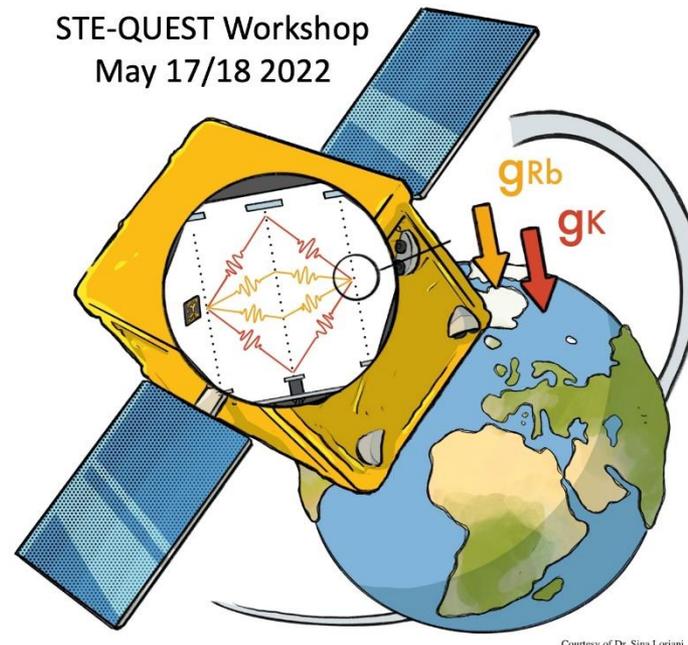


STE-QUEST M7

Feedback on the phase 1 proposal

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- General time-line (from ESA phase-1 briefing)
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The ESA M7 call

Call for an M and an F launch opportunity

13 December 2021



<https://www.cosmos.esa.int/web/call-for-missions-2021>

Call for a Medium-size and a Fast mission opportunity in ESA's Science Programme

Activity	Date
Release of Call for an M and an F mission	13 December 2021
Briefing for proposers	13 January 2022
Phase-1 proposal submission deadline	14 February 2022 – 12:00 (noon) CET
Phase-1 proposal assessment	February-April 2022
Phase-1 proposer notification	Mid-April 2022 (exact date TBD)
Workshops for Phase-2 proposers	End-April 2022 (exact date TBD)
Phase-2 proposal submission deadline	15 July 2022 – 12:00 (noon) CEST
Letters of Endorsement deadline	15 September 2022, 12:00 (noon) CEST
Proposal evaluation and scientific ranking	July – October 2022
Selection of missions for study	November 2022

- STE-QUEST is competing for the medium-size slot (M7)
- We passed the phase-1 screening
- Selection of 1-3 candidates in Nov. 2022
- Downselection to 1 candidate after 3 year phase A study
- Launch around 2037

General time line (post submission)

Reference schedules



For both F & M, selection of candidates by 2022

M-mission schedule

- Start of Phase 0: Q1 2023 (typ. 3 candidates)
- Mission selection: 2026 (end of Phase A)
- Mission adoption: 2029 (end of Phase B1)
- Launch: by ~2037 (mission dependent)

F-mission schedule

- Start of Phase 0: Q1 2023 (typ. Baseline and back-up candidates)
- Mission adoption: Q1 2026 (end of Phase A/B)
- Launch: ~ 2030 (mission dependent)

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→ THE EUROPEAN SPACE AGENCY

<https://www.cosmos.esa.int/documents/7423467/7423486/Briefing+13+Jan+2022+final.pdf/967c1dac-52bb-6ca4-7ab2-2d364cbc5c78?t=1642092849103>

General debriefing

- A 1/10 ratio of remaining candidates for M-missions in phase 2, ~2 will be selected for phase 0/A (3 years), 1 will fly.
- Proposals that are not supported by viable Member state (MS) payload (P/L) support scheme will be screened out. Need to speak to national delegates!
- Management for complex P/L will be done by ESA. But hardware provision remains with MS. In phase 2 there will be missions that do not pass screening because of lacking support from MS.
- Need TRL 5-6 at the end of phase A (3 yrs after selection). ESA can pay for some development. After that only one mission is left, undergoes a B1 phase for 3 years, one industrial contractor is selected after competitive phase with 2 contractors. Always think of fallback scenarios for the case that the phase A does not deliver for critical developments.

STE-QUEST specific debrief

Written comments on science:

- Mature proposal with detailed science case. Clear flow from science objective to mission design.
- Sets out a strong case for the wider value of developing ultra-cold atom technology in space.
- There is not a clear explanation of how ultralight dark matter signatures could be distinguished from modifications of the Equivalence Principle.
- It would have been helpful if the proposers had commented more critically on how their proposed EP sensitivity compares with possible future advances on the ground and in space.

In summary, the mission promises to test the Weak Equivalence Principle with a sensitivity very significantly improved over the best existing measurements. Detection of EP violation would be a ground-breaking discovery. Although the theoretical implications of no detected violation would benefit from further exploration, the three orders of magnitude improvement in precision beyond the best current results would nevertheless be an important step forward.

STE-QUEST specific debrief

Written comments on mission and P/L:

P/L Summary

- dual species atom interferometer (ATI), waves of ultra-cold(41K) Potassium and (87Rb) rubidium atoms
- Raman lasers probing 41K and 87Rb
- no microwave link as in previous STE-QUEST

P/L Maturity

- Significant developments in BEC handling incl micro-gravity by CNES & DLR since SteQUEST
- M3 Phase-A study highlighted low TRL, which has improved in the meantime. LPF demonstrated DFACS
- Heritage from MICROSCOPE was also explicitly and positively noted.

Feasibility

- improved in respect to M3, M4

Responsibilities

Programmatic risks

Feedback to Proposers (Phase1)

- It is recommended that a clear development plan for the payload elements is reported in the proposal showing feasibility to achieve TRL5 by Mission selection

Technical Evaluation Phase 1

probably feasible

STE-QUEST specific debrief

In person:

- STE-QUEST is a “complex single payload” mission.
- Overall responsibility of the payload should lie with ESA
- ESA is prepared to provide overall system engineering and AIVT for the payload (was already partially the case in M4 proposal)
- In the phase-2 proposal a clear development plan needs to be provided to show how the payload will reach TRL 5 by the end of the 3-year phase A.
- Concerning the platform stability (AOCS) any deviations from e.g. MICROSCOPE performance need to be clearly identified, explaining how they will be implemented/developed.
- Need to provide a complete funding scheme for all MS contributions to payload, appropriately backed up by MS funding agencies.

Lessons for phase-2 proposal

- The difficult task ahead is to “separate” main payload (Atom interferometer) into individual parts.
- Overall responsibility of the payload should lie with ESA, as well as SE and AIVT.
- But the subsystems and sub-subsystems, as well as other payload/platform elements (classical accelerometer, GNSS receiver (TBC), AOCS-system, ...) need to be split between the different member states and ESA according to expertise, financial possibilities, involved scientists and industry, ...
- Need to provide a complete funding scheme for all MS contributions appropriately backed up by MS funding agencies, whilst staying within total ESA budget.
- Although the TRL situation is clearly much less critical than in 2014, we still need to provide a clear development plan to reach TRL 5-6 by the end of phase-A (2025/26).