

5th Triennial International Aircraft Fire and Cabin Safety Research Conference
October 29 – November 1, 2007
Atlantic City, New Jersey

Office of Aviation Medicine Report

Authors:

Rick DeWeese
Civil Aerospace Medical Institute
Federal Aviation Administration
PO Box 25082
Oklahoma City, OK 73125-0082
Phone 405-954-7529
FAX 405-954-4984
rick.deweese@faa.gov

David Moorcroft
Civil Aerospace Medical Institute
Federal Aviation Administration
PO Box 25082
Oklahoma City, OK 73125-0082
Phone 405-954-5513
FAX 405-954-4984
david.moorcroft@faa.gov

Tom Green
AMSAFE Aviation
Inflatable Restraints Division
5456 E. McDowell Road, Suite 101
Mesa, AZ 85215
Phone 480-344-4704
FAX 480-344-4777
tgreen@amsafe.com

M. M. G. M. Philippens,
TNO Safety
Schoemakerstraat 97
PO Box 6033
2600 JA Delft
The Netherlands
Phone +31 152696950
mat.philippens@tno.nl

Title:

Assessment of Injury Potential in Aircraft Side Facing Seats using the ES-2 ATD

Abstract:

A project was conducted to assess the injury potential of current side facing aircraft seat configurations using the ES-2 Anthropomorphic Test Dummy proposed for use in Federal Motor Vehicle Safety Standards. The ability of inflatable restraint systems to mitigate injuries in these configurations was also assessed. Impact sled tests were conducted at the Federal Aviation Administration's Civil Aerospace Medical Institute using a side-facing sofa fixture with cushion construction representative of current business jets. The tests simulated three typical seating configurations: occupant in the middle seat, occupant seated next to a rigid wall, and occupant seated next to an armrest end closure. Two types of restraints were evaluated: a three-point body centered conventional restraint with inertia reel and a similar restraint incorporating a new inflatable shoulder restraint (airbag). The test conditions were the 16g, 44 ft/s, horizontal impact specified in 14 CFR 25.562 but without yaw. Test setup techniques were developed to ensure consistent occupant positioning. Test repeatability was assessed for some test conditions.

The suitability of the ES-2 for use in aircraft seat testing was evaluated. Injury criteria were calculated from the data gathered during the tests, including criteria currently published in the Federal Aviation Regulations and Federal Motor Vehicle Safety Standards such as the Head Injury Criteria, upper torso restraint loads, Thoracic Trauma Index, and peak lateral pelvis acceleration. Other research criteria and those identified in proposed Federal Motor Vehicle Safety Standards were also calculated. These criteria included neck forces and moments, Preliminary Lateral Nij, Viscous Criteria, rib deflection, abdominal forces, pubic force, upper spine acceleration, and femur torsion. Results were analyzed to identify criteria relevant for aviation use, and seating and restraint system configurations that indicated potential improvements in occupant protection for side-facing seats.