



The Io Volcano Observer (IVO) for NASA Discovery 2015

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IVO was first proposed as a NASA Discovery mission in 2010, powered by the Advanced Sterling Radioisotope Generators (ASRGs) to provide a compact spacecraft that points and settles quickly. The 2015 IVO uses advanced lightweight solar arrays and a 1-dimensional pivot to achieve similar observing flexibility during a set of fast (~ 18 km/s) flybys of Io. The John Hopkins University Applied Physics Lab (APL) leads mission implementation, with heritage from MESSENGER, New Horizons, and the Van Allen Probes. All science objectives from the Io Observer New Frontiers concept recommended in the 2011 Decadal Survey are addressed by IVO. There are 5 instruments plus gravity science: Narrow- and wide-angle cameras (NAC and WAC), Dual fluxgate magnetometers (DMAG), a thermal mapper (TMAP, from DLR), and particle environment package for Io (PEPI) consisting of an ion and neutral mass spectrometer (INMS, from UBE) and a plasma ion analyzer (PIA, from IRF). A student collaboration hotspot mapper (HOTMAP) is an option. The NAC and TMAP are on a $\pm 90^\circ$ pivot for off-nadir targeting during encounters and for distant monitoring. The DMAG sensors are on the end and middle of 3.8-m boom and collect data continuously. WAC and HOTMAP are mounted on the S/C nadir deck, and observe during ± 20 minutes of each Io closest approach, except orbits I0 and I2. PEPI is mounted on the S/C structure with the INMS field of view in the ram direction when the S/C nadir deck points at Io, and the PIA has a large (hemispheric) field of view that will often include the upstream direction. Gravity science requires pointing the high-gain antenna at Earth during the I0 and I2 encounters. IVO launches in 2021 and arrives at Jupiter in early 2026. A close Io flyby (I0) ~ 1.5 hrs. after Jupiter orbit insertion lowers the orbit period, followed by 8 additional encounters achieving the suite of science objectives. The highly elliptical orbit with perijove near Io is inclined $>40^\circ$ to Jupiter's orbital plane, which minimizes total ionizing radiation dose compared to other Jupiter orbiters ($<10\%$ that of JUICE). The apoapse period of each orbit provides extended monitoring of Io and Europa at high phase angles ($>120^\circ$), best to detect and monitor volcanic plumes as well as high-temperature hot spots on Io. Four of the encounters are designed for optimal measurement of induced magnetic signature from mantle melt. IVO will collect at least 20 Gb of science data per encounter: 100 times the Io data from the 8-year Galileo tour. Encounters last ~ 1 week, including global monitoring and four Io eclipses, with distant monitoring and data playback near apojoive. I8 includes a flythrough of Pele's plume, if it is active, for gas composition.

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