

## **Titan Lake Probe: Science Requirements and Instrumentation**

*J. Hunter Waite, Tim Brockwell      Southwest Research Institute*  
*John Elliott, Patricia Beauchamp      NASA Jet Propulsion Laboratory*

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 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 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.