WELCOME.

INTRODUCING...
M4 background and chronology

- **M4 call**  Aug 2014
- **27 proposals received** Jan 2015
- **ARIEL, THOR & XIPE selected** Jun 2015
- **ARIEL selection by SPC** Mar 2018

**Phase A**
- 2014
- 2015
- 2016
- 2017
- 2018
- 2019
- 2020

**Phase B1 (on-going)**

- **ARIEL CDF S/C design**
- **ARIEL S/C design at the end of phase A (Courtesy TAS & ADS) as found in the ARIEL Yellow Book**
ARIEL S/C overview

ARIEL S/C design at the end of B1, with Consortium PLM and dummy SVM (competitive studies on-going)
ARIEL in rough numbers

Spacecraft wet mass: 1335 kg allocation
- Includes 453 kg for the payload

Power budget: ≤1 kW
- Includes ≤190 W for the payload

Payload data budget: 236 Gbits/week

Pointing requirements: see table
- All @ 99.7% confidence level
- “Across LoS” refers to the error around any axis normal to the LoS (i.e. 2D cone radius)
ARIEL design approach

Engineering budgets are limited, following a design to cost approach with respect to the M4 programmatic constraints, with measures such as:

- Pointing stability requirements to enable an AOCS system based on reaction wheels only (no other fine pointing actuator)
- Modest data budget to enable a communications system based on X-band only, with minimal ground contact time (15 hrs/week split in only 3 contacts, no week ends)
- Mass limitation despite A62 high performance (dual launch with Comet-I)
- Power limitation for body mounted Solar cells only
- Lifetime limited to 4 yrs (6 yrs goal)

Albeit aiming for transformative, ground breaking science.
Mission analysis

- A62 launch with a direct transfer to Sun-Earth L2, in a dual launch configuration with Comet-I in the top position and ARIEL below.
- Eclipse-free (Earth and Moon) high-amplitude L2 orbit throughout the entire lifetime to ensure thermal and power stability.
- 4 years lifetime (6 years goal).
- ≥ 85% observation efficiency.
- De-orbiting manoeuvre at EoL to ensure low probability of Earth return, and minimum casualty risk on ground, complying with space debris regulations.
Technology developments activities

- No technology developments required at SVM level.
- All technology development activities concern the payload complement:
  - Aluminium cryogenic telescope with Silver coating
  - Ne JT cooler
  - Cryogenic M2 re-focussing mechanism
  - Detection chain (detectors and electronics)
  - And a few smaller items (e.g. dichroics, calibration unit etc.)
- These are currently on-going, with many tests happening now, with the aim to reach a Technology Readiness Level (TRL) of 6 for adoption.

See further details in the payload presentation(s).
Short/medium term plan (2020)

The main objective of the MAR is to support the adoption process and the initiation of the subsequent development phase. With (a few) extra details:

- Requirements completeness, adequacy and flow-down
- Clear and adequate I/Fs between all mission elements
- Feasibility of the baseline design, and adequacy of PA approach
- Adequacy of the development plan, risk assessment, and schedule
- Readiness of technology developments to support adoption
Development schedule (anticipated)

- Main milestones:

- Detailed schedule will include reviews for all elements (mission, S/C, payload, subsystems, ground segment). Payload reviews indicated here as an example:

<table>
<thead>
<tr>
<th>Milestone</th>
<th>Schedule</th>
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<tbody>
<tr>
<td>MAR</td>
<td>Q2 2020</td>
</tr>
<tr>
<td>Phase B2/C/D Kick-Off</td>
<td>Q3 2021</td>
</tr>
<tr>
<td>System PDR</td>
<td>Q4 2022</td>
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<tr>
<td>System SM Mechanical Test Campaign</td>
<td>Q3 2023</td>
</tr>
<tr>
<td>System CDR</td>
<td>Q1 2025</td>
</tr>
<tr>
<td>FAR</td>
<td>Q2 2027</td>
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<tr>
<td>Launch (L)</td>
<td>2028</td>
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<tr>
<td>LEOP</td>
<td>L + few hours</td>
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<tr>
<td>Start of Satellite and Payload Commissioning</td>
<td>L + few days</td>
</tr>
<tr>
<td>Start of nominal in-orbit science operation Phase</td>
<td>L + &lt; 6 months</td>
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<tr>
<td>End of nominal in-orbit operation Phase</td>
<td>L + 4 years</td>
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<table>
<thead>
<tr>
<th>Review</th>
<th>Schedule</th>
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<tbody>
<tr>
<td>Payload development and consolidation Review (pDCR)</td>
<td>Q2 2019</td>
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<tr>
<td>Payload System Requirement Review (pSRR)</td>
<td>Q2 2020</td>
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<tr>
<td>Payload Preliminary Design Review (pPDR)</td>
<td>Q2 2022</td>
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<tr>
<td>Payload Critical Design Review (pCDR)</td>
<td>Q4 2024</td>
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<tr>
<td>Payload Qualification and Acceptance Review (pQAR)</td>
<td>Q4 2026</td>
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<tr>
<td>Payload Flight Acceptance Review (pFAR)</td>
<td>TBD</td>
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Mission organisation & responsibilities

ARIEL mission

Space segment
- SVM
  - SVM subsystems & equipment
  - Warm payload units
  - Warm payload harness
- PLM

Launcher

Ground segment
- MOC
  - Ground stations network
- SGS
- SOC
- IOSDC

Payload Consortium

ESA