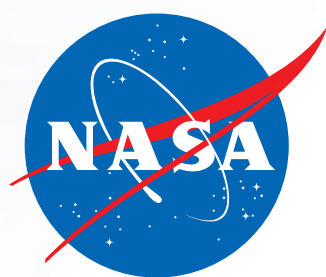


Robotic Concepts for Surface and Subsurface Exploration of Ocean Worlds



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Objectives

- Develop autonomous mobility and sensing systems to explore on the surface and subsurface conditions found on ocean worlds
- Design, prototype and demonstrate robotics systems and demonstrate them in laboratory testbeds and at relevant field sites

Proposed Science Goals

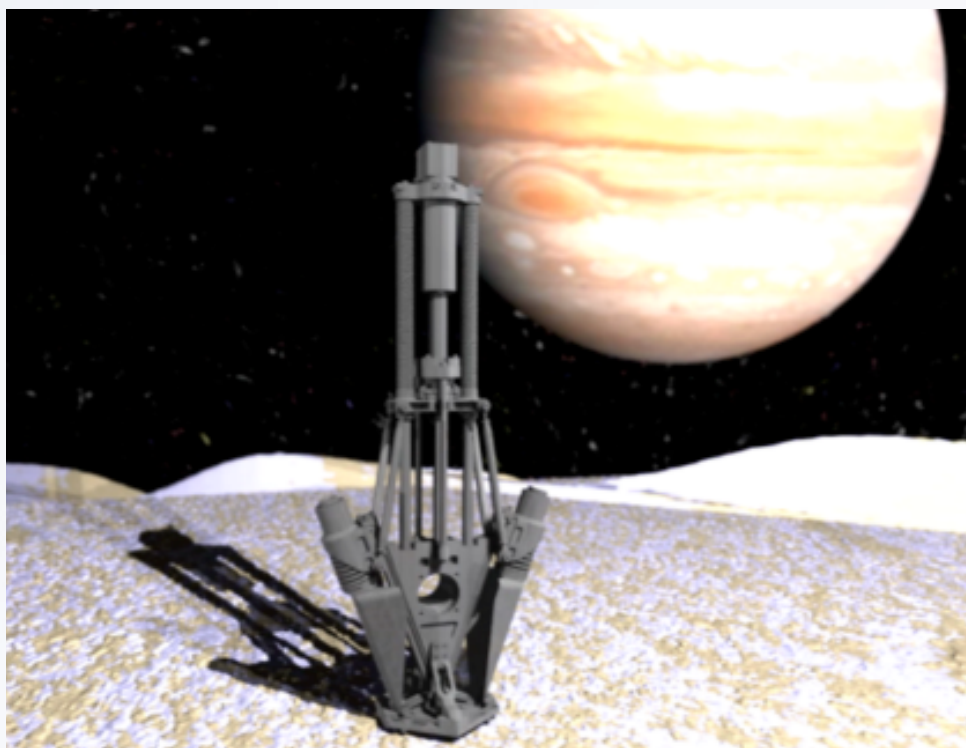
- Characterize ocean habitability
- Detect extant life
- Understand geology
- Determine origins

Notional Mission Scenarios

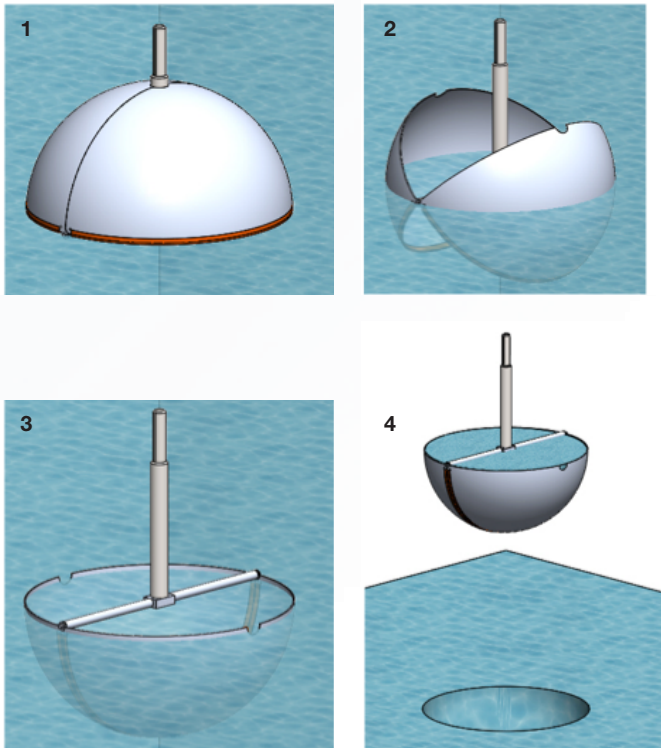
- Lander proximity science — 1-10 m range
- Long-range mobility — up to 10 km range
- Subsurface exploration — penetration to 1 km below surface

Sampling Concepts

Collect samples up to 10 cm below surface from a lander or mobility system



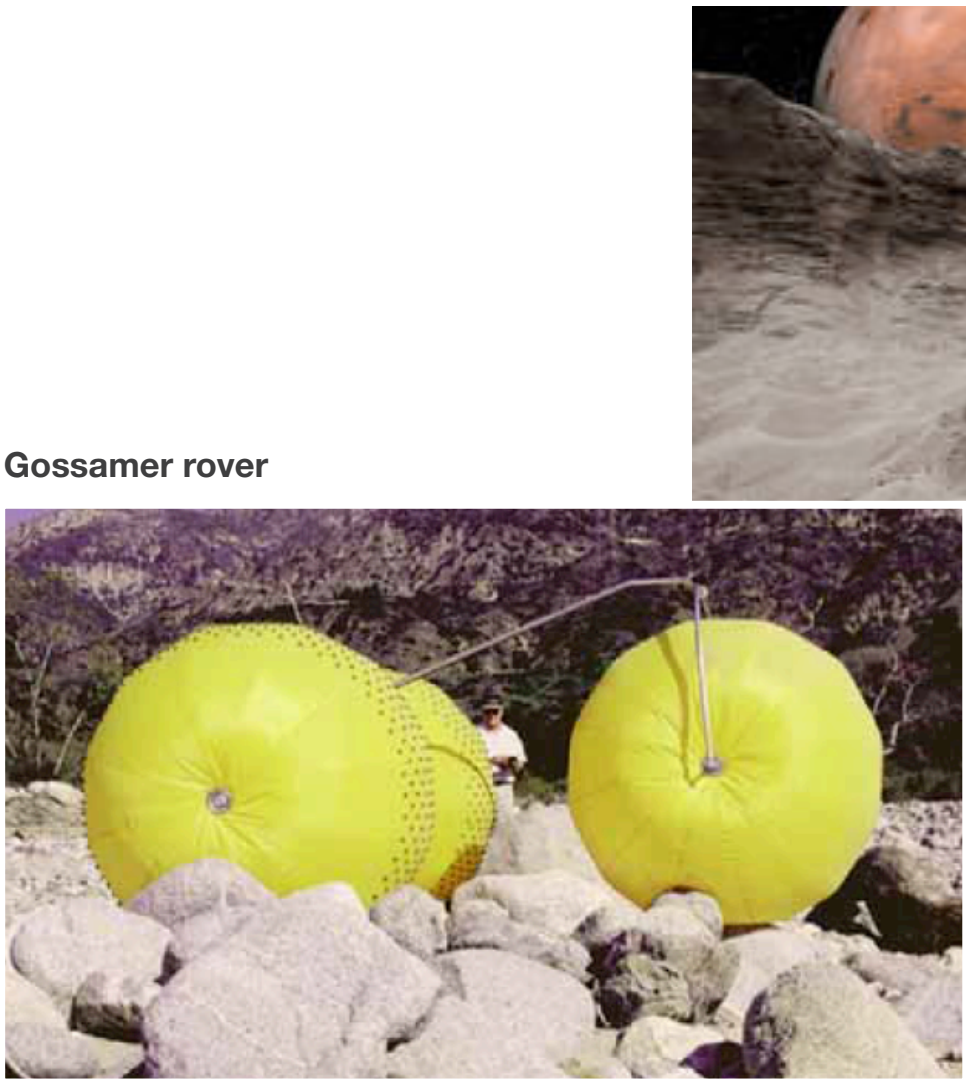
Bi-blade sampler



Bear-claw sampler

Long-Range Mobility Concepts

Traverse up to 10k m over the diverse terrains expected on ocean worlds



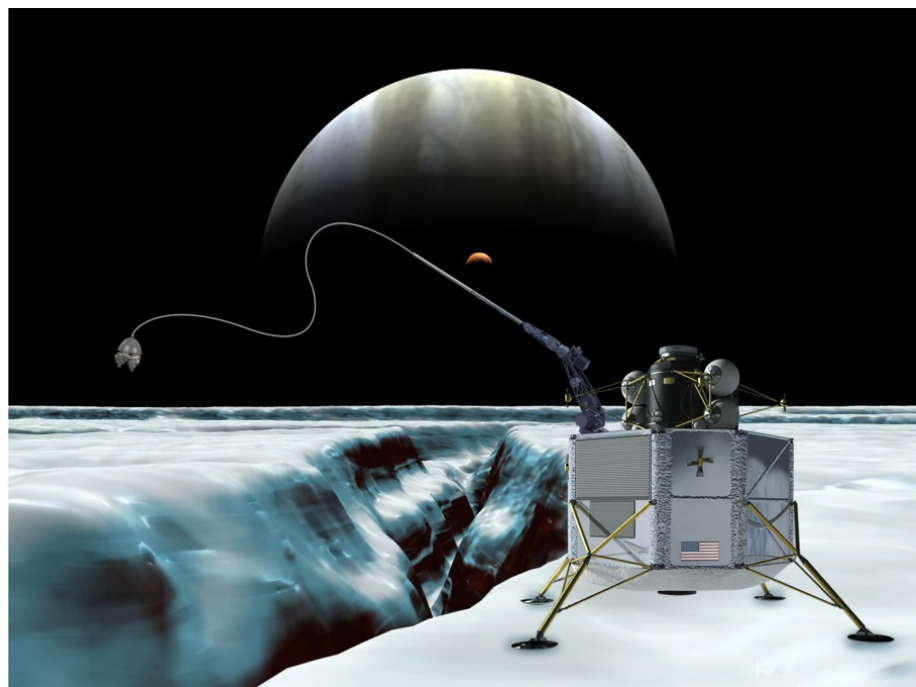
Gossamer rover



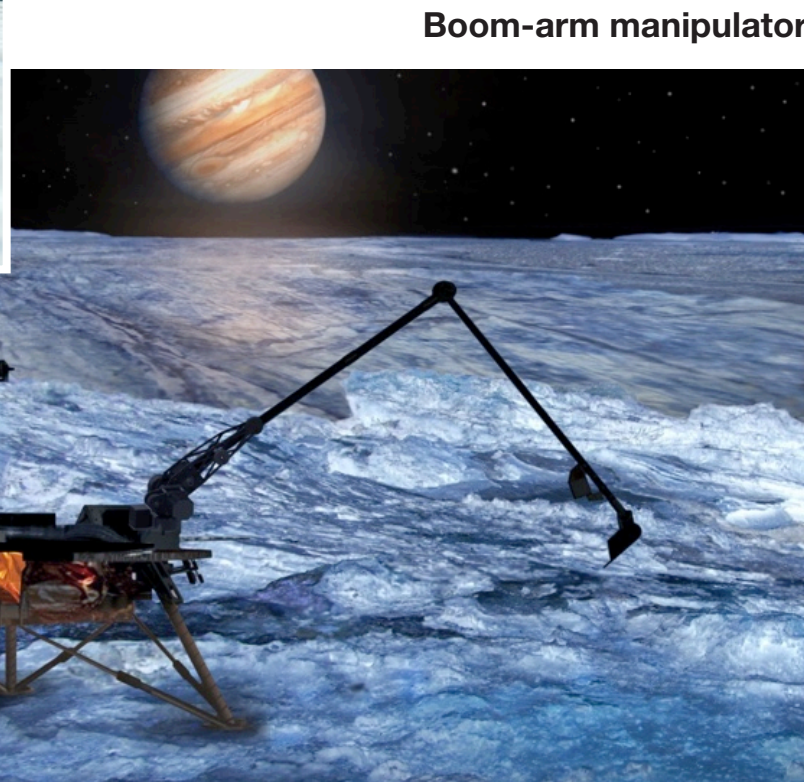
Distributed spacecraft and hedgehog concepts from JPL and Stanford University

Lander Proximity Science Concepts

Perform science operations up to 10 m from a landing site



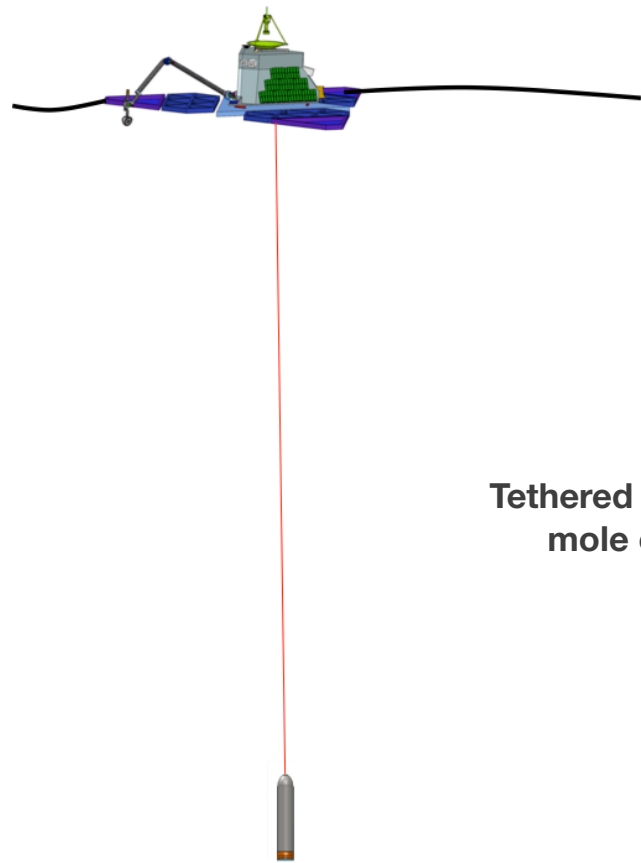
Projectile sampling



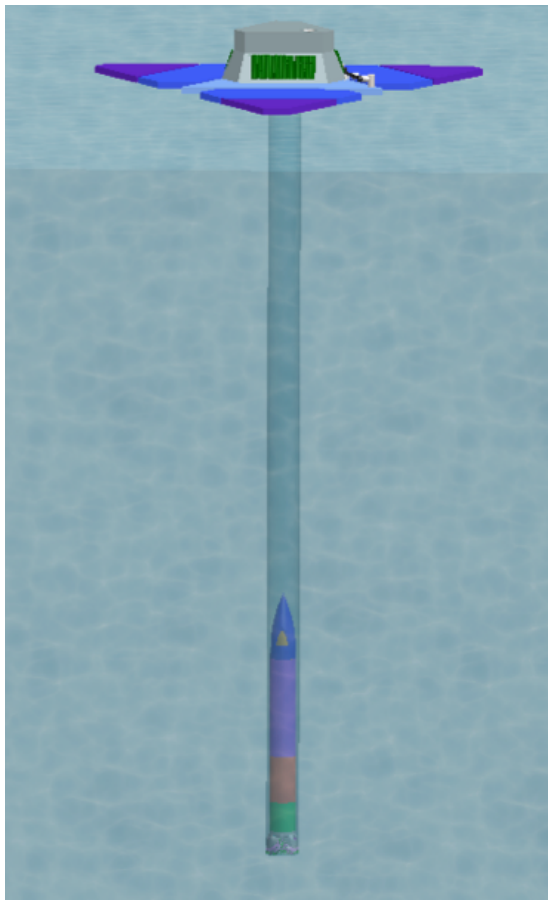
Boom-arm manipulator

Deep Subsurface Access Concepts

Perform science operations at up to 1 km depths on ocean worlds



Tethered and wireless mole concepts



Environment and Testbeds

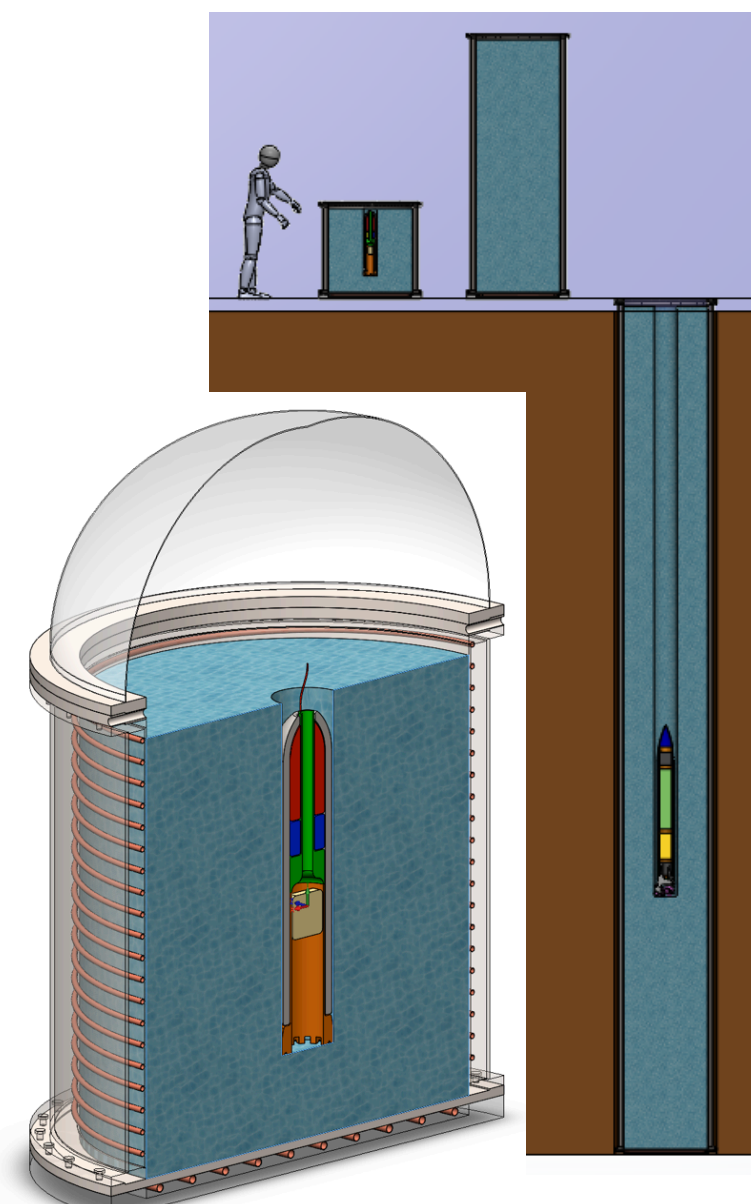
- Perform ice characterization experiments
- Develop subsurface testbed
- Develop mobility testbed



Mobility testbed: tilt-table



Mobility testbed: gravity off-loading



Subsurface access testbed