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Trojans' Odyssey: Unveiling the early history of Solar System

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The Trojans' Odyssey mission proposed by a team of European scientists with a strong participation of American scientists will be the first exploration mission to two largely unknown populations of the Solar System, the Jupiter Trojans and the Hilda asteroids. The prospects for major discoveries are very high as it has always been the case in all previous discovery missions: we are likely to see worlds that we do not expect or cannot predict in advance.
Jupiter Trojans and Hilda asteroids are small primitive bodies located beyond the 'snow line', around respectively the L4 and L5 Lagrange points of Jupiter at 5.2 AU (Trojans) and in the 2:3 mean-motion resonance with Jupiter near 3.9 AU (Hildas). Their total number is believed to be comparable or even exceed that of the Main Belt asteroids. Their origin – still unknown – remains a major challenge to present theories of the formation of the Solar System. There are two current scenarios, each one having distinct implications for the origin and early dynamical evolution of the Solar System. The first model proposes that the Trojans and a large fraction of the Hildas originally formed where they are seen today. An alternative model suggests that a large fraction of both the Trojans and the Hildas has formed in more distant regions - typically in the primordial trans-neptunian disk, which is also the precursor of the Kuiper belt - and subsequently chaotically migrated towards the inner Solar System during the time when all four giant planets migrated, before being trapped at their current location. The overarching science goal of the proposed Trojans' Odyssey mission to explore the Jupiter Trojans and Hilda asteroids ultimately aims at casting some light on these aspects of the early history of the Solar System.
The exploration of the Trojan and Hilda asteroids and their diversity and the reconnaissance aspect of the mission will be best achieved by visiting typically five Trojans and one Hilda. The proposed strategy consists in a direct trajectory to one of the Trojan swarm. Initial gravity assists from Venus and Earth will help reducing the cruise to 7 years. During the cruise phase, a Main Belt Asteroid could be targeted if requiring a modest Delta-V. Total mission duration of typically 9 years is anticipated.
The specific science objectives mission will be achieved with a payload that will perform high-resolution panchromatic and multispectral imaging, thermal-infrared imaging/radiometry, near- and mid-infrared spectroscopy, and radio science/mass determination.
The spacecraft is in the class of Mars-Express or a down-scaled version of the Jupiter Ganymede Orbiter. The mission operations concept (ground segment) and science operations are typical of a planetary mission as successfully implemented by ESA during, for instance, the recent flybys of Main Belt asteroids Steins and Lutetia. Because it relies on important heritage for both the spacecraft and the instruments, the proposed Trojans' Odyssey mission does not require any significant technology development and does not present any significant risks. It therefore remains within the available technical and financial resources of an ESA M class mission.
This proposal is supported by a team of 96 scientists that includes prominent, world-class experts of primitive solar system bodies and of space instrumentation.