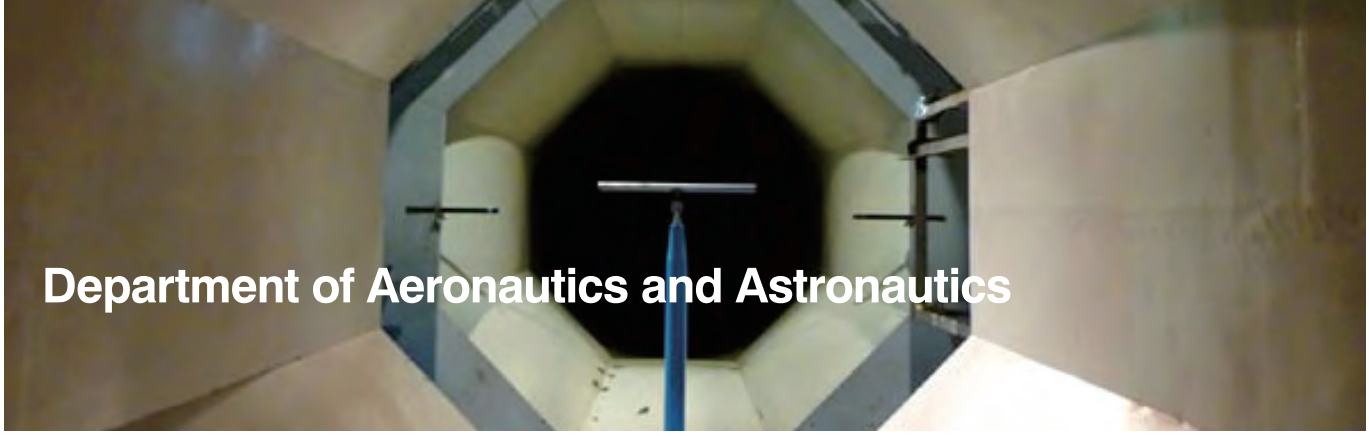
TOKYO METROPOLITAN UNIVERSITY

Faculty of Systems Design
Graduate School of Systems Design

TOKYO
METROPOLITAN
UNIVERSITY

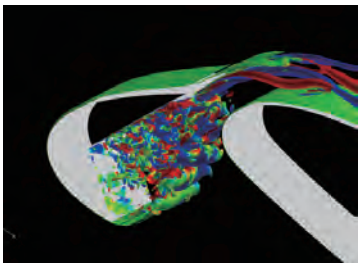
Department of Aeronautics and Astronautics

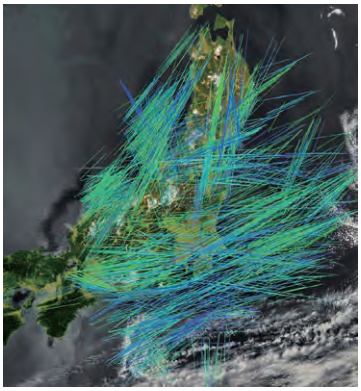
https://aeroastro.sd.tmu.ac.jp/



Department of Aeronautics and Astronautics

Introduction

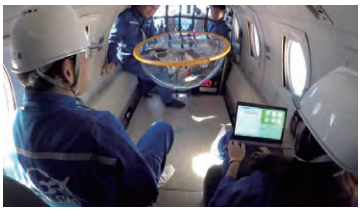




Transportation by large, long-range aircraft, the flight of space shuttles, and the construction of the space station are some examples of recent developments in aerospace engineering. These developments highlight cutting-edge technologies such as lightweight and high-strength materials, heat-resistant structures, miniaturization, highperformance propulsion systems, reductions in air drag, large-scale numerical simulations, and the construction of large structures in space. Aircraft for transportation, and artificial satellites for communication, GPS, and weather forecasting are part of our daily lives. These aerospace technologies are key technologies that support our modern society.

Tokyo is an international hub for human and technological exchange and has an important role to play through its international airport and in the overall development of the aerospace industry. Space-based information systems using satellites are essential in helping to prevent disasters and to observe and monitor the environment. In the Department of Aeronautics and Astronautics at Tokyo Metropolitan University (TMU), students are encouraged to study the elemental and systematic technologies necessary for the development and utilization of aircraft and spacecraft. Students are encouraged to become engineers and researchers who can apply knowledge and who have broad vision to enable the development of the next generation of scientific technologies, including those in the aerospace field.

“What” and “How” Do You Study?



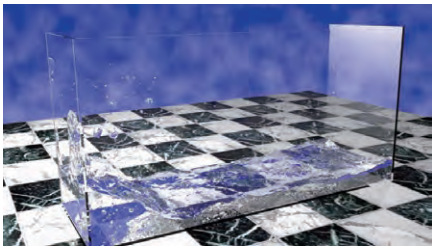
In undergraduate classes, students study the fundamental subjects of mathematics, physics, and chemistry. They proceed to study aerodynamics, propulsion engineering, structure and material dynamics, and control engineering. Upon completion of these studies, students will understand the system engineering for designing aircraft and spacecraft. The program includes studies of space utilization, space information,communication, and systems design. It is a program that will allow our students to play a role in a wide variety of fields.

Laboratories and exercises using “hands on” devices are essential in the study of aerospace engineering. For this purpose, experimental facilities include a large, low-speed wind tunnel, a supersonic/transonic wind tunnel, a jet engine, a small rocket engine, a large vacuum chamber, a flight simulator, a weightlessness simulator, and a hightemperature fatigue simulator. From the undergraduate stage, students can gain practical experience with these types of equipment, which will serve to enhance their skills and senses as engineers and researchers. In this manner, students can learn aerospace engineering through lectures, exercises, and laboratories.

In the fourth year, students are assigned to one of the laboratories. One faculty member will be responsible for a small group of about four students. In contrast to the prior three years of the program, students will study academic papers written in English, find core problems, select themes of study, find solutions by themselves, and present results to their peers. This is an arena for logical thinking and discussion and will help students to become experts in the field.

Educational Program

The Department of Aeronautics and Astronautics at TMU is interdisciplinary with teaching and research in the following six research areas: Aerodynamics and Fluid Dynamics; Materials and Structures; Propulsion Systems; Guidance, Control, and Dynamics; Systems Design Engineering ; and Space Utilization Technology.



Aerodynamics and Fluid Dynamics

Includes studies on boundary-layer instability and transition to turbulence, flow control for reduction of aerodynamic drag and sound, high-speed aerothermodynamics, and flow measurement techniques.

Associate Professors

INASAWA Ayumu (Aeroacoustics, Fluid Mechanics, Heat Transfer)
SHIMAMURA Kohei (Propulsion Systems)
TAGAWA Toshio (Magneto-hydrodynamics, CFD)

Propulsion Systems

Includes research on: electric and chemical propulsion systems for satellites/spacecraft, gas turbine engines for aircraft, and rocket engine systems for space launch vehicles.

Professor

KAKAMI Akira (Space Propulsion System)

Associate Professor

SAKURAI Takashi (Rocket Propulsion and Combustion)

Assistant Professor

NISHII Keita (Space Propulsion System)

Materials and Structures

The materials and structures area is categorized into: development of new light metals and composite materials, mechanical property analysis of high-performance materials, and the structural mechanics of satellites. Finite element analysis, numerical methods, and experimental studies are performed. Some experimental work is also carried out at the Japan Aerospace Exploration Agency (JAXA).

Professor

KITAZONO Koichi (Aerospace Materials)

Associate Professor

TORISAKA Ayako (Structural Dynamics, Space Structure)

Guidance, Control, and Dynamics

Includes theoretical, numerical, and experimental studies on dynamics and control of spacecraft and aircraft. Special attention is given to electrodynamic tether systems, space elevators, autonomous free-flying space robots, control moment gyros, underactuated spacecraft, formation flying, air traffic management, air traffic analysis, and trajectory optimization.

Professors

KOJIMA Hirohisa (Guidance and Control)
TAKEICHI Noboru (Air Traffic Management, Space Systems)

Assistant Professor

KESHTKAR Sajjad (Control and Design)

Systems Design Engineering

Includes research on design methodologies and their application, and development for components and systems of aircraft and spacecraft.

Professors

KANAZAKI Masahiro (Computer Aided Design)
SAHARA Hironori (Satellite System and Application)

Space Utilization Technology

Includes research and development of advanced capabilities in remote sensing, satellite communications, and key elemental technologies for space systems to bring space closer to our lives.

Professor

ISHII Shoken
(Fundamental Technology for Sensing available in Space)

Assistant Professor

TAKENAKA Hideki (Free-space Optical Communication)

Professors

Aerodynamics and Fluid Dynamics

Associate Professor
INASAWA Ayumu
Ph.D. in Engineering

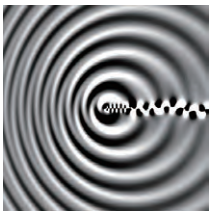
https://fluid.sd.tmu.ac.jp/

Lectures

■ Fluid Mechanics 1 ■ Aerodynamics 1
■ Advanced Aeroacoutics

Research activities

Wind-tunnel experiments and computational studies in the areas of aeroacoustics, heat-transfer, and trans- and super-sonic aerodynamics.



Vortex shedding and sound radiation in bluff body wake

Aerodynamics and Fluid Dynamics

Associate Professor
SHIMAMURA Kohei
Ph.D. in Engineering

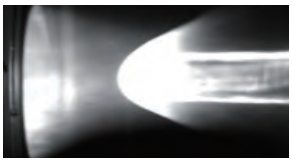
https://htgl.fpark.tmu.ac.jp/

Lectures

■ Propulsion 1
■ Aerodynamics 2

Research activities

Our research focuses on the hypersonic flow with the shock waves and ionized gas (plasma) using the wind tunnel experiments and numerical simulations.



Hypersonic wind tunnel experiment "Hayabusa Capsule"

Aerodynamics and Fluid Dynamics

Associate Professor
TAGAWA Toshio
Ph.D. in Engineering

https://aeroastro.sd.tmu.ac.jp/hydrodynamics/

Lectures

■ Fluid Mechanics 2 ■ Computational Fluid Dynamics 1
■ Advanced Numerical Fluid Dynamics

Research activities

We aim at elucidating various complex fluid phenomena including MHD, through the use of numerical simulations as well as experimental verification.

Propulsion Systems

Professor
KAKAMI Akira
Ph.D. in Engineering

https://sites.google.com/view/akira-kakami/

Lectures

■ Thermodynamics 2 ■ Aerospace Engineering : Experiment 1
■ Space Propulsion System

Research activities

Our laboratory focuses on small space propulsion devices (electric propulsion and chemical propulsion) and the thrust measurement using magnetic levitation to evaluate the thrust vectors.

Firing test of TAL type double channel Hall thruster

Propulsion Systems

Associate Professor
SAKURAI Takashi
Ph.D. in Engineering

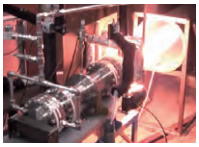
https://sites.google.com/view/tmupropulsion/home

Lectures

■ Thermodynamics 1
■ Combustion Phenomena ■ Combustion

Research activities

My research activities are related to aerospace propulsion and combustion. Research topics are (1) hybrid rocket engine toward safe and low-cost space transportation, (2) hydrogen combustion for aero-engines and industrial gas turbines toward realization of CO2 NetZero, and (3) pressure-gain combustion for improving the thermal efficiency of gas turbines.



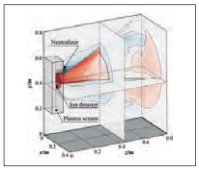
Swirling-flow hybrid rocket engine

Propulsion Systems

Assistant Professor
NISHII Keita
Ph.D. in Engineering

Research activities

I am working on both electric and chemical propulsion systems for spacecraft. The primary emphases are on developing new propulsion systems for microspacecraft and on studying facility effects during ground tests of the propulsion system through experiments and numerical simulations.



3D Particle-In-Cell simulation of ion thruster plumes in ground facilities

Materials and Structures

Professor
KITAZONO Koichi
Ph.D. in Engineering

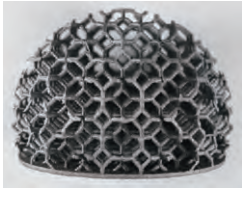
https://aeroastro.sd.tmu.ac.jp/materials/

Lectures

■ Strength of Materials ■ Aerospace Materials
■ Microstructure of Materials

Research activities

My research focuses on light metals and metal foams. Advanced energy absorbing materials have been developed through a collaborative research with JAXA.



Additively manufactured porous aluminum alloy

Materials and Structures

Associate Professor
TORISAKA Ayako
Ph.D. in Engineering

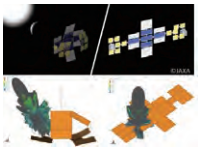
https://sss.fpark.tmu.ac.jp/

Lectures

■ Mechanics of Aerospace Structures 1,2
■ Light Weight Space Structures and Systems

Research activities

We are focusing on behavior analysis and design methods for the construction of lightweight large space structures such as solar sails and Solar Power Systems, and systematization using these. Recent topic is designing antenna performance and satellite body at the same time from the design stage.



Reflected antenna pattern by the structural panel of the Transformer Satellite

Guidance, Control and Dynamics

Professor
KOJIMA Hirohisa
Ph.D. in Engineering

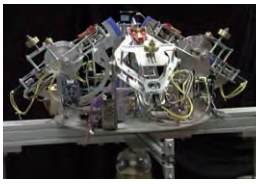
https://spacelab.fpark.tmu.ac.jp/

Lectures

■ Aerospace Control Engineering
■ Space Vehicle Control Engineering

Research activities

Main research interests include dynamics and control of spacecraft, such as electrodynamic tether systems, control-moment gyros, and space robotics.



Adaptive skew pyramid-array control moment gyro system

Guidance, Control and Dynamics

Professor

TAKEICHI Noboru

Ph.D. in Engineering

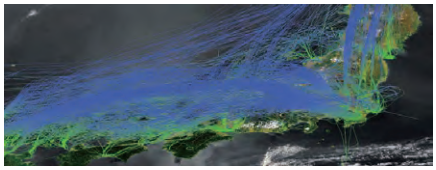
https://navi.fpark.tmu.ac.jp/

Lectures

- Dynamics of Atmospheric Flight
- Air Traffic Management

Research activities

Recent research topics include data analysis and 4D trajectory management for safe and efficient air transportation, as well as space traffic management, including space debris removal, for sustainable space activities.



Aircraft trajectories over Honshu

Guidance, Control and Dynamics

Assistant Professor

KESHTKAR Sajjad

Ph.D. in Engineering

https://spacelab.fpark.tmu.ac.jp/

Research activities

aerospace mechanisms, and development of mechanism and the logic of operation for the attitude control of complex space systems in special control moment gyros and tethered structures, covering both analytical and experimental activities

double-gimbal scissored-pair control moment gyros

Systems Design Engineering

Professor

KANAZAKI Masahiro

Ph.D. in Information Science

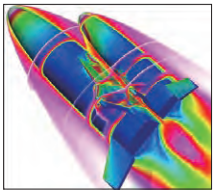
https://aerodesign.fpark.tmu.ac.jp/

Lectures

- Aerospace Design Engineering
- Computational Fluid Dynamics 2

Research activities

The main theme is the design of aircraft and spacecraft using numerical techniques. Our design targets are trans-sonic/supersonic aircraft integrated engine nacelles, winged spacecraft, re-entry capsules and hybrid rockets.



Numerical simulation for the separation phase of the next generation winged launch vehicle

Systems Design Engineering

Professor

SAHARA Hironori

Ph.D. in Engineering

https://ssl.fpark.tmu.ac.jp/

Lectures

- Basics of Vibration Engineering
- Astrodynamics

Research activities

We aim to create the future in space through the research and development of innovative space systems and their application in fields such as microsatellites.

Microsatellite, ORBIS

Space Utilization Technology

Professor

ISHII Shoken

Ph.D. in Science

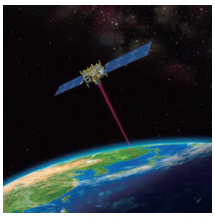
https://aa-sfl.cpark.tmu.ac.jp/aa_sfl/ja/index.html

Lectures

- Aerospace Radio Engineering
- Aerospace Information System Engineering

Research activities

We are studying sensing technology available in the field of aerospace. In the field of the sensing technology, we focus on an optical sensing technique in space, impact study of the space-based observations, and algorithm development for the air-borne and space-based sensing technique.



Space-based Doppler Wind Lidar

Space Utilization Technology

Assistant Professor

TAKENAKA Hideki

Ph.D. in Engineering

https://aa-sfl.cpark.tmu.ac.jp/aa_sfl/ja/index.html

Research activities

We are conducting research on free-space optical communication between satellites and the ground. Satellite-to-ground optical communications need to propagate through the atmosphere, the effect of atmospheric turbulence generated when passing through the atmosphere has become a problem. Therefore, we are studying the development of methods and algorithms to reduce the atmospheric fluctuation.

Satellite-to-ground optical communication

Cooperative Graduate School

Guest professor

MATSUMOTO Koji (Space Tribology)
Ph.D. in Engineering Affiliation: JAXA
https://www.kenkai.jaxa.jp/

Guest professor

MAKI Midori (Flight Systems Engineering)
Ph,D. in Engineering Affiliation:JAXA
https://www.aero.jaxa.jp/

Guest professor

KOGA Tadashi (Aircraft Communication,Navigation and Surveillance)
Ph.D. in Engineering Affiliation: ENRI
https://www.enri.go.jp/

Guest professor

MOROHASHI Isao (Radio Communication)
Ph.D. in Engineering Affiliation：NICT
https://www.nict.go.jp/

Curriculum

This course covers the fundamentals of aerospace engineering, and three subject groups that target (1) aerodynamics and propulsion systems, (2) dynamics and control, as well as space utilization of aircraft and spacecraft, plus elective compulsory subjects, and (3) materials and structural mechanics of aircraft, rocket, and spacecraft.
This curriculum will foster students learning through the trinity of lectures, exercises, and experiments.

Basic & liberal arts group

	Basic courses group	Cultural courses group	Introductory courses group
1st grade and 2nd grade	◎ Basic Seminar ◎ Language courses ◎ Information education courses ■ Career education courses ■ Health and physical education courses ◎ Elementary courses in science and technology	■ City, Society, and Environment ■ Culture, Arts, and History ■ Life, Humans, and Health ■ Science, Technology, and Industries ■ Synthesis Seminar	■ Humanities field ■ Social sciences field ■ Natural sciences field ■ Health sciences field

Major education group

	Compulsory / Elective Compulsory				
	Elementary courses in Aerospace Engineering	Aerodynamics and Propulsion Systems	Dynamics and Control / Space Utilization Technology	Materials and Structures	Other Departments
1st grade	◎ Introduction to Aerospace Engineering 1 ◎ Material Mechanics 1 ■ Introduction to Aerospace Engineering 2				■ Fundamentals of Electric Circuits
2nd grade	◎ Fluid Mechanics 1 ◎ Thermodynamics 1 ■ Thermodynamics 2 ◎ Basics of Vibration Engineering ■ Dynamics of Machines ■ Applied Mathematics and Dynamics : Exercise ■ Basics of Programming : Exercise ◎ Aerospace Engineering: Experiment 1	■ Fluid Mechanics 2	■ Fundamental Control Engineering	■ Strength of Materials ■ Aerospace Materials ■ Material Mechanics 2	
3rd grade	◎ Aerospace Engineering : Experiment 2 ■ Numerical Analysis : Exercise ■ Design and Drawing	■ Aerodynamics 1,2 ■ Computational Fluid Dynamics 1,2 ■ Propulsion 1,2 ■ Heat Transfer ■ Exercise in Thermodynamics ■ Combustion Phenomena ■ Space Propulsion System	■ Aerospace Control Engineering ■ Control Programming : Exercise ■ Space Vehicle Control Engineering ■ Satellite Communication Engineering ■ Astrodynamics ■ Dynamics of Atmospheric Flight ■ Aerospace Radio Engineering	■ Theory of Elasticity ■ Microstructure of materials ■ Mechanics of Aerospace Structures 1 ■ Aircraft Vibrations ■ Aerospace Design Engineering	
4th grade		■ Computational Fluid Dynamics : Exercise	■ Space Project Engineering ■ Spacecraft Systems Engineering : Exercise	■ Mechanics of Aerospace Structures 2 ■ Mechanics of Materials and Structures : Exercise	

	Graduation work in Aerospace Engineering (Compulsory)	Courses offered by the faculty of Systems Design (Elective)
3rd grade		■ Special Lectures on System Design ■ Internship ■ Technical English in Science and Engineering 1,2
4th grade	◎ Graduation Research in Aerospace Engineering 1,2	■ Laws and Regulations in Industries

◎ Compulsory ■ Elective compulsory ■ Elective

Student Life

Our faculty is located at the Hino campus to the west of Tokyo in a peaceful residential area. There are many facilities in the local area including public parks and a gymnasium. The Hino campus is also the main campus for all third and fourth year undergraduate students at TMU. Consequently, international students will have many opportunities to meet and interact with local students.



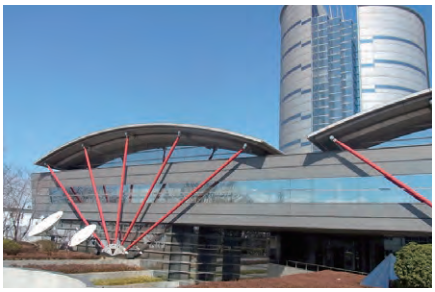




Admission

TMU seeks students equipped with basic academic ability and the following qualities.

1. Intellectual curiosity.
2. Distinctive personality, originality, and creativity.
3. Respect for personal relationships and the desire to contribute to society.
4. Ambition and a willingness to make an extra effort.



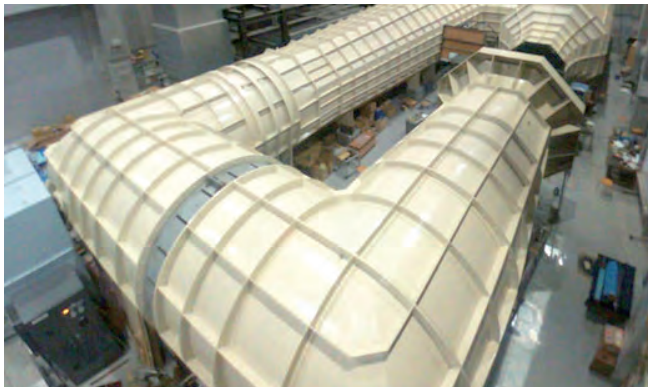
Admission Test for Undergraduate Students

Faculty of Systems Design requires applicants to take an entrance examination. Students will earn bachelor's degrees upon graduation once they complete the compulsory subjects and credits required by the department and faculty.
The admissions test and classes are provided in Japanese. Proficiency in the Japanese language is thus a critical prerequisite for enrollment.

Admission Test for Graduate School Students

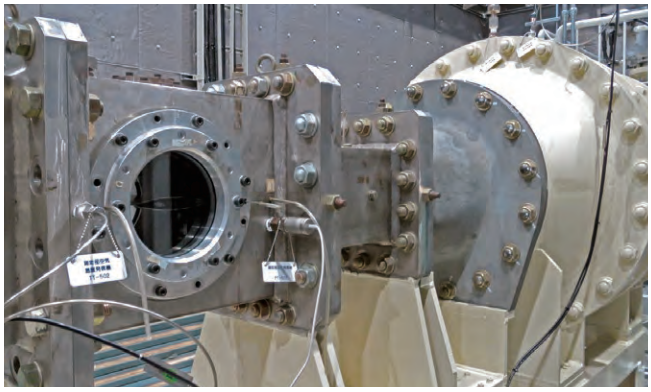
Since each graduate school manages its own recruitment and screening, students wishing to enroll as graduate students are encouraged to visit the website of the school they are interested in for application guidelines.

Facilities



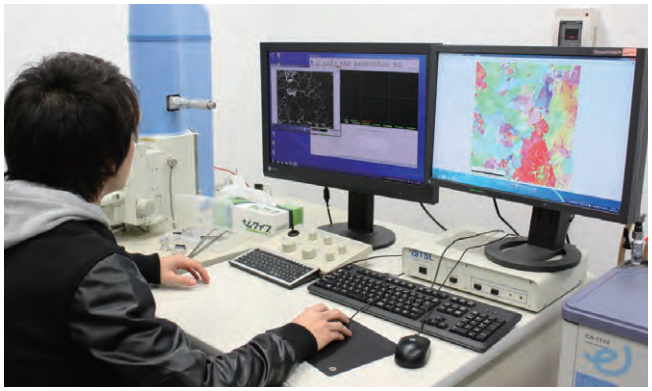
Low-speed Wind Tunnel Facility

The tunnel has an octagonal test section with diagonal distance of 1.75m. The maximum speed is 35m/s (120km/h). Six-components balance and smoke generation facilities enable us to examine aerodynamics and flow around aerospace vehicles.



Supersonic Wind Tunnel Facility

The tunnel has a rectangular test section of 100 × 150 mm. The maximum Mach number through the test section is 1.6. Flow around models can be visualized by Schlieren optics.



Materials Engineering Laboratory

Microstructural observation of various materials using a scanning electron microscope is conducted.

Rocket Engine and Gas Turbine Test Cell

Rocket engines and gas turbines can be operated. Experimental research on hybrid rocket engines is conducted. A micro gas turbine is operated in an undergraduate course experiment.

Department of Aeronautics and Astronautics

Faculty of Systems Design

Graduate School of Systems Design

6-6 Asahigaoka, Hino-shi, Tokyo 191-0065, JAPAN
TEL. +81-42-585-8600

Access

1. From Narita Airport to Toyoda Station

Narita Airport Station→ (JR Narita Express / 53 min.)→Tokyo Station→
(JR Chuo Line / Rapid train / 48 min.)→Toyoda Station.

2. From Haneda Airport to Toyoda Station

Haneda Airport Station→(Tokyo Monorail / 23 min.)→Hamamatsucho Station→
(JR Keihintohoku Line / 6 min.)→Tokyo Station→(JR Chuo Line / Rapid train / 48 min.)→Toyoda Station.

April, 2025