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Office of Aviation Safety

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Group Chairman's Factual Report

STRUCTURES

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Table of Contents

A.	Structures Group.....	2
B.	Summary	3
C.	Details of the Investigation	4
1.0	Airplane Description.....	4
2.0	Fire Damage	5
3.0	Structure	5
3.1	Fuselage.....	5
3.1.1	Fuselage Skin Panels.....	5
3.2	Wings	5
3.2.1	Right Wing	6
3.2.2	Right Wing High Lift and Control Surfaces	6
3.2.3	Left Wing	6
3.2.4	Left Wing and High Lift Surfaces.....	7
3.3	Engine Pylons and Engines.....	7
3.4	Vertical Stabilizer and Rudder	8
3.5	Horizontal Stabilizers and Elevators	8
3.6	Doors	8
3.6.1	Passenger Entry (PED) 1L	8
3.6.2	Service Entry Door (SED) 1R.....	8
3.6.3	Passenger Entry Door (PED) 2L	8
3.6.4	Lower Forward Cargo Door (LFCD)	8
3.6.5	Lower Center Cargo Door (LCCD).....	8
3.6.6	Lower Aft Cargo Door (LACD).....	8
3.7	Landing Gear	9
3.7.1	Nose Gear and Support Structure	9
3.7.2	Main Gears and Support Structure	9
3.7.3	Forward Electrical and Equipment (E&E) Compartment	9

Figures

Figure 1 – Overhead view of airplane.....	11
Figure 2 - View of impact area and perimeter fence	12
Figure 3 – Right side viewed looking aft.....	13
Figure 4 – Right hand side viewed looking forward.....	14
Figure 5 – Right hand side center fuselage.....	15
Figure 6 – Right hand side nose.....	16
Figure 7 – Right nose damage close up	17
Figure 8 – Left hand side viewed looking aft	18
Figure 9 – Left side view of the nose.....	19
Figure 10 – Left side view	20
Figure 11 – Lower fuselage damage.....	21
Figure 12 – Lower fuselage damage.....	22
Figure 13 – Right wing leading edge.....	23
Figure 14 – Right wing trailing edge	24
Figure 15 - Right wing flap track ground scars	25
Figure 16 - Left wing viewed looking aft	26
Figure 17 - Left wing viewed looking forward.....	27
Figure 18 - Right side view of the tail	28
Figure 19 - Left side view of the tail.....	29
Figure 20 – Main entry door (L1)	30
Figure 21 – Aft cargo door.....	31
Figure 22 – Nose wheel well damage	32
Figure 23 – Left hand main gear damage	34
Figure 24 – Right hand main gear damage	35
Figure 25 – Main gear marks at impact area.....	36

A. Structures Group

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B. Summary (reference Figures 1 and 2)

On March 8, 2017, about 1452 EST, Ameristar Air Cargo, Inc. dba Ameristar Charters flight 9363, a Boeing MD-83, N786TW, ran off the end of runway 23L after executing a rejected takeoff at Willow Run Airport (YIP), Ypsilanti, Michigan. (The MD-83 was manufactured by McDonnell Douglas, which merged with Boeing in August 1997.) All 110 passengers and 6 crewmembers evacuated the airplane. One passenger was reported to have received a minor injury. The airplane sustained substantial damage (no post-crash fire occurred). The airplane was operating under the provisions of 14 Code of Federal Regulations (CFR) Part 121 as an on-demand charter flight and was destined for Washington Dulles International Airport (IAD), Dulles, Virginia. Daytime visual meteorological conditions prevailed at the time of the accident.

C. Details of the Investigation

1.0 Airplane Description

Registration Number:	N786TW
Airplane Serial Number:	53123
Airplane Manufacturer:	McDonnell Douglas
Model:	DC-9-83 (MD83)
Engine Manufacturer:	P & W
Model:	JT8D-219
Airplane Year:	1992
Airworthiness Certificate:	Standard
Approved Operations:	121
Aircraft Type:	Fixed Wing Multi-Engine
Engine Type:	Turbo Fan
Airplane Category:	Transport
Number of Engines:	2
Max. T/O Weight:	160,000 pounds
Total Time:	41,008.6 hours
Total Cycles:	39,472
Type Certificate	A6WE Revision 30

2.0 Fire Damage

There was no fire damage to the airplane.

3.0 Structure

3.1 Fuselage

The fuselage shell is a semi-monocoque structure with skin, longitudinal longerons and circumferential frames and bulkheads. The fuselage is a complete torque box throughout its length. Cutouts for doors, windows, escape hatches, and other fuselage openings are reinforced by a local framework of frames, sills, and doublers.

The fuselage has a passenger entry door at the forward left hand side of the fuselage (L1), a galley service door on the forward right side of the forward fuselage (R1), a passenger door (L2) at the aft LH side of the fuselage and one air stair exit at the aft section of the cabin. There are also three lower lobe cargo doors on the right side of the fuselage. The entry doors are inward then outward opening plug type doors. All three of the lower lobe cargo doors (LCD) are inward opening, upper hinged type cargo doors. The forward and center cargo doors are located forward of the wings, the aft cargo door is located aft of the wings.

3.1.1 Fuselage Skin Panels (reference figures 3 thru 12)

The fuselage exterior lower skin panel assemblies including longeron and frames exhibited severe buckling, deformations, missing sections, and severed internal structure at numerous locations from fuselage station (STA) 37 to fuselage STA 229, from longeron 18 left hand (LH) to longeron 18 right hand (RH) to just below the RH side cusp. The damage was consistent with the nose gear collapsing aft and the fuselage impact with the ground. The LH and RH nose skin strakes were damaged and or severed at their leading edges. The LH angle of attack (AOA) vane also separated from the airplane. The RH AOA vane was intact.

The fuselage lower skin panel assemblies from longeron 26 LH to longeron 26 RH, extending from STA 229 to approximately STA 1429 were abraded and the deformation was consistent with impact damage. Numerous sections of the skin lower lobe skin panels were worn through exposing the longerons and substructure.

A large skin puncture and upward deformation due to impact with ground severed the longerons at STA 229 extending from longeron 26 LH to longeron 26 RH.

3.2 Wings

The outboard wing is comprised of the leading edge structure, the in-spar wing box, and the trailing edge structure. The wing box structure consists of the upper and lower skin panels and the front and rear spars with ribs located perpendicular to the rear spar. Major fittings that interface with the outboard wing box include the flap support structure and the main landing

gear support structure.

The main landing gear (MLG) of the MD-83 is supported by the MLG trunnion fitting which is attached to the upper wing skin. The MLG attaches to the MLG trunnion fitting by two clevis fittings and a vertical drag brace and over-centering links.

3.2.1 Right Wing (reference Figures 13 thru 15)

The right wing was fully attached to the wing center section. There was no evidence of major structural damage observed at the side of body joint.

The lower wing surface wing-to-body fairings were distorted, substantially damaged, and separated from the fuselage due to impact with the ground. Several areas along the wing-to-body lower fairings were had damage to the internal substructure.

The wing skin upper and lower surfaces did not exhibit any obvious visual damage from the incident or impact. There were no observed penetrations to the wing skins or wing fuel tank, and there were no fuel leaks.

3.2.2 Right Wing High Lift and Control Surfaces

All of the aerodynamic control and high lift surfaces were remained attached to the wing. The inboard section of the flap was damaged by impact with the MLG wheel and tire assembly after it rotated aft during the accident sequence. The MLG separated at the strut, and rotated aft due to contact with either dirt berms located forward and aft of the access road during the rejected take-off (RTO). The aft rotation of the MLG penetrated both the inboard section of the flap surface and the aft wing-to-fuselage fillet fairing.

The leading edge (LE) apex of the slats exhibited impact damage along the span of the wing, the impact (dented) areas run along the entire length of the wing slat apex approximately ten (10) feet apart matching the spacing of the fence posts.

The two inboard wing flap lower hinge-fitting pivot points contacted the dirt berm as evidenced from the ground witness marks along the berm just aft of the hinge lines. The flap hinge lower fairings were damaged and crushed from impact with the ground.

Neither of the spoiler panels nor the aileron exhibited any visual signs of damage from the impact.

All of the examined fracture surfaces exhibited features consistent with overstress with no evidence of fatigue.

3.2.3 Left Wing (reference Figures 16 and 17)

The left wing box remained attached to the wing center section. The left wing was found fully attached to the wing center section. No evidence of major damage was observed to

the side of body joint.

The lower wing surface and wing-to-body fairings were distorted, substantially damaged, and separated from the fuselage due to ground impact. Several areas along the wing-to-body lower fairings had damage to the internal substructure.

The wing skin upper and lower surfaces did not exhibit any obvious damage from the incident or ground impact. There was no penetration to the wing skins or wing fuel tank and there were no fuel leaks.

An internal visual examination of the left wing center section under the cabin floors revealed no signs of significant structural damage. This area of the cabin floor was opened to access the LH center fuel cavity for defueling and sumping of fuel prior to lifting of the aircraft.

3.2.4 Left Wing High Lift and Control Surfaces

All of the aerodynamic control and high lift surfaces remained attached to the wing. The inboard section of the flap was damaged by impact with the MLG wheel and tire assembly after it rotated aft during the accident sequence. The MLG separated at the strut, and rotated aft due to contact with either dirt berms located forward and aft of the access road during the rejected take-off (RTO). The aft rotation of the MLG penetrated both the inboard section of the flap surface and the aft wing-to-fuselage fillet fairing. The aft rotation of the MLG does not appear to have affected the wing-to-fuselage fillet fairing, as was the case on the RH side.

The leading edge (LE) apex of the slats exhibited impact damage along the span of the wing, the impact (dented) areas run along the entire length of the wing slat apex approximately ten (10) feet apart matching the spacing of the fence posts.

Neither of the spoiler panels nor the aileron exhibited any obvious signs of damage from the accident sequence.

The wing flap lower hinge-fitting pivot points exhibited no evidence of impact with the ground as was the case for the RH wing.

All of the examined fracture surfaces exhibited features consistent with overstress with no evidence of fatigue.

3.3 Engine Pylons and Engines

Both the left and right hand pylons and engines were intact and exhibited no evidence structural damage when viewed from the ground.

3.4 Vertical Stabilizer and Rudder (reference Figures 18 and 19)

Both the vertical stabilizer and rudder exhibited no evidence of structural damage when viewed from the ground.

3.5 Horizontal Stabilizers and Elevators (reference Figures 18 and 19)

Both the right and left hand stabilizers and elevators exhibited no signs of structural damage when viewed from the ground.

3.6 Doors

3.6.1 Passenger Entry Door (PED) 1L (Reference Figure 20)

The PED 1L remained attached to the airplane. The door when returned to the closed and locked position exhibited evidence of excessive fuselage distortion between door skin and fuselage skin. Measurements at the doorstop locations along the forward and aft edges of the doorjamb verified the fuselage distortion. The largest inward door mismatch between the door and fuselage measured $\frac{3}{4}$ of an inch at the upper aft stop location, and $\frac{1}{2}$ of an inch at the upper forward stop location.

3.6.2 Service Entry Door (SED) 1R

SED 1R remained attached to the airplane and exhibited no evidence of structural damage.

3.6.3 Passenger Entry Door (PED) 2L

PED 2L remained attached to the airplane and exhibited no evidence of structural damage.

3.6.4 Lower Forward Cargo Door (LFCD)

The LFCD remained attached to the airplane and exhibited no evidence of structural damage.

3.6.5 Lower Center Cargo Door (LCCD)

The LCCD remained attached to the airplane and exhibited no evidence of structural damage.

3.6.6 Lower Aft Cargo Door (LACD) (reference Figure 21)

The LACD remained attached to the fuselage at the upper hinge and exhibited substantial damage along the doorjamb forward and aft edges consistent with ground impact. The door was jammed in an ajar position. Access to the cargo compartment required the use of hydraulic scissor jaws to pry open the cargo door.

3.7 Landing Gear

The MD83 has three landing gears consisting of a forward nose gear and two main gears.

The MD-83 main landing gear is a two-wheeled gear, supported by a trunnion (located at the top of the gear post), a drag brace and a side brace. The side brace is connected to the trapezoidal fitting near the side-of-body in the wheel well. The MD83 nose gear is a two-wheeled, single chambered shock strut gear.

3.7.1 Nose Gear and Support Structure (reference Figure 22)

The nose landing gear (NLG) fractured during the impact sequence and rotated aft into the STA 110 bulkhead (BHD) and the forward electrical and equipment (E&E) compartment. The nose wheel well (NWW) LH and RH NLG trunnion support fittings and tunnel areas were fractured and bent during the impact sequence. The NLG WW upper pressure panel was creased and buckled due to impact forces. Components of the NLG, including the nose steering actuators and retract actuator trunnion attach fittings were severed and sheared due to impact forces.

The STA 110 BHD was deflected aft into the forward avionics bay from contact with the NLG. The upper horizontal pressure panel in the nose landing gear wheel well area sustained structural damage from the impact forces.

All of the examined fracture surfaces exhibited features consistent with overstress with no evidence of fatigue.

3.7.2 Main Gears and Support Structure (reference Figures 23 and 24)

Both of the main landing gear (MLG) rotated aft during the impact sequence contacting and penetrating the inboard flap surface. The lower wing area below, adjacent, and surrounding the MLG exhibited evidence of fluid splash from the gear strut breakage. The MLG strut sheared at the outer strut cylinder and separated in two pieces.

All of the examined fracture surfaces exhibited features consistent with overstress with no evidence of fatigue.

3.7.3 Forward Electrical and Equipment (E&E) Compartment

The STA 110 electrical panel was destroyed by NLG. The STA 218 electrical panel was also damaged due to impact forces. The NLG was trapped and lodged in the E&E compartment.

All of the examined fracture surfaces exhibited features consistent with overstress with no evidence of fatigue

Submitted by,

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Figures



Figure 1 – Overhead view of airplane



Figure 2 - View of impact area and perimeter fence



Figure 3 – Right side viewed looking aft



Figure 4 – Right hand side viewed looking forward



Figure 5 – Right hand side center fuselage



Figure 6 – Right hand side nose



Figure 7 – Right nose damage close up



Figure 8 – Left hand side viewed looking aft



Figure 9 – Left side view of the nose



Figure 10 – Left side view



Figure 11 – Lower fuselage damage



Figure 12 – Lower fuselage damage



Figure 13 – Right wing leading edge



Figure 14 – Right wing trailing edge



RH WING LKG FWD FLAP HINGE MARKS INTO BERM

Figure 15 - Right wing flap track ground scars



Figure 16 - Left wing viewed looking aft



Figure 17 - Left wing viewed looking forward



Figure 18 - Right side view of the tail



Figure 19 - Left side view of the tail



Figure 20 – Main entry door (L1)



Figure 21 – Aft cargo door



Figure 22 – Nose wheel well damage



Figure 23 – Left hand main gear damage



Figure 24 – Right hand main gear damage



Figure 25 – Main gear marks at impact area