

Bioburden Reduction Before, During, and After Flight – Planetary Protection for the Europa Lander Mission Concept

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Carrier Stage

- Final disposition: stable, high-radiation Europa orbit

Artist's Concept

The Europa Lander mission concept science goals:

- Search for biosignatures
- Evaluate overall habitability
- Investigate geophysical properties and dynamics of Europa

De-Orbit Stage

- Final disposition: Europa surface

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Powered Descent Vehicle

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Descent Stage

- Final disposition: Europa Surface

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Lander

- Final disposition: Europa Surface

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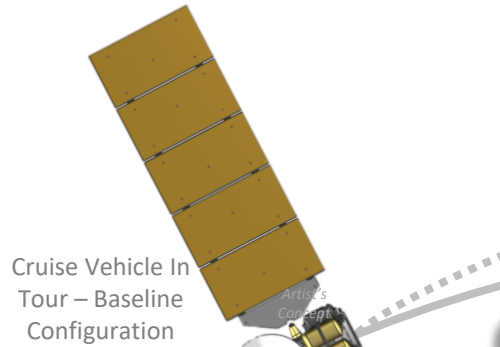
Europa missions must demonstrate that the probability of contamination (P_c) is less than 10^{-4} , where contamination is defined as the introduction of one or more viable organisms into a liquid water body

Key challenges

- **Scale:** Four-stage flight system concept, nominal mission would result in three stages contacting Europa
- **Stringency:** microbial reduction and control would be needed for all subsystems to meet the P_c requirement

Planetary Protection Implementation Concepts

- Apply microbial reduction and clean assembly to limit bioburden in/on primary structures and heat compatible components
- Assemble all three stages planned to contact Europa in a Biobarrier to limit recontamination
- Treat the Biobarrier-enclosed stages with Vapor Hydrogen Peroxide (VHP) after last physical access
- At end of mission, incinerate electronics and other components not previously subjected to microbial reduction



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Deorbit Vehicle (DOV)



Full Launch Stack