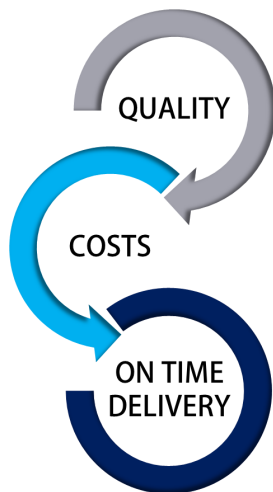


Am
Co

APCO QUALITY AND EXPERIENCE

OUR COMPANY

Established in Switzerland in 1992, APCO Technologies is a project-oriented company specialised in heavy machinery for the SPACE, ENERGY, and INDUSTRY sectors. To date, our company has known a continuous growth.



QUALITY FIRST

Our success is notably due to our stringent quality policy at every scale of the projects you are entrusting us with.

Our strategy is defined as:

- Meeting your requirements, be formulated or not.
- Developing a strong corporate culture which allows our collaborators to work and thrive in the best conditions.
- Keeping a step ahead in terms of innovation

TEST EQUIPMENT

Our experience in Mechanical Ground Support Equipment (MGSE) led us to develop specific test equipment such as positionners. Our first achievement was a vacuum positionner initially designed for ESA's Envisat instrument MERIS (Medium Resolution Imaging Spectrometer).

Today our MPMA (Mass Properties Measurement Adapter) has given good and loyal services at ESA's European Research and Technology Center (ESTEC) for almost ten years.



2 - APCO Technologies - Test Equipment



Certifications

EN 9100 : Quality Management Systems – Requirements for Aviation, Space and Defense Organizations

ISO 9001 : Quality Management

ISO 14001 : Environmental Management

ISO 27001 : Information Security Management

OHSAS 18001 : Occupational Health and Safety Management

Airbus DS IPCA + : Industrial Process Control Assessment



IXV (Intermediate eXperimental Vehicule) during its physical properties measurement campaign in ESTEC, Noordwijk

Source: European Space Agency

3 - APCO Technologies - Test Equipment

This document remains the intellectual property of APCO Technologies SA and may not be copied, or used without their prior written approval.

MPMS FUNCTIONING AND TEST SEQUENCE



PURPOSE

The Mass Properties Measurement System (MPMS) is a complete system allowing the measurement and calculation of a spacecraft:

- Mass
- Center of Gravity (CoG) coordinates
- Moments of Inertia (Mol)
- Products of Inertia (Pol)

1 Calibration of the system with appropriate dummies



Weighing of the S/C

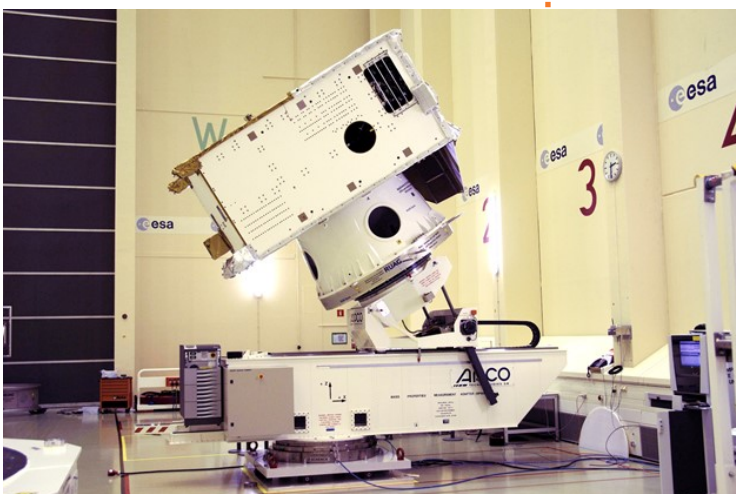
2

3 Transfer of the S/C to the MPMA



4 Measurement of CoG (X,Y)

4



5

5 Measurement of CoG (Z-axis)

6

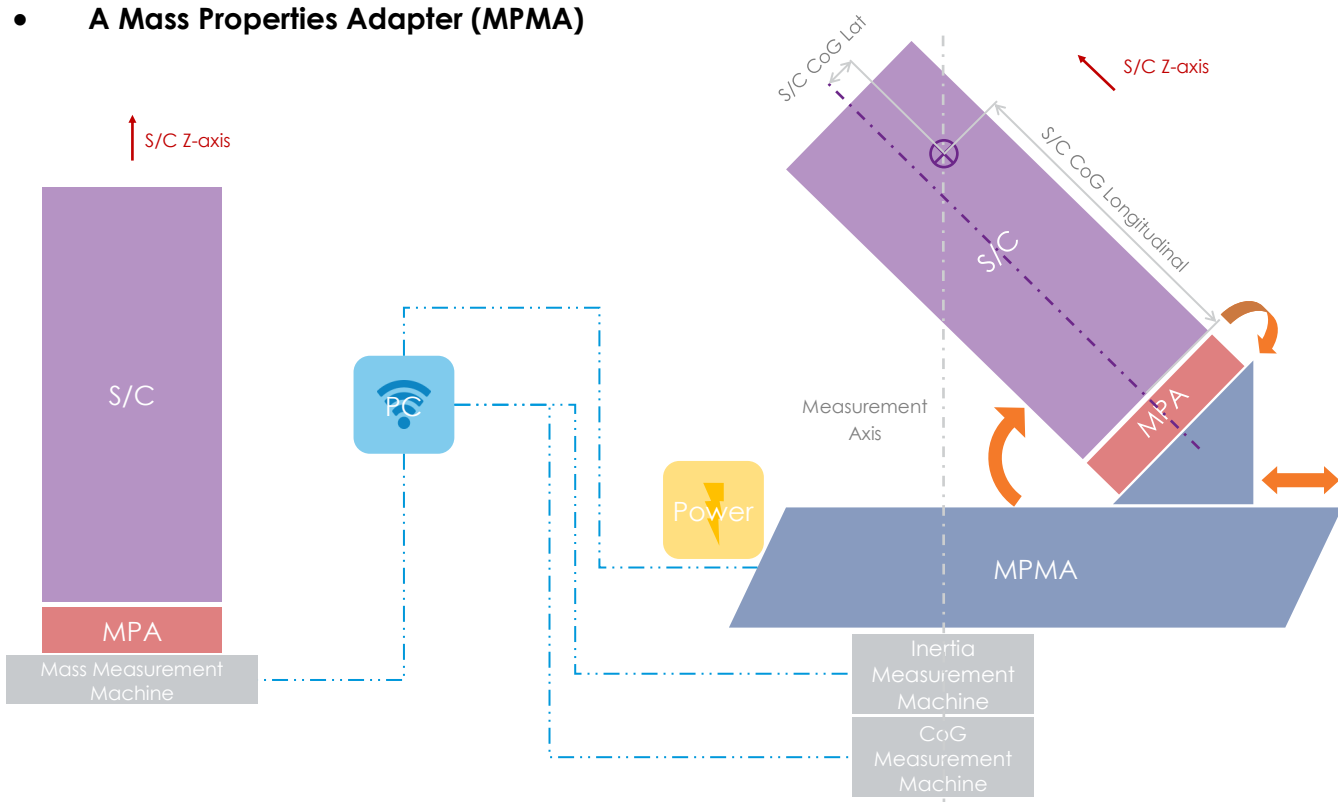
6 Measurement of Inertia

MPMS FUNCTIONING AND TEST SEQUENCE

COMPONENTS

Several elements are needed to obtain the most accurate measurement in a reduced time, such as measurement machines, **an automated positioning device**, and a global software. The MPMS is composed of:

- A weighing machine
- A CoG position measurement machine
- An inertia measurement machine
- **A Mass Properties Adapter (MPMA)**
- A physical properties adapter to link the S/C to the MPMA (MPA)
- Mass dummy, calibrated masses and Mol calibration disks



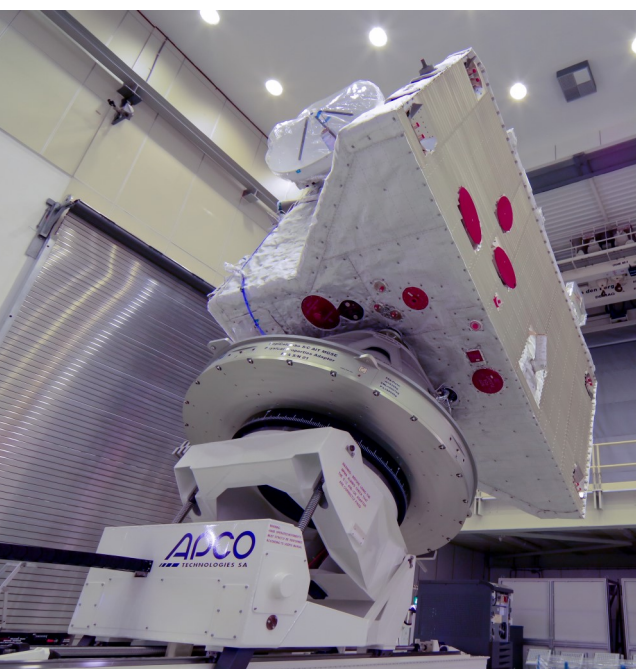
HERITAGE

The MPMA is a part of the MPMS measurement system in service in the « Hydra » clean room at the ESA European Space Research and Technology Center (ESTEC) in Noordwijk.

It is used in average in 3 to 4 campaigns per year. Recent campaigns include :

- IXV (eXperimental Test Vehicule)
- BepiColombo
- Metop-C
- Sentinel-2

BepiColombo in ESTEC, Noordwijk
Source: European Space Agency



MPMA CHARACTERISTICS

MPMA TROLLEY

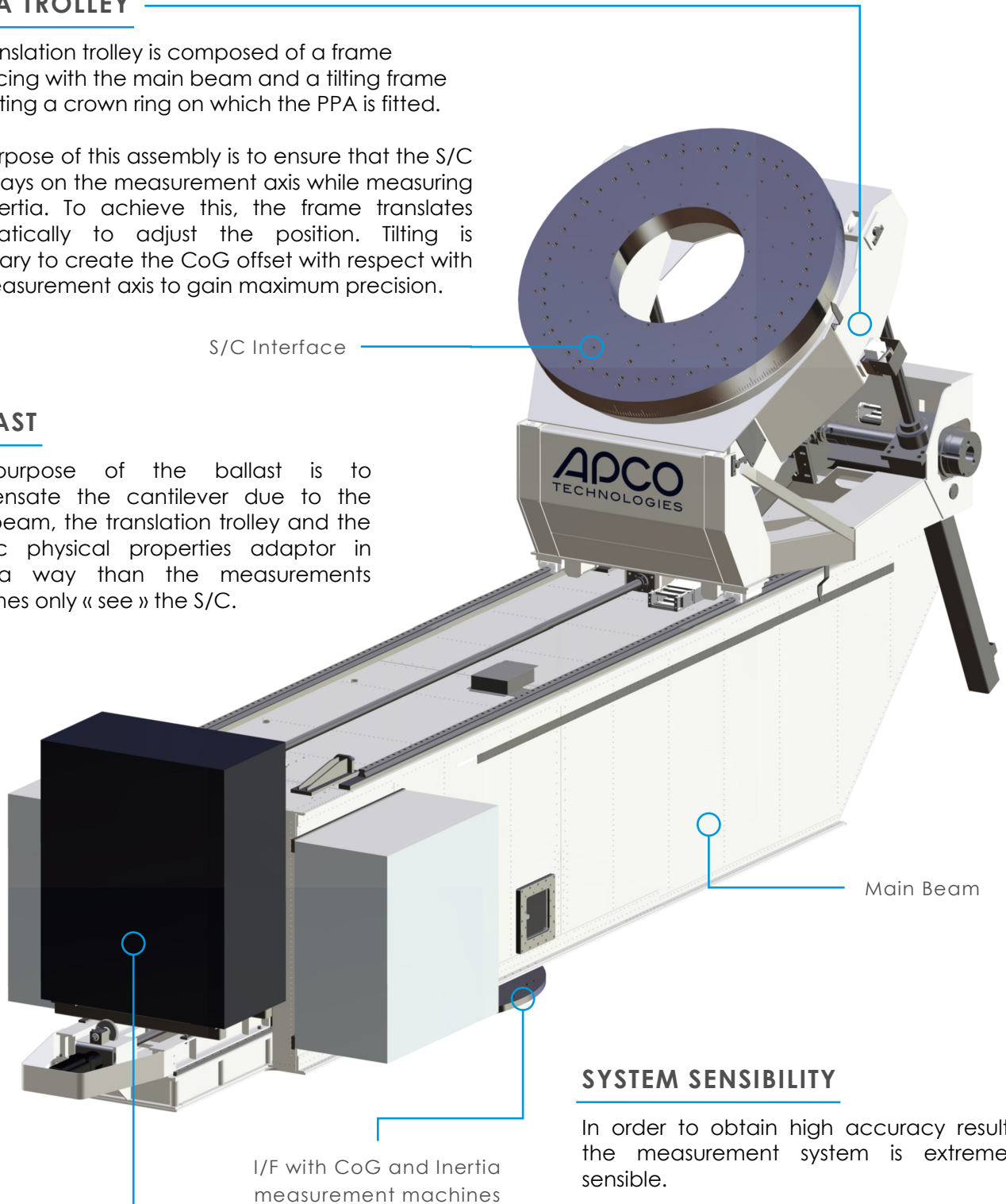
The translation trolley is composed of a frame interfacing with the main beam and a tilting frame supporting a crown ring on which the PPA is fitted.

The purpose of this assembly is to ensure that the S/C CoG stays on the measurement axis while measuring S/C inertia. To achieve this, the frame translates automatically to adjust the position. Tilting is necessary to create the CoG offset with respect with the measurement axis to gain maximum precision.

S/C Interface

BALLAST

The purpose of the ballast is to compensate the cantilever due to the main beam, the translation trolley and the specific physical properties adaptor in such a way that the measurements machines only « see » the S/C.



POWER

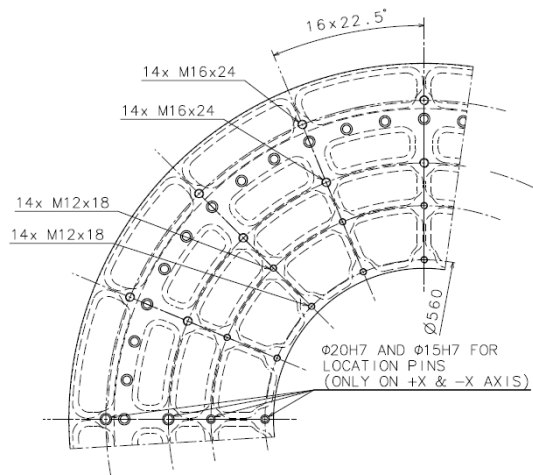
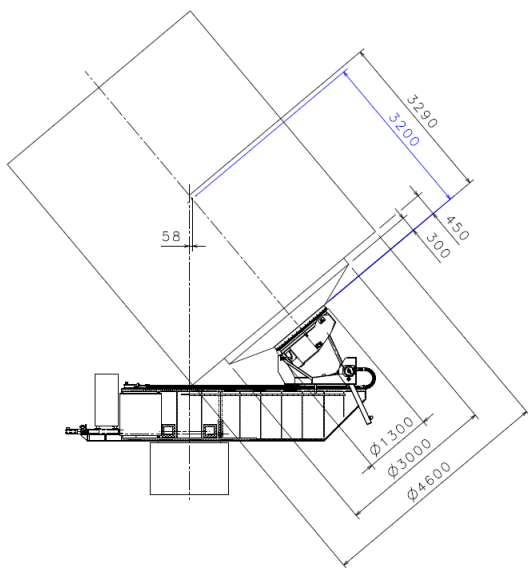
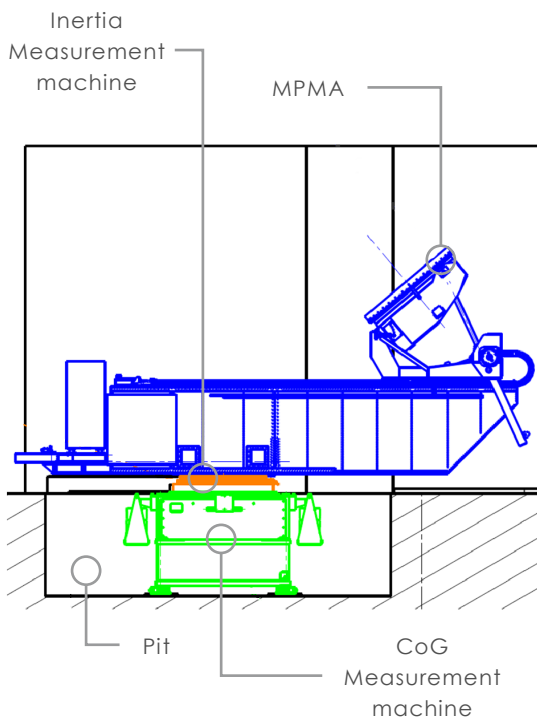
All MPMA movements are powered by an Uninterruptible Power Supply (UPS) and controlled from a remote computer by wireless connection.

SYSTEM SENSIBILITY

In order to obtain high accuracy results, the measurement system is extremely sensible.

To ensure accuracy goals, all parts of the MPMA are designed to procure maximum rigidity, manufactured with great care and are preloaded if applicable.

Possible disturbances from the system itself or the environment (like air conditioning) must be eliminated or at least reduced to a minimum during measurement phases.



Characteristics

Maximum Dimensions (LxWxH)	0°	5774 x 1640 x 1885 mm	
	40°	5915 x 1640 x 2643 mm	
Mass	3100 Kg		
Motion Mode	Electrical / manual (powerless mode)		
Motion Control	Wireless connection		
Power Supply	On battery during test phases		
Trolley Movements	Tilting	Rotation	Translation
- Range	0 - 40°	360°	Depending on CoG position
- Precision	± 0.1°	± 0.2°	± 0.1 mm
Facility Handling (for installation)			Crane
Environment Specifications			ISO 8

S/C Limits

Max Envelop Dimension (Ø)	4610 mm	
Max S/C Mass	5000 Kg	
Max S/C CoG position	Longitudinal	3200 mm
	Lateral	75 mm
Max S/C Inertia	Longitudinal	4000 m²kg
	Lateral	10000 m²kg

Interfaces

S/C	- 14 x M12 on a Ø560 mm + centering holes
(through specific properties adapter)	- 14 x M12 on a Ø750 mm + centering holes
	- 14 x M16 on a Ø900 mm + centering holes
	- 14 x M16 on a Ø1120mm + centering holes
Inertia measurement system	Depending on chosen measurement machines

Contact us

APCO Technologies
Chemin de Champex 10
CH-1860 AIGLE
SWITZERLAND
Phone: +41 (0) 24 468 98 00
Fax: +41 (0) 24 468 98 01
Website: www.apco-technologies.eu

APCO
TECHNOLOGIES

