

Enceladus multiple flyby (EMF)

Enceladus Multiple Flyby seeks to characterize Enceladus' habitability and look for evidence of life via multiple flybys and analysis of plume material. Enceladus, an active icy moon with a subsurface ocean in a relatively benign radiation environment, provides the best opportunity to directly sample a potential habitable subsurface ocean. Prior Cassini observations demonstrate the presence of alkali and carbonate salts and complex organic molecules in plume icy grains; gas-phase nitrogen- and oxygen-bearing as well as aliphatic and aromatic organic molecules; redox couples (e.g., H_2+CO_2), habitable temperature, salinity, and pH; alkaline hydrothermal activity; and water-rock reactions. However, Cassini flyby velocities were high, leading to fragmentation of large molecules, and ambiguity as to the precise identity of the parent organic molecules.

EMF Science Objectives:

- Search for and identify complex organic molecules in Enceladus plume materials, with velocities <4 km/s and sample volume >1 μ l with appropriate contamination control to enable life-detection investigations
- Determine the composition, energy sources, and physicochemical conditions of Enceladus' ocean to assess its habitability
- Characterize Enceladus's cryovolcanic activity to determine spatial and compositional variations in plume activity and the processes causing ocean material ejection and modification.

The mission shall address all three objectives.

The full Enceladus Multiple Flyby mission study report is available at

<https://drive.google.com/file/d/1XeKk9jWqwKUDa2MNqbBx1Eq-vJAXd0eE/view?usp=sharing>