

Thermal Systems



Together
ahead. **RUAG**

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 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

Thermal Systems for space and industry applications

RUAG Space is the leading European supplier of multi-layer insulation for spacecraft and market leader of superinsulation for cryogenic medical systems. The experience we have gained in more than two decades of thermal design and production enables us to increase your competitiveness with RUAG's leading edge technology solutions.

Our vision is to be the leading competence centre for vacuum thermal insulation solutions for space and industrial applications. Our mission is the development and production of multi-layer insulation for space and cryogenic industry to make our customers more competitive. To achieve this mission we focus on first-class products and reliable and long-standing partnerships with our customers.

RUAG Space activities for development and production of multi-layer insulation for space applications (satellites and instruments) have started in 1991. Since then we have developed our competencies and skills in more than 50 projects to become the leading European supplier of multi-layer insulation for spacecraft.

Moreover, RUAG Space has developed great expertise in the field of cryogenic insulation. Today RUAG also offers the development and the production of cryogenic super insulation for various applications such as Helium liquefiers or superconducting magnets.

Our development and production process comprises:

- Thermal and Mechanical Engineering
- Design and Development
- Production and Integration

Ongoing Space Programs	Customers
Gaia	Astrium, Germany & France
Lisa Pathfinder	Astrium, UK
BepiColombo	Thales Alenia Space, Italy
Sentinel1 & 3	Thales Alenia Space, Italy; Casa, Spain
Swarm	Astrium, UK

Completed Programs	Customers
Cluster	Fokker Space, Netherlands Dornier Satellite Systems, Germany
Soho Payload Module	Matra Marconi Space, UK
Huygens	Dornier Satellite Systems, Germany
Envisat Instruments	Matra Marconi Space, France Fokker Space, Netherlands Alenia Aerospazio, Italy Sener, Spain
Mechanisms	ITF, Austria Estec, Netherlands
Odin	RUAG Space, Sweden
Meteosat Second Generation	Alcatel, France
Seviri	Matra Marconi Space, France
XMM Payload Module	RUAG Space, Switzerland
Integral Payload Module	Alenia Aerospazio, Italy
Abrixis	OHB, Germany
Metop	Astrium, Germany & UK
Rosetta	Astrium, France
Mars Express	Astrium, France
Venus Express	Astrium, France
Rapid Eye	Jena Optronics, Germany; Nasa, USA
Herschel Dawn Field Camera	Astrium, Germany
Herschel & Planck Service Modules	Thales Alenia Space, Italy
Goce	Astrium, Germany
SAR-Lupe	OHB, Germany

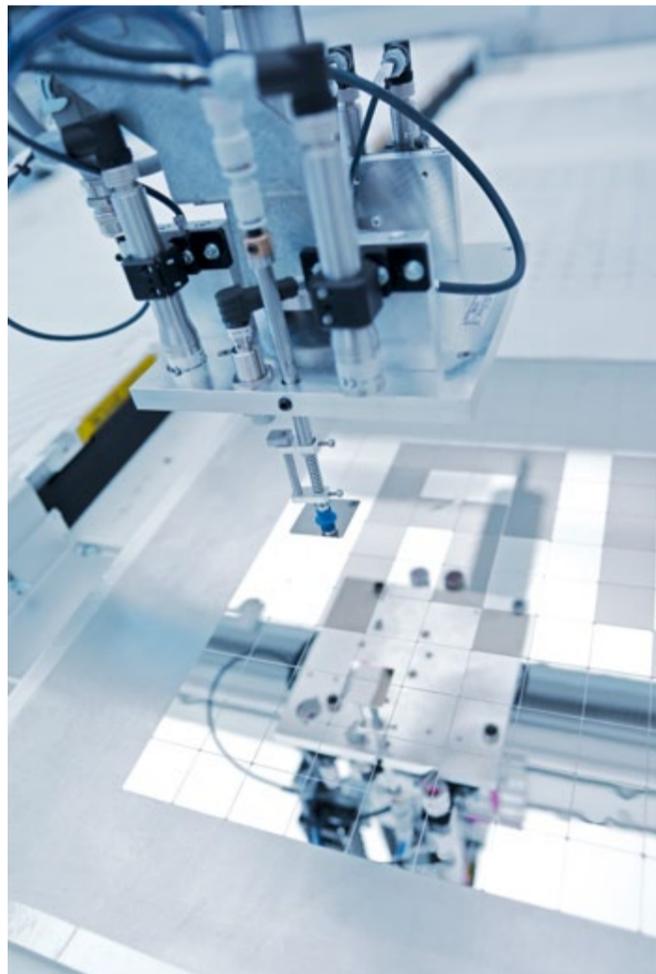
Design and development

Our design and development of thermal hardware is based on proven and efficient processes and aided by state-of-the-art design software tools. It can be applied to a wide range of materials. The design of the templates for the blankets including all fixations and grounding points is based on electronic 3D models of the satellite and/or instrument shape. For very complex shapes, 3D mock-ups can be built or a templates fit-check on the satellite will be performed.

The configuration of the individual insulation is designed and manufactured according to customer requirements. The blankets are then tested against verification requirements. RUAG Space also integrates the blankets on the instruments and satellites at the customers' premises.

Based on the geometrical inputs and the set of thermal, mechanical and other mission requirements, we provide three-dimensional design of insulation on CAD models for further development to the two-dimensional shape of insulation blankets which will be produced in our production facility. Optimum fit, well defined interfaces, minimum mass and the desired thermal performance are the design drivers for our engineering and design process.

Thermal Systems management, engineering, design and administration is located in RUAG Space Austria's Head Office in Vienna.



Pick and place facility for Optical Surface Reflectors

Design Tools	
CAD Programs:	NX I-DEAS, AutoCAD, NX
Data formats:	DXF, IGES, STEP
FEM Software:	I-DEAS Master Series, MSC-Nastran, Ansys
Thermal Software:	Ansys, Thermica

Materials & special products for space	
Polyester (Mylar) blankets (aluminized polyester foils with polyester interleaving spacer)	
Polyimide, Kapton blankets (aluminized polyimide foils, embossed or high temperature polyimide, spaced)	
Polyimide (Upilex) blankets	
High temperature shielding (Titanium)	
High radiation shielding	
Mechanism multi-layer insulation	
Teflon blankets and Second Surface Mirrors (SSM)	
Optical Surface Reflectors (OSR)	
Heaters, thermistors, thermostats, doublers, interfillers	

Production and integration



Our production processes for the cutting of blankets, electrical grounding and assembly of multi-layer insulation, velcros/stand-offs, attachments and advanced cleanliness are proven by many tests and several flight heritages. Advanced solutions have been worked out e.g. for high temperature multi-layer insulation around thrusters with Titanium foils, mechanism multi-layer insulation.

RUAG Space manufactures and integrates thermal insulation in-house or at the customers' sites. Based on our world wide connections to material suppliers, we have on stock a great range of multi-layer insulation reflective foils (Mylar, Kapton, Upilex, Teflon, etc.) and interleaving spacer (polyester, glass) for the specific requirements of most projects.

Further, we offer the procurement and the assembly of heaters, thermistors, thermostats or Optical Surface Reflectors (OSRs) and Second Surface Mirror (SSM) Tapes.

Since the beginning of 2012, RUAG Space has been offering the bonding of Optical Surface Reflectors on a new NC controlled pick and place facility for a maximum panel size of 2400 mm to 2600 mm.

Production Facility Berndorf

The production facility for space and cryogenic insulation is located in Berndorf, 50 km south of Vienna. It features:

- 300 m² of an ISO class 7 cleanroom for space insulation,
- 1200 m² production hall for cryogenic insulation,
- lay-up facility, laser cutting and cold cutting

Environmental Test Facility Vienna

Thermal Vacuum Chamber

Chamber dimensions	usable length 800 mm, width 600 mm, height 600 mm
Vacuum System	Operating pressure 10E-5
Temperature range	
Thermal wall:	- 85° C to + 95° C
Optional:	- 170° C to + 170° C
Thermal platform:	- 60° C to + 95° C

Coolcat Line – cryogenic application

RUAG Space has adapted space multi-layer insulation for cryogenic applications, used e.g. for superconducting magnet insulation in liquid Helium temperature range, for Nitrogen cryostats and for liquid Nitrogen piping. We can offer a broad range of standard vacuum insulation packages with polyester or aluminium foils and different spacer materials and also crinkled insulation lay-ups. We have even developed the procedures for production in a larger industrial scale. Multi-layer insulation for cryogenic applications is covered by the Coolcat Line of multi-layer insulation products.



COOLCAT 1 – Sheets

Multi-layer insulation made of single side aluminized, crinkled polyester film

COOLCAT 1 supercrinkled

Super-crinkled version of COOLCAT 1 with superior insulation performance

COOLCAT 2

Multi-layer insulation made of double side aluminized, perforated polyester film and knit-woven polyester spacer

COOLCAT 2 NW

Multi-layer insulation made of double side aluminized, perforated polyester film and non-woven polyester spacer

COOLCAT 2 NF

Non-flammable multi-layer insulation made of pure aluminium foil and glass fibre fleece

COOLCAT 2 LOX

Non-flammable, liquid oxygen compatible multi-layer insulation made of pure aluminium foil and glass fibre cloth

COOLCAT 2 NI

Non-inductive multi-layer insulation for minimum eddy currents, made of polyester film aluminized in squares and non-woven polyester spacer

COOLCAT B-R50

Low emissivity adhesive tape optimized for use under cryogenic environment

COOLCAT 4K

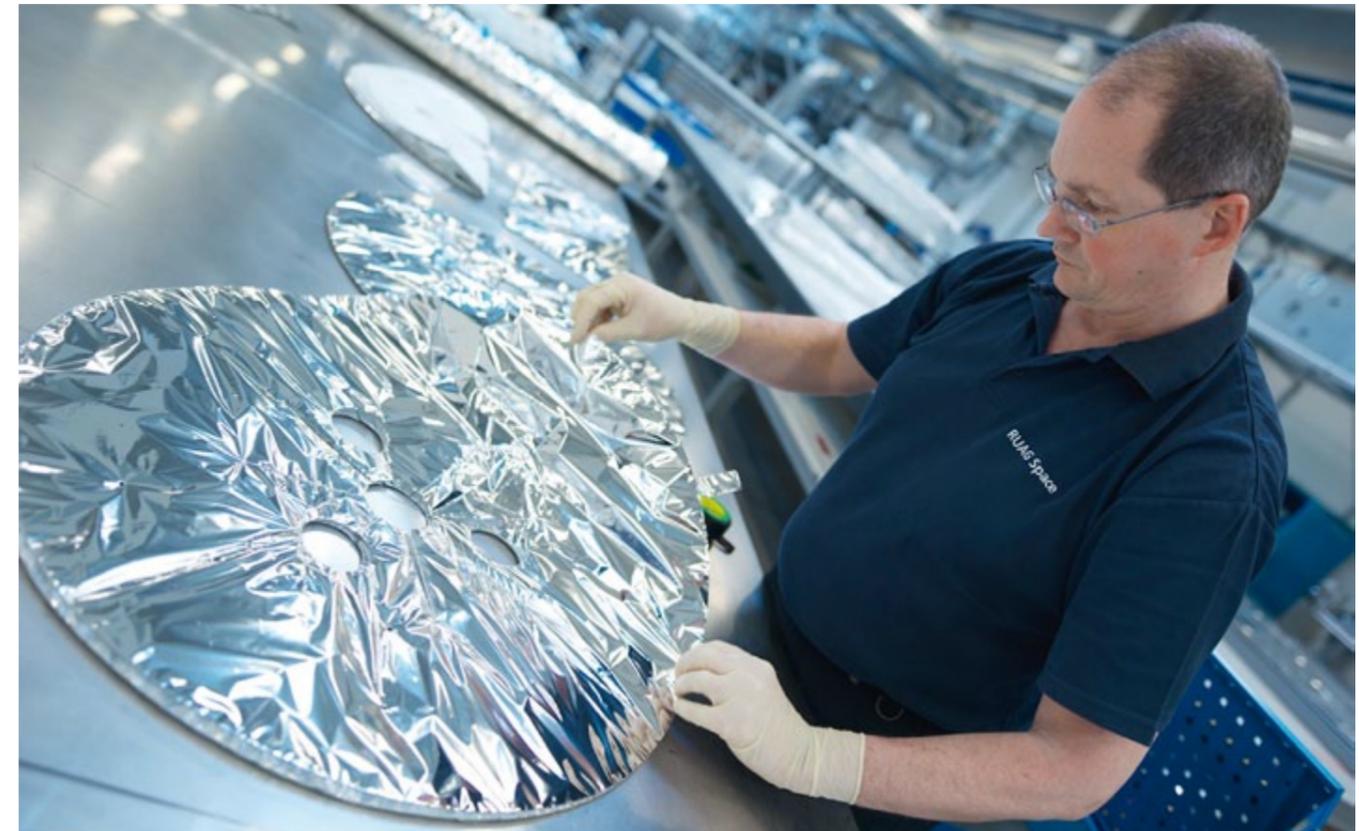
Low absorptance helium can laminate

COOLCAT H

Welding protection made of aluminium foil and fibre-glass cloth

For detailed product description and performance data please refer to our COOLCAT datasheet.

Custom-made insulation



Based on our customers' specific geometrical and thermal requirements, we can work out the composition and the design of specific pre-cut and pre-assembled insulation. For Helium and Nitrogen systems we will define the number of reflective layers, optimize the shape of blankets and overlaps, we cut and pre-assemble the blankets for minimized installation effort. Blankets can be made of aluminized polyester or aluminium foil, with polyester or glass fibre spacer, including He-Can foils, welding protection, tapes and Velcros for installation and even more features. The customer will receive one kit of insulation with all thermal components needed, even with heaters or temperature sensors.

We can supply prototype kits and we supply kits for serial production, if required to consignment stock or according to customers' logistics demand, for example just in time delivery or Kanban.

Programs / Experience

Cryogenic Insulation from RUAG Space is supplied for the following applications:

- Nitrogen and Helium Cryostats
- Cryogenic Piping and Storage Tanks
- Superconducting Magnets
- Particle Accelerators and Detectors
- Helium Liquefiers
- Test Chambers

