SURREY
SATELLITE TECHNOLOGY LTD

EARTH OBSERVATION
SMALL SATELLITE SOLUTIONS

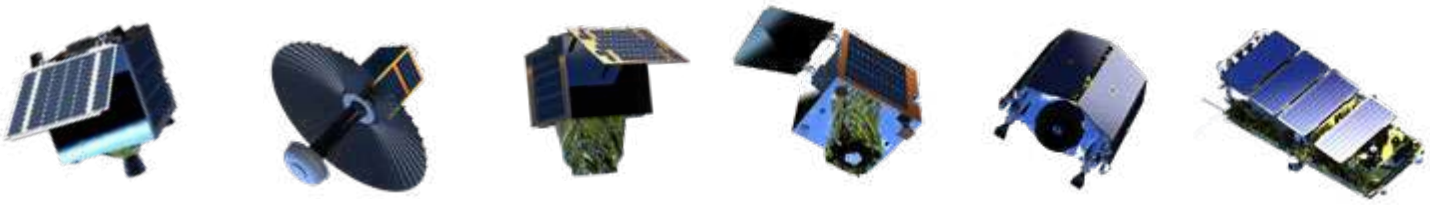
DOING SPACE DIFFERENTLY.

SURREY SATELLITE IS THE WORLD'S LEADING SMALL SATELLITE MANUFACTURER

Surrey Satellite Technology Limited (SSTL) is the world's leading small satellite company, delivering operational space missions for Earth observation, science and communications.

Headquartered in Guildford, UK, SSTL is part of the Airbus Group. The company designs, manufactures and operates high performance satellites and ground systems for a fraction of the price normally associated with traditional space missions.

Since 1981 SSTL has built and launched 70+ satellites as well as providing training and development programmes, consultancy services, and mission studies for ESA, NASA, international governments and commercial customers, with an innovative approach that continues to change the economics of space.



TRUECOLOUR CARBSAR DARKCARB CARBONITE PRECISION NOVASAR

DOING SPACE DIFFERENTLY.

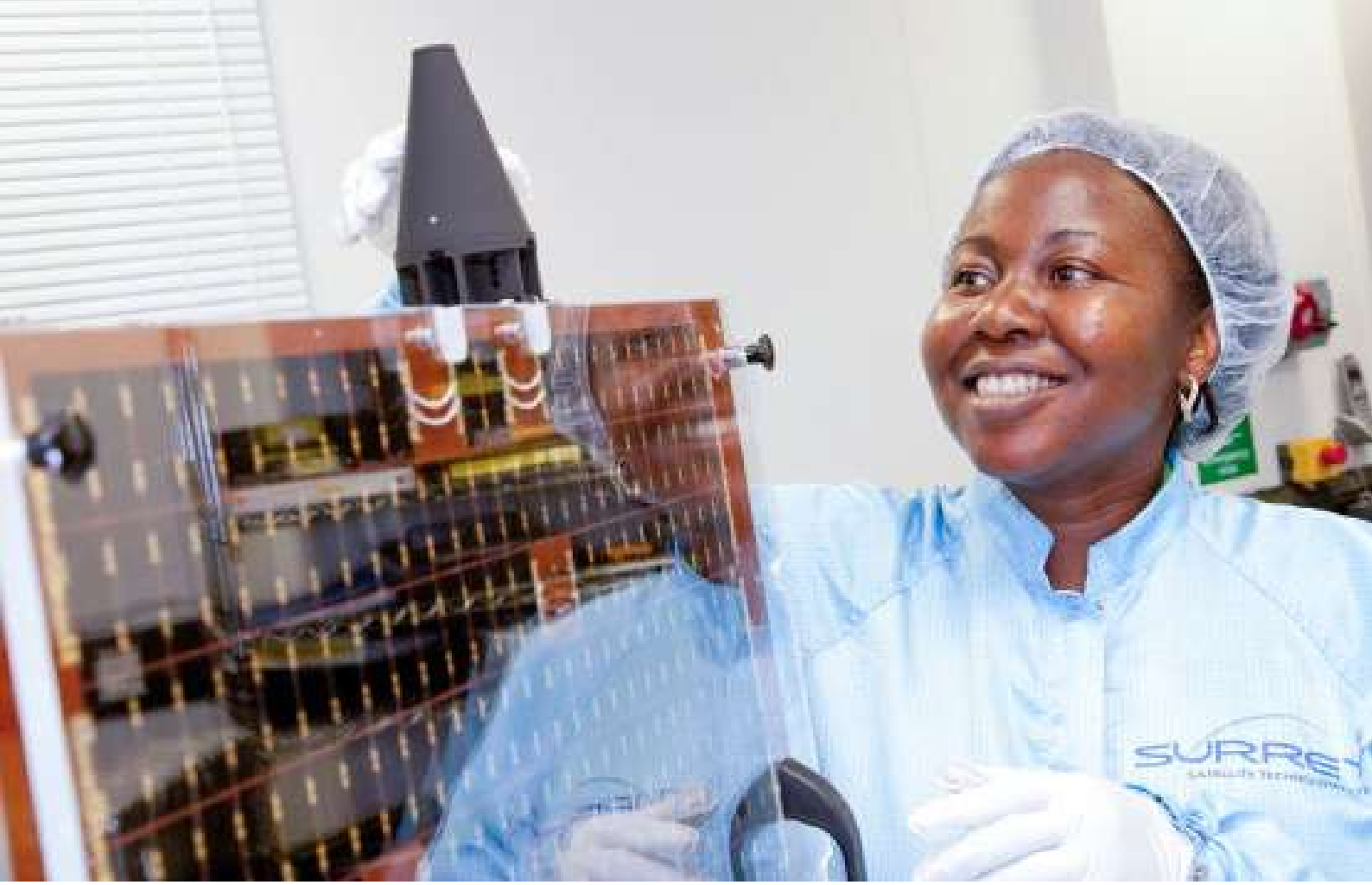


Image credit: NigeriaSat-X with NASRDA engineer, 2009. Credit: SSTL

...AND CUSTOMER TRAINING PROVIDER

We offer world class training opportunities, from academic courses to "hands-on" complete design and construction.

All of our training and development programmes are customisable and tailor-made to fit our customers' objectives. A unique end-to-end hands-on experience is available, including:

- Mission definition and design
- Subsystems design and manufacture
- Assembly and integration at spacecraft level
- Bench testing
- Environmental testing
- Launch services
- In orbit spacecraft commissioning
- Satellite operations and image processing

SSTL recognises that undertaking a Know-How Transfer and Training (KHTT) programme represents a significant investment for the customers programme.

SSTL's status as a market leader, in both small satellite solutions and training programs, ensures that the customer will greatly increase its capacity to design, build, and operate satellites as quickly as possible.

SSTL provides you with a range of flexible options to suit your programme training needs and budget, and

Proven training from SSTL includes:

Tailored training program to suit your needs & capabilities:

- On the job training using flight hardware
- Cost effective process approach
- Embedded in the project team
- Regular evaluation & ease of access to SSTL personnel
- Optional licence to our technology to rebuild the spacecraft in country

Independent capabilities empowerment:

- Satellite design, procurement & assemble at SSTL's own site with full system responsibility
- Ability to Write/create RFI, RFP, SoW, requirements, etc.
- Design/procurement of subsystem, pay load or mission on the open market

Knowledgeable customer at the end of the programme:

- Utilise existing, adapt or create new satellite design
- Satellite operation
- Exploitation of these technologies in non-space applications
- Strengthening the technology base and industrial competitiveness, and improving the quality of life.

Sustainability & long term vision for:

- Engineering taking part - knowledge advancement, future leaders both in commercial or academia environment, inspire & serve for future generation of the nation
- Provision of valuable new applications and business opportunities

PRECISION

The SSTL-Precision satellite provides very novel resolution, high quality imagery in support of pan-sharpened colour mapping and surveillance applications.

The spacecraft is designed to be compact in order to support affordable operations as a stand-alone unit or in constellations providing higher temporal resolution. Larger than the Carbonite high resolution imaging spacecraft, it provides higher resolution data as well as significantly greater data return.

Applications

For government applications the satellite can provide independent means of high priority, private tasking of imagery. For commercial applications the satellite can support data analytics and various value-added services at a very low cost-per-unit-area.

Mapping, surveillance, infrastructure and asset monitoring, disaster monitoring, insurance and loss adjustment.

Multispectral bands (can be customised)

- Blue: 440-510 nm
- Green: 510-590 nm
- Red: 600-670 nm
- NIR: 760-910 nm

Payload

Parameter	Spec
GSD	0.6m pan 1.2m multispectral – 4 bands
Resolution	<0.5m (achieved with ½ pixel shifting)
Swath	9.5km
Throughput	~130,000km2, 1.5TByte per day

Platform

Parameter	Spec
Platform	SSTL-300 / SSTL Mini
Orbit	500km SSO 10:30 LTAN
Lifetime	7 year design with 10 year target Redundant avionics
Launch mass	~280kg
Agility	±45deg Roll / Pitch 60s between successive images separated by 60 degrees
Propulsion	Orbit maintenance, corrections and end-of-life disposal

Sydney Airport, Sydney, Australia taken by DMC3/TripleSat

O2 Arena and Canary Wharf, London, United Kingdom taken by DMC3/TripleSat

Image credit: NovaSAR 2019. Credit: SSTL

NOVASAR

A small Synthetic Aperture Radar (SAR) mission

NovaSAR is a small S-band Synthetic Aperture Radar (SAR) mission designed for low-cost programmes and optimised for shared launch opportunities.

The system baselines SSTL-Mini platform avionics with an imaging payload developed by the spaceborne SAR team at Airbus in Portsmouth, UK.

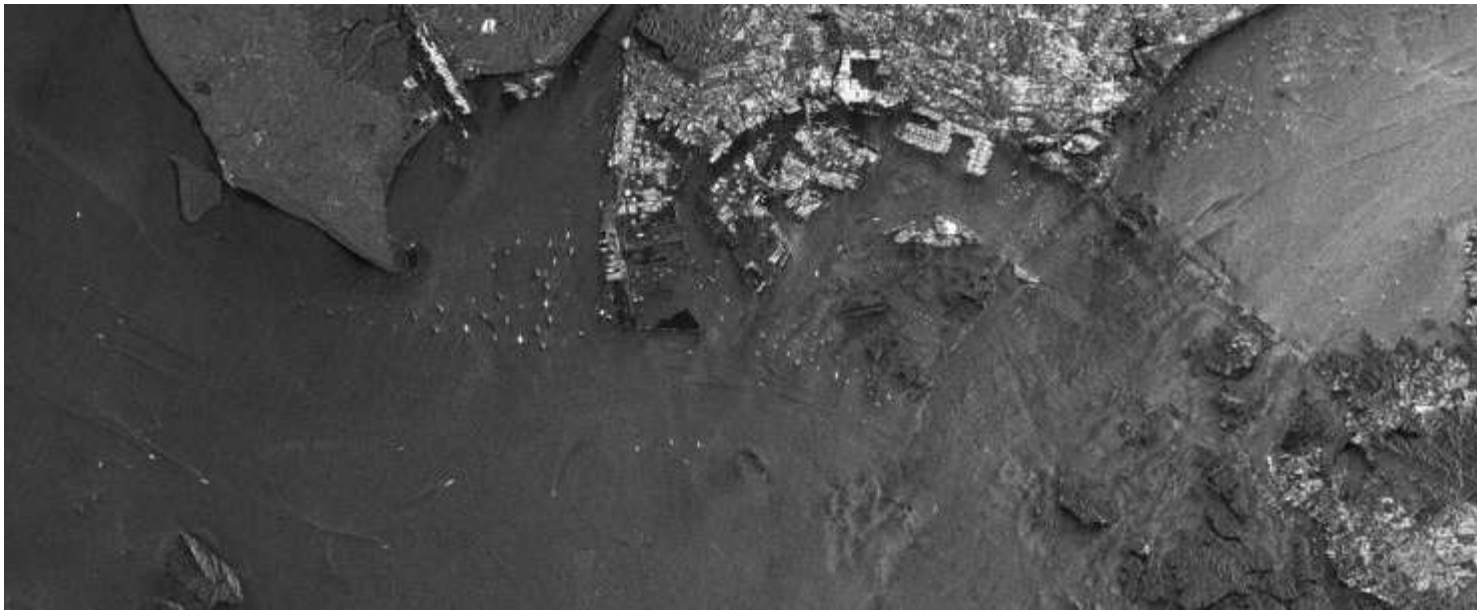
Key information

- Developed with the support of the UK government
- Launched 16th September 2018 from India
- Global access with average revisit 3-4 days
- Imagery can support a wide range of applications including maritime, forestry and disaster response
- Secondary AIS payload to provide information on detected ships

Key Satellite Specifications	
Imaging frequency band	3.1-3.3GHz (S-band)
Antenna	Microstrip patch phased array (3m x 1m)
No. of phase centers	18
Peak RF power	1.8kW
Polarisations (non-coherent)	HH, HV, VH, VV Single, dual, tri or quad
Design life	7 years
Orbit	580km SSO, 1030am LTAN
Propulsion system	Xenon
Payload duty cycle	>2 min per orbit
Payload data memory	544GBytes
Downlink rate	500Mbps (with uplink), 400Mbps (broadcast)
Geolocation	<50m

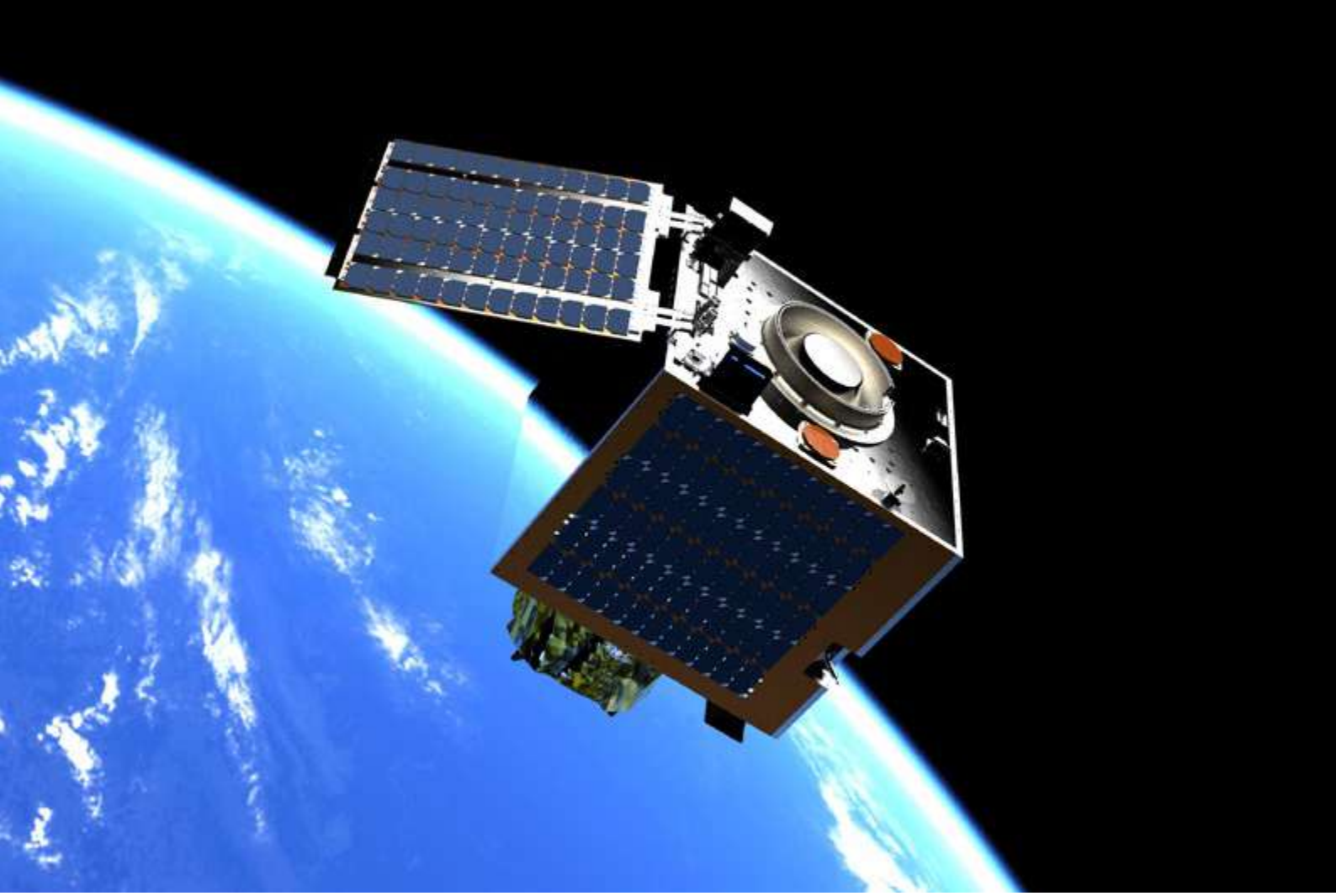
Imaging Modes	Resolution	Swath	Polarisation	Number of looks
Stripmap	6m	13-20km	HH or VV	3
Maritime (ScanSAR)	6x14m	400km	HH	1
ScanSAR	20m	50-100km	HH or VV	4
ScanSAR Wide	30m	55-150km	HH or VV	4
Dual pol (ScanSAR)	20m 45m	20-60km 195km	HH+VV HH+HV	4
Tri-pol (ScanSAR)	30m 35m	50-56km 100km	HH+VV+HV	4

Suez Canal - 30m Tri-Pol ScanSAR (HH: Green, VV: Blue, HV, Red)



Singapore - 20m HH Pol ScanSAR

Calgary, Canada – 6m HH Pol Stripmap Mode



CARBONITE

Carbonite-1, launched in July 2015, demonstrated low-cost 1m GSD imagery and was followed by Carbonite-2 in January 2018 which provided the world's first commercial HD colour video from space.

Operating at an altitude of 500km, Carbonite satellites provide 1m GSD colour video employing a Forward Motion Compensation (FMC) imaging mode which enables captures of >120 seconds of a single target, adding a new dimension to high resolution EO imagery.

Applications

Suitable for a wide variety of commercial, civil and security applications:

- Change detection
- Pattern of life assessments
- Humanitarian and disaster management
- Global high resolution situational awareness
- National security
- Elevation model generation
- Infrastructure and asset monitoring

A constellation of Carbonite satellites provide extremely high revisit rates over key areas of interest. A constellation would also provide robustness against weather conditions and target concealment.

Imaging at different times throughout the day dramatically minimises the predictability of observations.

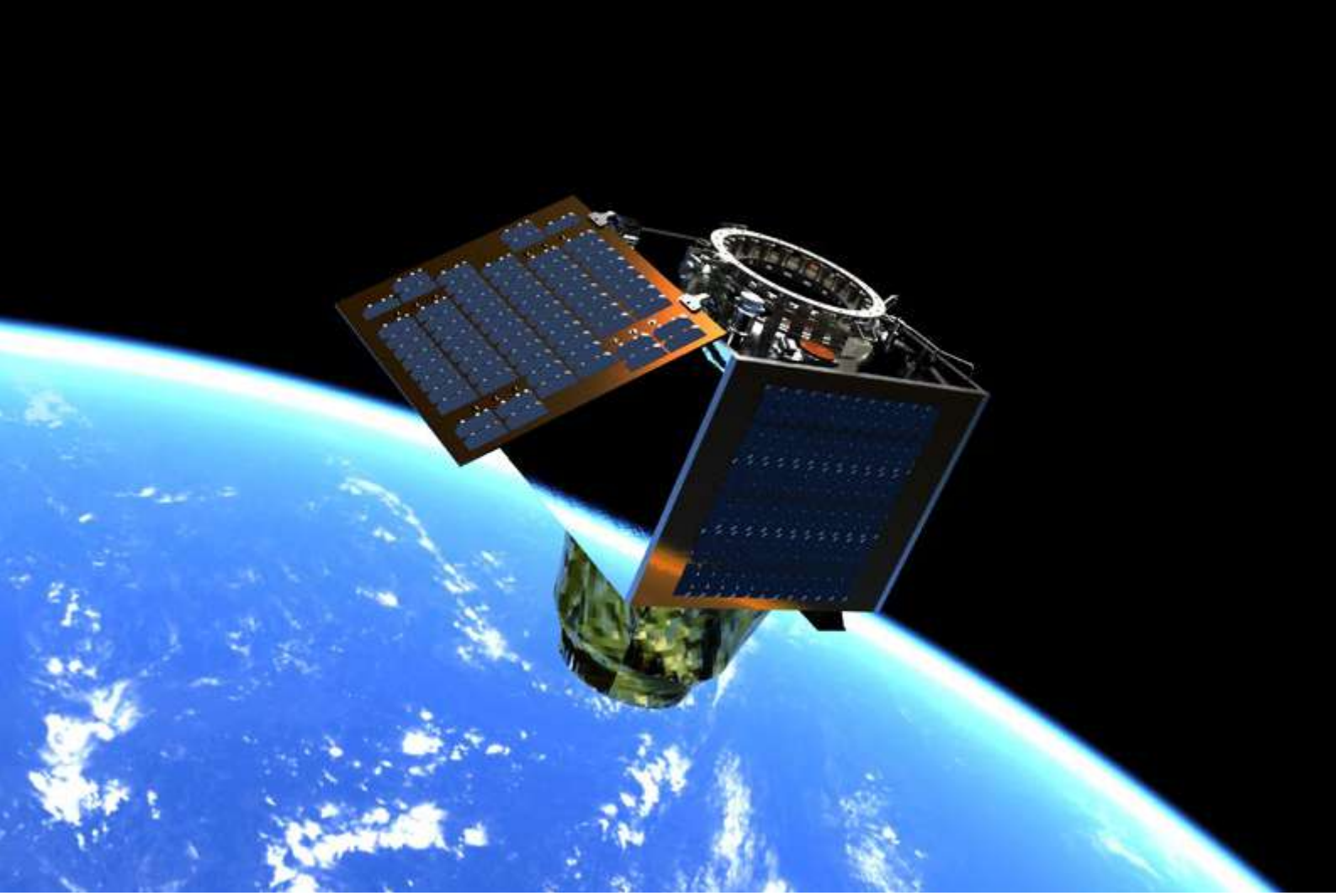
Payload

Parameter	Specification
GSD	1m
Swath	5.5km
Spectral bands	Optical (RGB Bayer)
Throughput	>200 images/day depending on GSN

Platform

Parameter	Specification
Reference orbit	500km SSO with 10:30 LTAN
Mission lifetime	5 years
Launch mass	107kg
Data storage	120GB
Downlink	400Mbps

To watch a showreel of videos from space taken by CARBONITE-2 head over to our YouTube channel 'SSTL TV'.



DARKCARB

DarkCarb is a high resolution mid-wave infrared (MWIR) imaging satellite which can produce thermal data with a comparable resolution to any currently available capability, at a tenth of the spacecraft mass.

DarkCarb is based on the SSTL Carbonite platform and makes use of a 0.32m diameter telescope and a Mercury Cadmium Telluride (MCT) cooled detector. One of the main benefits of this design is the ability to image throughout both the day and the night with no sensitivity to lighting conditions. As the imaging capability is not dependent on illumination conditions, non-SSO orbits can also be considered.

Applications

Suitable for a wide variety of commercial, civil and security applications:

- Change detection and human activity
- Pattern of life assessments
- Humanitarian and disaster management
- Global high resolution situational awareness
- National security and defence
- Infrastructure and asset monitoring
- Urban heat mapping

DarkCarb imagery provides the capability to differentiate between objects and surfaces of different temperature and emissivity, providing complementary information to traditional optical imagery and the ability to extend imaging opportunities into night time.

DarkCarb's video capability allows for change detection in a single pass. In addition, as the imager can detect temperature differences it should be possible to derive information on recent activity in a scene, such as recently used or moved vehicles, which is not normally discernible in Visible-NIR imagery. DarkCarb also has the potential to assist with disaster support activities; wildfires, volcanic eruptions and flooding for example.

Payload

Parameter	Specification
GSD	4m
Swath	4km
Spectral bands	MWIR (3.7-4.95µm)
Throughput	~30GB (SSTL GSN)

Platform

Parameter	Specification
Reference orbit	500km SSO with 10:30 LTAN
Mission lifetime	5 Years
Launch mass	130kg
Data storage	120GB
Downlink	140Mbps

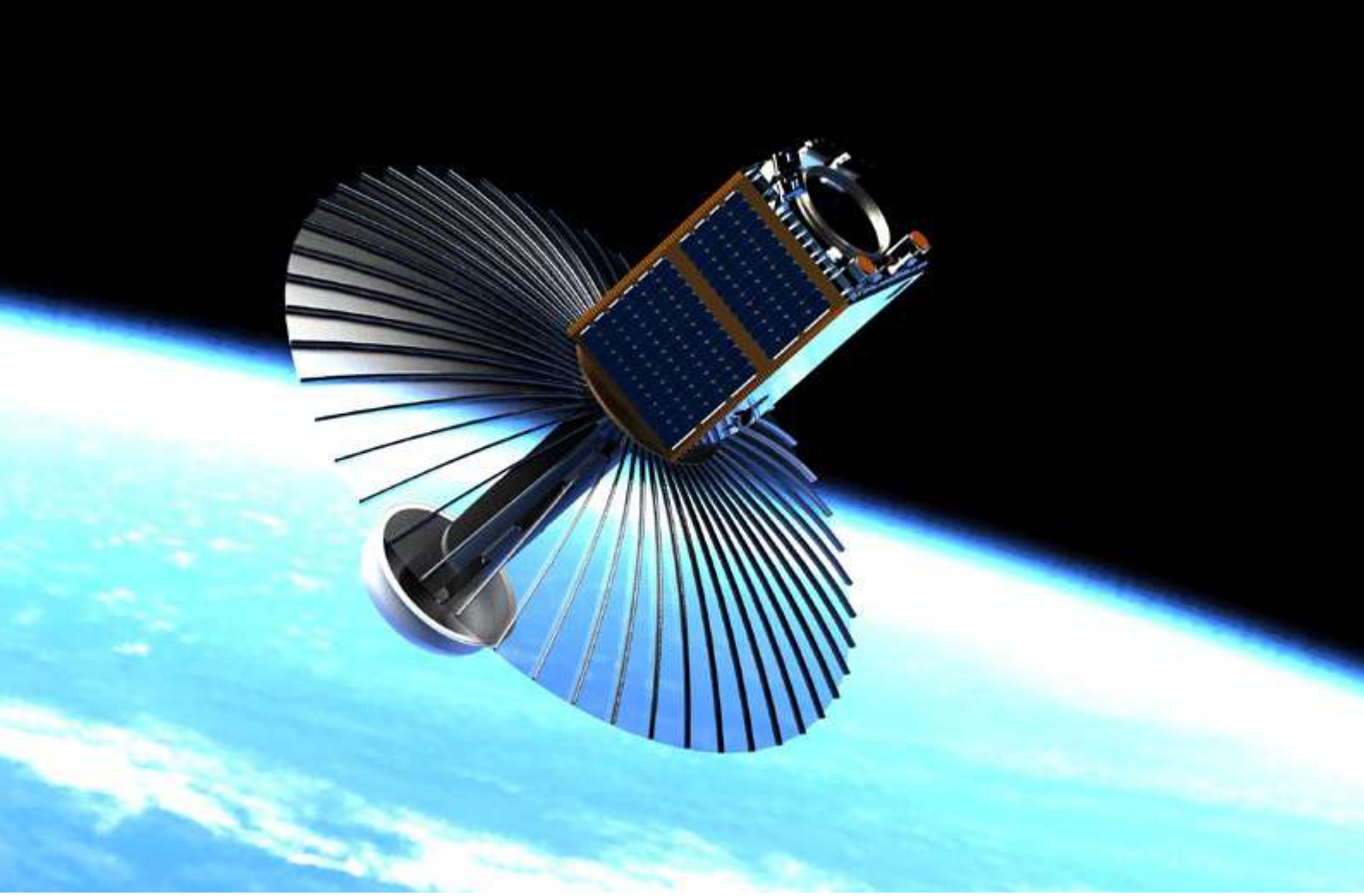


Image credit: CarbSAR render 2019. Credit: SSTL

CARBSAR

CarbSAR utilises the platform heritage of the Carbonite series and combines it with an innovative deployable X-band SAR payload to provide high resolution imaging capabilities night and day, whatever the weather.

Synthetic aperture radar (SAR) imagery can provide diverse surveillance intelligence like optical images but, deriving from an active sensor, is not subject to favourable solar illumination or weather conditions considered.

Applications

Suitable for a wide variety of commercial, civil and security applications:

- Defence and security
- Maritime
- Disaster response
- Environment and infrastructure

CarbSAR will capture high resolution SAR imagery during day or night, and in all weather conditions, allowing the reliable provision of information for a range of applications.

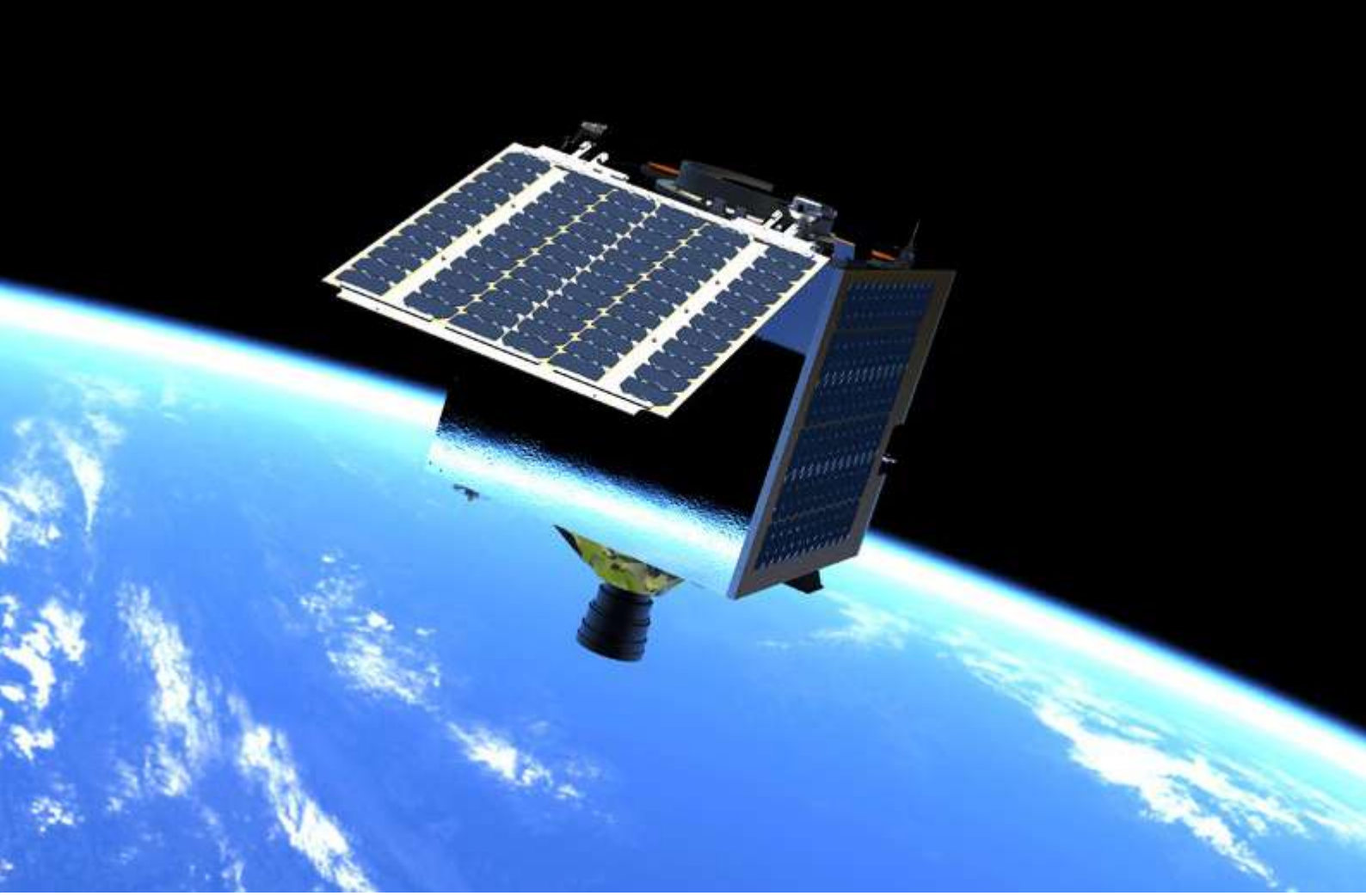
The high resolution and small footprint make it an ideal asset for acquiring more detailed information from known areas of interest.

Payload

Parameter	Specification
GSD	0.5m
Swath	4km
Spectral bands	X-Band
Throughput	180GB/day, 45 spotlight mode images per day

Platform

Parameter	Specification
Reference orbit	525km SSO with 10:30 LTAN
Mission lifetime	5 Years
Launch mass	140kg
Data storage	128GB
Downlink	500Mbps



TRUECOLOUR

The TrueColour satellite provides a medium spatial resolution and multi-spectral option in the series, whilst still using the Carbonite platform. The SSTL-TrueColour imager has a wide swath and images in 9 selected bands.

Applications

The combination of resolution, swath and spectral bands, allows the mission to address a broad range of applications across a number of sectors including:

- Forestry
- Agriculture
- Maritime
- Mapping and planning
- Disaster support

Multispectral (9 bands 433-907nm)

- Aerosol / Coastal: 433-453nm
- Blue: 458-523nm
- Green: 535-585nm
- Red: 640-690nm
- Red Edge-1: 690-720nm
- Red Edge-2: 727-753nm
- Red Edge-3: 769-797nm
- NIR-1: 777-907nm
- NIR-2: 845-885nm

Payload

Parameter	Specification
GSD	5m
Swath	120km
Spectral bands	Multispectral (9 bands 433-907m)
Throughput	500,000km^2 daily coverage

Platform

Parameter	Specification
Reference orbit	600km SSO with 10:30 LTAN
Mission lifetime	5 Years
Launch mass	~125kg
Data storage	120GB
Downlink	140Mbps

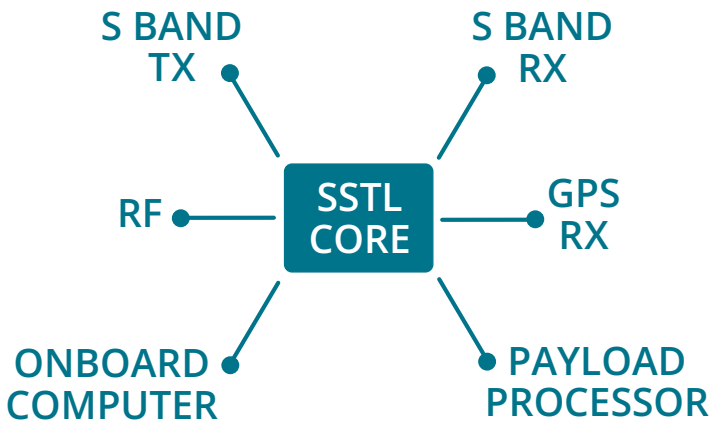
SSTL'S RANGE OF SMALL SATELLITE PLATFORMS

We have integrated our flight-proven avionics subsystems into a single compact module – the SSTL Core. It is a robust, scalable and flight-proven centralised avionics solution that is integral to all the satellites in our range.

THE SSTL CORE:

- is optimised for low cost manufacturing
- facilitates reduced build and test schedules
- supports compatible operations for multiple and diverse SSTL satellites via SSTL's ground stations or customer ground stations

SSTL has been building small satellites for more than 40 years. We have launched 70+ satellite missions and our small satellites expertise is unrivalled.



SSTL CUBE

Entry-level platform for training missions

- Ideal for training small groups of Customer Engineers
- 12U cubesat, using proven SSTL system engineering processes
- Suitable for range of payloads including Earth imaging, software defined radio, small LEO telecoms, technology demonstration, radiation monitoring, AIS
- Well suited to be built entirely in a customers own facilities

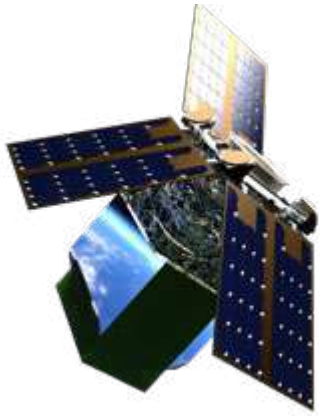
Example Configurations

- 12U+ Training Programme

SSTL MICRO

Outstanding payload resources and capability

- Highly capable system offering impressive payload power, mass carrying capability and redundancy
- Platform based on SSTL's Core Avionics suite providing excellent power provision with high capacity battery to enable continuous payload operations
- Suitable for a range of payloads including Earth imaging, software defined radio, science and atmospheric observation, LEO Telecoms, technology demonstration, radiation monitoring, AIS



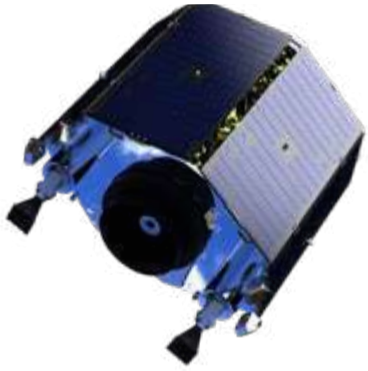
Example Configurations

- Platform-to-go
- Customer Provided Payload
- SSTL Payload
- Off-the-Shelf Payload
- Custom Payload

SSTL MINI

A customisable platform built on strong heritage foundations

- Highly capable and flexible platform based on SSTL's Core Avionics suite
- Supports SSTL's range of high performance payloads including very high resolution imagers and SAR payloads
- The structure is bespoke depending on the mission and payload requirements with a wide range of flight-proven options



Example Configurations

- Platform-to-go
- Customer Provided Payload
- SSTL Payload
- Off-the-Shelf Payload
- Custom Payload

Customer Engineer working on NigeriaSat-X satellite, 2009 Credit: SSTL/John Kemp

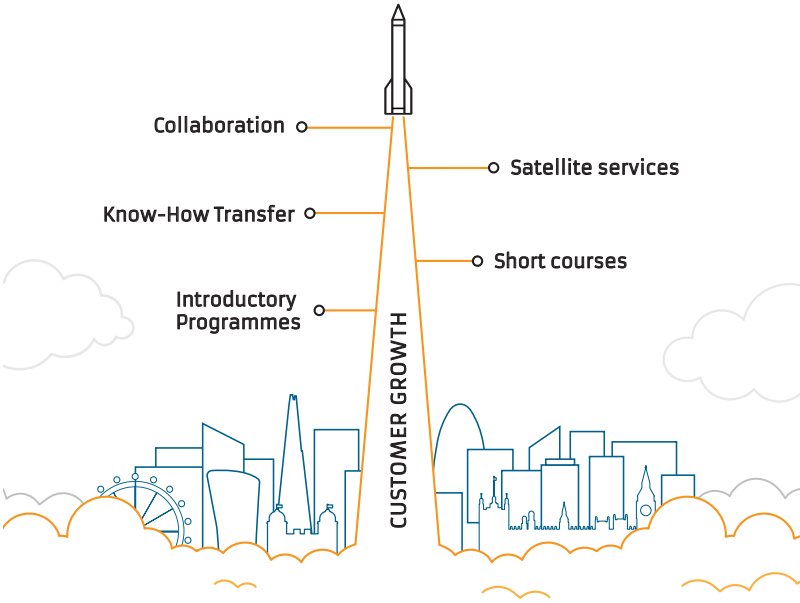
SSTL'S UNIQUE APPROACH TO CAPACITY BUILDING

Bespoke but with heritage

SSTL is a pioneering company in small satellites manufacturing and know-how transfer programmes. With more than 60 satellites launched and 20 capacity building programmes delivered, we have developed a very unique approach to training and teaching.

Key benefits our Know-how Transfer Programmes:

- Building together an operational, long lasting satellite mission that will provide high quality data to the end users
- Ability to licence our technology to rebuild the spacecraft in country in the future
- On-the-job training using flight hardware
- Customer Engineers embedded in the project team with daily and unlimited access to SSTL mentors, in a one-on-one manner
- Emphasis on in-country activities such as assembly, integration and testing (AIT), environmental testing (EVT), local procurement, engagement with local industry
- High quality training methodologies and progress reporting developed over many years
- In-depth subsystem know-how: we design everything in house
- Interactive engineering environment in state-of-art facilities
- Logistical and administrative support all way through
- Strong links to University of Surrey, who provides the academic part (MSc and PhDs) of our programmes



TRAINING PROGRAMMES DELIVERED

SSTL has more than 35 years' experience in delivering training and collaborative programmes to space nations across the world, with a focus on trainees gaining technical independence.

NATION
Philippines, PhilSA
TEAM 16 | PERIOD 2021-2026 | MISSION MULA

NATION
Kazakhstan, KGS
TEAM 24 | PERIOD 2012-2013 | MISSION KazEOSat-2

NATION
Algeria, ASAL
TEAM 18 | PERIOD 2014-2016 | MISSION AISAT-1B

NATION
Kazakhstan, Ghalam
TEAM 15 | PERIOD 2014-2016 | MISSION KazSTSAT

NATION
Canada, Urthecast
TEAM 8 | PERIOD 2017-2019 | MISSION Urthecast

NATION
Thailand, GISTDA
TEAM 48 | PERIOD 2018-2025 | MISSION THEOS-2A

NATION
USA, NASA / MSU
TEAM 3 | PERIOD 2007-2008 | MISSION Magnolia

NATION
Nigeria, NASRDA
TEAM 26 | PERIOD 2006-2009 | MISSION NigeriaSat-2 NigeriaSat-X

NATION
Nigeria, NASRDA
TEAM 12 | PERIOD 2001-2003 | MISSION NigeriaSat-1

NATION
Turkey, Bilten
TEAM 12 | PERIOD 2001-2003 | MISSION BILSAT-1

NATION
Algeria, CNTS
TEAM 12 | PERIOD 2000-2002 | MISSION ALSAT-1

NATION
Chile, FACH
TEAM 8 | PERIOD 1994-1998 | MISSION FASAT-A&B

NATION
Thailand, MUT
TEAM 12 | PERIOD 1995-1997 | MISSION Thai-Paht

NATION
Singapore, NTU
TEAM 2 | PERIOD 1995-1997 | MISSION UoSAT-12 (payload)

NATION
Malaysia, ATSB
TEAM 9 | PERIOD 1996-1998 | MISSION TiungSat-1

NATION
China, Tsinghua University
TEAM 12 | PERIOD 1998-1999 | MISSION Tsinghua-1

NATION
Japan, Fujitsu
TEAM 3 | PERIOD 1992-1994 | MISSION FjSAT

NATION
Portugal
TEAM 6 | PERIOD 1992-1994 | MISSION PoSAT-1

NATION
South Korea, KAIST
TEAM 12 | PERIOD 1989-1993 | MISSION KITSAT

NATION
South Africa
TEAM 2 | PERIOD 1989-1992 | MISSION UoSAT 3/4/5

NATION
Pakistan
TEAM 10 | PERIOD 1984-1988 | MISSION BADR-1

Surrey Satellite Technology Limited,
Tycho House, 20 Stephenson Road,
Surrey Research Park,
Guildford, GU2 7YE,
United Kingdom.

+44 (0)1483 803803
www.sstl.co.uk

@SurreySat @surreysatellites

©SSTL Commercial in Confidence / Proprietary & Confidential