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STRUCTURES/SYSTEMS GROUP CHAIRMAN'S FACTUAL REPORT

(24 PAGES)

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

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STRUCTURES/SYSTEMS GROUP CHAIRMAN'S FACTUAL REPORT

DCA-96-MA-068

A. ACCIDENT

Location:	Pensacola Regional Airport, Pensacola, Florida
Date:	July 6, 1996
Time:	1424 Central Daylight Time
Aircraft:	Delta Air Lines flight 1288, McDonnell Douglas MD-88, N927DA

B. STRUCTURES GROUP

Frank Hilldrup Chairman	National Transportation Safety Board Washington, DC
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C. SUMMARY

On July 6, 1996, at 1424 central daylight time, a McDonnell Douglas MD-88, operating as Delta Air Lines flight 1288, experienced an uncontained failure of the left engine during the beginning of its takeoff on runway 17 at Pensacola Regional Airport in Pensacola, Florida. Two passengers were fatally injured. One passenger sustained serious injuries and two passengers received minor injuries.

The Structures/Systems Group documented airplane debris locations, engine fragmentation damage to the airplane, and cockpit settings. Many punctures/holes were documented in the fuselage area adjacent to the engine fan location. Engine debris was found on both sides of the runway 17 centerline. After documentation of debris on the runway, cockpit settings, and some of the airplane external damage, the airplane was moved from the runway on July 7 to an area outside a hangar on the airport. The group also documented damage to wiring that may have been associated with the airplane's loss of electrical power. The investigation discovered that the right generator's differential protection loop wires, which compare incoming and outgoing current, were severed.

D. DETAILS OF THE INVESTIGATION

Several gouges were documented on the runway left of the centerline. As viewed from the runway 17 centerline, the gouges were oriented along a magnetic heading of approximately 110°. The first gouge was located 384 feet from the threshold and 13 feet left of the centerline. Four ground-impact marks (divots) were noted between the runway gouges and the larger (2/3) hub section, which was located approximately 725 feet from the runway threshold and 715 feet left of the centerline. As viewed from the runway gouges, the locations of the divots and the larger hub section arced slightly to the left. Figure 1 shows the locations of the divots relative to the runway gouges and the hub section. The smaller (1/3) hub section was located approximately 2,400 feet right of runway centerline and approximately 900 feet from the threshold. Various engine debris was found on both sides of the runway.

The airplane came to a stop on runway 17 approximately 1,350 feet from the threshold (as measured to the main landing gear), with the left tire of the right main landing gear just to the right of the runway centerline stripe. An oil streak was observed left of the runway centerline and was characterized by two oil spots followed by a continuous area of oil. The continous oil residue began at a location 410 feet from the threshold and 16 feet left of runway centerline and ended at a location beside the airplane's left engine. As the trail of oil progressed down the runway, it deviated to the left (East) and then veered back toward the centerline.

Locations of airplane/engine debris are provided in figure 2. Locations of the gouges in the runway surface are provided in figure 3.

1. Fuselage

a. Left Side

The primary area of damage to the left fuselage skin consisted of several large holes/tears between fuselage stations (FS) 1250 to FS 1282' and from the top of the window belt to longeron (L) -2. (Identification of fuselage stations and longerons is contained in figure 4). Also documented was a 5"x2" skin puncture near FS 1295 between L-8 and L-9, a 114" puncture near FS 1310 just above L-17, and a 118" puncture near FS 1315 between L-16 and L-17. A total of 16 holes, punctures, or tears were documented on the left fuselage skin.

The upper section of the window belt was severed between FS 1250 and 1271. The fuselage frame at FS 1250 was buckled at L-7 and between L-8 and L-9 and was cracked at L-11. The frame at FS 1271 was severed from the top of the window belt to L-4.

The following damage to the longerons was documented:

L-13 & L-12:	bent from FS 1271 to 1290
L-11, L-10, & L-9:	severed and bent from FS 1250 to 1290
L-8 & L-7:	severed and bent from FS 1250 to 1280
L-6:	severed and bent from FS 1260 to 1271
L-5 & L-4:	severed and bent from FS 1250 to 1271
L-3:	torn at FS 1260

The left fuselage adjacent to the engine was sooted between FS 1231 to 1322. The leading edge of the engine fan blades is adjacent to FS 1275.

a. Right Side

Damage to the right fuselage skin consisted of seven exit holeslpuncturesltears between FS 1228 to 1271, longeron 1 to longeron 11. The following damage to the right fuselage skin and associated structure was documented:

skin puncture (8"x4") @ L-11 just forward of FS 1250
- L-11 & intercostal severed at FS 1250; upper section of window belt damaged
skin puncture (6"x4 1/2" hole within 12"x8"tear) between L-6 & L-8, just aft of FS 1271
- near FS 1271: L-8 dented, L-7 severed, and L-6 bent
skin punctures (3"x1 1/2" and 1"x 1/2") between L-6 & L-5 near FS 1271
- L-5 severed
skin puncture (6 1/2"x5" hole within 9"x9" tear) near FS 1250 and L-5
- L-5 severed
skin puncture (10 1/2"x2" hole within 12"x5" tear) near FS 1231 and L-11

[1]This damaged area is adjacent to row 37.

- frame severed
skin puncture *(6* 1/2"x5" hole within **8** 1/2" diam. tear) near FS 1228 and L-12 fuselage frame at FS 1271 was torn and severed from L-9 to **L-4**

The largest of the right fuselage exit holes was smaller than the 113 disk piece found approximately **2400** feet right of the runway. Most of the wires in the wire bundle located along **L-4** (right) were severed at **a** location near **FS** 1250 *(see* section D.5).

There was no evidence of penetrations below the floor level on either fuselage side. The lowest location of penetration damage on either side of the fuselage consisted of two small punctures located just below the the window belt near **FS** 1310 and 1315. Attachment 1 contains a detailed list of the fragmentation damage to the fuselage, including the size and locations of the damaged areas. Documentation of damage to the interior of the airplane is included in the Survival Factors Group Chairman's factual report.

2. Wing/Flight Control Impact Damage

There was a puncture to the upper surface of the left wingtip. No damage to the lower surface of the left wingtip was observed. No other damage was noted to the right or left wing structure. However, there was a 2-inch puncture in the left aileron lower surface approximately **4** inches forward of the center of the inboard tab. The left, aft fuselage-to-wing fairing contained two gouges approximately 2" in length.

3. Control Surface Positions

Except as noted, the following observations of the flight control surfaces were made before the airplane was moved from runway 17.

Flaps: 11 degrees
Slats: mid position
Rudder: 2" right
Rudder trim tab: faired
Rt. aileron: up
Left aileron: down
Aileron tabs: faired
Spoilers: down
Horizontal stab position: leading edge down (cockpit trim indicator showed 5.5 degrees airplane nose up)
Elevators: trailing edge **up**
Elevator tabs: (tab position is relative to elevator position)

- control tab (inboard): **up**
- geared tab (center): down
- antifloat tab (outboard): faired

4. Cockpit Documentation

The positions of cockpit indications were documented on the day after the accident and are contained in Attachment **2.** The documented positions represent the condition of the cockpit after the flightcrew exited the airplane. All but three of the red- and white-collared circuit breakers[2] were open (see Attachment **2).** In addition to these circuit breakers, five circuit breakers were observed in the "open" (popped) position: those for the aft drain mast heater, the three for the aft right lavatory flush motor, and the top circuit breaker (phase A) for the aft left lavatory flush motor.

5. Electrical/Wiring

The electrical power feeder cables for the #2 (RH) generator system were visually inspected in the vicinity of the engine and aft cargo compartment area. All three wires were intact and undamaged.

Most of the wires in the wire bundle located along right longeron **4** were severed. Of the **154** wires in the bundle, **146** had been severed. Four of the severed wires were the right generator channel differential protection loop wires. The differential protection current transformers and associated wiring are used to detect a line-to-line or line-to-neutral fault by sensing and comparing the current flow between the generator neutral side and the load side of the generator bus circuit breakers. When a differential (fault) current of **20** to 40 amps is exceeded, the Generator Control Unit differential protection circuit de-excites the generator by opening the Generator Control Relay and trips the Generator Relay to remove power from the Generator Bus. In addition, the differential protection circuit will trip and lock out the AC Crosstie Relay to prevent a "good" generating system from being connected to a faulted distribution system.

Air traffic controllers attempted to contact the accident airplane following the engine event on the runway. Flight attendants also attempted to contact the cockpit using the interphones at the forward and aft stations immediately after the event. Communication with the cockpit was not possible until the emergency power switch was placed in the "on" position.

On July **10,** the Survival Factors Group Chairman conducted a test to verify operation of the passenger address and interphone systems using emergency power. Proper function of both systems was demonstrated.

6. Miscellaneous

- Both wingtip landing lights were down.
- The cabin pressure outflow valve was in the full-open position.

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[2] **Delta stated that red-collared circuit breakers are pulled when the airplane will be at the gate for more than 30 minutes and white-collared circuit breakers are pulled when the airplane is parked overnight.**

- The trailing edge of the left inboard flap contained a damaged area approximately 8"

- Thrust reversers were stowed.
- Each landing gear assembly was in the down and locked position and all tires were inflated; no damage was noted to the landing gear, tires, or landing gear doors.
- No puncture damage was observed on the vertical stabilizer, horizontal stabilizer, rudder, elevators, or tabs.

[redacted]
Frank Hilldrup
Structures/Systems Group Chairman

5/25/96

'Pictures indicate that this was in the same area where a ladder was placed to facilitate egress from, and access to, the airplane.

Attachment 1 -- Fuselage Damage from Engine Debris

Sixteen locations of fragmentation damage were identified on the left side of the fuselage[4] and seven on the right side of the fuselage. The following (X, Y, Z) locations of the damage were measured relative to the left engine pylon leading edge (the datum). As viewed from a position outboard of the datum, the X coordinate is the direction left(+)/right(-) from the datum; the Y coordinate is the direction fore(+)/aft(-) from the datum; and the Z coordinate is the direction up(+)/down(-) from the datum. The engine fan face is located approximately 3 1/2 inches forward of the pylon leading edge.

DAMAGE		SIZE (in.)		LOCATION		
No.	Description	Length	Width	X (in.)	Y (in.)	Z (in.)
1L	Tear	6	0.1	5 3/4	43	18
2L	Puncture	3/4	5/8	-4 1/2	44 1/2	19 5/8
3L	Puncture	1/2	3/8	3 3/8	46 1/2	22 1/4
4L	Tear	1 1/2	0.1	2 1/4	46 1/2	20 1/2
5L	Hole	2 1/2	2	1 3/4	48 1/2	28
6L	Hole	14 1/2	5	5 1/4	55	35
7L	Hole	6	3 3/4	5 3/4	51	31
8L	Hole	15	3	5 3/4	53	33
9L	Hole	32 1/2	9 1/4	11 1/2	66	45
10L	Hole	39	13 1/2	16 3/4	46 1/2	13 1/4
11L	Penetration	1 1/4	1/4	31 1/4	45	26 1/2
12L	Hole	1	1	30 1/4	45 1/2	28 1/2
13L	Hole	2	3/8	32 1/4	53	36 1/2
14L	Hole	5	2	-15	58	41
1R	Hole	6 1/2	5	25 3/4	*	49
2R	Penetration	3	1 1/2	8 3/4	*	54
3R	Penetration	1	1/2	6 3/4	*	47
4R	Hole	6	4 1/2	3 3/4	*	40
5R	Penetration	8	4	32 1/4	*	16
6R	Tear	10 1/2	2	47 1/4	*	24
7R	Hole	6 1/2	5	54 1/4		20

* (not obtained)

A portion of the hub conical section was found in fuselage hole "4R". The fragment was approximately 10 inches long by 11 inches wide at its widest point. A fan blade fragment was found in fuselage penetration "5R". The fragment included the fan blade root and partial span (approximately 1/3 to 1/2) and full chord span.

[4] Specific locations for two small penetrations--a 1/4" puncture near FS 1310 just above L-17 and a 1/8" puncture near FS 1315 between L-16 and L-17--were not obtained and are not included in the table.

Attachment 2---Cockpit Documentation

A. Aft Overhead

APU Ground Service Bus switch - Off
External Power Ground Service Bus switch - Off
Maintenance Intercom switch - Off
Oxygen Line Pressure - Green Band
Flight Recorder switch - Normal

Observer's Interphone Panel

No switches selected
Mic Selector - Mask

Fire Protection Panel

All Loop switches (Left, Right, and APU) set to Both

B. Overhead Circuit Breaker Panel

Row A - AI, 3, 4, 5, 7 open. All others in.
Row B - B5, 7, 8, 15 open. All others in.
Row C - C1, 4, 8, 12, 15 open. All others in.
All white or red collared CBs were open. All others in.

C. Overhead Panel

Captain's Side

Compass switch - Centered Vertical

Electrical Panel

Left/Right CSD switches - Normal, safety wires intact
Left/Right Generator switches - On
APU Generator switch - Normal
Electrical Meter switch - Batt Volts
Galley Power - Off
Left/Right APU Bus switches - Off
Left/Right Ext Power switches - Off
AC X tie - Auto
DC X tie - Open

APU Panel

APU Fire Agent Discharge switch - Off
APU Air switch - Off
APU Fire Control switch - Normal
APU Master switch - Off
APU Doors switch - Auto (Cover closed)

Emergency Power switch - Off
Battery switch - Off

Fuel Panel

DC Start Pump - Off
Ignition - Off
LeftlRight Fuel Heat switches - Off
Left/Right Engine Start switches - Off/Covers closed
Left/Center/Right Aft Boost Pump switches - Off
Left/Center/Right Fwd Boost Pump switches - Off
Emergency Lights switch - Off
No Smoking Light switch - On
Seat Belt Light switch - On
Pitot Heat switch - Off

Ice Protection Panel

Airfoil Anti-Ice switch - Off
Windshield Anti-Fog & Anti-Ice switches - Off
LeftlRight Engine Anti-Ice - Off
Overhead Annunciator Panel - Unpowered/Blank

First Officer's Side

Compass switch - Centered/Vertical
Engine Sync - Off
Ground Prox Warning - Norm/Guard Closed
Windshear Test switch -Norm
CADC/FLT Director/EFIS switches - Norm
Overhead Panel Lights - Off
Overhead Flood Lights - Off
Circuit Breaker Lights - Off
Standby Compass Lights - Off
Thunderstorm Lights - Off
Cockpit Flood Lights - Off
Anti-Skid switch - Arm; Test CKT Switch - Off
Stall Test switch - Off
Max Speed Warning Test switch - Off
Yaw Damper switch - On
Mach Trim switch - Norm

Air Conditioning Panel

Cockpit Temp switch - Auto Range @ Full Cold
LeftlRight Air Conditioning Supply switches - Off
Cabin Temp switch - Auto Range @ Almost Full Cold (8:30 Pos)
Temp Select switch - Cabin Supply

Radio Rack switch - Fan

Pressurization Panel

System Selector switch - Auto 1
Landing Altitude - 1020 Feet
Landing Baro - 30.02
Rate Limit Selector - On the "Mark" (12 o'clock)
Air Conditioning Shutoff - Auto
Ram Air switch - Off
Rain Repellent switch - Normal
Wiper switch - Off

D. Glareshield and Flight Guidance Control Panel

Wing Landing Lights - Retracted
Flood Lights - Off
Nose Lights - Off

Flight Guidance Control Panel

Captain's Flight Director switch - On
Autothrottle switch - Off
Bank Angle Limiter - 15 degrees
Autopilot switch - Off
DFGC 1-2 switch - 2
First Officer's Flight Director switch - On
Wing/Nacelle Lights switch - Off
Anti-Collision Lights - Off
Pos/Strobe Lights Switch - Pos

E. Fwd Instrument Panel

Captain's Instrument Panel

Panel Lights switch - Off
Digital fights switch - 3 O'clock Position
Flood Lights switches - Both Off
Static Air Source Selector - Norm
Floor Lights - Off
Clock - Unpowered
Airspeed Indicator - Off Flags
- Airspeed Bugs: 128/144/190/237; Orange Bug @ 240
RDMI - Off Flags; ADFNOR switch - VOR
PFD - Unpowered; PFD Brightness - Full Bright (8 O'clock)
ND - Unpowered; ND Brightness - Almost Full Bright (7:30 Position)
ND Contrast/WX Radar - Full Bright (8 O'clock)
TA/VSI - Unpowered
Altimeter - **29.97;** Off Flags; Orange Bug @ 120'

Speedbook - Norm Position in Holder, 130,000-lb Page Selected
Standby Attitude Indicator-Tumbled/Unpowered
Pitch Trim Knob - Half of One Tick Above Neutral
Standby Altimeter - 29.97
FMA - Unpowered

Center Instrument Panel

Brake Pressure - Left = 3100 psi; Right = 3000 psi
Left Fire Handle - Pulled; Vertical Position
Right Fire Handle - In; Normal Position
Automatic Reserve Thrust switch - Auto/Cover Closed
Engine Instruments - Unpowered
Fuel Quantity - Unpowered
Landing Gear Handle Release Button - Out
Landing Gear Handle - Down

First Officers Instrument Panel

FMA - Unpowered
TAS/SAT - Off Flags
Left/Right Engine Hydraulic Pump switches - On
Transfer Pump - Off
Aux. Hydraulic Pump - Off
Airspeed Indicator - Off Flags, Bugs - 124/147/188/236, Orange Bug - 247
RDMI - Off Flags, VOR Selected
Brake Temp Selector - All
PFD - Unpowered
PFD Brightness - Nearly Full Bright (7:30 position)
ND - Unpowered
ND Brightness - Almost Full Bright (7:00 position)
ND Contrast/WX Radar - *6* O'clock, Full Bright @ 8 O'clock
Altimeter - Off Flags, 29.97
TA/VSI - Unpowered
Clock - Unpowered
Floor Lights - Off
Static Air Source Selector - Norm
Instrument Panel Lights - Off
Digital Lights switch - 2 O'clock
Flood Lights - Both Off

First Officer's Audio Control Panel

Microphone Selectors - PA
Receiver Selections - VHF-1 (11:00), PA (7:00), AMP 1, BOOM, BOTH
Hand Mic - Stowed in Clip

Captain's Audio Control Panel

Microphone Selectors - VHF-1
Receiver Selectors - VHF -1 (8:30), VHF-2 (7:00), PA (8:30), Cab/Ser Int (7:00), I/C (1200), AMP-2, BOOM, BOTH
Hand Mic-Stowed in Clip

F. Pedestal

Left/Right MCDU - Unpowered

Radar

Brightness - 2 O'clock (Full Bright @ 4:30 Position)
Range - 40 Miles
Gain - Auto
Radar Mode Selector - Off
Antenna Tilt - 2 degrees up

Takeoff Condition Computer

CG - 16.2
Flaps -11 degrees
Long. Trim - ***5.5***
Trim Indicator - ***5.5***
Speedbrake Handle - Full Forward, Not Armed
Rudder Hydraulic Control Lever - Power
LeftlRight Throttles - Idle
LeftlRight Thrust Reverser Handles - Full Forward & Down
Fuel Crossfeed - Off
Cabin Altitude Control Lever (Pressurization) - Auto
Outflow Valve Position Indicator - Points at "Valve"
Flap Handle -11 degrees
Flap Take-Off Selector - 23 degrees
Left/Right Fuel switches - Off
NLG Indicator - Up
Comm One - Right Head
Comm Two - Right Head
ADF Control Panel - Right Head, Norm, ADF
Transponder - Standby; ATC and ALT - Both on One
Center Inst. Panel Lights - Off (Both)
Digital Lights switch - 1 O'clock
Flood Lights - Off
ACARS - Unpowered
Clip - Empty
Stabilizer Trim Stop switch - Norm, Cover Closed
LeftlRight Pneumatic Crossfeeds - Closed

Rudder Trim - Zero
Aileron Trim - Zero
Auto Brake switch - Off/Disarm
Cabin Interphone Handset - Hung-up

G. Main Circuit Breaker Panel

Power Ctr Work Light switch - Off
Row A - All In
Row B - B1, 3, 4, 5 out; All others in; All pulled have White Collars
Row C - C1, 2, 10 & 11 out (All White-Collared); All others in
Row D - D1, 8, 9,10,11, 13, 20 out (All White or Red-Collared); All others in
Row E - E8, 9, 12, 16 out (All White-Collared), All others in
Row F - F2, 3, 5, 6, 12, 13, 15, 16, 17 out (All White-Collared), All others in
Row G - G5,16 out (Both White-Collared), All others in
Row H - H2 out (White-Collared), All others in
Row J - J2 & 16 out (White- or Red-Collared), All others in
Row K - K9, 15, 16, 17, 18, 19, 27 out (All White-Collared), All others in
Row L - L25 & 27 out (Both White-Collared); All others in; Integral Lights First Officer's Inst. Panel CB has White Collar but not pulled;
Row M - M28 & 32 out (Both White-Collared), **All** others in
Row N - N28, 32, 33, 34 out (All White-Collared), All others in
Row P - P31 & 33 out (Both White- or Red-Collared), All others in
Row R - All in
Row S - S40 out (White-Collared), All others in
Row U - All in
Row W - All in
Row X - X21 thru 26, 30, 31, 35, 37 out (All White-Collared), All others in
Row Z - 221 thru 25, 27, 29, 30 out (All But 227 have White Collars); 227 does not have a white collar (Aft Drain Mast HTR); All others in; 222 (Right AOA Vane Heater) and 226 (Cockpit Window Anti-Fog, Clearview and Eyebrow) have White Collars but are not pulled
Crash Ax - in clip behind Captain's seat
Left/Right Generator Bus Circuit Breaker Panels - All in
Left Console C/B Panel - All in except all three breakers for the Right Aft Flush Motor and the Top C/B for the Left Aft Flush Motor
AC X-Tie switch - Cover Closed

H. Other

Captain's Hand Mic - Stowed in Clip
First Officer's Hand Mic - Stowed in Clip
Captain's & First Officer's Boom Mics/Earpieces - Not Present
Captain's & First Officer's Flight Kits - Not Present
Normal Procedures Checklist - Located Outboard of First Officer Audio Panel, dated 6/19/96, Folded Normally

Emergency Procedures Checklist - Located Outboard of First Officer Audio Panel, folded with Emergency Evacuation Procedures on outside
Captain's & First Officer's Seats - Full Aft
Captain's, First Officer's, & Observer's Oxygen Masks - Normal
Crew Oxygen Bottle - 1600 psi
Manuals Present - Flight Logbook, Aircraft Restriction Manual, Operational Data Manual, Mechanical Dispatch Manual, Engine Logs

ABBREVIATION LIST

ADF - Automatic Direction Finding
APU - Auxiliary Power Unit
CADC - Central Air Data Computer
CKT - Circuit
CSD - Constant-Speed Drive
DFGC - Digital Flight Guidance Computer
EFIS - Electronic Flight Instrument System
FMA - Flight Mode Annunciator
MCDU - Multi-Purpose Control and Display Unit
ND - Navigation Display
PA - Passenger Address
PFD - Primary Flight Display
RDMI - Radio Distance Magnetic Indicator
SAT - Static Air Temperature
TAS - True Airspeed
TAT - Total Air Temperature
TA/VSI - Traffic Advisory/Vertical Speed Indicator

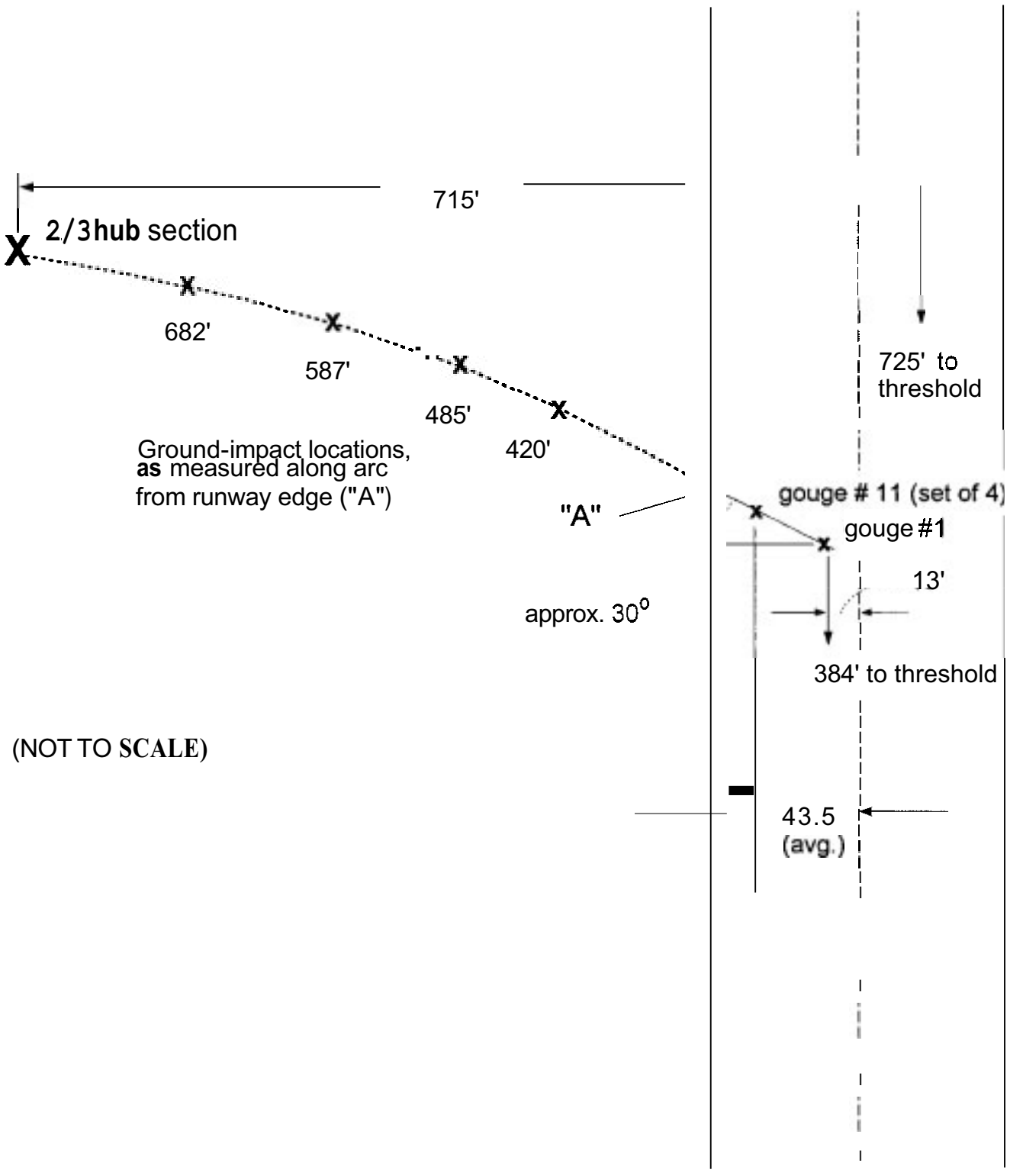


Figure 1. **2/3** Hub Ground-Impact Locations

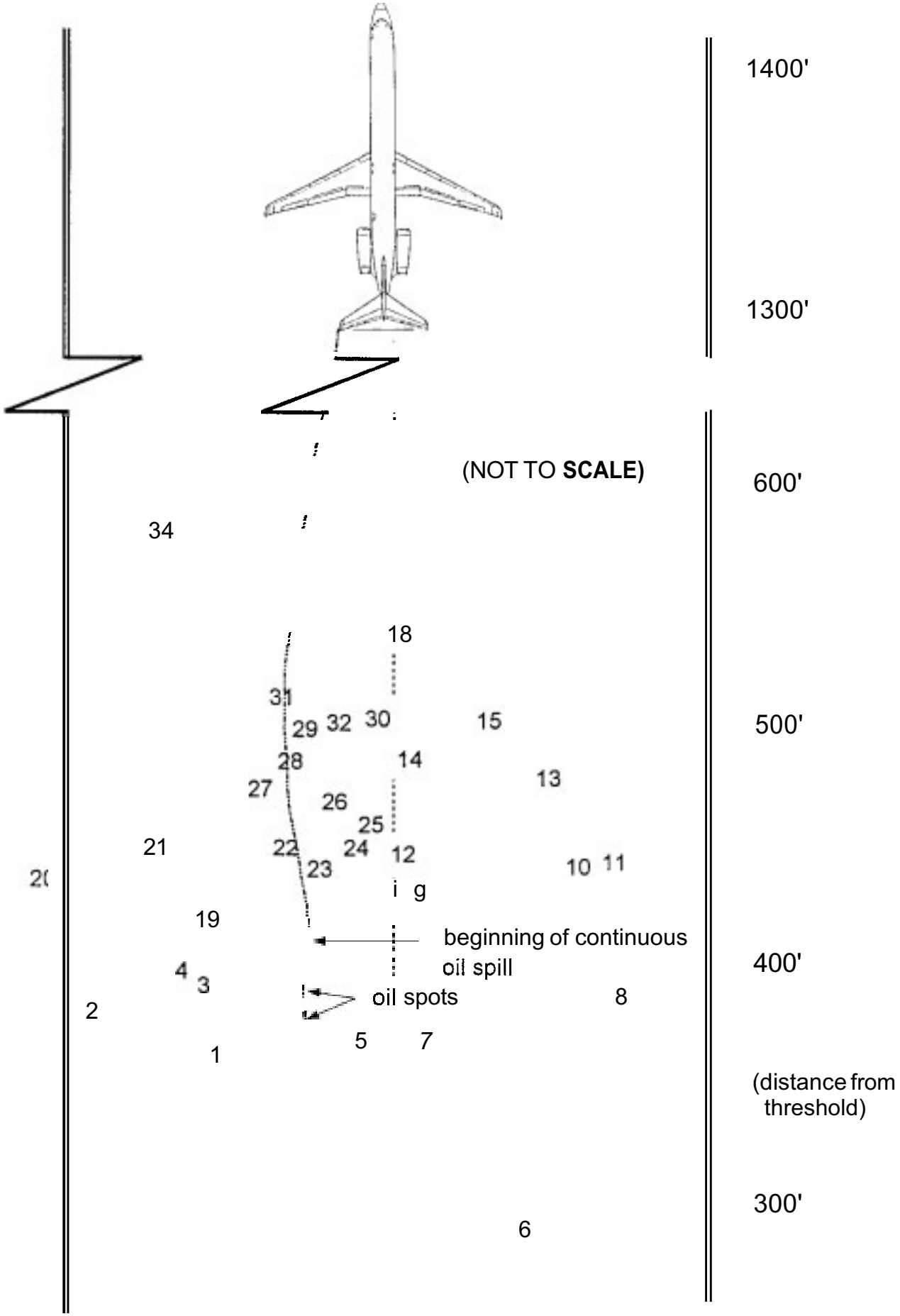


Figure 2. Runway 17 Debris Locations

Table 1. Runway 17 Debris Locations

Item #	Distance from Threshold (ft)	Distance (L/R) from Centerline (ft)	Item Description
1	360	39L	25"x15" fiberglass skin piece
2	379	68L	fan blade outer portion
3	396	43L	runway gouge #10 (9"L x 3"W x 2" deep)
4	398	45L	runway gouge #11 (set of 4; 36"L x 5"W x 1" deep)
5	370	7L	30" fan cowl support
6	291	36R	fan blade outer portion
7	370	12R	fan blade outer portion
8	386	56R	fan blade outer portion
9	428	9R	1st stage stator section
10	438	48R	4"x10" aluminum cowl section
11	441	61R	7"x14" engine case wall piece
12	440	3R	1st stage stator vane
13	475	39R	fan blade portion from root to below shroud
14	484	6R	fan blade mid-span portion
15	500	24R	fan blade mid-span portion
16	540	20R	#1 bearing outer race section
17	557	45R	#1 scavenge pump gear
18	532	4R	2"x2" hub pc. & blade root pc.
19	416	39L	8"x8" cowl section
20	433	77L	1st stage stator vane
21	445	54L	1st stage stator vane
22	445	24L	1st stage stator vane
23	437	19L	1st stage stator vane
24	445	10L	fan blade
25	457	7L	1st stage stator vane
26	461	15L	1st stage stator vane
27	470	29L	fan blade minus root
28	481	21L	fan blade
29	492	22L	fan blade
30	500	5L	fan blade
31	515	25L	tie rods w/nuts, #1 bearing retention nut
32	497	16L	#1 bearing outer race section
33	563	24L	nose cowl
34	579	56L	bullet nose

Gouge	Dist. from threshold (ft)	Dist. left of runway centerline (ft)
1	384	13
2	384	20 (set of 3)
3	384	23
4	384	28
5	386	17
6	387	22
7	392	27
8	395	36
9	395	39
10	396	43
11	398-399	41-46 (set of 4)

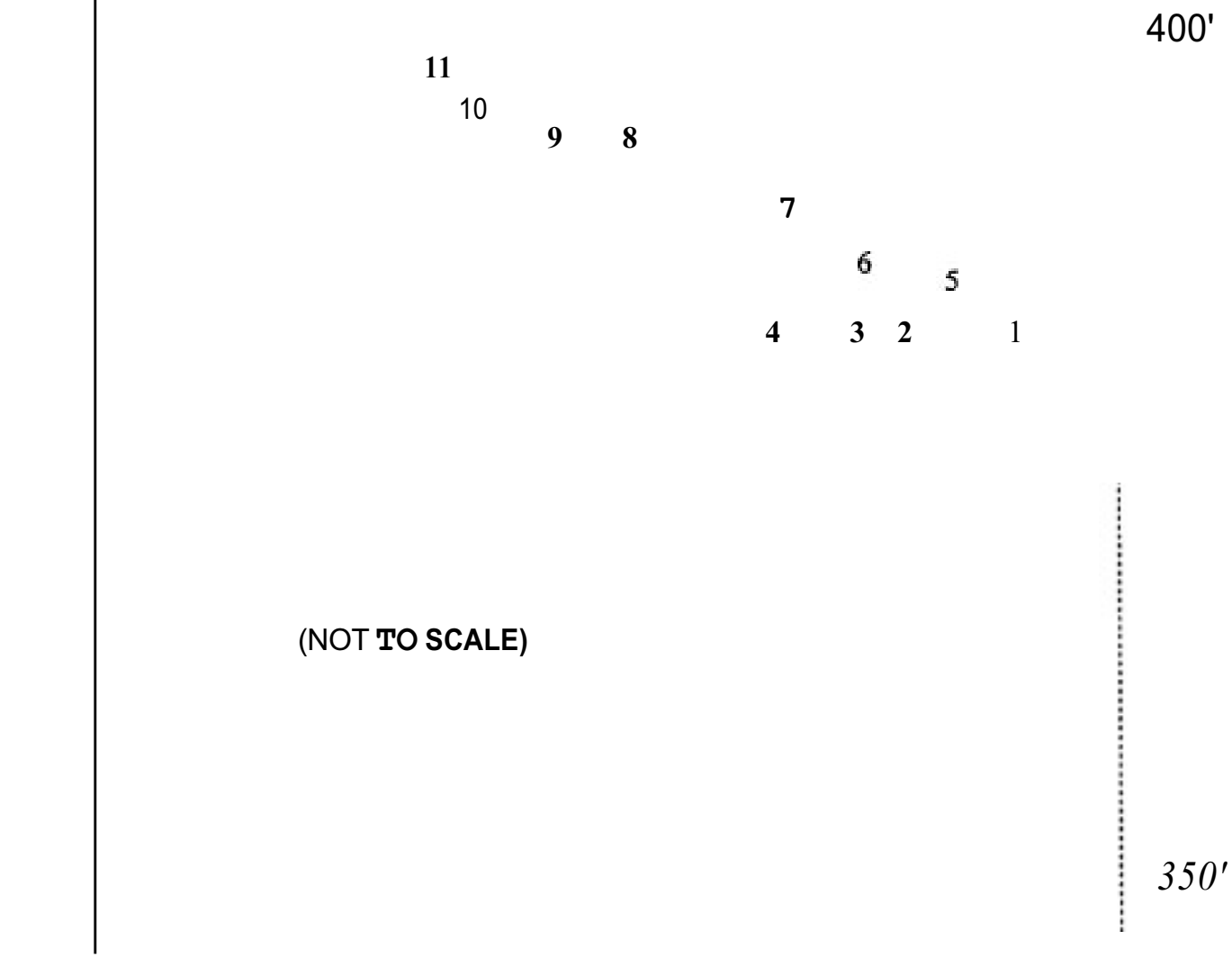
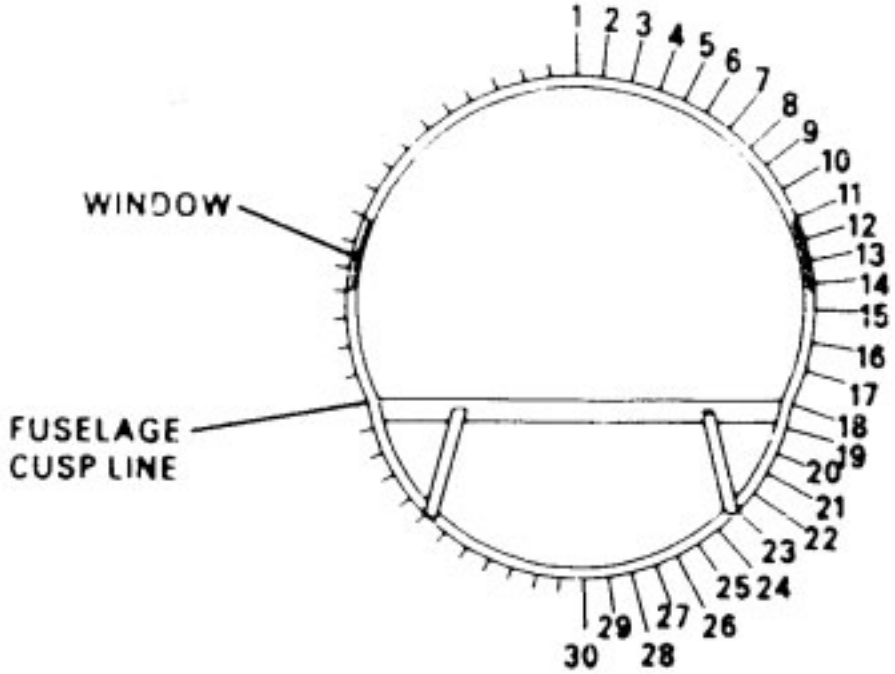
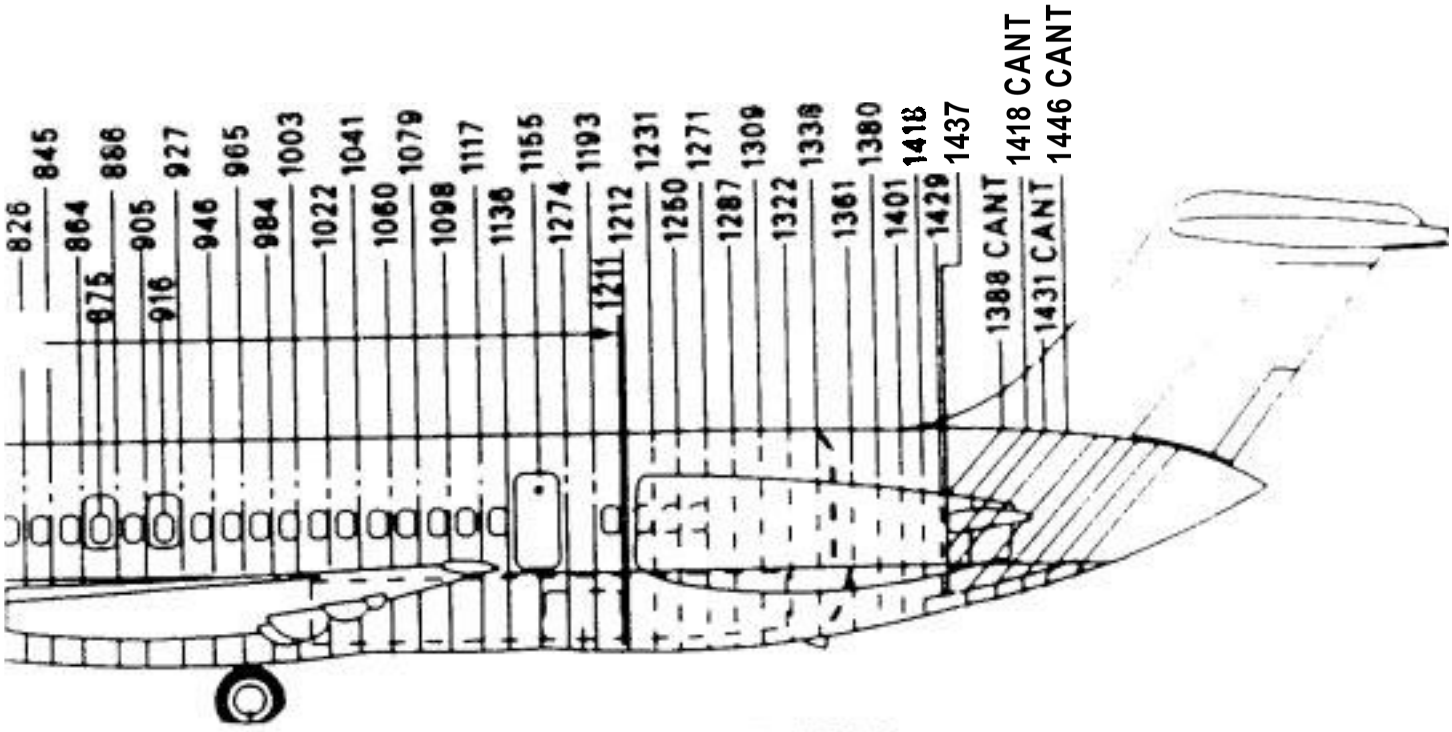


Figure 3. Runway 17 Gouges



FUSELAGE LONGERON NUMBERING ARRANGEMENT



FUSELAGE STATIONS
DC-9-80 SERIES AIRPLANES

Figure 4. Fuselage Station and Longeron Identifications