

Robotic Exploration of Icy Moons for the Search of Extraterrestrial Life

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Abstract: Many moons in the outer solar systems are known to have a subsurface ocean under the ice shell, which may harbor extraterrestrial life. The exploration of such “ocean worlds” would be a focus of NASA’s scientific Solar System exploration in the coming decades. In particular, Enceladus, a small icy moon of Saturn, is of substantial interest because Cassini found active geysers that eject high-speed water jets, which are believed to be originated from the subsurface ocean. This provides a unique opportunity for robotic probes to directly sample the ocean water and potentially explore the ocean itself by descending into the geyser. To enable such a bold mission, NASA’s Jet Propulsion Laboratory (JPL) is currently developing a snake robot called EELS (Exobiology Extant Life Surveyor), which can slither on the surface covered with unconsolidated materials, dive into a vertical hole, and deliver science instruments. This talk, intended for both science and engineering audiences, will give an overview of the scientific implications of the ocean world explorations as well as JPL’s robotic capabilities for enabling the search for life on icy moons, with a particular focus on EELS.

Bio 1 : Morgan L. Cable is the Ocean Worlds Program Area Scientist for the Planetary Mission Formulation Office at JPL, and Co-DPI of the PIXL Instrument aboard the M2020 (Perseverance) rover. She has worked on the Cassini Mission, is a Co-Investigator of the Dragonfly mission to Titan, and is serving multiple roles on the Europa Clipper mission. She previously served as supervisor of the Astrobiology and Ocean Worlds Group. Morgan’s research focuses on organic and biomarker detection, through both in situ and remote sensing techniques. She has designed receptor sites for the detection of bacterial spores, the toughest form of life, and developed novel protocols to analyze organic molecules using small, portable microfluidic sensors.

Bio 2: Hiro Ono is a Group Leader of the Robotic Surface Mobility Group (347F). As a member of the Mars 2020 Rover (M2020) Mission, he is supporting the tactical mobility operation. Previously, he developed M2020’s autonomous driving algorithm and also led the landing site traversability analysis. He is also the PI of the JNEXT EELS project. His research interest is centered around the application of robotic autonomy to space exploration, with an emphasis on machine learning applications to perception, data interpretation, and decision making. Before joining JPL in 2013, he was an assistant professor at Keio University in Japan. He graduated from MIT with PhD in Aeronautics and Astronautics in 2012. Father of a 6-year-old princess. Go Red Sox and Hanshin Tigers.



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