

Mission Concept: Io Volcano Observer (IVO)

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This 6-month study is to evaluate the viability of IVO within the Discovery Program and with a government-furnished power system, specifically the Advance Sterling Radioisotope Generator (ASRG). The ASRG is 6 times more efficient in Watts per kg of Pu than conventional radioisotope generators, which is a major advantage given the scarcity of Pu. NASA wants to flight-test it first on a Discovery-class mission. We have just begun this study, but our preliminary plan is for a small Jupiter orbiter in a highly inclined orbit with periods ranging from 200 to 30 days and an Io flyby near each perijove. Functioning within the intense trapped radiation belts of Jupiter is a major challenge. The high inclination orbit reduces the total dose for each perijove pass, allows Io observations at closer range versus dose rate, and enables unique science observations. We are focused on a few key science objectives: (1) understand active volcanic processes (repeat observations with similar lighting and viewing conditions in color, stereo, and thermal), (2) determine silicate lava compositions (measure peak temperatures and reflectance and/or emission spectroscopy), (3) constrain models for tidal heating (map global heat flow, measure satellite shape from limb fits, improved gravity data), and (4) better understand plume, atmospheric, Io plasma torus, and magnetospheric compositions and processes. We currently envision four baseline instruments: a Narrow-Angle Camera (NAC) with simultaneous color imaging, a Thermal Mapper (ThM) covering ~3, 8, and 15 microns and perhaps bandpasses for silicate compositions, a Neutral Mass Spectrometer (NMS), and a Radiation Detector (RaD). RaD will provide information useful to IVO operations and future Jupiter orbiters as well as magnetospheric science. Many other capabilities are desirable, such as a magnetometer, UV spectrometer, wide-angle camera, near-IR spectrometer, and ultra-stable oscillator. Unique polar monitoring of Jupiter would also be possible, limited by data rate.