Soft-Robotic Rover with Electromagnetic Power Scavenging

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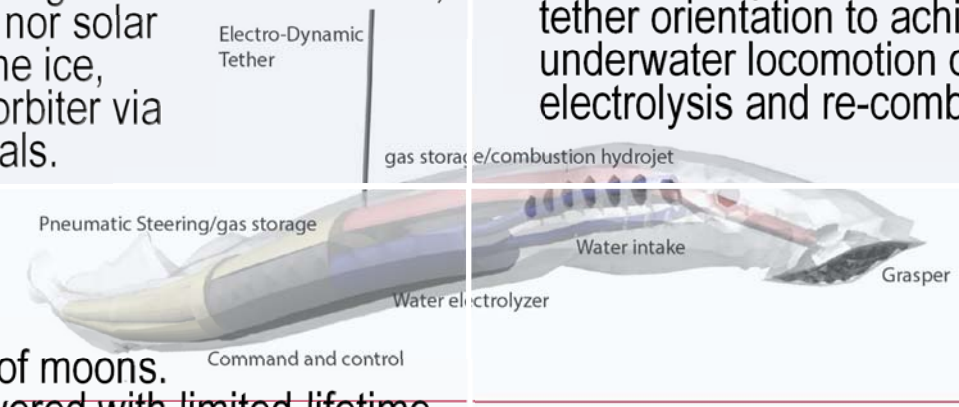
Concept

- Eel-like rover that exploits benefits of soft robotics—autonomous machines made of low-stiffness polymers or other compliant material.
- Designed for outer-planet missions, e.g. the moons of Jupiter such as Europa, whose velocity through Jupiter's magnetic field allows a rover with electrodynamic tethers to scavenge energy from currents induced in the tethers
- Electrolyzes then combusts H_20 to actuate the jellyfish-like body, swimming without mechanisms, and with neither nuclear nor solar power. It swims under the ice, telemetering data to an orbiter via submarine-like VLF signals.



Study Approach

- Analyze existing planetary-science data to estimate the power available through scavenging on Europa, leading to design principles and sizing estimates of a candidate power subsystem
- Devise a soft-robotics architecture that can achieve key science objectives as articulated in the Planetary Science Decadal as well as other objectives not contemplated therein.
- Architect a rover system that marries the two.
- Outline an operations concept that manages tether orientation to achieve suitable power for underwater locomotion on Europa through electrolysis and re-combustion of in-situ water.

Benefits

<u>If the concept eventually succeeds</u>

- Amphibious exploration of moons.
- Alternative to rovers powered with limited-lifetime batteries, large solar arrays, or unavailable nuclear power (due to ASRG cancellation).
- Bypass difficulties of typical mechanisms in fluid through uniquely suited soft robotics.

<u>Of this study, now</u>

- Assess the possibility that any life on Europa may use electromagnetic energy, with singular implications for astrobiology.
- Introduce soft robotics into future rover trades.