

SPACE DEBRIS SYMPOSIUM (A6)
Hypervelocity Impacts and Protection (3)

Author: Mr. James Hyde
Barrios Technology/ESC Group - NASA, United States, james.l.hyde@nasa.gov

Dr. Eric Christiansen
National Aeronautics and Space Administration (NASA), Johnson Space Center, United States,
Eric.L.Christiansen@nasa.gov

Mr. Dana Lear
United States, dana.m.lear@nasa.gov

MMOD IMPACT DAMAGE TO ISS

Abstract

Paper will describe micrometeoroid and orbital debris (MMOD) damage that has been observed on the International Space Station (ISS). Several hundred documented MMOD damage sites on ISS have been identified through imagery from the windows of ISS modules or docked vehicles. Sites that are observable from ISS or shuttle windows exhibiting distinct features of hypervelocity impact damage are usually greater than 5mm in diameter. Many smaller features are revealed in on-orbit imagery are typically less distinct and difficult to characterize but could be MMOD damage. Additional images of on-orbit damage features have been collected by astronauts during extra vehicular activities.

Ground inspection of returned ISS hardware has also contributed to the database of ISS MMOD impact damage. A handful of orbital replacement units (ORU) from the ISS active thermal control and electrical power subsystems were swapped out and returned during the Space Shuttle program. In addition, a reusable logistics module was deployed on ISS for a total 59.4 days on 11 shuttle missions between 2001 and 2011 and then brought back in the shuttle payload bay. All of this returned hardware was subjected to detailed post-flight inspections for MMOD damage, and a database with nearly 1000 impact records has been collected.

A description of the largest observed damages will be provided in the paper. In addition, a discussion of significant MMOD impact sites with operational or design aspects will be presented. Some of the ISS modules/subsystems damaged by MMOD to be included in the discussion are (1) Solar Arrays, (2) US and Russian windows, (3) EVA handrails, (4) Radiators, and (5) Russian FGB module.