

EVALUATION OF HEAD INJURY COMPONENT TESTER USING MULTIBODY ANALYTICAL TOOLS

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ABSTRACT

The certification of aircraft frequently requires engineers to demonstrate that a head strike into any one of several cabin furnishings complies with the Head Injury Criteria (HIC) requirements specified in 14 CFR 23.562 and 14 CFR 25.562. Full-scale sled tests, which are currently used to evaluate designs of aircraft interior furnishings, often consume several test articles in the development of engineering solutions and in the demonstration of the compliance of the design. Component testers are an alternative method to determine the HIC value without consuming a seat during each test, thus reducing the cost and time involved in testing.

Some of the existing component testers have been studied in this thesis. Analytical models have been developed to evaluate the component testers such as the bowling ball tester and free motion headform (FMH) tester. This was done to arrive at the optimal test condition/configuration in which these testers can be effectively used to represent a full-scale sled test. Different masses were utilized for the bowling ball analysis to determine the one that resulted in better comparison with the sled analyses. It was observed that an increase in mass of the ball resulted in a decrease in the HIC value. Ball analysis conducted with softer bulkhead panels resulted in poorer comparison while harder bulkhead panels yielded better results. The free motion headform analysis resulted in higher values when compared with the sled analyses. This could be attributed to the fact that the headform completely interacts with the bulkhead while in the sled analysis, the restraint system and the interaction of the various body segments with the bulkhead panel affects the outcome of the results. A component tester that represents the exact kinematics of an ATD in a sled analysis is likely to yield better results.