

## Benefit Analysis for Aircraft 16-g Dynamic Seats

DOT/FAA/AR-00/13

Office of Aviation Research  
Washington, D.C. 20591  
CAA Paper 99003  
Civil Aviation Authority  
London, England

From Pages 192 – 194 *Martinair DC-10 crash at Faro airport*

### EFFECT OF INTRODUCING 16-G SEATS

#### *Scenarios 1 and 2*

These scenarios contain only flight and cabin crew seats therefore benefit from the introduction of 16-g passenger seats is not applicable.

#### *Scenario 3 (= seat rows 1 – 10)*

Statements (in the form of questionnaires) from the surviving passengers indicated that most of them were able to unfasten their safety belts and that their seats resisted the impact. This part of the fuselage rested on its left side at 70 degrees. As a result, the majority of serious injuries sustained by the occupants in this section consisted of fractured bones. It is assumed that they were thrown out of their seats.

One passenger in seat 2D sustained head wounds as a result of the impact. Therefore, if 16-g seats were installed on the aircraft, this passenger might have been saved from head injury.

The high assessment assumes there is no reduction in the number of seriously injured occupants. The low and median assessments assume one serious injury would be saved with 16-g seats.

The high, median, and low predictions of the number of impact fatalities and injuries resulting from the use of 16-g seats are:

	<i>Minor or No Injuries</i>	<i>Serious Injuries</i>	<i>Fatal Injuries</i>
<i>High</i>	41	16	0
<i>Median</i>	42	15	0
<i>Low</i>	42	15	0

It is not known whether the aircraft was configured to the latest standard of fire requirements. However, since it is considered that the fire injuries were sustained outside of the cabin, they would have no influence on the injuries sustained.

#### *Scenario 4 (= seat rows 11 – 19)*

This section of the fuselage was transversally ruptured due to the explosion (in scenario 5) and/or the longitudinal twisting moment of the fuselage, while the aircraft was off the runway. Statements (in the form of questionnaires) from the surviving passengers indicated that most of the seats did not resist the impact, hence a large number of occupants in this section were ejected during the impact sequence. Only about eight seriously injured passengers said that their seats had survived the impact. Some passengers reported that they were hit by loose objects, including broken seats. The majority of serious injuries sustained by occupants in this section were fractured bones and internal lesions.

## Martinair crash Faro - Benefit Analysis for Aircraft 16-g Dynamic Seats

Therefore, it is assessed that introducing 16-g seats would have altered the injury pattern in this scenario. The low assessment is that all six fatally injured passengers would be saved with 16-g seats. However, they would still be seriously injured by the impact. All of the seriously injured passengers, except for the in-lap infant in 17C and the eight passengers, whose seats resisted the impact, would have been reduced to minor or no injuries.

The high assessment assumes no reduction in fatalities and injuries to the occupants. The median assessment is taken as the average of the high and the low assessments.

The high, median, and low predictions of the number of impact fatalities and injuries resulting from the use of 16-g seats are:

	<i>Minor or No Injuries</i>	<i>Serious Injuries</i>	<i>Fatal Injuries</i>
<i>High</i>	41	25	6
<i>Median</i>	49	20	3
<i>Low</i>	57	15	0

It is not known whether the aircraft was configured to the latest standard of fire requirements. However, since the known fire-injured passengers were located at the fuselage break, the injuries were probably caused outside of the cabin area or as a result of the fuel tank explosion. On this basis it is considered that had the aircraft been configured to the latest standard of fire requirements there would be no change in the injuries sustained.

### *Scenario 5 (= seat rows 20 – 27)*

It is concluded that no benefit would be gained in this scenario if 16-g seats were fitted, as almost all the fatalities are assessed to have resulted from the fire rather than impact, since there was an explosion in this area. The force of the explosion burst open the left wing (L3) emergency exit and a number of passengers were hit by loose objects which were probably caused by the explosion.

### *Scenario 6 (= seat rows 28 – 41)*

It is concluded that no benefit would be gained in this scenario if 16-g seats were fitted, as statements from the surviving passengers did not indicate any seat detachments in this part of the fuselage. Furthermore, a study of the survivor reports does not indicate that those seriously injured sustained head injuries. Their seats survived the impact sequence. Injuries sustained by the passengers in this section were mainly due to fire burns and loose objects.

### *Scenario 7*

Due to lack of information, it is not possible to assess any benefits associated with the two fatalities for which seat location and injuries were unknown.