TURKISH AEROSPACE

TURKISH AEROSPACE SPACE SYSTEMS ASSEMBLY, INTEGRATION AND TEST CENTER

ABOUT US

Turkish Aerospace is Turkey's Center of Technology in aerospace systems and ranks among the top hundred global players international aerospace and defense arena. Supporting Turkish Aerospace vision of "**becoming a world brand aerospace company with indigenous products and global competitive power**", Turkish Aerospace Space Systems takes essential role in national and international programs as prime contractor or risk sharing partner.

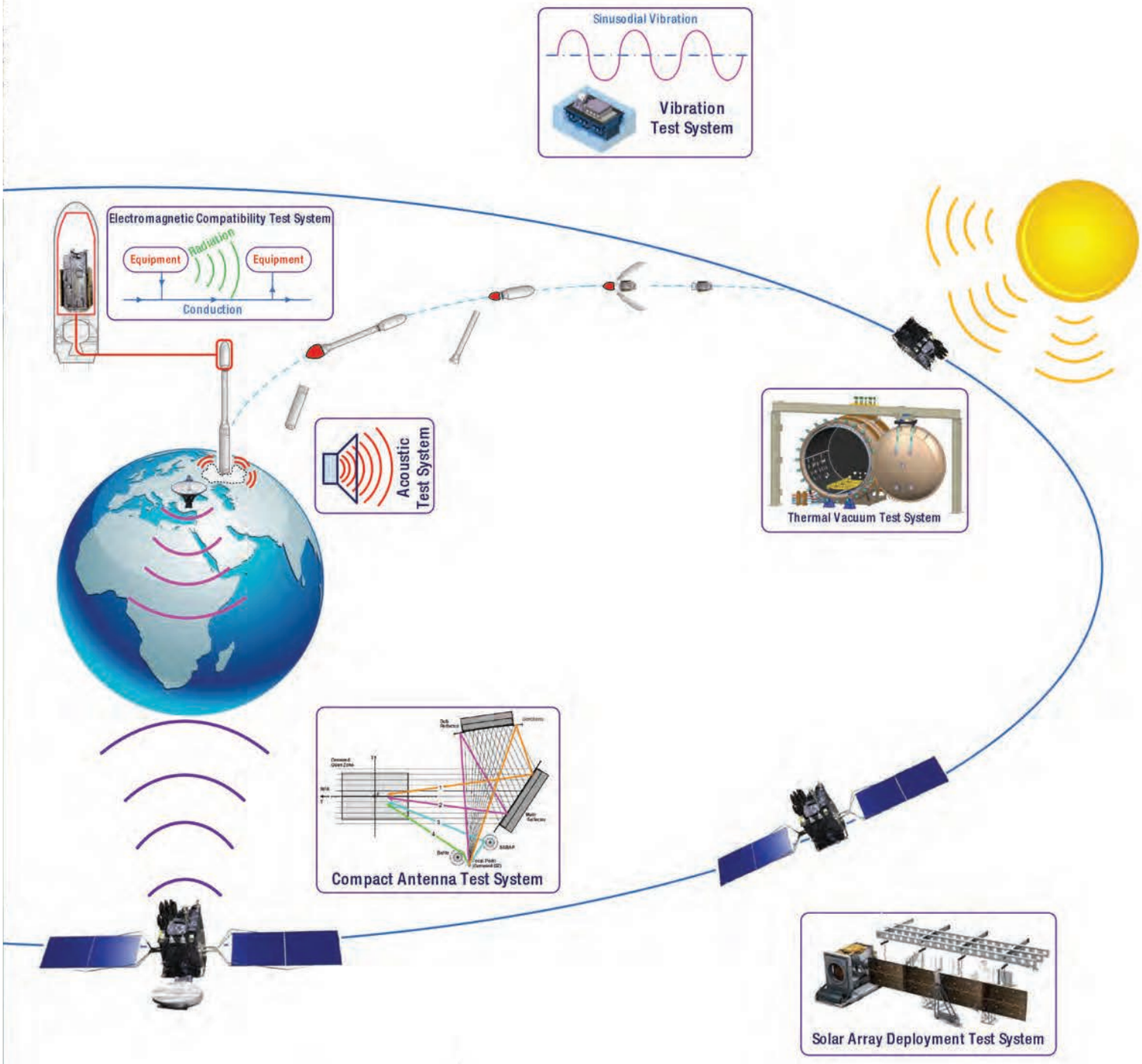
Turkish Aerospace reorganized key capabilities to space in 2002 and focused on sustainable growth in satellite market. Under the light of her global ideals on space; Turkish Aerospace enhances product range of space systems on earth observation, reconnaissance - surveillance and communication - navigation satellites. Building expertise through the Turkish Space Program, Turkish Aerospace offers ECSS compliant:

- Space-Systems Engineering (Based on experiences by GÖKTÜRK Satellites and R&D Programs)
- Structural, Thermal, Power, Mechanical, Harness, Electrical and Electronic Design, Analysis
- Production and Test Software Development and Verification for On Board Data Handling System
- Satellite Ground Control Stations
- Space Systems and Subsystems Assembly, Integration and Test (AIT) Services

TURKISH AEROSPACE - AIT CENTER WELCOMES YOU

Turkey's first Space Systems Assembly, Integration and Test (AIT) Center has been established in Turkish Aerospace. The investment of this state of art center is undertaken by Undersecretariat for Defence Industries (SSB) and TÜRKSAT. AIT Center consists of the required infrastructure for measurements and ground testing of space systems compatible with ECSS Standards. By adequate test capabilities and specialized technical experts, Turkish Aerospace - AIT Center has been organized to serve for both national and international space programs.

SATELLITE QUALIFICATION PHASES



ELECTROMAGNETIC COMPATIBILITY TEST SYSTEM

The purpose of Electromagnetic Compatibility (EMC) tests is to detect electromagnetic interference and verify electromagnetic compatibility at equipment, subsystem and system level. The EMC tests cover radiated emission (RE), radiated susceptibility (RS), conducted emission (CE) and conducted susceptibility (CS) tests. All these tests can be performed in the EMC Test System. The EMC Test System is compatible with MIL-STD-461 standard for space applications. In addition, electrostatic discharge (ESD) tests can also be performed in the system.

USABLE VOLUME	12 m x 10 m x 12 m
SHIELDING PERFORMANCE	88–128 dB
TEST CAPABILITY	CS-101, CS-103, CS-104, CS-105, CS-114, CS-115, CS-116, CE-101, CE-102, CE-106, RS-101, RS-103 (20V/m), RE-101, RE-102, RE-103
ESD TESTS	< 25 kV

ACOUSTIC TEST SYSTEM

Acoustic tests are performed to verify the spacecraft capability to withstand the acoustic pressure during the lift off (first seconds of the launch) and to check that the random responses on the spacecraft sub-systems. Acoustic Test System is used to simulate the acoustic environment generated by the launcher on the spacecraft. It consists of a gas generation system, noise generation system and a reverberation chamber. Liquid nitrogen is converted to gaseous nitrogen and modulated at noise generation system at desired frequency band and sound pressure level. Generated sound is imposed on spacecraft in the reverberant acoustic chamber. The chamber is isolated from the facility via spring-damper boxes.

MAX. SOUND PRESSURE LEVEL	156 dB
DIMENSIONS	9.5 m X 7.9 m X 12.6 m
FREQUENCY RANGE	25 – 10,000 Hz
CONTROL	Closed loop control via up to 16 microphones
DATA ACQUISITION SYSTEM	512 accelerometer channels

VIBRATION TEST SYSTEM

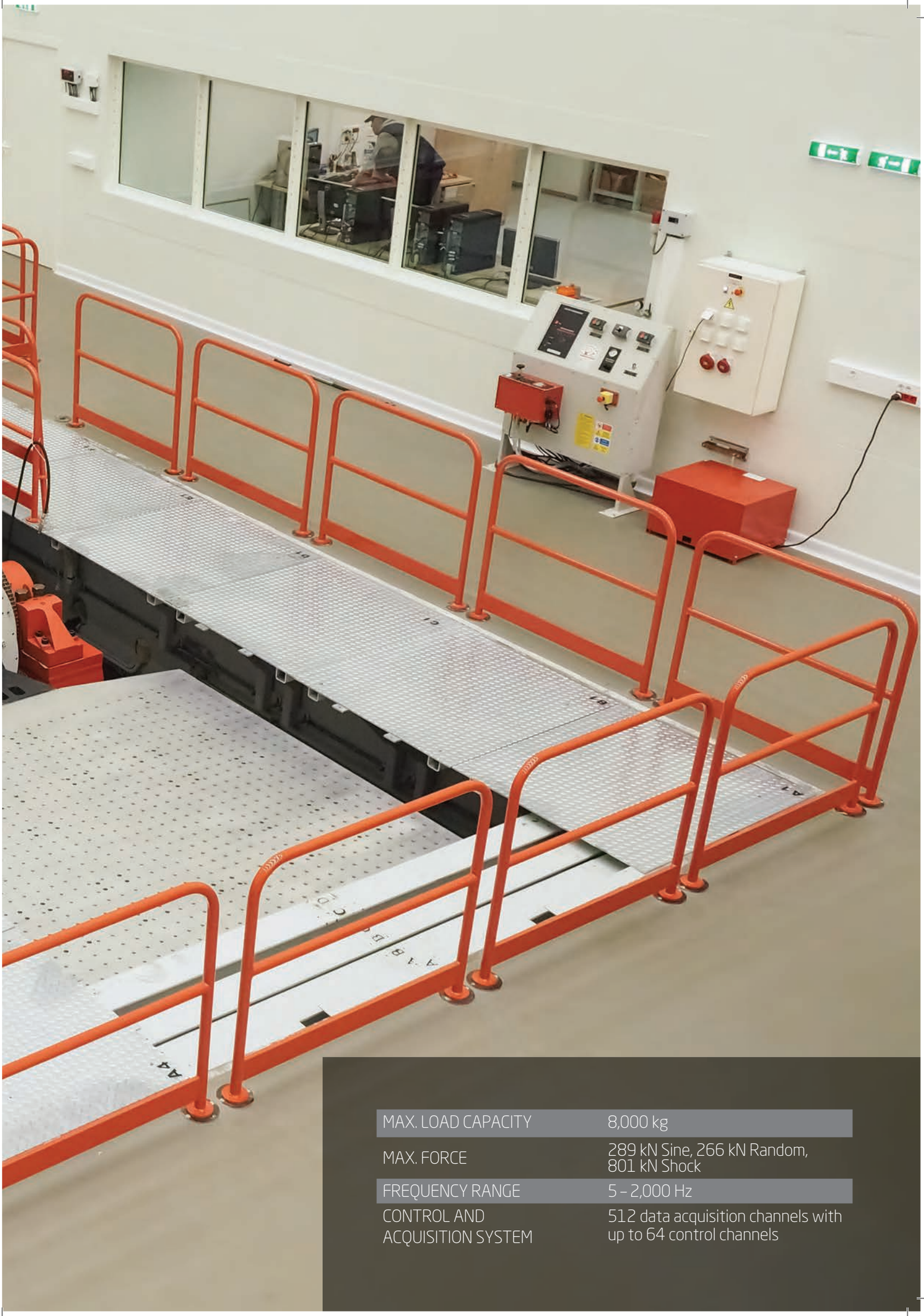
Vibration test system is used:

- To verify the endurance of the spacecraft against the vibration environment during the launch
- To validate the finite element models of the spacecraft for the Coupled Load Analysis (CLA).

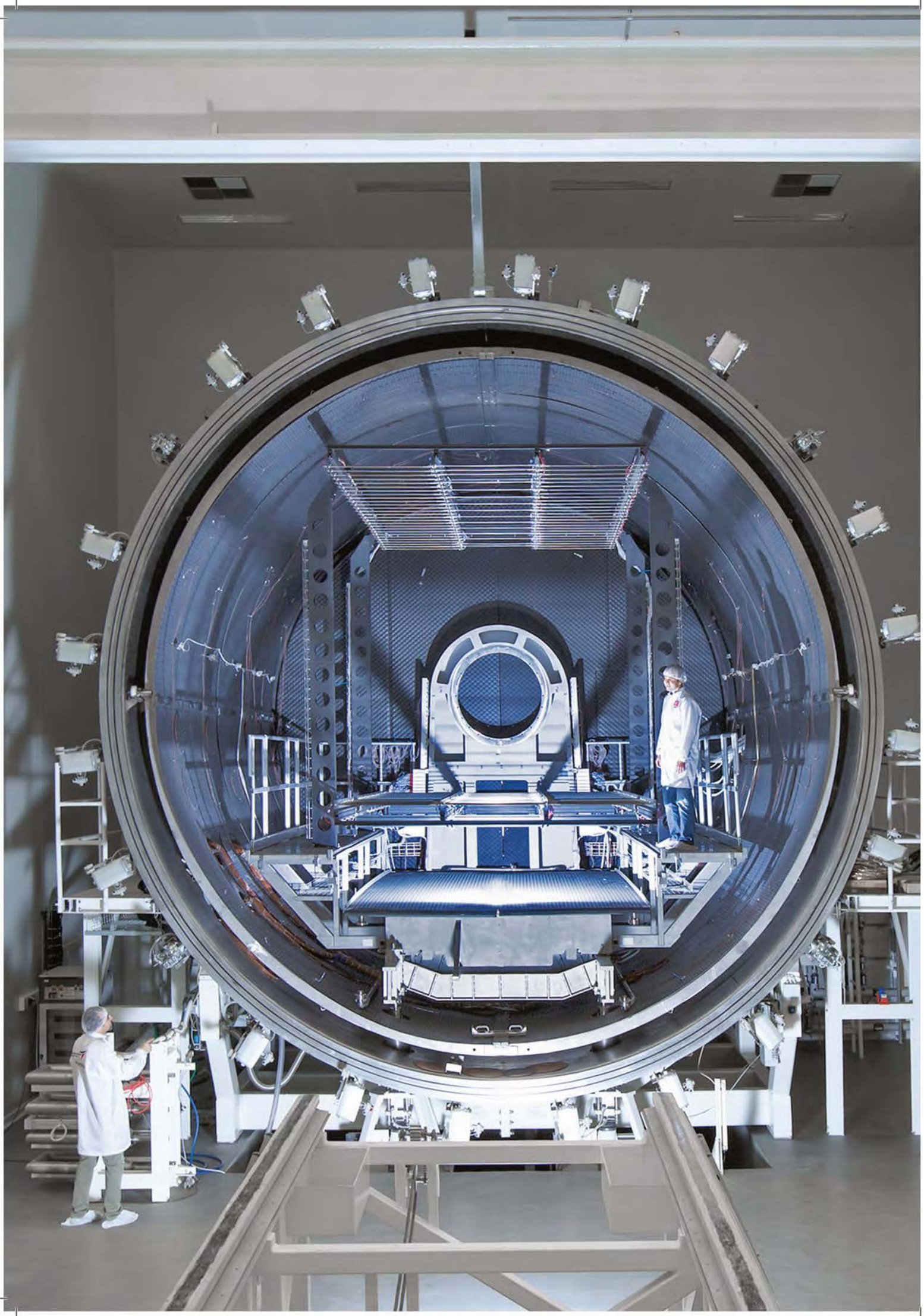
Vibration test system is composed of Control and Data Acquisition System (CAS) and Electrodynamic Shaker.

Electrodynamic Shaker is used to generate desired vibration profiles.

Response of the Device Under Test (DUT) is captured by data acquisition system. Shaker is isolated from the facility via seismic block and spring damper boxes.



MAX. LOAD CAPACITY	8,000 kg
MAX. FORCE	289 kN Sine, 266 kN Random, 801 kN Shock
FREQUENCY RANGE	5 – 2,000 Hz
CONTROL AND ACQUISITION SYSTEM	512 data acquisition channels with up to 64 control channels



Ø 6 m THERMAL VACUUM TEST SYSTEM

The purpose of thermal vacuum tests is to simulate the severe thermal and vacuum conditions of space and to test and verify the spacecraft's functionality under these conditions.

These conditions are created by using high vacuum pumping systems for vacuum (< 10^{-6} mbar) and feeding thermal shrouds by liquid nitrogen (around -180 °C) to simulate deep space temperature. Furthermore, external heat sources (solar, earth and albedo) are generated by using heating bars (calrods).

The distinctive horizontality control system possessed by the system allows testing of heat pipes without any significant performance degradation.

The advanced water cooling system lets the removal of excess heat generated due to high power emitting systems such as transponders.

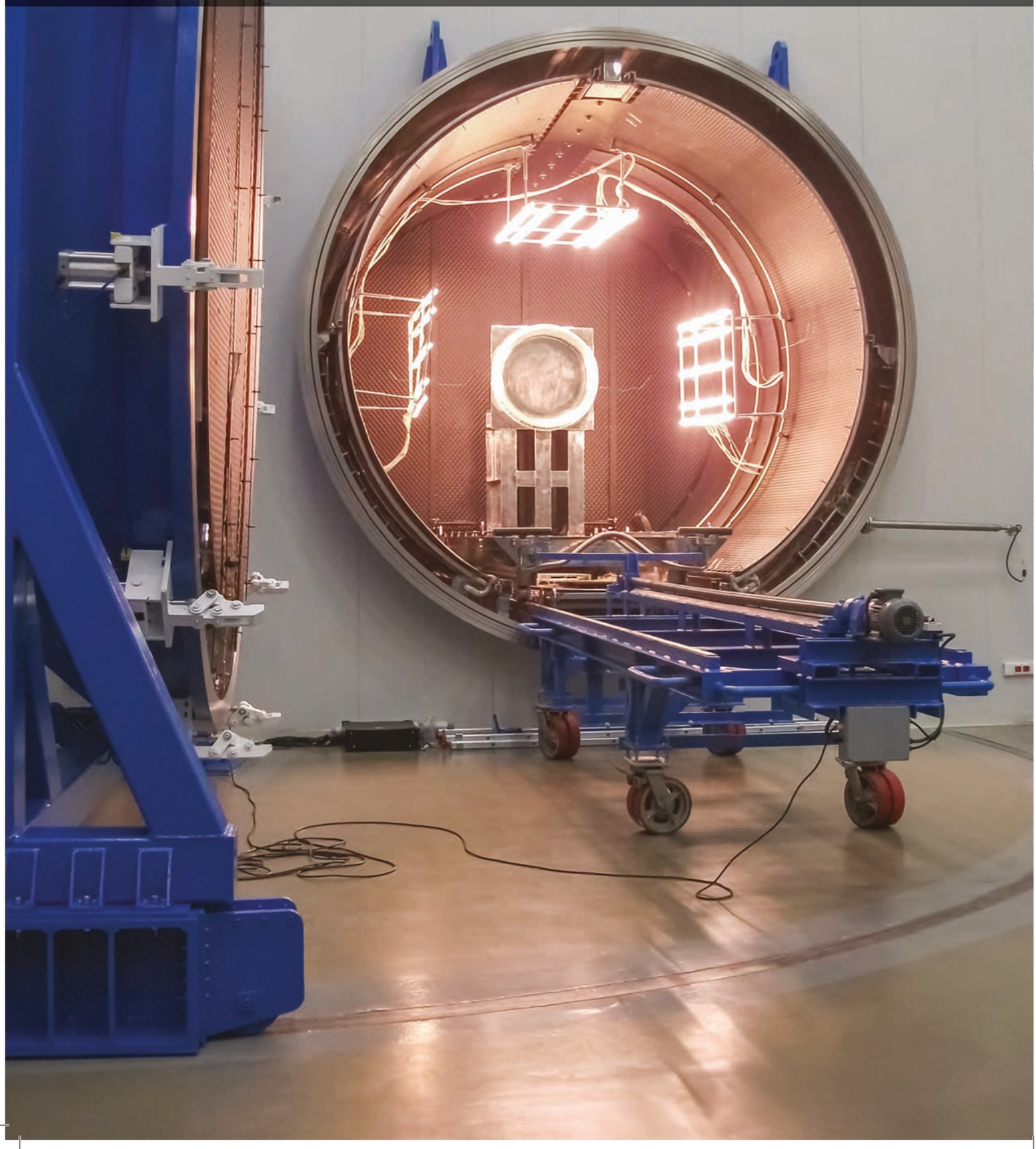
With these capabilities, the test system can be used for the testing of spacecraft ranging from LEO satellites to state of the art GEO telecommunication satellites.

(LEO) Low Earth Orbit
(GEO) Geosynchronous Earth Orbit

USABLE VOLUME	Ø 6.2 m x L 7.0 m (horizontal)
VACUUM LEVEL	< 10^{-6} mbar
SHROUD TEMPERATURE	-180 ± 5 °C (via LN2)
TEMPERATURE MEASUREMENT	1,200 channels
ADDITIONAL UTILITIES	¬ Horizontality control (± 4 mm/m) ¬ Water thermal control for RF thermal conditioning ¬ Residual gas analyzer ¬ Calrod frame

Ø 4 m THERMAL VACUUM TEST SYSTEM

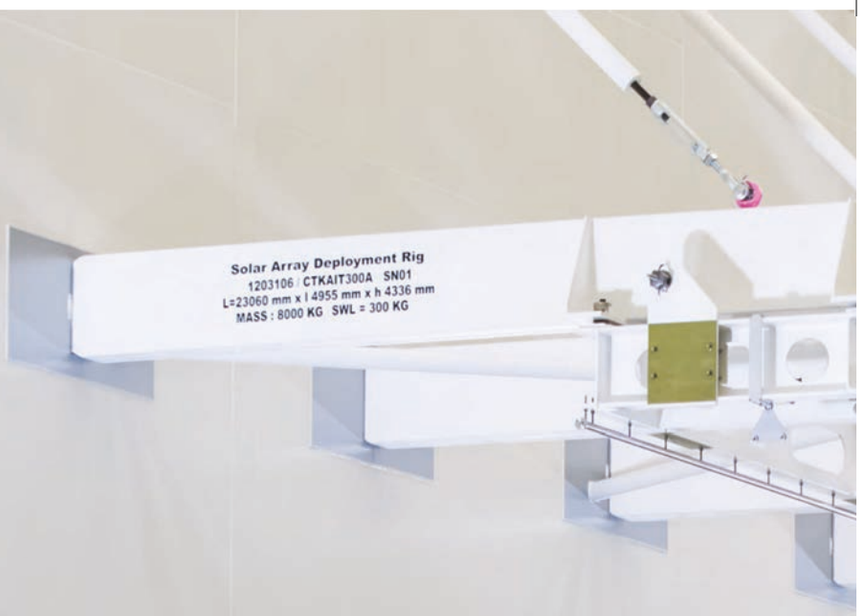
Like the Ø 6 m Thermal Vacuum Test System, this system is used to simulate space environment in terms of vacuum and thermal conditions. High vacuum pumping system is used to achieve the vacuum conditions (< 10^{-6} mbar). In addition to liquid nitrogen mode, thermal shrouds can be fed by gaseous nitrogen with the help of a hybrid thermal control system. The temperature of the shrouds can be regulated between -165 °C and +110 °C which makes the system suitable for performing not only system level but also sub-system and equipment level tests. The system is equipped with infra-red lamps rigs distributed along the shrouds enabling homogenous heating of the test item.



USABLE VOLUME	Ø 4.0 m x L 4.1 m (horizontal)
VACUUM LEVEL	< 10^{-6} mbar
SHROUD TEMPERATURE	¬ -165 – +110 ± 5 °C (GN2 mode) ¬ -180 ± 5 °C (LN2 mode)
TEMPERATURE MEASUREMENT	256 channels
ADDITIONAL UTILITIES	¬ Residual gas analyzer ¬ Infra-red lamp rigs

SOLAR ARRAY DEPLOYMENT TEST SYSTEM

Zero-g effect on solar panels is simulated by hanging the panels from their center of gravity to a dedicated test rig. Likewise, zero-g effect on antenna reflectors is simulated by hanging the reflectors from their center of gravity to helium balloons.



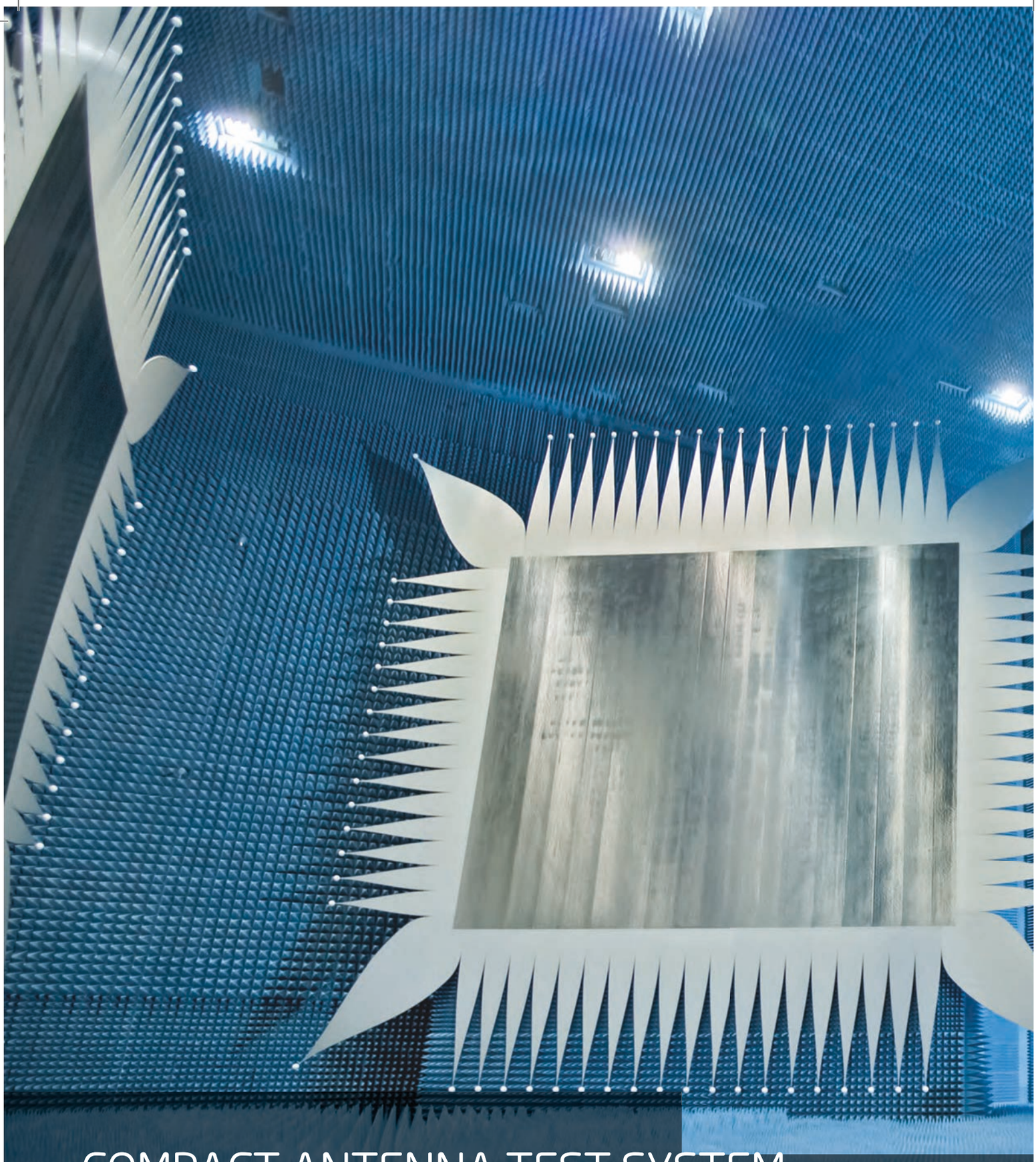
SOLAR ARRAY DEPLOYMENT TEST SYSTEM	Rail Length: 23 m Total Load Capacity: 300 kg
ANTENNA DEPLOYMENT RIG	3 balloons with 60 kg total lifting capacity
DATA ACQUISITION SYSTEM	96 channels with 204.8 kHz sampling frequency 384 channels with 51.2 kHz sampling frequency

SHOCK TEST CAPABILITIES

Shock effects occurs during:

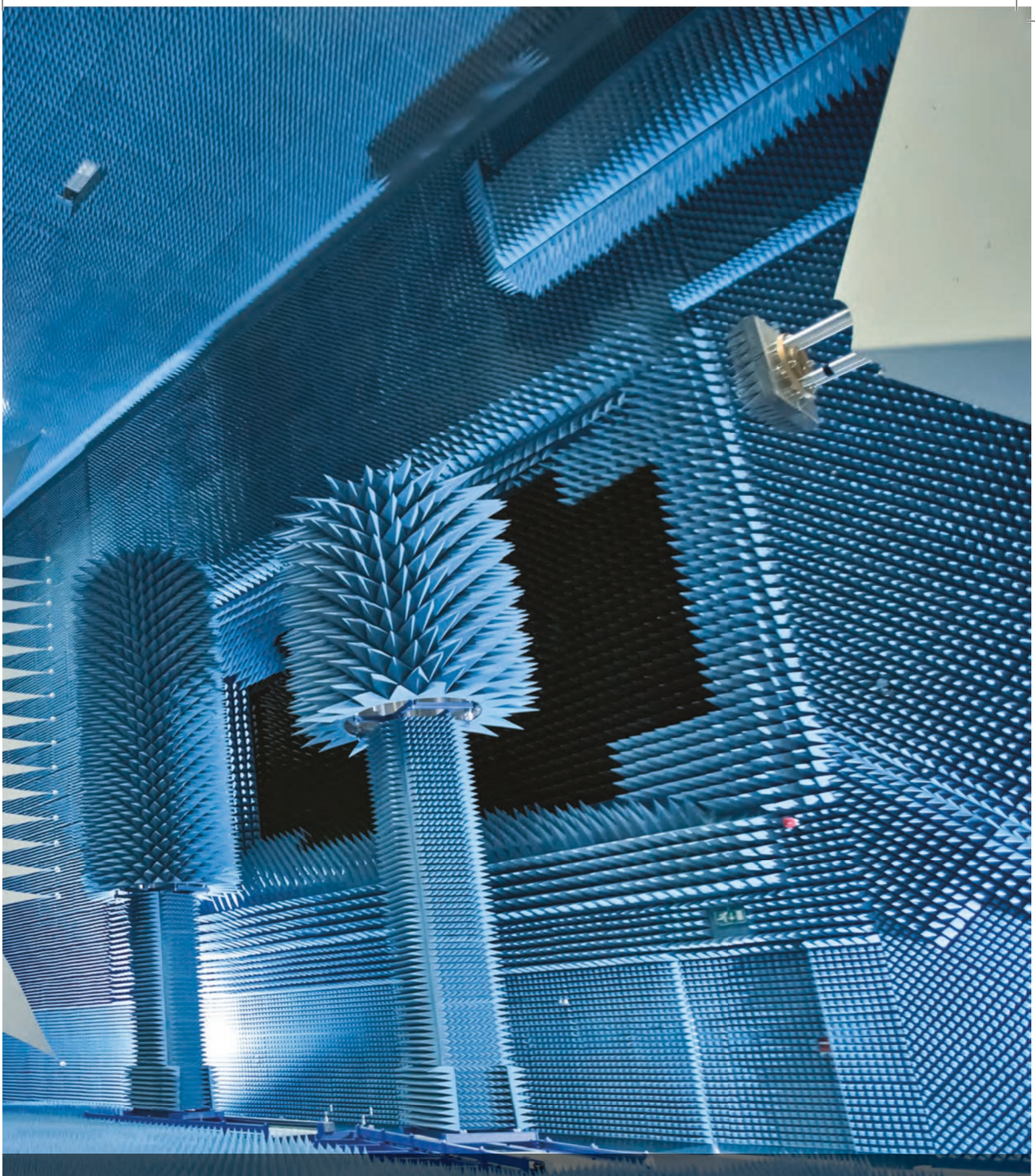
- Satellite separation from the launcher
- Solar panel deployment
- Antenna deployment

These shocks are generally generated by pyro device actuation and the shocks are measured using high frequency data acquisition systems.



COMPACT ANTENNA TEST SYSTEM

In order to verify the performance of the communication satellites, it is of utmost importance to perform the tests under realistic conditions i.e. similar to those expected in the orbit. In terms of Radio Frequency (RF) tests, the conditions similar to those in orbit can be created in Compact Antenna Test System (CATS). In this system, the RF communication environment at far field conditions can be simulated. CATS creates far field conditions in a limited indoor space and enables the characterization of antennas that would normally require thousands of meters of space. The system is capable of performing antenna radiation pattern and gain measurements, Effective Isotropic Radiated Power (EIRP) and Input Power Flux Density (IPFD) measurements, Passive Intermodulation (PIM) Tests, Gain over Temperature (G/T) Tests and System Auto-compatibility Tests.

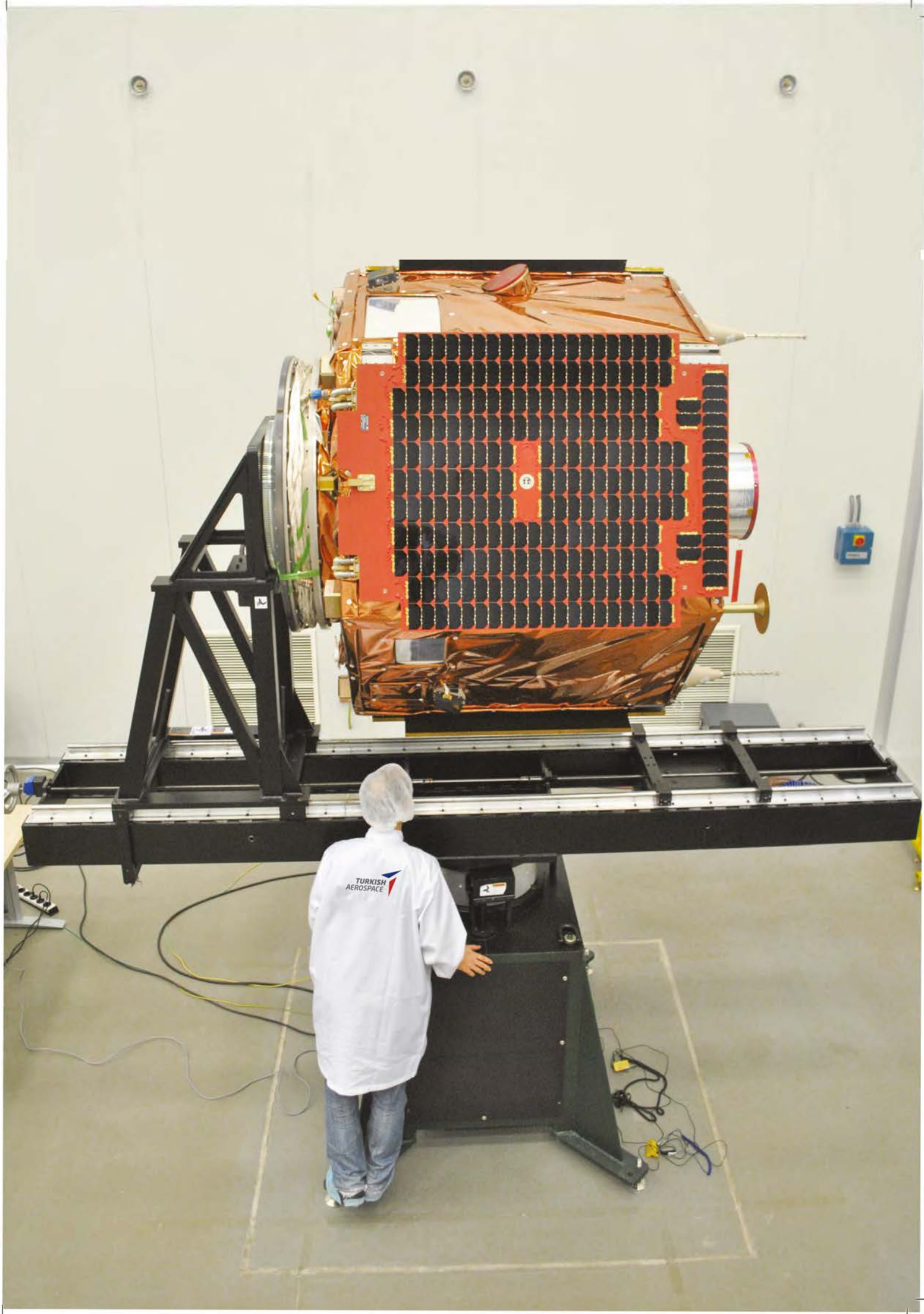


ANECHOIC CHAMBER DIMENSIONS	27 m x 19 m x 14 m
CENTRAL QUITE ZONE	Ø 5 m x L 6 m (Horizontal), 6m above floor
SHIELDING EFFECTIVENESS	95 - 137 dB
TEST FREQUENCY RANGE	1 - 200 GHz
HIGH RADIATED POWER TEST CAPABILITY	≤ 1.5 W/cm^2

MASS PROPERTIES MEASUREMENT SYSTEM

Mass properties are measured to determine the mass, the center of gravity (CoG) and the inertia matrix of spacecraft's for launch and orbital control. The measurement system consists of three main components: A device to measure weight, a device to measure both location of center of gravity and moment of inertia at the same time (KSR 6000 & KSR20000) and a positioner to rotate and translate spacecraft on this device. By this way it is possible to measure CoG and inertia matrix on a single installation.

MASS PROPERTIES MEASUREMENT	50 - 9,000 kg
MASS MEASUREMENT	Up to 5,850 kg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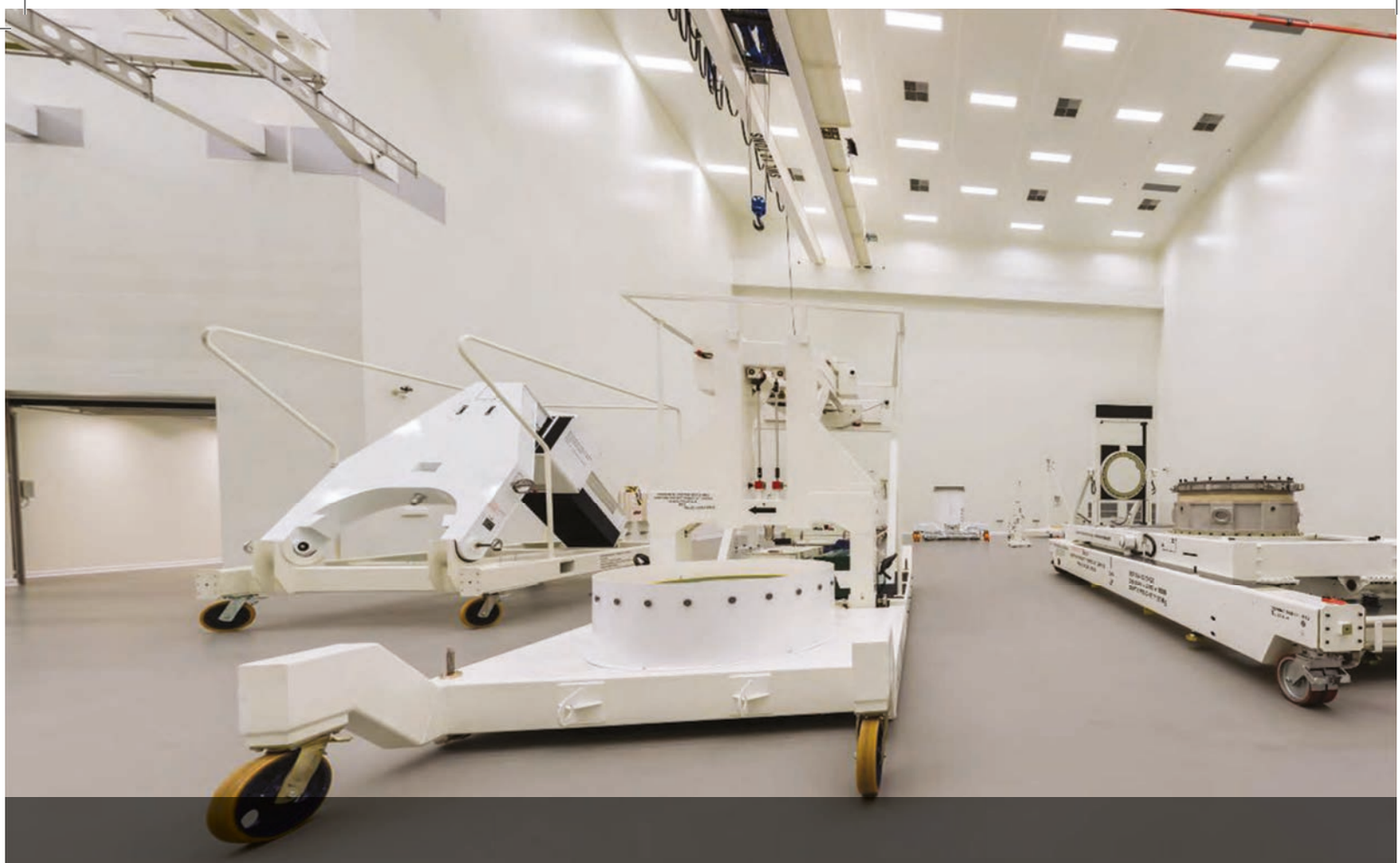

MECHANICAL GROUND SUPPORT EQUIPMENT

- Vertical and Horizontal Hoisting Devices
- Multi-Purpose Trolleys
- Acoustic Dolly
- 1194 Clamp Bend Mechanisms
- Theodolites and Their Stands
- Cherry Pickers and Manlifts
- Electric Tow Tractor

" Space Technology Gateway of Turkey "

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