

Effect of passenger position on crash injury risk

Abstract

Amanda Taylor, David Moorcroft and Rick DeWeese

It is a common misconception that in the event of an airplane crash all occupants will perish. In reality the vast majority of crashes are survivable. One action that an occupant can take to contribute to their survival is to assume an appropriate "Brace-For-Impact" position. This is an action in which a person pre-positions their body against whatever they are most likely to be thrown against, significantly reducing injuries sustained. The position that will protect the maximum range of occupants has long been one of the most frequently asked questions of crash safety researchers. During the 1980s, brace position effectiveness was investigated using the then new dynamic impact test techniques and the recommendations were adjusted to reflect the findings. By the late 1980s, the effort to develop crashworthy seats resulted in a large amount of data concerning the flail response of occupants seated in a variety of seat configurations. This data was used to develop specific brace recommendations for each potential seating configuration. Many of these recommendations formed the basis of the brace positions cited in AC 121-24B Appendix 4. After several recent commercial airline accidents, such as US Airways flight 1549, injuries sustained by occupants, as well as passenger confusion as to the proper brace position, brought to the forefront a need to review brace position effectiveness to determine if the recommended positions are still appropriate for passenger seats incorporating the latest technology.

The FAA investigated this by conducting a series of sled impact tests with two rows of forward facing passenger seats configured to represent the types of seats currently flying. The factors investigated were, seat back type, brace position, the spacing between rows, occupant stature, and interaction with the floor and interior walls. Eighteen tests were completed using the deceleration sled at the Civil Aerospace Medical Institute (CAMI) with the 16G, 44 feet per second impact severity defined in 14 CFR 25.562. This test series demonstrated that the arm and leg placement of the anthropomorphic test dummy (ATD) can affect the head and leg injury risk for an occupant braced against the seat back in front. Placing the hands at the sides of the legs resulted in a lower head injury risk than placing them on the seat back, as shown in some current brace position guidance. Placing the feet as far aft as possible reduced leg injury risk by controlling forward flailing. These trends were noted regardless of the seat back type being impacted.