

**Ocean Biomolecule Explorer for Astrobiology.** H.D. Smith<sup>1</sup>, A. G. Duncan<sup>2</sup>, C.R. Lloyd<sup>2</sup>, L. Merrill<sup>2</sup>, and J. Li<sup>3</sup>.  
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**Introduction:** The Ocean Biomolecule Explorer for Astrobiology is a life detection instrument suite designed towards an Ocean Worlds surface mission. The instrument suite relies on the modification of commercial off-the-shelf (COTS) instruments combined with newly developed biochemical analysis methods to paint a picture of the biological realm on Europa's Ocean World. This search for extant life relies on our understanding and assumptions of Europa, Enceladus, and Titan within the context of Earth's biochemistry and known metabolic process. To gain an initial picture of Europa life, if present, the instrument suite is designed to detect a range of targets associated with life on Earth including basic biomolecules as well as the yield from complex metabolic process. The instrument suite will both detect the presence of extant life and provide insight into evolutionary process on the Ocean World.

The Instrument Suite utilizes fluorescence, spectroscopy and colorimetric enzyme assays to determine the habitability potential in liquid samples. Combined with a nanotubes detection system to assess the environment in the gas phase. The Goal of the instrument is:

1. **Determine the chemistry of the Ocean.** – determine constituents within the brine. i.e. Salts, oxidants, CHNOPS to assess for habitability. Retego Labs Advanced Spectrometer and New Nose instrument.
2. **Detect Amino Acids and determine chirality (enantiomer)** – detect amino acids if present
3. **Detect Biomarkers** - Determine presence of biomolecules that are ubiquitous and unique indicating life and metabolic activity. For example nucleic acids (ubiquitous), and F420 (unique to methanogens), S reducers, etc.. Photosynthesis, chemosynthesis, Krebs cycle byproducts metabolism.

The engineering design of the instrument suite will be designed to fit within a portion of the resource allocation of the current best estimates of the Europa lander payload (26.6 Kg, 24,900 cm<sup>3</sup>, 2,500 W-hrs and 2700 Mbits). The instrument package prototype proposed here will aim to achieve the following engineering parameters: 5 kg mass, 50cm<sup>3</sup>, 5 watts, and 4Mbits

for suitability to propose as a Europa Lander payload instrument. The instrument package will be designed to ensure planetary protection is maintained and will function under the current Europa lander mission operations scenario of a two-year cruise phase, and 30-day surface operational phase on Europa.