



SURREY

SATELLITE TECHNOLOGY LTD

The GIOVE-A small navigation mission

...the first Galileo satellite in space

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Logan, Utah, August 2006





GIOVE-A

- Precursor to European Galileo programme
- Contracts signed for two test-bed satellites (SSTL & Galn) for launch before end of 2005

Objectives

- Secure frequency filings
- Demonstrate key payload technologies
- Measure MEO environment
- Provide Signal-in-Space for experimentation

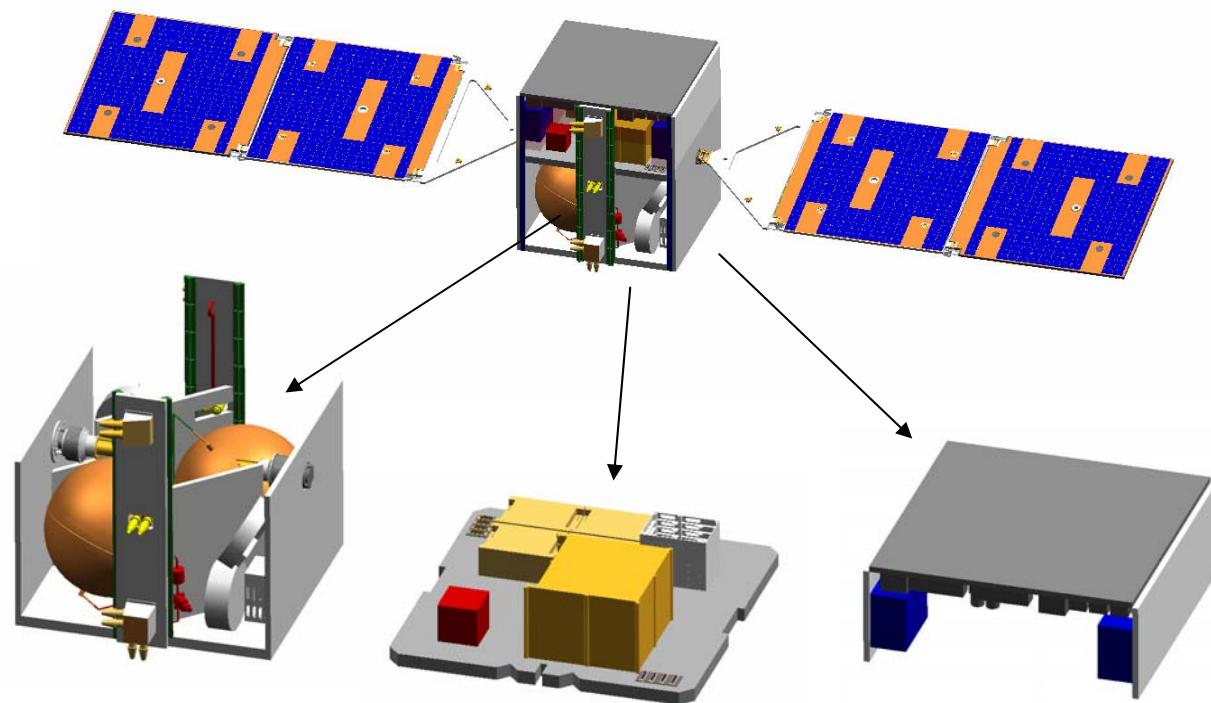
Requirements

- Two-year mission lifetime
- Lost-cost, rapid schedule. €28M, 30 months
Ideally suited to an SSTL solution





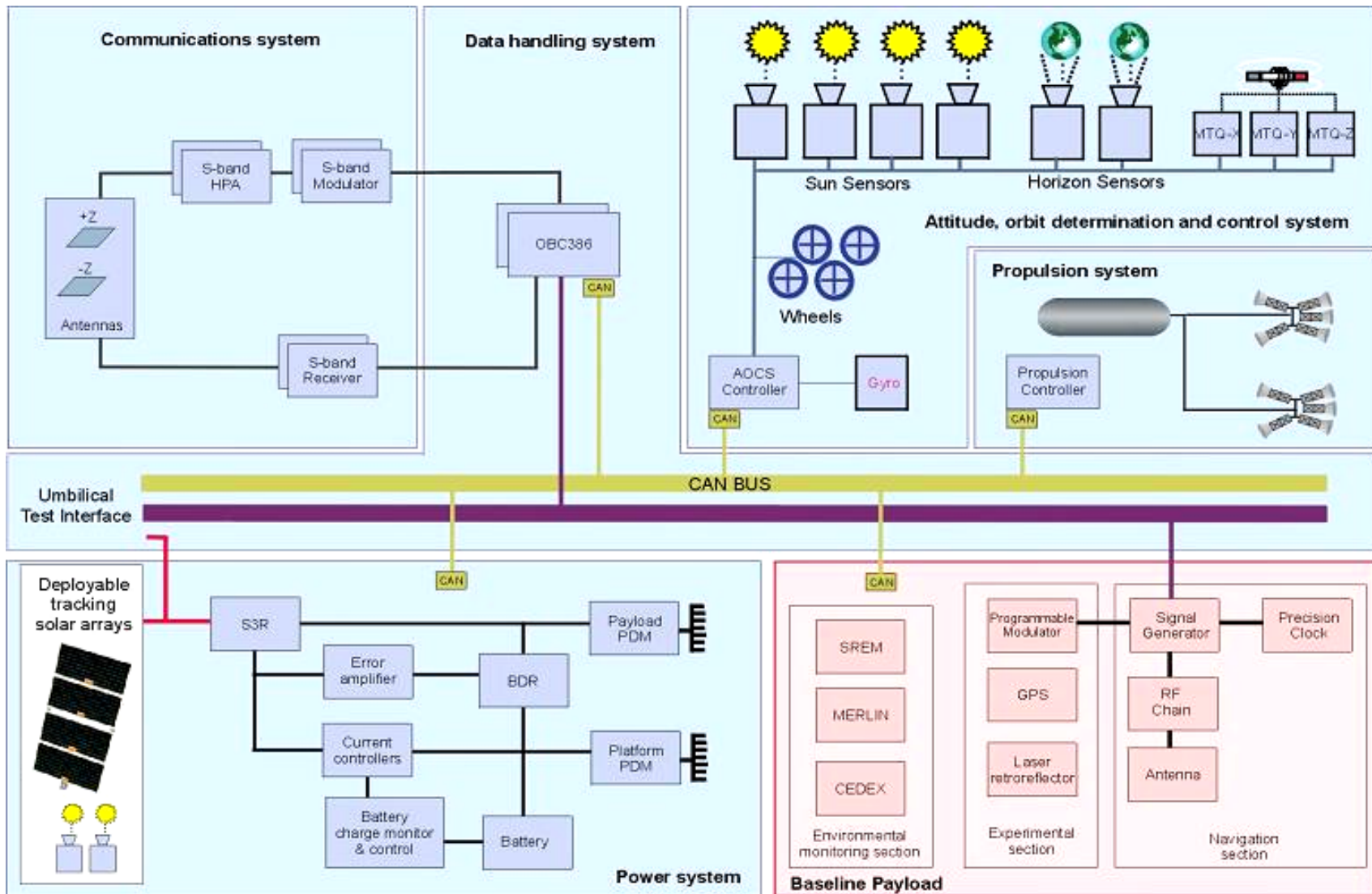
The GIOVE-A launch is the first launch of SSTL's new "Geostationary Minisatellite Platform" (GMP)



Propulsion Bay

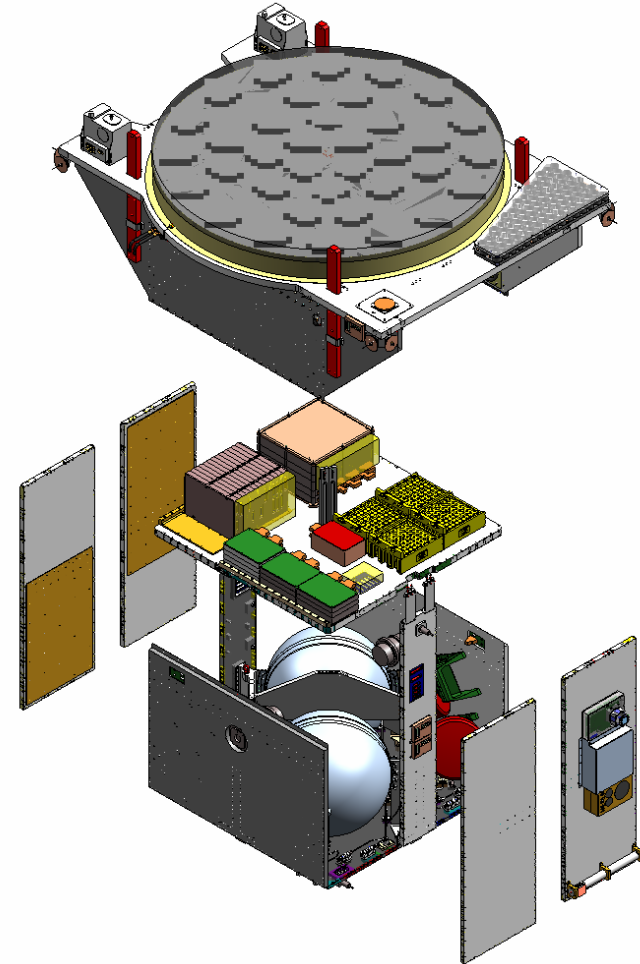
Avionics Plate

Payload Frame





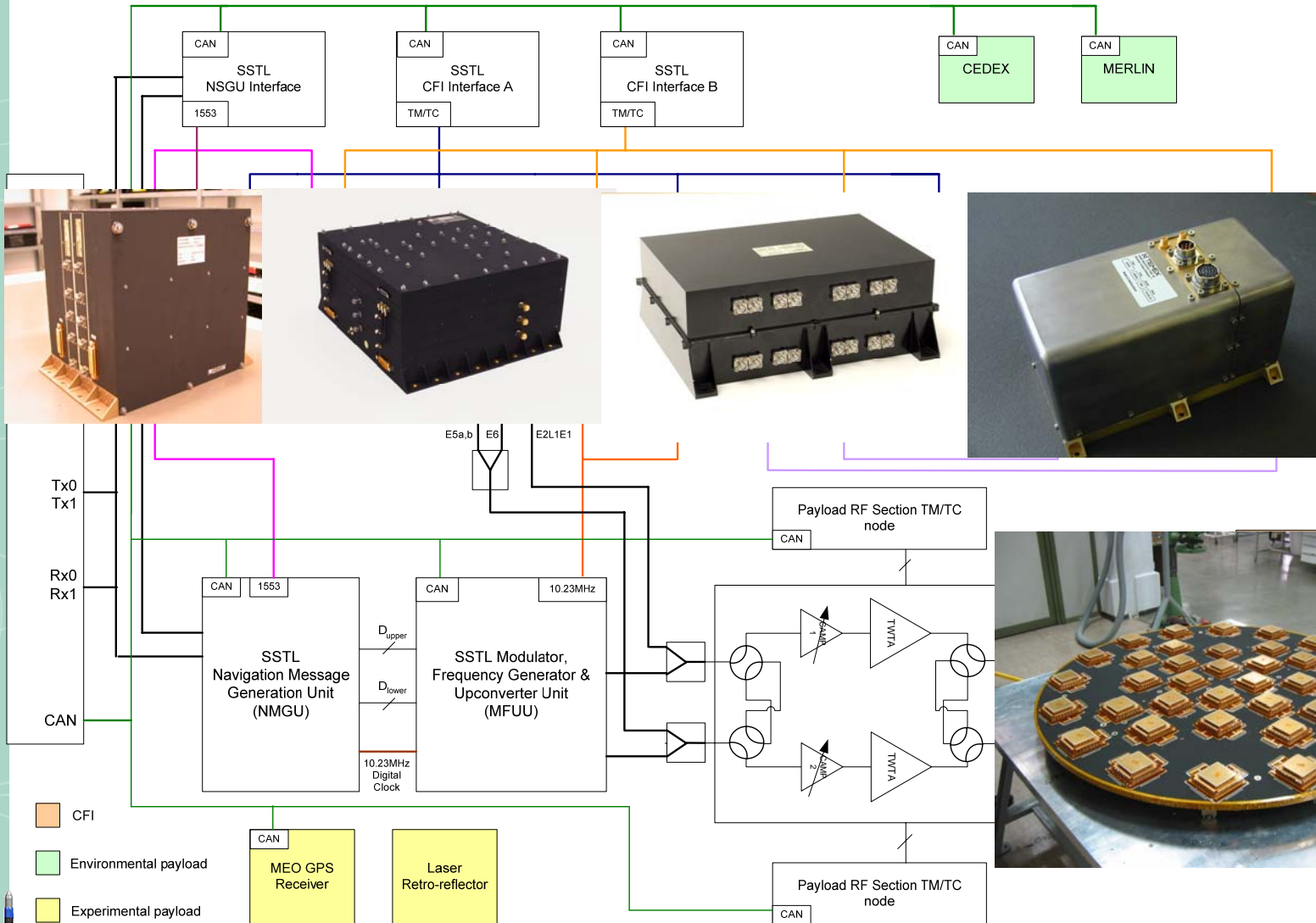
- **Dimensions:** 1.3m x 1.3m x 1.8m (stowed)
- **Wet mass:** 600kg
- **Power:** Sun tracking arrays ~900W
- **Sensors:** EHS, ASS, Gyro
- **Actuators:** Wheels, Magnetorquers, Cold gas thrusters
- **Pointing:** $\pm 0.55^\circ$ pitch/roll required (3σ), $\pm 0.1^\circ$ achieved; $\pm 2.1^\circ$ yaw required, $\pm 1.0^\circ$ achieved
- **Orbit:** NORAD, Laser ranging, GPS, reverse GNSS
- **Propulsion:** $90 \text{ ms}^{-1} \Delta v$ butane cold gas
- **TT&C:** S-Band
- **Avionics:** SSTL Enhanced Microsat

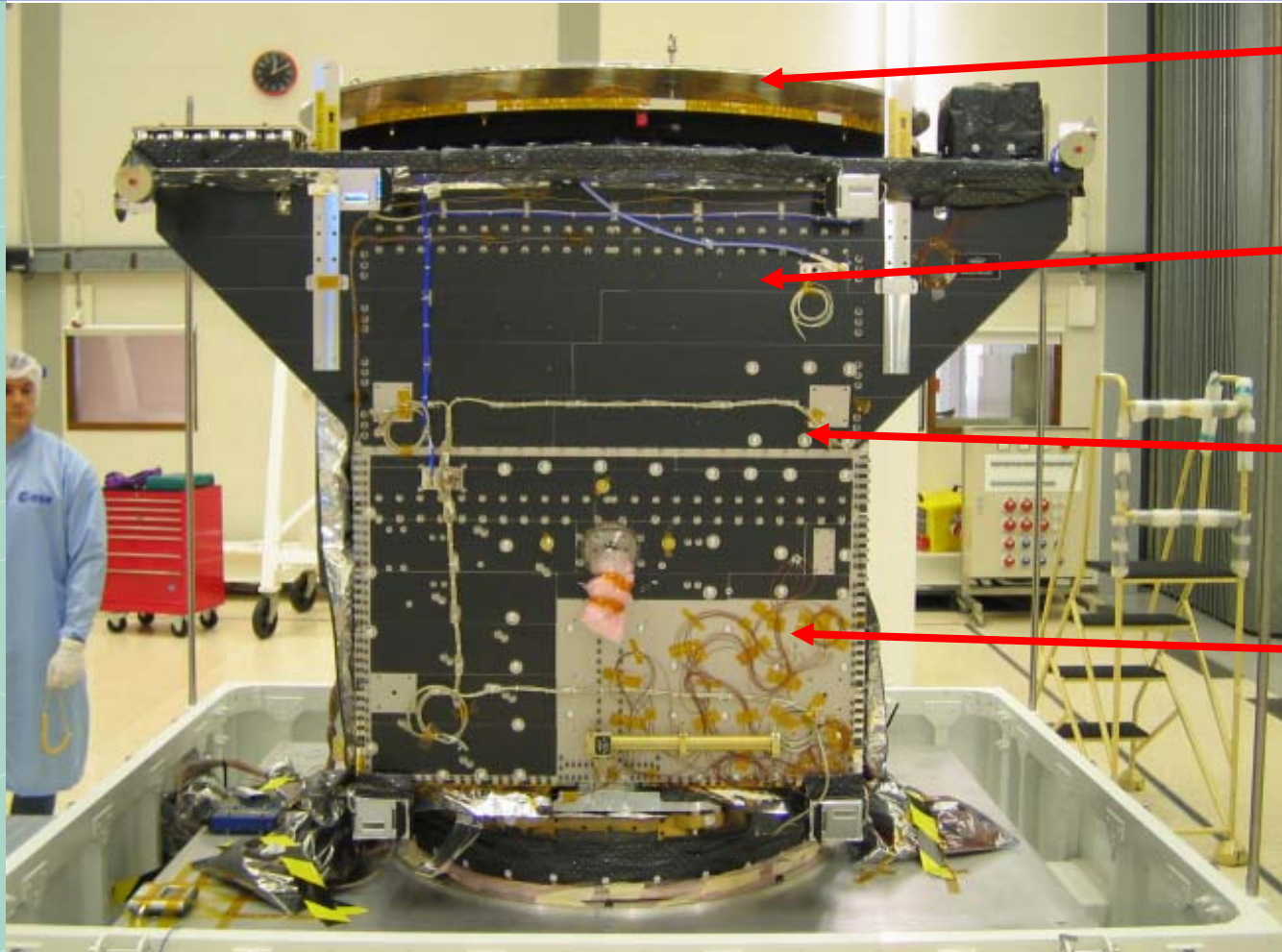




Platform manufacture at SSSL

GIOVE-A Payload: Block Diagram





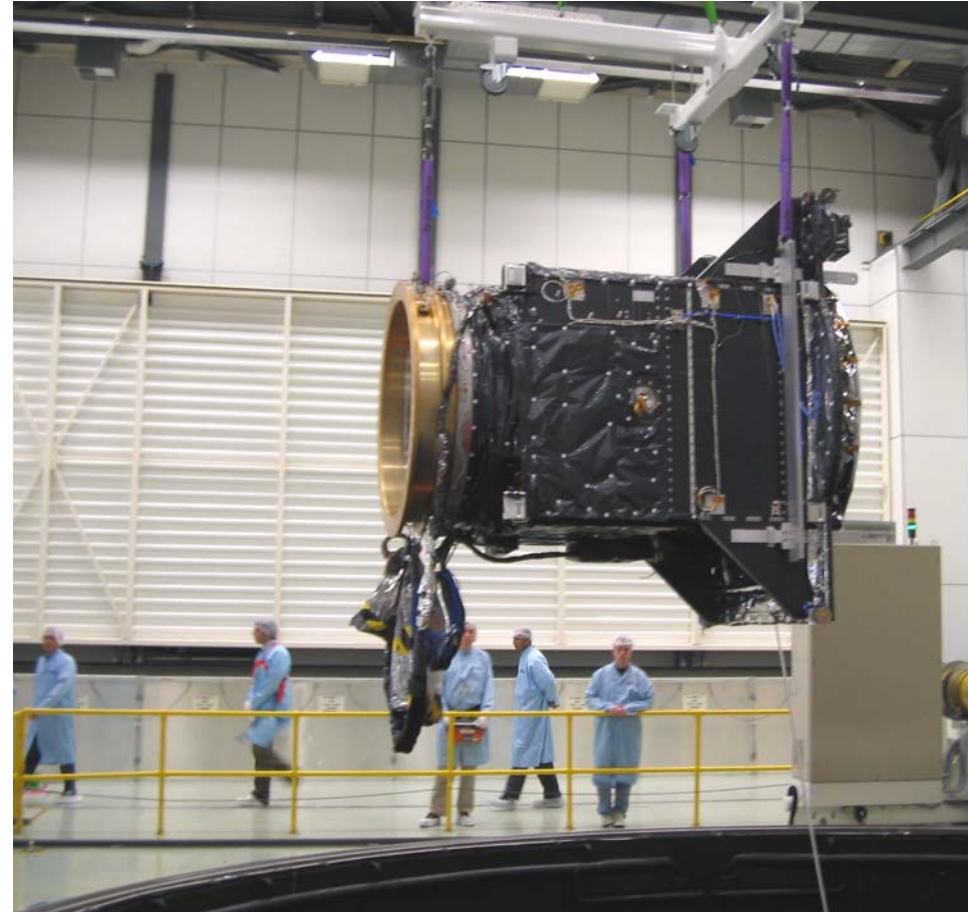
Antenna

Payload Bay

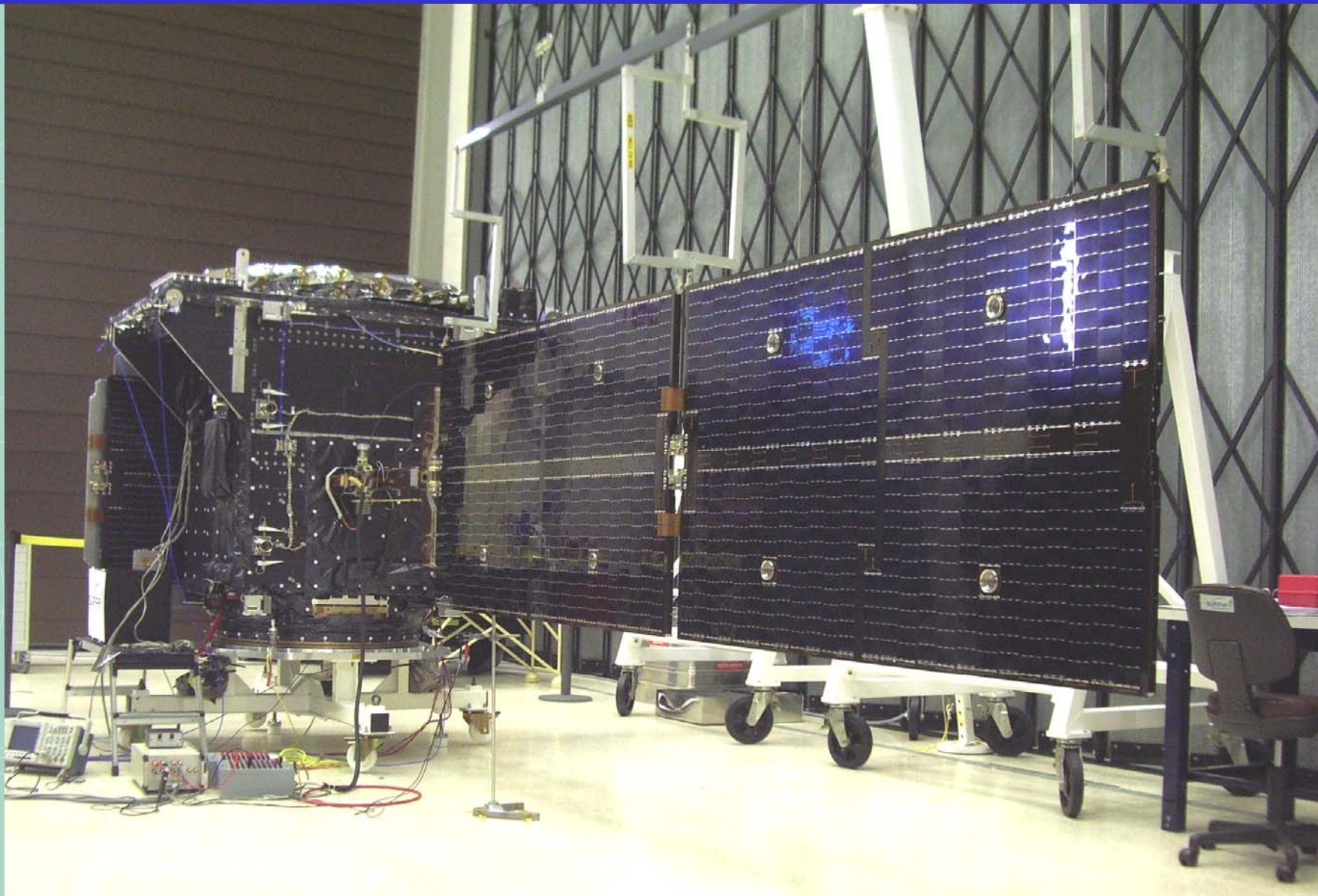
Avionics

Propulsion Bay

Integration activities undertaken at SSTL



3-month EVT campaign at ESTEC





GIOVE-A





GIOVE-A



Giove-A: ready for launch





- **GIOVE-A launched 05:19 GMT on 28 December 2005**
- **23,600km medium Earth orbit**





Guildford (UK)

- Master control station, TT&C, 3m tracking dish
- Septentrio GETR (GSTB Experimental Test Receiver) connected to omni-directional antenna

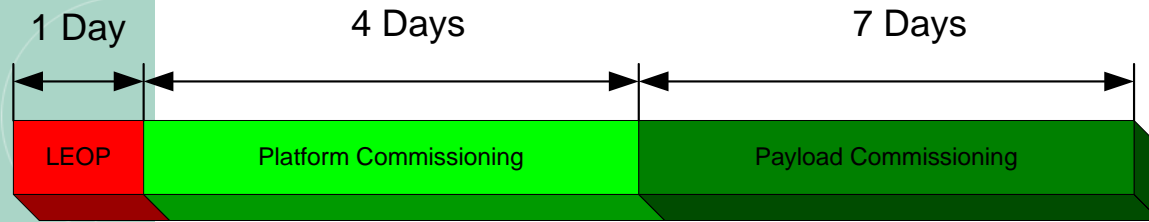
Chilbolton (UK)

- 25m tracking dish
- GETR - either to 25m or omni-directional antenna

Redu (Belgium)

- 3m tracking dish
- GETR connected to omni-directional antenna





LEOP complete in 3 hours

- GIOVE-A contact & telemetry received 2 minutes after s/c separation from launcher
- Both solar arrays deployed and solar-pointing within 2 hrs



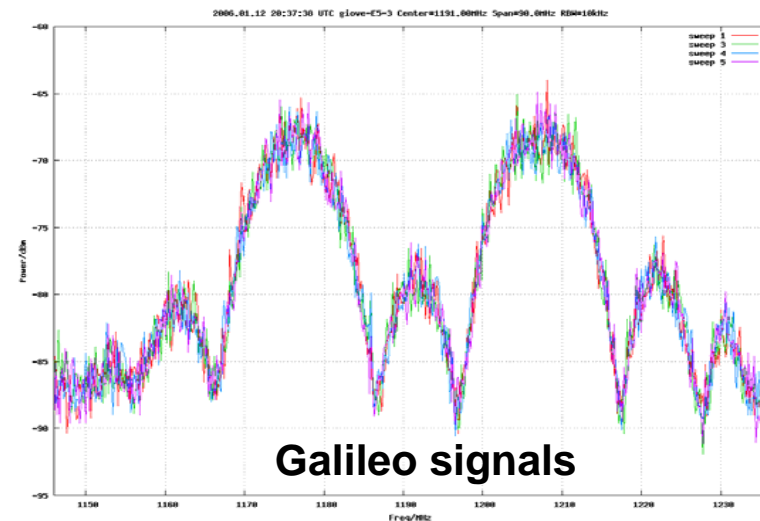
Environmental payload – 29 Dec

Earth pointing – 30 Dec

Nominal attitude – 06 January

Navigation payload – 10 January

First signals generated – 12 January





CFI payload-A

- Turned on: 10 January
- First signal: 12 January

CFI payload-B

- Turned on: 16 February
- Commissioned: 17 February

SSTL payload

- Turned on and commissioned: 20 February
Frequency Filing measurements
- Minimum data set complete by: 22 February
- Frequency Filing Notification to ITU: 8 - 9 March

Further payload operations

- Continuous transmissions of an E2 L1 E1-E5 signal to enable clock characterisation
- Operational time of 116 days- 67% operational, 34 signal modes exercised





Design to Proven Technology

Design to Cost and Reduce Risk

Design to Low Cost Launch

Design to Low Cost Groundstation/Operation

Deltas Management

Integrated Design and Manufacture

Provide Flight Proven Technologies

Appropriate Manufacturing Process

Use Terrestrial Technologies



Design to Proven Technology	Yes	Reuse - s/w, avionics/bus, propulsion, TT&C
Design to Cost and Reduce Risk	Yes	Significant saving to ESA
Design to Low Cost Launch	Yes/ No	Launch campaign, satellite powered off
Design to Low Cost Groundstation/Operation	Yes	Standard SSTL Ops concept modified for LEOP & Comm.
Deltas Management	Yes/ No	Modified for compatibility with ESA standards/reviews
Integrated Design and Manufacture	Yes	"Standard" SSTL platform
Provide Flight Proven Technologies	Yes	GEO GPS, OBC695, Wheels, ASM, GEO Power System
Appropriate Manufacturing Process	Yes	As for LEO missions with some extra EVT
Use Terrestrial Technologies	Yes/ No	COTS but some radiation hardening



- **Intense 3-month environmental test campaign undertaken at ESTEC**
- **Giove-A payload working exceptionally well**
 - Signals tracked successfully at Chilbolton and with GETRs
- **Main mission objectives have been achieved already**
 - Satellite launched before end of 2005
 - Frequency filing notification to ITU achieved in March
 - Environmental data logged near continuously since launch
 - Payload units working well in orbit
- **SSTL has successfully applied much of its standard “Small Satellite” engineering to this larger and more complex satellite**
- **Benefit to ESA: Giove-A delivered in-orbit for ESA in less than 2.5 years from contract signature to launch for ~ €28M**
- **Benefit to SSTL: Successful demonstration of SSTL’s Geostationary Minisatellite Platform - SSTL proven capability in satellites for beyond LEO & navigation satellites**

Thank you (to ESA)

