

## Facilities & Capabilities

MSSL is unusual among University based space research groups in having all the facilities needed to design, build and test high technology systems in-house.

The facilities are staffed by more than 50 experienced engineers and include:

- Design capabilities in electronic, mechanical and software engineering supported by advanced computer aided simulation and modelling systems
- Development of detector systems ranging from optical to x-ray, including laser and unique cryogenic capabilities
- Fabrication and integration of the developed systems
- Test facilities, including vibration and thermal vacuum testing of systems for harsh environments
- Project management skills that have stood the test of schedule and budgetary constraints in a large number of challenging projects

The co-location of these facilities enables MSSL to be a cost effective and efficient single-source solution provider for the development of simple inexpensive consumer products as well as complex commercial and industrial systems.



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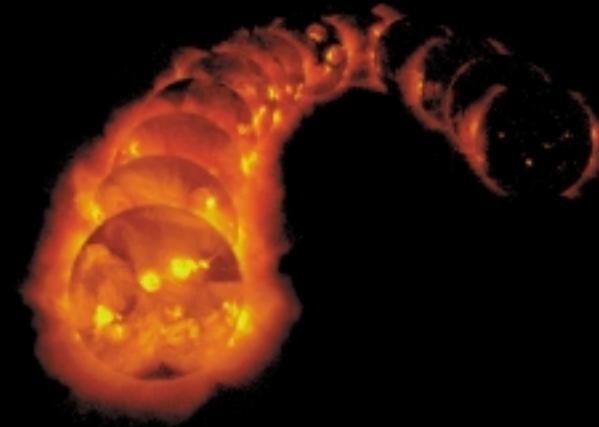


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# Mullard Space Science Laboratory



## Services to industry

## Introduction

**The Mullard Space Science Laboratory (MSSL)** is the largest and longest-established space science research laboratory in the UK, with an outstanding world-wide reputation for space engineering and scientific research.

MSSL's staff and facilities are available for commercial contracts for a wide variety of applications in both space and non-space related industry.

We welcome enquiries ranging from the smallest technical problem or assembly task, to large engineering projects involving considerable research and development.

**Heritage:** MSSL has been a major participant in space projects for more than 40 years. During this time we have developed innovative systems for more than 250 rocket and satellite projects, designing and manufacturing scientific research instruments for x-ray and solar astronomy, space plasma physics, earth remote sensing and planetary surface exploration.

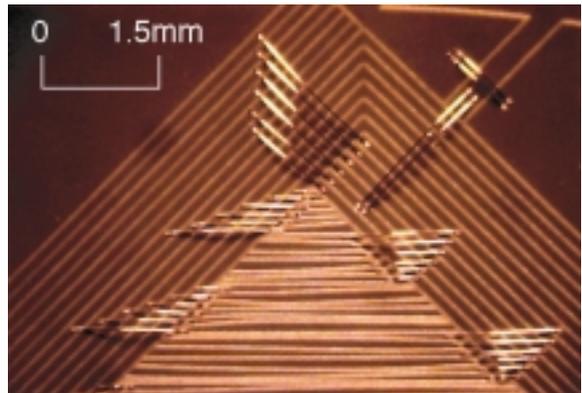
MSSL has developed a strong track record of links with industry including successful partnerships in the UK and internationally, on both small and large scale ventures.

As the main laboratory of the 'Space and Climate Physics' department of University College London, MSSL can also draw on the full range of skills and knowledge of a premier league university.

## Detector Physics

MSSL's experts apply a range of hardware and techniques to produce the detectors that are the heart of ground-breaking measurement and imaging instrumentation. The ability to think "out of the box" is essential to meet the extraordinary demands of science in space and other harsh environments. Specific areas of expertise include:

- CCDs and associated readout electronics – For imaging and spectroscopy from optical to x-ray wavelengths
- Cryogenics – New cooling techniques and photon detectors from room temperature down to below 10 mK
- Electron and ion analysers/detectors – Using microchannel plate (MCP) imaging Intensifiers
- Optical to x-ray imaging based on various combinations of intensifier tubes, MCPs, imaging anodes, phosphors, fibre-optics and CCDs



Laser-machined imaging anode

## Electronic Engineering

The electronic engineering group consists of 20 highly experienced engineers and technicians organised in groups dedicated to design, PCB layout and assembly. The areas of expertise include:

- Low noise and wideband analogue signal conditioning
- Precision instrumentation circuitry
- Signal conversion including high speed and high-resolution ADC and DAC functions
- Microprocessor, DSP, micro-controller & discrete logic systems often using FPGAs
- Low voltage and high voltage power conversion with compliance to demanding EMC specifications

'State of the art' CAE tools are used for PCB layout, design capture, simulation and synthesis. Technicians with space agency qualifications carry out assembly of complex PCBs and wiring harnesses.



High-performance electronics

## Mechanical Engineering

The mechanical engineering group consists of 18 highly qualified engineers and technicians who staff a design office, manufacturing workshop, environmental test facilities including vibration and thermal vacuum test and a class 100 cleanroom. Specialities include:

- Static & dynamic 3D structural analyses
- Thermal design/control of instruments
- The design of cryogenic, vacuum, detector and optical systems
- Packaging of complex electronics
- Integration and qualification testing of instruments

Innovative lightweight designs utilising a wide range of materials and construction techniques are used to meet challenging requirements. Extensive experience of working with aerospace industry and many national space agencies has been gained.



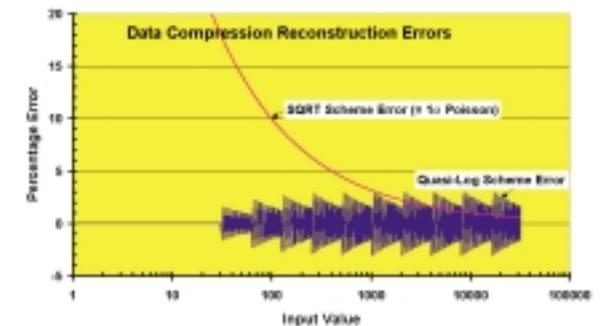
Preparing space telescope for delivery

## Software Engineering

MSSL's software engineering capabilities have been developed to meet the needs of real-time spacecraft instrument control and onboard data processing, where the ability to develop high quality, reliable, fault tolerant, efficient and flexible software to demanding schedules are essential qualities.

The capabilities are applied in three main areas: Flight Software; Test Software; and Modelling and Simulation Software, and include:

- Real-time, multi-tasking, embedded software
- Manual and autonomous control; monitoring and autonomous safing; data compression; diagnostic and corrective in-operation facilities
- High level scientific implementation
- Low and high level displays, error detection and reporting; networking and security
- Quality assured management and development to space agency standards



Research in data compression