TERMA
ALLIES IN INNOVATION

# PLAN

## MISSION PLANNING & SCHEDULING

**PLAN IS THE COMPONENT IN TGSS (TERMA GROUND SEGMENT SUITE) RESPONSIBLE FOR GENERATING AND IMPROVING MISSION SCHEDULES EXECUTED BY THE SATELLITE OR FLEET CONTROL CENTRE.**

### Constellation-Ready

PLAN computes the schedule to be executed considering the entire fleet or constellation. The tasks can be timed according to specific events (p.e ground station availabilities or spacecraft visibilities) which are used to define opportunity windows. Once the schedule has been generated, one can also make manual adjustments to the tasks before confirming them to the MCS to be executed.

In the case of CCS5 MCS, the AutoPilot instance executes tasks under its own responsibility (specific spacecraft, or group member) at the appropriate time.

PLAN supports retrieving orbital events and ground station/ satellite information from Terma's Flight Dynamics Software, ORBIT. Additionally, it can be tailored to integrate with other FD- systems. This orbital data is used to automatically generate uplink, downlink, image acquisition, etc requests, which become part of the final mission schedule.

### Customization through Mission Plugin

Each mission comes with its own unique set of resources, constraints, and objectives. To address this diversity, PLAN is designed with flexibility at its core, allowing the scheduling algorithm to be replaced or customized through ad hoc implementations.
Depending on the complexity of the task, PLAN can employ lightweight backtracking or greedy algorithms for simpler scenarios, as well as advanced machine learning techniques for highly complex scheduling challenges. Sophisticated algorithms can be developed, refined, and validated independently using a wide range of technologies, and then seamlessly integrated into the core PLAN product as plug-ins.
Combined with support for parallelization and multithreaded execution, this architecture enables efficient handling of complex missions carried out by multidisciplinary teams, allowing domain experts to contribute specialized solutions within a unified framework.

## Client Server Architecture

The PLAN solution adopts a client-server approach allowing multiple users to contribute to a common mission timeline. This makes it easier to compile sequences of tasks that address and prioritise the needs of multiple entities. Different sources can upload schedules to cater for different goals (payloads, manoeuvres, software patches, etc), so it is up to PLAN to facilitate the resolution of conflicts that may arise.

## Timeline Visualization

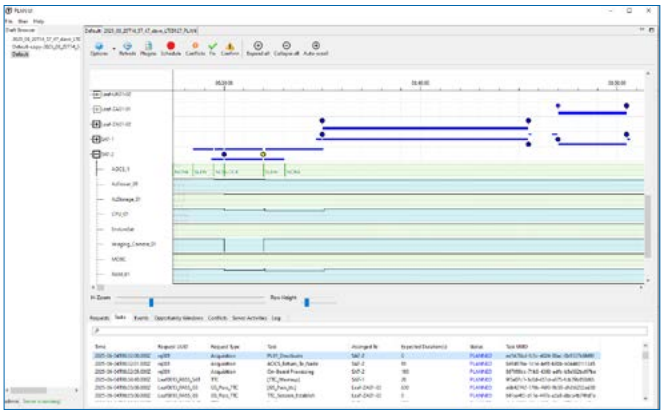
PLAN provides the necessary UI to interact with the PLAN server. Each user can connect using this component to follow the current state of the mission schedules as they are generated. The mission timeline is promptly displayed on a Gantt chart to see relevant orbital events and tasks organized by each satellite of the constellation.

## Comparison of Schedule Alternatives

The software supports schedule drafts, which can be used to create different variations of timelines. In each draft the user can generate a schedule, based on different sets of events, tasks and relying on different algorithm configurations.

The UI can be used to create multiple schedule drafts and then visualize the different resulting timelines. The comparison can be done by showing each timeline on its own or by displaying a merged timeline view.

PLAN can integrate with TRACK to generate a 3D visualization of image acquisition requests, displaying satellite camera footprints on the Earth's surface.



*The schedule is shown as an animated Gantt chart.*

## Interfaces

PLAN can interface with the TRACK ORBIT FDS and CCS5 MCS out of the box.

The software processes ORBIT event files, makes HTTP requests and reads and writes to the CCS5 Autopilot database.

Additionally, the server's REST API facilitates the integration of external tools which can exchange information in standard formats such as JSON. This API may also be extended by the Mission Plugin which can introduce new endpoints to handle specific requests.

Finally, PLAN supports the exchange of NATS messages, which facilitates the communication between components, and automation of behaviours based on received data.

PLAN is a live product that adapts to market needs.

## Upcoming Features

- Live updates from autopilot task execution.
- WEB-UI

## Product Support

Product support is available at: https://tgss.terma.com

If you have any questions, please contact our team, terma.space@terma.com.

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