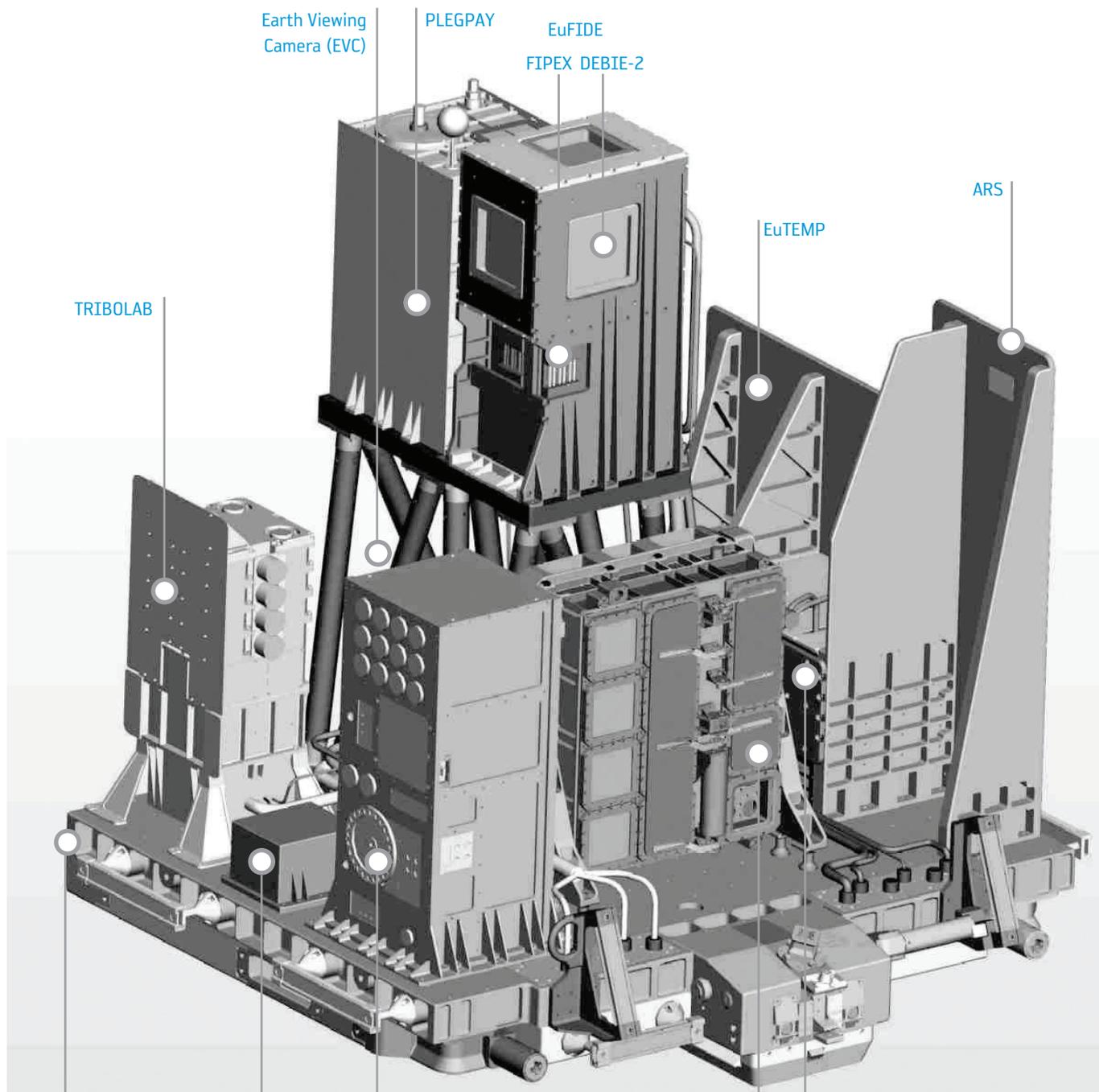


→ EUROPEAN TECHNOLOGY

EXPOSURE FACILITY - EUTEF

Multi-user external facility on outside of Columbus

Programmable, fully automated, multi-user facility with modular and flexible accommodation for a variety of technology payloads requiring direct access to the space environment. EuTEF is specifically designed to facilitate the rapid turnaround of experiments.



Columbus External Payload Adapter (CEPA)

DOSTEL

MEDET

DHPU

EXPOSE

	PROJECT:	International Space Station			
	TITLE:	European Technology Exposure Facility	DOCUMENT N°:	ESA-HSO-COU-017	REV.

Facility Description

COLUMBUS EXTERNAL PAYLOAD FACILITY - CEPF

The External Payload Facility consists of two external structures mounted symmetrically on the starboard end-cone of the Columbus Laboratory. The Facility provides a total of four accommodation locations with associated sets of resources for external payloads requiring specific viewing or exposure to the space environment. The accommodation locations are such that one faces towards the zenith direction (i.e., directly away from the Earth); one towards the nadir direction (i.e., directly towards the Earth), with the remaining two facing towards the starboard side of the ISS (i.e., per-pendicular to the ISS velocity vector).

The accommodation location facing Zenith Starboard was occupied by the multi-purpose facility EuTEF. A modular architecture provides standardised interfaces for nine instrument modules, all of which can be operated simultaneously. It is a platform to provide to the Principal Investigators (PI) and Industry community easy and low cost access to the external environment of the International Space Station, in terms of PA, Safety, Technical and Programmatic. EuTEF with its unique opportunities supported the utilisation of the ISS.

The experiments and facility infrastructure were accommodated on the Columbus External Payload Adapter (CEPA), consisting of an adapter plate, the Active Flight Releasable Attachment Mechanism (A-FRAM) and the connectors and harness. The instruments are mounted either directly on the Adapter plate or a support structure that elevates them for optimum exposure to the ram (direction-of-flight) and zenith directions.

The facility infrastructure consists of a Data Handling and Power Unit (DHPU) and its thermal control system, which translates the services from Columbus. It receives two feeds of 120 Vdc from the CEPF via the A-FRAM connectors. Feed 1 is converted to 28 Vdc as the instruments' primary supply; feed 2 is only for survival heaters, in case feed 1 is lost. Inside EuTEF, the DHPU distributes data using a MIL-1553B interface and a serial RS422 link for specific interfaces. The link to the CEPF uses an Ethernet connection, a MIL-1553B, and the HRDL for the pictures of the Earth Viewing Camera (EVC).



Additionally, temperatures are measured autonomously at several points on EuTEF while the assembly is unpowered (EuTEMP).

EuTEF accommodated nine instruments, all of which were operated simultaneously.

In total, the payload mass was < 350 kg, requiring < 450 W peak.

Experiments:

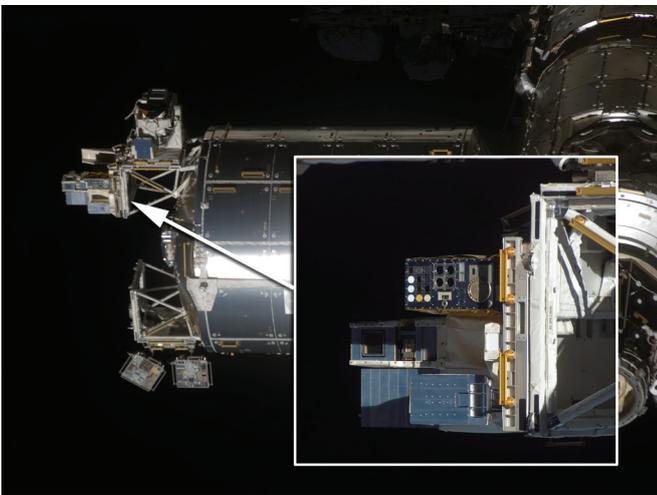
- **TRIBOLAB**, testbed for tribology properties of materials in space (INTA, INASMET, CDTI contract);
- **PLEGPAY**, PLasma Electron Gun PAYload for plasma discharge in orbit (AAS Florence, under ASI contract);
- **MEDET**, Material Exposure and Degradation Experiment on TEF in space (CNES, ONERA, University Southampton, ESA);
- **DEBIE-2**, micrometeoroid and orbital debris detection (Patria Finavitec, under ESA contract). Shares a standard berth with FIPEX);
- **FIPEX**, Flux Probe EXperiment, a atomic oxygen detector (University of Dresden). Shares a standard berth with Debie-2 in the module EuFIDE;
- **EXPOSE**, photobiology and exobiology (Kayser-Threde, under ESA contract);

- **DOSTEL**, a DOSimetric radiation TELEscope for radiation measurements (DLR Institute of Flight Medicine);
- **EuTEMP**, a EuTEF temperature measurement device for monitoring the thermal environment during unpowered transport from the Shuttle to the CEPF (EFACEC, under ESA contract);
- **EVC**, an Earth Viewing Camera, developed by ESA/Carlo Gavazzi Space for outreach activities.

INTEGRATION AND INSTALLATION

The experiments were being qualified separately before installation on EuTEF, where they were functionally tested with the facility electronics. After receiving the Flight Readiness Certificate from ESA, EuTEF was shipped to KSC in Florida to meet the Mission Peculiar Experiment Support Structure (MPRESS) that hosted it in the Shuttle cargo bay. After installation of EuTEF and SOLAR on the MPRESS, they were handed over to NASA's Shuttle team. After the attachment of Columbus to the ISS, first SOLAR and then EuTEF was installed.

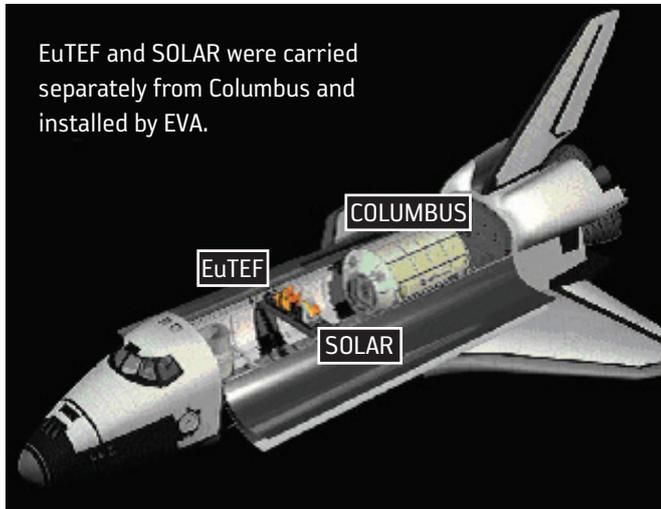
Number of payload models:	9
Retrieval opportunities:	After 1.5 years
Power availability:	< 450 W
Mass:	< 350 kg



Operations and Utilisation

ACCOMMODATION & TRANSPORT

EuTEF was launched aboard Space Shuttle Atlantis on 7 February 2008. EuTEF was mounted outside the Columbus module on the Columbus External payload adapter and completed its 18-month mission after returning to Earth with Space Shuttle Discovery in September 2009.



EuTEF and SOLAR were carried separately from Columbus and installed by EVA.

OPERATIONAL CONCEPT

The survival heaters raised the temperature so that the DHPU could be switched on after about 24 h to receive power from feed 1. The DHPU sequentially powered up all the experiments, allowing for the specific needs of several that could endanger the whole payload complement. Thirty days after switch-on, EuTEF was considered as operational.



The scientific and housekeeping data was downlinked via the Columbus Data Management System into the ISS. The Columbus Control Centre in Oberpfaffenhofen (D) relayed them to the EuTEF Facility Responsible Centre (FRC) in ESTEC's Erasmus Centre. Here, the required data was extracted and forwarded to the respective Principle Investigators (PIs).

EuTEF commands, restricted to parameter uploads to change, for example, experiment modes, came from the PI sites into the FRC.

The validation of commands and resources and verification of timelines were performed in the EuTEF Control Centre (ECC), which then returned them to the FRC for upload, using the Columbus/ISS channels.

UTILISATION SCENARIO

The Facility Responsible Centre (FRC) for all EuTEF instruments and operations was the Erasmus User Support and Operation Centre at ESA Noordwijk, The Netherlands. The FRC operated in conjunction with users at their User Home Bases (UHB).

SCHEDULE

The EuTEF flight unit, including the final set of instruments was integrated in February 2008 and returned to Earth in September 2009.

The prime contractor is Carlo Gavazzi Space (Italy).