

IAF MATERIALS AND STRUCTURES SYMPOSIUM (C2)  
Late Breaking Abstracts (LBA) (LBA)

Author: Mr. Anand Jude  
National Institute of Technology Calicut, India

Dr. Basil Kuriachen  
National Institute of Technology Calicut, India

ADDITIVE MANUFACTURING OF FUNCTIONALLY GRADED SHOCK ABSORBING LANDING  
LEG STRUTS FOR PLANETARY LANDERS**Abstract**

As planetary lander missions become more frequent and carry sophisticated payloads, the need for shockless landing systems is escalating. Conventional aluminum crushable tubes are not well suited to accomplish landing for varying touchdown velocities with minimum shock. This study presents a new solution, **functionally graded honeycomb crush structure** integrated directly into the lander's struts via **multi metal DED** and **hybrid manufacturing**. Crush structure has spatially varying yield strength, attained through varying material composition and process parameters during build. This enables effective energy absorption across a broad velocity range without shock. **MATLAB** code was developed to calculate touchdown velocities and determine the required crush length for safe landings. These analytical results were validated using **ANSYS Explicit Dynamics** simulations, that showed effective energy dissipation and low peak deceleration loads. This design reduces system complexity and mass, thereby increasing available payload capacity, all while improving mission reliability, and protecting sensitive instrumentation from shocks.