They were also evaluated, using anthropomorphic test dummies representing children, for their ability to limit occupant head excursion, head and chest acceleration and abdominal forces. In addition, the test program evaluated the effect that the impact load of an ''aft row occupant'' had on the performance of a child restraint located in an aircraft seat immediately in front of the aft row occupant. The aft row occupant impact load was generated in tests called ''double row tests,'' using an adult test dummy placed in the aft row seat.

Booster Seat Tests

CAMI tested four models of shield-type booster seats in six dynamic tests, three of which involved single row tests, and the other three, double row tests. With regard to fit and adjustment of the booster seats to the airplane seat, CAMI found that three had fit and adjustment problems. One booster seat had problems fitting an airplane seat because of the limited width between arm rests on the passenger seat. This may have occurred because of the difference in width between the representative aircraft seat (about 20 inches wide) used in FMVSS 213 and the aircraft seat (17.25 inches wide) used in the CAMI testing. Two booster seats had incompatibility problems between the buckle/webbing path molded in the front shield and the airplane web path and buckle position of the lap belt on the airplane passenger seat used by CAMI. In fact, the webbing could not be installed over the front shield in accordance with the positioning instruction of the booster seats' manufacturers. CAMI also found that one of the four booster seats failed structurally, and two of the others allowed forward head excursion in excess of the 32-inch distance permitted by FMVSS 213.

CAMI also found a problem with the loads that the child dummies restrained in the tested booster seats experienced when the boosters were on a seat with a breakover seat back and exposed to loads from the aft row occupant. Its tests showed that loads from an aft row adult occupant resulted in an increase in abdominal loading of the dummy in a booster seat, as compared to the abdominal loading of a dummy in an aircraft lap belt with an adult aft-row occupant. The CAMI study states that, when placed in a seat with a breakover seat back, the booster seat encounters problems because:

> With no back shell, the typical booster seat does not provide protection from the forces transmitted by the airplane seat back during horizontal impact conditions. Traditionally, restraint systems in airplanes have been designed to avoid loads transmitted to the soft tissues of the abdomen. A child restrained in a booster seat may be forced against the rigid shield due to the seat back breakover action. For the intended size of children in booster seats, the load path of these breakover forces may include the abdominal region.

It is to be noted that CAMI also found that the abdominal loads on a child dummy placed in a shield-type booster seat secured to an airplane seat with a locked seat back were higher than on a child dummy secured in a typical airplane seat lap belt with a locked seat back. The FAA recognizes in its NPRM, however, that there are no accepted criteria to assess the relationship between differences in measured levels of abdominal loadings and any resulting risk of abdominal injury, and the type and severity of such injury.

Harness Tests

CAMI tested one type of harness restraint. The restraint consisted of a torso vest with straps over the shoulders and around the waist, and a crotch strap. The shoulder and abdomen straps were attached to a rectangular metal plate on the back of the restraint. The airplane lap belts were routed through a loop of webbing attached to the metal back plate on the restraint.

The restraint was tested with a three-year-old test dummy in two single row tests. CAMI found incompatibility problems between the harness and the airplane seat lap belts: ''With the lap belts adjusted to the minimum length, the [harness] could be moved forward approximately 7 inches before tension was developed in the belts. This was considered unsatisfactory for testing.'' CAMI also found grossly excessive excursion of the child anthropomorphic test dummy(ATD) restrained in the harness:

> The ATD moved forward and over the front edge of the seat cushion and proceeded to submarine toward the floor. Elasticity in the webbing of the harness and the lap belts then heaved the ATD rearward. The force pulling the ATD back into the seat appeared to be applied by the Gz [crotch] strap directly through the pubic symphysis of the pelvic bone.

Based on this finding, CAMI concluded that a harness performs poorly in protecting the child occupant.

NHTSA Proposal

NHTSA has tentatively concluded that, if FAA were to adopt its proposed ban on the use of harnesses and backless booster seats on aircraft, consumers would be confused if manufacturers were to continue nevertheless to certify these types of restraints for aircraft use. Accordingly, NHTSA proposes to amend FMVSS 213 to require manufacturers to label these child restraint systems as not being for use on aircraft. The standard already requires that belt-positioning booster seats be so labeled.

In issuing this proposal, NHTSA believes that it is important to emphasize several points about the use and performance of child restraints. First, there are significant differences between the seating environment of motor vehicles and that of aircraft. Second, because of those differences, the problems encountered with child restraint use in aircraft are not encountered with child restraint use in motor vehicles. Therefore, notwithstanding this proposal, the use of harnesses and booster seats in motor vehicles continues to be important for child safety.

The problems reported by CAMI, i.e., the combined effects of aircraft seatback breakover designs and aft occupant impacts, are not encountered in motor vehicles. The seat back in a motor vehicle is designed to remain fixed in a crash and not ''breakover'' in the manner of an airplane seat. Also, a vehicle seat containing a child restraint is less likely to be impacted from the rear by an adult than is an aircraft containing a child restraint. There are several reasons for this. First, child restraints are recommended for use in the rear vehicle seating positions. Thus, if a child restraint is installed as recommended, there will not, in most cases, be any passenger rearward of the child restraint who could impact and load the seat containing the child restraint in the event of a frontal crash. Exceptions would be in vehicles, such as vans and some station wagons, which have three rows of seats. Second, if there were a passenger seated behind the seat containing a child restraint, and that person were sitting in an outboard seating position, the person would have a lap/shoulder belt system available for use. Most aircraft lack shoulder belts. If the vehicle passenger were restrained by that belt system, the person would not load the seat with the child restraint in the manner observed in the CAMI study. Third, given the number of persons typically carried in a motor vehicle, it is unlikely there would be an adult seated behind a child in a child restraint, regardless of the number or pattern of seats in the vehicle.

Further, harnesses and other child restraints are tested under FMVSS 213 on a seat assembly that is representative of a motor vehicle seat, and that is equipped with a safety belt