log #24888

National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation

Date: March 14, 1994

In reply refer to: A-94-67 through -69

Honorable David R. Hinson
Administrator
Federal Aviation Administration
Washington, D.C. 20591

On January 7, 1994, a Jetstream J4101, N304UE, operated by Atlantic Coast Airlines of Sterling, Virginia, as United Express flight 6291, was on a scheduled commuter flight from Dulles International Airport to Port Columbus International Airport, in Gahanna, Ohio. At 2321 eastern standard time, while on an instrument landing system (ILS) approach to runway 28L, the airplane struck a concrete block building that was about 1.2 miles east of the runway. The pilot, co-pilot, flight attendant, and two passengers were fatally injured, and the three other passengers, a husband and wife and their 5-year-old daughter, sustained minor injuries. The airplane was destroyed by postcrash fire.

On January 8, 1994, the Safety Board interviewed the husband, who is a frequent air traveler. He stated that his family was originally assigned to seats 3A, 3B, and 3C, but due to the light passenger load, for weight and balance purposes he was moved to seat 8B, his daughter to 8C, and his wife to 7C. Two other male passengers occupied seats 6B and 9B.

The husband stated that the seatbelt and no smoking signs were illuminated for the entire flight. At about 2310, the airplane began descending, and the pilot announced the descent for landing. The landing gear was lowered about 5 minutes before the accident. The husband said that the airplane continued to descend, and that he could see lights on the ground. Suddenly, the airplane rolled about 45° in one direction and then about 45° in the other direction--he could not recall whether the first roll was to the left or to the right, only that it happened very quickly. After the roll excursions, the husband stated that the airplane was "wobbly" and then dropped for about 1 second and stopped. He described the recovery from the airplane's drop as "cushy," then moments later the airplane struck the ground.

After the airplane came to rest, there were no lights in the cabin, and the only illumination came from a fire in the left engine. The husband said that he remained in his seat upright and that the seats remained attached to the airplane's floor. However, he said that he experienced a "terribly difficult time removing his seatbelt." He said that the plastic release lever on the buckle was "difficult" to operate because he believed that it had to be moved greater than

90°. He was accustomed to metal release levers that move about 45° before they release. After the airplane came to a rest, he noticed that his daughter had slid down onto her back and under her safety belt, and because he could not find the safety belt release lever, he had to pull her out from under the belt. His wife also had the same difficulty releasing her safety belt as he had experienced. After they were free of their safety belts, the husband went forward to the overwing exit at seat 6C, and the man who was sitting in seat 6B said the exit was jammed. The husband attempted to open the exit but was unsuccessful. The man in seat 6B appeared to be leaning over looking for something on the floor. The husband said that his family then went aft along the right side of the cabin wall between the seats and the wall, drawn by the feel of cold air. The husband found a loose panel, and he and his wife pushed on it until a 4-foot cabin panel moved enough to allow them to exit; he was uncertain at what seat row this opening was present. Smoke was stratifying along the cabin ceiling as they exited. He did not recall seeing the flight attendant or the passenger in seat 9B during his egress. After egressing, he pounded on the side of the fuselage and yelled for everyone to get out. When no one responded, he took his wife and daughter away from the airplane. The Safety Board was not able to determine why the man in seat 6B did not evacuate the airplane.

Because of the difficulty the husband and wife experienced in removing their safety belts, Safety Board investigators examined the safety belts in three Jetstream J-4101 airplanes operated by Atlantic Coast Airlines, and found that they were manufactured by the Pacific Scientific Company, Yorba Linda, California, to Technical Standard Order (TSO)-C22f. The passengers' safety belt buckles incorporated the 45° lift release lever and were identified as Part Number 1108435. The safety belt buckles which were installed on the flight attendant and cockpit observer seatbelts incorporated the 90° lift release lever and were identified as Part Number 1108460.[1] The Safety Board could not determine whether the passenger seat occupied by the husband had a 45° or 90° buckle, but noted that both buckle releases could be moved slightly more than 90°.

Both of the buckles are of the same basic design. The half that is inserted consists of a flat plate with a "D"-shaped hole. The buckle half consists of a bottom plate and the top release lever. The bottom plate has a "D"-shaped protrusion so that when the insert half of the belt is inserted into the buckle (between the release lever and the bottom plate), the "D"-shaped hole drops over the protrusion. A lockbar attached to the same shaft as the release lever is spring-loaded into a position to prevent disengagement of the insert and the buckle. When the release lever is pulled to the 45° (or 90° for part number 1108460) position, it rotates the lockbar, permitting the insert half of the buckle to move upward and disengage from the protrusion in the bottom plate of the buckle.

During examination of the buckles, investigators found that when the safety belts were tightened firmly around an occupant's waist, neither of the buckles would release consistently,

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[1] FAA Regulations require that safety belts in the United States release when the release lever has been pulled to 45°. CAA Regulations in the United Kingdom require that safety belts release when the release lever has been pulled to 90°.

regardless of how far the release levers were opened. Two specific conditions were identified that prevented the release. The first was the geometric relationship of the flat plate and the "D"-shaped hole in the insert half, and the "D"-shaped protrusion and the lockbar on the buckle half. It was found that under some circumstances even with the lockbar rotated into the "release" position, the end of the flat plate on the insert half would contact the lockbar shaft so that the insert would not lift completely off the "D"-shaped protrusion. This would happen when the buckle/insert assembly was subjected to an outward load, causing a misalignment between the two parts. With the release lever held in the normal release position, the insert could be disengaged from the buckle if pulled outward to align the two parts. The second condition that prevented release was when the release lever was pulled past its normal release position to its full open position. In this case, the end of the release lever itself interfered with the end of the insert and prevented the insert from being raised above the "D"-shaped protrusion on the bottom plate of the buckle. This occurred regardless of the alignment of the buckle and insert.

On February 8 and 9, 1994, the Safety Board and representatives from the Federal Aviation Administration's (FAA) Aircraft Certification Management Office, Jetstream Aircraft Company, Atlantic Coast Airlines, and the Air Line Pilots Association met to examine the safety belt release buckles at the Pacific Scientific Facility. During this meeting, Pacific Scientific demonstrated that the safety belts and release buckles met the requirements contained in FAA's TSO-C22f. This demonstration consisted of a passenger safety belt placed around a body block, and buckled, and then loaded in accordance with the TSO. Once it was demonstrated that the safety belt complied with the TSO, a 1-inch piece of dense foam was placed between the body block and the safety belt to represent the seat occupant's soft abdominal tissue. It was found that with the foam pad in place and with the belt loaded to the requirements of the TSO, the buckle would not release when its lever was opened. Further examination found that in order for the buckle to release, the buckle assembly must tilt when the release lever was opened. However, when the foam was placed between the buckle and the body block, it prevented the buckle assembly from tilting, which then prevented the buckle from releasing. All of the representatives agreed to this finding.

Although the restraint system met the requirements of the TSO, the TSO does not take into account the effect that soft abdominal tissue exerting pressure on the release buckle may have on a person's ability to release a safety belt.

As a result of these findings, Pacific Scientific has begun to examine modifications to its safety belt buckle release mechanisms used on all passenger, flight attendant, and cockpit observer seats. In addition, Jetstream Aircraft and Atlantic Coast Airlines have informed the Safety Board that they intend to replace these safety belts on all of the airplanes they operate in the United States. However, according to Pacific Scientific, these lift release lever buckle safety belt systems were first introduced by Pacific Scientific in early 1992 and are widely used on U.S. military, transport-category, commuter-category, general aviation, and rotary wing aircraft. There are approximately 27,000 of the passenger and crewmember restraint systems of this design in use worldwide.

The Safety Board believes that all operators that use these passenger and crewmember restraint systems should be notified of the Safety Board's findings, and that the FAA should take action to require the removal of this design and replacement with restraints of a different design as expeditiously as possible consistent with the availability of replacement buckles. The Safety Board also believes that until these restraint systems are replaced, the FAA should notify all operators to inform passengers and crewmembers on how to release their safety belts based upon the design deficiency found in this investigation.

Therefore, based on the above information, the Safety Board recommends that the Federal Aviation Administration:

Immediately notify all operators of the Safety Board's finding, including the U.S. Department of Defense and foreign governments, and require all operators whose aircraft have the affected Pacific Scientific safety belt buckles to inform passengers and crewmembers about the need to align the buckle insert to assure easy release of the safety belts. (Class I, Urgent Action) (A-94-67)

Issue an Airworthiness Directive to require the removal and replacement of all safety belts manufactured by Pacific Scientific for Part Number 1108435 buckles, with the 45° lift levers, and Part Number 1108460 buckles with the 90° lift levers, with belts having buckles of a different design as expeditiously as possible, consistent with the availability of replacement buckles. (Class I, Urgent Action) (A-94-68)

Amend TSO-C22f to incorporate procedures which would place material representative of soft abdominal tissue between the test apparatus and the release buckle to ensure that safety belts can be released when subjected to loads specified in the TSO. (Class II, Priority Action) (A-94-69)

Chairman VOGT, Vice Chairman COUGHLIN, and Members LAUBER, HAMMERSCHMIDT, and HALL concurred in these recommendations.

By: Carl W. Vogt
Chairman

Safety Recommendation Reiteration List

SR Number	Reiteration Number	Report Number	Report Date	Accident Description	Accident City	Accident State	Accident Date
A-94-069	1	AAR-94-07	10/6/1994	Stall and Loss of Control on Final Approach, Atlantic Coast Airlines, Inc./ United Express Flight 6291 Jetstream 4101, N304UE	Columbus	OH	1/7/1994