Astral

A versatile and modular end-to-end ground segment solution

STARION

Astral

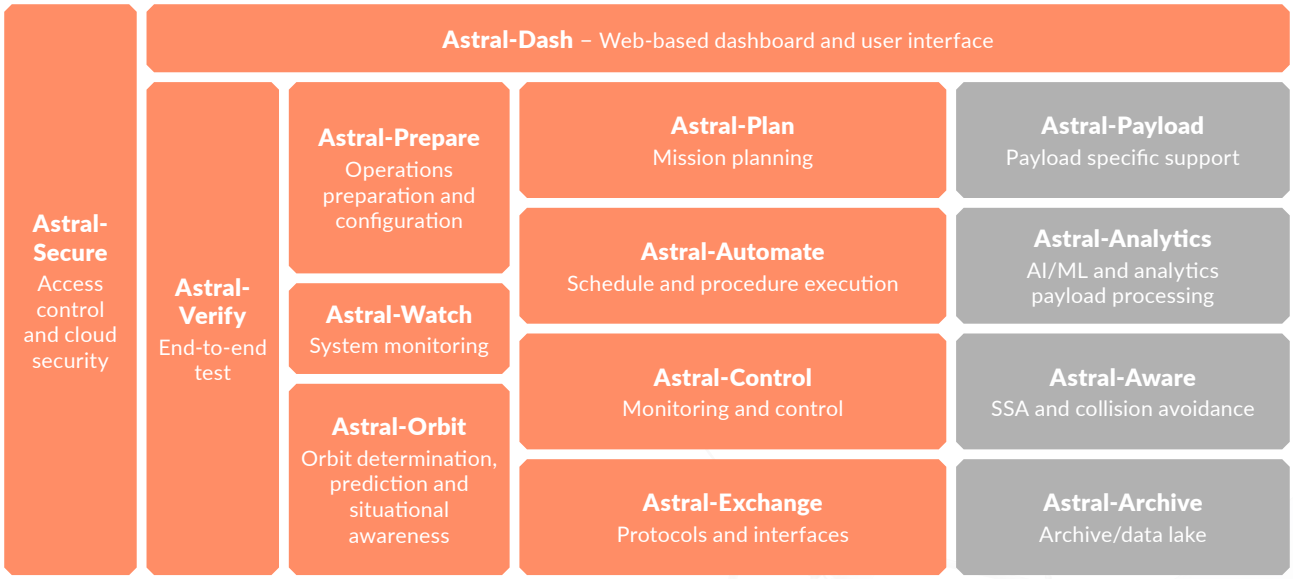
Astral is a component-based satellite ground segment solution, allowing customers a high degree of flexibility to integrate their own or third-party components and interface to other systems. Astral is operationally proven and offers a high degree of automation, which supports multiple missions and multiple spacecraft, and includes an industry-leading operations preparation environment. It can be deployed on a dedicated server, or on a private or public cloud.

Astral builds on Starion's long-standing operational heritage in ground segment development, mission automation and operations preparation.

The Astral approach

Astral provides an integrated environment for different ground segment systems, enabling end-to-end support from preparation to operations with the same toolset providing major benefits:

- Low learning curve for users avoiding having to learn different systems
- Complete end-to-end configuration of the mission support via a single system
- Seamless integration between assembly, integration and test (AIT) and operations
- Well-defined and standardised interfaces between Astral components and external systems, where required
- Cloud enabled with integrated security by design.



Astral consists of various components, each supporting different ground segment elements. Each element can be replaced by customer-provided or third-party components. The grey components tend to be mission specific and are not included as standard.

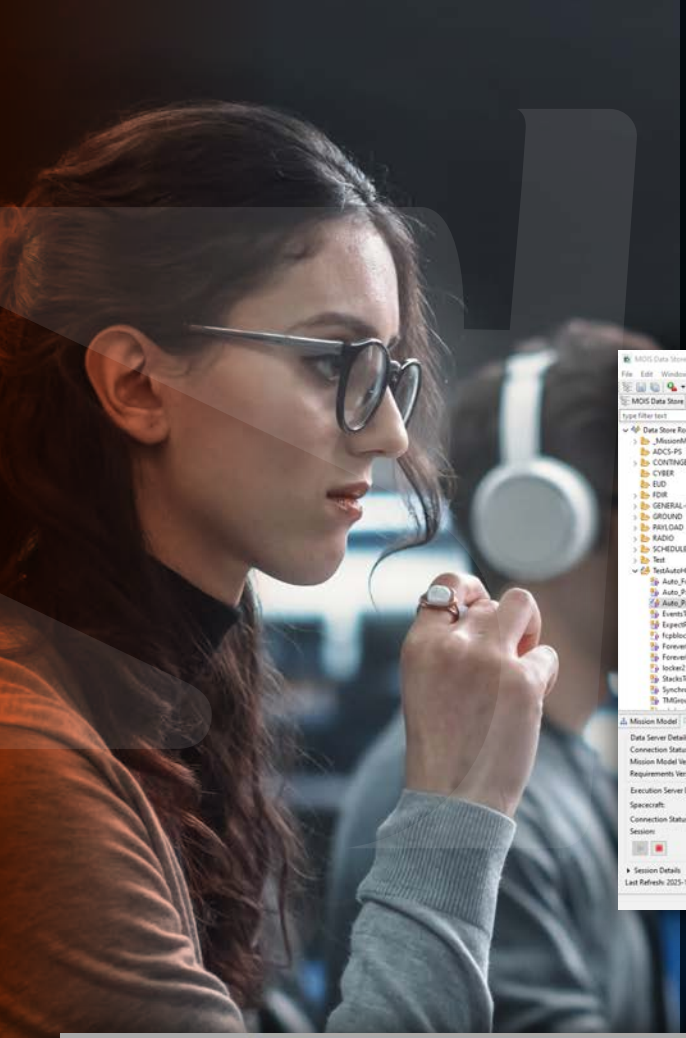
A modular system

Astral offers component-based satellite ground segment modules, which allows a high degree of flexibility for customers to integrate their own or third-party components, and interface to other systems. The modules within the Astral suite include:

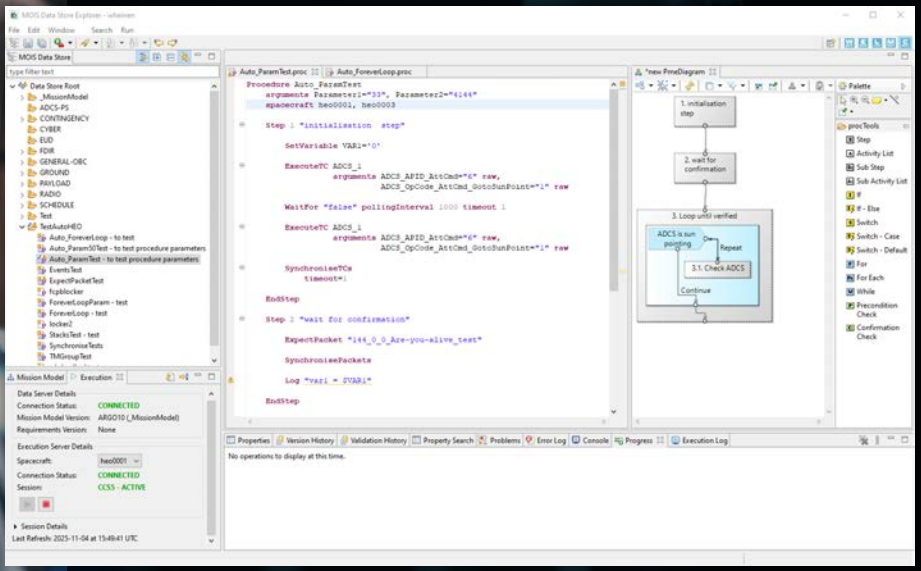
Astral-Dash – provides a high-level, browser-based view of the overall spacecraft and ground segment status and can be closely linked to each operator's concept of operations.

Typical dashboard displays can include: individual spacecraft and ground station status (e.g. red / green); next spacecraft pass over a ground station; status of ground segment elements; and current executing timelines. It can also include 3D views of the spacecraft orbit/attitude.

Astral-Dash

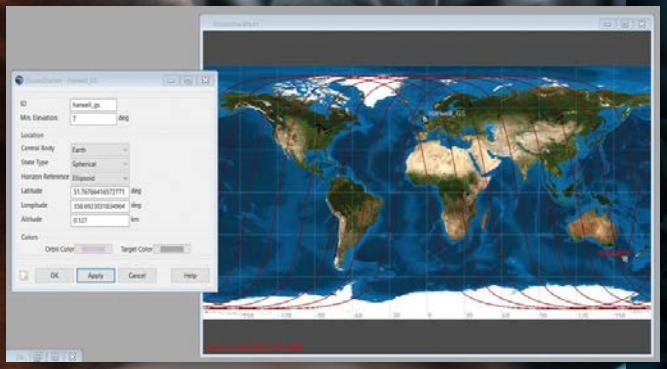


Astral-Prepare – provides management and editing of operational procedures. Validated operations procedures, whether manual, semi-automated or automated, are essential to ensure safe, reliable operations of your space segment and corresponding ground segment elements.



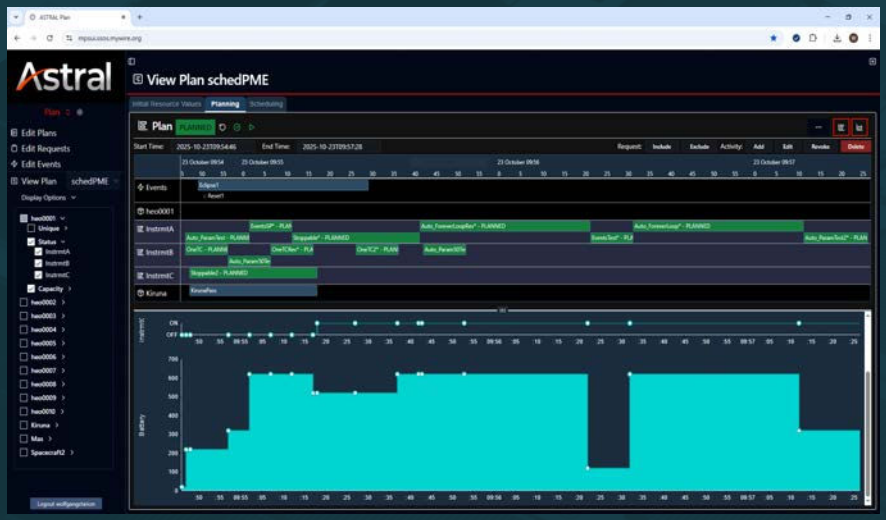
Astral-Prepare

Astral-Prepare supports authoring of manual and automated spacecraft and ground procedures and consistency checking of telemetry (TM) and telecommands (TC) with the spacecraft database. It also supports the validation and publishing of procedures to a flight operations manual and the spacecraft database management functions.



Astral-Orbit

Astral-Orbit – is an integration of GMAT, a third-party flight dynamics package supporting the automation process. GMAT provides a low-cost capability suitable for many missions. Third-party packages can be used instead, according to the client's preferences and needs.



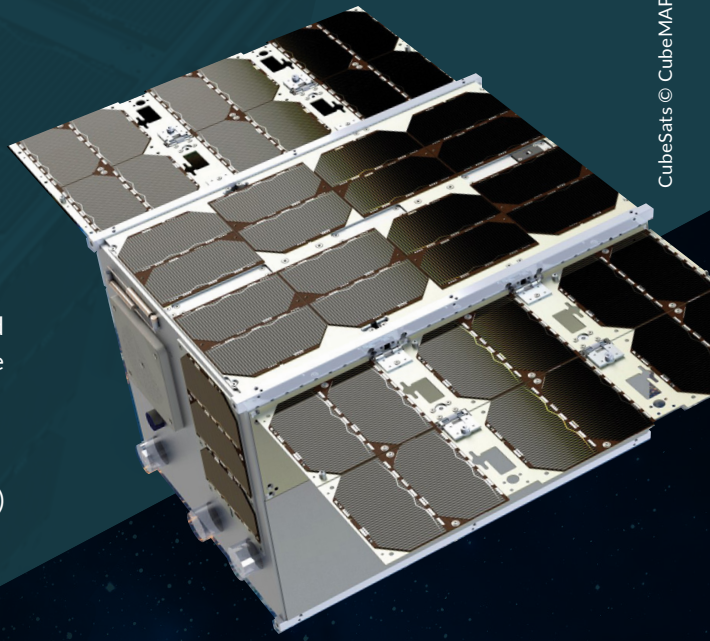
Astral-Plan

Astral-Plan – is a mission planning system enabling constraint-based planning for platform and payload operations. It supports planning of multiple spacecraft operations and multiple domains, allowing each spacecraft to have different payload and resource constraints. Because Astral-Plan is integrated with other Astral components, it will be aware of available spacecraft operations procedures and spacecraft commands.

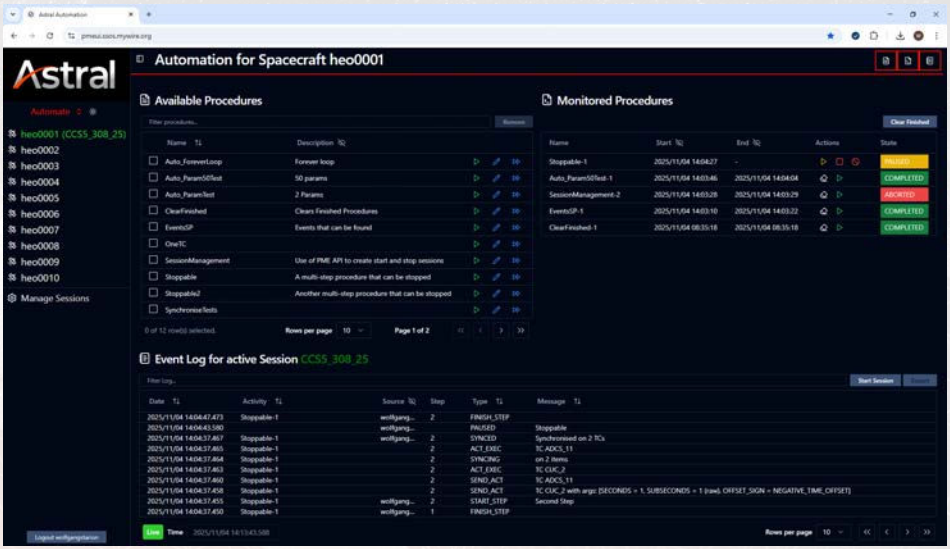
Astral-Verify – Often an operations simulator or flatsat is not available until rather late in the timeline of a ground segment development. Astral-Verify, configured using the spacecraft database, solves this problem, enabling early testing and end-to-end testing of the monitoring and control chain by simulating the reception of telecommands and generation of simple telemetry.

Astral-Watch – This component provides system monitoring and control, including local security monitoring. It monitors the entire Astral deployment, collects logs and supports alerting and post-event analysis.

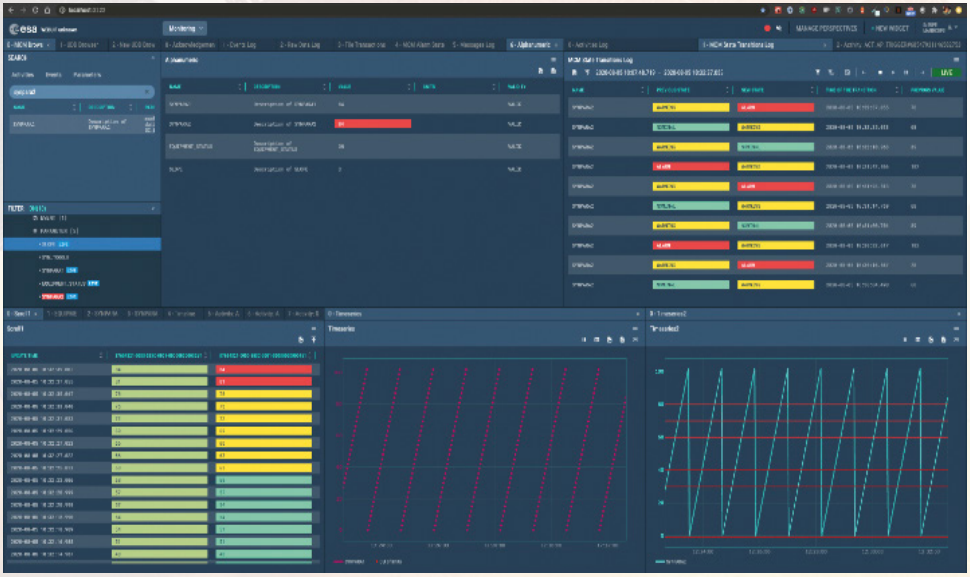
Astral-Secure – Astral employs role-based access control (RBAC) and reverse proxy technology to protect its components from unauthorised access when deployed in a cloud or on a dedicated server.



Astral-Automate – supports the execution of the schedule generated from Astral-Plan or another planning tool. It is typically used by operators as the primary view to monitor progress, only using the mission control system to look at parameter values or send manual commands. It additionally supports the automated execution and debugging of procedures developed by Astral-Prepare. It interfaces to the systems being automated (such as the mission control software) and allows you to step through a procedure to understand what is happening, and debug accordingly.



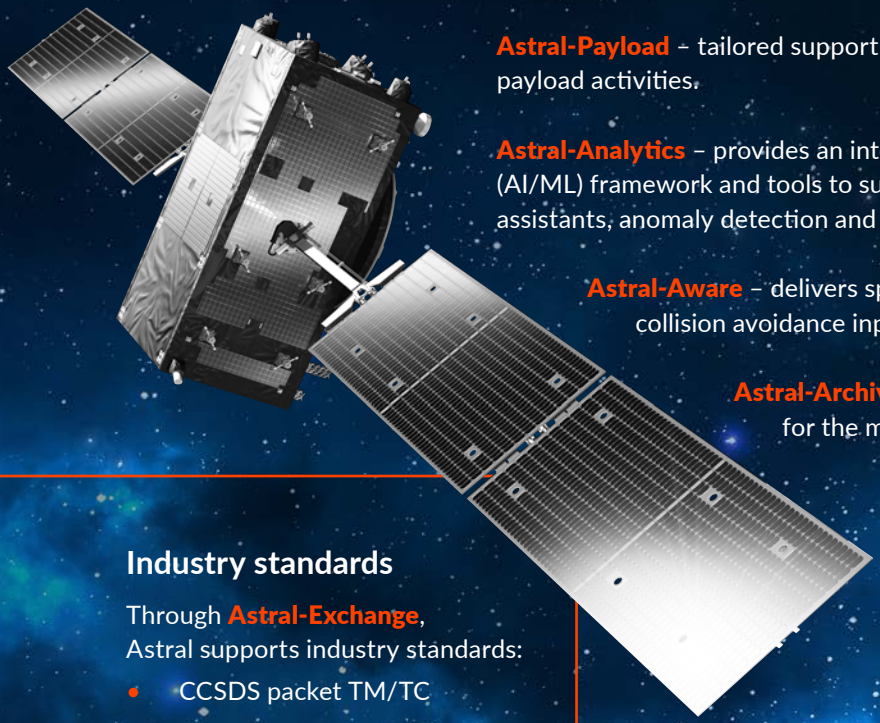
Astral-Automate



Astral-Control

Astral-Control – is designed to support different mission control system kernels. Current deployments support both the European Ground System – Common Core (EGS-CC) and the Satellite Control and Operation System 2000 (SCOS-2000), which Starion has expertise in configuring, adapting and deploying. The standard deployment of Astral-Control has a web-based graphical user interface (GUI).

EGS-CC SCOS-2000®



Astral-Payload – tailored support for mission-specific data processing and payload activities.

Astral-Analytics – provides an integrated artificial intelligence/machine learning (AI/ML) framework and tools to support operational activities such as AI assistants, anomaly detection and analysis support pattern recognition.

Astral-Aware – delivers space situational awareness capabilities and collision avoidance inputs to the planning system.

Astral-Archive – offers long-term storage functionalities for the mission.

Industry standards

Through **Astral-Exchange**, Astral supports industry standards:

- CCSDS packet TM/TC
- CCSDS SDLS
- ECSS Packet Utilisation Standards (PUS)
- AES-256 TM/TC encryption and TC authentication
- CCSDS CFDP and file-based operations
- CCSDS SLE interfaces.

Astral-Exchange support multiple ground station interfaces:

- SLE
- K-SAT
- ViaSat.

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In summary

Astral is a flexible, modular ground segment system that enables operators to select and integrate the best components for their mission needs, whether managing a single satellite or an entire constellation.

With its modular, component-based architecture, Astral can be configured in multiple ways to suit different mission requirements. Existing deployments have been successfully adapted to a wide range of mission profiles and integrated with third-party systems, including flight dynamics, payload processing, operations simulators, flatsats and various control systems.

Astral is designed to adapt to your mission – **today and in the future.**

STARION

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