

The easy to use, flight-proven Mission Control System for your nano and small satellites

Elveti is a complete, cost effective solution for operating and monitoring nano and small satellites. In addition to being easy to use, it is based on global aerospace standards and designed for customisation and extensibility. It thus adapts easily to mission-specific needs throughout their lifecycle. Elveti can indeed support the development of a mission from the first hardware tests on-ground to its long-term operations in space. Moreover, Elveti has multi-satellites and multi-ground-stations capabilities at its core and can efficiently handle a constellation.

What Does It Do?

Elveti handles all your data from the ground station to the operators and facilitates their dissemination to the final recipient (customers, scientists, etc.).

Using standard protocols combined to modern technologies, Elveti interfaces with your ground stations, decodes your telemetry and generates telecommands for your satellites. The operators interact with the system through simple, modern applications, which are designed to be used on multiple screens. The core of the processing is performed by server applications allowing for a distributed environment with remote ground stations and remote operators.

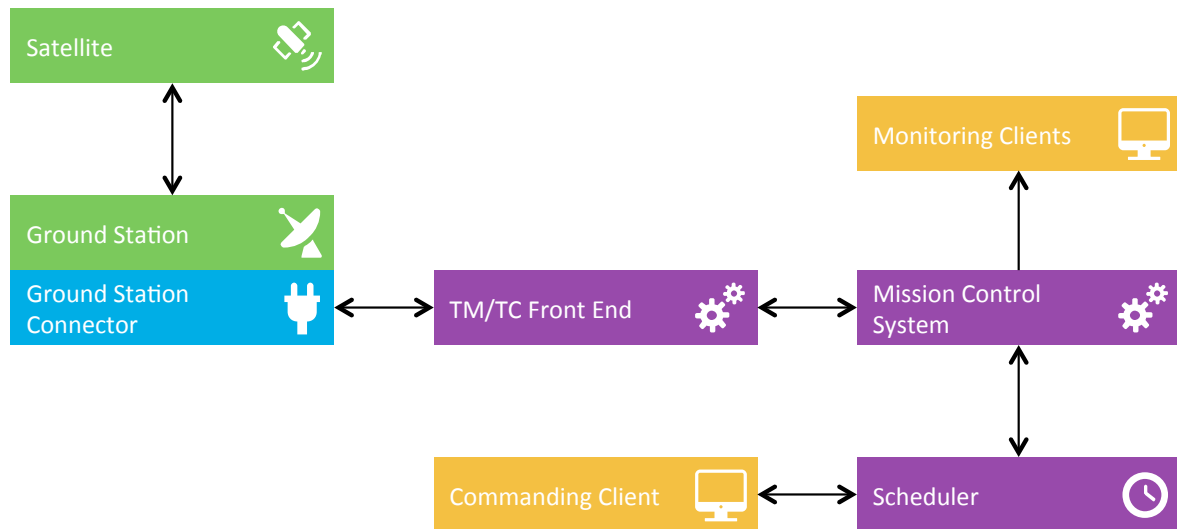
How Does It Help?

Elveti offers many benefits to both commercial and educational missions:

- Modern cost-effective solution that let's you focus your efforts on the building of the satellites;
- Open interfaces that allow integration with your systems;
- Extensible and customisable to tailor the ground segment to your needs;
- Full-stack from the ground station to the operators;
- Full monitoring and control functionality;
- Multi-satellites capability for constellations;
- Multi-ground-stations capability for an increased downlink and uplink capacity;
- Scripts for simplified operations;
- Leverage key aerospace standards;
- Flight-proven...

Overview

The figure below shows the main components of the Elveti ground segment. The components are further described in the next sections.



Blue: primary interface / Purple: server components / Yellow: client components / Green: not provided as part of the solution

Components

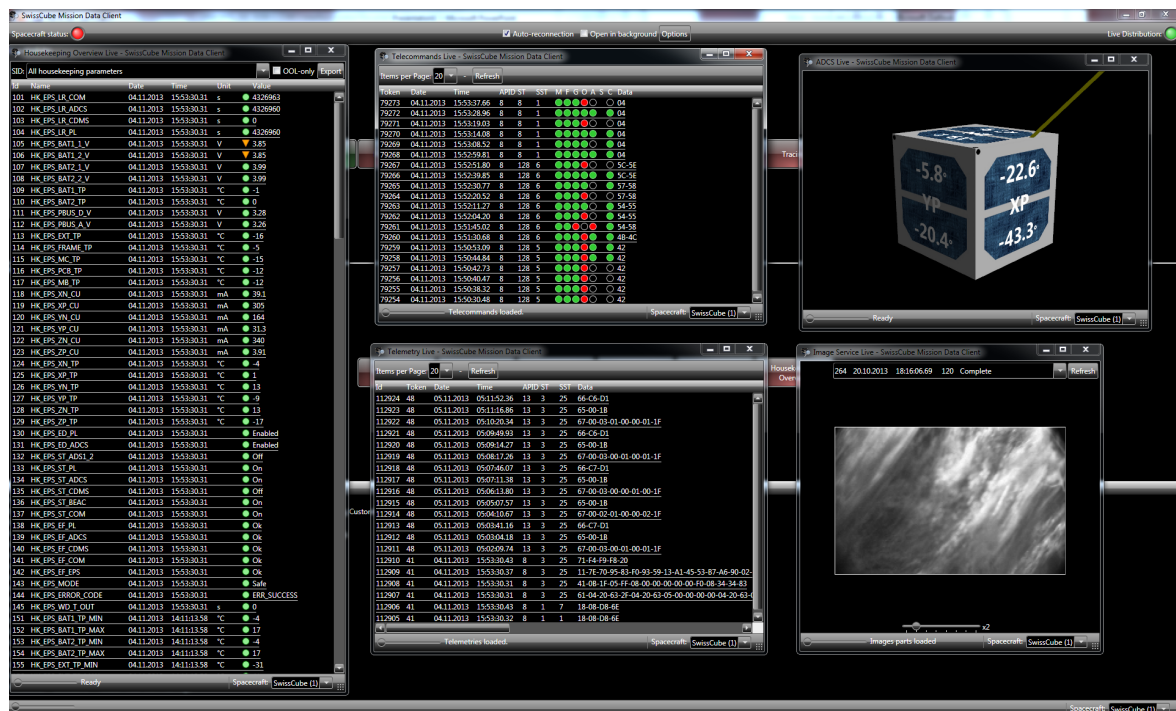
Mission Control System

The Mission Control System is composed of two elements: Core and Distribution. They perform the following tasks and handle the communication with client applications:

- Handling of telemetry packets sent by the satellite;
- Extraction of housekeeping and payload data out of the packets and pre-processing, e.g. calibration;
- Storage in a database of all raw and processed data for archiving, re-processing and/or further post-processing;
- Monitoring of the health of the satellite and the ground segment;
- Generation of telecommand packets and tracking of their execution.

The Core and Distribution are built and optimised for CCSDS PUS (ECSS-E-70-41A). Although other protocols can be supported via adapters, we recommend developing new missions following this standard for telecommand and telemetry packets.

Monitoring Clients

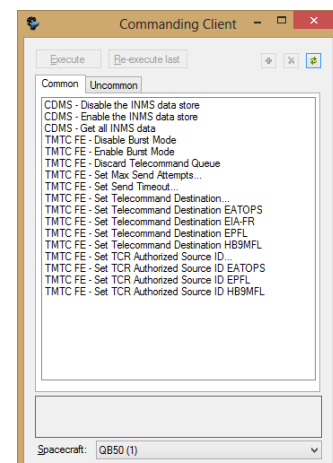


The monitoring clients allow operators to understand the status of the satellite and its related operations.

The Mission Data Client is desktop-based and gives access to the whole content of the Mission Data Repository, i.e. both historical and live data. This application is complemented by a Web Mission Data Client, which provides an on-the-fly overview of the telemetry (housekeeping and payload).

Scheduler and Commanding Client

The Commanding Toolkit is composed of the Scheduler Server and a Commanding Client. The server holds and executes Python scripts defined by the operations team and the client allows triggering these scripts. The scripts can generate new telecommands, wait for acknowledgements or data, access historical information from the Mission Data Repository, etc.



TM/TC Front End

For the uplink, the TM/TC Front End encapsulates the CCSDS PUS packets produced by the Core into one or multiple frames depending on the size limits of the frame protocol. For the downlink, it reassembles CCSDS PUS packets from one or multiple frames. If the frame protocol supports it, multiple packets can be concatenated into a single frame in order to reduce overhead. The current implementation supports AX.25 and support for standard CCSDS frames is under development. Other frame protocols can be implemented on request.

Ground Station Connector

The Ground Station Connector is a small application usually running on the ground station control computer, which relays frames from the TM/TC Front End to the radio equipment and vice-versa. It can connect to one (duplex) or two (uplink and downlink) TNCs currently using the KISS protocol over COM or TCP/IP. Other communication protocols with the ground station equipment can be implemented on request.

Extensibility

The various components of the Elveti solution are built with extensibility and mission-specific requirements in mind.

First, the Core and Distribution can be extended with processing and distribution modules respectively in order to handle mission-specific data such as payload data.

Second, the Mission Data Client (desktop client) can be extended with visualisation modules to create views specific to the mission, e.g. 3D model of the satellite with housekeeping data, visualisation of payload data, etc.

Furthermore, the Core, Distribution and Scheduler expose their features via Web services thus enabling unlimited integration and distribution of the data.

Finally, the communication between the Ground Station Connector, the TM/TC Front End and the Mission Control System uses the standardised EGSE protocol, which allows easily integrating and controlling other elements in the ground segment such as a test bridge for interfacing with the satellite hardware while it is developed.

Technical Specifications

Elveti is built using the Microsoft .NET Framework 4.5 and requires a Microsoft SQL Server for the Mission Data Repository. Some of the components run on Linux using Mono.

Complementary Tools

Solenix proposes complementary systems to Elveti, which are not included in its base license:

- An electronic operations logbook (Überlog);
- An advanced Web-based data analysis platform;
- An adaptive Web-based dashboard solution (in-development).

More information is available on request.