

OPAG EUROPA SUBGROUP

The goal: Develop science rationale for Europa Orbiter (taking into account previous studies, etc.)

The people:

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The process: Weekly telecoms and frequent e-mail exchanges

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Minimum Science Objectives for the Next Mission to Europa

(All are of equal importance)

- **Confirm the presence of a subsurface ocean**
- **Characterize the 3-dimensional configuration of the icy crust, including possible zones of liquid**
- **Map organic and inorganic surface compositions, especially as related to astrobiology**
- **Characterize surface features and identify candidate sites for future exploration**
- **Characterize the magnetic field and radiation environment**
- **Understand the heat source(s) and time history of Europa's ocean**

EUROPA ORBITER SCIENCE OBJECTIVES

*(Numbered sub-objectives in priority order)**

Confirm the presence of a subsurface ocean

1. Determine the amplitude and phase of the gravitational tide
2. Determine the amplitude and phase of the induced magnetic field at several frequencies
3. Determine the amplitude and phase of the surface motion during a tidal cycle
4. Determine the amplitude of libration
5. Search for active, tidally-induced crustal deformation features

Characterize the 3-dimensional configuration of the icy crust, including possible zones of liquid

1. Search for shallow subsurface liquids
2. Determine possible correlation of surface features to subsurface structure
3. Characterize the physical properties of the regolith and possible links to the interior

Map organic and inorganic surface compositions, especially as related to astrobiology

1. Relate compositions to geological processes, especially with regard to possible "communication" with the interior
2. Characterize past and present "habitability"
3. Search for indicators/constraints of past or present life

**It might not be possible to meet all of the sub-objectives, but they should be addressed by priority*

OPAG ORBITER SCIENCE OBJECTIVES

*(Numbered sub-objectives in priority order)**

Characterize surface features and identify candidate sites for future exploration

1. Characterize magmatic and tectonic features
2. Search for areas indicative of surface-subsurface exchange
3. Search for areas of recent or current geological activity
4. Assess erosion and deposition processes (impact gardening, mass wasting, micrometeoroid mass flux and composition in Europa's orbit, etc.)
5. Investigate local and global heat flow
6. Assess surface ages and subsurface structure using impact craters

Characterize the magnetic field and radiation environment

1. Characterize perturbations to the magnetic field from plasma
2. Determine the radiation effects on surface ice redox chemistry
3. Characterize exogenic material derived from the Jovian plasma
4. Characterize magnetospheric sputtering interactions with the surface
5. Determine the structure and dynamics of the ionosphere and neutral atmosphere
6. Characterize the deep interior of Europa

Understand the heat source(s) and time history of Europa

1. Determine the nature and history of the internal heat source(s)
2. Characterize the age of the surface via the cratering history of the Galilean satellites

Level 2 – not part of science floor

1. Study Jupiter's atmosphere as input to the magnetosphere and its role in Europa's evolution
2. Investigate Jovian aurora processes and links to the interplanetary solar wind and field-aligned current flows around the moons
3. Characterize the Jovian rings and the relations to collisions with the moons
4. Europa's initial bulk composition and evolution (salts, water)

**It might not be possible to meet all of the sub-objectives, but they should be addressed by priority*