

# **ESA Outer Planet Plans in 2009-2010**

**Christian Erd**

**Advanced Studies and Technology Preparations**

# Outline

- ❑ **Introduction: summary of JGO**
  
- ❑ **ESA Cosmic Vision Implementation**
  - System and Instrument studies
  - Downselections
  
- ❑ **Instrument preparatory activities**
  
- ❑ **Schedule**

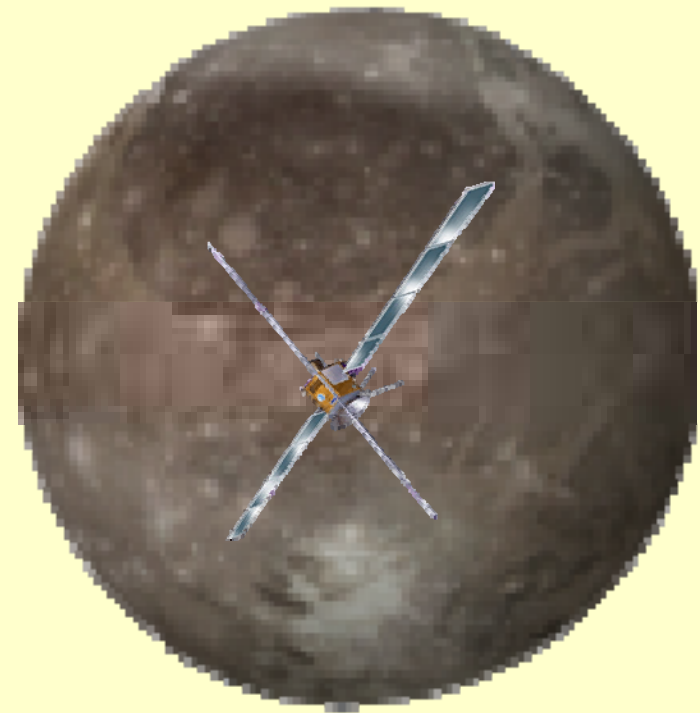
## JGO Summary: Spacecraft



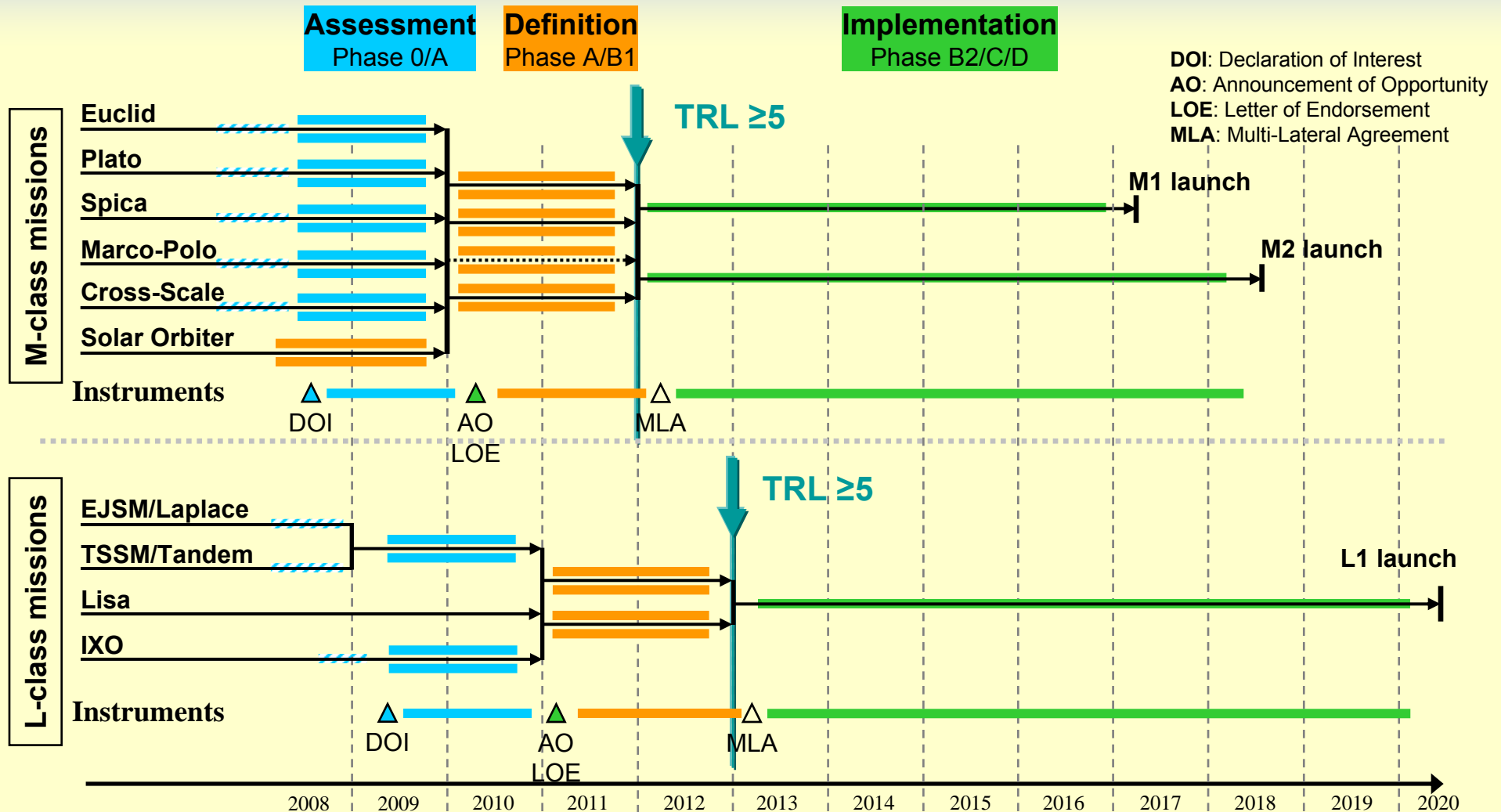
- ❑ **Mass:**
  - 1275 kg dry mass (incl margins, excl adapter)
  - 3493 kg wet mass incl adapter: 3493 kg
  - max launch mass is 4362 kg
  - A higher launch margin (more than 20% system margin) is beneficial in such an early study phase
- ❑ **Planning payload: 87 kg**
  - 73 kg excl margin, booms, shielding, mechanisms
- ❑ **Power: SA size: ~51 m<sup>2</sup>; mass: ~320 kg (incl margins, electronics, battery), LILT cells**
- ❑ **Comms: 40–66 kbps, 2.8-m HGA, X-band up- and downlink for TC/TM and science data downlink; Ka-band downlink for radio science experiment; mainly Cebreros ground station; assumed comm windows 8 h per day (@ Ganymede)**
- ❑ **Radiation:**
  - TID for whole mission and after 260 days in Ganymede orbit ~85 krad (= upper limit)
  - improved Ganymede radiation model [moon shielding,...], composite shielding material,... should reduce TID)

# JGO Summary: Tour

- ❑ **Launch:** 11 Mar 2020 (Ariane 5 ECA)
- ❑ **VEEGA** (1 Jul 2020, 27 Apr 2021, 28 Jul 2023)
- ❑ **5.9 years transfer time; 1 Ganymede GA**
- ❑ **JOI:** 4 Feb 2026; 13×245 Rj orbit; 5 Ganymede GA
- ❑ **Move to Callisto**
  - Science Phase 383 d
  - 1:1 and 2:3 resonant orbit
  - 19 low-altitude flybys (200 km)
- ❑ **Move to Ganymede with GOI**
  - Elliptical phase  $\leq 80$  d; 200×6000 km
  - Circular phase  $\leq 180$  d; 200 km
- ❑ **End of nominal mission: 6 Feb 2029**
  - Uncontrolled impact on to Ganymede's surface
- ❑ **Total Delta-V ~ 3000 m/s**



# Cosmic Vision 2015-2025 Implementation



## Share of Responsibilities of ESA Missions

### □ ESA

- All system level activities
- Study and procurement of spacecraft with industry
- Mission analysis
- Launcher procurement
- Management of interface between instruments and spacecraft

### □ Instruments

- Provided by science teams/labs
- Nationally funded developments:
  - of all hardware models
  - of all necessary technology preparations

# Instrument Development

- ❑ **Provision of instruments is national funded**
  
- ❑ **Consequences of SPRT/SPC recommendations on Payload development**
  - All instrument related technology preparation must be nationally funded through national funding agencies
  - Science Payload Phase A/B1 completed before entering the implementation phase
  - Move Payload selection AO at the beginning of the Definition Phase
  - Perform Instrument assessment studies before entering the Definition Phase
    - Purpose is to better prepare the AO of FM instruments
  
- ❑ **Activities on instruments are in parallel with industrial activity on system level**

## Objectives of Instrument Assessment Studies

- Achieve a level of technical definition of the science instruments consistent with the level of the other elements of the mission concept
- Enable a sound development risk assessment – including Technology Readiness Level (TRL) evaluation – as input to the mission down-selection at the end of the Assessment Phase
- Identify and initiate technology development as needed
- Establish a Rough Order of Magnitude (ROM) cost evaluation of the instrument
- Prepare the proposal for the instrument selection process (Announcement of Opportunity and selection) at the beginning of the Definition Phase
- Provide a preliminary assessment of the Member State interest in science instrumentation for the proposed mission
- Identify critical elements, key interfaces and resources needed from the spacecraft in support of the proposed instrument

## Call for Declaration of Interest (DOI)

- Proposal should address**
  - Technical definition of the item proposed for study
  - Interfaces with the spacecraft
  - Development plan, including model philosophy, verification approach, procurement scheme and schedule,
  - Definition of technology development activities and pre-developments if any, to be implemented before the Mission Implementation Phase.
  - Technology readiness analysis
  - Schedule risk analysis and identification of critical paths
- Activity must be nationally funded (no exchange of funds with ESA)**
- Lead PI's must be European, international participation possible**
- Call is requesting proposals for both JGO and JEO**
- A DOI is not a necessary pre-requisite for the instrument AO**

## DOI's: Next Steps

- ❑ **Review by ESA – will comment on**
  - Relevance of proposed activity for the mission (Sci-RD)
  - Adequacy of management and funding
  - Identified technology developments
- ❑ **Proposals will be passed to national delegates for decision**
- ❑ **A coordinated technology development plan will be defined in collaboration with instrument teams, national delegates and ESA**

# Preliminary Schedule

## Instrument Studies

<b>&lt; end March 2009</b>	<b>Call for studies DOI (open for 5 – 6 weeks)</b>
<b>End April 2009</b>	<b>DOI's due</b>
<b>Beg May 2009</b>	<b>Review of DOI's &amp; submission to national delegates</b>
<b>2<sup>nd</sup> half May 2009</b>	<b>Workshop with national delegates for technology development plan</b>
<b>Q2/3 2009 (TBC)</b>	<b>Joint ESA-NASA Instrument Workshop</b>
<b>September 2009</b>	<b>KO of instrument assessment studies (1 year)</b>

## Spacecraft Study

<b>End April 2009</b>	<b>ITT for industrial studies (6 weeks tender period)</b>
<b>July 2009</b>	<b>KO of 2 competitive industry studies (1 year)</b>
<b>July 2010</b>	<b>End of industry studies</b>
<b>2<sup>nd</sup> half 2010</b>	<b>Down-selection process (3 to 2)</b>

