# APPLICATION OF NON-DETERMINISTIC METHODS TO ASSESS AIRCRAFT IMPACT EXPERIMENTAL AND SIMULATION UNCERTAINTIES

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Full-scale aircraft impact simulations are traditionally performed deterministically with nonlinear, transient dynamic, finite element codes. These simulations rely on the modeling of complex structures using geometric and material behavior approximations. The assessment of the modeling accuracy is dependent on the comparison of the simulation results with experimental data. Due to the expense of conducting a full-scale impact dynamics test and because the test article is generally destroyed as part of the test, the acquisition of repeatability data is usually not feasible. Therefore little information exists to quantify the accuracy and repeatability of the measured results. Alternative means must be devised to estimate modeling and experimental uncertainties through simulation results.

The proposed paper will contain details about the application of a non-deterministic approach to bound experimental and analytical uncertainties. A pre-test finite element model for a Fokker F28 fuselage section was developed to aid in the experiment design. This finite element model contains approximately 6,000 elements and required about 1 hour per simulation. The model is considered sufficiently detailed to understand the capabilities and limitations of using non-deterministic approaches for full-scale impact dynamic applications. The analysis utilizes a commercial probabilistic code along with a finite element analysis code to generate numerical results. The simulations represent a recent drop test of a Fokker F28 fuselage section. The section was dropped from a height of 14 ft to achieve a pure vertical impact velocity of 30 ft/s. Approximately 1,700 lb was attached to the floor to simulate the additional weight of seat, passengers, etc. The section was densely instrumented with accelerometers, strain gages and displacement transducers. Sensitivity results from the probabilistic analysis will provide guidance on the parameters most likely to affect the response as well as to bound the results. The experimental data will be compared with the bounds established by the non-deterministic analysis. The sensitivity results can be used to identify areas requiring additional information or refinement to reduce the uncertainty.