NATIONAL TRANSPORTATION SAFETY BOARD
OFFICE OF AVIATION SAFETY
WASHINGTON, D.C.

June 22, 1998

ADDENDUM TO STRUCTURES GROUP FACTUAL REPORT OF INVESTIGATION

A. ACCIDENT : **DCA97MA055**

LOCATION	:	Newark International Airport, Newark NJ.
DATE	:	July 31, 1997
TIME	:	0131 Eastern Daylight Time (EDT)
AIRCRAFT	:	McDonnell Douglas MD-11, N611FE Operated by Federal Express Corporation

B. GROUP MEMBERS

Chairman	:	Cynthia L. Keegan National Transportation Safety Board Washington, D.C.
Member	:	Glen Beyer Federal Express Corporation Memphis, Tennessee
Member	:	Don Waller Douglas Products Division Boeing Airplane Group Long Beach, California
Member	:	Jon A. Hjelm Federal Aviation Administration Valley Stream, New York
Member	:	Tom Walsh Federal Express Pilots Association Virginia Beach, Virginia

C. SUMMARY

The structures group reconvened in Newark, New Jersey, on April 21, 1998, to re-examine the right wing, the number 3 engine pylon attachments, the number 3 engine cowling, and the right inboard wing spar. The purpose of the examination was to determine the sequence of failure and load path of the right wing and right landing gear. The structures group had also planned on examining the right wing rear spar web, the lower half of the number 3 engine forward mount fitting, and the right wing flap A-frames; however, a representative of the airplane recovery company reported that these parts, as well as other smaller airplane parts had been disposed of following the Safety Board's earlier release of the wreckage. This report includes documentation of the lower right wing surface, the inboard right wing rear spar, the number 3 engine pylon attachments, and the damage to the number 3 engine lower cowling. Photographs of the airplane structure and components are included in Appendix A of this report.

B. DETAILS OF THE INVESTIGATION

1.0 Right Wing Damage

The right wing separated approximately 3 feet inboard of the number 3 engine pylon at about wing station (WS) 264 (see figure 1). The spar web was melted and exhibited heat damage. The lower spar cap was bent downward and the forward 4 stringers on the inside upper surface of the wing exhibited compression buckling and longitudinal fractures. The upper forward spar cap was fractured about 9 inches outboard from the fractured end of the wing. The lower forward spar cap was also fractured. The 8th and 9th upper wing stringers from the wing leading edge were bent downward at the inboard end. The 9th stringer was buckled about 10 inches from the inboard end. All of the upper stingers were fractured along their flanges from the wing separation inboard to WS 298.5.

The right wing was raised to examine the lower wing surface. The lower wing surface was buckled and had fractured 9 feet inboard from the wing tip in the diagonal direction (as measured along the wing leading edge.) The fracture surface was clean, however, unlike other fracture faces that were found sooted at the accident site, suggesting that the fracture had occurred during the recovery of the airplane wreckage. The lower leading edge of the number 8 slat skin was rubbed away and the interior structure was embedded with vegetation.

The forward lower winglet attach fitting aft flange was bent rearward and fractured. Both the forward and aft fittings were ground smooth with the bottom surface of the wing in the inboard and outboard direction. The ground areas on the forward and aft fittings were free of soot and had traces of asphalt embedded in its surface (consistent with the damage occurring during the salvage removal of the wing.) No forward or aft scraping was observed on the outboard lower wing skin. The upper surface of the wing skin, 12 feet from the wing tip, was buckled upwards and the adjacent inboard skin exhibited compression wrinkling. Heat damage was observed throughout the buckled area.

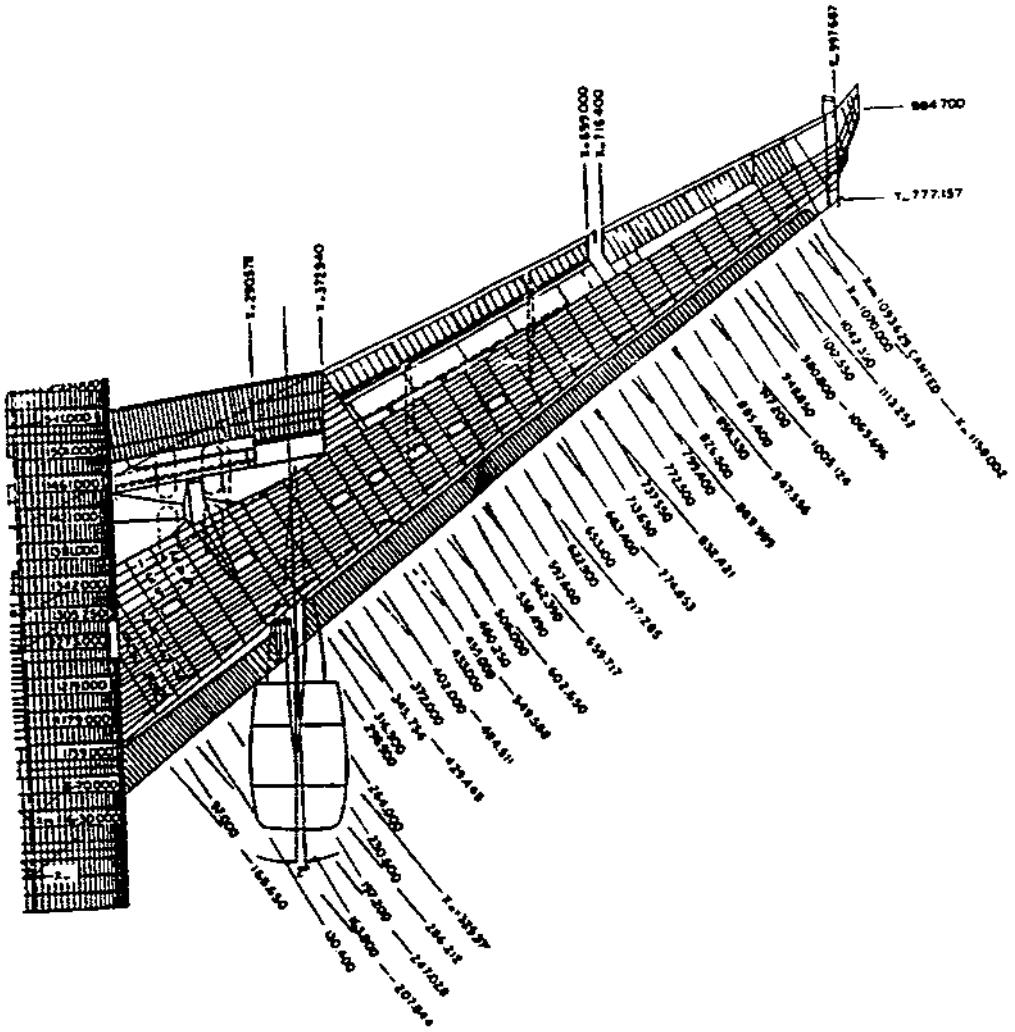


Figure 1
MD-11 Wing Station Diagram

2.0 Number 3 Engine Pylon

The pylon aft fairing was bent inboard but there were no scrape marks on the pylon skin. The front footstool fitting of the forward attachment for the number 3 engine showed a tension failure of the inboard forward pylon attach fitting (see figure 2) and twisting tension failure of the outboard side of the bulkhead. The outboard side of the pylon bulkhead was also bent aft. Both the inboard and outboard sides of pylon attach fitting hi-loks were fractured; the outboard hi-loks were fractured in shear.

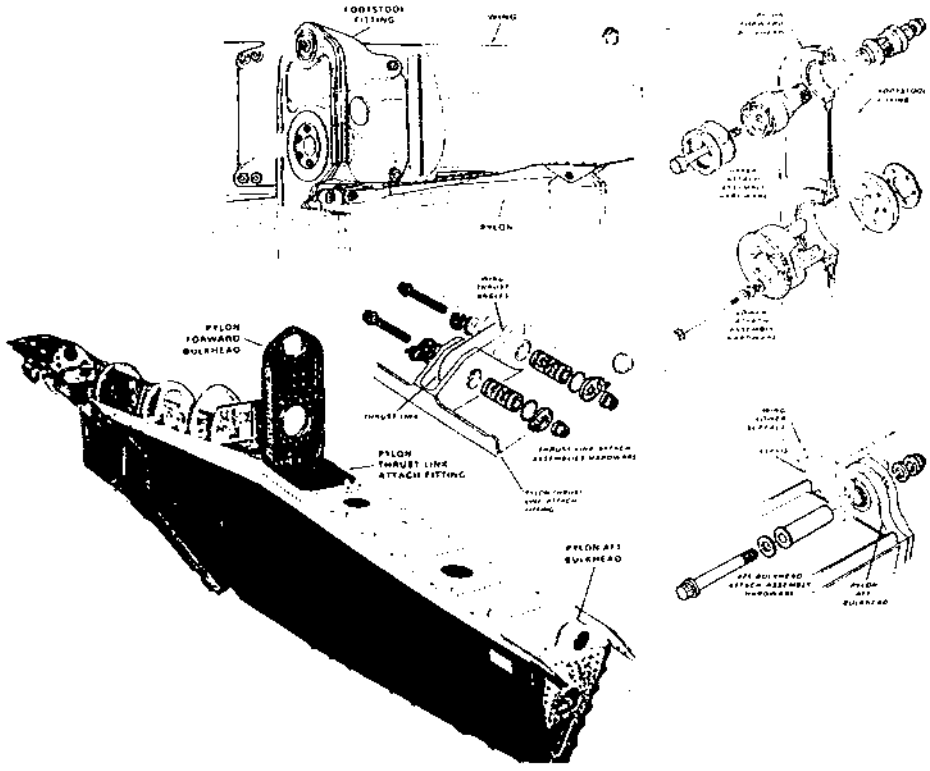


Figure 2

MD-11 Engine Pylon to Wing Attachment

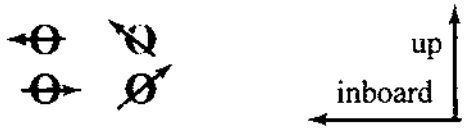
The thrust link inboard fasteners exhibited tension fractures. The aft end of the inboard thrust link angle was twisted and the thrust link also exhibited a tension fracture. The outboard thrust link was fractured between the flange and the web and the web was bent outboard. The angle attachments were fractured in the outboard, axial direction.

The inboard attach fitting fasteners for the outboard flap were fractured in shear. The outboard flap attach fittings for the rear spar were sheared in the directions shown:

The inboard side brace fitting was fractured in the outboard and aft direction. The outboard attachments for the outboard flap were sheared and the wing side fitting was heavily sooted. The outboard attach fitting for the outboard flap upper rear spar bolts exhibited the following fractures:

- Upper inboard bolt - tension fracture
- Upper outboard bolt - sheared flush with the spar, (and heavily sooted.)
- Two lower bolts were sheared flush with the spar
- Lower inboard bolt - bending tension
- Lower outboard bolt - sheared

The outboard side brace fitting was intact. The four outboard attachments for the outboard flap were fractured in the directions shown:



3.0 Right Inboard Wing

The right inboard wing section that remained attached to the fuselage was separated at the WS90 and WS150 (front and rear spar locations). The right wing section between rear spar WS264 and WS150 was destroyed. The upper rear spar cap at the intersection of the trapezoidal panel was fractured and sooted. The fracture face was cut away from the rear spar cap and sent to Douglas Products Division for further metallurgical analysis under the supervision of the Safety Board.

4.0 Number 3 Engine Casing Damage

No evidence of grinding or scraping on the integrated drive generator (accessory drive section) was observed. Some scrape marks were observed on the flange between the turbine casing and the tailcone at the 6-8 o'clock positions (as viewed from the rear of the engine looking forward). Grass particles were lodged within the scrapes. The turbine case was dented, but maintained its radial shape. The tailcone was deformed between the 2 and 7 o'clock positions (as viewed looking forward).

[redacted]

Cynthia L. Keegan
Structures Group Chairman

6/22/98