

# Se rms

environmental testing \_ mechanical design



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## performance reliability

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aerospace \_ automotive \_ naval \_ industrial components

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Design\_ www.mollydesign.com

Print\_ www.graphicmasters.it



#### mgse - mass ground support equipment

Special support equipment, such as MGSE (Mechanical Ground Support Equipment) is used for the handling, integration, testing and transportation of modules for satellite systems. The design, manufacture and testing of MGSE requires extreme precision in every phase of the Program development. SERMS can ensure a high quality design and production of support systems according to the most rigorous requirements.

#### thermal design & analysis

Thermal modeling and simulations play a fundamental role in the design and development process of any Space payload. SERMS is able to perform the complete general sequences for thermal simulations. The starting point is the definition of the Thermal Mathematical Model (TMM) and the Geometrical Mathematical Model (GMM) of the overall experiment.

The GMM is a mathematical representation of the physical surfaces of the system and its components: it is used to calculate the radiation couplings between all surfaces in the model, as well as heating rates to each surface from external flux sources. The TMM is a lumped-parameter representation of the thermal capacitance of each node and thermal conduction terms between nodes: it is used to define the thermal network used to solve the heat transfer equation.

#### thermal conductivity analysis

One of the SERMS capabilities is the measurement of thermal conductivity of materials. In particular some polymeric fiber reinforced composite and metal specimens have been successfully tested with innovative methods. The ASTM E1225 - 99 standard gives the method for the measurement of thermal conductivity of solids.

#### validation of the thermal model of mechanical structures

Validation of the overall thermal design is performed during the instrument qualification and acceptance phase by means of thermal vacuum (TV) and thermal balance (TB) tests. At SERMS it is possible to perform all the needed test to correlate the experimentally measured data with the simulated test prediction in order to optimize the thermal model.

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SERMS srl was established in 2004 as a spin-off venture of the University of Perugia, with the aim of transferring the highly innovative skills developed by its associates in the academic field, to entrepreneurial opportunities.

From the moment of its set up, SERMS has inspired and strengthened the cultural exchange between the academic and the the industrial worlds, which contributed to steadily broaden the selection and the quality of the services offered.

Today, SERMS operates on a national and international scale and can offer to its customers a wide range of services, spanning from the **Environmental Testing** to **Mechanical Design** of aerospace, automotive, naval and industrial components.

Its growing skills in these areas has gained SERMS increasing recognition, and now it can count on important collaborations with major national and international players like: INFN, ASI, ALSTOM, ANSALDO, NASA, ESA, BOEING, THALES ALENIA, SELEX, AIDC and JAXA.

OUALITY ASSURANCE The company is certified in accordance with the Standard **UNI EN 9100**:2009

SOME OF OUR TEST SPECIFICATION CAPABILITIES: MIL-STD-810, RCTA/DO-160, SAE, IEC, NASA, ECSS, CEI EN, CEI ASTM

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## environmental testing

#### vibration

Our vibration testing facility is comprised of several electrodynamic shakers to provide over 150kN force in practically any type of vibration testing event-sine, random, sine on random, and random on random testing.

## test fixture design

SERMS is able to design and product test fixtures and expander with a suitable dynamic stiffness to interface the item and the shaker armature in a proper way.

#### \_\_\_\_ altitude

Our altitude chamber (circa 1500 mm in diameter and 1550 mm in deep) is compliant with most of pressure test standards (RTCA DO160, MIL-STD810/883). The feasible tests are: Altitude, Decompression and Overpressure. Pressure range: 4mBar-1700mBar

## salt fog

The salt fog test is a standardized test method used to check corrosion resistance of coated samples. SERMS provides salt-fog testing to most industry standards.

## drop and impact

A vital test for many products and industries is drop and impact testing. SERMS built its own drop testing machine able to perform in accordance with the main standards.

#### failure and metallurgical investigations

Thanks to the collaboration with material dept. of the University of Perugia and the CSM Terni we can rapidly put together an experienced interdisciplinary failure analysis team to tightly define root cause of failure.









#### modal testing

By instrumented hammer or ED shakers we can execute modal tests in order to accurately determine modal frequencies and damping. FEM model calibration based on the experimental data is also possible.

## measuring "real world" vibration and thermal conditions

SERMS gained experience in acquiring real world data both for reproducing them in the laboratory and for optimizing the structural strength and fatigue life on both component and system assembly levels in time or frequency domains.

#### \_\_\_\_ instrumentation and data acquisition capability

thermo vacuum

SERMS has the capability of acquiring and recording more than 160 accelerometer channels and about 60 Strain Gage channels using systems from Spectral Dynamics, LMS and National Instruments. Our engineers can quickly tailor software programs for any type of data processing. SERMS can use a 2100 mm in diameter and 2100 mm deep TVT chamber, with a temperature range between -70°C and +125°C and a temperature gradient of 1°C/min. Heating and cooling can be done by conduction through direct contact with cold plates or by radiation through the use of the thermal vacuum chamber's shroud. It is possible to acquire up to 64 channels (PT100 class B temperature sensors) with different acquisition rate. \_\_\_\_ thermal (and humidity) Our environmental chambers vary from 2.0 to 0.5 cubic meter. We can simulate temperatures from -70°C to +180°C (up to 15°C/min both in heating and in cooling). Relative humidity can range from 10% to 98% RH. We can monitor temperature using thermocouples K-type; it is possible to acquire up to 64 channels with different acquisition rates. \_\_\_\_ pyrotechnic shock SERMS group has developed and refined several methods of producing

repeatable Shock Response Spectra (SRS) which can be tailored to produce the required shock pulse with a high degree of precision.





## mechanical design 3D CAD design SERMS regularly uses advanced 3D Modeling programs (especially CATIA V5) to design, optimize and produce mechanical components and assemblies.

## FEM analysis

SERMS has several years of experience in performing stress analysis for parts, assemblies. Static, modal, transient, random, thermal analysis have been done both for metallic and composite structures particularly for aerospace applications

## \_\_\_\_ fatigue life prediction

SERMS can analyze the product, develop a loading spectrum and make fatigue life predictions for a system. The strain information can come from test data or from finite element modeling. We can support strain gauges and load measurements to provide data for these analyses.

## vibration isolation systems

SERMS can design suitable transport containers for fragile hardware or systems reducing the transmitted vibrations to tolerable levels. Vibration dampers can be properly selected based on the dynamic behaviour of the object to be protected .

## bolt analysis

An extensive experience has been gained in doing bolt analysis mainly for aerospace components. A methodology and criteria that each preloaded joint must meet has been developed in order to guarantee a proper fastener selection to be used at extreme temperatures/loads conditions also in flanges made of composite materials.

## materials selection

SERMS can provide consultancy and support in material selection (sandwich panels, carbon fiber, ceramic and metallic).



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