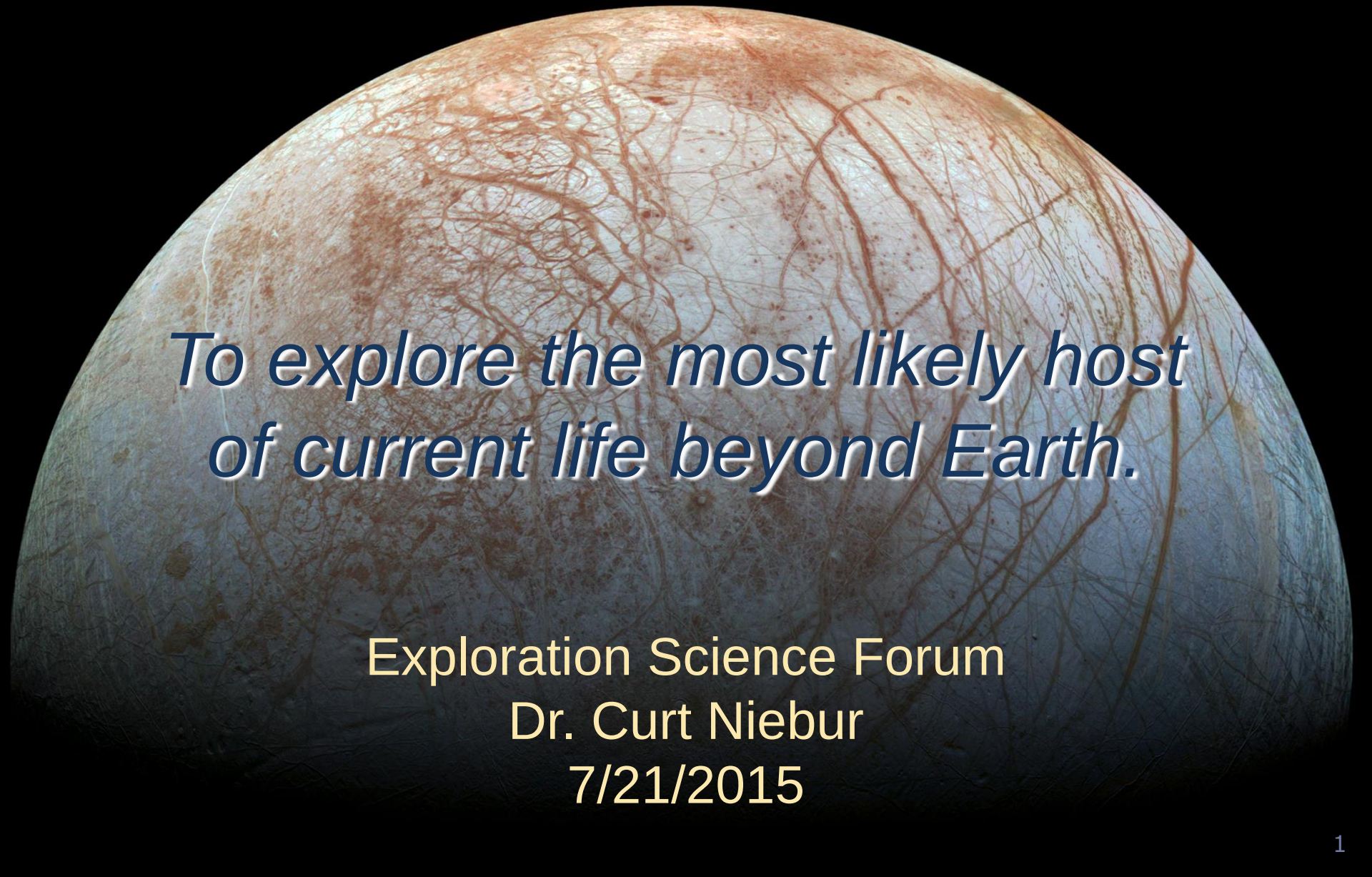
Europa Exploration



To explore the most likely host of current life beyond Earth.

Exploration Science Forum
Dr. Curt Niebur
7/21/2015

Habitability: Ingredients for Life

√ Water

- Probable saltwater ocean, implied by surface geology and magnetic field
- Possible lakes within the ice shell, produced by local melting

√ Chemistry

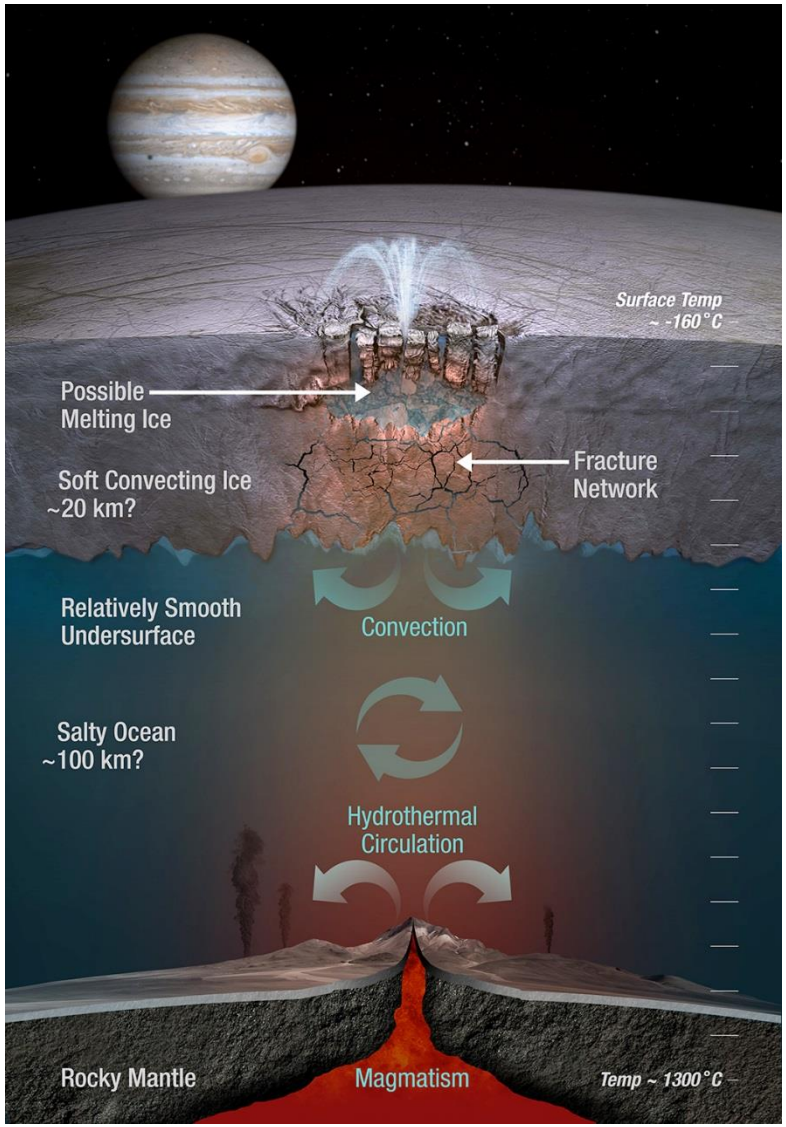
- Ocean in direct contact with mantle rock, promoting chemical leaching
- Dark red surface materials contain salts, probably from the ocean

√ Energy

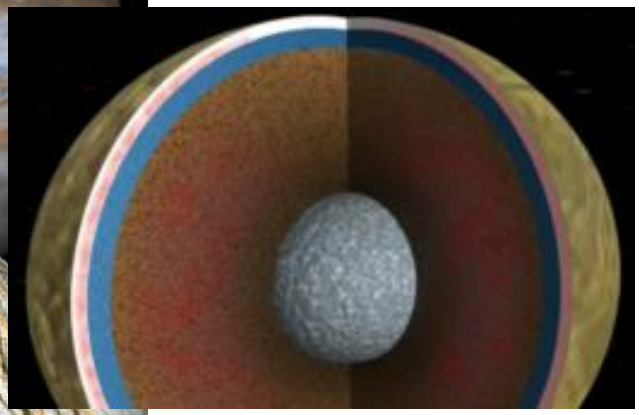
- Chemical energy could sustain life
  - Surface irradiation creates oxidants
  - Mantle rock-water reactions could create reductants

Geological activity "stirs the pot"

A Europa mission must verify key habitability hypotheses

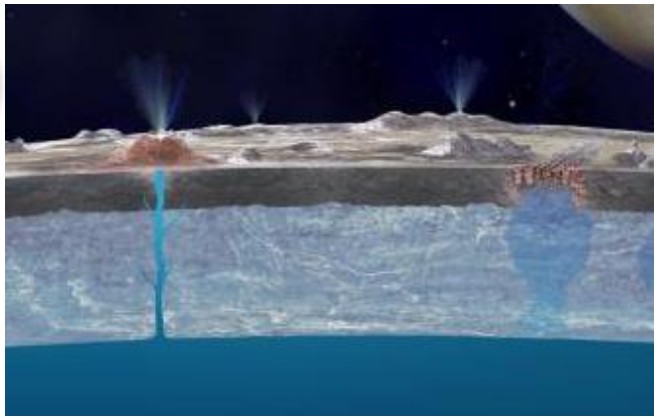


The Big Question: Is Europa Habitable?



How deep and salty is the ocean?
Gravity, Magnetometry (GRAIL, GRACE)

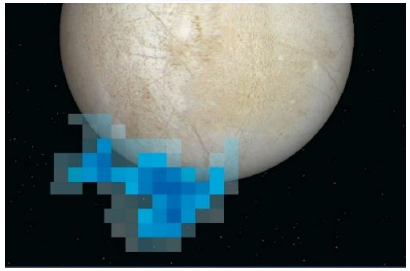
How thick is the ice shell?
Radar, Gravity (MRO, Cassini)



How active is the ice shell?
Camera, Thermal Imager (MRO, ICESat)

What's in the plumes?
Mass & Dust Spectrometers (Cassini)

What's the brown stuff?
IR & Mass Spectrometers (Landsat, MRO)

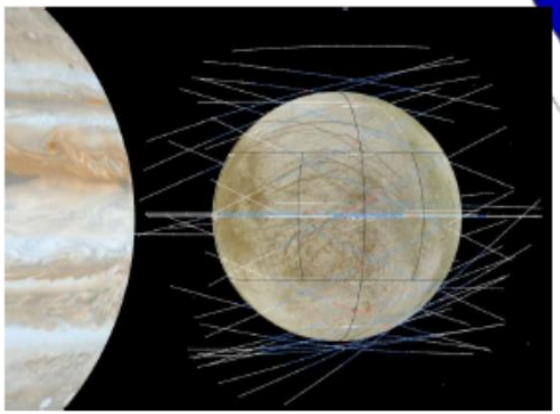


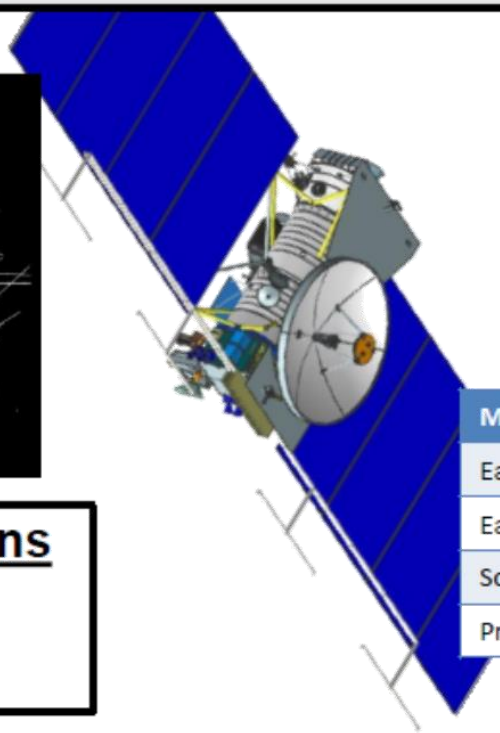
The drive to answer these questions has guided mission concepts for 15 years, drawing on our experience at Mars, Saturn and Earth

Europa Multi-Flyby Mission Concept

Science	
Objective	Description
Ice Shell & Ocean	Characterize the ice shell and any subsurface water, including their heterogeneity, 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.
Recon	Characterize scientifically compelling sites, and hazards for a potential future landed mission to Europa

Science Investigations	
Acronym	Instrument
REASON	Ice Penetrating Radar
MISE	Shortwave Infrared Spectrometer
EIS	Topographical Imager / Reconnaissance Camera
MASPEX	Mass Spectrometer
E-THEMIS	Thermal Imager
ICE-MAG	Magnetometer
PiMS	Faraday Cups
Europa-UVS	Ultra-Violet Spectrometer
SUDA	Dust Detector
GS	Gravity Science



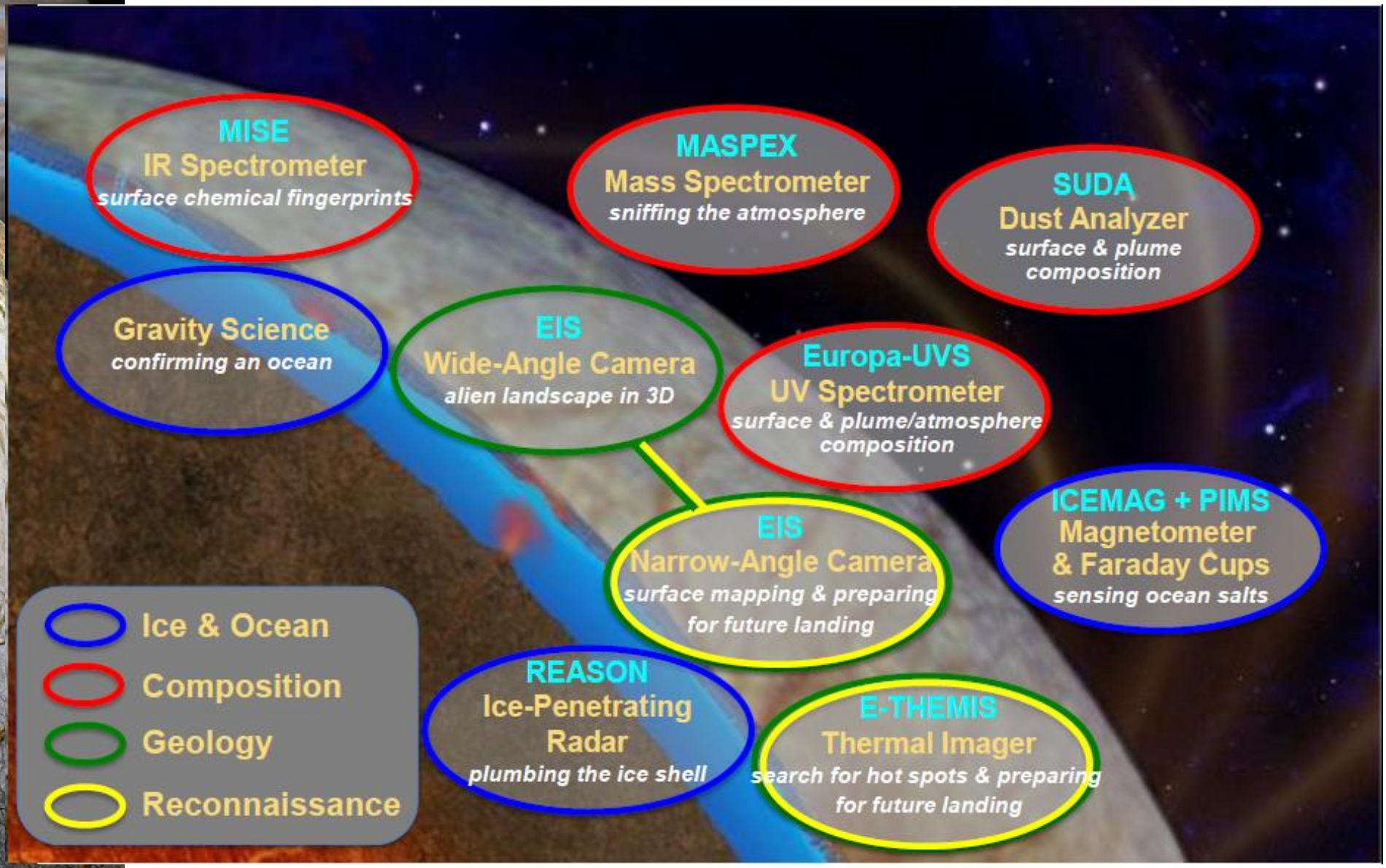


Mission Plan	
Earliest Launch Opportunity	June 6, 2022
Earliest Jupiter Arrival	March 5, 2025
Science Tour	45 Europa Flybys
Primary Mission End	December 6, 2028

Key Technical Margins

*37 - 41%	40%
Mass	Power

- Depending on Launch Opportunity and Launch Vehicle

http://solarsystem.nasa.gov/europa

NASA-Selected Payload