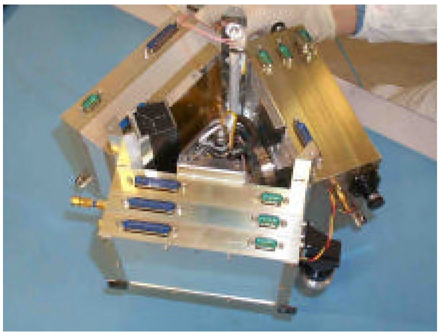
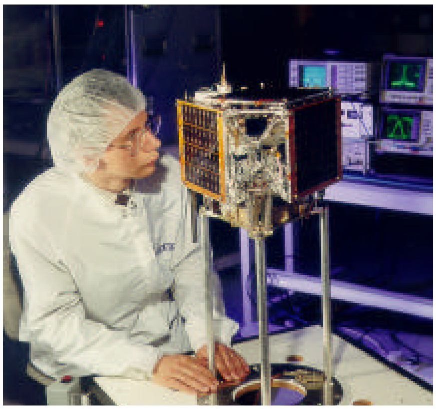
Surrey Nanosatellite Applications Platform

The Surrey Nanosatellite Applications Platform (SNAP) is a flexible commercial nanosatellite platform aimed at providing access to space at a cost an order of magnitude less even than Surrey's low-cost microsatellite missions. On-board propulsion and navigation, combined with a design suited for series production, make the platform ideal for constellations or 'swarms' of similar spacecraft. Payload accommodation is made easy using simple standard mechanical, electrical and data interfaces.

The SNAP concept will be verified by SNAP-1, due for launch in June 2000. SNAP-1 will demonstrate many of the new technologies necessary for the SNAP bus family to achieve ambitious missions, such as formation flying, inter-spacecraft communications, on-board navigation, propulsion and machine vision for remote inspection. Thanks to a careful and mature system concept, SNAP is to date the most mission-capable nanosatellite as well as being one of the least expensive.



The SNAP structure features triple-module stacks set around a triangular payload bay



Typically, small payloads are confined to secondary slots on large spacecraft, often resulting in a poor performance compromise, or in dedicated platforms which are more costly. Nanosatellites offer ultra-low cost access to space by providing a dedicated platform for payloads that require a small platform for performance or cost purposes.

The technology used in SNAP-1 will permit numerous nanosats to operate either as a single mission or in a variety of constellation applications.

Swarms will provide unique opportunities for simultaneous, multiple-point measurements or distributed sensors where each nanosat forms part of a much more powerful 'virtual instrument'.

Nanosatellites not only reduce launch costs, in both single and swarm launch modes, but also reduce mission risks in two ways. By using multiple spacecraft, no single spacecraft is essential to the mission, thus a failure is compensated by redundant spacecraft or graceful performance degradation. Instruments can also be accommodated on various self-sufficient platforms independent of each other.

Features

- **Modular Design** allow the use of previously qualified systems whilst maintaining flexibility
- **Rapid Availability** - Typically 9 months from contract signing
- **Customer oriented design** - The spacecraft is designed with simple interfaces, in order to facilitate payload accommodation integration
- **Low Cost** - SSTL has a commercial approach and experience in small satellites
- **Ground Segment** - SSTL can offer fully compatible ground station and mission control centre as well as a range of training activities

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Applications

- Remote inspection of spacecraft
- Low cost 'test beds'
- Simultaneous, multipoint sensing for space science and EO
- Distributed sensors to create larger 'virtual' instruments
- Communications and remote sensing constellations

Spacecraft

- 8.5 kg platform and separation system; 3 kg payload
- Expandable structure
- 400 - 1400km orbit altitude
- On-board propulsion and GPS
- Compatible with Ariane 4, Cyclone, Delta, Athena, Taurus, Zenit etc.
- Design life of 1 year or more
- Open architecture

Heritage

- SNAP-1 to be launched 06.2000
- 100 yrs SSTL in-orbit experience
- 15 microsatellites, 1 minisatellite

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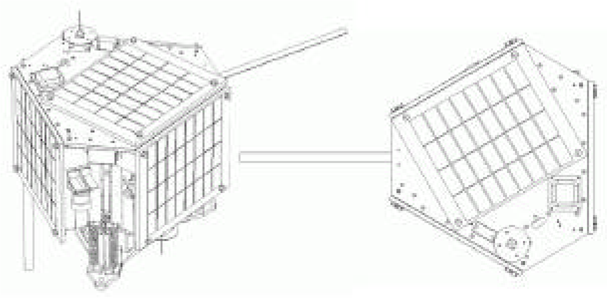

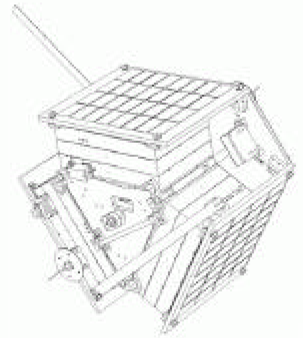

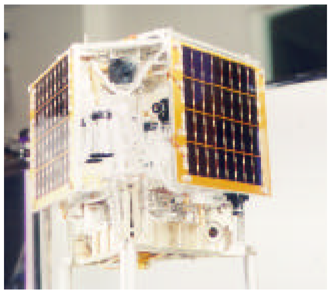

Platform and Payload Specifications

Mission Timeline	Contract to Launch Readiness	SNAP-1 was shipped within 9 months
	Design Life	Typically one year design life with an extended life expectancy.
	Lifetime	Mission dependent, SSTL buses have operated for over 10 years
Physical	Dimensions (stowed)	height 330 mm; diameter 330 mm
	Deployed antennas	330 x 450 x 500 mm
	Mass	6 kg to 12 kg
	Example : SNAP-1 Mass	6.5 kg spacecraft alone, and 8.3 kg total launched load
	Expandable structure	Baseline platform configuration: nine modules Expandable through stacking up to three platforms
Radio Frequency	S-band downlink	Bit rate: 38.4 kbps nominal; 76.8 kbps max. Selectable via TTC Modulation scheme: BPSK & QPSK. Selectable via TTC Convolutional encoding on QPSK
	VHF uplink	Bit rate: 9.6 kbps Modulation scheme: FSK
On-Board Computer	Microprocessor	Strong Arm SA1100 RISC Processor clock : 220 MHz
	Memory	2 MByte FLASH memory (Firmware) 4 MByte double bit per byte correcting Error Detection and Correction (EDAC). WATCHDOG Timer
	On Board Data Handling	Asynchronous uplink (9.6kbps) / downlink (76.8 or 38.4 kbps selectable) Synchronous downlink programmable from 2.4 kbps to 3.6 Mbps; synchronous uplink programmable from 2.4 kbps 2.4 Mbps
ADCS	Stabilization method	3 axis stabilisation
	ADCS hardware	Momentum wheel; magnetorquers in 3 axes; 3-axis magnetometer
	GPS receiver accuracy	Better than 15 metres
	Software	Attitude estimation using a Kalman filter
	Propulsion	Liquefied Gas Propulsion System: Ammonia (<5 ms^{-1}) or Butane (<3 ms^{-1})
Power	Solar Panels	SNAP-1 configuration: four body mounted panels of 6.5 W each. Higher power alternatives available.
	Peak Power	SNAP-1 configuration: 4 W orbit average, 9.1 W peak power
	Battery	6 cell 1.4 Ah NiCd battery (nominally 7.2 V to 9 V); 45Whr/kg
	Power Module	Four Battery Charge Regulators, one per panel, suitable for use with NiCd and Li-ion cells. Power conditioning. Commandable low-loss power distribution switches
Navigation	GPS (Option)	Nominally 15 m lateral accuracy using SGR-05 receiver
Operations Scheduling	On board clock	Accuracy: ±1 s; or via SGR-05
Payload Accommodation	Tray Module	Up to three tray modules (Eurocard size area available for PCBs) The propulsion system located inside of the stacks can be replaced by a payload. This volume is defined by an equilateral triangular with a base width of 150 mm and height of 110 mm
	External Surfaces	250x220mm
Payload Data Interface	TT&C Network:	1 Mbps Controller Area Network
Power Supply	Available lines	+8 V unregulated (from battery), +5 V regulated supply

affordable access to space