ADOPTED: 1/8/91

Log #2268

National Transportation Safety Board

Washington, D.C. 20594

Safety Recommendation

Date: January 8, 1991
In reply refer to: A-91-3 thru -8

Honorable James B. Busey
Administrator
Federal Aviation Administration
Washington, D.C. 20591

On December 3, 1990, at 1345 EST, Northwest Airlines Flight 299, a Boeing B-727, and Northwest Flight 1482, a McDonnell Douglas DC-9, collided near the intersection of runway 03C/21C and 09/27 at Detroit Metropolitan/ Wayne County Airport, Romulus, Michigan. The B-727 was taking off from runway 03C, and the DC-9 had taxied onto that runway just prior to the accident. Visibility was reported to have been 1/4 mile in fog at the time. One flight attendant and seven passengers onboard the DC-9 were killed; there were no injuries to the persons onboard the B-727.

The DC-9 was destroyed by fire that ignited when the B-727's right wing penetrated the right side of the DC-9 cabin. The captain of the DC-9 escaped via the left sliding cockpit window, 13 persons jumped from the left main boarding door exit, 4 persons jumped from the right forward service door exit, and 18 persons exited via the left overwing exit. The flight attendant who was assigned to the rear jumpseat, and a male passenger succumbed from smoke inhalation. The flight attendant was found lying on the catwalk inside the empennage/tailcone just below the tailcone release handle, and the passenger was found lying partially over the tailcone evacuation slide, also in the vicinity of the release handle. The tailcone had not been jettisoned, and the interior tailcone release handle was found free of its restraint clips and rotated clockwise about 60^{0}. The copper safety wire installed by Northwest Airlines was not found. The Safety Board's continuing investigation has found serious deficiencies with the manual release mechanism on the inside of the DC-9 tailcone. Further, the inside release mechanism is identical to the release mechanism installed on the outside of the DC-9 tailcone. The Safety Board has also determined that this release mechanism is identical to the release mechanism installed on the interior and exterior of the MD-80 series airplanes.

The investigation revealed that three of the four tailcone locks were found fully closed, and the upper left lock was found engaged but rotated counter-clockwise 1/2 inch from its fully closed position. The slider block pin for this lock had been misrigged. Although, it was determined that this rigging discrepancy alone would not have prevented the tailcone from being

jettisoned from either inside or outside the accident airplane, the Safety Board is concerned that improper rigging of the tailcone attachment and locking assembly could result in failure to jettison the tailcone.

After further inspection of the routing of the entire tailcone release cable, attempts were made to jettison the tailcone using the inside release handle. A 35-pound pull, which is the specified maximum force needed to release the tailcone handle, was exerted on the handle and the tailcone failed to jettison. The tailcone still did not jettison when 60 and 90+ pounds were applied to the handle. Closer examination of the handle and housing assembly showed that the handle shaft was broken and that a remnant of the handle shaft was entrapped in the cable release housing. This remnant prevented the cable end from releasing, thereby maintaining the lock on the tailcone release mechanism. The fact that the release handle was found free of its restraint clips and rotated 60^{0} indicates that the handle shaft was broken before any tests were performed.

The Safety Board's Materials Laboratory examination of the handle, which was part of the cable assembly, Douglas Part Number 3913359-533 revealed that its 1-inch-long aluminum alloy shaft had fractured transversely 0.65 inch from the handle shaft end. The entire fracture surface was indicative of an overstress separation that initiated along half the shaft circumference in the bottom of the manufactured groove on the shaft originally designed to contain an "O" ring for the cable assembly Part Number 3913359-551. The Safety Board has not determined when the fracture occurred. Preliminary stress analysis of the handle indicated that the handle shaft would be much easier to break under a sideward-bending load than under a straight tension load. For this reason, a test was conducted on a replacement handle that was supplied by Northwest Airlines to determine the bending load that would have been necessary to fracture the shaft. The shaft fractured at the manufactured groove when a 128-pound static weight was suspended from the handle and orientated 90^{0} to the centerline of the shaft. The results of this test indicate that the release handle shaft on the accident airplane could be fractured from a relatively low bending load. However, normal operation of the handle by pulling it straight out from the release housing would not produce a large bending stress in the shaft.

Examination further disclosed that the aluminum alloy shaft of the release handle on the accident airplane had a spherical wear depression caused by contact with the lock cable's steel ball-end fitting when the lock cable is situated against the shaft in the release housing. A second handle supplied by Northwest had a much larger and deeper depression on its shaft.

The second handle containing the deep depression in the handle shaft was manipulated within another lock cable release housing also supplied by Northwest. With the lock cable ball end installed in the lock cable release housing and the handle situated in the stowed position, the ball-end fitting positioned itself in the depression on the handle shaft. With a slight rotation of the handle in this assembly, the ball end could be wedged between the shaft and the housing. As long as the handle remained oriented in the wedged position, the resistance to remove the handle by pulling remained extremely high, and the handle appeared to be jammed in the housing. However,

it was found that when the handle was rotated from this jammed position, the indentation on the handle shaft would position itself relative to the ball-end fitting so as to allow the handle to be pulled free of the housing.

The Safety Board is concerned that extensive wear of handle shaft by the ball-end fitting could produce a condition that would substantially increase the resistance of movement of the handle from the stowed position. Under this condition, excessive force may be applied to the handle that could break the handle shaft. Once the handle shaft breaks, the lock cable would not be allowed to release from the housing and the tailcone could not be jettisoned.

The accident airplane had received a "C" check on November 6, 1990, 66 flight hours prior to the accident. Although there is no FAA requirement to jettison DC-9/MD-80 tailcones during scheduled maintenance, McDonnell Douglas recommends that it be done every 3 years. Northwest Airlines requires that tailcones be jettisoned during "C" checks that occur after 3,000 flight hours or at 12-13 months. Thus, the Northwest Airlines testing of tailcones exceeds that recommended by McDonnell Douglas. The tailcone was reportedly jettisoned and reinstalled without difficulty during the "C" check. Mechanics did not recall seeing the release handle broken either before or after the "C" check. However, the mechanics who reinstalled the tailcone assembly and the quality control inspector who inspected their work had not received training in the installation or rigging of the tailcone assembly. This situation could account for the misrigged upper left lock. The misrigging was not found during the final "C" check inspection. During the investigation of this accident, it was learned that Northwest Airlines maintenance procedures do not follow the detailed inspection guidelines in the DC-9 maintenance manual that specifies the functional test and rigging of the tailcone latching and release mechanisms. Furthermore, neither the DC-9/MD-80 tailcone maintenance manuals nor Northwest Airlines maintenance and inspection procedures contained instructions to inspect tailcone release handles for damage.

In view of the findings discussed above, the Safety Board recommends that the Federal Aviation Administration:

> Immediately require a fleet-wide inspection of all DC-9 tailcone assemblies, as outlined in the DC-9 Maintenance Manual "Tailcone-Maintenance Practices" "53-50-3" "Code 1" pages 201 through 208A and the MD-80 Maintenance Manual "Tailcone-Maintenance Practices" "53-50-3" pages 201 to 221; require detailed visual examinations of the interior and exterior tailcone release handles for broken or cracked shafts and for damage from contact with the lock cable ball-end fitting (Douglas Part Number 492740); and require that damaged handles be repaired or replaced. (Class I, Urgent Action) (A-91-3)

Immediately require DC-9/MD-80 tailcone maintenance manuals to include procedures for detailed visual examinations of interior and exterior tailcone release handles for broken, cracked, and damaged shafts. (Class I, Urgent Action) A-91-4)

Immediately require that the Safety Board's findings thus far regarding the DC-9 manual tailcone release be provided to operators of DC-9/MD-80 airplanes and their crewmembers. (Class I, Urgent Action) (A-91-5)

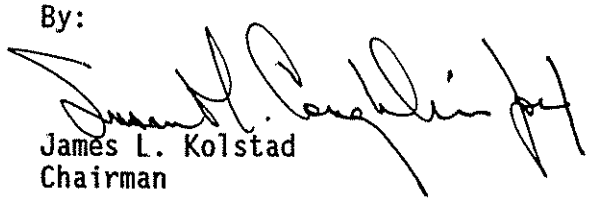
Immediately require operators of DC-9/MD-80 series airplanes to include in their flightcrew and flight attendant training programs the Safety Board's findings regarding the tailcone manual release system and tailcone familiarization tours and hands-on training on the operation of the release handle in DC-9/MD-80 airplanes using actual airplanes or FAA-approved simulators. (Class I, Urgent Action) (A-91-6)

Require McDonnell Douglas Aircraft Company to redesign the manual tailcone release mechanism on DC-9 and MD-80 series airplanes to correct its propensity for damage and malfunction. Require redesigned release mechanisms to be installed on newly manufactured and inservice airplanes. (Class II, Priority Action) (A-91-7)

Require operators of DC-9 and MD-80 airplanes to incorporate in their maintenance procedures a periodic inspection of the tailcone assemblies and release handles per recommendation A-91-3 above. (Class II, Priority Action) (A-91-08)

Chairman KOLSTAD, Vice Chairman COUGHLIN, Members BURNETT, LAUBER, and HART concurred in these recommendations.

By:



James L. Kolstad
Chairman