

# ANALYSIS OF PASSENGERS DYNAMIC RESPONSES ON AIRCRAFT SIDE-FACING SEATS

By

MAHESH SWAMY

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## ABSTRACT

In recent years there has been an increase in number of private aircrafts. The interiors of such commuter aircrafts are unique, some being custom made. Some of these aircrafts are equipped with couch type (side facing) seats. These seats are designed to accommodate a single or up to three occupants. Passengers seated on side facing seats experience a different dynamic response compared to that in forward facing seat in an event of crash. In side facing seats, the occupant dynamic response not only depends upon the restraint system but also the position of the bulkhead (divider panel) from the seat and also the number of occupants on the side facing seat. Certification of side facing seat is an important issue and it has been made mandatory by FAR 23.785 regulation which addresses the requirements of a side facing seat. Numerous software have been developed for analyzing the response of an occupant in different crash environments. In this thesis, a study is made on the response of an occupant in a side facing seat of an aircraft.

A crash simulation analysis on two crash test dummy models namely, Hybrid II and U S DOT SID were carried out using MADYMO, a crash simulation software. A 16 G triangular decelerating pulse with an initial velocity of 44 ft/sec as recommended by FAR 25.562 was used to study the occupant response. The tests were conducted for 10 degree yaw. The main areas of interest were response of the head, chest and pelvis of the dummies. In order to obtain accurate injury parameter, finite element belts were used for modeling the seat belts as they simulate phenomena such as submarining and belt roll out. A symmetrical 'X' shaped belt was used for the shoulder along with a lap belt as this combination was found to be more effective than a single lap belt. Also the effect of a side airbag on the occupant response was investigated.

Two different types of cases were studied,

1. The bulkhead ( or the divider panel) extending beyond the seat.
2. The bulkhead flush with the seat.

For both the above cases, the Hybrid 2 and US SID dummy were used. Of the two cases, the second one showed rapid motion of the lower extremities of the body, increasing the risk of submarining. The head injury predicted by SID turn this off general was higher than Hybrid II, but turn this off the absence of restraints SID showed fatal injuries to the head. The TTI predicted by SID dummy was higher than that predicted by Hybrid II. Turn this off the absence of restraints, fatal injuries to the vital organs like the heart, lungs were seen mainly on SID dummy. Also when only a lap restraint was used, submarining of the occupant was seen. The experimental test result conducted for Hybrid II at CAMI showed good agreement with computer simulation for the maximum value

and the time at which the maximum value were attained. It is concluded that for passenger on side facing seat should definitely be provided with both lap and shoulder restraints. Some means must be provided to block the motion of the lower extremities of the body. From the results obtained from the side airbag restraint, it would be wise if a side airbag is also provided.