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Hypervelocity Impacts and Protection (3)

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CHARACTERIZING DEBRISAT FRAGMENTS: SO MANY FRAGMENTS, SO MUCH DATA, AND
SO LITTLE TIME**Abstract**

The DebrisSat project was conceived to provide NASA and DoD with data for updating the standard break-up model to improve prediction accuracy. Since the beginning of the characterization phase of the DebrisSat project, over 130,000 fragments have been collected and approximately 250,000 fragments are expected to be collected in total, a three-fold increase over the 85,000 fragments predicted by the current break-up model. To update the standard break-up model, detailed characteristics of each fragment are necessary. These characteristics include physical size and dimensions, material, appearance, and more. In addition to the fragment characteristics, metadata associated with the fragments are also collected. For DebrisSat, fragments with at least one dimension greater than 2 mm are collected, characterized and archived. In addition, a database was developed to archive each fragment's the characterization data and associated metadata. The challenge throughout the project has been to ensure the integrity and accuracy of the characteristics of each fragment. To this end, the post hypervelocity-impact test activities, which include fragment collection, extraction, and characterization, have been designed to minimize handling of the fragments. The procedures for fragment collection, extraction, and characterization were painstakingly designed and implemented to maintain the post-impact state of the fragments, thus ensuring the integrity

and accuracy of the characterization data. Each process is designed to expedite the accumulation of data, however, the need for speed is restrained by the need to protect the fragments. Methods to expedite the process such as parallel processing have been explored and implemented while continuing to maintain highest integrity and value of the data. To minimize fragment handling, automated systems have been developed and implemented. Errors due to human inputs are also minimized by the use of automated systems. This paper discusses the processes and challenges involved in the collection, extraction, and characterization of the fragments as well as the time required to complete the processes. The objective is to provide the orbital debris community an understanding of the scale of the effort required to generate and archive high quality data and metadata for each debris fragment 2 mm or larger generated by the DebrisSat project.