

## Title: Simplified Abrasion Test Methodology for Candidate EVA Glove Lay-ups

During the Apollo Program, space suit outer-layer fabrics were badly abraded after performing just a few extravehicular activities (EVAs). For example, the Apollo 12 commander reported abrasive wear on the boots that penetrated the outer-layer fabric into the thermal protection layers after less than 8 hrs of surface operations. Current plans for the exploration planetary space suits require the space suits to support hundreds of hours of EVA on a lunar or Martian surface, creating a challenge for space suit designers to utilize materials advances made over the last 40 years and improve on the space suit fabrics used in the Apollo Program. Over the past 25 years the NASA Johnson Space Center Crew and Thermal Systems Division has focused on tumble testing as means of simulating wear on the outer layer of the space suit fabric. Most recently, in 2009, testing was performed on 4 different candidate outer layers to gather baseline data for future use in design of planetary space suit outer layers.

In support of the High Performance EVA Glove Element of the Next Generation Life Support Project, testing a new configuration was recently attempted in which require 10% of the fabric per replicate of that need in 2009. The smaller fabric samples allowed for reduced per sample cost and flexibility to test small samples from manufacturers without the overhead to have a production run completed. Data collected from this iteration was compared to that taken in 2009 to validate the new test method. In addition the method also evaluated the fabrics and fabric layups used in a prototype thermal micrometeoroid garment (TMG) developed for EVA gloves under the NASA High Performance EVA Glove Project. This paper provides a review of previous abrasion studies on space suit fabrics, details methodologies used for abrasion testing in this particular study, results of the validation study, and results of the TMG testing.