SURREY
SATELLITE TECHNOLOGY LTD

# SHORT COURSES PORTFOLIO

# OUR END-TO-END SMALL SATELLITE CAPABILITY ENABLES COMPREHENSIVE AND WORLD-LEADING TRAINING

# SHARING THE KNOW-HOW SINCE 1984

SURREY
SATELLITE TECHNOLOGY LTD

# ABOUT SSTL

Surrey Satellite Technology Limited (SSTL) is the world's leading small satellite company, delivering operational space missions for a range of applications including Earth observation, science and exploration.

You can benefit from knowledge and experience accumulated over 60 different satellite missions. SSTL has developed a full life-cycle small satellite capability - from design through development, manufacture, integration, test, launch, operations, de-orbit and applications. We design and manufacture a significant proportion of our satellite payloads, subsystems and equipment ourselves and we pride ourselves in sharing the know-how with others through courses and know-how transfer programmes.

*Assembly, Integration and Test Facility (The Kepler Building) in Guildford, Surrey*

# TAILORED SHORT COURSES

From systems engineering, Earth observation to GNSS science, we have the in-depth knowledge to tailor short courses to address your specific needs. Whether it is a few hours or a few weeks, we can create an event that will be of benefit to your organisation.

# LOCATION

SSTL delivers courses in our headquarters in Guildford near London with an easy access to our field experts or we can come to you to address a wider audience.

*Guildford 2016, imaged by DMC3/TripleSat Constellation. Credit 21AT.*

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.

# SSTL SYSTEMS ENGINEERING COURSE

## Objectives

Provide in-depth overview of systems engineering and how SSTL applies that successfully in real-life projects. Provide appreciation of the key issues and activities related to SSTL systems engineering throughout the project lifecycle. Focused on SSTL practises, which enables successful and reliable systems

## Participants Profiles

The course is intended for systems engineers, subsystem and payload engineers, satellite operators, managers, engineering students, procurement officers who want to broaden their perspectives and know more about the mission life cycle.

## Benefits to you

- Appreciation of the key design drivers / issues related to spacecraft engineering
- Learning techniques that SSTL has tested over 3 decades

## Suggested Group Sizes

8-15 participants

## Duration: 2-5 days

## Level:

Beginner Intermediate Advanced

## Course Roadmap

- Uniqueness of Space
- EO applications and Payloads
- Introduction to orbits
- Key Mission Drivers
- Spacecraft Engineering
- Concept of Operations (process, requirements, mission analysis)
- Key Engineering Guidelines
- Spacecraft architecture (AOCS, power, software, propulsion, thermal, electrical, structure)
- Redundancy
- Technical budgets
- Testing, verification
- AIT, EVT
- Ground segment
- Launch
- Operations

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

# INTRODUCTION TO EARTH OBSERVATION

## Objectives

Introduce Earth observation from small satellites and imagery applications. Explain benefits of space assets. Deliver greater understating of concept of operations and common terms and trade-offs (swath, resolution, revisits etc).

## Participants Profiles

The course is intended for users of imagery, decision makers, operators, managers, experts in other satellite fields, who want to learn more about Earth observation. No prior knowledge required.

## Course Roadmap

- **Introduction to Earth Observation space missions**
  (Orbits, Applications, Payloads: optical, SAR, IR, hyperspectral, Definitions and terms: swath, spectral bands, ground sample distance, field of view, signal to noise, latency, coverage etc).
- **Uniqueness of space**
  (Programmatic and technical impacts of space missions)
- **Concept of Operations**
  - The EO mission architecture (space segment, ground segment and launch)
  - Operations of the mission and spacecraft
  - Defining links between each mission element
- **Mission development life cycle**
  From concept design, through build and test to launch and commissioning

## Duration: 1 day

## Level:

Beginner Intermediate Advanced

## Benefits to you

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

- Help you understand popular, but often misunderstood terms used in Earth observation
- Guide you to specify EO mission requirements for your future needs
- Assist you to find the best payload to address your problem

## Suggested Group Sizes

8-15 participants

*Viasat RTE antenna at SSTL, Guildford*

# PRACTICAL SSTL GROUND SEGMENT AND MISSION & SPACECRAFT OPERATIONS

## Objectives

The course introduces SSTL ground segment and explains critical missions & spacecraft operations activities. The key to the course is the hands-on element, where participates get to operate, plan, download imagery and create final products from in-orbit SSTL missions, providing real-world experience.

## Course Roadmap

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

- Importance of Concept of Operations (CONOPS)
- Development of CONOPS
- Ground Segment System Overview
- Spacecraft Operations Centre in Detail
- LEOP and Commissioning
- Routine Operations
- Mission Operations Centre (MOC) & System Architecture
- MOC Hardware
- Image Terms/Concepts
- Mission Planning System
- Image Handling System
- Using Mission Planning System and scheduling imagery within mission constraints

## Duration: 5 days

## Level:

Beginner Intermediate Advanced

## Participants Profiles

The course is suitable for current and future spacecraft operators, systems engineers, managers.

## Benefits to you

- Access to SSTL staff with experience gathered over 35 years of spacecraft operations
- Real-time mission and spacecraft operations practical exercises

## Suggested Group Sizes

8-15 participants


# SMALL SATELLITE MARKET AND TECHNOLOGY TRENDS

## Objectives

Provide an overview of the current small satellite market and potential future trends. Highlight important considerations when building a business case with focus on EO applications. Share SSTL's experience as a pioneer of smallsat revolution and our view of the state of the art in that area.

## Course Roadmap

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

- Overview of smallsat market and trends in technology and applications
- Design considerations for small EO mission:
- Budget, schedule, resolution, swath, spectral bands, revisit, agility, area coverage, image quality
- Case studies: country mapping, hyperspectral, video, IR, VHR, multispectral missions
- Technology Trends

## Duration: 0.5 - 1 day

## Level:

Beginner Intermediate Advanced

## Participants Profiles

The course is intended for non-experts with varied backgrounds, interested in learning more about wide smallsat market. Suitable for decision makers, new entrants, investors, business oriented mind-sets. No prior knowledge required

## Benefits to you

- Help you get clearer picture of the current small satellite market structure
- Stay up-to-date with market trends
- Assist top-level decision making based on the current business landscape

## Suggested Group Sizes

8-15 participants

*Artist's conception of the deployed GIOVE-A satellite (image credit: ESA)*

# INTRODUCTION TO GNSS AND ITS APPLICATIONS

## Objectives

Provide an overview of the GNSS systems, usages and potential future trends. Outlining the exploitation of GNSS systems in LEO, MEO and GEO orbits.

## Participants Profile

The course is intended for non-experts with varied backgrounds, interested in learning more about GNSS. Suitable for decision makers, new entrants, investors, business oriented mind-sets. No prior knowledge required.

## Course Roadmap

- Introduction to GNSS systems and signals
- Outline of GNSS use in Orbit
- Introduction to Earth observation using GNSS signals (Reflectometry and Radio Occultation)
- Future developments in GNSS

## Duration: 2 days

## Level:

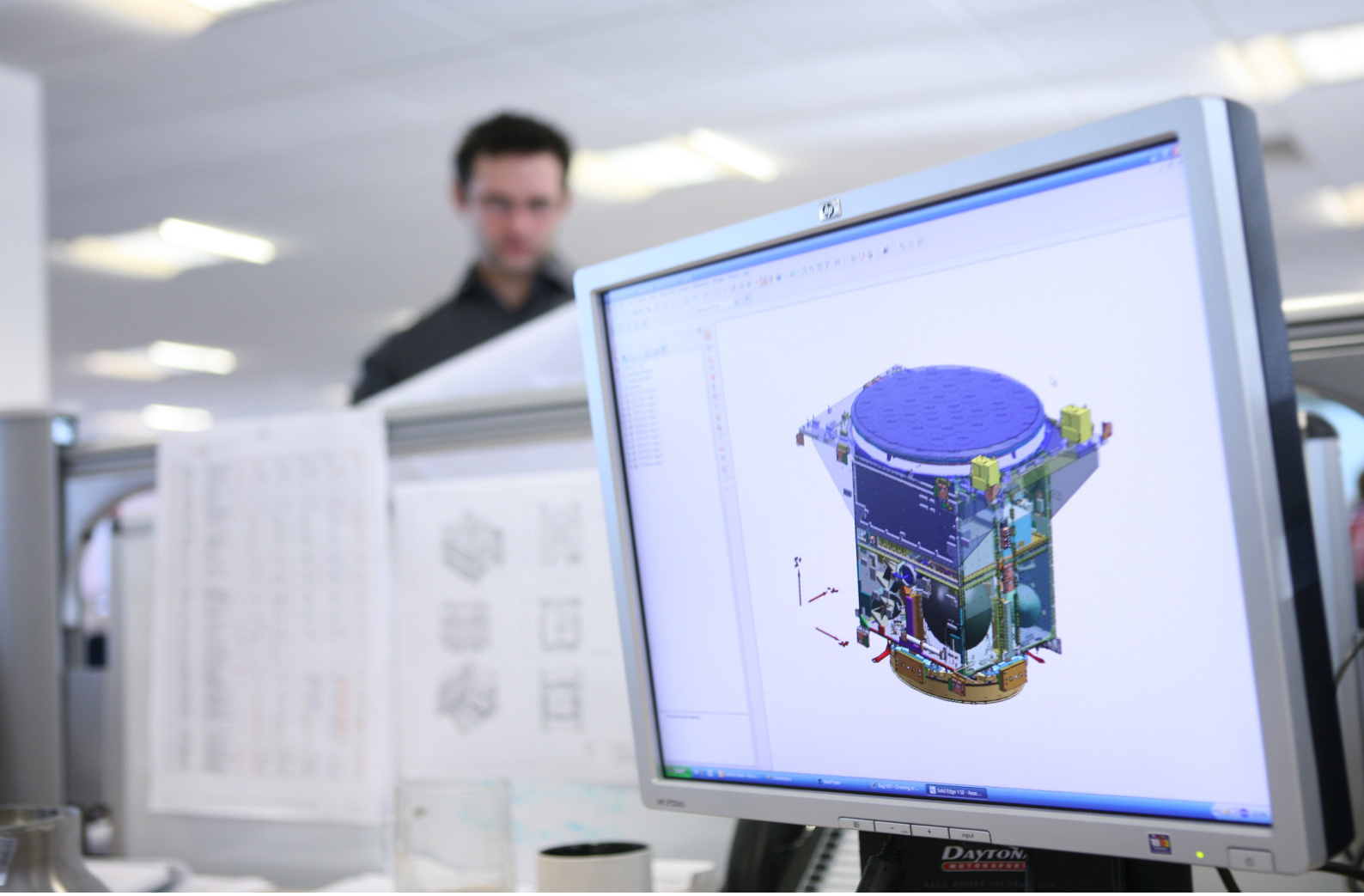
Beginner Intermediate Advanced

## Benefits to you

- Help you understand the ubiquitous, but often misunderstood GNSS impacts
- Guide you through uses and specifying GNSS solutions
- Assist you to understand future demand and opportunities
- Give you insights from SSTL experts, who are recognised as leaders in navigation payloads and GNSS reflectometry applications

## Suggested Group Sizes

8-15 participants



# MISSION DESIGN WORKSHOP

## Objectives

The course is based on a series of practical exercises to improve the understanding of the processes used at the concept stage of the mission design.

We will provide basis to understand steps necessary in every mission design and how to develop the concept for the whole mission. Participants will have a chance to present their results to SSTL's panel of experts.

## Participants Profile

This course is suitable for systems engineers or technical staff, who would like to understand the process of mission design. It could be of interest to decision makers or staff gathering user requirements and drafting RFPs. Participants could benefit from attending Systems Engineering Course first.

## Course Roadmap

- Requirements, Preliminary Heritage Baseline and System Architecture
- Sub-system Requirements & Preliminary Architecture & Heritage Baseline Selection (based on SSTL spacecraft)
- Mission Analysis (in STK), Launch & Budgets (power sizing, mass & delta-V)
- Concept of Operations, Ground Segment & Budgets (data & link budget)

## Duration: 5 days

## Level:

Beginner — Intermediate — Advanced

## Benefits to you

- Understanding of how all the elements of a space mission work and what are the trade-offs that lead to a successful mission
- Guide you through the process of gathering mission requirements that will not conflict with each other at a later stage
- Provide a safe and guided environment for putting theory into practise with support form SSTL team

## Suggested Group Sizes

8-15 participants

# EO IMAGER DESIGN

## Objectives

The course gives the core fundamental knowledge to be able to understand the design of Earth Observation instruments and the processing of their data. It talks about optical, mechanical and electronic aspects of the EO imager design.

## Participants Profile

This course is useful both as an introduction for designers new to EO imaging, and also for systems engineers and others who need to interact with imaging specialists. Systems Engineering course is recommended to be attended first.

## Course Roadmap

- An overview of the specification and design of Earth Observation optical instruments.
- The essentials of optics for EO imagers: an understanding of the optical concepts needed.
- Attitude and orbital control systems
- Earth geometry
- Radiometry
- Optical Instrument design (detector characteristics, aperture, focal length, light level)
- Optical Imager Manufacture (mounting optical elements, focal plane assemblies, materials, thermal analysis, vibration testing, focus mechanisms, optical alignments
- Instrument electronics
- Ground testing
- The processing of EO images: from instrument corrections to final products.

## Duration: 5 days

## Level:

Beginner Intermediate Advanced

## Benefits to you

- You will walk away with good understanding of aspects of imager design, in order to provide required performance and address targeted applications of your choice
- Enable you to knowledgeably specify the imager requirements for your future missions
- Access to Optical imager Designers with real mission experience

## Suggested Group Sizes

8-15 participants


# INDUSTRIAL PLACEMENTS

## Objectives

Provide experience in working at a satellite manufacturing company. Exposure to different aspects of running the space business, including engineering, project management, business development areas. Learning the culture, processes in aerospace field.

## Participants Profile

Engineers of different backgrounds (mechanical, electrical, systems, optical, software, RF), project managers, other staff members, students. The placements will be tailored to appropriate background and number of people.

## Example Activities

- Shadowing functional mangers during their day to day activities (focus on internal SSTL projects)
- Working as a mini project at the early stages of mission design, potentially resulting in a functional preliminary design of a spacecraft.
- Performing tasks required for the common goal of the project (assigned by functional leads)
- Market research, competitor analysis, support to marketing
- Depending on the number of participants, the placements could be on a regular rotation to enhance the varied experience

## Duration: 3-6 months

## Level:

Beginner Intermediate Advanced

## Benefits to Participant

- Help you get ahead in your field and understand how space industry works
- Invaluable when you enter the workplace
- Find out whether you want to commit your career to space industry

## Benefits to Organisation

- Prepare future workforce for your organisation with relatively small expenditure
- Apply observed processes and jump start development of your entity
- Provide practical exposure to satellite manufacturing for your employees

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