Abstract Submitted
for the DFD07 Meeting of
The American Physical Society

Prediction of Progressive Decomposition in Launching Space Vehicles Subject to Soft Foreign Object Impacts[1] JAVID BAYANDOR, The Sir Lawrence Wackett Aerospace Centre, Royal Melbourne Institute of Technology, Melbourne, VIC — Reusable space vehicles are subjected to high velocity to ballistic foreign object impact (FOI) events, particularly soft impacts. Such events and their consequent severe dynamic loading/unloading conditions occur during the launch phase or landing approach of the re-entry vehicles within their tropospheric flight windows. Effective prediction of non- linear dynamic responses of such structures, accentuated by the intricacy of the transient solid-fluid behavior of the projectile, can play a major role in developing a fail-safe design for these vehicles. A resulting crashworthy design can materialize through active control of the failure sequencing of the primary and secondary components. Two major discretized fluid-solid approaches, Smooth Particle Hydrodynamics (SPH) and Arbitrary Lagrangian-Eulerian (ALE), will be compared and presented which enable the effective prediction of complicated phase transition in the projectile. While the focus will be given to the SPH approach, a novel coupled micro constitutive/cohesive finite element solution will also be introduced, enabling the multi-scale analysis of progressive degradation and disintegration in impacted advanced space composite (sub)structures.

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Date submitted: 07 Aug 2007 Electronic form version 1.4