

Maximizing Return on Investment of Sample-Return Mission: Astromat's Services to Ensure Long-term Access and Reusability of Astromaterials Sample Data

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Samples returned from space are among the most precious specimens we study in our labs. Rigorous curation, archiving, and open dissemination of the data generated by their study in laboratories across the globe is vital to maximize the impact of this huge investment of tax-payer funds on science and society, supporting new scientific inquiry and providing learning opportunities beyond the immediate research community working on these samples for researchers, students, and instructors from other disciplines and the general public.

The Astromaterials Data System (Astromat) is operating critical data services for the preservation, curation, and dissemination of astromaterials samples data to drive new science, inform future sample-return missions, and support compliance with NASA's policy for Open Science SPD-41a. Astromat is officially designated as NASA's primary archive for laboratory analyses of astromaterials samples. Over the past year, Astromat has upgraded its existing data systems to improve its services to the astromaterials samples community. The previous Astromat data repository, AstroRepo, is replaced by the Astromat Data Archive (ADA) *to* offers increased capacity for data deposition and extended metadata for improved data search and discovery. Since early 2024, ADA has archived sample analysis data of the OSIRIS-REx mission and now contains >2,100 datasets for Bennu samples, contributed by >100 investigators. The Astromat Data Synthesis offers end-users a comprehensive, fully integrated, machine-readable, and analysis-ready data store, from which they can extract individual measurements from any number of datasets and publications and create customized data compilations that can be explored, visualized, and analyzed with new computational methods. The synthesis database now contains > 2.1 million data values with rich metadata about the data provenance and features a new search interface (Search v4) scheduled to be released in March 2025.

Astromat also established a workflow and criteria for peer-review of data and metadata submitted to the archive to ensure that disseminated data products meet the community's expectations for data quality and usability. Astromat is working to streamline the review process to minimize effort both for