Simulation Development and Prediction of Occupant Response in a Fokker F28 Full Scale Crash Test

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Abstract

In June of 2019 the National Aeronautics and Space Administration (NASA) Langley Research Center (LaRC) conducted a full scale crash test of a Fokker F28 MK100 aircraft. This test was conducted as part of an interagency research program funded by the Federal Aviation Administration (FAA) and also included research projects from the Department of Defense (DOD), National Highway Safety Administration (NHTSA), and industry partners. This partnership created one of the widest diversity of Anthropomorphic Test Devices (ATDs, a.k.a crash test dummies) simultaneously tested in a crash event. The ATD's tested included traditional Hybrid II and Hybrid III 5th, 50th, and 95th ATD's in addition to novel experimental ATD's including the Hybrid III Obese, Test Device for Human Occupant Restraint (THOR), and Warrior Injury Assessment Manikin (WIAMan). A variety of child/infant ATD's were also included. The resulting data set provided an excellent opportunity to evaluate variations in occupant response predicted by each ATD. In addition it provided an equivalent test point to baseline the predictive capability of each ATD Finite Element Model (FEM).

Figure 1. FE Simulation of the Fokker F28 (Left) and Occupant Breakout Model (Right)

A FEM of the Fokker F28 was developed and simulated under the crash test conditions to provide pre-test predictions of vehicle response [1]. In this study the predicted acceleration time history at each seat attachment location was used to simulate individual occupant breakout models (Figure 1). Simulations were performed with currently available ATD FEMs including the Hybrid III 5th, 50th, and THOR. ATD response and injury risk predictions were compared between test and simulation. The ISO 16250 curve comparison methodology [2] was used to provide a quantitative assessment of the prediction accuracy of each of these FEMs in this type of crash test scenario. After quantifying model accuracy a second set of simulations were performed to evaluate occupant response under varied impact conditions.

References

1. Jackson, K. E., Putnam, J. B., “Development of a Full-Scale Finite Element Model of the Fokker F28 Fellowship Aircraft and Crash Simulation Predictions”. Proceedings of the 9th Triennial International Aircraft Fire and Cabin Safety Research Conference, Atlantic City, NJ, October 28-31, 2019.
2. International Organization for Standardization, "Road Vehicles - Objective Rating Metrics for Dynamic Systems," ISO/TR 16250, 2013.