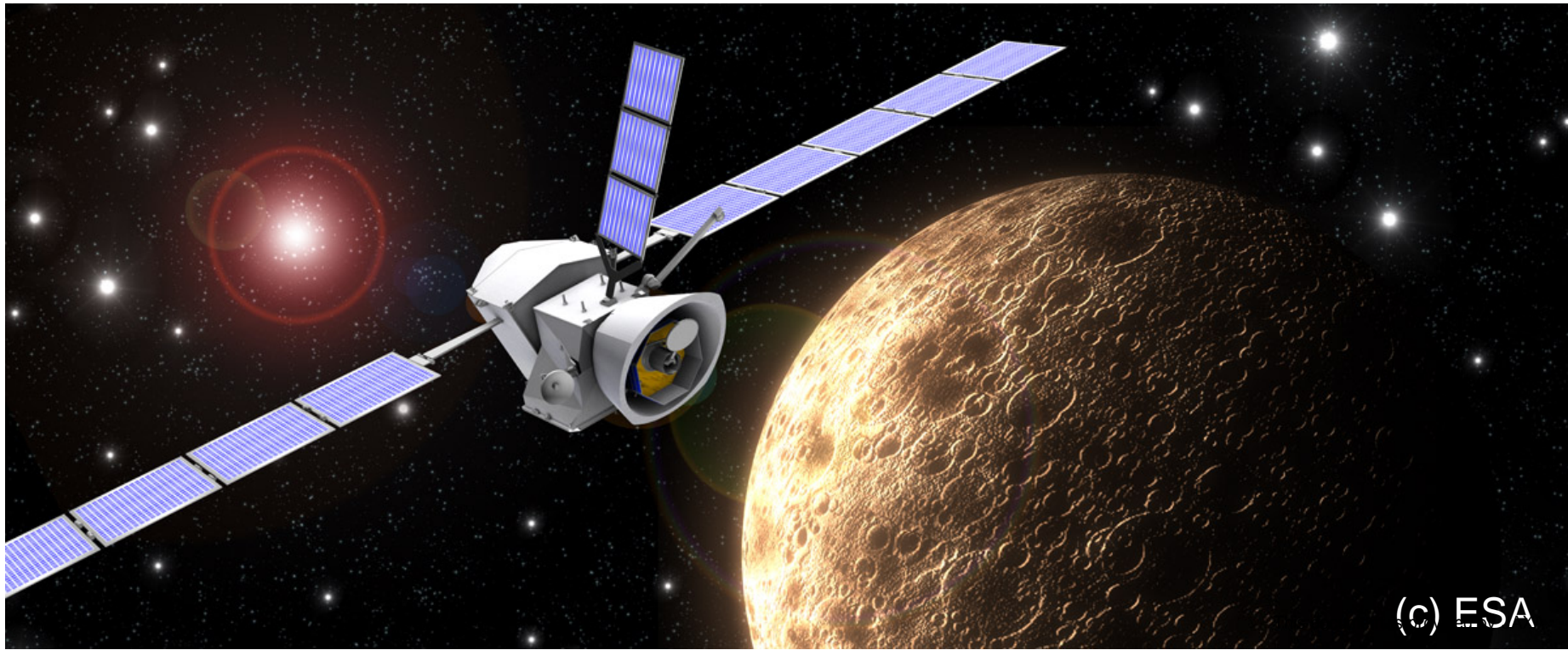


# BepiColombo MMO status update

H. Hayakawa<sup>1</sup> and H. Maejima<sup>1</sup>  
BepiColombo MMO Project Team

1: ISAS/JAXA



# BepiColombo: Two Orbiters

**MPO (Mercury Planetary Orbiter)** 3-axial



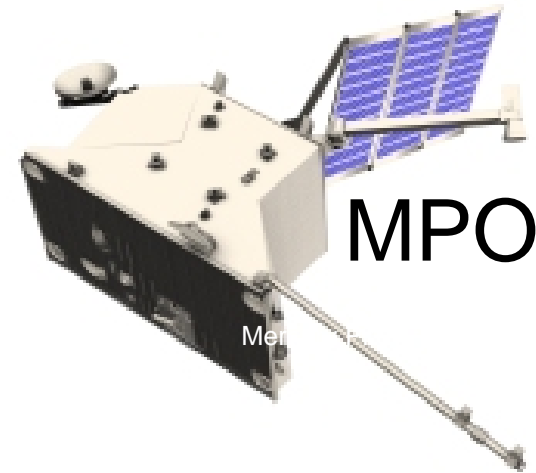
~Low-altitude polar orbit: for Surface & Interior observations~  
Study of the planetary formation near the Sun

**Camera:** Surface geology

**IR/UV/X/Gamma/neutron spectrometer:** Composition

**Magnetometer:** Internal & Magnetospheric magnetic field

**Precise orbit determination:** Gravitational field, Relativity etc.



MPO

**MMO (Mercury Magnetospheric Orbiter)** Spin



~Elliptical polar orbit: for Magnetosphere & Exosphere~  
First comparative study of the planetary magnetic field and Magnetosphere

**Magnetometer:** Internal & Magnetospheric magnetic field

**Plasma particle, Electric field, Plasma waves:**

Magnetosphere - Structure, Dynamics, energetic processes

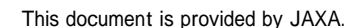
**Energetic neutrals:** Sputtered particles from Surface

**Na imager:** Exosphere – Structure & Variation

**Dust:** Interplanetary dust in the inner solar system



MMO



# Mission Scenario

Launch: Oct.  
2018

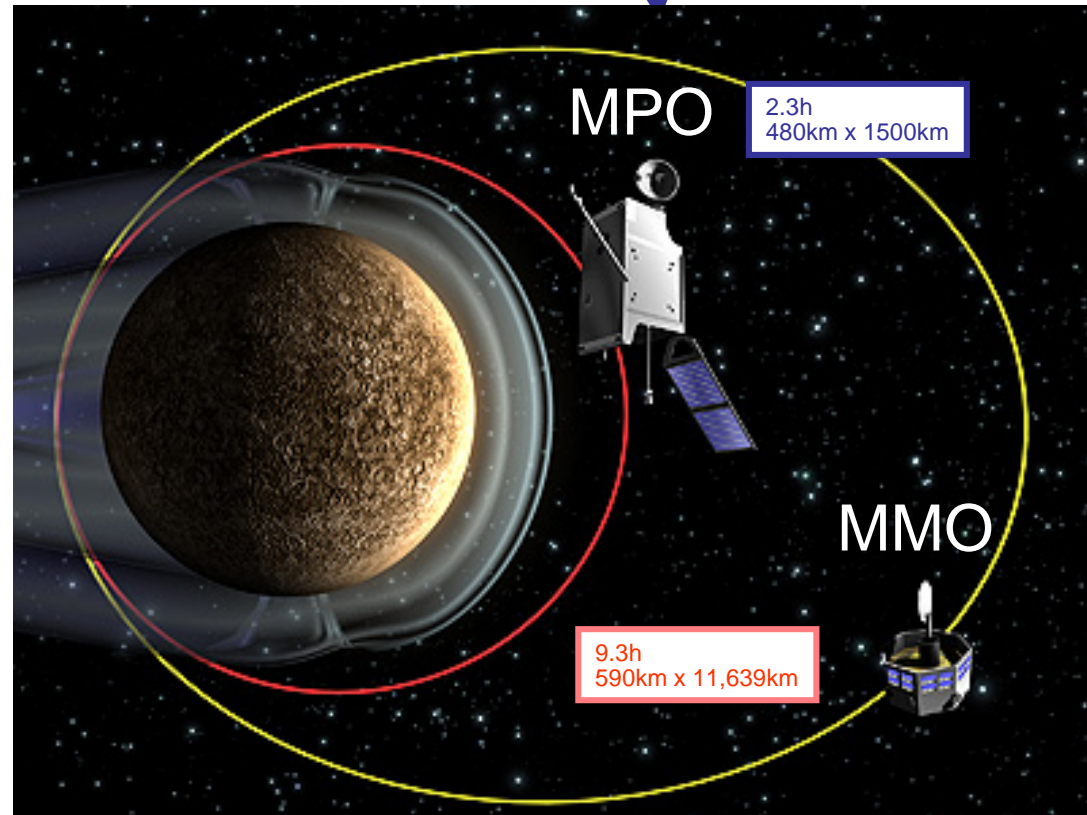
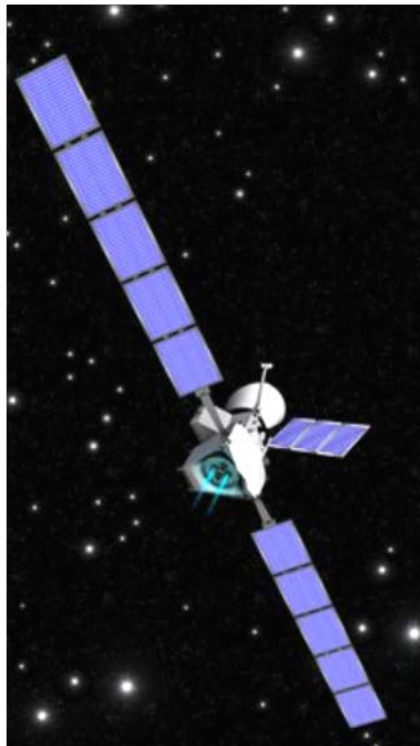
Earth swing-by x 1  
Venus swing-by x 2  
Mercury swing-by x 6

Arrival: Dec. 2025

Mercury Orbit Insertion  
Gravitational Capture

Interplanetary Cruising

Electric Propulsion  
[MTM]



Ariane-5:  
MPO+MMO

Red:  
Blue:

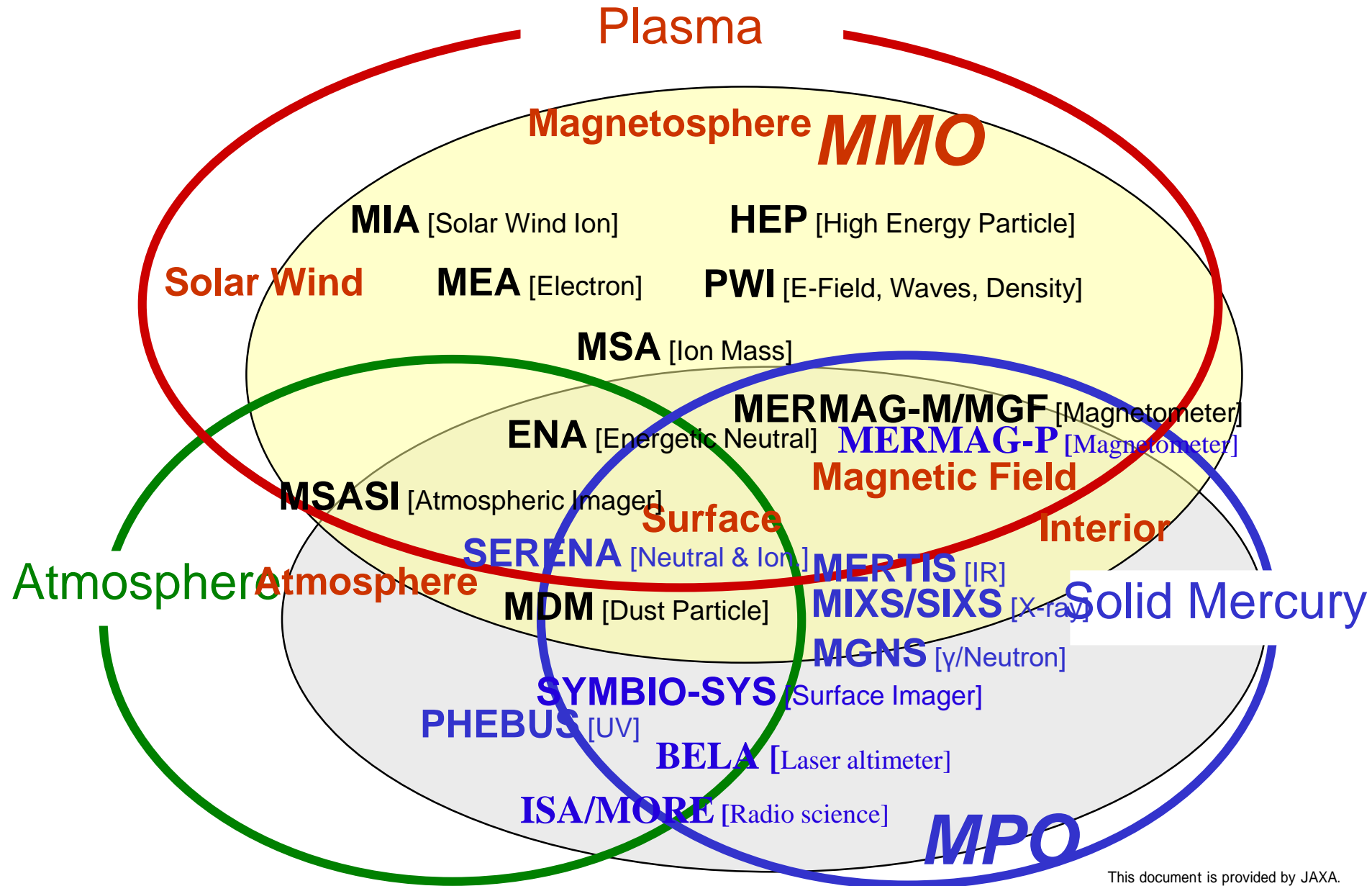


Observation: 1 Earth year (+Extension)

This document is produced by JAXA.



# BepiColombo: Science



# MMO Payload: Selected

5 teams – MPPE, MGF, PWI, MSASI, MDM

**MPPE**

**MEA** *low-energy e<sup>-</sup>*  
**MSA** *low-energy ion*  
**MIA** *solar wind ion*

**HEP-e** *high energy e<sup>-</sup>*  
**HEP-i** *high energy ion*

**ENA** *energetic neutral atom*

**MGF** *magnetic field*

**PWI** *radio/plasma wave/  
electric field*

**MDM** *dust*

**MSASI** *atmosphere (& surface)  
image*

**Internal magnetic field**  
 Structure & Distribution  
 Origin & Internal structure

**Magnetosphere**  
 Structure, Kinetics, Processes  
 Scaling law  
 Effect of “boundary conditions”  
 no-ionosphere, small-scale,  
 fast-process, & different SW

**Atmosphere (Exosphere)**  
 Structure, Variation  
 Production from surface  
 Loss to solar wind &  
 magnetosphere

**Surface/Crust**  
 Present structure & Evolution

**Interplanetary Plasma & Dust**

**Space physics  
at Mercury**

**Environment  
of Mercury**

**History  
of Mercury**

# BepiColombo MMO status (1/3)



- ◆ MMO standalone AIV@ESA/ESTEC is completed in Dec. 2015
- ◆ MMO handover closeout meeting was held on 15 Apr. 2016
- ◆ First battery maintenance check was performed in July 2016
- ◆ MMO-MPO mechanical/electrical interface check (PFM IST) was performed in July 2016
  - Problem found. The problem will be fixed in Sep.
- ◆ N2 gas for instrument purging is supplied continuously.
- ◆ Ground system test for MMO operation is ongoing.
- ◆ One JAXA employee is at ESTEC for baby-sitting MMO.

# BepiColombo MMO status (2/3)



## Coming activities

- ◆ Periodical maintenance (once in approx. 6 months) work for EM battery. Second maintenance work is expected in 4Q 2016.
- ◆ Next ETB IST Friedrichshafen is scheduled in 1Q 2017.
- ◆ MCS PFM AIT is expected to start from 2Q 2017.



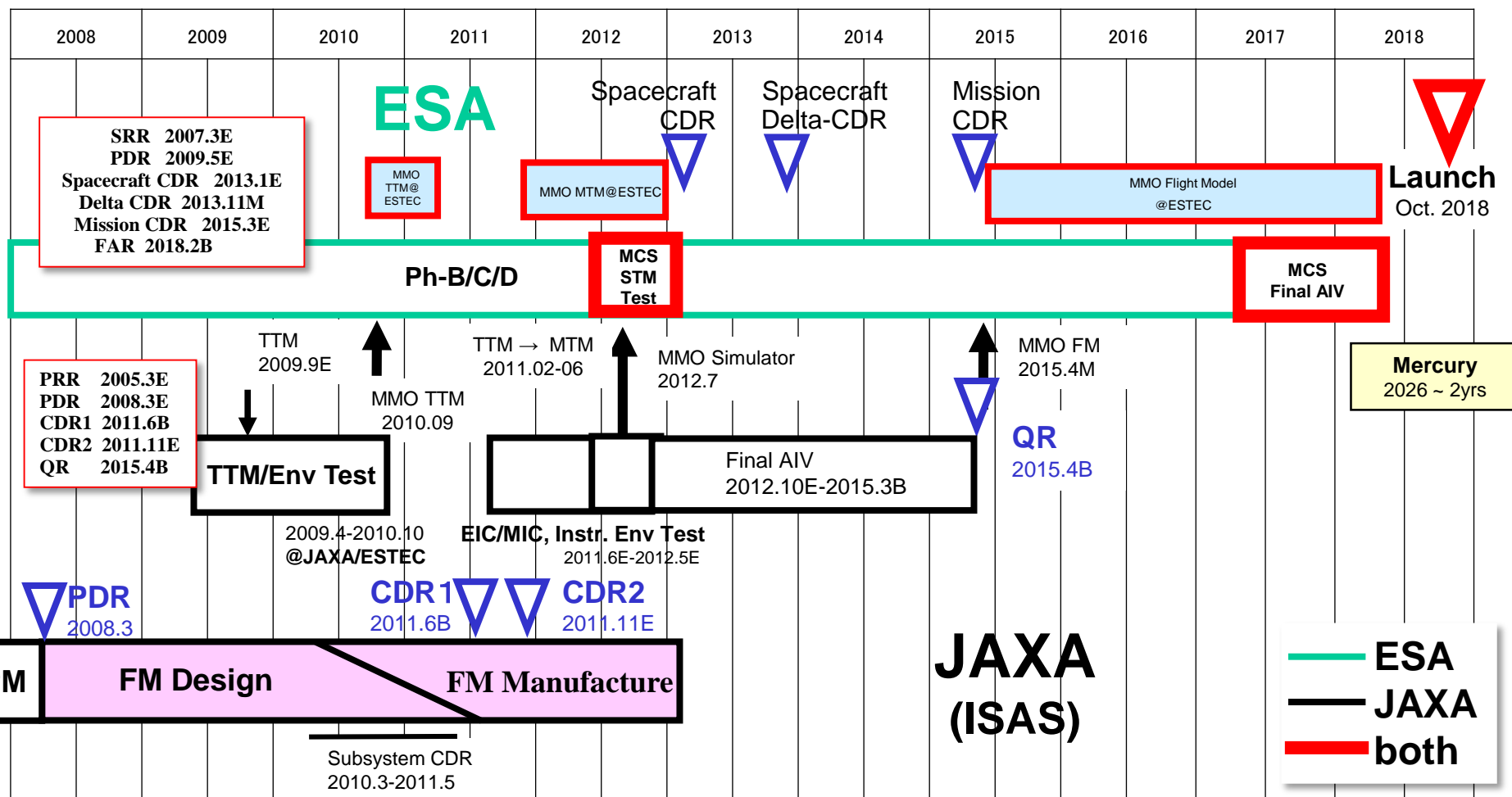
# BepiColombo MMO status (3/3)



## Science related activities

- ◆ Planning for MPO/MMO Near Earth Commissioning operation.
- ◆ Possibility of science observation during cruise. (Feasibility study is ongoing for 1<sup>st</sup> Venus Flyby.)
- ◆ Science observation plan at Mercury.

# BepiColombo MMO Schedule (Jan. 2017)



PRR=Preliminary requirements Rev.  
PDR=Preliminary Definition Rev.  
CDR=Critical Design Rev.  
QR=Qualification Rev.

(Calendar year)





# MMO at ROSETTA Clean Room



# Thank you!

