

Thomas Barth
Director of Research and Development
AmSafe Aviation
1043 N. 43rd Ave.
Phoenix, AZ 85043
tbarth@amsafe.com
Phone: 602 628-0322



TO: Sixth Triennial International Aircraft Fire and Cabin Safety Research Conference
April Horner
April.ctr.horner@faa.gov

DATE: April 1, 2010

Subject: Call For Papers

Injury Potential and Regulatory Compliance for Passenger Seats with Installation Angles above Eighteen Degrees

Objective: Premium class seats with installation angles above the 18 degree limit for forward facing seats are becoming more common. Compliance requirements for occupant safety are difficult to establish and can have subjective pass/fail criteria. Occupant kinematics and spine loads provide a means of evaluating potential injury, but do not have defined injury criteria. A series of dynamic impact tests are evaluated using designed experiments to better understand the potential injury for a range of installation angles. **Methods:** Eleven dynamic impact tests are used in a fractional factorial design to evaluate 3 factors: Yaw angle (10 and 35 degrees), Armrest (with and without), Airbag (with and without). Response measures include: Hybrid III Anthropomorphic Test Dummy (ATD) kinematics, lumbar spine forces and moments, head acceleration, and neck loads and moments. **Results:** An equation of motion is generated and main effects and first order interactions are presented. The airbag reduces failing and generally lowers spine and neck loads, but not for all directions and configurations. The results and issues related to establishing pass/fail criteria for regulatory compliance are discussed. **Conclusions:** Spine loads and neck loads provide insight to motion of the ATD, however lack of established injury thresholds and questions regarding variability and rate sensitivity preclude them from being used directly for compliance findings. Airbags provide a benefit, but in the configuration tested do not mitigate potential injury from lateral armrest intrusion into the occupant. Kinematics response remains the only accepted criteria for determining regulatory compliance until further understanding of other measures can be established.

Author: Thomas H. Barth, PhD