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Follow the Water

Outer Solar System

Program Options to Explore Ocean Worlds

About a dozen diverse ocean worlds in our solar system

"Find and understand life elsewhere" Science Agenda in Six Steps

1. Find liquid water
2. Quantify its habitability
3. Detect biosignatures in it
4. Confirm that life is present
5. Understand how that life operates
6. Learn the limits of life

Very different top priorities at the three best targets

Most intrinsically promising home for alien ecology

Awaits comprehensive investigation of habitability

✓ Europa Mission / Lander

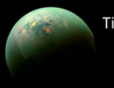
Later:
- Cryogenic deep access
- Roving ocean exploration

✓ Habitable, accessible

Easiest place to start directly searching for life

Plume Composition

Later:
- Particle soft capture, sample return
- Landing, vent access
- Roving ocean exploration



Best place to learn how different life might be.

Most complex world to explore and understand.

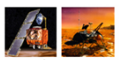
Lifecycle of the organics

Later:
- Aerial, buoyant, and submerged mobility
- Cryogenic deep access

The successful Mars Exploration Program offers a template for how to build a strategic program

1. Mars-distance missions are technically moderate
2. Extra-project investments develop key enabling technologies
3. 26-month synodic cadence and half-year transfers allow a mission sequence that responds to emergent knowledge
4. Fixed operational infrastructure lowers the bar for individual missions
5. NASA controls project new-starts within single budget line
6. $0.5-1B class directed missions are the backbone of the program


MO
$1.14B FY17


MCO / MPL
$0.35B FY17


MER rovers
$1.13B FY17


Mars Odyssey
$0.59B FY17


MRO
$0.77B FY17

2 SLS launch would halve trip time

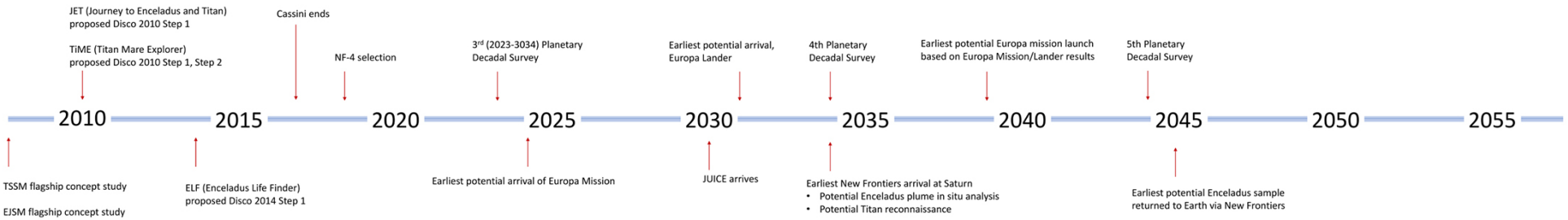
- 2 years to Jupiter
- 5 years to Saturn

3 $0.5 - 1B directed-mission class would assure steady progress

- Pursue key questions without the uncertainties of PI-led competitions
- Less costly than Flagship missions

1 Common technologies enable advanced exploration of all three targets

- Autonomous exploration and science investigation
- Planetary protection of and from ocean-world material
- "Life-detection" measurement techniques and instruments
- Sample acquisition, handling, preservation
- Cryogenic mechanisms and electronics
- Modular radioisotope power systems for landed missions



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