

NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

LOG 1276 AI-4

ISSUED: December 31, 1980

Forwarded to:

Honorable Langhorne M. Bond
Administrator
Federal Aviation Administration
Washington, D.C. 20591

SAFETY RECOMMENDATION(S)

A-80-125 through -131

The National Transportation Safety Board recently completed an assessment of the adequacy of occupant protection in general aviation aircraft during a crash. This study was conducted because of the Safety Board's longstanding concern that a majority of serious and fatal injuries which occur annually in these aircraft should be preventable. The Safety Board report reviewed accident investigation findings, crashworthiness research and studies, and the regulatory requirements to assess the adequacy of occupant protection during general aviation crash conditions which should be survivable. 1/

Accident investigation studies since 1943 have found that the primary cause of serious and fatal injuries in general aviation accidents is the unrestrained or partially restrained occupant flailing about within the cabin upon crash impact, striking various portions of his body against objects which penetrate or crush his body structure. This finding of these studies was confirmed by the Federal Aviation Administration's (FAA) 1971 report, "General Aviation Structures Directly Responsible for Trauma in Crash Decelerations." This report found that "in most instances the well-known principles (the packaging principles advocated by H. DeHaven in 1943) have been so grossly ignored that serious and fatal injuries have occurred in anything more severe than a hard landing." This report concluded that the use of properly designed and installed shoulder harnesses would help prevent impact of the head and upper torso—the areas stuck most often during crash conditions.

Research activities of the FAA and others have identified deficiencies in safety belt strength requirements, seat and safety belt anchorage requirements, seat designs, test requirements, and inertial crash deceleration standards. A 1966 FAA report, "Recommendations for Shoulder Harnesses!" found that the use of seatbelts alone cannot provide adequate protection to a seated occupant and that there is a critical need for the improvement and use of restraint systems in general aviation aircraft because of documented, significant increases in serious and fatal injuries sustained in potentially survivable accidents.

1/ For more detailed information, read "Safety Report—The Status of General Aviation Aircraft Crashworthiness" (NTSB-SR-80-2), December 17, 1980.

A 1973 FAA report, "A Summary of Crashworthiness Information for Small Airplanes," provided suggested minimum requirements that would protect occupants during crash decelerations for aircraft designers to consider. Most of the suggested requirements far exceed the FAA's current occupant protection requirements. A 1978 FAA initial project report, "Energy Absorbing Seat Design," reported the deficiencies in present seat requirements as (1) the use of static design and test requirements which do not account for the dynamic conditions under which seats must perform to protect occupants during crash decelerations; (2) the inadequacy of established inertial deceleration standards to provide protection for occupants of survivable crashes; and (3) the lack of standards in 14 CFR 23 for downward inertial forces in general aviation aircraft which do not have retractable landing gear. Many other FAA reports reviewed also identified needs for increased general aviation occupant protection. These reports identified and supported improvements long advocated by the Safety Board. The Safety Board report concluded that the FAA fails to make effective use of available research findings, including its own, to require the implementation of needed crashworthiness improvements for occupants of general aviation aircraft.

The Safety Board's assessment found that the FAA has made little improvement in the general aviation crashworthiness regulations since the 1950 Civil Air Regulations, even though continuing concern has been expressed since 1964 by the Civil Aeronautics Board, the Safety Board, and others. The FAA's 1977 crashworthiness regulatory improvements which required shoulder harnesses for the front seats of all general aviation aircraft manufactured after July 18, 1978, were of very limited scope, as was the requirement for manufacturers of newly certificated general aviation aircraft to eliminate injurious objects within striking radius of each occupant's head and upper torso. These changes provide little occupant crash protection improvement because the delethalization requirement need not be met for currently certificated, newly manufactured aircraft; no criteria have been established against which a manufacturer's delethalization effort is to be measured; and the shoulder harness requirement provides no protection for occupants other than those in the front seats of general aviation aircraft.

On December 17, 1980, the Safety Board reviewed the FAA's actions for accomplishing the safety improvements sought by Recommendation A-77-71 which states:

Amend 14 CFR 91.33 and .39 to require the installation of approved shoulder harness on all general aviation aircraft manufactured before July 18, 1978, after a reasonable lead time, and at all seat locations as outlined in NPRM [Notice of Proposed Rulemaking] 73-1.

Since this recommendation has been classified as "Open, Unacceptable Action" for 3 years, the Safety Board developed recommendations to specify a date certain by which the FAA should accomplish the safety objectives of Recommendation A-77-71 and included them as new recommendations.

As a result of its review of general aviation aircraft crashworthiness, the National Transportation Safety Board reiterates its Recommendation Nos. CY-70-42, Part 4, and A-77-70 which state:

CY-70-42, Part 4:

[Initiate] regulatory action...to raise the "minor crash landing" inertia forces of [14 CFR] 23.561 to a level comparable to those produced by a moderate-to-severe crash landing. Until a reasonable crash design condition is decided upon, including a specified crash acceleration pulse, it is suggested that the longitudinal inertia force be raised to 20 to 25 and the forces about other axes be similarly increased. (Recommendation Status: Previously closed when the FAA issued an NPRM whose requirements, if made final, would have accomplished the recommended action.)

A-77-70

Amend 14 CFR 23.785 to require installation of approved shoulder harnesses at all seat locations as outlined in NPRM 73-1. (Recommendation Status: Open, Unacceptable Action)

Additionally, the National Transportation Safety Board recommends that the Federal Aviation Administration:

Require that those general aviation aircraft manufactured to include attachment points for shoulder harnesses at occupant seats be fitted with shoulder harnesses no later than December 31, 1985, and, in the interim, require this modification as a requisite for change in FAA registration. (Class II, Priority Action) (A-80-125)

Develop, in coordination with airframe manufacturers, detailed, approved installation instructions for installing shoulder harnesses at each seat location in current models and types of general aviation aircraft in which shoulder harness attachment points were not provided as standard equipment. Publish and provide these instructions to owners of these aircraft by December 31, 1982. (Class II, Priority Action) (A-80-126)

Require that those general aviation aircraft for which FAA-approved harness installation instructions have been developed be fitted with shoulder harnesses at each seat location no later than December 31, 1985, and, in the interim, require this modification as a requisite for change in the FAA registration. (Class II, Priority Action) (A-80-127)


At established intervals, extend the application of all newly established occupant protection provisions of 14 CFR 23 to all newly manufactured general aviation aircraft. (Class II, Priority Action) (A-80-128)

Revise 14 CFR 23.785(j) to incorporate performance standards and test criteria to insure that an acceptable level of occupant safety is achieved through cabin "delethalization." (Class II, Priority Action) (A-80-129)

Revise current standards for seat and restraint systems to incorporate needed crashworthiness improvements identified in FAA Research Project reports. (Class II, Priority Action) (A-80-130)

Establish standards for the dynamic testing of occupant protection devices required in general aviation aircraft. (Class II, Priority Action) (A-80-131)

KING, Chairman, DRIVER, Vice Chairman, McADAMS, GOLDMAN, and BURSLEY, Members, concurred in these recommendations.



By: James B. King
Chairman
For