Using the Shuttle *In Situ* Window and Radiator Data for Meteoroid Measurements

Mark Matney

Every time NASA's Space Shuttle flew in orbit, it was exposed to the natural meteoroid and artificial debris environment. NASA Johnson Space Center maintains a database of impact cratering data of 60 Shuttle missions flown since the mid-1990's that were inspected after flight. These represent a total net exposure time to the space environment of 2 years. Impact damage was recorded on the windows and radiators, and in many cases information on the impactor material was determined by later analysis of the crater residue. This information was used to segregate damage caused by natural meteoroids and artificial space debris. The windows represent a total area of 3.565 m^2, and were capable of resolving craters down to about 10 μm in size. The radiators represent a total area of 119.26 m^2, and saw damage from objects up to ~1 mm in diameter. These data were used extensively in the development of NASA's ORDEM 3.0 Orbital Debris Environment Model, and gives a continuous picture of the orbital debris environment in material type and size ranging from about 10 μm to 1 mm. However, the meteoroid data from the Shuttles have never been fully analyzed. For the orbital debris work, special "as flown" files were created that tracked the pointing of the surface elements and their shadowing by structure (such as the ISS during docking). Unfortunately, such files for the meteoroid environment have not yet been created. This talk will introduce these unique impact data and describe how they were used for orbital debris measurements. We will then discuss some simple first-order analyses of the meteoroid data, and point the way for future analyses.