



The ESA JUICE mission: the Science and the Science Operations

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JUICE - JUPiter ICy moons Explorer - is the first large mission in the ESA Cosmic Vision 2015-2025 programme [1]. The mission was selected in May 2012 and adopted in November 2014. The implementation phase started in July 2015, following the selection of the prime industrial contractor, Airbus Defense and Space (Toulouse, France). Due to launch in May 2022 and arrival at Jupiter in October 2029, it will spend almost three years making detailed observations of the Jovian system, with a special focus on the planet itself, its giant magnetosphere, and the three icy moons: Ganymede, Callisto and Europa. In August 2032, JUICE will then orbit Ganymede for at least ten months.

The first goal of JUICE is to characterize the conditions that might have led to the emergence of habitable environments among the Jovian satellites, with special emphasis on the three giant icy worlds, likely hosting internal oceans [2].

The second goal is to explore the Jupiter system as an archetype of gas giants. Focused studies of Jupiter's atmosphere and magnetosphere, and their interaction with the Galilean satellites will further enhance our understanding of the evolution and dynamics of the Jovian system.

The JUICE payload consists of 10 state-of-the-art instruments plus one experiment that uses the spacecraft telecommunication system with ground-based instruments. This payload is capable of addressing all of the mission's science goals [1,2]. 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 via 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 current baseline assumes a launch in May 2022. Following an interplanetary cruise of 7.6 years, the Jupiter orbit insertion will take place in October 2029. The Jupiter tour will consist of ~50 orbits around the giant planet, and will include two flybys of Europa at 400 km altitude, eleven flybys of Ganymede, and thirteen flybys of Callisto, as close as 200 km altitude. The last part of the mission will be the orbital phase around Ganymede, for about 10 months, where the spacecraft will be placed into a series of elliptical and circular orbits, the latest one at 500 km altitude. The end of mission is currently planned as an impact on Ganymede in June 2033.

The ESA Science Operation Centre (SOC) is in charge of implementing the science operations of the JUICE mission. The SOC aims at supporting the Science Working Team (SWT) and the Science Working Groups (WGs) performing studies of science operation feasibility and coverage analysis during the mission development phase until launch, high level science planning during the cruise phase, and routine consolidation of instrument pointing and commanding timeline during the nominal science phase.

This presentation will provide the latest information on the status of the project, and on the designed spacecraft trajectory in the Jovian system. It will focus on the science operational scenario of the two Europa flybys of the mission, and on the overall science return.

References:

- [1] JUICE Definition Study Report, Reference ESA/SRE(2014)1,2014. <http://sci.esa.int/juice/54994-juice-definition-study-report/>
- [2] Grasset, O., et al., JUUpiter ICy moons Explorer (JUICE): An ESA mission to orbit Ganymede and to characterise the Jupiter system, Planetary and Space Science, Volume 78, p. 1-21, 2013