NATIONAL TEST PILOT SCHOOL

CATALOG

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The National Test Pilot School

Welcome to the National Test Pilot School (NTPS). Flight Test is a demanding and exacting field, and the preparation required to succeed in it is no less so. During your time studying at NTPS, your patience, talents and skills – both academic and aeronautical – will be challenged as perhaps never before.

The National Test Pilot School was established in 1981 as an independent, non-profit educational institution dedicated to producing graduates who are ready to contribute to the field of Flight Test. By offering a wide range of education and training programs covering both military and civilian flight test, NTPS provides its students with unparalleled advantages.

Many aerospace companies, military services and government agencies from around the world send their best and brightest to NTPS. We pride ourselves in our ability to offer diverse education and training programs that can be targeted directly at the specific needs of an organization and its flight test program requirements.

NTPS is designed for the real world of Flight Test, with an internationally recognized team of Test Pilot and Flight Test Engineer instructors, housed in a state-of-the-art facility equipped with cutting edge equipment including a large fleet of aircraft.

The National Test Pilot School is approved by the US Department of State to provide training to foreign nationals.

Mission of the National Test Pilot School

The mission of the National Test Pilot School is to improve global aviation and flight test safety and to promote the international flight test community by educating test pilots, flight test engineers, and graduate students in the mastery of flight test sciences.

Our mission is primarily accomplished through our professional courses and master's programs that provide graduate level flight test education and training to test pilots and flight test engineers who learn to safely and effectively plan, execute, and report on flight test programs for their military or civilian organizations.

Our mission is further accomplished through NTPS' continuing education programs, flight test-related research programs, and flight test support activities that increase competency, safety, and the breadth of knowledge in the aviation and flight test professions.

Values of the National Test Pilot School

NTPS is committed to core values of Respect, Integrity, Safety, Technical Competency, and Excellence.

Authorization and Accreditation

The National Test Pilot School is a private, nonprofit institution of higher education. The National Test Pilot School is accredited by the WASC Senior College and University Commission (WSCUC)
985 Atlantic Avenue, Suite 100, Alameda, CA 94501 510.748.9001

The Master of Science in Flight Test Engineering degree program is accredited by the Engineering Accreditation Commission of ABET, https://www.abet.org, under the General Criteria.

The National Test Pilot School is certified as an Approved Training Organization for Flight Test by the European Union Safety Agency (EASA).

The National Test Pilot School is ISO 9001:2015 certified and is recognized by the Society of Experimental Test Pilots (SETP).

The NTPS catalog is available to any prospective student on the NTPS website at www.ntps.edu under the information tab. As a prospective student, you are encouraged to review this catalog prior to signing an enrollment agreement.

Academic Programs

The National Test Pilot School provides flight test education and training at many different levels ranging from the year-long Professional Course to the Master's Degree Programs to numerous short courses of various lengths.

The year-long Professional Course curriculum for Test Pilots and Flight Test Engineers (fixed or rotary wing) emphasizes development of both technical and managerial skills, producing graduates capable of leading, supporting and managing a wide variety of aircraft flight test programs. NTPS teaches both Mil-Spec acceptance for military aircraft and FAA/EASA civilian aircraft certification.

The Master of Science degree programs are outlined in detail in this catalog. Master's programs' courses are available in an on-campus modality.

A typical course module in the on-campus classroom modality is 5 days long with 6-8 hours of class per day. A written exam is normally taken on the last day of the course.

Short courses are outlined later in this catalog and on the NTPS website. Regardless of the type of course, because NTPS provides a large continuing education program to the worldwide aerospace community, ample opportunity exists for students to interact with practitioners in the field.

Academic Research

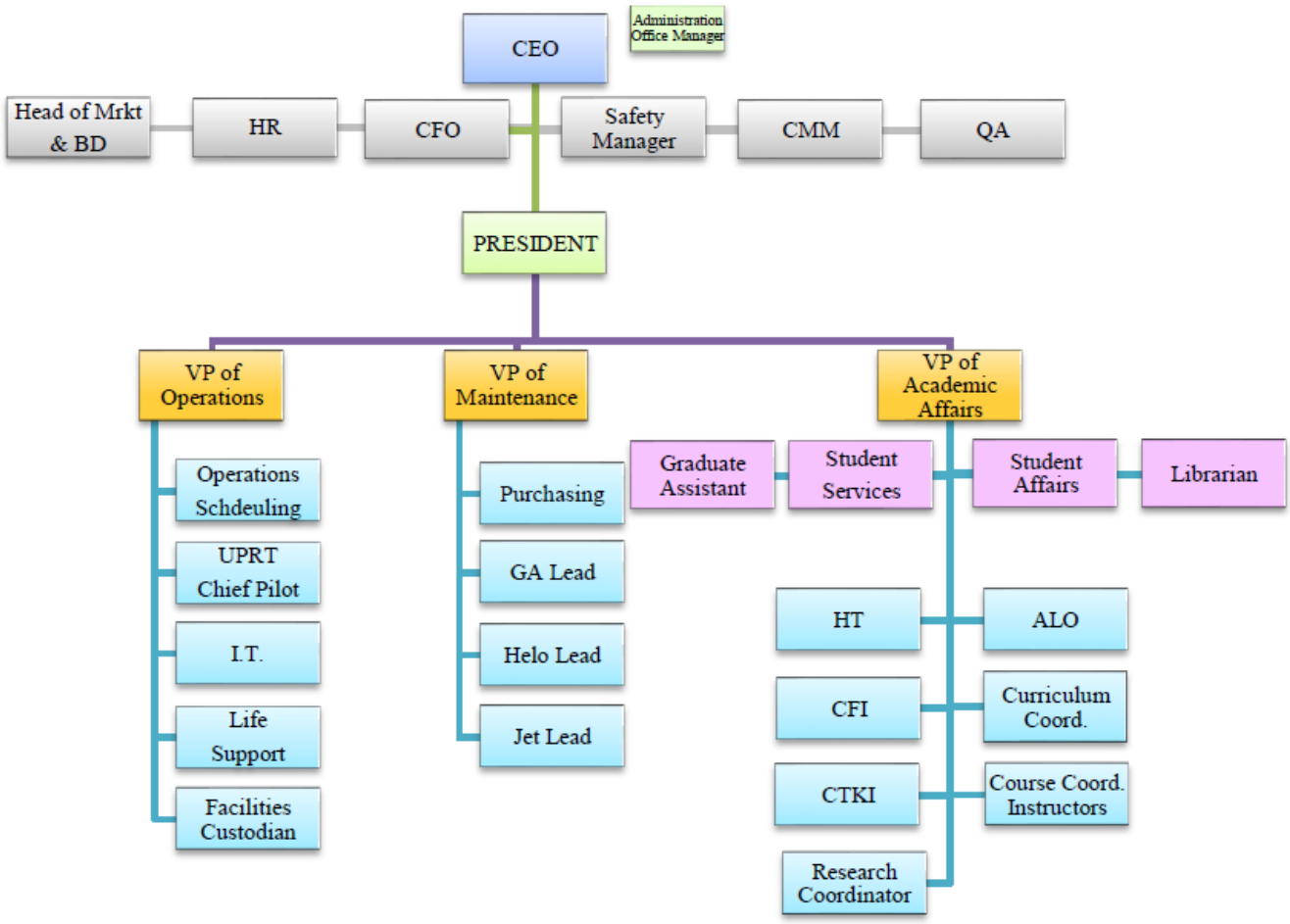
The National Test Pilot School participates in research activities. These activities can be fully funded research projects, cost sharing research projects with partner organizations, or internal research and development.

Catalog Updates

The National Test Pilot School catalog is updated annually (and as required) to reflect changes made in educational programs, education services, procedures or any other relevant changes to information presented in the catalog.

Organizational Structure

NTPS operates with a matrix structure where faculty and staff report to President and CEO, and to VP of Academics for academic related matters (e.g. curriculum). Students should contact the relevant course coordinators for questions relating to specific coursework.



School Calendar

The National Test Pilot School educational and training year consists of two primary semesters or phases: the Performance and Flying Qualities Phase, and the Systems Phase.

The Performance and Flying Qualities Phase begins in June and the Systems Phase begins in January. The Professional Track may be started either in January (the 'A' Class) or June (the 'B' Class) of each year. Professional students start with a week's introduction followed by T&E 4001 Fundamentals of Flight Test, and then they begin the academic modules of the applicable phase.

Students may petition to enroll in an academic course module any time during the calendar year, but it is strongly recommended that they complete T&E 4001 Fundamentals of Flight Test as soon as practical. The National Test Pilot School reserves the right to adjust the course outline, schedule, aircraft, flight hours, and teaching materials as the situation warrants. The accompanying table shows the typical flow of the program of instruction:

TYPICAL SCHOOL CALENDAR

	Week	A Class (start)	B Class
Jan	1	T&E 4001 T	Vacation
	2	T&E 4001 T	Vacation
	3	T&E 4001 T	T&E 4002 T
Systems Phase	4	T&E 4201 T	T&E 4201 T
	5	T&E 4201 P	T&E 4201 P
	6	T&E 4201 P	T&E 4201 P
	7	T&E 4202 T	T&E 4202 T
	8	T&E 4202 P	T&E 4202 P
	9	T&E 4207 T	T&E 4207 T
	10	T&E 4207 P	T&E 4207 P
	11	T&E 4207 P	T&E 4207 P
	12	T&E 4208 T	T&E 4208 T
	13	T&E 4208 P	T&E 4208 P
	14	T&E 4204 T	T&E 4204 T
	15	T&E 4204 P	T&E 4204 P
	16	T&E 4204 P	T&E 4204 P
	17	T&E 4203 T	T&E 4203 T
	18	T&E 4203 P	T&E 4203 P
	19	T&E 4203 P	T&E 4203 P
	20	Field Trip	Field Trip
	21	T&E 4205 T	T&E 4205 T
	22	T&E 4205 P	T&E 4205 P
	23	T&E 4206 T	T&E 4206 T
	24		**B Graduate**

T = theory / P = practical

	Week	A Class	B Class (start)
Jun	25	T&E 4002 T	T&E 4001 T
	26	Vacation	T&E 4001 T
	27	Vacation	T&E 4001 T
Performance and Flying Qualities Phase	28	T&E 4101 T	T&E 4101 T
	29	T&E 4101 P	T&E 4101 P
	30	T&E 4101 P	T&E 4101 P
	31	T&E 4102 T	T&E 4102 T
	32	T&E 4102 P	T&E 4102 P
	33	T&E 4102 P	T&E 4102 P
	34	T&E 4103 T	T&E 4103 T
	35	T&E 4103 P	T&E 4103 P
	36	T&E 4103 P	T&E 4103 P
	37	T&E 4104 T	T&E 4104 T
	38	T&E 4104 P	T&E 4104 P
	39	T&E 4104 P	T&E 4104 P
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	41	T&E 4105 T	T&E 4105 T
	42	T&E 4105 P	T&E 4105 P
	43	T&E 4105 P	T&E 4105 P
	44	T&E 4003 P	T&E 4003 P
	45	T&E 4003 P	T&E 4003 P
	46	T&E 4003 P	T&E 4003 P
	47	T&E 4003 P	T&E 4003 P
	48	T&E 4106 T	T&E 4106 T
	49	T&E 4106 P	T&E 4106 P
	50	**A Graduate**	

Academic Regulations and Procedures

Admission

The unique nature of flight test engineering and evaluation requires specialized knowledge embracing engineering, physical science, technical management, and human factors. Thus, a strong technical background and superior engineering and science skills are important to ensure success in the thorough, demanding, and specialized course of instruction at NTPS.

Each applicant is considered individually, and criteria may include scholastic ability, maturity, demonstrated accomplishment, statement of purpose, and capacity for growth. Enrollment is limited and applications are accepted in order of receipt.

Applicants are expected to possess a bachelor's degree (or equivalent) in an engineering discipline, mathematics, physical sciences, or related subjects. Applicants with an earned bachelor's degree in a discipline that is not a physical science or an engineering discipline will be considered but longer processing times will be required and, if admitted, will be granted provisional status.

Applicants should have earned a minimum overall cumulative grade point average (CGPA) of 2.50 on a 4.00 scale in their bachelor's degree to be considered for admission. A minimum CGPA of 3.00 on a 4.00 scale in the subjects of their discipline from their third year of studies (or equivalent, for transfer students and students with credit from institutions other than the one from which they obtained their bachelor's degree) until graduation is also required. If an applicant has a minimum CGPA between 2.50 and 2.99 on a 4.00 scale in the subjects of their discipline from their third year of studies until graduation and is admitted, they will be granted provisional status. Applicants with a CGPA below 2.50 in the subjects of their discipline from their third year of studies until graduation will not be considered for admission.

Students are encouraged to submit evidence of graduate degrees, certificates, and other relevant qualifications; however, these will not constitute a substitute to the bachelor's degree requirements as stated above.

If an admitted student is granted provisional status, the student will have to complete 12 credits of study without failing any course. **Failure of any course while in provisional status automatically results in dismissal from the program.** Advancement to full graduate student status is automatically gained after satisfactory completion of 12 credits. The 12 credits must be earned by attending core modules, not electives.

Some NTPS courses might have additional prerequisites related to flying and medical requirements.

Due to the technical nature of its courseware, the equipment used for training, and US Department of State restrictions under the International Traffic in Arms Regulations (ITAR), NTPS is unable to accept students who are nationals of the countries listed in the United States Code of Federal Regulations Title 22 restricted countries' list. This list can be accessed via the following link: https://www.ecfr.gov/current/title-22/chapter-I/subchapter-M/part-126/section-126.1.

Non-Discrimination Policy

The National Test Pilot School admits individuals of any sex, race, color, ancestry, religious creed, national origin (some foreign nationals may require US Department of State approval), disability, medical condition, age, marital status, sexual orientation, with access to all the rights, privileges, programs and activities generally accorded or made available to students at the school. NTPS can also accommodate persons with disabilities. Please call the National Test Pilot School office to discuss your particular needs. Students who are engaged in flight activities must be medically qualified by the appropriate authority in their home country or the FAA.

Policy on Sexual Harassment and Student Grievances

The National Test Pilot School has a zero-tolerance policy regarding sexual harassment and/or assault. Any employee or student found guilty of such unacceptable behavior is subject to dismissal. The State of California defines sexual harassment as unwanted sexual advances, or visual, verbal or physical conduct of a sexual nature. This definition

includes many forms of offensive behavior and includes gender-based harassment of a person of the same sex as the harasser.

Any occurrence of sexual harassment should be made known to the NTPS administration, who will:

- Fully inform the complainant of his/her rights and any obligation to secure those rights.
- Conduct a full and effective investigation that is immediate, thorough, objective, and complete. All those with information on the matter will be interviewed.
- Make a determination and communicate the results to the complainant, to the alleged harasser, and all others concerned, as appropriate.
- If the allegations are proven, initiate prompt and effective remedial action against the harasser and communicate this action to the complainant.
- Take steps to prevent further harassment and take appropriate action promptly to remedy the complainant's loss, if any.
- A copy of California pamphlet DFEH-185 is posted on the staff bulletin board. New students/staff are required to familiarize themselves with this policy as part of their incoming indoctrination and to the seriousness of violations of this sexual harassment policy. The above procedures also apply to any student grievance.

NTPS will use the procedures outlined in the Complaint and Grievance Procedures (available upon request) to respond to behavior which goes against the values of NTPS's community as defined in this statement. NTPS considers the procedures for resolving disputes a part of its educational mission and is committed to a process which provides both peer review and mediation. All complaints and grievances will be addressed through a formal statement; persons who have questions about the Statement should contact the Course Coordinator (CC). Resolution and appeal processes are administrative functions and are not subject to the same rules of civil or criminal proceedings. Because some violations of these standards are also violations of law, students may be accountable to both the legal system and NTPS.

Language Proficiency

English is the only language that is used for instruction at NTPS. NTPS expects all incoming students to be proficient in speaking, reading, and understanding the English language.

Students of any professional course and master's focused students whose native language is not English must submit evidence of English language proficiency. Evidence consists of an official test report for the Test of English as a Foreign Language (TOEFL), or equivalent, submitted directly to NTPS. Recommended minimum scores for the TOEFL are 70 for pilots in any of the professional courses and 60 for flight test engineers in any of the professional courses and master's focused students.

NTPS can arrange a tailored language training on demand through a second party service provider. Costs will be provided as requested and will be dependent on the service provider.

Registration

Students who are not attending one of the professional courses are required to register for each course module. Tuition and fee payments are due and payable at the NTPS Business Office prior to the start of instruction.

Student Responsibilities

Students are responsible for being fully aware of and informed about all procedures and regulations pertaining to their participation in the National Test Pilot School's education and training programs. This information can be found in the NTPS catalog, periodic notices published by NTPS, and for Professional Track (flight) students, in the Federal Aviation Regulations, posted Operational Notes, and the NTPS Master Briefing Guide. Lack of awareness of regulations, standards and procedures is not sufficient reason for waiving any applicable rule.

Attendance

Students are expected to attend all class sessions and associated activities unless excused by NTPS.

Academic Advising

The Accreditation Liaison Officer (ALO), or their designated representative, will act as the academic advisor for all students enrolled in the master's degree program. In addition, each course module at NTPS has assigned a Course Coordinator who is responsible for its overall conduct and is available to advise and counsel students regarding course particulars. Students are free to contact on these advisors whenever assistance or discussion is needed.

Transfer and Experiential Learning Credit

Courses completed at other institutions of higher education may be considered for transfer by NTPS. To be considered for transfer credit, a student must submit their transfer credit request no later than 90 calendar days after being admitted to the program. This request will be evaluated by the VP of Academics who will render the decision to the student. Any request for transfer made beyond 90 calendar days and any appeal to the transfer credit decision made by the VP of Academics will be reviewed directly by the president of NTPS and the decision will be final.

Transfer credit is applicable to master's focused students only. Transfer credit should be requested only for subjects taken that are completely or substantially related to the content of the courses of the Master of Science programs at NTPS. Subjects that include partial coursework or a subset of comparable topics are not candidates for transfer credit. The maximum amount of credit hours or units applicable to the Master of Science programs at NTPS will follow the current guidance of the corresponding academic accreditation agencies.

A course that was completed at another institution of higher education may be considered for transfer to any of the Master of Science programs at NTPS provided that:

- The course is classified as a graduate course.
- It was completed while the student was in a graduate or post-baccalaureate classification.
- The courses were completed with a minimum grade of B or equivalent.
- The college or university is accredited by a regional accrediting agency recognized by the United States Department of Education. Currently, the major regional accrediting agencies with such recognition are: the Southern Association of Colleges and Schools Commission on Colleges, the Middle States Commission on Higher Education, the New England Association of Schools and Colleges, the North Central Association of Colleges and Schools, the Northwest Commission on Colleges and Universities, and the Western Association of Schools and Colleges Senior College and University Commission. Exceptions to this requirement are allowed for transfer credit requests from foreign institutions if the department or program where the courses were taken provides adequate documentation demonstrating that the course is relevant to the graduate degree for which the courses were taken, with appropriate content and level of instruction resulting in student competencies comparable to those of the equivalent course at NTPS, and that the course was taught by faculty who are qualified to teach at the master's degree level.

NTPS will examine the course content, level of the course and the institution where the credit was earned. Where credit from other institutions is accepted the following conditions must also be met:

- Official transcripts from institutions where credit was earned are received directly from the institutions.
- The courses were completed with a minimum grade of B or equivalent.

The courses were completed within the five-year period immediately preceding the date the application for admission was received by NTPS..

Schedule of Classes

A schedule of courses is published each calendar year by NTPS. NTPS reserves the right to make necessary and appropriate adjustments to the published schedule to include cancellation or rescheduling of any course module.

Leaves of Absence

Students enrolled in the Master's Program perform their coursework in modules, which can be scheduled according to the student's particular needs. Any Leave of Absence should be requested in writing to the CAO and each will be considered.

The Professional Courses incorporate sequential, consecutive coursework, and any interruption of study presents a serious problem with continuity of instruction. Thus, leaves of absence are not granted, except in extreme circumstances, and on a case-by-case basis.

Academic Integrity

The National Test Pilot School has a strong commitment to maintaining and upholding intellectual integrity. The National Test Pilot School operates under an honor system, which states that no employee or student will lie, cheat, or steal nor tolerate those who do during the conduct of school activities. NTPS considers activities such as plagiarism, unauthorized procurement of exams, trading or otherwise dealing with exams or exam questions and/or answers and written reports to be a serious breach of ethical conduct and its honor system. A student is subject to expulsion for any unethical conduct or willful conduct contrary to the code of behavior established at NTPS and the general welfare of the student body.

A charge of unethical conduct is an extremely serious matter and shall be detailed in writing to the President NTPS and shall be signed by the person(s) making the charge. If the CAO deems that there is sufficient evidence to warrant an investigation of any charge formally presented in accordance with the above, he will then notify the President. The President shall appoint an Investigating Board consisting of five members, comprised of three faculty members, one student, and the President who shall coordinate the investigation and act as Chairman of the Investigating Board.

The accused student shall be furnished with a copy of the charge and shall be given ample opportunity to refute the charge either in person or by counsel before the Board of Investigation at a hearing called by the Board.

All members of the Board shall be present at any hearing pertaining to unethical conduct and a unanimous vote of the Board shall be required for expulsion. In the absence of a unanimous vote of the Investigating Board, the charge shall be dismissed.

Academic Freedom

NTPS actively promotes a policy of academic freedom. Instructors are encouraged to present a variety of perspectives on their subjects while adhering to the curriculum, particularly from the vantage point of their individual experience, education, and reflection, whatever that may be, insofar as they believe it to promote understanding of the subject.

To encourage wide ranging viewpoints, it is NTPS general policy to assign instructors to teach a range of subtopics within their general area of expertise on a rotational basis so that a varied approach to any given subject area is assured.

Students are encouraged to question, challenge, and respond. Faculty and students are free to examine all pertinent data, question ideas and concepts, and to be guided by evidence.

Grading Standards

Course modules include several separate graded activities, as described in the NTPS Curriculum and Syllabus, and typically include written examinations, data flights, oral presentations/group projects, and written reports.

All activities are graded on a numerical or Pass/Fail basis. Group projects/presentations generally result in a group score. However, if a student's performance is below standard, or if the student fails to contribute based on the guidelines provided for that course, the student may receive an individual grade lower than the group score or be asked to repeat the exercise on an individual basis. All activities within a module must be completed with a passing grade in order for that module to be considered successfully completed.

Typically, each event within a module is weighted equally (e.g., 25% each, for a module having four events); however, not all assignments are of equal scope, and different weighting factors may be assigned to specific assignments that are used in calculating a student's final grade. The syllabus of each module (Appendix A) indicates the weighting of each event and Course Coordinators may change the weighting if required. Any change to these weightings should be approved by the VP of Academics.

Demonstration flights are normally ungraded. However, a student may fail a demonstration flight by being unprepared for the training flight, by committing a safety violation, or not assimilating the training sufficiently to participate in the data flight. In these circumstances the instructor shall complete a Flying Grade Sheet and note the specific failure. After a demonstration flight failure, the Head of Training or Course Coordinator shall investigate the root cause and develop a remedial training package, if necessary. A repeat of the demonstration flight is at the discretion of the Head of Training or Course Coordinator.

Long Course

The following guidelines shall be used regarding probation and suspension of long course students:

- A long course student who fails to attain a passing grade for any graded activity will receive a verbal warning from the Course Coordinator or HT.
- A failed activity within a module may be repeated one time. Upon successful completion of the reexamination, the associated grade will be recorded as a 70, regardless of the score achieved on the reexamination.
- A second failure of the same graded activity will result in failure of the module and may result in suspension from the program, upon recommendation by the Course Coordinator or Head of Training and at the discretion of the NTPS President and NTPS CEO.
- Students having multiple failures in the same module, or demonstrating a pattern of unsatisfactory performance, or whose cumulative GPA is less than 2.50 after having taken three graded modules, shall be placed on probation by the Head of Training. Probation will proceed as follows:
- Notification of probation shall be made in writing:
- The notification of probation shall include required remedial training, reexamination, and criteria for removal from probation.
- Probation may also result in a student being precluded from participating in other non-mandatory activities, such as class trips or attendance in professional symposia.
- Failure of two or more different activities in the same module may result in failure of the module and may result in suspension from the program, upon recommendation by the Course Coordinator or VP of Academics and at the discretion of the NTPS President and NTPS CEO.
- A demonstrated pattern of unsatisfactory performance in multiple modules may result in probation and may result in suspension from the program, upon recommendation by the VP of Academics and at the discretion of the NTPS President and NTPS CEO. For example, failure of a similar activity (such as the written exam) in three of five modules constitutes a pattern of unsatisfactory performance.
- For those students placed on probation and suspension, the President will notify the sponsoring organization, as appropriate, of the failure and possible remedies.

Master of Science

The following guidelines shall be used regarding probation and suspension of Master of Science students who are not concurrently pursuing any of our professional courses, who are referred to as master's focused students:

- A master's focused student who fails to attain a passing grade for any graded activity will receive a verbal warning from the Course Coordinator or VP of Academics.
    - A failed activity within a module may be repeated one time. Upon successful completion of the re-examination, the associated grade will be recorded as a 70, regardless of the score achieved on the re-examination.
    - A second failure of the same graded activity will result in failure of the module.
    - A student that fails or withdraws from a course may retake the course one time at a later date. The transcript will reflect the failure/withdrawal, which will be factored into the grade point average.
- Students demonstrating a pattern of unsatisfactory performance (e.g., failure of a module or first failure of a written exam in multiple modules), or whose cumulative GPA is less than 2.50 after having taken three graded modules, shall be placed on academic probation by the VP of Academics. Academic probation will proceed as follows:
    - Notification of probation shall be made in writing:
    - The notification of probation shall include required remedial training, reexamination, and criteria for removal from probation.
- A student not maintaining these standards will be placed on probation for the next three consecutive modules. Notice of probation shall be made in writing. If, at the end of the next three modules taken after the written notice, the student has not achieved the minimum requirements, the student will be dismissed from the program. The conditions and terms of probation and dismissal will be documented and maintained in the student file.
- A demonstrated pattern of unsatisfactory performance in consecutive modules will result in probation and may result in suspension from the program, upon recommendation by the VP of Academics and at the discretion of the NTPS President and NTPS CEO. For example, failure of a similar activity (such as the written exam) in three of five consecutive modules constitutes a pattern of unsatisfactory performance.

NTPS Grading System

A passing grade in the NTPS Grading System is 70. The following is a descriptive guide to the NTPS grading system:

NTPS Grading System			
Letter Grade	**Numerical Equivalent**	**Grade Point Value**	**Meaning**
A	90 - 100	4.0	Accomplished
B	80 - 89	3.0	Competent
C	70 - 79	2.0	Satisfactory
U	<70	0.0	Unsatisfactory
I			Authorized Incomplete
IP			In Progress
P			Pass
W			Withdrawal from a course
WF			Withdrawal from a course - Failing
NC			No Credit
AU			Audit
T			Transfer Credit

Weighting for Class Standing (Long Course)

For determining class standing a single grade will be calculated for each student. The grade will be an average of each module grade plus the Capstone Project grade (T&E 4003), for which the grade will be weighed double.

Withdrawing from a Course

Students receive a grade of W if they withdraw from a course before the close of business on Wednesday of the week in which the course module is presented. Withdrawal after the 3rd day of academics within a module will result in a WF grade.

Incomplete Grades

Incomplete grades are temporary grades assigned when extenuating circumstances prevent a student from completing a course. If a student does not complete the course within the mutually agreed time period with the course advisor, the grade of I automatically converts to WF.

Graduation Requirements

Students will graduate with the degree of Master of Science after completing the curriculum requirements in effect at the time of their first enrollment as published in the NTPS catalog or, at their option, current published requirements. Completion of the entire prescribed curriculum is mandatory, including completion of all course work, and where

applicable, flight and project assignments, reports, and final capstone (or unknown aircraft) project report. An average grade point average of 2.0 or above is required for graduation. Students will not be awarded a degree until all debts and obligations owed NTPS have been satisfied and the student is in good standing in accordance with NTPS policies and regulations.

Degree Completion Time Limit

All requirements for a master's degree must be completed within five years from the date of initial enrollment unless an extension has been obtained.

Student Records

In carrying out its assigned responsibilities, the National Test Pilot School collects and maintains information about students. Although these records belong to the School, both School policy and federal law accord students a number of rights concerning these records. The NTPS policy is designed to inform students where records about students may be kept and maintained, what kinds of information are in those records, the conditions under which students or anyone else may have access to information in those records, and what action to take if students believe that the information in their record is inaccurate or that their rights have been compromised. The National Test Pilot School respects the rights and privacy of students in accordance with the Family Rights and Privacy Act (FERPA). Upon graduation, students are provided with a transcript of their academic records. Transcripts are kept indefinitely, and additional transcripts may be requested from the NTPS Admissions Office.

Student Services

Course and Supporting Materials

Full-time students are provided with all NTPS training notes and course material electronically. External course textbooks may be required to be purchased by the student.

Visa and Immigration Services

For students attending from countries other than the United States, the student or sponsoring agency is responsible for complying with any legislation or regulations of the United States or any other country governing entry into the United States.

NTPS can provide assistance in obtaining a student visa to the United States and will vouch for the student status. All charges associated with the visa process will be the responsibility of the student.

Student Housing

The National Test Pilot School (NTPS) does not provide student housing as it is located on an active airport. Thus, no NTPS on campus housing is available and NTPS has no dormitory facilities under its control. The near-by towns of Mojave, Tehachapi, Rosamond, California City, Lancaster and Palmdale all offer a full range of housing opportunities and amenities for students who wish to avail themselves of them. Students who need assistance in finding local housing can contact NTPS student services for general assistance with housing questions.

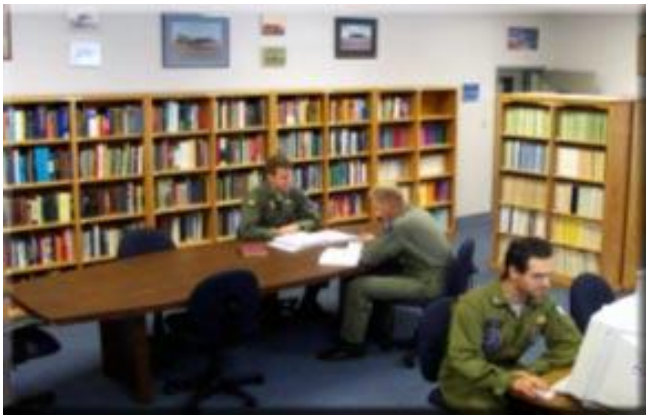
Facilities and Equipment

Producing world-class Flight Test graduates requires world-class facilities. All class sessions are held at the NTPS campus located in building #72 at 1030 Flight Line, Mojave, CA at the Mojave Air and Space Port, a Southern California airport established to accommodate the specialized needs of flight test activities. Mojave has unique facilities, airspace and climate.

The center of NTPS' training complex is a modern 18,000 square-foot classroom and laboratory building, which adjoins a 24,000 square-foot hangar. Six additional hangars are utilized for aircraft maintenance and storage. The building contains five classrooms, accommodating up to 100 students, a night vision technology lab, a high-tech data telemetry station, a data reduction lab, a library, and a life support equipment lab. There are two student/faculty lounges, a racquetball court, showers and locker rooms. The school has a secured Wi-Fi coverage to allow students access to the school intranet and the internet.

Library Resources

The NTPS library contains all of the resources that are required to successfully complete the NTPS courses to include a significant collection of reference textbooks, aircraft manuals, flight test reports, and other flight test and aviation related materials. The library is managed by a library administrative technician who is available to assist students during regular business hours. The library technician can also connect the students to the numerous Kern County and Los Angeles County libraries in the local area; the NASA/FAA Flight Test Safety Database; the Society of Experimental Test Plots Flight Test Database; and numerous other on-line resources. All students have ready access to the internet while at the school through the NTPS wireless internet access. NTPS' diverse student population comes from many locations around the globe and many students will come and go between learning sessions in residence at NTPS. Students with a research focused capstone project are likely to do much of their research from their home or work locations. To accommodate the research needs of this culturally and geographically diverse group, NTPS focuses on providing state of the art online resources, access and training on how to use them. Students can contact the school or the library if they need off-site assistance.



Aircraft Resources

NTPS operates a diverse fleet of over 40 training aircraft and instrumented flying laboratories. These aircraft are representative of worldwide aviation and were specifically selected to demonstrate a broad range of flying qualities and performance capabilities. Several models are unique in terms of their utility as fight test teaching aids, and some aircraft of foreign manufacture feature design philosophies not commonly found in US-designed aircraft. Additionally, a number of NTPS aircraft have been modified and instrumented to duplicate and demonstrate unusual and abnormal flying qualities that the students may encounter during actual flight test.

Aermacchi MB-326 Impala (5). Single engine jet trainer, Instrumented for Performance and Flying Qualities (1 AC), Spin test training, Upset training, Loads and flutter TM system (1 AC).

Bell OH-58C (2), Single engine turbine helicopter, Night vision goggle compatible, Instrumented for Performance and Flying Qualities.

Aero L-39 (2), Single engine jet trainer.

Bell UH-1N Huey, Twin engine turbine helicopter, Night vision goggle compatible, Instrumented for Performance and Flying Qualities, LORAS / FLIR, SAS & Auto Pilot.

Beechcraft BE-76 Duchess, One engine inoperative (OEI) flight testing, Night vision goggle compatible.

Cessna 182 Skylane, Flight test techniques training, Garmin 1000 cockpit.

Cirrus SR22 (3), Single engine, piston propeller, Sidestick controls for pitch and roll, Emergency Airframe Parachute System, Dual Garmin 430 navigation systems (1 AC), Large multifunction display (Avidyne FlightMax) (1 AC) Garmin 1000 Avionics (2 AC).

Airbus Helicopters EC-145, Twin engine light utility helicopter used for RW P&FQ and Systems testing.

Gippsland GA-8 Airvan, Single engine recip, Night vision goggle compatible, FLIR and Weather RADAR equipped.

King Air C90 (2), Twin engine turboprop transport aircraft.

MBB BO-105M (2), Light weight, twin-engine, multipurpose helicopter, Instrumented for Performance and Flying Qualities.

Northrop T-38A (1), Supersonic jet trainer.

Saberliner NA-265 (2), Instrumented for Performance and Flying Qualities (1 AC), Business jet, 2 crew and up to 7 passengers.

Swearingen SA-226 Merlin II, Instrumented for Performance and Flying Qualities, Twin turboprop commuter aircraft.

Laboratories, Systems and Training Aids

Because NTPS provides a high quality-testing environment, various aircraft systems such as radar, electronic displays, FLIR and threat and warning systems are frequently provided to NTPS by their manufacturers for student evaluation and training. Access to resources can be requested by the student.

NTPS provides its students with access to the latest in equipment needed to train them for the high-tech world of modern Flight Test. Here are some brief highlights of this equipment:

Simulators: NTPS owns a number of flight and systems simulators that allow students to explore various conditions and environments that would otherwise be too expensive or dangerous to experience in a real aircraft. Included is a Variable Stability Simulator which can mimic the real-world characteristics of an experimental aircraft. NTPS also has contractual arrangements for students to visit other organizations flight simulator centers for additional training and experience.

Camber Radar: NTPS has contracted with Camber Corp to provide a RADAR simulation program. The RADAR Simulation is a complex, real-world energy level model of the interaction of the emitted radio transmission and the simulated environment. The component based design provides ease of use and allows a user familiar with RADAR systems to quickly prototype complex RADAR systems and modes which include ground, weather, aircraft, ships and ground vehicle returns. Camber Corp is recognized worldwide as an industry leader in sensor simulation.

Telemetry: Much of the data acquisition during flight test is recorded remotely via telemetry. In order to provide a real-life flight test environment for our students, NTPS has assembled a telemetry ground station using state-of-the art equipment. Additionally, a telemetry van can be specially fitted to conduct ground support operations of various student flight test projects.

Forward Looking Infrared: FLIR is used both in the military and civilian operations, and the technology is always changing and improving. Our FLIR courses train tomorrow's flight test personnel to test this growing technology.

NVG Lab: The ability to see in the dark is the focus of much cutting-edge aviation developments, and our Night Vision Goggles lab allows the students a sampling of how such systems operate, their limitations, and what they can expect when flight testing such systems in harsh environments. Experiences learned in the lab are then applied in our NVG-equipped rotary and fixed-wing aircraft.

Ejection Seat training module and Life Support Equipment lab: NTPS stresses safety first and foremost, utilizing a number of training aids to acquaint the students with the use of life support equipment and aircraft emergency egress systems.

Cessna 150 Optionally/Remotely Piloted Aircraft: NTPS operates an optionally piloted aircraft for training students on theory and flight test techniques applied to unmanned aircraft.

Optionally/Remotely Piloted Aircraft Ground Control Station: The Cessna 150 OPA is controlled from a ground control station situated in the NTPS building and allows the aircraft to be flown in remotely piloted and autonomous modes.

Programs and Curricula

Master's Degree Programs

The National Test Pilot School (NTPS) offers Master of Science degrees in Flight Test Engineering (MS FTE) and Flight Test and Evaluation (MS FT&E). The curricula of the two programs are identical, only the prerequisites differ.

Master's Degree in Flight Test Engineering (MS FTE)

Students who have a bachelor's degree in engineering from an ABET or equivalent university program (e.g. Washington Accord) are eligible to enter the master's degree in Flight Test Engineering program.

Master's Degree in Flight Test and Evaluation (MS FT&E)

Students with a bachelor's degree in physical sciences, computer science, or mathematics are eligible to enter the master's degree in Flight and Evaluation program. Eligibility to the MS FT&E program for students presenting other bachelor's degree credentials will be evaluated on a case-by-case basis.

Program Educational Objectives

Within a few years of graduation, NTPS Master of Science in Flight Test Engineering alumni can be expected to:

- Demonstrate increasingly highly specialized communications skills required to execute safety critical tests in flight and in the control room.
- Successfully integrate the roles of a Flight Test Engineer throughout the aircraft/system design, development and testing process.
- Validate the airworthiness and mission capability of an air vehicle and/or system.
- Attain positions with increasing responsibilities in managing developmental flight test projects.
- Advance the flight test and evaluation discipline through reports, professional papers, journal articles, and/or symposia presentations.

Student Outcomes

Students graduating with the Master of Science in Flight Test Engineering degree from NTPS are expected to attain:

- Mastery in the analysis of complex engineering problems and subdivision into less complex tasks.
- Mastery of effective communications in a high workload, technically complex, interdisciplinary environment, while maintaining sound and supportive working relations with clients, partners, and leaders.
- Mastery of team leadership where all members create a collaborative and inclusive environment, determine goals, plan tasks, and achieve objectives subject to limited resources and stringent deadlines while ensuring safe practices.
- An ability to develop new experimentation approaches, determination of alternate paths, and employment of a wide variety of tools to analyze and interpret data, while applying engineering judgment to reach conclusions that uphold and improve safety within the flight test community and the broader aerospace industry.
- Mastery of the evaluation of engineering test data and outcomes, their comparison to learned theory and concepts, and reporting of well-evidenced findings in a logical, accurate, and concise manner.
- Mastery of trend recognition in the performance and behavior of an engineering system, to include interdependencies of subsystems and sound recommendations about its use based on engineering methodology.
- Mastery of engineering design to define iterative processes to produce recommendations to meet an evolving set of requirements with consideration of safety, as well as environmental, and economic factors.
- Mastery of the identification and characterization of risks associated with engineering test activities and proper management of them in a real-world context.
- Mastery of discernment and adaptation of new knowledge as needed, using appropriate learning strategies and evaluation methods.

Credit System

NTPS operates on a Quarter credit system wherein a minimum of 10 hours of instructor led classroom or in-flight instruction equals one quarter credit and 30 hours of practical exercises, including labs, preparation, data analysis, report writing and presentation where students work on their own equals 1 quarter credit hour.

Core Courses

Compulsory core modules include Fundamentals of Flight Test (T&E 4001), Test Management (T&E 4002), and the Capstone Project (T&E 4003). The Capstone Project is the culmination of the master's degree. This project serves as comprehensive project that covers much of the material taught during the entire course. Students have the option of arranging for use of NTPS assets or submitting a report based on a work-related project with the approval of their academic advisor and their employer. In either case the project must represent original work. The student will design a plan of action, execute that plan, collect and analyze data, and produce final reports, both oral and written. In order to graduate, students must take a core curriculum and select one of three specialty tracks (Fixed Wing Performance & Flying Qualities, Rotary Wing Performance & Flying Qualities or Systems). On-campus course academic modules are nominally 6-8 hours per day for one week (5 days) at the NTPS campus. Distance learning academic modules are nominally 5 weeks long in the remote learning environment.

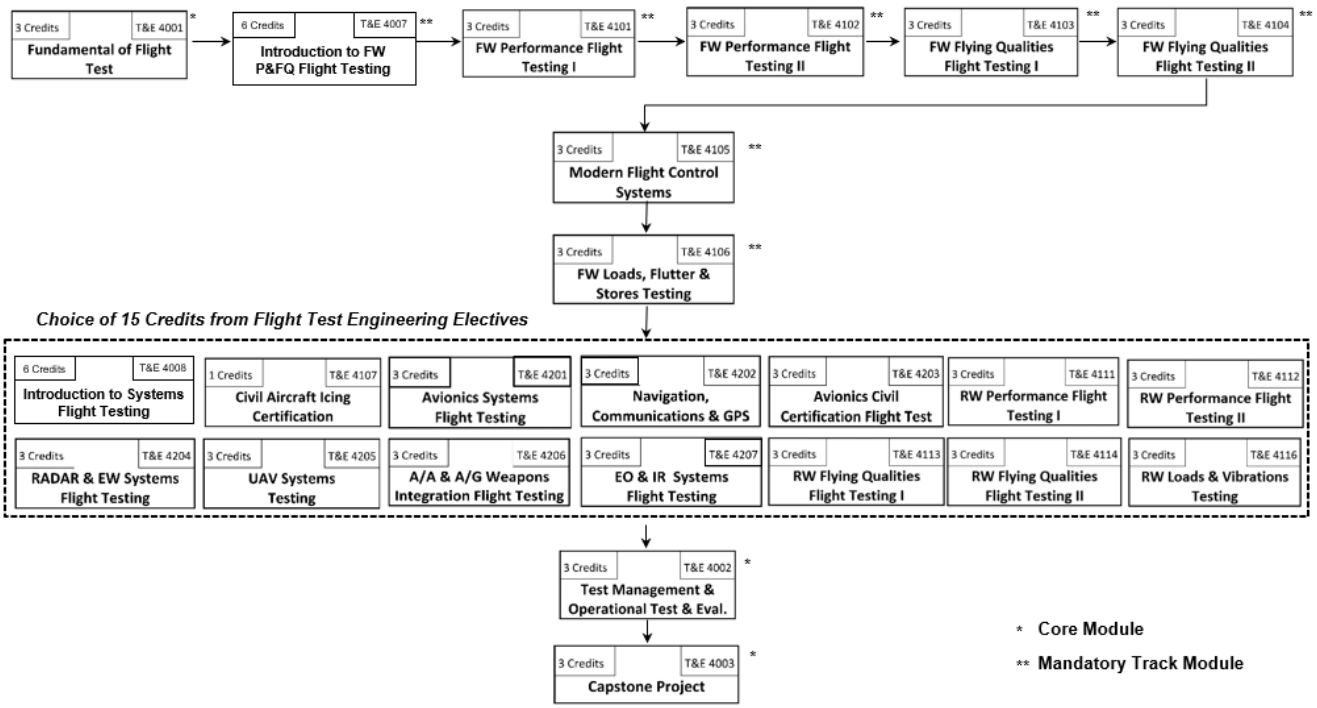
Master's Degree Track: Fixed Wing Performance and Flying Qualities

Students enrolled in the Fixed Wing Performance and Flying Qualities (FW P&FQ) track must take all three core modules; the FW P&FQ sequence T&E 4007, 4101, 4102, 4103, 4104, 4105, 4106; and 15 Flight Test Engineering elective credits. Track description is shown in the Master's Degree Track Fixed Track Wing Performance and Flying Qualities table.

Master's Degree Track: Fixed Wing Performance and Flying Qualities	***Quarter Credits***	
	Academics	*Practical*
Core Modules		
T&E 4001 – Fundamentals of Flight Test	3	
T&E 4002 – Test Management and Operational Test and Evaluation	3	
T&E 4003– Capstone Project		3
Total Core Credits (9 Required)		***9***
Fixed Performance and Flying Qualities Modules		
T&E 4007– Introduction to FW P&FQ Flight Testing	3	3
T&E 4101 – FW Performance Flight Testing I	3	
T&E 4102 – FW Performance Flight testing II	3	
T&E 4103 – FW Flying Qualities Flight Testing I	3	
T&E 4104 – FW Flying Qualities Flight Testing II	3	
T&E 4105 – Modern Flight Control Systems	3	
T&E 4106 – FW Loads, Flutter & Stores Testing	3	
Total P&FQ Credits (24 Required)		***24***
FTE Electives		
T&E 4008 – Introduction to Systems Testing	3	3
T&E 4201 – Avionics Systems Flight Testing	3	
T&E 4202 – Navigation, Communications, and GNSS Flight Testing	3	
T&E 4203 – 14 CFR Part 23/25/27/29 Avionics Certification Flight Testing	3	
T&E 4204 – Flight Test of RADAR and Electronic Warfare Systems	3	
T&E 4205 – UAV Systems Test	3	
T&E 4206 – Air-to-Air and Air-to-Ground Weapons Integration	3	
T&E 4207 – Electro-Optics and Infrared Systems Flight Testing	3	
T&E 4208 – NVG & HMD Testing	3	
T&E 4107 – Civil Aircraft Icing Certification	1	
T&E 4111 – RW Performance Flight Testing I	3	
T&E 4112 – RW Performance Flight testing II	3	
T&E 4113 – RW Flying Qualities Flight Testing I	3	
T&E 4114 – RW Flying Qualities Flight Testing II	3	
T&E 4116 – RW Loads and Vibrations	3	
Total Elective Credits (15 Required)		***15***
Minimum Total Credits Required to Graduate		**48**

Master's of Science Degree

FW Performance & Flying Qualities Track



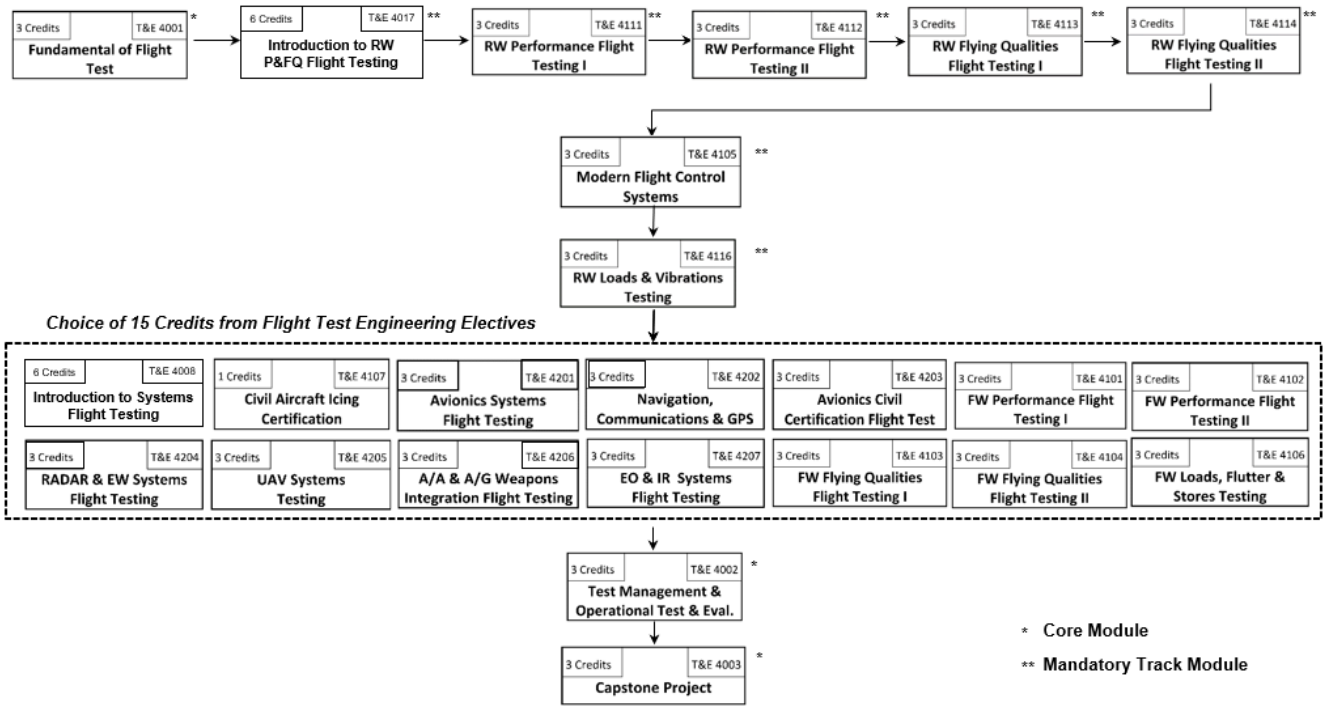
Master's Degree Track: Rotary Wing Performance and Flying Qualities

Students enrolled in the Rotary Wing Performance and Flying Qualities (RW P&FQ) track must take all three core modules; the RW P&FQ sequence T&E 4017, 4111, 4112, 4113, 4114, 4105, 4116; and 15 Flight Test Engineering elective credits. Track description is shown in the Master's Degree Track Rotary Wing Performance and Flying Qualities table.

Master's Degree Track: Rotary Wing Performance and Flying Qualities	***Quarter Credits***		
	Academics	*Practical*	
Core Modules			
T&E 4001 – Fundamentals of Flight Test	3		
T&E 4002 – Test Management and Operational Test and Evaluation	3		
T&E 4003– Capstone Project		3	
Total Core Credits (9 Required)			***9***
Rotary Performance and Flying Qualities Modules			
T&E 4017– Introduction to RW P&FQ Flight Testing	3	3	
T&E 4111 – RW Performance Flight Testing I	3		
T&E 4112 – RW Performance Flight testing II	3		
T&E 4113 – RW Flying Qualities Flight Testing I	3		
T&E 4114 – RW Flying Qualities Flight Testing II	3		
T&E 4105 – Modern Flight Control Systems	3		
T&E 4116 – RW Loads and Vibrations	3		
Total P&FQ Credits (24 Required)			***24***
FTE Electives			
T&E 4008 – Introduction to Systems Testing	3	3	
T&E 4201 – Avionics Systems Flight Testing	3		
T&E 4202 – Navigation, Communications, and GNSS Flight Testing	3		
T&E 4203 – 14 CFR Part 23/25/27/29 Avionics Certification Flight Testing	3		
T&E 4204 – Flight Test of RADAR and Electronic Warfare Systems	3		
T&E 4205 – UAV Systems Test	3		
T&E 4206 – Air-to-Air and Air-to-Ground Weapons Integration	3		
T&E 4207 – Electro-Optics and Infrared Systems Flight Testing	3		
T&E 4208 – NVG & HMD Testing	3		
T&E 4107 – Civil Aircraft Icing Certification	1		
T&E 4101 – FW Performance Flight Testing I	3		
T&E 4102 – FW Performance Flight Testing II	3		
T&E 4103 – FW Flying Qualities Flight Testing I	3		
T&E 4104 – FW Flying Qualities Flight Testing II	3		
T&E 4106 – FW Loads, Flutter & Stores Testing	3		
Total Elective Credits (15 Required)			***15***
Minimum Total Credits Required to Graduate			**48**

Master's of Science Degree

RW Performance & Flying Qualities Track



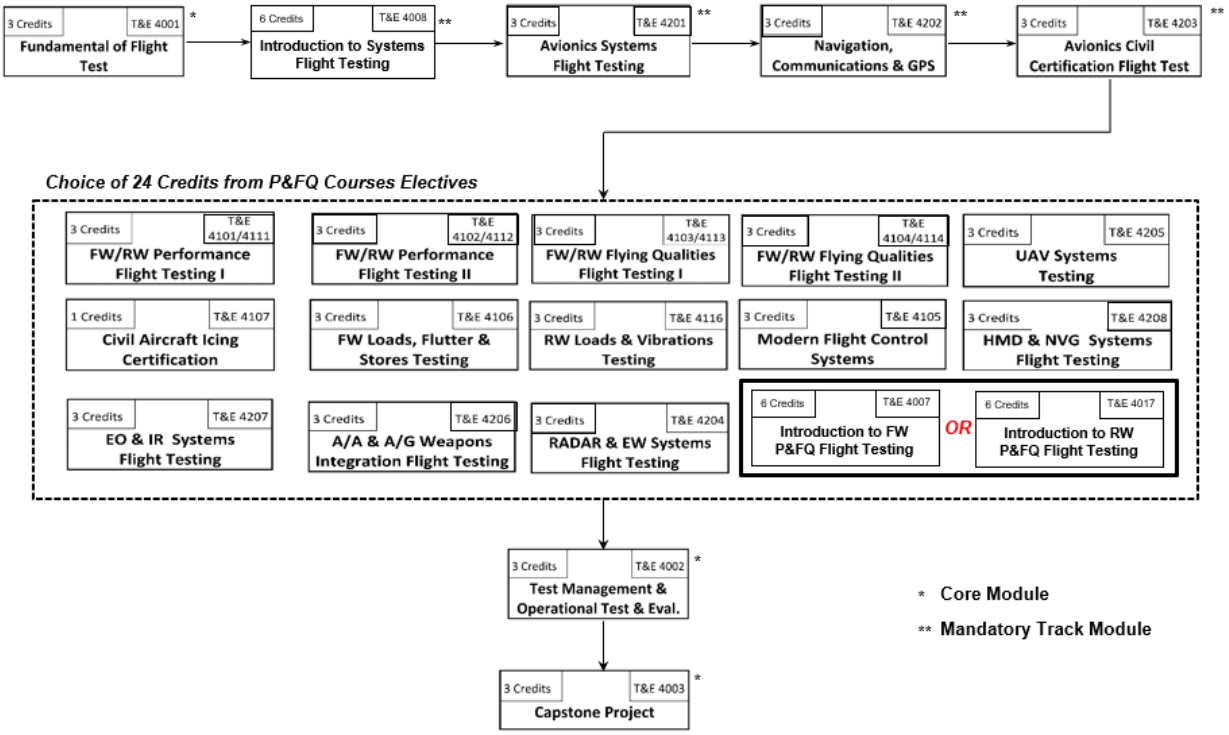
Master's Degree Track Systems

Students enrolled in the Systems track must take all three core modules; the Systems sequence T&E 4008, 4201, 4202, 4203; and 24 Flight Test Engineering elective credits. Track description is shown in the Master's Degree Track Systems table.

Master's Degree Track Systems	***Quarter Credits***	
	Academics	*Practical*
Core Modules		
T&E 4001 – Fundamentals of Flight Test	3	
T&E 4002 – Test Management and Operational Test and Evaluation	3	
T&E 4003– Capstone Project		3
Total Core Credits (9 Required)		***9***
Systems Modules		
T&E 4008 – Introduction to Systems Testing	3	3
T&E 4201 – Avionics Systems Flight Testing	3	
T&E 4202 – Navigation, Communications, and GNSS Flight Testing	3	
T&E 4203 – 14 CFR Part 23/25/27/29 Avionics Certification Flight Testing	3	
Total Systems Credits (15 Required)		***15***
FTE Electives		
T&E 4007 or 4017 – Introduction to P&FQ Flight Testing (FW or RW)	3	3
T&E 4101 or 4111 –Performance Flight Testing I (FW or RW)	3	
T&E 4102 or 4112 –Performance Flight testing II (FW or RW)	3	
T&E 4103 or 4113 –Flying Qualities Flight Testing I (FW or RW)	3	
T&E 4104 or 4114 – Flying Qualities Flight Testing II (FW or RW)	3	
T&E 4105 – Modern Flight Controls	3	
T&E 4106 – FW Loads, Flutter & Stores Testing	3	
T&E 4116 – RW Loads, Vibration and Stores Testing	3	
T&E 4204 – Flight Test of RADAR and Electronic Warfare Systems	3	
T&E 4205 – UAV Systems Test	3	
T&E 4206 – Air-to-Air and Air-to-Ground Weapons Integration	3	
T&E 4207 – Electro-Optics and Infrared Systems Flight Testing	3	
T&E 4208 – NVG & HMD Testing	3	
T&E 4107 – Civil Aircraft Icing Certification	1	
Total Elective Credits (24 Required)		***24***
Minimum Total Credits Required to Graduate		**48**

Master's of Science Degree

Systems Track



Professional Courses

Test Pilot / Flight Test Engineer Professional Course

The Professional Course is the ultimate in-flight test education. Graduates of this 50 week course are prepared to perform envelope expansion, civil certification, and military suitability flights meeting FAR/EASA/Military certification or military specifications. This course is designed to equip experienced pilots and engineers with the knowledge and practical experience to certify new or modified aircraft to stringent FAR/EASA/Military certification standards or to recommend the aircraft for specific military missions. This is not a basic flight training course. It is an intense academic curriculum designed to produce world class test pilots and flight test engineers.

The course is structured in two phases: The Systems Phase begins in January and the Performance and Flying Qualities Phase begins in July. Students may join the course either in January ('A' Class) or June ('B' Class). All students start with a three-week module of general topics and then join the applicable phase. At the end of their first phase there will be a field trip to representative flight test centers and aircraft and avionics manufacturers. The capstone project is a limited evaluation of an aircraft unfamiliar to the student. Course subjects are taught in modular form, generally one week of theory followed by two weeks of practical laboratory exercises flight demonstrations, test planning, data collection and analysis, and reporting.

Required Modules

T&E 4001 Fundamentals of Flight Test
T&E 4002 Test Management
T&E 4003 Capstone Project

T&E 4101 or 4111 Performance Flight Testing I
T&E 4102 or 4112 Performance Flight Testing II
T&E 4103 or 4113 Flying Qualities Flight Testing I
T&E 4104 or 4114 Flying Qualities Flight Testing II
T&E 4105or 4115 Modern Flight Control Systems
T&E 4106 or 4116 Loads, Flutter/Vibration
T&E 4107 Civil Aircraft Icing Certification Testing

T&E 4201 Avionics Systems Flight Testing
T&E 4202 Communication, Navigation and GNSS Flight Testing
T&E 4203 14 CFR Part 23/25/27/29 Avionics Certification Flight Testing
T&E 4204 RADAR and EW Systems Testing
T&E 4205 UAV Systems Test
T&E 4206 Weapons Integration Testing
T&E 4207 Electro-Optic and Infrared Systems Testing
T&E 4208 HMD & NVG Testing

Pre-requisites

Pilots: A minimum of 750 hours of pilot-in-command time and a bachelor's degree in math, science, or engineering (or equivalent military academy) plus medically qualified to perform flight duties.

Engineers: A bachelor's degree in math, science, or engineering (or equivalent military academy) plus medically qualified to perform flight duties.

All Students: English language proficiency. Non-native English speakers must pass a Test of English as a Foreign Language (TOEFL) with a minimum score of 70 for pilots and 60 for FTEs.

Pre-Course study: All students must study and understand the content of NTPS handbooks Volume I (Math and Physics for Flight Testers) and Volume II (Aerodynamics for Flight Testers); both volumes are available for download at the NTPS website: *https://www.ntps.edu/tps-preparation/*.

Master's Degree

Students who complete the Test Pilot / Flight Test Engineer Professional Course will have completed all the required modules for the master's degree program and will graduate with one of the two master's degrees in the Fixed Wing Professional or Rotary Wing Professional Track, depending on their undergraduate qualifications.

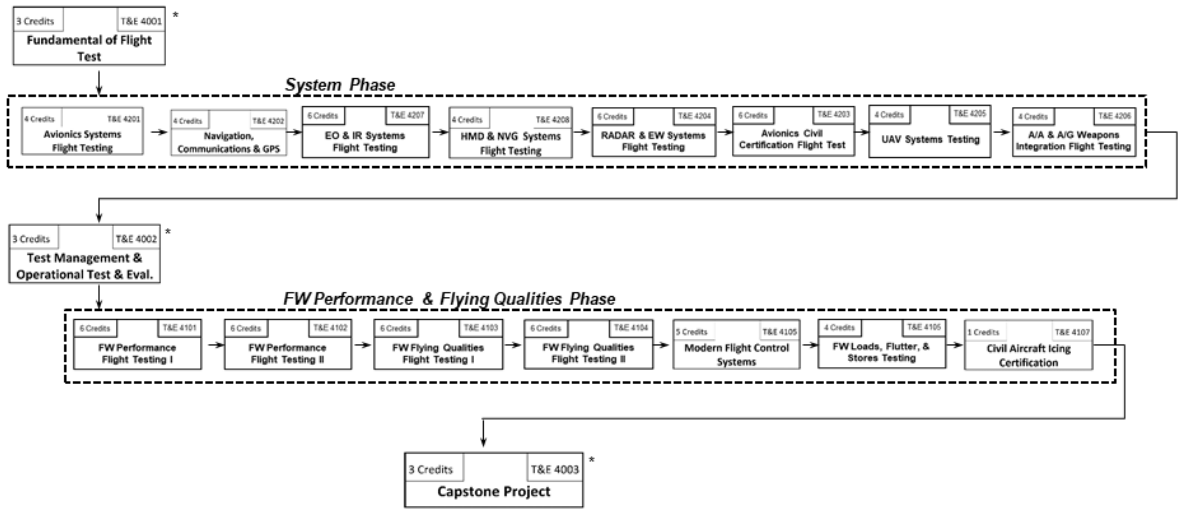
Fixed Wing Professional Course Track

Students enrolled in the Fixed Wing Professional Course track take all three core modules, 34 Credits of P&FQ Flight Testing, and 38 credits of Systems Flight Testing. The modules consist of both theory and practical credits. Track description is shown in the Fixed Wing Professional Course Track table. This track exceeds the master's graduation requirements.

Fixed Wing Professional Course Track	***Quarter Credits***		
	Theory	*Practical*	
Core Modules			
T&E 4001 – Fundamentals of Flight Test	3		
T&E 4002 – Test Management and Operational Test and Evaluation	3		
T&E 4003– Capstone Project		3	
Total Core Credits (9 Required)			***9***
Performance and Flying Qualities Modules			
T&E 4101 – FW Performance Flight Testing I	3	3	
T&E 4102 – FW Performance Flight testing II	3	3	
T&E 4103 – Flying Qualities Flight Testing I	3	3	
T&E 4104 – Flying Qualities Flight Testing II	3	3	
T&E 4105 – FW Modern Flight Controls	3	2	
T&E 4106 – FW Loads, Flutter & Stores Testing	3	1	
T&E 4107 – Civil Aircraft Icing Certification	1		
Total P&FQ Credits			***34***
Systems Modules			
T&E 4201 – Avionics Systems Flight Testing	3	1	
T&E 4202 – Navigation, Communications, and GNSS Flight Testing	3	1	
T&E 4203 – 14 CFR Part 23/25/27/29 Avionics Certification Flight Testing	3	3	
T&E 4204 – Flight Test of RADAR and Electronic Warfare Systems	3	3	
T&E 4205 – UAV Systems Test	3	1	
T&E 4206 – Air-to-Air and Air-to-Ground Weapons Integration	3	1	
T&E 4207 – Electro-Optics and Infrared Systems Flight Testing	3	3	
T&E 4208 – NVG & HMD Testing	3	1	
Total Systems Credits			***38***
Total Credits Earned			**81**

Master's of Science Degree

FW Professional Course Track



* Core Module

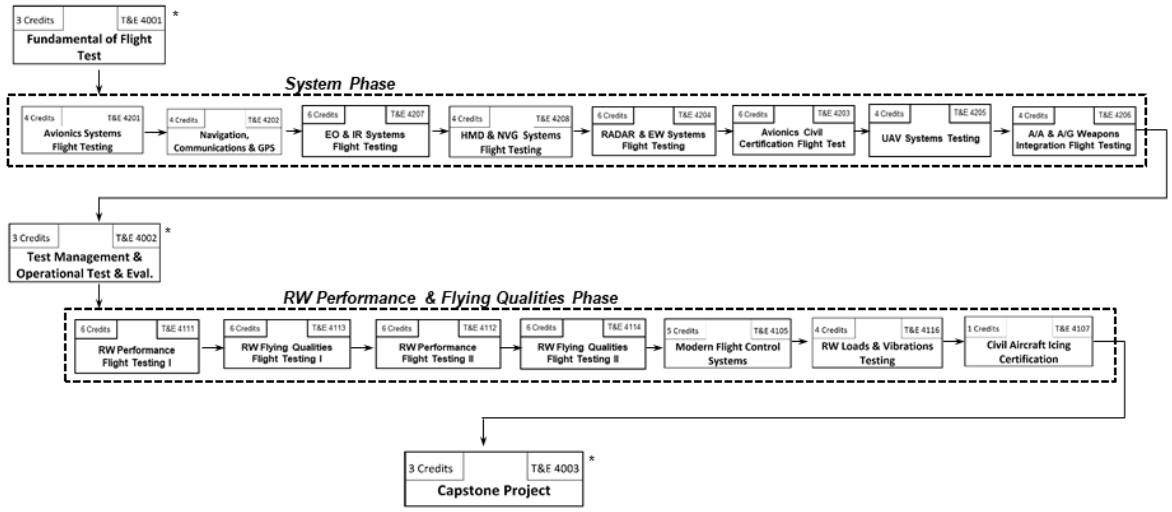
Rotary Wing Professional Course Track

Students enrolled in the Rotary Wing Professional Course track take all three core modules, 34 credits of P&FQ Flight Testing, and 38 credits of Systems Flight Testing. The modules consist of both theory and practical credits. Track description is shown in the Rotary Wing Professional Course Track table. This track exceeds the Master's graduation requirements.

Rotary Wing Professional Course Track	***Quarter Credits***		
	Theory	*Practical*	
Core Modules			
T&E 4001 – Fundamentals of Flight Test	3		
T&E 4002 – Test Management and Operational Test and Evaluation	3		
T&E 4003– Capstone Project		3	
Total Core Credits (9 Required)			***9***
Performance and Flying Qualities Modules			
T&E 4111 – RW Performance Flight Testing I	3	3	
T&E 4112 – RW Performance Flight testing II	3	3	
T&E 4113 – RW Flying Qualities Flight Testing I	3	3	
T&E 4114 – RW Flying Qualities Flight Testing II	3	3	
T&E 4115 – RW Modern Flight Controls	3	2	
T&E 4116 – RW Loads and Vibration Testing	3	1	
T&E 4107 – Civil Aircraft Icing Certification	1		
Total P&FQ Credits			***34***
Systems Modules			
T&E 4201 – Avionics Systems Flight Testing	3	1	
T&E 4202 – Navigation, Communications, and GNSS Flight Testing	3	1	
T&E 4203 – 14 CFR Part 23/25/27/29 Avionics Certification Flight Testing	3	3	
T&E 4204 – Flight Test of RADAR and Electronic Warfare Systems	3	3	
T&E 4205 – UAV Systems Test	3	1	
T&E 4206 – Air-to-Air and Air-to-Ground Weapons Integration	3	1	
T&E 4207 – Electro-Optics and Infrared Systems Flight Testing	3	3	
T&E 4208 – HMD & NVG Testing	3	1	
Total Systems Credits			***38***
Total Credits Earned			**81**

Master's of Science Degree

RW Professional Course Track



Performance and Flying Qualities Professional Course

Graduates of this 26 week course are prepared to perform Performance and flying qualities (P&FQ) envelope expansion, civil certification, and military suitability flights meeting FAR/EASA/Military certification or specifications. This course is designed to equip experienced pilots and engineers with the knowledge and practical experience to certify new or modified aircraft to stringent FAR/EASA/Military P&FQ certification standards or to recommend the aircraft for specific military missions. This is not a basic flight training course. It is an intense academic curriculum designed to produce world class test pilots and flight test engineers regarding P&FQ testing and certification. Students enrolled in the Master of Science degree program will receive credits towards their master's degree and can complete the remaining modules on a part-time basis.

Pre-requisites

Pilots: A minimum of 750 hours of pilot-in-command time and a bachelor's degree (or equivalent military academy) in math, science or engineering.

Engineers: A bachelor's degree (or equivalent military academy) in math, science or engineering, plus medically qualified to perform flight duties.

All Students: English language proficiency. Non-native English speakers must pass a Test of English as a Foreign Language (TOEFL) with a minimum score of 70 for pilots and 60 for FTEs.

Pre-Course Study. All students must study and understand the content of NTPS handbooks Volume I (Math and Physics for Flight Testers) and Volume II (Aerodynamics for Flight Testers); both volumes are available for download at the NTPS website: *https://www.ntps.edu/tps-preparation/*.

Required Modules

T&E 4001 Fundamentals of Flight Test
T&E 4101 or 4111 Performance Flight Testing I
T&E 4102 or 4112 Performance Flight Testing II
T&E 4103 or 4113 Flying Qualities Flight Testing I
T&E 4104 or 4114 Flying Qualities Flight Testing II
T&E 4105 Modern Flight Control Systems
T&E 4106 Structures, Loads and Weapon Testing
T&E 4107 Civil Aircraft Icing Certification
T&E 4003 Capstone Project

Master's Degree

Students who complete the Test Pilot / Flight Test Engineer Performance and Flying Qualities Professional Course will have completed some of the required modules for the master's degree program and can graduate with one of the two master's degrees in the Fixed Wing Professional or Rotary Wing Professional Track upon completion of remaining credits.

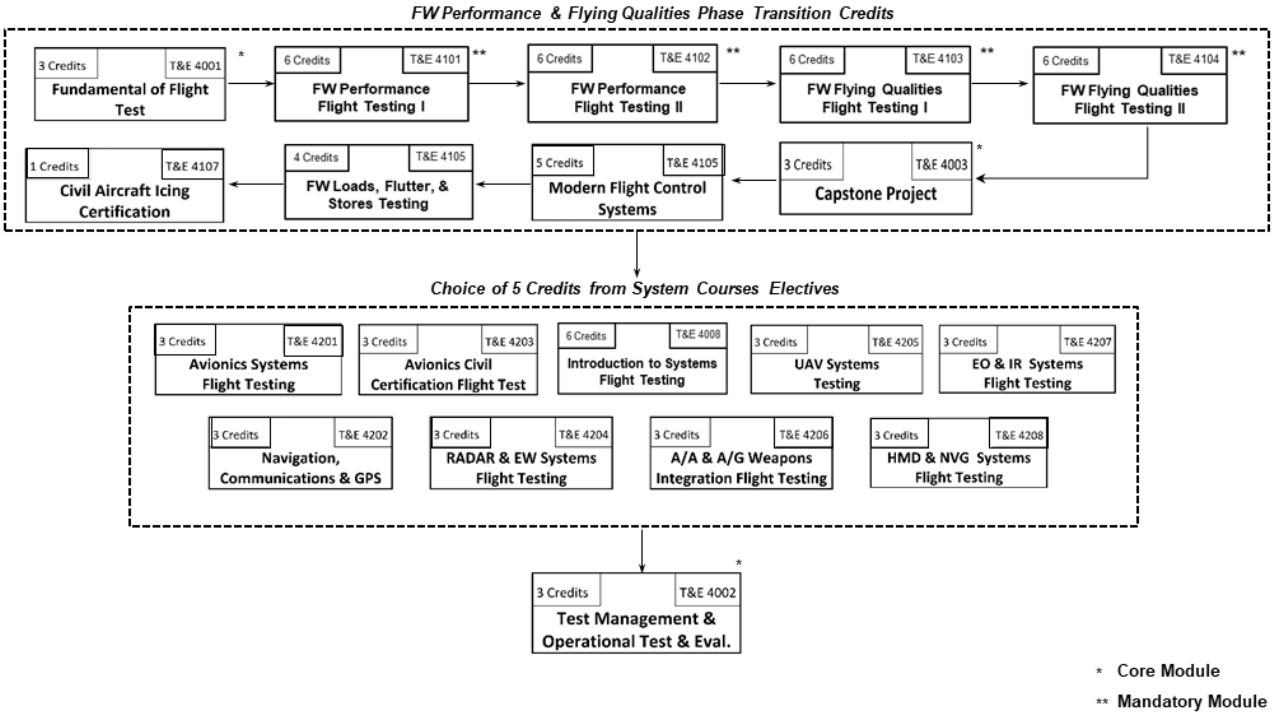
Fixed Wing P&FQ Professional Course (6 month) Transition to Master's Degree Track FW P&FQ

Students transitioning from the Fixed Wing Performance and Flying Qualities Professional Course to the Master's Degree take the remaining core module T&E 4002 and 5 credits of Flight Test Engineering electives. Track description is shown in the Fixed Wing P&FQ Professional Course (6 month) Transition to Master's Degree Track FW P&FQ table.

Fixed Wing P&FQ Professional Course (6 month) Transition to Master's Degree Track FW P&FQ	***Quarter Credits***	
	Theory	*Practical*
P&FQ Transition Modules		
T&E 4001 – Fundamentals of Flight Test	3	
T&E 4003 – Capstone Project		3
T&E 4101 – FW Performance Flight Testing I	3	3
T&E 4102 – FW Performance Flight testing II	3	3
T&E 4103 – FW Flying Qualities Flight Testing I	3	3
T&E 4104 – FW Flying Qualities Flight Testing II	3	3
T&E 4105 – FW Modern Flight Controls	3	2
T&E 4106 – FW Loads, Flutter & Stores Testing	3	1
T&E 4107 – Civil Aircraft Icing Certification	1	
Total Included Credits		***40***
Additional Required Modules		
T&E 4002 – Test Management and Operational Test and Evaluation	3	
Total Additional Required Credits (3 Required)		***3***
FTE Electives		
T&E 4008 – Introduction to Systems Testing	3	3
T&E 4201 – Avionics Systems Flight Testing	3	
T&E 4202 – Navigation, Communications, and GNSS Flight Testing	3	
T&E 4203 – 14 CFR Part 23/25/27/29 Avionics Certification Flight Testing	3	
T&E 4204 – Flight Test of RADAR and Electronic Warfare Systems	3	
T&E 4205 – UAV Systems Test	3	
T&E 4206 – Air-to-Air and Air-to-Ground Weapons Integration	3	
T&E 4207 – Electro-Optics and Infrared Systems Flight Testing	3	
T&E 4208 – HMD & NVG Testing	3	
Total Elective Credits		***5***
Minimum Total Credits Required to Graduate		**48**

Master's of Science Degree

FW P&FQ 6 Month Professional Course Transition to Master's Degree Track



* Core Module

** Mandatory Module

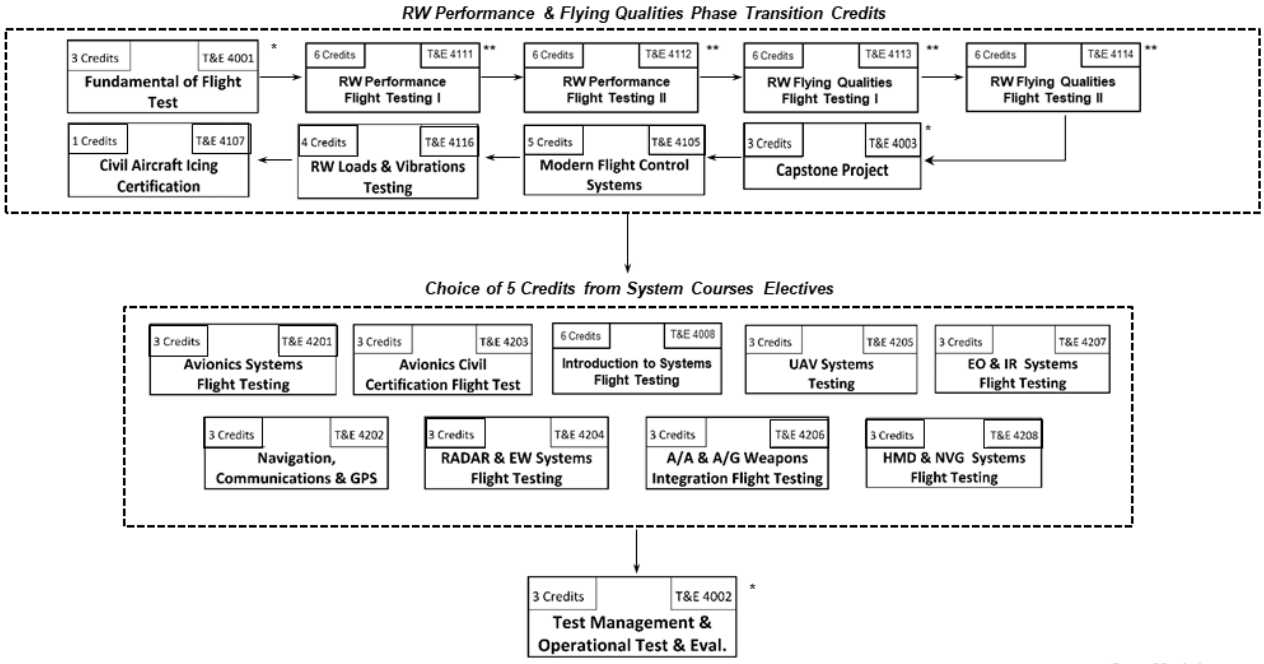
Rotary Wing P&FQ Professional Course (6 month) Transition to Master's Degree Track RW P&FQ

Students continuing from the Rotary Wing Performance and Flying Qualities Professional Course to the Master's Degree take the remaining core module T&E 4002 and 5 credits of Flight Test Engineering electives. Track description is shown in the Rotary Wing P&FQ Professional Course (6 month) Transition to Master's Degree Track RW P&FQ table.

Rotary Wing P&FQ Professional Course (6 month) Transition to Master's Degree Track RW P&FQ	***Quarter Credits***	
	Theory	*Practical*
P&FQ Transition Modules		
T&E 4001 – Fundamentals of Flight Test	3	
T&E 4003 – Capstone Project		3
T&E 4111 – RW Performance Flight Testing I	3	3
T&E 4112 – RW Performance Flight testing II	3	3
T&E 4113 – RW Flying Qualities Flight Testing I	3	3
T&E 4114 – RW Flying Qualities Flight Testing II	3	3
T&E 4105 – Modern Flight Controls	3	2
T&E 4116 – RW Loads and Vibration Testing	3	1
T&E 4107 – Civil Aircraft Icing Certification	1	
Total Transition Credits		***40***
Additional Required Modules		
T&E 4002 – Test Management and Operational Test and Evaluation	3	
Total Additional Required Credits (3 Required)		***3***
FTE Electives		
T&E 4008 – Introduction to Systems Testing	3	3
T&E 4201 – Avionics Systems Flight Testing	3	
T&E 4202 – Navigation, Communications, and NSS Flight Testing	3	
T&E 4203 – 14 CFR Part 23/25/27/29 Avionics Certification Flight Testing	3	
T&E 4204 – Flight Test of RADAR and Electronic Warfare Systems	3	
T&E 4205 – UAV Systems Test	3	
T&E 4206 – Air-to-Air and Air-to-Ground Weapons Integration	3	
T&E 4207 – Electro-Optics and Infrared Systems Flight Testing	3	
T&E 4208 – HMD & NVG Testing	3	
Total Elective Credits		***5***
Minimum Total Credits Required to Graduate		**48**

Master's of Science Degree

RW P&FQ 6 Month Professional Course Transition to Master's Degree Track



Systems Professional Course

Graduates of this 24 week course are prepared to perform civil certification, and military suitability flights meeting FAR/EASA/Military certification or specifications for aircraft systems. This course is designed to equip experienced pilots and engineers with the knowledge and practical experience to certify new or modified aircraft to stringent FAR/EASA/Military system certification standards or to recommend the aircraft for specific military missions. This is not a basic flight training course. It is an intense academic curriculum designed to produce world class test pilots and flight test engineers regarding Systems testing and certification. Throughout the course there are multiple student-planned projects addressing all of the main systems taught.

There are nine modules in the course, which are the same for either fixed or rotary wing including six mandatory modules. Students enrolled in the master's degree program will receive credits towards their master's degree and can complete the remaining modules on a part-time basis.

Pre-requisites

Pilots: A minimum of 750 hours of pilot-in-command time and a bachelor's degree in math, science or engineering (or equivalent military academy) plus medically qualified to perform flight duties.

Engineers: A bachelor's degree in math, science or engineering (or equivalent military academy) plus medically qualified to perform flight duties.

All Students: English language proficiency. Non-native English speakers must pass a Test of English as a Foreign Language (TOEFL) with a minimum score of 70 for pilots and 60 for FTEs.

Required Modules

T&E 4001 Fundamentals of Flight Test
T&E 4201 Avionics Systems Flight Testing
T&E 4202 Communications, Navigation, and GPS Testing
T&E 4203 14 CFR Part 23/25/27/29 Avionics Certification Flight Testing
T&E 4204 RADAR and Electronic Warfare Testing
T&E 4205 UAV Systems Test
T&E 4206 Weapons Integration Testing
T&E 4207 Electro-Optic and Infrared Systems Testing
T&E 4208 HMD & NVG Testing

Master's Degree

Students who complete the Test Pilot / Flight Test Engineer Systems Professional Course will have completed some of the required modules for the master's degree program and can graduate with one of the two master's degrees in the Systems Professional Track upon completion of remaining credits.

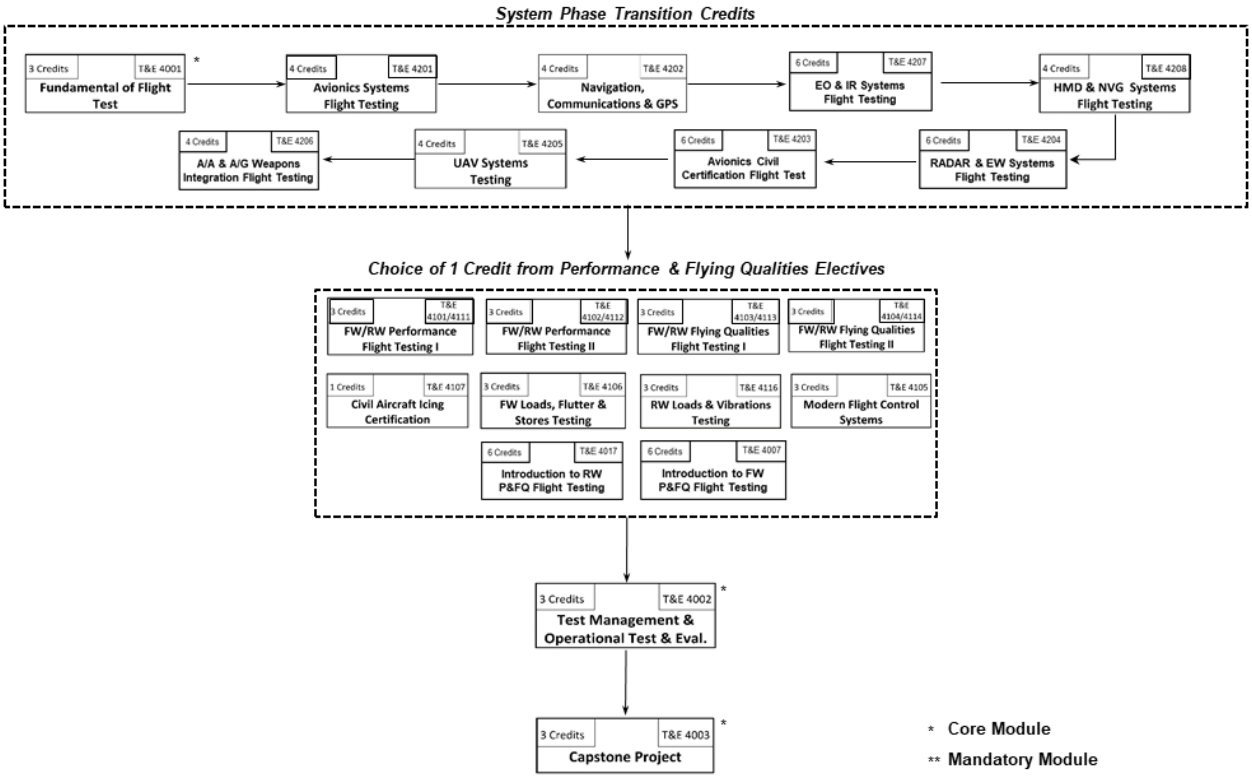
Systems Professional Course (6 months) Transition to Master's Degree Track Systems

Students continuing from the Systems Professional Course to the Master's Degree must take the remaining two core modules T&E 4002 and 4003), and 1 Flight Test Engineering elective credit. Track description is shown in the Systems Professional Course (6 months) Transition to Master's Degree Track Systems table.

Systems Professional Course (6 months) Transition to Master's Degree Track Systems	***Quarter Credits***	
	Academics	*Practical*
Systems Transition Modules		
T&E 4001 – Fundamentals of Flight Test	3	
T&E 4201 – Avionics Systems Flight Testing	3	1
T&E 4202 – Navigation, Communications, and GNSS Flight Testing	3	1
T&E 4203 – 14 CFR Part 23/25/27/29 Avionics Certification Flight Testing	3	3
T&E 4204 – Flight Test of RADAR and Electronic Warfare Systems	3	3
T&E 4205 – UAV Systems Test	3	1
T&E 4206 – Air-to-Air and Air-to-Ground Weapons Integration	3	1
T&E 4207 – Electro-Optics and Infrared Systems Flight Testing	3	3
T&E 4208 – NVG & HMD Testing	3	1
Total Transition Credits		***41***
Additional Required Modules		
T&E 4002 – Test Management and Operational Test and Evaluation	3	
T&E 4003– Capstone Project		3
Total Additional Required Credits (6 Required)		***6***
FTE Electives		
T&E 4007 or 4017 – Introduction to P&FQ Flight Testing (FW or RW) **Mandatory*	2	2
T&E 4101 or 4111 –Performance Flight Testing I (FW or RW)	3	
T&E 4102 or 4112 –Performance Flight testing II (FW or RW)	3	
T&E 4103 or 4113 –Flying Qualities Flight Testing I (FW or RW)	3	
T&E 4104 or 4114 – Flying Qualities Flight Testing II (FW or RW)	3	
T&E 4105 – Modern Flight Controls	3	
T&E 4106 – FW Loads, Flutter & Stores Testing	3	
T&E 4116 – RW Loads, Vibration and Stores Testing	3	
T&E 4107 – Civil Aircraft Icing Certification	1	
Additional Elective Credits		***1***
Minimum Total Credits Required to Graduate		**48**

Master's of Science Degree

Systems 6 Month Professional Course Transition to Master's Degree Track



Category 2 Test Pilot / Flight Test Engineer Course

A twenty-week course demonstrating techniques to evaluate fixed wing aircraft and helicopters for FAA/EASA Part 23/25/27/29 certification. The course contains the EASA Category 2 training requirements. Training includes flight time in various aircraft/helicopters. Systems, Performance, Flying Qualities and the accompanying FAA certification procedures are emphasized.

Required Modules

- T&E 4008 Introduction to Systems Testing
- T&E 4001 Fundamentals of Flight Test
- T&E 4101 or 4111 Performance Flight Testing I
- T&E 4102 or 4112 Performance Flight Testing II
- T&E 4103 or 4113 Flying Qualities Flight Testing I
- T&E 4104 or 4114 Flying Qualities Flight Testing II
- T&E 4105 Modern Flight Control Systems ** (Optional)
- T&E 4003 Capstone Project

Depending on the customer's needs the course can be taken in one of three options: a fixed wing aircraft track that includes light / medium propeller and jet aircraft; a rotary wing track that includes single/multi engine helicopters; and a light aircraft track that predominantly utilizes propeller aircraft under 2000kg.

This course includes seven mandatory modules. ** Modern Flight Control Systems is optional at additional cost. Students will participate in modules together with NTPS Professional Course students. Students enrolled in the Master of Science degree program will receive credits towards their master's degree and can complete the remaining modules on a part-time basis.

Pre-requisites

Pilots: A minimum of 750 hours of pilot-in-command time and a bachelor's degree (or equivalent military academy) in math, science or engineering.

Engineers: A bachelor's degree (or equivalent military academy) in math, science or engineering, plus medically qualified to perform flight duties.

All Students: English language proficiency. Non-native English speakers must pass a Test of English as a Foreign Language (TOEFL) with a minimum score of 70 for pilots and 60 for FTEs.

Pre-Course Study: All students must study and understand the content of NTPS handbooks Volume I (Math and Physics for Flight Testers) and Volume II (Aerodynamics for Flight Testers); both volumes are available for download at the NTPS website: *https://www.ntps.edu/tps-preparation/*.

Master's Degree

Students who complete the Category 2 Test Pilot / Flight Test Engineer Course will have completed some of the required modules for the master's degree program and can graduate with one of the two master's degrees in the Fixed Wing Professional or Rotary Wing Professional Track upon completion of remaining credits.

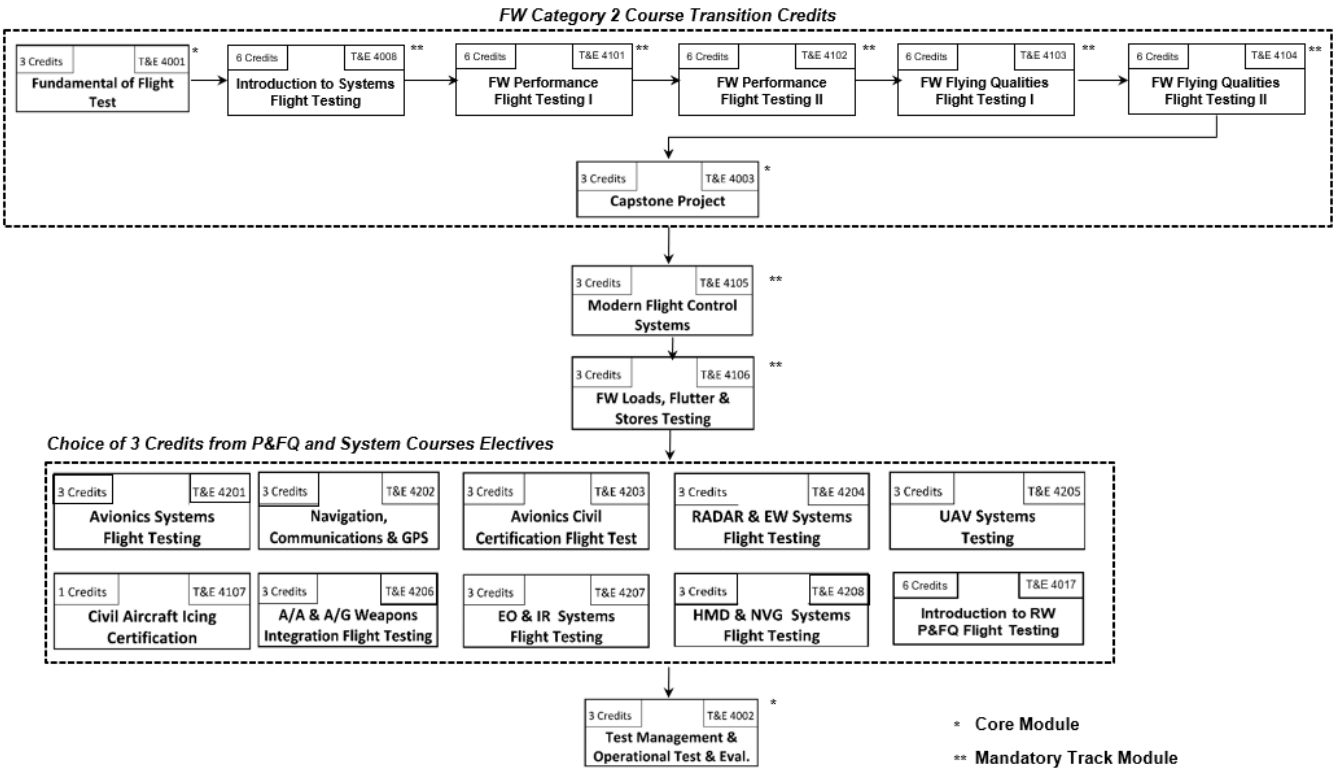
Fixed Wing Category 2 Course (5 Month) Transition to Master's Degree Track FW P&FQ

Students continuing from the FW Category 2 Test Pilot / Flight Test Engineer Course to the Master's Degree take the remaining core module T&E 4002; the remaining mandatory track modules T&E 4105 and T&E 4106, and 3 Flight Test Engineering elective credits. Track description is shown in the Fixed Wing Category 2 Course (5 Month) Transition to Master's Degree Track FW P&FQ table.

Fixed Wing Category 2 Course (5 Month) Transition to Master's Degree Track FW P&FQ	***Quarter Credits***	
	Theory	*Practical*
Cat 2 Transition Modules		
T&E 4001 – Fundamentals of Flight Test	3	
T&E 4003 – Capstone Project		3
T&E 4008 – Introduction to Systems Testing	3	3
T&E 4101 – FW Performance Flight Testing I	3	3
T&E 4102 – FW Performance Flight testing II	3	3
T&E 4103 – FW Flying Qualities Flight Testing I	3	3
T&E 4104 – FW Flying Qualities Flight Testing II	3	3
Total Included Credits (36 Required)		***36***
Addition Required Modules		
T&E 4002 – Test Management and Operational Test and Evaluation	3	
T&E 4105 –Modern Flight Control Systems	3	
T&E 4106 –FW Loads, Flutter & Stores Testing	3	
Total Additional Required Credits (9 Required)		***9***
FTE Electives		
T&E 4107 – Civil Aircraft Icing Certification	1	
T&E 4201 – Avionics Systems Flight Testing	3	
T&E 4202 – Navigation, Communications, and GNSS Flight Testing	3	
T&E 4203 – 14 CFR Part 23/25/27/29 Avionics Certification Flight Testing	3	
T&E 4204 – Flight Test of RADAR and Electronic Warfare Systems	3	
T&E 4205 – UAV Systems Test	3	
T&E 4206 – Air-to-Air and Air-to-Ground Weapons Integration	3	
T&E 4207 – Electro-Optics and Infrared Systems Flight Testing	3	
T&E 4208 – HMD & NVG Testing	3	
T&E 4017 – Introduction to RW P&FQ Flight Testing	6	
Additional Elective Credits (3 Required)		***3***
Minimum Total Credits Required to Graduate		**48**

Master's of Science Degree

FW P&FQ Category 2 Course Transition to Master's Degree Track



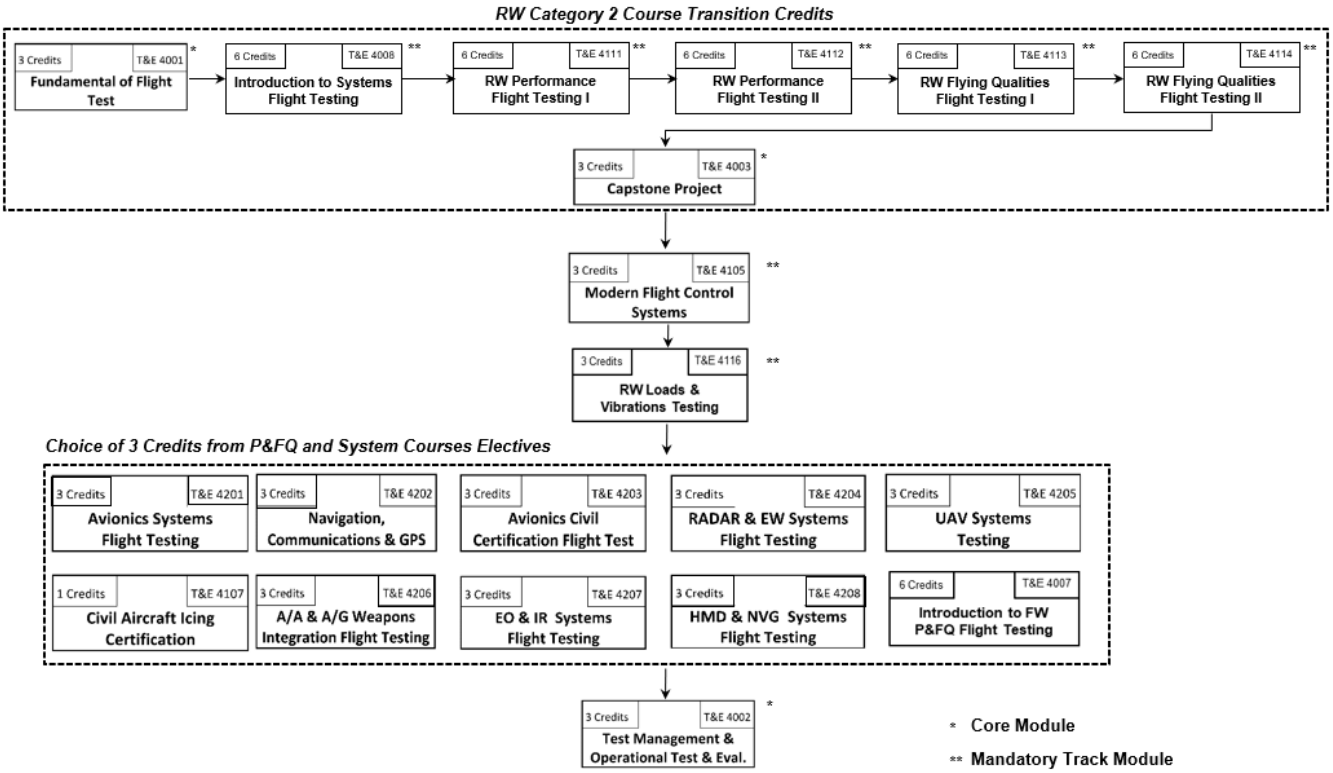
Rotary Wing Category 2 Course (5 month) Transition to Master's Degree Track RW P&FQ

Students transitioning from the RW Category 2 Test Pilot / Flight Test Engineer Course to the Master's Degree take the remaining core module T&E 4002 and 9 Flight Test Engineering elective credits. Track description is shown in the Rotary Wing Category 2 Course (5 month) Transition to Master's Degree Track RW P&FQ table.

Rotary Wing Category 2 Course (5 month) Transition to Master's Degree Track RW P&FQ	***Quarter Credits***	
	Theory	*Practical*
Cat II Included Modules		
T&E 4001 – Fundamentals of Flight Test	3	
T&E 4003 – Capstone Project		3
T&E 4008 – Introduction to Systems Testing	3	3
T&E 4111 – RW Performance Flight Testing I	3	3
T&E 4112 – RW Performance Flight testing II	3	3
T&E 4113 – RW Flying Qualities Flight Testing I	3	3
T&E 4114 – RW Flying Qualities Flight Testing II	3	3
Total Included Credits (30 Required)		***36***
Addition Required Modules		
T&E 4002 – Test Management and Operational Test and Evaluation	3	
T&E 4105 –Modern Flight Control Systems	3	
T&E 4116 – RW Loads and Vibration Testing	3	
Total Additional Required Credits (9 Required)		***9***
Additional Elective Modules		
T&E 4107 – Civil Aircraft Icing Certification	1	
T&E 4201 – Avionics Systems Flight Testing	3	
T&E 4202 – Navigation, Communications, and GNSS Flight Testing	3	
T&E 4203 – 14 CFR Part 23/25/27/29 Avionics Certification Flight Testing	3	
T&E 4204 – Flight Test of RADAR and Electronic Warfare Systems	3	
T&E 4205 – UAV Systems Test	3	
T&E 4206 – Air-to-Air and Air-to-Ground Weapons Integration	3	
T&E 4207 – Electro-Optics and Infrared Systems Flight Testing	3	
T&E 4208 – HMD & NVG Testing	3	
T&E 4007 – Introduction to FW P&FQ Flight Testing	6	
Additional Elective Credits (3 Required)		***3***
Minimum Total Credits Required to Graduate		**48**

Master's of Science Degree

RW P&FQ Category 2 Course Transition to Master's Degree Track



Short Courses

Pre-TPS Course

The Pre-TPS Course helps prepare the student academically for the mathematics and physical sciences required for the long course. It also introduces the student to aircraft performance and stability and control and airborne systems evaluation techniques they will soon utilize. The six-week course is divided into three two-week sections:

- Two Week refresher in mathematics (algebra, trigonometry, calculus, differential equations) and physics (classical mechanics)
- T&E 4008 Introduction to Systems Testing
- T&E 4007/4017 Introduction to Fixed/Rotary Wing Performance and Flying Qualities Flight Testing

This course is offered twice a year on-campus. The course has proven to be a very successful preparatory course for pilots and engineers prior to entering test pilot schools both in the US and abroad. Foreign students who speak English as a second language find the course particularly useful as an immersion course in technical English and as an exposure to a different culture. Supplemental English language training can also be arranged for those needing to enhance their English skills.

Course descriptions and Course Learning Outcomes are as per T&E 4007, T&E 4017, and T&E 4008.

Operational Test and Evaluation (OT&E) Course

The course teaches basic flight test principles, concepts, and processes. Classroom instruction is reinforced by two demonstrations and two project flights designed to provide "hands-on" experience in flight testing. A final project further reinforces classroom instruction. The final project uses operational requirements/capability documents to plan, flight test, and report on how well an aircraft or system meets mission needs. Previous class projects have included fixed wing, rotary wing, air vehicle and avionics systems evaluations.

This course develops a "customer-centric" view of testing by providing an overview of current OT&E philosophies, processes, concepts and issues. Specifically, the course provides an understanding of how OT&E fits into the acquisition process, the interrelationships of DT&E and OT&E, how test objectives are derived from user requirements, and the importance of relating test results to mission requirements. The course is extremely beneficial to anyone involved in OT&E; to DT&E testers who interface with OT&E; and to Program Office personnel, Program Managers and Test Managers whose programs are subject to OT&E and who need to certify a system ready for OT&E. The course is continually updated based on customer feedback.

The course is suitable for foreign government personnel and for civil airline pilots, engineers, and managers who are in a position to evaluate a new aircraft or systems for their government or company, who need to work with the manufacturer to define special mission or customer requirements, and who must evaluate resulting modifications to ensure an operationally viable aircraft.

Subjects Covered

- The Acquisition Process
- Performance and Handling Qualities Test
- DT&E / OT&E Philosophy and Processes
- Techniques
- User Requirements Process
- Overview and Laboratory Exercise
- OT&E test criteria development
- Test Crew Resource Management
- Test Planning and Data Concerns
- Crew Station Evaluation Techniques
- Risk Management and Test Safety
- Workload Assessment Techniques
- Reliability, Maintainability, and Availability
- OT&E Lessons Learned
- Testing Integrated Systems

Technical Pilot Course

This course introduces the student to the philosophy, procedures, and theory of acceptance / maintenance / production flight test. A review of basic aerodynamics and aircraft performance, plus risk management, upset recovery theory, aircraft pilot compatibility, an introduction to stability and control and acceptance / maintenance / production flight test procedures are accomplished prior to in-flight / simulator practical application exercises. During one of the inflight exercises, an actual aircraft acceptance flight test to include crew resource management exercise is performed. A complete takeoff speed development and stability and control exercise for large jet aircraft is performed in the Simulator. At the completion of this course the student will have a basic knowledge of the Type Certificate Requirements / Process, and the role maintenance and acceptance flight test plays in ensuring the aircraft performance, flying qualities, and systems meet the critical Type Certificate Requirements.

Subjects Covered

- Subsonic Aerodynamics
- Certification Process/Documentation
- Takeoff & Land/Takeoff Speed Development
- Integrated Avionics
- Introduction to Stability and Control (S&C)
- Aircraft Subsystems
- Aircraft Design/Modification Effects on S&C
- Mach Effects on S&C
- Introduction to Variable Stability Simulation
- Upset Recovery Theory
- Transonic Aerodynamics
- Acceptance Test Checklist
- Flight Management System
- Flight Controls
- Crew Resource Management
- Warning Systems
- Ground Acceptance Inspection
- PIO Theory
- Stalls and High Angle of Attack
- Asymmetric Flight
- Introduction to Acceptance Testing
- Navigation Systems
- Aeroelasticity and Flutter Hazards
- Safety In Flight Test

HMD & NVG Testing

This course is designed to provide technical and human factors information regarding Helmet Mounted Displays (HMDs), Night Vision Imaging System (NVIS) compatible lighting, and the integration of both in the aircraft. Emphasis is placed on system evaluation techniques, which are based on years of practical experience in a number of different aircraft. Topical information in the academic lectures is reinforced during HMD lab and aircraft demonstrations. Emphasis is placed on various approaches to system design that impact usability, and methods of test that will identify potential deficiencies.

UAV Systems Test

This Course addresses the unique testing requirements when evaluating a UAV system. It is assumed that the participants are generally knowledgeable in manned aircraft flight testing as this course builds on that knowledge. The students will be involved with four UAV missions utilizing the NTPS FAA-approved C150 Optionally Piloted Aircraft (OPA). Course lectures will introduce the students to UAV-specific testing when compared to manned Fixed and Rotary Wing testing. Issues such as data latency, human factors, data link coverage, failure modes, contingency management, telemetry issues, guidance, navigation and control, mission planning, and sensor cueing/integration will be addressed. Flight Test Techniques for testing both Remotely Piloted and Command Directed (autonomous) Vehicle modes will also be covered.

Courses On-Demand

Upset Training Course

This course familiarizes the pilot with what to expect under upset conditions. It is well suited to those who have not flown in aircraft that are cleared for inverted flight or that can depart controlled flight.

Formation / Low Level / Chase Training Course

This course introduces the pilot to the special requirements of these unique flight conditions. The course would be beneficial to any pilot whose job requires formation, low-level, or chase flight.

Spin Training Course

This course familiarizes the pilot with the unique environment of an aircraft in a classic spin. Upright and inverted spins are demonstrated and practiced with both pro-spin and anti-spin control inputs. Different recovery techniques are practiced and evaluated.

Crew Resource Management for Flight Testers - Initial (3 Days)

This short course is designed to introduce Flight Test aircrew and control room members the coordination concepts and procedures, the necessary attitude which recognizes the importance of good aircrew coordination for effective mission accomplishment, and the skills to implement the crew coordination procedures.

Crew Resource Management for Flight Testers - Refresher (1 Day)

This short course is designed to review Flight Test aircrew and control room members the coordination concepts and procedures, the necessary attitude which recognizes the importance of good aircrew coordination for effective mission accomplishment, and the skills to implement the crew coordination procedures.

Aviation Safety Course (3 Days)

This course is an introduction to flight safety, which is designed for those persons who are involved in flight operations and have had little or no Flight Safety training.

Space Operational Test & Evaluation Course (3 Weeks)

The three-week Space Operational Test & Evaluation Course teaches basic flight test principles, concepts, and processes of Operational Test and Evaluation (OT&E). The course consists of classroom lectures, academic activities, and flight, simulator, and ground test sorties. These sorties cover: basic flight test principles, processes, practices and concepts; demonstrations and project flights; flight simulation training to reinforce space and flight test techniques; and Crew Resource Management. A student Final Project is the course capstone to further reinforce classroom instruction, and to logically carry a space test scenario from requirements analysis to test planning to test conduct to data analysis to a final test report. During the Space final project exercise, the students plan, flight test, collect and analyze the test data, and report on space system performance in meeting the stated user operational requirements/capabilities.

The Space Operational Test Course is designed to provide an understanding of how Space Testing fits into the acquisition process, the interrelationships between Space Developmental Test & Evaluation (DT&E) and OT&E, and those concepts and issues specific to Space OT&E Testing. The NTPS philosophy behind the Space OT&E course is to teach a repeatable test process and provide a fundamental knowledge and practical understanding of the key subjects.

Subjects Covered

- Test Planning, Execution, Data Analysis and Reporting of OT&E Test Strategies
- How Space DT&E and OT&E fits into weapon system acquisition and engineering processes
- Space DT&E and OT&E test processes and procedures
- Key differences between DT&E and OT&E requirements, planning, execution
- Overview of Space OT&E test theory and standard flight test techniques
- Emphasis on User and Operational Requirements development and analysis

- Test Planning, Execution, Data Analysis and Reporting of OT&E Test Strategies
- How Space DT&E and OT&E fits into weapon system acquisition and engineering processes
- Space DT&E and OT&E test processes and procedures
- Key differences between DT&E and OT&E requirements, planning, execution
- Overview of Space OT&E test theory and standard flight test techniques
- Emphasis on User and Operational Requirements development and analysis

- Conduct, procedures and techniques of OT&E testing
- All aspects of Space test planning, execution, analysis, and reporting (PEAR)
- All aspects of flight test planning and mission execution
- Emphasis on testing relative to the User's mission and mission tasks
- Tools for effective Space OT&E test planning
- Generic flight test processes, concepts and practices

- Conduct, procedures and techniques of OT&E testing
- All aspects of Space test planning, execution, analysis, and reporting (PEAR)
- All aspects of flight test planning and mission execution
- Emphasis on testing relative to the User's mission and mission tasks
- Tools for effective Space OT&E test planning
- Generic flight test processes, concepts and practices

Academic Modules

The academic modules make up the core of the Master's Degree program and professional courses. However, academic modules can be taken on their own as short courses provided that prerequisite modules have been completed and entrance requirements have been met.

T&E 4001 Fundamentals of Flight Test

This two week (masters) / three week (TP/FTE Course) course is typically offered twice a year and consists of academic lecture, laboratory exercises, and airborne flight instruction offered daily on a Monday through Friday schedule. This is a foundational course for the Master's Degrees and the Test Pilot and Flight Test Engineer courses that covers the fundamental subjects of flight test. The role of the test pilot and flight test engineer is described along with an explanation of the different types of flight test including R&D, DT&E, and OT&E. Other key subjects covered include: Report Writing, Human Factors and Cockpit Evaluation, Test Planning, Risk Management, Safety in Flight Test, Data Analysis, Certification Standards, and Math/Physics Review.

Pre-requisites:

- None.

Anticipated Course Learning Outcomes*:*

a. Be familiar with:
   - Computer-based data analysis tools.
   - The techniques used to conduct a cockpit evaluation.

b. Understand:
   - The purpose of flight test and evaluation and am familiar with the T&E process.
   - The roles and responsibilities of a test pilot and flight test engineer.
   - Human factors considerations applicable to conducting flight test.
   - Basic statistics concepts and how they apply to flight testing.
   - Areas to be considered in planning a mission and how to write test cards.
   - Risk management and safety considerations while planning and conducting a flight test program.
   - The format and content of technical reports, both written and oral
   - The importance of crew resource management in test and evaluation.

T&E 4002 Test Management and Operational Test and Evaluation

This one-week course is typically offered twice a year and consists of academic lecture and laboratory exercises. Test and Evaluation is an integral part of the acquisition process. As such, flight testers need to understand the programmatic aspects of their business. This course prepares students to manage flight test programs/projects by providing an understanding of the role of T&E within the acquisition process, and the role of T&E within a typical program office. It examines the requirements process and introduces typical test management issues such as budget management, contractor business environment, schedule management, resources planning, and test item configuration control. In order to broaden the tester's horizon, the module also introduces Operational Test and Evaluation (OT&E) principles, as well as Reliability, Maintainability, Logistics and Availability (RML&A) concepts. Finally, the module introduces the students to the challenges of testing commercial off the shelf (COTS) systems.

Pre-requisites:

- T&E 4001.

Anticipated Course Learning Outcomes

a. Be Familiar With
   - Budget tracking and the Earned Value Management concept

b. Understand
   - The requirements process and how user requirements drive the scope of test programs
   - The similarities and differences between OT&E and DT&E
   - The resource factors which must be considered during T&E planning
   - The elements of RML&A tests including their purpose and challenges
   - The basic management concepts needed to run a test program
   - Risk management and safety considerations while planning and conducting a flight test program.

c. Know
   - How to develop COI/MOE/MOS/MOAs from user requirements/capabilities documents

T&E 4003 Capstone Project

For the Master's students, the Capstone Project is an extensive flight test engineering related project conducted under the supervision of a faculty advisor (or a designated representative) and includes a significant written and oral report. The Capstone Project may be a traditional test pilot school final project or it may be a flight test related test project, research study, independent study, or practical exercise that encompasses at least 90 hours of flight test engineering related student work. A Capstone Project proposal must be submitted to and approved by the CAO prior to the project start.

For Professional Course students, the capstone project is a comprehensive ground and flight exercise offered once annually at the completion of the Performance and Flying Qualities phase. The capstone project is intended to encapsulate the entire process of a flight test program. This is primarily an independent study course with in-flight exercises included. Under the supervision of a staff instructor, the students conduct and develop mission analysis, test planning, test plan reviews for safety and technical completeness, flight test execution, data analysis and reporting, both oral and written. To the extent possible, the scope of the project should include elements of performance, flying qualities and systems, as they apply to the assigned mission and purpose of the project. To demonstrate Information Literacy, the student will utilize on-line flight test databases in preparation of the test plan for the project. The project is normally accomplished in small teams on an aircraft or system not previously used during the course of instruction, but complete unfamiliarity is not a requirement. Even though teamwork is emphasized on test preparation, execution and analysis, every student should individually prepare a formal written report.

Pre-requisites:
- All compulsory core courses for Master's Focused Students.

T&E 4007 Introduction to Fixed Wing Performance & Flying Qualities Flight Testing

This two-week course is offered on-campus twice a year. The course consists of academic lectures, simulator exercises and in-flight instruction. It is designed to satisfy the demand for engineers, pilots and flight test support personnel who require practical experience in aircraft performance, stability and control, handling qualities, flight test instrumentation data handling, as well as a working knowledge of civil and military requirements pertaining to piloted aircraft. The objective is to provide the student with practical in-flight data gathering experience and an overview to flight test engineering. Classroom sessions are tailored to prepare the students for practical in-flight tests. Flights are performed in an aircraft instrumented to serve as an in-flight laboratory. On each of the sorties the students participate as flight test engineers, gathering data for post-flight analysis. An additional sortie is flown in a light aircraft to allow the students to get practical hands-on experience in performing the various flight test techniques. At the conclusion of the course, students present their findings and recommendations on both mission suitability and regulatory compliance in an oral report to the staff

Pre-requisites:

- None, but familiarity with the NTPS handbooks Volume I (Math and Physics for Flight Testers) and Volume II (Aerodynamics for Flight Testers) is highly recommended and encouraged in preparation for the course; both volumes are available for download at the NTPS website: *https://www.ntps.edu/tps-preparation/*.

Anticipated Course Learning Outcomes

a. Be familiar with:
   - Aircraft Control Systems.
   - Jet Cruise.
   - Mach Effects on Stability and Control
   - Dimensional Analysis
   - Drag Polar
   - Takeoff and Landing
   - Energy Management
   - Subsonic Aerodynamics
   - Closed Loop Handling Qualities
   - Aero-elasticity
   - Standard Atmosphere
   - Longitudinal Non-Linearities
   - Light Aircraft Engine-Out
   - Transonic Aerodynamics

b. Understand:
   - Pitot-Statics
   - Propeller Cruise
   - Climb Performance
   - Longitudinal Static Stability
   - Longitudinal Maneuvering Stability
   - Lateral-Directional Static Stability
   - Stalls
   - Equations of Motion and Dynamics

T&E 4008 Introduction to Systems Testing

This two-week course is offered on-campus twice a year and consists of academic lecture, laboratory exercises and in-flight instruction. It is designed to provide an overview of Systems testing and is ideally suited to newcomers entering the field, experienced personnel who are returning to the field or need refresher training, and flight test managers or support personnel newly assigned to a systems flight test program. In addition to systems theory and operating practice, the principles and techniques of avionics flight testing are emphasized to provide students with a firm understanding and background necessary to participate immediately in any flight test program upon return to their respective organizations. Practical flight exercises are structured to build on material covered in the classroom lectures and to reinforce the students' knowledge through practical application of theory. Students will conduct a final project and present their findings and recommendations on mission suitability and specification compliance in an oral briefing.

Pre-requisites:

- None.

Anticipated Course Learning Outcomes

a. Be familiar with:
   - Avionics flight test process, specifications and regulations.
   - Areas to be considered in planning a mission and how to write test cards.
   - The format and content of technical reports, both written and oral.
   - Risk management and safety considerations while planning and conducting a flight test program.
   - Human factors and workload evaluation.
   - Communications and navigation systems testing.
   - Data bus structure and TSPI.
   - Airborne radar testing.
   - Passive Electro-optical (ultraviolet, visible and infrared) systems testing.
   - Software development testing.
   - Electromagnetic compatibility and interference

b. Understand:
   - The approach to safely and effectively execute ground and flight test of avionic systems.
   - The techniques used to conduct a cockpit evaluation.
   - The techniques for evaluating GNSS.
   - The techniques for evaluating systems for Required Navigation Performance (RNP) operations.
   - The techniques for evaluating workload.
   - The techniques for evaluating ground based NavAids.

T&E 4017 Introduction to Rotary Wing Performance & Flying Qualities Flight Testing

This two-week course is offered on-campus once a year. The course includes academic lectures, laboratory exercises, in-flight instruction and flight-test data analysis. The aim of the course is to it is to introduce pilots, engineers, flight test support and management personnel to helicopter flight test theory and procedures. This course can also serve as a refresher course for experienced flight test personnel. The scope of the course includes the evaluation of helicopter performance, handling qualities, data acquisition and analysis, as well as an overview of applicable civilian regulations (US CFR title 14 and EASA) and military specifications pertaining to piloted helicopters. The academic classes prepare the students to effectively plan and conduct helicopter flight tests. Students participate as flight test engineers on several flights in an instrumented helicopter, gathering data for post-flight analysis. The students present their findings and recommendations on mission suitability and regulatory compliance in a group oral briefing to the staff.

Pre-requisites:
   - None. However, familiarity with the NTPS handbooks Volume I (Math and Physics for Flight Testers) and Volume II (Aerodynamics for Flight Testers) is highly recommended and encouraged in preparation for the course; both volumes are available for download at the NTPS website: *https://www.ntps.edu/tps-preparation/*.

Anticipated Course Learning Outcomes

a. Be familiar with:
   - The Standard Atmosphere
   - Various Types of Rotor Systems
   - Closed Loop Handling Qualities
   - Low Airspeed Characteristics
   - Mechanical Characteristics of Flight Controls
   - Height-Velocity Testing
   - Engine Characteristics

- Takeoff and Landing Performance
- Aircraft control Systems

b. Understand:
   - Pitot-Static Systems Theory and Flight Testing
   - Turbine Engine Flight Testing
   - Hover Performance Flight Testing
   - Level Flight Performance Flight Testing
   - Forward Flight Climb and Descent Flight Testing
   - Longitudinal Static and Dynamic Stability

T&E 4101 Performance Flight Testing I

This course is offered once per year on-campus and once per year distance learning. An intensive overview of the methods used to make performance evaluations of propeller driven aircraft. Emphasis is placed on subsonic aerodynamics, pitot-statics and reciprocating engine theory. Cruise performance testing methods for propeller aircraft is stressed. Takeoff and landing theory and flight test methods for all types of aircraft is also covered.

Pre-requisites:
- T&E 4001.

Anticipated Course Learning Outcomes

a. Be familiar with
   - The fundamentals of dimensional analysis.
   - Subsonic aerodynamics principles.

b. Understand
   - Standard atmosphere and the associated tables.
   - Pitot static principles and PEC requirements
   - Reciprocating engines and propeller theory and applicable certification requirements.
   - Takeoff and landing theory and requirements

c. Know
   - How drag polars are determined and how they are used for modeling.
   - How to measure and evaluate pitot static position errors.
   - How to test and evaluate takeoff and landing performance.
   - How to test and evaluate the cruise performance of propeller-driven aircraft.
   - How to measure the weight and center of gravity of an aircraft.

T&E 4102 Performance Flight Testing II

This course is offered once per year on-campus and once per year distance learning. The course is designed to provide a continuation of the theory and flight test techniques employed during the performance evaluations of propeller-driven aircraft. An intensive overview of the methods used to make cruise performance evaluations of turbine and jet powered aircraft. Emphasis is placed on stalls and turbine/jet engine theory. Climb and turn performance testing for all types of aircraft is also taught. Energy management and transonic/supersonic aerodynamics are also covered.

Pre-requisites:

- T&E 4001 & 4101.

Anticipated Course Learning Outcomes:

a. Be familiar with
   - Supersonic Aerodynamics Principles
   - Transonic Aerodynamics Principles

b. Understand
   - Turbine engine theory and test procedures.
   - Optimization and Prediction of Cruise Performance
   - Aircraft energy management concepts.
   - Advanced Performance – Gathering Techniques

c. Know
   - Climb performance theory and test methods.
   - Turn performance theory and test methods.
   - Stall theory and test methods.
   - How to test and evaluate cruise performance of a jet aircraft.

T&E 4103 Flying Qualities Flight Testing I

This course is offered once per year on-campus and once per year distance learning. The course is designed to provide an intensive overview of the methods used to make static stability determinations of aircraft. Subjects include the theory, regulatory requirements and flight test techniques involved in determining the longitudinal, lateral-directional, maneuvering, and flight path stability of single and multi-engine aircraft. Engine out testing of multi-engine aircraft is included along with a brief explanation of mechanical flight control systems and Mach effects on stability and control.

Pre-requisites:

- T&E 4001, 4101 & 4102.

Anticipated Course Learning Outcomes:

a. Be familiar with
   - Aircraft trim systems.
   - Mach effects on stability and control.

b. Understand
   - Mechanical flight control systems.
   - Regulatory requirements of each type of stability.
   - The big picture of flying qualities evaluation.
   - How to determine the engine-out capability of an aircraft.

c. Know
   - How to determine the longitudinal static stability of an aircraft.
   - How to determine the maneuvering stability of an aircraft.
   - How to determine the lateral-directional static stability of an aircraft.
   - How to determine the flight path stability of an aircraft.

T&E 4104 Flying Qualities Flight Testing II

This course is offered once per year on-campus and once per year distance learning. This follow-on course to T&E 4103 is designed to provide an intensive overview of the methods used to make dynamic stability determinations of aircraft.

Pre-requisites:

- T&E 4001, 4101, 4102 & 4103.

Anticipated Course Learning Outcomes:

a. Be Familiar with
   - The fundamentals of aircraft motion analysis and the equations of motion.
   - Aircraft coupling dynamics

b. Understand
   - Aircraft dynamics theory
   - Regulatory requirements pertaining to aircraft dynamics
   - Regulatory requirements pertaining to aircraft departure susceptibility, and spin recovery devices.

c. Know
   - Flight test techniques used to quantitatively and qualitatively determine aircraft dynamics
   - Spin theory and flight test techniques
   - Closed-loop handling qualities testing and techniques.
   - How to determine the stall characteristics of an aircraft.

T&E FW 4105 Modern Flight Controls

The course is designed to provide a "top-level" introduction to Modern Flight Control Systems (FCS's). Basic elements of modern FCS's are reviewed along with typical basic structures and system elements for modern fly-by-wire FCS's. Classic linear control tools (Root Locus, Bode Plots, Block Diagram Algebra) and their practical application are discussed. Modern software analysis tools are introduced and demonstrated during the course. Handling qualities criteria and special issues related to modern complex FCS's such as Pilot Induced Oscillations (PIO's) are reviewed. The need for systematic closed-loop handling qualities evaluations is emphasized. Different control strategies are presented (pre-filters, response feedback, g-command and q-command systems, and model following). The effects of common control system feedback implementations are presented using software and the dedicated Navion and FastJet Variable Stability Ground Simulators (VSGS) and Variable Stability Instructors. Command path shaping and the effects of time delay and rate limiting are also discussed. Course learning objectives are reinforced when students go through a hands-on guided demonstration on the VSGS. The objective of the course is to provide a high level of understanding of the Principles, Issues, and Test Methods related to modern FCSs to enable the student to conduct a professional engineering evaluation. Daily review, tutorials and a final written exam are part of the course.

Pre-requisites:

- T&E 4001, 4101 (or 4111), 4102 (or 4112), 4103 (or 4113) & 4104 (or 4114).

The Anticipated Course Learning Outcomes:

a. Be familiar with
   - Block diagram representation of a system and block diagram Algebra.

- Generic structure of flight control systems.
- The Poles and zeros formalism of a system
- Application of Pre-filters in modern flight controls systems.
- Response feedback technique used by modern flight control systems in order to augment stability of an aircraft.
- Effects of common parameters feedback on aircraft stability.
- Basic concepts of systems command and dynamic inversion.
- General design criteria used for modern flight controls.

b. Understand
- The relationship between poles location on the S-Plane and dynamic modes of the system.
- The relationship between transfer functions and frequency response of a system
- The meaning of Gain and Phase margins and how to extract those from the Bode plots.
- The meaning of bandwidth and phase delay and how to extract those from Bode plots.
- The basic approach in flight testing of a highly augmented aircraft. This includes angle of attack, pitch rate command / pitch attitude hold, NzU, Nz, C*U, C*, roll rate command / roll attitude hold, and P-Beta. This also includes envelope protection features.

c. Know
- How to construct Bode plots and how to interpret the frequency response information they retain.
- How to implement the Root Locus analysis in order to assess the closed loop stability of a system.
- How to use software to solve for basic stability augmentation problems.
- How to use the Cooper Harper rating scale, PIO rating scale, and comment cards for the evaluation of modern flight control systems
- How to use and set up synthetic tracking tasks

T&E 4106 FW Loads, Flutter & Stores Testing

This course is offered once per year on-campus. The course is designed to provide an extensive review of vehicle structures, loads and flutter/vibration testing takes the student from basic properties of materials through advanced instrumentation methods for determining vibrations/flutter regions and divergence. Industry standards for determining loads limits and vibrations/freedom from flutter are addressed as well as possible ways for obtaining required data in a limited amount of flight time. A study of the instrumentation installation on an NTPS aircraft enhances the students' knowledge of the correct test methods for in-flight loads determination. Stores clearance may be considered an extension of aircraft loads and flutter/vibrations testing. Unique stores load and flutter/vibrations issues are examined as well as theory and methods for clearing stores for external carriage and separation/launch.

Pre-requisites:
- T&E 4001, 4101, 4102, 4103 & 4104.

The Anticipated Student Academic Outcomes:

a. Be familiar with
- The aero-elastic/vibration effects of an aircraft.

b. Understand
- The properties of different materials used in aircraft.
- Performing basic loads testing of aircraft.
- Loads and ground vibration test methods.

c. Know
- The flight test techniques employed to determine aircraft in flight loads.
- The flight test techniques employed to demonstrate an aircraft is free from adverse aero-elastic/vibration effects.
- The theory & test methods to clear stores for carriage.
- The theory & test methods to clear stores for separation.

T&E 4107 Civil Aircraft Icing Certification

This course is offered twice per year on-campus and once per year distance learning. The course is designed to provide an in-depth discussion of icing cloud microphysics and atmospheric thermodynamics, FAA icing certification requirements, and ground and flight test procedures necessary to validate aircraft and ice protection systems to show compliance with the Federal Aviation Regulations.

Pre-requisites:
- T&E 4001.

The Anticipated Student Academic Outcomes:

a. Be familiar with
- Icing regulations and FAA / EASA guidance materials.
- Icing Certification procedures and processes.
- 14 CFR Part 25 & 29 / CS 25 & 29 Icing Envelopes and the need and methods for converting them to other exposure distances.

b. Understand
- The unique problems associated with airframe icing.
- Icing cloud formation.
- Data collection, reading, and data analysis procedures.
- Icing test principles and the reasons for dry air, simulated ice accretions and natural icing tests.
- The requirement for measuring icing cloud parameters.

T&E 4111 RW Performance Flight Testing I

This course is offered once per year on-campus. The course is designed to provide an intensive overview of the methods used to measure and predict performance of turbine engine helicopters. Emphasis is placed on subsonic aerodynamics, dimensional analysis, International Standard Atmosphere, pitot-static and turbine engine theory. Hover and vertical climb performance theory and flight testing methods are stressed.

Pre-requisites:
- T&E 4001.

The Anticipated Student Academic Outcomes:

a. Be familiar with
- Standard atmosphere and the associated tables.
- The non-uniform induced velocity theory through the hovering disk
- Basic definitions of disk loading, power loading, solidity ratio and figure of merit

b. Understand
- The fundamentals of dimensional analysis
- Subsonic aerodynamics principles
- Pitot static principles and PEC requirements
- Momentum theory and blade element theory
- Determination of turbine engine characteristics
- The effect of atmospheric properties and rotor parameters on the hover and vertical climb performance of a helicopter.

c. Know
- How Coefficient of Power and Coefficient of Thrust are used for determining hover ceiling
- How to measure and evaluate pitot static position errors
- How to test and evaluate hover performance of rotary wing aircraft
- How to assess engine performance
- How to measure the weight and center of gravity of an aircraft.

T&E 4112 RW Performance Flight Testing II

This course is offered once per year on-campus. The course is designed to provide a continuation of the theory and flight test techniques employed during T&E 4111 by providing an intensive overview of the methods used to measure and predict forward flight performance of turbine helicopters. Climb and descent performance testing is also taught, as is engine failure testing for single and multi-engine helicopters. The course also includes a through look into the takeoff and landing performance of a helicopter including the civilian regulation requirements.

Pre-requisites:
- T&E 4001 & 4111.

Anticipated Course Learning Outcomes:

a. Be familiar with
- FADEC testing.

b. Understand
- Transonic aerodynamics principles.
- Autorotation descent performance.

c. Know
- Climb and descent performance theory and test methods.
- Take-off/landing performance theory and test methods.
- Height-velocity theory and test methods.
- Level flight performance theory and test methods.
- How to predict significant airspeeds from performance data.
- The effects of engine failure.

T&E 4113 RW Flying Qualities Flight Testing I

This course is offered once per year on-campus. This course is designed to provide an intensive overview of the methods used to determine static stability of helicopters. Subjects include the theory, regulatory requirements and flight test techniques involved in determining the longitudinal, maneuvering and lateral-directional, stability of

helicopters. Mechanical flight control systems, low airspeed stability and control, and closed loop handling qualities are also are taught.

Pre-requisites:

- T&E 4001, 4111 & 4112.

Anticipated Course Learning Outcomes

a. Understand
   - Flight controls mechanical characteristics.
   - Fundamentals of helicopter equations of motion.
   - Helicopter trim systems.
   - Closed-loop handling qualities.
   - The applicable Mil and CFR/CS regulatory requirements.
   - Rotor system characteristics.

b. Know
   - How to determine the critical azimuth in the low airspeed envelope.
   - How to determine the longitudinal static stability of a helicopter using the appropriate flight test techniques.
   - How to determine the maneuvering stability of a helicopter using the appropriate flight test techniques.
   - How to determine the lateral-directional static stability of a helicopter using the appropriate flight test techniques

T&E 4114 RW Flying Qualities Flight Testing II

This course is offered once per year on-campus. The course is designed to provide an intensive overview of the methods used to make dynamic stability determinations of helicopters. Subjects include rotary wing equations of motion, dynamics requirements and flight test techniques. Included is a brief review of mathematical concepts used for analysis in the frequency domain such as the Laplace transform.

Pre-requisites:

- T&E 4001, 4111, 4112 & 4113.

Anticipated Course Learning Outcomes

a. Be familiar with:
   - AFCS flight testing.
   - Data analysis software applications.

b. Understand:
   - Fundamentals of aircraft motion analysis.
   - The regulatory requirements pertaining to helicopter dynamics.
   - Helicopter coupling dynamics.
   - ADS-33 closed loop handling qualities testing and techniques.
   - Rotary wing control and gust response.

c. Know:
   - The flight test techniques used to quantitatively and qualitatively determine helicopter dynamics.

T&E 4115 RW Modern Flight Control Systems

The course is designed to provide a "top-level" introduction to Modern Flight Control Systems (FCS's). Basic elements of modern FCS's are reviewed along with typical basic structures and system elements for modern fly-by-wire FCS's. Classic linear control tools (Root Locus, Bode Plots, Block Diagram Algebra) and their practical application are discussed. Modern software analysis tools are introduced and demonstrated during the course. Handling qualities criteria and special issues related to modern complex FCS's such as Pilot Induced Oscillations (PIO's) are reviewed. The need for systematic closed-loop handling qualities evaluations is emphasized. Different control strategies are presented (pre-filters, response feedback, and explicit model following). The effects of common control system feedback implementations are presented using software and the dedicated MBB Bo-105 full motion Variable Stability Ground Simulators (VSGS) and Variable Stability Instructors. Command path shaping and the effects of time delay and rate limiting are also discussed. Course learning objectives are reinforced when students go through a hands-on guided demonstration on the VSGS. The objective of the course is to provide a high level of understanding of the Principles, Issues, and Test Methods related to modern FCSs to enable the student to conduct a professional engineering evaluation. Daily review, tutorials and a final written exam are part of the course.

Pre-requisites:

- T&E 4001, 4111, 4112, 4113 & 4114.

Anticipated Course Learning Outcomes

a. Be familiar with
   - Block diagram representation of a system and block diagram Algebra.
   - Generic structure of flight control systems.
   - The Poles and zeros formalism of a system
   - Application of Pre-filters in modern flight controls systems.
   - Response feedback technique used by modern flight control systems in order to augment stability of an aircraft.
   - Effects of common parameters feedback on aircraft stability.
   - Basic concepts of systems command and dynamic inversion.
   - General design criteria used for modern flight controls

b. Understand
   - The relationship between poles location on the S-Plane and dynamic modes of the system.
   - The relationship between transfer functions and frequency response of a system
   - The meaning of Gain and Phase margins and how to extract those from the Bode plots.
   - The meaning of bandwidth and phase delay and how to extract those from Bode plots.
   - The basic approach in flight testing of a highly augmented aircraft. This includes rate feedback, rate command / attitude hold, attitude command / attitude hold, translational rate command, and position command. This also includes envelope protection features.

c. Know
   - How to construct Bode plots and how to interpret the frequency response information they retain.
   - How to implement the Root Locus analysis in order to assess the closed loop stability of a system.
   - How to use software to solve basic stability augmentation problems.
   - How to use the Cooper Harper rating scale, PIO rating scale, and comment cards for the evaluation of modern flight control systems
   - How to use software and ratings to predict flying qualities and handling qualities.

T&E 4116 RW Loads and Vibrations

This course is offered once per year on-campus. The course is designed to provide an extensive review of vehicle structures and then loads and vibration testing takes the student from basic properties of materials through advanced instrumentation methods for determining vibration frequencies. Industry standards for determining loads limits and vibration analysis are addressed as well as possible ways for obtaining required data in a limited amount of flight time. A study of the instrumentation installation on an NTPS aircraft enhances the students' knowledge of the correct test methods for in-flight loads and vibration determination.

Pre-requisites:

- T&E 4001, 4111, 4112, 4113, 4114 & 4105.

Anticipated Course Learning Outcomes

a. Be familiar with
   - The properties of materials used in RW aircraft structures.
   - Flight Test Instrumentations (FTI) used for RW aircraft loads and vibration testing.
   - The basic concepts and methods to alleviate inherent vibrations in RW aircraft.
   - The regulatory requirements pertaining to RW aircraft vibration levels.

b. Understand
   - The principal of operation of a stain-gauge.
   - The method of transforming in-plane stresses and strains.
   - The mechanism which governs the manifestation of main and tail rotor alternating loads as discrete fuselage vibrations.

c. Know
   - The flight test technique (FTT) used to conduct a RW aircraft vibration survey.
   - The practicality of decomposing a time-based measured signal into its frequency content using a FFT algorithm in engineering software.

T&E 4201 Avionics Systems Flight Testing

This course is offered once per year on-campus and once per year distance learning. The course is designed to provide the fundamental groundwork for all subsequent systems modules. An overview of testing integrated avionics systems is discussed. Software and avionics systems development and testing is explained. Types of Time, Space, Position Information (TSPI) and their relationship to flight test requirements are discussed. The basics of electrical circuits, electromagnetism and logic circuits are discussed. Data bus architecture and protocols shall be explained with an emphasis on MIL-STD-1553/SAE AS 15531. Data acquisition, correlation, merging and analysis with an inclination towards true versus predicted performance shall be explained.

Pre-requisites:

- T&E 4001.

Anticipated Course Learning Outcomes

a. Be familiar with:
   - Avionic systems data bus specifications and regulations
   - Electrical, electromagnetics and logic circuits as they relate to Avionics flight testing
   - Cyber security impacts on avionics system flight testing

b. Understand:
   - Other types of Data Busses
   - The unique problems associated with Avionics Systems Flight Testing
   - Software test and configuration management principles

c. Know:
   - Workload evaluation test techniques for Avionic systems.
   - Workload data collection and data analysis procedures
   - MIL-STD-1553B data bus architectures

T&E 4202 Communication, Navigation and GPS Flight Testing

This course is offered once per year on-campus and once per year distance learning. The course is designed to provide an extensive examination of Avionic communications and navigation systems, their modes of operation, and procedures for evaluating and testing the equipment are formulated. Electromagnetic interference and compatibility testing is discussed. Voice and datalink communication testing is discussed. Ground based radio navigation aids and GNSS flight testing are discussed. Inertial navigation systems and the testing of integrated navigation systems are explained.

Pre-requisites:
   - T&E 4001 & 4201.

The Anticipated Student Academic Outcomes

a. Be familiar with the fundamentals of:
   - Antennas
   - EMI/EMC
   - Inertial Navigation Systems
   - Integrated Navigation Systems
   - Data Link Communications and Tactical Datalinks
   - Transponders and ADS-B

b. Understand the:
   - Fundamental concepts behind GNSS and GNSS augmentation systems.

c. Know the technique for:
   - Evaluating radio communication intelligibility
   - Evaluating GNSS as installed on aircraft
   - Evaluating systems for Required Navigation Performance (RNP) operations
   - Evaluating ground based NavAids

T&E 4203 14 CFR Part 23/25/27/29 Avionics Certification Flight Testing

This course is offered once per year on-campus and once per year distance learning. The course is designed to provide a primary emphasis on the evaluation of civil avionics systems and the means of showing compliance with the applicable Civil Regulations i.e., Code of Federal Regulations Title 14 and Regulations (EU) 2018/1139 of the European Parliament and of the Council. Since many of the civilian requirements are now applicable in military aircraft, this module is especially important for those individuals involved with showing military compliance with these civil requirements. The importance of Flight Management System evaluation in today's automated cockpits will be emphasized. The student will be instructed in the evaluation and test of proximity warning systems such as Traffic Alert and Collision Avoidance (TCAS) and Terrain Awareness and Warning Systems (TAWS). Flight Guidance Systems,

Automated Landing Systems, Weather RADAR, Reduced Vertical Separation Minima and civil certification of positioning and navigation systems will be examined. A history of the Civil certification regulations and other documentation, as well as the Human Factors impact to certifications, will be addressed. Controls and Displays implementation, and Software considerations in the certification process, as well as considerations for complex systems are also identified.

Pre-requisites:

- T&E 4001 & 4201.

The Anticipated Student Academic Outcomes

a. Be familiar with:
   - The history and overview of Civil certification requirements
   - Civil certification requirements for software
   - Civil certification requirements for Avionic systems

b. Understand:
   - Civil certification requirements for crew station controls and displays
   - Human Factor effects on Civil certification requirements for Avionic systems
   - Civil certification requirements for Flight Management Systems and Flight Guidance Systems
   - Civil certification requirements for landing systems

c. Know:
   - The Civil certification process for issuing design, production and airworthiness approvals
   - The test and evaluation process of avionic systems to show compliance with Civil regulations

T&E 4204 Flight Test of RADAR and Electronic Warfare Systems

This course is offered once per year on campus. The course is designed to assist the student in the development and test of airborne RADAR systems. The basic concept and modes of operation as well as RADAR fundamentals are explained in detail. The student is afforded hands-on operation of the Camber Corporation RADAR toolkit. This simulation is a complex, real-world, energy level model of the emitted radio transmissions and incorporates a digital terrain database to show the student effects of changing RADAR parameters on RADAR performance. Lectures cover basic RADAR theory as well as the multi-mode operation of today's airborne applications. The student will learn the most correct and efficient methods of demonstrating specification compliance and performance of airborne RADARs.

Pre-requisites:

- T&E 4001 & 4201.

Anticipated Course Learning Outcomes

a. Be familiar with:
   - EW Introduction and Integrated Air Defense systems (IADS)
   - Electronic Attack
   - Electronic Protection
   - Electronic Support

b. Understand:
   - Basic RADAR fundamentals
   - RADAR modes of operation

- Pulsed, Doppler and Pulse Doppler RADAR
- Test and Evaluation of EW Systems

c. Know:
- Test and Evaluation of Air-to-Air RADAR
- Test and Evaluation Air-to-Ground RADAR

T&E 4205 UAV Systems Test

This course is offered once per year on-campus. The course is designed to address the unique testing requirements when evaluating a UAV system. It is assumed that the participants are generally knowledgeable in manned aircraft flight testing as this course builds on that knowledge. Course lectures will introduce the students to UAV-specific testing when compared to manned Fixed and Rotary Wing testing. Issues such as data latency, human factors, data link coverage, failure modes, contingency management, telemetry issues, guidance, navigation and control, mission planning, and sensor cueing/integration will be addressed. Flight Test Techniques for testing both Remotely Piloted and Command Directed (autonomous) Vehicle modes will also be covered.

Pre-requisites:
- T&E 4001 & 4201.

Anticipated Course Learning Outcomes

a. Be familiar with:
- The techniques for UAV guidance, control, and limit protection flight test
- The techniques for UAV command and control link and sensor link ground/flight test
- Airworthiness Requirements (Civil and Military) for UAVs
- The requirements for assessing human factors of UAV Ground Control Stations (GCSs)

b. Understand:
- The fundamental differences in ground/flight testing of a UAV system versus a manned aircraft
- The primary modes for controlling a UAV, to include Remotely Piloted Vehicle (RPV) and Command Directed Vehicle (autonomous) operations
- The fundamentals behind UAV data link communications
- The concept of sense and avoid systems and their importance to UAV operations
- The techniques and data analysis for Unmanned Air Vehicle (UAV) systems ground/flight test

c. Know:
- The techniques for assessing human factors of UAV Ground Control Stations (GCS)
- The development of a structured test plan/cards for UAV systems ground/flight test
- The fundamentals of safety planning and risk mitigation for UAV systems ground/flight test
- The approach to safely and effectively executing a UAV systems flight test sortie

T&E 4206 Air-to-Air and Air-to-Ground Weapons Integration

This course is offered once per year on-campus. The course is designed to provide an overview of MIL-STD-1760D/E, Interface Standard for Aircraft/Store Electrical Interconnection Systems as the baseline for Weapons Integration. Evaluation of Stores Management Systems (SMS) and Hazard Analysis considerations are covered. Error budgeting and analysis are key elements in undertaking ballistics evaluations.

Pre-requisites:

- T&E 4001 & 4201.

Anticipated Course Learning Outcomes

a. Be familiar with:
   - MIL-STD-1760D/E
   - Weapon to aircraft interface
   - Weapon templates and safety footprints
   - Air drop testing

b. Understand:
   - Stores Management Systems
   - Error budgets
   - Weapons accuracy analysis

c. Know:
   - Air-to-air weapons evaluations techniques and considerations
   - Air-to-ground weapons evaluations techniques and considerations
   - Weapon evaluations hazard analysis considerations

T&E 4207 Electro-Optics and Infrared Systems Flight Testing

This course is offered once per year on campus. The course is designed to provide a review basic Electro-optical (ultraviolet, visible and infrared) theory and then teach practical application of this theory. Electro-optical ground and flight test theory shall be explained and demonstrated. The first part of the course is designed to review radiation theory, while the remainder is arranged to review, in significant detail, typical electro-optical systems components and both passive and active electro-optical systems. Test plan formulation and the determination of the necessary test points for validating system capabilities are also addressed.

Pre-requisites:
- T&E 4001 & 4201.

Anticipated Course Learning Outcomes

a. Be familiar with:
   - The history, evolution and application of electro-optic and infra-red systems
   - Electro-Optic and Infra-Red system components

b. Understand:
   - Atmospheric propagation
   - Target signatures
   - Sources of radiation
   - Lasers and laser range finders

c. Know:
   - How to calculate spatial frequency
   - How to calculate range predictions
   - How to conduct electro-optic and infra-red systems evaluations

T&E 4208 NVG & HMD Testing

This course is offered twice per year on-campus. The course is designed to provide technical information and human factors considerations regarding Helmet Mounted Displays (HMDs), Night Vision Imaging System (NVIS) compatible lighting, and the integration of both into an aircraft. Emphasis is placed on hands-on test techniques to evaluate the total NVIS as integrated in fixed and rotary wing aircraft. The academic lectures are reinforced during laboratory demonstrations and through practical exercises performing both ground and flight-testing. This course enables the students to effectively plan and execute HMD and NVIS ground and flight tests.

Pre-requisites:

- T&E 4001.

Anticipated Course Learning Outcomes

a. Be familiar with:
   - Night Vision Imaging Systems (NVIS) lighting specifications and Code of Federal Regulations (CFR) Title 14, NVG requirements.
   - HMD relay optics considerations
   - HMD head tracking systems

b. Understand:
   - Night vision sensors and image sources
   - Image intensification technology
   - NVIS modification methods for interior and exterior lighting
   - Biodynamics factors affecting HMD designs
   - NVIS to aircraft integration testing
   - Aeromedical and human factor considerations

c. Know:

   - Procedures for helmet mounting, aligning and adjusting the focus of NVG
   - Evaluate the NVG image for possible defects
   - Perform a qualitative evaluation of the NVG performance
   - Perform a ground and flight evaluation of a NVIS

T&E 4301 Independent Research

Independent research on a topic selected with the approval of the student's advisor. This module is worth between 1 and 3 quarter credits, depending on the scope of work agreed upon by the student advisor.

Financial Information

Refund/Cancellation Policy

STUDENT'S RIGHT TO CANCEL: Students have the right to cancel their enrollment with National Test Pilot School. Attendance at the first class session is the last day to cancel and obtain a refund of charges paid. The method of communication by the student to NTPS will be in writing. The date that the withdrawal is considered effective, is the date that the communication from the student is received by NTPS. If you cancel any payment you have made, except for nonrefundable/cancellation fees, shall be returned to you within 30 calendar days following the receipt of your written notice to withdraw from the program.

The National Test Pilot School reserves the right to cancel any course and return all fees in the event of insufficient registration. In this event, NTPS will not be responsible for any expenses incurred by the registrants, including but not limited to airline cancellation charges or hotel deposits.

Tuition

Tuition for the current academic year is posted on the NTPS website (http://www.ntps.edu/information/schedule-costs).

All tuition and fees as specified are in US Dollars (USD). The minimum charge for attendance and completing a master's degree in the NTPS is valued at approximately $54,130 USD. This charge is also estimated as the total charges for the entire master's degree educational program. A detailed example breakdown of the charges can be found below.

The National Test Pilot School is committed to providing an exceptional educational experience at a reasonable cost. For more detailed information about tuition and fees, contact our student office at 661-824-2977.

Bills for tuition are issued when a student registers and are payable prior to the first day of class. There are typically no incidental fees at NTPS but, if a student employs NTPS assets such as aircraft or simulators during his or her project research, the use of those assets and any fees for such use will be negotiated on an individual basis. All fees are payable in U.S. dollars. The National Test Pilot School is not currently a Title IV university and therefore does not participate in federal or state financial aid programs and does not provide any other form of financial aid or student loans.

Example Minimum Charges for a Master's Degree Educational Program (48 quarter credits)

Core Academic Modules		Cost	Quarter Credits
T&E 4001	**Fundamentals of Flight Test**	$2,995	3
T&E 4002	**Test Management / Operational Test and Evaluation**	$2,995	3
T&E 4003	**Capstone Project**	$2,995	3
T&E 4007	**Introduction to Fixed Wing P&FQ Flight Testing**	$12,200	6
T&E 4101	**FW Performance Flight Testing I**	$2,995	3
T&E 4102	**FW Performance Flight Testing II**	$2,995	3
T&E 4103	**FW Flying Qualities Flight Testing I**	$2,995	3
T&E 4104	**FW Flying Qualities Flight Testing II**	$2,995	3
T&E 4105	**Modern Flight Control Systems**	$2,995	3
T&E 4106	**Structures, Loads, and Flutter**	$2,995	3
T&E 4201	**Avionics Systems Flight Testing**	$2,995	3
T&E 4202	**Communications, Navigation, and GPS Flight Testing**	$2,995	3
T&E 4203	**14 CFR Part 23/25/27/29 Avionics Certification Flight Testing**	$2,995	3
T&E 4204	**Flight Test of RADAR and Electronic Warfare Systems**	$2,995	3
T&E 4207	**Electro-Optics and Infrared Systems Flight Testing**	$2,995	3
	Total Charges	$54,130	48