Geophysical Research Abstracts
Vol. 12, EGU2010-14762, 2010
EGU General Assembly 2010

Titan Lake Probe: The Ongoing NASA Decadal Study Preliminary Report

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This talk provides an update on the scientific requirements and preliminary design of a Titan Lake Probe for a future NASA Flagship mission. The starting point for this study is the joint NASA ESA TSSM mission. Using this as a starting point we have revisited the scientific requirements and expanded them to include the possibility of a lake floater and a submersible. The preliminary results of this ongoing study will be presented.

The scientific objectives of a Titan Lake Probe mission are: 1) to understand the formation and evolution of Titan and its atmosphere through measurement of the composition of the target lake (e.g. Kraken Mare), with particular emphasis on the isotopic composition of dissolved minor species and on dissolved noble gases, 2) to study the lake-atmosphere interaction in order to determine the role of Titan's lakes in the methane cycle, 3) to investigate the target lake as a laboratory for both pre-biotic organic chemistry in both water (or ammonia-enriched water) solutions and non-water solvents, and 4) to determine if Titan has an interior ocean by measuring tidal changes in the level of the lake over the course of Titan's sixteen-day orbit.

The driving requirements for the mission are: 1) the need to land on and explore the lake at depth while adequately communicating the data back to Earth via either direct to Earth or relay communications, 2) thermal design that allows sustained (>32 days) sampling of the 94K lake environment, and 3) a mass spectrometer inlet system that allows sampling of gas, liquid, and solids from the 94K environment.

The primary payload is an analytical chemistry laboratory that includes an inlet system for sampling gas, liquid, and solids in and above the lake feeding two capable mass spectrometers that determine the organic and isotopic composition of the sampled materials. The instrumentation also includes a meteorological package that can measure the rate of gas exchange between the lake and the atmosphere, and a lake physical characteristics package that includes pressure and temperature measurements as well as sonar.