National Aeronautics and Space Administration

FY23 Strategic Initiatives Research and Technology Development (SRTD)

Technology Development for Next Generation Ocean World Geodesy: Enceladus

Principal Investigator: Ryan Park (392)**; Co-Investigators:** John Paul Borgonia (357), Nathaniel Harvey (332), Yasser Hussein (337), James Keane (322), Nickolaos Mastrodemos (392), Joseph Riedel (392), Zaid Towfic (337), Marshall Smart (346), Steven Vance (322), Andrew Vaughan (392), Mark Simons (California Institute of Technology)

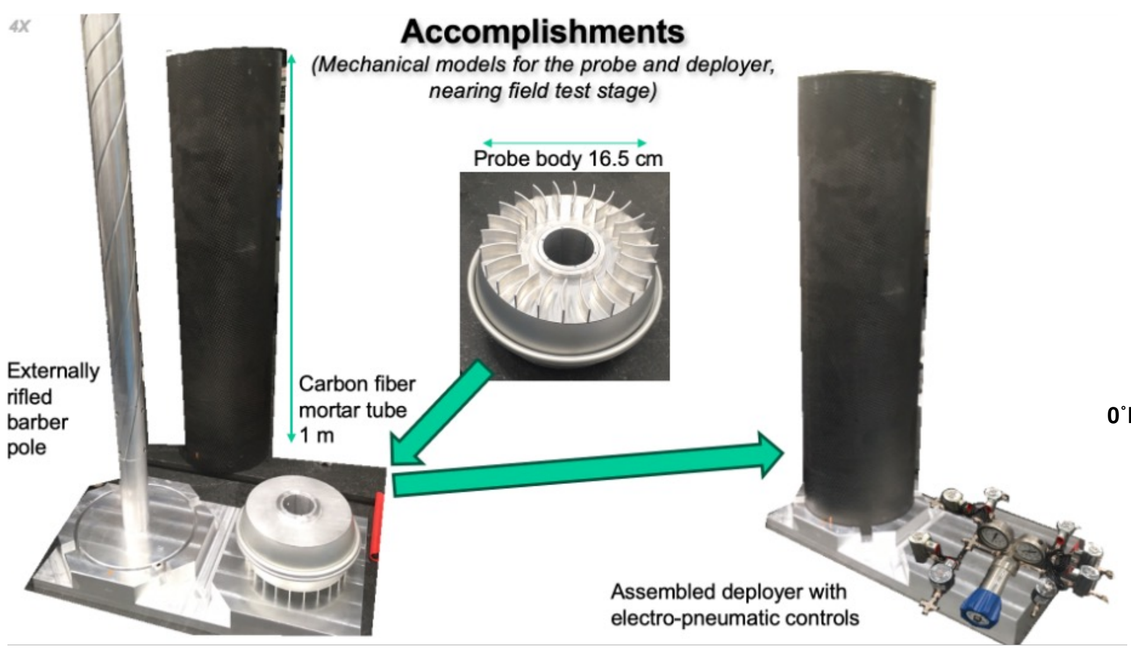
Strategic Focus Area: Next-Generation Ocean World Geodesy: Enceladus | **Strategic Initiative Leader:** Steve Vance

Objectives: This task has three principal objectives addressing the question of how to economically obtain accurate and detailed gravity and shape of a dynamic body that might harbor life-habitats. Understanding the gravity and its changes in time as well as the surface morphology give strong evidence of the energy flow above, on, and inside the body, and thus reveals where, when, and for how long liquid water may exist and have existed on these bodies, the key to searching for life and understanding its potential history. In this respect, we are driven by the companion science- focused proposal in this initiative.

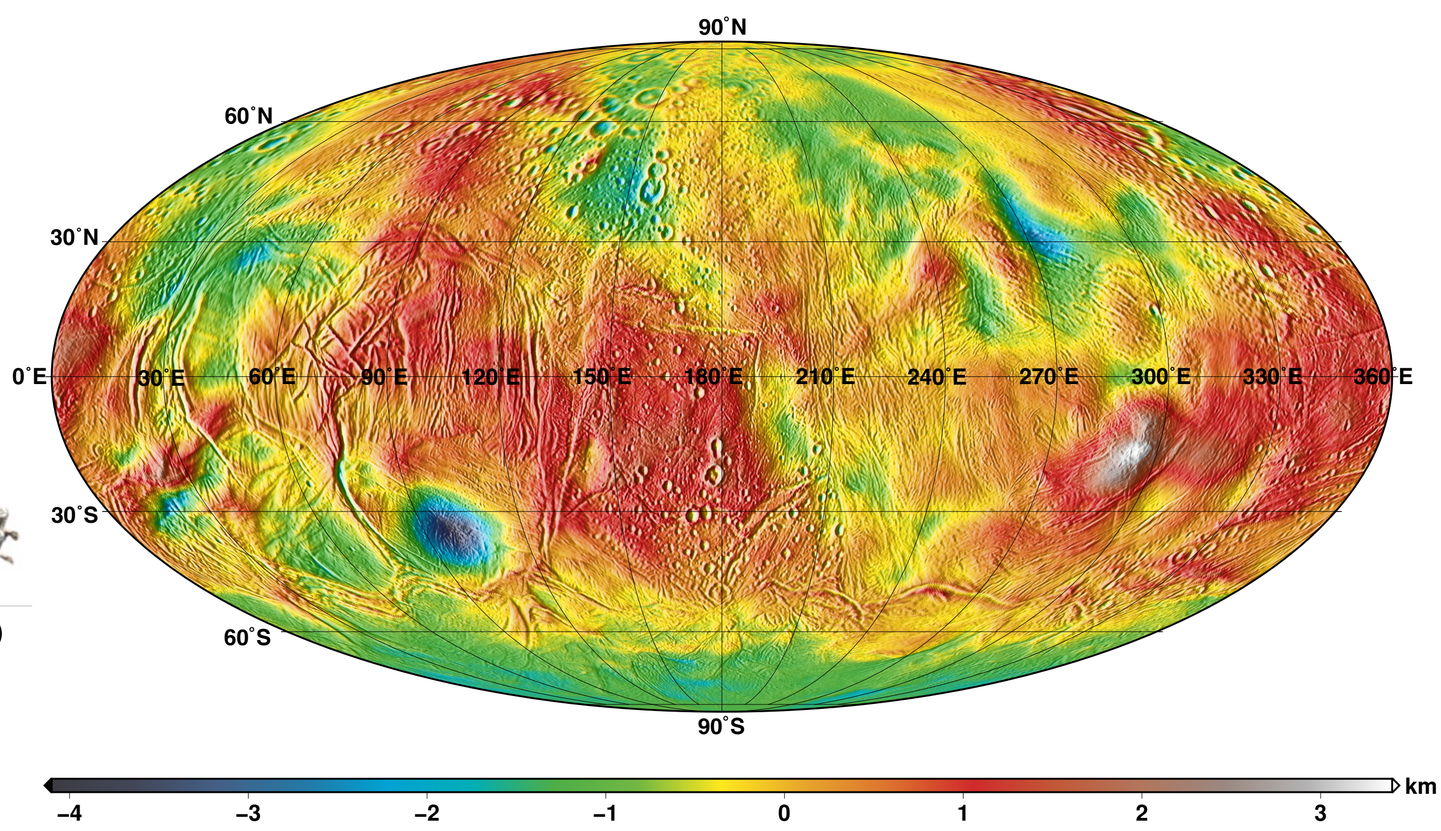
Objective 1: Determine the configuration of radio beacons required to recover a static and time-dependent gravity field of a given degree and order for Enceladus, which will constrain spatial variations in shell thickness and ocean density.

Objective 2: Develop an engineering model for deployable radio beacons and deployer that can perform two-way radio communication with the main spacecraft with velocity measurement accuracy ≤0.01 mm/s.

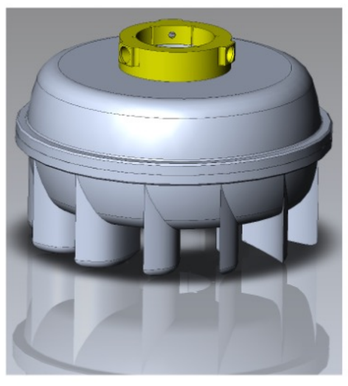
Objective 3: Develop a high-resolution topography model for Enceladus using the existing Cassini imaging data and assess optimal/efficient imaging geometry and configuration based on a realistic future mission scenario.

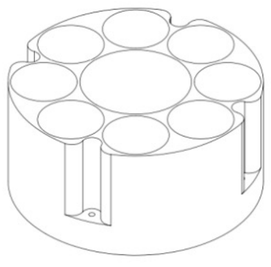


A Prototype probe body and deployer (including electro-pneumatic release) has been designed and fabricated, and is nearing test stage.



Using a stereophotoclinometry technique, a new model of Enceladus has been developed, which reveals important features of that body unseen heretofore.





The next-generation probe structure has been designed, and configured to accommodate the light beacon. The external structure will be 3-D printed of sintered titanium, the battery cassette of polymer.

National Aeronautics and Space Administration

Jet Propulsion Laboratory
California Institute of Technology
Pasadena, California

www.nasa.gov

Clearance Number: CL#23-5076
Poster Number: RPC#193

Publications:

Park, R.S., N. Mastrodemos, R.A. Jacobson, A. Berne, A.T. Vaughan, D.J. Hemingway, E.J. Leonard, J.C. Castillo-Rogez, C.S. Cockell, J.T. Keane, A.S. Konopliv, F. Nimmo, J.E. Riedel, M. Simons, and S. Vance, “The global shape, gravity field, and libration of Enceladus,” submitted to J. Geophy. Res.-Planets, 2023.

PI Contact Information: *818-354-4401 / Ryan.S.Park@jpl.nasa.gov*