Characterizing GEO Titan IIIC Transtage Fragmentations using Ground-based and Telescopic Measurements

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Abstract

In a continued effort to better characterize the Geosynchronous Orbit (GEO) environment, NASA's Orbital Debris Program Office (ODPO) utilizes various ground-based optical assets to acquire photometric and spectral data of known debris associated with fragmentations in or near GEO. The Titan IIIC Transtage upper stage is known to have fragmented four times. Two of the four fragmentations were in GEO while a third Transtage fragmented in GEO transfer orbit. The forth fragmentation occurred in Low Earth Orbit.

In order to better assess and characterize these fragmentations, the NASA ODPO acquired a Titan Transtage test and display article previously in the custody of the 309th Aerospace Maintenance and Regeneration Group (AMARG) in Tucson, Arizona. After initial inspections at AMARG demonstrated that the test article was of sufficient fidelity to be of interest, the test article was brought to JSC to continue material analysis and historical documentation of the Titan Transtage. The Transtage has been subject to two separate spectral measurement campaigns to characterize the reflectance spectroscopy of historical aerospace materials. These data have been incorporated into the NASA Spectral Database, the goal being to enable comparison with telescopic data and potential material identification. A LIDAR scan has been completed and a scale model has been created for use in the Optical Measurement Center for photometric analysis of an intact Transtage, including a BRDF.

An historical overview of the Titan IIIC Transtage, the current analysis that has been done to date, and the future work to be completed in support of characterizing the GEO and near GEO orbital debris environment will be discussed in the subsequent presentation.