Evaluation of Aerospace Seat Belt Webbing Material Under Dynamic Test Conditions

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ABSTRACT

There is no requirement for full-scale testing of aircraft to certify a design as safe or crashworthy. The Federal Aviation Administration has a number of standards and regulations that are designed to protect occupants in the event of a crash. These standards focus primarily on frontal and vertical impact protection of the occupant seating system and those items in the cabin interior that surround the occupant. With the adoption of Title 14 Code of Federal Regulations (CFR) 25.562, as well as the corresponding portions of 14 CFR 23.562, 27.562, and 29.562, a seating system is comprised of the seat, all attachment hardware, and the restraint system. In this methodology, the attachments and the restraint are approved for use at the same time as the seat itself. One restraint cannot be readily swapped out for another restraint and any repairs of the restraint itself must return it back to its original specifications. Inherent material properties of common webbing materials may affect the dynamic response of the seat system. To determine how differences in elongation properties affect seat dynamic response, a test program using a rigid seat setup in different configurations with different webbing materials was conducted by the FAA. The selected configurations represented seats commonly in use. Both new and newly repaired belts were acquired for this study. As part of this test program, a second phase was conducted to investigate the effects of belt stiffness. Original belt webbing material and several replacement webbing material candidates were statically tested to determine their elongation properties. These belts were then subjected to the same test setup as in phase 1; however, unlike phase 1, only one seating configuration was tested. All these different belts were then subjected to dynamic impact tests using a rigid seat and the sled test pulse from Title 14 Code of Federal Regulations 25.562. No structural failures occurred in any of the tests. A trend was noted that higher belt stiffness resulted in less occupant excursion and higher belt loads. It was also noted that static belt stiffness can be used to characterize relative belt performance in dynamic tests. These data can be used to develop general guidelines on allowable webbing changes for previously approved seat belts.