Are we alone?

This simple question remains one of the most fundamental that has compelled humanity for centuries. As we focus research and energy on our "cosmic backyard", the Solar System, Titan emerges as a likely candidate for the development of life outside of Earth.

The NASA-ESA Cassini-Huygens mission has shed light on this question, with data supporting a subsurface water ocean, numerous surface lakes, and complex atmospheric organic photochemistry. Titan is one of the strongest candidates for life in our Solar System beyond Earth. Adiotionally, Saturn's largest moon may be a useful early earth analogue, giving us insight on how our own home planet was formed.

However, many aspects of Titan remain unknown. **The ORACLE** mission travels to a Ligeia Mare to study the unique intersection of geology, hydrology, and photochemistry on a foreign planetary body. We study Titan's capability to host life while simultaneously deepening our understanding of the mechanics and chemistry of this mysterious and wondrous alien world.

SCIENCE

SCIENCE GOAL A

Profile of a Titan sea

Conduct a thorough characterization of Ligeia Mare, Titan's second largest body of surface liquid.

SCIENCE GOAL B

Sample Return

Collect solid, liquid, and gaseous samples from an outer solar system planetary body and return them to earth for further scientific analysis.

18
Samples

1.06 dm^3
Sample Volume

JOURNEY

LAUNCH DATE
2036-08-28

LAUNCH MASS
13570 kg

SATURN ARRIVAL
2044-07-07

TITAN ARRIVAL
2045-06-15

OUTBOUND TRANSIT SEQUENCE
Earth-Jupiter-Saturn

OUTBOUND TRANSIT TIME
8.78 Years

SAMPLE TITAN DEPARTURE
2046-07-17

SAMPLE EARTH ARRIVAL
2053-12-24

INBOUND TRANSIT SEQUENCE
Saturn-Earth

INBOUND TRANSIT TIME
8.26 Years

SCIENCE ORBIT
Polar, circular 1500 km Alt.

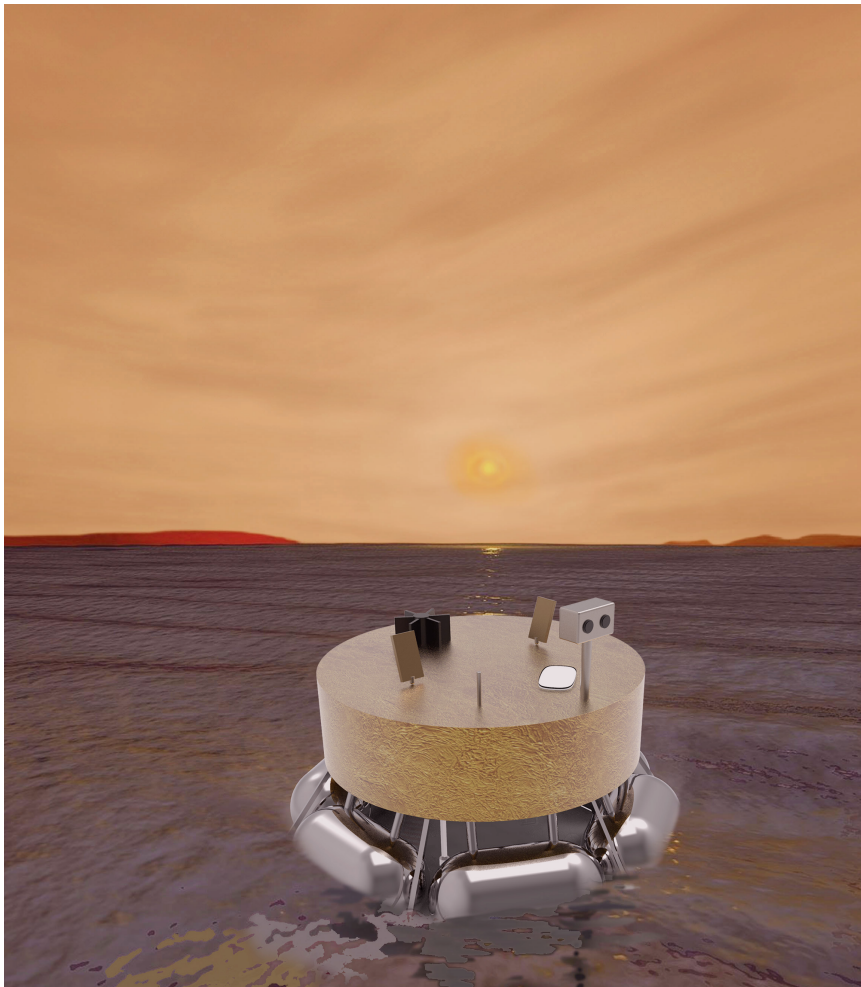
SCIENCE OPERATION AT TITAN
5 Years

MISSION BUDGET
$4.01 B (Launch Costs Excl.)

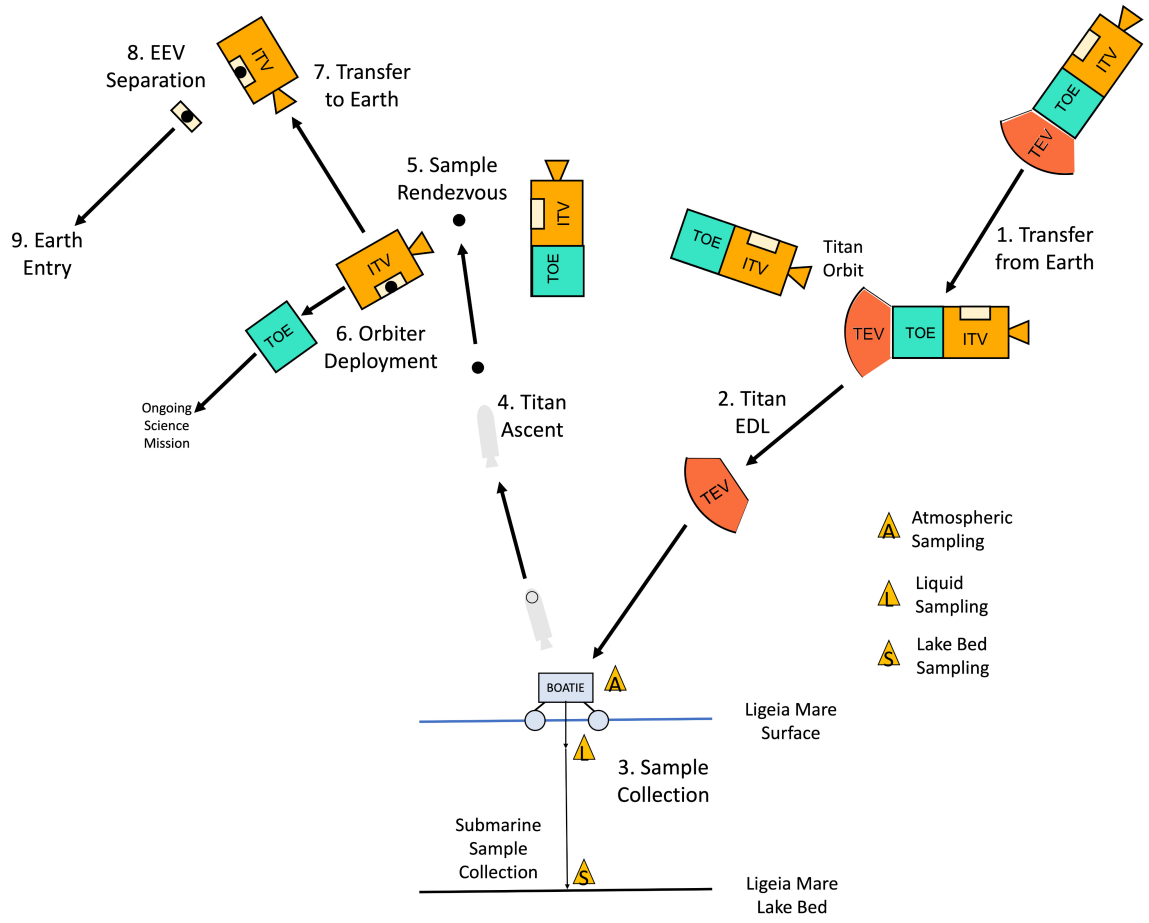
The ORACLE

The value proposition of The ORACLE has 5 key points:

1. Ligeia Mare sample acquisition capability (atmospheric, liquid, solid)
2. Return of samples to Earth for further analyses
3. *In situ* sample analysis and contextualization continued after sample return
4. Tolerance to imprecise landing on the lake
5. Stable, insulated and mobile pontoon platform



TITAN OPERATIONS



SPACECRAFT OVERVIEW

INTERPLANETARY TRANSFER VEHICLE (ITV)

DRY MASS
2880 kg

WET MASS
10278 kg

POWER
7 MMRTGs,
875W BOL,
700W EOL

TITAN ORBITAL ELEMENT (TOE)

DRY MASS
1100 kg

WET MASS
1412 kg

POWER
5 MMRTGs,
625W BOL,
500W EOL

BUOYANT AUTONOMOUS TITAN INSITU EXPLORER (BOATIE)

Pontoon boat for sample collection, *in situ* measurements and ascent vehicle launch.

Stable platform **limiting heat transfer** to the lake.

Holds 2 SAS (Sample Acquisition Systems) for redundancy.

Can **transfer the samples to on-board instruments** (MS) or to the TAV.

Six propellers for continuous stationkeeping and up to **0.5m/s** locomotion burst

MMRTG and **batteries**.

SAMPLE ACQUISITION SUBMERSIBLE (SAS)

The SAS is **tethered** to BOATIE, it reaches the bottom of the lake using **negative buoyancy**.

Collects **Atmospheric and Liquid Samples** at varying depths by opening and closing the sampling tubes.

Collects **Solid Samples** using a multi-tool for different lake floor properties (coring drill and suction sampler).

Performs ***in situ* measurements** and **sample contextualization.**

Returns to BOATIE by being **reeled in via a winch.**