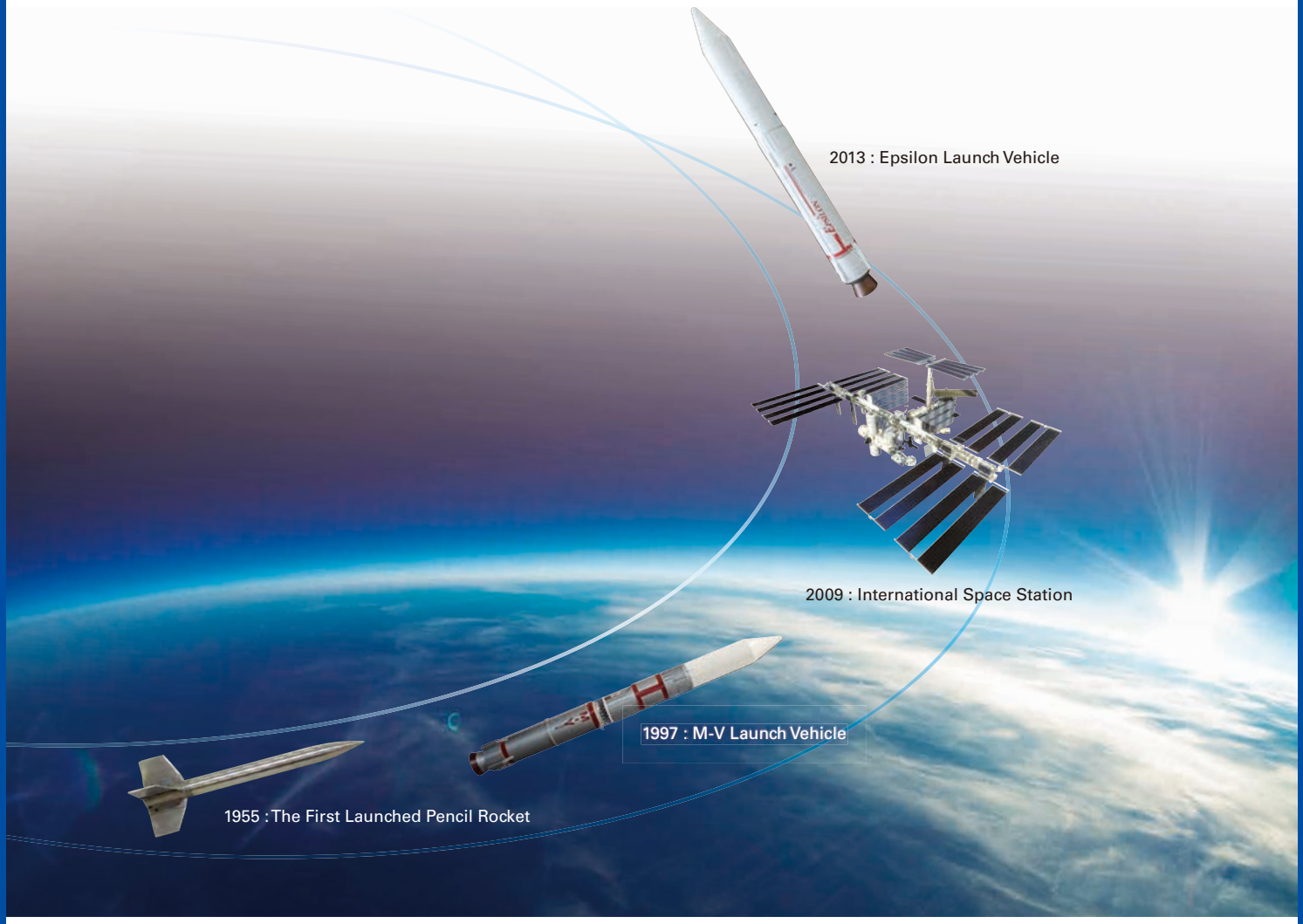


Corporate Profile

IHI AEROSPACE Co., Ltd.

IHI Realize your dreams

Looking Ahead to Future Progress

IHI Aerospace (IA) is carrying out the development, manufacture, and sales of rocket projectiles, and has been contributing in a big way to the indigenous space development in Japan.

We started research on rocket projectiles in 1953. Now we have become a leading comprehensive manufacturer carrying out development and manufacture of rocket projectiles in Japan, and are active in a large number of fields such as rockets for scientific observation, rockets for launching practical satellites, and defense-related systems, etc.

In the space science field, we cooperate with the Japan Aerospace Exploration Agency (JAXA) to develop and manufacture various types of observational rockets named K (Kappa), L (Lambda), and S (Sounding), and the M (Mu) rockets. With the M rockets, we have contributed to the launch of many scientific satellites.

In 2013, efforts resulted in the successful launch of an Epsilon Rocket prototype, a next-generation solid rocket which inherited the technologies of all the aforementioned rockets.

In the practical satellite booster rocket field, We cooperates with the JAXA and has responsibilities in the solid propellant field including rocket boosters, upper-stage motors in development of the N, H-I, H-II, and H-IIA H-IIB rockets. We have also achieved excellent results in development of rockets for material experiments and recovery systems, as well as the development of equipment for use in a space environment or experimentation. In the defense field, we have developed and manufactured a variety of rocket systems and rocket motors for guided missiles, playing an important role in Japanese defense. With our wealth of technological expertise accumulated to date, the company will further enhance research and development activities to prepare for the coming space utilization age represented by a space station, as well as boldly take on the new fields of FRP components for jet engines, robot systems and so forth, ultimately contributing to the realization of mankind's dreams and advancement of society.

Company Overview

Company name	: IHI AEROSPACE CO., LTD
Head office	: Toyosu IHI Bldg., 1-1, Toyosu 3-chome, Koto-ku, Tokyo, 135-0061, JAPAN
Tel	: +81-3-6204-8000
Fax	: +81-3-6204-8810
http	: www.ihi.co.jp/ia/
Paid in capital	: ¥5 billion (Wholly-owned subsidiary of IHI)
Details of business	: Design, development, production, and sales of space equipment systems, defense rocket systems and other aerospace related products, etc.
Employees	: Approx. 1,000
Factories and facilities	: Tomioka Plant (900, Fujiki, Tomioka-shi, Gunma, land area of about 490,000m^2)
History	: 1924 : Aircraft engine plant of Nakajima Aircraft Industries Co., Ltd. (Ogikubo, Tokyo)
	1945 : Fuji Sangyo Co., Ltd. (Company name change)
	1950 : Founded Fuji Seimitsu Kogyo Co., Ltd.
	1954 : Merged with Prince Motor Co., Ltd.
	1961 : Prince Motor Co., Ltd. (Company name change)
	1966 : Merged with Nissan Motor Co., Ltd. and its Aerospace Dept. (later Aerospace Division)
	1998 : Completed the Tomioka Plant
	2000 : Transferred business rights to Ishikawajima-Harima Heavy Industries Co., Ltd. and founded IHI Aerospace Co., Ltd.
	2003 : Merged part of Ishikawajima-Harima Heavy Industries Co., Ltd., Space Development Department
	2007 : Completed move of the Kawagoe Plant to Tomioka
	2008 : IHI Aerospace Co., Ltd. (Company name change)
	2012 : Integrated the IHI Rocket Test Center; Founded the Aioi Test Center
	2014 : Completed the Tomioka Plant No. 3
Subsidiary	: IHI Aerospace Engineering Co., Ltd.

Basic Philosophy

We respect 'originality', 'innovation', and 'harmony with society', and contribute to the realization of human beings' dreams and social development with rocket related technologies.

IA VISION

We act creatively and nimbly in our space, defense, and aerospace efforts, thus delivering outstanding value to our customers and inspiration and satisfied smiles to the world.

Code of conduct to realize the IA Vision

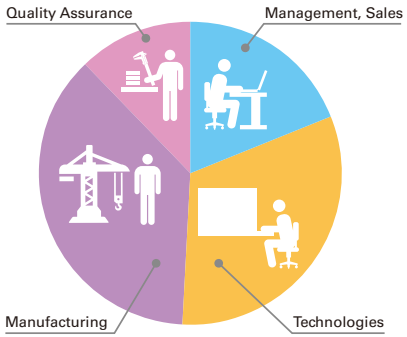
- Considering the true needs of clients
- Developing the capacity to compete on the global stage
- Thinking, deciding, and acting on our own with personal enthusiasm
- Working and reacting together as a unified team

Organization

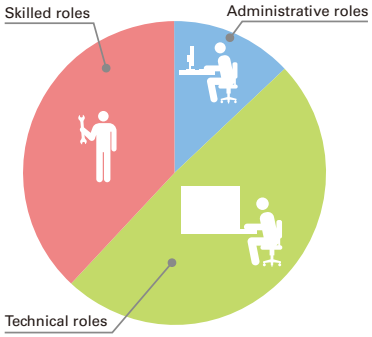
- General Advisory Staff G.
- Epsilon Launch Service Project Dept.
- Corporate Planning Dept.
- Internal Audit Office
- Administration Dept.
- Finance & Accounting Dept.
- Purchasing Control Dept.
- Sales & Marketing Dept.
- Space Systems Dept.
  - Space Vehicle Office
  - Liquid Propulsion Office
  - Space Utilization Office
- Defense Systems Dept.
  - Rocket & Ammunition Systems Office
  - Defense Systems Office
  - Unmanned Ground Vehicle Development Office
  - Advanced Rocket Systems Office
- Technologies Development Dept.
  - Technologies Development Office
  - Electronics Technologies Office
- Rocket Systems Dept.
  - Space Launch Vehicle Project Office
  - Defense Project Office
  - System Engineering Office
  - Solid Propulsion Office
- Experiment Dept.
- Production Dept.
- Quality Assurance Dept.

Personnel Breakdown

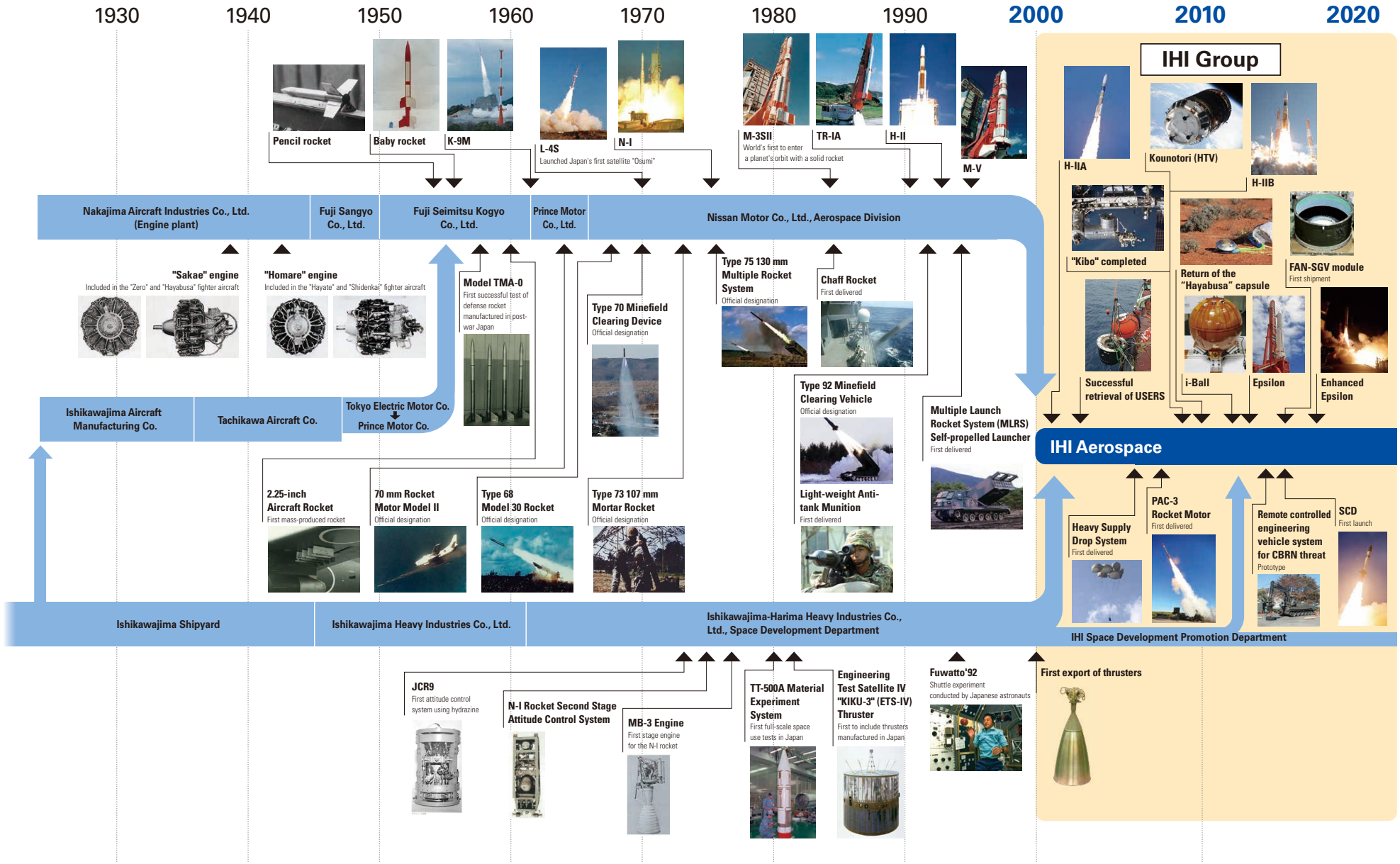
By department



By occupation



Brief History

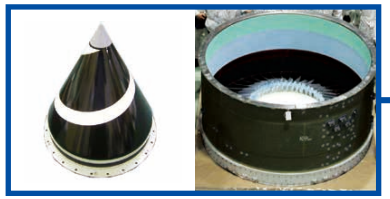


Breakdown of Sales

H-IIA Rocket (booster, etc.)

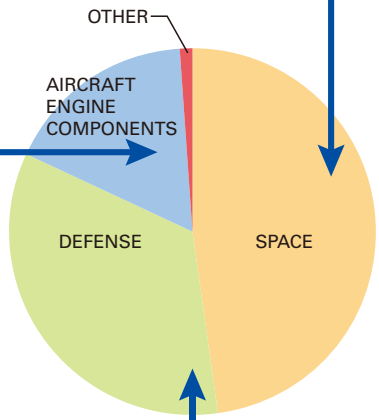
Epsilon Rocket

KOUNOTORI (HTV)
(propulsion system, exposure pallet, etc.)



Inlet Cone

FAN-SGV Module



(Sales ratio
for period ending Mar. 2017)

70 mm Rocket

Multiple Launch Rocket System (MLRS)

Patriot PAC-3 (rocket motor)

(Examples of major products)

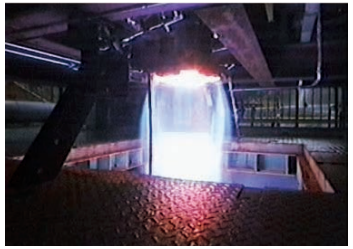
Technology Research

● Solid Propulsion System

Study has been made in a wide range of propulsion systems, solid, ducted and hybrid rockets.
Characteristics of solid propellants, including ingredients, mechanical properties, burn rate, generated energy, and burning processes, are examined to design and develop high performance, high reliability rocket motors. With various types of analyzers and optical observation apparatus, characteristics of explosives and organic/inorganic materials are also explored. The overall performance of a rocket motor is evaluated at our in-house test site for up to 200 kN thrust level and at customer's test site for the full-size motor with more than 200 kN of thrust.

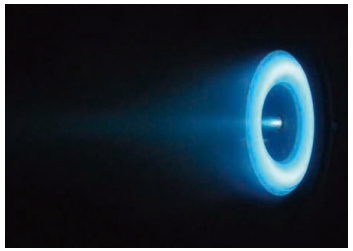
● Liquid Propulsion System

With the major target in the research and development of a liquid propulsion system placed in an upper stage engine and an orbit control engine, we are making efforts in the research and development of engines over an extensive range of thrust from 1 N through 100 kN. Through low toxicity and non-toxic propellants, we are also researching next-generation clean orbit control engines. Further, we are conducting research to develop a propulsion system of high reliability capable of manned flight and interplanetary flight, by observing and analyzing the combustion status of various engines and providing autonomous control in the detection of abnormal states.



● Electric Propulsion Systems

We engage in R&D of high performance electric propulsion systems as the engines for future spacecraft propulsion.
The hall thrust we are currently developing has a small thrust (between 100 mN and 500 mN) however the specific impulse is high (between 1000 seconds and 3000 seconds) therefore it is expected to become increasingly popular as a future space propulsion system.



● Heat-resistant Materials

We are researching heat-resistant materials for use in rocket nozzles and heat shields for recovery systems. The Carbon/Carbon (C/C) composite, composed of carbon fiber and carbon matrix, has the following advantages: (1) good heat resistance (sublimed at 3000 deg. C or higher), (2) high specific strength and stiffness, (3) high fracture toughness, (4) small thermal expansion coefficient, (5) high thermal conductivity, and (6) desirable friction characteristics. It is used for the solid rocket nozzle throat, heat resistant material for re-usable spacecraft, high-temperature furnace material, and brake material. We are manufacturing the world's top class C/C composites for use as nozzle throat materials in SRB-A rockets.
Furthermore, our heat-resistant shield materials using FRP technology has achieved success in applications such as the Hayabusa re-entry capsule.

● TVC System

Our electric actuator system has achieved great reductions in the weight and cost compared to a hydraulic one, so it is used for the movable nozzle system, one of the rocket's TVC (Thrust Vector Control) systems.
Development of the high output actuator with the high-voltage, large capacity power source has enabled applying the electric actuator system to large-scale rocket systems such as SRB-A and Epsilon.
We are also developing a compact, high-precision actuator system for use in precision guidance.
The application of the electric actuator system satisfying high reliability requirements will be expanded in future rocket systems and space station designs.

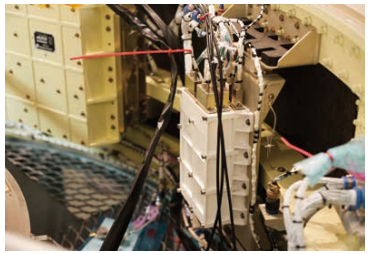

Epsilon 2nd-stage TVC


Epsilon 2nd-stage TVC (actuator)


SRB-A TVC actuator

● Avionics

Avionics are the electronic components equipped on rockets. We develop various avionics, including induction control systems, electrical component systems, measurement communication systems and on-board inspection systems, and equip these on rockets. Moreover, in regards to the Epsilon Rocket, we developed an automatic/autonomous inspection system which will innovate booster systems, designed and developed ROSE (Responsive Operation Support Equipment) and LCS (Launch Control System), which uses mobile control devices, and facilitated the overall system.

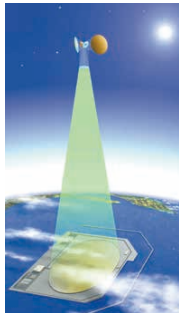

ROSE equipped on Epsilon Rocket

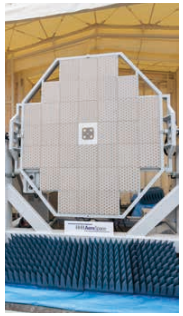
● Nondestructive Inspection Technology

In order to assure the reliability of space rockets, we have developed an inspection unit that uses the latest sensor technology and wave analysis technology to evaluate the quality of products. The non-contact ultrasonic inspection system does not use water couplant, but transmits ultrasonic waves into the air to make the interior of metals and thick FRP parts visible for inspection. In addition, all acquired data is digitized and is used to maintain quality through trend analysis and the like.

● Space Solar Power System

Space Solar Power System (SSPS) is a power generation system concept involving transmitting power generated from solar power generation stations located in space to the earth via microwave and Japan leads the research in this area. We have contributed to SSPS research through more than 20 years of various R&D activities. In recent years, we have undertaken projects for the Ministry of Economy, Trade and Industry and participated in R&D of solar power generation wireless transmission technology implemented by Japan Space Systems, taking charge of the design, fabrication and experimentation of power receiving equipment. In this development, we demonstrated world top-class standards in all open experiments in regards to high efficiency and operational stability. There are many hurdles which must be overcome for SSPS to become a reality, including low-cost transportation, construction of large space structures and further improvements in power transmission efficiency, however we will continue to steadily advance its research and help to realize this goal.


SSPS conceptual diagram


Receiving portion

● Air Launch System

An air launch system is a system to launch a satellite from mid-air using an aircraft. Air launch systems can take advantage of the Pacific Ocean stretching from the east of Japan for a more flexible means of launching small satellites and this has broadened the options regarding locations from which to launch satellites and made efficiency launching possible. Moreover, we intend to utilize this system as a fast-response launching system for small satellites, etc. capable of disaster response, something for which there has been a growing need in recent years, and to make space accessible to users in the future through low-cost and timely launching.

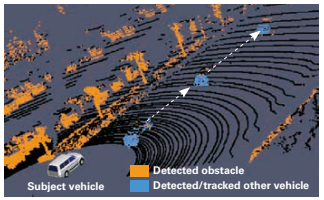

Air launch system concept diagram


Full-scale test specimen for ground tests

● Unmanned Ground System

We are researching robots for gathering information or disposing of dangerous objects and obstacles in areas that are difficult for humans to enter, in situations due to disaster or terrorist attacks.
These robots must be moved and operated remotely in complicated environments, so the robots must have a certain level of intelligence and movement mechanisms that can traverse over rubble and stairs.
We are researching and developing the core technologies necessary to realize these types of robots. For example, we are researching technologies to recognize traversable terrain from topographical information gathered from sensors (environment recognition technology), technologies to plan traversable paths by combining human instruction with these recognition results (behavior control technology), technologies for higher maneuverability with movable wheels and tracks, and technologies that enable multiple robots to cooperate and move together.
In the future, we will heighten these robot technologies while continuing development of practical robots that meet society's needs. Through this, we aim to realize robots that can release humans from hazardous tasks in case of coping with disaster, reconstruction and other similar situations.

Autonomous test vehicle



Environment recognition technology (obstacle, other vehicle)


Mobile robot

Environment recognition technology (recognition of an unsealed road)

Remote controlled engineering vehicle system for CBRN threat
Prepared based on the "Performance Confirmation Tests for Remote controlled engineering vehicle systems for CBRN threat" from the official website of the Technical Research & Development Institute, Ministry of Defense (http://www.mod.go.jp/trdi/news/1502_1.html)

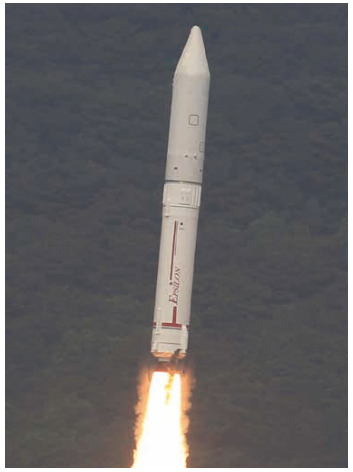
Epsilon Launch Vehicle

The Epsilon Rocket is a next-generation solid rocket that can be used to efficiently launch small satellites. The Epsilon Rocket builds upon Japanese rocket technology, such as the M-V and SRB-A rockets, for a highly reliable vehicle. With newly developed technologies, such as an autonomous on-board checkout system, improved satellite injection accuracy, and built-in environment damper for the satellite, this rocket is easier to use for satellite users.

As the main contractor for the design and manufacture of this new rocket, we are engaged in system integration and component development.

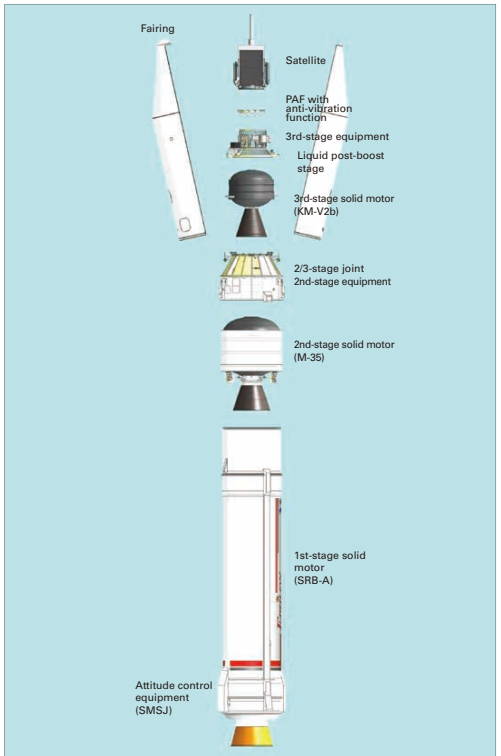
In September of 2013, the first Epsilon Launch Vehicle (Epsilon-1) was successfully launched.

Developed with the aim of enhancing launching capacity and expanding satellite envelope area, Epsilon-2 was successfully launched in December of 2016 and Epsilon-3 was successfully launched in January of 2018.



Epsilon-1

Epsilon-2



Enhanced Epsilon Rocket

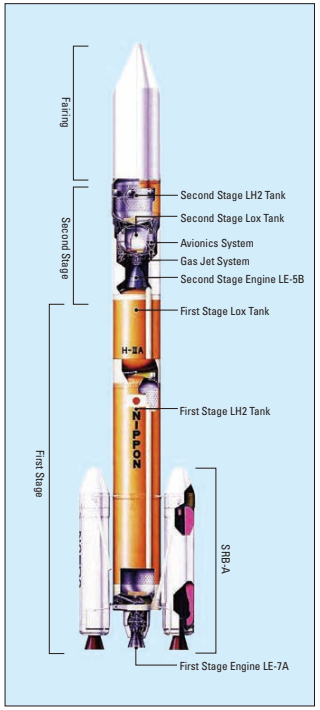
	Epsilon-1		Enhanced model	
Overall length [m]	24		26	
Overall mass [ton]	91		96	
Diameter [m]	2.5			
Propellant	Solid, three stage Optional liquid post-boost stage available			
Launch capability [ton]	Low earth orbit (LEO)	1.2	Low earth orbit (LEO)	1.2
	Sun-synchronous orbit (SSO)	0.45	Sun-synchronous orbit (SSO)	0.59
	Highly elliptical orbit	0.3	Highly elliptical orbit	0.365

H-IIA and H-IIB launch vehicles

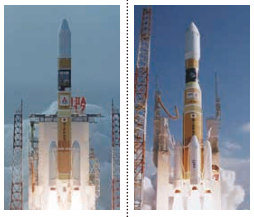
JAXA has evolved its H-II launch vehicle into the H-IIA launch vehicle that has better reliability and lower cost than the H-II and further expanded its efforts to develop the H-IIB launch vehicle to have a larger launch capability. The maiden flight of these launch vehicles was in August 2001 and September 2009 respectively for the H-IIA and H-IIB launch vehicles.

The H-IIA launch vehicle is supporting launches of various satellites as the Japan's primary launch vehicle. Alternatively the H-IIB launch vehicle can be used in international missions such as cargo transport to the International Space Station (ISS) and to the Moon.

We are in charge of development and manufacturing of the solid rocket booster (SRB-A), gas jet system on the second stage, pyrotechnics, etc. in these launch vehicles.



Comparison of H-IIA and H-IIB



		H-IIA launch vehicle H2A202	H-IIB launch vehicle H2B
Overall length [m]		53	57
Mass (payload mass not included) [ton]		289	531
	SRB-A	2	4
Maximum launch capacity [ton]	GTO	3.7	Approx. 8
	Orbit for HTV	-	16.5

H3 Launch Vehicle

The H3 Launch Vehicle is an innovated version of H-IIA and H-IIB, currently Japan's primary launch vehicles, and succeeds in significantly reducing launching costs as well as improving versatility. The new launch vehicle aims to take care of Japan's space transportation from the 2020s onwards and make full-scale entry into the international satellite launching market. We began development in FY2014 with the aim of the first launch in FY2020. We engage in development of a new solid booster (SRB-3), etc. together with the JAXA and the prime contractor, Mitsubishi Heavy Industries.

Draft for the H3 Launch Vehicle body

Launch Rockets

S-type Sounding Rockets

The S-type sounding rockets include S-310, S-520, and SS-520 which are used for scientific observations and various experiments at altitudes of up to 190 km, 350 km and 1000 km respectively. The S-310 and S-520 rockets are used for ultra-high altitude atmospheric observations and various recovery experiments and the SS-520 rocket is used for observations of the magnetosphere over Spitsbergen, Norway.

S-310 sounding rocket

S-520 sounding rocket

SS-520 sounding rocket

LNG Propulsion System

The LNG propulsion system uses liquefied natural gas (LNG) as fuel for excellent on-orbit storability. This fuel has a density higher than the liquid hydrogen fuel, which allows the tank to be smaller, and thus this propulsion system is strongly expected to be suitable for upper stage rockets, future inter-orbit transporters, lunar/planetary explorers, and space planes. We began development for this propulsion system with JAXA in order to acquire necessary technologies through flight demonstrations. In July 2009, the full-size (107 kN propulsion) demonstration engine (LE-8 engine) successfully passed a 600 second firing test, and in January 2012, the small-sized, high-pressure (40 kN propulsion) downsized engine achieved combustion in a vacuum.

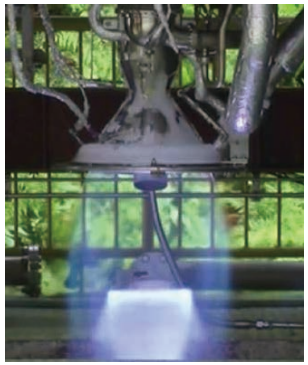
Moreover, we are working together with IHI on internal research into a regenerative cooling LNG engine and in 2013 succeeded a 300-second consecutive ground combustion experiment using a 100 kN thrust class gas-generator cycle engine.

LE-8 engine

LE-8 engine

Propellant	Liquid oxygen and liquefied natural gas
Engine cycle	Gas generator cycle
Combustion chamber cooling system	Abrasion
Vacuum thrust [kN]	107

Downsized engine (vacuum combustion test)



Regenerative cooling LNG engine

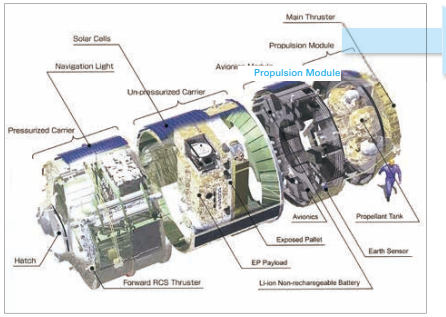
Spacecraft Propulsion

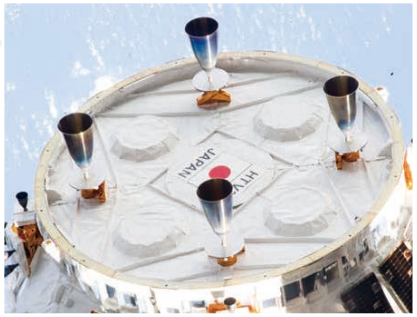
Space Station Supply Vehicle "Kounotori" H-II Transfer Vehicle (HTV) Propulsion System

The Kounotori (HTV) is a space vehicle used to transport supplies to the International Space Station (ISS). We are in charge of the propulsion system that will be used to change the orbit and attitude of the HTV.

Although the HTV itself will be unmanned, because it will approach and make contact with the manned Space Station the design philosophy behind the propulsion system will be the same as that for a manned space vehicle.

By making full use of our propulsion system technologies nurtured in the development of JAXA's operational satellites, we have developed a manned specification propulsion system for the space vehicle, the first-in-Japan system featuring high reliability and safety. Beginning from the launch of the HTV technology demonstration equipment by the H-IIB rocket in September 2009, a total of six vehicles have been launched up to 2016. In the future, there are plans to launch one HTV every year.



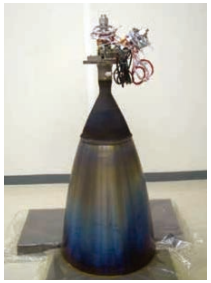


Propulsion Module

HTV Thrusters

We developed the 500N main engine (HBT-5) and 120N RCS thruster (HBT-1) under JAXA contract for applying to the propulsion system of HTV-3, HTV-5 and later.

These thrusters are the first flight-proven thrusters developed in Japan as the MON-3/Monomethylhydorazine (MMH) bi-propellant thruster. Compared with the imported thrusters used for the HTV-1, HTV-2, and HTV-4, our thrusters have improved operability, including thermo-stability over the wide operation range.



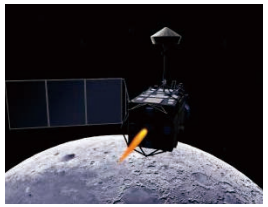
500N main thruster (HBT-5)

120N RCS thruster (HBT-1)

Unified Propulsion Subsystem (UPS)

In order to enhance orbit injection in accordance with the increasing size of satellites, it was necessary to switch from a solid propellant Apogee Motor to a liquid propellant Apogee Engine, and this was performed by IHI Aero. The 1700 N-class liquid propellant Apogee Engine was first used on COMETS, and after the development of the easy-to-use 500 N-class engine, was also adopted on DRTS (Data Relay Test Satellite) and SELENE (lunar orbiter "Kaguya"), as well as WINDS (ultra-high speed internet satellite "Kizuna").

IHI Aero designed, developed and manufactured the new product as a unified propulsion subsystem (UPS) combining a catalytic decomposition thruster, fuel tank, etc., and completed verification as a system. These accomplishments have contributed to the field across a broad scope, demonstrating IHI Aero's capability is not limited to components, but also extends to system design.



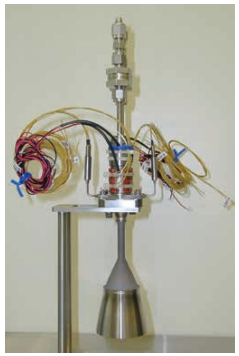
SELENE (lunar orbiter "Kaguya")

Spacecraft Propulsion

Bipropellant Thrusters

We have developed world-class products based on our experience in thrusters developed together with JAXA and are marketing them. One of these world-class products is an apogee engine of the 500 N class for the GTO mission used to inject a spacecraft from the transfer orbit to a geostationary orbit, and it is highly regarded by customers across the globe for having the world's top performance (specific impulse) and high reliability with zero problems in orbit since its first flight. (As of March 2018, totally 122 units have been flown, and 163 units have been exported.)

500N Apogee Engine

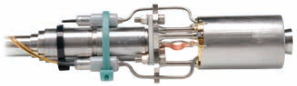


22N Thruster

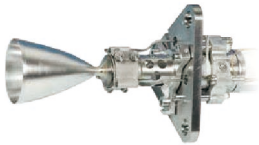
Satellite Posture Control Thruster and RCS (Reaction Control System)

Satellites that have been launched into orbit use catalytic decomposition thrusters to maintain the predetermined altitude and orbit. Catalytic decomposition thrusters achieve propulsion force when fuel decomposes and generates heat due to a catalytic reaction and thereby produces high-temperature gas, which then spouts out of a nozzle.
IHI Aero's thruster has been used on a large number of practical satellites since 1981 and are even sold to overseas customers. There are various propulsion levels available, ranging from 1 N to 50 N.

1N Thruster



4N Thruster



20N Thruster

Satellite Propellant Tanks

With the unified propulsion subsystem (UPS) and posture control thruster (RCS), a tank to hold fuel is required, however it must be capable of discharging fuel at zero gravity without gas becoming combined.
IHI Aero leveraged unique Japanese technology to develop a tank with an internal device, which was then manufactured in a range of capacities. Since 1981, these tanks have been adopted on various practical satellites.

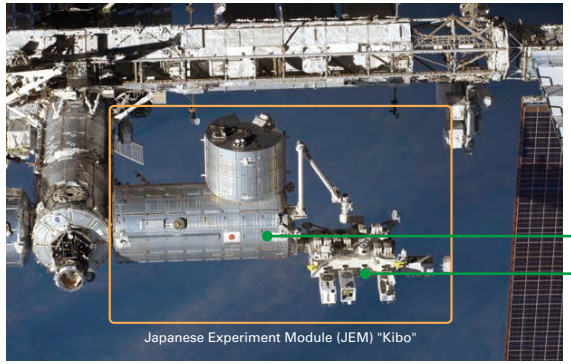
430L tank for SELENE

552L tank for HTV

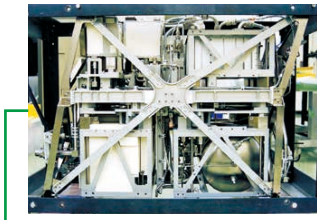
Space Station Equipment

International Space Station Japanese Experiment Module "Kibo"

The International Space Station (ISS) is a permanent, expandable, multipurpose manned facility approximately 110 meters in overall length and 75 meters in width that was built in earth orbit at an altitude of 400 kilometers through international cooperation among Japan, USA, Russia, and Europe. Operations such as scientific observation, space observation, space communications experiments, and the manufacture of materials and pharmaceuticals will be carried out aboard the international space station. The experiment module "Kibo," under the charge of Japan, is the first manned facility developed in Japan. In addition to the Kibo's exposed facility and experiment logistics module-exposed section, we are developing experiment racks and experimental equipment installed in the pressurized modules, the exposed pallet, and the propulsion module for the Kounotori space station H-II Transfer Vehicle (HTV), and other propulsion modules.

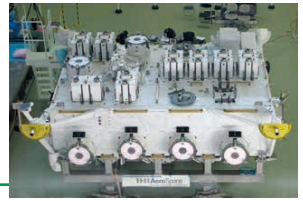


Japanese Experiment Module (JEM) "Kibo"



Pressurized module thermal control system

Performs cooling water circulation using the thermal control of the pressurized module.

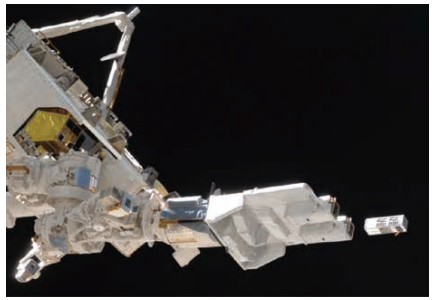


Exposed Facility (EF)

This external experiment platform, directly exposed to space, mounts equipment to observe the Earth's environment and space, and conducts communication experiments.

JEM Small Satellite Orbital Deployer (J-SSOD)

This device meets CubeSat specifications (10 x 10 x 10 cm) for miniature satellites and is placed in orbit by being launched from the "Kibo" airlock. It was transported to the ISS in HTV-3 and deployed its first satellite in October 2012. A total of 20 devices were successfully deployed by January 2017. The deployed satellites are mounted on a special-purpose case protected with cushioning material then mounted on a pressurization carrier such as an HTV and transported to the ISS, meaning that they can be injected into orbit in a milder environment compared to direct rocket launch. This offers benefits such as greater opportunity for launch and on-orbit checkout.
By changing the case into which the satellite is mounted, J-SSOD can now deploy satellites weighing 50 kg (55cm x 55cm x 35cm), which is greater than the CubeSat specification, and in April 2016 the Philippine's first satellite, DIWATA-1, was successfully launched into orbit.



Satellite deployment from a standard J-SSOD

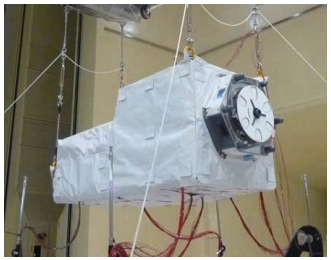
Deploying Philippine satellite (DIWATA-1) from J-SSOD

Space Station Equipment

CALorimetric Electron Telescope (CALET)

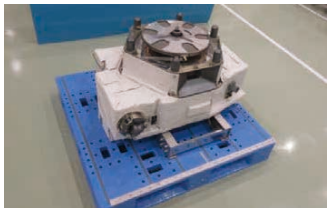
This is Japan's fifth experiment facility attached to the exposed facility on "Kibo". This cosmic ray observation facility observes the direction and energy from high energy electron rays, gamma rays, and other cosmic rays.
It is hoped that CALET will lead the world in revealing the following mysteries which remain unexplained since cosmic rays had been firstly found 100 years ago:
- Acceleration/propagation mechanism of high energy cosmic rays
- Dark matter
- Gamma-ray burst

We are developing CALET for JAXA as well as multi-mission consolidated equipment.
In August 2015, CALET was transported to ISS on HTV5 and commenced operation.



IVA supply type, small exposure experiment platform (i-SEEP, EFU adaptor)

A device which acts as an adaptor to test launched test devices in a pressurized environment on the exposed facility of "Kibo". The test device is mounted inside Kibo, enters and exits Kibo via the airlock and is mounted on the port of Kibo's exposed facility using Kibo's robot arm. Test devices can be replaced inside Kibo, therefore it is anticipated the number of users will increase as multiple users can prepare test devices with relative ease.



Space Environment Utilization

The utilization of the special space environment which cannot be duplicated on the earth is called "space environment utilization." The micro-gravity environment in particular is attracting attention since it assists in the production of materials that have a high degree of homogeneity, quality, and performance. Our activities are not limited to only the development of the equipment and systems for experiments in the micro-gravity environment, but also cover an extensive range in this field, including providing a means for experiments, preliminary experiments on the ground, integration of the experiment facilities, and operation of space experiments.

Kibo's pressurized module

On-board Experiment Rack Integration

Experiment facilities on the space station use single racks with standard interfaces for easier exchange and recovery. We oversee the work of integrating experiment facilities and experiment support functions onto single racks.
The Japanese Experiment Module "Kibo" includes a fluid experiment rack, cell experiment rack, gradient heating furnace rack, multi-purpose experiment rack, and multi-purpose experiment rack 2.

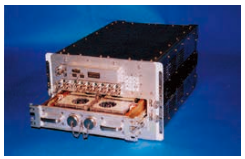
Experiment Facilities

We have overseen the development and manufacture of the following experiment facilities.

Solution/Protein Crystal Growth Facility (SPCF)

This facility performs basic research about the crystal growth of various solutions and proteins.
The SPCF is composed of two parts: the Solution Crystallization Observation Facility (SCOF) and the Protein Crystallization Research Facility (PCRF).

Solution Crystallization Observation Facility (SCOF)



Protein Crystallization Research Facility (PCRF)

Fluid Physics Experiment Facility (FPEF)

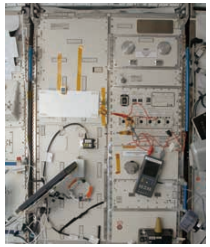
This experiment facility is used to perform fluid physics experiments in an environment close to normal temperature. It observes Marangoni convection (convection that occurs due to surface tension) in a microgravity environment.

Fluid Physics Experiment Facility (FPEF)

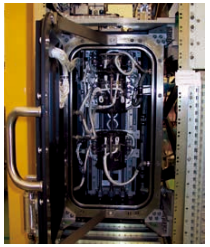
Test specimen for Marangoni convection experiments

Gradient Heating Furnace (GHF)

This experiment facility investigates crystal growth of semiconductor material and vapor position growth in microgravity.



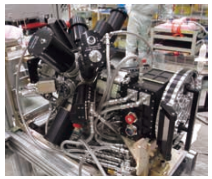
GHF rack



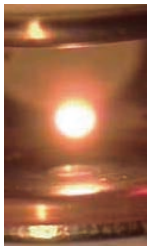
Gradient Heating Furnace (GHF)

Electrostatic Levitation Furnace (ELF)

This experiment facility heats, melts, cools, and coagulates samples without contact by floating charged samples using static electricity. Containers are not required, which enables heating experiments on highly reactive samples or samples with high melting points.



Observation with the ELF



Floating state

Controlled Combustion Engine (CCE)

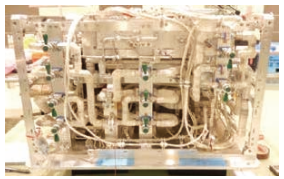
A structure in which a combustion test device is placed when performing combustion tests in a weightless environment. It has functions to enable combustion tests to be conducted safely on space stations.

Controlled Combustion Engine (CCE)

Inside of a CCE (circulation exhaust method)

Boiling Two-Phase Flow Experiment Equipment (TPF)

Equipment that observes behavior of the boiling phenomenon and gas-liquid two-phase flow within liquid under microgravity conditions, as well as obtains heat transfer characteristics.



Boiling Two-Phase Flow Experiment Equipment (TPF)

Inside the transparent heat transfer tube for boiling/two-phase flow observation

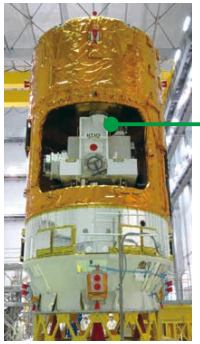
Space Station Equipment

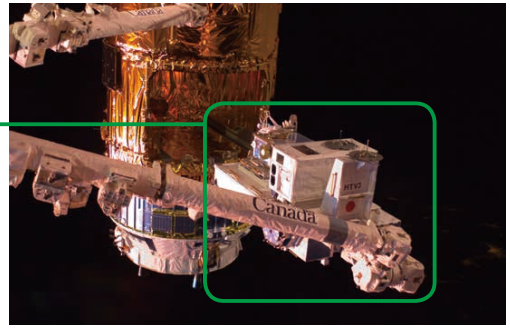
Space Station Supply Vehicle "Kounotori" H-II Transfer Vehicle (HTV) Cargo Transportation System

HTV is an unmanned space vehicle with a manned operation capability developed by Japan, and is used to transport supplies to the International Space Station (ISS).
We are in charge of developing the Exposed Pallet (EP) stored in the Unpressurized Logistics Carrier (ULC), the related mechanisms, and the HTV Resupply Rack (HRR) containing the supplies used inside the ISS. Since the launch of the HTV technology demonstrator in 2009, HTV has achieved success by meeting high reliability and stringent safety requirements.

Development of Exposed Pallet (EP)

The Exposed Pallet (EP) is to carry cargoes (such as the EP Payloads and the Orbital Replacement Unit (ORU)), and transport them to the ISS. During the launch it is stored in the Unpressurized Logistics Carrier (ULC) of the HTV, and when in orbit, it is pulled out of the section by the robotic manipulator on the ISS. After the cargo is transported onto the ISS, the pallet is re-stored in the ULC of the HTV, and then reenters the atmosphere together with the HTV.
We develop various types of exposure pallets able to support a range of cargo.





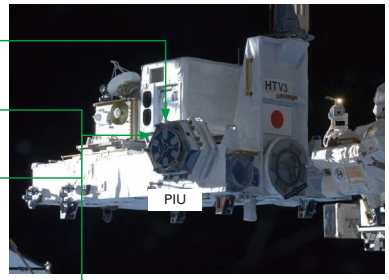
Multi-purpose exposure pallet extractable with a robot arm

Exposed Pallet mechanical systems

Payload Interface Unit (PIU)
This is to connect the Exposed Pallet (EP) to the Exposed Facility (EF) of the "Kibo".

HTV Cargo Attachment Mechanism (HCAM)
This is to secure the EF Payloads on the Exposed Pallet (EP) so that the payloads can be safely transported to the ISS.

HTV Connector Separation Mechanism (HCSM)
From the launch of the HTV until the EF Payloads are mounted on the Exposed Facility (EF), heater power to the payloads is supplied from the Exposed Pallet (EP). The HCSM must disconnect the heater power line just before the payloads are transported to the EF.



HTV Resupply Rack (HRR)

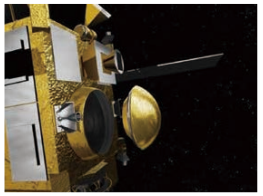
This is to hold supplies (such as experiment samples and specimens, foods, water and clothes) used inside of the ISS, and the rack is stored in the Pressurized Logistics Carrier (PLC) of the HTV.

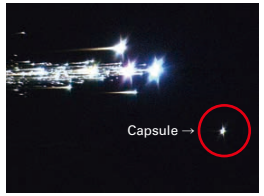
HTV pressurized area

Re-entry Systems

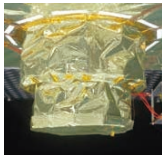
Hayabusa and Hayabusa 2 Re-entry Capsules and Impactor

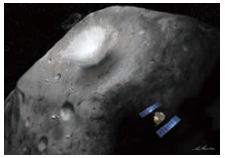
We designed and manufactured the re-entry capsule for the asteroid probe "Hayabusa," which was developed by the JAXA Institute of Space and Astronautical Science and returned to Earth on June 13, 2010. The capsule entered the atmosphere at a speed of 12 km/s, protected from harsh temperatures by thermal protection materials, and safely delivered samples from the asteroid Itokawa to Earth. Based on this success, the next-generation asteroid probe "Hayabusa 2" was launched in December 2014 and the thermal protection reentry capsule was used again with ablators and thermal protection materials that we developed.





"Hayabusa 2" includes a collider using new technologies to create artificial craters on the asteroid surface. The collider separates from the probe after landing on the asteroid, and once the probe has retreated a safe distance to the other side of the asteroid, it uses pyrotechnics to crash into the asteroid at high speed to create an artificial crater. We participated in the development of this collider system, which will be used in 2019.





(Illustration: Akihiro Ikeshita)

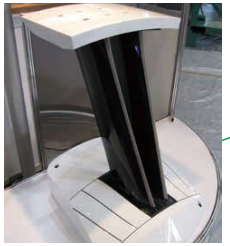
Aircraft Engine Parts

FRP Parts for Jet Engines

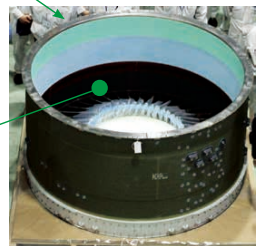
Since 2004, We have leveraged our manufacturing technologies relating to FRP parts for rockets accumulated over many years to manufacture FRP parts for jet engines and deliver them to IHI. Moreover, IHI is engaged in the development of new FRP parts to lighten aircraft engines and thus improve the fuel efficiency of aircraft even further, and we are in charge of the manufacture of these new parts. The fan case and structural guide vane (SGV) prototyped for civil passenger aircraft engines has been used in flight tests from 2014 and their commercial navigation was started in January, 2016.

Fan case

Air bus A320Neo in a test flight equipped with our fan case ©AIRBUS



Structural guide vane (SGV)



FAN-SGV module

Photos by courtesy of Japanese Aero Engines Corporation (JAEC)

Defense

Multiple Launch Rocket System (MLRS)

The Multiple Launch Rocket System (MLRS) is a surface-to-surface rocket system jointly developed by the USA, UK, France, Germany, and Italy in the early 1980s primarily through Lockheed Martin. According to the Memorandum of Understanding between the Japanese and American governments, we began licensed production of Japanese modified self-propelled launchers in 1992. Since 2005, we have been working on overhaul and improvement of the fire control system of the launchers.

Type 92 Minefield Clearing Vehicle and Minefield Clearing Rocket

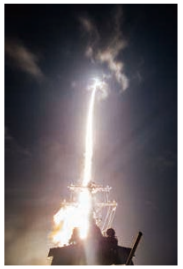
After the development prototyping accomplished in 1991, the Type 92 minefield clearing vehicle and minefield clearing rocket was officially designated as equipment for the Japan Ground Self-Defense Force in 1992.
This system is used to clear minefields and establish vehicle routes quickly.
Since 2005, the overhaul program of the clearing vehicle has been taken place.

Heavy Supply Drop System

After the development prototyping accomplished in 2003, mass production of the Parachute Air Drop System started in 2004.
This system has airbags to absorb shock upon impact, so that equipment with low shock resistance can be air dropped.

SM-3 Cooperative Development Program (SCD)

We participated in the planning of the jointly developed Standard Missile-3 Block IIA (SM-3 Blk IIA), a key section of the ballistic missile defense (BMD) system. The SM-3 Blk IIA is a 3-stage guided missile that is launched from the Aegis Destroyer at sea to intercept an enemy missile midcourse.
Combined with the previously deployed PAC-3, this becomes a multi-layer defense system. We oversaw development of the 2nd and 3rd stage rocket motors with thrust vector controls (TVC) system. We greatly contributed to improvement of the guided missile with development of the highly functional TVC and highly competitive rocket motor that both use all of the material, design, manufacturing, and quality control technologies that we can offer.
In 2017, we successfully completed the first intercept test.

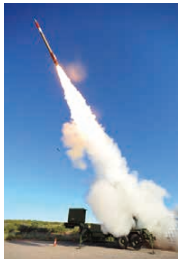


First Intercept Test

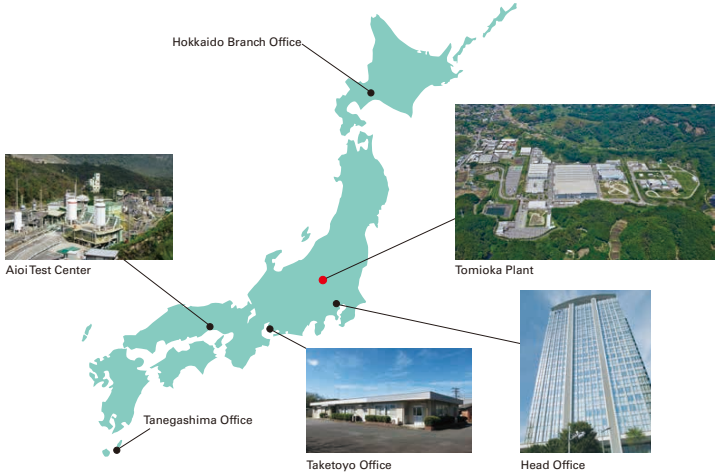
SM-3 Blk IIA (model)

Patriot PAC-3

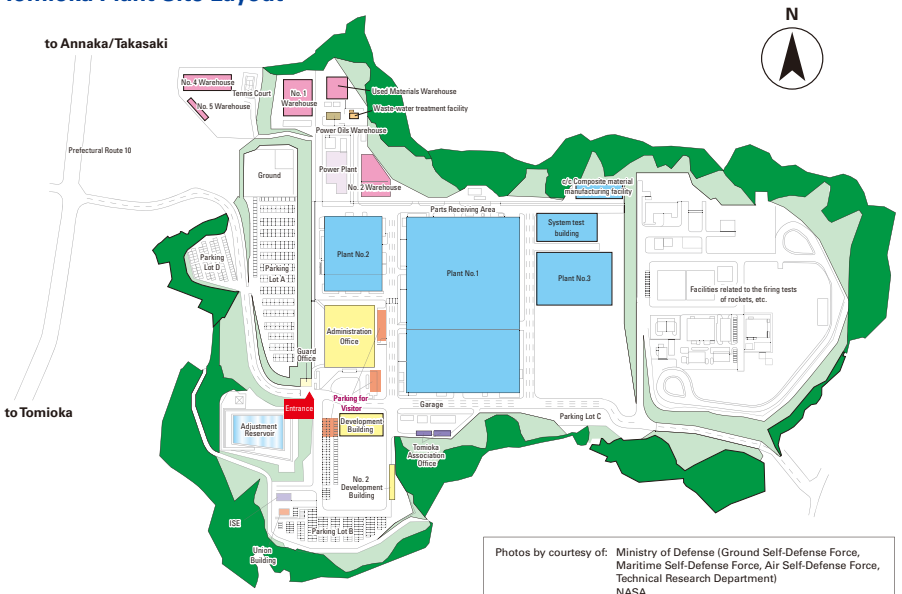
The Patriot PAC-3 missile is an interception missile that employs a "hit-to-kill" method of interception, striking ballistic missiles directly, used as a last resort for incoming ballistic missiles at a short range. Based on a license production agreement with Lockheed Martin, we have overseen manufacture of rocket motors since 2005 and supplied them to Mitsubishi Heavy Industries, Ltd.



Office and Plants



Tomioka Plant Site Layout



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