



JUICE (Jupiter Icy Moon Explorer): A European mission to explore the emergence of habitable worlds around gas giants

Olivier Witasse¹ and the JUICE teams*

¹European Space Agency, Noordwijk, Netherlands (owitasse@cosmos.esa.int)

*A full list of authors appears at the end of the abstract

JUICE - JUpiter ICy moons Explorer - is the first large mission in the ESA Cosmic Vision 2015-2025 programme. The mission was selected in May 2012, and is currently in full integration and testing phase. Due to launch in June 2022 and to arrive at Jupiter in October 2029, it will spend at least three ½ years making detailed observations of Jupiter and three of its largest moons, Ganymede, Callisto and Europa. The status of the project and the main milestones for 2021 are presented.

The focus of JUICE is to characterise the conditions that might have led to the emergence of habitable environments among the Jovian icy satellites, with special emphasis on the three worlds, Ganymede, Europa, and Callisto, likely hosting internal oceans. Ganymede, the largest moon in the Solar System, is identified as a high-priority target because it provides a unique and natural laboratory for analysis of the nature, evolution and potential habitability of icy worlds and waterworlds in general, but also because of the role it plays within the system of Galilean satellites, and its special magnetic and plasma interactions with the surrounding Jovian environment.

JUICE will also perform a multidisciplinary investigation of the Jupiter system as an archetype for gas giants. The Jovian atmosphere will be studied from the cloud top to the thermosphere. Concerning Jupiter's magnetosphere, investigations of the three dimensional properties of the magnetodisc and of the coupling processes within the magnetosphere, ionosphere and thermosphere will be carried out. JUICE will study the moons' interactions with the magnetosphere, gravitational coupling and long-term tidal evolution of the Galilean satellites.

The JUICE payload consists of 10 state-of-the-art instruments plus one experiment that uses the spacecraft telecommunication system with ground-based instruments. A remote sensing package includes imaging (JANUS) and spectral-imaging capabilities from the ultraviolet to the sub-millimetre wavelengths (MAJIS, UVS, SWI). A geophysical package consists of a laser altimeter (GALA) and a radar sounder (RIME) for exploring the surface and subsurface of the moons, and a radio science experiment (3GM) to probe the atmospheres of Jupiter and its satellites and to perform measurements of the gravity fields. An in situ package comprises a powerful suite to study plasma and neutral gas environments (PEP) with remote sensing capabilities of energetic neutrals, a magnetometer (J-MAG) and a radio and plasma wave instrument (RPWI), including electric fields sensors and a Langmuir probe. An experiment (PRIDE) using ground-based Very

Long Baseline Interferometry (VLBI) will support precise determination of the spacecraft state vector with the focus at improving the ephemeris of the Jovian system.

The key milestones in 2021 are:

- - Implementation reviews of the ground segment and of the science ground segment
- - Integration of the remaining instruments
- - Spacecraft flight model environmental acceptance test campaign: thermal, EMC, mechanical
- - Spacecraft flight model end-to-end communication tests with ESOC
- - Start of the mission qualification acceptance review

JUICE teams: Science Working Team, JUICE Project (ESTEC, ESOC, ESAC), Industrial Consortium