

ANALYSIS OF NECK INJURY FOR OCCUPANTS IN SIDE FACING AIRCRAFT SEATS

By

BALASUNDARAM NARASINGAPURAM BHASKARAN

Summer 2003

ABSTRACT

With available injury criteria side facing seats used in business flights and private jets cannot be certified to a level of safety compared to the forward or aft facing seats. The Federal Aviation Administration (FAA) is working with number of research organizations to develop injury criteria that will be applicable for occupants of side facing aircraft seats in order that they can be certified to an equivalent level of safety. Research has been done on various acceleration and compression based injury criteria such as pelvic acceleration, Thoracic Trauma Index (*ITI*), viscous criteria and Head injury criteria (*HIC*). FAA has recommended for these injury criteria to be added to the certification of side facing seats in aircrafts. But neck injury has so far never been considered as a serious mode of injury in side facing seats and there is no specific tolerance limit that has to be considered for the certification. In this study the importance of neck injury in side facing seats is demonstrated and the need for it be considered as a premier injury criteria in certification is emphasized. The model used for parametric studies has been validated with the results of sled test data. Parametric studies are conducted with single and double occupant with various belt configurations and different seating positions. Neck injury criteria (*Nij*) is shown to fail below the critical limit of 1.0 in all the cases studied. Inflatable restraint system has been used to bring the *Nij* value within the safe limit. Inflatable seat belt has been used for occupant sitting away from the barrier, and side airbag has been fixed on the barrier to prevent neck injury for the occupant sitting next to it. With the use of inflatable restraint system, the neck loads and moments have been reduced considerably below the tolerance limits.