Environmental Test Technology Unit
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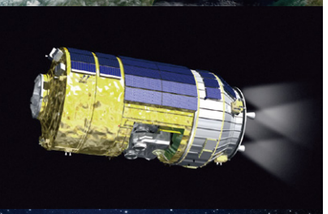
Japan Aerospace Exploration Agency

Environmental Test Technology Unit

Explore to Realize

Introduction to our Test Facilities

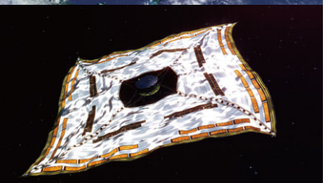
ALOS-2



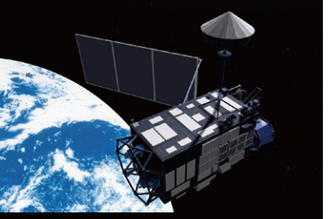
HTV

WINDS

GCOM-W



IKAROS



SELENE

GOSAT

QZSS

Epsilon Launch Vehicle

Environmental Test Technology Unit

Spacecraft such as satellites that pursue various missions in space are launched by a launch vehicle after “designed”, “manufactured”, and “tested”. They go through extremely severe environments during launch and in space. To help them perform successfully even in such severe environments, it is imperative to verify their endurance, functions, and performances in environmental tests on ground. And it is our responsibility at the Environmental Test Technology Unit to support the successes of those “tests”.

Environmental Test Technology Unit is in charge of Japan’s largest facilities to perform various environmental tests, being engaged in the maintenance and management of the facilities so that they can be made available to users in their best conditions. We have also been executing researches and developments on test technologies to establish more effective and efficient maintenance or testing methods suitable for the facilities, based on the new assessment methods or environment prediction techniques derived from the technologies accumulated through the tests having been performed at JAXA.

By supporting the successes of diversified increasingly-challenging missions with those test technologies, the Environmental Test Technology Unit is striving for maximizing Japan’s R & D achievements, while creating new values with broader prospects to respond to mankind’s expectations. We are also promoting the leasing service of the well-maintained test facilities and our test technologies established through spacecraft developments as one of the ways to make them contributable to society.

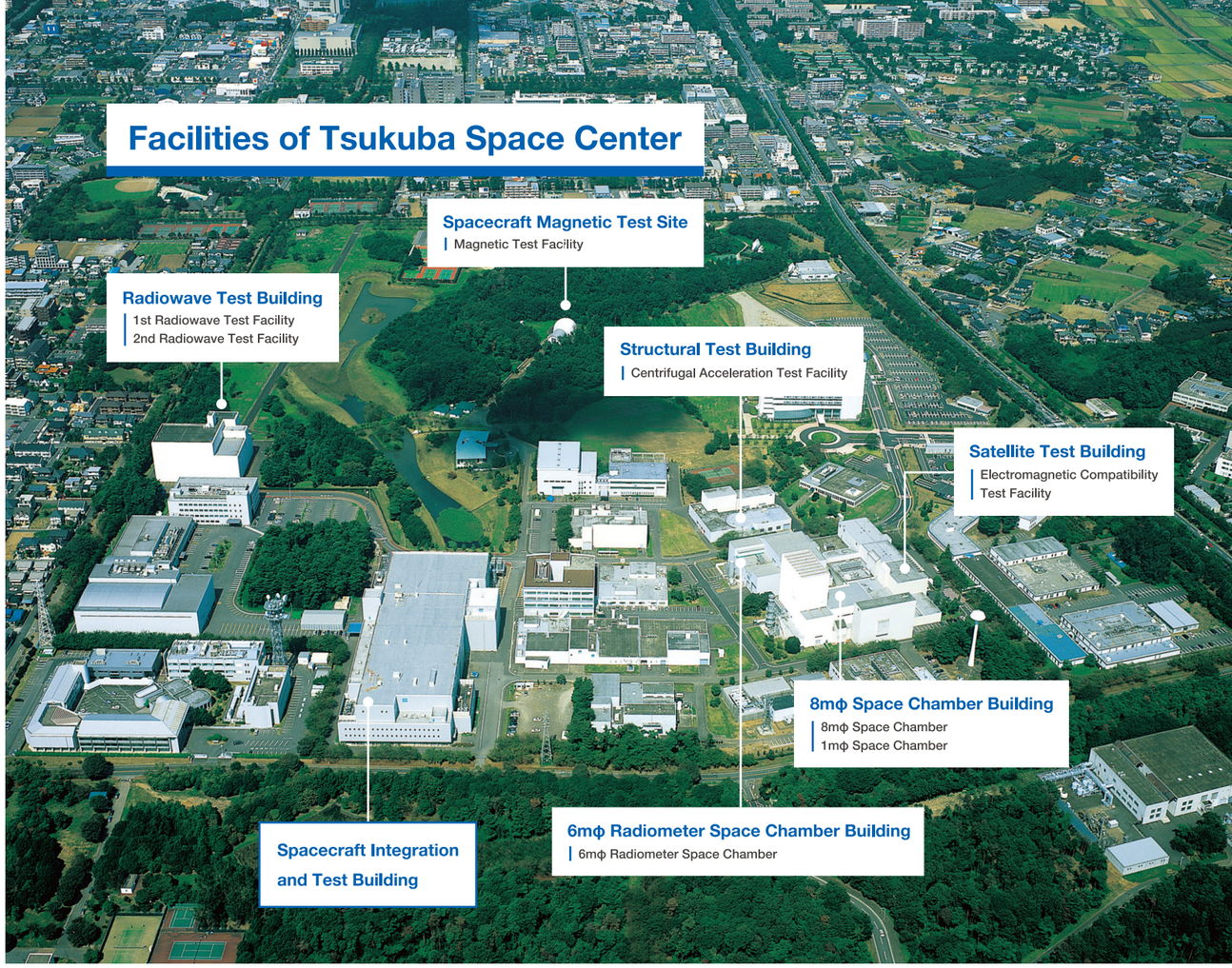
Development of Test Technologies

- R & D on test methods and test-data analysis methods
- plans for the publication of test standards and handbooks (for accaumulating technologies and clarifying technological bases)
- support for satellite and launch vehicle projects
- development, RFB, and renewal of test facilities

Achievements supported by Environmental Test Technology Unit

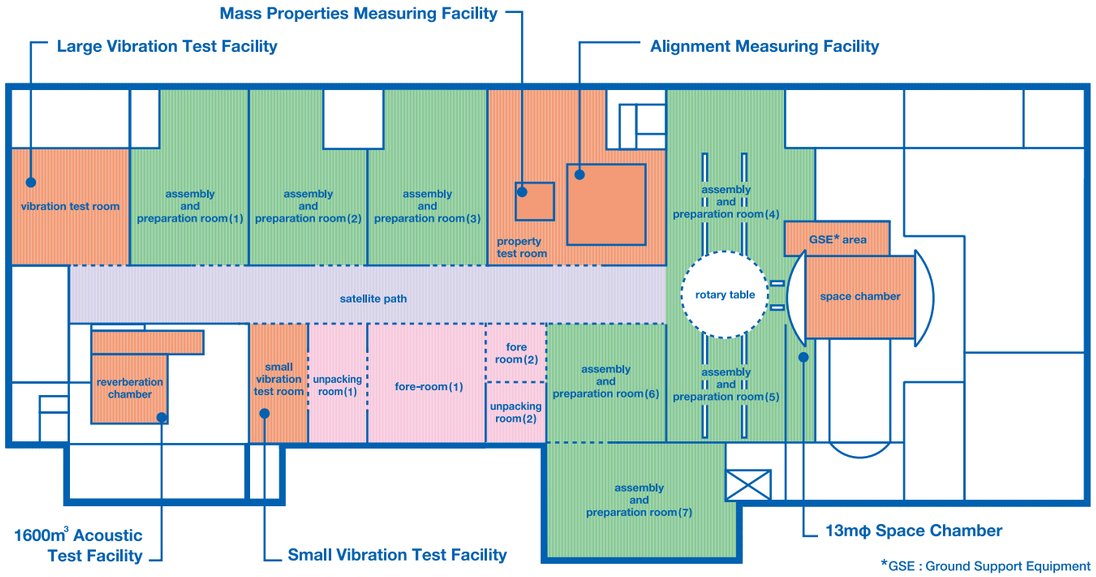
- HAYABUSA 2
- ALOS-2
- GPM-DPR
- HTV
- GCOM-W
- QUASI-ZENITH SATELLITE
- GOSAT
- IKAROS
- WINDS
- SELENE
- ASTRO-H
- GCOM-C
- EarthCARE/CPR
- Epsilon Launch Vehicle

Facilities of Tsukuba Space Center



Spacecraft Integration and Test Building

Large-scale Separation Shock Test Facility
It can be moved or set in the assembly and preparation room.



*GSE : Ground Support Equipment

1st Radiowave Test Facility

This facility is used to test the radiowave characteristics of the antennas or sensors on board spacecraft. It comprises a shielded room to shut out the electromagnetic waves coming in from outside. The walls of the room are covered with a structure called a radiowave absorber that absorbs electromagnetic waves to prevent their reflection inside the facility.

Centrifugal Acceleration Test Facility

This facility can generate large acceleration to the equipment installed on the mounting table at one end of the arm-like structure by its rotary motion. The arm with the radius of about 7m rotates 80 revolutions per a minute, being capable of loading acceleration as great as 55G.

1600m^3 Acoustic Test Facility

This facility simulates the heavy acoustic environment loaded on a spacecraft during launch, using high-pressure nitrogen gas to generate acoustic pressure. The generated acoustic pressure is then blasted out of the air outlet called a horn or a jet nozzle into a room called a reverberation chamber, which is specifically designed to have high echo effect, to achieve heavy acoustic environment.

Small Vibration Test Facility

This facility simulates the vibration environment that a spacecraft goes through during launch. What is called an vibration table is shaken with the force of up to 18 ton. The vibration table can generate both horizontal and vertical vibration, in combination with a shaker.

13mϕ Space Chamber

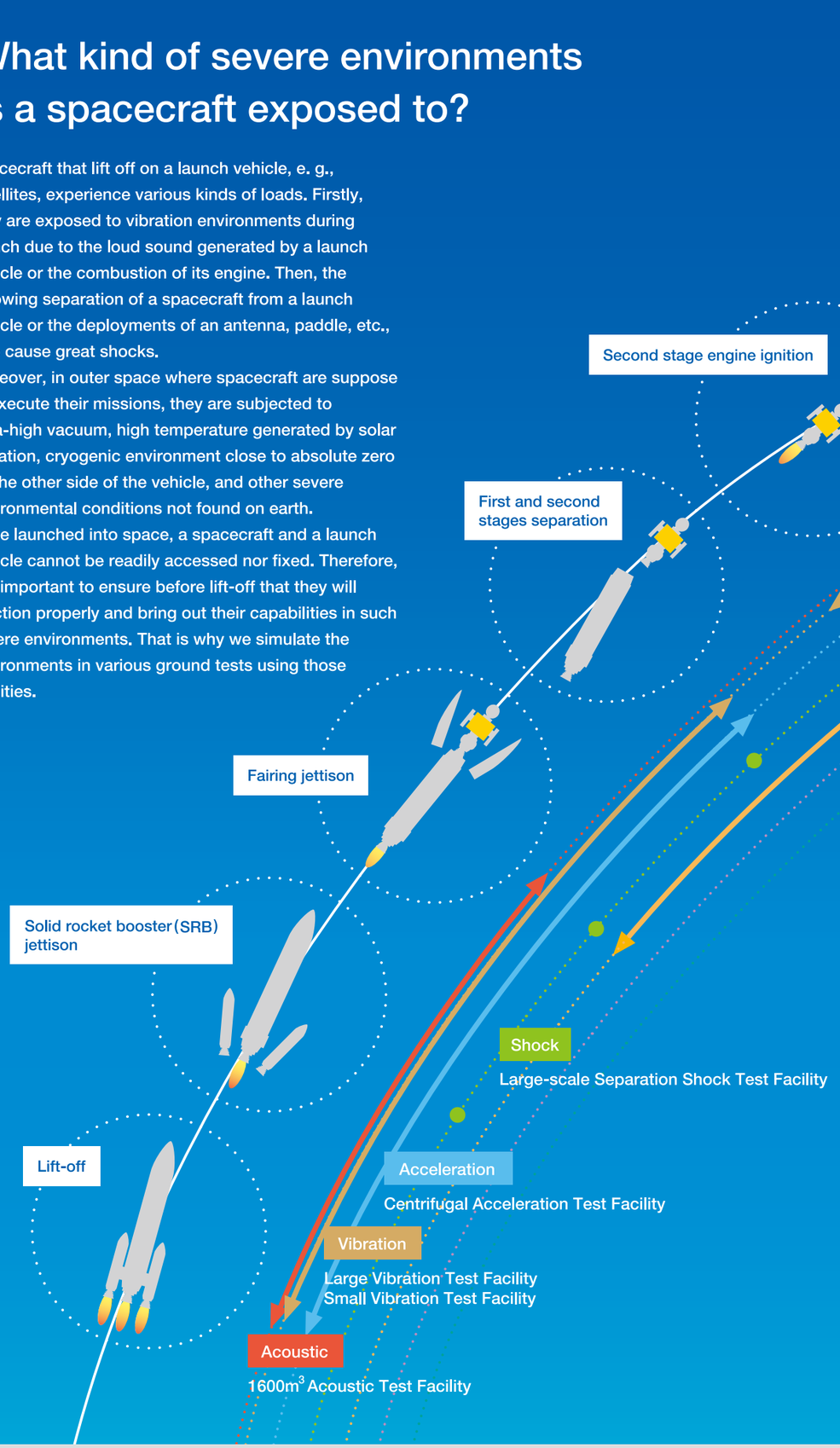
This facility simulates each of the high-vacuum, cryogenic, and solar light environments in space, respectively with vacuum pumps, liquid nitrogen, and Xe lamps, in the huge space of 13m diameter, which altogether produce so called “miniature space.” This facility is the world largest chamber equipped with a solar simulator.

Spacecraft Integration and Test Building

This building is composed of many test facilities and assembly preparation rooms used to prepare for tests gathered together to achieve efficient environmental tests on spacecraft. Spacecraft go back and forth in the areas through which a 100-meter path called a satellite path runs, to enable environmental tests to be performed in sequence.

What kind of severe environments is a spacecraft exposed to?

Spacecraft that lift off on a launch vehicle, e. g., satellites, experience various kinds of loads. Firstly, they are exposed to vibration environments during launch due to the loud sound generated by a launch vehicle or the combustion of its engine. Then, the following separation of a spacecraft from a launch vehicle or the deployments of an antenna, paddle, etc., also cause great shocks.
Moreover, in outer space where spacecraft are suppose to execute their missions, they are subjected to ultra-high vacuum, high temperature generated by solar radiation, cryogenic environment close to absolute zero on the other side of the vehicle, and other severe environmental conditions not found on earth.
Once launched into space, a spacecraft and a launch vehicle cannot be readily accessed nor fixed. Therefore, it is important to ensure before lift-off that they will function properly and bring out their capabilities in such severe environments. That is why we simulate the environments in various ground tests using those facilities.



Acoustic / Vibration

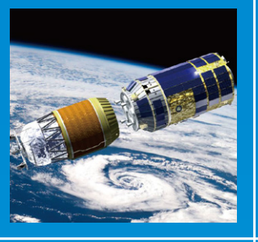
The blast from a rocket engine exposes a spacecraft inside a fairing to a severe acoustic environment of about 140 decibel (equivalent to about 100 jet engines.) Just like loud noise does harm to human ears, such huge volume of noise confers a risk of breaking down a spacecraft. Not only that, the vibration transmitted from a launch vehicle puts a spacecraft in a very severe environment.

Acceleration

A launch vehicle keeps putting on acceleration until it reaches the target orbit. Just like a human is pushed back into a seat when a car makes a jackrabbit start, a spacecraft is influenced by the acceleration on a launch vehicle. The magnitude of acceleration can be as great as about 3G. Not only spacecraft, equipments loaded on an aircraft which goes through sudden acceleration or steep turns are also exposed to similar acceleration environments.

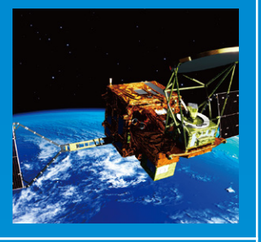
Shock

A spacecraft is bonded to a launch vehicle with very strong force, and the instant release of the bond separates them from each other. The shock generated at that moment imposes an extremely severe environment on the equipments on board a spacecraft. Likewise, a solar paddle or an antenna mounted on a spacecraft, which is folded with strong force during launch, causes a great shock when it is deployed in space.



Thermal Vacuum

Spacecraft are exposed to severe environments such as high vacuum, cryogenic temperature (-270°C), or intense sunbeam.
With no atmosphere convection in vacuum, a huge temperature gap from the high temperature of more than 100°C in the sun to the cryogenic temperature of about -200°C in the shade can easily take place.

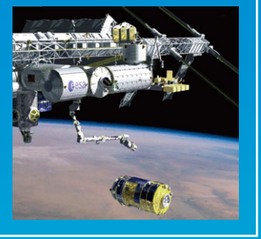


Radiowave and Magnetic

Spacecraft antennas are designed to transmit and receive only the target radiowaves. That is why the properties of an antenna are to be accurately measured to see if it can transmit and receive the needed radiowaves. Also, the space around the earth has magnet-like properties, which can move a spacecraft out of its orbit and disturb its attitude in reaction to the magnetic properties of a spacecraft. Therefore, it is necessary to accurately measure and control the magnetic properties of a spacecraft before launch.

Function and Performance

The purposes of function and performance verification tests are to ensure the functions and performances of spacecraft to be precisely executed in space.
Tests such as measurement of the mass, CG position, moment of inertia, of a spacecraft (mass properties measurement), or precise measurement of the mounting angles, etc., of equipments, e. g., sensors or an antenna (alignment measurement), are essential for supporting a spacecraft to bring out its functions and performances in space.



INDEX

Acoustic Test Facility
Vibration Test Facility
Large-scale Separation Shock Test Facility
Centrifugal Acceleration Test Facility
Space Chamber
Magnetic Test Facility
Electromagnetic Compatibility Test Facility
Radiowave Test Facility
Mass Properties Measuring Facility
Alignment Measuring Facility

Among the facilities, there are four space chambers that come in different diameters, and vibration test facilities of small and large scales, which offer users options of choice for the most appropriate facility that suits the size of a test item, that is, from a small to large spacecraft, to perform a sequence of environmental tests.

P12 1600m³ Acoustic Test Facility

P13 Large Vibration Test Facility

P14 Small Vibration Test Facility

P15 Large-scale Separation Shock Test Facility

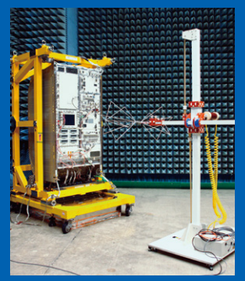
P16 Centrifugal Acceleration Test Facility

P17 13mφ Space Chamber

P18 8mφ Space Chamber

P19 6mφ Radiometer Space Chamber

P20 1mφ Space Chamber



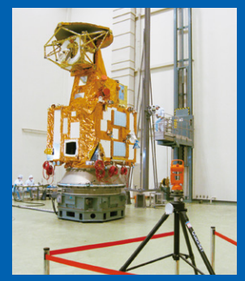
P21 Electromagnetic Compatibility Test Facility

P22 Magnetic Test Facility

P23 1st Radiowave Test Facility

P24 2nd Radiowave Test Facility

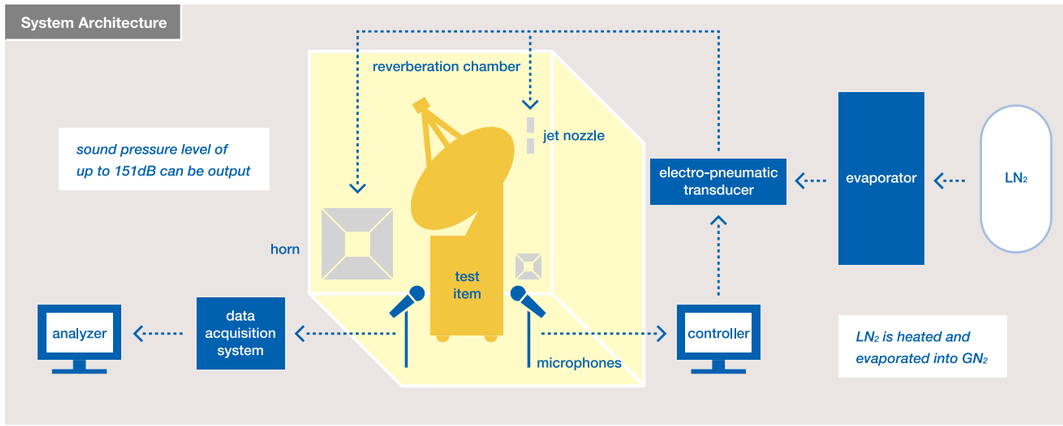
P25 Mass Properties Measuring Facility



P25 Alignment Measuring Facility

1600m³ Acoustic Test Facility

System Architecture



The acoustic test facility is used to conduct tests to confirm the functions and structural robustness of a spacecraft in a simulated interior acoustic environment of a launch vehicle fairing during the launch and flight stages.
The test room called a "reverberation chamber" is enclosed by thick concrete walls to minimize the acoustic absorptivity on them. The acoustic source is composed of seven electro-pneumatic transducers and one jet nozzle, which can generate the acoustic power of about 70 kW. The high-pressure GN_2 supplied to the electro-pneumatic transducers and the jet nozzle derives from LN_2 heated and evaporated in the outdoor GN_2 system, to be effectively blasted out of the air outlets of horns for 25 Hz, 100 Hz, and 200 Hz, and the jet nozzle, into the reverberation chamber.
The target sound pressure for a test is loaded on a test item (sound application) after frequency analyses and automatic controlling are performed on the sound collected by 4 to 6 microphones installed on stands and deployed in the chamber to match its acoustic field (the diffusion of sound) to the required sound pressure spectrum.

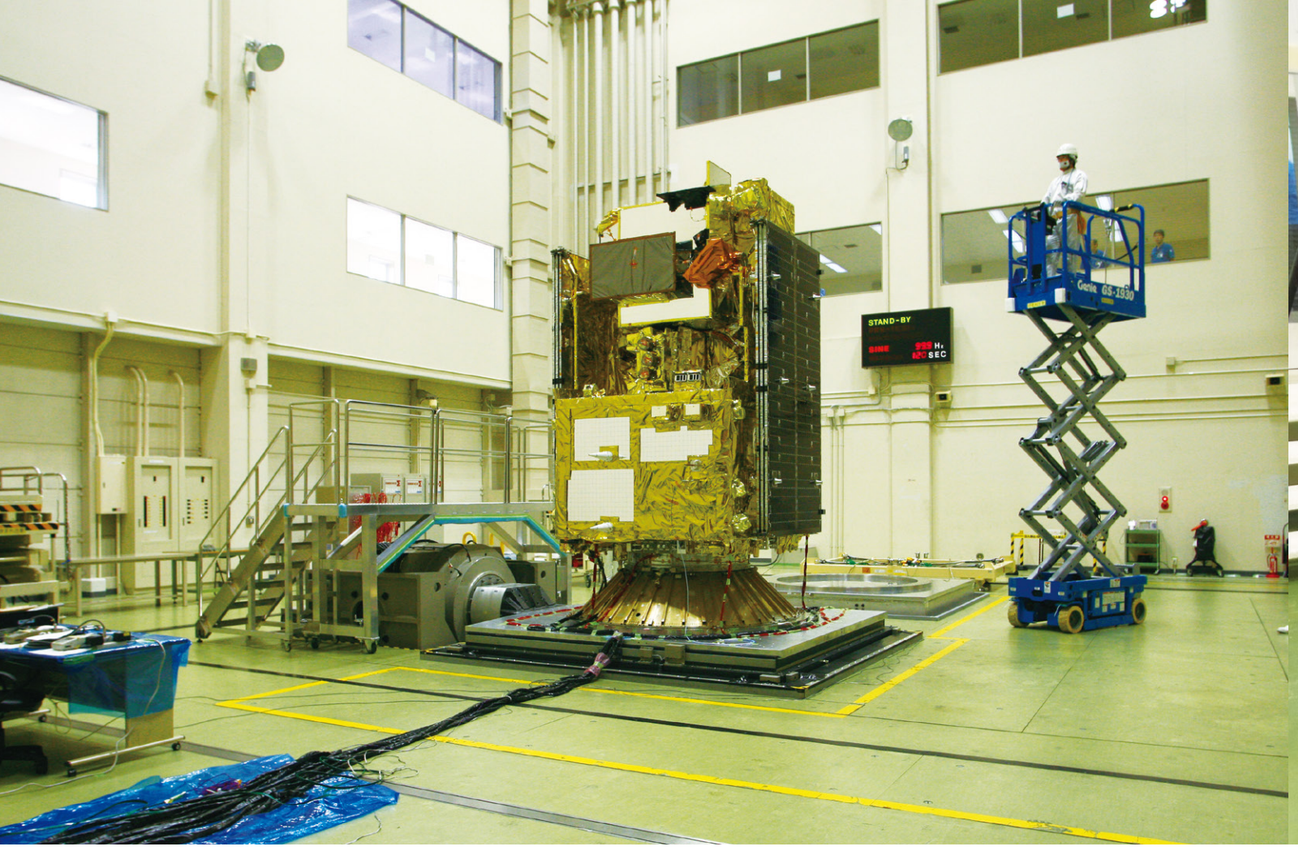
SPECIFICATION

max sound pressure level	151dB (empty sound field, overall value)
reverberation chamber capacity	1607m³ (10.5m [W] × 17.1m [H] × 9.0m [D])
sound source medium	GN_2
acoustic output	70kW

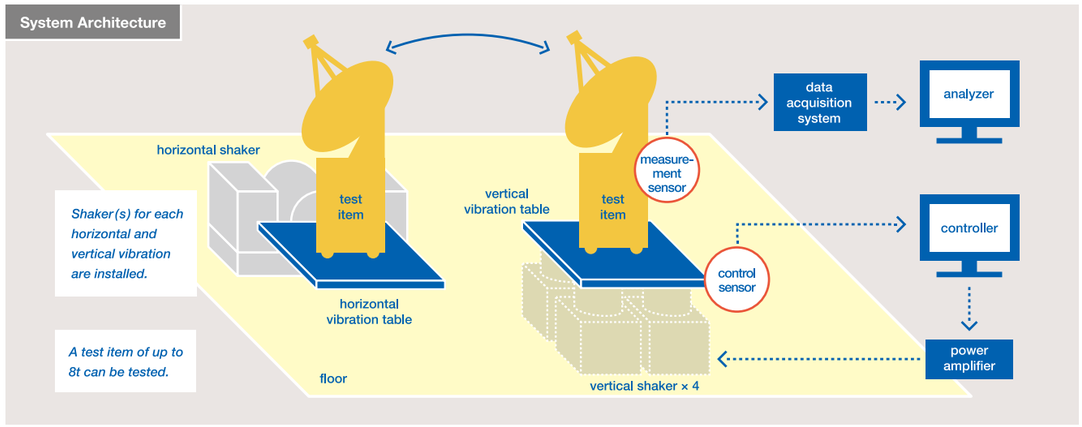
ACTUAL APPLICATIONS

Epsilon Launch Vehicle, GCOM-W, IKAROS, PLANET-C, HTV, HAYABUSA 2, CALET, ASTRO-H, etc.

PUBLIC APPLICATIONS: commercial satellites, small satellites developed by private companies, etc.



Large Vibration Test Facility



The large vibration test facility is used to verify the endurance of a spacecraft stored inside a satellite fairing or onboard equipment against the vibration environments during launch. With vibration load larger than in launch provided by an electrodynamic shaker, the structure of a test item is verified to have no damages caused by vibration environment or no abnormality after the vibration.
The electrodynamic shaker of this facility has a nation's highest vibration ability with its maximum load mass of 8t, making it suitable for tests on larger test items. It also has many measurement channels (500channels), which enable simultaneous measurement on multiple points. Besides this facility, Tsukuba Space Center has a small vibration test facility, which together offer options of facilities to users depending on the size of a test item or intended test purposes.

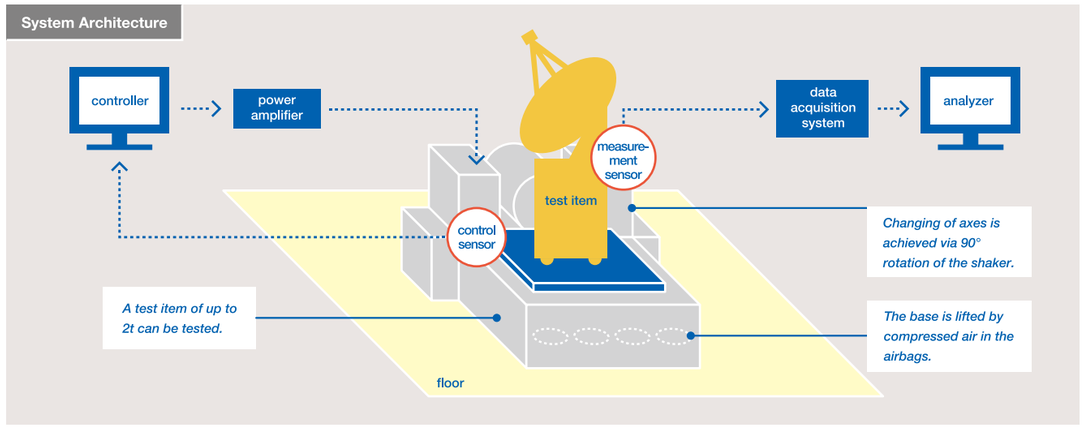
SPECIFICATION

max load capacity	8,000kg	
oscillation ability	vertical 800kN	horizontal 250kN
kind of oscillation	sine wave, random wave	
freq. range	sine wave 5~100Hz	random wave 5~200Hz
the number of channels	control 54ch	measurement 500ch

ACTUAL APPLICATIONS

- experiment systems in ISS, propellant tank of HTV, GCOM-C, ASTRO-H, etc.
- communication antennas for cellular phones, cargoes, etc.

Small Vibration Test Facility



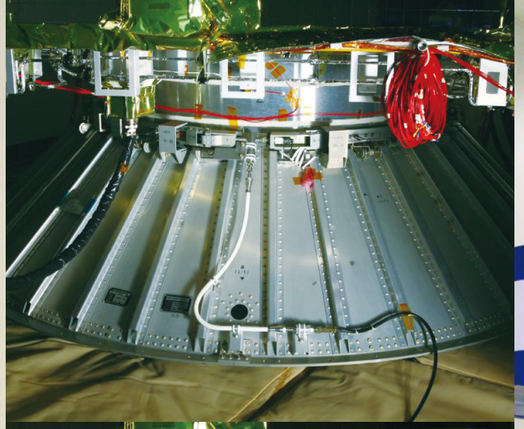
As with the case of the large vibration test facility, the small vibration test facility is used to verify the endurance of systems or equipment on board a spacecraft against simulated launch vibration environments.
This facility is differentiated from the large vibration test facility in that it is used mainly for tests on small to middle size spacecraft or spacecraft equipment, which offers options of facilities to users depending on the size of a test item or intended test purposes.
This facility is equipped with interlock functions appropriate for its software and hardware to mitigate human errors and thus protect a test item.
Possessing many control/measurement channels and ability to handle high frequencies up to 2000Hz or generate transient waves as shock, this facility makes vibration tests not specific to aerospace fields but applicable to general purposes.

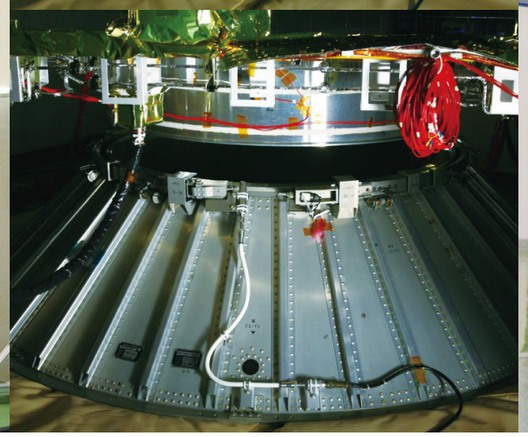
SPECIFICATION

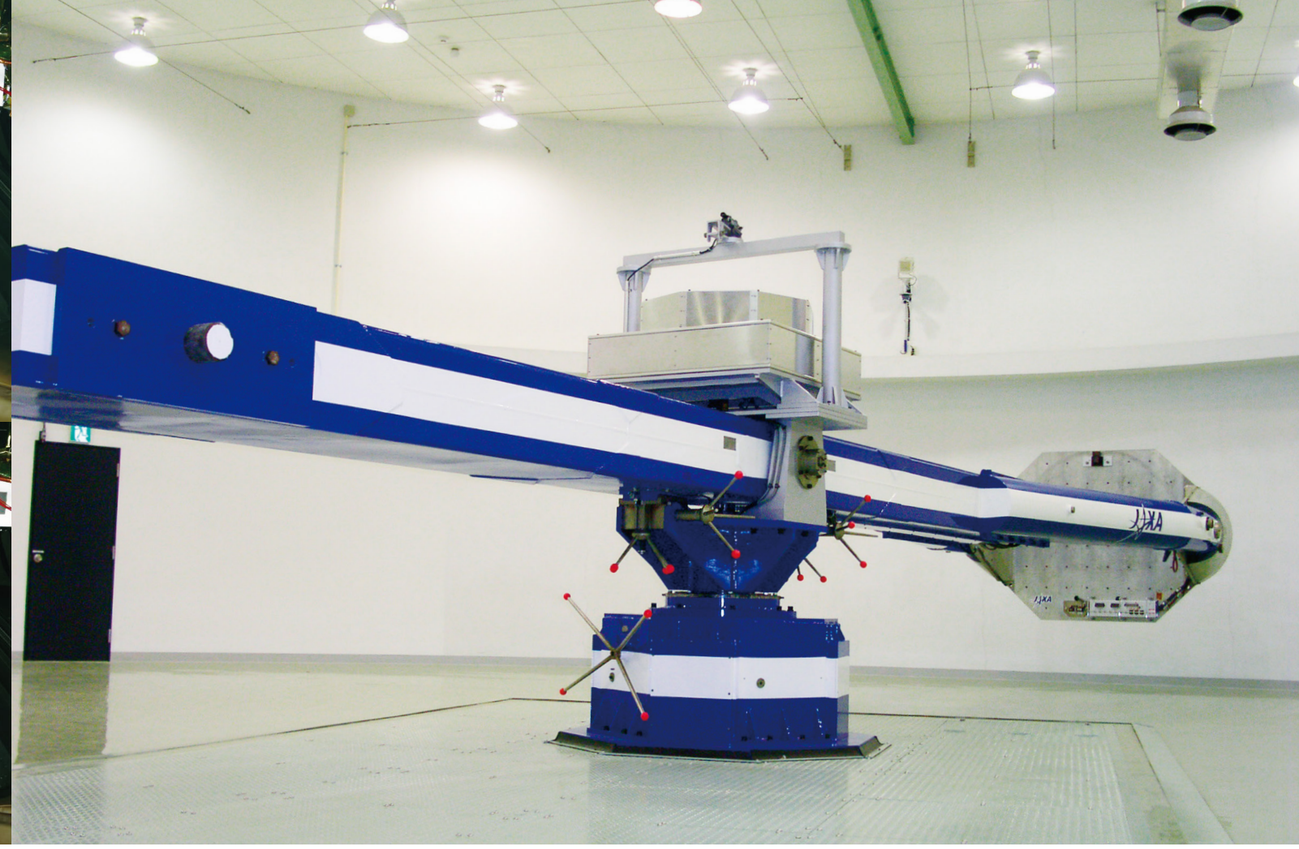
max load capacity	2,000kg	
oscillation ability	sine wave, random wave 178kN	transient wave 334kN
kind of oscillation	sine wave, random wave, transient wave	
freq. range	5~2000Hz	
the number of channels	control 48ch	measurement 192ch

ACTUAL APPLICATIONS

- newly established in 2015

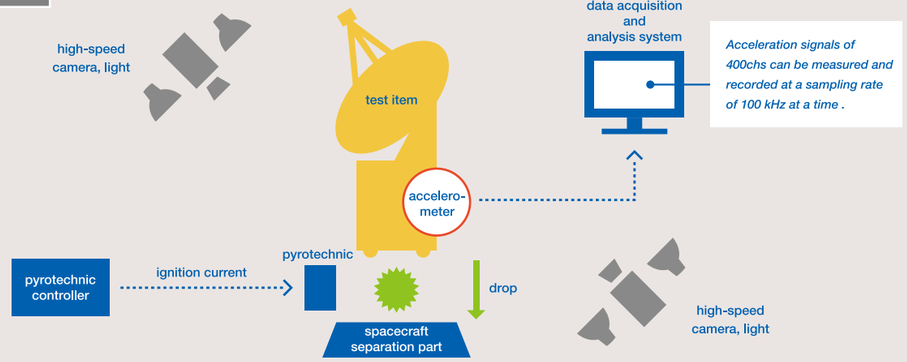






Large-scale Separation Shock Test Facility

System Architecture



The separation shock test facility is used to measure and analyze the shock levels applied to a spacecraft when it separates from the launch vehicle and when the antenna is deployed in response to activated pyrotechnics, in simulated shock environments on ground.
The facility consists of a controller, an analyzer, high-speed cameras, etc. The pyrotechnic controller sends electric ignition current to the pyrotechnics to separate a spacecraft while simultaneously controlling the analyzer and high-speed cameras. The response data collected by the accelerometers mounted on a spacecraft are temporarily read into the data recording system, then uploaded in the analyzer for Fourier transform, shock response spectrum analysis, and other data processing. The photographic images of the state of separation are recorded by the high-speed cameras.

SPECIFICATION

applicable shock source	pyrotechnics / other shock sources are also applicable for data measurement and processing
measurement time	max 1 hour
measurement freq. range	~10kHz (sampling frequency 100kHz)
the number of measurement channels	accelerometer 400ch, ignition current 1ch

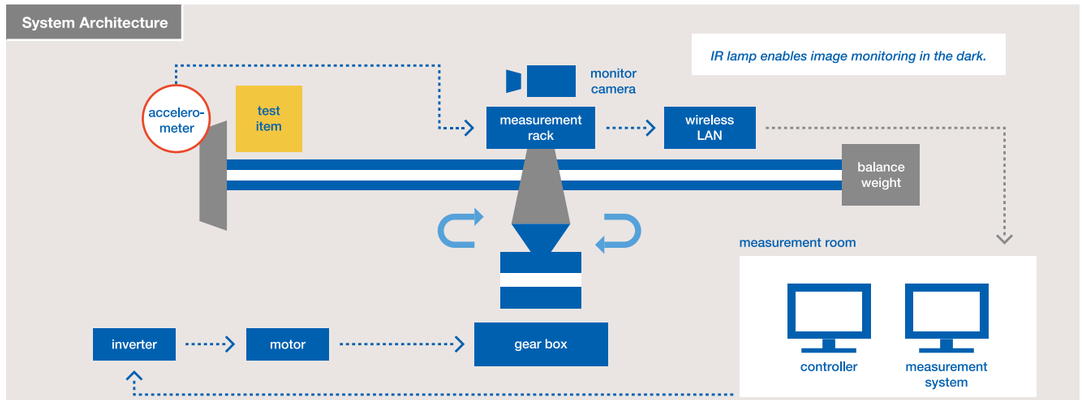
ACTUAL APPLICATIONS

antenna of GCOM-W, SELENE, piggyback payloads on GCOM-W, etc.

PUBLIC APPLICATIONS: small satellites, etc., developed by universities and private companies

Centrifugal Acceleration Test Facility

System Architecture



The centrifugal acceleration test facility is used to verify the endurance and performance of a test item under the static acceleration environment. It simulates such acceleration environments as on a spacecraft during launch or airborne equipment during flight, and occasionally performs tests on small animals.
Acceleration up to 55.7G is generated by the rotary motion of the arm-like structure. A high-speed data logger is mounted on the measurement rack at the rotation center of the arm to send measurement data, e.g., acceleration, strain, voltage, temperature, video signals, etc., acquired by it to a measurement system via a wireless LAN to be monitored and recorded there.
This facility is capable of continuous operation and safe automatic abort of itself at the times of earthquakes.

SPECIFICATION

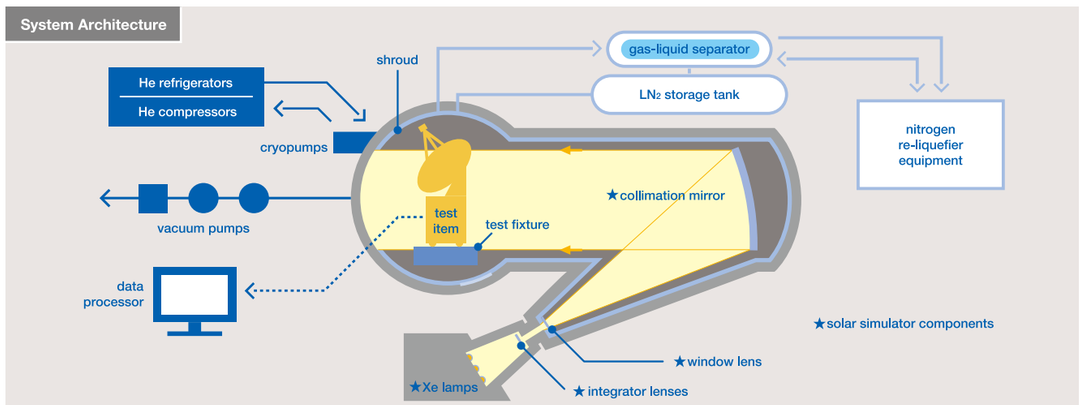
standard rotation radius	7,250mm
range of acceleration	0.2~546m/s²(0.02~55.7G)
rotation speed range	1.6~82.9r/min
direction of rotation	clockwise
max load capacity	400kg

ACTUAL APPLICATIONS

hypergravity experiments on small animals, experiments on plant cells, etc.

PUBLIC APPLICATIONS: airborne equipment, etc.

13mϕ Space Chamber



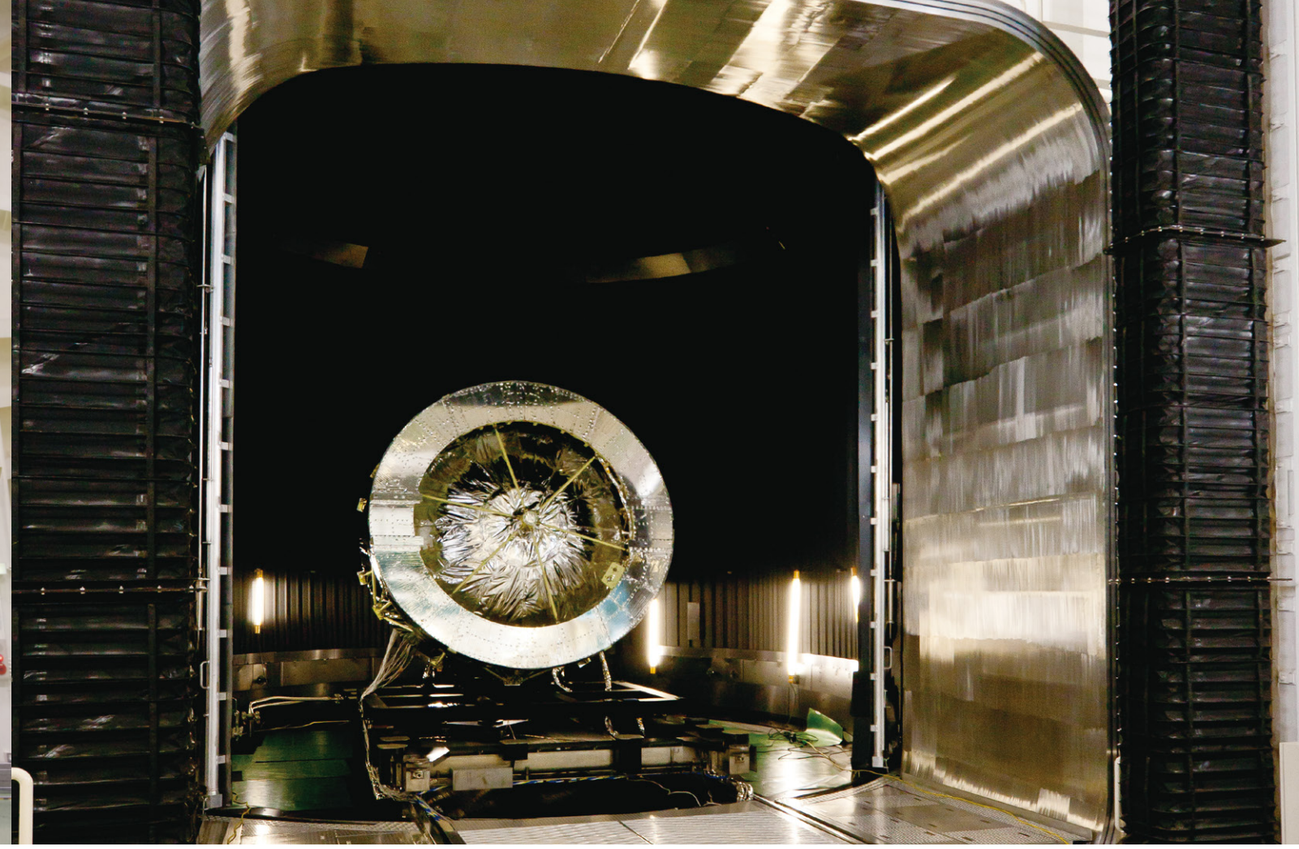
The 13mϕ space chamber is used to simulate environments a spacecraft is exposed to in space, such as high vacuum, cryogenic temperature, or high temperature due to the intense heat from the sun, for the purposes of verifying the endurance, function, and temperature, of a test item. With its diameter of 13m, the facility can store an entire large spacecraft inside it for testing.
It simulates the high vacuum and cryogenic environments in space respectively with vacuum pumps and shrouds covering the walls of the facility through which LN_2 circulates.
This facility is equipped with a solar simulator, which is a system that simulates solar light with Xe lamps whose light properties are similar to those of the sun, reflects them on a collimation mirror to make them parallel, and casts them upon a test item. This facility is precious in that it is not only the sole facility in Japan that can perform tests on a large spacecraft, but is barely found even worldwide.
Its ability to provide semi-solar light enables thermal tests in space-like environments. The facility is also capable of heating a test item with IR heaters.

SPECIFICATION

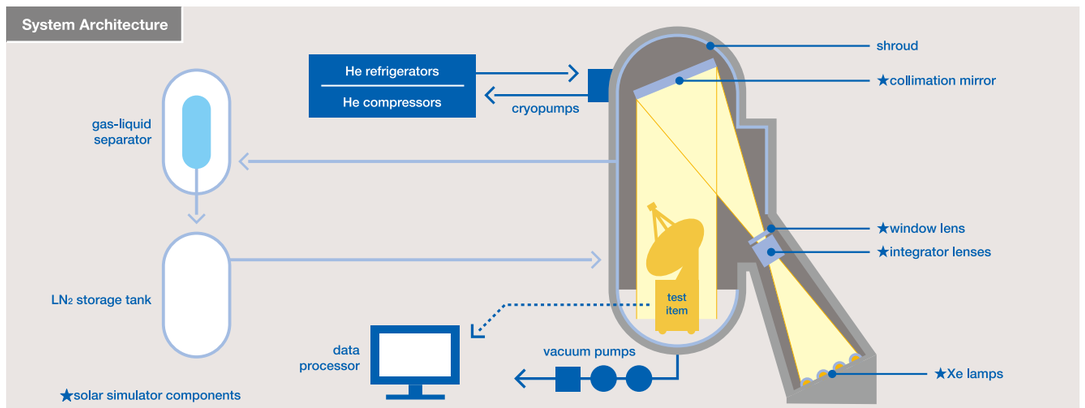
vacuum vessel	shape	side laid hammer-like shape
	inner dimensions	13m(dia)×16m(L)
vacuum pressure/pumpdown time		1.33×10^{-5}Pa(1.0×10^{-7}Torr) or less/within 24
shroud temperature		-170˚C or less
solar simulator	light source	Xe lamps
	max. solar radiation	1.8kW/m²

ACTUAL APPLICATIONS

GCOM-W, HTV, Bepi Colombo(for Mercury exploration), ALOS-2, ASTRO-H, etc.



8mϕ Space Chamber



The 8mϕ space chamber is used to simulate environments a spacecraft is exposed to in space, such as high vacuum, cryogenic temperature, or high temperature due to the intense heat from the sun, for the purposes of verifying the endurance, function, and temperature, of a test item. It can store a test item of up to 5.4m in width and 5m in height, which allows testing on a small to middle-sized spacecraft or equipment to be loaded on a spacecraft.
It simulates the high vacuum and cryogenic environments in space respectively with vacuum pumps and shrouds covering the walls of the facility through which LN_2 circulates.
This facility is equipped with a solar simulator, which is a system that simulates solar light with Xe lamps whose light properties are similar to those of the sun, reflects them on a collimation mirror to make them parallel, and casts them upon a test item. Its ability to provide semi-solar light enables thermal tests in space-like environments. The facility is also capable of heating a test item with IR heaters.

SPECIFICATION

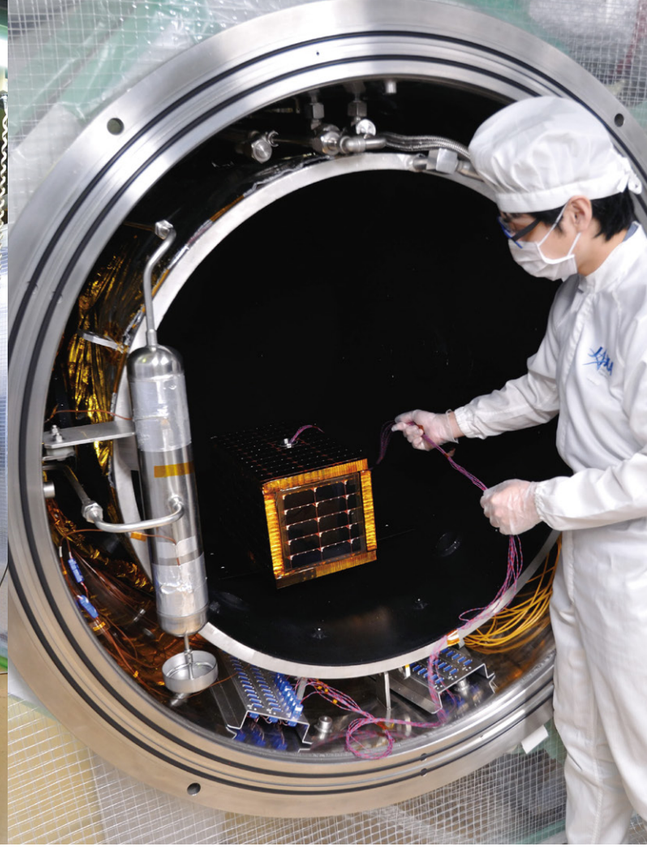
vacuum vessel	shape	vertical cylindrical shape
	inner dimension	7.5m(dia)×19.6m(L)
vacuum pressure/pumpdown time		1.33×10^{-4}Pa(1.0×10^{-6}Torr) or less /within 12h
shroud temperature		-170˚C or less
solar simulator	light source	Xe lamps
	max. solar radiation	2.4kW/m²

ACTUAL APPLICATIONS

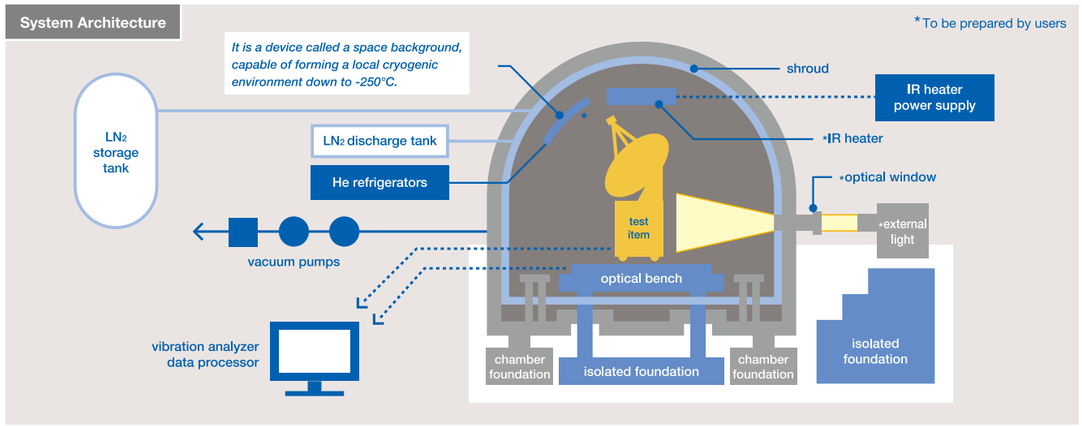
GOSAT, GPM-DPR, H-IIA, equipment loaded on ASTRO-H, etc.

PUBLIC APPLICATIONS: commercial satellites, etc.

Acoustic
Vibration
Shock
Acceleration
Thermal Vacuum
Radiowave and Magnetic
Function and Performance



6mφ Radiometer Space Chamber



The 6mφ radiometer space chamber is used to simulate environments a spacecraft is exposed to in space, such as high vacuum or cryogenic temperature, for the purposes of verifying the endurance, function, and temperature, of a test item. With its diameter of 6m, the facility allows testing on a small to middle-sized spacecraft or equipment to be loaded on a spacecraft.
It simulates the high vacuum and cryogenic environments in space respectively with vacuum pumps and shrouds covering the walls of the facility through which LN_2 circulates. It is also capable of local cooling down to below –250°C by using a device called a space background.
A solar simulator, which is installed in both 13mφ and 8mφ space chambers, is not installed in this chamber, but high temperature environment can be simulated with IR heaters instead.
The facility is designed for optical properties verification tests on optical equipment on board earth observation satellites, etc. which utilizes reflection and interference of light. Due to high susceptibility to varied light incidence angles, optical properties verification tests require isolation from the ground vibration, which is achieved with the aid of an optical bench and an isolated foundation in this facility. This facility is also characterized by its clean room with a higher clean room level (ISO 14644, class7) than those of other space chambers, and a clean booth kept in a high clean level environment (ISO 14644, class5).

SPECIFICATION

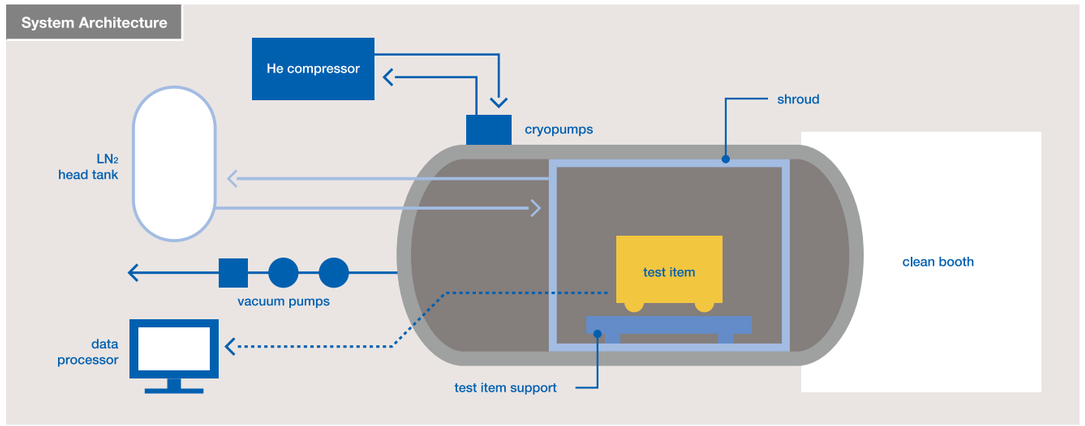
vacuum vessel	shape	mailbox shape
	inner dimension	6m (dia) ×8m (L)
vacuum pressure/pumpdown time		1.3×10^{-5}Pa (1×10^{-7}Torr) or less /within 8h
shroud temperature		-170°C or less, or ambient temperature
other characteristics		vibration isolation

ACTUAL APPLICATIONS

sensors mounted on GOSAT, SMILES, GCOM-C, ALOS-2, antenna on WINDS, etc.

PUBLIC APPLICATIONS: commercial satellites, etc.

1mφ Space Chamber



The 1mφ space chamber is used to simulate environments a spacecraft is exposed to in space, such as high vacuum or cryogenic temperature, for the purposes of verifying the endurance, function, and temperature, of a test item.
It has a 1m (dia) ×1.38m (L) storage space for a test item, where tests on very small satellites (50cm³) or spacecraft parts can be performed.
It simulates the high vacuum and cryogenic environments in space respectively with vacuum pumps and shrouds covering the walls of the facility through which LN_2 circulates. A solar simulator, which is installed in both 13mφ and 8mφ space chambers, is not installed in this chamber, but high temperature environment can be simulated with IR heaters instead.
The chamber is applicable to flight products as well owing to the clean booth (ISO14644, class8) attached to it, which is controlled in terms of cleanliness and humidity.

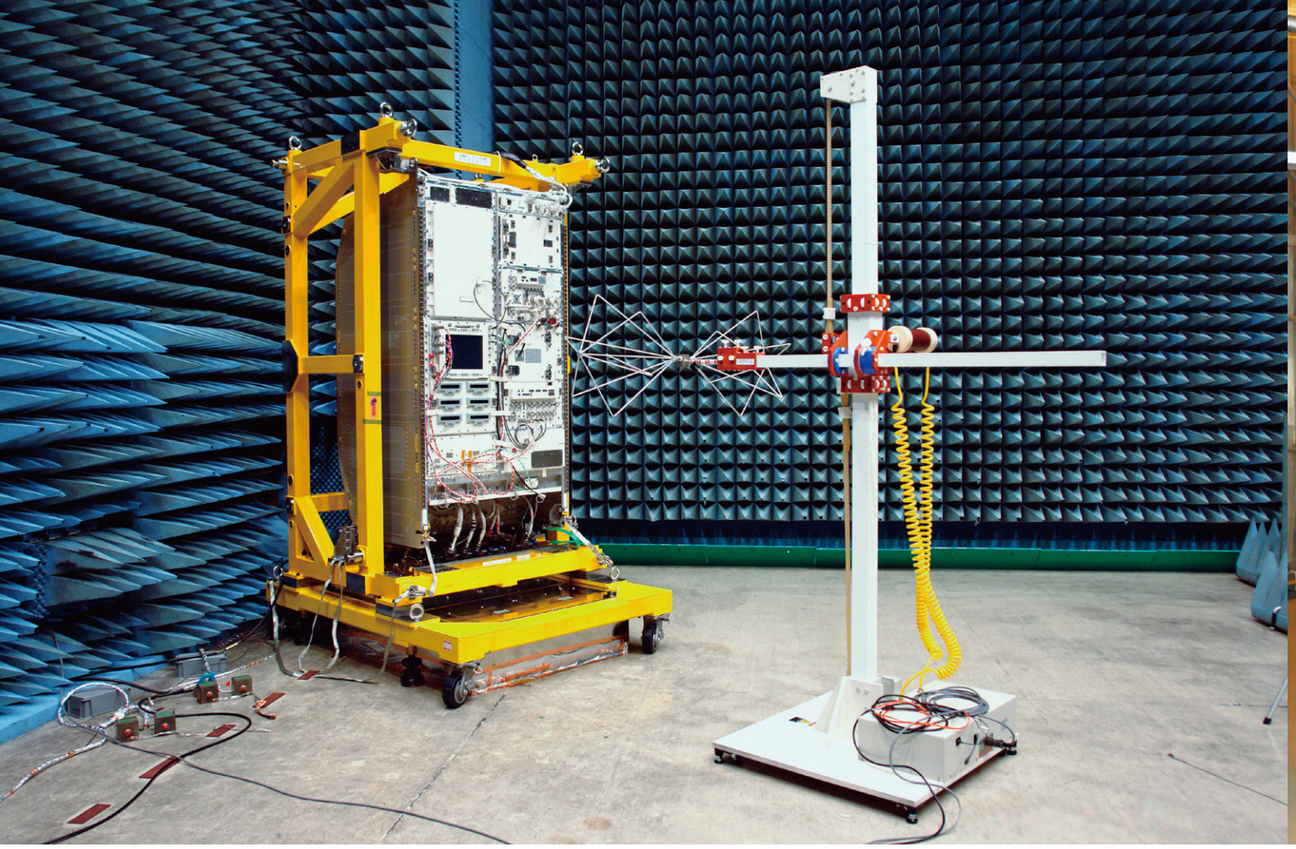
SPECIFICATION

vacuum vessel	shape	horizontal cylindrical shape
	inner dimensions	with shroud:1,000mm (dia) ×1,380mm (L)
		without shroud:1,280mm (dia) ×3,200mm (L)
vacuum pressure / pumpdown time		1.3×10^{-3}Pa (1×10^{-5}Torr) or less / within 4h
shroud temperature		-170°C or less, or ambient temperature

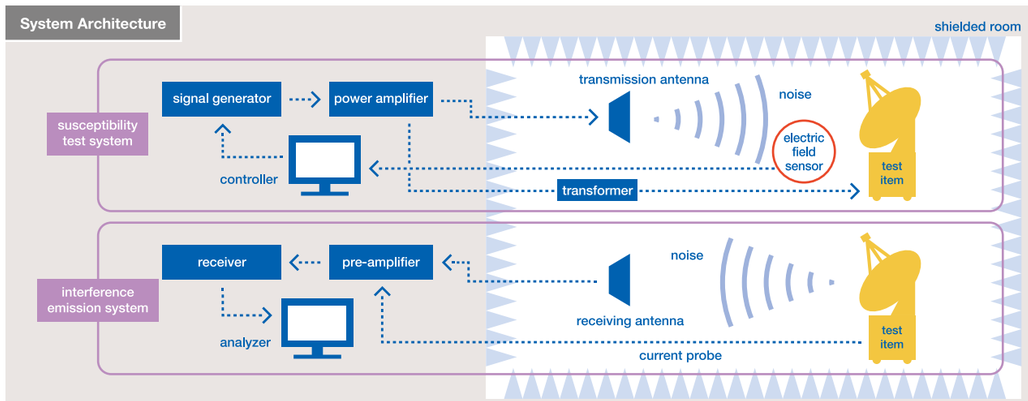
ACTUAL APPLICATIONS

equipment loaded on Quasi-zenith Satellite, equipment loaded on CALET, etc.

PUBLIC APPLICATIONS: university satellite (piggyback payload of GPM main satellite), etc.



Electromagnetic Compatibility Test Facility



The electromagnetic compatibility test facily is used for checking the functional deterioration of electronic equipment on board launch vehicles and spacecraft due to electromagnetic interference between the equipment themselves. This facility offers interference emission testing to measure the electromagnetic noise emitted from a test item, and susceptibility testing to verify the normal functions of a test item by providing it with electromagnetic noise.
Tests are performed in a shielded room which isolates a test item from external electromagnetic noise. In interference emission testing, the electromagnetic noise emitted from a test item into the open space is measured with an antenna while that conducted along cables is measured with a current probe. In susceptibility testing, meanwhile, electromagnetic noise which has been either feedback-controlled using an electric-field sensor or generated by a signal generator connected to the cables of a test item is applied to a test item.
Possessing a test system which can handle up to 40GHz, this facility makes it possible to perform tests with the levels required by the Military Standards and the International Space Station (ISS.)

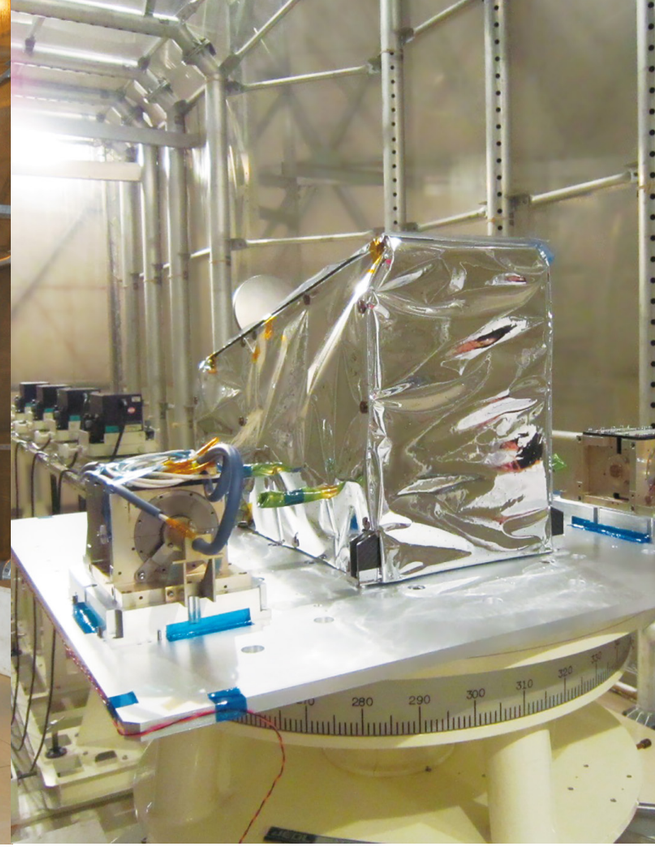
SPECIFICATION

test equipment		in accordance with the Military Standard test requirements (MIL-STD-461C, etc.) and International Space Station requirements (SSP30237) in terms of the measurement and susceptibility testing for the emitted electromagnetic noise provoked by current.
shielded room	inner dimensions	10m(W)×8.8m(H)×10m(D)
	shield effect	for electric field: 10kHz~40GHz 100dB or more for magnetic field: 150kHz~200kHz 85dB or more
radiowave absorbing properties		6dB@80MHz~250MHz, 10dB@250MHz or more

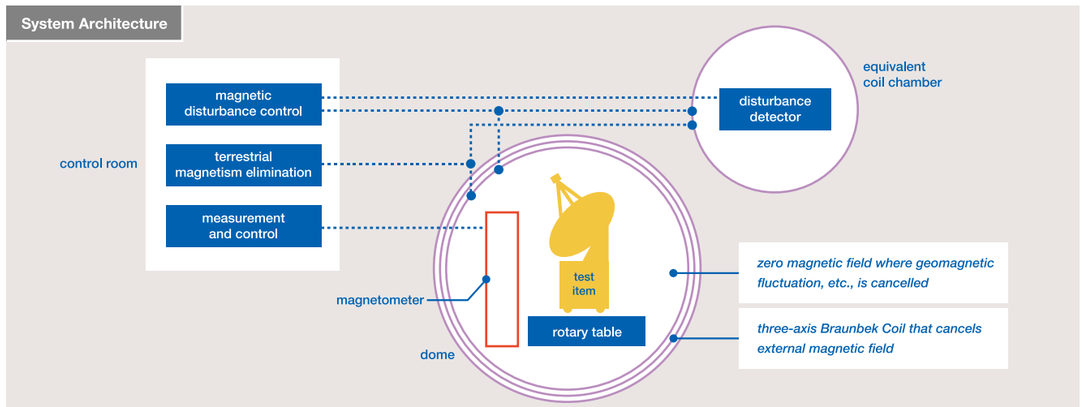
ACTUAL APPLICATIONS

SELENE, HTV, sensors loaded on HAYABUSA 2, modules on board ISS, etc.

PUBLIC APPLICATIONS: airborne equipment, etc.



Magnetic Test Facility



The magnetic test facility is used for measuring magnetic moment, eliminating residual magnetism, and verifying the functions of a magnetic attitude controller, etc., to prevent the disturbance on the attitudes of a spacecraft due to the magnetism from the geomagnetic field and the magnetized spacecraft itself. Since those tests require a space free of the disturbance magnetic field derived not only from the geomagnetic field but from buildings, vehicles, etc., this facility provides a high precision wide-area “zero-magnetic field” by means of a three-axis Braunbek coil (main coil) with the maximum diameter of 15.5m and a disturbance detector which detects magnetic disturbance, in addition to a magnetically-controlled field kept in the area of 300-m radius centered around the measurement room.
The facility is also capable of highly-accurate calibration on magnetometers by creating the standard magnetic field in the “zero-magnetic field”, where diversified magnetometers to be loaded on spacecraft have been calibrated.
This is the largest and an extremely rare magnetic test facility in Japan that can cancel the geomagnetic field to create a “zero-magnetic field”, and is therefore expected to contribute to a wide variety of fields.

SPECIFICATION

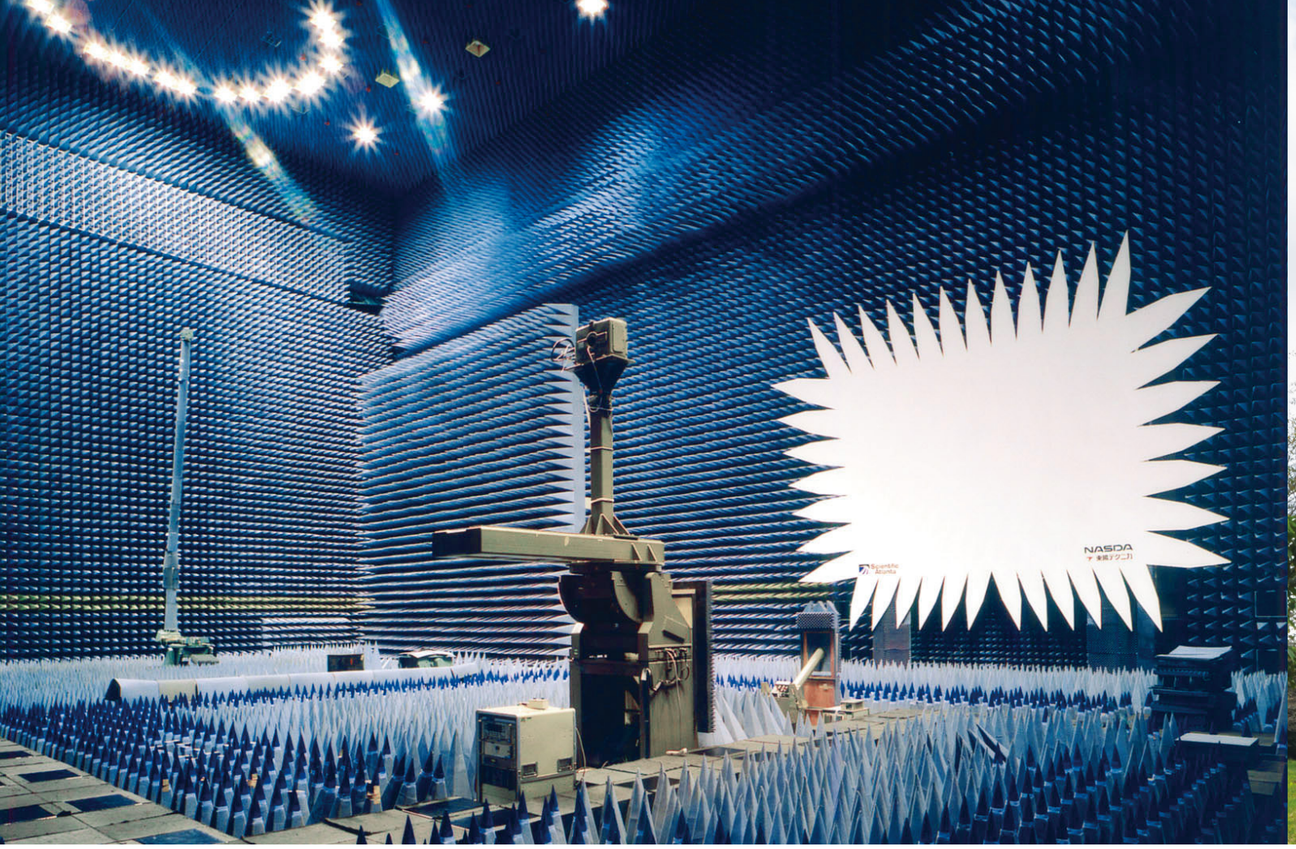
test area	dimension	1.6m dia. spherical space
	magnetic field uniformity	within ±2.5nT
magnetic disturbance control		disturbance control range : within ±1000 nT frequency characteristics : DC~10Hz (-3dB)
measuring properties	measuring range	±100,000nT
	accuracy	±2%
	frequency characteristics	DC~10Hz (-3dB)

ACTUAL APPLICATIONS

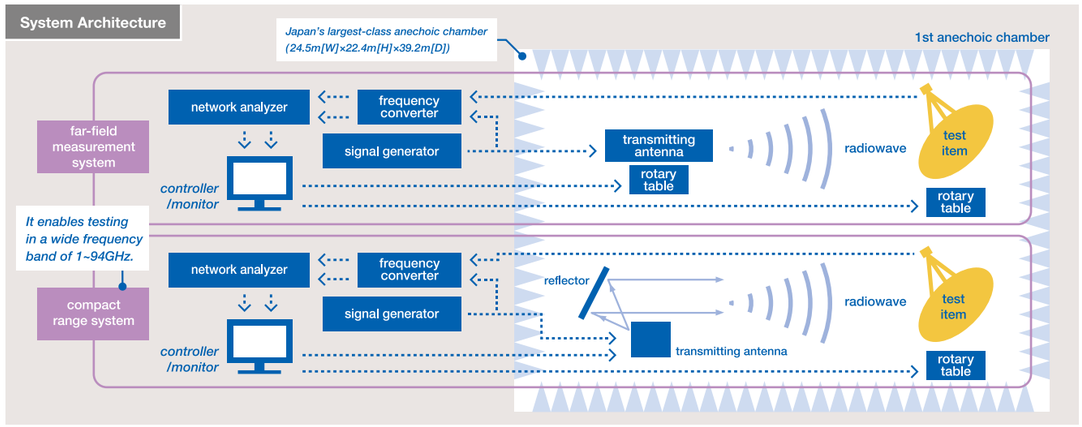
equipment loaded on Quasi-zenith Satellite, Bepi Colombo, EarthCARE/CPR, etc.

PUBLIC APPLICATIONS: scientific experiments, etc.

Acoustic
Vibration
Shock
Acceleration
Thermal Vacuum
Radiowave and Magnetic
Function and Performance



1st Radiowave Test Facility



The radiowave test facility is used for analyzing the radiowave properties of antennas and radiowave sensors to be on board launch vehicles and spacecraft. The radiowave properties analysis is performed by transmitting radiowaves from various directions to an antenna or a radiowave sensor mounted on a rotary table and measuring their reception sensitivity.
The 1st anechoic chamber is the largest RF-shielded radiowave test room in Japan. It is an air-conditionable ISO14644 class 8 cleanroom, comprising a "far-field measurement system" with a distance of 24.6m between transmitting and receiving equipment and a "compact range system" which simulates far-field measurement using a reflector even when only a limited distance can be secured between transmitting and receiving equipment.

ACTUAL APPLICATIONS

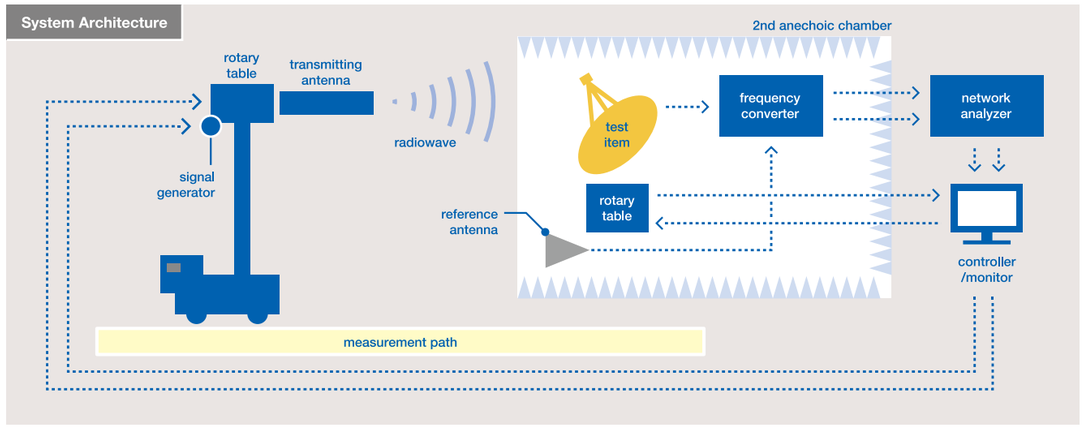
antenna on GCOM-W, antenna on Epsilon Launch Vehicle, Quasi-zenith Satellite, etc.

PUBLIC APPLICATIONS: evaluation tests on equipment related to satellite communication, etc.

SPECIFICATION

1st anechoic chamber	dimensions	24.5m(W)×22.4m(H)×39.2m(D)
	radiowave absorption	450MHz~10GHz or more -22dB~-45dB or less
	electric field shielding	90kHz~30GHz against electric field -80dB~-60dB
compact range system	test zone	horizontally cylindrical space of 3.6m(dia)×3.6m(L)
	test zone properties	amplitude taper 1.0dB or less
	phase variation	10°or less(1GHz~18GHz), 20°or less(18GHz~94GHz)
	freq. range	1GHz~94GHz
far-field measurement system	test zone	spherical space of 6m dia. centered around a point 11m above the center of the rotary table
	distance bet. transmitting and receiving equipment	24.6m fixed
	freq. range	450MHz~26.5GHz

2nd Radiowave Test Facility



The 2nd anechoic chamber is a semi-closed-type radiowave test room one side of which can be wide-open to the outside. With the shutter opened, one can see a measurement path extending further, which can be a constituent of a far-field measurement system with a distance of up to 450m between transmitting and receiving equipment with the aid of an outdoor mobile collimation tower. The 2nd anechoic chamber is on the 4th floor of the building comprising it, and the mobile collimation tower can be vertically stretched for 26m to align its height to that of the chamber, thereby allowing tests to be performed with no impact of the reflection from the ground surface.

SPECIFICATION

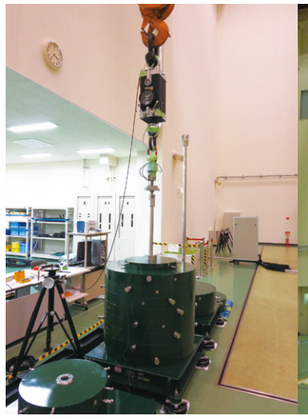
2nd anechoic chamber	dimensions	13.9m(W)×12.5m(H)×10.7m(D)
	radiowave absorption	500MHz~40GHz -25dB~-50dB
far-field measurement system	distance bet. transmitting and receiving equipment	max about 450m with the aid of the collimation towe
	freq. range	any freq. admitted by the Radio Law in the rage of 1770MHz~33.88GHz

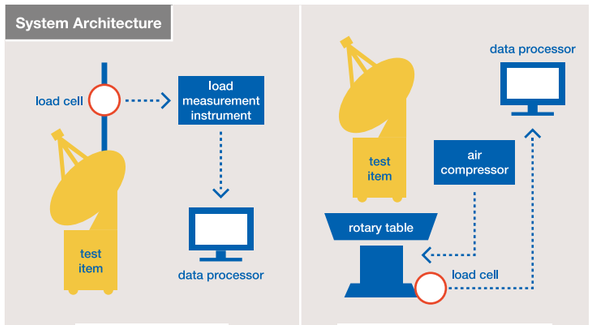
ACTUAL APPLICATIONS

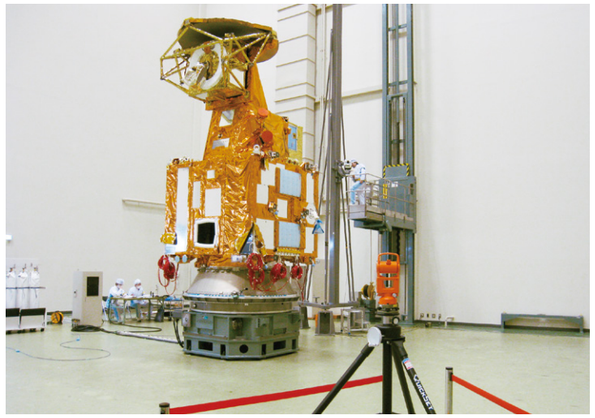
GPM-DPR, antenna on Epsilon Launch Vehicle, etc.

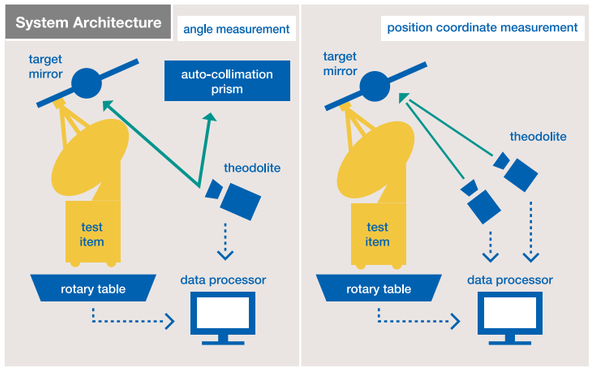
PUBLIC APPLICATIONS: properties acquisition testing for radio signals, etc.

Acoustic
Vibration
Shock
Acceleration
Thermal Vacuum
Radiowave and Magnetic
Function and Performance









Mass Properties Measuring Facility

6tons Mass Properties Measuring Facility

The mass properties measuring facility is composed of a “mass measuring system” and a “mass properties measuring system”, which respectively measure the mass, and the CG and MOI, of a spacecraft.
The former system measures the mass of a test item by hanging it with a crane through a load cell. The mass of a test item weighing 150 kg or less can be measured with a large-scale precision mass measuring table which belongs to the facility.
The latter system, meanwhile, measures the CG and MOI of a test item by rotating it on the rotary table supported by air bearings, simultaneously applying free vibration around its vertical axis.

SPECIFICATION

mass measuring system (load cell)	measurement range	100~6,500kg
	measurement accuracy	0.1% or less
auxiliary equipment (large-scale precision weight)	measurement range	0.01~150kg
	measurement accuracy	50kg or less: ±5g more than 50kg~150kg or less: ±10g
mass properties measuring system	load capacity	60~6,000kg
	diameter of rotary table	2,000mmφ
	accuracy of CG measurement	(0.02+300/M+S/2,500) mm or less [M: test item mass (kg) S: CG offset (mm)]
	accuracy of MOI measurement	50kg-m² or more: ±0.5%

ACTUAL APPLICATIONS

SELENE, GCOM-W, GOSAT, GPM-DPR, ASTRO-H, etc.

Alignment Measuring Facility

10m Alignment Measuring Facility

The alignment measuring facility is used to measure the dimensions of a test item, or the mounting positions and angles of all the sensors and antennas on it.
In angle measurement, the mounting directions and angles of sensors and actuators, etc., which require orientation accuracy can be measured with high precision.
In positioning, meanwhile, the coordinates of an actuator, which is supposed to be at a specific distance from the CG, or of outermost or protruding parts whose clearance from the inner surface of a launch vehicle fairing is critical, are precisely measured.
Furthermore, a working platform and a tooling bar in the facility allow angle measurements and positioning to the height of 10 m, which enables alignment measurements on small to large spacecraft.

SPECIFICATION

optical alignment measuring device	distance accuracy	±0.5mm or less
	angle accuracy	±20sec or less
portable high-precision measuring device (for three-dimensional coordinate measurement)	positioning accuracy	0.5sec (standard deviation)
	vertical and horizontal measurement range	collimatable range to the target
rotary table	diameter	2,000mmφ
	max load capacity	5,000kg

ACTUAL APPLICATIONS

SELENE, GCOM-W, GOSAT, ASTRO-H, etc.

PUBLIC APPLICATIONS: small satellites developed by private companies, etc.

Information for the general users

Our leasing service of facilities makes them open to users not only in the aerospace field but in various fields.

1. Merits of the system

- Capable to perform environmental test on large scale test items.
- Each test facility has its own experienced operators available for general users.
- All the testing facilities including the ones in the Spacecraft Integration and Test Building are designed to enhance test effectiveness, while possessing high reliability owing to thorough quality control.
- Each facility is protected by a rigid security system which achieves high secrecy for any test.
- Upon your request, test-technology-related solutions can be suggested by us concerning the practice of your environmental testing with our facilities.

2. Procedure for general use

- If you wish to use the facilities, please contact us at the following numbers at the earliest possible timing so that you can arrange your test plan.
- Fees for using a test facility is basically estimated from daily charge rates.

Contact

Contact us for the application fees, the specific information on test interfaces or facility specifications, etc.

Environmental Test Technology Unit,
Japan Aerospace Exploration Agency (JAXA)
TEL: +81-50-3362-3956
FAX: +81-29-868-2967
E-mail: shiken-kyouyou@jaxa.jp
URL: http://shiken.jaxa.jp/en/f_guide_e.html

Application

Please download the application from the following homepage.

New Enterprise Promotion Department,
Japan Aerospace Exploration Agency (JAXA)
URL: http://aerospacebiz.jaxa.jp/en/program/facilities.html

Examples of general use

- evaluation tests on equipment developed by universities and corporations
- vibration tests on communication antennas for cell-phones
- evaluation tests on equipment developed by universities and corporations, etc.

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Design: Taeko Isu (NNNNY), Asuka Watanabe, Kai Ito / Edit: Madoka Hattori