

Eureca

Achievements: world's first dedicated microgravity free-flyer; Europe's first reusable satellite

Launch date: 31 July 1992

Mission end: 24 June 1993

Launch vehicle/site: NASA Space Shuttle from Kennedy Space Center, Florida

Launch mass: 4490 kg (payload capacity up to 1000 kg)

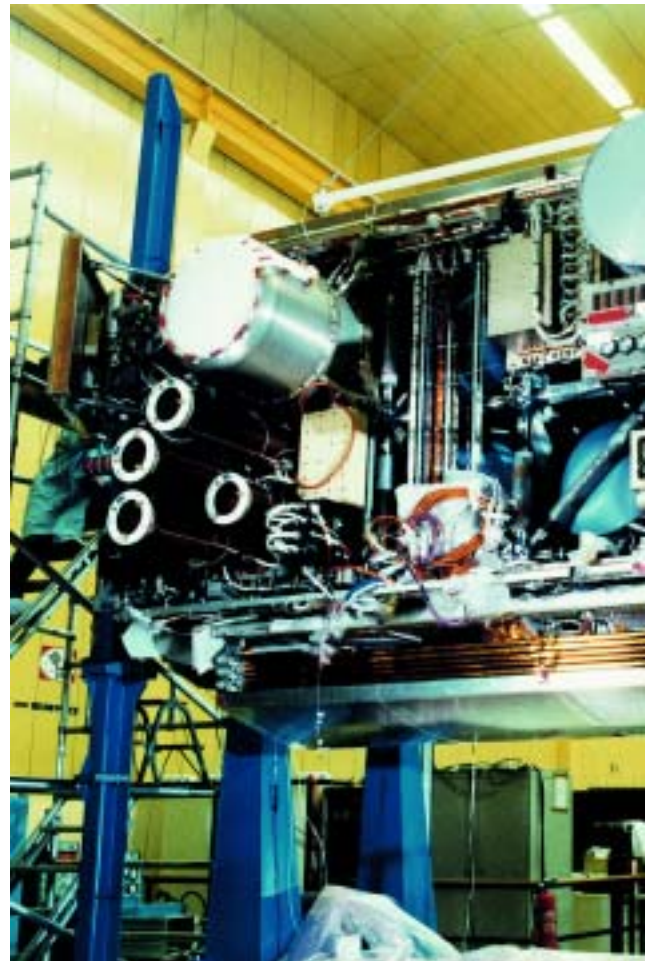
Orbit: released from Shuttle into 425 km, 28.5°, raised to 508 km for experiment operations, lowered to 476 km for retrieval by Shuttle

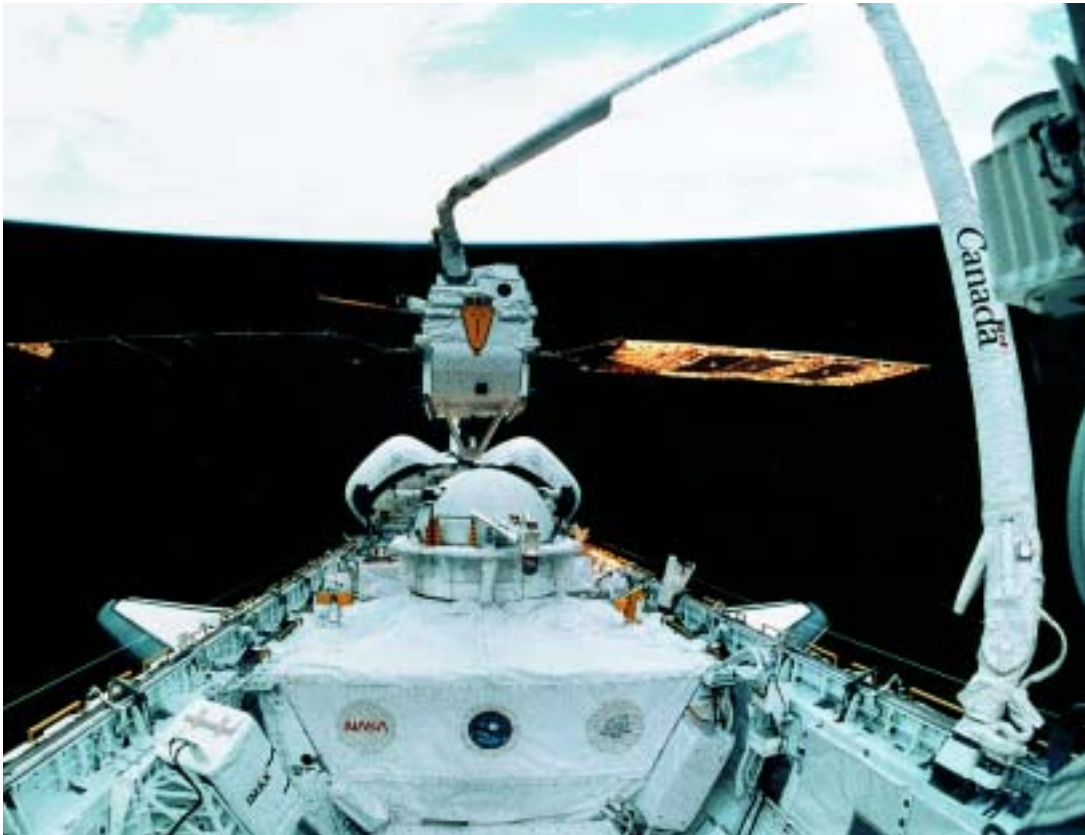
Principal contractors: MBB-ERNO (prime)

ESA began studying the European Retrieivable Carrier (Eureca) in 1978 as a follow-on to the manned Spacelab programme; the ESA Council approved it in December 1981. Eureca was designed to carry a mix of experiments totalling up to 1 t for 6-9 months in orbit, released and retrieved by NASA's Space Shuttle. It was the world's first free-flyer designed specifically to satisfy microgravity experiments, providing $10^{-5} g$ conditions for long periods. Although Eureca was controlled from ESOC in Germany, it could operate autonomously for up to 48 h. An important feature was reusability: Eureca was capable of making five flights over a 10-year period.

Eureca-1 and its 15 experiments (see separate box) were launched aboard Shuttle mission STS-46 in July 1992 and released from the Shuttle's robot arm by ESA Mission Specialist Claude Nicollier on 2 August. Eureca's thrusters raised its orbit by 83 km within a week and the 6 months of operations began on 18 August. Most of the microgravity experiments were completed by January 1993, but others continued even as it Eureca waited for recovery during Shuttle mission STS-57 in June 1993. By that time, its orbit had decayed through atmospheric drag to 490 km and its thrusters lowered it further to 476 km for NASA astronaut George Low to capture it during 24 June.

The Eureca-1 mission was rated as highly successful, and a 1995 Eureca-2 mission was planned but ESA Ministerial meetings rejected further funding. The carrier was stored at DASA (ex-MBB/ERNO) in Bremen, where it was hoped that a DASA-led consortium could provide commercial flights.





Eureca's solar wings were safely deployed before the free-flyer was released. (NASA)



Eureca-1 Payload

ESA's five microgravity core multi-user facilities:

- Automatic Mono-ellipsoid Mirror Furnace (AMF)
- Solution Growth Facility (SGF)
- Protein Crystallisation Facility (PCF)
- Multi Furnace Assembly (MFA)
- Exobiological Radiation Assembly (ERA).

Two further microgravity elements were:

- High Precision Thermostat (HPT, Germany)
- Surface Forces Adhesion Experiment (SFA, Italy).

The five space science experiments were:

- Solar Spectrum Experiment (SOSP)
- Solar Variation Experiment (SOVA)
- Occultation Radiometer (ORA)
- Wide Angle Telescope for Cosmic and X-ray Transients (WATCH)
- Timeband Capture Cell Experiment (TICC).

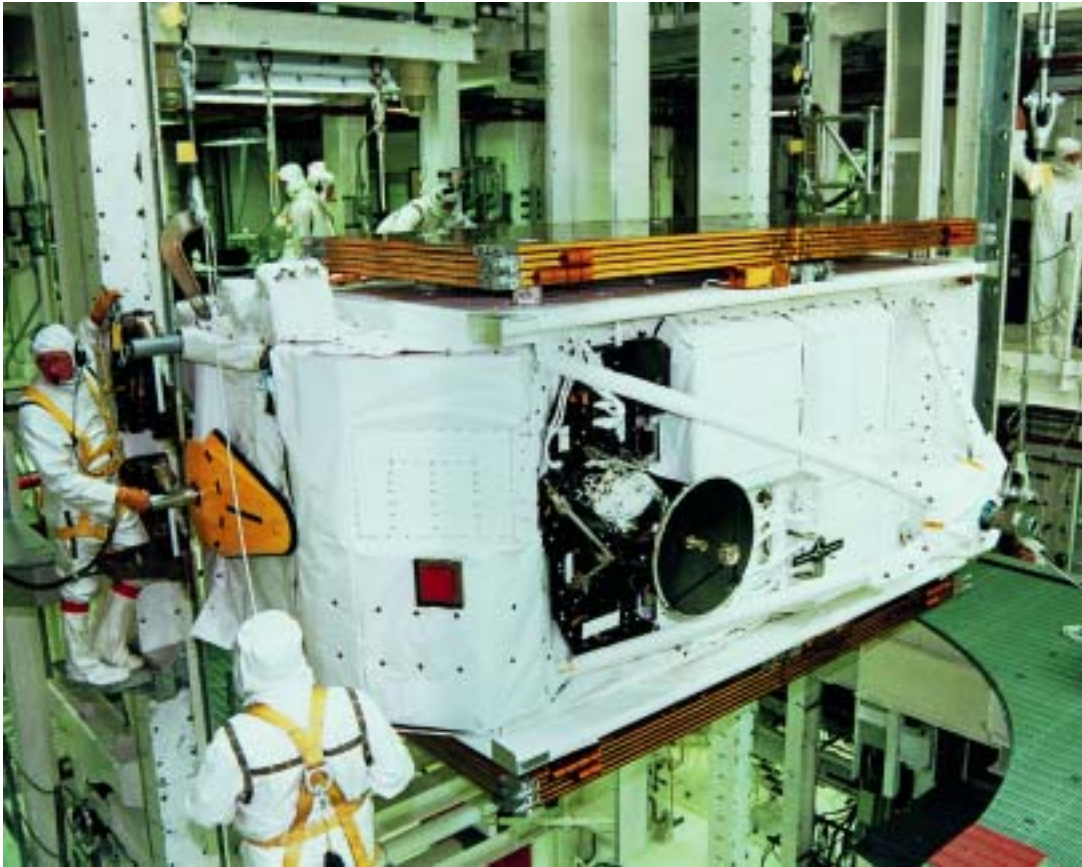
The three technology demonstrations were:

- Radio Frequency Ionization Thruster Assembly (RITA)
- Advanced Solar Gallium Arsenide Array (ASGA)
- Inter Orbit Communication Experiment (IOC, working with Olympus).

Integration of Eureca at DASA in Bremen. (DASA)



Eureca – with its solar wings already folded against its sides – was recaptured in June 1993 after almost a year in orbit. (NASA)



Processing Eureka at the Kennedy Space Center for insertion into the Space Shuttle cargo bay. (NASA)

Satellite configuration: total width 4.6 m, total height about 2.6 m. Bus structure consisted of carbon fibre struts connected by titanium nodal joints. The nodes carried larger hardware loads, while smaller assemblies were fastened to standard Equipment Support Panels. Supported in Shuttle cargo bay by two longeron and one keel fitting. Grapple fixture allowed deployment/retrieval by Shuttle Remote Manipulator System.

Attitude/orbit control: 3-axis control (normally Sun-pointing) by magnetorquers, supported by Reaction Control Assembly of 6x21 mN nitrogen thrusters. Orbit transfers between about 400-500 km by Orbit Transfer Assembly of redundant 4x21 N hydrazine thrusters (supply sized for two transfers plus 9-month on-orbit stay). Attitude/rate determination by accelerometer package, gyros and IR Earth and Sun sensors.

Power system: twin deployable/retractable 5-panel Si-cell wings



Eureka has been displayed since November 2000 at the Swiss Museum of Transport and Communication in Lucerne. (Courtesy of the Museum)

generated 5 kW at 28 Vdc, providing 1 kW average for payload operations (1.5 kW peak). Supported by 4x40 Ah nickel cadmium batteries.

Communications: controlled from ESOC in Darmstadt, Germany. S-band link provided up to 256 kbit/s downlink for payloads, with 128 Mbit onboard memory.