SCS space

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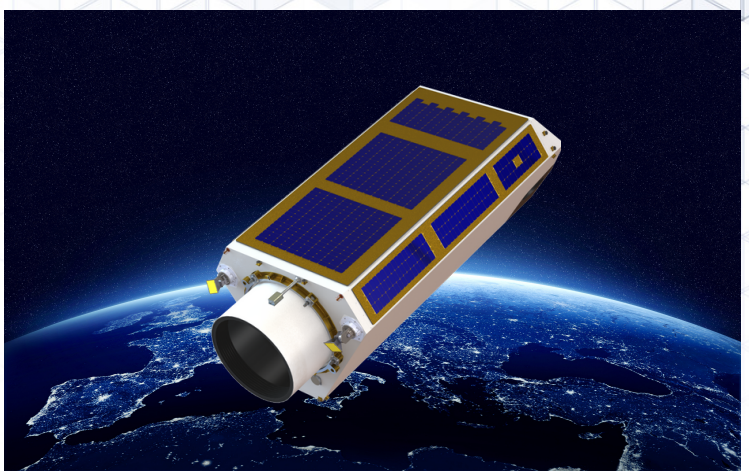
SCS450

The innovative use of space technology

SCS450 is a very high resolution Electro-Optical imaging satellite solution that will satisfy the demanding needs of current and future earth observation missions. The structure has been optimised and appropriate components chosen to realise a lightweight, cost-effective spacecraft that can be operated as a single asset or as part of a constellation. Due to its competitive low cost, the opportunity to establish a constellation becomes a reality enabling frequent revisits and increased flexibility.



Capable of imaging and downloading of scenes from an area of over a half million square kilometers each day, the satellite has been designed for near continuous mission operation. The design also caters for tasking and downlinking in real-time from multiple fixed and mobile ground stations across the globe greatly reducing the delivery time for data products.

Overview

The satellite has been designed for a high data capacity mission in a non-sun-synchronous orbit. The solar panels gather the energy and use the inboard energy storage to support satellite operations.

Accurate attitude and orbital control knowledge is obtained from numerous sub systems such as star trackers, fibre optic gyros, magnetometers, GPS, sun and horizon sensors. Attitude control is performed by reaction wheels and magnetic torque rods. Orbit maintenance is achieved by onboard propulsion.

An S-band communication subsystem is used for telecommands and telemetry with the spacecraft and an X-band communication subsystem with steerable antennas for the payload data download.

SCS450 Specifications

Design Lifetime	5 Years
Orbit	500km Sun-synchronous
Revisit time	5 days (30° off-nadir)
Ground Accuracy	44m (3 σ) without GCP
Ground Sampling Distance	0.5m (PAN) 2m (MS)
Swath Width	10 km
Spectral Bands	Panchromatic, Coastal blue, Blue, Green, Yellow, Red, Red-edge, NIR-1, NIR-2
Telemetry & Telecommand	S-Band
Payload Data Downlink	1 Gbps (X-band)
Mass	450 kg
Image Modes	Strip, Area, Lines-Of-Communication, Point
Imagery Products	All levels up to Orthorectified images
Image Data Storage	155,000 km²
Image File Format	DIMAP

Electro-Optical Payload

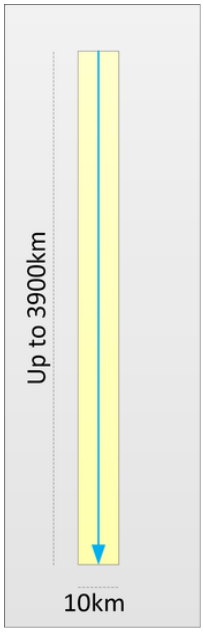
The SCS450 imaging payload is a Modified Ritchey–Chrétien reflecting telescope based on a heritage flight proven design. The image detectors provide a large number of spectral bands that cover most of the spectrum from 400-1040 nm. The resolution and spectral bands chosen enable surveillance and reconnaissance as well as monitoring of infrastructure, vegetation, urban planning and disaster management.

Imaging Modes

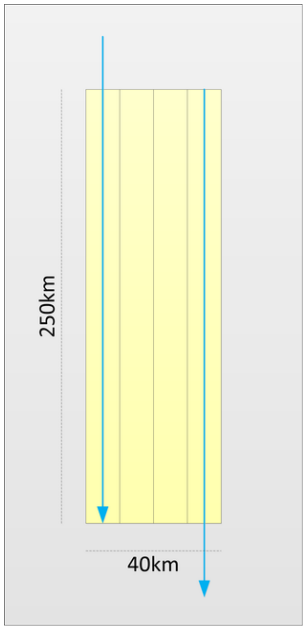
Strip - standard push broom sensor mode where the satellite images in a straight line parallel to the ground track covering an area of imager swath width by custom length. Live imaging in this mode over a ground station can cover an area up to 39 000 km2.

Area - the satellite performs an imaging pattern where four parallel strips 250km long are imaged side by side to cover a broad area of 10 000 km2.

Lines-Of-Communication - used to image a target path that does not run parallel to the ground track and may meander e.g. borders, roads, railways, coastlines, rivers. The path is constructed from small strip sections imaged side by side. In this mode the area covered depends on path.

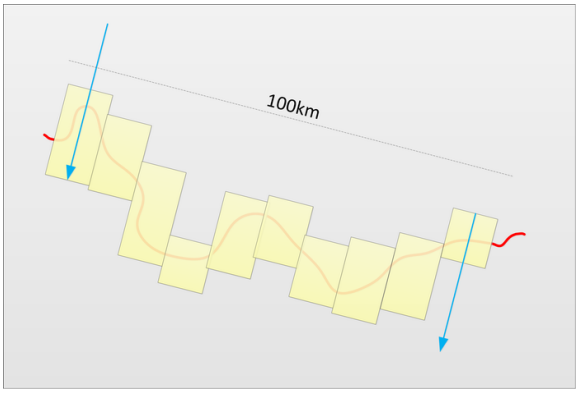


Strip



Area

Point - used to cover many targets in a region during the same pass. The area covered depends on the targets selected. The large dispersion of the targets in the diagram is possible due to the agility of the satellite. The satellite boresight path between targets will be optimized to maximize the number of targets accessible in a given pass.



Lines-Of-Communication

Point

The table shows the satellite coverage related to number of minutes of imaging per orbit

per	Swath	Resolution	2 min	5 min	7.2 min [1]	9.5 min [2]	15 min
Orbit	10 km	0.5 m	8 400 km²	21 100 km²	30 400 km²	40 200 km²	63 500 km²
Day	10 km	0.5 m	128 900 km²	322 300 km²	464 100 km²	612 300 km²	[3] 612 300 km²

Note 1: average length of pass for 500 km orbit and 5° elevation from ground station
Note 2: average imaging duration per orbit based on full imaging capacity per day
Note 3: maximum imaging and downlink capacity per day

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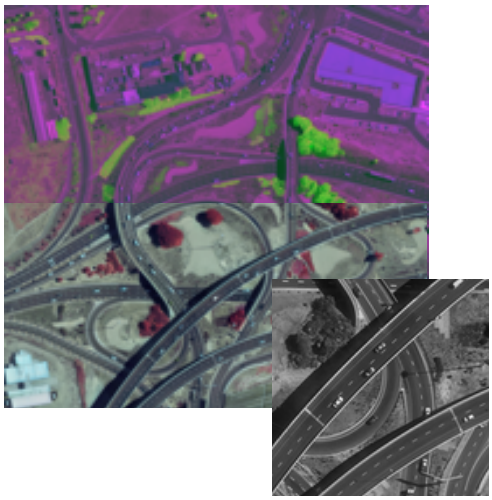
Applications - The satellite payload data can be ingested into geospatial analysis systems to support a wide range of applications. The information extracted from the imagery will support geographic information system, intelligence, mapping, charting and geodesy. A few applications of the image data are explored below.



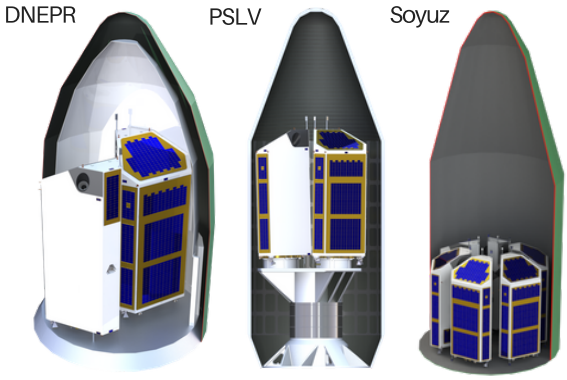
Environmental Monitoring and Food security - Food security in developing countries and emerging economies is jeopardized by crop losses due to extreme weather events. Yield forecasting and area estimation in advance of the harvest is crucial. Monitoring the effects of climate changes on agricultural production through satellite imagery enables adaptation measures to be implemented. The narrow spectral bands provided allow the study of sharp spectral features such as the 'red-edge' of live green vegetation and the measurement of soil moisture and water content of plant leaves. In addition, observations from different angles can provide information on the structure of vegetation. High resolution and high frequency imagery enables precision farming, where fertilizers and other chemicals are applied only when and where needed.

Infrastructure and Asset Monitoring - No matter where in the world, the wealth of infrastructure that is essential to everyday life, is increasing each day. Solid infrastructure such as harbours, roads, railways, airports, bridges, pipelines, dams and antennas are exposed to weather and overuse, ultimately resulting in accelerated degradation. This infrastructure is a considerable asset to any country and remote sensing enables monitoring the state of this infrastructure, especially in sparsely populated countries or rapidly developing countries. For these applications the high resolution (0.5m) panchromatic imagery will provide the best results.

Disaster monitoring - Earthquakes, floods, severe storms and fires are only a small sample of the natural disasters that occur everyday. These can trigger national emergencies and the costs incurred are calculated in billions of dollars each year. For managing hazards and disasters high resolution imagery with a high revisit frequency is most useful. The satellite has specifically been designed to be deployed in a constellation for this purpose.

Constellation - The low cost, shape and small footprint of the satellite enables launching multiple satellites on a single launcher to form a constellation. Up to six of the satellites can be launched on a number of the available launch vehicles. A constellation of three satellites can provide daily image access to any location between 85° North and 85° South and multiple imaging opportunities per day over a mid-latitude region with a GSD of less than 1m. Shorter revisit times can provide a near-constant stream of imagery for timeous use in disaster management and decision support.

Constellation launch configurations



Delivery Schedule - The delivery schedule for a satellite ready for launch is 24 months, from receipt of order. Complete environmental testing will be done at appropriate levels according to customer requirements combined with tailored European Cooperation for Space Standardization (ECSS) standards. Complete system verification will be performed prior to delivery and payload performance verification and calibration will be executed prior to integration with the satellite.

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