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Imaging Spectroscopy for Mapping Domestic Critical Mineral Resources as Part of the U.S. Geological Survey's Earth Mapping Resource Initiative

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The U.S. Geological Survey's (USGS) Earth Mapping Resources Initiative (Earth MRI) seeks to substantially improve our understanding of the geological framework of the United States, while also targeting regions that may contain undiscovered occurrences of critical mineral resources. The goal of this initiative is to reduce the US dependence on imported critical mineral resources while strengthening our national security and economy. Visible to shortwave infrared (VSWIR) spectra can be used to identify surface minerals that contain critical elements such as rare earth element-bearing carbonates and phosphates, lithium clays, and minerals associated with hydrothermal alteration of mineralized systems. Through Earth MRI funding, the USGS has partnered with the National Aeronautics and Space Administration (NASA) and Jet Propulsion Laboratory to collect imaging spectrometer data using the Airborne Visible/Infrared Imaging Spectrometer, Airborne Visible/Infrared Imaging Spectrometer 5, and the Moderate Resolution Imaging Spectroradiometer/Advanced Spaceborne Thermal Emission and Reflection Radiometer airborne simulator. The joint Geological Earth Mapping Experiment (GEMx) mission utilizes NASA's high altitude ER-2 aircraft to collect data over the arid western regions of the US. Since 2023, this mission has collected over 850,000 km² of new imaging spectrometer data in California, Arizona, Nevada, Utah, New Mexico, Oregon, Idaho and Texas. While we are currently in the data collection and calibration phase of the mission, preliminary mapping has begun. Additional data is being collected in 2026 which will extend our coverage to include more targets in New Mexico, Texas, Utah and parts of Colorado. The Earth MRI imaging spectrometer (hyperspectral imaging) coverage encompasses many deposit types and mineral systems that are known to host critical mineral commodities. These data contribute an additional layer of information for use with Earth MRI airborne geophysics, geochemical sampling, and geologic mapping to better understand the distribution of areas prospective for critical mineral resources.