

Log 1574

NATIONAL TRANSPORTATION SAFETY BOARD  
WASHINGTON, D.C.

ISSUED: February 24, 1983

Forwarded to:

Honorable J. Lynn Helms  
Administrator  
Federal Aviation Administration  
Washington, D.C. 20591

SAFETY RECOMMENDATION(S)

A-83-1

There has been a significant increase in the past 2 to 3 years in the awareness of the traveling public and safety-related government agencies of the need to protect infants and small children from the crash risks inherent in transportation. Since children travel mainly by motor vehicle, most of the attention on child passenger safety has been focused on this mode. It is estimated that five million child car safety seats are in use today, and another two million are being purchased each year. Since 1977, 19 States have passed laws requiring use of child safety seats during motor vehicle travel. The National Transportation Safety Board recently wrote to the remaining States and the District of Columbia, urging that similar mandatory child protection laws be introduced and that effective child restraint education and enforcement programs be initiated.

Among the areas of transportation crash protection most neglected over the years is that for infants and small children during air travel. The Safety Board is concerned that such protection has not been forthcoming in this important area.

Under current regulations, the use of child restraint devices during takeoff and landing is prohibited by the Federal Aviation Administration (FAA), unless the device bears a label indicating that the FAA has approved it. As of this date, one model child restraint device has apparently received a Supplemental Type Certificate (STC) permitting its use in a limited number of aircraft; none has received Technical Standard Order (TSO) approval. Although carriers' practices apparently vary, at least some airline passengers have been required to stow their child safety seats as baggage, so they cannot be used even during flight. Thus, the vast majority of parents wishing to provide protection to their small children, even to the extent of purchasing an additional adult passenger seat, may not do so. These parents must either place their small children in an adult lap belt or (if the children are under 2 years of age) hold them on their lap. Neither of these arrangements provides acceptable protection during takeoff and landing. Even in the not infrequent instance of in-flight turbulence, an adult typically cannot adequately restrain small children from flying upward or about the cabin, risking injury to the child and to other passengers or crewmembers.

The National Highway Traffic Safety Administration (NHTSA) promulgated the first child restraint device minimum performance standard more than 10 years ago, in early 1971. Since then, the NHTSA and child safety seat manufacturers have carried out extensive research and, importantly, the NHTSA several years ago developed instrumented anthropomorphic dummies to simulate small children for child safety seat testing purposes. In December 1979, the NHTSA published an improved performance standard for child and infant safety seats. The improved standard requires a series of crash tests and defines specific limits on the crash force loads imposed on the child safety seat occupant, represented by an anthropomorphic dummy. After a year's lead time, this performance standard, Federal Motor Vehicle Safety Standard (FMVSS) 213--Child Restraint Systems, went into effect on January 1, 1981.

During 1974-75, the FAA's Civil Aeromedical Institute (CAMI) performed crash tests on a few then-available motor vehicle child restraint systems. <sup>1/</sup> The tests were conducted on child and infant seats meeting the NHTSA standard in effect at that time (and revised in 1979, as described above), using an aircraft passenger seat considered by the FAA to be "representative" of transport category passenger seats. The tests were run at speeds high enough to represent a "maximum crash for which protection can be provided with existing [aircraft] seatbelts"--that is, at speeds considerably higher than those at which, in a real crash, seats occupied by adults would tear loose from the floor. Thus, these test speeds were at a level at which, in most actual crashes, the accidents would be nonsurvivable, given current passenger seat and seatbelt design. Noninstrumented infant and small child "bean bag" dummies were used. Aircraft belt loads were measured in these tests; otherwise, no occupant injury measurements were taken to evaluate the protective capabilities of the devices. The researchers' evaluation of the effectiveness of these devices was "arbitrary" and "subjective," according to the test report, based on judgmental analyses of test films. The report concluded that a uniform test procedure must be established.

Within a few months of the publication of the FAA test report in 1978, a United Airlines DC-8 crashed in Portland, Oregon. <sup>2/</sup> As a result of this crash, in which several unrestrained infants and a small child were killed and others were injured, the Safety Board recommended in 1979 that the FAA expedite research with a view toward early rulemaking on effective restraints for infants and small children during turbulence and survivable crash landings (Recommendation A-79-63). This recommendation has been in an "Open--Acceptable Action" status since January 1980.

On May 28, 1982, the FAA issued TSO C-100, Child Restraint Systems. The intent of this TSO is to describe the minimum performance requirements for infant and child restraint devices permissible for use on aircraft as "approved" seats. Its dynamic requirements beyond those of FMVSS 213 were shaped in large part by the 1974 CAMI test report. The TSO requires that all such devices meet not only the dynamic performance requirements of FMVSS 213, but also several additional dynamic tests, engineering data analyses, static tests, and separate marking and labeling requirements.

During the development of TSO C-100, the NHTSA pointed out to the FAA that the additional requirements being contemplated for the TSO (beyond those already required by FMVSS 213) were unnecessary. In particular, the NHTSA staff urged that the TSO's requirement for crash tests run at 30 mph (a speed derived from the 1974 CAMI tests) was unreasonable, since at that speed, aircraft seats and seatbelts would be unable to

<sup>1/</sup> The tests were reported in FAA-AM-78-12, "Child Restraint Systems for Civil Aircraft," March 1978.

<sup>2/</sup> See, NTSB-AAR-79-7.

restrain their adult occupants. (A 30-mph test of this sort produces peak forces of approximately 24 g's; aircraft seats and belts must provide impact protection only up to 9 g's.) After several discussions with NHTSA personnel, the FAA reduced the required crash test speed to 20 mph (a speed at which forces of approximately 17 g's are produced--still nearly twice the force for which aircraft seats and belts are required to protect an adult). Subsequently, the NHTSA proposed a joint FAA/NHTSA crash test program designed to determine whether the TSO's additional requirements are in fact necessary for safe air use of these devices. The FAA declined and proceeded with the issuance of the final TSO.

During the issuance of TSO C-100 in May 1982, the NHTSA contracted with the Calspan Corporation to conduct the crash test program described above, using the general test requirements of the TSO.<sup>3/</sup> The crash tests performed by Calspan included a selection representing a cross-section of a large number of car seat models currently in use. They included tests on infant seats and convertible seats used in both infant and child positions. They also included tests of seats for which a top tether is provided, but without the tether attached. All tests were conducted with instrumented anthropomorphic dummies representing a 9-month-old infant and a 3-year-old child, using the aircraft passenger seat provided by CAML. This seat has been designated by the FAA as "representative" of a passenger seat whose back is able to move forward freely. These sled tests were conducted at 20 mph, in accordance with the general direction of TSO C-100.

In all tests, measurements were taken of all crash forces for which standards are set in FMVSS 213 and these measurements were well below the limits specified in the 213 standard. For seats in the forward-facing child position, measurements of maximum head excursion and maximum knee excursion (in inches) were made. These were 12.8 inches and 13.6 inches (head) and 17.0 inches and 19.6 inches (knee)--well within the space available for such movement in transport category planes today.

The aircraft seat back peak resultant acceleration and the seat back maximum rotation (in degrees) were also measured. The peak accelerations ranged from 23 g to 36 g. The aircraft seat back never rotated forward more than 17 degrees from the vertical. The potential for injury to infant or child seat occupants from the passenger seat back folding forward has been of concern to the FAA. The test results indicated that there were "no significant occurrences" during the contact with the child or infant occupants. In the tests with rearward-facing infant dummies, the padded part of the seat back did contact the child restraints and in some cases the feet of the infants, but not the head or torso parts. These occurrences were found mainly in the chest acceleration and seat back acceleration measurements, but their effects were negligible. The seat back contact with the child restraints and infants was found to be nondangerous and verified that "no unusual or excessive loading occurred."

Overall, Calspan concluded from the tests that the 20-mph dynamic tests required by TSO C-100 "would not be necessary for seat certification for use aboard aircraft."

The Safety Board has carefully reviewed TSO C-100, the 1974-75 crash tests performed by CAML, and the NHTSA/Calspan tests of current motor vehicle child restraint systems. We have concluded that a need has not been demonstrated for the additional performance tests outlined in TSO C-100 beyond those already required by

<sup>3/</sup> Report No. 7063-V-1, "Performance Evaluation of Child Restraint Systems" (Calspan Corp., July 1982), prepared under Contract No. DTNH22-82-C-02035 for the National Highway Traffic Safety Administration.

FMVSS 213, and that the additional tests do not ensure any greater effectiveness in air travel use than that already assured by FMVSS 213. We believe that any currently 213-certified infant or child car seat with an internal harness system (even those with top tether straps) will protect its occupant during in-flight turbulence and survivable emergency landings or crashes. All these devices are certified to be effective in 30-mph crash tests. Such tests produce forward g forces well beyond those which adult aircraft seating and restraint systems are required to withstand. As for horizontal or vertical forces, these devices will provide far superior protection to their occupants than either an adult lap belt or a parent's lap (the only restraint alternatives available to small children). A small child restrained in a device meeting the requirements of FMVSS 213 would be continuously protected from the sudden, frequently unanticipated hazards associated with in-flight turbulence. Even the few models of restraint devices without an internal harness system are much more likely to prevent injury in turbulence to the small children for whose use the devices are designed than the adult's arms or lap belt alternatives.

In the course of the Safety Board's review of TSO C-100, we have talked with eight of the major manufacturers and marketers of infant and child restraint devices. One has apparently received STC approval for the use of one restraint model in a limited number of aircraft. One other indicated that it intends to seek FAA approval. Several of the remaining six manufacturers indicated that they have decided not to seek FAA approval in the foreseeable future. They cited high testing costs, lack of market incentive, the unclear test requirements of TSO C-100, and discouragement that two agencies within the U.S. Department of Transportation have set forth two different sets of performance requirements for their safety products. Other manufacturers indicated that they may be willing to seek FAA approval under the terms of the TSO at some later date, depending largely on the market response to any seats that are approved in the near future. Thus, it appears that within the next several months there may be one or two models available for purchase which are approved for use on aircraft. However, even for the one or two models expected to be approved under the TSO during the next few months, it is not certain that parents will be able to use already-purchased units of these models on aircraft, since they do not bear FAA's TSO label. Further, the large majority of models available for purchase will not be approved for air travel use, and the estimated five million child car safety seats now in use in motor vehicles, certified to meet the severe crash requirements of FMVSS 213, also will remain unapproved for air use.

We believe that the overall effect of TSO C-100 is to delay further and unnecessarily the convenient availability of child passenger restraint protection for air travel. Given the size of most child restraint device manufacturing companies and the high costs associated with the additional tests required by the TSO, we believe that insisting on the inclusion of these additional and costly requirements (which NHTSA-sponsored tests have established as unnecessary) is contrary to the intent of Executive Order 12291 and will discourage most manufacturers from seeking FAA approval of their safety products. If this is so, many parents who wish to use their already-purchased child restraint systems during air travel will continue to be prohibited from doing so, just as they were before the issuance of TSO C-100.

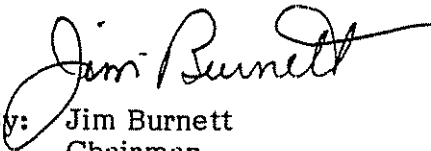
If the FAA believes there remain any significant child restraint device design problems not addressed by FMVSS 213 that render such devices unsuitable for aircraft use, the FAA and the NHTSA should work closely together to resolve these problems; if appropriate, they should jointly promulgate standards regarding child restraint devices to encompass use both in automobiles and aircraft. In the interim, however, the Safety Board believes that any infant or child restraint device now certified to meet the requirements of FMVSS 213 should be regarded by the FAA as an "approved" seat under

the occupant seating rules of the Federal Aviation Regulations and therefore permissible for appropriate use during takeoff, landing and in-flight operations. Therefore, the National Transportation Safety Board recommends that the Federal Aviation Administration:

Amend TSO C-100 to permit the use of any infant or child restraint device bearing a label in conformance with 49 CFR 571.213, S5.5.2 (e) aboard aircraft during takeoff, landing, and in-flight operations, until such time as the Federal Aviation Administration and the National Highway Traffic Safety Administration issue standards for devices acceptable for use in both motor vehicles and aircraft. (Class II, Priority Action) (A-83-1)

Recommendation A-79-63 has been placed in a "Closed--Superseded" status.

BURNETT, Chairman, GOLDMAN, Vice Chairman, McADAMS, BURSLEY, and ENGEN, Members, concurred in this recommendation.

  
By: Jim Burnett  
Chairman