently accepted a U.S. Coast Guard Officer into a Master's degree program, and this option may continue in the future. The U.S. Navy manages the initial application process for Naval Officers prior to consideration by the Joint Program. Two Joint Committees now consider Naval Officers for admission to the master's degree program: the Joint Committee for Applied Ocean Science and Engineering (JCAOSE) and the Joint Committee for Physical Oceanography (JCPO). The Master's degree program is suitable for motivated students with undergraduate degrees in geoscience, physics, chemistry, mathematics, or engineering. The program is designed to be completed in 27 months (two years and a summer), and there is typically very little flexibility in the timing, as this is dictated by the U.S. Navy. The first year is spent taking courses and beginning research with an advisor. In the second year, the student conducts research, culminating in a Master's thesis.

The Navy Master of Science (SM) Degree program offered through the MIT/WHOI Joint Program in Applied Ocean Science and Engineering requires that the student:

1. Satisfy the requirements for the Masters of Science imposed by the MIT Mechanical Engineering Department.
2. Complete course 2.688 *Principles of Oceanographic Instrumentation*. This requirement may, under some circumstances, be substituted by an equivalent experience or course by petitioning the Joint Committee of Applied Ocean Science & Engineering (JCAOSE) for approval. This petition must be received by JCAOSE by the beginning of the second academic year.
3. Complete one summer, fall or spring term of research at Woods Hole. All incoming JP Navy students are encouraged to spend their first summer at WHOI, prior to the official start of the first academic year. A math refresher class is offered to get Navy officers, who may have been out of school for a number of years, back up to speed and help prepare them for the upcoming semester taking classes at MIT.
4. Participate annually in the AOSE student seminar and annual review process, typically held in mid-summer at WHOI. The exact date is announced in late spring, but is typically the first Wednesday in August

Thesis/Research Advisor

Any MIT faculty member in any of the MIT engineering departments participating in the MIT/WHOI Joint Program or any member of the WHOI faculty (see below for definition) can

serve as a primary research advisor for a Navy Master's student in AOSE. Many incoming JP Navy Master's students are matched with a research advisor prior to their arrival in the Joint Program. However, some students may spend part of the first summer in the program (the summer before the start of first full academic year) identifying a research advisor. All JP Navy Master's students must notify the chair of JCAOSE and the MIT ME Graduate Office of their thesis advisor within six week of arrival. Unlike JP Doctoral students, JP Navy Master's students do not form a thesis committee, do not take the MIT ME qualifying examinations, and do not publicly defend a thesis. The Master's thesis is considered to be the centerpiece of a student's graduate experience. The thesis is an original work of research, design, or development. The Master's thesis is signed off by the research advisor and the chair of JCAOSE (or the chair of JCPO if the Navy student enters through JPPO). In addition, if neither the thesis advisor or chair of JCAOSE is a member of the Mechanical Engineering Department, a reader who belongs to the Mechanical Engineering faculty must also endorse the thesis.

Academic Advisor

Navy students must identify an Academic Advisor in the MIT Mechanical Engineering Department prior to the start of the first full semester. JCAOSE must approve the choice of Academic Advisor. As with the incoming JP Doctoral students, the academic advisor will sign registration forms each semester and will check that the student is aware of and is meeting milestones and fulfilling MIT departmental course requirements. In addition, the MIT academic advisor may be a valuable resource for helping a student with course selection. All JP Navy Master's students must notify the chair of JCAOSE and the MIT ME Graduate Office of their MIT academic advisor within six weeks of arrival.

5. Available Resources

Education Coordinator

The AOSE Education Coordinator is a member of AOPE at WHOI. The role of the education coordinator is to strengthen the quality of the AOSE education program by serving as a source of information and advice to both students and advisors. The education coordinator is available to talk with students and advisors about any aspect of the education program or the graduate school experience. Specific duties of the education coordinator include providing information on curriculum matters, WHOI and MIT policies and regulations, and research funding sources. The education coordinator also acts in cooperation with advisors, JCAOSE, and APO to help resolve academic or personal problems. Students are encouraged to ask the education coordinator to attend committee meetings throughout their time in the JP.

Academic Programs Office (APO) at WHOI

The Academic Programs Office (APO) at WHOI is responsible for administrative details concerning student registration, stipend support, housing, and WHOI-MIT interactions. The APO should be kept informed through copies of all student progress reports, examination notices and results, advisor assignments, and any other documents pertaining to the student's progress

in the program. Copies of dissertation proposals should be sent to the APO. The student's official record is kept in the WHOI APO and the MIT department office. The WHOI APO will copy materials and forward them to the appropriate MIT department when necessary. The APO can be reached by phone at (508) 289-2219 or through e-mail at education@whoi.edu.

Joint Program Office at MIT

The MIT Joint Program Office performs functions similar to those performed by the APO except in the case of stipend support, which for MIT-based students is handled by the appropriate MIT department. The MIT Joint Program Administrator can best direct the student to the appropriate MIT office for any administrative matters (i.e., registration, on-campus or off-campus housing) pertaining to the student's stay on campus. The Joint Program Office can be reached via e-mail at mit-who-www@mit.edu.

Individual MIT Engineering Departments Offices

MIT department chairs or administrators are available to help students become familiar with departmental requirements or answer questions about the department and its expectations.

Faculty Members at WHOI and MIT

WHOI Faculty refers to any member of the WHOI Education Assembly, which includes all members of the Scientific Staff as well as Senior Technical/Engineering Staff who have been approved by the WHOI Dean. MIT Faculty members, as defined in *Policies and Procedures*, include only Professors, Associate Professors, and Assistant Professors. In this handbook, "MIT faculty" is used loosely and as a catch-all term meaning all the MIT faculty as defined in MIT's *Policies and Procedures*, as well as other MIT personnel who are allowed to participate in the graduate program by MIT, which may differ by MIT department.