Reference:

P. Serafini, *Views and Regulatory Challenges of TAS as Large Space Integrator in Europe*, 6th ESA REACH Workshop, ESA ESTEC, Noordwijk, the Netherlands, 17th June 2025

Author affiliation:
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VIEWS AND REGULATORY CHALLENGES OF TAS AS LARGE SPACE INTEGRATOR IN EUROPE

6TH ESA REACH WORKSHOP 17TH JUNE 2025 ESTEC/ESA

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THALES ALENIA SPACE OPEN

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THALES ALENIA SPACE IN 2024

2,23
BN € SALES

8,100
EMPLOYEES

JOINT VENTURE

ThalesAlenia Space
a Thales / Leonardo company

THALES (67%)
LEONARDO (33%)

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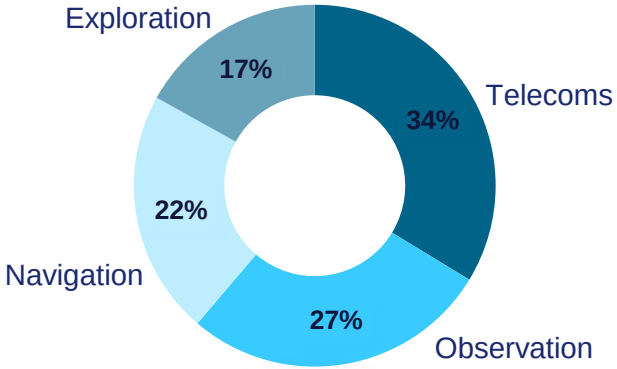
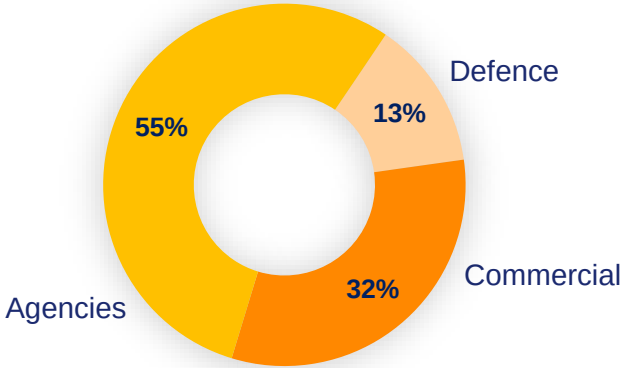
SALES BREAKDOWN 2024

PER ACTIVITY



PER MARKET



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THALES ALENIA SPACE INDUSTRIAL PLANTS

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TAS ORGANISATION

The Legal Compliance is crucial for Thales Alenia Space to ensure the safety, reliability and sustainability of space missions, while maintaining high standards of quality and environmental protection.

Chemicals regulatory compliance brings significant changes and challenges to TAS's space business, requiring continuous adaptation and innovation to ensure our space missions remain safe, sustainable and regulated.

The management and substitution of chemicals regulated by REACH and others Regulations not only represents a technical challenge, but also an opportunity for Thales Alenia Space to innovate and develop materials and solutions that ensure the reliability, durability and performance of space systems, maintaining regulatory compliance and promoting sustainability.

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IMPACT OF CHEMICALS REGULATION ON THE SPACE INDUSTRY

/// **Health and Safety**: Protects the health of workers (and consumers) by reducing exposure to hazardous chemicals.

/// **Environment**: Minimizes the environmental impact of harmful chemicals.

/// **Innovation**: Stimulates research and development in the field of new, sustainable and safe materials.

/// **Competitiveness**: Ensures a solid basis for the European chemical industry, promoting global compliance and trust in European products.

/// **Impact on Thales Alenia Space**:

- More and more in recent years it is not only the Reach regulation that is being monitored, but an extension of the Directives or Regulations that deal with chemical products or raw materials is now being considered: among all of these, the POP Regulation is now kept under strict control and monitoring.
- REACH and others regulations influences the selection of materials and chemicals used in space products.
- Requires proactive management of regulated substances to ensure compliance without compromising performance.
- Prevent material obsolescence due to legislative limitations or commercial decisions by manufacturers.

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INFLUENCE ON DESIGN, PRODUCTION AND USE

/// Impact on Design:

- Materials Selection: REACH requires the choice of materials that comply with the restrictions and legislation in force, influencing the initial design phase of space components.
- Sustainable Innovation: Stimulates the development of new technologies and alternative materials that comply with regulations, promoting research and innovation in design.
- Documentation and Compliance: Need to provide detailed documentation and specific certifications for each material used, ensuring long-term compliance.

/// Impact on Production:

- Regulated Substances Management: Implementation of advanced management practices for regulated substances, so that they are used safely and reduce the risk of non-compliance.
- Manufacturing Process Changes: Adapting manufacturing processes to replace critical materials with REACH compliant alternatives while maintaining quality and reliability.
- Training and Capacity: Continuous training is required for staff to ensure knowledge of regulations and effective management of chemicals.

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INFLUENCE ON DESIGN, PRODUCTION AND USE

/// **Impact on the Use of Space Components**:

- Monitoring and Traceability: Constant monitoring of substances used in space components, ensuring they are compliant and safe for use in space missions.
- Durability and Performance: Ensuring that alternative substances do not compromise the durability and performance of space components, which must withstand extreme conditions.
- Logistics and Disposal: Efficient and compliant management of logistics and disposal processes of chemical substances, minimizing environmental impact.

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SPECIFIC EXAMPLES OF CRITICAL MATERIALS OR SUBSTANCES FOR TAS

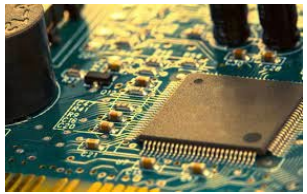
It is important to focus on those substances that are essential for the performance and reliability of space systems, but may be subject to regulation under REACH or others Regulations. Here are some examples and considerations to include:

/// Electronic Materials and Metal Alloys:

- Cadmium and Lead: Historically used in electronic components for their effectiveness, they are now subject to severe restrictions under REACH.
- Alternatives: Need to develop and integrate alternative materials such as lead-free alloys (or soldering process) to comply with regulations.

/// Coatings and Protections:

- Eg. Zinc Chromate: Used to protect metal components from corrosion, essential for the durability of structural components, is now regulated.
- Alternatives: Application of new coatings that offer the same corrosion protection but are REACH compliant.



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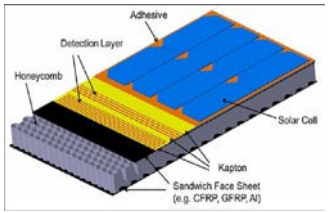
SPECIFIC EXAMPLES OF CRITICAL MATERIALS OR SUBSTANCES FOR TAS

/// Composites and Adhesives:

- Epoxy resins: Important for the construction of space structures, must comply with REACH regulations.
- Bisphenol A (BPA): used in epoxy resins to reinforce composite structures, needed for lightweight, strong components.
- Alternatives: Development of resin formulations with less restrictive and compliant components.

/// Propellants and Lubricants:

- Hydrazine: A highly effective propellant but subject to stringent restrictions and safety requirements. Essential for maneuverability and trajectory correction.
- PFPE (Perfluoropolyether) and PFAS: used in mechanical components to operate maintenance-free in extreme space conditions.
- Alternatives: Research and development of new propellants that are less toxic and compliant with REACH regulations. Develop and integrate PFPE / PFAS alternative materials such as to comply with regulations.



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NEED FOR SPACE SYSTEMS RELIABILITY AND PERFORMANCE

/// **Resistance to Extreme Space Conditions**:

- The materials and chemicals selected must withstand temperature changes, radiation, vacuum, and mechanical forces present in space.

/// **Durability**:

- The materials themselves must ensure long-term durability without deterioration, maintaining operational function for the duration of the mission.

/// **Reliability**:

- For space systems, reliability is crucial. Chemicals must maintain their properties without failure, ensuring uninterrupted operations.

/// **Electronic Performance**:

- Chemical compounds used in electronic circuits and components must offer high performance to provide precision and stability in communications and controls.

/// **Protection against Corrosion and Oxidation**:

- External surfaces must be protected with coatings that prevent corrosion, preserving their structural integrity.

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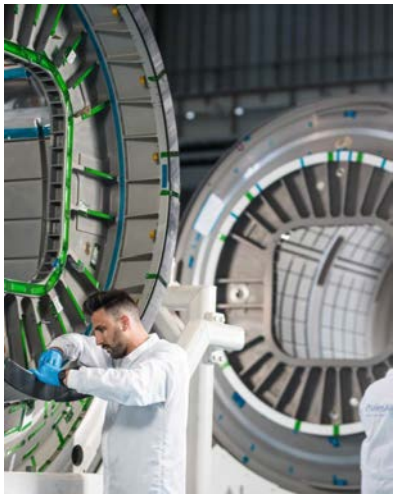
NEED FOR SPACE SYSTEMS RELIABILITY AND PERFORMANCE

/// **Material Compatibility**:

- Materials must be compatible with each other to avoid unwanted chemical reactions that could compromise the integrity of the components. New substances must be compatible with existing materials and manufacturing technologies. The integration of alternative materials may require significant changes to manufacturing processes and may require a complete review of existing designs.



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PROBLEMS TO FINDING ALTERNATIVES WITHOUT COMPROMISING PERFORMANCE

Adherence to REACH and POP regulations requires a thoughtful and innovative approach in the space industry. The challenges of compliance and finding alternatives to regulated substances, such as PFAS, represent an opportunity to develop new technologies and materials that ensure high performance, reliability and environmental sustainability.

/// **PFAS (Per- and Polyfluoroalkyl)**:

- These compounds are frequently used for their exceptional thermal and chemical resistance properties, which are essential in space applications. The possible restriction or prohibition of PFAS represents a significant challenge for space engineers, who must find alternative materials without compromising performance.

/// **Regulatory Procedures and Authorization**:

- REACH regulations require lengthy and costly authorization procedures for the use of regulated chemicals. Registration and evaluation of substances require extensive testing of their properties and safety, increasing production times and costs.

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PROBLEMS TO FINDING ALTERNATIVES WITHOUT COMPROMISING PERFORMANCE

Thales Alenia Space invest to remain compliant with regulations while ensuring excellence in space missions. Addressing these issues requires a **collaborative effort between engineers, materials technicians and regulatory experts, as well as an innovative approach to balancing performance and compliance.**

/// **Research and Development**:

- Regulated substances often do not have easy-to-implement alternatives that provide the same operating conditions. This situation can lead to performance sacrifices, where some mission-critical tasks may be compromised.
- The ongoing search for REACH and POP compliant alternatives is time and resource consuming. In space environments, alternatives must be rigorously tested to ensure they maintain the same performance.
- Adoption and development of new materials entail high costs; these include research, testing, implementation and staff training. In addition, availability constraints and supply problems for innovative materials may arise.
- Among the actions undertaken by TAS on investments in research and development for compliant alternatives, there are also:
  - collaboration with suppliers, universities and regulatory bodies,
  - long-term planning for adaptation to new regulations,
  - continuous monitoring and updating of its internal procedures,
  - internal training and awareness on REACH and POPs or legislation on chemicals in general.

INNOVATION AND REPLACEMENT

Thales Alenia Space (TAS) is involved in several R&D projects to create new advanced materials that comply with the regulations and performance requirements of the space sector. I can provide you with an overview based on historical data and typical knowledge of R&D projects in similar companies.

/// **Advanced Composite Materials**: To develop lightweight, high-strength composite materials for building space structures.

- Research: Expanding the mechanical and thermal properties of composites to improve durability and performance in space environments.

/// **Thermal Protection:** To innovate in thermal protection materials for spacecraft and satellites.

- Research: Development of new coatings and heat shields that can withstand extreme temperatures.

/// **Self-healing materials**: To create materials that can repair themselves after damage, reducing the need for maintenance.

- Research: Incorporation of microcapsules of repair agents into structural materials.

/// **Advanced Sensors and Smart Materials**: To develop materials with integrated monitoring capabilities, for self-diagnosis and adaptive responses.

- Research: Integration of sensors and actuators in composite and structural materials.

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INNOVATION AND REPLACEMENT

/// **R&D Laboratories and Equipment**

/// Materials Analysis Laboratories: Advanced testing and characterization of materials, using techniques such as electron microscopy and spectroscopy.

- Equipment: Scanning microscopes, mass spectrometers, differential scanning calorimeters.

/// Composite Engineering Laboratories: Fabrication and testing of composite materials for space structures.

- Equipment: Autoclaves, tensile testing machines, lamination machines.

/// Thermal Testing Labs: Testing of thermal resistance and thermal protection of materials.

- Equipment: Temperature controlled chambers, calorimeters, thermal shock testing apparatus.

/// Materials Innovation Labs: Development and testing of new materials and technologies for space applications.

- Equipment: Thin film deposition plants, chemical reactors, materials synthesis equipment.

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A CULTURE OF INNOVATION

OPEN INNOVATION

FABLAB

VENTURES

EMPLOYEE-DRIVEN INNOVATION

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We believe in Space as humankind’s new horizon to build a better, sustainable life on Earth

SPACE FOR LIFE

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