**IVO** will be the first mission dedicated to Io, the most volcanically active world in the solar system. The IVO mission design and payload will transform our understanding of this unique world and how tidal heating shapes planetary worlds across the cosmos.

**IVO** is relevant to major themes in the 2011 Decadal Survey for Planetary Science:

**Workings of Solar Systems**
Extremely active Io is ideal for studying planetary processes, including tidal dissipation, volcanism, tectonism, and atmosphere–magnetosphere interactions.

**Planetary Habitats**
The tidal heating driving Io’s extreme volcanism also controls Jupiter’s habitable zone, and understanding it gives insight into potential habitats in extrasolar systems.

**Building New Worlds**
Voluminous and high-temperature volcanic processes help us understand analogous processes on the early Earth, Moon, and other terrestrial worlds.

**IVO’s primary goal is to “Follow the Heat” to understand how tidal heat (A) is generated, (B) is lost, and (C) drives the evolution of Io:**

<table>
<thead>
<tr>
<th>SCIENCE OBJECTIVES:</th>
<th>KEY MEASUREMENTS:</th>
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</thead>
<tbody>
<tr>
<td>A1</td>
<td>Gravity, libration, magnetic induction, lava temperature and composition.</td>
</tr>
<tr>
<td>B1</td>
<td>Gravity, libration, magnetic induction, topography.</td>
</tr>
<tr>
<td>B2</td>
<td>Visible and thermal imaging.</td>
</tr>
<tr>
<td>C1</td>
<td>Precision ranging from Earth.</td>
</tr>
<tr>
<td>C2</td>
<td>Gas compositions, plasma measurements, imaging.</td>
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</tbody>
</table>

**IVO** returns more than 1000 times the data volume that we received from Galileo.

**IVO’s science experiments consist of high-heritage experiments, optimized for exciting Io science:**

**NAC**
Narrow-Angle Camera
10 µrad/pixel, 2048×4096 pixels (1.2°×2.3° FOV), color stripes for pushbroom imaging in 12 bands from 350–1050 nm, framing images.

**TMAP**
Thermal Mapper
125 µrad/pixel, 480×640 microbolometer array (3.4°×4.5° FOV), 9 spectral bandpass stripes for pushbroom imaging from 3–20 µm, framing images.

**DMAG**
Dual Fluxgate Magnetometers
Low-noise sensors, range/sensitivity: 4000/0.01 nT (line), 65,000/0.12 nT (coarse).

**PIMS**
Plasma Instrument for Magnetic Sounding
0.05–2.0 keV (electrons), 0.05–6.0 keV (ions), 2×30° conical FOV.

**GS**
Gravity Science
2-way Doppler tracking to measure tidal deformation and precision ranging to determine Io’s orbital evolution.

**INMS**
Ion & Neutral Mass Spectrometer
Mass range 1–1000 amu/q with M/ΔM=1100. First comprehensive measurements of ion and neutral species escaping from Io.
**IVO** will provide >100× more high-resolution (<50 m/pixel) image coverage than Galileo, like this view of Radegast Patera.

**IVO** will acquire global views of Io in visible and thermal wavelengths during each flyby.

**IVO**'s tour is optimized for geophysical measurements of Io, while minimizing radiation exposure:

- High heritage; compact, redundant, low-power S/C.
- Limited deployables (solar arrays, magnetometer boom).
- 761-kg dry mass (46% total margin).
- 1830-kg wet mass (13% launch vehicle margin).
- Radiation tolerances from rad-hard parts and shielding of sensitive electronics.
- Roll-out solar arrays (ROSAs) yield robust power margins through all 10 Io encounters (>40% total power margins in all modes).
- 2.1-m high-gain antenna (HGA) and redundant 25-W traveling wave tube amplifiers provide >10 kbps/s to 34-m DSN in X-band.
- Bi-propellant for maneuvers; three-axis attitude control.
- Low-power avionics combined with RAD750 processor.
- NAC and TMAP on pivot enable concurrent science data collection from all six experiments.

**IVO** relies on a simple, robust spacecraft (S/C), optimized for operations around Jupiter:

10 Io flybys, over 3.9 years

**Schedule Summary**

- **Development:** 2/2020 – 12/2026
- **Cruise to Jupiter:** 12/2026 – 12/2031
- **Jupiter Tour:** 12/2031 – 11/2035
- **Extended Mission:** 12/2035 – TBD

**IVO** enhances the science return from **Juno**, **Europa Clipper**, and **JUICE**. Studying Io’s intertwined tidal heating and orbital evolution completes our understanding of the Jovian system.