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Orbiter, Flyby and Lander Mission Concepts for Investigating Europa's Habitability

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Introduction: Assessment of Europa's habitability requires understanding whether the satellite possesses the three "ingredients" for life: water, chemistry, and energy. The National Research Council's Planetary Decadal Survey [1] placed an extremely high priority on Europa science but noted that the budget profile for the Jupiter Europa Orbiter (JEO) mission concept [2] is incompatible with NASA's projected planetary science budget. Thus, in April 2011, NASA enlisted a small Europa Science Definition Team (ESDT) to consider Europa mission options that might be more feasible over the next decade from a programmatic perspective.

The ESDT has studied three Europa mission concepts: a Europa orbiter, a Europa multiple-flyby mission, and a Europa lander. These share an overarching goal: Explore Europa to investigate its habitability. Each of the three mission options would address this goal in different and complementary ways, and each has high science value of its own, independent of the others. Each mission concept traces geophysical, compositional, and/or geological investigations that are best addressed by that specific platform. Investigations best addressed through near-continuous global data sets that are obtained under relatively uniform conditions could be undertaken by the orbiter; investigations that are more focused on characterization of local regions could be accomplished by a spacecraft making multiple flybys from Jupiter orbit; and measurements that are most effective from the surface could be addressed by a lander. Although there is overlap in the science objectives of these three mission concepts, each stands alone as a viable Europa mission concept.

References: [1] Space Studies Board, 2011. Vision and Voyages for Planetary Science in the Decade 2013–2022. The National Academies Press, Washington, DC. [2] Greeley, R., et al., 2010. Joint Jupiter Science Definition Team Report to NASA. JPL D-67959.