Science of the Jupiter Europa Orbiter, Part of the Joint NASA-ESA Europa Jupiter System Mission (EJSM)

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Jupiter's diverse Galilean satellites—three of which are believed to harbor internal oceans—are the key to understanding the habitability of icy worlds. To this end, the Europa Jupiter System Mission (EJSM), an international joint mission under study by NASA and ESA, has the overarching theme to investigate *the emergence of habitable worlds around gas giants*. The reference mission architecture consists of the NASA-led Jupiter Europa Orbiter (JEO) and the ESA-led Jupiter Ganymede Orbiter (JGO). JEO and JGO will execute a coordinated exploration of the Jupiter System before settling into orbit around Europa and Ganymede, respectively. JEO and JGO carry sets of complementary instruments, to monitor dynamic phenomena (such as Io's volcanoes and Jupiter's atmosphere), map the Jovian magnetosphere and its interactions with the Galilean satellites, and characterize water oceans beneath the ice shells of Europa and Ganymede.

Encompassed within the overall mission theme are two science goals, (1) Determine whether the Jupiter System harbors habitable worlds and (2) Characterize the processes within the Jupiter System. Both spacecraft launch separately in 2020 and use a Venus-Earth-Earth Gravity Assist (VEEGA) trajectory to reach Jupiter in 2026. After orbit insertion, each would perform a multi-year tour of the Jovian system. The tours would include i) multiple flybys of Io, Europa, Ganymede, and Callisto, ii) continuous magnetospheric monitoring, and iii) regular monitoring of Io and Jupiter's atmosphere and Jupiter's ring system. JEO's Europa orbital phase would start on a circular 200 km altitude around Europa at 90°-100° inclination for about one month before transferring to a 100 km orbit. JEO would investigate the potential habitability of the active ocean-bearing moon Europa, detailing the geophysical, compositional, geological and external processes that affect this icy world. JEO would eventually impact Europa, bringing the joint mission to a close.

Operation of two spacecraft in the Jupiter system provides the unparalleled opportunity to address the high-priority questions posed by the NASA Decadal Survey and ESA

Cosmic Vision for exploration of the outer solar system. The EJSM mission concept represents a conservative and robust design approach to successfully answering these high-priority questions and making a major step forward in understanding the emergence of habitable worlds around gas giants.