Abstract Submitted
for the DFD10 Meeting of
The American Physical Society

Fluid-Solid Interactive Methodology for Prognosis of Passenger Jet Structural Damage in Water Crash Landing JAVID BAYANDOR, Virginia Tech — Today, crashworthiness studies constitute a major part of modern aerospace design and certification processes. Of important consideration is the assessment of structural damage tolerance in terms of the extent of progressive damage and failure caused by aircraft emergency ditching on soft terrain or on water. Although a certification requirement, full scale crash landings are rarely tested using fully functional prototypes due to their high associated costs. This constraint makes it difficult for all crashworthy features of the design to be identified and fine-tuned before the commencement of the manufacturing phase. The current study presents aspects of a numerical methodology that can drastically subside the dependency of the certification assessments to full scale field trials. Interactive, fully nonlinear, solid-structure and fluid- structure analyses have been proposed using coupled Lagrangian- Eulerian and independent meshless Lagrangian approaches that run on a combined finite element-computational fluid dynamics platform. Detailed analysis of a key landing scenario pertaining to a large passenger jet will be provided to determine the relevance and accuracy of the proposed method. The work further identifies state-of-the-art computational approaches for modeling fluid-solid interactive systems that can help improve aircraft structural responses to soft impact and water ditching.

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Date submitted: 09 Aug 2010 Electronic form version 1.4