

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

**February 23, 1998**

**STRUCTURES GROUP CHAIRMAN'S 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 : Dave Blake  
FAA  
Atlantic City, NJ

Member : Nate Glinbizzi  
FAA Flight Standards District Office  
Teterboro Airport  
Teterboro, NJ

Member : Don Waller  
McDonnell Douglas Division of  
Boeing Airplane Group  
Long Beach, CA

Member : Sean O'Leary  
FedEx Pilots Association  
Memphis, TN

Member : Glen A. Beyer, P.E.  
Federal Express Corporation  
Memphis, TN

Member : Richard Anderson  
Boeing Commercial Airplane Group  
Seattle, WA

### **C. SUMMARY**

On July 31, 1997, at about 0131 EST, Federal Express (FedEx) flight 14, a McDonnell-Douglas MD-11, registration number N611FE, was involved in accident while landing on runway 22R at Newark International Airport, Newark, New Jersey. The airplane was on a regular scheduled cargo flight from Anchorage, Alaska to Newark, New Jersey. On board the aircraft were two pilots, a cockpit jumpseat passenger, and two non-revenue passengers. The airplane touched down, became airborne, touched down again, and broke apart as it slide along the shoulder of runway 22R. The impact and postimpact fire destroyed the aircraft and cargo. All 5 occupants exited the wreckage through the captain's cockpit sliding window and were treated for minor injuries.

The airplane came to rest in the inverted position at the end of the wreckage path that began with pieces of the right inboard trailing edge flap and culminated at the main wreckage site. The wreckage was distributed over a 2,900 foot debris path that gradually arced to the right of runway 22R. The fuselage was oriented with it's nose on a 95 degree magnetic heading. No evidence of pre-impact fire was observed on any of the airplane wreckage. The main wreckage consisted of the fuselage, left wing, nose gear, left main landing gear, center main landing gear and horizontal stabilizer. The remaining components and structure had separated from the airplane and were located along the wreckage distribution path. A 1,574-foot area along the right side of runway 22R was sooted and smelled of fuel. The

separated right wing was found 4,577 feet beyond the threshold. Five runway/taxiway signs along the right side of runway 22R were damaged or destroyed.

The Structures group convened on July 31, 1997 at the Newark International Airport to document the airplane structure, the wreckage distribution, and the postimpact fire damage to the airplane and adjacent runway area. The Structures Group completed their documentation on August 3, 1997. A wreckage distribution diagram and wreckage list is included in Appendix A, a diagram of airport taxiway signs that were damaged during the accident is included in Appendix B, and photographs of the airplane wreckage are included in Appendix C of this report. See Airplane Performance Group Factual Report for documentation of the airplane touchdown tire marks, and runway scrapes, gouges, and paint marks, and the Systems Group Chairman's Factual Report of Investigation for documentation of the airplane's right main landing gear.

#### **D. DETAILS OF THE INVESTIGATION**

##### **1.0 Wreckage Path**

Composite pieces of the airplane's right inboard trailing edge flap were the first pieces found along the wreckage path, 2,226 feet from the runway 22R threshold (and 1,100 feet from the airplane's first tire touchdown marks.) Runway ground scars consistent with damage and white runway paint transfer on the No. 3 engine nacelle tail cone were found 2,164 feet from the runway threshold. The right inboard trailing edge flap was found 2,376 feet from the runway threshold; all four corners of the flap were rounded and scraped. A gouge in the runway surface (consistent with the size of the airplane's VHF 3 aluminum antenna on the underside of the tail) began at 2,676 feet from the threshold and extended 35 feet. The fractured antenna was found 49 feet to the left of the centerline and 3,053 feet from the threshold. A large diamond shaped section of the center main tire was found 3,084 feet from the threshold, and a section of the right main landing gear door was found 3,219 feet from the threshold.

All three engines, the vertical stabilizer, and the right wing had separated from the airplane and came to rest in the grassy area to the right of the runway between taxiways "G" and "F". The small fin mounted just above the No. 2 engine

was found on top of the right wing. The fin was covered with soot; there were some small sections of purple paint visible. The area in front of the right wing had several scorch marks extended approximately 4 feet from the leading edge slats. The area behind the trailing edge of the wing was coated with fuel and was scorched. The wreckage as well as the grassy area and the adjacent runway was burned and sooted.

A portion of the right main landing gear strut consisting of the diagonal link, inboard section of the diagonal tube, retract cylinder, the aft half of the bogie beam, and the aft two wheels and tires, came to rest on the right side of the runway 4,805 feet from the threshold. The forward half of the right main landing gear bogie beam, wheels and tires were found 235 feet to the right of the runway centerline, and 4,957 feet from the runway 22R threshold. The airplane's fuselage came to rest inverted with its left wing attached; 5,126 feet from the runway 22R threshold, and 580 feet to the right of the runway centerline.

## 2.0 Wreckage Description

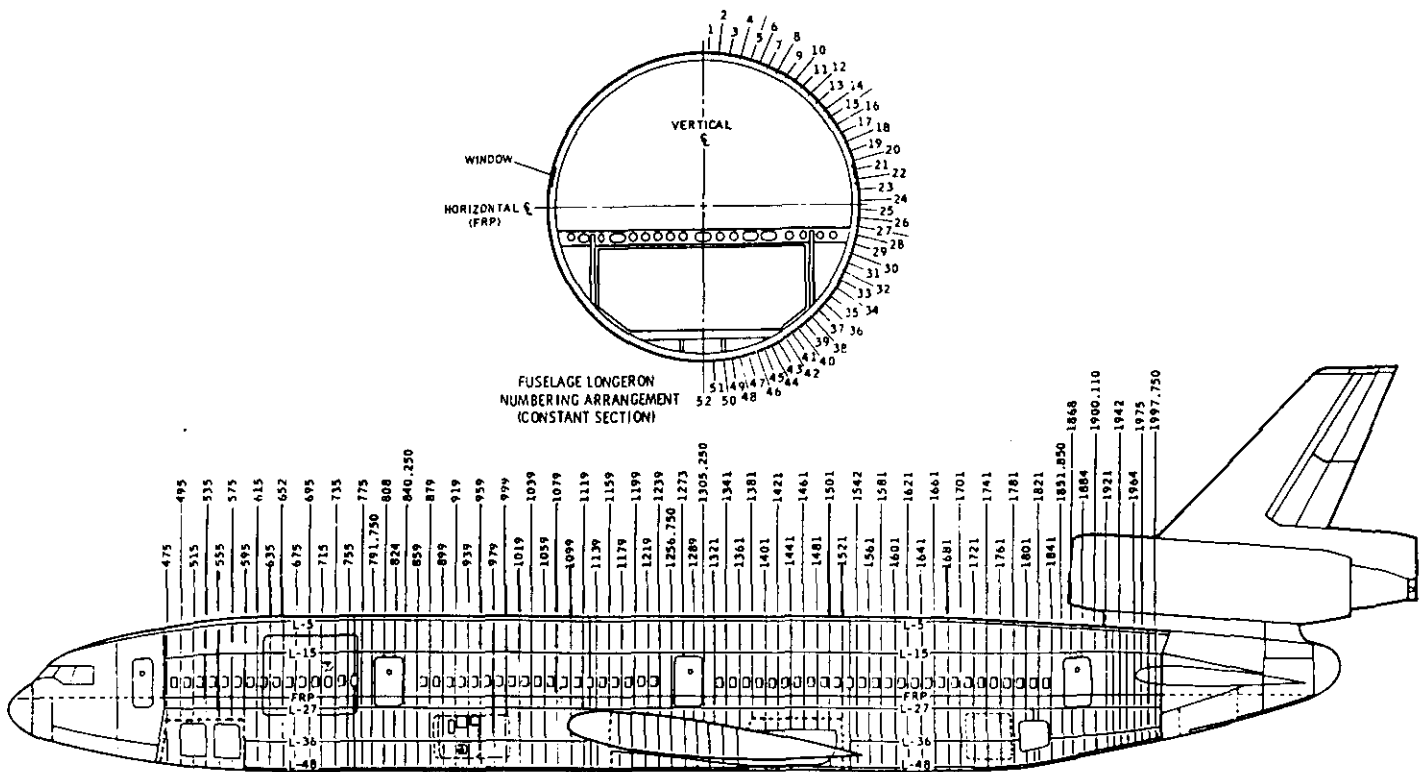
### 2.1 Fuselage

The airplane came to rest inverted, rolled slightly towards its left side and leaning on its left wing. The upper fuselage was wrinkled between the crown and the cockpit windows. The captain's sliding window was open and all six cockpit window panes were crazed and shattered. The nose cone was intact, and the paint on the radome boot was sooted and bubbled. The right side of the cockpit exterior was lightly sooted. The fuselage skin was wrinkled and the paint was scraped, exposing the metal. The scraping continued along the right side of the fuselage from the upper aft corner of the aft left cockpit window to about the forward edge of R2 door.<sup>2</sup> The scraping was angled from forward to aft, and from top to bottom along the fuselage. The nose landing gear was extended and the tires were inflated. The strut appeared to be fully extended and there was no visible damage to nose landing gear support structure. The nose landing gear doors were intact.

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<sup>2</sup> The MD-11 airplane has four cabin doors on either side of the fuselage numbered consecutively from the front to the rear of the airplane: R1 being the first door from the nose of the airplane on the right side (as viewed looking forward) and L4 being the last door near the tail of the airplane on the left side of the fuselage.

The R1 door was found open approximately 2 feet. The upper portion of the door, where the door track is installed was resting against the ground. The right side of the fuselage had extensive fire and soot damage with the outer fuselage skin peeled outward towards the crown of the fuselage between the R1 and R2 doors (See Figure 1, below, for MD-11 Fuselage Station and Longeron Locations diagram).



**Figure 1**  
**MD-11 Fuselage Station and Longeron Locations**

The main cabin floor was burned through the entire length of the fuselage from aft of the cockpit to the aft cabin pressure bulkhead. The fuselage belly skin was consumed by fire from just aft of the nose gear assembly to about fuselage station (FS) 879, and along the forward edge of the forward lower cargo door to the floor along the R2 door. The fuselage skin aft of the R2 door to FS1039 was sooted and burned and drooped into the fuselage. The right wing was separated at

the root. The top and bottom of the fuselage skin on the right side from FS1119 to 1501 was burned and melted. A large hole was burned through the bottom of the fuselage from FS1159 to 1401.

The center main landing gear was extended and the base of the gear structure was sunken inside the melted surrounding fuselage. Half of the right center main landing gear tire was missing from the wheel. The oleo piston was separated just above the axle. The remaining portion of the oleo piston was inside the cylinder. The right upper drag brace was separated about mid-point and the upper portion was missing. The cross tube was broken in the middle portion and the right hand portion was missing. The remaining drag braces were intact. Lock links were broken at the mid section of the lower lock link and the lower portion was attached to the lower/upper drag brace joint. The remaining portion of the lower lock link and the upper lock link were missing. The retract actuator was intact with the strut assembly. The retract actuator attach structure was separated from the airframe.

The left and right landing lights were found extended. A black rubber smudge was found level with the windows on the right side of the fuselage from FS553 to 573. The fuselage skin had been cut away by fire crews at FS1761 from the ground up to mid-window level and aft to a consumed area in the fuselage, and from the forward edge of the R4 exit to the aft pressure bulkhead.

The skin on the bottom and left side of the fuselage forward of the aft pressure bulkhead was wrinkled and burned between the bulkhead and the lower aft cargo door, and between FS2007 and 1940. The fuselage was also severely burned from the aft body fairing to FS1801. The entire left side of the fuselage and wing was heavily sooted. Fuel line was strewn on the ground with the melted fuselage skin. The fuselage skin between the floor and the window belt doubler was wrinkled from FS1841 to the trailing edge of the left wing in decreasing severity and in increasing severity from forward of the wing to the L2 exit door.

There was an 8-inch-diameter tear in the fuselage skin at FS1119, and an oblong skin tear at FS1100 along the lower cargo compartment. Two engine fan blades were embedded in the fuselage forward of, and above the left wing leading edge. The fan blades measured 6 X 16 inches and 2 X 4 inches, respectively.

## 2.2 Empennage

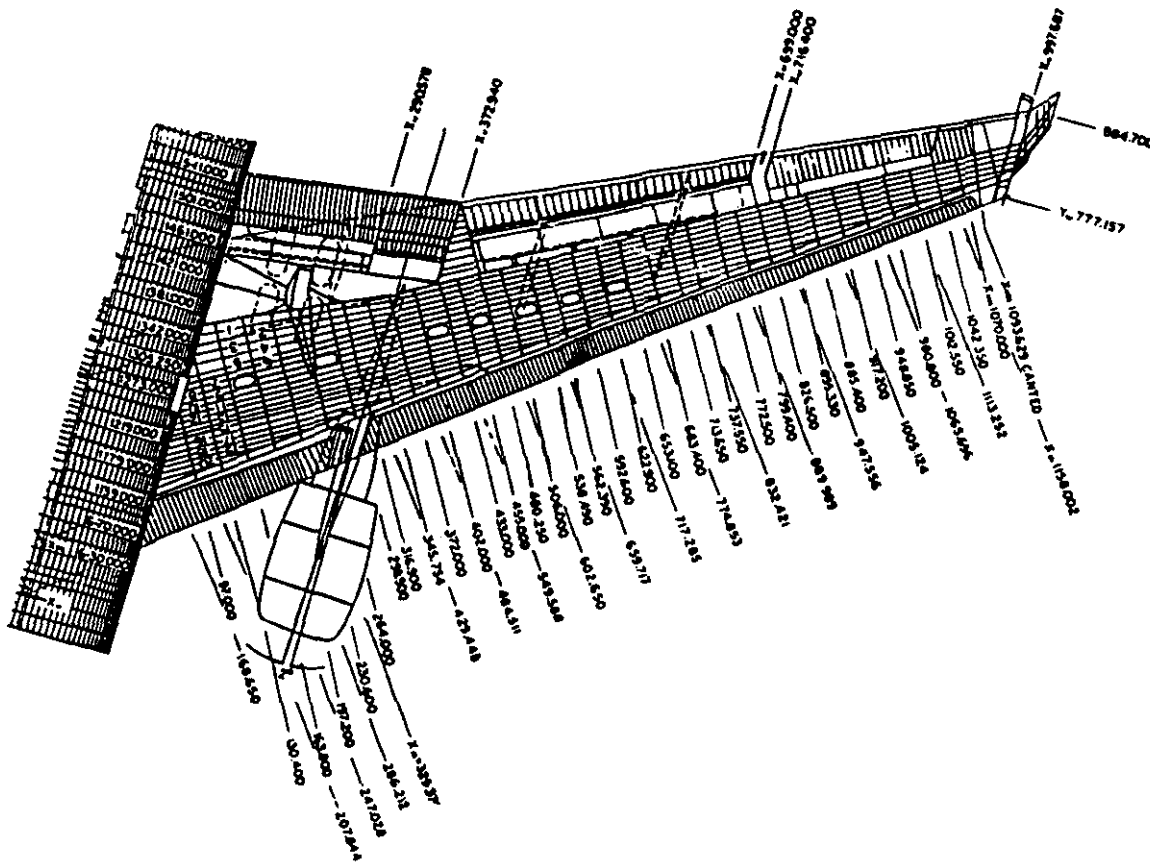
The vertical stabilizer, the number 2 engine, and the outboard half of the right horizontal stabilizer's outboard elevator separated from the fuselage. The top skin on the inboard end of the right horizontal stabilizer was torn. The lower surface of the right elevator had a puncture hole and "X"-shaped damage. The outboard end of the left horizontal stabilizer was fractured. The inboard upper surface of the left horizontal stabilizer was severely burned. The aft and forward portions of the tail cone were found separated from the empennage. The bottom of the tail cone had no structural damage or significant scrape marks, and the top of the aft section of the tail cone was scraped. A crease in the forward section of the tail cone matched the size and shape of the elevator. There were yellow paint chips throughout the tail cone sections and the right elevator that match the color of the taxiway marking paint.

## 2.3 Left Wing

The left wing and left main landing gear remained attached to the fuselage. All of the control surfaces remained attached to the left wing, except for the No. 8 leading edge slat (the MD-11 slats on each wing are numbered inboard to outboard, 1 through 8) that was located approximately 4,101 feet from the runway threshold. The inboard section of wing and control surfaces were sooted and the outboard section of wing and flaps were damaged by post-impact fire. The left main gear was extended and intact and its two tires were inflated. The outer half of the outboard aileron, the outboard wing tip, and the winglet were separated. The winglet splice bolt were stripped and the nuts had separated. The No. 8 leading edge slat had separated and the attached leading edge slats were severely fire damaged. The spoilers were found in the extended position. The wing's front spar was burned and shattered along the entire length of its spar. The outboard flap was intact and burned. The outboard flap showed no visible evidence of scraping or contact with the runway surface. The pylon and the No.1 engine had separated from the wing. The aft pylon mount was intact, and the forward pylon mount was partially sheared. The lower wing skin remained intact.

## 2.4 Right Wing

The right wing separated from the fuselage just inboard of the inboard fuel closure bulkhead at wing station (WS) 264. The upper surface was intact and sooted. (See Figure 2, below, for MD-11 Wing Station Location Diagram.) The skin was buckled approximately 12 feet inboard from the outboard end on the top of its aft skin panel. The aft pylon mount was intact at the wing and the forward pylon mount was partially attached. The lower winglet separated from the wing tip at its attach interface. The upper right winglet remained attached and had heavy sooting and some burn damage to the composite skin. Strands of composite material were found hanging from the upper winglet.



**Figure 2**  
**MD-11 Wing Station Locations**

The ends of 5 stringers protruded approximately two feet outboard of the upper wing skin. The stringers were twisted and bent upwards. The upper wing chord was fractured close to the bulkhead and was bent in an upwards direction.



The corresponding chord on the bottom wing surface was fractured. The fracture face of the front wing spar corresponded to the intersection of the WS264 bulkhead. Portions of the fracture face were burned and melted. The rear spar fractured near the intersection of the WS264 bulkhead and was bent rearwards. The wing bulkhead/fuel close-out panel (the inboard wing fuel tank) and its associated stringers were consumed by fire exposing the inside of the wing fuel tank. Significant sooting was observed on the inside of the wing fuel tank.

The forward lug of the fuel closure bulkhead's forward trunnion was found intact and a portion of the trunnion pin was protruding from the forward side of the lug.<sup>3</sup> Both lugs of the landing gear fixed brace mounting point were intact. Six inches of the fixed brace remained attached to the mounting lugs (with its associated pin) and was bent aft at the fracture face.

The right wing's leading edge slats remained attached to the wing. The trailing edge of the slats were burned and sooted and the bottom surface of the slats were resting on the ground. The outboard edge of No. 3 slat was bent upwards and its inboard edge was separated from its track and was bent upwards. All of the spoiler panels (composite material) were consumed by fire. The spoiler actuators and their attachment points were intact and in their retracted positions. The inboard trailing edge flap's outboard actuator and a portion of the flap's attach fitting were found on the ground adjacent to the right wing. The cylinder end of the actuator was attached to the wing and the rod end was attached to the flap fitting; the actuator was fully extended. The inboard flap hinge had fractured from the wing at the wing to hinge interface. The hinges for the outboard flap were separated at the bolt interface on the lower surface of the wing.


The inboard aileron was attached to the right wing and was melted and burned. One half of the outboard aileron was intact and the other half was burned. The aileron was found in the near-faired position and it could be manually moved up and down.

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<sup>3</sup> The WS264 fuel closure bulkhead at the aft section of the wing fracture consists of a large fitting that has three attach points (forward and aft gear trunnions and the outboard fixed brace attach point) for the right main landing gear. The main landing gear trunnion attach points consist of two lugs.

### 2.4.1 Right Inboard Trailing Edge Flap

The right inboard flap had separated at the flap vane tracks. All four corners of the panel were rounded and scraped. There were several puncture holes on the top surface of the flap panel at the track locations. The flap skin was buckled two feet from the leading edge on the lower surface at the inboard end. Approximately 2 feet of the leading edge vane remained attached to the inboard vane track at the inboard end of the flap. A second portion of vane (about 6 inches) remained attached to the outboard vane track of the flap, and was also attached to the flap. The center vane track and a 4 foot section of the vane were fractured (vane pieces were found on the runway). The inboard flap track had separated and was found attached to the flap; the trailing edge of the track was bent outboard and there were scrape marks on the track's surface. The flap hinge had separated from the panel and the attach bolts remained attached to the lower surface of the panel. No evidence of soot or fire was observed on the flap or flap vane pieces. Further examination of the right inboard trailing edge flap was conducted at the airplane manufacturer's facility. The report of the examination will be included into the docket for this accident.

  
Cynthia L. Keegan  
Aerospace Engineer

*JKW* 2/24/98

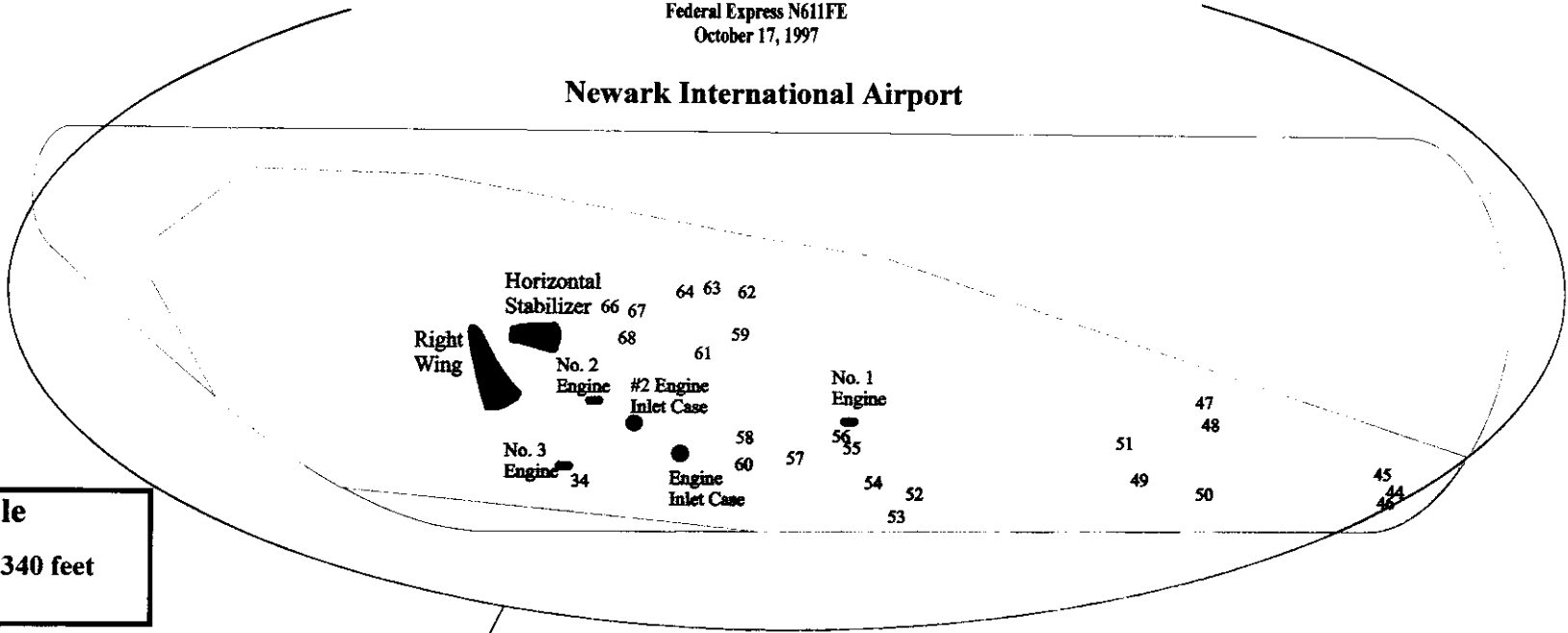
## **APPENDIX A**

**“Wreckage Distribution Diagram and Wreckage List”**

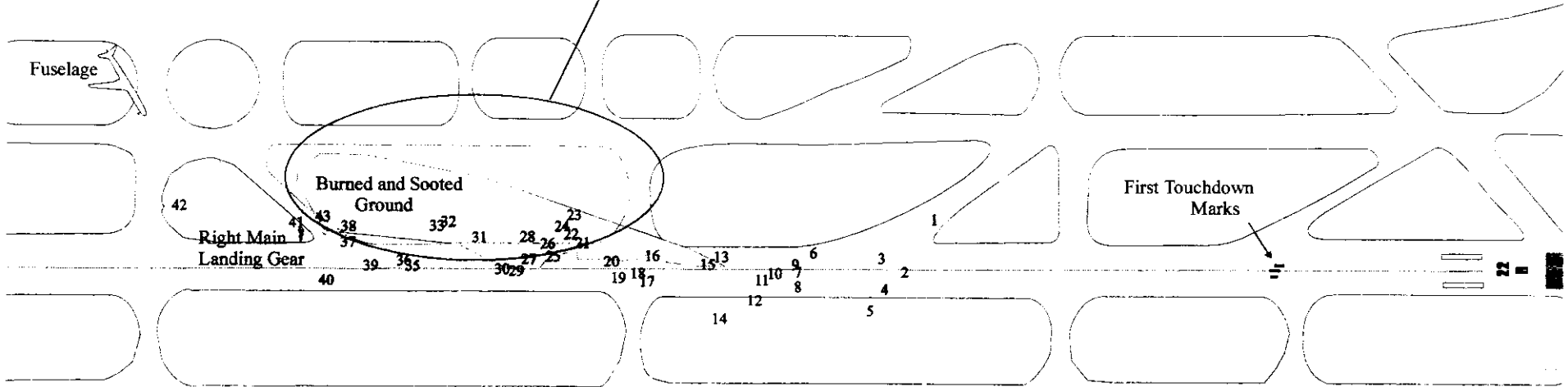
# Wreckage Distribution Diagram

McDonnell Douglas MD 11  
Federal Express N611FE  
October 17, 1997

## Newark International Airport



**Scale**  
1 inch = 340 feet



## Wreckage Distribution Part Identification

| Part Number | Description of Wreckage                |
|-------------|--|
| 01          | Right Inboard wing flap                |
| 02          | Wing flap Piece                        |
| 03          | Strip of Alum                          |
| 04          | Blackened Bracket                      |
| 05          | Tire Piece                             |
| 06          | Cone ARB0213-0401                      |
| 07          | Fairing                                |
| 08          | Tire Tread                             |
| 09          | Prox Sensor, Wing Flap                 |
| 10          | Bendix 913310-749168                   |
| 11          | Antenna                                |
| 12          | Tire(lg)                               |
| 13          | Brkt p/n ARG748-501B                   |
| 14          | PC Gear Door                           |
| 15          | ARB0116 - Firex Bay Intercostal Instl. |
| 16          | ARB-3303-502                           |
| 17          | Fuel Sump                              |
| 18          | Bracket ANN-008 9                      |
| 19          | Wing Tip Lens                          |
| 20          | Reverser Cowl Latch                    |
| 21          | Top Pylon Fairing-AWB-7735-63          |
| 22          | Reverser PC & PC Fan Blade             |
| 23          | Wing Fuel Line #ARL 0213-778           |
| 24          | Reverser Part #224 2101-567            |
| 25          | ARB300942001                           |
| 26          | Burnt Lower Eng Cowl & Latch           |
| 27          | ARC0367-15                             |
| 28          | Pylon Pneumatic Duct                   |
| 29          | PC Wing Trling edge ARC7012 406        |
| 30          | Strut Door ARC2880-506W                |
| 31          | Top of Vertical Stab & Eng Intake      |
| 32          | Lwr Sect Vert Fin L.E. JC 48-140L 004  |
| 33          | Lower Rudder NMC 6015 505              |
| 34          | Engine #3                              |
| 35          | R. Gear Fuse Pin (Trunnion)            |
| 36          | PC of Bogie Beam                       |
| 37          | Brake Control Valve                    |
| 38          | Gear PC                                |
| 39          | R. Gear Bogie PC                       |

|    |  |
|----|--|
| 40 | Counter Weight AMC 7430-503B                               |
| 41 | R. Main Gear Strut   |
| 42 | R. Main Gear Tires   |
| 43 | Wing Rib   |
| 44 | #3 Engine Cowl Strake                                      |
| 45 | Section of Outboard Flap                                   |
| 46 | Nose Cowl Mount  |
| 47 | Wing Pylon Fairing AUB & Fairing Pylon to Wing             |
| 48 | Fan Cowl Part  |
| 49 | Fan Cowl Part  |
| 50 | Fan Cowl Part  |
| 51 | Piece of Engine Pylon                                      |
| 52 | Section of No. 3 Pylon Bulkhead                            |
| 53 | Wing Skin Section  |
| 54 | Lower Right Wing Skin                                      |
| 55 | Aft Lip of Engine No. 2 Inlet                              |
| 56 | Slat Section, #2 RH, ARB 6225-50                           |
| 57 | Outboard Flap Section                                      |
| 58 | Wing Tip Trailing Edge Light                               |
| 59 | Large Section of Engine Fan Cowling                        |
| 60 | Skin, From Between Engine and Fuselage                     |
| 61 | Section of RH Outboard Aileron                             |
| 62 | Engine Fan Cowl Piece                                      |
| 63 | Engine Fan Cowl Piece                                      |
| 64 | Engine Fan Cowl Piece                                      |
| 65 | Vert Stab Lower Aft Spar, #4 Tailcone Bulkhead & Flap Actr |
| 66 | Slat   |
| 67 | RH Outboard Flap Section                                   |
| 68 | PC of Fuselage and Wing Fillet                             |

## **APPENDIX B**

**“Newark International Airport”**

**“Locations of Damaged Runway/Taxiway Signs”**

# Newark International Airport

## Locations of Damaged Runway/Taxiway Signs

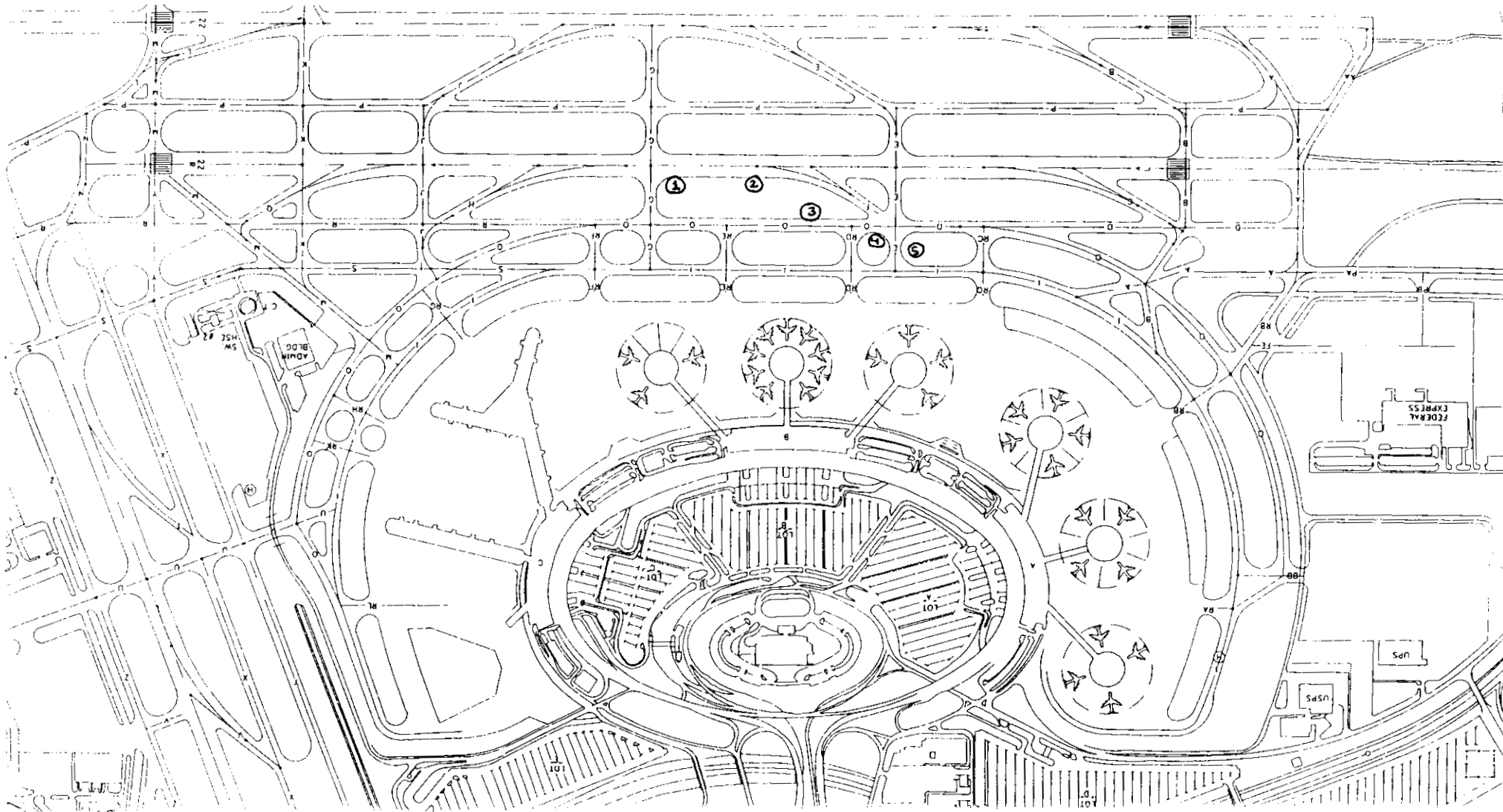
1. Sign : #55C  
Legend : G

3. Sign : #55  
Legend : B RD

4. Sign : #99C  
Legend : RD B

2. Sign : #55D  
Legend : F

5. Sign : #59B  
Legend : E A





## **APPENDIX C**

### **“Photographs”**