Development of Side Impact Neck Injury Criteria and Tolerances for Occupants of Sideward Facing Aircraft Seats

M.Philippens
TNO Defence Security and Safety
Lange Kleiweg 137
P.O.Box 45
2280 AA Rijswijk, The Netherlands

J.Mordaka and J Wismans
TNO Science & Industry
Steenhovenweg 1
5708 NH, Helmond, The Netherlands

N.Yoganandan, F.Pintar
Biomed Eng.,
Department of Neurosurgery
9200 West Wisconsin Avenue
Medical College of Wisconsin
Milwaukee, WI 53226
USA

Stephen J. Soltis
Federal Aviation Administration
3960 Paramount Blvd.
Lakewood, CA 90712 USA

Richard DeWeese,
Federal Aviation Administration
Civil Aerospace Medical Institute
P.O. Box 25082
Oklahoma City, OK 73125 USA

ABSTRACT

Dynamic performance standards for the certification of aircraft seats have been defined by the Federal Aviation Administration (FAA) in 14 Code of Federal Regulations (CFR) Part 25. The focus in this standard is on forward or aft facing seats. Currently, without applicable human occupant impact injury criteria, sideward facing aircraft seats cannot be certified to a level of safety consistent with that afforded by forward and aft facing seats. To remedy this deficiency, the Federal Aviation Administration (FAA) is working with a number of research organizations to develop human impact injury criteria that will be applicable for occupants of sideward facing aircraft seats. This presentation reviews the progress of this research program and most recent findings in a dynamic seat test program with EuroSID-2 side impact dummies and Post Mortem Human Subjects. A first PMHS test series with a side wall and a three point restraint with trailing shoulder belt revealed no injuries to the head

neck, although the ribcage was severely injured. A second series with a full rigid restraint thorax did not result in any serious injuries. However a third series using a realistic three point belt with retractor at armrest sitting position resulted in AIS4+ neck injuries, with additional injuries to thorax, and lower extremities. The latter set up was chosen as a potentially worst loading condition based on a test database available at CAMI. Further tests are planned where loading conditions close to the expected injury tolerance are selected, based on estimates made by numerical modeling techniques. This research is expected to result in the assessment of proper side impact neck injury criteria and tolerance levels, and the proposal, evaluation, and validation of a standard sideward facing seat dynamic test and certification procedure.

This research was sponsored by FAA and supported in part by VA Medical Research.