

Surrey Missions: TopSat



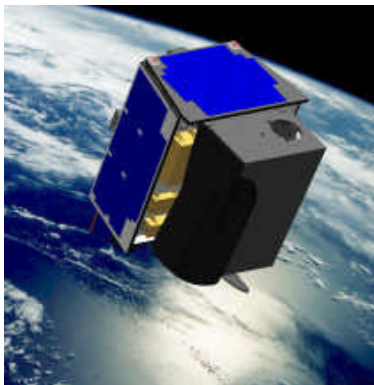
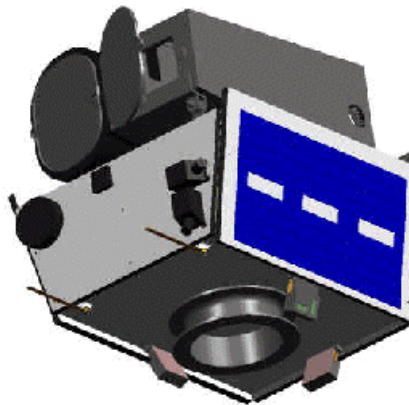
The TopSat mission will demonstrate provision of 'rapid response' high resolution imagery direct to users at low cost. Based on SSTL's Constella platform, TopSat will supply near real time images from a small spacecraft in LEO to both fixed and transportable X-band ground stations, with image processing software and archiving capabilities.

The TopSat Mission

TopSat is an unclassified collaborative mission between DERA, SSTL, RAL and InfoTerra, funded by the MoD and the BNSC Mosaic Programme. The TopSat platform and TTC ground segment are supplied by SSTL. The imaging payload is provided by RAL, whilst the payload downlink, on-board payload data handling and operations are supplied by DERA who also lead the project management. InfoTerra will be responsible for marketing of imagery and value adding functions. The TopSat demonstration mission is required to deliver five images per day direct to users, from a low Earth orbit (approximately 600 km SSO, 10.30 am). The spacecraft can select a 10 x 10 km target, image this to 2.5 metre ground sampling distance, and deliver the data to a mobile or fixed ground station within hours. The 120 kg TopSat spacecraft employs SSTL's Constella enhanced microsatellite platform.

The TopSat Spacecraft

The payload is a lightweight, compact high resolution CCD imager employing three mirror off-axis optical design. The imager can also operate in time delay integration (TDI) mode to increase performance over a range of illumination conditions. Up to four full images can be stored on-board for this demonstration mission. The platform is fully three-axis stabilised with attitude stability of $\pm 0.0025^\circ/\text{s}$ during the image acquisition (lasting up to 16 seconds), $\pm 0.2^\circ$ control accuracy, and $\pm 0.1^\circ$ absolute attitude knowledge in all axes. The platform provides accurate target selection via off-pointing from nadir by ± 30 degrees, also enabling a four day target revisit capability. On-board computers, GPS and sophisticated attitude and data handling systems enable safe, semi-autonomous operations. Payload data is delivered via a 10 Mbit/s X-band downlink to 2.5 m fixed and mobile receiving stations. Spacecraft tracking, telemetry and commanding is by VHF / UHF links to the SSTL mission control centre, offering a low data rate alternative route for payload data transmission. An S-band beacon allows spacecraft tracking by user ground stations. Each fixed and mobile user ground station will be capable of receiving, processing and archiving TopSat data.



TopSat Applications

- The TopSat demonstration mission aims to stimulate the EO market development through the provision low cost and timely high resolution data
- InfoTerra will use TopSat EO data to develop value added products for example, for: cartography; crop identification; forest and habitat mapping
- Providing shutter control to individual owners, with end users ranging from the UN, ESA and environment agencies to mining companies, farm consultants, and town planners

Applications

- Cartography, urban planning
- Environmental & disaster monitoring
- Crop identification
- Offshore (pollution control)
- Forestry & habitat mapping

Mission

- 600 km Sun-sync. orbit
- 120 kg total spacecraft mass
- 2.5 m GSD imaging payload
- 10 x 10 km target area selection
- 3-axis attitude control $\pm 30^\circ$ off-track pointing capability
- 4 day target revisit capability
- GPS orbit determination
- X-band 10 Mbps payload data downlink
- VHF/UHF tracking, telemetry & control
- Near real-time operation
- 2.5 m mobile & fixed GSNs
- Direct-to-User images
- Design life of 1 year as a demonstration mission

Heritage/Experience

- Over 100 years in-orbit experience at SSTL
- Verifies SSTL's low cost management & engineering approach
- 17 microsatellites to date
- 400 kg advanced minisatellite
- 7 kg advanced nanosatellite

Issue Number & Notice

SSTL-5020-02. 06-06-2001. This mission data sheet is not contractual and can be changed without any notice. Please contact SSTL for further information.

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TopSat Mission & Spacecraft Specifications

Mission	Launch date	Late 2003
	Orbit	600 km SSO 10.30
	Type	Technology demonstrator for UK BNSC / MoD
	Lifetime	1 year design life, possible extended operations
Payload	Payload modules	Panchromatic camera; Data handling unit ; X-band downlink; S-band beacon
	Camera optics and sensor	3 mirror off-axis design with CCD array with 8-step TDI
	GSD and image area	2.5 m GSD and 15 x 15 km image areas @ 600 km
	Data downlink	X-band, 10 Mbit/s
	Payload mass	45 kg
	Payload dimensions	Approximately 800 x 600 x 350 mm
	Payload power	13 W OAP
Physical	Spacecraft dimensions	800 x 850 x 850 mm, including separation system
	Spacecraft mass	110 kg
Power	Solar panels	Three body-mounted GaAs cell panels
	Battery	NiCd: 28 V, 4 Ah
Attitude determination and control	Sensors	Earth horizon sensors, fibre optic gyroscope, magnetometers, sun sensors
	Actuators	Solid core magnetorquers & low noise reaction wheels
	Attitude	3-axis stabilised zero momentum bias; momentum bias optional
	Pointing knowledge	Absolute: $\leq \pm 0.1^\circ$ (3 σ); relative: 0.01° (3 σ) over 16s
	Pointing capability	Control better than $\pm 0.2^\circ$ (3 σ); 0.0025° /s stability during imaging; $\pm 30^\circ$ off-pointing from nadir
Orbit determination	Orbit determination	GPS receiver: 15 m position accuracy (3 σ) without SA
Command & data handling	Processor	80386EX, 25MHz with co-processor
	Memory	8 MB RAM, payload uses own memory
	Operating system	In-house design Operating System. In-orbit reprogrammable
Communications	TTC uplink	VHF receiver
	TTC downlink	UHF transmitter
Operations scheduling	On-board data surveys	1 s sampling programmable
	On-board clock	Updated via GPS
	Autonomy	Ground station supports 3 days worth of advanced commanding. Commanding and data relay via internet

Other Products and Services

SSTL can enhance your space activities by making use of our pioneering design philosophies, experienced teams and state of the art facilities - all backed by a unique, impressive track record. SSTL can combine low-cost and excellence in engineering to suit a wide range of user-driven applications in the following areas:

turnkey systems - spacecraft, constellations in LEO and higher orbits

platforms - 5 to 500 kg, from nanosatellites to small satellites

sub-systems - proven, flexible COTS units for all areas of spacecraft

payloads - EO (6.5m PAN / 26 m MS), comms, space science etc.

launch services - expertise procurement of low cost launches

ground support - assembly, integration and verification

training - from short courses to full know-how transfer programmes

operations - primary or back-up operations for spacecraft

consultancy - for organisations, insurance, commercial enterprises



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