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NATIONAL TRANSPORTATION SAFETY BOARD
WASHINGTON, D.C.

STRUCTURES GROUP CHAIRMAN'S FACTUAL REPORT

by

Frank Hilldrup

NATIONAL TRANSPORTATION SAFETY BOARD
Office of Aviation Safety
Washington, D.C. 20594

August 30, 1994

STRUCTURES GROUP CHAIRMAN'S FACTUAL REPORT

DCA-94-MA-065

A. ACCIDENT

Location: 2180 feet southwest of runway 18R threshold, Charlotte/Douglas
International Airport, Charlotte, NC
Date: July 2, 1994
Time: 1843 Eastern Daylight Time
Aircraft: USAir flight 1016, DC-9-31, N954VJ

B. STRUCTURES GROUP

Chairman: Frank Hildrup
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Member: Bill Monson
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C. SUMMARY

On July 2, 1994, about 1843 eastern daylight time, a Douglas DC-9-31, N954VJ, owned by USAir, Inc., and operated as USAir flight 1016, collided with trees and a private residence while executing a missed approach procedure for the instrument landing system (ILS) approach to runway 18R at Charlotte/Douglas International Airport in Charlotte, North Carolina. The captain and one flight attendant received minor injuries; the first officer, two flight attendants, and 18 passengers sustained serious injuries; and 37 passengers received fatal injuries. The airplane was destroyed by impact forces and a post-accident fire. Instrument meteorological conditions prevailed, and an instrument flight rules flight plan had been filed. Flight 1016 was being conducted under 14 Code of Federal Regulations Part 121 as a domestic, scheduled passenger service flight from Columbia, South Carolina, to Charlotte.

The Structures Group was responsible for overall scene documentation and examination of the airplane structure.

D. DETAILS OF THE INVESTIGATION

1. Wreckage and Impact Information

Several distinct ground-impact marks from the airplane were identified. The first ground-impact mark was located on airport property in a grassy field approximately 2180 feet on a bearing of 240^{o1} from the threshold of runway 18R. The elevation of this location was identified by Global Positioning System (GPS) equipment as 748 feet (elevation of runway 18R is 743 feet). The spacing of the ground scars was compared with the airplane's dimensions to correlate the ground scars with specific airplane structure. The initial ground scar was consistent with being from the right main landing gear. The next ground scar (18 feet farther in the direction of airplane travel) was consistent with the left main landing gear. The furrows attributed to the right and left main gear wheels were approximately 9 inches deep and 40 feet and 53 feet long, respectively. These ground scars were followed by narrow ground scars that were consistent with the spacing of the right wing's flap hinges. There was also a large swath in the grass along the right side of the airplane's ground travel path; the distance to the edge of the swath was consistent with one-half of the airplane's wing span. Narrow cuts observed in the grass along the left side of the airplane's travel path were consistent with the spacing of the left wing's flap hinges. Figure 1 contains a diagram of impact marks and wreckage distribution.

The Structures Group found no evidence of any impact prior to the stated initial ground impact. Measurements of an undamaged telephone pole located across Old Dowd Road yielded an angle of approximately 6° down from the top of the pole to the first ground impact mark. The pole was located approximately 515 feet on a bearing of about 30° (i.e., in a direction reciprocal to the debris path heading) from the initial impact.

¹All heading measurements in this report are in degrees magnetic.

2. Wreckage Distribution

Portions of the wreckage were scattered throughout the debris path, which was oriented along a heading of approximately 211°. The first item in the debris field was identified as the water spray deflector for the APU, which is located on the underside of the fuselage at fuselage station 996. One of the lower VHF antennas and pieces of red glass were found 75' beyond the water spray deflector. The debris field contained a wooded area of sheared trees between approximately 500 and 800 feet from the initial impact mark. The aft portion of the fuselage, including the empennage and the two engines, was the last major section of the airplane in the debris field and came to rest through a carport adjacent to a house located across Wallace Neel Road. The length of the debris field, as measured (by tape measure) from the initial ground scar to the aft end of the fuselage, was 1063 feet.

The locations of other major pieces of the airplane and ground obstacles are as follows. A portion of the left inboard gear door was found approximately 200 feet from the initial ground impact mark. A berm located along the left side of the debris field approximately 300 feet from the initial impact mark contained ground scars consistent with the left wing flap hinges. Two large gum trees (approximately 2-foot diameter) broken approximately 10 and 12 feet above ground level were located nearly 500 feet from the initial impact. These trees were located just to the right (northwest) of the centerline of the debris field and were the first major trees to be impacted. The tail cone was found approximately half-way down the debris field. The nose gear was found among the remnants of a small brick structure approximately 50 feet beyond the tail cone. Most of the right wing was found in one section approximately 90 feet beyond the tail cone. Several tall trees along the right side of the debris field in the vicinity of the right wing had been discolored by fuel. Two separate fires that had burned car tires found on the ground were located near the right wing and the brick structure. Two sections of the fuselage were crushed against large trees across the street from the house, and an adjacent tree contained scraping on its north and west sides. The cockpit and a section of the forward fuselage came to rest on Wallace Neel Road in front of the house. A portion of the airplane that included the center wing section, most of the left wing, and a section of the fuselage over the center wing section was located near the house and aft fuselage section. The left main landing gear had separated from the wing and was jammed against the house beneath the aft fuselage section. The right main landing gear was located between the empennage and Wallace Neel Road.

3. Airplane Structure

An approximate 40-foot portion of the forward fuselage consisting of the cockpit, the forward galley, and the left side of the passenger cabin and forward cargo compartment came to rest on Wallace Neel Road facing a southerly direction. This section was lying on its right side and the nose section was canted to the left relative to the fuselage. Except for a portion of the skin above floor level on the left side aft of the cockpit, only the skin, frames, and stringers on the left side below floor level remained with this fuselage section.

A portion of forward fuselage and seats from the forward cabin were found wrapped around two large oak trees northeast of the cockpit section on Wallace Neel Road. This section included a portion of left and upper skin that mated with a section of left skin attached to the cockpit section.

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A portion of the airplane consisting of most of the inspar section of the left wing, the center wing section, and a section of the fuselage over the center wing section was located beside the empennage. Most of the fuselage section had been destroyed by fire.

The aft fuselage section located against the house on Wallace Neel Road consisted of the fuselage from near station 870 (i.e., between the third and fourth aft-most windows) to the point where the tail cone had separated. The empennage sustained severe fire damage, with greater fire damage on the left side. Power lines along Wallace Neel Road were entangled with the empennage.


Fire had burned away the left elevator and a portion of the left horizontal stabilizer section that remained attached to the empennage. The right horizontal stabilizer and elevator were intact except for the outboard tip, but had sustained substantial fire damage and sooting on the underside. Most of the rudder aft of the hinge line had been destroyed by fire. Fire had also destroyed upper portions of the leading edge and inspar areas of the vertical stabilizer.

Nearly all of the left wing's leading edge, a portion of the front spar, and the wingtip were missing. The center section and the inboard area of the left wing had sustained extreme fire damage. Approximately 2/3 of the flap structure remained attached to the wing. The spoilers and aileron remained attached to the wing, but some sections of their trailing edges were missing. The spoilers were down and the aileron appeared to be near the neutral position.

The inboard section of the right wing measuring from approximately Wing (Rear Spar) Station (WS) 164 remained attached to the center wing section but had extreme fire damage. The section of right wing from approximately WS 164 to WS 267 was found in the debris field between Wallace Neel Road and the outboard section of the right wing. The outboard section of the right wing (outboard of WS 267, except for the wingtip and a small portion of the trailing edge inboard of the wingtip) was found upright approximately 640 feet from the initial ground impact. The inboard area of this wing section had been exposed to a ground fire. The flap, slats, and spoilers were not attached. (Documentation of flap, slat, and horizontal stabilizer trim positions is included in the Systems Group Chairman's factual report.)

The right and left main landing gear attach fittings sheared from the rear spar. The left main landing gear was confirmed in the down and locked position. The position of the right main and nose gear could not be positively confirmed due to damage.

The left engine remained attached to the fuselage. The right engine had structurally separated, but remained attached by wiring and cables and was located on the ground adjacent to its normal position on the right side of the fuselage.

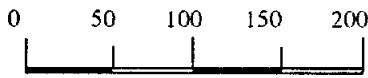

Frank Hilldrup
Structures Group Chairman

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211 degrees mag.

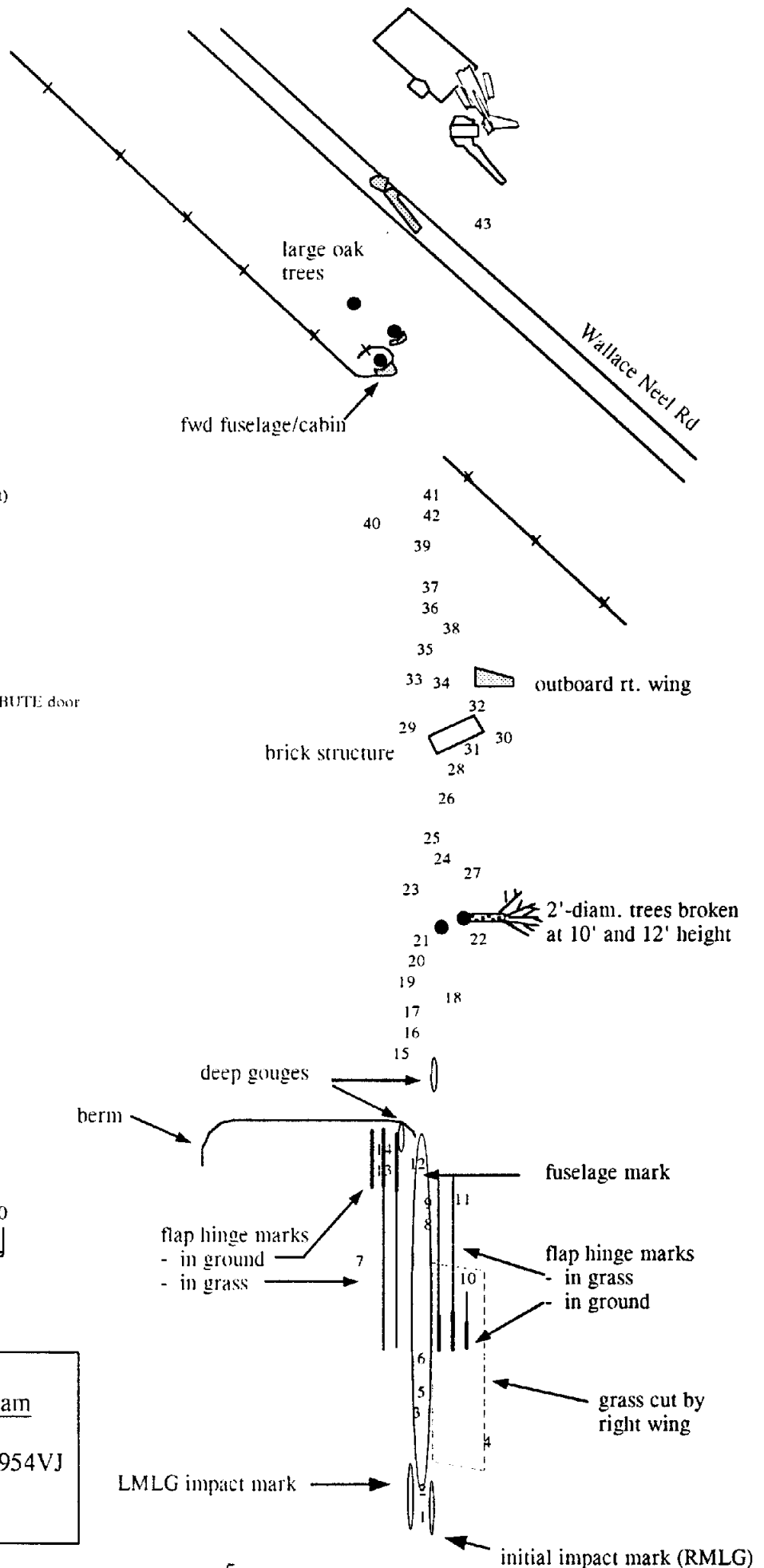


1. APU water spray deflector
2. Rt. engine cowl access door
3. Red glass pieces
4. Landing light lens
5. Lower VHF antenna
6. Lower VHF antenna
7. 2" diam. tree, sheared 6' from ground
8. Piece of left inboard gear door
9. Left outboard gear door
10. Flap track fairing
11. APU access panel
12. Left wing upper aft T.E. panel (w/non skid paint)
13. Left main gear fairing hydraulic access door
14. Left flap fitting fairing
15. Left inboard flap track assembly
16. Left nose gear door
17. Primary static port
18. Flap trailing edge section
19. Left foreflap inboard section
20. Audio select from E/E bay
21. Right inboard gear door
22. Debris in tree: left wing front spar piece & left BUTE door
23. Battery box cover
24. Aft spar section with BUTE door hinge
25. Leading edge slat
26. Tailcone
27. Right wing leading edge sections
28. Large piece of right flap and foreflap
29. Nose gear assembly
30. Right wing leading edge slat
31. Right wingtip
32. Inboard section of right flap assembly
33. Right foreflap section
34. Leading edge slat section
35. Left wingtip
36. 6' section of right wing midflap
37. 8' section of left horizontal stabilizer
38. Flap track
39. 7 1/2' section of right inboard lower wing
40. Right nose gear door
41. 8' section of fuselage skin
42. Right upper wing/spoiler section
43. Right main landing gear



SCALE (ft.)

Figure 1
Wreckage Distribution Diagram
USAir flight 1016, DC-9-31, N954VJ
Charlotte, NC
July 2, 1994



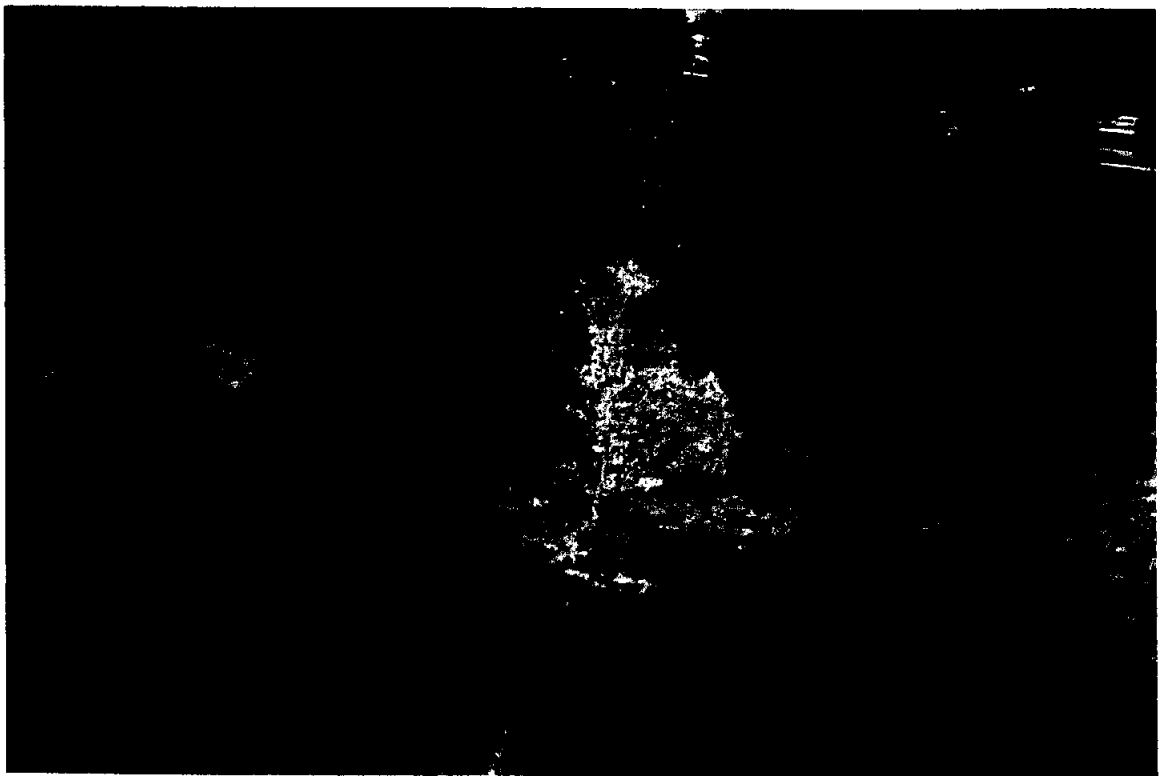


Figure 2. Aerial view of initial impact area. Arrows denote ground impact marks consistent with the right main landing gear ("R") and left main landing gear ("L") and a swath cut in the grass from the right wing ("RW").



Figure 3. Initial impact marks consistent with the right (R) and left (L) main landing gear. Note the tree swath (in background) angled down from left to right.



Figure 4. View from debris field looking northeast (back along the flight path).



Figure 5. Aerial view of forward fuselage section, aft fuselage section and empennage, and center/left wing section (arrow).



Figure 6. Cockpit and left/forward fuselage section on road.



Figure 7. Aft fuselage, empennage, and left/center wing section.