

# TESTING AND VALIDATION OF A TWO DEGREE-OF-FREEDOM COMPONENT HIC TESTER

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## ABSTRACT

The certification of aircraft frequently requires engineers to demonstrate that head strike into anyone of the cabin furnishing complied with the Head Injury Criteria (HIC). This represents a significant challenge to engineers designing cabin interior furnishings for all classes of aircraft. The dynamic seat tests required in 14 CFR 23.562 and 25.562 for the evaluation of this injury measure are costly, time consuming and provide too much scatter on HIC. Component testers are an alternative method to determine the HIC value without consuming a seat during each test. Many segments of the aerospace industry have expressed the desire for an effective component test with which to address this problem. Although industry and research institutions have developed several component testers such as Bowling ball tester, the Free Motion Headform tester and the MGA tester and employed them in the aircraft and automotive industry, none of them have been capable of reproducing all the parameters obtained during sled testing. The objective of this research was to develop a component tester capable of reproducing sled test results. In order to accomplish this task several sled tests, biomechanical models, and parametric studies were conducted to better understand the Anthropomorphic Test Dummy (ATD) response under several test conditions. The component tester is capable of two different modes of operation, it can be operated as a single degree of freedom system, or as a two degree of freedom system. Both modes of operation were capable of reproducing sled test results accurately. In this thesis the component tester has been tested and validated for the two-degree freedom of operation. This component tester significantly reduces the test design cycles for interior certification.