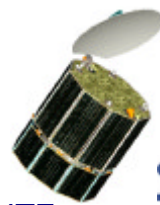


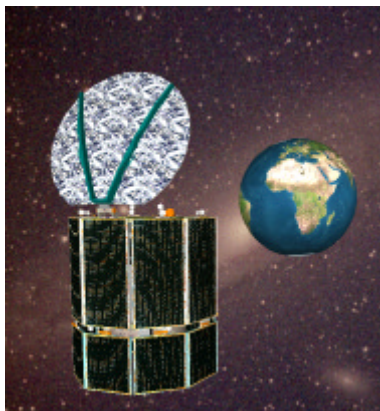
Surrey Missions: GEMINI

A GEOSTATIONARY MINISATELLITE



The first implementation of SSTL's Geostationary minisatellite, the GEMINI mission, will result in the in-orbit service demonstration of a low cost, commercial Geostationary communications minisatellite. The GEMINI spacecraft carries four digital transponders and is designed to provide reliable and accessible communications services for Nigeria and West African Countries, for a contract cost less than £26 Million.

GEMINI Mission



The GEMINI mission, funded by the Nigerian Federal Ministry of Science and Technology, a consortium of private investors in Nigeria, and the British National Space Centre will be undertaken in a programme of international collaboration with Nigeria. GEMINI carries four digital transponders with antenna beam providing coverage of Nigeria and West Africa with services ranging from:

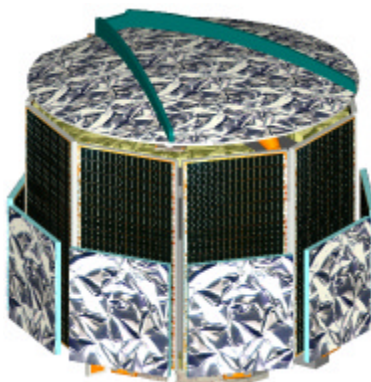
- 8 digital MPEG2 TV channels
- 400 digital radio channels
- 400 VSAT Internet terminals
- 2000 ISDN phone lines
- 18 000 voice channels

providing these regions with reliable communications services for commercial business, the financial banking system, government, entertainment and public use.

GEMINI Spacecraft

GEMINI is based on SSTL's 400 kg class minisatellite platform: the structure is a 9-sided prism measuring 1 x 1 x 1 m. A 550 m/s (approx.) delta-V monopropellant propulsion system meets orbital slot acquisition and station keeping requirements, over a nominal 7 year lifetime. On-board computers and in-orbit reprogrammable operating system software allow a high level of autonomous operation and flexibility. The on-board ADCS can support high pointing

knowledge and capability requirements for accurate antenna pointing. S-band communications provide up to 8 Mbps downlink for telemetry functions and uplinks for spacecraft commanding. A good power margin is achievable up until end-of-life (EOL) using high performance, deployable panels. Nigeria has a geostationary orbital slot and Ku-band frequency allocation for this nominal 7 year mission. At EOL the propulsion system will provide safe satellite disposal from GEO, manoeuvring into a graveyard orbit.



SSTL Geostationary Minisatellite Features

- **Rapid Development** - ready-to-launch 36 months from contract signing
- **Low Cost** - SSTL commercial approach & pioneering experience in small satellites
- **Mission & Payload Flexibility** - can be tailored to meet user-requirements
- **Launcher Compatibility** enables launch on a wide variety of launch vehicles
- **Heritage** - SSTL's first minisatellite platform was launched early 1999 and has been operating successfully since. Based on SSTL's management & engineering design approach, the platform benefits from over 100 years of in-orbit experience
- **Turn Key System** - SSTL can offer mission design, spacecraft and fully compatible ground station and mission control centre, as well as training

Mission & Spacecraft

- Shared Proton launch to GEO
- 400kg class satellite
- Ku-band transponder payload providing broadcast services
- S-band TTC
- Monopropellant orbit control
- 3-axis high performance ADCS
- Autonomous control & operations
- Reprogrammable on-board software
- 9 deployable solar panels
- Active thermal control
- Radiation design -7 yr lifetime

Heritage/Experience

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

SSTL Beyond LEO

- Flight hardware on STRV-1a,b,c,d GTO missions
- In-house mission studies: Lunar; Venus; Mars; L1
- LunarSat mission study (ESA)
- MMS mission study (NASA)
- Momentum wheel for the Rosetta comet mission (ESA)

Issue Number & Notice

SSTL-5019-01. 01-09-2000. This mission data sheet is not contractual and can be changed without any notice. Please contact SSTL for further information.

Surrey Missions: GEMINI

A GEOSTATIONARY MINISATELLITE



GEMINI Mission & Spacecraft Specifications

Mission	Launch Date	2003 (est.)
	Launch	Direct injection into Geostationary parking orbit
	Launch Vehicle	Proton, secondary passenger
	Lifetime	7 year nominal; 10 year propellant-limited
	EOL Disposal	Geostationary + 300 km graveyard orbit
Payload	Transponder	Ku-band (12-17 GHz)
	Antenna	1 m deployable parabolic dish
	Orbital Slot	25° West
	Frequency Allocation	Frequencies allocated - 5 channels
	Channel Bandwidth	27 MHz
Physical	Dimensions (stowed)	1 x 1 x 1 m (approx.), excluding external equipment
Power	Mass	< 400 kg
Thermal	Solar Panels	9 deployable, high performance panels
ADCS	Thermal	Active control
	Sensors	Complement of Earth, Sun and gyroscopic sensors
	Actuators	Reaction wheels, thrusters
	Attitude	3-axis stabilised zero momentum bias
	Pointing Knowledge	$\pm 0.02^\circ$ (3σ)
	Pointing Capability	Control $\pm 0.1^\circ$ (3σ)
Orbit Determination	Orbit Determination	Ranging
Orbit Control	Delta-V	550 m/s (est.)
	Propulsion	Monopropellant thruster, propellant storage in 3 tanks
Command & Data Handling	Processor	Dual redundant: 80386EX, 25MHz with co-processor
	Payload Data Interface	Triple redundant CAN 1Mbps packet (ISO-11898);
	Memory	8 MB RAM per processor
	Operating System	In-house design operating system. In-orbit reprogrammable
Communications	TTC Uplink	Hot redundant S-band receiver
	TTC Downlink	Cold redundant S-band transmitter. Up to 8 Mbit/s
Redundancy	Spacecraft	Dual & functionally redundant systems
Receiving Stations	Antenna	Existing ground network
Operations Scheduling	On board clock	Updated daily via groundstation, ± 0.1 s
	On board Data Surveys	1 s sampling programmable
Contract Value	GEMINI Mission	£26 Million (FY2000)

Geostationary Minisatellites, Other Products and Services

- SSTL can provide low cost geostationary minisatellites for a range of user-driven applications
- The transponder payload beam may be tailored to provide user-specified regional coverage, supporting a variety of broadcast voice, TV and Internet services
- The low cost of the SSTL geostationary minisatellite and high launch vehicle packing density makes it ideal for rapid in constellation implementation
- Geostationary minisatellite constellation will directly benefit from SSTL's in-orbit experience of autonomous orbit determination & control and formation flying
- With over 100 years of in-orbit experience, SSTL is currently designing and building constellations employing our low cost nano-, micro-, and mini- satellite platforms
- SSTL also provides: Mission & Constellation Design; Systems Engineering; Payload Design; Ground & Launch Support; In-Orbit Commissioning & Operations
- **Please contact SSTL for further details and a quotation on any product**

Contact



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