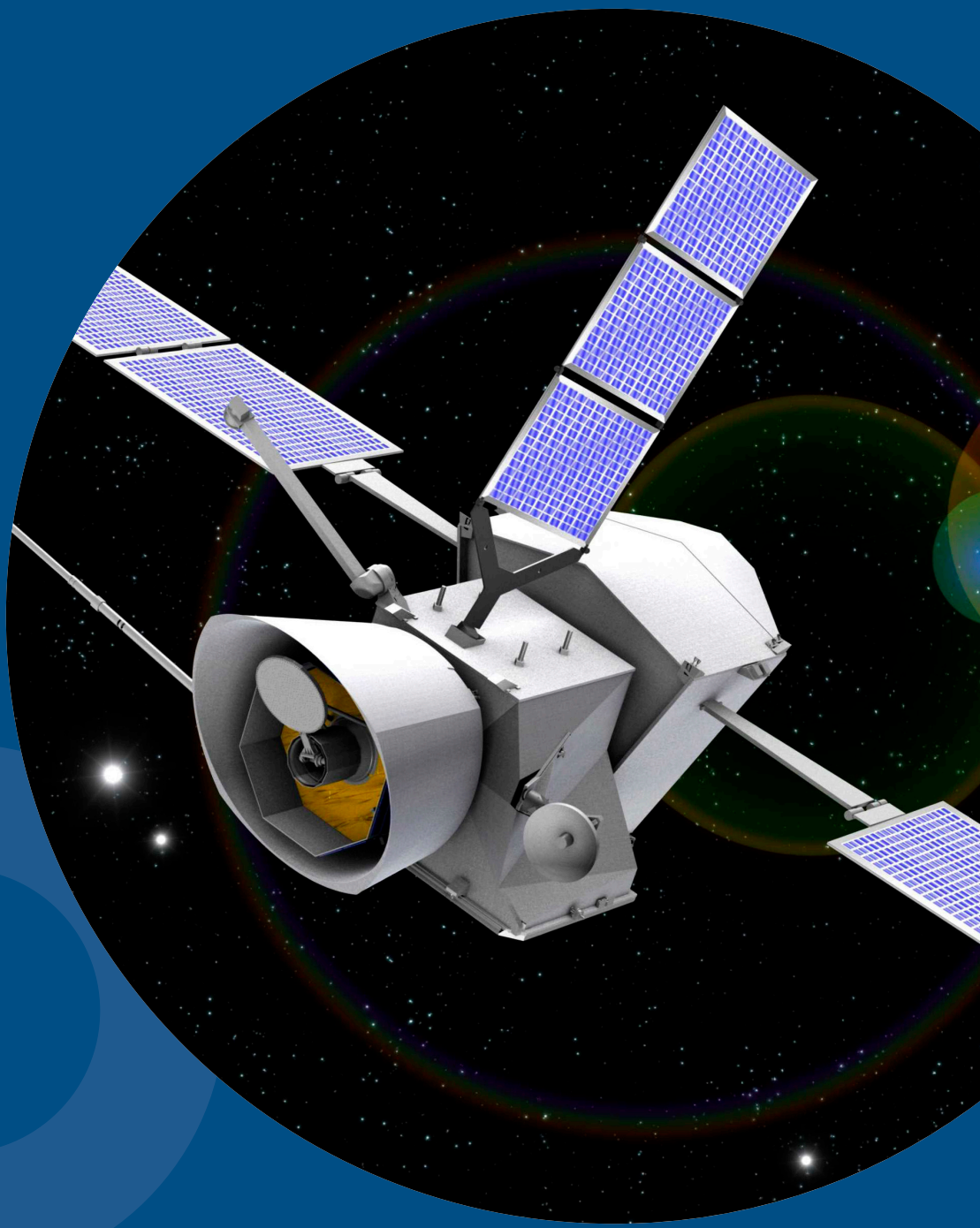
Ensinger

High-Performance Polymers for Extreme Space Conditions

Product Portfolio



What specific product forms and material types does Ensinger offer for the space industry?

	Material type	Product forms	Specific characteristics for space
Duroplast	PI	Shapes and machined parts or direct forming	The key material for space: High purity and low outgassing in accordance with ESA regulations (ECSS-Q-70-02). High strength from -270 °C to +350 °C. Extremely high dimensional stability (HDT/A up to 470 °C).
Thermoplast	PEEK	Compounds, composites, filaments, shapes, injection moulding, machined parts and profiles	Resistant to high-energy radiation and chemical influences, inherently flame-retardant and suitable for vacuum applications. Can also be used as a material for direct laser structuring.
	PEI	Composites, filaments, shapes, machined parts and profiles	Highly thermally and mechanically resilient, resistant to high-energy radiation and suitable for vacuum technology.
	PEKK	Filaments	High thermal and mechanical capacity; inherently flame-retardant. Offered as a filament for additive manufacturing.
	LCP	Compounds	HF/RF antennas, 3D interconnections.
	PTFE	Shapes and machined parts	Very good sliding/friction properties, suitable for cryogenics.

Applications and forms in satellite systems

→ Components for solar panel deployment systems
→ Cable insulation blocks and platform systems
→ Thermal spacers
→ Bearing cages and slide guides for large deployment systems
→ Components for ion propulsion systems
→ Antennas and high-frequency applications such as metasurface antennas (LEO)



Produced by S2P - Smart Plastic Products



TECASINT 8591, Ball Bearing

Ensinger as a strategic ’one-stop shop‘ for the space industry

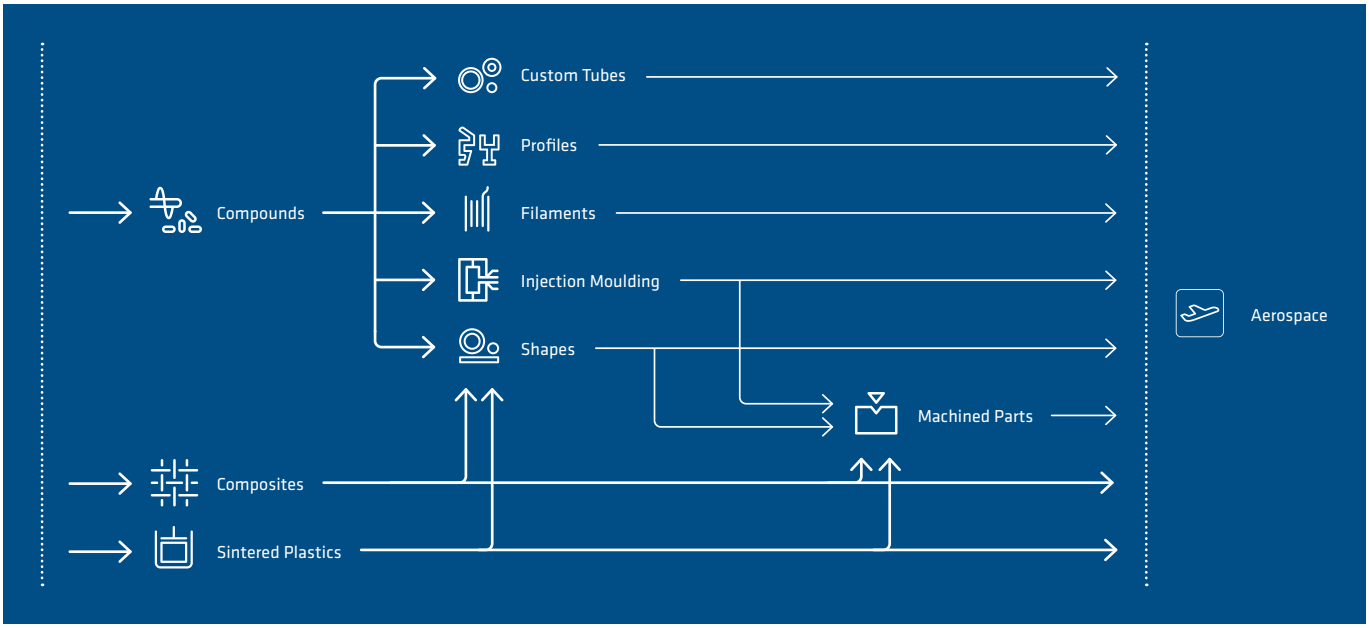
Ensinger has established itself as a comprehensive solution provider that supports customers from the initial idea to the space-qualified finished part.

→ **Integrated value chain:** Starting with the development and manufacture of application-specific compounds and composites, Ensinger produces semi-finished products such as sheets, tubes and rods – as a basis for injection-moulded, sintered or machined finished parts

→ **In-house processing technologies:** All key processes available in-house – from semi-finished product production to precision machining and injection moulding to sintering and profile extrusion. Complementary assembly processes for assemblies round off the portfolio

→ **Qualifications and partnerships:** Long-standing collaborations with leading companies in the space segment and a deep understanding of the entire supply chain secure Ensinger‘s strong position in the market. Ensinger operates four AS/EN 9100-certified machining facilities worldwide in France, the United Kingdom, China and the USA.

→ **Comprehensive support:** Beyond simply supplying materials, Ensinger offers industry-specific expert advice, support in the qualification of materials and components, and close support from the concept phase through to the final approval of the end product



Materials expertise for tomorrow's space industry

Space travel places the highest demands on materials – they must be lightweight, robust and reliable under extreme conditions. High-performance polymers from Ensinger have been making an important contribution to the efficiency and safety of modern systems for years. As an established partner to leading OEMs, Ensinger develops customised plastic solutions for applications in satellites, launch systems and base stations. The result: precisely manufactured components that help to reduce mass, increase performance and open up new design possibilities.

Strategic advantages of high-performance polymers for use in space

- → **Significant weight reduction:** A significant reduction in component mass leads to lower fuel consumption and reduced launch costs
- → **Resistance to extreme environmental conditions:** High resistance to vacuum, cosmic radiation and extreme temperature fluctuations
- → **Superior mechanical and tribological properties:** Excellent strength, stiffness and wear resistance – even under cryogenic conditions and without lubrication
- → **Application-specific material modification:** Materials can be specifically adapted to specific requirements using additives and fillers

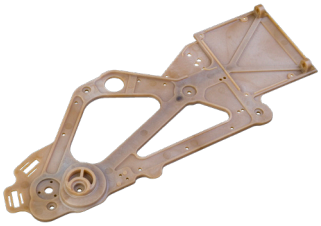
Core competencies that make Ensinger an integrated partner in the space industry



Compounds



Shapes



Injection Moulding



Microsystems



Filaments



Machined Parts

Flight Heritage – proven in space*

Material type	Main properties	Example applications in space travel
TECASINT 1011	Good temperature resistance up to 280 °C, high rigidity.	Thermal washers and spacers (BepiColombo mission).
TECASINT 2011	Good toughness and rigidity, better thermal ageing and lower outgassing than 1011.	Wire coils (Estcube 1), thermal spacers for sensors.
TECASINT 2391	Contains molybdenum disulphide for excellent tribological properties in space.	Cone inserts (Sentinel 5), hubs for wire coils, gearboxes and bearings.
TECASINT 4011	High-temperature type with good toughness and excellent dimensional stability.	Components for ion propulsion systems (Eutelsat 172 B / SES-12).
TECASINT 4111	Highest thermal requirements, HDT of 470 °C, minimal water absorption, high rigidity.	Satellite components exposed to extreme heat, antenna mounts (NORSAT 2).

***Advanced Polymers for Space Applications – in partnership with ESA**



TECASINT 2011, wire coil (Estcube 1)

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The paper used comes from sustainable forestry.

The Ensinger Group is engaged in the development, manufacture and sale of compounds, semi-finished materials, composites, technical parts and profiles made of engineering and high-performance plastics. To process the thermoplastic polymers, Ensinger uses a wide range of production techniques, such as extrusion, machining, injection moulding, casting, sintering and pressing. With a total of more than 2,500 employees at over 30 locations, the family-owned enterprise is represented worldwide in all major industrial regions with manufacturing facilities or sales offices.

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