

M3 Candidate Missions: Outcome of the Technical and Programmatic Reviews

Frédéric Sifa

Future Missions Office (SRE-F)

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Review objectives

- Assess the mission technical feasibility for M3 slot
- Identify/assess critical areas and risks for the requirements, design and development
- Provide recommendations for the next phase, should the mission be selected
- Assess ESA Cost at Completion

Review Implementation

Independent review team for each mission

- Conducted in October-November 2013
- Two panels, technical and cost, chaired by senior staffs, 15-20 people involved per mission

ESA Cost at Completion assessment

Evaluated by the Cost Panel, by involving senior project controllers

Inputs to the evaluation process:

- Detailed industrial cost estimates provided by the industrial contractors,
- Independent estimates and analysis provided by ESA cost division
- Study team inputs
- Development risks assessment made by the Review Technical Panel

M3 Reference Schedule Assumptions



Industrial Phase B1: Jul 14-Nov 15

System Requirements Review: Nov 15-Jan 16

Mission Adoption & IPC approval: Feb-March 2016

Industrial Phase B2 kick-off: Oct 16

Launch: end 2022-2024 (depending on the mission)

Summary of M3 candidates



Mission key features	EChO	LOFT	MARCOPOLO-R	PLATO
Nominal mission profile				
Launch date (earliest)	mid 2023	mid 2023	Dec 2022, back-up 2023	Jan 2024
Launcher & orbit	Soyuz, orbit at Lagrange point L2	Soyuz, LEO equatorial 550 km	Soyuz	Soyuz, orbit at Lagrange point L2
Cruise phase/transfer	< 3 months	< 1 day	~ 1 year	< 3 months
Operations (+extension)	4 (+2) yrs	3 (+2) yrs	1 yr cruise 6 month ops Sample back in Jun 2027	6.25 (+2) yrs
Spacecraft features				
Launch mass (kg)	1500	4200	1700	2100
MS instrum. mass (kg)	120	1100	25	600
Power (kW)	1	3.6	3	1.6
Data volume	35 Gbits/week	7 Gbits/orbit (95 mn)	120 Gbits	109 Gbits/day
Dimensions (m)	Φ 3.6 x 2.6	16 x 7 x 9	2.2 x 1.9 x 1.4	5 x 3 x 3

Summary of Technical and Programmatic reviews: Major Risks



EChO, LOFT, MARCOPOLO-R and PLATO:

- No basic feasibility issue. Numerous recommendations made for the next Phase

STE-QUEST:

No basic issue for the platform, but low technology maturity of the payload:

- TRL 3 for some payload elements, meaning no full demonstration of measurement concept in the lab
- High schedule risk for M3 slot. Success oriented schedule requiring substantial funding in Phase B1
- Funding difficulties noted for several Member States

ESA did not retain STE-QUEST as a valid candidate for M3 slot

Summary of Technical and Programmatic reviews: Other Risks (1/2)



PLATO and LOFT

- Mainly schedule risks resulting from serial production of payload elements. Slippage of ~1 year can occur
- No basic technical feasibility issue in both cases: successful PLATO CCD prototype development, existing technologies for LOFT although requiring to put in place a serial production line

ECHO

- Use of US infrared HgCdTe detectors from Teledyne as baseline, as for Euclid.
- MWIR detector under development by Teledyne for NEOCAM (NASA/JPL candidate mission): not yet fully qualified, but prototypes have been built and performance demonstrated in 2013

Summary of Technical and Programmatic reviews: Other Risks (2/2)



MARCO POLO-R

- No applicable previous experience in Europe: Touch-and-go sampling is also a “première” in Europe, although extensively studied.
- Sampling mechanism to be pre-developed in phase B1 for securing the mission schedule
- Target accessibility: The selected primitive asteroid has allowed to simplify the spacecraft (and reduce costs), but it is best accessible with a launch in end 2022 and end 2023. Launching end 2024 extends the cruise by ~ 2 years. Beyond that point, a change of the asteroid target could be considered.

- ❑ The overall assessment of M3 candidate missions leads to 4 missions that could be selected for M3 launch slot, with moderate/acceptable risks and reasonable schedule margins
- ❑ ESA CaC estimates are comparable for the four missions (within +/- 5% dispersion) and budget issues are not influencing the selection
- ❑ The target CaC The target is exceeded by ~ 10% in the worst case.
 - The Intermediate Cost review achieved early 2013 proved to be very effective for identifying/implementing early descoping options

The End