

## The NASA Cosmic Dust Collection: Current Status and Advanced Curation Planning

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Cosmic dust, composed of what is otherwise known as interplanetary dust particles (IDPs), has been collected by NASA U-2, ER-2, and WB-57 aircraft in the stratosphere on oil-coated Lexan surfaces since 1981. This collected material composes the NASA Cosmic Dust collection curated at the Johnson Space Center. Many thousands of 2 – 100  $\mu\text{m}$  particles have been collected, and it is believed that both comet and asteroid samples are present. Several cosmic dust collections have been flown during periods that coincided with prominent meteor streams and low velocity fresh cometary dust trails. These samples therefore have great scientific value. This material is curated by the NASA Curation office and is made available for allocation to the international scientific community through a sample requests with input from the Curation Analysis and Planning Team for Extraterrestrial Materials (CAPTEM).

Collection and curation of the Cosmic Dust collection is now in its 37<sup>th</sup> year. Material is collected during regularly-scheduled flights of NASA high altitude aircraft at altitudes of ~18-25km on plates coated with silicone oil. Particles are extracted from the oil and rinsed to remove oil in an ISO 5 cleanroom, and then given a preliminary examination. SEM and EDS analysis of each particle facilitates a tentative classification and provides requestors enough information to make an informed sample request. Approximately 1/10<sup>th</sup> of the collection consists of extraterrestrial particles which may originate from all bodies in the Solar System, with cometary and asteroidal sources predominating. The remaining collection of terrestrial particles includes volcanic debris, rocket exhaust components, aerospace debris, and other material that has been requested for study and is scientifically valuable in its own right.

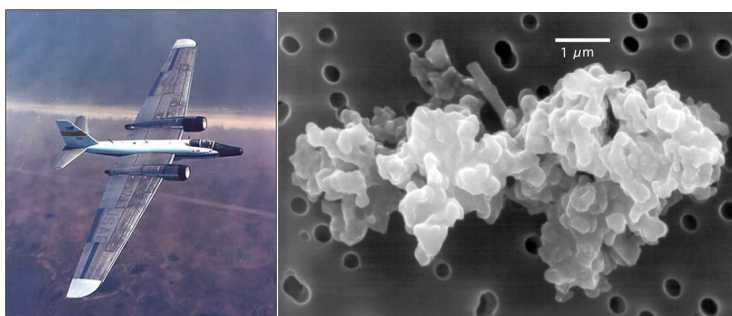


Figure 1: LEFT: One of the NASA WB-57 high altitude research aircraft used to collect Cosmic Dust in the stratosphere. RIGHT: A Cosmic Dust particle of chondritic composition, which was then allocated to a researcher for analysis.

NASA Curation actively strives to improve current collections in order to increase the scientific, historical, and cultural value of NASA's collections through the Advanced Curation program. In accord with this goal, Advanced Curation efforts for improving the Cosmic Dust collection include investigation of expanding Cosmic Dust collection through NASA's high-altitude scientific balloon program, addition of oil-free collection methods as a supplemental collection technique, and investigation of potential improvements in sample processing and preliminary data analysis. Short-term plans include development of a prototype high-altitude balloon collector for Cosmic Dust. This will be an undergraduate student project involving engineering students from Texas A&M University, with at least one balloon flight expected in 2019. "Dry", or oil-free, collection methods will also commence testing. While silicone oil is an efficient collection medium, it introduces contamination that causes interference with some measurements such as analysis of organic compounds, oxygen isotopes, and primitive silicate glasses. The first dry collection trials will use foam collectors on the balloon prototype, as the low air speed collection afforded by a balloon-based system may be especially suitable for foam collectors. Future trials may expand into 3D printed collectors optimized for dry collection, depending on results from the foam trials. In addition, data from the entire history of the Cosmic Dust program will be collated into comprehensive statistics on the types of particles collected, collection efficiency, and other factors.

The NASA Cosmic Dust program has enjoyed almost four decades of successfully sampling the Earth's natural infall of extraterrestrial material. The material has been carefully curated and provided to the international scientific community and this will continue into the indefinite future. NASA's Advanced Curation efforts will continue to improve the collection in response to scientific need, using the most up to date technology and methods available.