

KINEMATICS OF OCCUPANTS ON SIDE-FACING AIRCRAFT SEATS USING SID AND BIOSID

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ABSTRACT

Individual and couch type side-facing aircraft seats (SFS) have presented new challenges in certification to the aerospace industry. Certification of the side-facing seats has become mandatory under FAR 25.785, requiring equivalent level of occupant protection as compared to a forward or aft-facing seat. However, passengers seated on side-facing seats experience different dynamic response compared to those on forward- or aft-facing seats in an aircraft accident. The regulations established by amendment 25-64 was developed from a database of forward facing seat test results, and no specific guidelines for the certification of SFS were given, but recommendation is made to use the injury criteria as well as side-impact ATD's from the automotive industry.

This thesis presents a study detailing some of the injury criteria that might be used for the evaluation of the injuries for passengers on SFS seats. These include the acceleration based criteria such as pelvic acceleration and thoracic trauma index (ITI (d)), compression based criteria such as rib deflections and viscous criteria ($V \cdot C$), and load-based criteria such as the lateral abdominal, Iliac and pubic symphysis forces. For evaluating these injury parameters, SFS sled tests are conducted at the FAA Civil Aeromedical Institute (CAMI) utilizing a rigid divan type couch, with a rigid bulkhead. A BioSID ATD is used to assess the various injury values. SID, EuroSID, and BioSID responses are compared to identify the most suitable ATD for a crash scenario. A three-point restraint system consisting of polyester webbing with a shoulder retractor is utilized. Tests are conducted for different lap belt spacing, distance to barrier and distance between ATD's. The data generated are compared in the level of biofidelity, instrumentation, and in predicting the potential injuries in a SFS test. Analytical studies are conducted using occupant simulation program MADYMO, to validate the test results and perform parametric studies. Through the conclusion, the related injury and pass/fail criteria along with the most appropriate testing procedures for certification of these seats with some design guidelines to meet this certification are outlined.