

# RUAG Space Testing Services



Together  
ahead. **RUAG**

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**Certified by the Swiss Association for non-destructive testing for:**  
EN 473 / ISO 9712

Pre-and in service testing of equipment, plant and structure, Aerospace

**We are certified by the German Association for non-destructive testing for:**  
Ultrasonic Phased Array Technique



STS 193

**S** SCHWEIZERISCHER PRÜFSTELLENDIE  
**T** SERVICE SUISSE D'ESSAI  
**S** SERVIZIO DI PROVA IN SVIZZERA  
SWISS TESTING SERVICE





# Proven reliability, safety and durability. RUAG Space testing services.

With long experience and extensive knowledge RUAG Space can test a wide range of materials in our test facilities in Zurich. The mechanical testing of samples for qualification and testing of flight hardware belongs to our core competences. This includes destructive as well as non-destructive testing.

RUAG Space offers extensive problem solving including, if necessary, model simulation, suggestions for improvement as well as cross-checking of the measures taken. Supported by the RUAG Aviation documentation centre, we also provide consultation in all matters of standards and inspect products according to national and international standards.

Many methods and equipment are available for non destructive testing of samples and components. Hardness measurements, x-ray fluorescence, eddy-current testing, optical microscopy, ultrasonic and acoustic testing as well as liquid penetrant give us the possibility to not only characterise the material under test, but also detect defects such as cracks, pores or delamination.

For mechanical and static load testing our labs are well equipped with tensile testing machines and static load rigs for unit and component level tests as well as testing of large structures. A shock machine and the possibility to test for pyroshock complete our testing facilities.

RUAG Space is also able to do environmental testing with a variety of shakers, climatic chambers and a centrifuge to test for temperatures, humidity, pressures as well as vibrations arising in space.

RUAG Space does not only provide the testing service but also offers consultation with regard to the selection of materials, machining processes and heat treatments for an optimisation of the microstructure. With our skills we also assist in finding the root cause of damage and try to optimise future test procedures and manufacturing.

Tests will be performed according to well established standards such as DIN, ISO, MIL, etc. However, RUAG Space has the possibilities to test according to other standards after consultation. All our equipment is calibrated according to national and international standards.



Payload Fairing Separation Test in the NASA Vacuum Chamber in Plum Brook Station, Ohio.

# Non Destructive Inspection & Physical Testing

The RUAG Space Materials Test Lab is certified for Non Destructive Inspection of composite structures and fully equipped for physical property measurements of materials. X-Ray analysis, microscopy and Dye Penetrant testing are also part of the expertise that our specialists can perform as a service for external customers as well as our own in-house projects.

## Hardness

Equipped with the multipurpose hardness measurement device SwissMax from Gnehm RUAG Space can determine the Vickers-, Brinell-, as well as the Rockwell Hardness of materials.

Supplementary to tensile testing the hardness gradient is also often determined since the hardness value is proportional to the tensile strength.

Two portable devices from Testor and Gnehm are available to measure the Shore Hardness of plastics and rubbers. Hardening of thermosets can be followed via measuring the hardness after different time periods.

With the Proceq Equotip 2 a portable device is available to measure the Leeb Hardness of samples with a minimum weight of 5 kg. This value can then be converted to HV, HB, or HR by using a conversion table.

- Vickers Hardness
- Brinell Hardness
- Rockwell Hardness
- Shore Hardness
- Leeb Hardness
- Hardness Gradient



Hardness test device

## X-Ray Fluorescence

With the portable XRF Analyzer Delta X the alloy composition of a sample can be determined in a matter of seconds. This device uses X-rays and measures the fluorescent X-rays which are specific for every element. With the program Alloy Plus almost all of the metal and other trace elements can be detected.

- Determination of Alloy Composition
- Detection of Trace Elements



XRF Analyzer

## Optical Microscopy

To investigate micro sectioned parts but also other samples more closely, an optical microscope and stereoscope is available. Grain structures of etched metal surfaces can be made visible using polarized light for which a range of polarizing filters is offered to the user. The microscopy is used for many more purposes like fibre volume content, microstructures, pore content, coating thickness and detection of non-metallic inclusions in stainless steels.

- Microstructure
- Texture Gradient
- Fibre Volume Content
- Porosity Content
- Coating Thickness



Microscopy equipment

Type	Model	Resolution
Binocular	Wild	6–50 x
Light Microscope	Olympus BX51	50 x, 100 x, 200 x, 500 x, 1000 x

## Electrical Conductivity (SIGMATEST)

To determine the layer thickness of inorganic coatings on non-ferromagnetic substrates the Fischer Isoscope MP30 is used.

This is a portable device and works with the eddy-current technology. We use the method mainly to analyze the thickness of "Ematal" coatings.

- Coating Thickness
- Mostly used for "Ematal" coatings

With the SIGMATEST® it is possible to determine the specific electrical conductivity of nonferromagnetic conductors. In combination with hardness measurements or XRF testing it is therefore possible to not only determine the alloy composition of a sample but also its condition.

- Conductivity measurement
- Determination of alloy condition

## Liquid Penetrant Testing

With our stationary equipment for penetration testing we can visually determine irregularities and cracks on parts. Using a fluorescent dye it is possible to make pores and cracks visible in the UV light. Brushing and spraying are also used for larger parts to apply the penetrant.

As equipment the Ardrex Test Fluid System with high sensitive class III is used.

- Detection of surface and subsurface defects
- High Sensitive Class III



Test Fluid System for Penetration Testing



## Ultrasonic and Acoustic Testing

For our composite structures it is crucial to test the CFRP Panels on delamination. Therefore we invest significant effort in NDI testing using ultrasonic and acoustic examination. The interference pattern of the reflected sound waves gives information about the bonding properties of laminates and the like. The portable equipment offers a high amount of flexibility and can be used on large as well as smaller structures.

Equipped with the Bondmaster 1000 and 1000e+ it is possible to test for delamination in the ultrasound and acoustic frequency range.

With the Olympus Omniscan MX we are even capable of doing Phased Array Ultrasonics and normal UT for fast scanning of large volumes.

- Detection of delamination (Sonic Bondmaster)
- Phased Array Ultrasonics
- Ultrasonics



Ultrasonic NDI test on VEGA fairing



NDI-Equipment

# Mechanical & Structural Testing

RUAG Space has a long history of management and performance of mechanical and structural testing. The extensive experience and expertise gained during many years of testing our in-house projects, combined with the specialised test facilities developed in this time, ensure a reliable partner is available for all test services also to external customers.

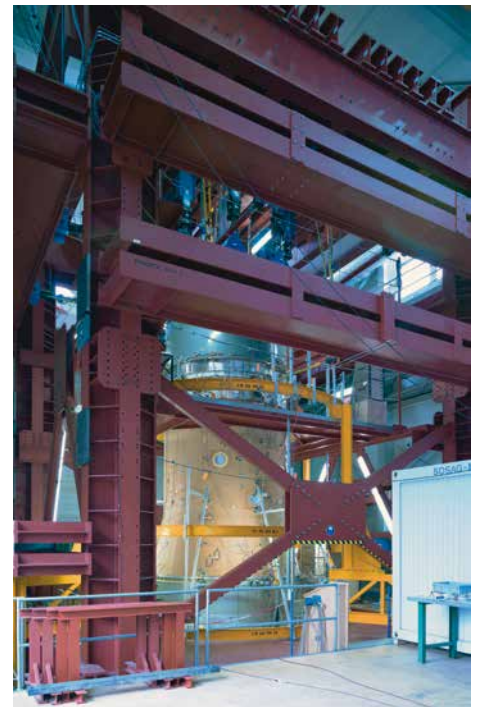
## Static Load Testing

Two different test rigs in different sizes are available for large scale structural testing under static load. Structures up to 10 meters in size can be tested with axial and lateral loads of 2200 kN and bending moments of 6600 kNm.

All of the test rigs are modular in their assembly and can thus be adapted to the structure being tested. With hydraulic control systems it is possible to apply axial and lateral loads as well as bending moments while the data is collected with up to 1085 channels.

### Specifications of test equipment

- Load cells to monitor and control the load application
- Hydraulic actuators up to 500 kN
- Independent reference frame on which displacement transducers can be mounted
- Independent pressure monitoring system
- Computer controlled hydraulic benches
- The test item can be equipped to monitor its behaviour in real time during the test with:
  - Heater Blankets
  - Load cells
  - Strain Gauges
  - Displacement Transducers
  - Pressure Transducers
  - Thermocouples
  - Angular Inclination Sensors



Static Test Rig

Facility	Working Area	Max. Axial Loads	Max. Lateral Loads	Max Bending Movement	Hydraulic Control System	Overhead Cranes	Data Aquisition
<b>Large Static Test Rig</b>	10 × 10 × 13 m	2200 kN	1600 kN	6600 kNm	32 channels	6.3 T and 10 T at heights of 6.5 m and 12 m	1085 channels
<b>Small Static Test Rig</b>	6 × 6 × 11 m	120 kN	50 kN	–	32 channels	10 T at height of 10 m	1085 channels



## Tensile Testing

The tensile test machines are able to deliver results for tensile, compression, bending and shear force tests.

The tensile testing machines from Instron, Amsler and Shimadzu are most often used for tensile and compression tests. Strain gauges and displacement transducers provide a tool for very exact displacement determination. Forces up to 200 kN can be applied.

The two ovens mounted to the tensile testing machines enable testing between -70°C and 350 °C.

With special devices bending and shear properties can also be evaluated.

A broad variety of adapters enable testing of different geometries and particularly component testing requires special equipment. The obtained properties include but are not limited to stiffness under compliance, spring constants, force displacement diagrams etc. to characterize brackets, hinges, fittings and the like.



Shimadzu AG-X with oven



Component testing

Model	Maximal Load	Electrical Strain Gauges	Temperature Range
<b>Instron 1251</b>	200 kN	6 Channels	from -70 °C to +350 °C
<b>Shimadzu AG-X plus</b>	100 kN	8 Channels	from -70 °C to +280 °C
<b>Shimadzu AG-X</b>	20 kN	–	from +25 °C to +280 °C

### Measurable Properties for metallic and/or composite Materials:

- Young's Modulus E
- Proof Stress Rp
- Yield Strength ReH, ReL
- Tensile Strength Rm
- Elongation at break A
- Compressive Strength at Break RbB
- Flexural Strength  $\sigma_B$
- Shear Modulus G for composites

# Environmental Testing at the Space Test Center

The RUAG Space Test Center is specialised in the execution of mechanical and climatic environmental testing. Not only the performance of Engineering and Qualification tests but also consulting, organising, coordinating and managing test programmes in internal and external facilities, on behalf of our customers, is an integral part of our expertise.

## Vibration Testing

The Ruag Space Test Center is equipped with three shakers allowing the testing of payloads with different sizes and weight under a wide range of forces and external conditions.

The Vibration Systems available at RUAG Space perform both vertical and horizontal tests and offer advanced measurement technologies. For all the shakers a large variety of different head expanders, slip tables, adapters and angle support structures are available to support all kind of test configurations.

The T4000 Series, one of the most modern and advanced equipment, is designed to operate over a wide force range covering moderate to extreme test conditions and accommodating small to large test payloads. Samples up to 1800 kg dependent on their configuration can be tested vertically with forces of 178 kN in vibration mode and 534 kN in shock mode. In horizontal direction much higher masses can be tested \*.

The medium sized shaker LDS V964 is situated in a clean environment, allowing for testing of sensitive samples under a controlled level of contamination. The LDS V964 is capable of testing large payloads up to a mass of 900 kg with a maximum sine force rating of 89 kN.

For the small shaker LDS V850 a climatic chamber is available, enabling testing in the temperature range of -60 °C to +100 °C. The LDS V850 is designed for the vibration testing of medium-sized payloads up to 350 kg with a maximum sine force of 22 kN.

### Accredited test methods:

- YEN 60068-2-6
- EN 60068-2-64
- MIL-STD-202 Method 201, 204, 214
- MIL-STD-810 Method 514
- RTCA DO-160 Section 8
- ECSS-E-10-03A
- V009 100 Guideline USP of GR test Nr. 301
- Or according to customer test plan



Shaker T4000

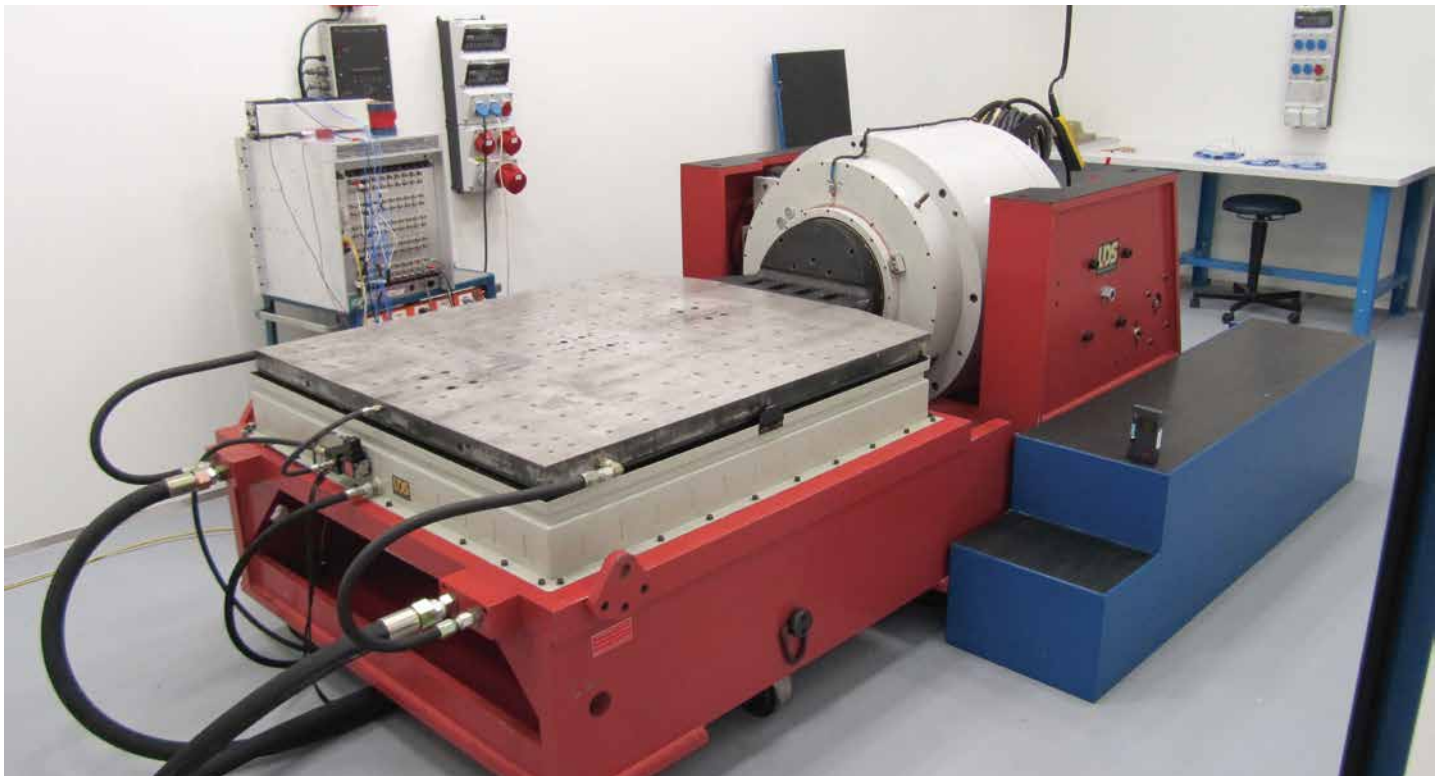


Shaker LDS V850

## Shaker Technical Details:

	T4000			LDS V964			LDS V850		
	Sine	Random	Shock	Sine	Random	Shock	Sine	Random	Shock
Max. Thrust *	178 kN	178 kN	534 kN	89 kN	89 kN	267 kN	22.2 kN	22.2 kN	66.7 kN
Max. Acceleration *	130 g	80 g	250 g	100 g	70 g	210 g	60 g	50 g	180 g
Max. Velocity *	2.1 m/s			1.7 m/s			2.0 m/s		
Displacement	50.8 mm			38 mm			50.8 mm		
Frequency Range	3 – 2'000 Hz			5 – 2500 Hz			5 – 3'000 Hz		
Max. Load (vertical) *	1'800 kg			900 kg			350 kg		
Large Slit Table (horizontal)	122 cm × 154 cm			121 cm × 135 cm			–		
Large Head Expander (vertical)	148 cm × 148 cm			Ø 91 cm			Ø 65 cm		
Controller / Data Acquisition	LMS SCADAS III (52 +48 Channels) and LMS SCADAS Mobile (24 Channels)								
Temperature	Ambient			Ambient			-60 °C to +100 °C		

\* Maximum values may depend on the specifications of the test piece (weight, spacial dimensions, configuration, etc.).  
For further information please contact the test center directly.



Shaker LDS V964

## Shock Testing

With a Shock machine RUAG Space is equipped to conduct shock tests under more extreme conditions than the shakers are capable of. Loads up to 150 kg can be tested with an acceleration of up to 2000 g\* and pulse duration between 0.6 and 25 ms.

Samples can be tested horizontally on the test table with size 69×65 cm as well as vertically on two different test tables with diameter Ø 28 cm and Ø 81 cm.

### Shock Machine MTS

Acceleration	2 – 2000 g
Pulse Duration	50 – 0.6 ms
Max. Load	150 kg
Orientation	Horizontal and vertical
Horizontal Test	Table 69 cm × 65 cm
Vertical Test Table	Ø 28 cm and Ø 81 cm



Shock Machine MTS

### Accredited test methods:

- EN 60068-2-27
- MIL-STD-202 Method 213
- MIL-STD-810 Method 516
- RTCA DO-160 Section 7
- ECSS-E-10-03A
- V009 100 Guideline USP of GR test Nr. 302

## Pyroshock Testing

Pyroshock is the oscillating response of a structure to a high frequency and high amplitude mechanical excitation. The frequencies of the response can rise up to 20 kHz. They consist of resonant frequencies of the sample being tested. The peak acceleration can be as high as 10'000 g for weights up to 45 kg\*.

In the aerospace industry most of the current launch vehicle, payload and spacecraft designs utilize numerous pyrotechnic devices over the course of their mission. These devices are generally used to separate structural subsystems, deploy appendages or activate on-board operational systems.

The RUAG Space Test Center is equipped to test mechanisms for pyroshock in a broad spectrum of frequency and amplitude.



Pyroshock facilities

### Accredited test methods:

- MIL-STD-810 Method 517
- ECSS-E-10-03A

\* Maximum values may depend on the specifications of the test piece (weight, spacial dimensions, configuration, etc.)



## Centrifuge Testing

RUAG Space is also equipped with a large scale centrifuge enabling the testing of test specimens up to 30 kg in weight and 50 × 50 × 50 cm in size with very high g-forces.

It is possible to reach rotational speed of up to 215 rpm with an acceleration of 80 g.



Centrifuge

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### Centrifuge

Rotational Speed	43 – 215 rpm
Acceleration	4 – 80 g
Test Object Container	50 × 50 × 50 cm
Max weight of test item	30 kg
Connections for Slip Rings	5 electr. Shielded lines + 10 electr. Signal lines

## Climatic Testing

The Space Test Center is equipped with three climatic test chambers, three temperature chambers, one shock chamber and one high altitude chamber allowing to test at different temperatures, humidity and pressure.

Our Climatic Chambers are able to regulate humidity from 10% RH up to 95% RH in addition to temperature. It is also possible to perform a variety of wet tests as dripping water, splash water and immersion tests.

Our temperature chambers are able to regulate the temperature between a minimum  $-80\text{ }^{\circ}\text{C}$  up to a maximum of  $+300\text{ }^{\circ}\text{C}$ . One of the temperature chambers has a removable bottom plate and can therefore also be used for the small shaker to operate vibration tests under special temperature conditions between  $-60$  to  $+100\text{ }^{\circ}\text{C}$ .

The temperature shock chamber is able to test samples for thermal shock in the temperature range from  $-75\text{ }^{\circ}\text{C}$  to  $+200\text{ }^{\circ}\text{C}$ .

With a special high altitude chamber it is possible to regulate pressure down to 5 mbar. Temperatures from  $-70\text{ }^{\circ}\text{C}$  to  $+95\text{ }^{\circ}\text{C}$  can be obtained in atmospheric conditions. It is thus possible to simulate altitudes up to 36'000 meters.



Feutron Climatic Chamber



Temperature Shock Chamber



Thermotron Small Temperature Chamber

Type	Model	Temperature	Volume	Humidity	Pressure
Climatic Chamber	Feutron	-40 to +180 °C	72 x 86 x 62 cm	10 – 48% rF	–
Climatic Chamber	New Model January 2014	-72 to +180 °C	200 x 200 x 135 cm	10 – 95% rF	–
Climatic Chamber	Vötsch VC 7034	-80 to +180 °C	50 x 56 x 50 cm	10 – 95% rF	–
Temperature Chamber	Vötsch VMV 06	-60 to +100 °C	85 x 70 x 85 cm	–	–
Temperature Chamber	Thermotron Small	-73 to +177 °C	39 x 31 x 28 cm	–	–
Temperature Chamber	Eliog	+70 to +300 °C	60 x 150 x 60 cm	–	–
Temp. Shock Chamber	Vötsch	-75 to +200 °C	40 x 40 x 44 cm	–	–
High Altitude Chamber	Weiss Technik	-70 to +95 °C	64 x 60 x 45 cm	–	5 mbar

#### Accredited test methods:

##### Heating

- EN 60068-2-2
- MIL-STD-810 Meth. 501
- V009 100 Guideline USP of GR test Nr.101
- RTCA-DO-160 Section 4

##### Cooling

- EN 60068-2-1
- MIL-STD-810 Met. 502
- V009 100 Guideline USP of GR test Nr.102
- RTCA-DO-160 Section 4

##### Cycling

- RTCA DO-160 Section 5
- ECSS-E-10-03A

##### Temperature Shock

- EN 60068-2-14
- MIL-STD-810 Meth. 507
- RTCA DO-160 Section 5
- V009 100 Guideline USP of GR test Nr. 103

##### Thermal Vacuum

- EN 60068-2-13
- MIL-STD-810 Meth. 500
- RTCA DO-160 Section 4
- V009 100 Guideline USP of GR test Nr. 203
- ECSS-E-10-03A

##### Humidity

- EN 60068-2-30
- EN 60068-2-38
- EN 60068-2-78
- MIL-STD-202 Meth. 103
- MIL-STD-810 Meth. 507
- RTCA DO-160 Section 6
- ECSS-E-10-03A
- V009 100 Guideline USP of GR test Nr. 201

#### Or according customer specifications



Vötsch VC 7034 Climatic Chamber



High Altitude Chamber

## Drop Test

As a part of environmental testing we can also perform drop tests. These tests are used to simulate typical handling errors in the loading and unloading process of cargo. For drop tests with large test samples a crane which is mounted to the ceiling is used. With this crane the drop height can be set up to 3 meters. We can perform drop tests on following surfaces: Concrete, Sand / Gravel, Wood. For safety reason the drop test can be released with a remote control.

### Accredited test methods:

- EN60068-2-27
- MIL-STD810 Meth. 516
- Or according to customer specifications



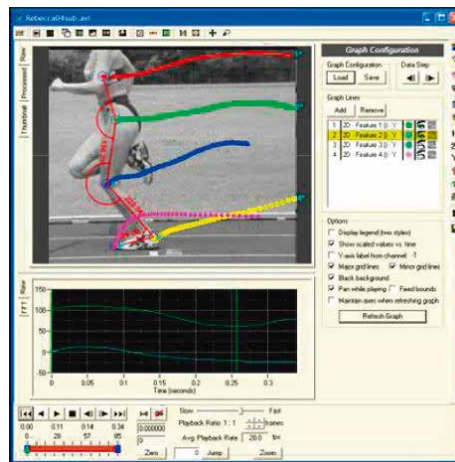
Drop Test of large objects

## Highspeed Imaging

Can be applied for:

- Measurement of trajectories
- Visualization of fast function tests
- Acquisition of complicated 3D movements

Cameras	4 single use or in network
Speed	1'000 frames per seconds 100'000 fps at reduced resolutions
Lighting systems	– Halogen – LED – Daylight system
Analysis	ProAnalyst 3D motion analysis tool
Full Resolution	1504 x 1128



ProAnalyst Software



Highspeed Camera

ProAnalyst® is a software for extracting ("tracking"), analyzing, and presenting motion from pre-recorded video.

### Features:

- 2-D feature tracking. Track features without having to use special markers in your experimental setups.
- 1-D feature tracking: Detect and track intensity changes along a line.
- Create 2- and 3-axis graphs comparing any set of motion features.
- View real-time annotations of distance and angle, and measurements of position and velocity.
- Export data, analysis results, notes, and video clips to an HTML web page, PowerPoint presentation, or directly to a printer.
- Scene calibration. Easily set the scale, origin, and coordinate system in your video.
- Perspective calibration for videos filmed with non-perpendicular camera angles.
- 3-D Professional Edition for 3-D motion analysis using video acquired with two cameras.
- 3-D Flight Path Edition designed exclusively for characterizing flight dynamics of projectile motion. Calculate pitch, roll, yaw, orientation, position, velocity, and other metrics of ballistics in flight.



# Mechanism Testing

RUAG Space can perform highly demanding tests on various electro-mechanical components for space and non-space applications. Various vacuum chambers located in clean rooms as well as a wide range of calibrated measurement equipment operated by experienced engineers guarantee the quality of RUAG services.

RUAG Space operates various test equipment suited for performance verification of components for spacecraft and satellites in the test facility at Zurich. Several vacuum chambers of different sizes are installed in the ISO class 8 cleanroom together with additional electronic test equipment.

These facilities are qualified for the performance of space projects on highest technological as well as organizational level. All equipment is calibrated in periodical intervals. Cleanliness requirements are fulfilled according to ECSS standards. The test facilities and the test items are kept under ISO Class 8 cleanroom conditions at any time.

## Thermal Vacuum Chambers

Five fixed installed vacuum chambers, are able to maintain pressures below  $10^{-4}$  Pa and are equipped with automatic thermal control systems for conductive and radiative heat transfer. The test item in the vacuum chambers can be maintained at temperatures from  $-80$  °C to  $+100$  °C. Optionally, liquid nitrogen can be used to achieve even lower temperatures. The thermal control systems offer the possibility to run automatic thermal cycles. The remote accessible data acquisition systems record the sampled data during the test. Additional electric feedthroughs allow the connection of equipment to the specimen inside the chamber. The biggest chamber in operation (VTC) can be loaded with a crane.

Several chambers for smaller test items ( $m < 4.0$  kg) with a usable diameter of 445 mm on trolleys are in use. Also these chambers reach the pressure level of  $10^{-4}$  Pa and are partly equipped with liquid thermal control system. They are equipped with hot/cold plates as well as thermal shrouds. The process thermostats acting as the thermal control system can reach temperatures of  $-60$  °C to  $+80$  °C at the specimen. Several ports for exchangeable electrical and mechanical feedthroughs provide the option to connect all kinds of measurement equipment to the specimen which means they can be adapted to customer needs.

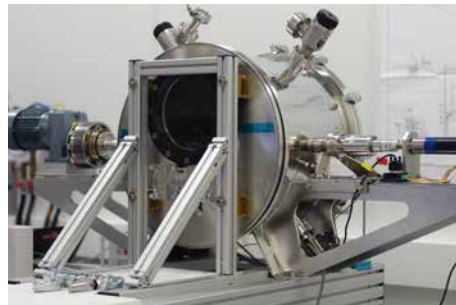


VTA	VTB	VTC	VTD	VTE
Ø 400 mm x 740 mm (vertical cylinder)	Ø 450 mm x 740 mm (vertical cylinder)	Ø 1'450 mm x 2000 mm (horizontal cylinder)	Ø 500 mm x 800 mm (vertical cylinder)	Ø 450 mm x 740 mm (vertical cylinder)
0.09 m <sup>3</sup>	0.12 m <sup>3</sup>	3.3 m <sup>3</sup>	0.16 m <sup>3</sup>	0.12 m <sup>3</sup>

One chamber is especially equipped for torque and efficiency measurement of small gears and bearings. The design allows accurate measurement of input and output torque. The output torque can be controlled in a closed loop by using the attached eddy-current clutch as a brake. The motion on the input shaft is programmable. The hot/cold plate guarantees accurate temperature control and the integrated slip ring allows to perform temperature measurements on rotating parts.



For the qualification of space rated mechanisms at very high or very low temperatures one vacuum chamber is located in an ISO class 7 cleanroom, which is able to provide an extended temperature range of -120 °C up to +150 °C. The usable volume of that vacuum chamber is Ø 650 mm x 700 mm.



RUAG Space maintains a vacuum chamber especially suited for bake out procedures in a non-cleanroom area. This chamber reaches vacuum pressures below  $10^{-4}$  Pa. The usable volume is Ø 800 mm x 2000 mm and the thermal heating system is capable of maintaining temperatures between ambient and +150 °C.

## Static Load Test Bench

The static load bench with its stiff frame and the modular configuration is located in a separate ISO class 8 cleanroom, it allows to perform various stiffness measurements on specimen. Two electro-mechanical actuators and several guide pulleys and weights can be used to apply the loads. Displacements can be measured with dial gauges and optical encoders with up to 21 bit resolution allow high precision angular measurement.

## Continuity and Insulation Resistance Test Bench

A programmable automatic test bench for high and low electric resistances is available for electrical tests. It can be used for the fast, efficient and reliable measurement of electrical continuity and insulation resistances on electromechanical components. The automatic test bench provides up to 126 independent lines that can be measured separately or in groups against each other.

## Contact



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# Precision on earth. Reliability in space.

RUAG Space is the leading supplier of products for the space industry in Europe. Experience, outstanding reliability, customer focus and a comprehensive, clearly structured product portfolio all make RUAG Space the partner of choice for manufacturers of satellites and launchers across the globe.

## **Our vision: Number one independent space product supplier**

RUAG Space's vision is to be the leading supplier of space products. We laid the foundations for realizing this vision as a partner in institutional European space programs from the very beginning. RUAG Space has played a part in all major European missions, where we have acquired know-how that benefits our customers all over the world today.

## **Our values: Collaboration, high performance, visionary thinking**

Our corporate culture is based on the values of collaboration, high performance, visionary thinking. These values determine our actions and characterize our relationships with our customers and partners.

For more than four decades RUAG Space has been an industrial partner to national and European space agencies. And we have been supplying our products to the manufacturers of satellites and launchers for just as long.

Outstanding product performance and consistency in meeting delivery deadlines are the yardsticks by which we measure success. And above all else we are focused on reliability, as there is no scope for failure in space.

At the heart of RUAG Space's strategy is a clearly structured product portfolio, which we expand according to a definite plan. In expanding the portfolio, we place particular emphasis on space products that are attractive in growth markets outside the institutional European sphere.

## **The cornerstone of our success: Our employees**

In Switzerland, Sweden and Austria, more than 1,100 employees of RUAG Space develop, manufacture and test products for satellites and launchers. Teamwork, trust and respect characterize the work environment at RUAG Space. Our employees work in close cooperation with customers and partners. The success of RUAG Space is based on the skills and commitment of our staff, on the accuracy and reliability of our mechanics, and on the creativity and know-how of our engineers.

## **RUAG Space: Part of an international technology group**

RUAG Space is a dedicated division within RUAG, an international technology group for aerospace and defense. RUAG has its sites in Switzerland, Germany, Austria, Hungary, Sweden and the USA. RUAG employs 7,700 people worldwide.

Product areas	Product lines
Launcher Structures & Separation Systems	Launcher Fairings & Structures Payload Adapters & Separation Systems Sounding Rocket Guidance
Satellite Structures, Mechanisms & Mechanical Equipment	Satellite Structures Satellite Mechanisms Sliprings Mechanical Ground Support Equipment Thermal Systems
Digital Electronics for Satellites and Launchers	Satellite & Launcher Computers Navigation Receivers & Signal Processing
Satellite Communication Equipment	Receivers & Converters Antennas Optical Communication
Satellite Instruments	Satellite Instruments

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