



National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation

Date: May 16, 2001

In reply refer to: A-01-27 and -28

Honorable Jane F. Garvey
Administrator
Federal Aviation Administration
Washington, D.C. 20591

On March 17, 2001, about 0708 eastern standard time, an Airbus Industrie A320-200, N357NW, manufacturer serial number (MSN) 830, operated by Northwest Airlines as flight 985, ran off the runway and onto terrain during a rejected takeoff at the Detroit Metropolitan Wayne County Airport, Detroit, Michigan. The captain, copilot, 4 flight attendants, and 145 passengers were not injured. Three passengers reported minor injuries that occurred during the emergency evacuation. The airplane sustained substantial damage. The 14 *Code of Federal Regulations* Part 121 flight was operating in instrument meteorological conditions, and an instrument flight rules flight plan was filed. The flight was destined for Miami, Florida.

The flight crew reported that during the takeoff roll, at an airspeed of about 110 knots,¹ the nose of the airplane began to lift off the runway. The captain attempted to lower the nose and, because he believed that the airplane was unresponsive, reduced power on both engines. The airplane then became airborne and climbed a few feet. As the airplane returned to the runway, the tail of the airplane struck the runway. The airplane traveled about 400 feet off the end of the 8,500-foot runway and came to rest in muddy terrain. An emergency evacuation was then performed.

During the evacuation, three of the four floor-level emergency exits operated as designed. However, the emergency evacuation slide/raft at door 2L separated from the airplane and fell to

¹ The rotation speed for this flight was 148 knots.

the ground when the flight attendant opened the door. The flight attendants then redirected passengers to door 2R.

Although this accident investigation is ongoing,² the National Transportation Safety Board identified a safety issue regarding the survivability of passengers and crewmembers that requires the Federal Aviation Administration's (FAA) immediate attention.

Airbus Industrie A319, A320, and A321 airplanes that are overwater equipped, like the accident airplane, have a slide/raft at each floor-level emergency exit that is attached to the door by a packboard. Attached to the slide/raft are a fabric girt and telescopic girt bar. The telescopic girt bar enables the slide/raft pack to be removed from one floor-level exit's floor fittings and deployed outside the airplane from another door, if necessary, in the event of a ditching and emergency evacuation in the water.³ (Figure 1 shows a girt bar on Airbus Industrie A319, A320, and A321 airplanes.) When the door is "armed," the girt bar is attached to the floor fittings on the doorsill so that when the door is opened, the girt bar will pull on the slide/raft and initiate its deployment. When the door is "disarmed" and opened, the girt bar remains attached to and moves with the door, thereby preventing the slide/raft from deploying.

The telescopic end of the girt bar is locked in the extended position by a spring-loaded trigger. (Figure 2 shows the telescopic end of the girt bar.) Squeezing the trigger causes the trigger locking mechanism to retract within the telescopic end of the girt bar, allowing it to slide into the stationary portion of the girt bar and shorten the overall length of the girt bar so that the slide/raft can be removed from the floor fittings. The stationary portion of the girt bar is designed to have a chamfer (beveled edge) that measures 0.50 millimeter (mm) on the horizontal surface by 0.50 mm on the vertical surface, +/- 0.10 mm, where the end of the trigger locking mechanism contacts this portion of the girt bar. In addition, the end of the trigger locking mechanism is designed to have a 7° cutback to provide for better contact with the stationary portion of the girt bar when it is locked in the extended position.

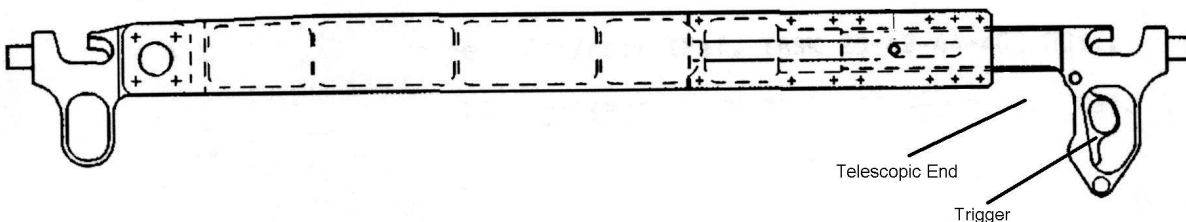


Figure 1. Girt Bar on Airbus Industrie A319, A320, and A321 Airplanes

² The description for this accident, CHI01FA104, can be found on the Safety Board's Web site at <<http://www.nts.gov>>.

³ Airbus Industrie A319, A320, and A321 airplanes that are not overwater equipped have slides and nonretractable girt bars.

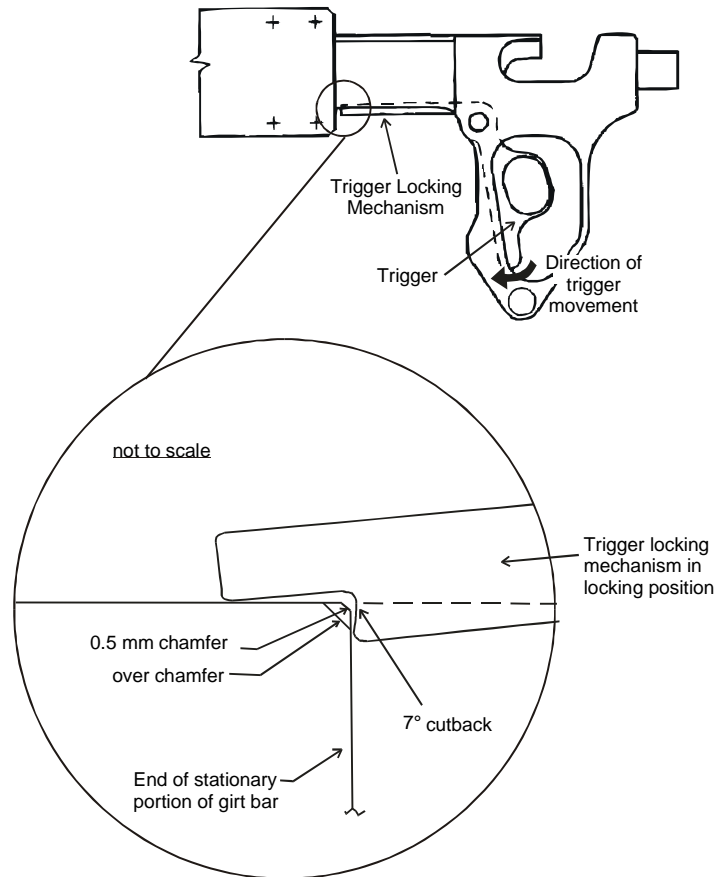


Figure 2. Telescopic End of Girt Bar

The girt bar is designed so that the exposed end of the trigger locking mechanism overlaps and will contact the stationary portion of the girt bar to prevent retraction. The Safety Board's investigation determined that the amount of chamfer on the stationary portion of the girt bar can directly impact the effectiveness of the engagement between the trigger locking mechanism and the stationary portion of the girt bar. Specifically, an increase in the amount of chamfer reduces the amount of overlap between the two surfaces and thus reduces the likelihood of a secure engagement between the two surfaces and increases the possibility of an unintended retraction of the telescopic girt bar.

Further, Safety Board investigators discovered that even a properly chamfered girt bar can routinely be retracted by slightly bumping the end of the telescoping portion with the heel of a hand. The bumping appears to produce a dynamic action that causes the trigger to move and the locking mechanism to disengage. It is not clear at this time if this dynamic disengagement of the trigger locking mechanism could occur during a crash sequence or deployment or use of the slide. Because the investigation is continuing to evaluate the adequacy of the girt bar design, additional recommendations to address design issues may be forthcoming.

Postaccident examination of the accident airplane's 2L telescopic girt bar⁴ revealed that its chamfer was approximately 0.77 mm on the horizontal surface by 0.93 mm on the vertical surface instead of 0.50 mm by 0.50 mm. When the 2L door was opened in the "armed" mode, the force of the door opening apparently caused the trigger locking mechanism to slide over the improperly chamfered surface, which allowed the telescopic end of the girt bar to retract within the stationary portion of the girt bar. This retraction allowed the aft end of the girt bar to slip from its floor fitting and rotate forward. This movement and the weight of the slide/raft pulled the forward end of the girt bar from its floor fitting and caused the uninflated slide/raft pack to separate completely from the airplane and fall to the ground. Although the 1L and 2R doors opened and the slides/rafts deployed normally, the Safety Board's investigation also revealed the presence of improperly chamfered girt bars on those two doors.⁵ The Board is concerned that the potential existed for slide/raft separations at these doors as well. If this had occurred, three of the four floor-level emergency exits on the accident airplane would have been unusable by passengers during the evacuation.

In March 1999, Airbus Industrie revised its A319/A320 Aircraft Maintenance Manual⁶ (AMM)⁷ and added subtask 52-10-00-220-077, "Check of the Adjustment of the Girt Bar," which describes an examination of the telescopic girt bar to ensure that the length of the girt bar could not be shortened without depressing the trigger. The check involves placing the door in the "disarmed" mode, pressing the trigger and shortening the length of the telescopic end of the girt bar, extending the girt bar, and ensuring that it is not possible for the telescopic end of the girt bar to retract without squeezing the trigger. This subtask was to be performed approximately every 36 months. The accident airplane had not had this check performed. Although the 2L girt bar consistently retracted when static force was applied, when investigators attempted to retract the telescopic end of the 1L and 2R girt bars with static force without squeezing the trigger, investigators were successful in retracting the girt bars in some attempts and unsuccessful in others. This indicates that the results from conducting the test specified in the AMM are likely unreliable and suggests that the improperly chamfered girt bars on the 1L and 2R doors might not have been detected by that test.

During the investigation of this accident, Airbus Industrie informed the Safety Board of two additional slide/raft separations that were attributed to improperly chamfered girt bars. The first occurred on June 3, 1999, when the slide/raft on the 1R door of an Air Macau Airbus Industrie A321, MSN 557, detached from the floor fittings and fell to the ground during a routine maintenance deployment test performed by Air Macau. An Airbus Industrie investigation revealed that the telescopic girt bar's chamfer was approximately 1.50 mm by 1.50 mm. As a result of this incident, an Airbus Quality Improvement Request dated September 21, 1999, stated that "during the manufacturing process the chamfer is done manually and the part is inspected.

⁴ The accident airplane was equipped with telescopic girt bars and slides/rafts at doors 1L, 1R, 2L, and 2R.

⁵ The chamfers of the 1L and 2R bars were approximately 0.32 mm on the horizontal surface by 0.69 mm on the vertical surface and 0.54 mm on the horizontal surface by 0.75 mm on the vertical surface, respectively.

⁶ The manufacturer's maintenance manual provides operators with information on the recommended maintenance of the aircraft. This manual is suitable for training and may be used as the operator's maintenance manual or to aid operators in developing maintenance manuals and procedures.

⁷ The A319/A320 AMM also applies to A321 airplanes.

The assembled girt bar is functionally tested prior to delivery.⁸ This case was the consequence of a chamfer incorrectly performed and not detected by the inspector.” The document further stated that “as a corrective action, the vendor has changed the manufacturing process and [the] chamfer is going to be machined.⁹ This is considered an isolated case and no action is going to be taken for in service [aircraft].” Further, Air Macau inspected its fleet and reported that all of the telescopic girt bars on the floor-level emergency exits of its other Airbus Industrie airplanes locked properly.¹⁰

The second event occurred on April 1, 2001, when Air Macau experienced another slide/raft failure on a floor-level emergency exit of an Airbus Industrie A320, MSN 573, during a routine maintenance deployment test. A preliminary incident report by Airbus Industrie states that “the 1L passenger [door] has been inadvertently opened while in armed mode...[and] the telescopic girt bar...detached from the door sill preventing the slide [*sic*] to be extracted from the door and then to inflate.” The report further states that the investigation revealed an improper chamfer “in the area where the trigger end contacts the bar thus preventing its locking in extended position.”¹¹ Although Air Macau had inspected its fleet after the June 3, 1999, incident, Airbus Industrie indicated that this airplane had been leased to another company at that time and had not been inspected upon its return to the Air Macau fleet.

On April 11, 2001, Airbus Industrie issued All Operators Telex (AOT) A320-52A1110¹² for all overwater-equipped A319, A320, and A321 airplanes (up to and including MSN 1173). The AOT recommends that operators perform a “one time test for the non-retraction of the telescopic girt bar without manually activating the trigger” for each floor-level emergency exit within 500 flight hours of receipt of the AOT. The AOT instructs the mechanic to disarm and open the main cabin doors and gain access to the girt bars from beneath the doors.¹³ The mechanic should then “without activating the trigger, push the girt bar ends to try to retract it with a measured force of...34 lbs [pounds] to 45 lbs.”

According to the AOT, no further action is necessary if the girt bar does not retract during the test. If the girt bar retracts, it must either be replaced or modified before the next flight. Modification of the girt bar requires the installation of an L-shaped corner on the girt bar, which covers the improperly chamfered area and is intended to prevent the girt bar from retracting unless the trigger is pressed. The AOT recommends that the L-shaped corner be inspected for

⁸ According to Airbus, this functional test was intended to ensure that the telescopic end of the girt bar could retract; it was not intended to test the locking function of the girt bar.

⁹ Overwater-equipped Airbus Industrie A319, A320, and A321 airplanes up to and including MSN 1173 were delivered with manually chamfered girt bars, while those subsequent to MSN 1173 were delivered with machine-chamfered girt bars. According to Airbus Industrie, the first delivered overwater-equipped airplane after MSN 1173 was MSN 1180.

¹⁰ Air Macau tested the telescopic girt bars to ensure that they stayed locked when static force was applied.

¹¹ To date, Airbus Industrie personnel in Toulouse, France, have not received the girt bar and have been unable to measure the chamfer.

¹² The Direction Generale de L’Aviation Civile of France issued a Consigne de Navigabilité (the French equivalent of an airworthiness directive), effective April 27, 2001, that requires French operators to perform the AOT test and advises other countries to take appropriate action.

¹³ As indicated earlier, when the door is in the “disarmed” mode and opened, the girt bar remains attached to the door rather than the doorsill.

damage or wear approximately every 18 months (or less). The modified girt bar is to be replaced with a properly chamfered girt bar within approximately 54 months (or less).

On April 19, 2001, during a scheduled operational test, the 2L slide/raft of an FTI (a German charter company) Airbus Industrie A320, MSN 338, detached from its floor fittings, fell to the ground, and inflated. Airbus Industrie stated to Safety Board investigators that Airbus Industrie personnel examined the girt bar and found that it was slightly improperly chamfered.¹⁴ Additionally, Airbus Industrie personnel noted that there was no 7° cutback at the end of the trigger locking mechanism, as called for by the design. According to Airbus Industrie, the cutback angle was 0°. Airbus Industrie indicated that on April 18, 2001, the operator had performed the one-time test recommended by AOT A320-52A1110 and found no anomalies.

The Safety Board is concerned that despite Airbus Industrie's revision of the A319/A320 AMM to include an examination of the telescopic girt bar and its issuance of AOT A320-52A1110, improperly manually chamfered girt bars continue to exist and slide/raft separations continue to occur on Airbus Industrie A319, A320, and A321 airplanes. The Board considers this a serious safety issue because slide/raft separations could render emergency floor-level exits unavailable to passengers during an emergency evacuation. In addition, the Board is concerned that AOT A320-52A1110 allows as much as 500 flight hours to elapse before the one-time inspection; this time period is unacceptable considering the serious consequences of slide/raft failures on an airplane during an emergency evacuation.

In addition, the Safety Board is concerned that Airbus Industrie has apparently not yet developed a method to detect trigger mechanisms that have been improperly cut back. Further, there may be additional factors that could also contribute to inadequate engagement between the trigger locking mechanism and the stationary portion of the girt bar. For example, improper machining on other components in the girt bar, deterioration of parts, or contamination of the trigger locking mechanism could also hinder proper engagement. Therefore, the Board is concerned that even if a girt bar's chamfer met the design specifications of 0.50 mm by 0.50 mm, it is still possible that unintended retractions could occur.

The Safety Board also questions the effectiveness of the one-time static test procedures in AOT A320-52A1110. The procedure calls for mechanics to test the girt bar by pushing on the ends of the bar "with a measured force of...34 lbs to 45 lbs." Safety Board investigators manually pushed on the ends of the three improperly chamfered girt bars from the accident airplane and concluded that the 2L girt bar would likely have been identified through this test. However, the 1L and 2R girt bars would most likely not have been identified even though both have chamfers greater than 0.50 mm by 0.50 mm. Additionally, Airbus Industrie reported that the girt bar from the April 19, 2001, incident was subjected to 80 kilograms (approximately 176 lbs) of static force and the girt bar did not retract. Further, as previously noted, a static test may not adequately replicate the dynamic operational environment to which a girt bar is subjected. For these reasons, the Board is concerned that even after operators perform the

¹⁴ Airbus Industrie indicated that the chamfer measurement was 0.65 mm by 0.65 mm. Because the design specification for the chamfer is 0.50 mm +/- 0.10 mm, the chamfer was 0.05 mm out of tolerance on both surfaces.

inspection recommended by the AOT, improperly chamfered girt bars and improperly cutback trigger locking mechanisms could still exist.

Therefore, the Safety Board believes that the FAA should immediately issue an emergency airworthiness directive (AD) to require operators of overwater-equipped Airbus Industrie A319, A320, and A321 airplanes with manually chamfered girt bars to (1) ensure that the dimensions of the trigger locking mechanism and the stationary portion of the girt bars conform to the design specifications; (2) perform a reliable functional test to demonstrate the proper engagement of manually chamfered girt bars under realistic door opening conditions; and (3) repair or replace any girt bars that do not meet the dimensional requirements or do not pass the functional test, before the airplanes are returned to service.

The Safety Board notes that although overwater-equipped Airbus Industrie A319, A320, and A321 airplanes subsequent to MSN 1173 were delivered with machine-chamfered girt bars, some operators may not, and are not required to, track telescopic girt bars and their location in their fleet. If an operator decided to equip an airplane for over-water use, it would replace the slides and nonretractable girt bars with slides/rafts and telescopic girt bars. The FAA should emphasize in its emergency AD that operators may have installed manually chamfered girt bars on airplanes subsequent to MSN 1173 after the airplanes were delivered and that the AD applies to any manually chamfered girt bar, regardless of the airplane's serial number.

Although all of the slide/raft separations that the Safety Board is aware of to date have occurred on Airbus Industrie A319, A320, and A321 airplanes that have manually chamfered girt bars, the Board is concerned that all girt bars, even those that are machine-chamfered, may be susceptible to inadequate engagement between the trigger locking mechanism and the stationary portion of the girt bar for the same reasons that the manually chamfered girt bars are susceptible. Therefore, the Safety Board believes that the FAA should issue an AD to require operators of overwater-equipped Airbus Industrie A319, A320, and A321 airplanes with machine-chamfered girt bars to, by the next scheduled maintenance activity, (1) ensure that the dimensions of the trigger locking mechanism and the stationary portion of the girt bars conform to the design specifications; (2) perform a reliable functional test to demonstrate the proper engagement of the girt bars under realistic door opening conditions; and (3) repair or replace any girt bars that do not meet the dimensional requirements or do not pass the functional test, before the airplanes are returned to service.

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

Immediately issue an emergency airworthiness directive to require operators of overwater-equipped Airbus Industrie A319, A320, and A321 airplanes with manually chamfered girt bars to

- (1) Ensure that the dimensions of the trigger locking mechanism and the stationary portion of the girt bars conform to the design specifications;

- (2) Perform a reliable functional test to demonstrate the proper engagement of manually chamfered girt bars under realistic door opening conditions; and
- (3) Repair or replace any girt bars that do not meet the dimensional requirements or do not pass the functional test, before the airplanes are returned to service. (A-01-27) (Urgent)

Issue an airworthiness directive to require operators of overwater-equipped Airbus Industrie A319, A320, and A321 airplanes with machine-chamfered girt bars to, by the next scheduled maintenance activity,

- (1) Ensure that the dimensions of the trigger locking mechanism and the stationary portion of the girt bars conform to the design specifications;
- (2) Perform a reliable functional test to demonstrate the proper engagement of the girt bars under realistic door opening conditions; and
- (3) Repair or replace any girt bars that do not meet the dimensional requirements or do not pass the functional test, before the airplanes are returned to service. (A-01-28)

Acting Chairman CARMODY and Members HAMMERSCHMIDT, BLACK, and GOGLIA concurred in these recommendations.

By: Carol J. Carmody
Acting Chairman