

NEW OFFERING



CERTIFICATE IN AEROSPACE INNOVATION

Innovation through entrepreneurship is the future of aerospace. Let us show you how to get there.

OVERVIEW

This certificate program is offered by the **MIT Department of Aeronautics & Astronautics** in collaboration with the **MIT Innovation Initiative** and the **Martin Trust MIT Center for Entrepreneurship**. Open to graduate students (S.M./Ph.D.), postdocs, and staff, the program is taking place this Fall, IAP, and Spring semesters, and is comprised of three elements:

LEARN FROM THE BEST

The **cross-disciplinary curriculum** consists of coursework in the aerospace-focused domain and in the entrepreneurship-focused domain offered by the Sloan School of Management. The certificate program is optional, but some associated classes and workshops may carry academic credit that may be counted to a degree program. To obtain the certificate, students are expected to complete 18 units. [View the full curriculum online.](#)

DO IT YOURSELF

During the Independent Activities Period (IAP) in January, students will participate in the **Aerospace Innovation Workshop**, where they will be expected to draft a business plan and pitch deck (a short 20-minute presentation) for a new aerospace-related startup. Working in teams, students will present their business plans identifying the underlying technical innovation and potential for business disruption to a panel of aerospace-related venture capitalists and entrepreneurs for feedback and scoring. A sponsored prize of \$10K will be awarded to the top finisher.

Alternatively, students can satisfy the requirements for the certificate by participating in some of the hands-on MIT summer programs in entrepreneurship and business acceleration, such as [MIT Delta v](#) or the [Venture Exploration Program](#).

HEAR FROM EXPERIENCE

The **Aerospace Innovator's Seminar Series** will feature speakers from some of the biggest names in entrepreneurial aerospace — many of whom started from exactly where you are, as students in AeroAstro!

YOU BELONG WHERE THE FUTURE IS HAPPENING

Register | <http://tiny.cc/aa-innovation>

Learn more | <http://tiny.cc/aa-innovation-more-info>

Contact | aa-innovation@mit.edu



Certificate in Aerospace Innovation

Department of Aeronautics and Astronautics
Massachusetts Institute of Technology

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Introduction

The field of *Aerospace Engineering* as we know it today started in the late 1800s and early 1900s with the advent of heavier-than-air aircraft pioneered by the Wright Brothers (and others), leading to their first successful flight at Kitty Hawk in 1903. The early days of aviation were marked by individual inventors and experimentation and relatively little government intervention or sponsorship. One important exception is the subsidized air mail service. Prizes for establishing new records for distance and endurance were a major driver of progress. This changed with the advent of WWI and WWII, where aviation became a major contributor to the war effort. In space, the story begins in 1957 with the launch of Sputnik by the Soviet Union and continued with the lunar landings of the U.S. Apollo program from 1969-1972. Today, the aerospace sector has returned to its original roots of innovation and entrepreneurship, driven not exclusively by large government or corporate entities, but by small and mid-size firms. These are experimenting with, and launching electric Vertical Takeoff and Landing and electric Short Takeoff and Landing (eVTOL and eSTOL) vehicles, cutting-edge CubeSat missions, and new drone-enabled services that offer data analytics in agriculture, renewable energy and in other sectors. Students in Aerospace Engineering and related fields have expressed a strong desire to hear from and learn about how to launch their own ventures and initiatives in aerospace. Responding to this need the MIT Department of Aeronautics and Astronautics (“MIT AeroAstro”) is proud to launch a new *Certificate in Aerospace Innovation* in collaboration with the MIT Innovation Initiative and the Martin Trust Center for MIT Entrepreneurship.

Offering

The new *Certificate in Aerospace Innovation* will initially be open to graduate students (SM, PhD) and postdocs, as well as staff members who wish to participate in it. The certificate is open to candidates with a valid MIT ID number. In future years the program may be expanded to undergraduates and alumni, but we initially focus on the graduate population. We expect that about 10-20 participants will obtain the certificate each academic year. The certificate is open to all graduate students, postdocs and staff in the MIT community, however, in the case of over-enrollment, first priority will be given to applicants associated with Course 16, i.e. MIT AeroAstro.

The certificate is optional and is not a requirement for graduation at the S.M. and Ph.D. level. It is a co-curricular offering, however some of the classes and workshops associated with it may carry some academic credit that may be counted towards a degree program.

Curriculum

1. Core class and electives

The following classes and organized activities are part of the certificate. These classes are both aerospace domain specific (left side) and entrepreneurship and innovation specific (right side). The list of classes will be reviewed and updated on an annual basis.

Aerospace Domain Classes	Innovation Domain Classes
16.445J Entrepreneurship in Aerospace and Mobility Systems (3-0-9= 12 unit ¹ (new))	16.990 Leading Creative Teams (3-0-6= 9 units) ³
16.71 The Airline Industry (3-0-9= 12 units)	6.927 Negotiation and Influence Skills for Technical Leaders (2-0-4 = 6 units) (new)
16.886 Air Transportation Systems Architecting (3-2-7 = 12 units)	6.S979 Multi-Stakeholder Negotiation for Technical Experts (2-0-4 = 6 units)
16.893 Engineering the Space Shuttle (3-0-9 = 12 units)	15.390 New Enterprises (2-2-8 = 12 units)
16.895[J] Engineering Apollo: The Moon Project as a Complex System (4-0-8 = 12 units)	15.378 (G) Building an Entrepreneurial Venture: Advanced Tools and Techniques (3-1-8 = 12 units) - prerequisite: 15.390
16.707[J] The History of Aviation (3-0-9 = 12 units)	15.364 Innovation Ecosystems for Regional Entrepreneurship Acceleration Leaders (iEco4REAL) (3-0-6 = 9 units)
	15.368 Disciplined Entrepreneurship Lab (1-0-5 = 6 units)

¹ New course to be offered by Prof. David Mindell

³ This class also counts towards the Graduate Certificate in Technical Leadership awarded by the GradEL program and the MIT School of Engineering

<p>16.88[J] Prototyping our Sci-Fi Space Future: Designing & Deploying Projects for Zero Gravity Flights (3-0-9 = 12 units) (new)</p> <p>16.S982 Business Principles in the Space Industry² (3-0-6=9 units)</p>	<p>15.379[J] Mobility Ventures: Driving Innovation in Transportation Systems (3-3-6 = 12 units) (new)</p> <p>15.394 Entrepreneurial Founding and Teams (3-0-6 = 9 units)</p> <p>15.618 Entrepreneurship, Innovation, Startups and the Law (2-0-4 = 6 units)</p> <p>6.903 Patents, Copyrights, and the Law of Intellectual Property (2-0-4 = 6 units)</p>
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In order to qualify for the *Certificate in Aerospace Innovation*, candidates must take at least two classes from this list for credit and must receive at least a letter grade of B or a P/PE for each class. At least one class must be from the aerospace domain (left column), and one from the innovation domain (right column) for a total of at least 18 units. Candidates for the certificate are welcome to take additional classes but the above requirement is the minimum. If a candidate opts to take the [MIT delta v](#) or the [Venture Exploration Program \(VEP\)](#), units will be counted as shown in track B below.

2. Aerospace Innovation Workshop (during IAP)

During the Independent Activities Period (IAP) in January the MIT Department of Aeronautics and Astronautics will sponsor an aerospace innovation workshop. The main deliverables of the workshop are a draft business plan and a pitch deck (a short 20 min presentation followed by Q&A with a panel of judges representing potential investors) for the creation of a new aerospace-related startup. This workshop will be offered annually during January and will guide participants (typically in teams of two or three) to jointly develop an aerospace-related business plan, including the explanation of the underlying technical innovation and potential for business disruption. This business plan will then be pitched to a panel of aerospace-related venture capitalists and entrepreneurs for feedback and scoring. A sponsored cash prize of \$10K will be awarded by MIT AeroAstro to the top finisher.

² This class was offered in Fall 2019 as a one-time offering by Prof. David W. Thompson (Hunsaker Visiting Professor), but could be expanded to a regular class using a mix of pre-recorded video lectures, live lectures and interactive exercises. Email: aa-innovation@mit.edu if you are interested in this class.

Participation in the IAP aerospace innovation workshop is mandatory to obtain the graduate certificate in aerospace innovation for those selecting track A.

3. Aerospace Innovator's Seminar Series

The number of aerospace startups has been growing sharply over the last 5-10 years. Companies that will be invited to present at the aerospace innovator's seminar series include founders from MIT, but not exclusively so. We will change the mix of companies that present every year. The seminar series may also include innovation units that are part of or embedded in larger organizations such as Skunkworks (Lockheed Martin), etc.. We will strive for a healthy balance of aeronautics and astronautics businesses.



Upper left to lower right: Accion Systems, Raptor Maps, Blue Canyon Technologies, Zipline, iSpace

Potential companies to be invited to present at the innovator's workshop series:

- Accion Systems - electrospray propulsion systems
- Raptor Maps - drone diagnostic services for solar farms (winner 2015 MIT 100K)
- Humatics - geolocation services for manufacturing and mobility
- Aurora Flight Sciences - drones and urban air mobility (UAM)
- Blue Canyon Technologies - Cubesat hardware and software and mission design
- Princeton Satellite Systems - Attitude control system design for satellites
- Virgin Orbit - air-launching services to orbit for small satellites from a B747
- Blue Origin - space tourism, launch vehicles and services, and lunar logistics
- SpaceX - launch services (Falcon-9, Starship) and communications (Starlink)
- Motional - self-driving vehicles (formerly nutonomy)
- Zipline - delivering medical supplies via drones in Africa and Asia

- Spinlaunch - launching small rockets via centrifuge under partial vacuum
- iSpace - Japanese startup working on lunar in-situ resource utilization
- Made in Space (Redwire) - in-space manufacturing with 3D printing on ISS et al.
- Altaeros - providing connectivity to un/under-served rural communities
- Terrafugia - “Transition” flying car for future hybrid road and air mobility
- XWing - autonomy software and solutions for unmanned aircraft
- Others (e.g. Merlin, Beta, Whisk, Joby, Archer ...)

To ensure some consistency across the monthly seminar series on aerospace innovation we will pose each presenter the following questions to be addressed during their talk. They may choose to focus on a subset of these in their presentation and interaction with the participants:

- *When and why did you start the venture?*
- *What is the key product or service offering of your firm?*
- *How has being an entrepreneur affected your professional and personal life?*
- *Who is your competition and what are the key hurdles to success?*
- *What are the key differentiators and what is your competitive advantage?*
- *How do you know your idea will be successful?*
- *What are your three most important recommendations to new aerospace innovators?*
- *What are the key technical and leadership skills needed by current and future aerospace innovators?*
- *What values and attitudes do you find particularly important when fundraising and talking to prospective investors and employees?*

All of these talks will be offered on zoom but there will also be an in-classroom opportunity for participation on the MIT campus (hybrid format). Participation and attendance will be logged for each session and counted towards the certificate.

4. MIT entrepreneurship accelerator programs

One alternative way in which participants can satisfy the requirements for the certificate is to participate in some of the hands-on MIT summer programs in entrepreneurship and business acceleration. This is what we call “track B”. We recommend these two programs at MIT:

- MIT delta v (3 month summer program) in a co-working environment provided by the MIT Trust Center for Entrepreneurship to work on transforming an idea to a company : <https://entrepreneurship.mit.edu/accelerator/program/>

- Venture Exploration Program (6 week summer program) which is a step-by-step guided journey along the key milestones of entrepreneurship . For details on this program go to: <https://innovation.mit.edu/vep/>

MIT delta v is a three month summer entrepreneurship acceleration program (June to September) hosted at the MIT Martin Trust Center for Entrepreneurship. Over this period teams will define and refine their target market, conduct primary market research and build knowledge about their customers and users. They will run experiments to validate or invalidate their key hypotheses with potential customers. They will be building and nurturing their founding team. They will make progress on the mechanics of starting their venture. Several MIT | Aero Astro startups have successfully participated in the delta v program in the past. Entry to the delta v program is subject to a competitive application process given limited capacity.

VEP is a 6-week, virtual program for PhD students, postdocs, and staff researchers to develop a business model for their research-derived product or service. VEP is also offered over the summer and is the successor to the former Translational Fellows Program (TFP) at MIT. Participants learn the methodology and techniques of customer discovery—the process of obtaining valuable, firsthand feedback on ideas for the use of a technology—and business model development. Additionally, they are able to apply for day-a-week funding through participation in the [NSF I-Corps](#) national program.

Successful completion of either the delta v or the VEP programs will yield an equivalent credit of 6 units towards the *Certificate in Aerospace Innovation*, from the right column in the table of classes shown above, and also count in lieu of the participation in the IAP Aerospace Innovation Workshop.

However, participants who successfully complete either the delta v program or the VEP are still welcome to participate in the IAP Aerospace Innovation Workshop should they choose to do so (but it is not a formal requirement for delta v or VEP graduates).

We will recruit participants into the Aerospace Innovation Certificate at the start of each term (Fall and Spring) and hold information sessions as well as send updated flyers and “live” information sessions. At the moment of enrollment in the *Aerospace Innovation Certificate* each participant will be asked about their current academic standing and will be required to submit answers to short essay questions as to their motivation for participating in the program. They will also be asked which track, A or B, they wish to participate in. It is possible to switch tracks after starting the certificate.

There are two different tracks A and B for earning the *Certificate in Aerospace Innovation*. The main difference between the tracks is the participation in one of MIT's official entrepreneurship summer programs (see 4. below).

Requirements for earning the Aerospace Innovation Certificate

Element	Track A	Track B
1 Aerospace Innovation Classes	minimum 18 units one class from each domain column	minimum 12 units minimum one from aerospace domain
2 Aerospace Innovation Workshop (IAP) - Competition for a \$10K Prize	X	
4 Aerospace Innovator Seminar Series (monthly sponsored talks)	attend a minimum of 4 seminars	attend a minimum of 6 seminars
4 MIT Summer Acceleration Program (either delta v with Trust Center, or VEP with MIT Innovation Initiative)		X

Logistics

The new certificate will launch in September 2021 in collaboration with the [MIT Innovation Initiative](#) and the [Martin Trust Center for MIT Entrepreneurship](#). A flyer, program description, and information session will be organized for potential participants. Participants will be asked which track they want to join (A or B) and the department will keep track of attendance. Participants can switch tracks if they choose to do so.

The program is financially supported by the [MIT AeroAstro](#) department initially, but will then move to a fundraising model with both operating and endowed funds coming from individual and corporate donors. There is no extra cost for participation in this program.

The first IAP Aerospace Innovation Workshop will be offered in January 2022.

We expect the first *Certificates in Aerospace Innovation* to be awarded in June 2022. Our initial goal is to have about 50 certificates awarded in the first three years of the program.

The program is managed by a small committee at MIT AeroAstro (Prof. O. de Weck, Prof. Z. Spakovszky, Julie Finn (coordinator), Beth Marois (graduate administrator)) and can be reached at: aa-innovation@mit.edu.

References

List of Aerospace Startups: <https://angel.co/aerospace>

Werner D., “Frustration drove scientist to entrepreneurship”, Aerospace America, June/July 2020, online version:

<https://aerospaceamerica.aiaa.org/departments/frustration-drove-scientist-to-entrepreneurship/>