

THE HYSPIRI DECADEAL SURVEY MISSION: UPDATE ON THE MISSION CONCEPT AND SCIENCE OBJECTIVES FOR GLOBAL IMAGING SPECTROSCOPY AND MULTI-SPECTRAL THERMAL MEASUREMENTS

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The NASA HypsIRI mission is planned to provide global solar reflected energy spectroscopic measurement of the terrestrial and shallow water regions of the Earth every 19 days with all measurements downlinked. In addition, HypsIRI will provide multi-spectral thermal measurements with a single band in the 4 micron region and seven bands in the 8 to 12 micron region with 5 day day/night coverage. A direct broadcast capability for measurement subsets is also planned. This HypsIRI mission is one of those designated in the 2007 National Research Council (NRC) Decadal Survey: Earth Science and Applications from Space. In the Decadal Survey, HypsIRI was recognized as relevant to a range of Earth science and science applications, including climate: “A hyperspectral sensor (e.g., FLORA) combined with a multispectral thermal sensor (e.g., SAVII) in low Earth orbit (LEO) is part of an integrated mission concept [described in Parts I and II] that is relevant to several panels, especially the climate variability panel.”

The HypsIRI science study group was formed in 2008 to evaluate and refine the mission concept. This group has developed a series of HypsIRI science objectives:

- Climate: Ecosystem biochemistry, condition & feedback; spectral albedo; carbon/dust on snow/ice; biomass burning; evapotranspiration
- Ecosystems: Global plant functional types, physiological condition, and biochemistry including agricultural lands
- Fires: Fuel status, fire frequency, severity, emissions, and patterns of recovery globally

- Coral reef and coastal habitats: Global composition and status
- Volcanoes: Eruptions, emissions, regional and global impact
- Geology and resources: Global distributions of surface mineral resources and improved understanding of geology and related hazards

These objectives are achieved with the following measurement capabilities. The HypsIRI imaging spectrometer provides: full spectral coverage from 380 to 2500 at 10 nm sampling; 60 m spatial sampling with a 150 km swath; and fully downlinked coverage of the Earth's terrestrial and shallow water regions every 19 days to provide seasonal cloud-free coverage of the terrestrial surface. The HypsIRI Multi-Spectral Thermal instrument provides: 8 spectral bands from 4 to 12 microns; 60 m spatial sampling with a 600 km swath; and fully downlinked coverage of the Earth's terrestrial shallow water regions every 5 days (day/night) to provide nominally cloud-free Monthly coverage. The HypsIRI mission also includes an on-board processing and direct broadcast capability, referred to as the Intelligent Payload Module (IPM), which will allow users with the appropriate antenna to download a subset of the HypsIRI data stream to a local ground station.

These science and science application objectives are critical today and uniquely addressed by the combined imaging spectroscopy, thermal infrared measurements, and IPM direct broadcast capability of HypsIRI. Two key objectives are: (1) The global HypsIRI spectroscopic measurements of the terrestrial biosphere including vegetation composition and function to constrain and reduce the uncertainty in climate-carbon interactions and terrestrial biosphere feedback. (2) The global 8 band thermal measurements to provide improved constraint of fire related emissions. In this paper the current HypsIRI mission concept that has been reviewed and refined to its current level of maturity with a Data Products Symposium, Science Workshop and NASA HWorkshop is presented including traceability between the measurements and the science and science application objectives.

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