



TERMA IN SPACE

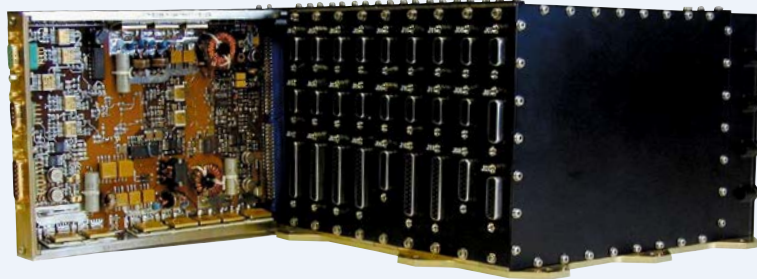


TERMA[®]
ALLIES IN INNOVATION



T1 Star Tracker

Power Control and Distribution Unit



Terma in Space

From the early days of space exploration, Terma has participated in many space missions – covering both the flight and ground segments with our products, systems, and services.

Terma has been a recognized member of the space community since the 1960s. We have repeatedly demonstrated our ability to evolve in, and in many cases lead, the markets in which we operate. We cover all phases of the mission life cycle – from initial feasibility studies, through realization and operation to exploitation of the mission results.

Currently, Terma is providing software and hardware systems for numerous current and future missions. Examples of these are:

- [BepiColombo](#) – launched to Mercury in 2018 with our power electronics, tested with our checkout software, and controlled with our satellite control system software;
- [Euclid](#) (with expected launch in 2020) – with our power electronics and tested with our checkout and simulation software;
- [Aeolus](#) – launched in 2018 with our Star Trackers on board;
- [Electra](#) – in development with our RTU;
- [Heinrich Hertz](#) – in development with our RTU;
- [SARah](#) – in development, with our power electronics, RTU hardware, test and simulation software and to be operated with our satellite control software;
- [OptSat](#) – in development, with our power electronics, RTU hardware, test and simulation software, and controlled with our satellite control software;
- [OneWeb](#) – being tested with our checkout software.

For the highly sophisticated [ASIM](#) observatory, Terma is technical prime under contract with the European Space Agency (ESA). This

was launched in April 2018 and is now attached to the exterior of the International Space Station (ISS) performing valuable science in the field of climate research.

Space Segment

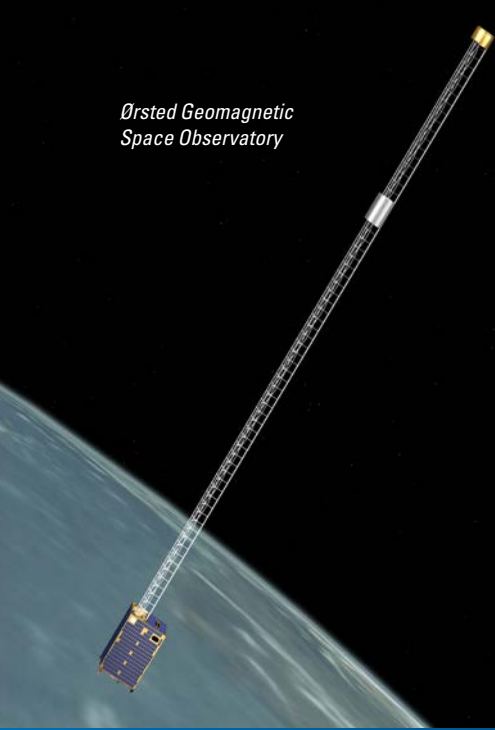
- System integration
- Star Trackers and optical instruments
- Power electronics
- Remote Terminal Units
- Onboard software
- Central checkout systems

Ground Segment

- Mission control systems
- Satellite simulators and processor emulators
- Flight dynamics

Engineering Services

Terma provides specialist engineering services for spacecraft flight dynamics, operations engineering, Assembly, Integration and Test (AIT)/Assembly, Integration and Verification (AIV), specialist consultancy services, and IT support. Our engineers and specialists are located at Terma premises in Denmark, Germany, the Netherlands, UK, USA, and at numerous customer sites.



Specialized Products and Services

Terma is a renowned system integrator with capability to develop and deliver small spacecraft and complex instruments for larger missions. We participate in feasibility studies, as specialists, prime contractor, as well as integrator. The specialist areas include slotted waveguide antennae, optical instrumentation, and power subsystems.

Star Trackers and Sensors – focusing on fully autonomous attitude determination with high accuracy. Different versions support missions ranging from satellites with short mission lifetimes to satellites having long lifetimes and stringent requirements for radiation tolerance. End customers include ESA, the U.S. Department of Defense, and ROSCOSMOS.

Electrical Power Management and Power Systems – state-of-the-art power designs covering power conditioning and distribution. Terma has supplied power electronics for all ESA deep space and planetary missions in orbit including Rosetta, Venus express, Mars Express, BepiColombo, ExoMars, and Euclid. They are also in the Galileo IOV satellites. We are currently developing Power Condition and Distribution Units (PCDUs) for PLATO and for radar- and optical reconnaissance satellites.

Remote Terminal Units – a product line of modular Remote Terminal Units (RTU). The RTUs are applied as part of the data handling system of Earth observation, scientific, and telecommunication satellites, providing the control and monitoring interfaces to equipment and sensors including heaters, thermistors, Attitude and Orbit Control System (AOCS) equipment, etc. They are being supplied to the SARah, Electra and H2Sat projects.

Flight Software – Terma develops flight software for AOCS and data handling. We developed the AOCS software for Solar Orbiter and OBC software for Sentinel-6/Jason-CS. We delivered the AOCS software for the Herschel and Planck missions. We are also part of the software development for the ExoMars rover and have previously provided software for the European Robotic Arm (ERA) to be mounted on the ISS.

Satellite Test Software – products for integrated Electrical Ground Support Equipment (EGSE) systems at all levels of Assembly, Integration, and Test (AIT) – including instrument, platform, payload, and satellite level. Today, the majority of these systems are based on our Test Sequence Controller (TSC) / Central Checkout System (CCS5) product. We also supply specialized thermal data handling software.

Mission Control Systems – Terma has a suite of products to build complete ground segments. These include satellite control systems for single satellites through to mega-constellations together with the necessary orbit visualization tools.

Simulators – Terma develops spacecraft simulators to support development of spacecraft (including software validation) as well as for ground segment validation and operations training. We have also developed TEMU – a software-based flight processor emulator.

In-House Test and Manufacturing Facilities

Our facilities for flight hardware development include clean room, optical laboratory, environmental test facilities, including shock test stand, vibrators, thermal vacuum chamber, and conducted Electro Magnetic Compatibility (EMC) test equipment. Our manufacturing facilities are certified for fully automated mounting of surface mount components as well as hand soldering of through-hole components.



Operating in the aerospace, defense, and security sector, Terma supports customers and partners all over the world. With more than 1,600 committed employees globally, we develop and manufacture mission-critical products and solutions that meet rigorous customer requirements.

At Terma, we believe in the premise that creating customer value is not just about strong engineering and manufacturing skills. It is also about being able to apply these skills in the context of our customers' specific needs. Only through close collaboration and dialog can we deliver a level of partnership and integration unmatched in the industry.

Our business activities, products, and systems include: command and control systems; radar systems; self-protection systems for ships and aircraft; space technology; and advanced aerostructures for the aircraft industry.

Terma has decades of hands-on know-how in supporting and maintaining mission-critical systems in some of the world's most hostile areas. Terma Support & Services offers through-life support of all our products to maximize operational availability, enhance platform lifetime, and ensure the best possible cost of ownership.

Headquartered in Aarhus, Denmark, Terma has subsidiaries and operations across Europe, in the Middle East, in Asia Pacific as well as a wholly-owned U.S. subsidiary, Terma North America Inc., headquartered in Washington D.C. and with offices in Georgia and Texas.

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