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The Europa Jupiter System Mission: Opportunities for Synergistic JEO and JGO Jovian Tour Science

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The Europa Jupiter System Mission (EJSM), a joint mission currently under study by NASA and ESA would consist of two flight elements, the NASA-led Jupiter Europa Orbiter (JEO) and the ESA-led Jupiter Ganymede Orbiter (JGO). Three overarching science goals form the basis for the mission: (1) Explore Europa to investigate its habitability (JEO-focus); (2) Characterize Ganymede as a planetary object including its potential habitability (JGO-focus) and (3) Explore the Jupiter system as an archetype for gas giants (both JEO and JGO). The last goal would be addressed primarily during the tour phase of the mission that would last upwards of 2.5-years. During this period, each spacecraft would perform multiple Galilean satellite fly-bys and make measurements of Jupiter, the Jupiter system and the magnetospheric environment.

As currently envisioned, the EJSM Jupiter tour would provide numerous opportunities to perform coordinated Jupiter system science, including fields and particles/magnetometer observations; Jupiter atmosphere monitoring; Io monitoring; spacecraft-to-spacecraft radio occultations of various targets; Galilean satellite flybys; and distant observations of the Galilean moons, small moons, and rings. Within the objective of understanding the Jovian environment, fields and particles/magnetometer measurements could be carried out nearly continuously, providing unique multipoint measurements of the time-dependent three-dimensional structure of the magnetosphere. In terms of understanding the structure and dynamics of the Jupiter atmosphere, it would be possible to perform coordinated, long-duration (20+ hours), observations over regular periods throughout the tour to monitor weather and assess the behavior of individual storm systems. In a similar manner, regular monitoring of volcanic activity at Io would make it possible to determine the variability in levels of volcanic activity, characterize plume structure, and aid in constraining heat flow and transport. Unique spacecraft-to-spacecraft radio occultation experiments would provide a technique for studying Jupiter's atmosphere and tenuous rings. Imaging of the Galilean satellites, with emphasis on Callisto (JGO) and Io (JEO) during multiple fly-bys would complete and augment (through different viewing geometries and capabilities) surveys begun by the Voyager and Galileo spacecraft.

The operation of two spacecraft in the Jupiter system would provide the opportunity to address high-priority science formulated by the NASA Decadal Survey and the ESA Cosmic Vision for outer planets exploration. Science achieved during the Jovian tour would provide a context and a comparative planetological basis for the investigations that would take place when JEO and JGO are in orbit around Europa and Ganymede respectively. Taken in its entirety, the EJSM mission concept provides a powerful approach to understanding the emergence of habitable worlds around gas giants.