on the CAMI research and further analysis, the FAA believes that, in an aircraft crash, vest- and harness-type child restraint systems put children in a potentially worse situation than the alternatives permitted in the FAA regulations.

In an aircraft crash, these systems allow unacceptable levels of body excursion and/or submarining (the occupant's lower body slides underneath the restraint system). The FAA believes that if a child under 2 falls in the weight use limits (25–50 pounds) recommended by vest and harness manufacturers, the child would be safer in a passenger seat restrained by a lap belt than in a vest- and harness-type device if no other approved device were available.

However, the FAA believes that a child weighing between 25 and 40 pounds, a weight range consistent with harness use, would be better protected in a forward facing child restraint device than in a lap belt. The FAA notes that the CAMI study demonstrated that six of the eight forward facing child restraint systems it tested did not provide a desirable level of head injury protection (i.e., head injury criterion (HIC) less than 1,000) in the worst-case simulated survivable airplane crash. Nonetheless, based on an analysis of CAMI's testing of the harness, the lap belt, and forward facing child restraint devices, the FAA finds that forward facing child restraint devices will provide higher levels of protection than lap belts and harnesses for children between 25 and 40 pounds. In addition, CAMI testing revealed that lap belts provide a superior level of protection for children weighing more than 40 pounds to that provided by harnesses and booster seats. Consequently, the FAA recommends the use of forward facing child restraint devices for children weighing between 25 pounds (the threshold weight for a harness device) and 40 pounds; the FAA further recommends the use of lap belts for children weighting more than 40 pounds. The agency is continuing to analyze the relative protection afforded by forward facing child restraint devices and is aggressively examining methods by which the efficacy of such devices can meet desired testing levels.

Belt-Positioning Booster Seats

Belt-positioning booster seats require shoulder harnesses, and transport airplanes do not have passenger shoulder harnesses. In addition, in other aircraft that may have shoulder harnesses for passengers, the FAA believes that during an aircraft crash there is a likelihood that a belt-positioning booster seat will shift from the passenger seat, causing a degradation in the performance of that child restraint system, thus resulting in injury. NHTSA recently issued an amendment (59 FR 37164; July 21, 1994) to its standard requiring that belt-positioning booster seats be labeled with a statement that they are not certified for use on aircraft. Based on further analysis, the FAA is proposing to ban all use of belt-positioning booster seats on aircraft.

It should be noted that, while booster seats and vest- and harness-type child restraints may be appropriate for use in automobiles, further analysis has indicated that their design may render them unsuitable for use in aircraft during takeoff, landing, and movement on the surface. The aircraft environment differs from the automobile environment in ways that are significant to this rulemaking and that add justification for the proposal of this notice. First, many booster seats require the use of a shoulder harness for proper restraint; however, shoulder harnesses are usually not available in transport airplane passenger seats. Second, the action of the shoulder harness inertial reels in automobiles is different than those in aircraft. Third, automobiles employ a rigid seat back system that maximizes the effectiveness of these child restraint systems, but aircraft usually do not have rigid seatbacks. Further, as a practical matter, a uniform application of this proposal to all aircraft is desirable, regardless of whether the aircraft has breakover seats.

Other Issues

The CAMI study identified other types of child restraint systems that did not provide the level of protection in a worst-case simulated survivable airplane crash that the FAA anticipated they would provide when the child restraint rule was originally promulgated. As previously noted, six of the eight forward facing child restraint systems in the CAMI study did not provide a level of head injury protection that is desirable in the worst case simulated survivable airplane crash. Because, unlike shield-type booster seats, forward facing child restraint devices have backs, the FAA has determined that forward facing child restraint devices are likely to provide a higher level of protection than shield-type booster seats at crash levels below the worst case survivable airplane crash.

The FAA notes that Roger N. Hardy of the Cranfield Impact Centre tested forward facing child restraint devices on behalf of the British Civil Aviation Authority (BCAA). In his report, entitled *The Restraint of Infants and Young Children in Aircraft* (BCAA Paper 92929, December 12, 1992), Dr. Hardy concluded that while forward facing child restraint devices did not provide the optimal level of protection, they provided a higher level of protection relative to either the use of a belly belt or the holding of children on the laps of adults without the use of a belly belt.

The FAA believes that forward facing child restraint devices are superior to vest- and harness-type devices, booster seats, belly belts, and the holding of children on laps. Consequently, the FAA recommends the use of forward facing seats for children weighing between 20 and 40 pounds. (For children who weigh up to 20 pounds, and for children weighing over 40 pounds, the FAA recommends the use of aft facing child restraint devices and passenger lap belts, respectively.) While the FAA acknowledges that some forward facing child restraint devices may not presently provide a desired level of protection in a worst case survivable aircraft crash, it is examining means by which these seats will perform at optimal levels in such crashes. In addition, the agency is working with NHTSA to develop appropriate modifications to FMVSS No. 213 for future seat design approvals for airplane seats.

The FAA has issued directives to its inspectors that emphasize the existing prohibition on the use of devices, e.g. belly belts, that are not designed to be secured to forward-facing seats or berths. In issuing these statements, the FAA was motivated by its concern that such restraint systems could potentially result in a worse situation for children than the allowable alternatives would provide in the event of an aircraft crash.

The FAA is concerned as to whether the implementation of this rule may induce a significant number of parents to fail to provide child restraint devices for automotive travel to or from airports. Factors to be considered in addressing this issue are the share of the market that booster seats and vest- and harness-type devices comprise, the extent to which state laws require the use of child restraint systems in automobiles, and the availability of child restraint devices from car rental companies. The FAA seeks comments on the risks of children suffering increased injury due to their continued use of shield-type booster seats. The agency asks whether there are specific types of aircraft crashes or other aircraft events in which the measured difference in abdominal loading would have a greater potential for increasing the severity of injury to children.