EuROpA

OPAG

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Europa Mission Science Overview

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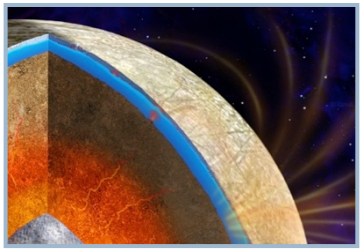
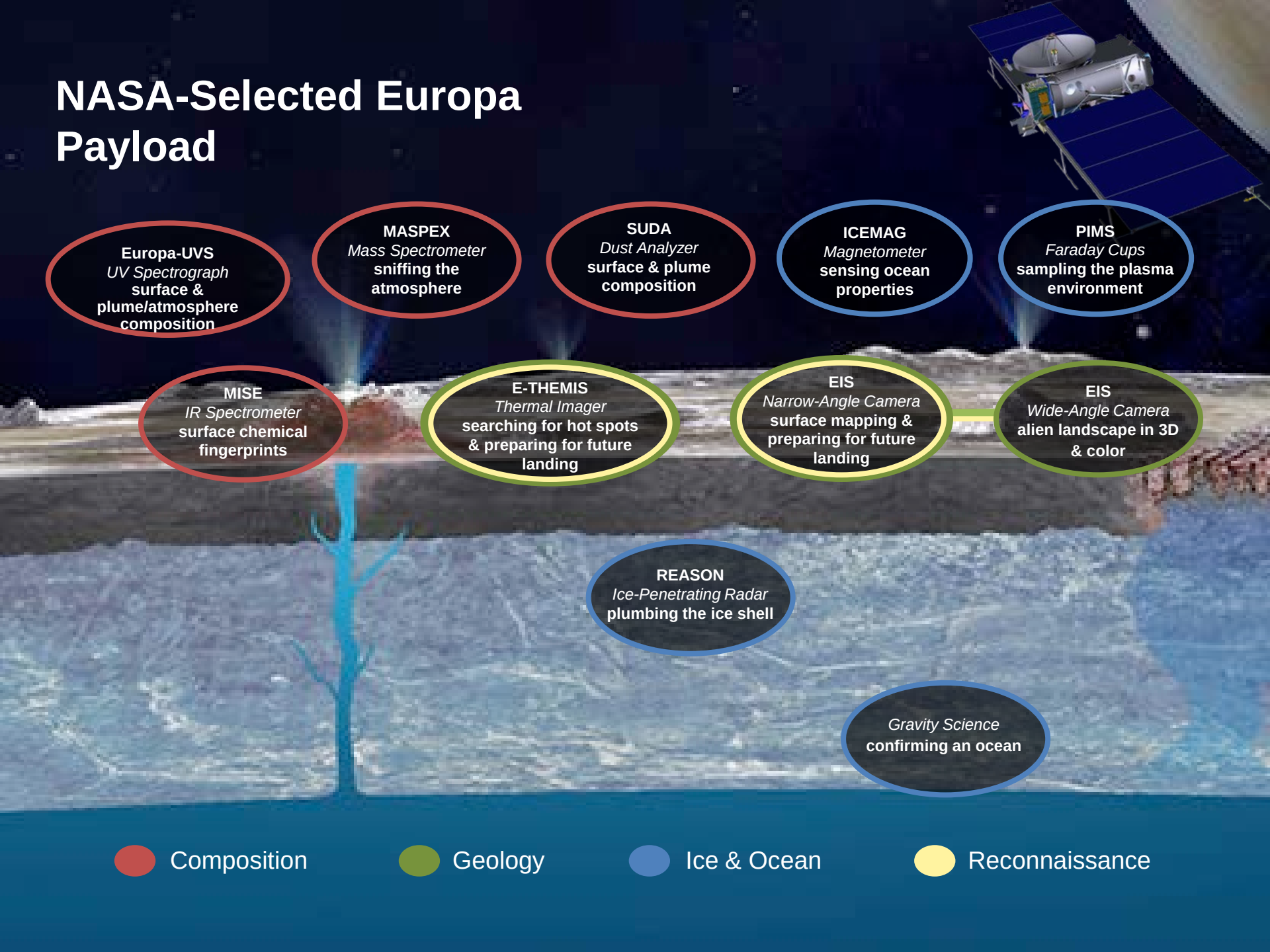
Science Goal & Notional Objectives

- *Goal:* **Explore Europa to investigate its habitability**
- *Objectives:*
  - **Ice Shell & Ocean:** Characterize the ice shell and any subsurface water, including their heterogeneity, ocean properties, and the nature of surface-ice-ocean exchange
  - **Composition:** Understand the habitability of Europa's ocean through composition and chemistry
  - **Geology:** Understand the formation of surface features, including sites of recent or current activity, and characterize high science interest localities
  - **Reconnaissance:** Characterize scientifically compelling sites, and hazards, for a potential future landed mission to Europa

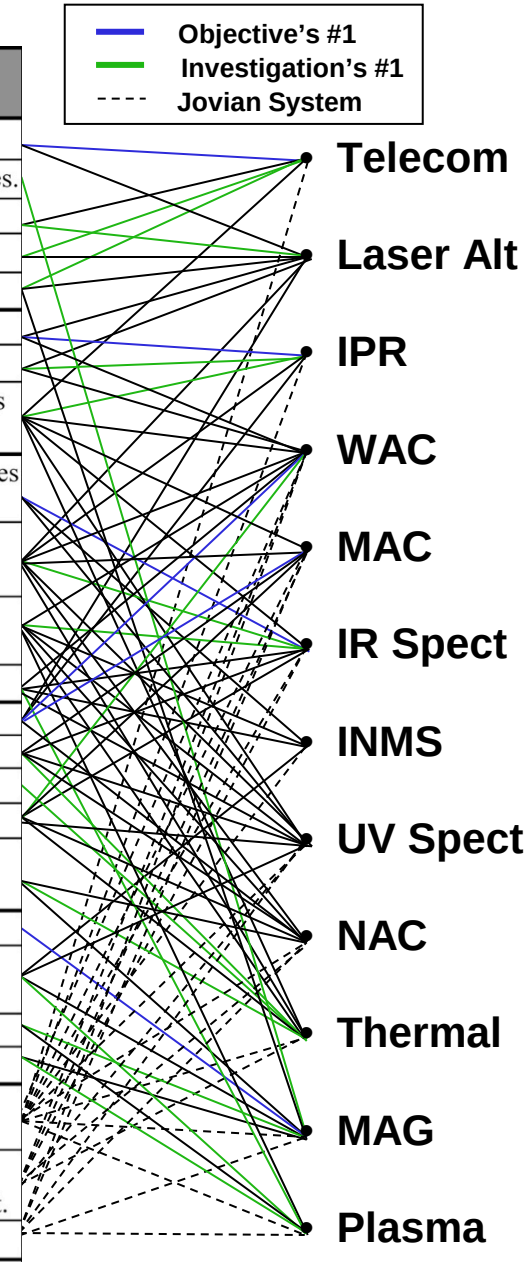


NASA-Selected Europa Payload

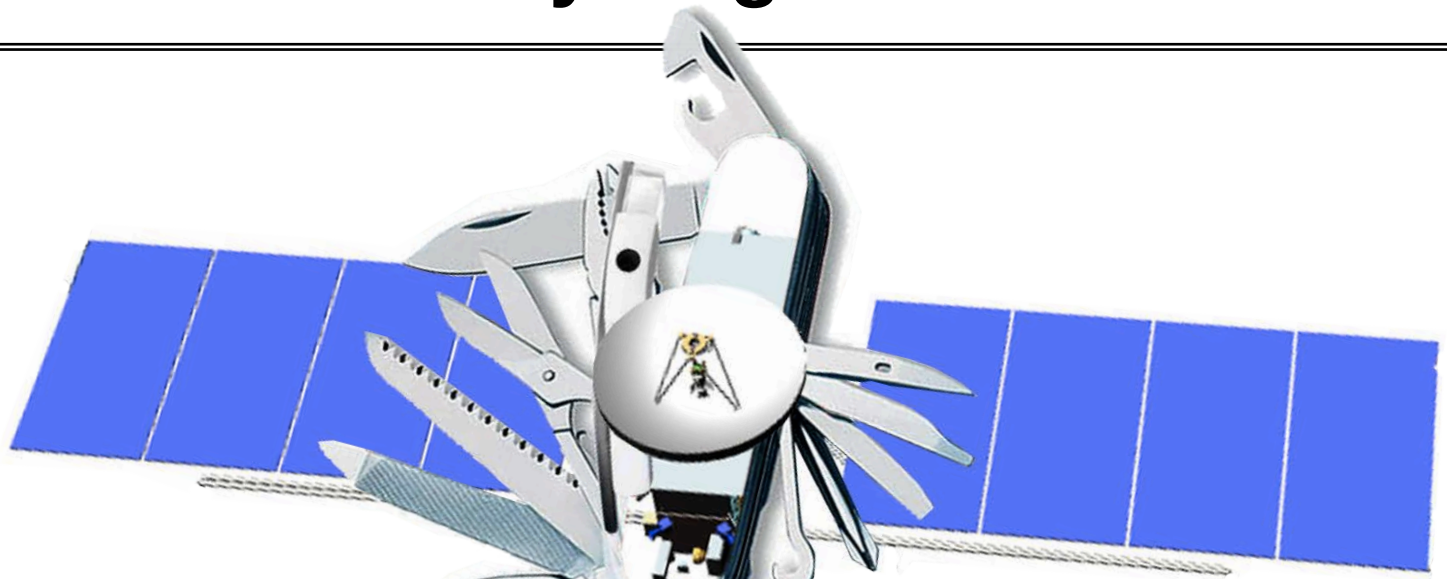


Europa Explorer 2007: Instrument Mapping to Investigations

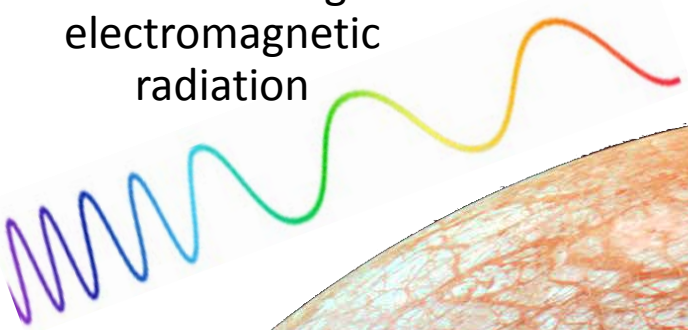
	Science Objective	Science Investigation
A. Ocean	**Characterize the ocean and deeper interior.**	A1. Determine the amplitude and phase of the gravitational tides.
		A2. Determine the induction response from the ocean over multiple frequencies.
		A3. Characterize surface motion over the tidal cycle.
		A4. Determine the satellite's dynamical rotation state.
		A5. Investigate the core and rocky mantle.
B. Ice	**Characterize the ice shell and any subsurface water, and the nature of surface-ice-ocean exchange.**	B1. Characterize the distribution of any shallow subsurface water.
		B2. Search for an ice-ocean interface.
		B3. Correlate surface features and subsurface structure to investigate processes governing communication among the surface, ice shell, and ocean.
C. Chemistry	**Determine global surface compositions and chemistry, especially as related to habitability.**	C1. Characterize surface organic and inorganic chemistry, including abundances and distributions of materials, with emphasis on indicators of habitability.
		C2. Relate compositions to geological processes, especially communication with the interior.
		C3. Assess the effects of radiation on surface composition, albedo, sputtering, and redox chemistry.
		C4. Characterize the nature of exogenic materials.
D. Geology	**Understand the formation of surface features, including sites of recent or current activity, and identify and characterize candidate sites for future *in situ* exploration.**	D1. Characterize magmatic, tectonic, and impact features.
		D2. Search for areas of recent or current geological activity.
		D3. Investigate global and local heat flow.
		D4. Assess relative surface ages.
		D5. Characterize the physical properties of the regolith, and assess processes of erosion and deposition.
E. External	**Characterize the magnetic environment and moon-particle interactions.**	E1. Characterize the magnetic environment.
		E2. Characterize the ionosphere and neutral atmosphere and their dynamics, with implications for surface interactions.
		E3. Characterize relationships between the magnetic field and plasma.
		E4. Characterize the global radiation environment.
F. Neighbors	**Determine how the components of the Jovian system operate and interact, leading to potentially habitable environments in icy moons.**	F1. Determine the nature and history of the geological activity and interior evolution of the Galilean satellites.
		F2. Understand the processes that determine the composition, structure and dynamics of the Jovian atmosphere as a type example of a gas giant planet.
		F3. Study the interactions between Jupiter's magnetosphere and its satellites.



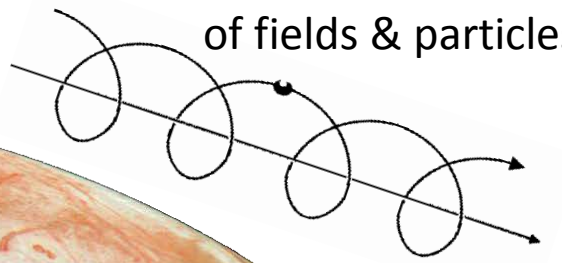
Simultaneous Synergistic Observations

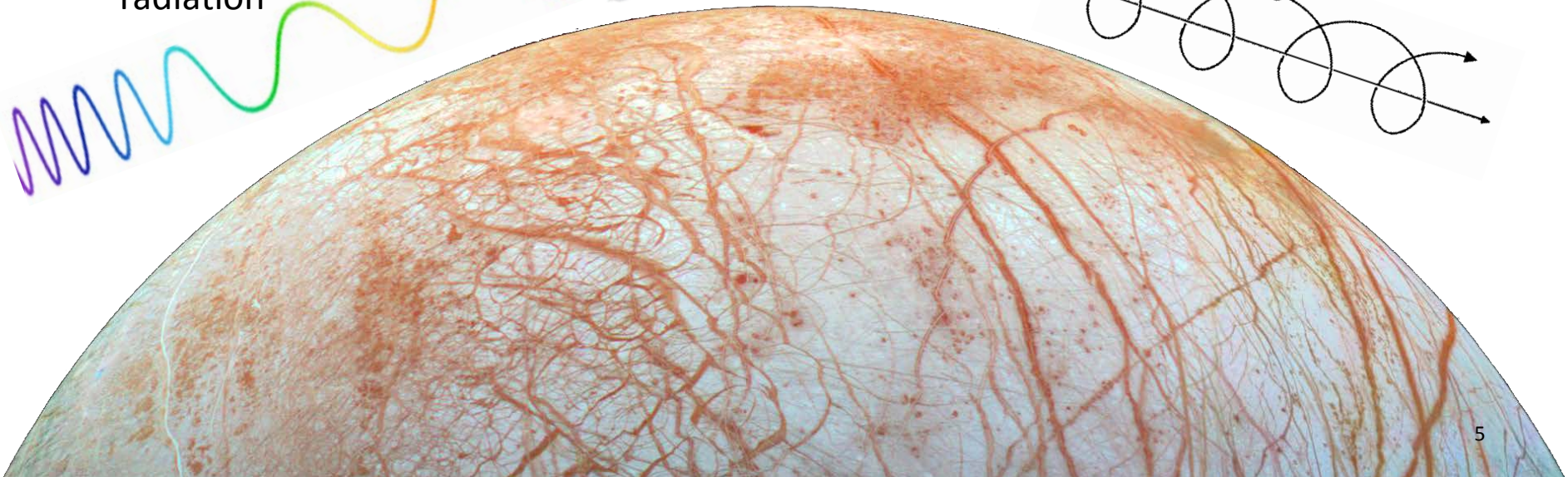


remote sensing of electromagnetic radiation

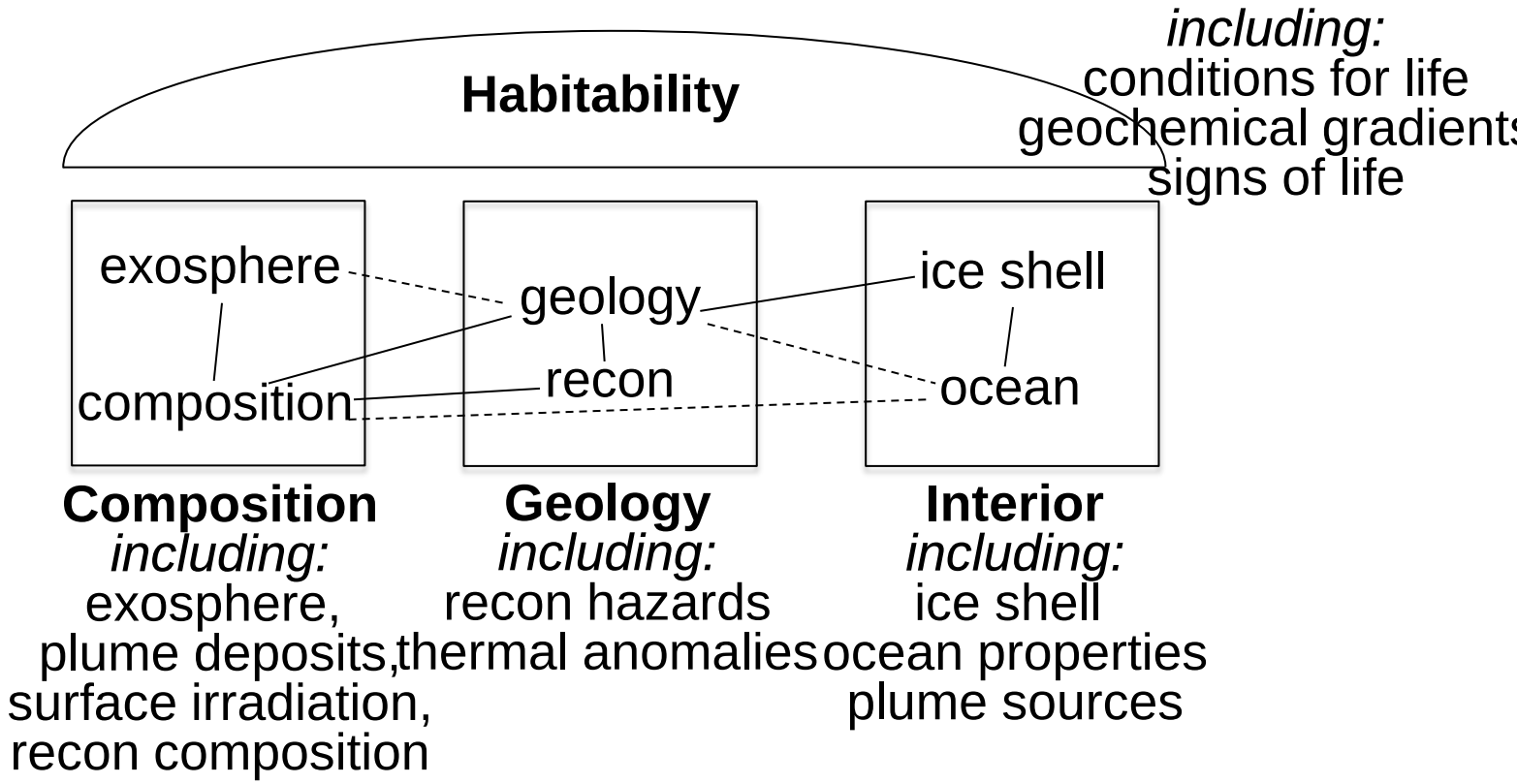


in situ measurement of fields & particles



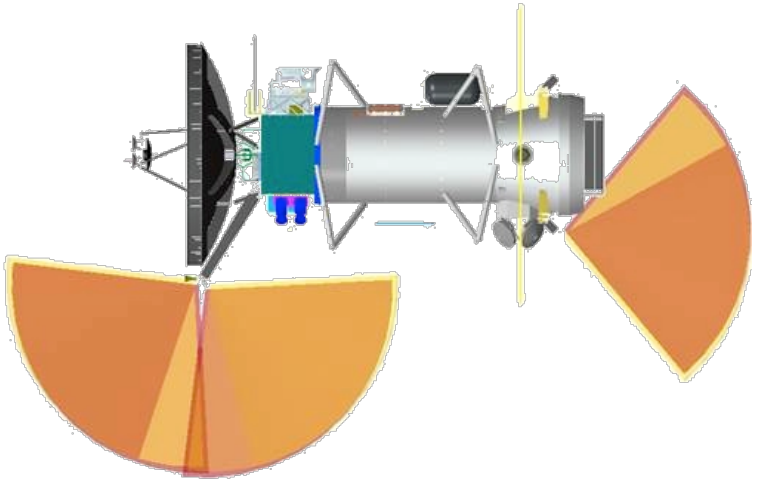


Thematic Working Group (TWG) Structure

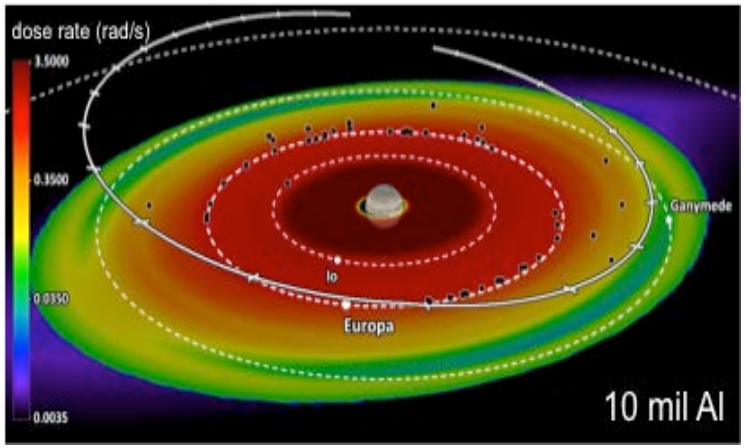


NASA-Appointed Working Groups

- Gravity Working Group
  - Focus on whether the existing mission concept and instrument payload can successfully confirm the presence of an ocean, and if not, how that can be corrected

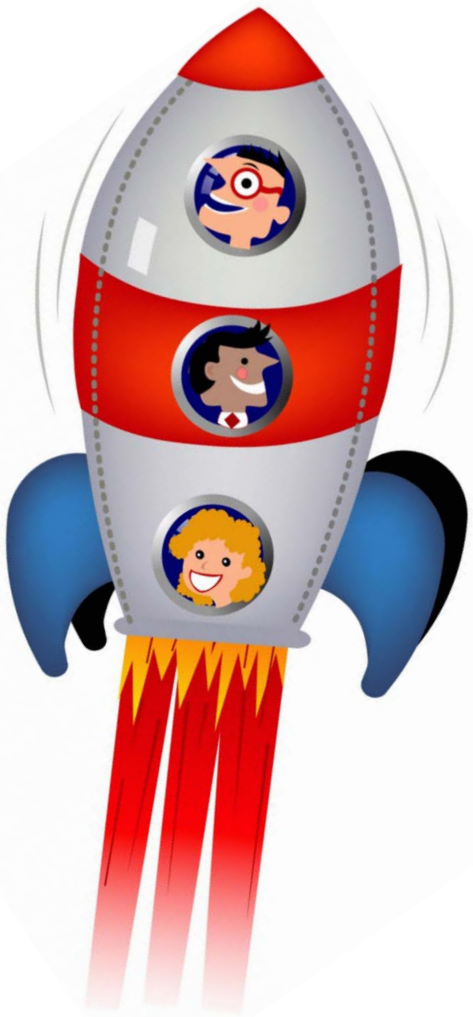


- Radiation Working Group
  - Consider the scientific applications of the data set to be produced by the spacecraft's planned radiation monitoring system



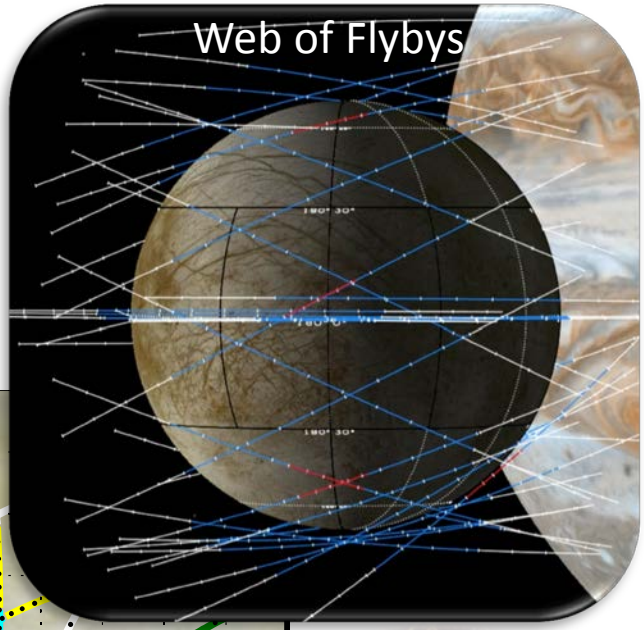
Three Europa Data Types

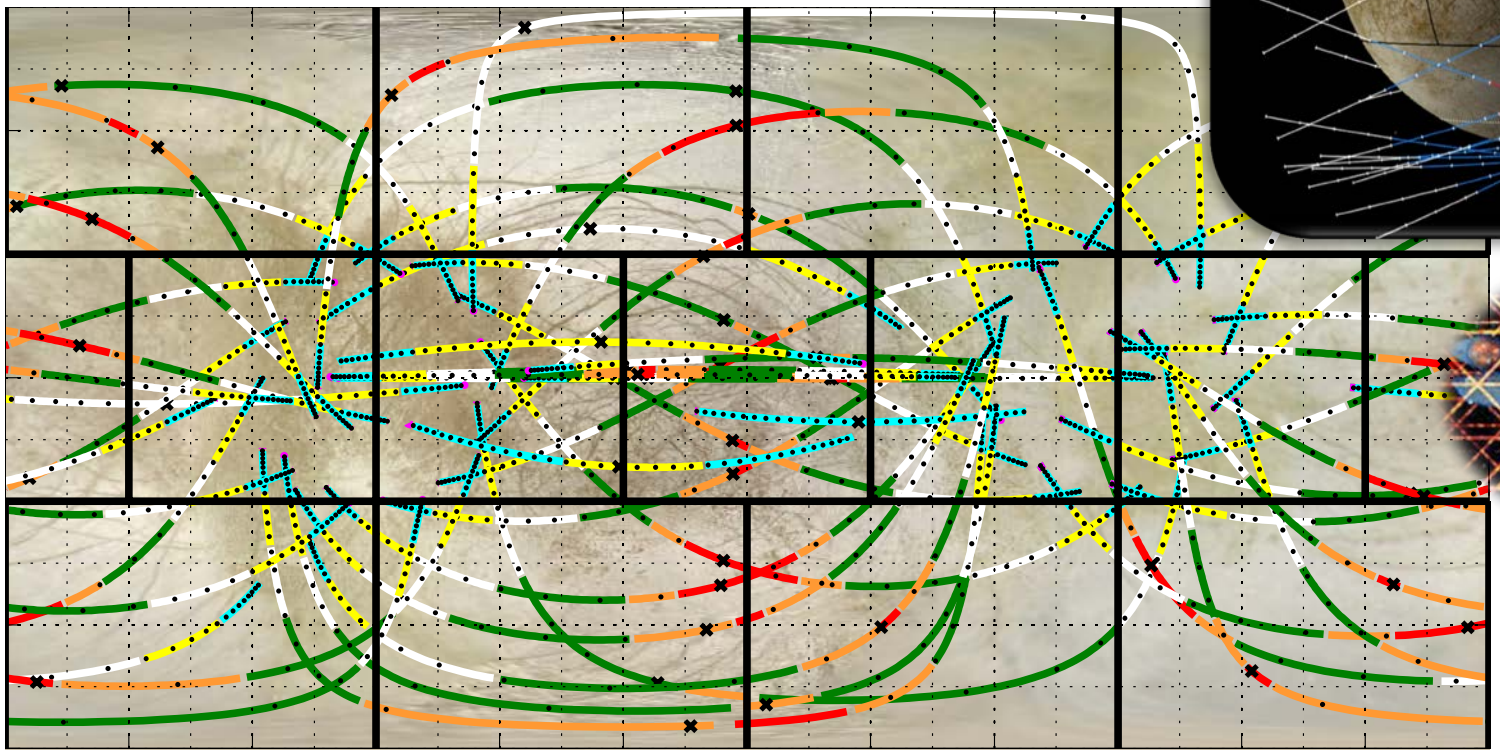
- **Archival data products**
  - Delivered to the Planetary Data System (PDS)
  - Calibrated and documented, with necessary algorithms (i.e. “usable”)
- **Collaborative data products**
  - Delivered to the Europa PSG
  - “Quick-look” products for internal PSG and Project use within ≈3 days of ground receipt
- **Public Data Products**
  - Delivered to Science Communications for public dissemination
  - Documented highlights of high public appeal, within ≈1 week of data receipt or production



“Global-Regional” Surface Coverage

- Utilize multiple satellite gravity assists to enable “global-regional” coverage of Europa while in orbit around Jupiter
- Current mission design consists of 45 low-altitude flybys of Europa from Jupiter orbit over 3.5 yr





Tholian Web

00 km | 100–400 km | 400–1000 km | 1000–2000 km | 2000–4000 km | 4000–10000 km

Europa

Project Science Group Meeting #1

August 4, 2015

Europa: The Adventure Begins!