Prioritized Technology: Instruments to Identify Life Processes on Ocean Worlds

Technical Goal

Detect enclosed vesicles that contain a chemical environment that differs from the macro-environment
Detect the replication of information carrying molecules
Detect the catalytic action carried out at the direction of information carrying molecules
Test for metabolic uptake of tracer molecules from a putative cell's surroundings.
Detect metabolic products generated by living organisms.
Detect Indicators of Extant Life: Metabolism; Motility; Chemical Disequilibrium; Biological Catalysis; Reproduction

Technical Status/SOA

Metabolism and Reproduction
Viking labeled release experiment; Viking gas exchange experiment; Viking pyrolysis release experiment
Built and flown but not operated: two microscope-IR spectrometers, Rosetta Philae CIVA-M/V (Bibring et al., 2007ab) and Phobos-Grunt Videospectrometer (Korbalev et al., 2010).
Population Enumeration via Diffuse Light Scattering
Colorimeter for assay of microbe metabolic activity.
CubeSats (O/OREOS, PharmaSat, EcAMSat, PowerCell, BioSentinel)
Motility
Holographic Microscopy & Bright Field Microscopy;

Mission Applications

- Identification of structures within microenvironment distinctly different from the macro-environment would be a strong indicator of semipermeable membranes, probably a requirement for life.
- Identification of replicating, information carrying molecules would be a strong indicator of life.
- Identification of catalytic activity carried out at the direction of information carrying molecules would be a strong indicator of life.