宇宙航空研究開発機構
Japan Aerospace Exploration Agency

Overview of the Tanegashima Space Center

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1. Tanegashima Island

Tanegashima Island is located approximately 115km south of Kagoshima City, Kagoshima Prefecture, the southernmost province of Kyushu. Tanegashima is a long, narrow and flat island stretching 57.5 km from north to south with a width of 12 km at its widest point and 5 km as its narrowest. A small island called “Magejima Island” sits next to Tanegashima providing a scenic view. Tanegashima Island is approximately 445 km^2, and it is the fifth largest among Japan's offshore islands. Tanegashima Island consists of one city (Nishinoomote City) and two towns, (Nakatanecho and Minamitanecho). The western coast facing the East China Sea features white sandy beaches. The eastern coast facing the Pacific Ocean has scenic views of the interesting harmony between the emerald-colored ocean and the eroded odd-shape rocks.

The island is situated in a subtropical climate zone, and is abundant in tropical plants such as hibiscus, banyan trees and cycad. Historically, the island is associated with the introduction of firearms to Japan from Portugal in 1543. Tanegashima is rich in myths and folklore legends related to the introduction of firearms and the tragic love story of Princess Wakasa.

Nowadays, the island is known as the closest island to space or the entrance to space in Japan because of the largest Japanese launch site for large-scale satellites, the Tanegashima Space Center (TNSC). This modern aspect mixed with historical features attracts an ever-growing number of tourists to the island.

＜Basic Information on the Island＞

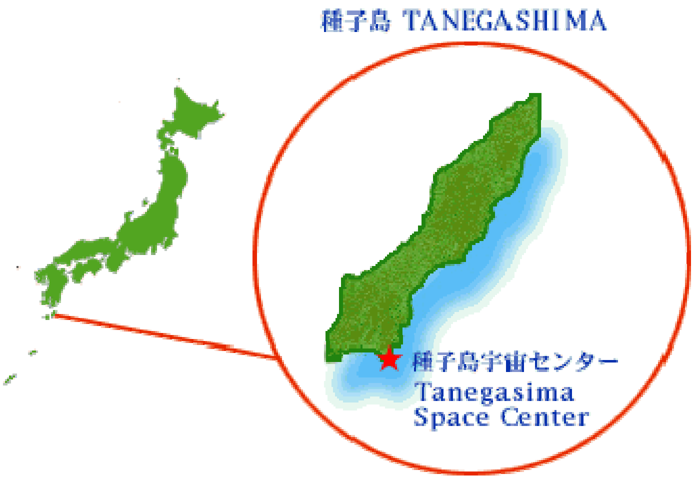
-Population: 35,103 (According to the “Overview of Kumage JFY 2004”, there are 6,997 people in Minamitanecho, 9,473 in Nakatanecho and 18,633 in Nishinoomote City)

-Total Land Area: Approx. 445 km^2.

-Shape of the island: 57.5 km north to south, with an east to west width ranging from 5 km to 12 km.

-Circumference: Approx. 166 km, the highest point is 282 m above sea level.

-Climate: Subtropical climate, annual mean temperature of 19.6 degrees Celsius, annual precipitation of 2,321.7 mm.



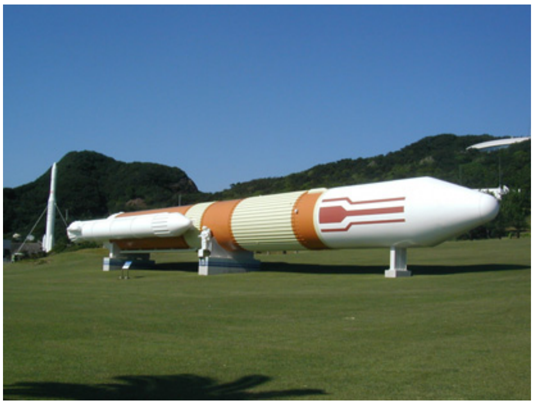
2. Tanegashima Space Center (TNSC)

2-1 Outline of the Tanegashima Space Center (TNSC)

The Tanegashima Space Center (TNSC) is located in the southeastern corner of the island. Construction of the site began in 1966. With a site area of 9.7 million m^2 (*), the TNSC is the largest launch site in Japan. It consists of the Takesaki Range for small launch vehicles, the Osaki Range for medium to large launch vehicles, the Masuda Tracking and Communication Station (situated 18 km to the north of Osaki Range), the Uchugaoka Radar Station (situated 6km to the west of the range), and the Kadokura Optical Tracking Station (13 km to the southwest of the range). It is also equipped with other facilities including those for ground firing tests of both liquid engines and solid motors.
At the TNSC, a whole range of activities are carried out such as pre-launch operations for satellites and launch vehicles including inspection, coordination and assembly, launch countdown work, and launch vehicle tracking. In addition to its central role in conducting launches of satellites for research and development, it also engages in other development fields such as conducting ground firing tests for liquid engines and solid motors.

Apart from the above-mentioned practical aspects, the TNSC has been widely praised for its scenic beauty.

* The area of the TNSC includes a state forest that is about 3 km in diameter around the launch pad.



2-2 Reason Why Tanegashima was Selected for the Center

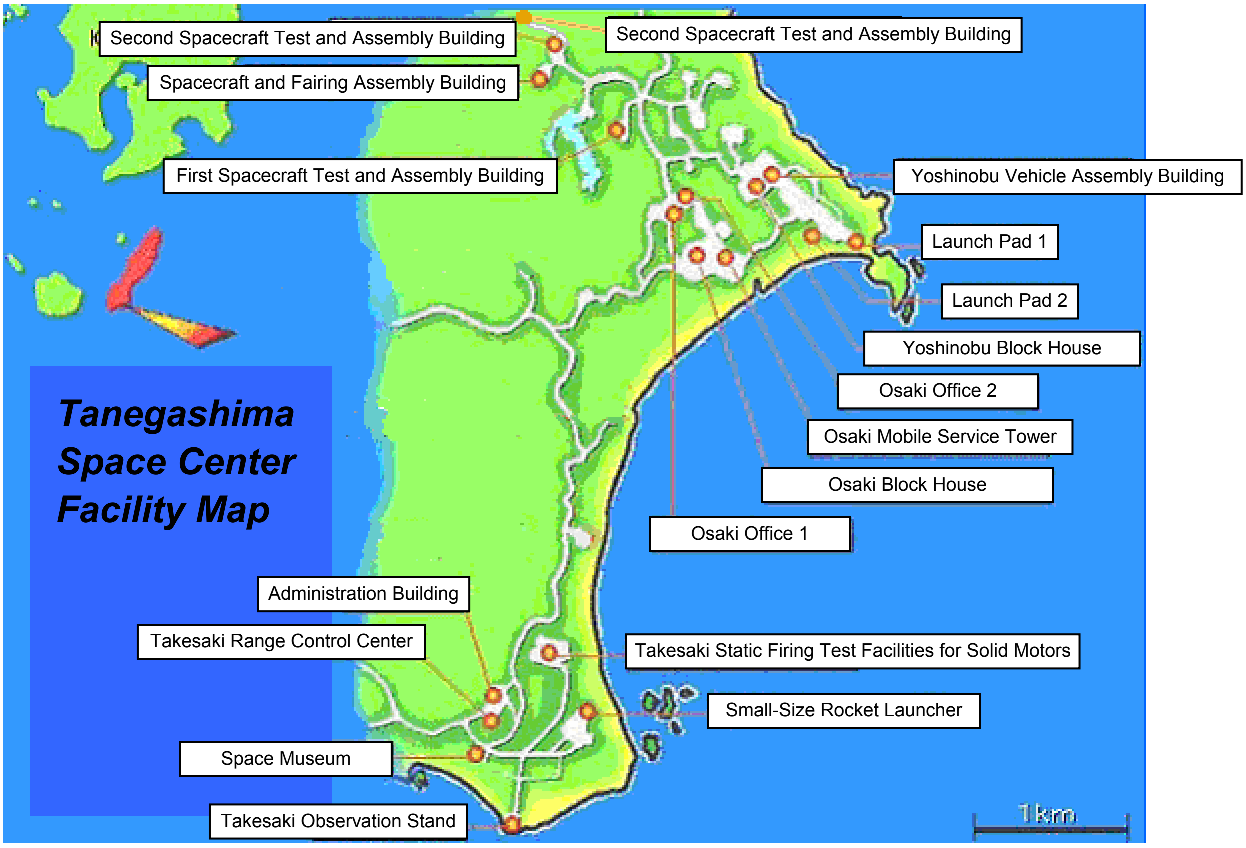
The criteria for choosing the site for launching rockets and satellites was as follows:

a. The site should be favorably located for using the earth's rotation (from west to east) for geostationary transfer orbit launches, and causing the least possible conflict with land, sea, and air safety at the time of polar orbit launches toward east and south.
b. The site should be as close to the Equator as possible within the territory of Japan. (Tanegashima is situated at a latitude of 31°N.)
   Note: When the construction of the space center began, Okinawa had not yet been reverted to Japan. The southernmost point in Japan then was Yoron Island with a latitude of 27°N. The current southernmost point in Japan is Okinotori Island with a latitude of 20°N.
c. The site should be located where it would create minimum interference for offshore fishermen.
d. The site should be located in a place where swift acquisition of the required acreage and relatively easy land development are possible.
e. The site should be accessible for communications, electric power, and water supply.
f. The site should be accessible by public transportation and other means for the ease of transportation of staff, materials, and equipment.
g. The site should be as remote as possible from any demographically concentrated areas.

It was extremely difficult to find a place that fulfilled all the above-mentioned criteria, especially since some of the criteria contradicted each other. During the search and review of the candidate sites, the current site on Tanegashima Island was found to be the most ideal.

3. Major Facilities

The major facilities of the Tanegashima Space Center (TNSC) are as follows.



3-1 Takesaki Range

(1) Takesaki Range

The Takesaki Range, no longer in use, was a site from which small-sized rockets (LS-C, JCR, TT-500A, TR-I, etc.) were launched for technological development. The range facilities include the Takesaki Block House and small-size rocket launcher.
From 1991, this range was used to launch a series of small-size rockets (TR-IA "Takesaki", which was an improved TR-I) for space experiments. The mission of the TR-IA experimental project concluded with the TR-IA No. 7 as the purpose of the current technological developments had been achieved, such as the improvement of space experiment technology for early utilization of a space station, common experiments, and development of enabling technology for equipment.

(2) Takesaki Static Firing Test Facilities for Solid Motors

The Takesaki Static Firing Test Facilities are currently used for Solid Rocket Boosters of the H-IIA launch vehicles (SRB-As). The ground firing tests of strap-on solid rocket boosters of the H-I launch vehicles (SOBs) and solid rocket boosters of the H-II launch vehicles (SRBs) were also conducted at these facilities. The test area is equipped with a measuring room, test stand with a shelter, and camera room.

(3) Takesaki Observation Stand

Located about 3.6km away from the Osaki Range, this is a place where media personnel such as television, newspaper, and magazine reporters gather information on launch activities. Equipped with a rooftop outdoor stand, the observation stand has a press conference room, offices for observers and JAXA PR staff, pressroom, time display, and photo darkroom.

(4) Space Museum

The Space Museum, opened in August 1979 as Japan's first full-scale space development museum, is designed to nurture cooperation from the general public by providing them with information on the purpose, significance, necessity, and current situation of space development in Japan. It hopes to encourage younger generations with dreams, hopes and interests in space and space development programs. The museum exhibits a broader range of space-related materials on the relationship between space and human beings, visions of future space development, the contribution of space development to human beings, mechanisms and functions of satellites and launch vehicles and their launches, tracking, and control. The museum is free of charge and open to the general public.
After a mockup of the "Kibo" (Japanese Experimental Module, JEM) and space information center were added to the space development exhibition hall, it was renamed the "Space Museum" and reopened on March 26, 1997.

(5) Mockup of the H-II launch vehicle

A life-size mockup of the H-II, a 100% made-in-Japan large-size launch vehicle developed as a result of lengthy, desperate efforts by Japanese engineers, is on display outside in the lawn area of the Takesaki Range as a symbol of the center.
The mockup is displayed horizontally so that visitors can feel closer to space development and can deepen their understanding by touching the mockup, realizing the size of the launch vehicle, and feeling its dynamism.
[References]
<Dimensions: Total length: 50 m, Diameter: 4 m
SRB: Total length: 23 m, Diameter: 1.8 m>

(6) Takesaki Range Control Center (RCC)

At the Takesaki Range Control Center (RCC), all coordination and control is performed for the final launch operations in Tanegashima including pre-liftoff operations of a launch vehicle and satellite(s), ground safety coordination, launch, and launch vehicle tracking after liftoff. The RCC also serves as a control center for communications and coordination with tracking stations on and off the island as well as with down range stations around the world to perform the entire launch/flight operations smoothly. In order to do so, information is gathered, analyzed, and judged in the RCC so that required planning, communications with related sections, data processing, and situation control according to its progress can be carried out there.
The RCC contains range control facilities, communications equipment, digital time unit, meteorological observation equipment, optical tracking facilities, and various monitors.

3-2 Osaki Range (Osaki Launch Complex for Mid-size Rocket Launches)

(1) Osaki Mid-size Launch Complex

The Osaki Mid-size Launch Complex was used to launch N-I, N-II, and H-I launch vehicles. The existing facilities were renovated and tailored to J-I launch vehicles. In February 1996, the J-I launch vehicle was launched. A separation test on an SRB-A of the H-IIA launch vehicle was also conducted in November 1998. This range consists of the Osaki Mobile Service Tower (MST) to assemble, check out, and inspect launch vehicles, a launch pad to fix and launch vehicles, and a mid-size launch vehicle support tower to support cables and ducts for supplying electricity to launch vehicles, payloads, air conditioners, and high-pressure gas until liftoff.

Osaki Mid-size Launch Complex

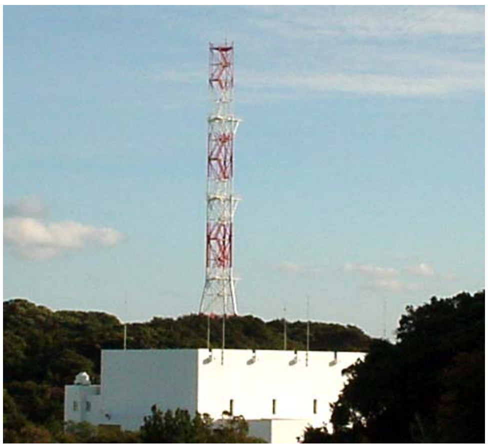
The launch complex that used to launch N-I, N-II, and H-I launch vehicles was renovated and used effectively as J-I launch vehicle launching facilities. They were tailored to J-I launch vehicles by adding new facilities. Like H-I launch vehicles, the assembly and launch operations of J-I launch vehicles were conducted in the Mobile Service Tower. The tower part is designed to recede 100 m on a rail from the launch pad at the time of launch.

(2) Osaki Block House

The Osaki Block House, a semi-underground explosion-proof building, is located about 170 m away from the Osaki launch pad. When a launch vehicle is launched, about one hundred operators work in this building. The roof is covered with one-meter-thick concrete and two-meter thick soil so that in the event of a launch vehicle explosion, the accident would not affect the operators inside the building. In the Osaki Block House, launch operations, namely assembly, coordination, inspection, high-pressure gas loading, and launch, are instructed, coordinated, and monitored. Information on launch operations at the launch pad was also transmitted to the Osaki Range Control Center, and final launch operations were remotely controlled from the Block House. In short, major control and coordination of launch operations were performed in this building.
The launch vehicle ignition timer start and countdown were also carried out in this Block House.

(3) 80-meter Meteorological Observation Tower

An 80-meter meteorological observation tower was installed on a mountain behind the Osaki Block House to obtain meteorological data (wind direction, wind velocity, etc.) The tower transmits data required for safety and smooth progress of launch activities to the Range Control Center.



3-3 Osaki Range (Yoshinobu Launch Complex for H-IIA Launchs)

Originally, the construction of the Yoshinobu Launch Complex was started in 1986 as a range for launching H-II launch vehicles. It was completed at a total construction cost of 50 billion yen in September 1991. After the development of the H-IIA launch vehicle, the successor of the H-II, was decided, the addition of new facilities for H-IIA launch vehicles and the modification of existing facilities were started in 1997 at a cost of 25 billion yen and completed in March 2000.

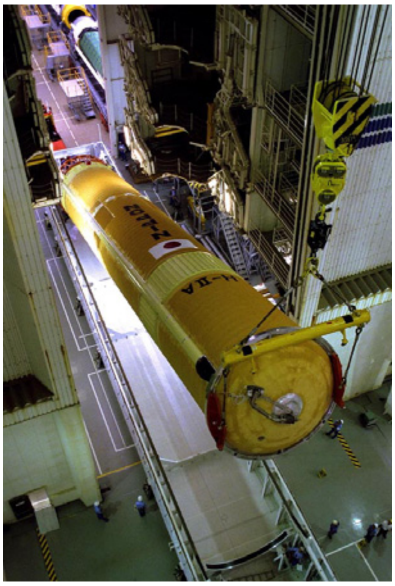
The Yoshinobu Launch Complex includes the Yoshinobu Vehicle Assembly Building (VAB), Yoshinobu Block House (B/H), Launch Pad 1 (LP1), Launch Pad 2 (LP2), Yoshinobu Mobile Launcher (ML), propellant/high-pressure gas storage facilities, etc. The H-IIA launch vehicle is assembled, inspected, checked, loaded with propellant, and launched at this launch complex.

(1) Yoshinobu Vehicle Assembly Building (VAB)

The Yoshinobu Vehicle Assembly Building (VAB) is a place where each stage of the launch vehicle (SRB-As, first stage, and second stage) is delivered from the factory. In the VAB, each stage is unpacked from a shipping container, and assembled as a launch vehicle on the Yoshinobu Mobile Launcher (ML).

The VAB was modified on a large scale so that two H-IIA launch vehicles can be simultaneously prepared and inspected. All launch operations, including assembly and checkout, for the H-IIA launch vehicle are performed in the VAB, and the ML loaded with a launch vehicle is transported to a launch pad on the launch day. This feature is a significant difference from H-II operations. For the H-II, only the first and second stages and SRBs were assembled in the VAB, and a vehicle was transported to the Yoshinobu Pad Service Tower (current LP 1) before (a) fairing-encapsulated satellite(s) was/were loaded onto it. The mating of the satellite(s) with the vehicle and final inspections were performed in the tower.

[References]
<Height: 81 m/ Width: 64 m/ Depth: 34.5 m/ Total weight: Approximately 5,600 t>




2M4F12R
2M4F13L
2M4F12L


NASDA

(2) Launch Pad 1 (LP1) / Former Yoshinobu Pad Service Tower (PST)

The 2-ton class geostationary satellites are launched by the H-IIA launch vehicles from Launch Pad 1 (LP1).
The LP1 was originally constructed for the H-II launch vehicle and was called the Yoshinobu Pad Service Tower (PST). The facilities were renovated for launching H-IIA launch vehicles.
During the H-II era, the PST consisted of a rotating part and fixed pad part. The H-II launch vehicle (on a ML) whose assembly process up to the second stage had been completed in the VAB was transported to the PST. The rotating part of the PST opened to house the vehicle. After the transportation, the PST was closed again, then the rest of the launch operations such as loading (a) fairing-encapsulated satellite(s), and final inspections, were performed in the PST. The rotating part was opened again on the launch day, and terminal countdown operations were remotely conducted from the B/H such as propellant loading and electrical supply provided through tubes and pipes called umbilical lines from related facilities.
A total of seven H-II launch vehicles and ten H-IIA launch vehicles were launched from the LP1 (or the former PST).

[References]
<Height: 61 m/ Total weight: 1,000 t/ steel structure>

(3) Launch Pad 2 (LP2)

The Launch Pad 2 (LP2) was newly constructed for the H-IIA launch vehicle. From the LP2, a 2 to 4-ton class geostationary satellite can be launched by the H-IIA launch vehicle. A certain degree of flexibility has been taken into consideration so that this pad can be used for larger launch vehicles in the future.
The LP 2 has the same function as the LP 1. The H-IIA launch vehicle is assembled with all stages and (a) fairing-encapsulate satellite(s) in the VAB. Therefore, the LP 2 is composed of only a connecting base section (pad) with a ML and a concrete pavement.

[References]
<Lightening tower: Height: 74.5 m>

(4) Mobile Launcher (ML) / Mobile Launcher transportation vehicle (called "Dolly")

The Yoshinobu Mobile Launcher (ML) holds the H-IIA launch vehicle, which was assembled in the VAB, and it is used as part of the launch pad at the time of launch. Two Mobile Launcher transportation vehicles (Dollies) with multi-wheels transport the ML from the VAB to a launch pad, which is approximately 500 m away. The H-shape mast on the ML is an umbilical mast to sustain umbilical lines such as cryogenic lines, electric wires, ducts for air conditioning, etc.
The ML for the H-II launch vehicle ran on a steel rail automatically from the VAB to the PST (current LP1).

[References]
<Mobile Launcher 1 (ML1), For the 2t class H-IIA launch vehicle>
Height 65.5 m/ Width: 22 m/ Depth 21 m/ Total weight: approx. 850 t
<Mobile Launcher 3 (ML3), For the 3t class H-IIA launch vehicle>
Height 65.5 m/ Width: 22 m/ Depth 25.4 m/ Total weight: approx 1,040 t
<Transportation system: Mobile launcher transportation vehicle (Dolly) >
Two dollies are used to transport a Mobile Launcher.
Total length: 25.4 m/ Vehicle width: 3.3 m/ Vehicle height: 2.84 m – 3.44 m/ Total weight: approx. 150 t
Urethane solid tires: 56 tires in 14 axis/ Maximum speed: 2 km/h
The vehicle can move forward and backward with a mobile launcher (loaded with a launch vehicle). In addition, it can move sideways like a crab and a 180°turn on the spot.

(5) Yoshinobu Block House (B/H)

The Yoshinobu Block House is located about 500 m away from both launch pads (LP1 and 2). The launch control room of the H-IIA launch vehicle is adjacent to that of the H-II launch vehicle. In the B/H, control, instruction and supervision are conducted for the assembly, operations, and inspection of a launch vehicle at the launch pad, as well as for propellant loading and final operations on the launch day. Necessary information is also timely sent to the Range Control Center (RCC) from the B/H, and a series of terminal countdown operations up to the liftoff of a launch vehicle are performed by remote control from the B/H.
The B/H for the H-IIA is constructed 12m under ground. Compared to the H-II launch vehicle, the launch control system for H-IIA is automated with more computers, and requires fewer operators to conduct a launch.
The B/H for H-II is a one-story octagonal building made of reinforced concrete. It is also an explosion-proof and airtight structure so that it can protect operators inside from falling objects. Approximately 120 operators worked in the B/H at the time of launch. This B/H is not used anymore.

(6) Yoshinobu Static Firing Test Stand (for Liquid Engines)

The ground firing test facilities were constructed for a static firing test of the main engine (LE-7) of the H-II launch vehicle, and were also used for development of the main engine (LE-7A) of the H-IIA launch vehicle. The facilities play an important role in obtaining ground firing data and determine the engine design at the development stage. After the development, the facilities continue to be used for an engine acceptance firing tests for a flight.

3-4 Launch Vehicle Tracking Facilities

(1) Radar Stations

Three radar stations are to measure launch vehicle flight paths. Radar and its peripheral equipment are installed in respective stations in the districts of Nogi, Uchugaoka, and Osaki in order to form the redundant system. The flight position of a launch vehicle is measured by three stations, and acquired data is sent to the Range Control Center (RCC).

(2) Telemetry Stations

Telemetry stations receive telemetry data such as acceleration, pressure, temperature, etc., sent from each stage of a launched launch vehicle. The stations, which are in two districts, Nakanoyama and Masuda, monitor and record the flight status of the launch vehicle, and send data required for flight safety control to the RCC.

(3) Optical Tracking Facilities

As an optical tracking system can track the launch vehicle at a low altitude at which radio frequencies are not received consistently by radar stations, it is used to perform initial acquisition immediately after liftoff and to track a launch vehicle until it reaches a beeline distance of about 200 km.

The optical tracking facilities are to track and observe a launched vehicle by an optical camera and to send data to the RCC. There are three optical tracking stations in the districts of Hirota, Takesaki, and Kadokura.

The Hirota Optical Tracking Station is located 2.3 km northwest of the Yoshinobu Launch Complex. The Takesaki Optical Tracking Station is in the RCC, which is located 3.3 km away from the Yoshinobu Launch Complex. The Kadokura Optical Tracking Station is on Cape Kadokura, located 10.2 km southwest of the Yoshinobu Launch Complex.

3-5 Payload Facilities

(1) First Spacecraft Test and Assembly Building (STA1)

Unpacking and visual inspection of 1-ton class small and medium satellites after transport, its assembly, and various tests are conducted including a radio frequency characteristic test, functional inspection, and compatibility test in the First Spacecraft Test and Assembly Building (STA1).
Satellites are housed in a high bay where the environmental conditions (10,000 class cleanliness, temperature and humidity requirements, etc.) are controlled and maintained. With inspection instruments installed in an adjacent checkout room, satellite operations are performed such as a functional test.

(2) Second Spacecraft Test and Assembly Building (STA2)

After transport, assembly, and various tests, unpacking and visual inspection of large-size satellites are conducted in the Second Spacecraft Test and Assembly Building (STA2) including a radio frequency characteristic test, functional inspection, and compatibility test.
In addition, at STA2, it is possible to remotely monitor a satellite after it is transported to the Spacecraft and Fairing Assembly Building (SFA) or VAB. It is also possible to remotely control and monitor loading operations of hydrazine and propellant for satellite attitude control, or filling operations in a bi-propellant apogee engine performed in the SFA from the STA2.
The STA2 consists of airlocks, spacecraft preparation halls (high bays), GSE storage rooms, a preparation room, checkout rooms, and an unpacking room.
The environment for a satellite (100,000 class cleanliness) is maintained in the 25 m high spacecraft preparation halls (high bays) where each unit of a satellite delivered separately is assembled and inspected, an alignment measurement is conducted, and satellite functions such as an electric functions are checked. These activities can be remotely controlled and monitored from adjacent checkout rooms.
Moreover, the STA2 is equipped with optical fiber cables as well as antennas connected to the VAB and ML so that a satellite can be monitored and checked from the STA2 after it is transported to the VAB or ML. In addition, the STA2 has an antenna for communications with the Masuda Tracking and Communication Station.
The STA2 was renovated in March 1997 in order to cope with the anticipated future demand of more frequent launches. Following the renovation, it is now possible to perform operations for two large-size satellites simultaneously in the STA2, and that contributes to shorten launch intervals.

(3) Spacecraft and Fairing Assembly Building (SFA)

The SFA consists of a 30 m high spacecraft-fairing assembly hall with 100,000-class cleanliness, airlocks, filling and assembly hall, checkout room, and filling equipment room.
Following the completion of operations in the STA1 or 2, a high-pressure leak test on a satellite propulsion system is conducted in this building, as well as propellant loading into a satellite, pressurization, pyrotechnics installation, satellite solid rocket motor installation, etc. At the end of SFA operations, a satellite is encapsulated by a fairing.

(4) Second Spacecraft and Fairing Assembly Building (SFA2)

The SFA2 is equipped with the function of the STA2 and SFA. Therefore, a whole series of satellite launch site operations can be completed in the one building after its arrival at the TNSC including various tests, propellant loading, and fairing encapsulation.
The SFA2 consists of an airlock, spacecraft preparation hall (high bay), spacecraft-fairing assembly hall, checkout rooms, and other necessary facilities.
The 28-m high spacecraft preparation hall can maintain a class 100,000 cleanliness environment, and operations are carried out there such as satellite assembly after its delivery, function verification, propellant loading, pressurization and checkout.

The 34-m high spacecraft-fairing assembly hall can also maintain a class 100,000 cleanliness environment, and operations are carried out there including satellite and fairing mating and preparation for transporting to the VAB. The activities there can be remotely controlled and monitored from the checkout room.
Moreover, the SFA2 is equipped with optical fiber cables that are connected to the VAB and ML so that a satellite can be monitored and checked from the SFA 2 after it is transported to the VAB or ML.

3-6 Common Facility

(1) Second Non-Destructive Test Building

The Second Non-Destructive Test Building is a place to check the SRB-A with X-ray equipment. X-ray scans show whether any defects are inside the solid propellant. Two types of X-ray inspections are conducted in this building. For one method, a detector converts X-ray data into an electric signal and projects a digital image. The other method is to photograph with X-ray film.
The former method is used to inspect defects inside the solid propellant. The latter is aimed at detecting exfoliation on the surface of the solid propellant.

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