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DC-9 FLIGHT DEMONSTRATION PROGRAM WITH REFANNED JT8D ENGINES

FINAL REPORT

VOLUME IV

FLYOVER NOISE

by

Douglas Aircraft Company
McDonnell Douglas Corporation
Long Beach, California 90846

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16. Abstract

During the period of June 1973 to July 1975, Phase II of the NASA Refan Program, flyover-noise tests were conducted to determine the noise reductions achievable by modifying the engines and nacelles of DC-9-30 airplanes. The modifications consisted of replacing the two-stage fan of the JT8D-9 engine with a larger-diameter, single-stage fan and incorporating sound-absorbing materials in the engines and nacelles.

The noise levels determined in accordance with Federal Aviation Regulations, Part 36 were 95.3 EPNdB at the sideline, 96.2 EPNdB for a full thrust takeoff, 87.5 EPNdB for takeoff with thrust cutback, and 97.4 EPNdB for landing approach. The noise reductions relative to the hardwall JT8D-9 were 8.2 EPNdB for takeoff with cutback and 8.7 EPNdB for landing approach.

The 90 EPNdB noise-contour areas were reduced by 40 percent for missions requiring maximum design takeoff and landing weights. At the weights required for a typical mission, the reductions were 19 percent for full-thrust takeoff and 34 percent for takeoff with cutback. The 95 EPNdB contour areas were reduced by 50 percent for takeoff and 30 percent for takeoff with cutback for both missions. The two-segment landing approach provided reductions of 1 to 5 percent in the 90 EPNdB contour areas, depending upon the gross weights and takeoff procedure.

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SUMMARY

The purpose of the DC-9 Refan Program was to establish the technical and economic feasibility of reducing the noise of existing JT8D powered DC-9 aircraft. The Refan Program was divided into two phases.

Phase I provided engine and nacelle/aircraft integration definition documents for installation of the JT8D-109 Refan engine on the DC-9 series aircraft, prepared preliminary design of nacelle and airplane modifications, conducted model tests for design information, and provided analyses for economic and retrofit considerations. Phase II included detailed analyses, hardware design and fabrication, and flight testing to substantiate the design and obtain flyover-noise data.

The JT8D-109 Refan derivative of the basic JT8D-9 engine with the minimum treatment acoustic nacelle was selected from Phase I for the design, analyses, construction and flight testing during Phase II. The work described in this report documents the effort carried out under this phase of Contract NAS 3-17841.

The noise levels determined as a result of the DC-9 Refan test program conducted in compliance with Federal Aviation Regulations, Part 36 were 95.3 EPNdB for sideline, 96.2 EPNdB for takeoff, 87.5 EPNdB for takeoff with cut-back, and 97.4 EPNdB for landing approach.

The noise reductions achieved by the DC-9 Refan airplane may be indicated by comparison with a baseline airplane equipped with JT8D-9 hardwall nacelles. A limited flyover-noise test of a C-9A military version of this configuration indicated that the FAR Part 36 noise levels were 95.7 EPNdB for takeoff with cutback and 106.1 EPNdB for landing approach.

The DC-9 Refan flight test program provided extensive flyover noise data in a range of power settings and distances from the aircraft to the microphones. Because of the completeness of the data the limits of the 90 percent confidence for all derived noise levels were within ± 0.8 EPNdB.

The use of the Refan engine on the DC-9 would reduce the 90 EPNdB community noise exposure contour areas by 40 percent for the maximum gross weight airplane and between 19 and 34 percent (takeoff with and without cutback, respectively) for a typical mission airplane. The 95 EPNdB contour area was reduced by 50 percent for takeoff without cutback for both the maximum gross weight and typical mission airplanes. For takeoff with cutback, the 95 EPNdB contour area is reduced by 30 percent for both the maximum gross weight and typical mission airplanes.

The use of microphones at a height of 10 meters (33 feet) to acquire free-field noise data and the effect of air turbulence on noise propagation were studied.

The test data also provided information for the study of engine noise source levels and engine/nacelle acoustic characteristics. A description

is provided of the noise source separation and prediction procedures used to identify, isolate, and predict jet, core, fan inlet, fan exhaust and turbine noise levels, spectra and directivity from ground static and flyover noise data. Evaluation of inlet and tailpipe treatment effectiveness, flight effects on jet and core noise, and engine installation effects on turbomachinery noise are also included.

INTRODUCTION

The continuing growth of the air transportation industry, with resulting increased numbers of operations from established or emerging airports and increased population density near airports, has resulted in an effort to control human exposure to aircraft noise. The government and industrial organizations have pursued a number of programs directed at producing quieter airplanes and aircraft engines. During the late 1960's, research related to the noise generated within the engine itself and research related to absorptive materials were sufficiently refined to be applied to the development of the quieter high-bypass-ratio turbofan power plants for the new generation of wide-body commercial transports.

However, much of the existing and expanding fleet of standard-bodied transports are powered by the JT3D of JT8D low-bypass-ratio engines. Two approaches to reduce the noise of these low-bypass-ratio engines appear to be feasible. One approach is to apply the technology of sound absorbing materials (SAM) to nacelle treatment, with possibly a jet noise suppressor. A number of government and industry studies have considered that approach, and commercial transports being delivered in the mid-1970's include the SAM treatment. A second approach is to replace the fans of the present low-bypass-ratio engines (JT3D and JT8D engines) with larger fans with minimal changes in the components and general operating characteristics of the core engine. The result would be a reduction in jet exhaust noise - of particular interest for the JT8D engine - and possibly both improved engine fuel consumption and a substantial increase in thrust.

In August 1972, the NASA Lewis Research Center authorized the Douglas Aircraft Company, the Boeing Company, and Pratt and Whitney Aircraft Company to develop and investigate the economic and technical feasibility of reducing noise by developing engine and airframe/nacelle modifications. The program covered the JT3D engine and the DC-8 and B-707 it powers and the JT8D engine and the DC-9, B-727, and B-737 it powers. At the end of approximately four and one-half months, all effort on the JT3D was terminated. All subsequent studies were performed on a derivative engine of the Pratt and Whitney JT8D-9 engine designated the JT8D-109.

On the basis of the results of the Phase I effort the Douglas Aircraft Company was authorized on 30 June 1973 to proceed with a Phase II study that would include the nacelle/aircraft design and construction, kit costs, ground compatibility tests, analysis of ground static noise data, and flight worthiness, flight engine/aircraft performance and flyover noise tests.

This volume presents FAR Part 36 noise levels, EPNL- and dB(A)-distance maps, noise contours, spectral studies on extra ground attenuation, turbulence, ground reflection, noise source levels, static-to-flight predictions, and engine/nacelle acoustical characteristics of the DC-9/JT8D-109 Refan aircraft.

The Douglas effort on the Phase II of the NASA Refan program is documented as a "Summary" in reference 1, the "Design and Construction" in reference 2, and the "Performance and Analysis" in reference 3, which contains the engine/aircraft performance, flight test results, supplemental test results, structural analysis, and the economic and retrofit analysis.

In this report, both U.S. Customary Units and International System of Units (SI) are used, however, all calculations and measurements are with U.S. Customary Units.

AIRCRAFT AND ENGINE/NACELLE DESCRIPTION

The Refan flight test program was performed using a DC-9-31 aircraft powered by Pratt and Whitney Aircraft JT8D-109 engines with acoustically treated nacelles. The aircraft had a structurally modified fuselage and a new shorter span pylon to accommodate the new larger engine/nacelle and thrust reverser. Figure 1 compares the JT8D-109 Refan engine/nacelle with the existing JT8D-9 baseline engine/nacelle.

The Refan engine/nacelle installation (which replaces the existing two-stage fan with a larger diameter single-stage fan) includes an extended inlet with 49 inches of treatment on the cowl wall, a long acoustically treated fan duct with a treated duct-length-to-height ratio (L/H) of 7.2, and an extended tailpipe with 51 inches of treatment (L/H = 2.3) on the tailpipe walls (figure 2). Photographs of the inlet and tailpipe acoustical treatments are shown in figures 3 and 4, respectively.

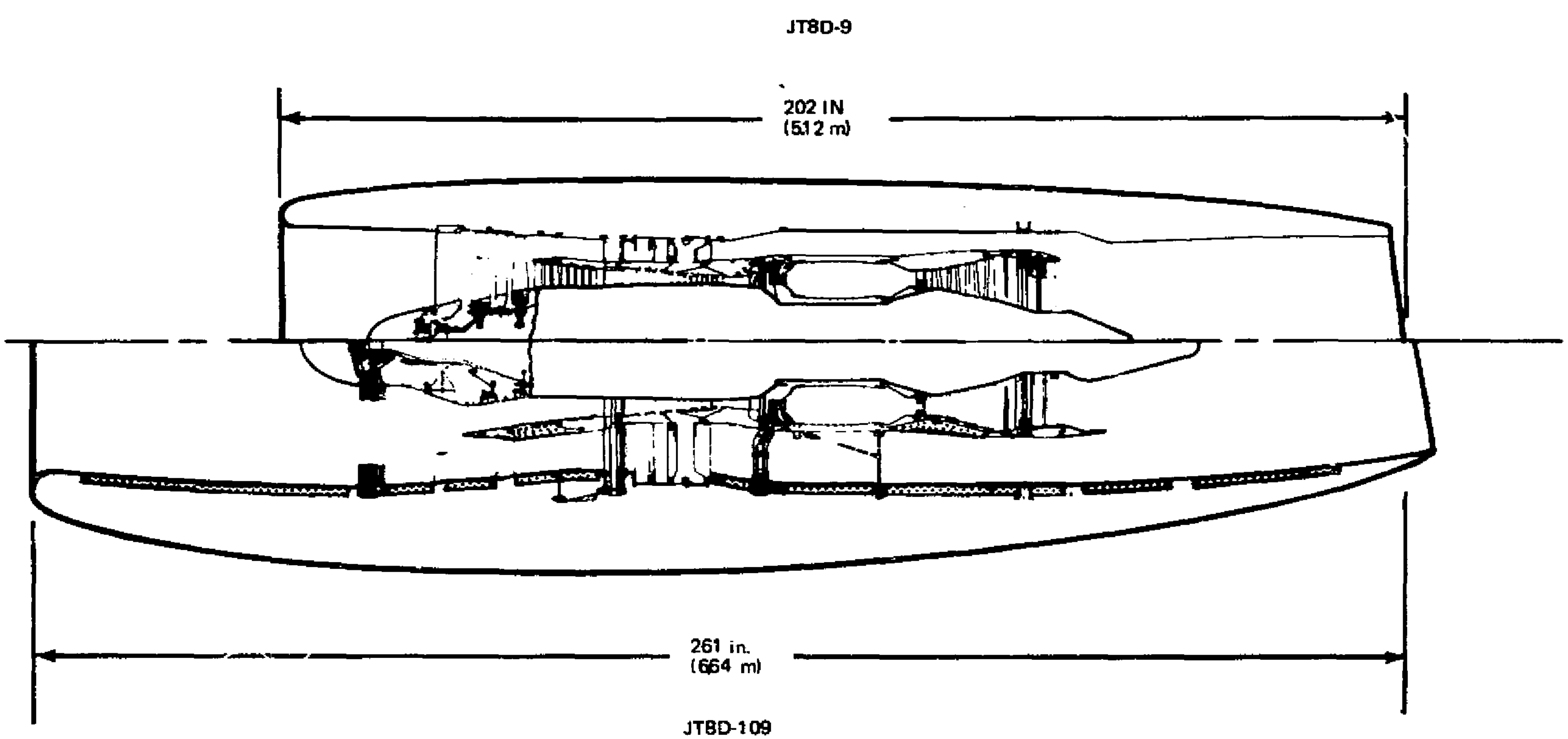
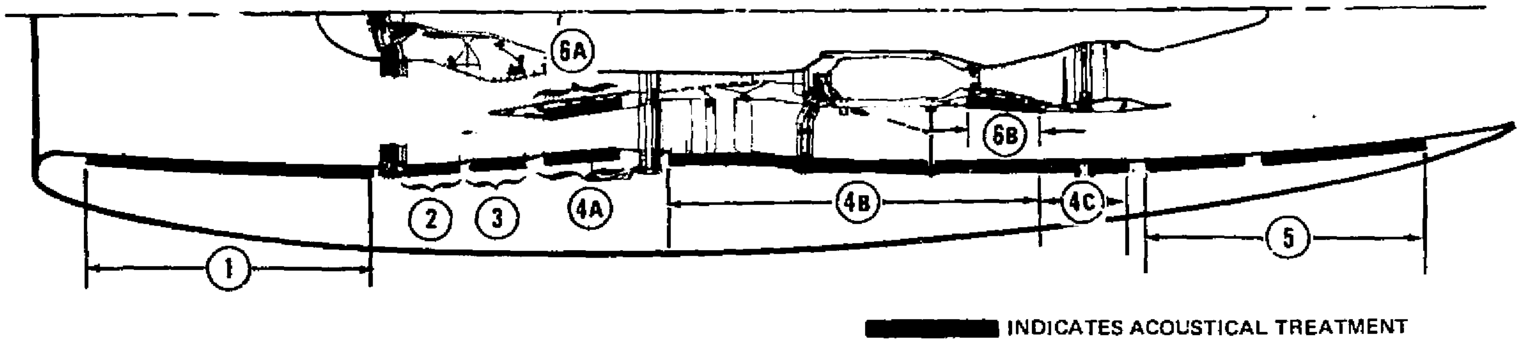


FIGURE 1. JT8D ENGINE/NACELLE COMPARISON



LOCATION		TREATMENT LENGTH (L)		PASSAGE HEIGHT (H)		DUCT LENGTH/ HEIGHT RATIO	HONEYCOMB DEPTH		PERCENT OPENING FACE SHEET	TUNING FREQUENCY OF ACOUSTIC TREATMENT (Hz)
AREA	SYMBOL	in.	(m)	in.	(m)	L/H	in.	(cm)		
INLET	1	48.6	(123.4)	24.0*	(60.9)*	2.00	0.56	(1.42)	6	3150
FAN CASE FWD OF ROTOR	2	7.0	(17.7)	33.2	(84.3)	0.2	1.0	(2.54)	20	1250
FAN CASE AFT OF ROTOR	3	6.0	(15.2)	8.7	(22.1)	1.5	0.5	(1.27)	12	
FAN DUCT	4A	11.25	(28.6)	6.1	(15.5)	0.4	0.25	(0.64)	12	6300
	4B	56.0	(14.2)	8.9	(22.6)	2.5	0.5	(1.27)	12	3150
	4C	15.6	(39.5)	7.9	(20.1)	1.0	0.5	(1.27)	12	3150
TAILPIPE	5	51.0	(129.5)	22.5	(57.2)	2.27	0.35	(0.89)	12	6300
FAN DUCT INNER SURFACE	6A	8.4	(21.3)	6.1	(15.5)	1.6	0.25	(0.64)	12	
	6B	11.0	(27.9)	8.4	(21.3)	1.3	0.5	(1.27)	12	

NOTE: (1) ALL ACOUSTIC TREATMENT WAS HONEYCOMB CORE ON PERFORATED SHEET
(2) TOP SHEET HOLE DIAMETER IS 0.114-0.152 cm (0.045-0.060 in.)
(3) TOP SHEET THICKNESS IS 0.0405 cm (0.016 in.)
(4) CORE HONEYCOMB CELL SIZE IS 0.95 cm (0.375 in.)
*(RADIUS)

FIGURE 2. ACOUSTICAL TREATMENT DETAILS FOR THE DC-9 REFAN

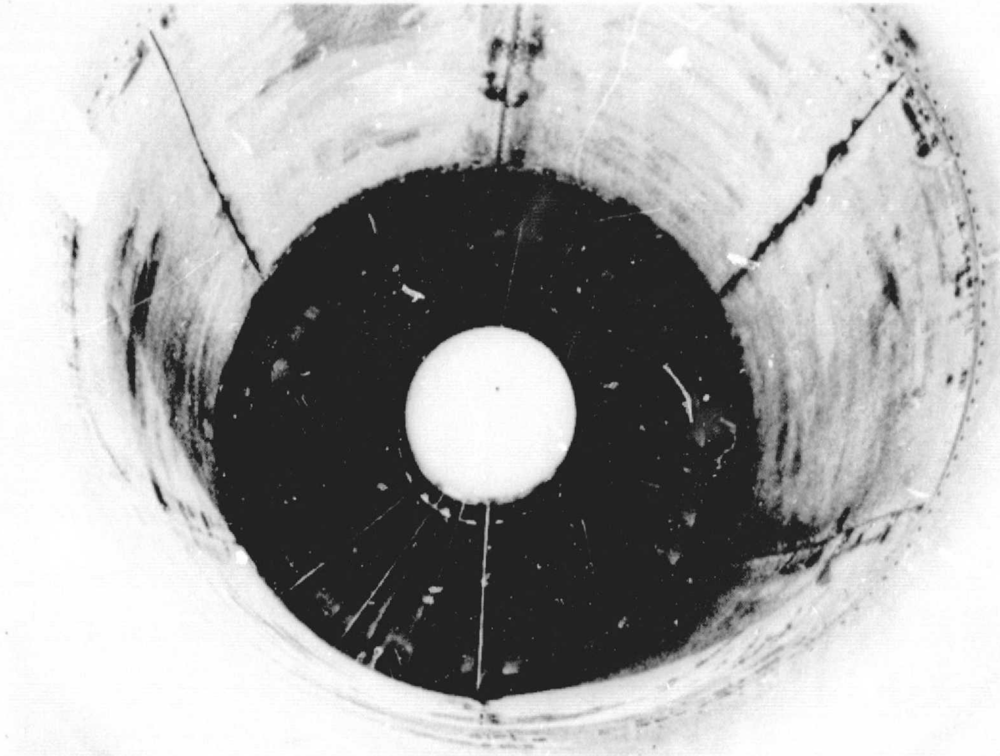


FIGURE 3. JT8D-109 INLET ACOUSTICAL TREATMENT

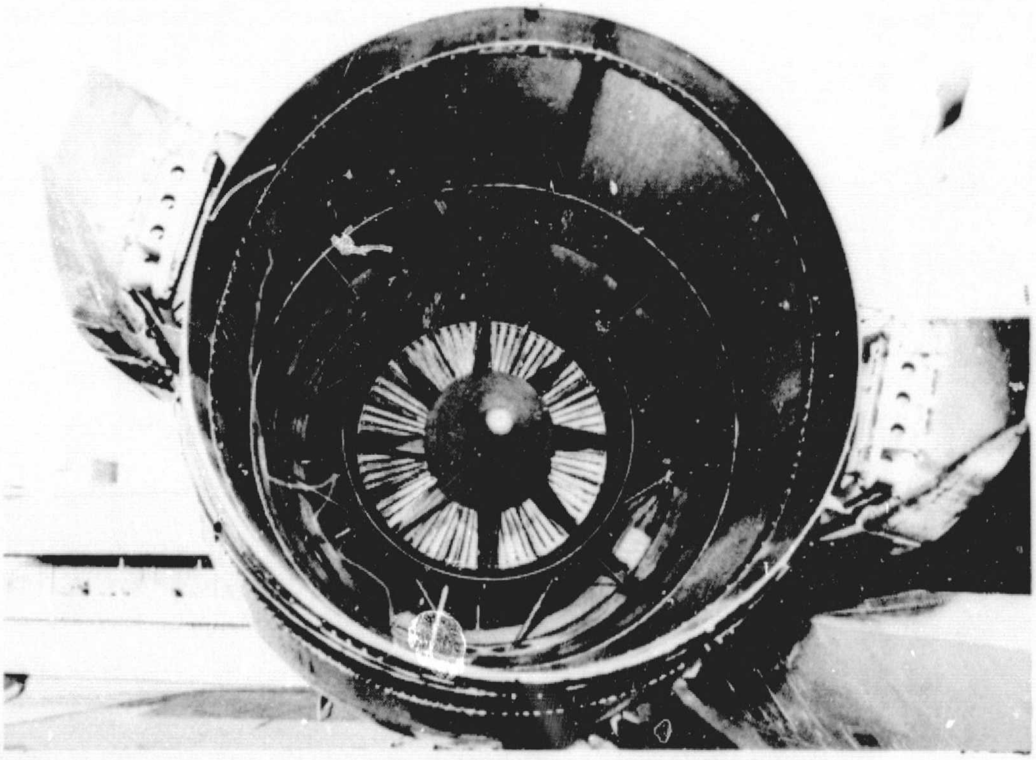


FIGURE 4. JT8D-109 EXHAUST DUCT TAILPIPE ACOUSTICAL TREATMENT

TEST DESCRIPTION

Flyover Noise Tests

The flyover-noise tests consisted of actual and simulated takeoff and approach flights and correction flyover flights as listed in table 1 , with flight profiles as shown in figures 5 through 14. A total of 112 runs (aircraft flyovers) were attempted; 48 to simulate takeoff including takeoff with cutback and 47 to simulate approach including two segment approaches. Data from 17 of the runs were not analyzed because of various equipment or operational problems. However, sufficient data were obtained to satisfy all test objectives. The microphone locations required to acquire the necessary data are shown in figure 15.

The test aircraft was a DC-9 Series 31 (Fuselage 741) equipped with JT8D-109 Refan engines. The configuration of the aircraft systems for the noise test were: pneumatic and hydraulic systems normal, auxiliary power unit off, air conditioning packs off during takeoff and bleeds off during approach, and landing gear up for takeoffs and down for approaches.

TABLE 1
DC-9 REFAN FLYOVER-NOISE MEASUREMENTS

RUN	DATE TIME	TARGET THRUST LB	TARGET THRUST (N)	TYPE OF FLYOVER	HEIGHT OVER MICROPHONE C6 ft	HEIGHT OVER MICROPHONE C6 (m)	FLIGHT PROFILE (SEE FIGURES 5 THROUGH 14)
1				NO TRACKING			
2				NO TRACKING			
3				NO TRACKING			
4	1-29-75 0744	13,500	(60,048)	FULL POWER TAKEOFF	2250	(686)	D1
5	0755	13,500	(60,048)	FULL POWER TAKEOFF	2200	(671)	E1
6	0804	13,500/9,500	(60,048/42,256)	TAKEOFF/CUTBACK	2150	(655)	F1
7	0814	13,500/9,500	(60,048/42,256)	TAKEOFF/CUTBACK	2150	(655)	F2
8	0823	13,500	(60,048)	FULL POWER TAKEOFF	2350	(716)	E2
9	0932	13,500	(60,048)	FULL POWER TAKEOFF	2316	(706)	D1
10	0948	13,500	(60,048)	FULL POWER TAKEOFF	2428	(740)	E1
11	0956	13,500/9,500	(60,048/42,256)	TAKEOFF/CUTBACK	2322	(708)	F1
12	1003	13,500/9,500	(60,048/42,256)	TAKEOFF/CUTBACK	2248	(685)	F2
13	1011	13,500	(60,048)	FULL POWER TAKEOFF	2382	(726)	E2
14				MILITARY JETS			
15	1034	13,500	(60,048)	FULL POWER TAKEOFF	2550	(777)	E3A
16	1043	13,500/9,500	(60,048/42,256)	TAKEOFF/CUTBACK	2288	(697)	F3
17	1050	13,500/9,500	(60,048/42,256)	TAKEOFF/CUTBACK	2163	(659)	F4
18	1100	13,500/9,500	(60,048/42,256)	TAKEOFF/CUTBACK	2206	(672)	F5
19	1118	13,500/9,500	(60,048/42,256)	TAKEOFF/CUTBACK	2175	(663)	F6
20	1125	13,500/9,500	(60,048/42,256)	TAKEOFF/CUTBACK	2247	(685)	G4
21	1134	13,500/9,500	(60,048/42,256)	TAKEOFF/CUTBACK	2399	(731)	G1
22	1142	13,500/9,500	(60,048/42,256)	TAKEOFF/CUTBACK	2213	(675)	G2
23	1149	13,500/9,500	(60,048/42,256)	TAKEOFF/CUTBACK	2189	(667)	G3
24	1-31-75 0929	6,900	(30,691)	δ_F = 50-DEG APPROACH	825	(251)	D1
25	0940	5,800	(25,798)	δ_F = 50-DEG APPROACH	808	(246)	D2
26				NO TRACKING			
27	1014	5,500	(24,464)	δ_F = 50-DEG APPROACH	800	(244)	E1a
28	1033	5,100	(22,685)	δ_F = 50-DEG APPROACH	803	(245)	E2
29	1042	5,300	(23,574)	δ_F = 50-DEG APPROACH	792	(241)	E3
30	1052	5,600	(24,909)	δ_F = 50-DEG APPROACH	841	(256)	E4
31	1102	5,200	(23,130)	δ_F = 50-DEG APPROACH	845	(258)	E5
32	1110	5,600	(24,909)	δ_F = 50-DEG APPROACH	857	(261)	E6
33	1120	4,700	(20,906)	REDUCED THRUST APPROACH	846	(258)	D3
34	1129	4,500	(20,016)	REDUCED THRUST APPROACH	832	(254)	D4
35	1137	4,300	(19,126)	REDUCED THRUST APPROACH	856	(261)	D5
36	1143	3,400	(15,123)	REDUCED THRUST APPROACH	949	(289)	D6
37	1151	3,200	(14,234)	REDUCED THRUST APPROACH	801	(244)	D7
38	1157	2,800	(12,454)	REDUCED THRUST APPROACH	826	(252)	D8
39	2-1-75 0932	6,500	(28,912)	δ_F = 50-DEG APPROACH	850	(259)	D1
40	0940	6,900	(30,691)	δ_F = 50-DEG APPROACH	826	(252)	D2
41	0948	6,100	(27,133)	δ_F = 50-DEG APPROACH	813	(248)	D3
42	0956	3,200	(14,234)	δ_F = 50-DEG APPROACH	825	(251)	E1
43	1004	4,600	(20,461)	δ_F = 35-DEG APPROACH	825	(251)	E2

TABLE 1 (CONTINUED)
DC-9 REFAN FLYOVER-NOISE MEASUREMENTS

RUN	DATE TIME	TARGET THRUST LB	(N)	TYPE OF FLYOVER	HEIGHT OVER MICROPHONE C6 ft	(m)	FLIGHT PROFILE (SEE FIGURES 5 THROUGH 14)
44	1013	3,800	(16,902)	δ_F = 35-DEG APPROACH	842	(257)	E3
45				TRAFFIC			
46	1031	3,800	(16,902)	δ_F = 35-DEG APPROACH	837	(255)	E4a
47	1040	3,800	(16,902)	δ_F = 35-DEG APPROACH	844	(257)	E5
48	1049	3,800	(16,902)	δ_F = 35-DEG APPROACH	827	(252)	E6
49	1100	4,000	(17,792	δ_F = 35-DEG APPROACH	830	(253)	E7
50	1110	4,100	(18,237	δ_F = 35-DEG APPROACH	833	(254)	E8
51	1119	5,400	(24,019)	δ_F = 50-DEG APPROACH	817	(249)	D4
52	1129	3,100	(13,789)	REDUCED THRUST APPROACH	796	(243)	D5
53	2-2-75 0939	13,700	(60,938)	FULL POWER TAKEOFF	2062	(629)	C
54	0946	13,700	(60,938)	FULL POWER TAKEOFF	2117	(645)	D0
55	0953	13,700	(60,938)	FULL POWER TAKEOFF	2208	(673)	D1
56	1001	12,700	(56,490)	TAKEOFF	2066	(630)	D2
57	1008	12,700	(56,490)	TAKEOFF	2169	(661)	D3
58				ABORT			
59	1021	11,700	(52,042)	TAKEOFF	2230	(680)	D4
60	1030	11,700	(52,042)	TAKEOFF	2155	(657)	D5
61	1037	10,700	(47,594)	TAKEOFF	2134	(650)	D6
62	1047	10,700	(47,594)	TAKEOFF	2214	(675)	D7
63				NO TRACKING			
64				NO TRACKING			
65	2-3-75 1105	13,500	(60,048)	FULL POWER TAKEOFF	2312	(705)	C1
66	1115	13,500	(60,048)	FULL POWER TAKEOFF	5592	(1704)	E1
67	1123	13,500	(60,048)	FULL POWER TAKEOFF	5594	(1705)	E2
68				MILITARY JETS			
69	1140	13,500	(60,048)	FULL POWER TAKEOFF	6112	(1863)	E1a
70	1149	9,500	(42,256)	TAKEOFF	4860	(1481)	E3
71				N.G.			
72	1209	8,000	(35,584)	TAKEOFF	4014	(1224)	E5
73	1218	9,500	(42,256)	TAKEOFF	3890	(1186)	E4a
74	1226	8,000	(35,584)	TAKEOFF	3940	(1201)	E6
75	1241	13,500	(60,048)	FULL POWER TAKEOFF	4293	(1309)	E1c
76				N.G.			
77	2-3-75 1302	8,000	(35,584)	TAKEOFF	2435	(742)	H1a
78	1319	8,000	(35,584)	TAKEOFF	2200	(671)	H2
79	1327	7,000	(31,136)	TAKEOFF	2200	(671)	H3
80				MILITARY JETS			
81				MILITARY JETS			
82	1348	7,000	(31,136)	TAKEOFF	2300	(701)	H4b
83	1358	7,000	(31,136)	TAKEOFF	2500	(762)	H4c
84	1504	13,500	(60,048)	FULL POWER TAKEOFF	2350	(716)	C1
85	1513	13,500	(60,048)	LEVEL	808	(246)	D1
86	1521	13,500	(60,048)	LEVEL	745	[illegible]	D2
87	1528	9,500	(42,256)	LEVEL	625	(191)	D3

TABLE 1 (CONCLUDED)
DC-9 REFAN FLYOVER-NOISE MEASUREMENTS

RUN	DATE TIME	TARGET THRUST LB	(N)	TYPE OF FLYOVER	HEIGHT OVER MICROPHONE C6 ft	(m)	FLIGHT PROFILE (SEE FIGURES 5 THROUGH 14)
88				MILITARY JETS			
89				MILITARY JETS			
90	1546	9,500	(42,256)	LEVEL	505	(154)	D4b
91	1553	9,500	(42,256)	LEVEL	570	(174)	D3a
92	2-5-75 0857	6,000	(26,688)	δ_F = 50-DEG APPROACH	2275	(693)	D1
93				N.G.			
94	0914	6,000	(26,688)	δ_F = 50-DEG APPROACH	2420	(738)	D1b
95	0923	6,000	(26,688)	δ_F = 50-DEG APPROACH	2427	(740)	D1c
96	0932	6,000	(26,688)	δ_F = 50-DEG APPROACH	2531	(771)	D2
97	0940	5,400	(24,019)	δ_F = 50-DEG APPROACH	2555	(779)	D3
98	0947	5,400	(24,019)	δ_F = 50-DEG APPROACH	2516	(777)	D4
99	1008	3,900	(17,347)	γ = 5.5-DEG APPROACH	1700	(518)	E1
100	1015	3,900	(17,347)	γ = 5.5-DEG APPROACH	1801	(549)	E1a
101	1023	3,500	(15,568)	γ = 5.5-DEG APPROACH	1910	(582)	E2
102	1030	3,100	(13,789)	γ = 5.5-DEG APPROACH	1902	(580)	E3
103	1038	2,900	(12,899)	γ = 5.5-DEG APPROACH	1921	(586)	E4
104	1046	3,100	(13,789)	γ = 5.5-DEG APPROACH	1918	(585)	E5
105	1053	3,100	(13,789)	γ = 5.5-DEG APPROACH	1918	(585)	E6
106	1102	3,200	(14,234)	γ = 5.5-DEG APPROACH	1800	(549)	F1
107	1115	2,000	(8,896)	γ = 5.5-DEG APPROACH	1897	(578)	F3
108	1157	3,200	(14,234)	γ = 5.5-DEG APPROACH	1951	(595)	F2
109	1205	2,000	(8,896)	γ = 5.5-DEG APPROACH	1879	(573)	F4
110	1213	1,500	(6,672)	γ = 5.5-DEG APPROACH	1940	(591)	F5
111	1220	1,500	(6,672)	γ = 5.5-DEG APPROACH	1850	(564)	F6
112	1227	2,000	(8,896)	γ = 5.5-DEG APPROACH	1899	(579)	F4a

NOTE:

TAKEOFFS

- RUNS 4, 9, 53, 65, AND 84 FULL POWER TAKEOFFS FROM RUNWAY
- ALL REMAINING TAKEOFF RUNS STARTED FROM LEVEL FLIGHT, SIMULATED AFTER ARRIVAL AT A SELECTED POINT OVER RUNWAY
- FULL POWER TAKEOFFS — RATED TAKEOFF ENGINE PRESSURE RATIO MAINTAINED
- REDUCED THRUST TAKEOFF — POWER ADJUSTED FOR SPECIFIED ENGINE PRESSURE RATIO AND PRESCRIBED AIRSPEED

LANDING APPROACHES

- POWER MAINTAINED UNTIL END OF RUN ARRIVAL AT SELECTED POINT OVER RUNWAY, CONTINUED LEVEL UNTIL CLEAR OF AREA
- FOR CONSTANT FLAP SETTING RUNS — FLIGHT SPEED MAINTAINED CONSTANT, ENGINE PRESSURE RATIO AS REQUIRED
- FOR REDUCED POWER RUNS OR HIGHER ANGLE GLIDESLOPE RUNS — FLIGHT SPEED AND ENGINE PRESSURE RATIO MAINTAINED, FLAP SETTING ADJUSTED AS REQUIRED

δ_F INDICATES FLAP SETTING

γ INDICATES GLIDESLOPE

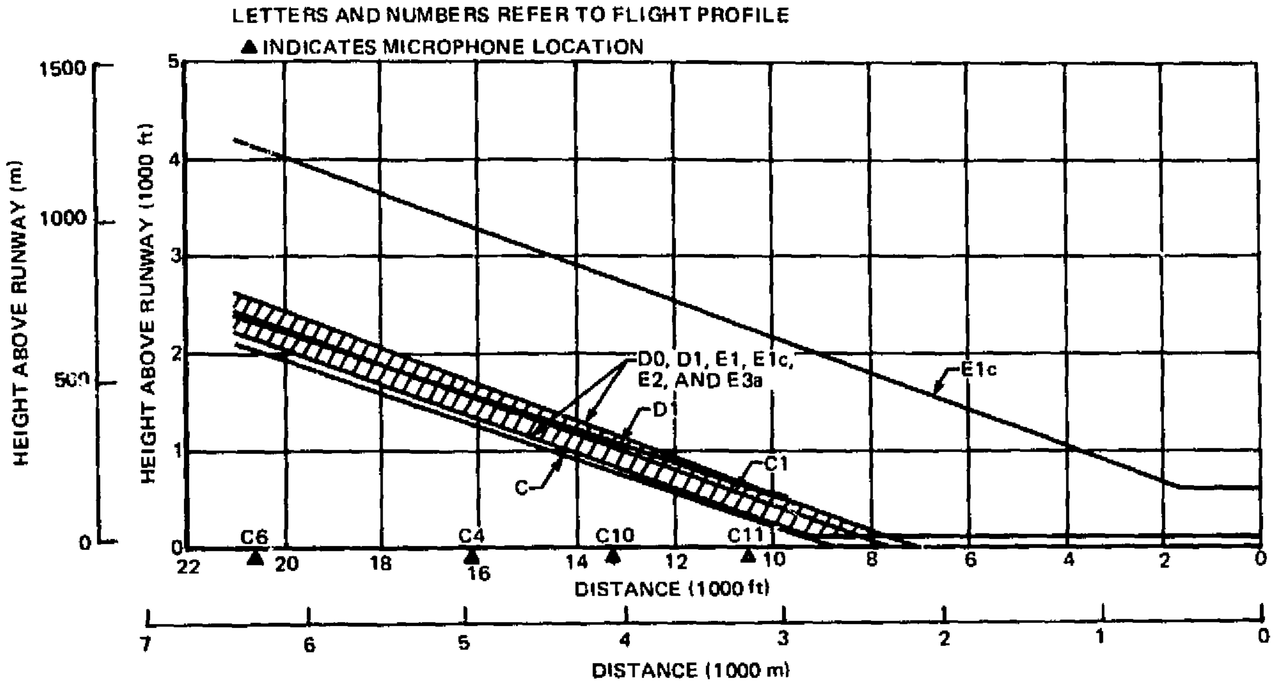


FIGURE 5. DC-9 REFAN FAR PART 36 FLYOVER PROFILES – FULL POWER TAKEOFFS

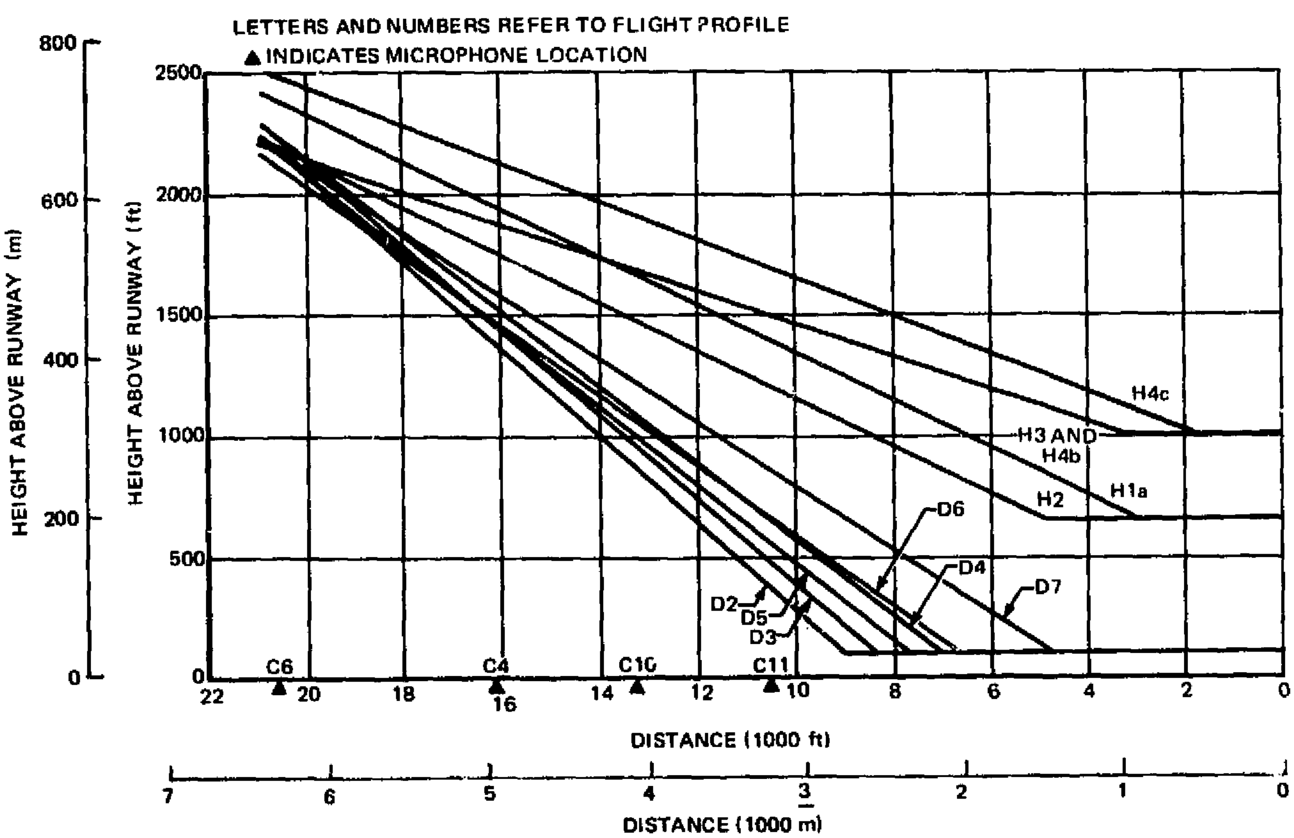


FIGURE 6. DC-9 REFAN FAR PART 36 FLYOVER PROFILES – REDUCED POWER TAKEOFFS

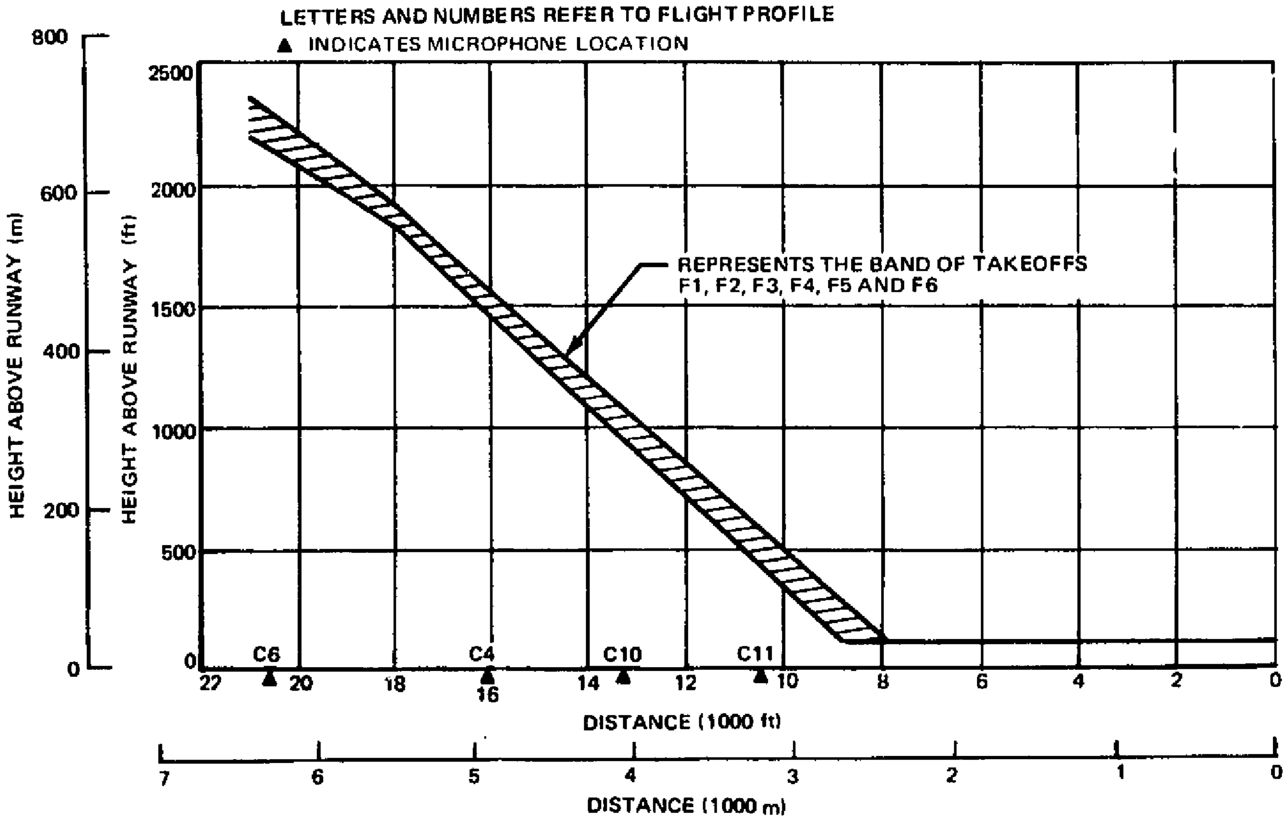


FIGURE 7. DC-9 REFAN FAR PART 36 FLYOVER PROFILES – TAKEOFFS WITH CUTBACK

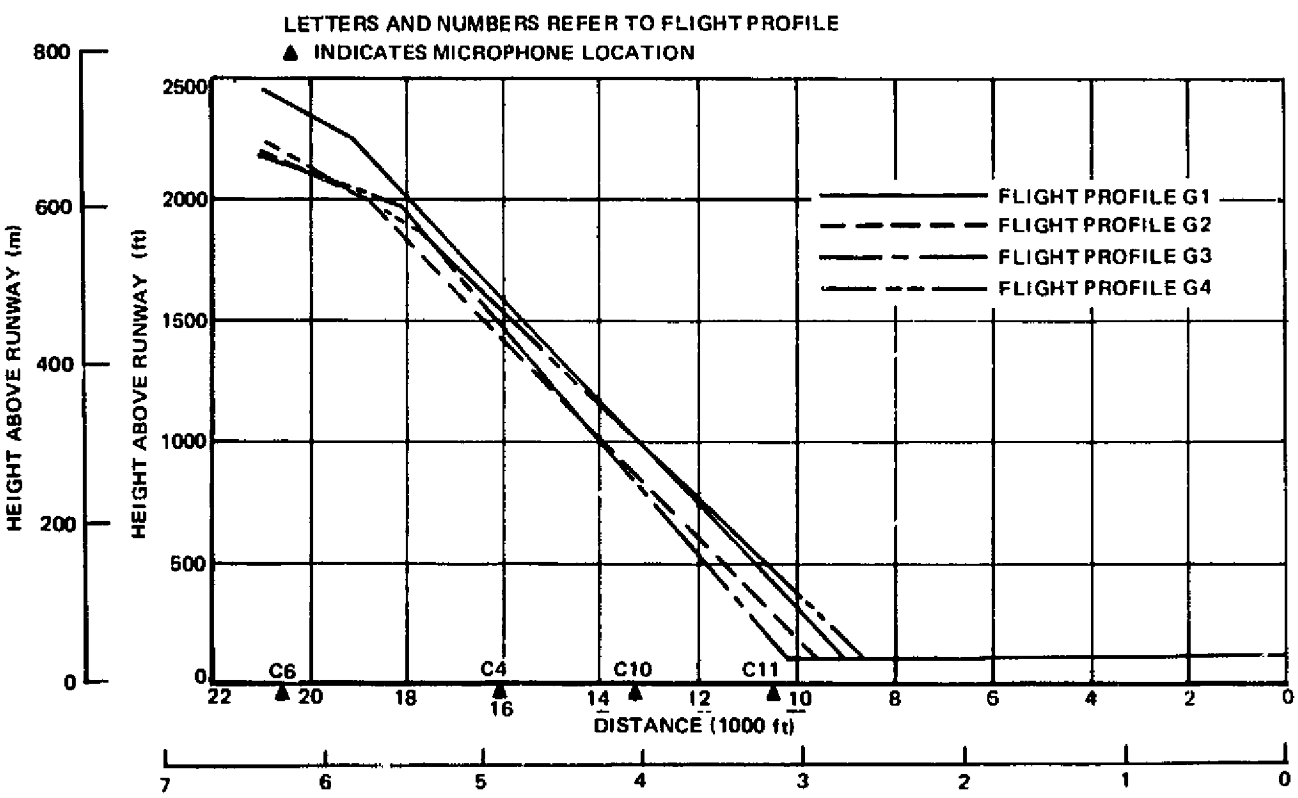


FIGURE 8. DC-9 REFAN FAR PART 36 FLYOVER PROFILES – TAKEOFFS WITH VARIED CUTBACK DISTANCES FROM MONITOR

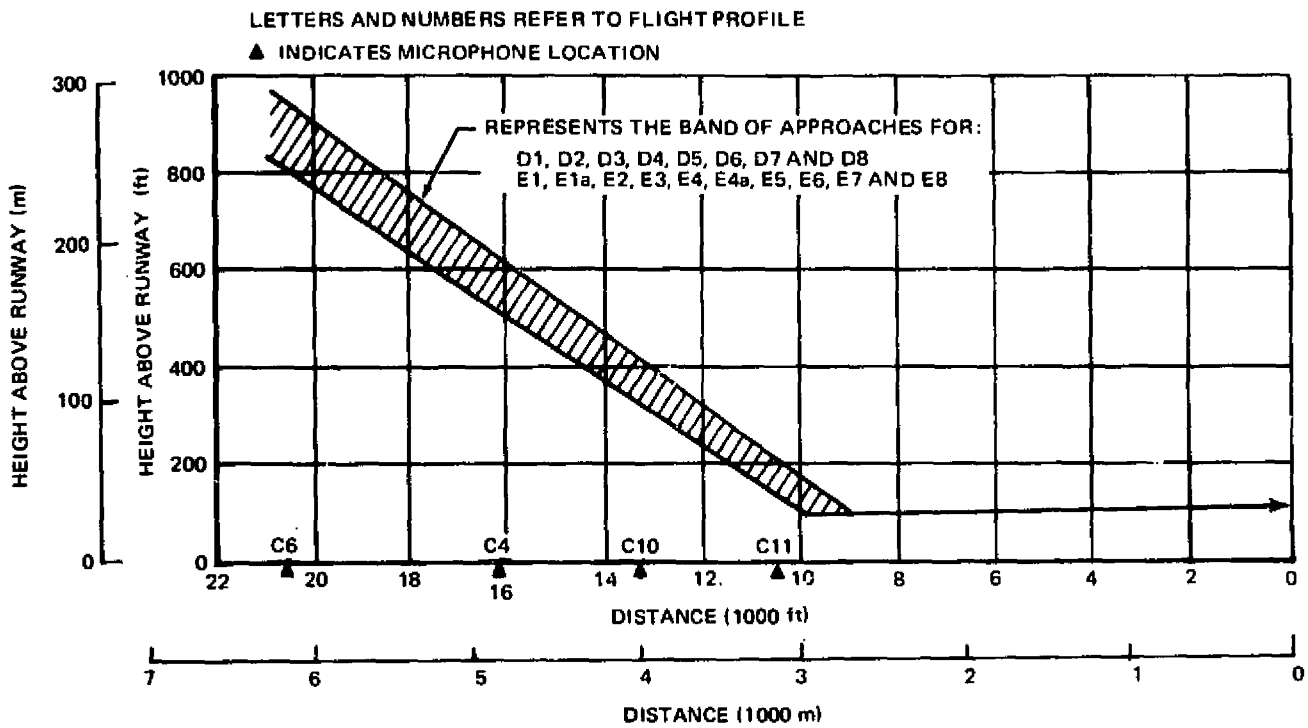


FIGURE 9. DC-9 REFAN FAR PART 36 FLYOVER PROFILES – LANDING APPROACHES

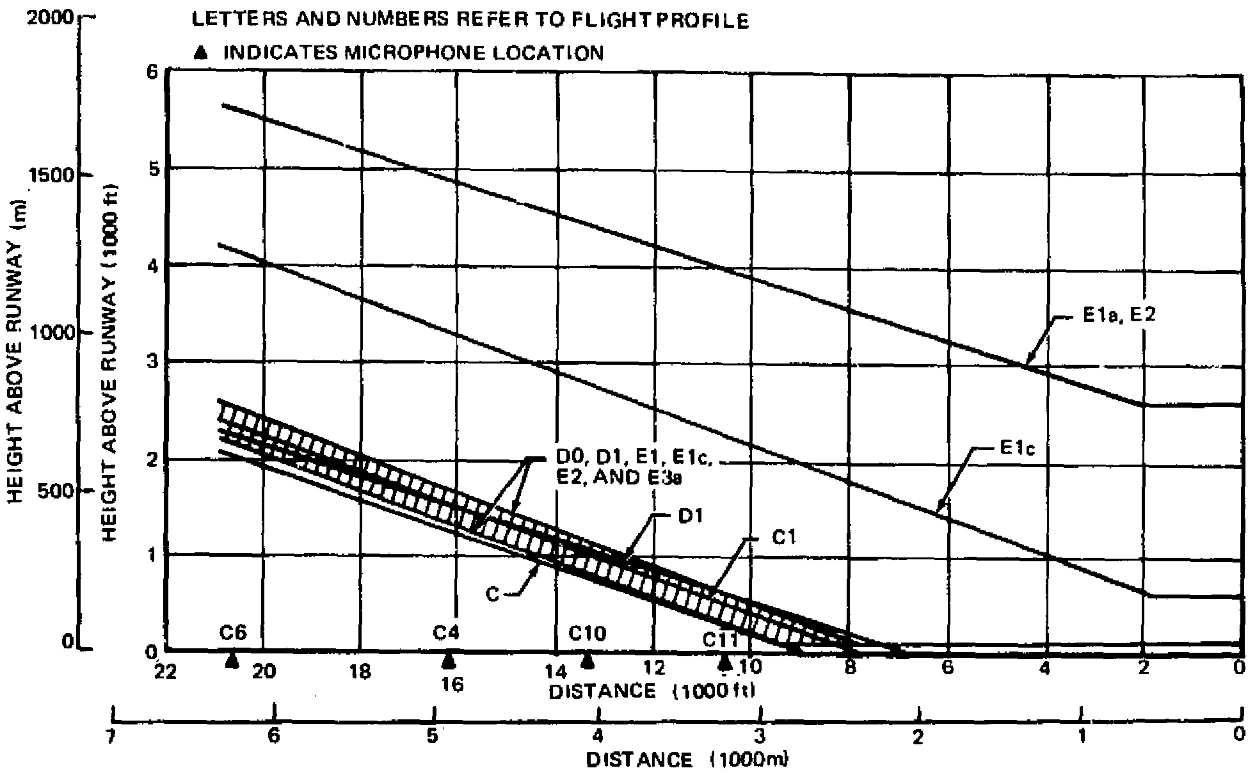


FIGURE 10. DC-9 REFAN COMMUNITY NOISE SURVEY FLIGHT PROFILE – FULL POWER TAKEOFFS

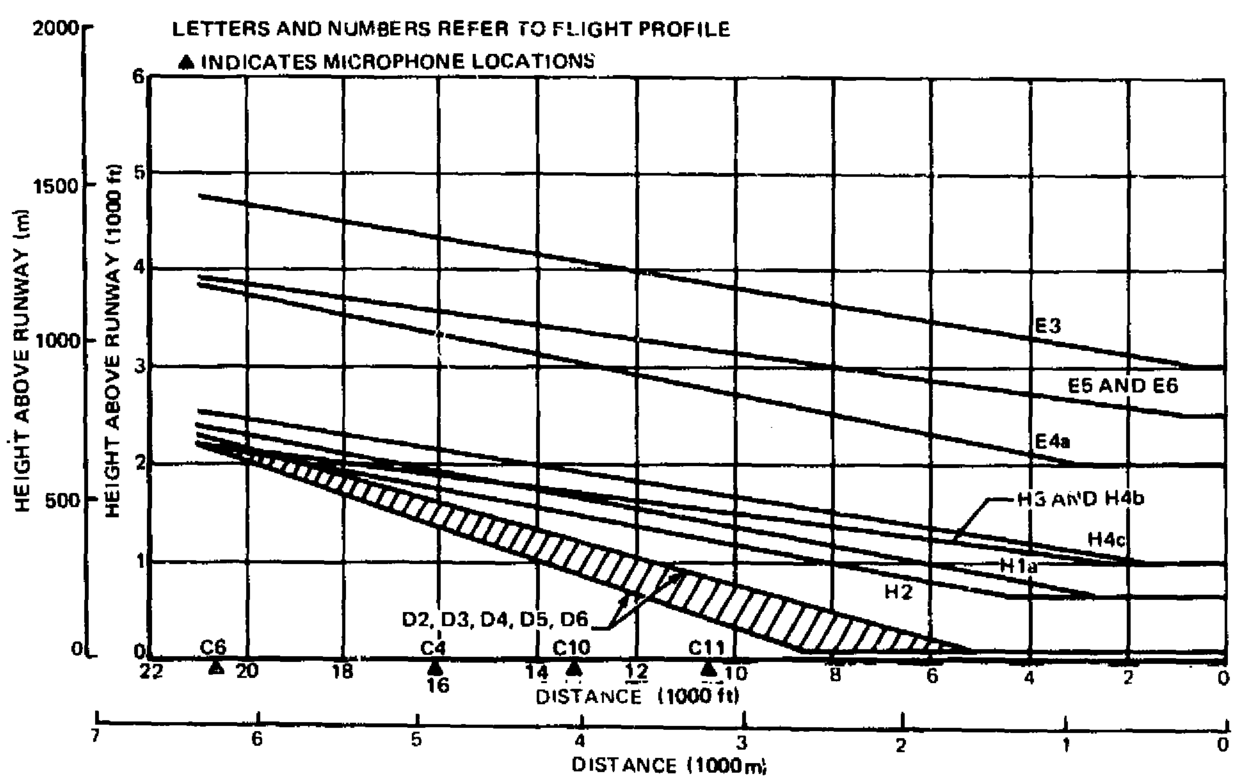


FIGURE 11. DC-9 REFAN COMMUNITY NOISE SURVEY FLIGHT PROFILES – REDUCED POWER TAKEOFFS

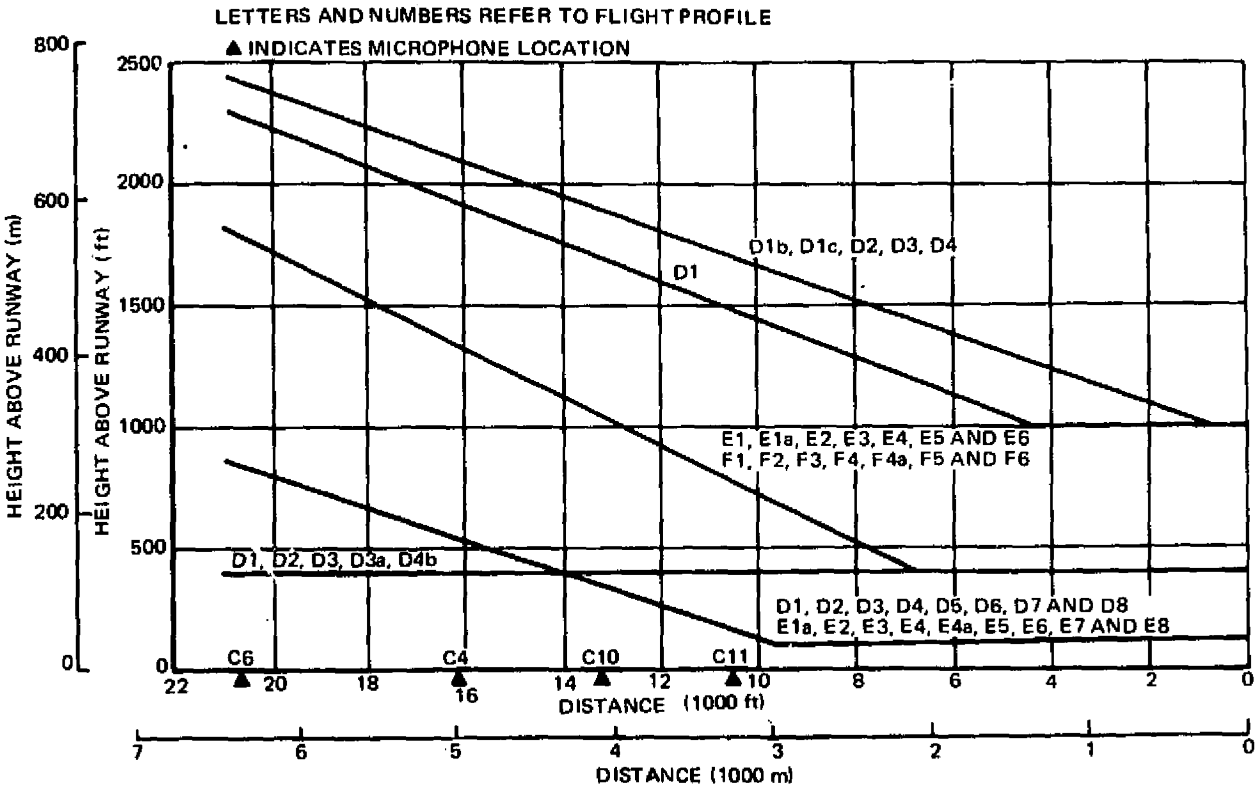


FIGURE 12. DC-9 REFAN COMMUNITY NOISE SURVEY FLIGHT PROFILES – LEVEL FLIGHT AND LANDING APPROACHES

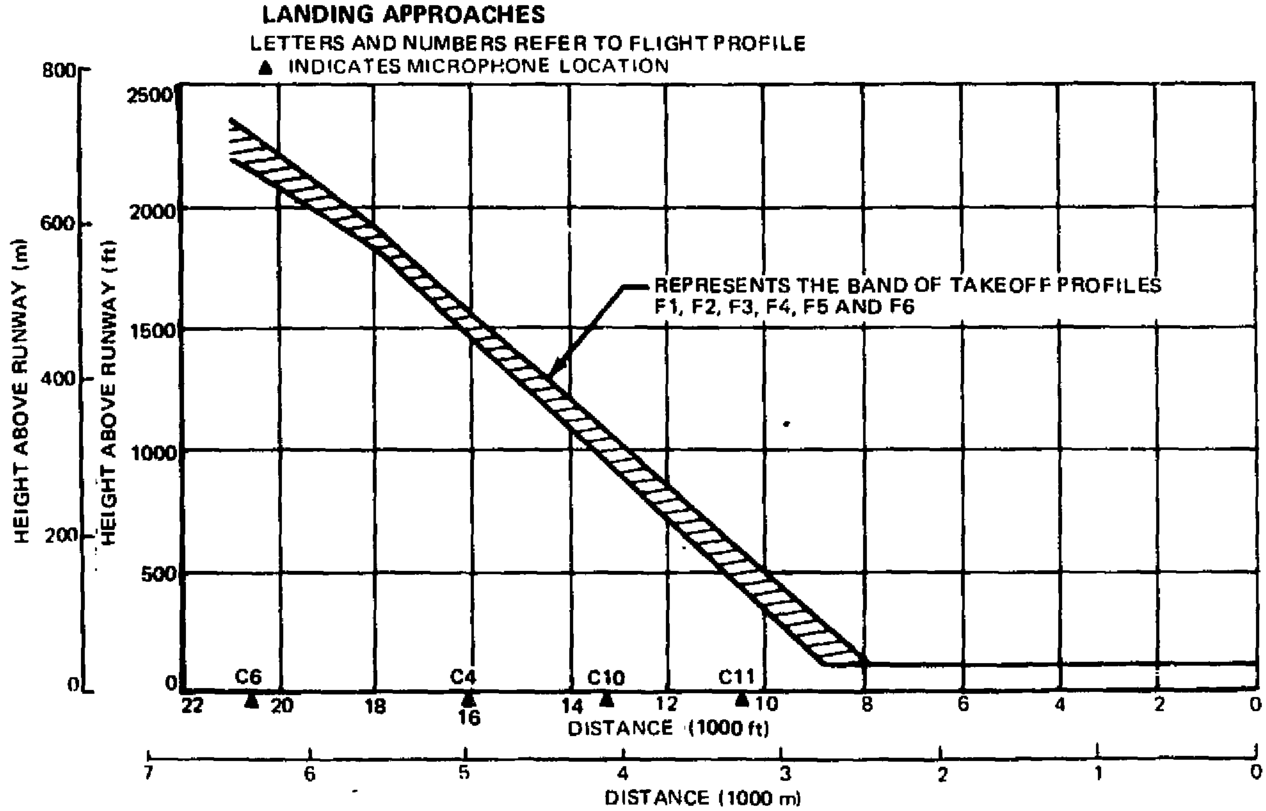


FIGURE 13. DC-9 REFAN COMMUNITY NOISE SURVEY FLIGHT PROFILES – TAKEOFFS WITH CUTBACK

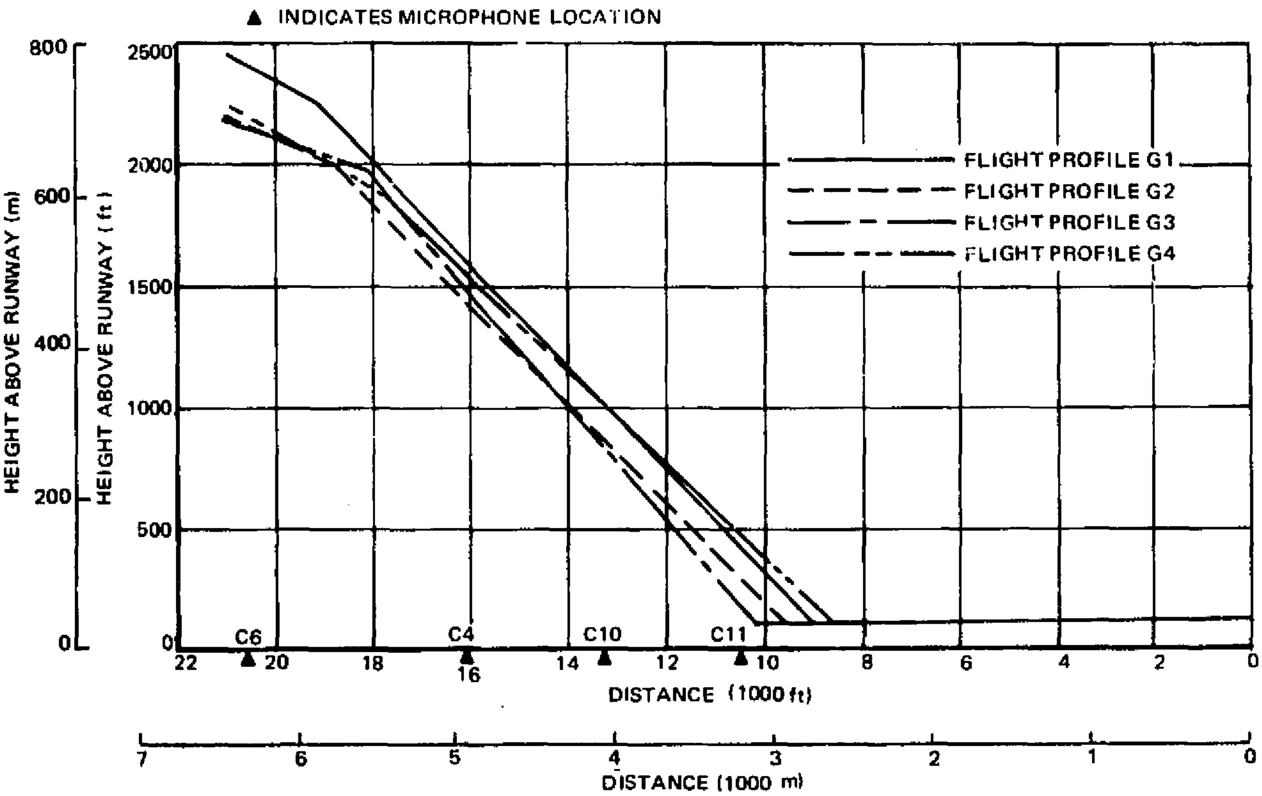
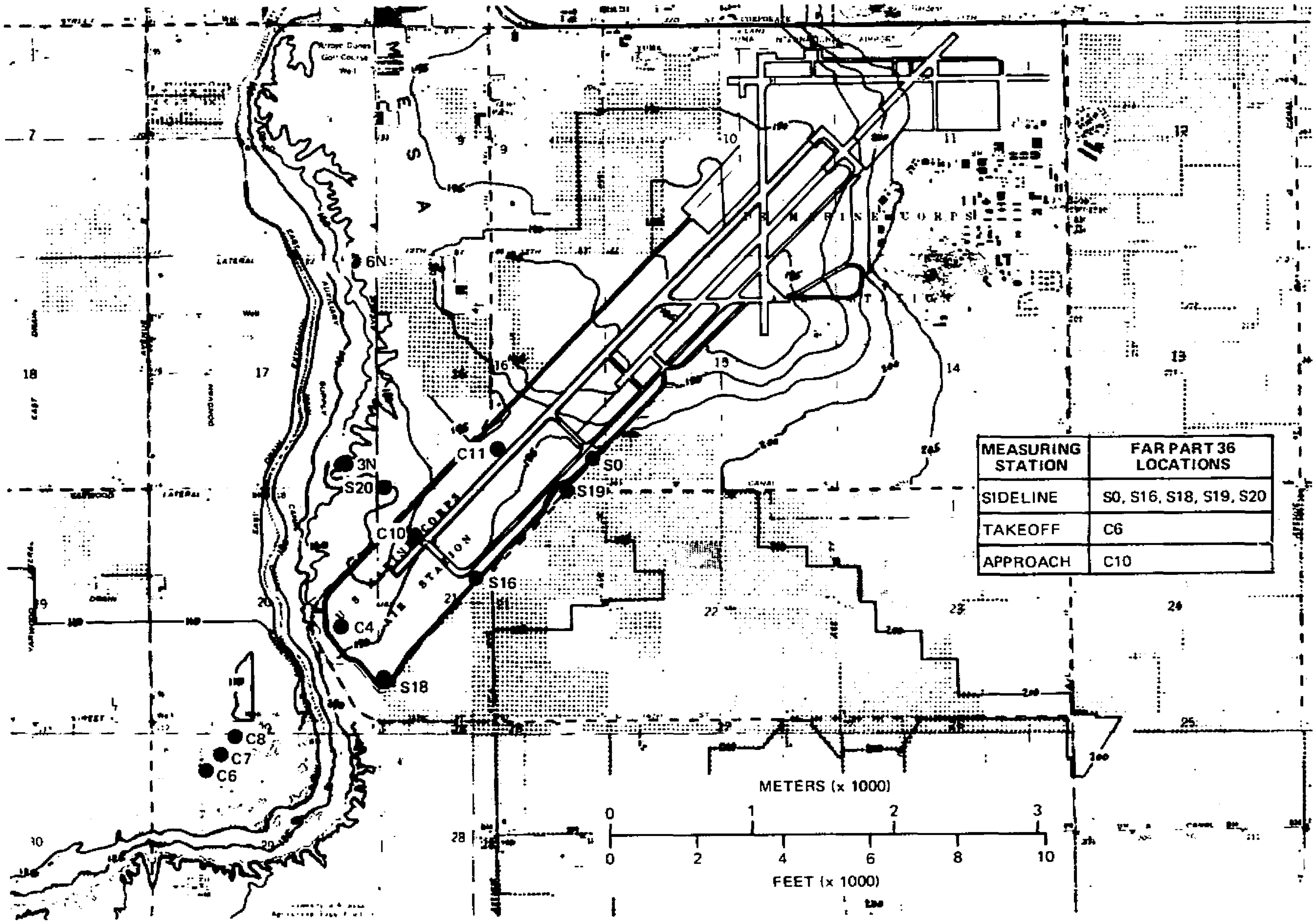


FIGURE 14. DC-9 REFAN COMMUNITY NOISE SURVEY FLIGHT PROFILES – TAKEOFFS WITH VARIED CUTBACK DISTANCES FROM MONITOR



MEASURING STATION	FAR PART 36 LOCATIONS
SIDELINE	S0, S16, S18, S19, S20
TAKEOFF	C6
APPROACH	C10

FIGURE 15. MICROPHONE LOCATIONS FOR DC-9 REFAN FAR PART 36 FLYOVER-NOISE TEST

Test Site

The Douglas Aircraft Company maintains flight test facilities at Yuma International Airport, Yuma, Arizona. The Yuma test site has ground handling equipment, airspace, weather conditions, and a 4054 m (13,300 ft) runway that satisfy the requirements of the test program. It also has a Douglas maintained CAT II ILS, a Laser Tracking System, a surveyed flyover-noise test range, and a microwave transmission system.

The general topography of the test site is shown in figure 15. The measurement locations were situated in an agricultural area southwest of the Yuma airport, with an elevation of approximately 36.5 to 65.5 m (120 to 215 ft) above sea level. The natural surfaces are sandy soil having various degrees of compaction, with loose compaction predominating. The surfaces adjacent to all test microphones were spaded in a random pattern, to assure consistent surface conditions for all microphones and also to eliminate the possibility of excessive surface absorption at any of the measurement locations. There are no obstructions, for example, trees, buildings, hills or cliffs at any measurement point. The test site meets the requirements of reference 4.

Although microphone location C6 was 70 feet below the runway elevation and near a declivity, an analysis of the flyover noise data at microphone locations C4 and C6 (Appendix E) shows that the C6 data were not significantly affected.

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Measurement Systems

The Douglas Aircraft Company has designed and developed a variety of special equipment and instrumentation subsystems to meet the requirements of the various company conducted acoustical tests. The subsystems used during aircraft flyover-noise testing are grouped into four categories: those for acoustical, meteorological, space-positioning, and airplane operation parameters. The subsystems are shown in figure 16 and described below.

The components that make up the acoustical subsystem for the acquisition of flyover-noise is shown in figure 17. The control of the system is from the mobile sound-recording van shown in figure 16.

The microphones were tripod-mounted with the microphone cartridge 1.22 m (4 feet) above the ground and oriented in such a way that the sound impingement on the microphone diaphragm was at approximately grazing incidence throughout the noise recording. Several microphones were flush-mounted with the cartridge of the microphone mounted horizontally in the center of a plywood board 1.2 m (4 ft) by 2.4 m (8 ft) by 19 mm (0.75 in.) thick with the microphone diaphragm normal to the ground plane. An additional microphone was mounted on each of two movable towers 10 m (33 foot) high. All microphones (except the flush-mounted) used windscreens for all tests. High-frequency preemphasis was utilized to extend the dynamic range of the measurement system.

For each noise recording, the gain settings on the signal-conditioning amplifiers were set to obtain optimum signal-to-noise ratios for optimum dynamic recording range on the magnetic tape. The flyover-noise data were recorded on a 14-channel intermediate-band FM recorder operating at 76 mm (30 in) per second. In addition, the time of day (IRIG-B code) synchronized to the standard-time broadcast by radio station WWV (National Bureau of Standards) was recorded on a separate tape channel, along with each flyover-noise recording. A dynamic system calibration with a reference sound pressure level was recorded in the field with a piston phone. Also, the frequency response of the recording systems (excluding microphone cartridge) was calibrated with a recording of a broadband "pink" noise generated by a precision pseudo random noise generator for a period of 2.2 seconds. Immediately before or after each flyover-noise measurement, a recording was made of the ambient noise levels, with the same system gain setting as that used for the flyover recording.

The definition of flyover-noise levels for specific aircraft operation parameters requires the monitoring and recording of (1) airplane flight conditions, (2) propulsion system operation, and (3) airplane systems configuration.

The flight test aircraft was equipped with the Douglas Airborne Digital Data System (ADDS) and a cockpit camera focused on the pilot instrument panel.

The ADDS is designed to monitor the aircraft and engine operating parameters by means of an airborne integrating data system, a telemetry microwave link, and a ground data center. The ADDS system provided real-time monitoring aboard the aircraft and a magnetic tape recording for subsequent processing.

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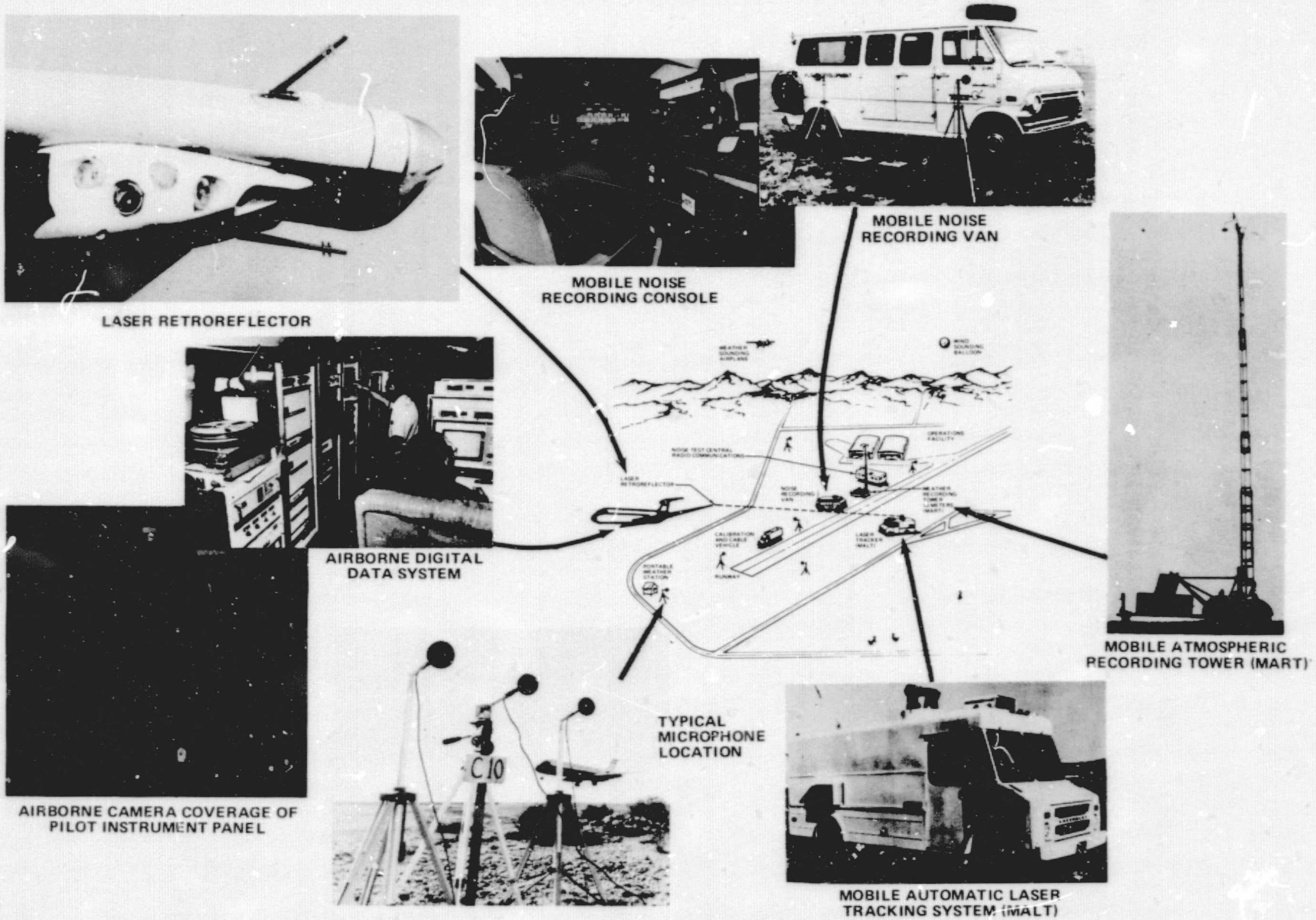


FIGURE 16. AIRPLANE FLYOVER – NOISE MEASUREMENT SYSTEMS

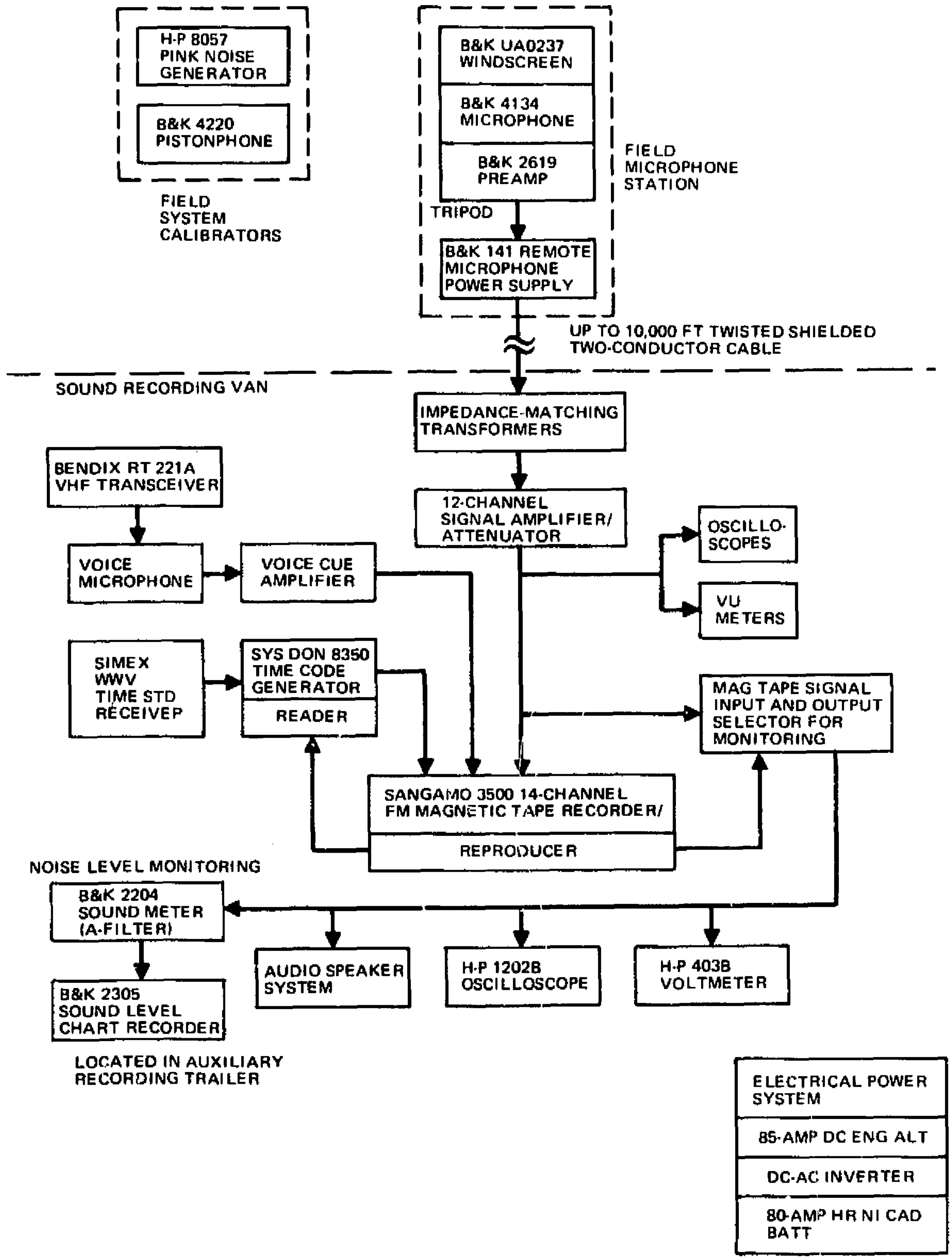


FIGURE 17. FLYOVER NOISE DATA ACQUISITION SYSTEM

Surface temperature and relative humidity required for determining the attenuation of flyover-noise due to atmospheric absorption and for correcting the measured SPL's to standard or reference-day weather conditions were recorded.

The meteorological equipment used to measure surface weather conditions includes a 10 meter Mobile Atmospheric Recording Tower (MART) system (figure 18) with a Weather Measure temperature and relative-humidity measuring system and Beckman-Whitney wind measurement system. Each produced a strip chart record on time-calibrated paper.

Soundings of upper-air weather data were taken before, during, and after the flyover-noise tests, to define the vertical gradients of temperature, humidity, air turbulence, and wind. Temperature and relative humidity were obtained from continuous analog recordings obtained from an instrumented light airplane (figure 19). The aircraft sensors are part of a Meteorology Research Inc. (MRI) airborne instrument package. The ambient air temperature was measured by an MRI Vortex Temperature Sensor. The Humidity Sensor shown in figure 19 was supplemented by a Dewpoint Sensor, to obtain a greater degree of accuracy for these tests. The wind speed and direction were obtained from theodolite tracking of weather balloons. The minimum accuracies of the measurements are ± 0.3°C (± 0.5°F) for air temperature and the difference between dry- and wet-bulb temperature, ± 1.5 m/s (± 3 knots) for wind speed, and ± 10° for wind direction.

Also installed in the airplane was a MRI Universal Indicated Turbulence System, which consisted of four components: a pitot-static tube(figure 19), a sensitive fast response differential pressure transducer, a solid-state signal converter, and an appropriate panel indicator. Through the use of a miniature computer, the turbulence signal was converted to an output that was then displayed on an analog recorder. The levels of turbulence R, are scaled from 0.0 for calm air to 10.0 for severe turbulence in a small aircraft. The quoted accuracy of the system is ± 1.0 R.

Space-positioning data were measured during the flyover-noise testing to determine sound-path distances. The sound path distances were synchronized in time with the noise data. The Mobile Automatic Laser Tracking system (MALT) uses an auto-track monopulse optical-radar, with a multipower laser as the ranging-beam energy source. MALT , is self contained in a small truck (figure 20), uses a portable power source, and can acquire, track, and record the position of a retroreflector-equipped airplane (figure 16). Tracking range is up to 18 288 m (60,000 ft) with elevation coverage of -0.09 to + 0.79 rad (-5° to +45°), and azimuth coverage of ± 2.09 rad (± 120°). Line of sight permitting, microphone locations were also determined from the MALT van, thereby eliminating the need of a transit survey. All space positioning data (and time codes) were recorded on magnetic tape in a digital format for subsequent computer processing.

Certain of the landing approach flyovers were made with flight test paths other than that of the Yuma airport ILS. To help the pilot maintain the required glideslope, a pulsed light visual landing aid (PLVLA) consisting of a portable light system was used (figure 21).

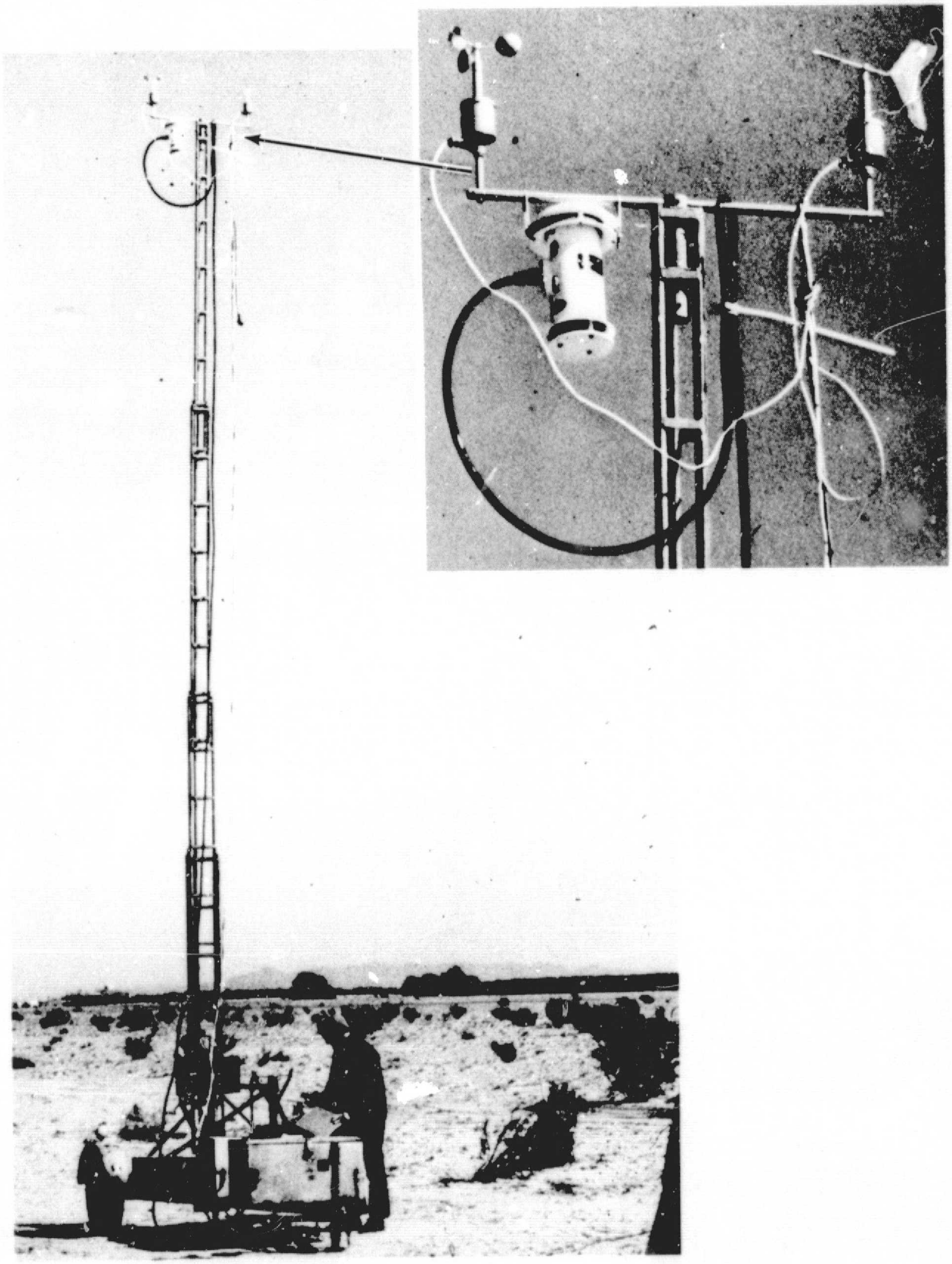


FIGURE 18. 10-METER MOBILE ATMOSPHERIC RECORDING TOWER (MART)

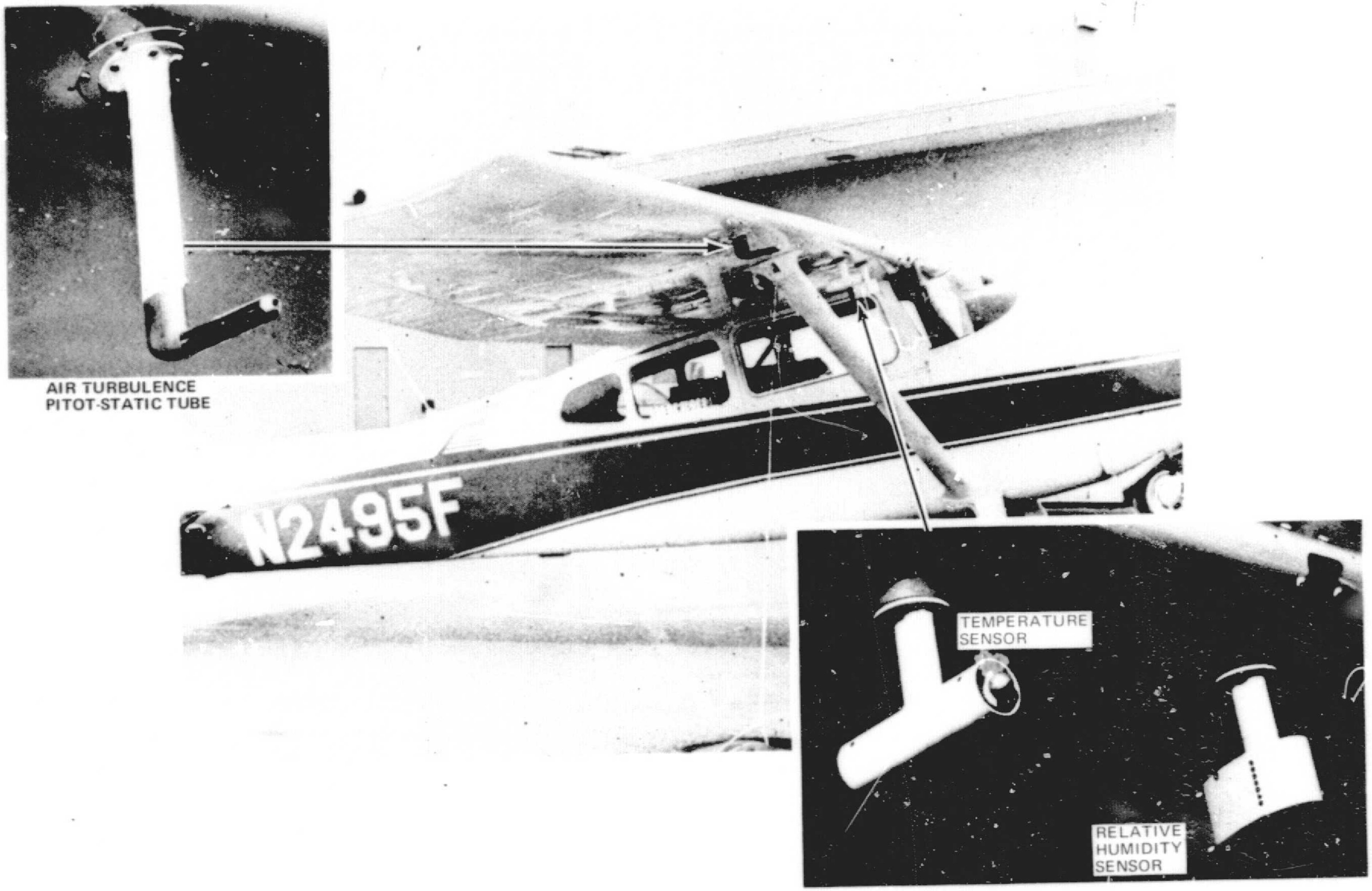


FIGURE 19. VIEW OF METEOROLOGICAL AIRCRAFT

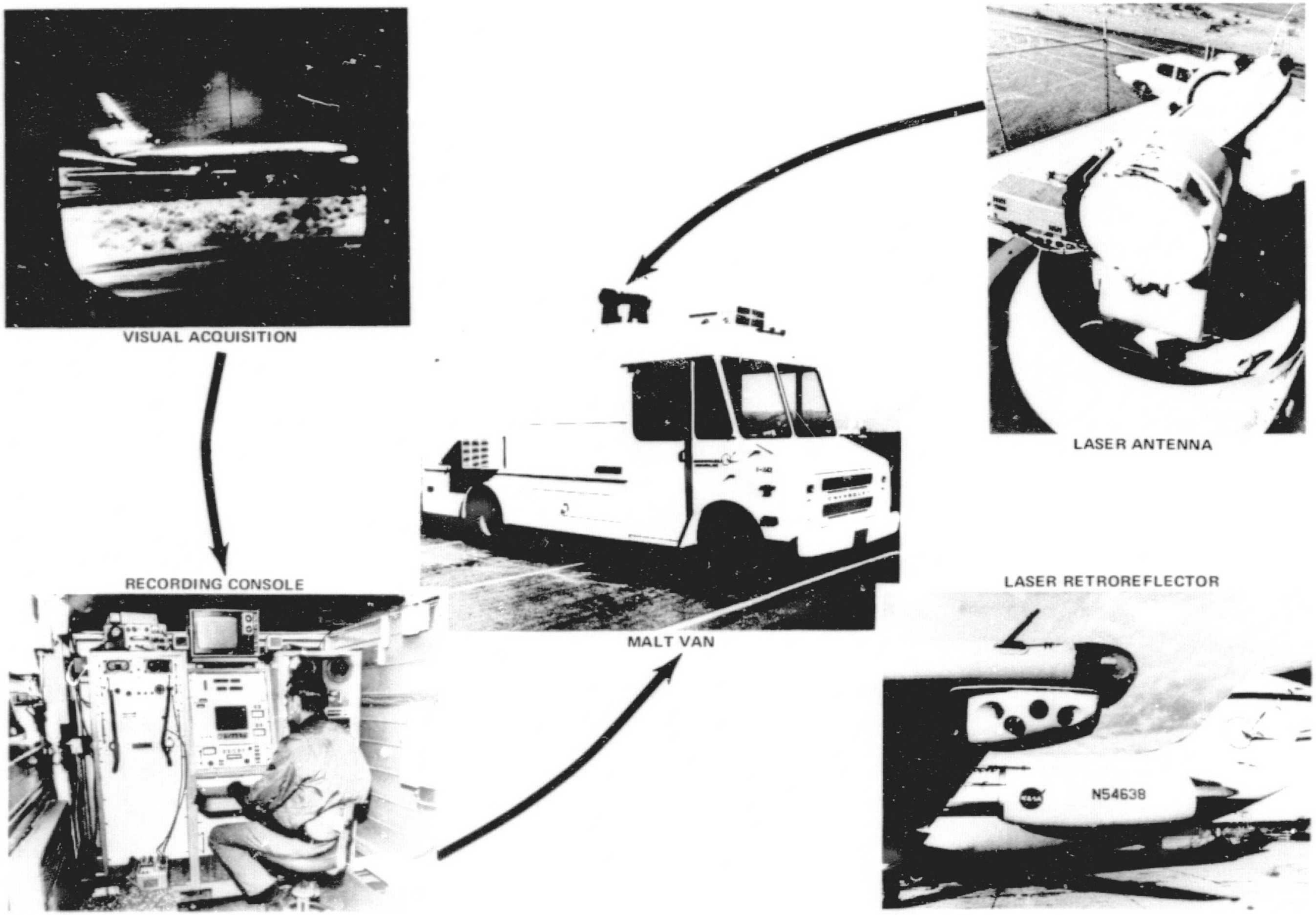


FIGURE 20. MOBILE AUTOMATIC LASER TRACKER SYSTEM (MALT)

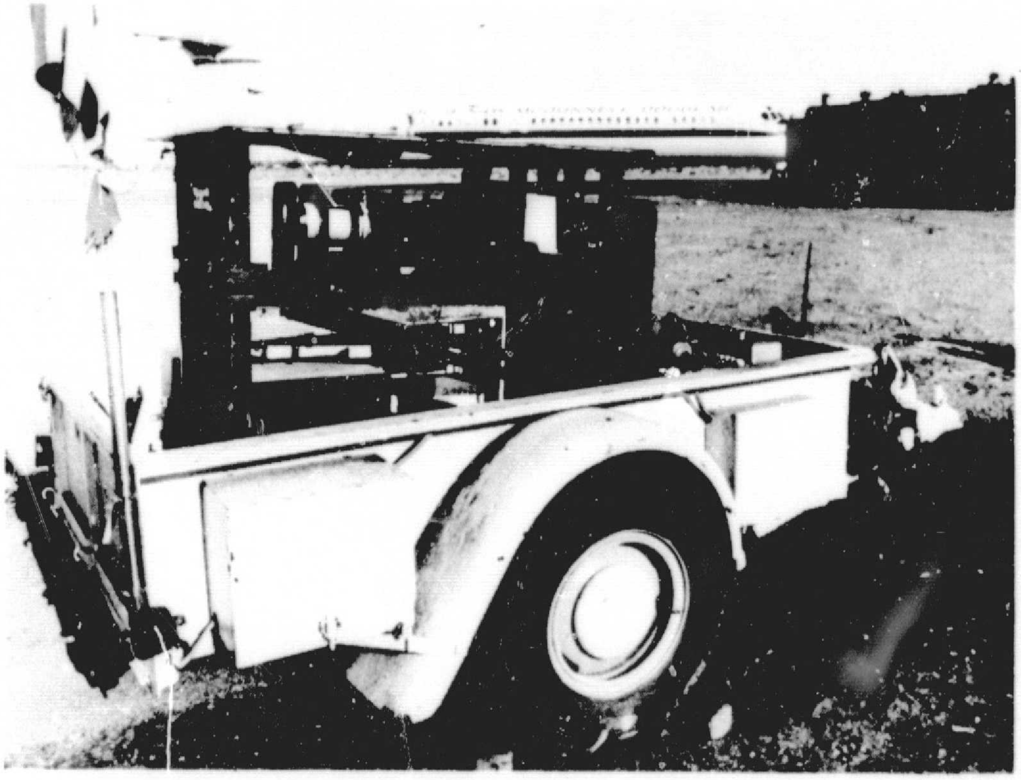


FIGURE 21. PULSED LIGHT VISUAL LANDING AID (PLVLA)

Data Processing Systems

Noise signal recordings were reduced to time-series spectra by the Douglas-developed Controlled Integrating Spectrum Analyzer (CISA) shown in figure 22. Figure 23 is a block diagram of the system, illustrating the data flow and monitoring points. The system consists primarily of a General Radio (GR) 1921 Real-Time Audio Spectrum Analyzer controlled by a small digital computer. An incremental magnetic tape is generated for further data processing within a large-scale digital computer. The GR-1921 is a hybrid spectrum analyzer with 24 analog 1/3-octave-band filters and a digital detector section employing true integration techniques. This analysis system meets the requirements specified in paragraph A36.2(d) of FAR Part 36. Table 2 lists some of the basis characteristics of the major components comprising CISA.

Each flyover-noise recording was digitized by using a 0.5 second integration period mode within the GR-1921, to encompass ambient noise and the 10-PNdB down points both before and after the point of maximum Tone Corrected Perceived Noise Level (PNLTM). The digitizing time-spans were determined from A-weighted-level histories of the flyover-noise recordings.

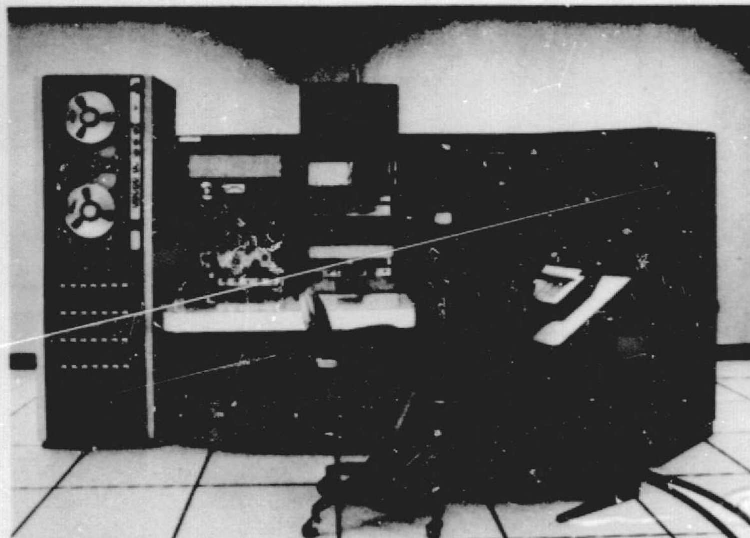
The SPL reference calibration signals, the broadband "pink" random noise, the frequency-response calibration signals, and the ambient noise were digitized for subsequent computer processing. An approximate 10 second period of ambient noise was analyzed for each flyover-noise recording.

The computer program accounts for all gain adjustments applied to the data generated by CISA, normalizes the 1/3-octave-band levels by using reference-level calibration signals of any frequency in the range of interest, adjusts for system frequency response by using recorded broadband-random "pink" noise signals, and accounts for the presence of background noise on an energy basis.

To obtain the maximum degree of repeatability, the "pink" noise frequency response calibration was processed by ensemble averaging of thirty data sample points with 2.3 second integration-time.

The computer program corrects any effects that the ambient noise may have on the flyover-noise SPL's and to ensure that erroneous spectral irregularity corrections are not computed when the flyover-noise levels fall below the ambient noise levels. All flyover-noise levels between 5 dB and 10 dB of the ambient noise were corrected for the presence of the ambient noise on an energy basis. All flyover-noise band levels within 5 dB of the ambient-noise level were deleted

To meet the requirements of FAR Part 36, Paragraph A36.2(d)(4), the computer program performs "moving averages" of three 0.5 second scans (obtained from the CISA 0.5 second integration-time samples) to produce sound pressure values (corresponding to "Slow" on a Sound Level Meter) every 0.5 second. For those engine performance parameters that vary during a flyover, average values were determined over a short time interval (minimum distance divided by 200) centered at time of maximum tone corrected perceived noise level. Other performance parameters that remain constant were obtained from the data tabulations.



CONTROLLED INTEGRATING SPECTRUM ANALYZER (CISA)

FLIGHT DATA CENTER COMPUTING FACILITIES

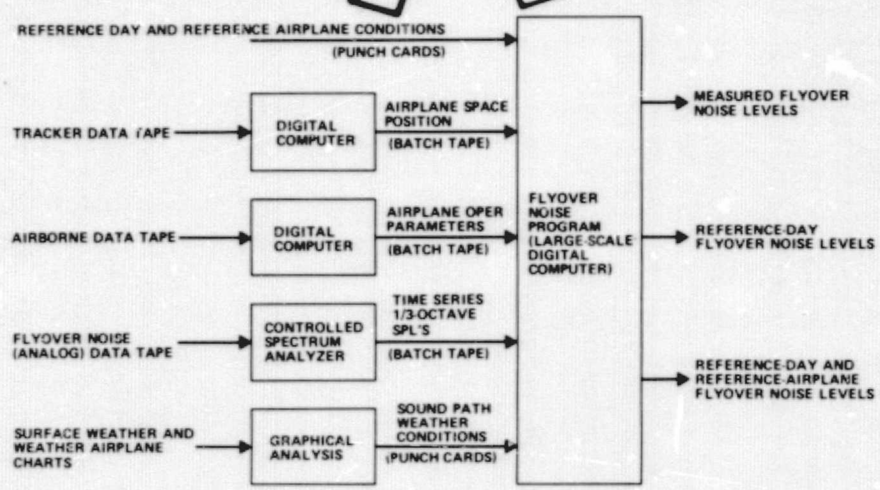


FIGURE 22. FLIGHT DATA CENTER

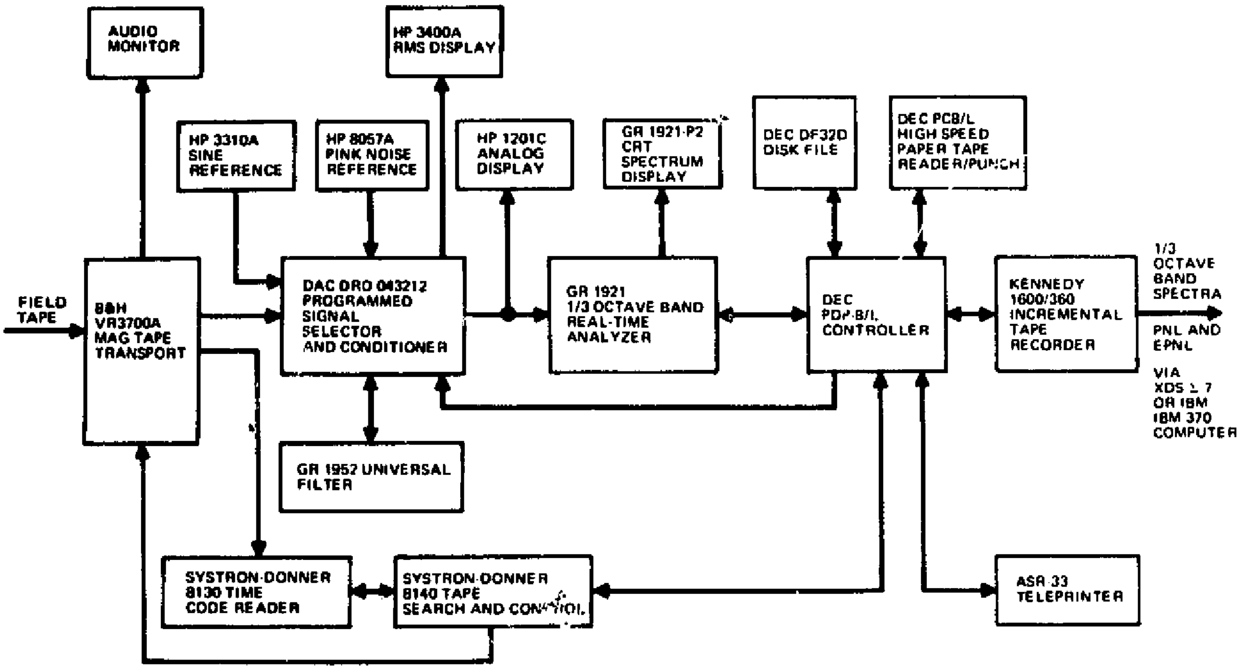


FIGURE 23. CONTROLLED INTEGRATING SPECTRUM ANALYZER (CISA)

TABLE 2

CHARACTERISTICS OF THE CONTROLLED INTEGRATING SPECTRUM ANALYZER (CISA)

I.	GENERAL RADIO 1921 REAL-TIME AUDIO SPECTRUM ANALYZER		
	FILTERS	ONE-THIRD OCTAVE BAND (ANALOG)	
	CHANNELS	30 PARALLEL	
	FREQUENCY RANGE (GMF)	12.5 Hz TO 10 KHz	
	DYNAMIC RANGE	60 dB (DISPLAYED)	
	TYPE OF DETECTOR	DIGITAL (TRUE INTEGRATION)	
	BASIC ACCURACY	±0.5 dB (+1.0 dB OVER ENTIRE AMPLITUDE RANGE)	
	RESOLUTION	±0.25 dB	
	CREST FACTOR CAPACITY	10 dB AT FULL SCALE	
	DETECTOR CHARACTERISTICS	RMS WITH TRUE (LINEAR) INTEGRATION	
	INTEGRATION PERIODS	NOMINAL (SEC)	ACTUAL (SEC)
		1/8	0.111
		1/4	0.231
		1/2	0.500
		1	1.150
		2	2.300
		4	4.600
		8	9.199
		16	18.398
		32	36.794
	DIGITAL OUTPUTS	BCD AND BINARY	
	NOMINAL SENSITIVITY	0.1 VOLTS RMS, FULL SCALE	
II.	DIGITAL EQUIPMENT CORP. PROGRAMMED DATA PROCESSOR (PDP 8/L)		
	MEMORY SIZE	4096 12-BIT WORDS	
	CYCLE TIME	1.6 MICRO-SECONDS	
	I/O FACILITIES	ASR-33 TELETYPE HIGH SPEED PAPER TAPE READER/PUNCH	
	PROGRAM LANGUAGE	PAL III	
III	KENNEDY MODEL 1600/360 INCREMENTAL TAPE RECORDER		
	TAPE DENSITY	800 BPI	
	WRITING SPEED	500 CHAR/SEC	
	TAPE	1/2 INCH COMPUTER TAPE	
	TAPE FORMAT	IBM SYSTEM/360 COMPATIBLE 9 TRACK NR	
	CONTINUOUS READ CAPABILITY		
IV	SYSTRON DONNER 8130 TIME CODE TRANSLATOR		
	CODE	MODIFIED IRIG B	
	CODE OUTPUT	BCD OF HOUR, MINUTE, AND SECOND	
V	BELL & HOWELL VR-3700A CEC/DATATAPE		
	TRACKS	14	
	SPEED	3 3/4 IPS TO 120 IPS	
	TAPE	1-INCH WIDTH	
	MODE	FM	
	BANDWIDTH (±3 dB)	DC 10,000 Hz AT 30 IPS IN FM MODE	
VI	PROGRAMMED SIGNAL SELECTOR AND CONDITIONER		
	ATTENUATION	16.2 dB STEPS	
	ACCURACY	±0.1 dB/STEP	
VII	SYSTEM OUTPUT AND TIMING		
	MAGNETIC TAPE OUTPUT FORMAT	BINARY AND ASCII	
	CONTENTS	BAND NO. LEVEL (dB) PLUS IDENTIFICATION	
	24 CHANNEL GR1921/PDP 8 DATA TRANSFER	1.3 MSEC (TOTAL TIME PER INTEGRATION PERIOD THAT NOISE DATA IS NOT BEING ANALYZED)	

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A computer program was used to edit and combine the measured 1/3-octave band levels from the CISA system, the space-positioning data generated by MALT, the airplane-performance data as recorded by the ADDS, and the meteorological data from MART. The resulting magnetic tape was then input to another Douglas-developed computer program for subsequent data analyses.

DATA ANALYSIS AND CONFIDENCE

Data Analysis

The magnetic tape generated by the digital computing system is the source of input data for an IBM 360 computer program used to process the flyover-noise data, to calculate test and reference EPNL's and peak A-weighted sound levels.

A flow diagram of that Douglas-developed computer program is shown in figure 24. The computer print out can provide a variety of selectable data presentation formats. One of the basic data presentations available is the measured SPL history that provides 1/3-octave band spectra at 0.5 second intervals. Other data also presented at these same intervals are: overall SPL (OASPL), A-weighted sound level dB(A), perceived noise level (PNL), tone corrected perceived noise level (PNLT), acoustic range, and optical range.

A number of corrections must be applied to the measured data to account for differences between test conditions and required reference conditions. The parameters which must be adjusted to reference conditions are temperature, relative humidity, flight path, referred net thrust, and airplane path speed. Temperature and relative humidity adjustments affect noise attenuation during propagation along the sound path as calculated according to the procedures of ARP 866. Flight path adjustments affect sound attenuation due to noise path distance changes, but in addition the duration correction is also affected. The airplane path speed adjustment also requires a change in the duration correction factor. The application of all the preceding corrections excepting the thrust and path speed corrections is as specified in FAR Part 36, paragraph A36.6.

The thrust correction is actually derived from the weight correction and approach angle correction as discussed in the above referenced paragraph, but a brief explanation of its implementation should help clarify its application. Measured data obtained during regular and correction runs are corrected to reference weather, distance, and airspeed to provide EPNL values at a range of thrusts at each of the FAR Part 36 measurement locations. A plot of EPNL vs referred net thrust (FN/δ) is made for sideline, takeoff, cutback, and approach as required. A thrust correction factor is then found from these plots for each of these measurement locations at reference conditions. This thrust correction factor can be input to the computer program to be used in adjusting measured thrust to reference thrust.

The path speed correction, although not originally included in FAR Part 36, was specified later by the Federal Aviation Administration. This correction is calculated by the following formula $\Delta EPNL = 10 \log_{10}$ (test airspeed/reference airspeed).

Studies using flush microphones have shown that ground reflections sometimes produce pseudotones at low frequencies. As a result of these studies, computer calculated tone corrections having tone correction frequencies 630 Hz and below have been removed.

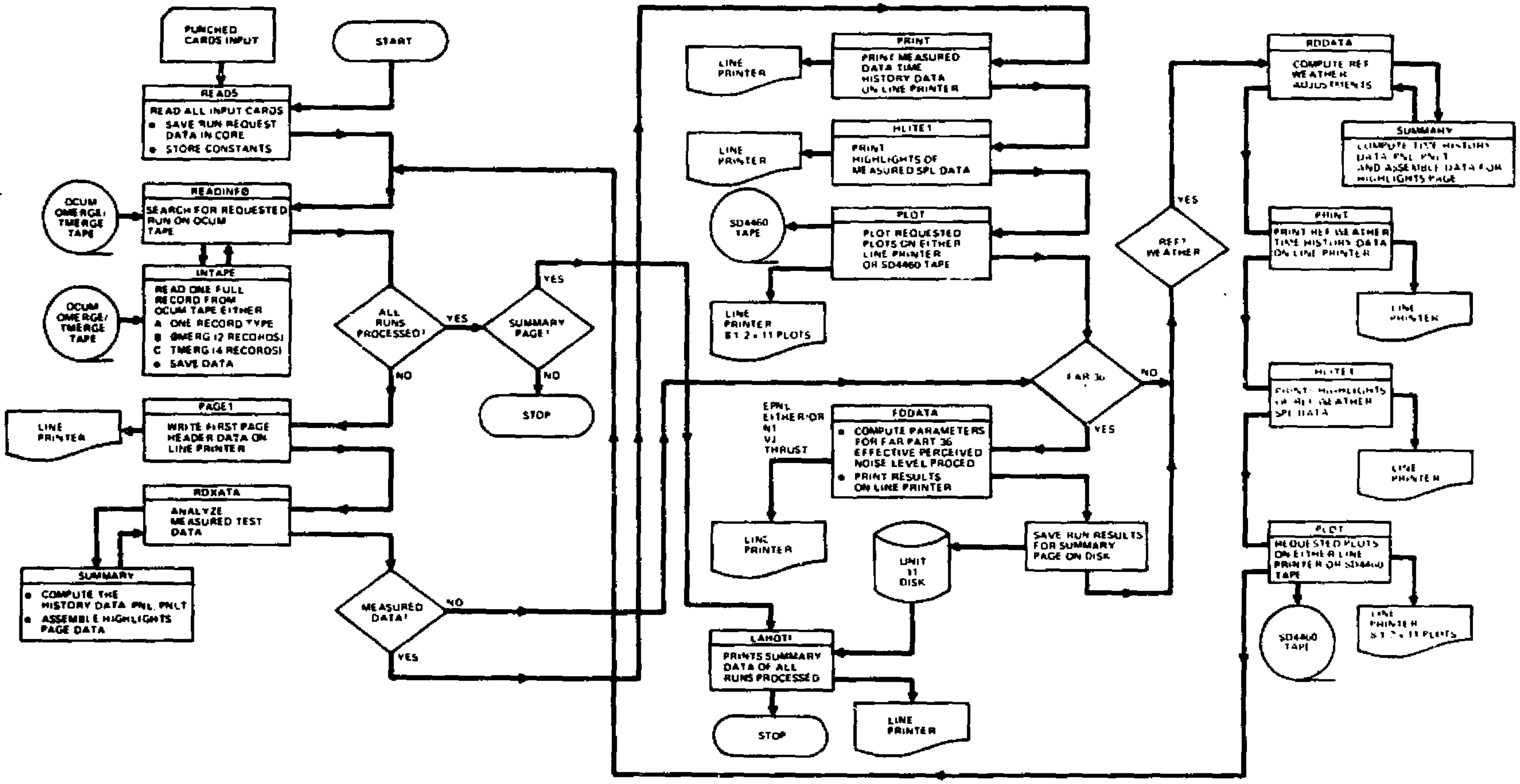

FIGURE 24. FLOW DIAGRAM OF IBM 360 NOISE COMPUTER PROGRAM

Data Confidence

The statistical accuracy based on 166 points is tabulated in table 3 in terms of the 90 percent confidence limits. The noise data used were measured at the centerline microphones, corrected to reference-weather conditions, adjusted to the reference airspeed, and normalized to a particular altitude. No adjustment was made in the measured thrust.

The data values were grouped into sets according to the aircraft flight condition (i.e., takeoff, takeoff with cutback, and approach) and adjusted to a common altitude by the technique shown in figure 25. The sample data point was adjusted from its measured CPA of 2040 feet to a common slant range of 2270 feet along a path parallel to a segment of the 13,000 pound thrust curve from figure 32. Applying a ΔEPNL of -1.7 EPNdB to the measured 97.9 EPNdB (at CPA) results in an EPNL of 96.2. Each data point was similarly adjusted to 2270 feet, and the percent confidence limits of the eight data points were determined by using the small-sample t-distribution method (page 244 of reference 5) as follows:

The 90 percent confidence limits, μ, for a small-sample is given by

$$\mu = \bar{X} \pm t_{(.05)} \frac{S}{\sqrt{n}}$$

where $t_{(.05)}$ is the distribution factor that depends on the number of samples,

$$S = \sqrt{\frac{(X_1-\bar{X})^2 + (X_2-\bar{X})^2 + (X_n-\bar{X})^2}{n-1}},$$

and $\bar{X}$ is the average of n samples consisting of $X_1, X_2, \ldots, X_n$.

Confidence limits were calculated for several slant ranges (normalized altitude) and power settings. The results, shown in table 3, indicate the 90 percent confidence limits are less than $\pm$ 0.8 EPNdB for all aircraft flight conditions and altitudes.

TABLE 3
DC-9 REFAN FLYOVER-NOISE CONFIDENCE LIMITS

FLIGHT CONDITION	ALTITUDE TO WHICH DATA WERE NORMALIZED, FEET (m)	AVERAGE THRUST F_N/δ, LB (N)	NO. OF DATA POINTS	90-PERCENT CONFIDENCE LIMITS (EPNdB)
TAKEOFF	500 (152.1)	13,635 (60,648)	4	±0.72
	1000 (304.8)	13,606 (60,519)	4	±0.60
	2200 (670.6)	13,690 (60,893)	3	±0.76
	2270 (691.4)	13,748 (61,151)	8	±0.59
CUTBACK	2270 (691.4)	9,070 (40,343)	10	±0.41
APPROACH 50° FLAPS	370 (112.8)	5,742 (25,540)	23	±0.51
	400 (121.3)	5,762 (25,629)	12	±0.76
	550 (167.6)	5,579 (24,815)	12	±0.66
	800 (243.8)	5,746 (25,558)	11	±0.78
	1220 (371.9)	3,113 (13,847)	9	±0.56
	1810 (551.7)	3,313 (14,736)	7	±0.64
APPROACH 35° FLAPS	370 (112.8)	3,711 (16,506)	24	±0.23
	400 (121.3)	3,803 (16,916)	12	±0.44
	550 (167.6)	3,732 (16,600)	14	±0.32
	800 (243.8)	3,776 (16,796)	13	±0.63

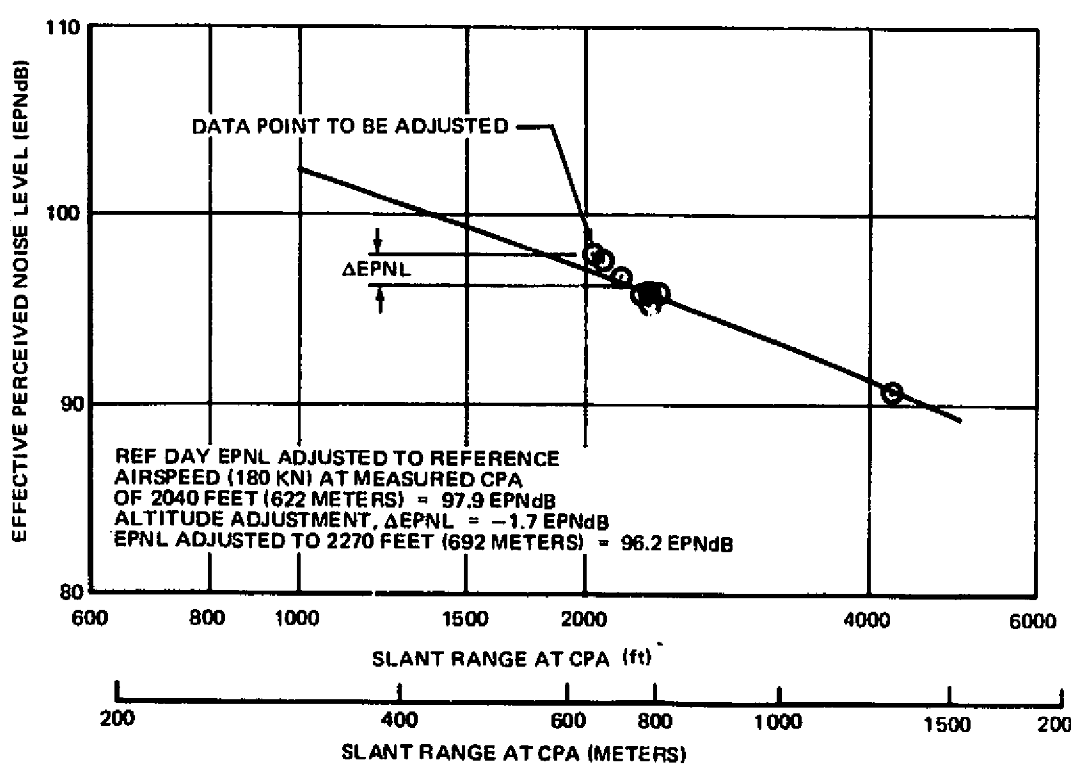

FIGURE 25. DATA POINT ALTITUDE ADJUSTMENT

NOISE LEVELS AT FAR PART 36 LOCATIONS

The effective perceived noise levels (EPNL) for the FAR Part 36 conditions for sideline, takeoff with and without cutback, and approach flights were determined. Selected test data were analyzed according to procedures defined in FAR Part 36, Appendix A, Section A36.6 (reference 4). The statistical confidence limits associated with the noise levels presented are included.

The FAR Part 36 noise levels were calculated using aerodynamic reference conditions without pitch limit for the Refan aircraft and with a 0.272 rad (15.6 deg) pitch limit for both the C9A and the October 1974 baseline hardwall nacelle airplanes. The pitch limit was used for the hardwall airplanes in order to be consistent with existing certification noise data.

Sideline

Four microphones located to the left of the extended runway centerline (locations S0, S19, S16, and S18, figure 15) and one located to the right of centerline (location S20, the symmetrical microphone to S16, figure 15) were used to record sideline noise during six takeoff runs.

By FAR Part 36 procedures, sideline noise levels must be measured during regular takeoff runs. For these tests, the data were acquired during takeoff runs which include a thrust cutback. To show that the microphone location selected for sideline measurements represents the point of maximum sideline noise during takeoff, EPNL values measured at the five sideline locations were plotted as a function of aircraft distance from brake release (DFBR). Figure 26 shows the curve faired through the average values of EPNL. The data were adjusted to the reference aircraft conditions of thrust altitude and airspeed along the flight path. Since application of reference thrust to the noise levels measured at S18 was impractical due to thrust cutback during this period, noise levels were normalized to the average thrust of the six runs. The data plotted for S18 reflect this normalization. Figure 26 shows that the maximum noise along the 463 meter (0.25 N Mi) sideline occurs at a DFBR of approximately 3900 meters (12,750 ft) at microphone locations S16 and S20.

The effect of aircraft altitude on sideline EPNL is presented in figure 27. It shows that the maximum sideline noise level may occur at aircraft altitudes of 214 meters (700 ft) to 305 meters (1,000 ft.).

Test day EPNL values shown in figure 28 were used to establish a correction curve from which thrusts of individual runs were adjusted to that of the reference thrust. The reference sideline noise level was obtained from the average of the six runs listed in table 4. The maximum sideline noise reference EPNL values are listed in table 5 for an aircraft takeoff gross weight of 48,988 kg (108,000 lb) using zero degree flap and 6% overspeed. These values, obtained from the averaged EPNL levels of microphone S16 and S20 were taken from test runs 11, 12, and 16 through 19. Removal of tones due to ground refelections was performed on EPNL values where tones appeared at frequencies of 630 Hertz or less. The average EPNL values for the FAR Part 36 reference sideline noise level is 95.3 EPNdB.

The EPNL values shown in figure 28 may show a slight difference from the average FAR Part 36 reference sideline noise levels because the correction run flap settings, climb gradients, and altitude are different than the FAR Part 36 reference conditions. The correction runs are only performed to determine the relative variation in EPNL versus thrust, not absolute levels. The airplane was flown at a reference airspeed and power setting with various flap angles and climb gradients used to maintain that airspeed. Therefore, slightly different noise levels are to be expected.

Appendix C contains supporting summary computer listings of the aircraft performance (table C-1.1) and flyover-noise data (table C-2). It includes a flyover-noise analysis computer program print out for Run 16, microphone location S16, which is typical of the sideline noise data (table C-7.1).

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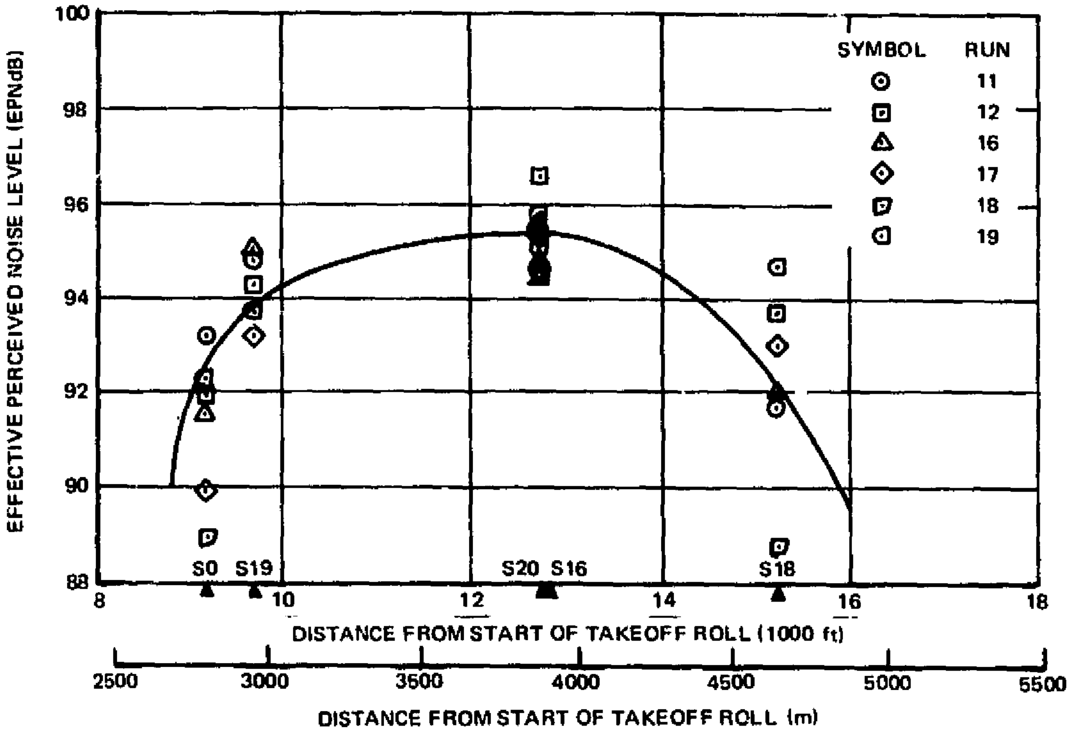

FIGURE 26. VARIATION OF SIDELINE NOISE LEVEL WITH DISTANCE FROM BRAKE RELEASE

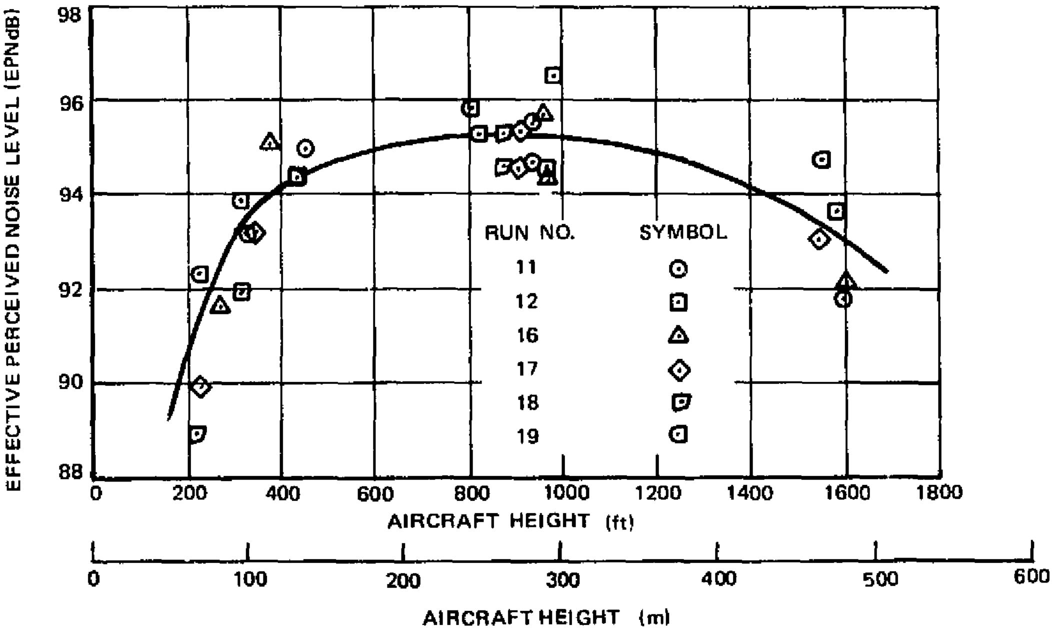

FIGURE 27. VARIATION OF SIDELINE NOISE LEVEL WITH AIRCRAFT HEIGHT

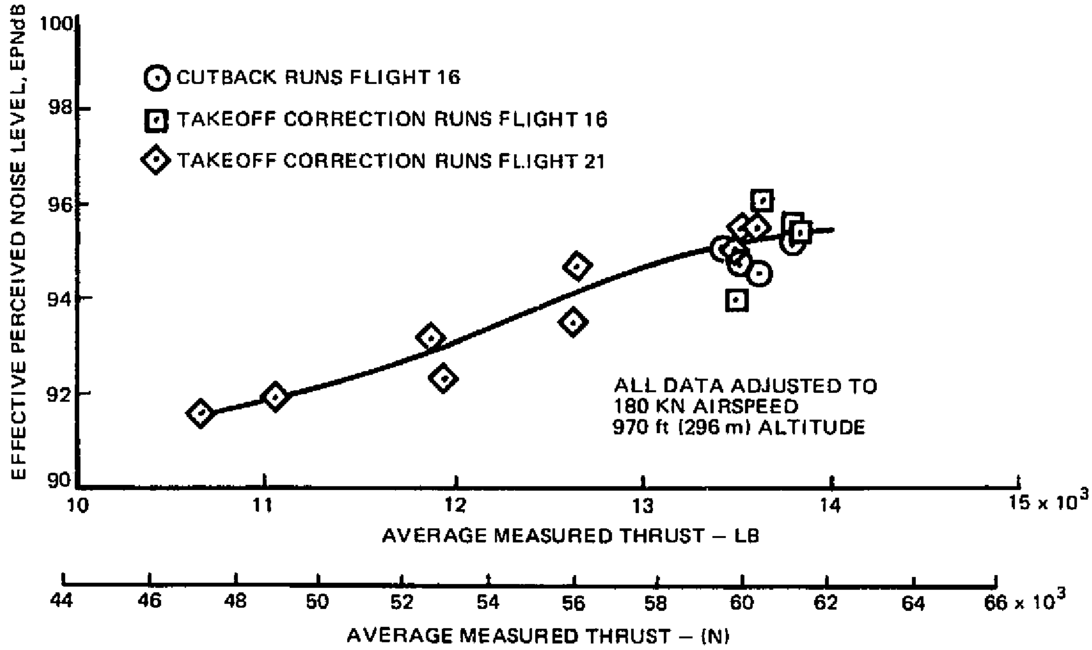

FIGURE 28. VARIATION OF DC-9 REFAN FAR PART 36 SIDELINE NOISE LEVEL WITH THRUST

TABLE 4
SUMMARY OF FAR PART 36 SIDELINE FLYOVER-NOISE DATA

MODEL DC-9-31 FUSELAGE NO. 741 REGISTRATION NO. N54638 TEST DATE 1-29-75

DC-9 REFAN SIDELINE REFERENCE CONDITION CHANGE
*REFERENCE CONDITIONS
PATH SPEED= 176.8 KN, FN/D=13721.0 LBS

ITEM / CASE	1	2	3	4	5	6
FLIGHT NUMBER	16	16	16	16	16	16
RUN NUMBER	11	11	12	12	16	16
MICROPHONE LOCATION	16	20	20	16	16	20
MICROPHONE NUMBER	9	10	10	9	9	10
AMBIENT TEMPERATURE (DEG F)	51.2	51.2	52.1	52.1	52.5	52.5
RELATIVE HUMIDITY (PERCENT)	36.0	36.0	34.0	34.0	35.1	35.1
GROSS WEIGHT (1000 LBS)	106	106	105	105	100	100
FLAP ANGLE (DEG)	UP2.1	UP2.1	UP2.1	UP2.1	UP2.1	UP2.1
CALCULATED EPR	1.731	1.731	1.724	1.726	1.729	1.732
AIRCRAFT PATH SPEED (KNOTS)	176.1	176.1	176.5	176.3	175.0	175.0
AIRPLANE HEIGHT (FEET)	940.	951.	976.	966.	958.	968.
MEAS. MIN. DISTANCE (FEET)	1784.	1700.	1692.	1821.	1779.	1724.
REF. MIN. DISTANCE (FEET)	1789.	1789.	1802.	1802.	1798.	1798.
MEAS. NOISE PATH DIST.(FEET)	1898.	1819.	2033.	1905.	1856.	1919.
REF. NOISE PATH DIST. (FEET)	1896.	1896.	2111.	1885.	1874.	1970.
NOISE DIRECTION (DEG)	70.0	69.2	56.3	72.9	73.4	63.9
X COORD. MICROPHONE (FEET)	538.	555.	555.	538.	538.	555.
Y COORD. MICROPHONE (FEET)	-1461.	1464.	1464.	-1461.	-1461.	1464.
Z COORD. MICROPHONE (FEET)	4.	-9.	-9.	4.	4.	-9.
AVE. MEASURED FN (LBS)	12934.	12934.	12775.	12836.	12895.	12889.
AVE. MEAS REFERRED FN (LBS)	13521.	13521.	13404.	13420.	13485.	13503.
PNLTM TIME REF. TO O.H.(SEC)	4.1	4.2	5.9	3.9	3.7	4.8
PNLTM MEASURED (PNDB)	98.9	99.4	98.5	98.7	98.5	99.0
PNLM TIME REF. TO O.H. (SEC)	4.1	4.2	5.9	3.9	3.7	4.8
PNLM MEASURED (PNDB)	96.6	97.7	97.4	96.6	96.1	97.3
PNLTM ADJUSTED (PNDB)	99.4	99.4	98.4	99.4	98.9	99.1
MAXIMUM NOY FREQUENCY (GMF)	315	500	250	500	500	250
TONE CORRECTION (PNDB)	2.3	1.6	1.0	2.1	2.4	1.7
TONE CORRECTION FREQ. (GMF)	500	500	500	500	500	500
DURATION CORRECTION FACTOR	-2.3	-2.5	-1.2	-2.8	-2.2	-1.9
EPNL MEASURED (EPNDB)	96.6	96.9	97.3	95.9	96.3	97.1
DELTA 1 (ARP866) (EPNDB)	0.5	0.0	-0.1	0.6	0.3	0.2
DELTA 2 (EPNDB)	0.0	0.2	0.3	-0.0	0.0	0.2
DELTA 3 (EPNDB)	-0.0	-0.0	-0.0	-0.0	-0.0	-0.0
DELTA FN/D (EPNDB)	0.2	0.2	0.3	0.3	0.2	0.2
EPNL REF. FN/D (EPNDB)	97.3	97.3	97.8	96.7	96.9	97.6

TABLE 4 (CONTINUED)

SUMMARY OF FAR PART 36 SIDELINE FLYOVER-NOISE DATA

MODEL DC-9-31 FUSELAGE NO. 741 REGISTRATION NO. N54638 TEST DATE 1-29

DC-9 REFAN SIDELINE REFERENCE CONDITION CHANGE
*REFERENCE CONDITIONS
PATH SPEED= 176.9 KN, FN/D=13721.0 LBS

ITEM / CASE	7	8	9	10	11	12
FLIGHT NUMBER	16	16	16	16	16	16
RUN NUMBER	17	17	18	18	19	19
MICROPHONE LOCATION	16	20	16	20	16	20
MICROPHONE NUMBER	9	10	9	10	9	10
AMBIENT TEMPERATURE (DEG F)	53.6	53.6	55.4	55.4	56.5	56.5
RELATIVE HUMIDITY (PERCENT)	35.5	35.5	32.8	32.8	30.4	30.4
GROSS WEIGHT (1000 LBS)	99	99	98	98	97	97
FLAP ANGLE (DEG)	UP2.1	UP2.1	UP2.1	UP2.1	UP1.9	UP1.9
CALCULATED EPR	1.730	1.730	1.737	1.736	1.747	1.748
AIRCRAFT PATH SPEED (KNOTS)	173.6	174.0	173.5	173.5	173.4	173.6
AIRPLANE HEIGHT (FEET)	912.	922.	872.	882.	814.	827.
MEAS. MIN. DISTANCE (FEET)	1770.	1684.	1748.	1664.	1708.	1647.
REF. MIN. DISTANCE (FEET)	1774.	1774.	1754.	1754.	1725.	1725.
MEAS. NOISE PATH DIST.(FEET)	1861.	1886.	1874.	1856.	1749.	1773.
REF. NOISE PATH DIST. (FEET)	1860.	1959.	1874.	1927.	1763.	1838.
NOISE DIRECTION (DEG)	72.0	63.2	68.9	63.7	77.6	68.2
X COORD. MICROPHONE (FEET)	538.	555.	538.	555.	538.	555.
Y COORD. MICROPHONE (FEET)	-1461.	1464.	-1461.	1464.	-1461.	1464.
Z COORD. MICROPHONE (FEET)	4.	-9.	4.	-9.	4.	-9.
AVE. MEASURED FN (LBS)	12938.	12900.	13015.	13005.	13205.	13204.
AVE. MEAS REFERRED FN (LBS)	13506.	13490.	13586.	13589.	13736.	13762.
PNLTM TIME REF. TO O.H.(SEC)	3.9	4.9	4.2	4.8	3.0	4.1
PNLTM MEASURED (PNDB)	98.8	99.4	97.9	99.9	99.9	99.7
PNLM TIME REF. TO O.H. (SEC)	3.4	4.9	4.2	4.8	3.0	4.1
PNLM MEASURED (PNDB)	96.6	97.3	95.9	97.8	98.2	97.7
PNLTM ADJUSTED (PNDB)	99.3	99.4	98.3	100.0	100.5	99.9
MAXIMUM NOY FREQUENCY (GMF)	500	250	315	250	315	315
TONE CORRECTION (PNDB)	2.3	2.1	2.0	2.1	1.7	2.0
TONE CORRECTION FREQ. (GMF)	500	500	500	500	500	500
DURATION CORRECTION FACTOR	-2.7	-2.1	-1.6	-2.8	-2.8	-2.6
EPNL MEASURED (EPNDB)	96.1	97.3	96.3	97.1	97.1	97.2
DELTA 1 (ARP866) (EPNDB)	0.5	-0.0	0.4	0.1	0.6	0.1
DELTA 2 (EPNDB)	0.0	0.2	0.0	0.2	0.0	0.2
DELTA S (EPNDB)	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
DELTA FN/D (EPNDB)	0.2	0.2	0.1	0.1	-0.0	-0.0
EPNL REF. FN/D (EPNDB)	96.7	97.7	96.8	97.4	97.7	97.4

TABLE 5

FAR PART 36 SIDELINE REFERENCE NOISE LEVEL

REFERENCE CONDITIONS

GROSS WEIGHT	LB (KG)	108,000 (48,988)
FLAP SETTING — OVERSPEED	(DEG-PERCENT)	0-6
V_{TAS}	KNOTS)	176.8
REFERRED F_N/δ	LB (N)	13,721 (61,031)
MICROPHONE LOCATION		AVERAGE OF S16/S20
MICROPHONE NUMBER		9/10

	MICROPHONE LOCATION S16		MICROPHONE LOCATION S20		AVERAGE LOC S16 AND S20
RUN NUMBER	TONE CORRECTION INCLUDED (EPNdB)	TONE CORRECTION REMOVED (EPNdB)	TONE CORRECTION INCLUDED (EPNdB)	TONE CORRECTION REMOVED (EPNdB)	TONE CORRECTION REMOVED AVERAGE (EPNdB)
11	97.3	95.0	97.3	95.7	95.4
12	96.7	94.6	97.8	96.8	95.7
16	96.9	94.5	97.6	95.9	95.2
17	96.7	94.4	97.7	95.6	95.0
18	96.8	94.8	97.4	95.3	95.0
19	97.7	96.0	97.4	95.4	95.7
REFERENCE NOISE LEVEL (EPNdB)					95.3
90-PERCENT CONFIDENCE LEVEL (EPNdB)					±0.3
REQUIREMENT (EPNdB)					103.1

Takeoff

Reference noise levels for takeoff without power cutback were determined from measurements obtained at a location 3.5 N Mi from brake release (location C6 in figure 15).

The measured data for the six test runs, adjusted to the reference condition, were averaged to obtain the reference takeoff noise level and are listed in table 6 . A plot of the takeoff noise levels from the takeoff correction runs at various power settings is shown in figure 29. From this figure, adjustments for thrust differences from the reference conditions were obtained and applied.

The reference EPNL value for takeoff with a gross weight of 48,988 kg (108,000 lb) and 0° flap setting with 6 percent overspeed is presented in table 7 . It was obtained from the average of noise levels from test runs 9, 10, 13, 53, 54 and 55. The FAR Part 36 reference takeoff noise level is 96.2 EPNdB.

The EPNL values shown in figure 29 may show a slight difference from the average FAR Part 36 reference takeoff noise levels because the correction run flap settings, climb gradients, and altitude are different than the FAR Part 36 reference conditions. The correction runs are only performed to determine the relative variation in EPNL versus thrust, not absolute levels. The airplane was flown at a reference airspeed and power setting with various flap angles and climb gradients used to maintain that airspeed. Therefore, slightly different noise levels are to be expected.

Appendix C includes supporting summary computer listings of the aircraft performance (table C-7.2) and flyover-noise data (table C-7.3). Also, a more detailed flyover-noise computer program print out for test run 10 was included as typical of the takeoff noise data (table C-7.2).

TABLE 6

SUMMARY OF FAR PART 36 TAKEOFF FLYOVER-NOISE DATA

MODEL DC-9-31 FUSELAGE NO. 741 REGISTRATION NO. N54638 TEST DATE 1-29-75

DC-9 REFAN TAKEOFF WITHOUT CUTBACK SLOPE FROM FINAL CORR CURVE
*REFERENCE CONDITIONS
PATH SPEED= 180.3 KN, FN/D=13891.0 LBS

ITEM / CASE		1	2	3	4	5	6
FLIGHT NUMBER		16	16	16	21	21	21
RUN NUMBER		13	9	10	53	54	55
MICROPHONE LOCATION		C6	C6	C6	C6	C6	C6
MICROPHONE NUMBER		1	1	1	1	1	1
AMBIENT TEMPERATURE	(DEG F)	52.5	48.8	50.4	55.1	55.3	56.6
RELATIVE HUMIDITY	(PERCENT)	36.1	41.4	34.5	41.8	42.5	41.9
GROSS WEIGHT	(1000 LBS)	104	109	106	109	107	106
FLAP ANGLE	(DEG)	UP2.1	UP2.1	UP2.1	UP1.7	UP2.0	UP2.1
CALCULATED EPR		1.758	1.749	1.757	1.745	1.737	1.735
AIRCRAFT PATH SPEED	(KNOTS)	177.1	179.6	178.3	181.3	179.8	179.4
AIRPLANE HEIGHT	(FEET)	2382.	2316.	2428.	2062.	2117.	2208.
MEAS. MIN. DISTANCE	(FEET)	2352.	2295.	2403.	2040.	2090.	2187.
REF. MIN. DISTANCE	(FEET)	2443.	2443.	2443.	2443.	2443.	2443.
MEAS. NOISE PATH DIST.	(FEET)	2899.	2757.	2919.	2609.	2156.	2497.
REF. NOISE PATH DIST.	(FEET)	3011.	2935.	2968.	3124.	2519.	2790.
NOISE DIRECTION	(DEG)	54.2	56.3	55.4	51.5	75.9	61.1
X COORD. MICROPHONE	(FEET)	-7301.	-7301.	-7301.	-7301.	-7301.	-7301.
Y COORD. MICROPHONE	(FEET)	0.	0.	0.	0.	0.	0.
Z COORD. MICROPHONE	(FEET)	-81.	-81.	-81.	-81.	-81.	-81.
AVE. MEASURED FN	(LBS)	12517.	12484.	12538.	12724.	12666.	12543.
AVE. MEAS REFERRED FN	(LBS)	13859.	13750.	13876.	13782.	13661.	13631.
PNLTM TIME REF. TO O.H.	(SEC)	7.6	7.2	7.8	7.4	3.3	5.8
PNLTM MEASURED	(PNDB)	96.7	96.1	96.2	99.0	99.3	97.7
PNLM TIME REF. TO O.H.	(SEC)	7.6	5.2	7.8	7.4	3.3	5.8
PNLM MEASURED	(PNDB)	95.7	95.4	95.4	98.2	98.3	96.7
PNLTM ADJUSTED	(PNDB)	96.3	95.3	96.1	97.0	97.6	96.5
MAXIMUM NOY FREQUENCY	(GMF)	315	315	315	200	315	315
TONE CORRECTION	(PNDB)	1.0	0.9	0.8	0.9	1.0	1.0
TONE CORRECTION FREQ.	(GMF)	315	315	315	200	315	315
DURATION CORRECTION FACTOR		0.2	0.6	0.4	-0.3	-0.4	0.1
EPNL MEASURED	(EPNDB)	96.9	96.7	96.6	98.8	98.8	97.8
DELTA 1 (ARP866)	(EPNDB)	-0.4	-0.8	-0.1	-2.0	-1.6	-1.2
DELTA 2	(EPNDB)	0.2	0.3	0.1	0.8	0.7	0.5
DELTA S	(EPNDB)	-0.1	-0.0	-0.0	0.0	-0.0	-0.0
DELTA FN/D	(EPNDB)	0.0	0.1	0.0	0.1	0.2	0.3
EPNL REF. FN/D	(EPNDB)	96.6	96.3	96.5	97.7	98.1	97.3

TABLE 7
FAR PART 36 TAKEOFF REFERENCE NOISE LEVELS

REFERENCE CONDITIONS		
GROSS WEIGHT	LB (KG)	108,000 (48,988)
FLAP SETTING – OVERSPEED	(DEG-PERCENT)	0-6
HEIGHT AT 3.5 N MI	ft (m)	2472 742)
CLIMB GRADIENT	PERCENT	15.54
V_{TAS}	(KNOTS)	180.3
REFERRED F_N/δ	LB (N)	13,891 (61,787)
MICROPHONE LOCATION		C6
MICROPHONE NUMBER		1

RUN NUMBER	TONE CORRECTION INCLUDED (EPNdB)	TONE CORRECTION REMOVED (EPNdB)
9	96.3	95.4
10	96.5	95.7
13	96.6	95.6
53	97.7	96.8
54	98.1	97.1
55	97.3	96.3
REFERENCE NOISE LEVEL (EPNdB)		96.2
90-PERCENT CONFIDENCE LEVEL (EPNdB)		±0.6
REQUIREMENT (EPNdB)		95.6

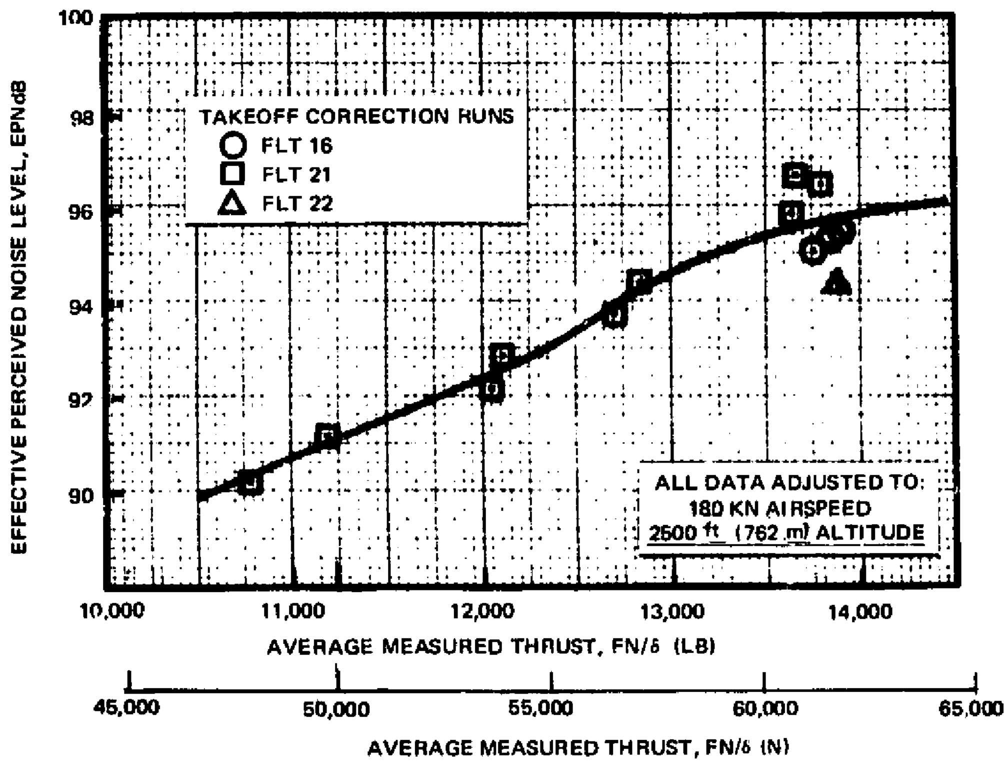

FIGURE 29. VARIATION OF DC-9 REFAN FAR PART 36 TAKEOFF NOISE LEVEL WITH THRUST

Takeoff With Cutback

Reference noise levels for takeoff with power cutback were determined from measurements obtained at a location 3.5 N Mi from brake release (location C6 in figure 15).

To insure that stabilized cutback power conditions were reached before the noise measurement point, several cutback correction test runs were made. Table 8 presents the test aircraft speed, elapsed times between start of cutback and the time where the EPNL noise level was 10 dB down from the maximum, and the average elapsed time of all the test runs. From this information, the average cutback distance before the monitor was found to be 1014 m (3327 ft), indicating that the cutback in engine power was stabilized and that the measured noise levels were not affected by engine spooldown. Further evaluation indicated that spooldown was complete by 300 m (986 ft), however, to eliminate noise produced before cutback from affecting the 10 dB down point, the cutback distance before the monitor, based on results from the correction runs, was 915 m (3,000 ft). This value was used for all cutback reference determinations. The measured test data for the six runs averaged to obtain the reference takeoff with cutback noise level are listed in table 9 .

The noise adjustment curve used for takeoff with cutback for various power settings is shown in figure 30. Noise levels from the six test runs were adjusted to the reference takeoff with cutback performance conditions for a gross weight of 48,988 kg (108,000 lb) and 0° flap setting with 6 percent overspeed. Tone corrections were removed by using the criteria discussed above. The average reference EPNL for test runs 11, 12 and 16 through 19 was determined. The FAR Part 36 reference for takeoff with cutback noise level is 87.5 EPNdB.

The EPNL values shown in figure 30 may show a slight difference from the average FAR Part 36 reference takeoff cutback noise levels because the correction run flap settings, climb or descent gradients, and altitude are different than the FAR Part 36 reference conditions. The correction runs are only performed to determine the relative variation in EPNL versus thrust, not absolute levels. The airplane was flown at a reference airspeed and power setting with various flap angles and climb or descent gradients used to maintain that airspeed. Therefore, slightly different noise levels are to be expected.

Appendix C, contains supporting computer listings of aircraft performance and flyover-noise data are presented in tables C-1.3 and C-4. Table C-7.3 includes the flyover-noise computer program print out for test Run 16, which is typical of the data for takeoff with cutback.

TABLE 8

CUTBACK DISTANCE DETERMINATION

RUN NUMBER	AIRSPEED (KNOTS)	AIRSPEED, ft/SEC (m/SEC)	START OF CUTBACK TIME	TIME OF COMPLETE CUTBACK	SPOOLDOWN TIME (SEC)	TIME OF OVERHEAD AT C6	TIME OF OVERHEAD AT C6 – START OF CUTBACK TIME (SEC)	DISTANCE ALONG FLIGHT PATH FROM CUTBACK TO C6, ft (m)	SPOOLDOWN DISTANCE ALONG FLIGHT PATH ft (m)	GROUND DISTANCE FROM CUTBACK TO C6, ft (m)	1ST 10 dB DOWN TIME PNLT C6	2ND 10 dB DOWN C6	PNL TM AT C6
11	175.4	296.1 (90.3)	9-55-57.0	9-56-01.0	4.0	9-56-02.7	5.7	1687.8 (514.4)	1184.4 (361.0)	1682.4 (512.8)	9-55-56.0	9-56-18.5	9-56-08.5
12	175.3	295.9 (90.2)	10-3-42.0	10-3-45.5	3.5	10-3-53.4	11.4	3373.3 (1028.2)	1035.6 (315.6)	3359.4 (1023.9)	10-3-49.5	10-4-11.0	10-4-00.0
16	174.4	294.4 (89.7)	10-42-37.5	10-42-40.0	2.5	10-42-49.9	12.4	3650.6 (1112.7)	736.0 (224.3)	3641.7 (1110.0)	10-42-45.5	10-43-0.5	10-42-56.0
17	176.8	298.4 (90.9)	10-49-52.5	10-49-56.0	3.5	10-50-06.6	14.1	4207.4 (1282.4)	1044.4 (318.3)	4195.6 (1278.8)	10-50-02.5	10-50-22.5	10-50-11.5
18	175.0	295.[illegible] (90.0)	11-0-19.5	11-0-22.5	3.0	11-0-32.1	12.6	3722.0 (1134.5)	886.2 (270.1)	3709.5 (1130.7)	11-0-27.5	10-0-46.0	11-0-38.5
19	174.7	294.9 (89.9)	11-17-40.0	11-17-43.5	3.5	11-17-51.5	11.5	3391.4 (1033.7)	1032.1 (314.6)	3374.0 (1028.4)	11-17-47.5	11-18-08.0	11-17-56.5

AVERAGE 3327.1 (1014.1)

NOTE: ALL TIMES ARE IN TERMS OF HR:MIN:SEC EXCEPT WHERE NOTED OTHERWISE

TABLE 9

SUMMARY OF FAR PART 36 TAKEOFF WITH CUTBACK FLYOVER-NOISE DATA

MODEL DC-9-31 FUSELAGE NO. 741 REGISTRATION NO. N54638 TEST DATE 1-29-75

DC-9 REFAN TAKEOFF WITH CUTBACK REFERENCE CONDITIONS CHANGE
*REFERENCE CONDITIONS
PATH SPEED= 179.7 KN, FN/D= 9451.0 LBS

ITEM / CASE	1	2	3	4	5	6
FLIGHT NUMBER	16	16	16	16	16	16
RUN NUMBER	12	11	16	17	18	19
MICROPHONE LOCATION	C6	C6	C6	C6	C6	C6
MICROPHONE NUMBER	1	1	1	1	1	1
AMBIENT TEMPERATURE (DEG F)	52.1	51.2	52.5	53.6	55.4	56.5
RELATIVE HUMIDITY (PERCENT)	34.0	36.0	35.1	35.5	32.8	30.4
GROSS WEIGHT (1000 LBS)	105	106	100	99	98	97
FLAP ANGLE (DEG)	UP2.1	UP2.1	UP2.1	UP2.1	UP2.1	UP1.8
CALCULATED EPR	1.466	1.442	1.446	1.447	1.442	1.438
AIRCRAFT PATH SPEED (KNOTS)	175.3	175.4	174.4	176.8	175.0	174.7
AIRPLANE HEIGHT (FEET)	2248.	2322.	2288.	2163.	2206.	2175.
MEAS. MIN. DISTANCE (FEET)	2240.	2309.	2287.	2159.	2201.	2166.
REF. MIN. DISTANCE (FEET)	2237.	2237.	2237.	2237.	2237.	2237.
MEAS. NOISE PATH DIST. (FEET)	2567.	2526.	2505.	2298.	2496.	2325.
REF. NOISE PATH DIST. (FEET)	2564.	2447.	2451.	2381.	2537.	2401.
NOISE DIRECTION (DEG)	60.8	66.1	65.9	70.0	61.9	68.7
X COORD. MICROPHONE (FEET)	-7301.	-7301.	-7301.	-7301.	-7301.	-7301.
Y COORD. MICROPHONE (FEET)	0.	0.	0.	0.	0.	0.
Z COORD. MICROPHONE (FEET)	-81.	-81.	-81.	-81.	-81.	-81.
AVE. MEASURED FN (LBS)	8626.	8241.	8342.	8349.	8269.	8214.
AVE. MEAS REFERRED FN (LBS)	9426.	9026.	9111.	9080.	9019.	8949.
PNLTM TIME REF. TO O.H. (SEC)	6.6	5.8	6.1	4.9	6.4	5.0
PNLTM MEASURED (PNDB)	87.8	87.8	87.6	87.7	88.7	88.1
PNLM TIME REF. TO O.H. (SEC)	4.1	5.8	6.1	4.4	6.4	5.0
PNLM MEASURED (PNDB)	87.2	87.2	87.1	87.2	88.1	87.5
PNLTM ADJUSTED (PNDB)	88.0	88.2	88.1	87.6	88.8	88.1
MAXIMUM NOY FREQUENCY (GMF)	315	315	315	315	315	315
TONE CORRECTION (PNDB)	0.7	0.6	0.5	0.6	0.6	0.5
TONE CORRECTION FREQ. (GMF)	315	315	315	160	315	160
DURATION CORRECTION FACTOR	0.0	0.1	-0.5	-0.7	-1.1	-0.8
EPNL MEASURED (EPNDB)	87.8	87.9	87.2	87.0	87.6	87.3
DELTA 1 (ARP866) (EPNDB)	0.2	0.4	0.5	-0.1	0.1	0.0
DELTA 2 (EPNDB)	-0.0	-0.1	-0.1	0.2	0.1	0.1
DELTA S (EPNDB)	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
DELTA FN/D (EPNDB)	0.0	0.6	0.5	0.5	0.6	0.7
EPNL REF. FN/D (EPNDB)	88.0	88.7	87.9	87.5	88.3	88.0

TABLE 10

FAR PART 36 TAKEOFF WITH CUTBACK REFERENCE NOISE LEVEL

REFERENCE CONDITIONS		
GROSS WEIGHT	LB (KG)	108,000 (48,900)
FLAP SETTING — OVERSPEED	(DEG-PERCENT)	0-6
HEIGHT AT 3.5 N MI	ft (m)	2245 (707)
CLIMB GRADIENT	(PERCENT)	15.54/8.27
V_{TAS}	(KNOTS)	179.7
REFERRED F_N/δ	LB (N)	9,451 (42,038)
CUTBACK DISTANCE	FT (M)	3000 (915)
MICROPHONE LOCATION		C6
MICROPHONE NUMBER		1

RUN NUMBER	TONE CORRECTION INCLUDED (EPNdB)	TONE CORRECTION REMOVED (EPNdB)
11	88.7	88.1
12	88.0	87.3
16	87.9	87.4
17	87.5	86.9
18	88.3	87.7
19	88.0	87.5
REFERENCE NOISE LEVEL (EPNdB)		87.5
90-PERCENT CONFIDENCE LEVEL (EPNdB)		±0.3
REQUIREMENT (EPNdB)		95.6

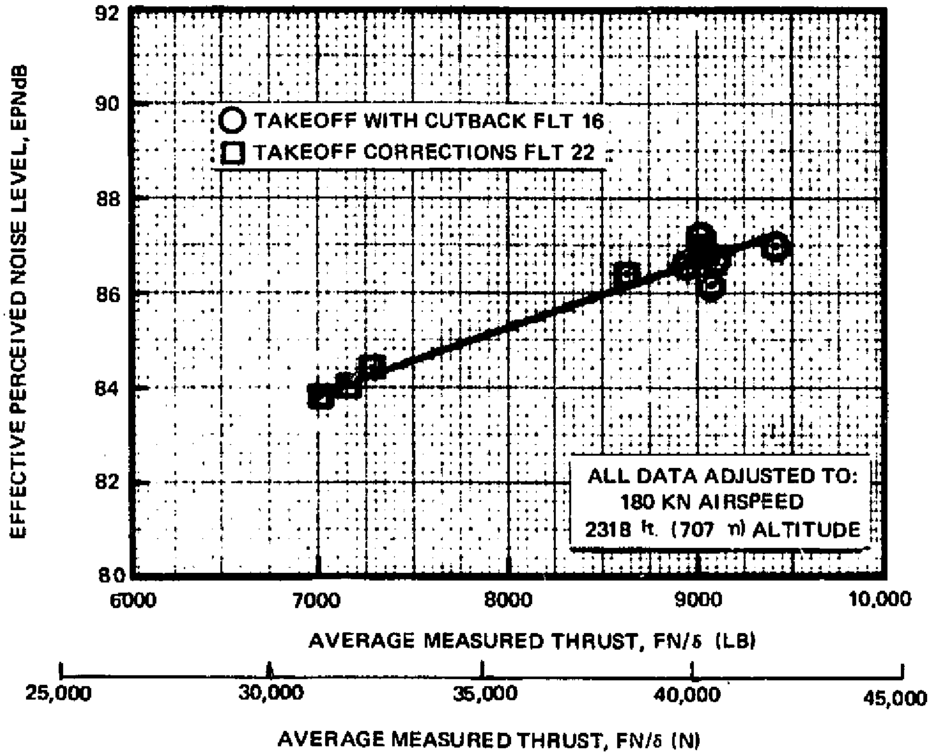

FIGURE 30. VARIATION OF DC-9 REFAN FAR PART 36 TAKEOFF WITH CUTBACK NOISE LEVEL WITH THRUST

Approach

Landing approach noise levels were determined from measurements obtained from a location simulated to be 1.0 N.Mi. from the runway threshold (location C10 in figure 15).

The measured data for the test runs averaged to obtain the reference landing approach noise levels are listed in tables 11 and 12. Figure 31 shows the noise levels for various landing approach power settings. Adjustments were applied for the differences between the measured and reference conditions for a gross weight of 44,906 kg (99,000 lb) and 0.873 rad and .611 rad (50 and 35 degrees) flap setting. Tone corrections were removed by using the criteria discussed previously. In addition, any tones occurring above 630 Hz were given special consideration as to whether they represented actual tones, or were psuedotones to be removed from the reference EPNL v lue.

The EPNL values shown in figure 31 may show a slight difference from the average FAR Part 36 reference approach noise levels because the correction run flap settings, descent gradients, and altitude are different than the FAR Part 36 reference conditions. The correction runs are only performed to determine the relative variation in EPNL versus thrust, not absolute levels. The airplane was flown at a reference airspeed and power setting with various flap angles and descent gradients used to maintain that airspeed. Therefore, slightly different noise levels are to be expected.

The noise level for landing approach with a 0.873 rad (50 degrees) flap setting was determined from the average of the reference EPNL values for test runs 27 through 32. Similarly, the noise level for landing approach with a .611 rad (35 degree) flap setting was determined from the average of the reference EPNL values obtained from test runs 42 through 44, 45, and 48 through 50 (table 13). The FAR Part 36 reference approach noise levels are 97.4 EPNdB for 0.873 rad flap setting and 95.7 EPNdB for 0.611 rad flap setting.

Appendix C contains supporting computer listings of aircraft performance and flyover-noise data are presented in tables C-1.4, C-1.5, C-5 and C-6. Table C-7.4 and C-7.5 include the flyover-noise computer program print out for test Runs 27 and 44, which are included as typical of the landing approach data.

TABLE 11

SUMMARY OF FAR PART 36 APPROACH FLYOVER-NOISE DATA – 50-DEGREE FLAP SETTING

MODEL DC-9-31 FUSELAGE NO. 741 REGISTRATION NO. N54638 TEST DATE 1-31-75

DC-9 REFAN 50 DEG APPROACH REFERENCE CONDITION CHANGE
*REFERENCE CONDITIONS
PATH SPEED= 141.4 KN, FN/D= 5362.0 LBS

ITEM / CASE		1	2	3	4	5	6
FLIGHT NUMBER		19	19	19	19	19	19
RUN NUMBER		30	27	28	29	31	32
MICROPHONE LOCATION		10	10	10	10	10	10
MICROPHONE NUMBER		6	6	6	6	6	6
AMBIENT TEMPERATURE	(DEG F)	55.9	53.1	54.1	54.3	56.0	56.0
RELATIVE HUMIDITY	(PERCENT)	45.7	49.7	51.7	51.4	46.8	46.8
GROSS WEIGHT	(1000 LBS)	94	98	96	95	93	92
FLAP ANGLE	(DEG)	49.3	49.3	49.5	49.7	49.5	49.5
CALCULATED EPR		1.238	1.235	1.213	1.218	1.220	1.235
AIRCRAFT PATH SPEED	(KNOTS)	140.2	135.9	134.8	125.3	134.1	137.1
AIRPLANE HEIGHT	(FEET)	369.	344.	292.	354.	366.	379.
MEAS. MIN. DISTANCE	(FEET)	412.	395.	332.	393.	417.	429.
REF. MIN. DISTANCE	(FEET)	369.	369.	369.	369.	369.	369.
MEAS. NOISE PATH DIST.	(FEET)	428.	405.	378.	405.	447.	449.
REF. NOISE PATH DIST.	(FEET)	383.	379.	419.	380.	396.	386.
NOISE DIRECTION	(DEG)	74.4	76.7	61.7	76.3	68.8	73.0
X COORD. MICROPHONE	(FEET)	22.	22.	22.	22.	22.	22.
Y COORD. MICROPHONE	(FEET)	198.	198.	198.	198.	198.	198.
Z COORD. MICROPHONE	(FEET)	-1.	-1.	-1.	-1.	-1.	-1.
AVE. MEASURED FN	(LBS)	5495.	5451.	5016.	5170.	5150.	5451.
AVE. MEAS REFERRED FN	(LBS)	5558.	5507.	5059.	5225.	5209.	5517.
PNLTM TIME REF. TO O.H.	(SEC)	1.7	1.6	1.9	1.7	2.0	1.8
PNLTM MEASURED	(PNDB)	102.7	103.6	103.7	102.2	101.7	101.9
PNLM TIME REF. TO O.H.	(SEC)	1.7	1.6	1.4	1.7	2.0	1.8
PNLM MEASURED	(PNDB)	102.0	103.0	103.0	101.4	101.0	101.3
PNLTM ADJUSTED	(PNDB)	104.6	105.0	103.2	103.5	103.7	104.2
MAXIMUM NOY FREQUENCY	(GMF)	2500	2500	2500	2500	2500	2500
TONE CORRECTION	(PNDB)	0.7	0.7	0.7	0.9	0.7	0.7
TONE CORRECTION FREQ.	(GMF)	8000	8000	8000	315	8000	8000
DURATION CORRECTION FACTOR		-5.8	-6.2	-6.2	-5.8	-5.8	-5.7
EPNL MEASURED	(EPNDB)	96.8	97.4	97.5	96.4	95.9	96.3
DELTA 1 (ARP866)	(EPNDB)	1.9	1.4	-0.5	1.3	2.0	2.2
DELTA 2	(EPNDB)	-0.5	-0.3	0.5	-0.3	-0.5	-0.7
DELTA S	(EPNDB)	-0.0	-0.2	-0.2	-0.5	-0.2	-0.1
DELTA FN/D	(EPNDB)	-0.4	-0.3	0.5	0.2	0.3	-0.3
EPNL REF. FN/D	(EPNDB)	97.9	98.1	97.7	97.2	97.4	97.4

TABLE 12

SUMMARY OF FAR PART 36 APPROACH FLYOVER-NOISE DATA – 35-DEGREE FLAP SETTING

MODEL DC-9-31 FUSELAGE NO. 741 REGISTRATION NO. N54638 TEST DATE 2-01-75

DC-9 REFAN 35 DEG APPROACH USING FINAL CORR CURVE SLOPE
*REFERENCE CONDITIONS
PATH SPEED= 146.9 KN, FN/D= 3810.0 LBS

ITEM / CASE		1	2	3	4	5	6	7
FLIGHT NUMBER		20	20	20	20	20	20	20
RUN NUMBER		44	46	49	43	48	42	50
MICROPHONE LOCATION		10	10	10	10	10	10	10
MICROPHONE NUMBER		6	6	6	6	6	6	6
AMBIENT TEMPERATURE	(DEG F)	56.1	57.2	58.4	56.0	57.8	55.8	58.2
RELATIVE HUMIDITY	(PERCENT)	45.3	40.5	38.0	46.2	40.7	45.0	37.8
GROSS WEIGHT	(1000 LBS)	102	100	96	103	98	104	95
FLAP ANGLE	(DEG)	34.7	34.7	34.1	34.6	34.7	34.9	33.7
CALCULATED EPR		1.153	1.152	1.164	1.193	1.151	1.125	1.166
AIRCRAFT PATH SPEED	(KNOTS)	137.5	137.8	138.8	150.8	135.1	131.5	142.5
AIRPLANE HEIGHT	(FEET)	363.	377.	368.	368.	356.	356.	387.
MEAS. MIN. DISTANCE	(FEET)	412.	428.	414.	417.	406.	405.	428.
REF. MIN. DISTANCE	(FEET)	369.	369.	369.	369.	369.	369.	369.
MEAS. NOISE PATH DIST.	(FEET)	462.	454.	436.	445.	435.	407.	428.
REF. NOISE PATH DIST.	(FEET)	413.	392.	389.	394.	396.	371.	369.
NOISE DIRECTION	(DEG)	63.3	70.5	71.5	69.4	68.8	83.7	0.0
X COORD. MICROPHONE	(FEET)	22.	22.	22.	22.	22.	22.	22.
Y COORD. MICROPHONE	(FEET)	198.	198.	198.	198.	198.	198.	198.
Z COORD. MICROPHONE	(FEET)	-1.	-1.	-1.	-1.	-1.	-1.	-1.
AVE. MEASURED FN	(LBS)	3736.	3722.	3963.	4567.	3729.	3181.	4001.
AVE. MEAS REFERRED FN	(LBS)	3764.	3753.	3994.	4604.	3756.	3205.	4038.
PNLTM TIME REF. TO O.H.	(SEC)	2.2	1.9	1.8	1.8	1.9	1.4	1.2
PNLTM MEASURED	(PNDB)	99.9	99.9	100.2	101.6	100.2	99.7	99.6
PNLM TIME REF. TO O.H.	(SEC)	2.2	1.9	1.8	1.8	1.9	1.4	1.7
PNLM MEASURED	(PNDB)	98.9	99.0	99.4	100.8	99.3	98.2	98.8
PNLTM ADJUSTED	(PNDB)	102.0	102.6	102.4	103.7	102.1	101.7	102.3
MAXIMUM NOY FREQUENCY	(GMF)	2500	2500	2500	2500	2500	2000	2500
TONE CORRECTION	(PNDB)	0.9	0.9	0.8	0.8	0.8	1.5	1.2
TONE CORRECTION FREQ.	(GMF)	6300	315	6300	315	6300	5000	500
DURATION CORRECTION FACTOR		-5.8	-5.7	-5.3	-5.9	-5.8	-6.2	-5.6
EPNL MEASURED	(EPNDB)	94.1	94.2	94.9	95.7	94.4	93.5	94.0
DELTA 1 (ARP866)	(EPNDB)	2.1	2.7	2.2	2.1	2.0	1.9	2.7
DELTA 2	(EPNDB)	-0.5	-0.6	-0.5	-0.5	-0.4	-0.4	-0.6
DELTA S	(EPNDB)	-0.3	-0.3	-0.2	0.1	-0.4	-0.5	-0.1
DELTA FN/D	(EPNDB)	0.0	0.0	-0.1	-0.6	0.0	0.5	-0.2
EPNL REF. FN/D	(EPNDB)	95.5	96.0	96.2	96.7	95.6	95.0	95.7

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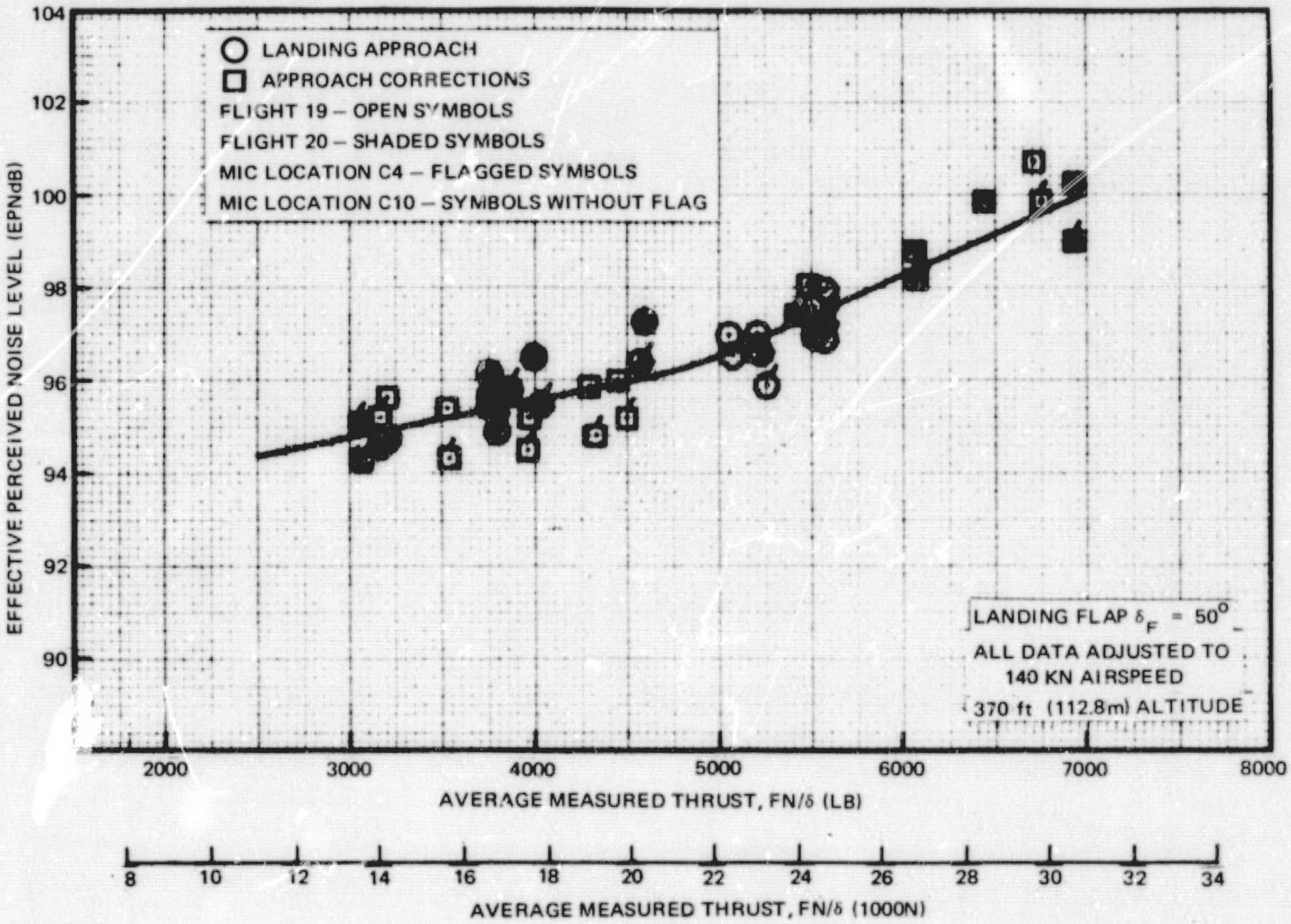

FIGURE 31. VARIATION OF DC-9 REFAN FAR PART 36 APPROACH NOISE LEVEL WITH THRUST

TABLE 13

FAR PART 36 LANDING APPROACH REFERENCE NOISE LEVEL

REFERENCE CONDITIONS			
GROSS WEIGHT	LB (KG)	99,000 (44,906)	99,000 (44,906)
FLAP SETTING	(DEG)	50	35
HEIGHT AT 1.0 N MI	FT (m)	370 (113)	370 (113)
GLIDESLOPE	(DEG)	3	3
V_{TAS}	(KNOTS)	141.4	146.9
REFERRED F_N/δ	LB (N)	5,362 (23,850)	3,810 (16,947)
MICROPHONE LOCATION		C10	C10
MICROPHONE NUMBER		6	6

50-DEGREE FLAP		35-DEGREE FLAP	
RUN NUMBER	TONE CORRECTION REMOVED (EPNdB)	RUN NUMBER	TONE CORRECTION REMOVED (EPNdB)
27	97.9	42	95.0
28	97.5	43	96.5
29	96.9	44	95.5
30	97.7	46	95.0
31	97.3	48	95.6
32	97.3	49	96.2
		50	95.3
REFERENCE NOISE LEVEL (EPNdB)	97.4		95.7
90-PERCENT CONFIDENCE LEVEL (EPNdB)	±0.3		±0.4
REQUIREMENT (EPNdB)	103.1		103.1

Accuracy

Applying the small-sample t-distribution and standard deviation equation as noted previously, the confidence limits on the DC-9 Refan FAR Part 36 noise levels were determined. The results indicate the 90 percent confidence limits to be better than ± 0.6 EPNdB. This is well under the ± 1.5 EPNdB established as an FAA requirement. The following are the FAR Part 36 noise levels and the respective limits of 90 percent confidence:

Sideline	Takeoff	Takeoff with Cutback	Approach
			δ_F = 0.873 rad (50 degrees)
95.3 ± 0.3 EPNdB	96.2 ± 0.6	87.5 ± 0.3 EPNdB	97.4 ± 0.3 EPNdB
			δ_F = 0.611 rad (35 degrees)
			95.7 ± 0.4 EPNdB

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Baseline Noise Levels

Two sets of baseline noise levels may be used to determine the noise reductions achieved by the Refan flyover test program. The first set of noise levels were obtained from tests conducted in October 1974 as a part of intermix certification of DC-9-30 airplanes. The second set were the results of the limited flyover noise tests (C-9A) conducted as a part of the Refan program. The noise levels obtained from both tests are tabulated, below.

	S.L.	T.O.	C/B	APPR. 0.873 rad (50 degrees)	APPR. 0.611 rad (35 degrees)
Hardwall Intermix DC-9-30/JT8D-9	99.8	102.7	97.4	103.0	100.9
Hardwall C-9A DC-9-32/JT8D-9	N.A.	N.A.	95.7	106.1	N.A.

N.A. = Not Available

The differences between two sets of noise levels may be attributed to the differences in meteorological conditions experienced during both flyover noise tests. The baseline and DC-9 Refan airplane noise levels reported herein were adjusted for deviations from the atmospheric condition of 25°C (77°F), 70 percent relative humidity and sea level pressure on the basis of data recorded at the 10 meter mobile atmospheric recording tower. This method of adjusting for atmospheric conditions does not account for dissimilarities in weather along the sound/path that existed during the tests of the different airplanes. Several current research efforts are investigating the feasibility of developing reliable analytical methods of adjusting noise levels recorded under diverse sound-path atmospheric conditions to values corresponding to a uniform atmosphere at standard FAR Part 36 conditions. The application of such methods to the data used for the comparison above would lead to more accurate absolute and relative levels.

NOISE-LEVEL VARIATIONS WITH DISTANCE

The procedure used for developing a family of noise-level-vs-distance curves will be described. The parameter used to characterize individual curves in the family is referred net thrust F_N/δ.

A computer program printout of test day effective perceived noise levels (EPNL) adjusted to the reference conditions of weather, distance, and airspeed is used to obtain corrected reference-weather noise levels. Tone corrections due to pseudotones are removed. From the available overhead flyover-noise data, (table 14), plots of EPNL variations with F_N/δ at various reference distances are prepared by fairing lines of best fit through the individual data points. From those plots, the noise level at selected values of referred net thrust can be found for various distances. The EPNL's at the selected referred net thrust values and at the available reference distances are plotted, and curves of constant F_N/δ are drawn through the data points.

Certain assumptions must be made in fairing curves through the data points, since the points generally do not all fall either in straight lines or on simple curves. The assumptions are (1) that each curve of EPNL plotted on semilog paper is a smooth monotonically decreasing function of distance and (2) that the set of curves is really a family such that a cross plot at any selected distance would also be a smooth curve. These assumptions are based on the position that noise levels decrease smoothly with distance and that noise levels increase smoothly with thrust if other parameters remain constant.

The distances used are the distance at the closest point to aircraft (CPA), that is the minimum distance between the flight path and the microphone. This is not necessarily the distance the sound travels from the airplane to the receiver at the time of PNLTM. The distance CPA is more convenient in relating to the community noise exposure.

From the family of curves based on the best overall fit to the data, cross plots at selected ranges from 61 m (200 ft) to 2 440 m (8,000 ft) are derived. Any irregularities observed in the family of cross plots are smoothed out, but with minimum shifts in the position of the original curves.

The curves for F_N/δ above 31 136 N (7,000 lb) are normalized to a takeoff airspeed of 180 knots. For F_N/δ values equal to or less than 31 136 N (7,000 lb) the curves are normalized to an approach airspeed of 140 knots. Therefore, the family of cross-plot curves will have a discontinuity at F_N/δ = 31 136 N (7,000 lb). When the airspeed correction factor is used, the discontinuity is found to have a value of $10 \log \frac{180}{140} = 1.1$ EPNdB. The airspeed correction, as described in the data analyses section, is primarily intended to adjust for variations in the duration correction factor, which is included in the EPNL computations.

In theory, the noise level from a given source will vary with distance, because of spreading losses and atmospheric attenuation. Since EPNL is a combination of factors computed in a complex manner, spreading losses for

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TABLE 14
SUMMARY OF DATA ACQUISITION FOR NOISE LEVEL DETERMINATION

FLIGHT NO.	RUN NO.	TYPE OF FLYOVER	TARGET THRUST (LB)	MICROPHONE LOCATION*				FLIGHT PROFILE (FIG. 10-14)
				C4	C6	C10	C11	
15	4	FULL POWER TAKEOFF	13,500		1			D1
	5	FULL POWER TAKEOFF	13,500		1			E1
	6	TAKEOFF/CUTBACK	13,500/9,500		1			F1
	7	TAKEOFF/CUTBACK	13,500/9,500		1			F2
	8	FULL POWER TAKEOFF	13,500		1			E2
16	9	FULL POWER TAKEOFF	13,500		1			D1
	10	FULL POWER TAKEOFF	13,500		1			E1
	11	TAKEOFF/CUTBACK	13,500/9,500		1			F1
	12	TAKEOFF/CUTBACK	13,500/9,500		1			F2
	13	FULL POWER TAKEOFF	13,500		1			E2
	16	TAKEOFF/CUTBACK	13,500/9,500		1			F3
	17	TAKEOFF/CUTBACK	13,500/9,500		1			F4
	18	TAKEOFF/CUTBACK	13,500/9,500		1			F5
	19	TAKEOFF/CUTBACK	13,500/9,500		1			F6
	20	TAKEOFF/CUTBACK	13,500/9,500		1			G4
	21	TAKEOFF/CUTBACK	13,500/9,500		1			G1
	22	TAKEOFF/CUTBACK	13,500/9,500		1			G2
	23	TAKEOFF/CUTBACK	13,500/9,500		1			G3
19	24	δ_F = 50 DEG APPROACH	6,900	4	1	6		D1
	25	δ_F = 50 DEG APPROACH	5,800	4	1	6		D2
	27	δ_F = 50 DEG APPROACH	5,500	4	1	6		E1a
	28	δ_F = 50 DEG APPROACH	5,100	4	1	6		E2
	29	δ_F = 50 DEG APPROACH	5,300	4	1	6		E3
	30	δ_F = 50 DEG APPROACH	5,600	4	1	6		E4
	31	δ_F = 50 DEG APPROACH	5,200	4	1	6		E5
	32	δ_F = 50 DEG APPROACH	5,600	4	1	6		E6
	33	REDUCED THRUST APPROACH	4,700	4	1	6		D3
	34	REDUCED THRUST APPROACH	4,500	4	1	6		D4
	35	REDUCED THRUST APPROACH	4,300	4	1	6		D5
	36	REDUCED THRUST APPROACH	3,100	4	1	6		D6
	37	REDUCED THRUST APPROACH	3,200	4	1	6		D7
	38	REDUCED THRUST APPROACH	2,800	4	1	6		D8
20	39	δ_F = 50 DEG APPROACH	6,500			6		D1
	40	δ_F = 50 DEG APPROACH	6,900	2	1	6		D2
	41	δ_F = 50 DEG APPROACH	6,100	2	1	6		D3
	42	δ_F = 35 DEG APPROACH	3,200	2	1	6		E1
	43	δ_F = 35 DEG APPROACH	4,600	2		6		E2
	44	δ_F = 35 DEG APPROACH	3,800	2	1	6		E3
	46	δ_F = 35 DEG APPROACH	3,800	2	1	6		E4a
	47	δ_F = 35 DEG APPROACH	3,800	2	1			E5
	48	δ_F = 35 DEG APPROACH	3,800	2	1	6		E6
	49	δ_F = 35 DEG APPROACH	4,000	2	1	6		E7
	50	δ_F = 35 DEG APPROACH	4,100	2	1	6		E8
	51	δ_F = 50 DEG APPROACH	5,400	2	1	6		D4
	52	REDUCED THRUST APPROACH	3,100	2	1	6		D5

*LISTED ARE THE NUMBERS OF THE ACTIVE MICROPHONES FOR A GIVEN LOCATION (I.E., FOR RUN 4 MICROPHONE 1 WAS ACTIVE AT LOCATION C6

δ_F INDICATES FLAP SETTING

TABLE 14. (CONTINUED)
SUMMARY OF DATA ACQUISITION FOR NOISE LEVEL DETERMINATION

FLIGHT NO.	RUN NO.	TYPE OF FLYOVER	TARGET THRUST (LB)	MICROPHONE LOCATION*				FLIGHT PROFILE (FIG. 10-14)
				C4	C6	C10	C11	
21	53	FULL POWER TAKEOFF	13,700		1	6	3	C
	54	FULL POWER TAKEOFF	13,700		1	6	3	D0
	55	FULL POWER TAKEOFF	13,700		1	6	3	D1
	56	TAKEOFF	12,700		1	6	3	D2
	57	TAKEOFF	12,700		1	6	3	D3
	59	TAKEOFF	11,700		1	6	3	D4
	60	TAKEOFF	11,700		1	6	3	D5
	61	TAKEOFF	10,700		1	6	3	D6
	62	TAKEOFF	10,700		1	6	3	D7
22	65	FULL POWER TAKEOFF	13,500		1	6	3	C1
	67	FULL POWER TAKEOFF	13,500		1	6		E2
	69	FULL POWER TAKEOFF	13,500		1	6	3	E1a
	70	TAKEOFF	9,500		1	6	3	E3
	72	TAKEOFF	8,000		1	6	3	E5
	73	TAKEOFF	9,500		1			E4a
	74	TAKEOFF	8,000		1	6	3	E6
	75	FULL POWER TAKEOFF	13,500		1			E1c
	77	TAKEOFF	8,000		1	6	3	H1a
	79	TAKEOFF	7,000		1	6	3	H3
	82	TAKEOFF	7,000		1	6	3	H4b
	83	TAKEOFF	7,000		1			H4c
23	84	FULL POWER TAKEOFF	13,500			6	3	C1
	85	LEVEL FLIGHT	13,500		1	6	3	D1
	86	LEVEL FLIGHT	13,500		1	6	3	D2
	87	LEVEL FLIGHT	9,500		1	6	3	D3
	90	LEVEL FLIGHT	9,500		1	6	3	D4b
	91	LEVEL FLIGHT	9,500		1	6	3	D3a
25	95	δ_F = 50 DEG APPROACH	6,000		1			D1c
	96	δ_F = 50 DEG APPROACH	6,000		1			D2
	97	δ_F = 50 DEG APPROACH	5,400		1			D3
	98	δ_F = 50 DEG APPROACH	5,400		1			D4
	100	γ = 5.5 DEG APPROACH	3,900	2	1	6		E1a
	101	γ = 5.5 DEG APPROACH	3,500	2	1			E2
	102	γ = 5.5 DEG APPROACH	3,100	2	1			E3
	103	γ = 5.5 DEG APPROACH	2,900	2	1			E4
	104	γ = 5.5 DEG APPROACH	3,100	2	1			E5
	105	γ = 5.5 DEG APPROACH	3,100	2	1			E6
	106	γ = 5.5 DEG APPROACH	3,200	2				F1
	107	γ = 5.5 DEG APPROACH	2,000	2	1	6		F3
26	108	γ = 5.5 DEG APPROACH	3,200	2	1	6		F2
	109	γ = 5.5 DEG APPROACH	2,000	2	1	6		F4
	110	γ = 5.5 DEG APPROACH	1,500	2	1	6		F5
	112	γ = 5.5 DEG APPROACH	2,000	2	1	6		F4a

*LISTED ARE THE NUMBERS OF THE ACTIVE MICROPHONES FOR A GIVEN LOCATION (I.E., FOR RUN 53 MICROPHONE 6 WAS ACTIVE AT LOCATION C10)

δ_F INDICATES FLAP SETTING

γ INDICATES GLIDESLOPE

EPNL are not expected to vary in a simple inverse-square relationship. However, a mathematical expression containing a constant term for the initial level at a reference distance, a logarithmic term to account for spreading, and a term containing the product of distance and an atmospheric-attenuation coefficient should be capable of describing the variation of EPNL with distance. Such an expression is shown below:

$$L = L_0 - a \log (X/X_0) - b \ (X-X_0)/1000 \ ,$$

where L = noise level at distance X, EPNdB

L_0 = noise level at reference distance, EPNdB

a = coefficient of spreading term

X = distance, feet

X_0 = reference distance of 250 feet

b = coefficient of atmospheric attenuation term, EPNdB/1,000 ft.

A Douglas-developed computer program will determine L_0, a, and b for a least-squares fit to the curves or for a sampling of points along the curves found by the previously described procedures. As a result of the computations, an equation for each EPNL-vs-distance curve for a particular value of F_N/δ was derived. The family of curves so determined was then plotted by the use of a programmed Automated drafting Machine (ADM), figure 32 shows the plot of EPNL vs slant range at closest point of approach (CPA).

To develop a plot of A-weighted sound levels, dB(A), the corrected SPL spectrum at the time of PNLTM, the same as that used in computing the EPNL-vs-distance curves described above, was used to compute the corresponding dB(A) levels and the same basic procedures as were described previously for the EPNL plots, applied.

One important difference in the two procedures is that since there is no duration correction involved in calculating dB(A), there is also no airspeed normalization adjustment made in the dB(A) curves such as is applied to the EPNL curves. Thus, in the cross plots of dB(A) vs F_N/δ at selected distances, there is no discontinuity as there is in the EPNL cross plots.

A family of dB(A)-vs-distance curves at a number of F_N/δ values was then plotted by use of a programmed ADM. Figure 33 shows the plot of A-weighted sound levels dB(A) as a function of slant range at closest point of approach (CPA).

DC-9 REFAN
TWO JT8D-109 ENGINES

REFERENCE: TEMPERATURE 77°F (25°C)
RELATIVE HUMIDITY 70%

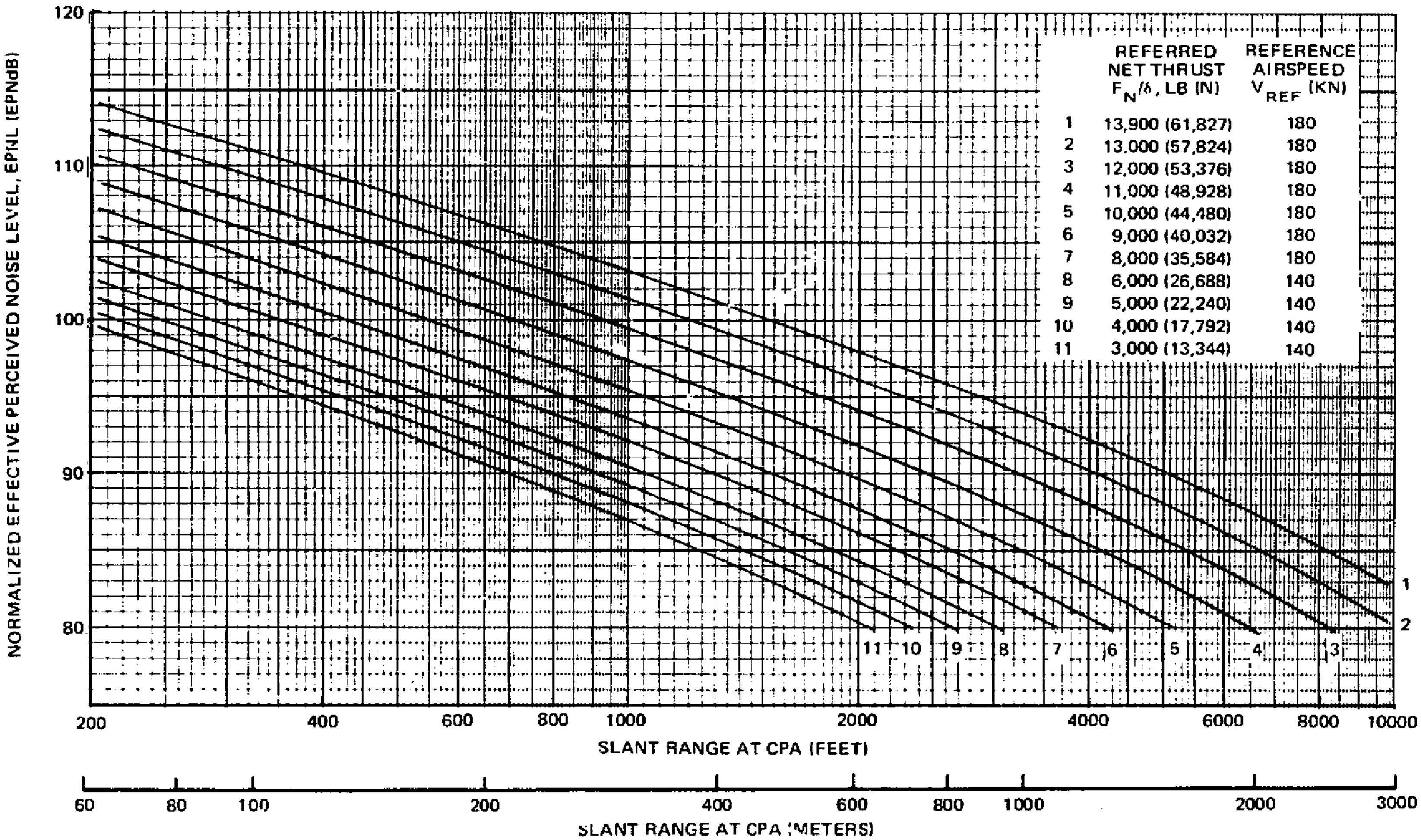


FIGURE 32. VARIATION OF EFFECTIVE PERCEIVED NOISE LEVEL WITH SLANT RANGE

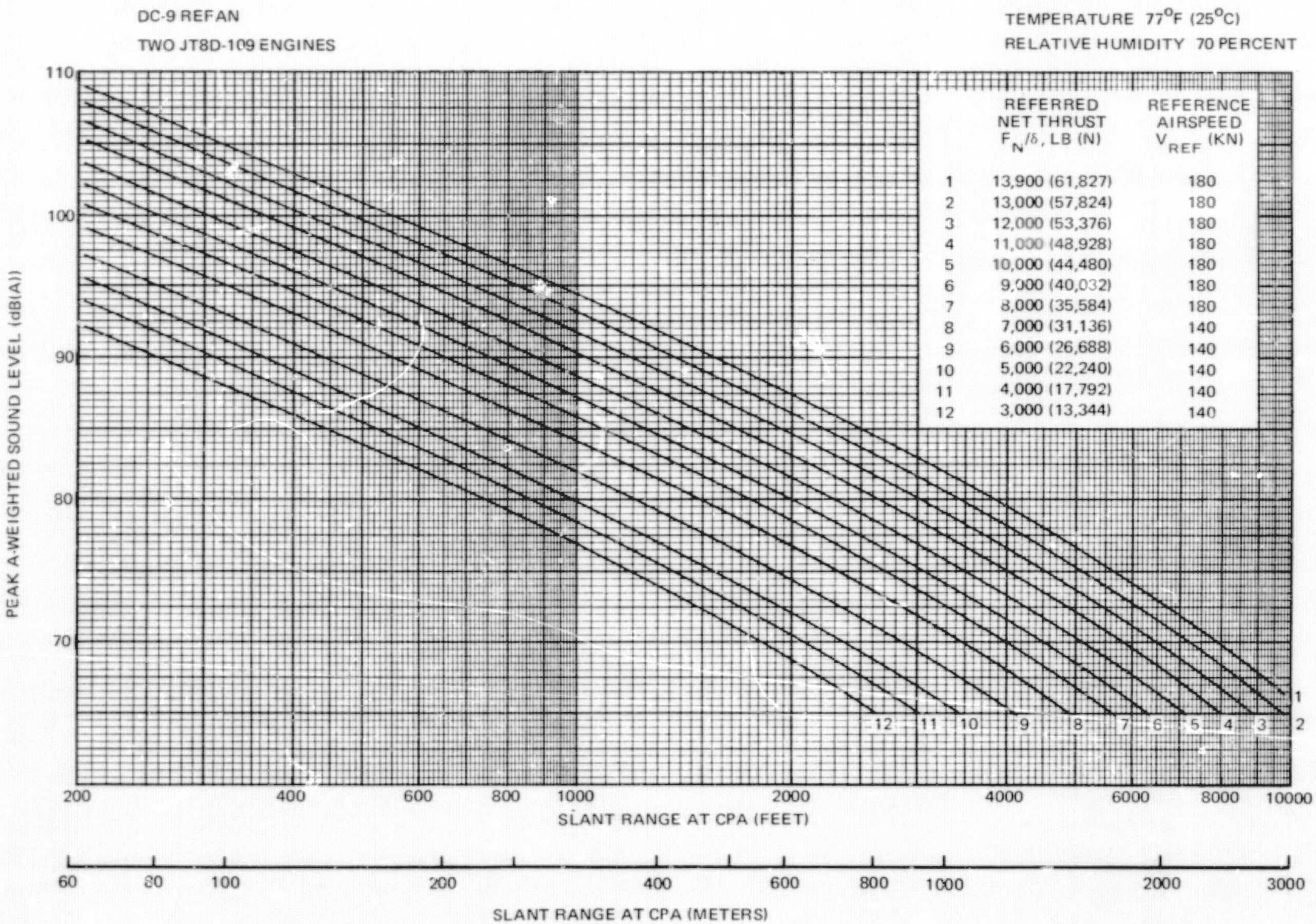


FIGURE 33. VARIATION OF PEAK A-WEIGHTED SOUND LEVEL WITH SLANT RANGES

LATERAL NOISE ATTENUATION

Lateral noise attenuation is the difference between the noise level measured beneath a flyover and the noise level measured at the side of the flight path at the same distance and engine power. The difference in noise level is principally due to extra ground attenuation (EGA), fuselage and wing shielding, and directivity effects. The determination of the contribution of each of the three factors is complex and beyond the scope of this work. The combined effects are therefore considered as lateral noise attenuation.

Noise measurements were obtained from several locations to the side of the flight paths for various engine power settings and aircraft altitudes. To calculate lateral noise attenuation, it is necessary to obtain overhead noise levels at similar distances and engine power settings. Since the EPNL-vs-distance plots consist of averaged overhead noise levels at selected referred net thrust levels, that are normalized to typical airplane velocities, the overhead noise levels obtained from these plots are chosen to compare with the measured sideline noise levels.

In processing the measured sideline noise levels, the computer adjusted the noise level to appropraite normalized airspeeds and to reference weather. Also, adjustments were made to correct for the lateral deviation of the flight path from the reference flight path. No thrust or other distance adjustments were made by the computer. Minimum distances to the flight path were used for slant range, just as in the construction of the EPNL-vs-distance curves. Tone corrections attributed to pseudotones, that is, those with tone correction frequencies of 630 Hz and below were removed.

The referred net thrust and the minimum distance to the flight path associated with each of the sideline noise measurements are entered into the overhead noise-level computer program, together with the Refan EPNL-curve equations, and the overhead EPNL is then calculated at the same referred net thrusts and distances as those found for the sideline noise levels. Lateral noise attenuation is then simply calculated by subtracting the sideline measured noise level from the overhead calculated noise level.

Table 15 shows the data used in calculating lateral noise attenuation. Figure 34 presents a plot of lateral noise attenuation as a function of elevation angle.

TABLE 15
SUMMARY OF DATA ACQUISITION FOR LATERAL NOISE ATTENTUATION STUDY

FLIGHT NO.	RUN NO.	TYPE OF FLYOVER	TARGET THRUST (LB)	MICROPHONE LOCATION*							FLIGHT PROFILE (FIG. 10-14)
				S0	S16	S18	S19	S20	3N	6N	
16	9	FULL POWER TAKEOFF	13,500	12	9	7	11	10			D1
	10	FULL POWER TAKEOFF	13,500	12	9	7	11	10			E1
	11	TAKEOFF/CUTBACK	13,500/9,500	12	9	7	11	10			F1
	12	TAKEOFF/CUTBACK	13,500/9,500	12	9	7	11	10			F2
	13	FULL POWER TAKEOFF	13,500	12	9	7	11	10			E2
	15	FULL POWER TAKEOFF	13,500	12	9	7	11	10			E3a
	16	TAKEOFF/CUTBACK	13,500/9,500	12	9	7	11	10			F3
	17	TAKEOFF/CUTBACK	13,500/9,500	12	9	7	11	10			F4
	18	TAKEOFF/CUTBACK	13,500/9,500	12	9	7		10			F5
	19	TAKEOFF/CUTBACK	13,500/9,500	12	9	7	11	10			F6
	20	TAKEOFF/CUTBACK	13,500/9,500	12	9	7	11	10			G4
	21	TAKEOFF/CUTBACK	13,500/9,500	12	9	7	11	10			G1
	22	TAKEOFF/CUTBACK	13,500/9,500	12	9	7	11	10			G2
	23	TAKEOFF/CUTBACK	13,500/9,500	12	9	7	11	10			G3
19	24	δ_F = 50 DEG APPROACH	6,900			5			11		D1
	25	δ_F = 50 DEG APPROACH	5,800	9		5		10	11		D2
	27	δ_F = 50 DEG APPROACH	5,500	9		5		10			E1a
	28	δ_F = 50 DEG APPROACH	5,100	9		5		10	11		E2
	29	δ_F = 50 DEG APPROACH	5,300	9		5		10	11		E3
	30	δ_F = 50 DEG APPROACH	5,600	9		5		10	11		E4
	31	δ_F = 50 DEG APPROACH	5,200	9		5		10	11		E5
	33	REDUCED THRUST APPROACH	4,700	9		5		10			D3
	34	REDUCED THRUST APPROACH	4,500	9		5		10	11		D4
	35	REDUCED THRUST APPROACH	4,300	9		5		10	11		D5
	36	REDUCED THRUST APPROACH	3,400	9		5		10			D6
	37	REDUCED THRUST APPROACH	3,200	9		5		10	11		D7
	38	REDUCED THRUST APPROACH	2,800	9		5		10	11		D8
20	39	δ_F = 50 DEG APPROACH	6,500			3		10	11		D1
	40	δ_F = 50 DEG APPROACH	6,900	9		3		10	11		D2
	41	δ_F = 50 DEG APPROACH	6,100	9		3		10	11		D3
	42	δ_F = 35 DEG APPROACH	3,200	9		3		10			E1
	43	δ_F = 35 DEG APPROACH	4,600	9		3		10			E2
	44	δ_F = 35 DEG APPROACH	3,800	9		3		10	11		E3
	46	δ_F = 35 DEG APPROACH	3,800	9		3		10	11		E4a
	47	δ_F = 35 DEG APPROACH	3,800						11		E5
	48	δ_F = 35 DEG APPROACH	3,800	9		3		10			E6
	49	δ_F = 35 DEG APPROACH	4,000						11		E7
	50	δ_F = 35 DEG APPROACH	4,100	9		3		10	11		E8

*LISTED ARE THE NUMBERS OF THE ACTIVE MICROPHONES FOR A GIVEN LOCATION (I.E., FOR RUN 9 MICROPHONE 9 WAS ACTIVE AT LOCATION S16)

δ_F INDICATES FLAP SETTING

TABLE 15 (CONTINUED)
SUMMARY OF DATA ACQUISITION FOR LATERAL NOISE ATTENUATION STUDY

FLIGHT NO.	RUN NO.	TYPE OF FLYOVER	TARGET THRUST (LB)	MICROPHONE LOCATION* S0	S16	S18	S19	S20	3N	6N	FLIGHT PROFILE (FIG. 10-14)
21	53	FULL POWER TAKEOFF	13,700		9			10	11	12	C
	54	FULL POWER TAKEOFF	13,700		9			10	11	12	D0
	55	FULL POWER TAKEOFF	13,700		9			10	11	12	D1
	56	TAKEOFF	12,700		9			10	11	12	D2
	57	TAKEOFF	12,700		9			10	11	12	D3
	59	TAKEOFF	11,700					10	11	12	D4
	60	TAKEOFF	11,700		9			10	11	12	D5
	61	TAKEOFF	10,700		9			10	11	12	D6
	62	TAKEOFF	10,700		9			10	11	12	D7
22	65	FULL POWER TAKEOFF	13,500		9			10	11		C1
	67	FULL POWER TAKEOFF	13,500						11	12	E2
	69	FULL POWER TAKEOFF	13,500		9			10	11	12	E1a
	70	TAKEOFF	9,500		9				11	12	E3
	72	TAKEOFF	8,000		9			10	11	12	E5
	73	TAKEOFF	9,500		9			10	11	12	E4a
	74	TAKEOFF	8,000		9			10		12	E6
	75	FULL POWER TAKEOFF	13,500		9			10		12	E1c
	77	TAKEOFF	8,000		9			10	11	12	H1a
	78	TAKEOFF	8,000		9			10	11		H2
	79	TAKEOFF	7,000		9			10	11		H3
	82	TAKEOFF	7,000		9			10		12	H4b
23	84	FULL POWER TAKEOFF	13,500		9			10		12	C1
	85	LEVEL FLIGHT	13,500		9			10		12	D1
	86	LEVEL FLIGHT	13,500		9			10	11	12	D2
	87	LEVEL FLIGHT	9,500		9			10			D3
	90	LEVEL FLIGHT	9,500		9			10	11		D4b
	91	LEVEL FLIGHT	9,500		9			10	11	12	D3a
25	95	δ_F = 50 DEG APPROACH	6,000						11		D1c
	96	δ_F = 50 DEG APPROACH	6,000					10			D2
	97	δ_F = 50 DEG APPROACH	5,400		9			10			D3
	98	δ_F = 50 DEG APPROACH	5,400		9			10	11		D4
	100	γ = 5.5 DEG APPROACH	3,900		9			10			E1a
	101	γ = 5.5 DEG APPROACH	3,500					10			E2
	103	γ = 5.5 DEG APPROACH	2,900		9						E4
	104	γ = 5.5 DEG APPROACH	3,100		9						E5
	105	γ = 5.5 DEG APPROACH	3,100		9						E6
	106	γ = 5.5 DEG APPROACH	3,200		9			10	11		F1
26	108	γ = 5.5 DEG APPROACH	3,200		9			10			F2
	109	γ = 5.5 DEG APPROACH	2,000		9			10			F4
	110	γ = 5.5 DEG APPROACH	3,200		9			10			F5
	111	γ = 5.5 DEG APPROACH	1,500		9			10			F6
	112	γ = 5.5 DEG APPROACH	2,000		9			10			F4a

*LISTED ARE THE NUMBERS OF THE ACTIVE MICROPHONES FOR A GIVEN LOCATION (I.E., FOR RUN 53 MICROPHONE 9 WAS ACTIVE AT LOCATION S16)

δ_F INDICATES FLAP SETTING

γ INDICATES GLIDESLOPE

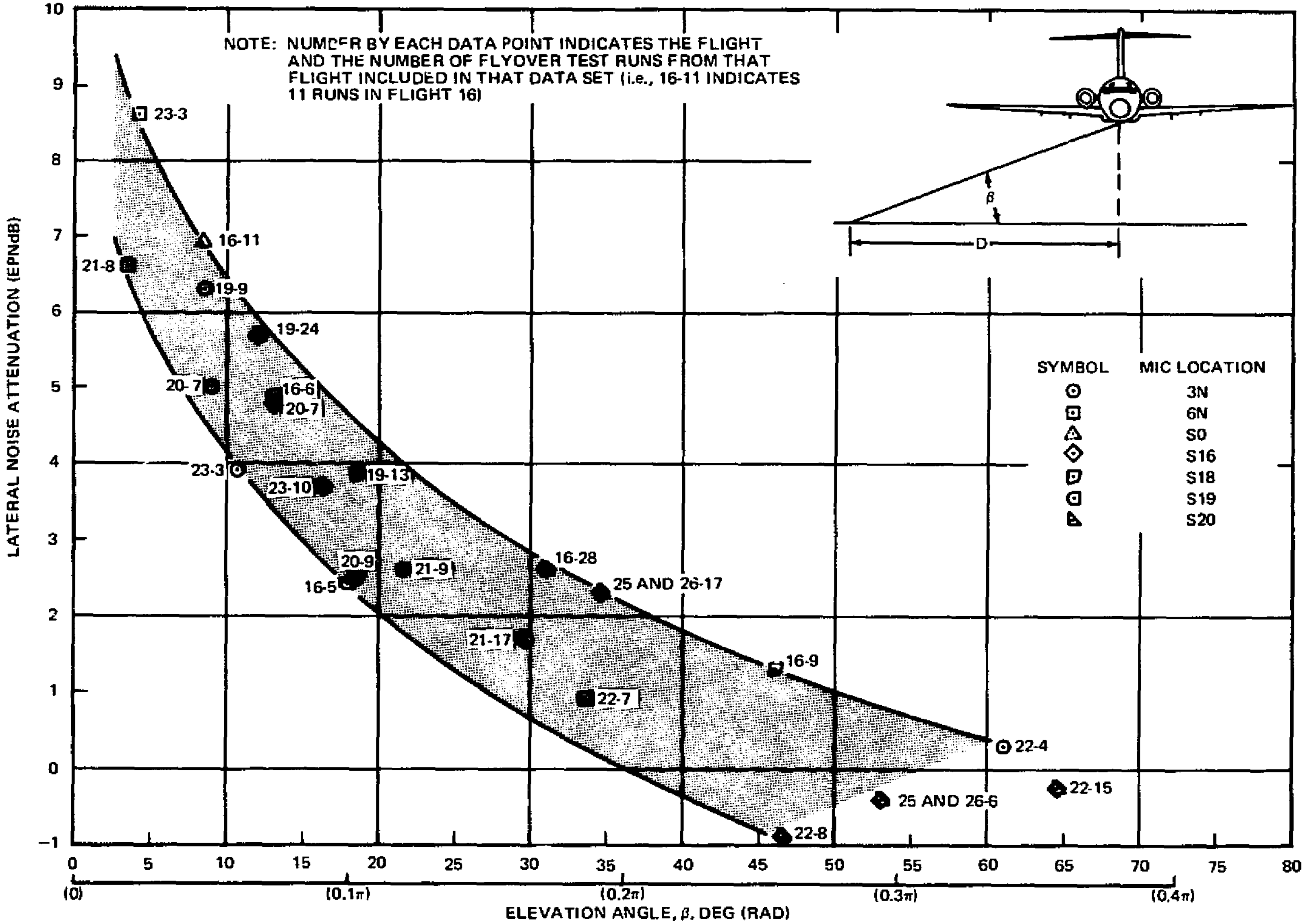


FIGURE 34. VARIATION OF LATERAL NOISE ATTENUATION WITH ELEVATION ANGLE, β

NOISE CONTOURS

Contours of equal effective perceived noise level (EPNdB) for single takeoff and approach operations of both a JT8D-9 hardwall nacelle and JT8D-109 Refan engined DC-9 were developed. The contour lines are generated by a method that determines points on the ground surface that are equidistant from the aircraft flight path. The sound path distance is adjusted by a procedure discussed in reference 6 that includes empirically derived corrections for ground-to-ground noise attenuation and aircraft noise shielding. Also included are the effects of the time-duration increase during ground roll and the increased inlet and jet noise at low forward velocities (reference 6). The contours are generated for reference-day conditions, i.e., 25°C (77°F), 70 percent humidity.

The plotting of the noise-exposure area contours is accomplished by a Douglas-developed computer/plotter technique. The information necessary to generate the noise contours consists of data for noise-level variation with distance and the associated aerodynamic performance in the form of an aircraft flight path. The noise-level variation with distance may be expressed mathematically for each defined engine power setting. That information was obtained for the generation of the EPNL-vs-distance curves.

The aerodynamic parameters used are distance from brake release, geometric altitude, engine thrust (F_N/δ), and true airspeed. Both the hardwall and Refan DC-9 flight paths were constructed using a 0.349 rad (20 degree) pitch limit.

The flight paths for this study (figure 35) are:

(1) full-thrust takeoff and 0.052 rad (3 degrees) glideslope approach,

(2) Full-thrust takeoff and two-segment 0.105/0.052 rad (6/3 degrees) glideslope approach,

(3) takeoff with cutback and a 0.052 (3 degrees) glideslope approach,

(4) takeoff with cutback and a two-segment 0.105/0.052 rad (6/3 degrees) glideslope approach.

For maximum weight takeoff with cutback operation, the FAR Part 36 procedures were used with a 0° flap setting and 6 percent aircraft overspeed. For the typical mission takeoff with cutback operation, the procedure proposed by the Aircraft Transport Association (ATA) was applied. That procedure consists of a liftoff at V_2 + 10 at 0° flap setting and 6 percent overspeed; a climb to 492 m (1500 ft); a cutback with thrust set at 5 m/s (1000 F/M), maintaining V_2 + 10 and retaining takeoff flap setting; continued climb at 984 m (3000 ft) with maximum climb power set and accelerating to 128.6 m/s (250 kt); and finally proceeding on a normal enroute climb.

The representative 90 and 95 EPNdB noise contours shown in figures 36 through 39, compare the DC-9, Series 30, equipped with JT8D-9 engines and hardwall nacelles with the DC-9 Refan for two aircraft takeoff and landing gross weights and four different flight paths. The first case is for the

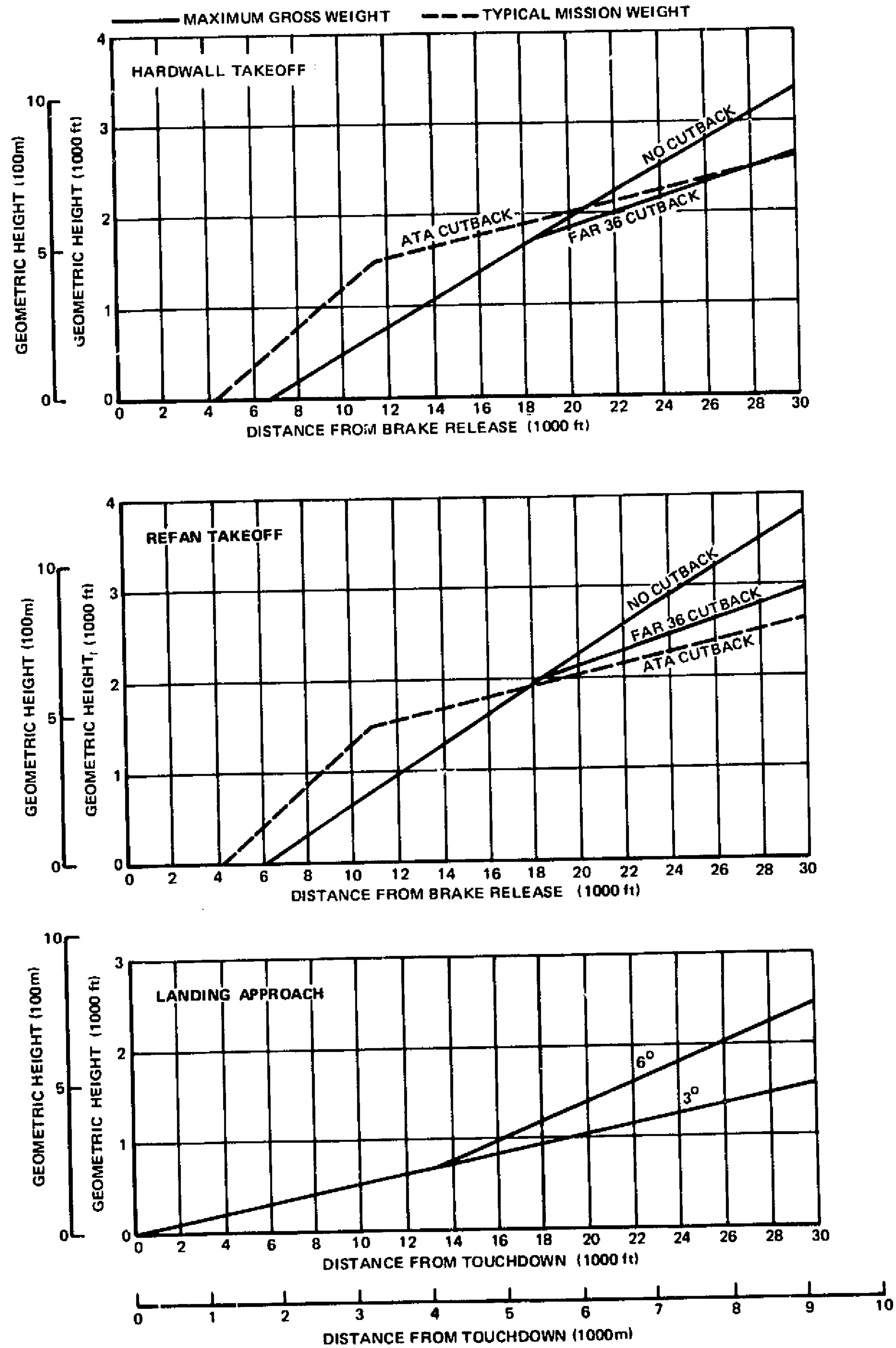
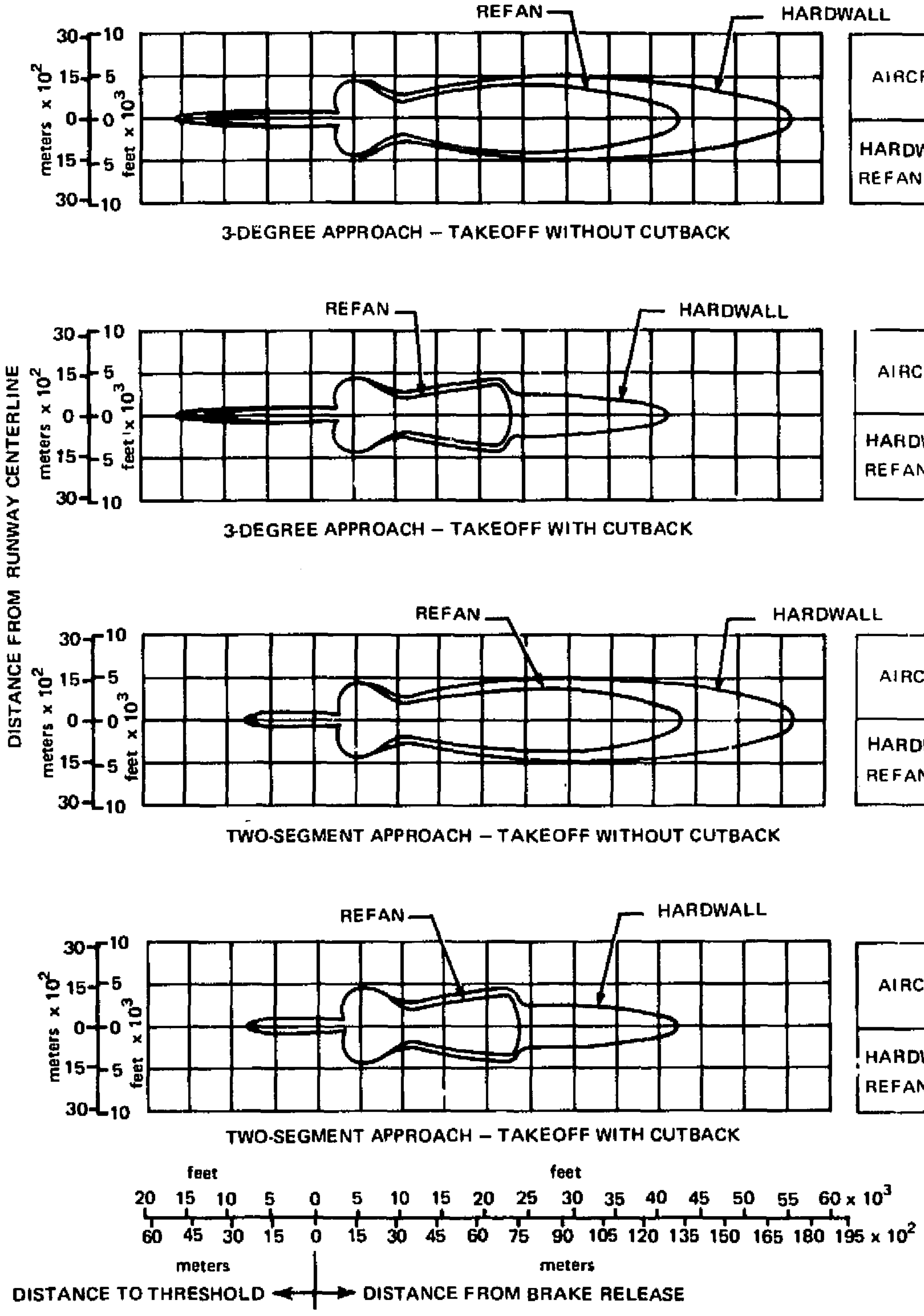


FIGURE 35. REFERENCE FLIGHT PROFILES FOR HARDWALL AND REFAN DC-9-30 AIRCRAFT



3-DEGREE APPROACH – TAKEOFF WITHOUT CUTBACK

AIRCRAFT	AREA WITHIN CONTOUR, sq mi (sq km)
HARDWALL	15.3 (39.6)
REFAN	9.3 (24.1)

3-DEGREE APPROACH – TAKEOFF WITH CUTBACK

AIRCRAFT	AREA WITHIN CONTOUR, sq mi (sq km)
HARDWALL	8.6 (22.3)
REFAN	5.0 (13.0)

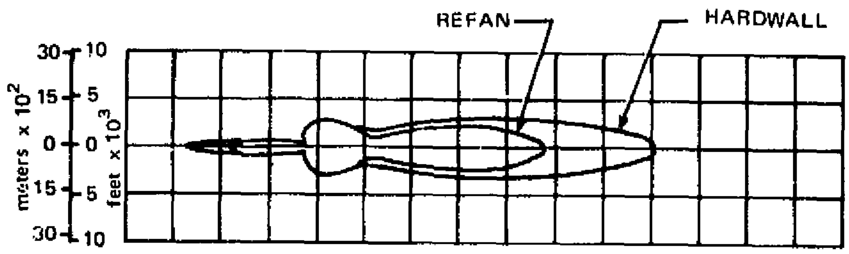
TWO-SEGMENT APPROACH – TAKEOFF WITHOUT CUTBACK

AIRCRAFT	AREA WITHIN CONTOUR, sq mi (sq km)
HARDWALL	15.0 (38.9)
REFAN	9.2 (23.8)

TWO-SEGMENT APPROACH – TAKEOFF WITH CUTBACK

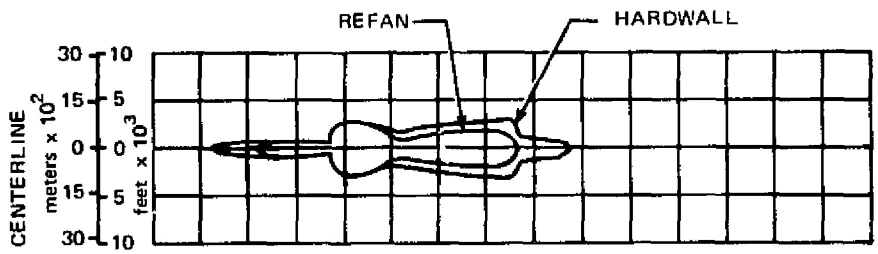
AIRCRAFT	AREA WITHIN CONTOUR, sq mi (sq km)
HARDWALL	8.3 (21.5)
REFAN	4.9 (12.7)

FIGURE 36. 90-EPNdB NOISE CONTOURS FOR HARDWALL AND REFAN DC-9-30 AIRCRAFT FOR MAXIMUM TAKEOFF AND LANDING GROSS WEIGHTS



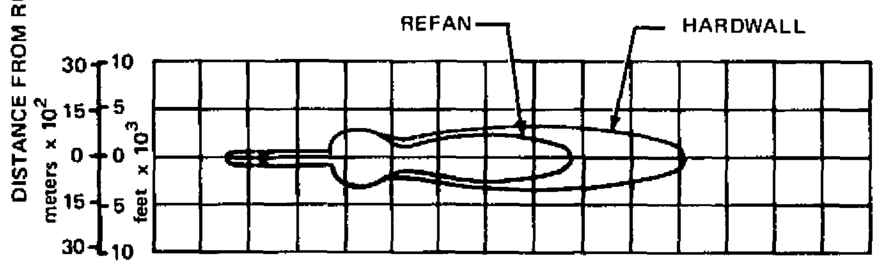
3-DEGREE APPROACH – TAKEOFF WITHOUT CUTBACK

AIRCRAFT	AREA WITHIN CONTOUR, sq mi (sq km)
HARDWALL	6.9 (17.9)
REFAN	3.4 (8.8)



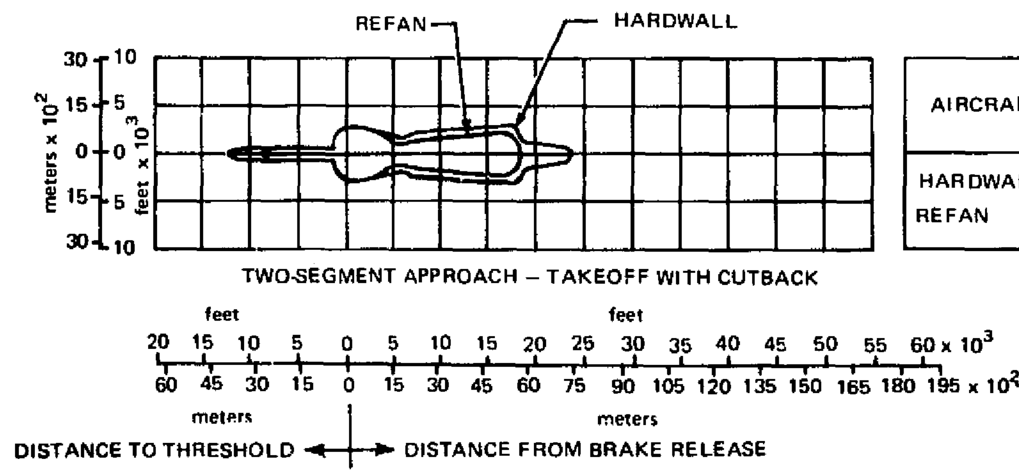
3-DEGREE APPROACH – TAKEOFF WITH CUTBACK

AIRCRAFT	AREA WITHIN CONTOUR, sq mi (sq km)
HARDWALL	4.2 (10.9)
REFAN	2.8 (7.3)



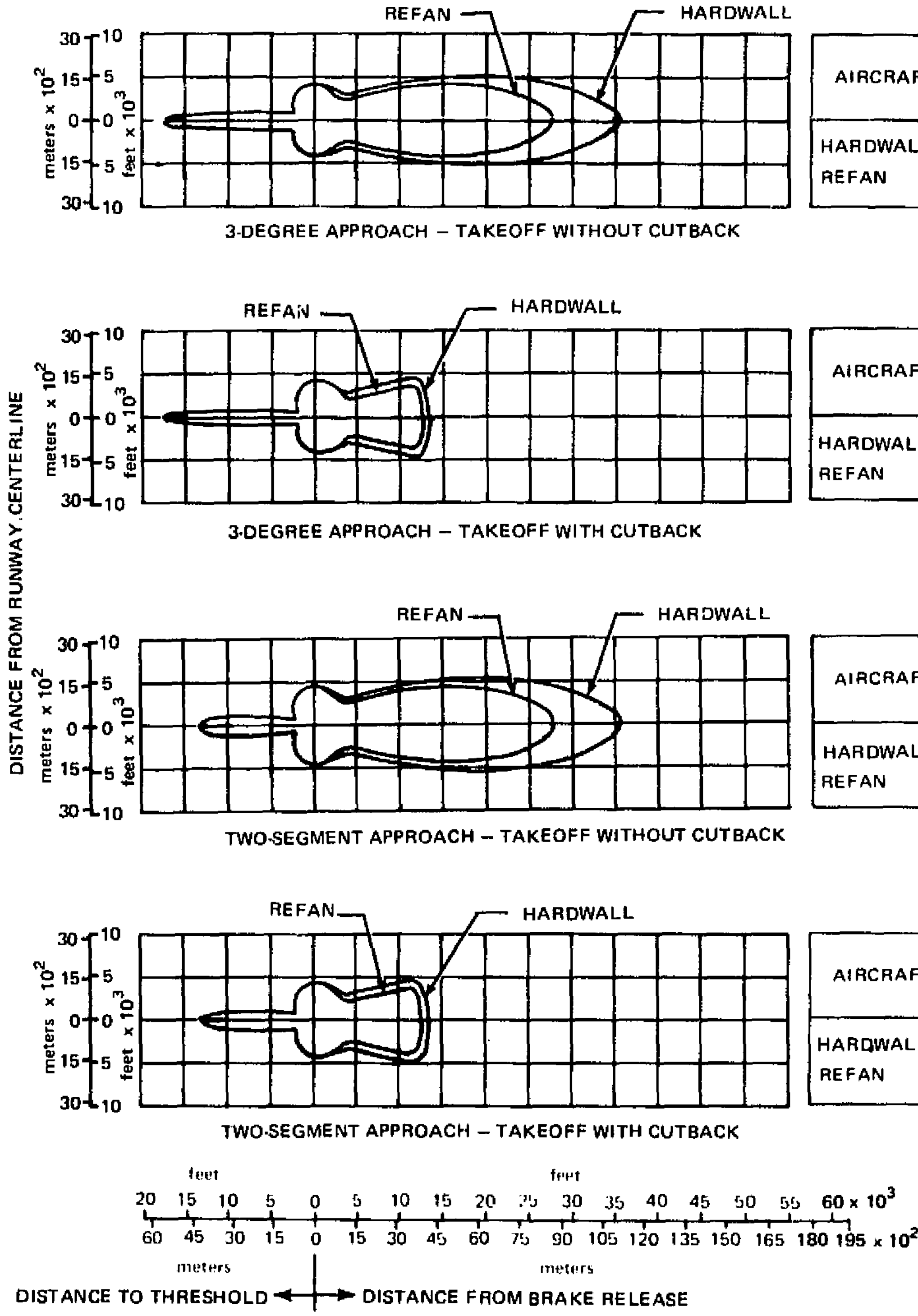
TWO-SEGMENT APPROACH – TAKEOFF WITHOUT CUTBACK

AIRCRAFT	AREA WITHIN CONTOUR, sq mi (sq km)
HARDWALL	6.8 (17.6)
REFAN	3.4 (8.8)



AIRCRAFT	AREA WITHIN CONTOUR, sq mi (sq km)
HARDWALL	4.2 (10.9)
REFAN	2.8 (7.3)

FIGURE 37. 95-EPNdB NOISE CONTOURS FOR HARDWALL AND REFAN DC-9-30 AIRCRAFT FOR MAXIMUM TAKEOFF AND LANDING GROSS WEIGHTS



3-DEGREE APPROACH – TAKEOFF WITHOUT CUTBACK

AIRCRAFT	AREA WITHIN CONTOUR, sq mi (sq km)
HARDWALL	11.2 (29.0)
REFAN	7.4 (19.2)

3-DEGREE APPROACH – TAKEOFF WITH CUTBACK

AIRCRAFT	AREA WITHIN CONTOUR, sq mi (sq. km)
HARDWALL	4.7 (12.2)
REFAN	3.8 (9.8)

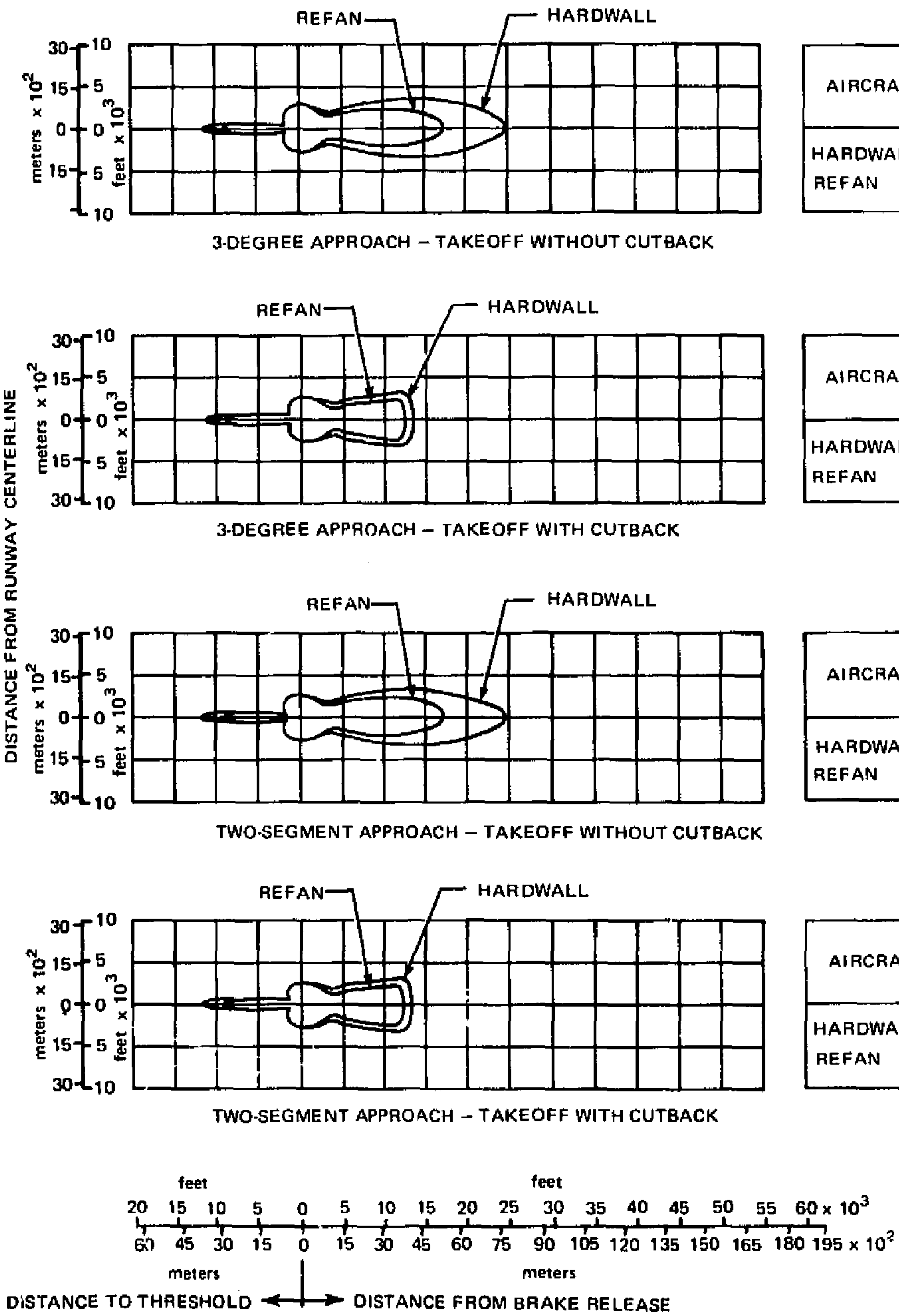
TWO-SEGMENT APPROACH – TAKEOFF WITHOUT CUTBACK

AIRCRAFT	AREA WITHIN CONTOUR, sq mi (sq km)
HARDWALL	11.0 (28.5)
REFAN	7.3 (18.9)

TWO-SEGMENT APPROACH – TAKEOFF WITH CUTBACK

AIRCRAFT	AREA WITHIN CONTOUR, sq mi (sq km)
HARDWALL	4.6 (11.9)
REFAN	3.6 (9.3)

FIGURE 38. 90-EPNdB NOISE CONTOURS FOR HARDWALL AND REFAN DC-9-30 AIRCRAFT FOR TYPICAL MISSION OPERATION



AIRCRAFT	AREA WITHIN CONTOUR, sq mi (sq km)
HARDWALL	5.2 (13.5)
REFAN	2.7 (7.0)

AIRCRAFT	AREA WITHIN CONTOUR, sq mi (sq km)
HARDWALL	3.0 (7.8)
REFAN	2.1 (5.4)

AIRCRAFT	AREA WITHIN CONTOUR, sq mi (sq km)
HARDWALL	5.2 (13.5)
REFAN	2.7 (7.0)

AIRCRAFT	AREA WITHIN CONTOUR, sq mi (sq km)
HARDWALL	3.0 (7.8)
REFAN	2.1 (5.4)

FIGURE 39. 95-EPNdB NOISE CONTOUR FOR HARDWALL AND REFAN DC-9-30 AIRCRAFT FOR TYPICAL MISSION OPERATION

FAR Part 36 operational requirements of maximum takeoff and landing gross weights, 48,988 kg (108,000 lb) and 44,906 kg (99,000 lb), respectively.

The second case is for a typical mission comprising an intermediate stop between two 375-nautical-mile stage lengths where the airplane is not fueled at the intermediate stop. The landing gross weight, at the intermediate stop, for the Refan airplane is 40,550 kg (89,400 lb) and the takeoff gross weight is 40,425 kg (89,210 lb). For the typical mission hardwall airplane, the landing gross weight is 39,464 kg (87,000 lb) and the takeoff gross weight 39,332 kg (86,710 lb). The larger weights for the Refan airplane reflect the different operating empty weights and trip fuel required for the two airplanes.

The contours generated using the FAR Part 36 operational requirements (maximum gross weights) represent the maximum noise exposure levels that would occur around an airport. The typical mission contours, however, are more representative of the landing and takeoff noise levels that might occur during daily airline operations at the intermediate stop between two 375-nautical-mile stage lengths.

The contour areas are summarized in table 16 for both the maximum gross weight and the typical mission operations. The Refan engine on the DC-9 reduces the 90 EPNdB contour area, for takeoff with and without cutback, by 40 percent for the maximum-gross-weight airplane and 19 percent for takeoff with cutback and 34 percent for takeoff without cutback for the typical mission airplane. The 95 EPNdB contour area is reduced about 50 percent for takeoff without cutback for both the maximum-gross-weight and the typical mission airplanes. For takeoff with cutback, the 95 EPNdB contour area is reduced by 30 percent for both the maximum-gross-weight and typical mission airplanes. The two segment approach provides very little reduction in contour area for either the 90 or the 95 EPNdB contours.

TABLE 16
CONTOUR AREA SUMMARY

MAXIMUM GROSS WEIGHT CONFIGURATION	AREA, SQUARE MILES (sq km)			
	DC-9 PRODUCTION		DC-9 REFAN	
FLIGHT CONDITION	90 EPNdB	95 EPNdB	90 EPNdB	95 EPNdB
TAKEOFF – 3-DEGREE APPROACH	15.3 (39.6)	6.9 (17.9)	9.3 (24.1)	3.4 (8.8)
TAKEOFF/CUTBACK – 3-DEGREE APPROACH	8.6 (22.3)	4.2 (10.9)	5.0 (13.0)	2.8 (7.3)
TAKEOFF – 2-SEGMENT APPROACH	15.0 (38.9)	6.8 (17.6)	9.2 (23.8)	3.4 (8.8)
TAKEOFF/CUTBACK – 2-SEGMENT APPROACH	8.3 (21.5)	4.2 (10.9)	4.9 (12.7)	2.8 (7.3)

TYPICAL MISSION CONFIGURATION	AREA, SQUARE MILES (sq km)			
	DC-9 PRODUCTION		DC-9 REFAN	
FLIGHT CONDITION	90 EPNdB	95 EPNdB	90 EPNdB	95 EPNdB
TAKEOFF – 3-DEGREE APPROACH	11.2 (29.0)	5.2 (13.5)	7.4 (19.2)	2.7 (7.0)
TAKEOFF/CUTBACK – 3-DEGREE APPROACH	4.7 (12.2)	3.0 (7.8)	3.8 (9.8)	2.1 (5.4)
TAKEOFF – 2-SEGMENT APPROACH	11.0 (28.5)	5.2 (13.5)	7.3 (18.9)	2.7 (7.0)
TAKEOFF/CUTBACK – 2-SEGMENT APPROACH	4.6 (11.9)	3.0 (7.8)	3.6 (9.3)	2.1 (5.4)

GROUND EFFECTS

All aircraft noise measurements are significantly affected by the presence of reflecting surfaces near the microphones. Even in the absence of man-made reflecting surfaces such as near-by buildings, flyover-noise measurements are affected by reflections from the ground. The test microphones therefore never sense free-field sound but always receive a sound wave resulting from superposition of a direct sound wave from the airplane and a reflected sound wave from the ground. The combined signal is either stronger or weaker than the direct (free-field) signal, depending upon the relative strengths and phase differences between the direct and the reflected waves. The strengths and phase difference depend on the physical characteristics of the reflecting ground, the altitudes of aircraft and microphone, the angular position of the airplane with respect to the microphone, and the frequency of the sound.

Flyover-noise measurements are ordinarily made with microphones at a height of 1.2 m (4 feet) above the ground. For typical flyover-noise test conditions, ground reflections cause large peaks and valleys in the measured sound spectra below a frequency of roughly 1000 Hz. The peaks and valleys may be eliminated by mounting the microphones at the level of the ground plane over a nearly perfect reflecting surface. For all frequencies, the signal received by the microphone is then 6 dB higher than the free-field value at least in theory. A second method of eliminating large peaks and valleys in the spectra is to locate the microphones at some distance above the ground plane. If a microphone is many wavelengths above the ground, any large peaks and valleys in the spectra caused by ground reflections will be shifted to very low frequencies. However, unless the microphone height is comparable to the height of the airplane (an unrealistic condition), the microphone will still not measure free-field sound but will measure a signal about 3 dB higher than the free-field signal for all frequencies.

For the DC-9 Refan tests both "flush-mounted" microphones and microphones pole-mounted at a height of 10 m (33 feet) were used in order to minimize ground-reflection effects and to supplement the measurements of the numerous microphones at a height of 1.2m (4 feet). For some of the flights, at the measurement location all three microphones were used. In order to interpret the measured results for the three different microphones, a typical flyover (flight 20, run 39) was studied in some detail. A 1.2m (4 ft) microphone (Mic 6), two 10m (33 ft) microphones (Mic 4P and Mic 5P), and a flush-mounted microphone (Mic 7F) were located within about 60m (200 feet) of each other. Standard ground-reflection theory (e.g., reference 7) was used to make calculations of the expected changes in sound spectra, relative to the free-field spectra, for each microphone. A perfect reflecting ground surface was assumed. The results are functions of the microphone height, the distance of the airplane from the microphone, and the angular position of the airplane with respect to the microphone (figure 40). The computer spectral changes due to ground reflection are shown in figure 41. The aircraft location relative to each of the microphones is approximately that corresponding to maximum perceived noise level. It can be seen from the figure that large excursions in SPL are expected to occur for the 1.2m (4 ft) microphone because of ground reflections, whereas much smaller excursions in SPL are expected for the 10m

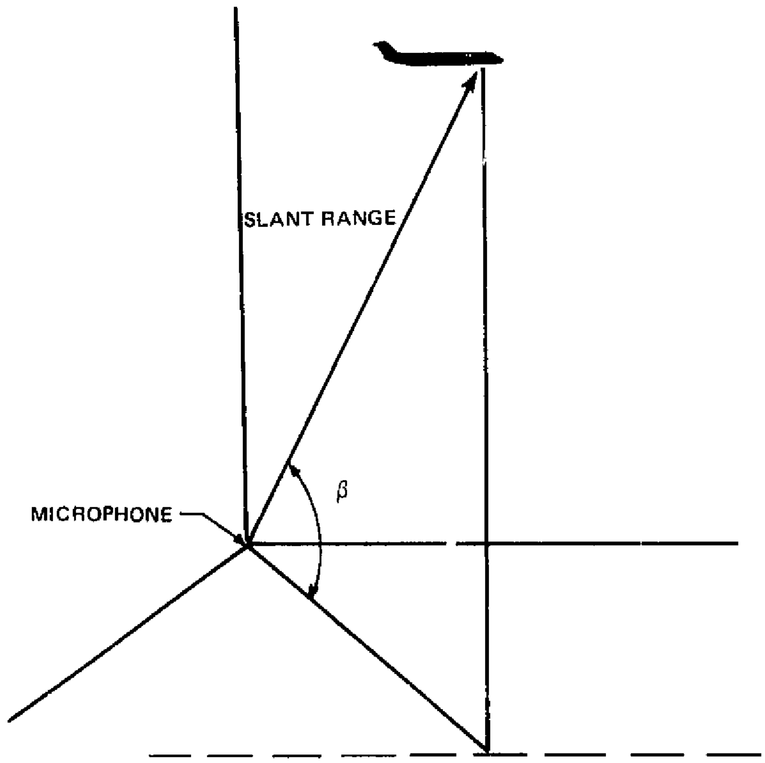


FIGURE 40. COORDINATE SYSTEM FOR GROUND REFLECTION ANALYSIS

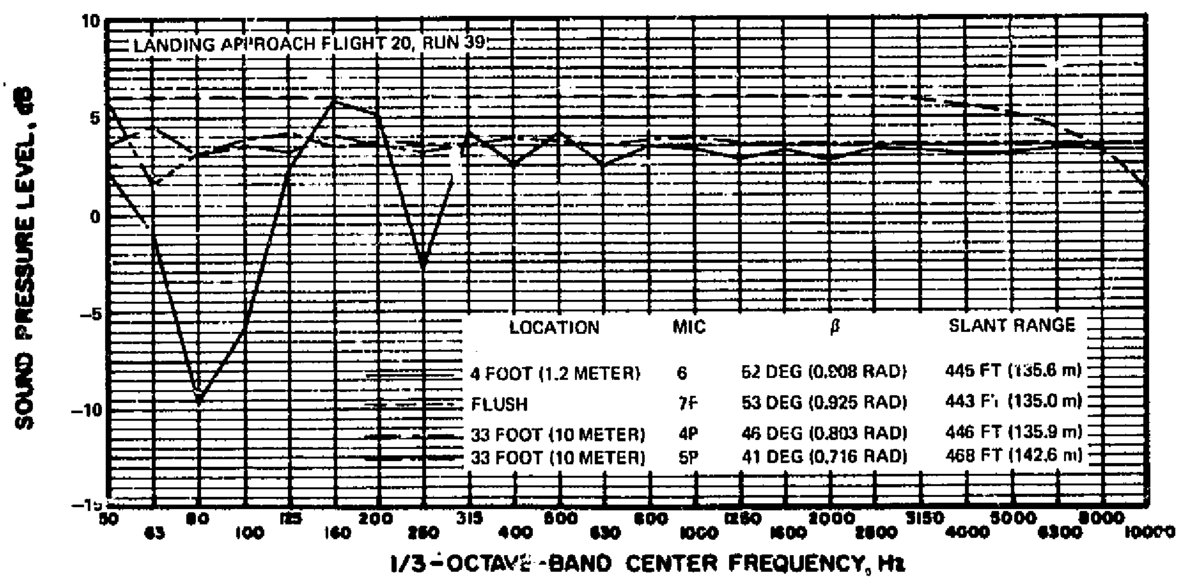


FIGURE 41. CALCULATED SPECTRAL CHANGES TO FREE-FIELD FLYOVER NOISE

(33 ft) microphones. Furthermore, for frequencies above about 1000 Hz, both the 1.2 m (4 ft) microphone and the 10 m (33 ft) microphones should indicate SPLs about 3 dB above the free-field value. The calculations for the "flush mounted" microphone were actually done for a microphone height of 0.6 cm (0.02 ft). That height was used because the flush-mounted microphones were actually microphones of 1.25 cm (0.5 in) diameter taped on their sides in the center of a plywood board. Thus, the center of the microphone diaphragm was about 0.6 cm (0.02 ft) above the surface of the board. It can be seen from figure 41 that even such small height has an effect on the measured SPL at high frequencies.

The curves in figure 41 can be used to calculate the differences in SPL's measured with the flush microphone, the 1.2 m (4 ft) microphones, and the 10 m (33 ft) microphones. Furthermore, if the measured spectrum from the flush microphone is used, the spectra from 1.2 m (4 ft) microphone and 10 m (33 ft) microphones can be calculated. The results of such calculations, together with the measured spectra, are shown in figures 42 and 43 . It can be seen that the calculated spectra and the measured spectra agree fairly well for both the 1.2 m (4 ft) microphone and one of the 10 m (33 ft) microphones (Mic 5 P). However, the measured and the calculated spectra for the other 10 m (33 ft) microphone (Mic 4P) do not agree well. Furthermore, the measured spectrum from microphone 4P does not coincide with the measured spectrum from microphone 6 (see figure 43) at high frequencies, although it would be expected to do so.

Calculations were also made to compute the spectrum for a 1.2 m (4 ft) microphone oriented in such a way that the airplane was flying toward the microphone at a shallow angle, β , with respect to the microphone (about 25°). A comparison of measured and calculated spectra (figure 44) shows that for that shallow-angle case the agreement between the calculated and measured spectra is poor. The poor agreement may be due to the fact that the assumption of a perfectly reflecting surface is not valid as β becomes small. It should be noted, however, that the measured spectrum from microphone 5P is consistent with the spectrum from microphone 6 in that the two spectra coincide at high frequencies, as they should.

Comparisons of 1.2 m (4 ft) microphone and 10 m (33 ft) microphone spectra were also made for a takeoff flyover (flight 16, Run 9). Figure 45 shows the measured spectra obtained from one 1.2 m (4 ft) microphone (Mic 1) and two 10 m (33 ft) microphones (Mic 2P and Mic 3P). Again, one of the spectra measured with a 10 m (33 ft) microphone (Mic 3P) agrees well with the spectrum measured with the 1.2 (4 ft) microphone in the high-frequency range and the other spectrum, measured with Mic 3P, does not agree well.

Since the peaks and valleys discussed above are not associated with the noise source, they are classified as pseudotones. The Douglas flyover-noise analysis computer program provides as an output the designated tone corrections, by frequency and amplitude, that were determined by the procedures specified in Appendix B of FAR Part 36. The tone corrections that are identified as pseudotones should not be applied to the PNL values to obtain PNLT.

Reference Appendix D, table D-4 is a summary of those tone corrections that were considered as pseudotones in the determination of the FAR Part 36

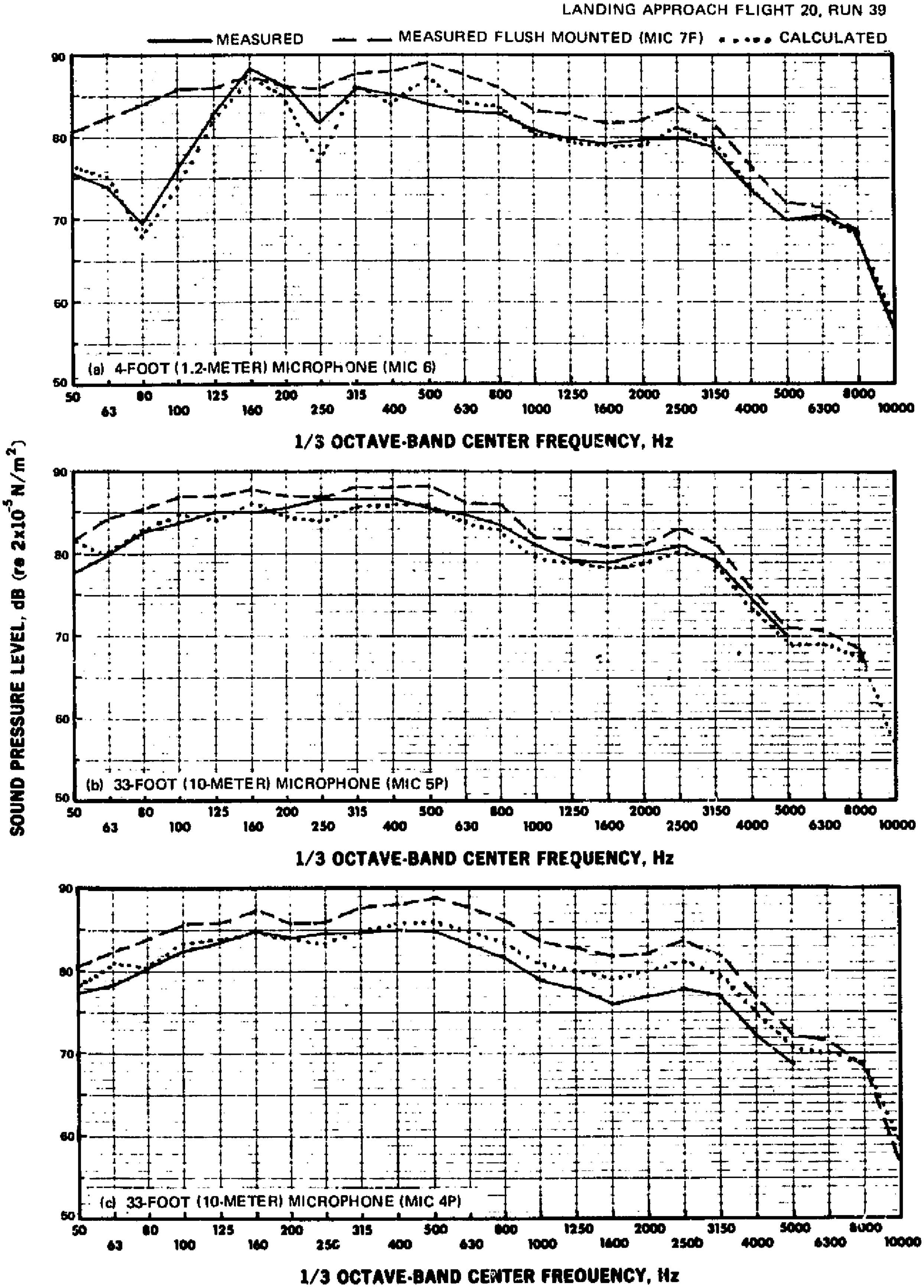


FIGURE 42. COMPARISON OF MEASURED AND CALCULATED FLYOVER-NOISE SPECTRA AT TIME OF MAXIMUM PNL

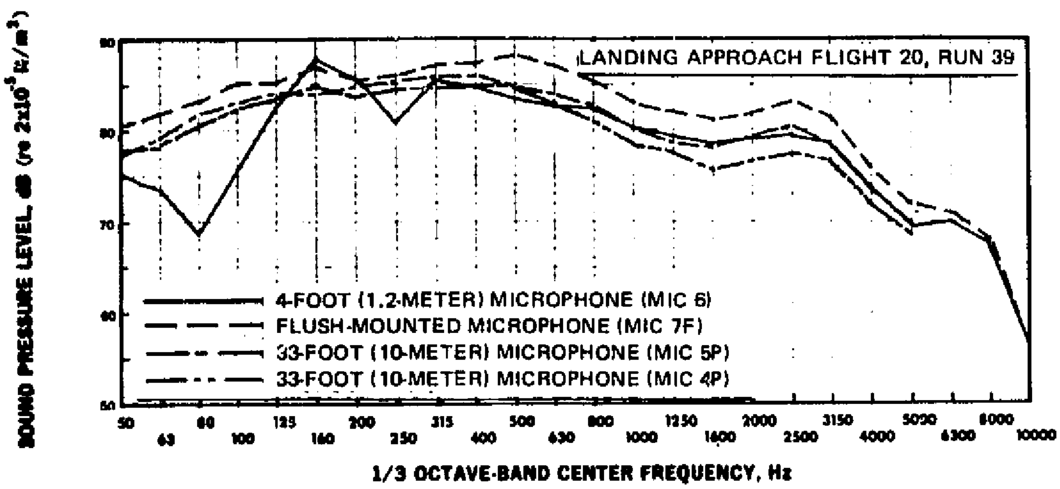


FIGURE 43. MEASURED LANDING APPROACH FLYOVER NOISE SPECTRA AT TIME OF MAXIMUM PNL

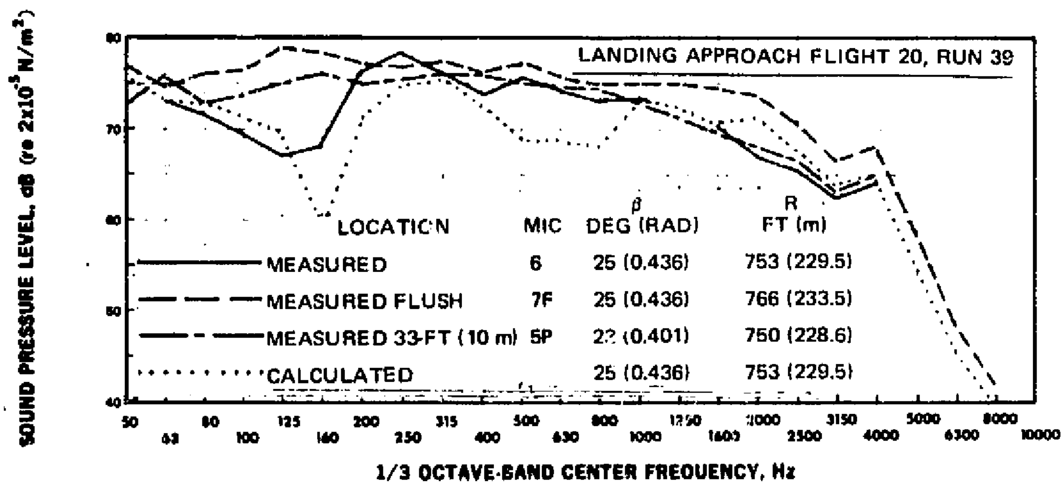


FIGURE 44. COMPARISON OF MEASURED AND CALCULATED FLYOVER-NOISE SPECTRA FOR LOW β ANGLE

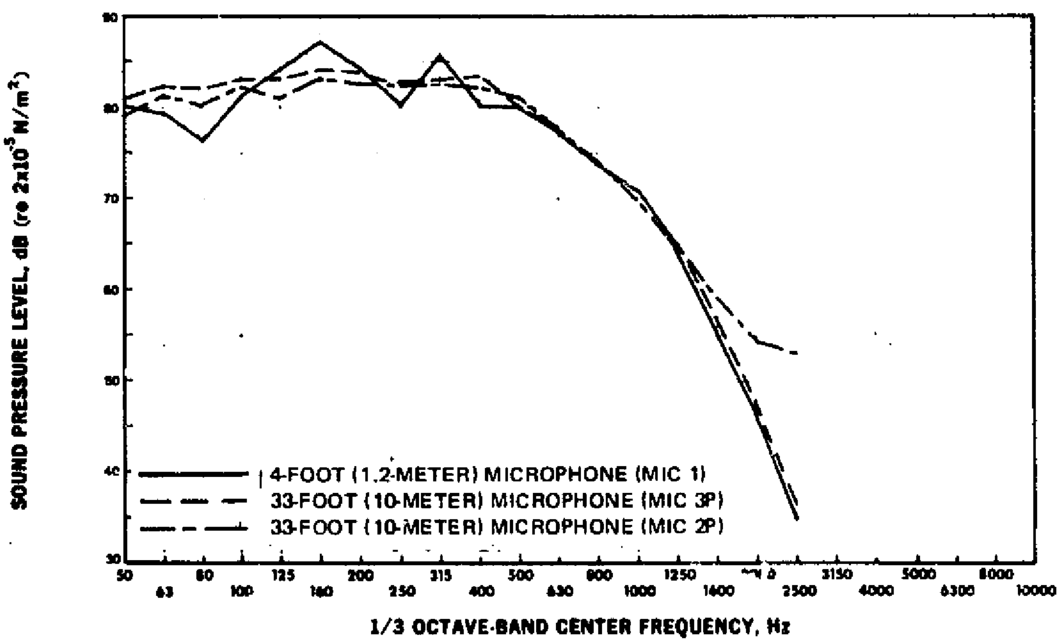


FIGURE 45. MEASURED TAKEOFF FLYOVER-NOISE SPECTRA AT TIME OF MAXIMUM PNL

noise levels. The tone corrections associated with the airport community noise data are included in the computational listings of table D-1. Pseudo-tone corrections were removed from the reference EPNL values listed.

The sound spectra from microphones measuring flyover-noise are subject to ground-reflection effects. For the typical flyover-noise measurement height of 1.2 m (4 ft), ground-reflections caused large peaks and valleys in the sound spectra below a frequency of 1000 Hz. Mounting the microphone flush with the ground plane eliminated the peaks and valleys, however, the signal received by the microphone was 6 dB higher than the free-field value for that location. In order to minimize ground-reflection effects several microphones were pole-mounted at a height of 10 m (33 ft).

Sound spectra from the 1.2 m (4 ft) and the 10 m (33 ft) showed good agreement with theory and when compared. The large peaks and valleys were eliminated from the 10 m (33 ft) measured spectra, but not completely. Ground-reflection effects were still present in the low (<80 Hz) frequencies.

ATMOSPHERIC TURBULENCE EFFECTS

The attenuation in excess of spherical spreading losses and classical and molecular absorption of a sound wave propagating from an elevated source to the ground has been attributed mainly to the effects of turbulence in the atmosphere. The theory of sound attenuation in the free atmosphere was studied by DeLoach (reference 8), who paid particular attention to the effects of atmospheric turbulence on the transmission of sound. His findings were: (1) Although there are other mechanisms, the scattering of sound by turbulent density and momentum fluctuations is a major cause of the excess attenuation for the case of air-to-ground propagation. (2) Failure to correct for the excess attenuation contributes substantially to the relatively large standard deviation that usually characterizes outdoor sound propagation measurements. (3) The frequency dependence of the excess attenuation lies between a square-law dependence and a cube-root dependence. For a homogeneous isotropic medium, the excess attenuation depends on the square of the frequency, but for a medium with more irregular outer scale the frequency dependence is much weaker. In such a medium the frequency (f) dependence is very nearly $f^{1/3}$ when the outer scale is large compared with half an acoustic wave length. (4) The reported non-linear altitude dependence of the excess attenuation is attributed to the decrease in atmospheric turbulence intensity with increasing altitude.

Normally, only mean values of meteorological parameters are recorded for outdoor acoustical measurements. But recently MacCready et al (reference 9) have advanced the concept of the universal turbulence measurement toward operational status. A simple system called Universal Indicated Turbulence System (UITS) gives an output reading R, which is a quantitative measure of turbulence intensity that is unaffected by the characteristics or speed of the aircraft on which it is mounted. To accomplish a selective measurement, the UITS utilizes a high-frequency dynamic sensor.

During the DC-9 Refan flyover-noise tests, the turbulence in the atmosphere was measured by using the UITS. Such measurements provided data from which to investigate the effect on sound propagation of excess attenuation due to atmospheric turbulence.

Actual measurements of the atmospheric turbulence are classified according to the value of R, which is defined to be

$$R = (\rho\epsilon/\rho_0)^{1/3} \quad , \quad m^{2/3}/sec \qquad (1)$$

where

ϵ = dissipation rate $\simeq \nu \left(\frac{\partial u'}{\partial X}\right)^2$, m^2/sec^3

ρ = density of the air, kg/m^3

ρ_0 = sea-level density of air, kg/m^3

ν = kinematic viscosity, m^2/sec

u' = fluctuating component of the wind velocity in the direction of propagation, m/sec

The dissipation rate, ϵ, is therefore related to the epsilonmeter value of, R. Also $(\partial u'/\partial x)^2$ is the mean square of the rate of local change of u', and such changes are assumed to be brought about by the smallest eddies that are present in the turbulent flow field. Hence, the dissipation rate provides in effect a measure of the size of the smaller eddies, defined to be the microscale of turbulence, λ_g ; or λ_g is a measure of the dimension of eddies that at the same intensity produce the same dissipation as the turbulence considered. Another important characteristic of the structure of turbulence is the longest correlation distance between the velocities at two points of the flow field, a length designated L. It is reasonable to expect that the degree of correlation decreases with increasing distance and, that beyond a certain distance, the correlation will be practically zero. Therefore, if λ_g is considered to be an inner scale (size of the smaller eddies), then L may be referred to as the outer scale (size of the large eddies) of the turbulent flow field. DeLoach's basic assumption was that the scale of turbulence is quite large compared to the half-wave length of the incident sound wave. That means that in order for his results to be applicable to this study the integral scale, or outer scale of turbulence, L, is the dimension of interest. The steps that relate the dissipation rate to the outer scale of turbulence are given below.

Two Reynolds Numbers, based on the two lengths λ_g and L, can be defined for a turbulent flow field. They are

$$R_{e\lambda} = \frac{u'\lambda_g}{\nu} \quad \text{and} \quad R_{eL} = \frac{u'L}{\nu} \tag{2}$$

The dissipation rate ϵ can be expressed, according to reference 10 as

$$\epsilon = 15\nu u'^2/\lambda_g^2, \quad \left(m^2/sec^3\right) \tag{3}$$

or

$$\epsilon = A\,\frac{u'^3}{L}, \quad \left(m^2/sec^3\right) \tag{4}$$

where A is a dimensionless constant of the order of unity. Also according to reference 10,

$$R_{eL} = \frac{A}{15} R^2_{e\lambda} \quad \text{and} \quad R_{eL} = \frac{u'L}{\nu}, \tag{5}$$

Therefore,

$$L = \frac{\nu}{u'} R_{eL} = \frac{A^{1/3}}{L^{1/3}\epsilon^{1/3}} \left(\nu R_{eL}\right) \tag{6}$$

and, from Equations (1) and (4),

$$L = \left(\frac{\nu R_{eL}}{R}\right)^{3/4} \qquad \frac{A^{1/4}}{(\rho_o/\rho)^{1/4}} \tag{7}$$

Since A is of order unity and most of the test data are taken at an altitude less than 800m (2440 ft), $\rho_o \simeq \rho$ and thus

$$L = \left(\frac{\nu R_{eL}}{R}\right)^{3/4}, \text{ (meters)} \tag{8}$$

with R the reading obtained from the epsilonmeter of the UITS. Thus, to obtain the outer scale of turbulence L from the measured value of R, the Reynolds number of the turbulent flow field in the atmosphere must be known. The free atmospheric Reynolds numbers are large. For calculation purposes a typical value of $R_{eL} = 3.85 \times 10^5$ (reference 11) will be used. Therefore, with the known kinematic viscosity of the atmosphere, the outer scale of turbulence L can be obtained from the measured values of R.

The excess attenuation due to turbulence, α_s, is given in reference 8 as

$$\alpha_s = \frac{0.455\left(\frac{C_V^2}{c^2} + .136\ \frac{C_T^2}{T^2}\right)k^{1/3}}{\left(\frac{\pi}{kL} + \text{Sin}\ \frac{\theta_c}{2}\right)^{5/3}} \text{ nepers/304.8m (nepers/1000 ft)} \tag{9}$$

The structure constants C_V^2 and C_T^2 are given in reference 7. They are

$$C_V^2 = b^2\, u_*^2 / (\kappa r)^{2/3}, \left(\frac{m^{4/3}}{sec^2}\right) \tag{10}$$

and

$$C_T^2 = \frac{a^2\, \kappa^{4/3} T_*^2}{r^{2/3}}, \left(\frac{{}^oC}{m^{1/3}}\right)^2 \tag{11}$$

where C_T = temperature-structure constant, °C/$m^{1/3}$

C_V = wind-structure constant, $m^{2/3}$/sec

c = speed of sound, m/sec

k = acoustic wave number, 1/m

κ = von Karman constant

T = temperature, °C

θ_c = difference between true scattering angle and the Bragg scattering angle (ranging from 0.4 to 0.6)

u_* = friction velocity, typically 0.4 m/sec (reference 8)

T_* = temperature constant, ranging from 0.1°C in winter to 0.5°C in summer.

Also from reference 8 are the numerical values for the constants κ, the von Karman constant = 0.4, and the empirical constants a and b whose numerical values are 2.40 and 1.40, respectively.

The accumulated excess attenuation (A_S) over the path traveled by the sound waves is obtained by integrating equation (9) over the propagation path.

$$A_S = \int_{h_1}^{h_2} a_s(r) \; dr \tag{12}$$

$$= \frac{21.4\left(\frac{u_*^2}{c^2} + 0.0693\frac{T_*^2}{T^2}\right) k^{1/3}\left(h_2^{1/3} - h_1^{1/3}\right)}{\left(\frac{\pi}{kL} + \sin\frac{\theta_c}{2}\right)^{5/3}}, \text{ dB}$$

Note that in the above equation an average value of L is used for altitudes between h_1 and h_2.

Reference 9 classified turbulence in the atmosphere as negligible, light, moderate, heavy, or extreme according to epsilonmeter (R) readings. Two typical cases, with turbulence classified as light in one case ($0.2 \le R \le 0.8$) and moderate ($1.2 \le R \le 4.0$) in the other were chosen for analysis (figures 46 and 47 and table 17). Both cases have approximately the same gradient of wind speed with altitude.

From Equation (7), L varies from 41.75 m to 119 m (137 ft to 390 ft) for Case 1 and from 19 m to 31 m (62 ft to 100 ft) for Case 2. It is found from Equation (9) that the excess attenuation rate α_s varies directly with L up to a limiting value of L. If the turbulence scale L or the size of eddy is quite large compared to the incident wave length, then the scattering of the incident wave has no meaning or validity, which can be seen from Equation (9), where the upper limit of validity of L is given by

$$\frac{\pi}{kL} = \sin \frac{\theta_c}{2}$$

or

$$L = \frac{\pi / k}{\sin \frac{\theta_c}{2}}$$

Figure 48 shows the variations of cumulative excess attenuation A_s decibels as a function of frequency, for both the light dissipation and moderate dissipation. The dashed curves refer to the case where the epsilonmeter reading R was first related to L, which was then used in Equation (10), according to DeLoach, to calculate A_s. The same figure shows the results calculated by DeLoach for two values of L and two altitudes. For the light-turbulence case (larger L) the attenuation is greater than for the moderate-turbulence case (smaller L). To illustrate, at 2500 Hz the case for larger L predicts an excess attenuation, A_s, of nearly 8 dB as compared to 1.45 dB for the case with the smaller turbulence scale L.

The value of R is a measure of the dissipation rate ϵ in the turbulent flow field. It is also stated by Hinze (reference 10) that the proper scale of turbulence associated with the dissipation rate should be the microscale or dissipation scale, λ_g. Furthermore, the scale λ_g is approximately of the same order of magnitude as the incident wave length of the sound wave. But, it cannot be used directly in conjunction with the theoretical analysis of DeLoach, since by assumption his results are good for a much larger scale of turbulence than the acoustic half-wavelength.

AIRPLANE MODEL DC-9-31 REG. NO. N54638 TEST SITE YUMA, ARIZONA

DATA SOURCE METEOROLOGY RESEARCH INC. DATE FEBRUARY 3, 1975

MEASUREMENT TIMES (PST): TEMP/RH 1528 WIND 1530

Wind direction is heading from which wind is blowing referenced to magnetic North.

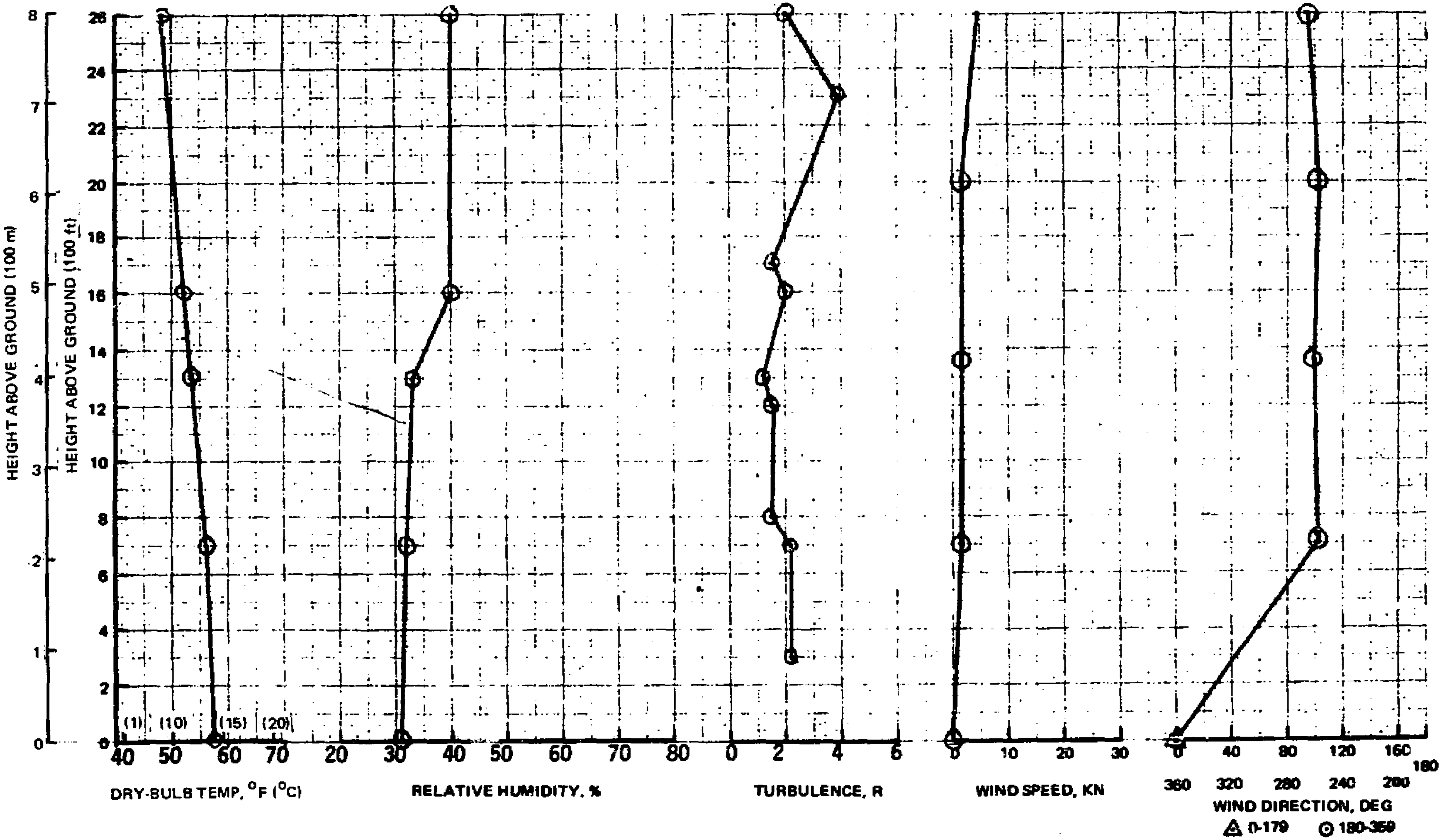


FIGURE 46. SOUND PATH WEATHER DURING FLYOVER NOISE TESTS – MODERATE TURBULENCE R

AIRPLANE MODEL DC-9-31 REG. NO. N54638 TEST SITE YUMA, ARIZONA

DATA SOURCE METEOROLOGY RESEARCH INC. DATE JANUARY 29, 1975

MEASUREMENT TIMES (PST): TEMP/RH 1022 WIND 1035

Wind direction is heading from which wind is blowing referenced to magnetic North.

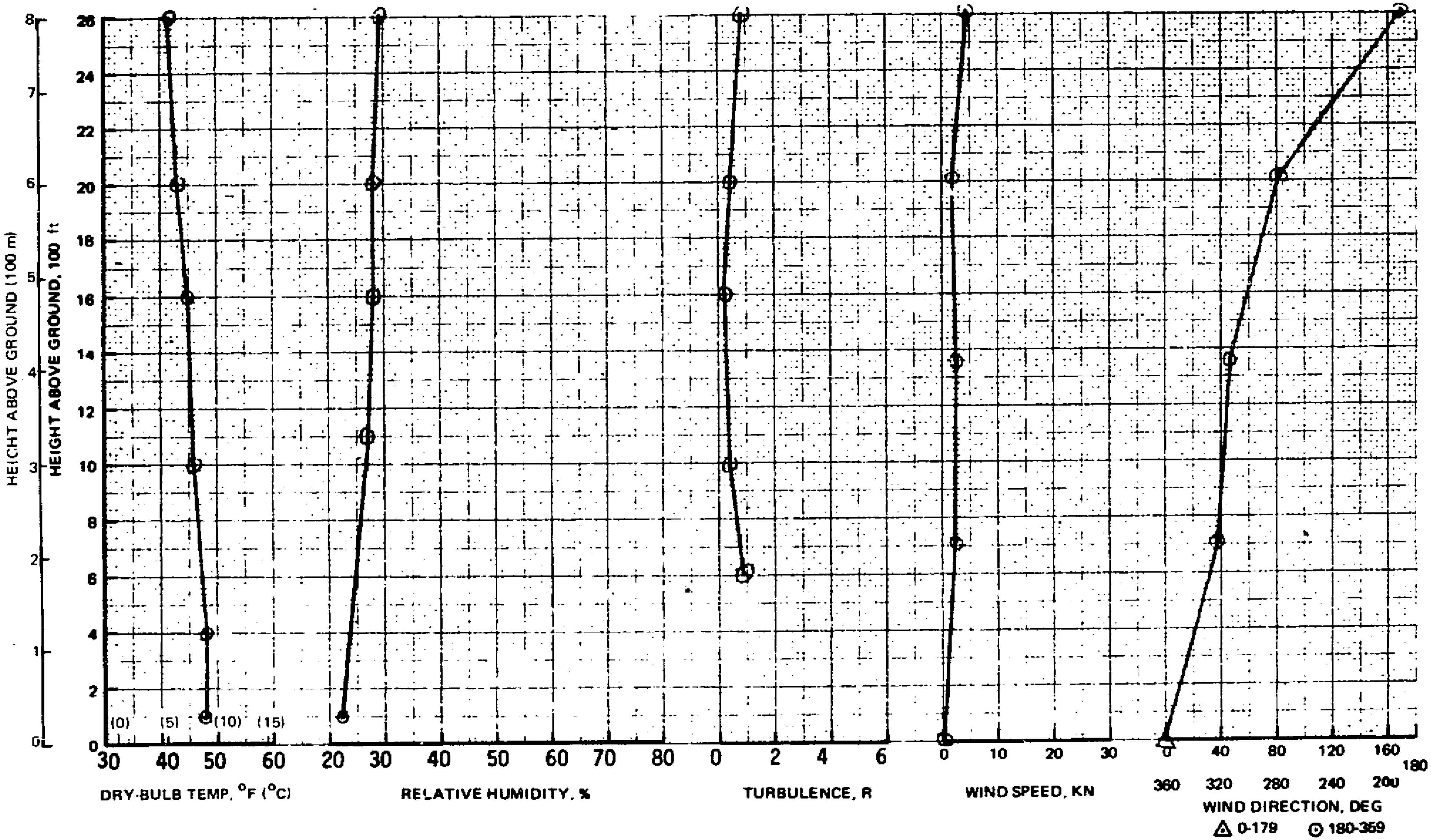


FIGURE 47. SOUND PATH WEATHER DURING FLYOVER NOISE TESTS – LIGHT TURBULENCE R

TABLE 17
SUMMARY OF DISSIPATION R LEVELS
θ_C = 0.5 DEG

CASE NO. 1: LIGHT DISSIPATION

ALTITUDE		R	L	TEMP	
FEET	METERS	$cm^{2/3}$/SEC	METERS	°F	°C
2600	793	0.8	41.75	41.0	5.5
2000	610	0.4	69.25	43.0	6.5
1360	415	0.2	119.00	55.0	7.0
700	214	0.4	69.25	46.5	9.0

	FREQUENCY – Hz			
	750	1000	1500	2500
A_S	1.12	2.32	4.40	8.56

CASE NO. 2: MODERATE DISSIPATION

ALTITUDE		R	L	TEMP	
FEET	METERS	$cm^{2/3}$/SEC	METERS	°F	°C
2600	793	2.0	20.90	47.5	9.5
2300	703	4.0	12.45	49.0	10.0
1700	520	1.6	24.85	52.0	11.5
1300	397	1.2	31.25	53.5	12.5
700	214	2.2	19.30	56.0	14.0
300	91.5	2.2	19.30	57.0	14.5
0	0	0	∞	57.5	14.7

	FREQUENCY – Hz			
	750	1000	1500	2500
A_S	0.167	0.290	0.604	1.448

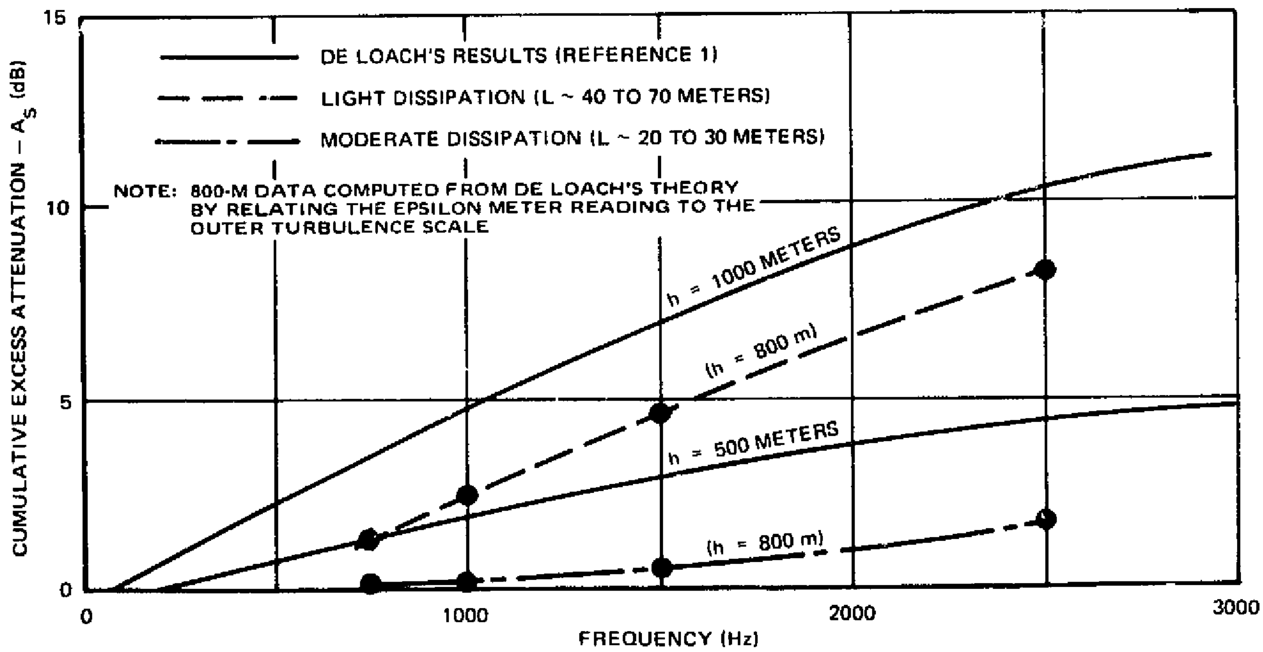


FIGURE 48. CUMULATIVE EXCESS ATTENUATION A_S (dB) VARIATION WITH FREQUENCY

NOISE SOURCE LEVELS AND ENGINE/NACELLE ACOUSTICAL CHARACTERISTICS

This section of the report describes the noise source levels, static-to-flight predictions and engine/nacelle acoustical characteristics of the DC-9/JT8D-109 Refan aircraft. A description is provided of the noise source separation and prediction procedures used to identify, isolate, and predict jet, core, fan inlet, fan exhaust and turbine noise levels, spectra and directivity from ground static and flyover noise data. The flyover noise data were from approach and takeoff without cutback tests. The approach tests used a 0.052 rad (3 degree) glide slope and 0.873 rad (50 degree) flap setting, and had a minimum slant range distance of 237 m (776 feet). The full thrust takeoff tests had a minimum slant range distance of 313 m (1026 ft). The data from these tests used 10 m (33 foot) high pole microphones and flush mounted ground microphones to minimize ground reflection problems. Evaluation of inlet and tailpipe treatment effectiveness, flight effects on jet and core noise, and engine installation effects on turbomachinery noise are also included.

Noise Source Separation Procedures

Jet and core noise - static data. - Since core engine noise (core noise) has been described under different terminology reflecting different opinions about the nature of one or more source mechanisms of core noise, it was necessary to first establish a definition for core noise as it applied to the analysis presented here. Core noise will be used in this report to denote the total contribution of all the internal (core engine) noise sources including:

(1) unsteady pressures accompanying combustion in the components of the burner section of an engine

(2) velocity and temperature fluctuations generated within the burner components and interacting with rotors and stators of the turbine stages

(3) noise generated at the exhaust struts down stream of the last turbine stage due to the turbulence and/or swirl in the exhaust flow

(4) noise generated at the nozzle lip due to the fluctuating forces imposed on the medium surrounding the nozzle.

High frequency turbine noise related to turbine blade passage is not included in the definition of core noise but rather as a separate turbo-machinery noise component. Low frequency (50 to 1000 Hz) core noise is the difference between the total noise level and the assumed level of the pure jet noise produced by the jet exhaust external to the engine (see figure 49). The high frequency (1250 to 10 000 Hz) portion of the core noise spectra was determined using an assumed "roll-off" rate based on inspection of measured data at each far-field angle. Roll-off rates were found to vary from 4 to 6 dB per octave depending on inlet angle.

Core noise engine correlating parameters: Core noise levels have been correlated with various engine operating parameters by various investigators. References 12 and 13 showed measured core noise overall sound pressure levels (OASPLs) to increase with primary jet velocity. References 14, 15 and 16 correlated core noise OASPLs with the following engine internal parameters:

(1) turbine pressure ratio

(2) compressor overall pressure ratio

(3) turbine inlet temperature

(4) temperature rise across the combustor

Since all four of these core noise engine correlating parameters are directly proportional to primary jet velocity (figure 50), primary jet velocity was selected for use in correlating core noise OASPLs for the study presented here.

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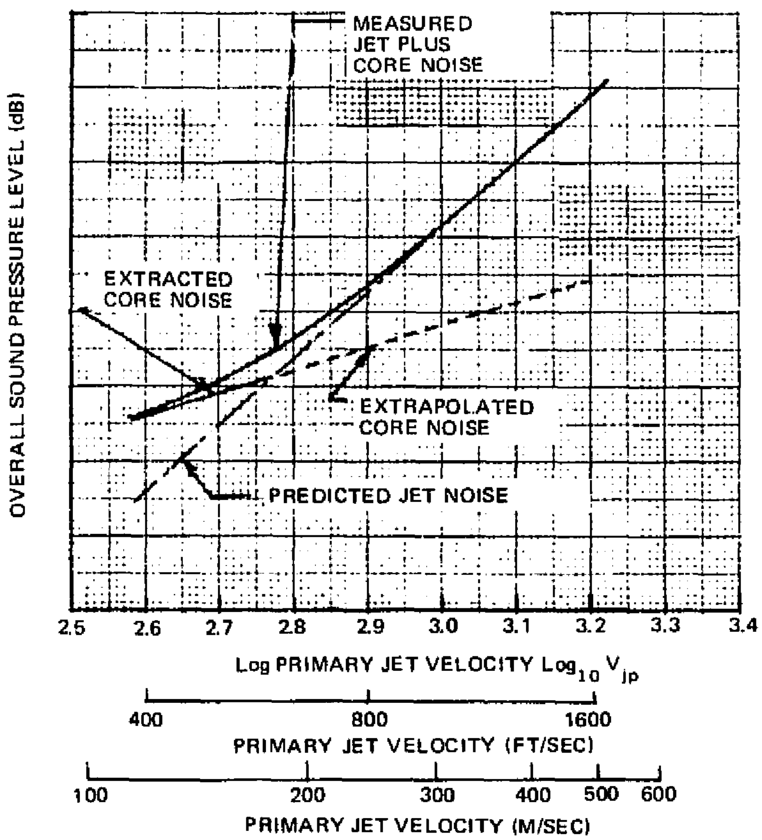
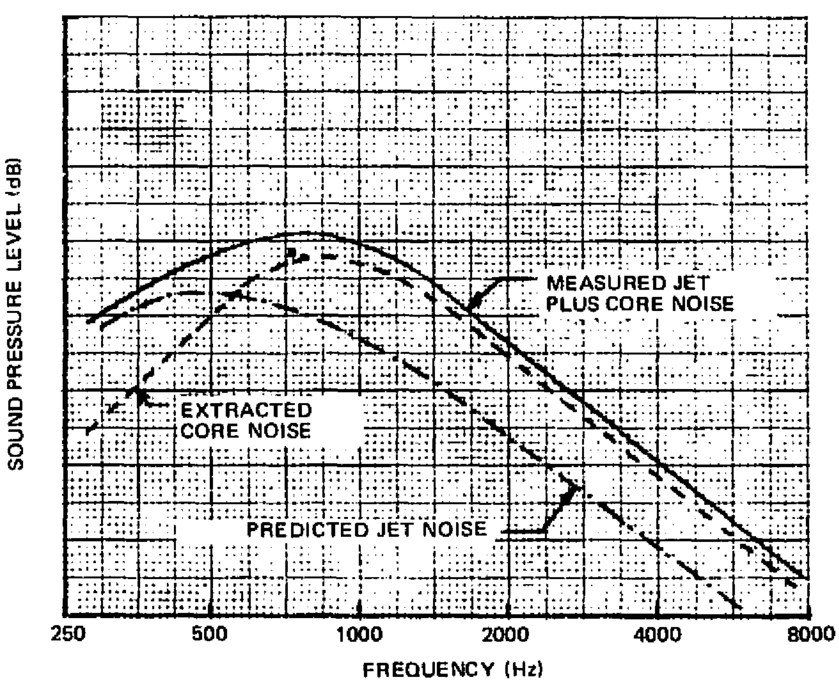


(a) CORE NOISE OASPL



(b) CORE NOISE SPECTRUM SHAPE

FIGURE 49. DEFINITION OF CORE NOISE

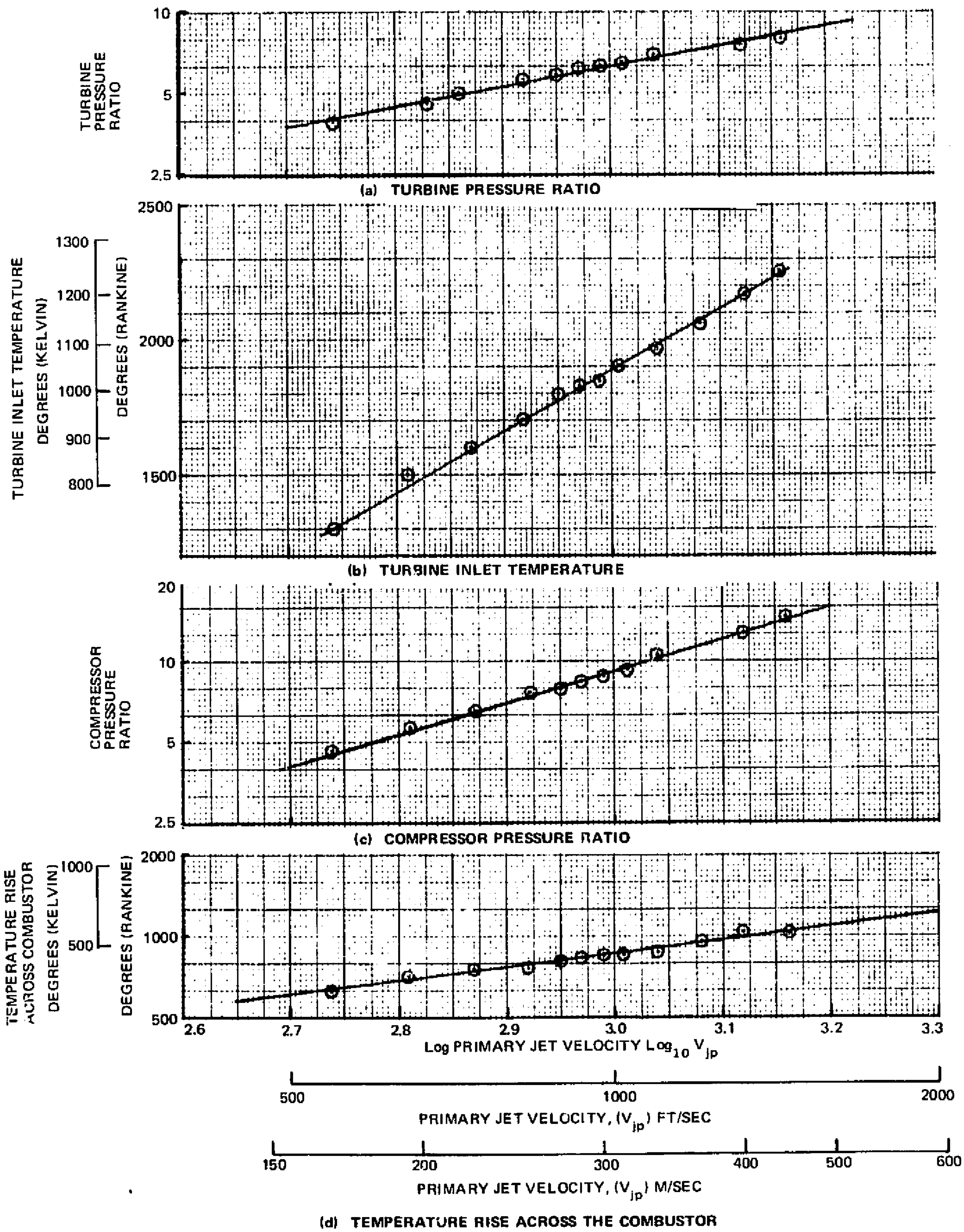


FIGURE 50. JT8D-109 CORE ENGINE NOISE CORRELATING PARAMETERS

Jet noise spectra and levels: Initially, a proposed SAE A-21 jet-noise-prediction procedure (unpublished document prepared by the Jet Noise Subcommittee of the SAE A-21 Committee, October 1973) was considered for use in predicting static jet noise. However, the levels and spectra of the jet noise estimated by the proposed SAE procedure differed significantly from measured data from the JT8D-9 and two JT8D-109 engines at high power settings, where jet noise dominated. A new jet-noise-prediction procedure described below was therefore developed based on ground-static data. Figures 51 and 52 present OASPL/jet-velocity correlations and normalized measured spectra of jet plus core noise at 45.7 m (150 foot) radius and 2.1 rad (120 degrees) for the baseline and Refan engines. The spectral plots in figure 52 were normalized in terms of 1/3-octave band sound pressure levels (SPLs) relative to OASPLs, and Strouhal numbers that were modified by the temperature factor $[(T_j/T_o)^{.26}]$ as suggested in the proposed SAE procedure. The OASPL/jet-velocity correlation at 2.1 rad (120 degrees) showed jet plus core noise OASPLs followed a $V^{6.7}$ power law for primary jet velocities greater than 305 m/sec (1000 ft/sec). For velocities greater than 305 m/sec (1000 fps), the normalized spectra for all three engines collapsed, indicating low frequency noise levels and spectra were controlled by jet noise. Jet noise levels at low jet velocities were established by extrapolating the $V^{6.7}$ correlation to lower jet velocities (figure 51). Subsequent analysis using a spectral method described later produced similar results for jet velocities less than 305 m/sec (1000 ft/sec). The resulting normalized jet noise spectra at 2.1 rad (120 degrees) from the inlet were nearly the same for the baseline and Refan engines, as anticipated (figure 53). Spectra at other angles were also nearly the same for both engines.

Correlations for static free-field jet-noise OASPLs for the JT8D-9 and JT8D-109 engines are presented in table 18, for inlet angles of 0.87 rad (50 degrees) to 2.62 rad (150 degrees). Figure 54 shows the "average" normalized static jet noise spectra as a function of far-field engine inlet angle for the JT8D-109 Refan engine.

Core noise spectra and levels: Since jet plus core OASPLs deviated from $V^{6.7}$ for jet velocities below 305 m/sec (1000 ft/sec), figure 51, and since the normalized jet plus core spectra indicated a progressive "shifting" from the jet noise spectrum for decreasing jet velocities for velocities below 305 m/sec (1000 ft/sec), it was hypothesized that the amounts of "shift" of the jet plus core spectra were determined by the relative levels of the jet and core noise (figure 55). At high power settings measured spectra were controlled by jet noise, at mid power settings spectra were controlled by jet and core noise, and at low power settings spectra were controlled by core noise. Replotting the jet plus core normalized spectra using very low engine power data from Refan engines 1 and 2 presented in figures 52b and 52c with the abscissa in the form of a different nondimensional parameter (fD_p/c_o) provided good correlation of the data, figure 56. The nondimensional parameter fD_p/c_o (where (f) is the 1/3-octave band center frequency, (D_p) is the diameter of the primary nozzle, and (c_o) is the speed of sound in ambient air) used for correlating core noise spectra was suggested in SAE A-21 jet-noise prediction procedure. Initially, the core noise spectrum was assumed to peak in the 400 Hz 1/3-octave frequency band (dashed line in figure 56). Later analysis of flyover noise data produced a core noise spectrum similar to that obtained from the ground data, but with a peak frequency higher than 400 Hz. The spectrum obtained from the flyover noise data is recommended for future static-to-flight core noise prediction (solid line on figure 56). The "first-generation" core noise spectra shapes obtained from the ground static data and used in the current analysis are presented in figure 57.

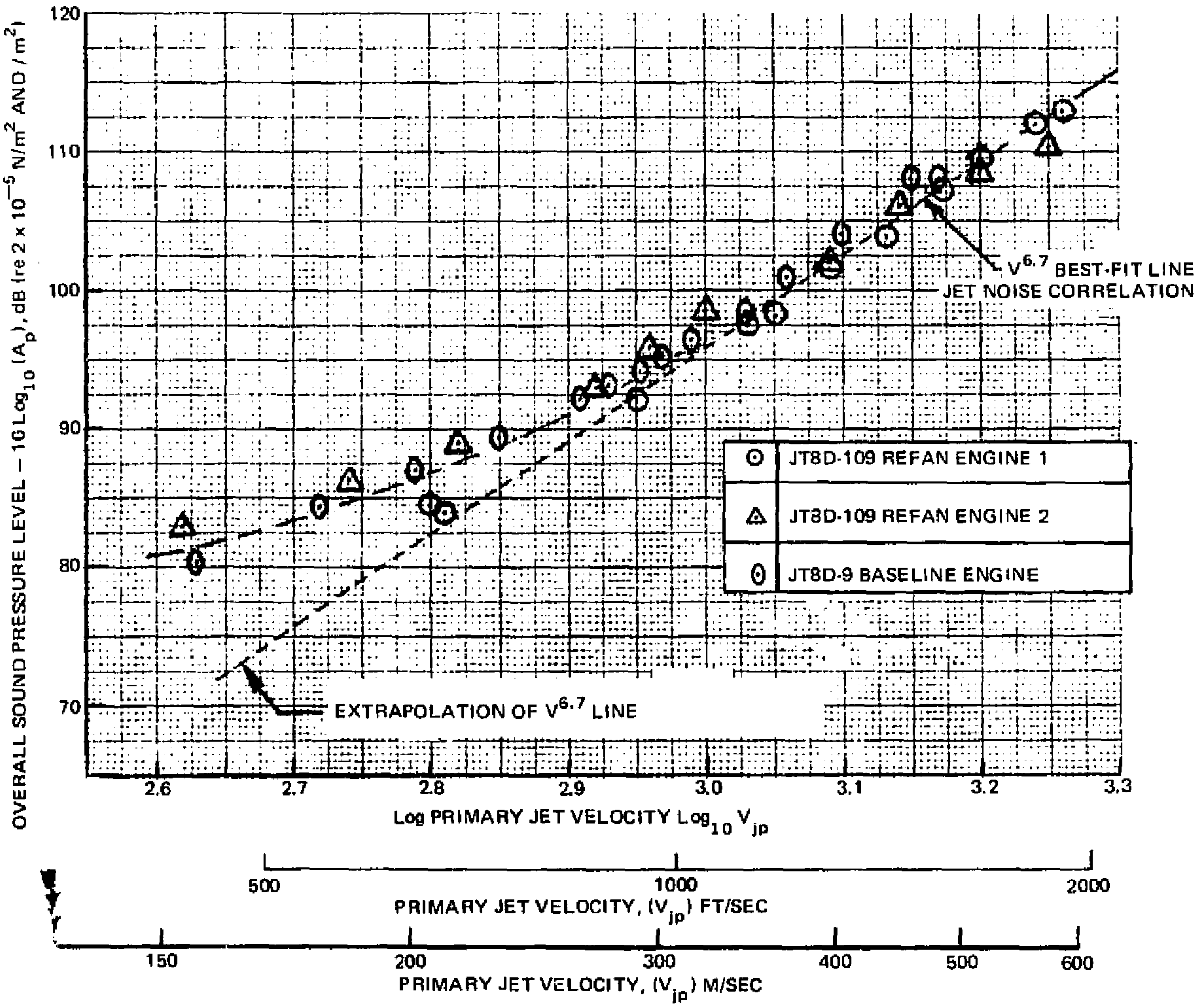


FIGURE 51. CORRELATION OF STATIC JET + CORE NOISE OASPL AND PRIMARY JET VELOCITY AT 150 FEET (45.7 M) AND 120 DEGREES (2.1 RAD)

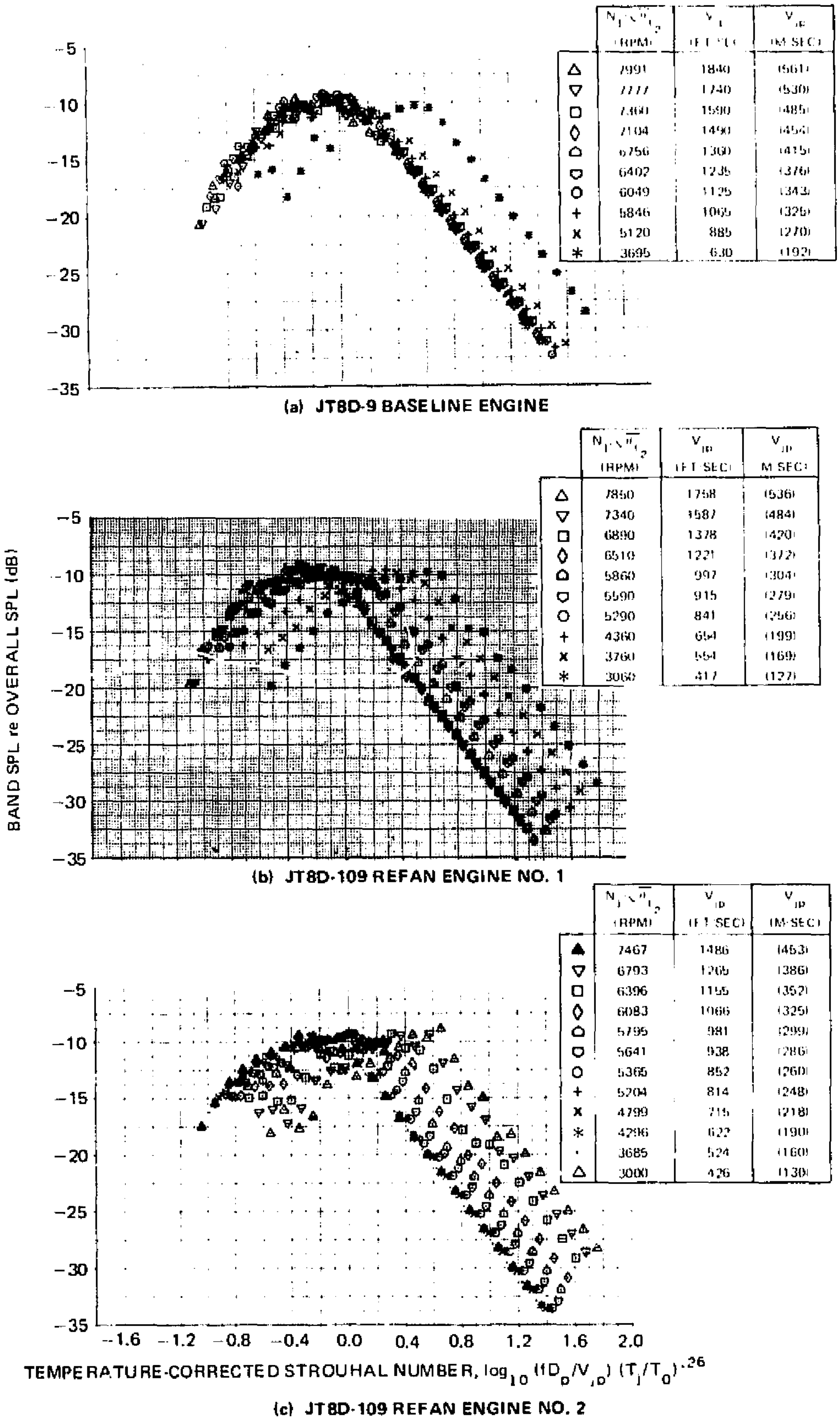


FIGURE 52. NORMALIZED SPECTRA OF STATIC JET + CORE NOISE AT 150 FEET (45.7 METERS) AND 120 DEGREES (2.1 RAD)

TABLE 18 - JET NOISE OASPL CORRELATIONS BASED ON STATIC NOISE DATA FOR JT8D-9 AND JT8D-109 ENGINES*

$$OASPL_{jet} = M \times 10 \text{ Log}_{10} V_{jp} + 10 \text{ Log}_{10} A_p + \text{Constant}$$

INLET ANGLES Degrees (Radians)	50 (0.87)	60 (1.05)	70 (1.22)	80 (1.40)	90 (1.57)	100 (1.75)	110 (1.92)	120 (2.09)	130 (2.27)	140 (2.44)	150 (2.62)
M	5.65	5.75	5.85	5.95	6.00	6.30	6.25	6.67	7.40	7.60	7.73
CONSTANT	-80.8	-83.6	-86.0	-88.6	-88.6	-96.5	-92.2	-103.7	-123.4	-127.7	-131.3

* Single Engine, 150 Foot (45.7 Meter) Radius and Free-Field

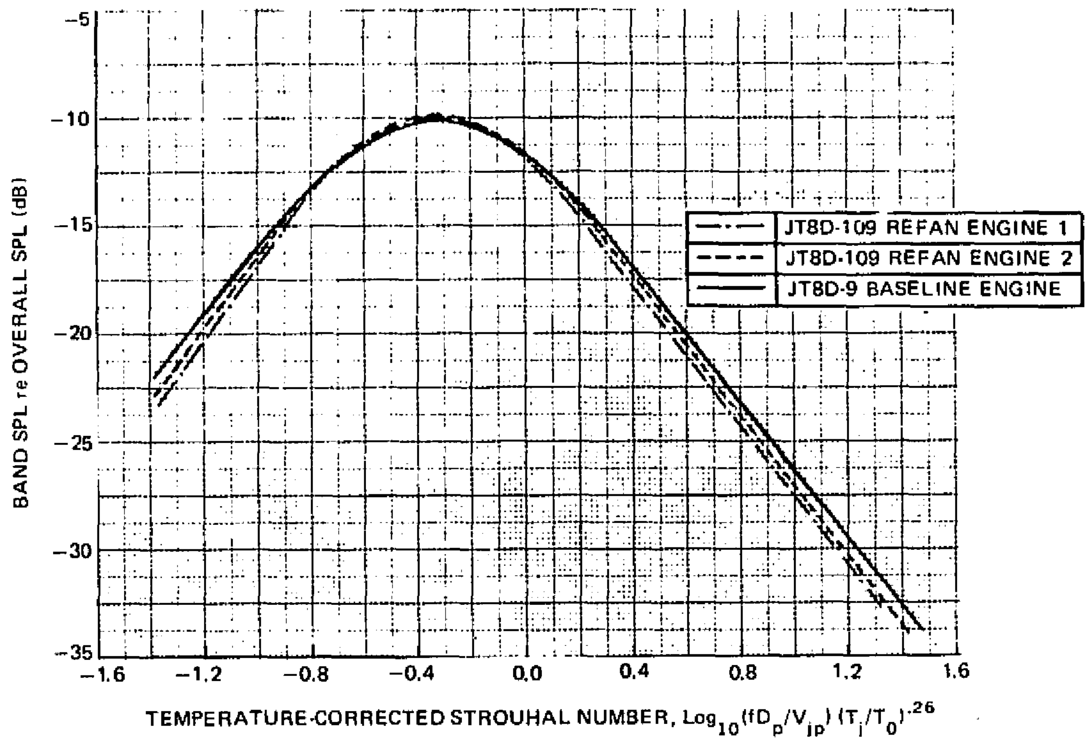


FIGURE 53. COMPARISON OF AVERAGE SPECTRA OF STATIC JET NOISE FROM BASELINE AND REFAN ENGINES AT 150 FEET (45.7 M) AND 120 DEGREES (2.1 RAD)

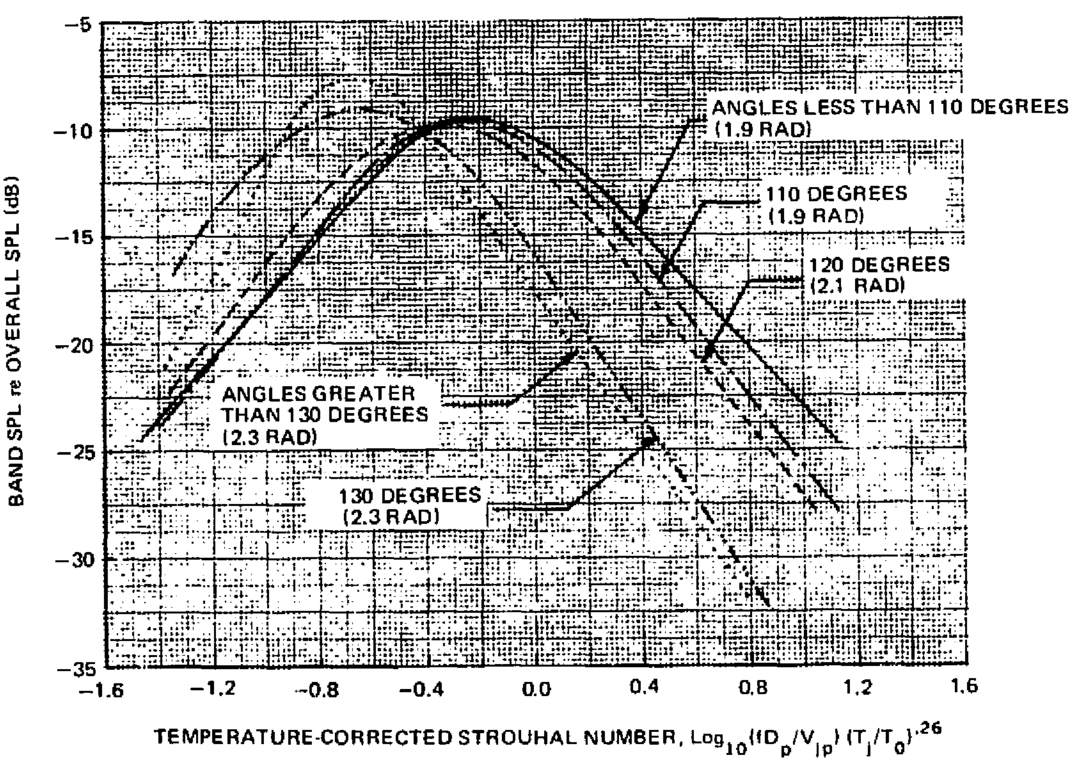


FIGURE 54. AVERAGE NORMALIZED SPECTRA OF STATIC JET NOISE AT 150-FOOT (45.7-M) RADIUS FOR JT8D-109 ENGINE AT DIFFERENT ANGLES RELATIVE TO THE INLET

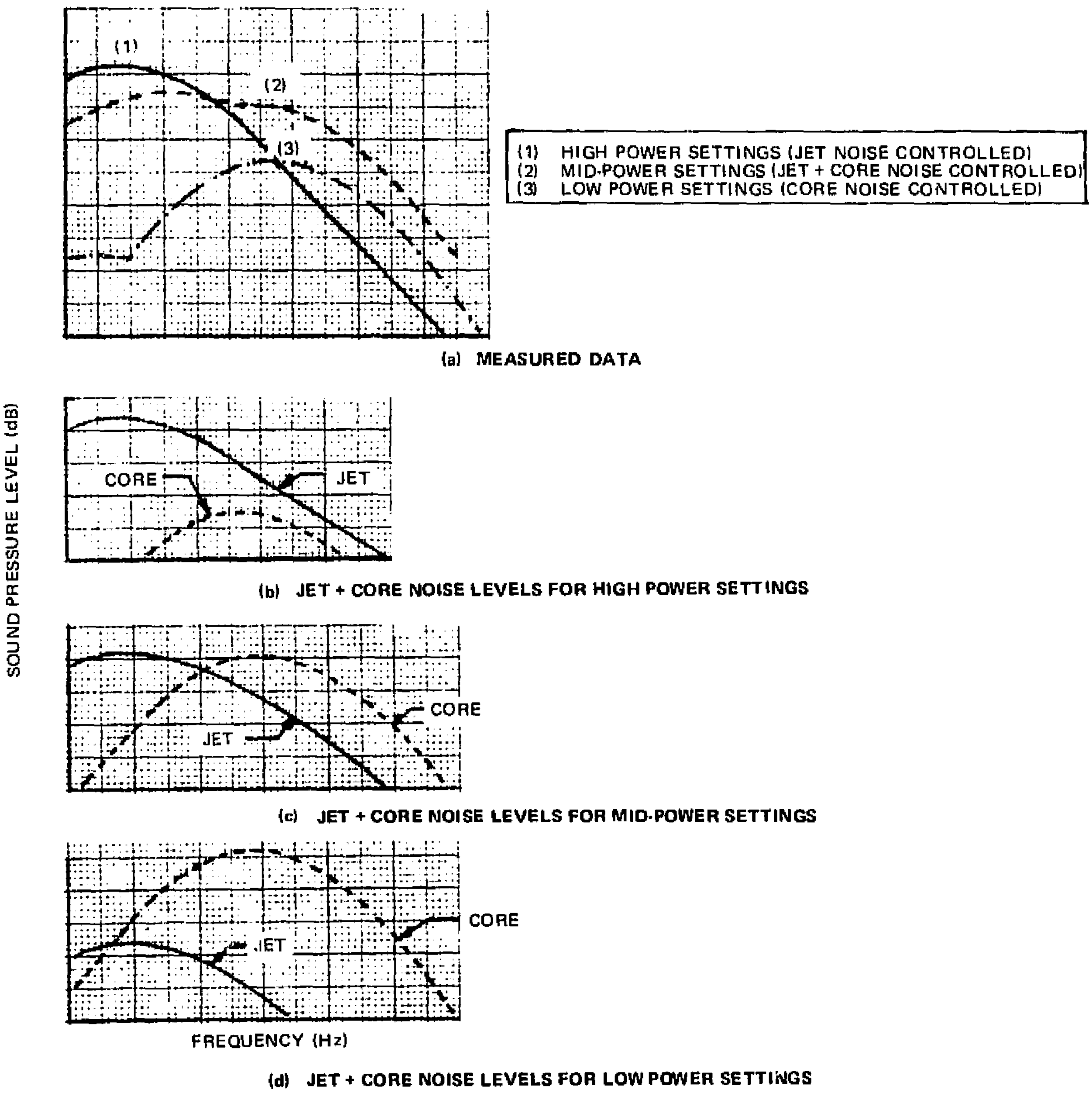


FIGURE 55. DETERMINATION OF RELATIVE JET AND CORE NOISE LEVELS FROM MEASURED DATA

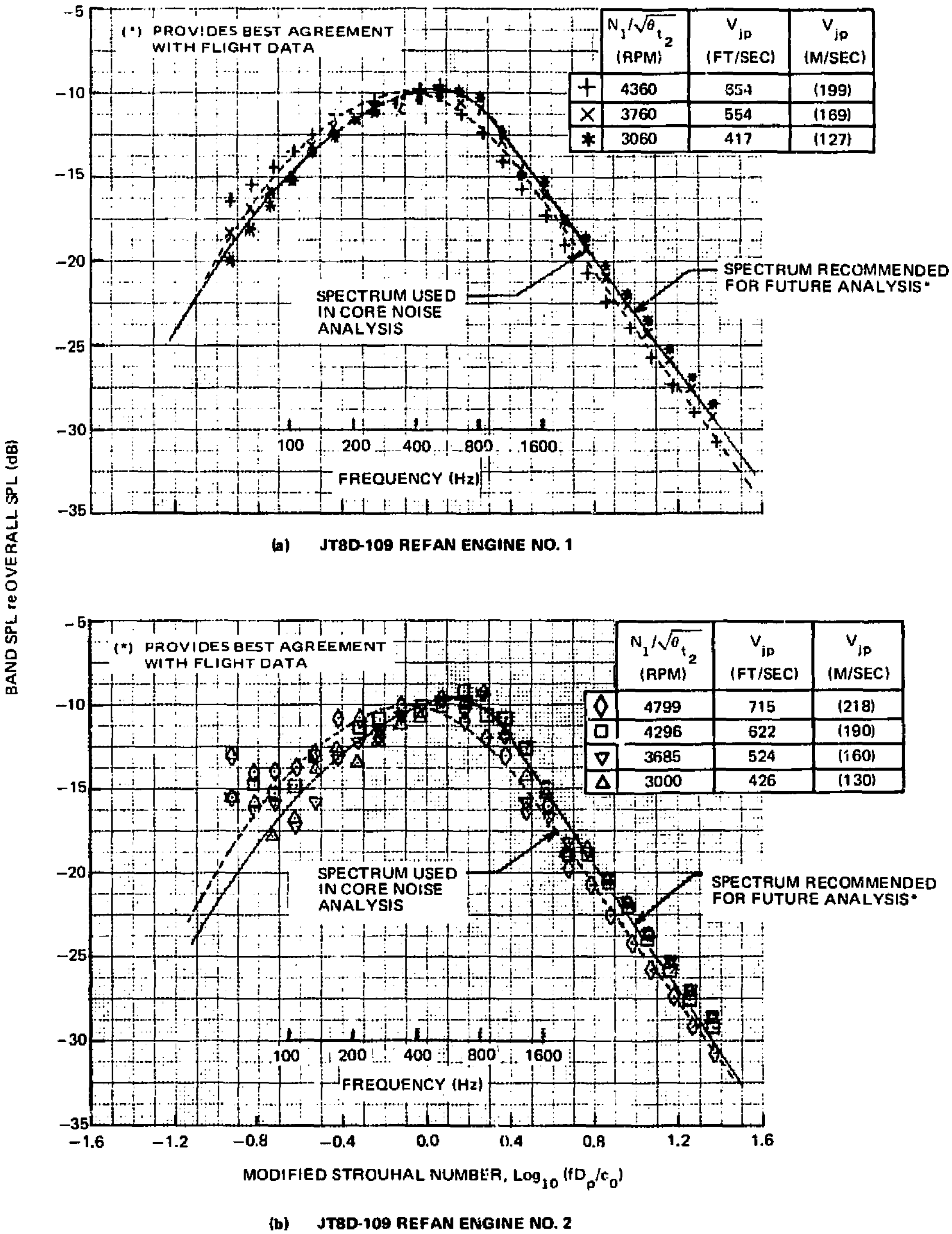
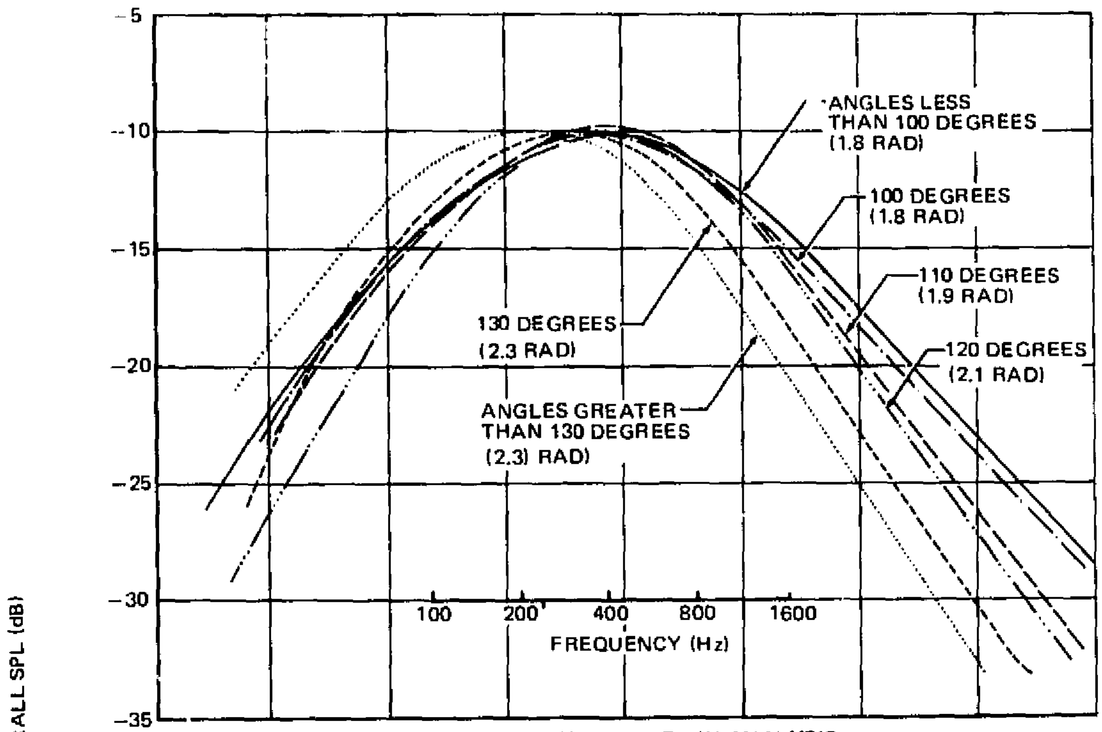
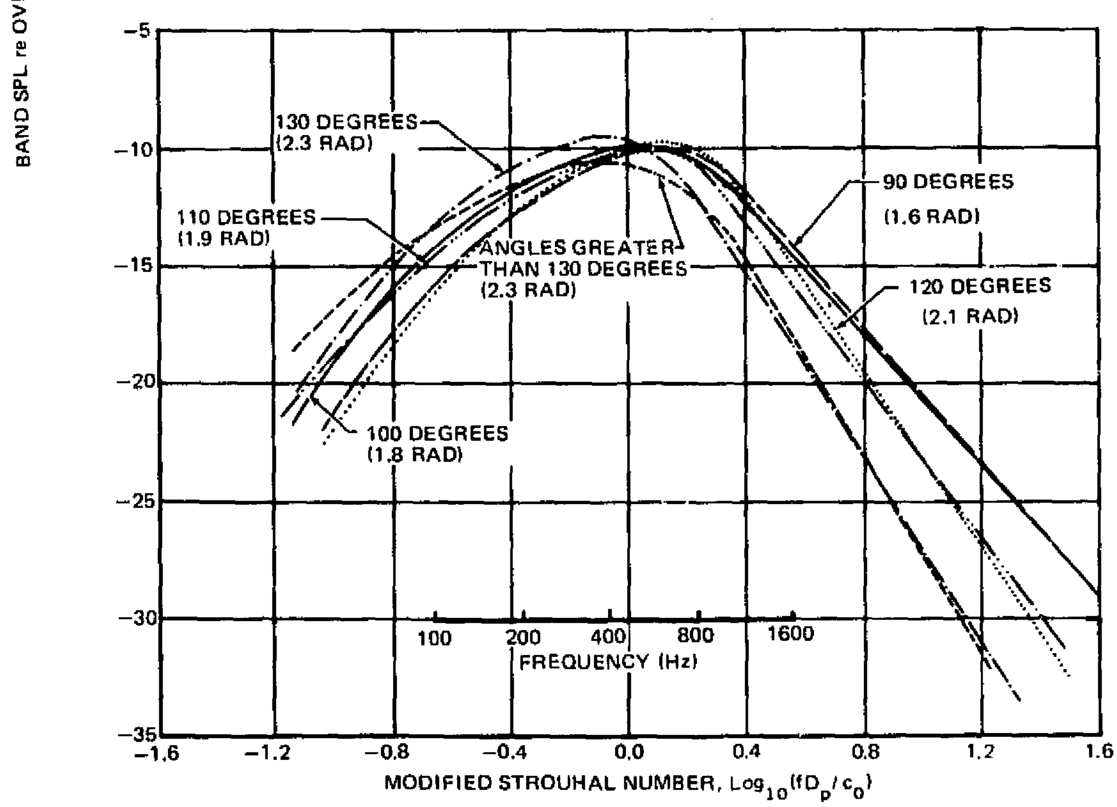


FIGURE 56. NORMALIZED SPECTRA OF STATIC CORE NOISE AT 150 FEET (45.7 M) AND 120 DEGREES (2.1 RAD)



(a) SPECTRAL SHAPES USED IN ANALYSIS



(b) RECOMMENDED SPECTRAL SHAPES

FIGURE 57. AVERAGE NORMALIZED SPECTRA OF STATIC CORE NOISE AT 150-FOOT (45.7-M) RADIUS AT DIFFERENT ANGLES RELATIVE TO THE INLET

TABLE 19 - CORE NOISE OASPL CORRELATIONS BASED ON STATIC NOISE DATA FOR THE JT8D-109 ENGINE*

$$OASPL_{Core} = N \times (10 \, Log_{10} \, V_{jp}) + 10 \, Log_{10} \, A_p + Constant$$

INLET ANGLES Degrees (Radians)	50 (0.87)	60 (1.05)	70 (1.22)	80 (1.40)	90 (1.57)	100 (1.75)	110 (1.92)	120 (2.09)	130 (2.27)	140 (2.44)	150 (2.62)
N	1.92	1.95	2.00	2.00	2.30	2.70	3.20	2.75	2.75	2.70	2.75
CONSTANT	27.1	25.3	23.5	24.0	16.4	7.7	-4.8	9.0	9.3	9.0	4.5

* Single Engine, 150 Foot (45.7 Meter) Radius and Free-Field

Estimated core noise OASPLs at low power settings were calculated using two methods:

(1) subtracting the predicted jet noise OASPLs from the measured data

(2) using a spectral method (see figure 58)

In the spectral method, the relative jet and core noise peak SPLs were obtained by "adjusting" the levels of jet and core noise SPL spectra calculated from figures 54 and 57a respectively, so that the sum of the contributions from the two sources approximately equaled the measured levels. The jet and core noise OASPLs were then calculated from Equations 13 and 14

$$OASPL_{Core} = 10 \, Log_{10} \left[\left(\frac{10^{A/10}}{1 + 10^{\Delta/10}} \right) \right] \quad (13)$$

$$OASPL_{Jet} = OASPL_{Core} + \Delta \quad (14)$$

where A is the measured OASPL of the total noise and $\Delta$is the difference between the jet and core noise peak 1/3-octave band levels, see figure 58.

Calculated values of core noise OASPLs at primary jet velocities below 305 m/sec (1000 ft/sec) using the two different methods agreed to within 1 dB, as anticipated. The resulting correlations were extrapolated to jet velocities higher than 305 m/sec (1000 ft/sec).

Correlations for static free-field core-noise OASPLs for the two JT8D-109 engines are presented in table 19, for inlet angles of 0.87 rad (50 degrees) to 2.62 rad (150 degrees). Based on limited data at low-power settings, core noise OASPL for the JT8D-9 engine was found to be 3 dB lower than the levels for the JT8D-109 engines at comparable primary jet velocities and inlet angles.

Jet and core noise - flight data. - The methodology used to identify, isolate, and predict jet and core noise levels, spectra, and directivity for the DC-9 Refan/JT8D-109 based on flyover noise data was essentially identical to that developed and used for the static noise source analyses described above.

Jet noise spectra and levels: A typical measured flyover overall jet plus core noise normalized spectra at 2.1 rad (120 degrees) from the inlet is presented in figure 59a as a function of engine power setting. Figure 59b shows the same data replotted with the term in the abscissa scale modified by the factor $[(1+V_a/V_{jp})/(1-V_a/V_{jp})]$. The spectra collapsed better when the abscissa was modified by the velocity-ratio factor. Average normalized jet noise spectra from figure 59b at high power settings were selected for use in estimating inflight jet noise spectra at 2.1 rad (120 degrees). Normalized inflight jet noise spectra used for other angles are presented in figure 60.

The first step in calculating inflight jet noise OASPLs assumed core noise OASPLs at 1.57 rad (90 degrees) were the same statically and in-flight for the same primary jet velocity. This assumption was believed to be valid

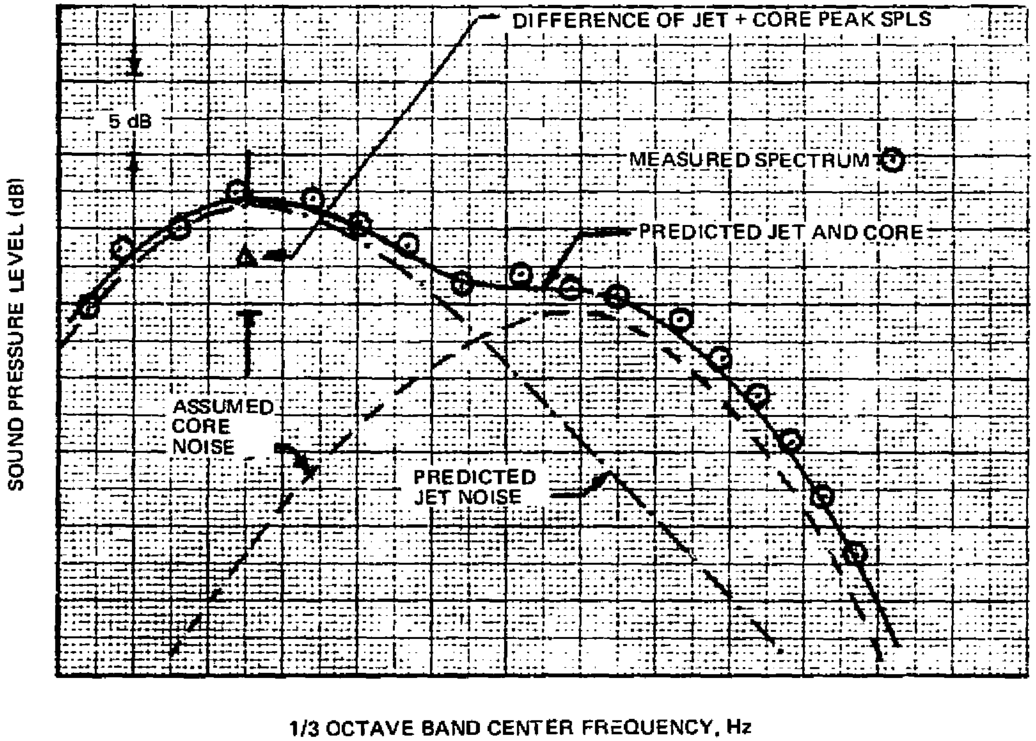


FIGURE 58. SPECTRAL METHOD OF DETERMINING CORE NOISE

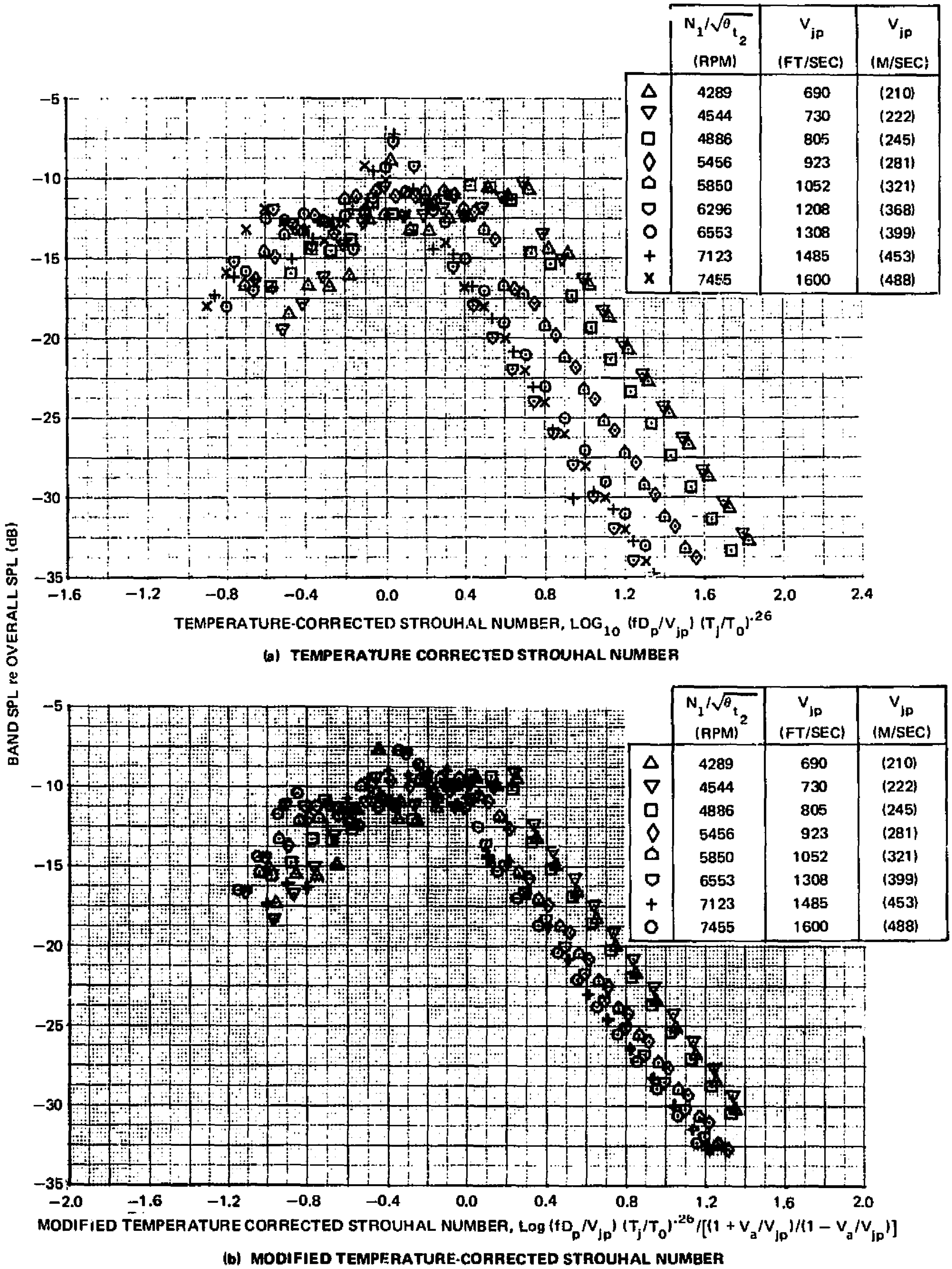


FIGURE 59. NORMALIZED SPECTRA OF INFLIGHT JET + CORE NOISE AT 150 FEET (45.7 M) AND 120 DEGREES (2.1 RAD)

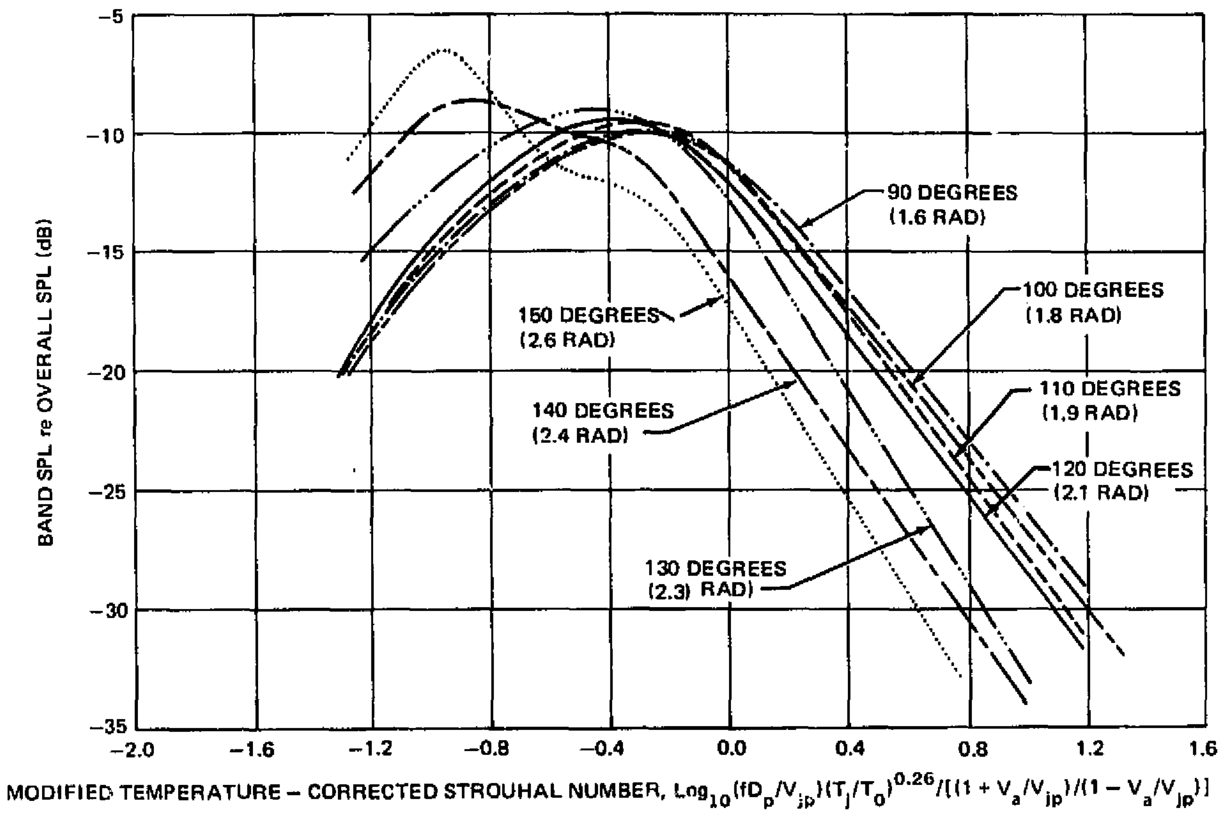


FIGURE 60. AVERAGE NORMALIZED SPECTRA OF INFLIGHT JET NOISE AT 150-FOOT (45.7-M) RADIUS AT DIFFERENT ANGLES RELATIVE TO THE INLET

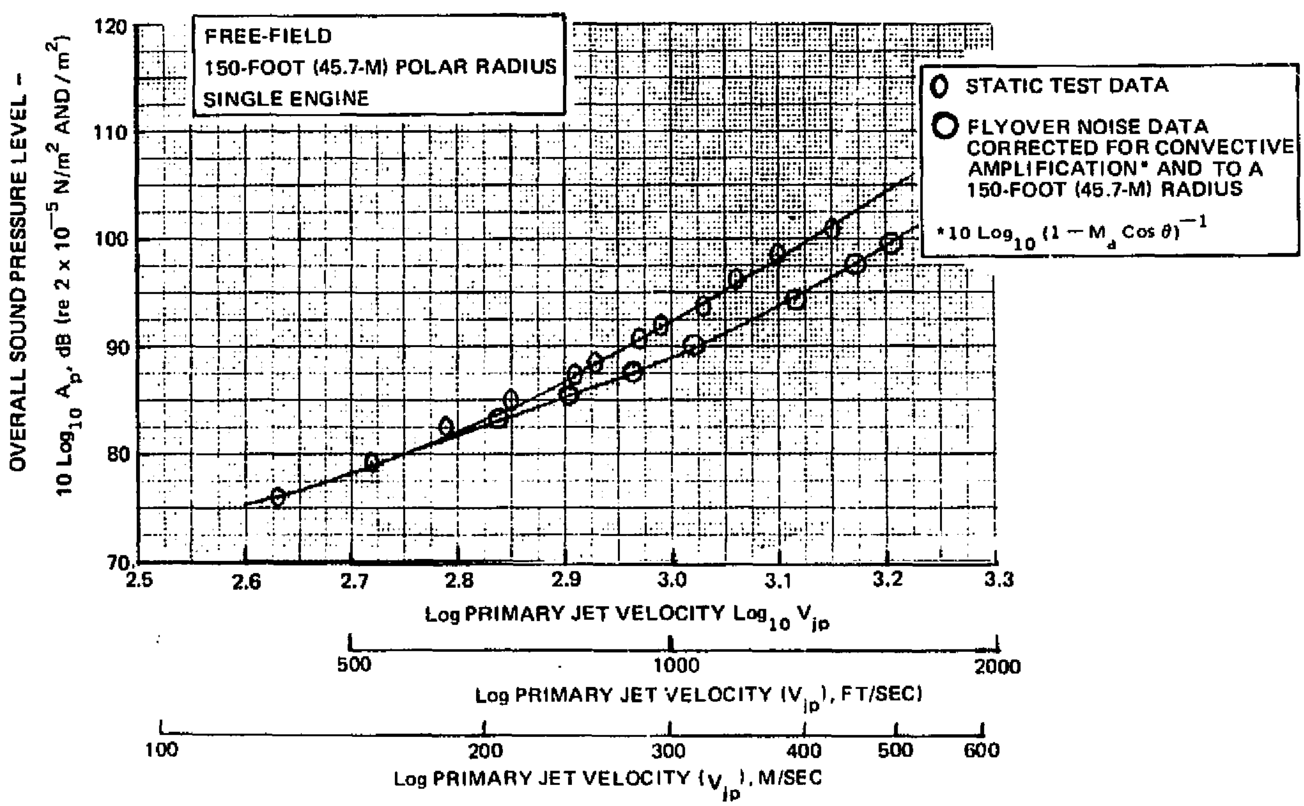


FIGURE 61. COMPARISON OF STATIC AND ADJUSTED FLIGHT JET + CORE OVERALL SOUND PRESSURE LEVELS AT 90 DEGREES (1.6 RAD)

TABLE 20 - JET NOISE OASPL CORRELATIONS BASED ON DC-9/JT8D-109 FLYOVER NOISE DATA*

$$OASPL_{jet} = m \times 10 \, Log_{10} \, V_{j,rel} + 10 \, Log_{10} \, A_p + Constant$$

INLET ANGLES Degrees (Radians)	50 (0.87)	60 (1.05)	70 (1.22)	80 (1.40)	90 (1.57)	100 (1.75)	110 (1.92)	120 (2.09)	130 (2.27)	140 (2.44)	150 (2.62)
m	4.10	4.10	4.20	4.30	4.50	4.60	5.30	5.70	5.70	5.90	6.60
CONSTANT	-33.0	-30.9	-33.3	-34.4	-41.5	-43.9	-65.2	-73.7	-73.5	-80.2	-100.6

* Single Engine, 150 Foot (45.7 Meter) Radius and Free-Field

since, for a given engine operating condition, differences in engine internal core-noise correlating parameters (see figure 50) are quite small between static and flight environments. Figure 61 highlights a comparison of the Refan engine free-field static and adjusted inflight jet plus core noise OASPLs at 1.57 rad (90 degress) from the inlet as a function of the primary jet velocity (the flyover noise data presented here were corrected for the convection effect using 10 Log_{10} $(1-M_a \text{Cos } \theta)^{-1}$ and adjusted to a 45.7 m (150 foot) radius). At high primary jet velocities where jet noise is dominant, inflight OASPLs were lower than static levels as a result of jet noise relative velocity effects. For jet velocities below 213 m/sec (700 ft/sec) where core noise dominates, little or no reduction in inflight OASPLs were observed.

The second step in calculating jet noise OASPLs assumed changes in the directivity of core noise OASPLs between static and flight environments could be expressed by 10 Log_{10} $(1-M_a \text{Cos } \theta)^{-1}$.

The inflight jet-noise OASPLs were calculated by subtracting the calculated inflight core-noise OASPLs from the measured inflight OASPLs. The resulting calculated jet-noise OASPLs at 120 degrees are shown in figure 62. Correlations for inflight free-field jet-noise OASPLs for the JT8D-109 engine are presented in table 20, for inlet angles of 0.87 rad (50 degrees) to 2.62 rad (150 degrees).

Core noise spectra and levels: Inflight core-noise OASPLs were obtained by correcting the static core-noise OASPL correlations described in table 19, for the convection effect due to forward motion. Normalized inflight core noise spectra were obtained using average measured flyover noise data from approach power settings. Figure 63 shows the normalized inflight core noise spectra for engine inlet angles from 1.57 to 2.6 rad (90 to 150 degrees) that were used in the analysis presented here. Frequency of peak core noise for the Refan JT3D-9 engine was shown in reference 12 to occur at 400/500 Hz, and not to vary with inlet angle.

A cursory study was made to determine if the noise levels in the 630/800 bands were from source mechanisms other than combustion noise (for example strut or obstruction noise). The frequencies at which strut/obstruction noise peaked (determined using methods outlined in references 14 and 17) were 630/800 Hz, as shown below.

	Frequency of Peak Noise Level, Hz
Predicted, (using reference 14)	800
Predicted, (using reference 17)	630
Measured (Refan flyover noise data)	630/800

These results indicated that the noise levels in the 630/800 Hz bands for low power settings may be caused by strut noise.

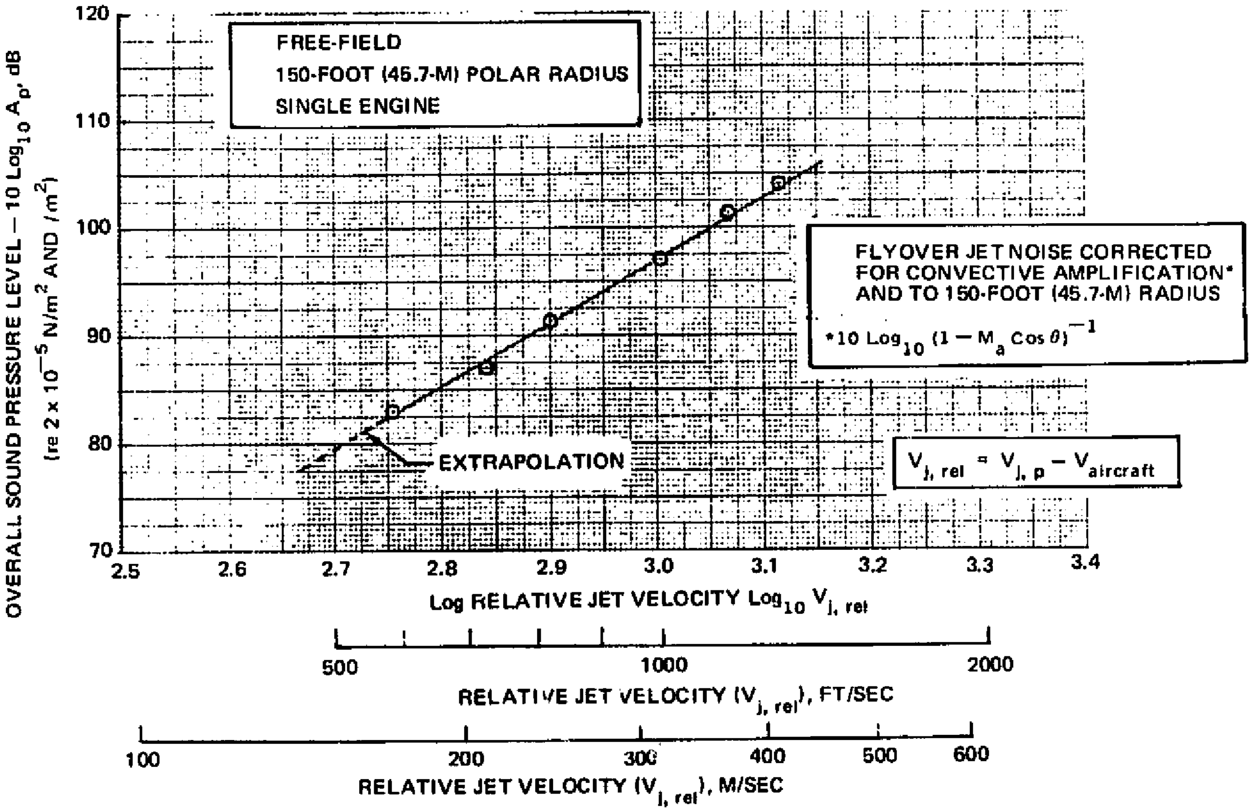


FIGURE 62. CORRELATION OF INFLIGHT JET NOISE OVERALL SOUND PRESSURE LEVELS WITH RELATIVE JET VELOCITY AT 150-FOOT (45.7-M) AND 120 DEGREES (2.09 RAD)

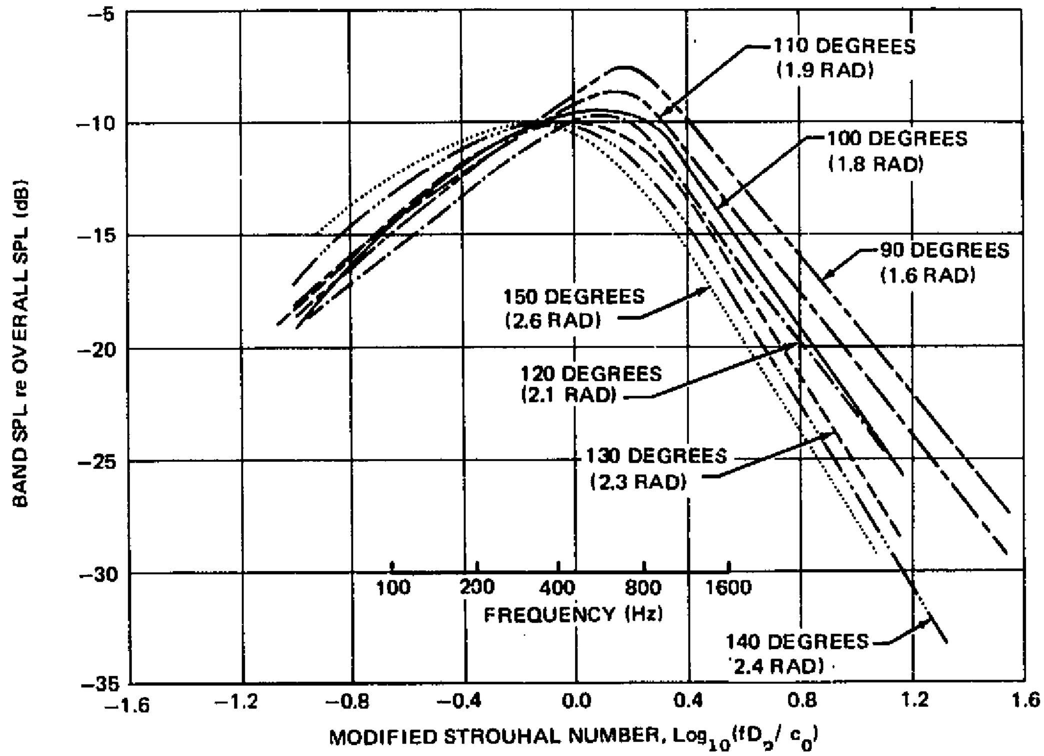


FIGURE 63. AVERAGE NORMALIZED SPECTRA OF INFLIGHT CORE NOISE AT 150-FOOT (45.7-M) RADIUS AT DIFFERENT ANGLES RELATIVE TO THE INLET

Turbomachinery noise - static data. - The methodology developed to identify, isolate, and predict high-frequency turbomachinery noise levels, spectra, and directivity for the DC-9/JT8D-109 Refan aircraft separated turbomachinery noise into components consisting of fan inlet, fan exhaust, and low pressure turbine noise on a 1/3-octave band level basis at a 45.7 m (150 foot) radius as a function of relevant engine cycle parameters. The method required development of computer programs to: (1) separate noise sources, (2) empirically predict levels and spectra of each noise source, and (3) extrapolate the predicted levels to flight conditions.

The static test configurations used in separating turbomachinery noise sources are described in table 21. The data from these tests were obtained using 4.9 m (16 foot) high microphones located on an arc 45.7 m (150 feet) from the engine inlet centerline. No attempt was made to remove ground-reflection effects from the data.

Removal of jet and core noise from measured data: Before turbomachinery noise sources could be separated into components, all other significant sources of noise (i.e., jet and core noise) were removed from the measured data. Low frequency noise (50 to 1000 Hz) was assumed to be jet plus core noise. A roll-off rate for the contribution of jet plus core noise was assumed for each angular location for the 1/3-octave bands from 1000 to 10 000 Hz.

Beginning with the 10 000 Hz band and continuing to successively lower bands, the assumed jet plus core noise levels were subtracted from the total noise level, giving the total turbomachinery noise level as

$$SPL_{Turbomachinery} = 10 \, Log_{10} \, [10^{(SPL_{Total}/10)} - 10^{(SPL_{j/c}/10)}]$$

The subtraction procedure continued band by band, until the assumed jet plus core noise spectrum was within one dB of the total measured noise level. The high-frequency turbomachinery noise was then extrapolated to lower frequencies at a roll-off rate consistent with fan/compressor test stand data previously obtained from engine manufacturers of 3 dB/octave.

Results from the use of this method are illustrated in figure 64 for data from Refan engine 1 (configurations A, B, and C) at angles of 0.7 and 2.1 rad (40 and 120 degrees) for a nominal engine fan speed of 5900 RPM.

Separation of data into discrete tones and broadband noise: The procedures for separating and predicting turbomachinery noise required determining the relative contributions of tones and broadband noise to a given spectra. The following criteria for separating broadband and discrete tone noise were used:

(1) The only tones considered were the fan blade passing frequency (BPF), the 2nd fan harmonic, and the BPF tones from each of the three low pressure turbine stages (harmonics of higher order than those listed were generally in frequency bands higher than 10 000 Hz and hence, were not included in the separation procedure)

TABLE 21

JT8D-109 STATIC ENGINE TEST CONFIGURATIONS

ENGINE DESIGNATION NUMBER	CONF CODE	INLET	FAN CASE	FAN DUCT	TAILPIPE
1	A	UNTREATED	TREATED	TREATED	UNTREATED
1	B	TREATED	TREATED	TREATED	UNTREATED
1	C	TREATED (PLUS INLET "HUSH HOUSE")*	TREATED	TREATED	UNTREATED
2**	—	TREATED	TREATED	TREATED	TREATED

(*) PURPOSE OF THE INLET "HUSH HOUSE" WAS TO MINIMIZE CONTRIBUTION OF INLET NOISE RADIATED IN THE AFT QUADRANT

(**) INCLUDES MODIFIED TURBINE SUPPORT FRAMES

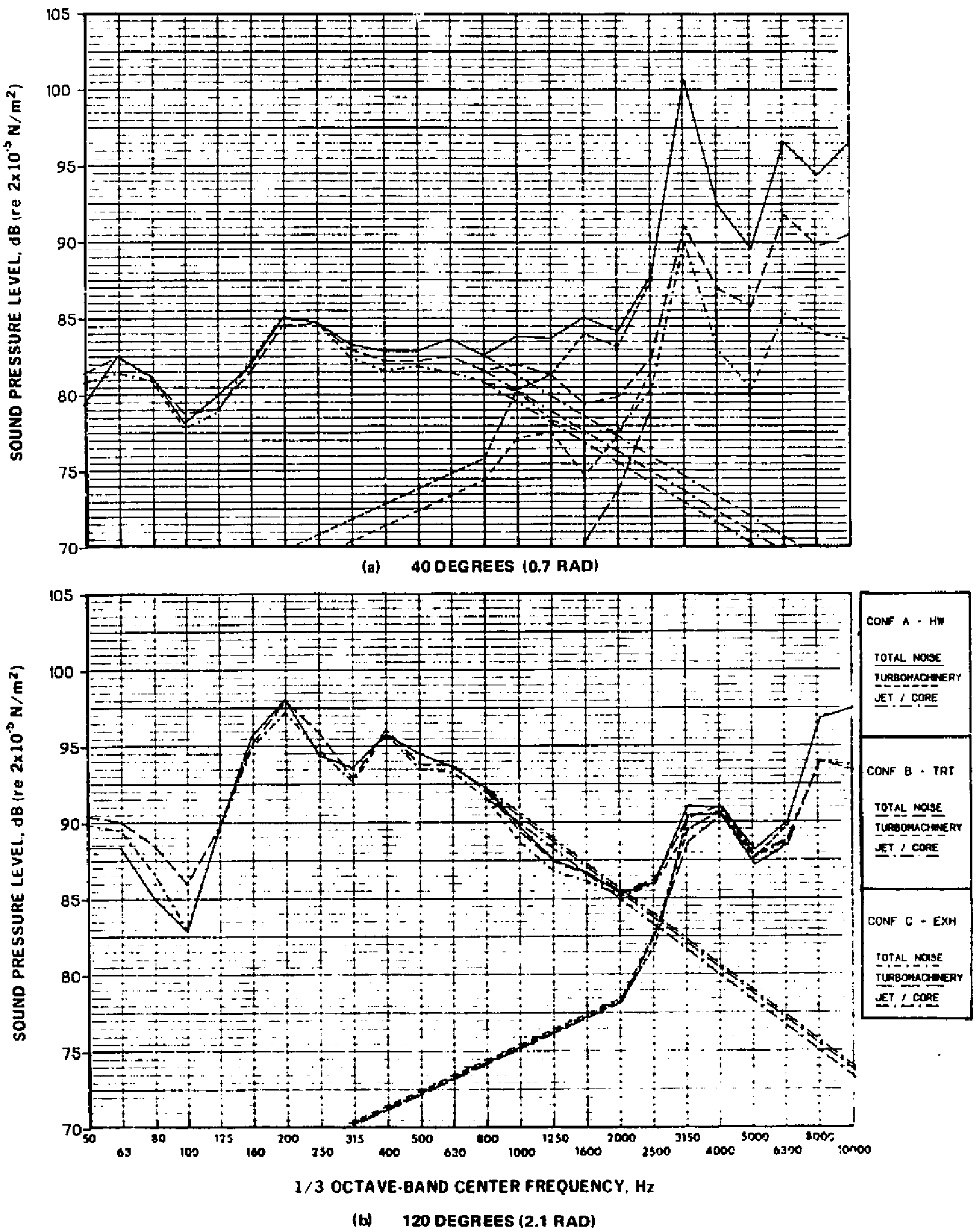


FIGURE 64. JET + CORE AND TURBOMACHINERY NOISE SEPARATION FOR REFAN ENGINE 1, CONFIGURATIONS A, B, AND C, AT A NOMINAL $N_1/\sqrt{\theta}$ OF 5900 RPM

(2) if multiple tones occurred in the same 1/3-octave band (e.g., BPF for two or more turbine stages, or the fan 2nd harmonic and one or more turbine BPFs), they were assumed to have equal strength

(3) the broadband turbomachinery noise spectrum was assumed to be piecewise linear with 1/3-octave band number.

The application of this method required analysis of narrow band data to determine the angles and fan speeds where each tone had sufficient strength to influence the 1/3-octave band data, and to distinguish between and separate tones from different sources (i.e., fan and turbine) which occurred in the same 1/3-octave band.

For each angle and fan speed, broadband and discrete tone levels were separated as follows: Fan and turbine BPFs and fan 2nd harmonics were calculated from the fan rotor speed and appropriate fan blade number. Each tone of significance, determined from narrow band data, was located in its proper 1/3-octave frequency band. Broadband noise for bands containing one or more tones was calculated. The mean-square pressure of the tone(s) in the bands was obtained by subtracting the mean-square broadband pressure from the total mean-square turbomachinery sound pressure:

$$\overline{P^2_{Tone(s)}}/P^2_{ref} = 10^{(SPL_{Turbomachinery}/10)} - 10^{(SPL_{Broadband}/10)}$$

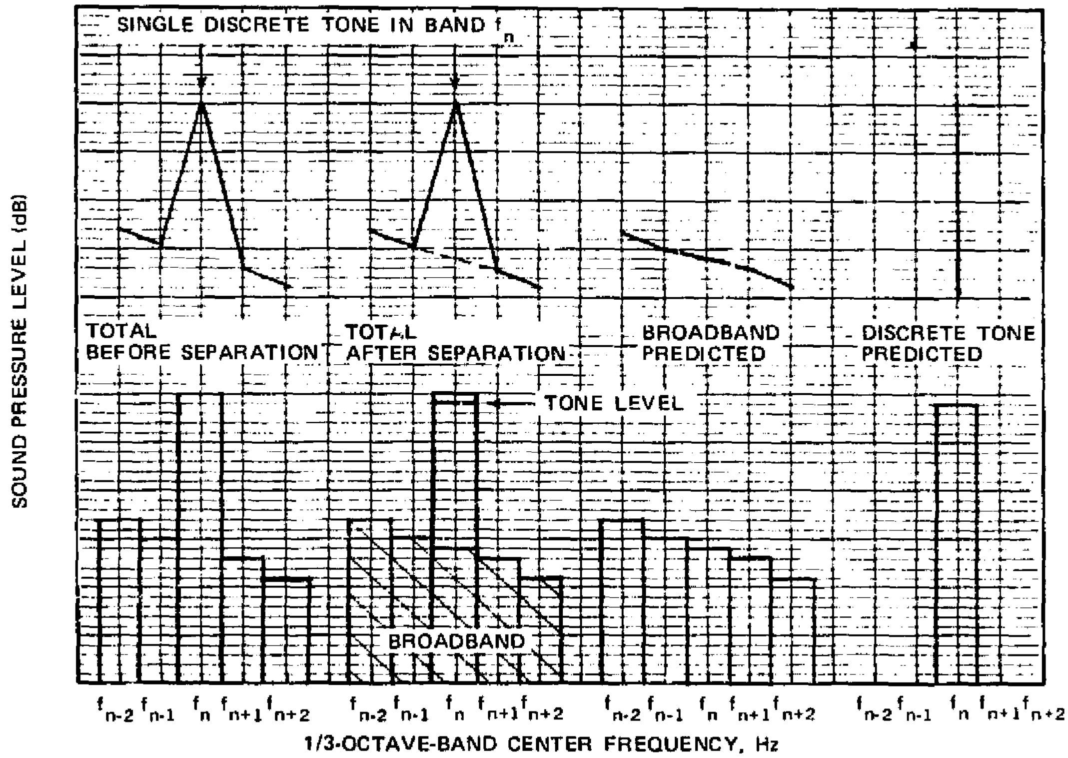
The total mean-square pressure of the tone(s) was then distributed equally among the tones present in the bands and converted to an SPL by:

$$SPL_{Each\ Tone} = 10 \log_{10} [(\overline{P^2_{Tone(s)}}/P^2_{ref})/N_{Tone(s)}]$$

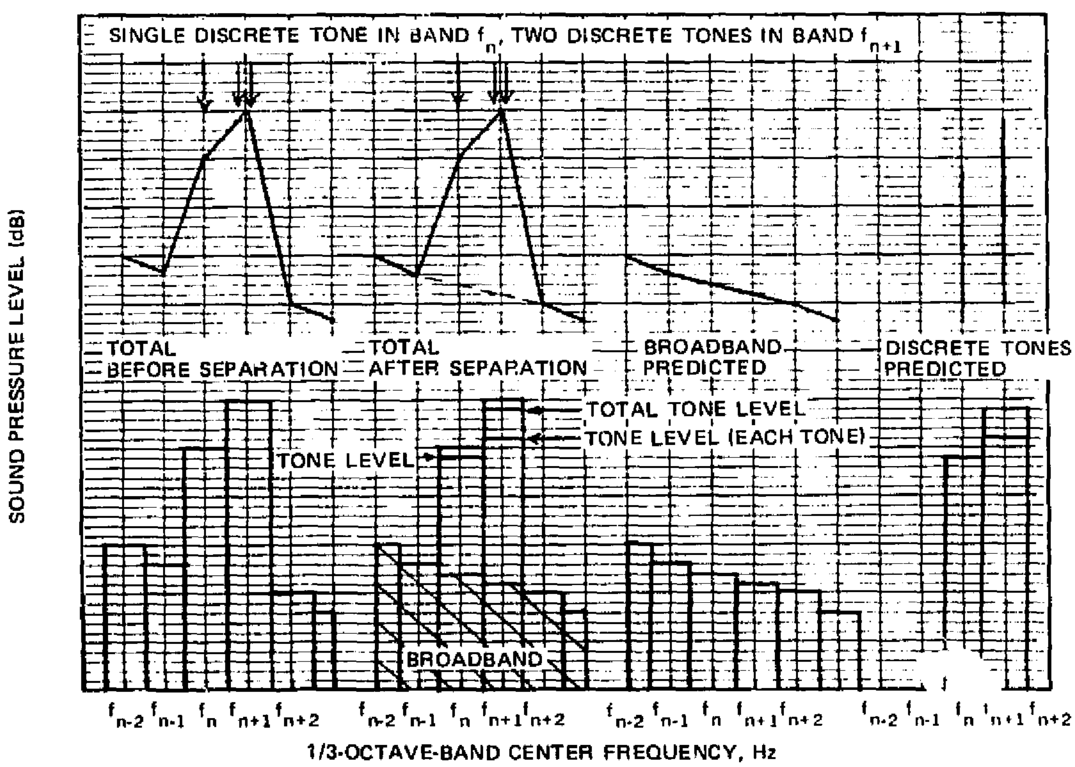
Examples of the separation of single and multiple tones are shown schematically in figure 65.

Separation of inlet and aft turbomachinery noise: At the time of this analysis "hush-house" data (configuration C) was available for Refan engine 1 and not for Refan engine 2. The methodologies for separating inlet and aft turbomachinery noise therefore will be presented separately for these two cases, with Refan engine 1 considered first.

The purpose of the hush-house was to minimize the contribution of inlet-radiated noise to the total noise measured in the far field and, hence, obtain a good indication of aft noise levels at angular locations where inlet noise would otherwise dominate or make a significant contribution to the total measured noise. Using this data in conjunction with corresponding data with no hush-house, permitted a determination of the relative contribution of inlet noise.



(a) SINGLE DISCRETE TONE



(b) MULTIPLE DISCRETE TONE

FIGURE 65. EXAMPLE OF THE SEPARATION OF BROADBAND NOISE AND MULTIPLE DISCRETE TONES

Since the hush-house was open in front, little or no blockage of inlet noise occurred at shallow angles. Sound pressure level directivity plots for each frequency band and fan speed indicated the effective angular range of the hush-house to be greater than 1.05 rad (60 degrees). Consequently, configuration C data were assumed to be aft dominated between 1.0 and 3.1 rad (60 and 180 degrees). For angles less than 1.05 rad (60 degrees), data were extrapolated linearly for each 1/3-octave band at a rate of 2.5 dB/0.2 rad (2.5 dB/10 degrees). This roll-off rate was based on observed trends of configuration C data above 1.05 rad (60 degrees) and represents an average for all frequencies and fan speeds. The resulting data, after removal of jet plus core noise and after extrapolating the data to shallow angles, represented what was called "aft turbomachinery noise".

Inlet turbomachinery noise for Refan engine 1, configurations A and B, was obtained by subtracting the aft turbomachinery noise from the corresponding total turbomachinery noise for forward angles, and extrapolating the result to the aft quadrant at the rate of 2.5 dB/0.2 rad (2.5 dB/10 degrees). Results from the use of these methods are illustrated in figure 66.

Because there were no "hush-house" data for Refan engine 2 at the time of this analysis, two assumptions were made concerning the nature of aft generated turbomachinery noise for engine 2:

(1) total turbomachinery noise is aft dominated for angles aft of 1.57 rad (90 degrees)

(2) aft noise follows the same directivity as that of engine 1 for forward angles i.e., 2.5 dB/0.2 rad (2.5 dB/10 degrees).

The methodology presented above for engine 1 was applied to Refan engine 2 to separate inlet noise from aft noise.

Separation of fan exhaust and turbine noise: For low engine power settings where jet and fan discharge noise are significantly reduced by lower jet velocities and the existing extensive fan duct treatment, noise generated by the three stages of the low pressure turbine could in most cases be readily identified. Analysis of narrow band spectra from flush mounted microphones located on the wall of the tailpipe (see figure 67) indicated that tones were the dominant feature of turbine noise. Also, 1/3-octave band data indicated that turbine spectra shapes were almost totally controlled by the distribution of tones within the 1/3-octave bands. Small changes in engine fan speed could easily alter the spectrum shape if a corresponding shift of one or more tones into an adjacent 1/3-octave band also occurred. Hence, the turbine peak frequency dependence and spectral characteristics were attributed to tones, with turbine broadband noise considered to be of secondary importance.

Based on the results of the narrow band spectra analysis, the methodology for separating fan exhaust and turbine noise was divided into three categories depending on fan speed:

A. For low fan speeds (where turbine noise was clearly identified for all angles),

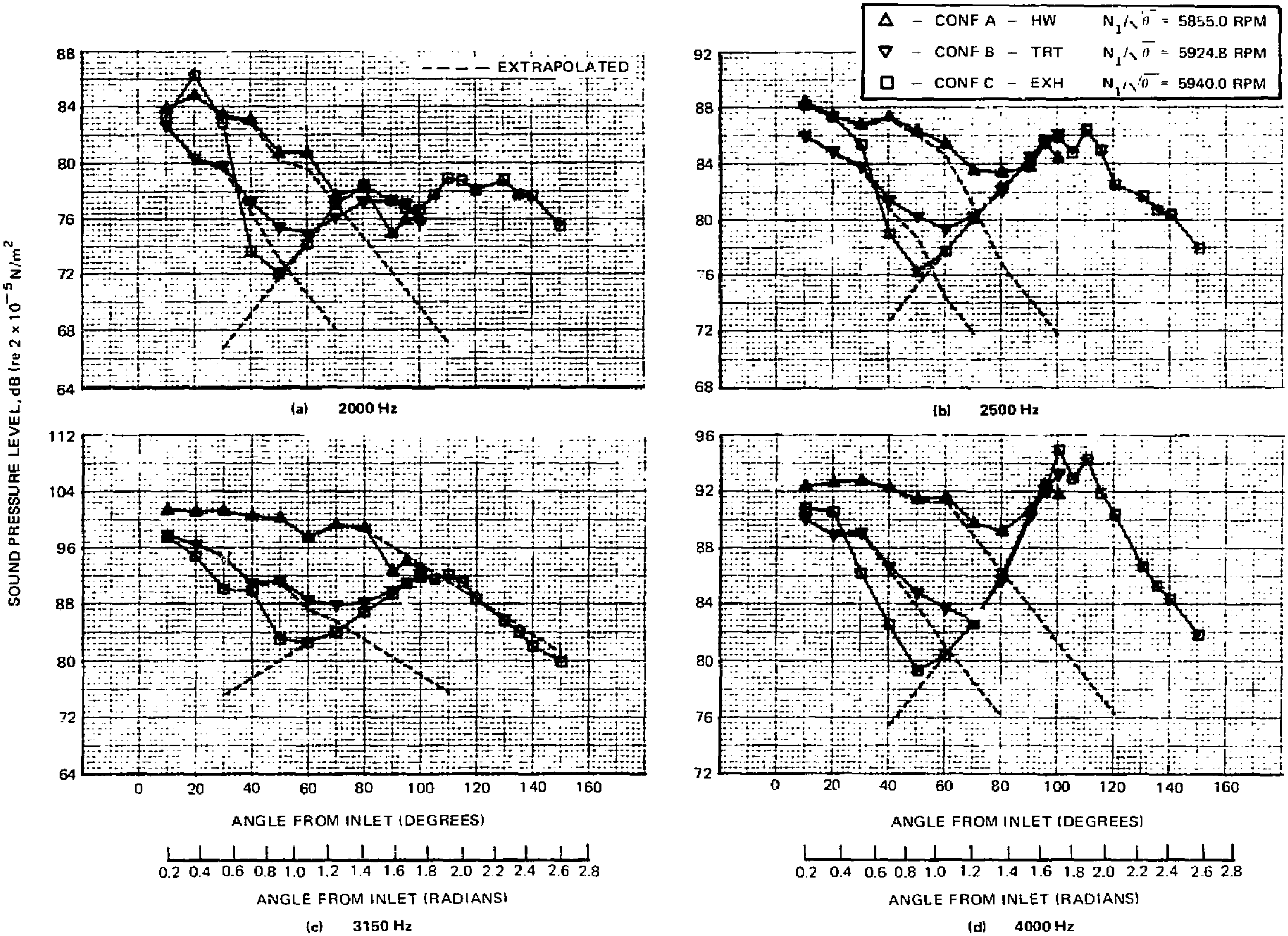


FIGURE 66. INLET AND AFT TURBOMACHINERY NOISE SEPARATION FOR REFAN ENGINE 1, CONFIGURATIONS A, B, AND C, AT A NOMINAL $N_1/\sqrt{\theta}$ OF 5900 RPM

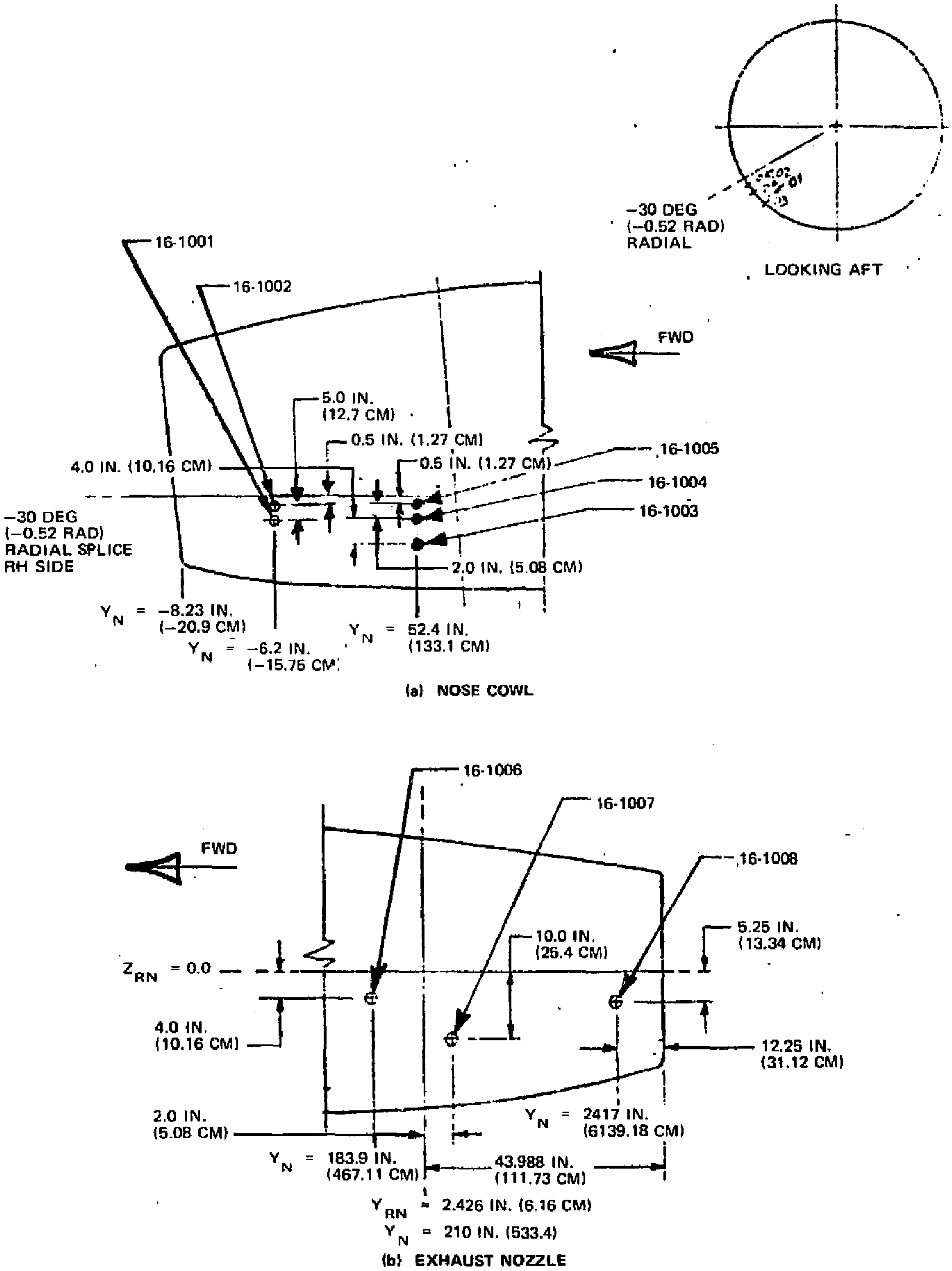


FIGURE 67. FLUSH-MOUNTED MICROPHONE LOCATIONS

B. For mid-range fan speeds (where turbine noise was clearly identified for aft angles only), and

C. For high fan speeds (where turbine noise could not be clearly identified at any angle).

For category (A) fan speeds, estimates of high frequency broadband fan noise were made by examining total turbomachinery noise at high fan speeds and forward angles where turbine noise was least influential. Using this procedure, the roll-off rate of the high frequency (above fan BPF) broadband fan noise was determined to be 5 dB/octave. For frequencies above and below the highest and lowest turbine BPF's, the roll-off rate of the turbine broadband noise was assumed as 20 dB/octave. This value was based on the observed trends from category (A) data and was in agreement with the Pratt and Whitney Aircraft recommended generalized turbine spectrum for JT8D-9 engines.

An iteration procedure was developed which applied the assumed fan and turbine roll-off rates to the aft turbomachinery spectra and adjusted the levels of each noise source to produce the component noise source levels.

For category (B) fan speeds, aft turbine and fan exhaust noise levels were determined using the procedure just described. For forward angles, aft turbine noise was extrapolated using the directivity roll-off rates shown in table 22. The spectral characteristics of turbine noise at these angles were assumed to be the same as those at the shallowest inlet angle where turbine noise could be separated using category (A) procedure. Fan exhaust noise was obtained at these angles by subtracting turbine noise levels from total turbomachinery noise levels.

For category (C) fan speeds (above 6800 rpm), levels and spectra were estimated using a procedure based on an extrapolation of data from lower fan speeds. Examination of the data over a range of engine fan speeds showed peak turbine levels to gradually decrease and then level-off as fan speed increased (highest peak levels occurred at approximately 5300 rpm). The leveling-off enabled peak turbine levels for high fan speeds to be obtained from corresponding peak levels at lower power settings (typically 6800 rpm) where turbine noise was more clearly identified.

Examination of data over a range of fan speeds indicated that turbine spectrum shapes were controlled by the distribution of tones within 1/3-octave bands. At high fan speeds, three possible distributions of tones can occur to produce three generalized spectrum shapes: (1) left skewed, (2) right skewed, and (3) clustered (see figure 68). These spectrum shapes, combined with the extrapolated peak levels, established turbine noise definition for high fan speeds. Fan exhaust noise levels, spectra, and directivity for category (C) data were obtained by subtracting turbine noise levels from total turbomachinery noise levels.

Results from the use of these methods (categories A, B, and C) are illustrated in figure 69 for data from Refan engine 1 (configuration C) at angles of 1.05 and 2.4 rad (60 and 140 degrees) for a nominal engine fan speed of 5940 rpm.

TABLE 22

DIRECTIVITY "ROLL-OFF" RATES USED FOR DETERMINING TURBINE NOISE LEVELS

ENGINE DESIGNATION NUMBER	N_1/ ABOVE WHICH DATA WERE EXTRAPOLATED INTO INLET QUADRANT, RPM.	ANGLE BELOW WHICH DATA WERE EXTRAPOLATED INTO INLET QUADRANT	DIRECTIVITY "ROLL-OFF" RATES
1	6165	100 Degrees (1.7 Rad)	3dB/10 Deg for $\leq 60 \quad \theta \leq 100$ deg (3dB/0.2 rad for $\leq 1.0 \leq \theta$ 1.7 rad) 2.5dB/10 Deg for $\theta < 60$ DEG (2.5dB/0.2 rad for $\theta < 1.05$ rad)
2	6397	90 Degrees (1.57 Rad)	2.5dB/10 Deg for $\theta < 90$ Deg (2.5dB/0.2 rad for $\theta < 1.57$ rad)

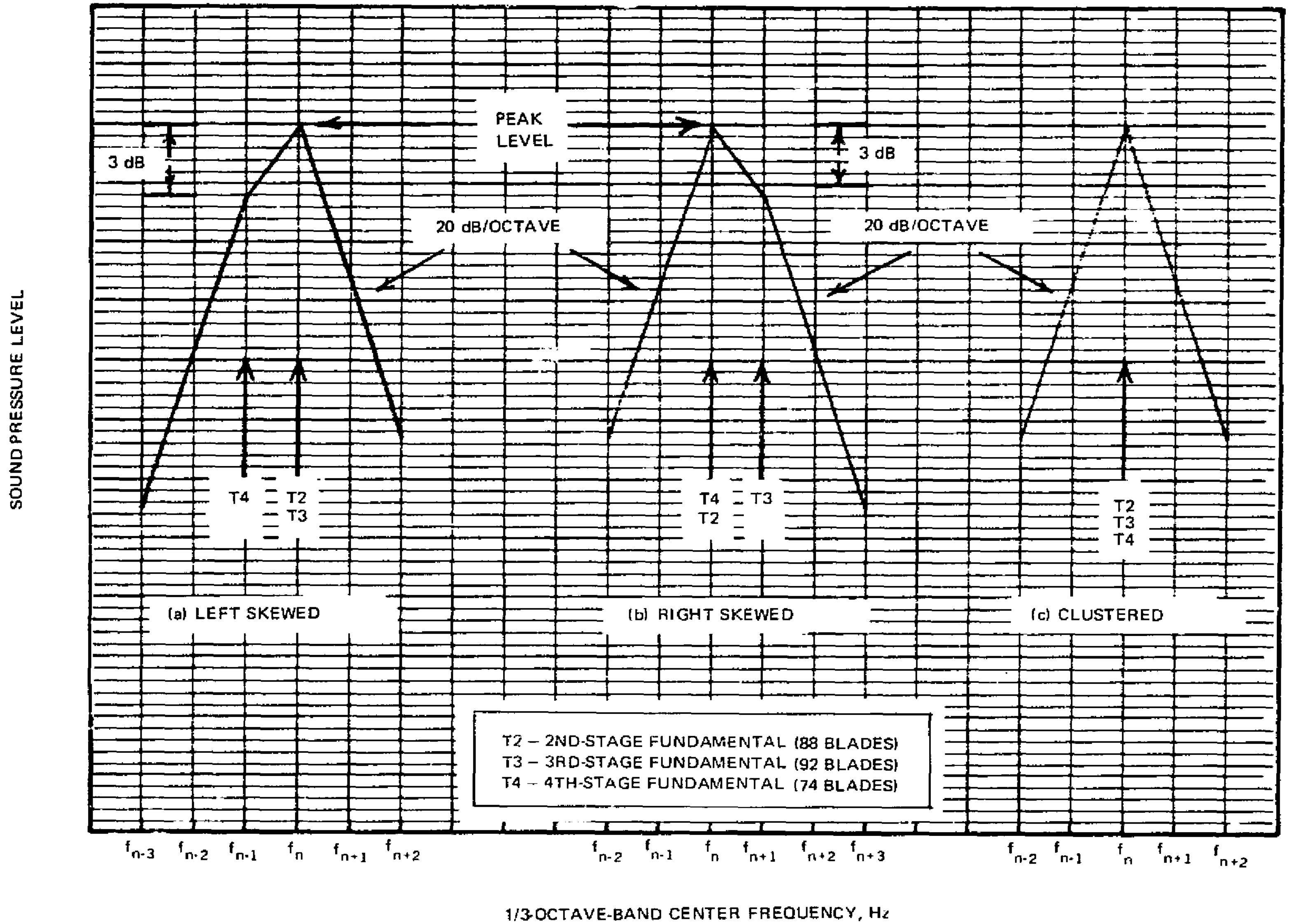


FIGURE 68. FUNDAMENTAL TURBINE BPF TONE DISTRIBUTIONS AND CORRESPONDING SPECTRUM SHAPES FOR HIGH-POWER SETTINGS

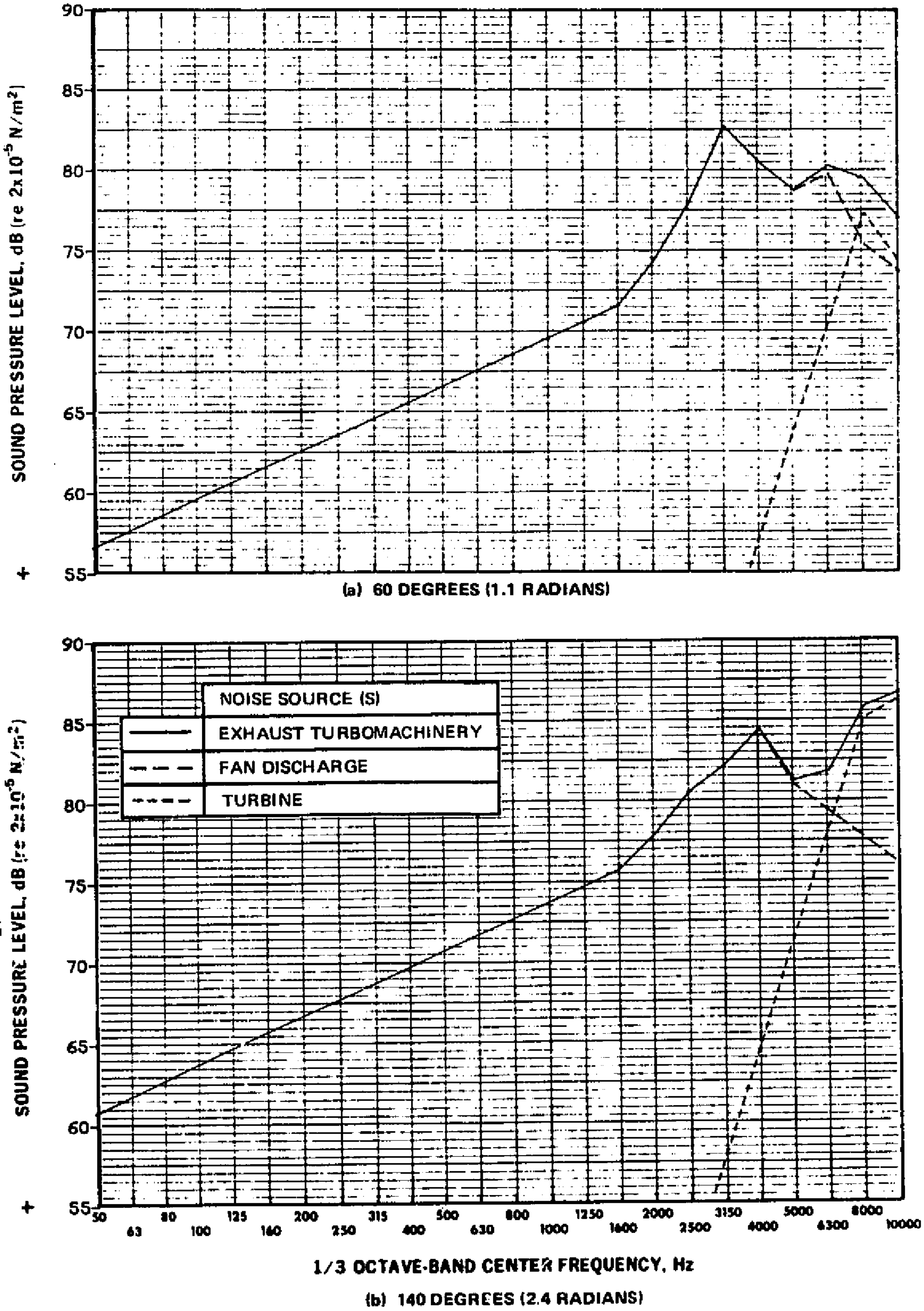


FIGURE 69. FAN EXHAUST AND TURBINE NOISE SEPARATION FOR REFAN ENGINE 1, CONFIGURATION C, AT A $N_1/\sqrt{\theta}$ OF 5940 RPM

Source spectra correlation and normalization: In order to predict individual turbomachinery noise source levels for engine fan speeds other than those for which engine static data were taken, a procedure was developed to adjust broadband and discrete tone levels and spectra to any desired condition. The 1/3-octave band spectra for each noise source were normalized with respect to airflow rate and correlated with the relevant engine cycle parameters in table 23.

Turbomachinery noise - flight data. - The flyover noise data used for separating turbomachinery noise sources were adjusted and normalized to a format similar to that used to develop the turbomachinery noise separation methodology described above. This required developing techniques to:

(1) Adjust data to reference weather conditions

(2) Determine the acoustic angle from inlet at each point in the flyover

(3) Convert SPLs measured beneath airplane flight path to 45.7 m (150 foot) polar data

(4) Remove effects of Doppler frequency shifts.

In addition, all spectra were inspected for completeness. Incomplete spectra contain "data dropouts". These generally occurred at very high frequency bands, usually 8000 and 10 000 Hz, caused by SPLs being too close to background noise levels. In these cases, estimated values were supplied.

After the flyover data had been projected to a 45.7 m (150 foot) polar radius, the procedures previously described for the static case were used to separate, correlate, and normalize the turbomachinery noise sources. For the approach condition, a full separation of fan inlet, fan exhaust, and turbine noise was made. For takeoff, however, long distance atmospheric propagation effects on high frequency noise did not permit the separation of turbine noise from fan discharge noise. Hence, aft generated turbomachinery noise on takeoff is referred to as "exhaust turbomachinery noise" and includes all turbomachinery noise sources. These levels were determined to be considerably below the jet noise levels at a height of 313 m (1026 feet). as described later.

TABLE 23

NORMALIZATION FACTORS AND ENGINE CORRELATING PARAMETERS USED FOR PREDICTING TURBOMACHINERY NOISE SOURCES

TURBOMACHINERY NOISE SOURCE	NORMALIZATION FACTOR, dB	ENGINE CORRELATING PARAMETER
FAN INLET	$10\ LOG_{10}\ (W_T)$*	FAN ROTOR TIP RELATIVE MACH NO.
FAN EXHAUST	$10\ LOG_{10}\ (W_T)$*	FAN ROTOR TIP RELATIVE MACH NO.
TURBINE	$10\ LOG_{10}(W_C)$**	FAN ROTOR SPEED, RPM

(*) W_T is the total inlet weight flow, in lbs/sec

(**) W_C is the total core weight flow, in lbs/sec

Prediction Procedures

Core noise. - Two static-to-flight effects on core noise were considered in the jet and core flyover noise prediction procedure. The first effect was an alteration of the directivity of the OASPL of core noise. The correct method of accounting for the change in directivity has not yet been established. For example, in reference 14, the term dynamic effect is given as $40 \text{ Log}_{10} (1-M_a \text{Cos } \theta)^{-1}$ was used to model core noise as a distribution of dipoles convected with the aircraft, where (M_a) is the aircraft Mach number and (θ) the angular location. In reference 18, the same effect was described as a "source correction factor" given as $20 \text{ Log}_{10} (1-M_a \text{Cos } \theta)^{-1}$. Results of DC-9/JT8D-9 flyover noise measurements however, indicated that a correction term expressed as $10 \text{ Log}_{10} (1-M_a \text{Cos } \theta)^{-1}$ provided the best agreement between projected static data and flyover noise data. Consequently, this latter expression was used for the analysis presented here.

The second effect was a doppler-shift on the spectra of core noise. As the aircraft approaches, the energy shifts from low to higher frequencies-the reverse being true for the case where the aircraft recedes. However, since the doppler-shift factors would have resulted in shifts of no more than one 1/3-octave band, and would not have significantly changed any of the calculated perceived noise levels (PNLs), doppler shift effects were not included in this analysis.

Jet noise. - Three static-to-flight effects on jet noise were considered. These effects were (1) the alteration of the directivity due to convection, (2) the reduction of OASPL due to relative velocity, and (3) the change in the spectral distribution of sound pressure level.

First, the effect of convection on the directivity of jet noise OASPL was given in reference 19 as

$$C = 10 \text{ Log}_{10} \left[\frac{[1-M_c \text{Cos}(180-\theta)]^2 + 0.09\, M_c^{\,2}}{[1-M_r \text{Cos}(180-\theta)]^2 + 0.09\, M_r^{\,2}}\right]^{-3.8/2} + 10 \text{ Log}_{10} (1-M_a \text{Cos } \theta)^{-1} \quad (15a)$$

where $M_c = 0.65\,(V_{jp}/c_o)$ (15b)

and $M_r = 0.65\,[(V_{jp} - V_a)/c_o]$ (15c)

C is the change in OASPL between static and flight conditions, θ is the far-field angle relative to the inlet direction, M_c and M_r are the eddy Mach numbers in the jet corresponding to the static and flight cases, M_a is the aircraft Mach number, V_{jp} and V_a are the primary jet and aircraft velocities, respectively, and c_o is the speed of sound in ambient air.

The first term in Equation 15 was purported to account for changes in sound radiation patterns due to differences in the convection of the eddies within the jet exhaust. The second term was attributed to the changes in the distribution of noise sources in the acoustic volume as the jet exhaust convected with the aircraft. When the OASPL directivity correction term C was applied to JT8D-9 ground static data, the directivity of the predicted jet noise OASPL did not agree with comparable DC-9/JT8D-9 flyover noise (measured with 4 foot pole microphones). But, when only the second term (i.e. the volume - convection term) was used for C, fairly good agreement for the directivity was obtained and therefore, only the second term was used for C in the current procedures. However, subsequent analysis using JT8D-109 ground static noise and DC-9/JT8D-109 flyover noise data measured with flush ground microphones indicated that both the first and the second term in C in Equation 15 should be used to correct the OASPL directivity. The discrepancy between the two results can be attributed to the DC-9/JT8D-9 flyover noise data which was measured with 4 foot pole microphones, and hence, producing low frequency levels masked by ground reflections.

Second, the relative velocity effect on jet noise OASPL is still not fully understood. For example, references 19 and 20 showed model test results indicating that forward motion reduced jet noise at 1.57 rad (90 degrees) from the inlet (1.57 rad (90 degrees) was selected to avoid confusion with convection effect). Reference 21, however, stated that there was no reduction of inflight jet noise at 1.57 rad (90 degrees). Table 24 lists the empirical and theoretical correlating parameters for relative velocity effects suggested in references 19, 20 and 22. The empirical correlation for relative velocity effects in reference 20 agreed best with results from measured DC-9/JT8D-9 flyover noise data and, therefore, was used for the analysis presented here.

The total change in jet-noise OASPL between static and flight conditions, produced by the convection and relative velocity effects, is given by Equation 16

$$\Delta OASPL = OASPL_{static} - OASPL_{flight}$$

$$= 10 \, Log_{10} \left[\frac{[1 - M_c \, Cos\,(180-\theta)]^2 + 0.09 \, M_c^{\,2}}{[1 - M_r \, Cos\,\theta\,(180-\theta)]^2 + 0.09 \, M_r^{\,2}} \right]^{-1.9}$$

$$+ 10 \, Log_{10} \, (1 - M_a \, Cos\,\theta)^{-1} \qquad (16)$$

$$+ 10 \, (M-2) \, Log_{10} \, (V_{jp}/V_{j,rel})$$

where M is the slope of the measured static jet-noise OASPL versus jet velocity correlations described in table 18, as function of inlet angle.

The third effect considered is the shift of jet noise spectrum due to changes in the spectral distribution of sound pressures in flight. In 1965, the SAE jet noise prediction procedure (ref. 23) recognized that forward motion shifts a jet noise spectrum to higher frequencies at all far-field angles. The apparent shift of inflight jet noise spectrum is thought to be due to: (1) moving source (i.e., doppler) effects, and (2) source alteration effects. As discussed previously, analyses were not made to incorporate doppler-shift effects because these effects on PNL were small. Source-alteration effect on jet noise spectra are illustrated in figure 70.

A characteristic frequency, f, radiated by a jet eddy in flight is higher than the corresponding frequency, f*, radiated by the same eddy within the same jet statically. The change in characteristic frequency is due to changes in the characteristic length scale of the eddy in flight as compared to the static case. The length scale change is proportional to the ratio of the typical mixing-layer thicknesses. This ratio has been found to vary according to the relation (private communication with Professor Lauffer of the University of Southern California).

$$\frac{\delta}{\delta^*} = \frac{(1-V_a/V_{jp})}{(1+V_a/V_{jp})} \qquad (17a)$$

where δ and δ^* are the typical mixing-layer thicknesses of the moving and stationary jets respectively, V_a is the free stream or flight velocity, and V_{jp} is the primary jet velocity. Assuming (ref. 24) that a typical frequency radiated by an eddy is proportional to jet velocity and inversely proportional to eddy size or characteristic length scale, which is proportional to mixing layer thickness, then the ratio of typical frequencies f and f* radiated by similar noise-producing eddies in a moving and a stationary jets, can be expressed as

$$\frac{f}{f^*} = \left(\frac{V_{jp}-V_a}{V_{jp}}\right)\left(\frac{\delta^*}{\delta}\right) = \left(1 + V_a/V_{jp}\right) \qquad (17b)$$

Consequently, the ratio of Strouhal numbers, $\left[\frac{fD_p/(V_{jp}-V_a)}{f^*D_p/V_{jp}}\right]$, corresponding to typical frequencies f and f*, is expressed as

$$\frac{fD_p/(V_{jp} - V_a)}{f^*D_p/V_{jp}} = \frac{1 + V_a/V_{jp}}{1 - V_a/V_{jp}} \qquad (17c)$$

where D_p is the primary nozzle diameter.

TABLE 24 - SUGGESTED CORRELATING PARAMETER FOR JET NOISE OASPL RELATIVE VELOCITY EFFECTS AT 90 DEGREES FROM THE INLET

AUTHOR	REFERENCE	PARAMETER*
COCKING AND BRYCE	19	$10(M-3.1)\ \mathrm{Log}_{10}\ (V_{jp}/V_{j,rel})$
VON GLAHN	20	$10(M-2)\ \mathrm{Log}_{10}\ (V_{jp}/V_{j,rel})$
FFOWCS WILLIAMS	22	$10(M-1)\ \mathrm{Log}_{10}(V_{jp}/V_{j,rel})$

* M = Slope of Static Jet Noise OASPL Versus Jet Velocity Correlation; M is approximately 8 for the above cases.

$V_{j,p}$ = primary jet velocity.

$V_{j,rel}$ = primary jet velocity relative to the speed of the aircraft $(V_{j,p} - V_a)$.

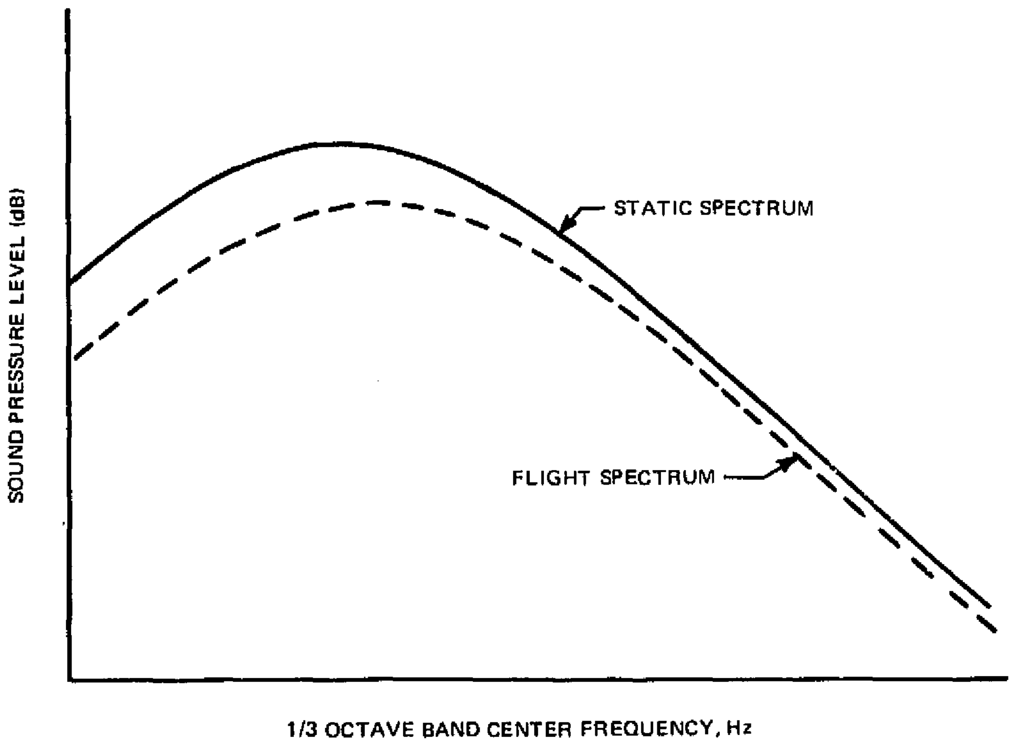


FIGURE 70. SHIFTING OF THE STATIC JET NOISE SPECTRUM AT 90 DEGREES (1.6 RAD) AS A RESULT OF INFLIGHT SOURCE-ALTERATION EFFECTS

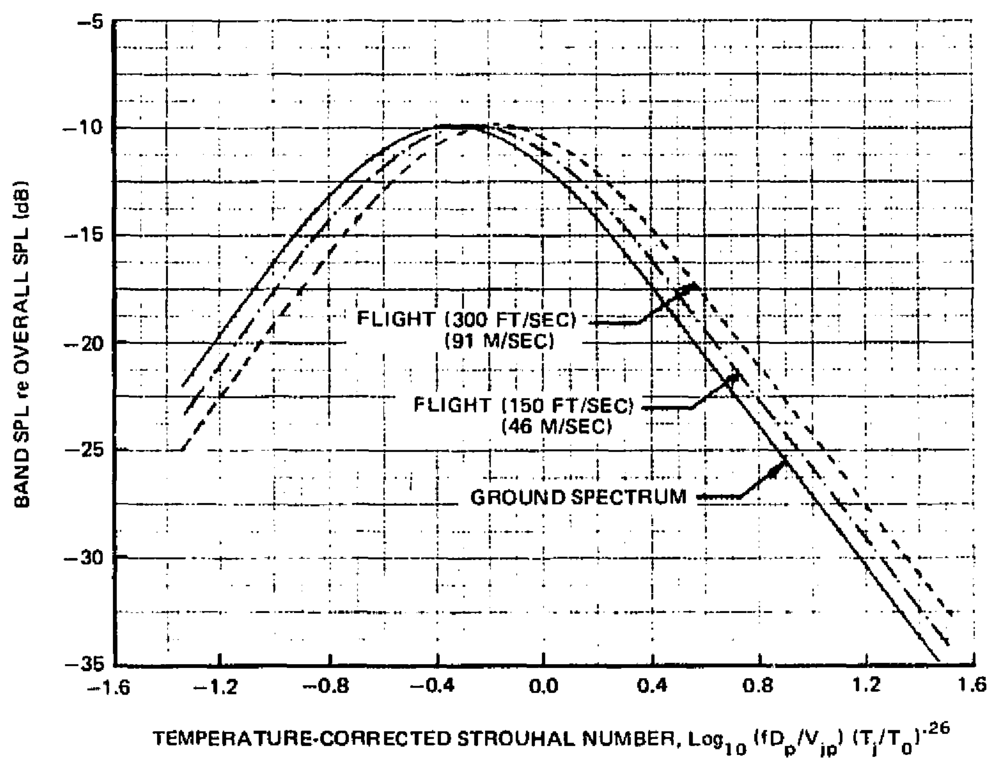


FIGURE 71. NORMALIZED SPECTRA FOR PREDICTING INFLIGHT JET NOISE AT 150 FEET (45.7M) AND 120 DEGREES (2.1 RAD)

The effect on the predicted jet noise spectra shape of incorporating Equation 17c into the flyover noise prediction procedure is illustrated in figure 71 for an inlet angle of 2.1 rad (120 degrees).

Turbomachinery noise. - Fuselage-mounted engines on DC-9 airplanes provide favorable shielding of high frequency turbomachinery noise especially during approach operations (see figure 72). Comparisons of measured flyover noise levels with levels projected from ground static data indicated that projected static data overpredicted forward and aft radiated noise (figure 73).

This part of the report discusses the methodology used to account for engine installation effects on predicting flyover noise levels from ground static data.

Three types of installation effects can occur in different angular regions summarized below (see figure 74).

REGION	MECHANISM	METHODOLOGY
1	Wing Shielding	Barrier Theory
2	Wing/Wheel Sound Scattering	Scattering Theory
3	Jet Exhaust Sound Scattering	Scattering Theory

The intent of this analysis of DC-9 installation effects was to modify existing theories to develop workable methods of accounting for engine installation effects.

Wing Shielding: The approach for predicting noise reduction by wing shielding was adapted from the barrier theory described by Beranek (ref. 25). This theory was based on optical-diffraction (Fresnel) theory, which assumed that only the incident wavefield close to the top edge of the barrier would contribute to the wavefield diffracted over the barrier. The diffracted wave is not just restricted to the shadow zone, but as shown in figure 75 it also affects a small transition region close to the shadow zone by interfering with the direct wave. The barrier was modeled by the flaps-down configuration. The noise source generated by the fan inlet was assumed to be a point source. These assumptions were also used in other shielding studies (ref. 26, 27, 28, 29).

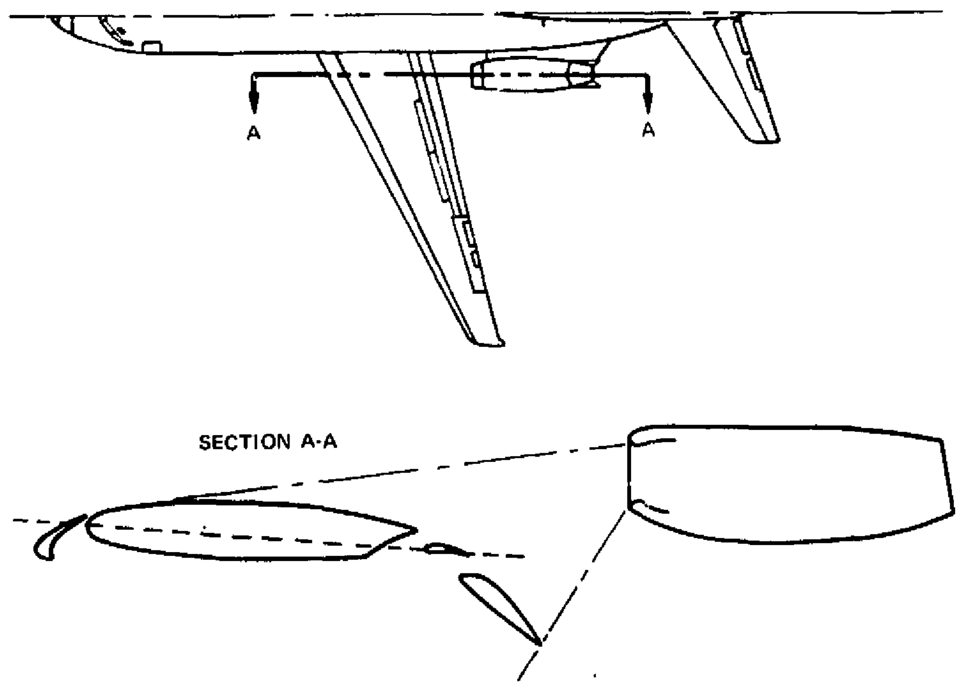


FIGURE 72 DC-9-30 WING/NACELLE SPACING FOR 50-DEGREE (0.9-RAD) FLAPS

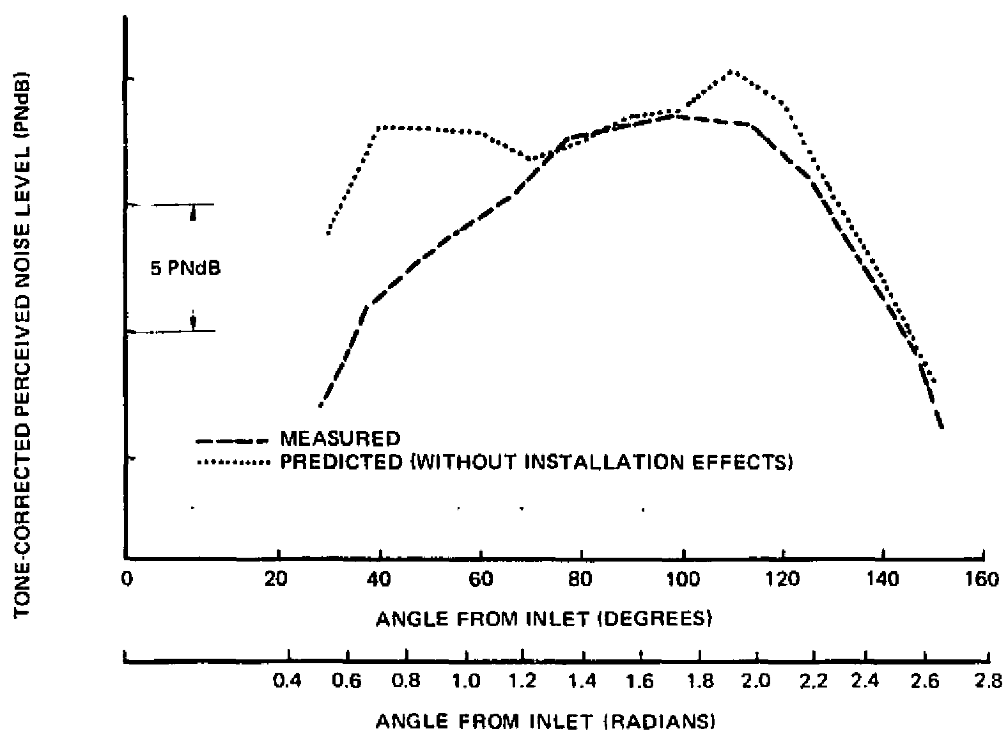


FIGURE 73. COMPARISON OF MEASURED AND PREDICTED FLYOVER PNLT DIRECTIVITY AT APPROACH OPERATION AND 400 FOOT (122 M) HEIGHT

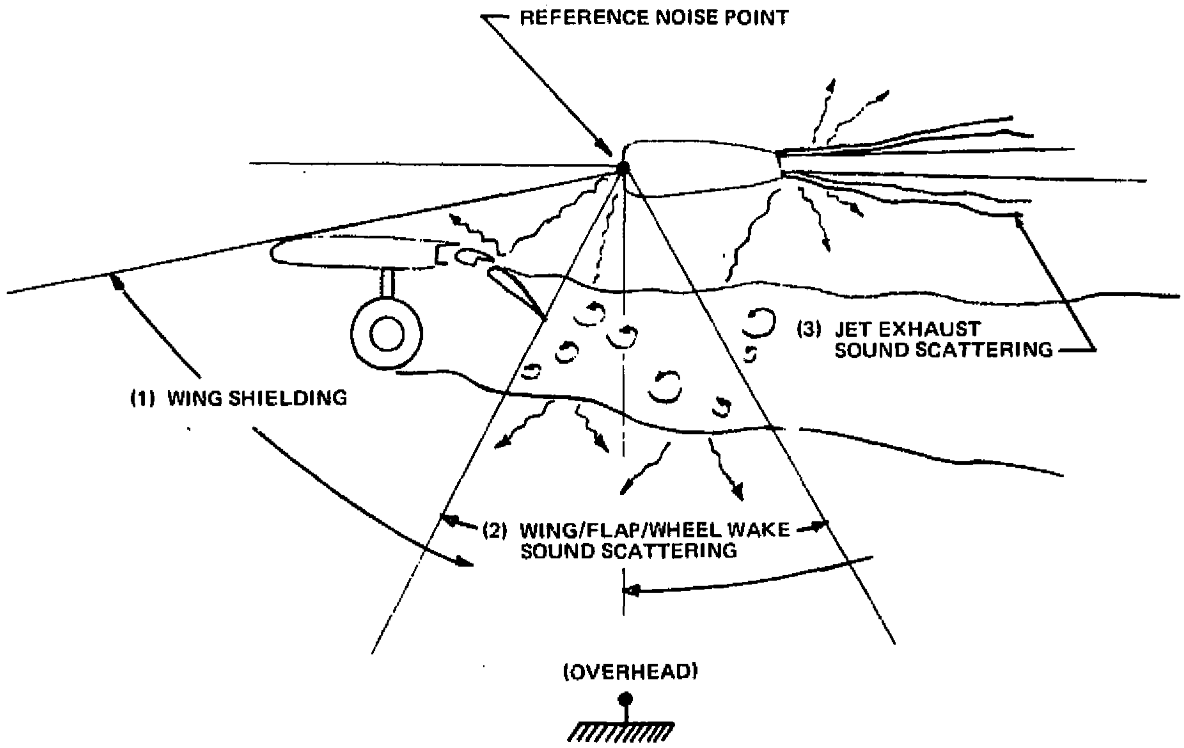


FIGURE 74. SHIELDING MECHANISMS FOR DC-9 FORWARD AND AFT-RADIATED NOISE

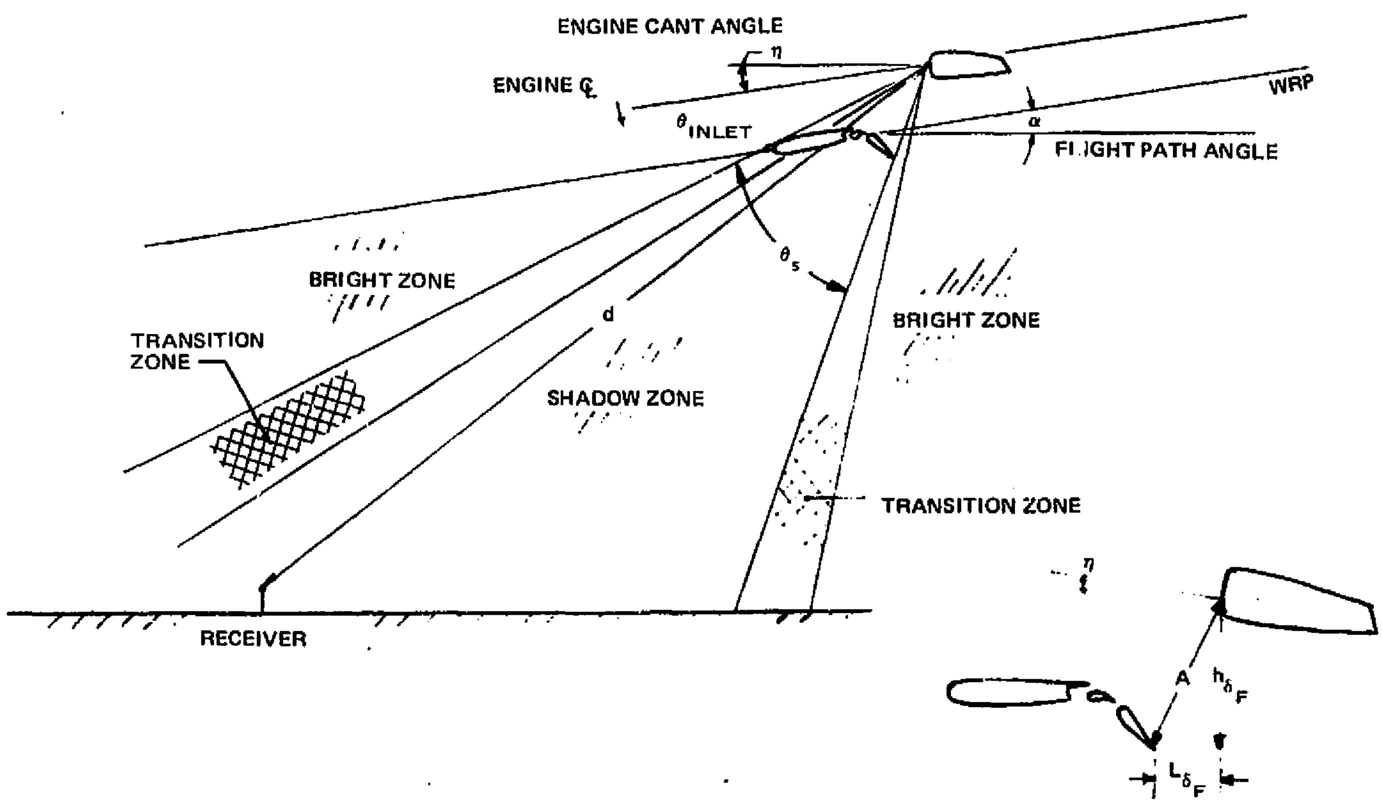


FIGURE 75. GEOMETRY FOR WING SHIELDING ANALYSIS BY BARRIER THEORY

Determination of Noise Reduction (NR) by wing shielding is given in Equation 18:

$$NR(f) = \begin{cases} 20 \log \dfrac{\sqrt{2\pi N}}{\tanh\sqrt{2\pi N}} & ; N \geq 20 \quad (18a) \\ 20 \log \dfrac{\sqrt{2\pi N}}{\tanh\sqrt{2\pi N}} + 5 & ; 0 \leq N < 20 \quad (18b) \\ 20 \log \dfrac{\sqrt{2\pi N}}{\tan\sqrt{2\pi N}} + 5 & ; -0.2 \leq N < 0 \text{ (Transition Zone)} \quad (18c) \\ 0 & ; N < -0.2 \quad (18d) \end{cases}$$

The Fresnel number, N, is defined as:

$$N = \pm \frac{2f_i \delta}{c}$$

where:

c = speed of sound, m/sec

f_i = frequency: subscript i refers to the 1/3 octave band number, Hz

δ = difference in path length between source and receiver, m

$$A - d + \sqrt{d^2 = A^2 - 2dA \cos (\theta_s - (\theta_{Inlet} - \eta)}$$

$A = \sqrt{h_{\delta_F}^2 + L_{\delta_F}^2}$, m

d = direct path length from source to receiver, m

θ_s = $\tan^{-1} h_{\delta_F}/L_{\delta_F}$, degrees

h_{δ_F} = vertical distance from the reference source point to the edge of the deflected flap, m

L_{δ_F} = horizontal distance from the reference source point to the edge of the deflected flap, m

δ_F = flap deflection angle, degrees

θ_{Inlet} = angle from inlet centerline, degrees

η = engine cant angle, degrees

α = flight path angle, degrees

+ = receiver in shadow zone for sign of N

- = receiver in bright zone for sign of N

Since the noise reduction values calculated from Equation 18 primarily affect high frequency noise, only frequencies greater than 2000 Hz were analyzed.

Jet Exhaust Sound Scattering: The noise reduction due to jet exhaust sound scattering is primarily on the jet exhaust wake thickness, r_j. The wake thickness is defined as a function of the nacelle-exhaust-duct configuration (e.g. short versus long fan exhaust duct) and the flight condition. The jet exhaust sound scattering analysis presented here was based on Rudd's (ref. 30) treatment of the Tartarski-Monin equation for scattering sound by turbulence, developed primarily for the scattering of sound by jets (see figure 76). For the propagation of sound through turbulence, the turbulence was assumed frozen for the duration of interaction. The sound wave would then be reflected from a component of the turbulence possessing the correct wavenumber and scattering angle.

Rudd's analysis of the Tartarski-Monin equation centered on the scattering length concept. Rudd defined this length as the distance which a sound wave has to travel through turbulence for its intensity to be reduced by a factor of 1/e (see figure 77). This length is related to the scattering cross section area (σ) of a volume (V) of turbulence by the expression $\ell = V/\sigma$. Noise reduction due to scattering of sound by turbulence was expressed by Rudd as:

$$NR = 10 \log e^{L_o \sigma / V} \quad (19)$$

The following is a synopsis of Rudd's calculation of scattering length. The expression produced by Tartarski-Monin for the differential cross section for scattering sound by turbulence is shown in Equation (8).

$$\frac{\partial \sigma(\theta)}{\partial \Omega} = 2\pi k^4 V \left[\frac{1}{c^2} E(K) \cos^2 \theta/2 + \frac{1}{4T^2} \Phi(K) \right] \cos^2\theta \quad (20)$$

where:

θ = scattering angle

k = wavenumber

K = 2k sin $\theta/2$

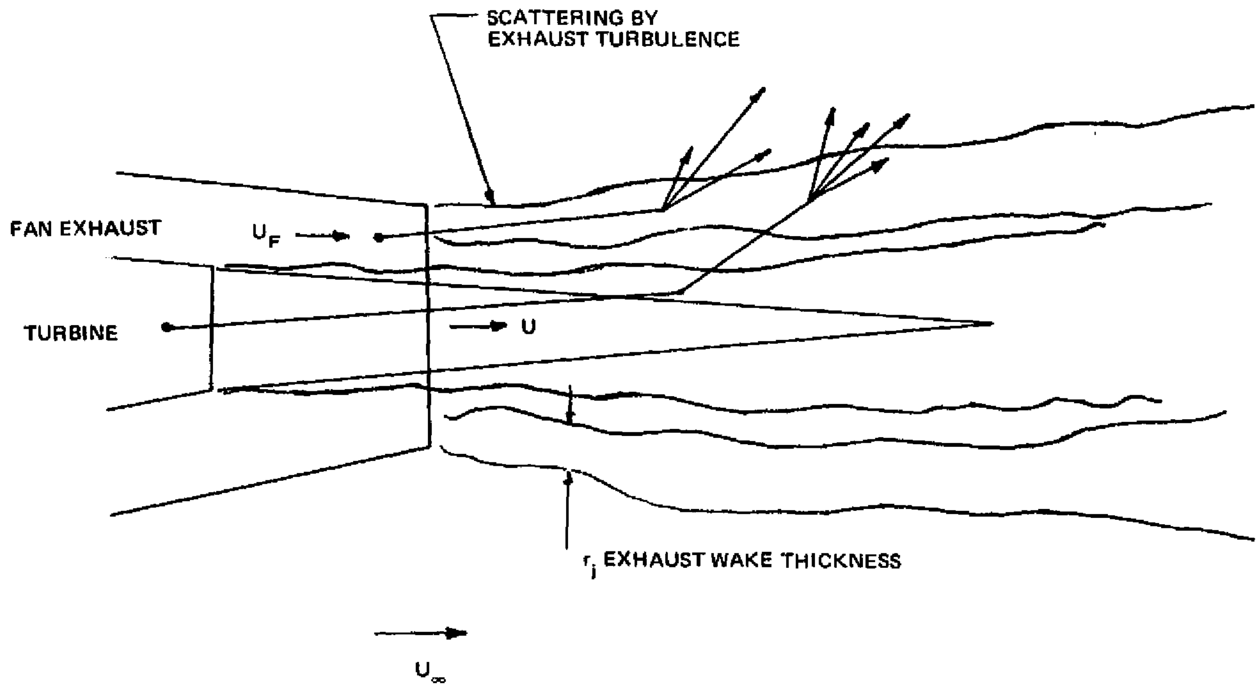


FIGURE 76. SOUND SCATTERING OF FAN EXHAUST AND TURBINE NOISE

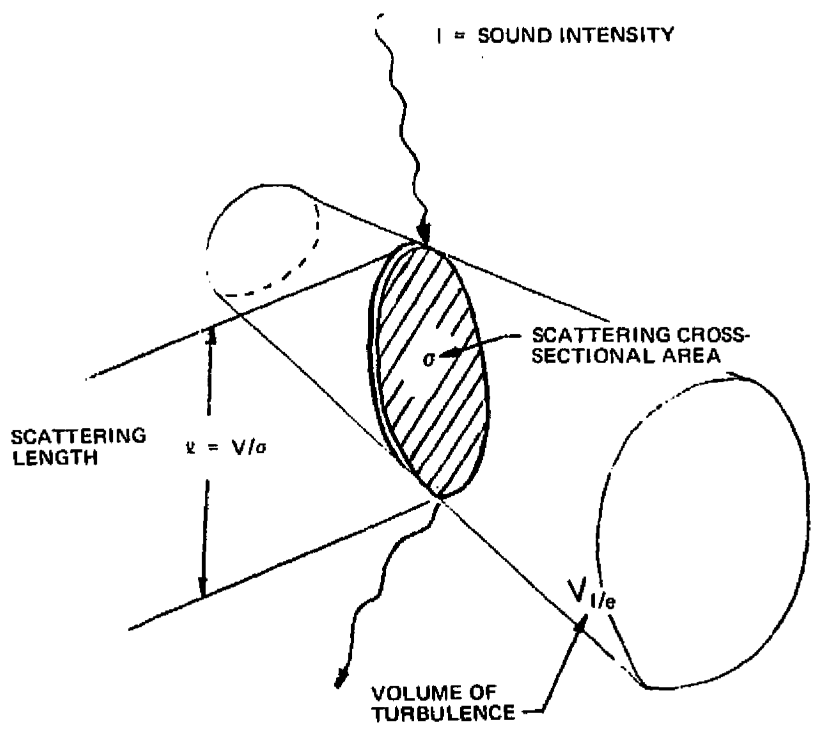


FIGURE 77. DEFINITION OF SCATTERING LENGTH AND INTENSITY REDUCTION FACTOR

$E(K)$ = spectral density of velocity fluctuations

$= 0.061\ C_V^2\ K^{-11/3}$

$\Phi(K)$ = spectral density of temperature fluctuations

$= 0.033\ C_T^2\ K^{-11/3}$

c = speed of sound

T = temperature

$C_V^2 = 2\ \xi^{2/3}$

$C_T^2 = a^2\ L_o^{4/3}\ G^2$

ξ = mean rate of energy dissipation per unit mass

L_o = integral scale of turbulence

a = 2.50, constant given by Rudd

G = mean temperature gradient $\frac{T}{L_o}$

V = volume of turbulence

The total scattering cross section was defined as:

$$\sigma = \int_0^{\pi} \frac{\partial \sigma(\theta)}{\partial \Omega}\ 2\ \pi\ \text{Sin}\ \theta\ d\theta \tag{21}$$

such that,

$$\sigma = \frac{0.812\ V\ L_o^{5/3} f^2}{c^2} \left[\frac{C_V^2}{c^2} + 0.13\ \frac{C_T^2}{T^2} \right] \tag{22}$$

For a jet of velocity, U, the rate of dissipation was determined from,

$$\xi = U^3/6L_o$$

The scattering length is represented in Equation 26 as a function of frequency, scale of turbulence, and jet Mach number (M)

$$\ell = V/\sigma = \frac{1.23\ c^2}{L_o\ f^2\ (0.7\ M^2 + 0.81)} \tag{23}$$

However, for significant scattering to occur, Rudd limited the application of these equations for frequencies;

$$f > \frac{c}{L_o \sqrt{M^2 + 1.1}}$$

Equations 7 and 11 were used to estimate noise reduction of fan exhaust and turbine noise sources. The jet Mach number was calculated from the fan exhaust velocity, U_F (see figure 76).

Wing/Wheel Wake Sound Scattering: Analysis of flyover noise data indicated that some noise reduction mechanism in addition to wing shielding and jet exhaust sound scattering occurs during flight. It was hypothesized that this mechanism which effects forward and aft quadrant noise levels occurs as a result of the wake generated by the extended flaps and wheels during approach operation, and by the flaps in the takeoff configuration. The similarity in the rate of spreading and velocity distributions between this wing/wheel wake and jet exhaust wake made it possible to apply Rudd's concept of scattering of sound by turbulence as described in the preceding section. The equations derived by Rudd were modified by eliminating the temperature term, such that the scattering length became:

$$V/\sigma = \frac{1.23\, c^2}{L_o\, f^2\, (0.7\, M_d^2)} \qquad (24)$$

The Mach number (M_d) was determined from the velocity deficit ($U_\infty - \Delta\bar{u}$) where:

U_∞ = free stream or flight velocity

$\Delta\bar{u}$ = velocity deficit

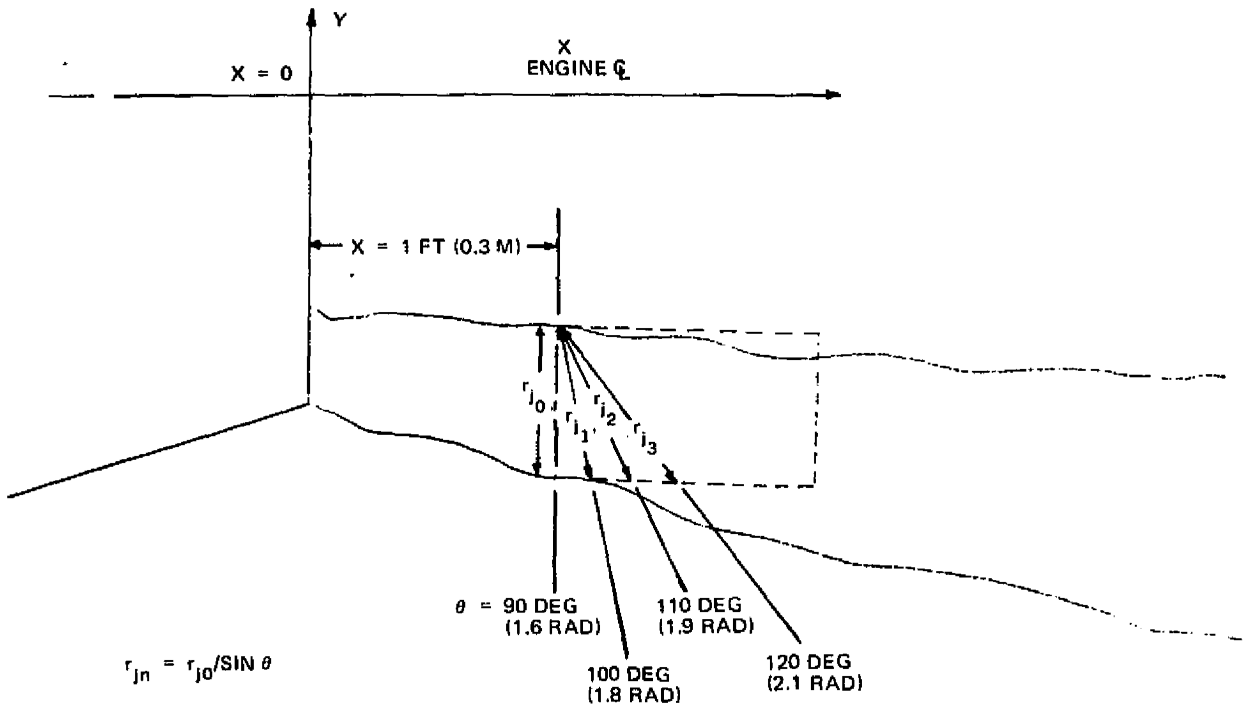
Modeling Techniques: The scale of turbulence (L_o) in the analyses of both jet and wake sound scattering was determined from:

$$L_o = b\, r_{j,w} \qquad (25)$$

where the proportionality constant, b, was assumed to be 0.20 as a result of consultation with Professor John Laufer of the University of Southern California concerning wake thickness (r_w), and C. Y. Chen's definition of the scale of turbulence (jet exhaust wake thickness, r_j)(ref. 31).

The reference jet exhaust wake thickness ($r_{jo} = r_{jo} = 1.57$ rad (90 deg.)) was estimated from velocity profiles at the position X = 0.3 m (1 foot) downstream of the nozzle exit as shown in figure 78. Since the wake from the fan portion of the jet exhaust is thinner in flight than it is statically, a study of the velocity profiles was made to determine the loss in noise reduction from static to flight conditions. Estimates of the jet wake thickness as a function of angle (r_{j1}, r_{j2}, r_{j3}) was simplified by considering the exhaust wake to be a constant section as shown in figure 78.

Since information concerning the flow field in the region of interest (inboard flap of the DC-9) was not available, a model of the flow field was developed to estimate the wake and velocity distributions. The wake and velocity distributions due to flow separation from the flaps modeled by a two-dimensional wake analysis (ref. 32). Circular wake analysis (ref. 32) was used to model the wake growth and velocity deficit due to the interference of the free stream by the landing gear and wheels (see figures 79 and 80). The flow field model was designed for approach configurations. Analysis of takeoff configurations assumed a negligible velocity deficit with the wake growth determined using the wing curve in figure 79 with the initial wake thickness, y_0, equal to the inboard wing chord thickness, Z. The definitions of the reference wing/wheel wake thickness, $r_{wI_0} = r_{wI_\theta} = 1.57$ rad (90 deg.) and $r_{wE_0} = r_{wE_\theta} = 1.57$ rad (90 deg.) are illustrated in figure 81. Estimates of the wake thickness as a function of angle were calculated in the same manner as the jet exhaust wake (see figure 82).



$r_{jn} = r_{jo}/\sin\theta$

$n = 1, 2, 3$

FIGURE 78. DEFINITION OF JET EXHAUST WAKE THICKNESS

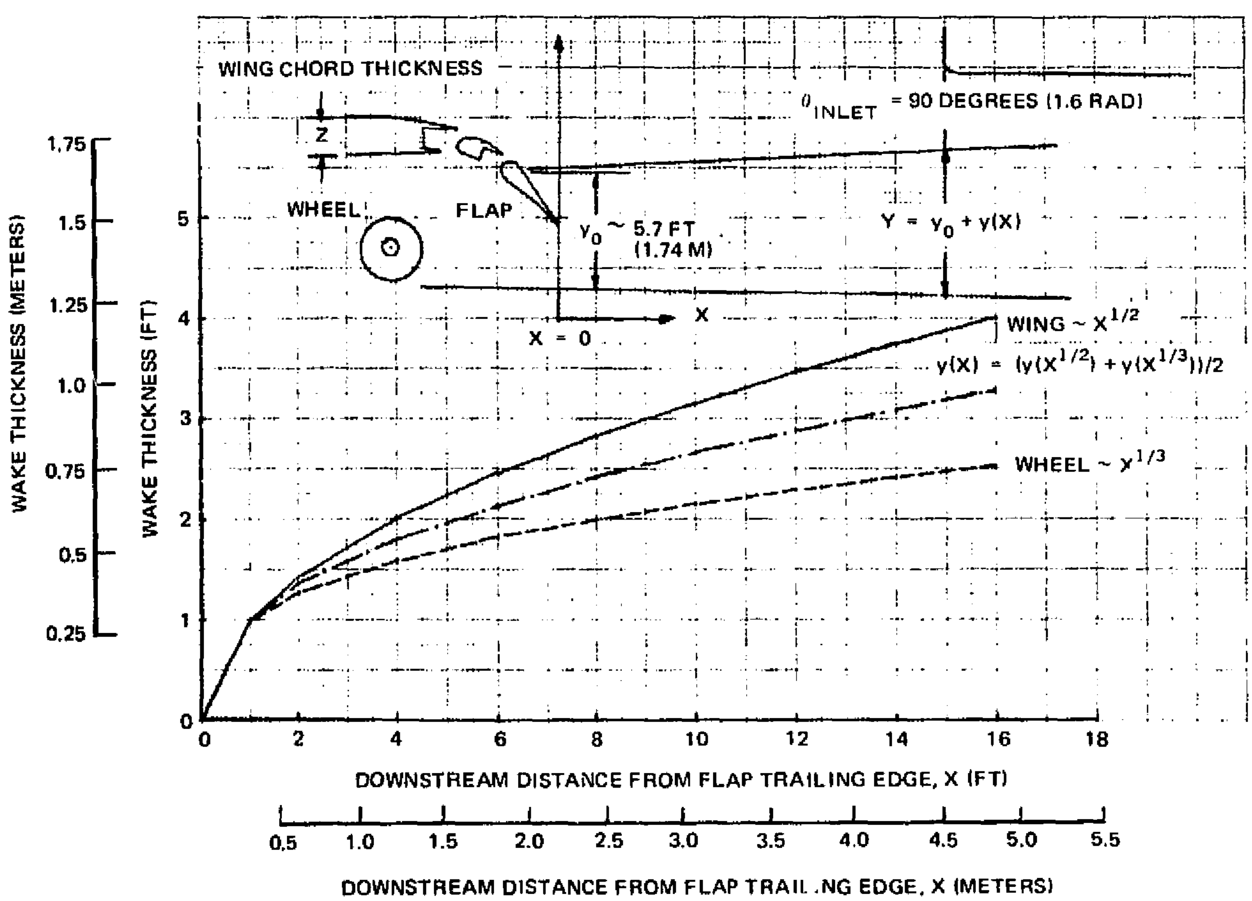


FIGURE 79. WAKE GROWTH WITH DISTANCE X

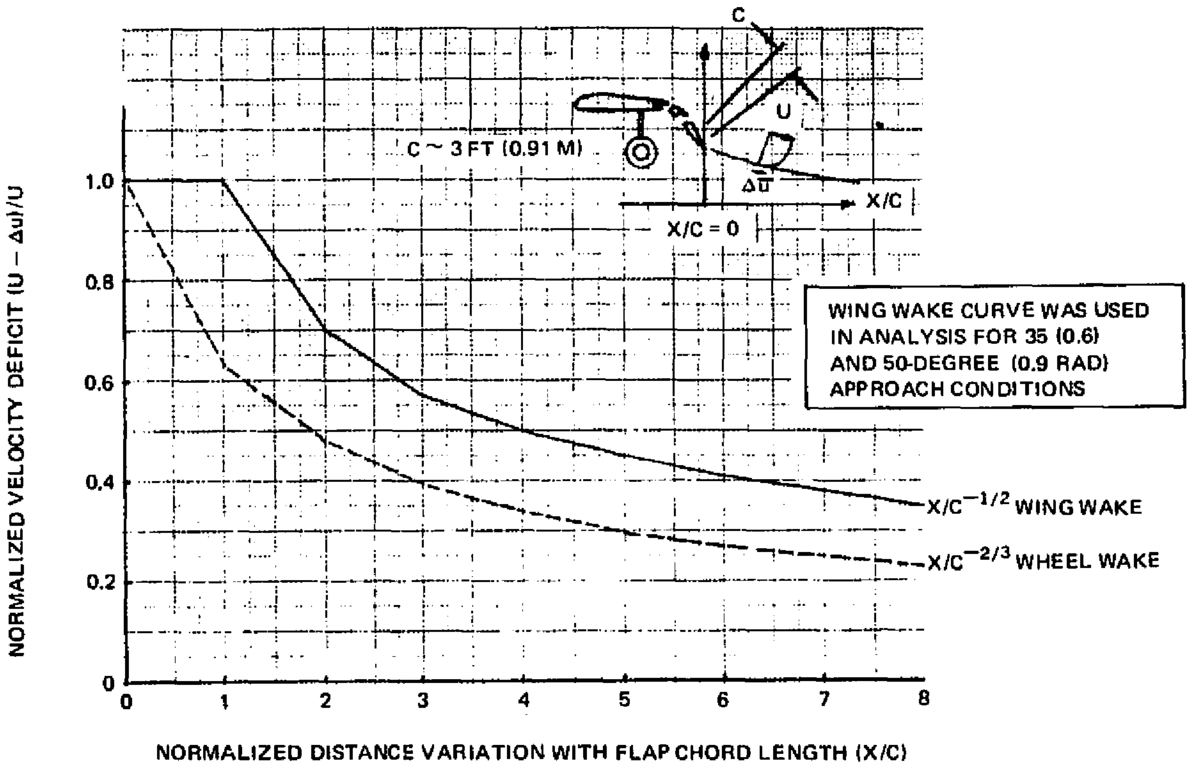
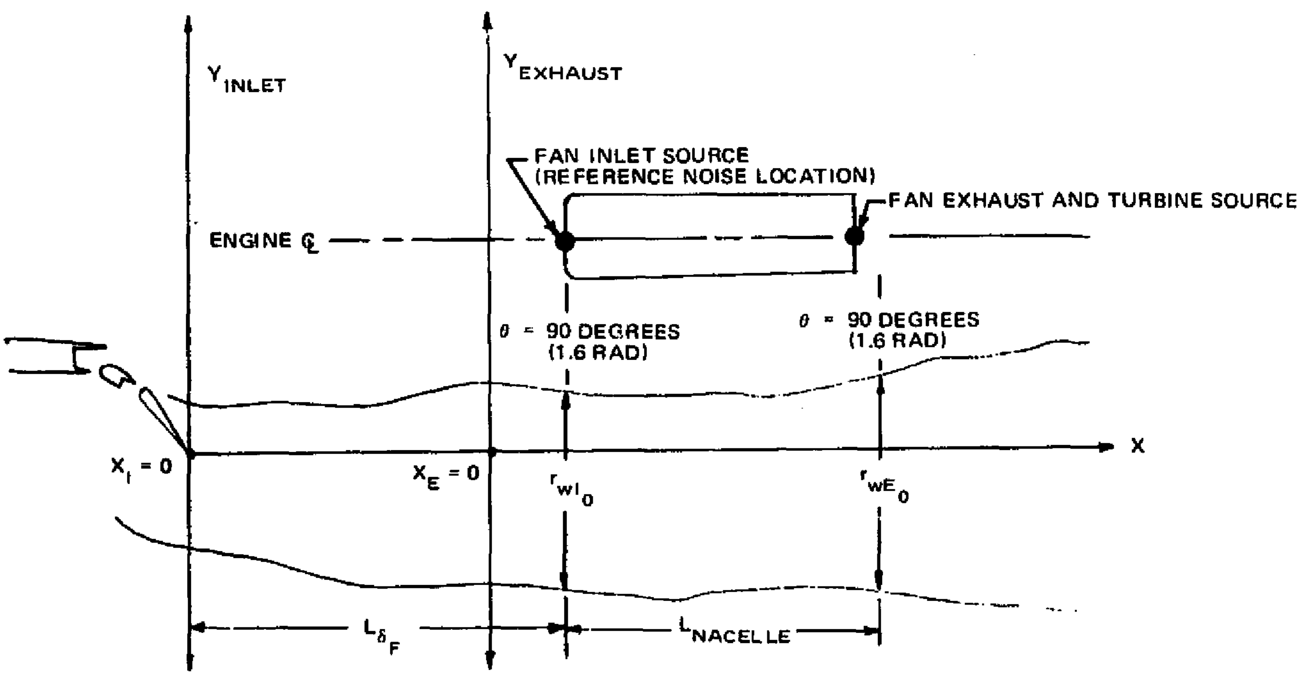


FIGURE 80. VELOCITY DEFICIT WITH DISTANCE



NOTE: THE FAN INLET, EXHAUST AND TURBINE SOURCE LOCATIONS WERE ASSUMED TO BE AT THE REFERENCE LOCATION. THIS ASSUMPTION SHIFTS THE Y AXIS BY THE AMOUNT EQUAL TO THE LENGTH OF THE NACELLE ($L_{NACELLE}$).

FIGURE 81. GEOMETRY FOR WAKE SOUND SCATTERING

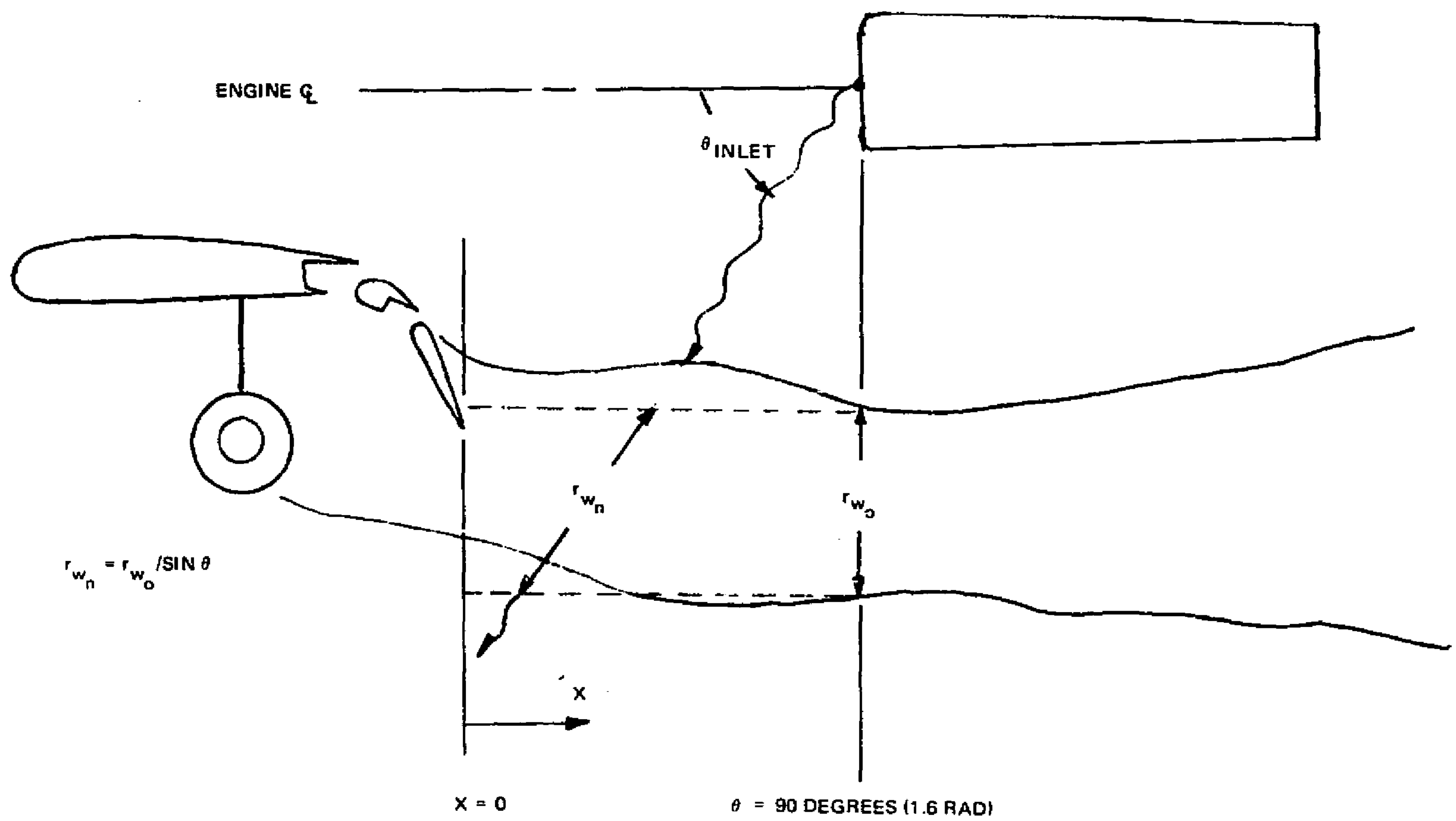


FIGURE 82. DEFINITION OF WING/WHEEL WAKE THICKNESS

Engine/Nacelle Acoustic Characteristics

Comparisons of measured ground static data from the JT8D-15 (baseline) and the JT8D-109 (Refan) engines are presented in figures 83 through 89 (the JT8D-15 is acoustically identical to the JT8D-9 at the same referred fan speed). Figure 83 shows peak forward and peak aft 61 meter (200 foot) sideline PNLs as a function of static engine thrust. Comparison of the baseline and Refan engine shows reductions in peak forward quadrant noise levels of 5 to 7 PNdB for engine 1 (Configuration B) and 6 to 9 PNdB for engine 2, depending on thrust. Inlet acoustic treatment reduced total forward radiated 61 meter (200 foot) sideline noise from the Refan engine in the 26 688 to 44 480 N (6,000 to 10,000 pound) thrust range by 5 to 7 PNdB for engine 1 and engine 2, respectively. Refan engine 2 achieved a 8 to 10 PNdB reduction in peak aft 61 meter (200 foot) sideline noise levels compared to the baseline engine from 17 793 to 71 172 N (4,000 to 16,000 pounds) of thrust. The aft quadrant noise levels for engine 2 with its treated tailpipe and modified turbine support frames were 3 PNdB lower than those from engine 1 for the thrust range from 8 896 to 71 172 N (2,000 to 16,000 pounds).

Figures 84 through 87 compare 45.7 meters (150 foot) PNL directivity and SPL spectra for the baseline and Refan engines 1 and 2 at selected peak forward and peak aft noise angles, for simulated FAR Part 36 thrusts. Inlet and aft attenuation spectra from the inlet and tailpipe acoustic treatment are shown in figure 88 for three simulated FAR Part 36 thrusts: approach 0.873 and 0.611 radian (50 and 35 degree) flaps and cutback. The maximum inlet noise reduction of 14 dB occurred at cutback thrust in the 1/3-octave frequency band centered at 4000 Hz (the band containing the fan fundamental BPF). At 0.611 radian (35 degree) flap approach power where turbine noise is most prevalent, tailpipe treatment reduced the SPL in the 8000 Hz frequency band by 6 dB. Inlet and tailpipe treatment noise reduction of 8.0 and 3.3 PNdB were obtained from projecting static data to the FAR Part 36 approach [(0.873 m) (50 degree) flaps] condition, for which the nacelle acoustic treatment was designed. The inlet treatment noise reduction of 8 PNdB agreed quite well with the estimated value of 7 PNdB from the inlet treatment design chart (ref. 33) used for establishing preliminary guidelines in determining the amount of inlet treatment needed to achieve a "balanced configuration" (a nacelle is considered to have a "balanced configuration" if the peak forward quadrant noise levels are equal to the peak aft quadrant noise levels). The tailpipe treatment noise reduction of 3.3 PNdB from the 1.30 m (51 in) treatment was somewhat less than the estimated value of 3.9 PNdB for a .89 m (35 in.) treatment length (ref. 33).

The combined nacelle treatment (inlet, fan case, fan duct and tailpipe) had essentially achieved the design goal of a "balanced configuration". This finding is based on results of controlled approach flyover noise tests which showed the spread between the peak forward quadrant noise levels [1.4 rad (80 degrees)] and peak aft quadrant noise levels [1.8 rad (100 degrees)] to be only 1 PNdB (figure 89).

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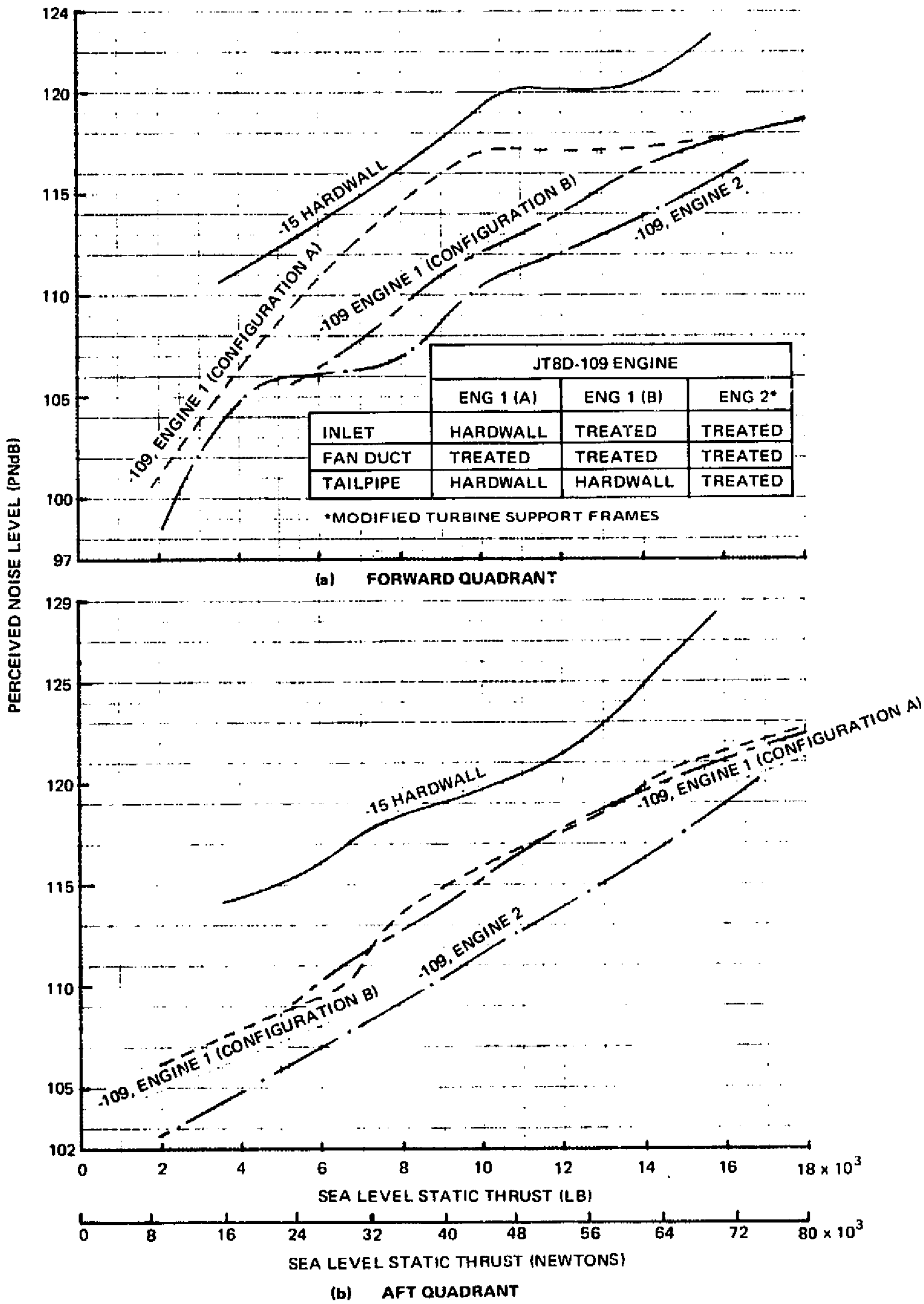
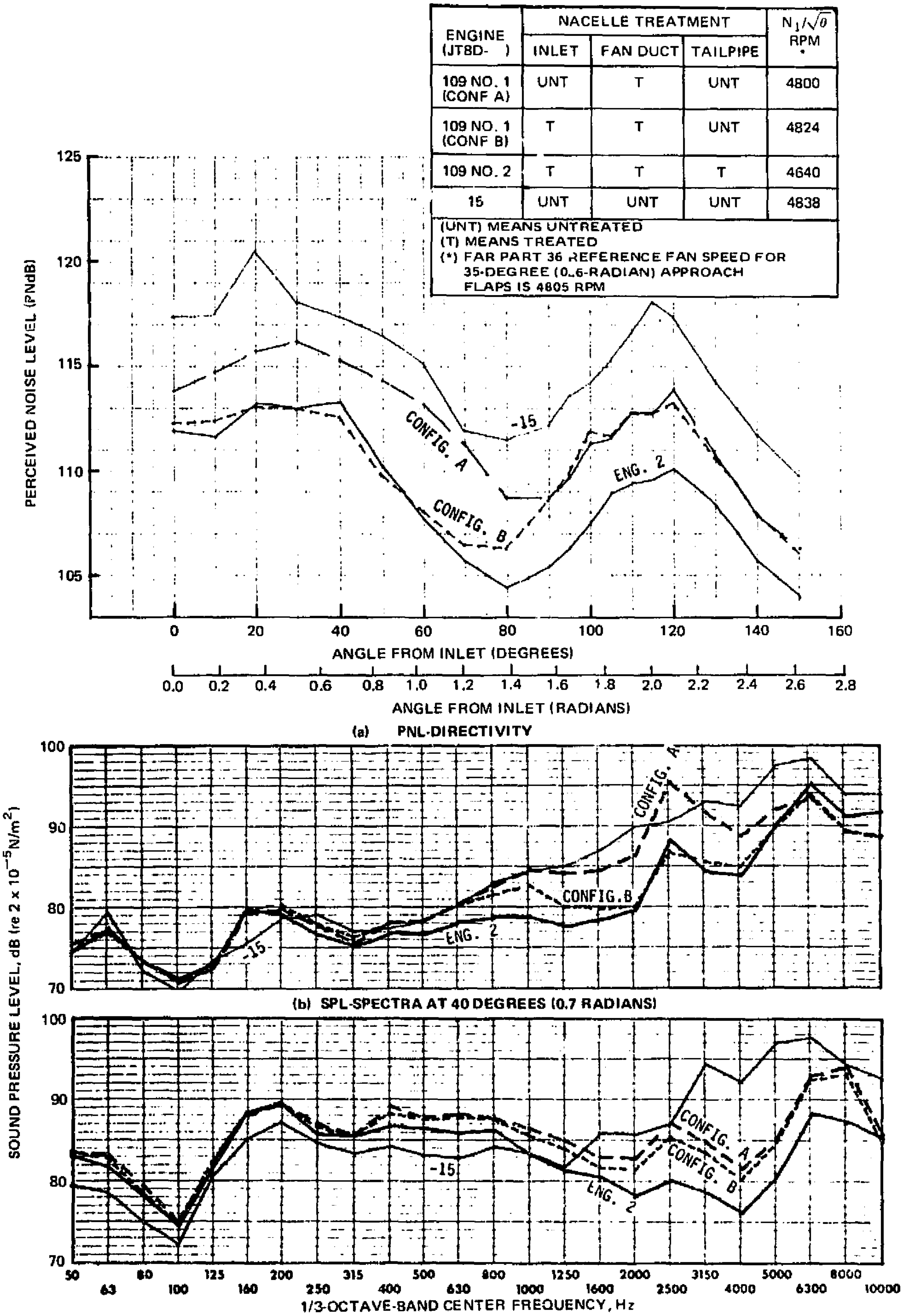


FIGURE 83. COMPARISON OF JT8D-15 AND JT8D-109 PEAK FORWARD AND PEAK AFT 200 FOOT (61 METER) SIDELINE PERCEIVED NOISE LEVELS FROM 150 FOOT (45.7 METER) STATIC DATA



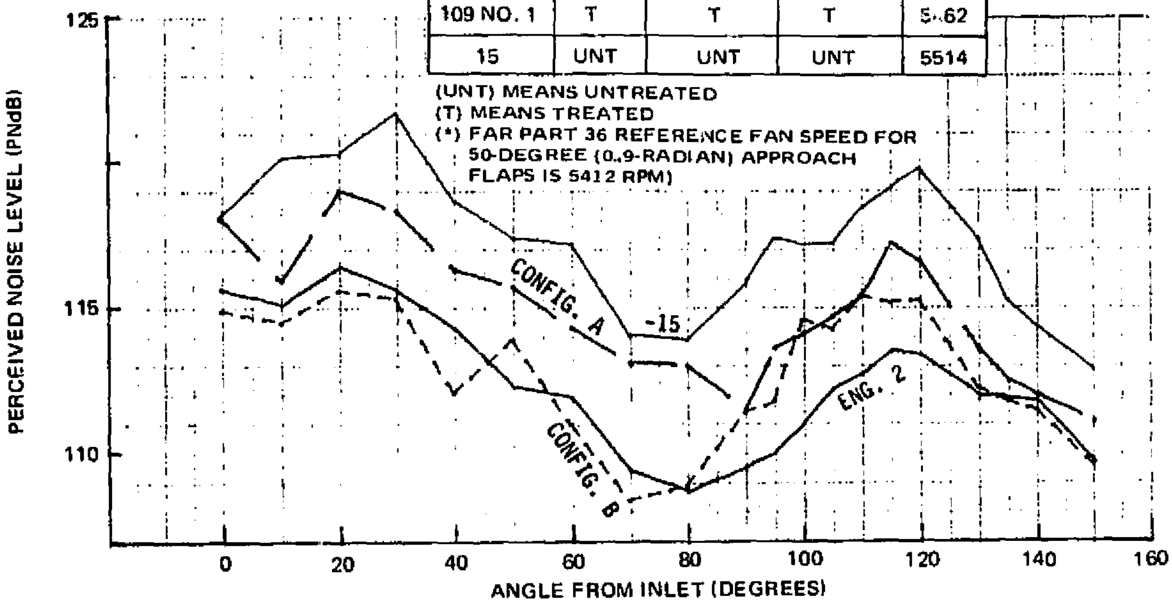
ENGINE (JT8D-)	NACELLE TREATMENT			$N_1/\sqrt{\theta}$ RPM *
	INLET	FAN DUCT	TAILPIPE	
109 NO. 1 (CONF A)	UNT	T	UNT	4800
109 NO. 1 (CONF B)	T	T	UNT	4824
109 NO. 2	T	T	T	4640
15	UNT	UNT	UNT	4838

(UNT) MEANS UNTREATED
(T) MEANS TREATED
(*) FAR PART 36 REFERENCE FAN SPEED FOR 35-DEGREE (0.6-RADIAN) APPROACH FLAPS IS 4805 RPM

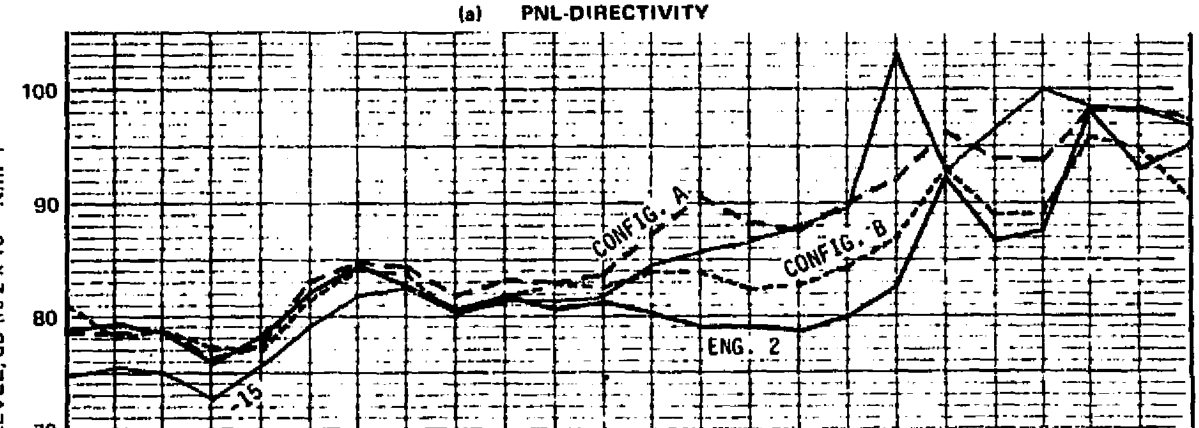
FIGURE 84. COMPARISON OF JT8D-15 AND JT8D-109 150-FOOT (45.7-METER) PNL-DIRECTIVITY AND AND SPL-SPECTRA AT 35-DEGREE (0.6-RADIAN) FLAP APPROACH THRUST

ENGINE (JT8D-)	NACELLE TREATMENT			$N_1/\sqrt{\theta}$ RPM*
	INLET	FAN DUCT	TAILPIPE	
109 NO. 1 (CONF A)	UNT	T	UNT	5493
109 NO. 1 (CONF B)	T	T	UNT	5497
109 NO. 1	T	T	T	5[illegible]62
15	UNT	UNT	UNT	5514

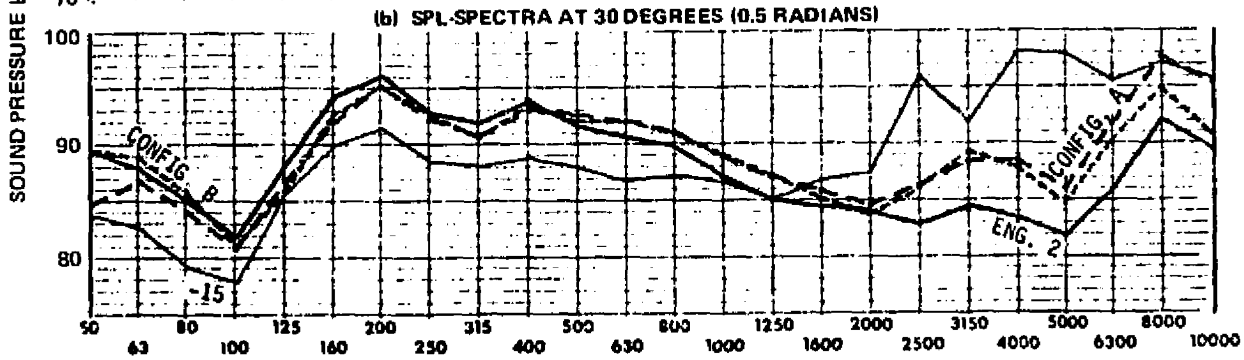
(UNT) MEANS UNTREATED
(T) MEANS TREATED
(*) FAR PART 36 REFERENCE FAN SPEED FOR 50-DEGREE (0.9-RADIAN) APPROACH FLAPS IS 5412 RPM)



(a) PNL-DIRECTIVITY



(b) SPL-SPECTRA AT 30 DEGREES (0.5 RADIANS)



(c) SPL-SPECTRA AT 120 DEGREES (2.1 RADIANS)

FIGURE 85. COMPARISON OF JT8D-15 AND JT8D-109 150-FOOT (45.7-METER) PNL-DIRECTIVITY AND SPL-SPECTRA AT 50-DEGREE (0.9-RADIAN) FLAP APPROACH THRUST

ENGINE (JT8D-)	NACELLE TREATMENT			$N_1/\sqrt{\theta}$ RPM *
	INLET	FAN DUCT	TAILPIPE	
109 NO. 1 (CONF A)	UNT	T	UNT	6371
109 NO. 1 (CONF B)	T	T	UNT	6401
109 NO. 2	T	T	T	6415
15	UNT	UNT	UNT	6380

(UNT) MEANS UNTREATED
(T) MEANS TREATED
(*) ~ FAR PART 36 REFERENCE FAN SPEED FOR CUTBACK OPERATION IS 6545 RPM

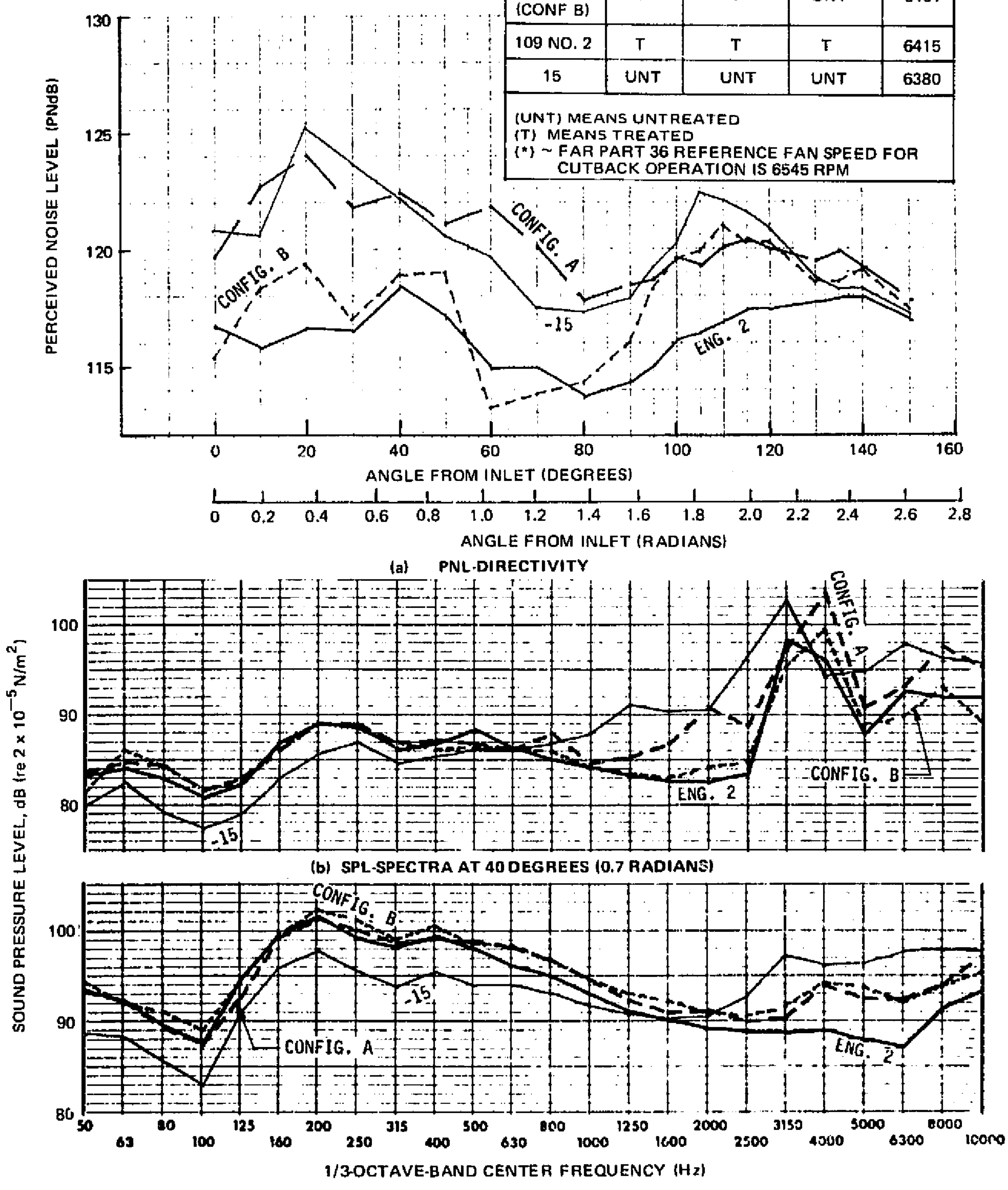
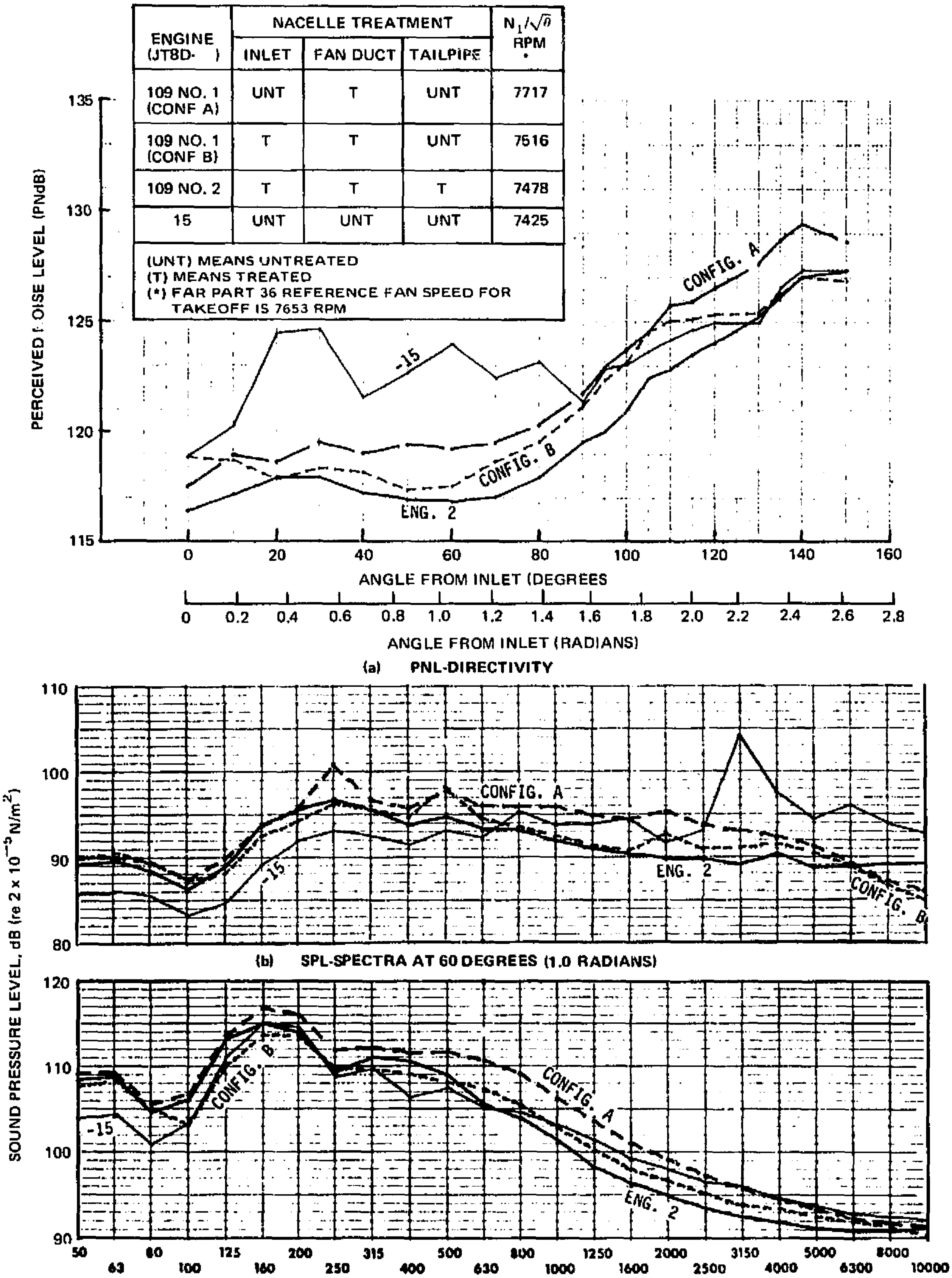


FIGURE 86. COMPARISON OF JT8D-15 AND JT8D-109 150-FOOT (45.7-METER) PNL-DIRECTIVITY AND SPL-SPECTRA AT CUTBACK THRUST



ENGINE (JT8D-)	NACELLE TREATMENT			$N_1/\sqrt{\theta}$ RPM *
	INLET	FAN DUCT	TAILPIPE	
109 NO. 1 (CONF A)	UNT	T	UNT	7717
109 NO. 1 (CONF B)	T	T	UNT	7516
109 NO. 2	T	T	T	7478
15	UNT	UNT	UNT	7425

(UNT) MEANS UNTREATED
(T) MEANS TREATED
(*) FAR PART 36 REFERENCE FAN SPEED FOR TAKEOFF IS 7653 RPM

(a) PNL-DIRECTIVITY

(b) SPL-SPECTRA AT 60 DEGREES (1.0 RADIANS)

(c) SPL-SPECTRA AT 140 DEGREES (2.4 RADIANS)

FIGURE 87. COMPARISON OF JT8D-15 AND JT8D-109 150-FOOT (45.7-METER) PNL-DIRECTIVITY AND SPL-SPECTRA AT TAKEOFF THRUST

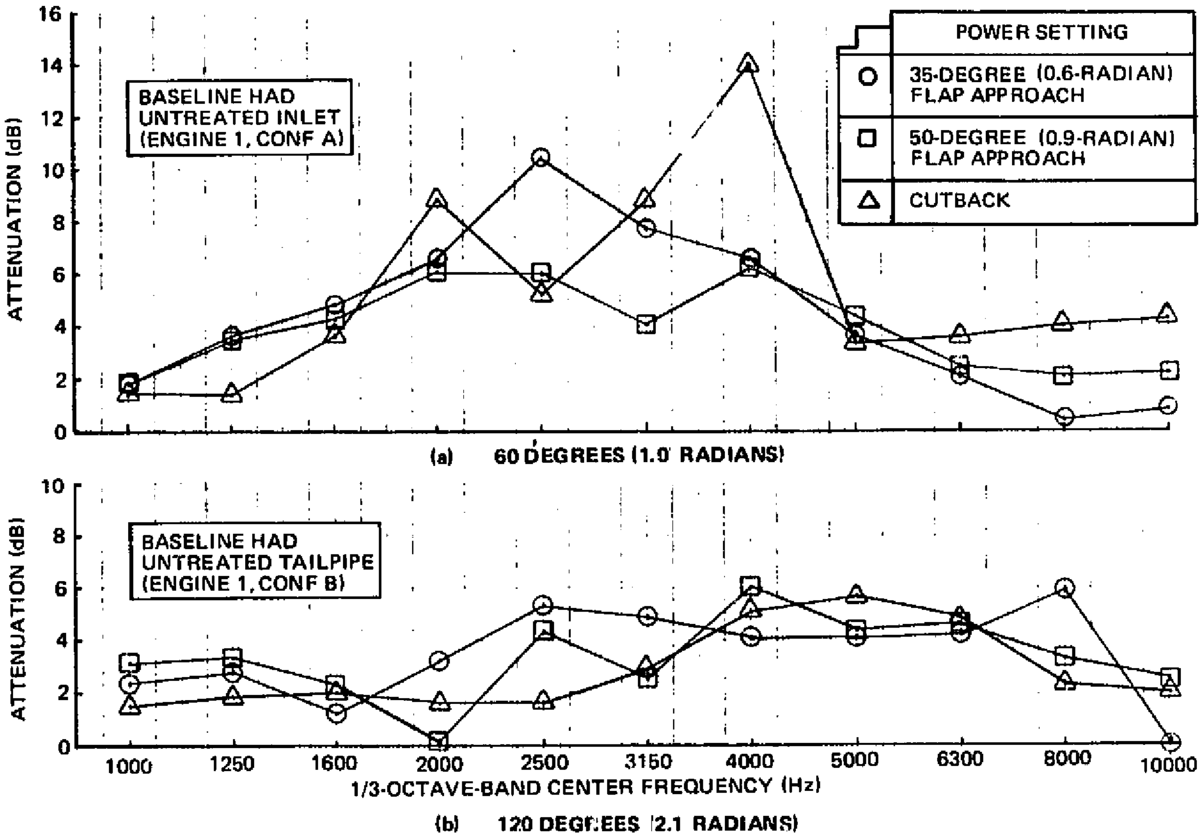


FIGURE 88. MEASURED ATTENUATION SPECTRA FROM REFAN ENGINE 2 (FULLY TREATED NACELLE)

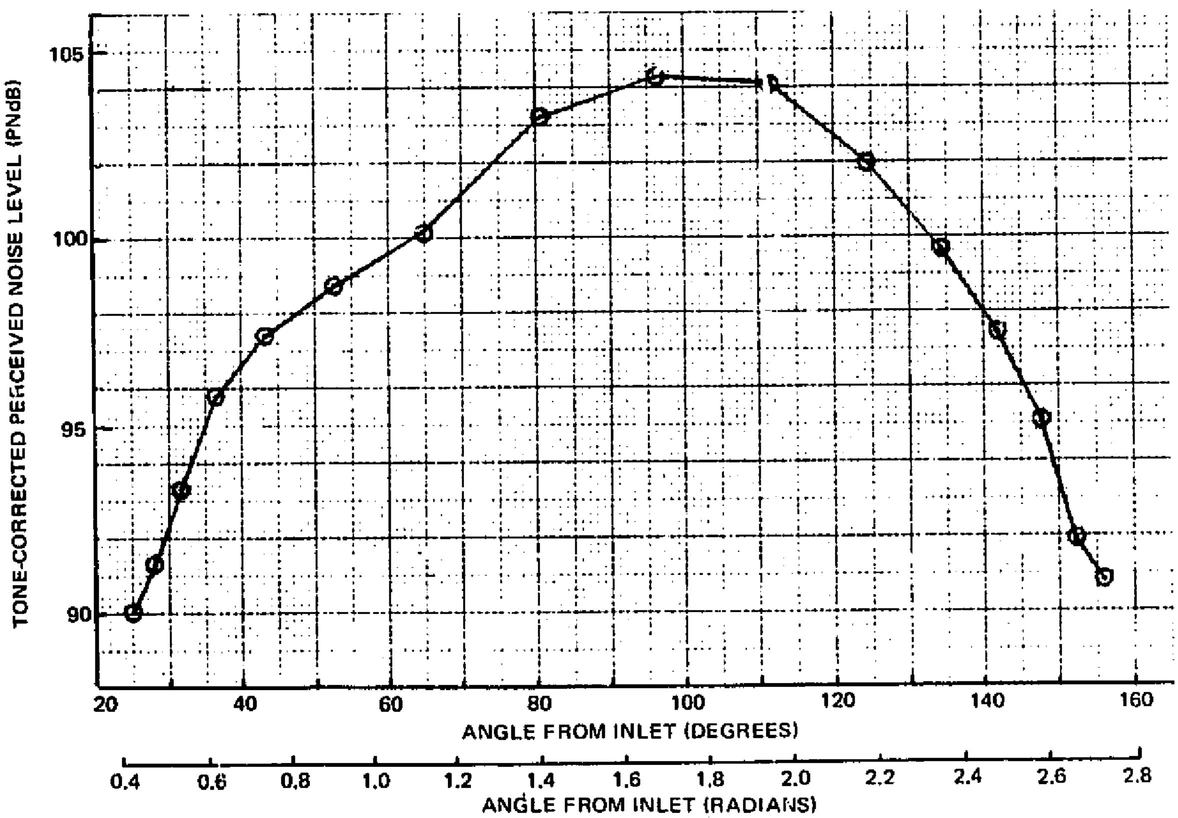


FIGURE 89. ILLUSTRATION OF A "BALANCED CONFIGURATION": DC-9 REFAN PNLT-DIRECTIVITY FROM 50-DEGREE (0.87 RAD) FLAP APPROACH FLYOVER NOISE DATA AT 400-FOOT (122-M) HEIGHT

Noise Source Levels

Noise source levels from ground static and flyover noise data are presented in figures 90 through 99. Figures 90 to 93 present source SPL spectra for Refan engine 2 at 1.05 and 2.1 rad (60 and 120 degrees) from measured 45.7 m (150 ft) ground static data for four simulated FAR Part 36 power settings.

Figures 94 through 99 show source PNLT time-histories and SPL and perceived noisiness spectra from approach and takeoff flyover noise data. The data from these tests used 10 m (33 ft) high pole microphones and flush mounted ground microphones to minimize ground reflection problems. The approach tests (figures 94 to 96) used a 0.052 rad (3 degree) glideslope and 0.873 rad (50 degree) flap setting, and had a minimum slant range distance of 237 m (776 ft). At these conditions, further noise reductions to improve community noise levels would require reducing jet, core, fan exhaust and fan inlet noise--each source having a peak noise level within a range of $\pm$1.5 PNdB.

The full thrust takeoff tests (figures 97 to 99) had a minimum slant range distance of 313 m (1026 ft). The takeoff noise levels at this distance were dominated entirely by jet noise, with turbomachinery and core noise levels approximately 8 to 10 PNdB below the jet noise levels (figure 97).

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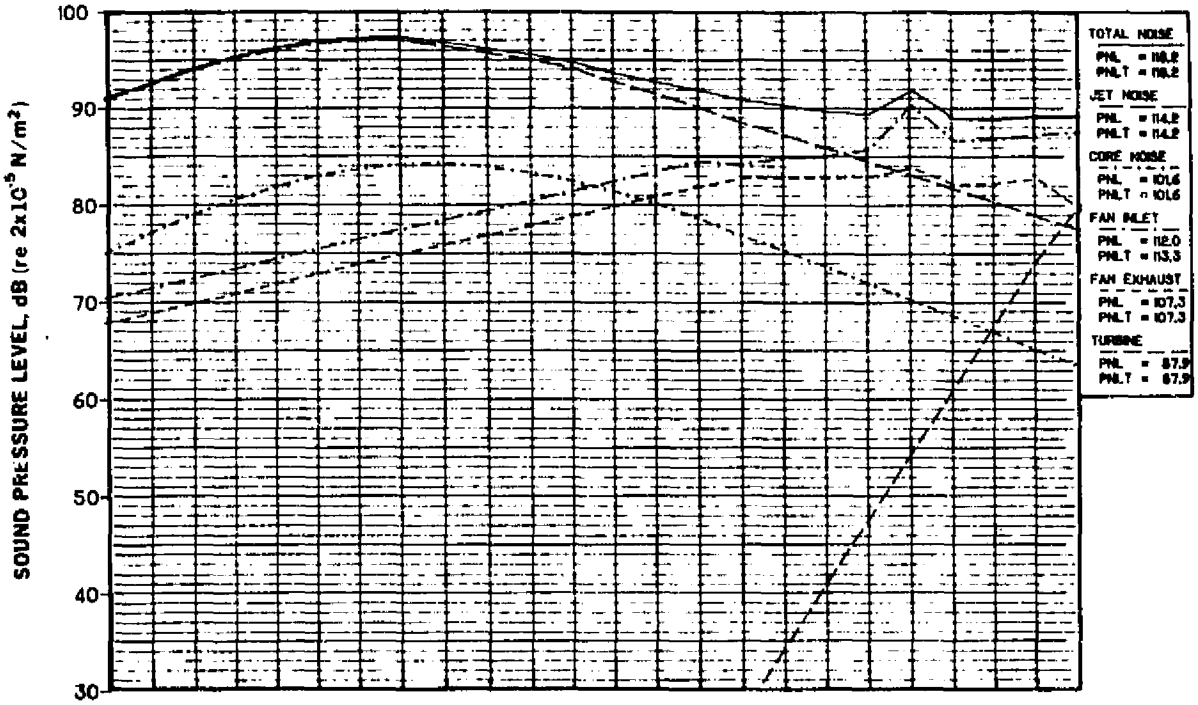
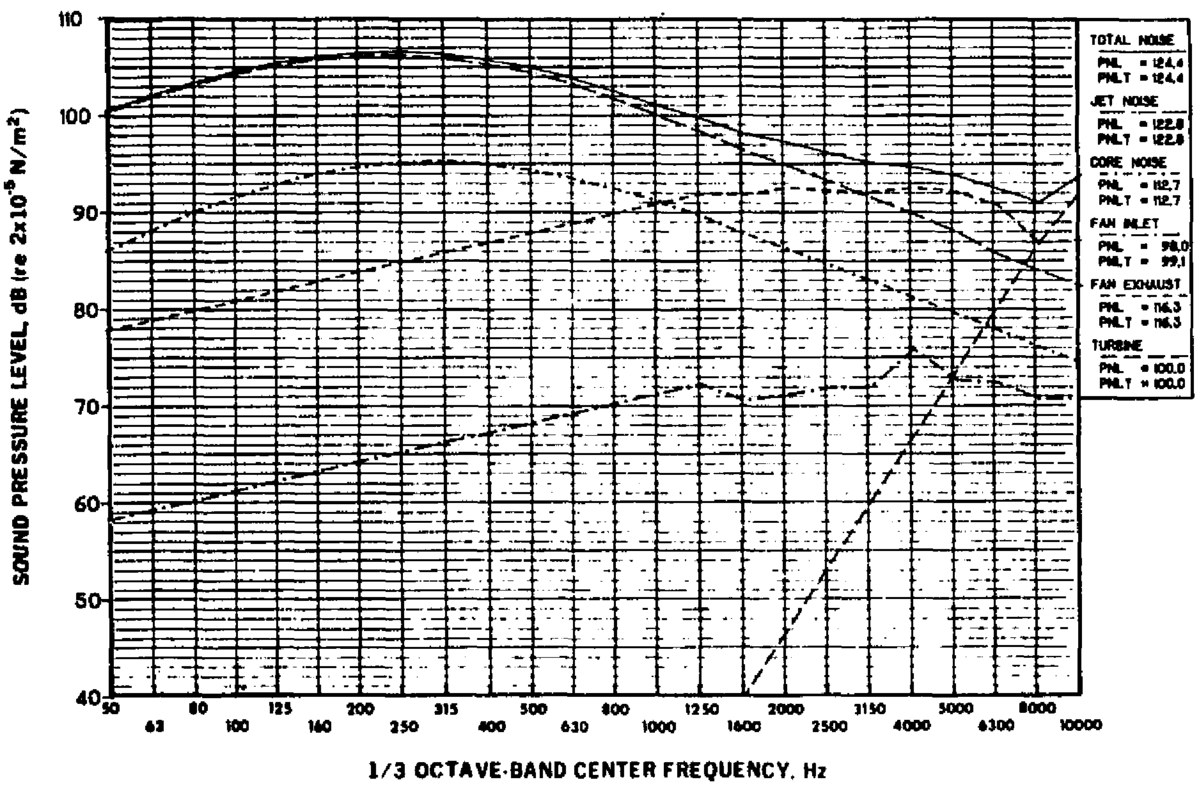
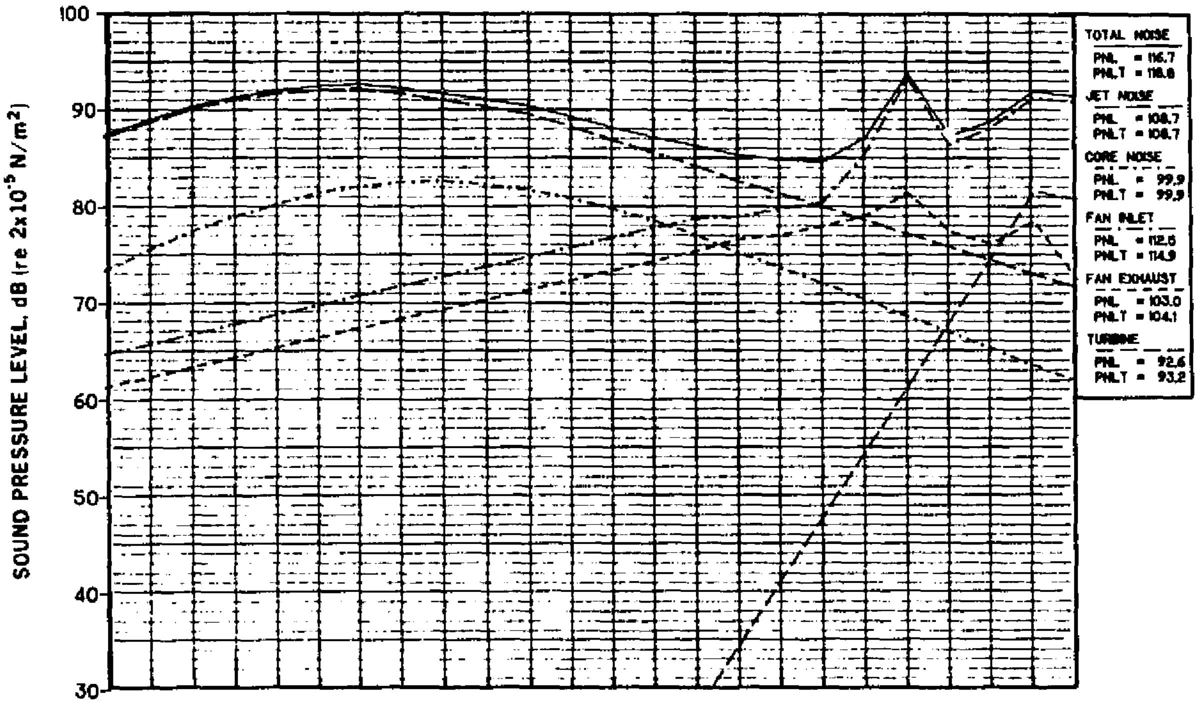


(a) 60 DEGREES (1.0 RADIANS)

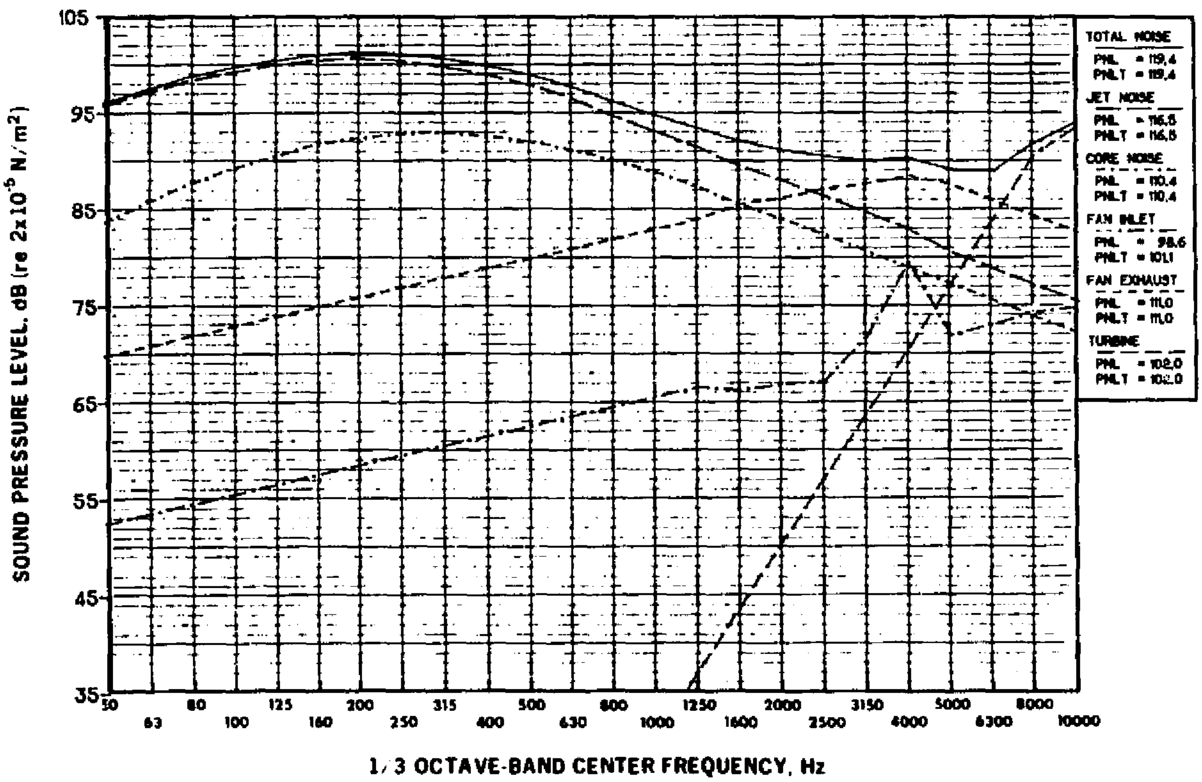


(b) 120 DEGREES (2.1 RADIANS)

FIGURE 90. NOISE SOURCE SPL SPECTRA AT TAKEOFF POWER (7455 RPM) AND 150-FOOT STATIC CONDITIONS FROM REFAN ENGINE 2

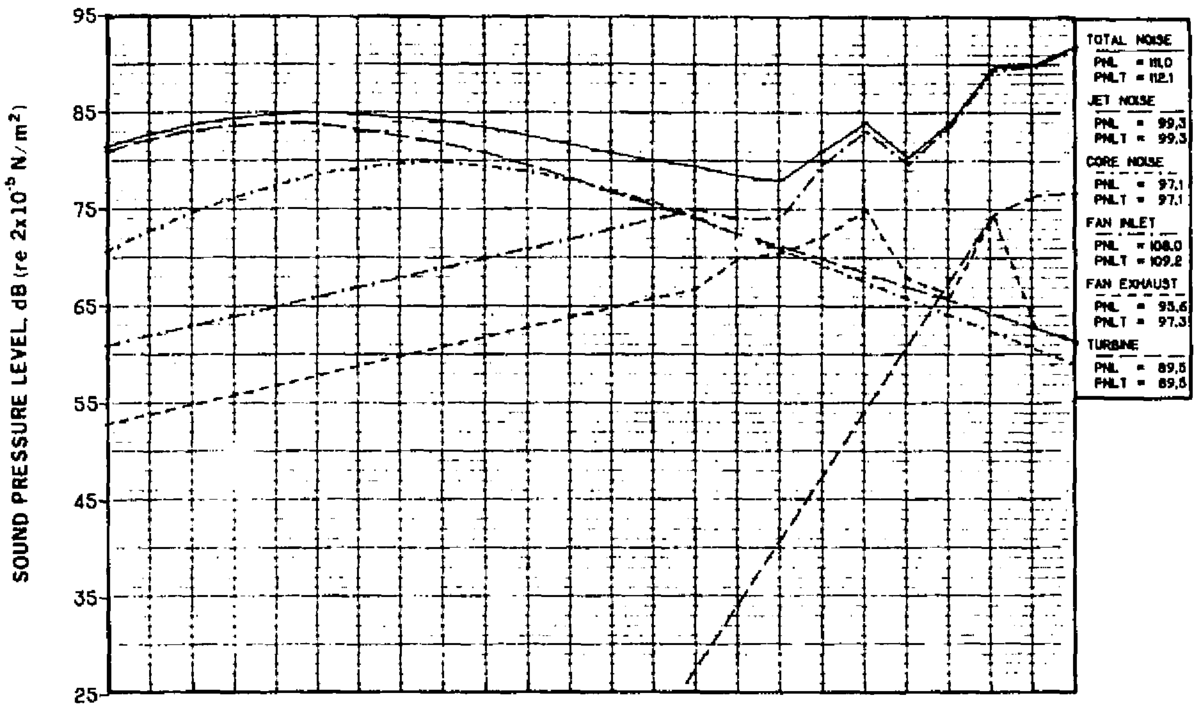


(a) 60 DEGREES (1.0 RADIANS)

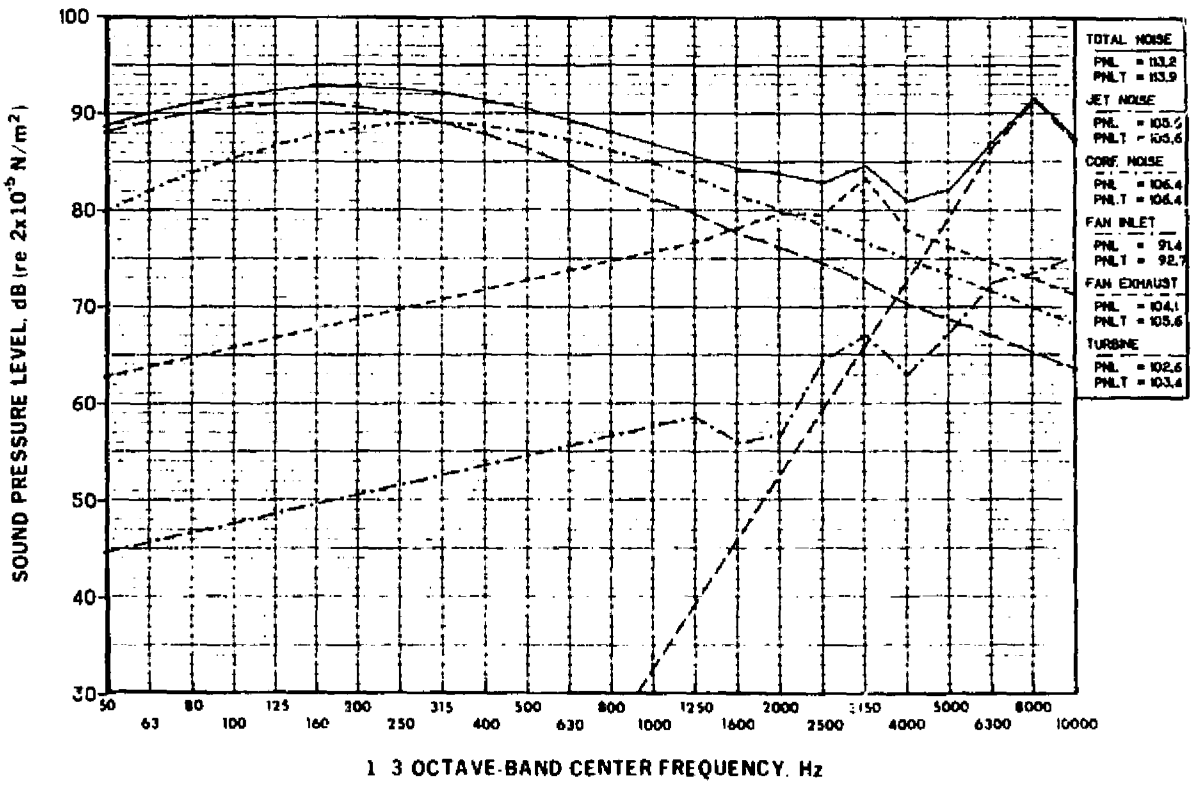


(b) 120 DEGREES (2.1 RADIANS)

FIGURE 91. NOISE SOURCE SPL SPECTRA FOR CUTBACK POWER (6548 RPM) AND 150-FOOT (45.7-M) STATIC CONDITIONS FROM REFAN ENGINE 2

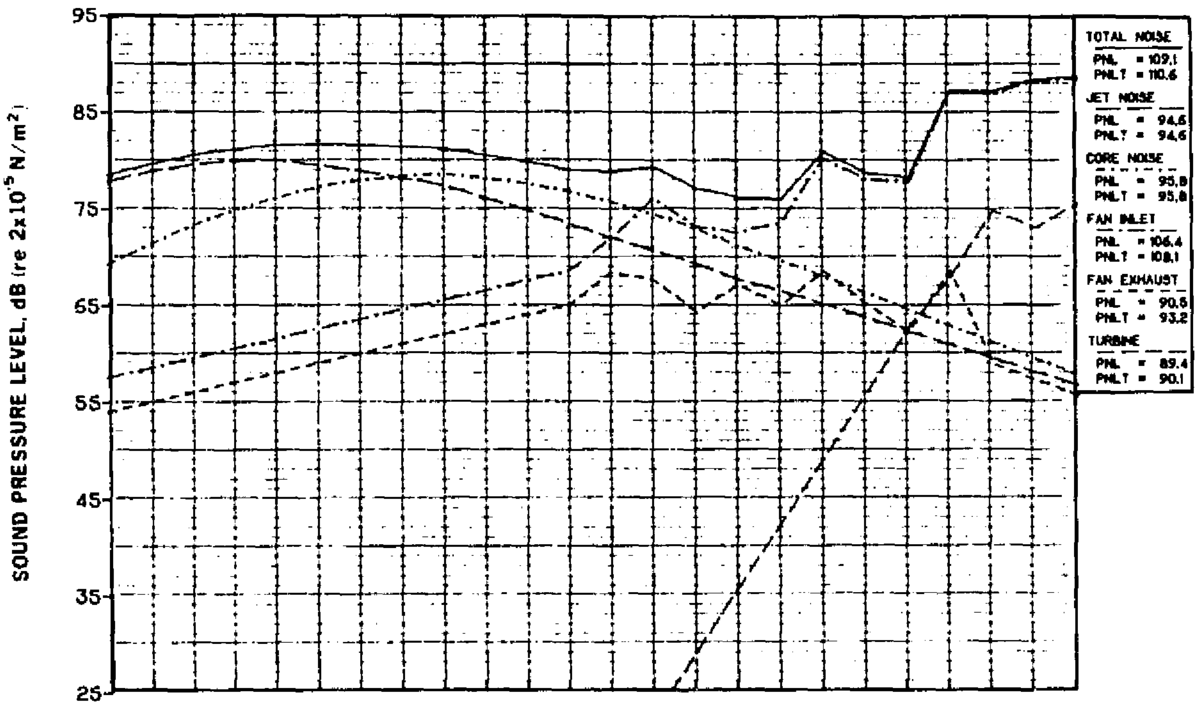


(a) 60 DEGREES (1.0 RADIANS)

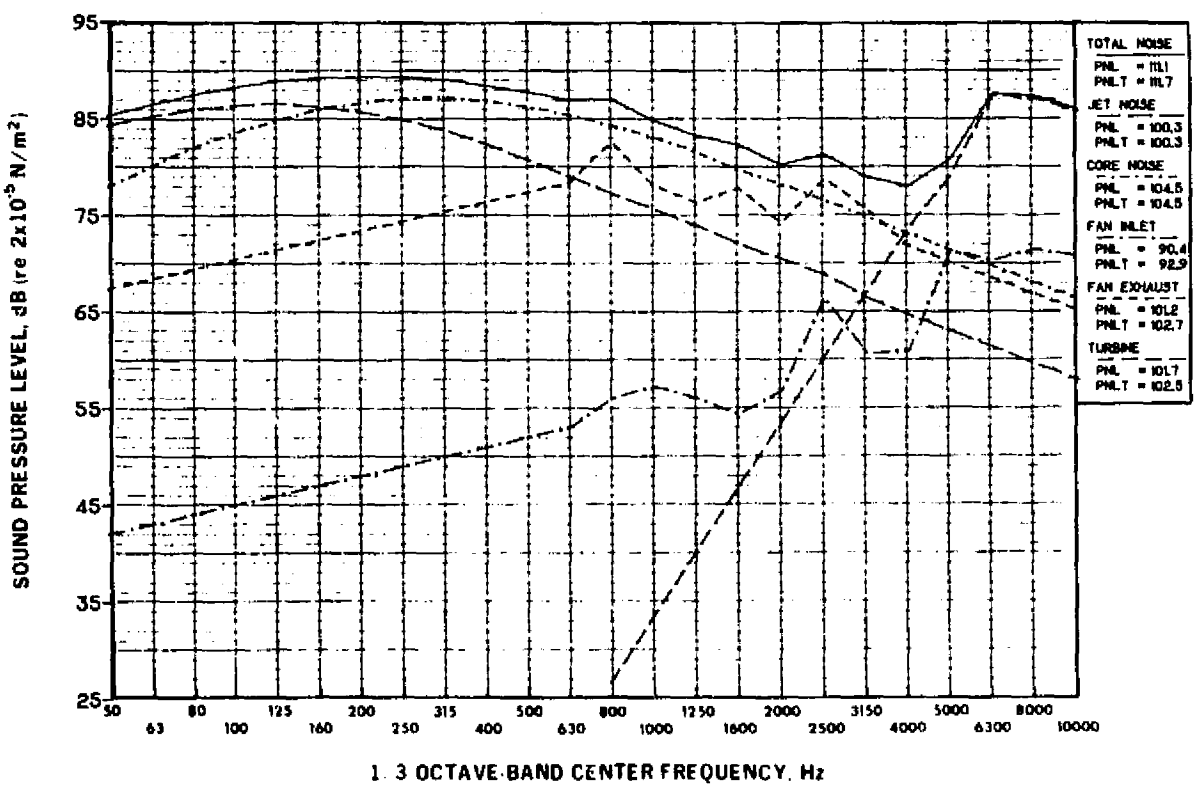


(b) 120 DEGREES (2.1 RADIANS)

FIGURE 92. NOISE SOURCE SPL SPECTRA FOR 50-DEGREE (0.87-RAD) FLAP APPROACH POWER (5520 RPM) AND 150-FOOT (45.7-M) STATIC CONDITIONS FROM REFAN ENGINE 2



(a) 60 DEGREES (1.0 RADIANS)



(b) 120 DEGREES (2.1 RADIANS)

FIGURE 93. NOISE SOURCE SPL SPECTRA FOR 35-DEGREE (0.67-M) FLAP APPROACH POWER (4614 RPM) AND 150-FOOT (45.7-M) STATIC CONDITIONS FROM REFAN ENGINE 2

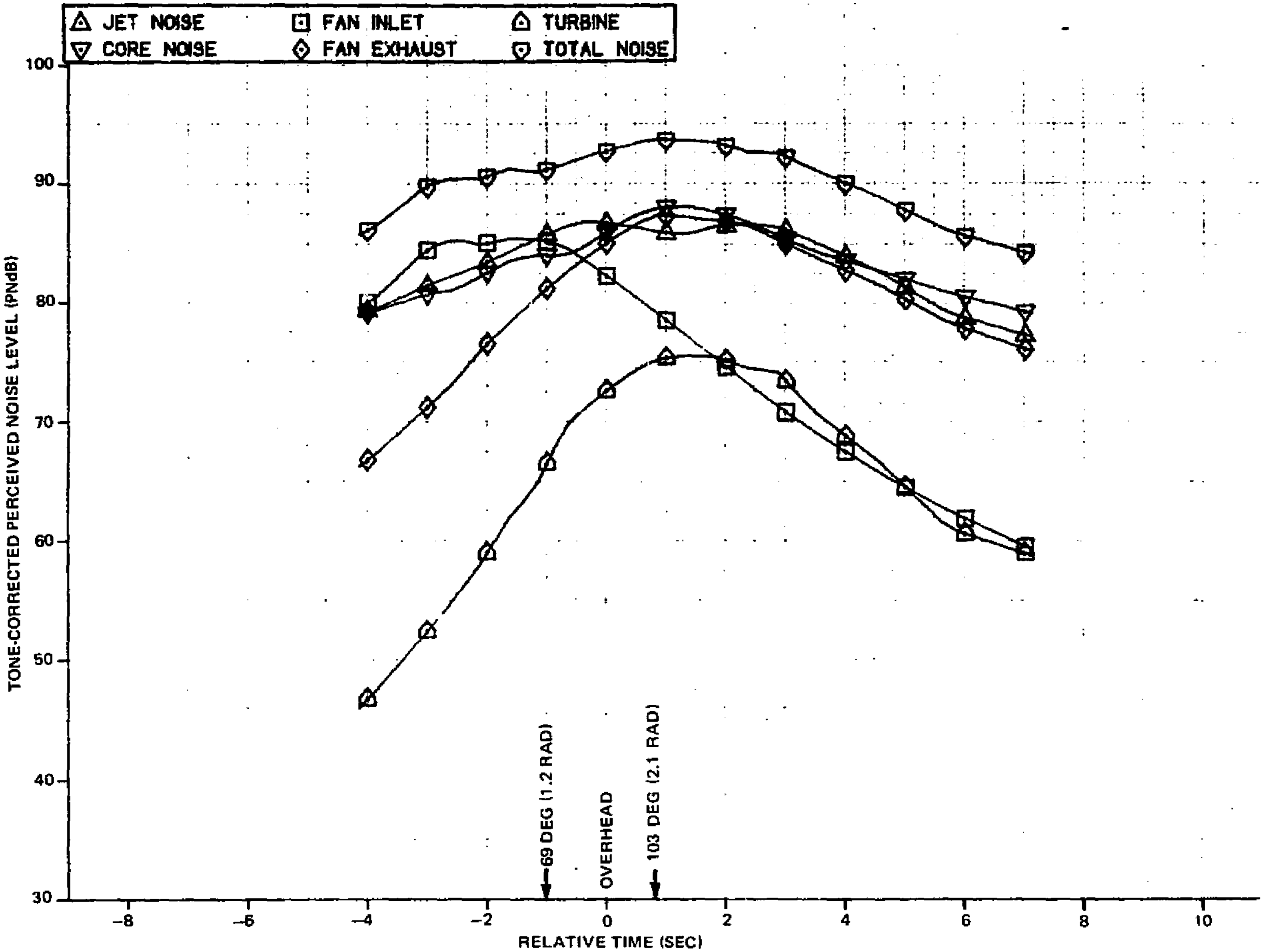
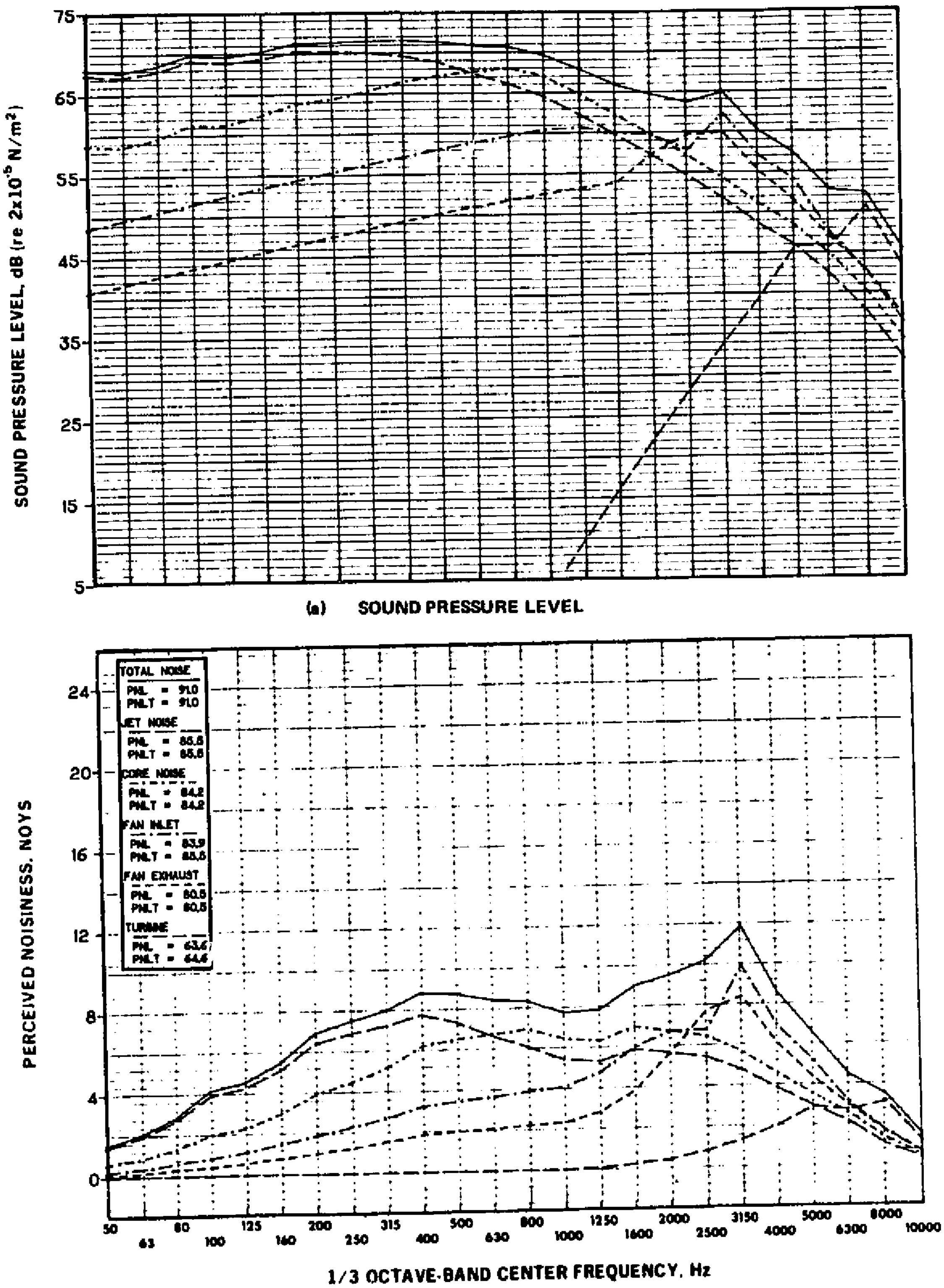
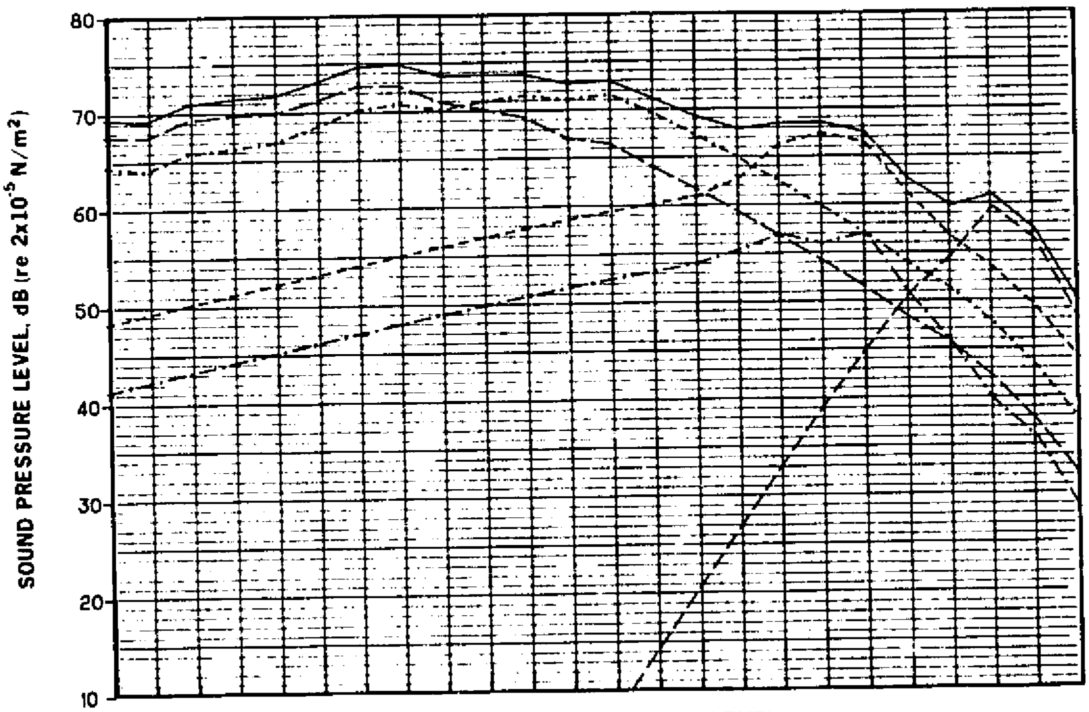


FIGURE 94. NOISE SOURCE PNLT TIME-HISTORIES FOR DC-9 REFAN AIRCRAFT AT APPROACH POWER, 3-DEGREE (0.05 RAD) GLIDESLOPE AND 776-FOOT (236.5M) HEIGHT

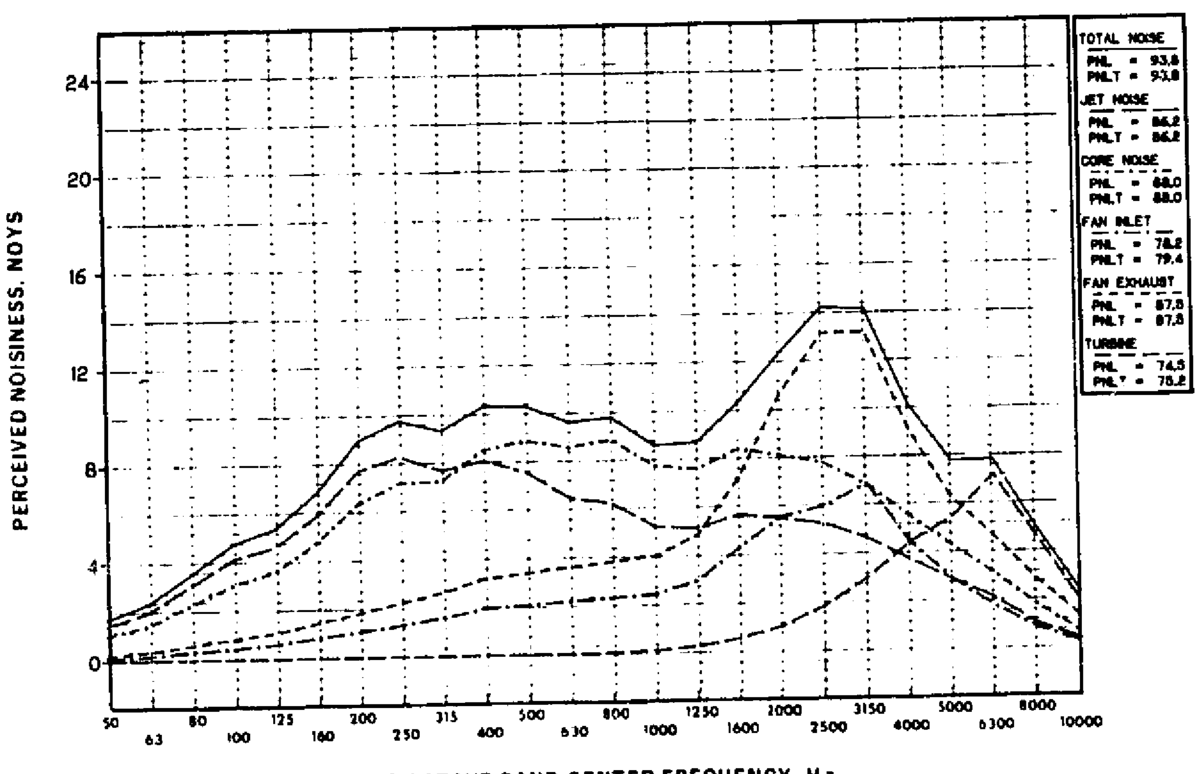


(b) PERCEIVED NOISINESS

FIGURE 95. NOISE SOURCE SPECTRA FROM DC-9 REFAN AIRCRAFT AT APPROACH POWER, 3-DEGREE (0.05-RAD) GLIDESLOPE, 776-FOOT (236.5-M) HEIGHT AND 69 DEGREES (1.2 RAD) FROM ENGINE INLET



(a) SOUND PRESSURE LEVEL



(b) PERCEIVED NOISINESS

FIGURE 96. NOISE SOURCE SPECTRA FROM DC-9 REFAN AIRCRAFT AT APPROACH POWER, 3-DEGREE (0.05-RAD) GLIDESLOPE, 776-FOOT (236.5-M) HEIGHT AND 119 DEGREES (2.1 RAD) FROM ENGINE INLET

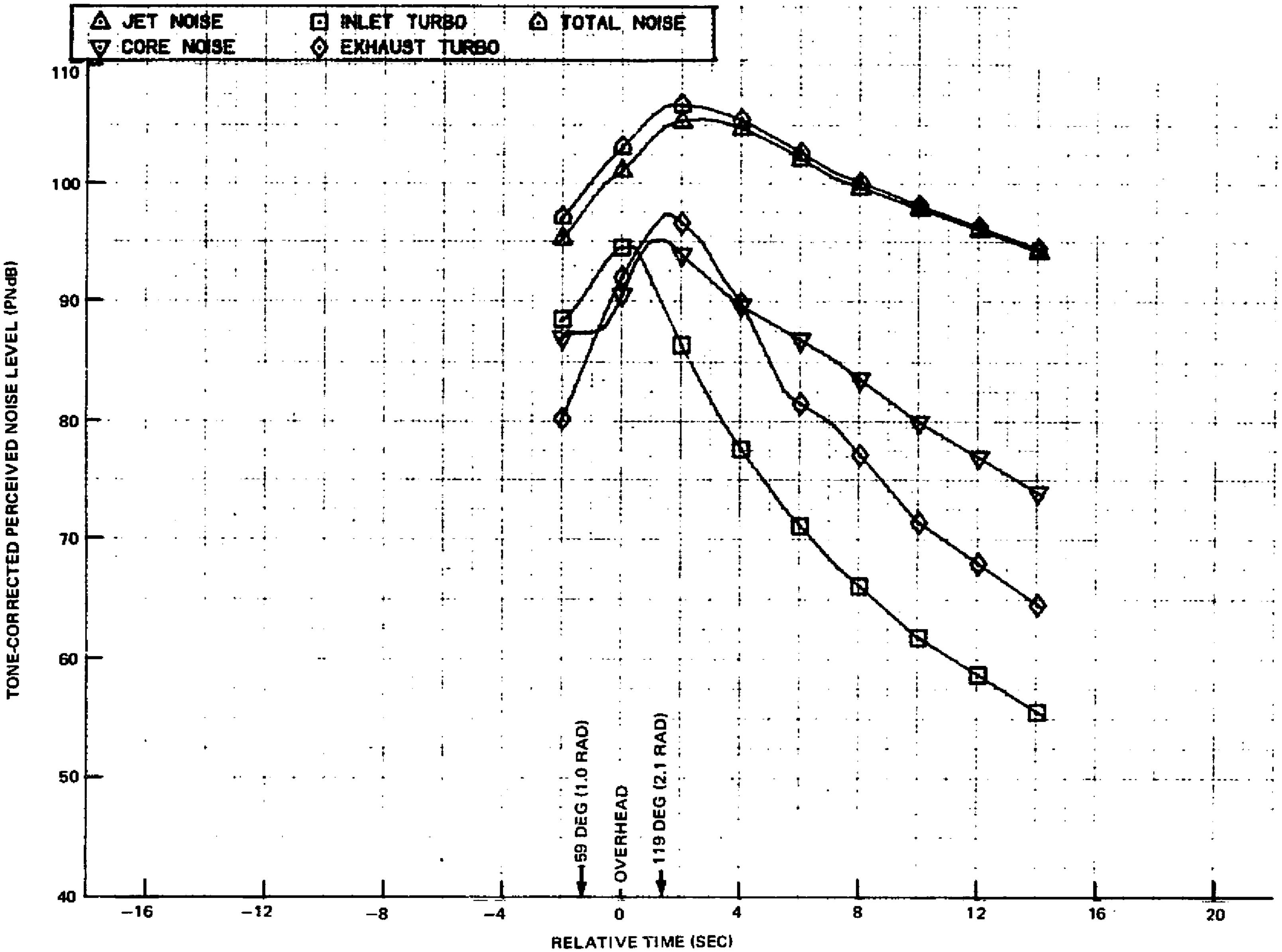


FIGURE 97. NOISE SOURCE PNLT TIME-HISTORIES FOR DC-9 REFAN AIRCRAFT AT TAKEOFF POWER AND 1026-FOOT (312.7-M) HEIGHT

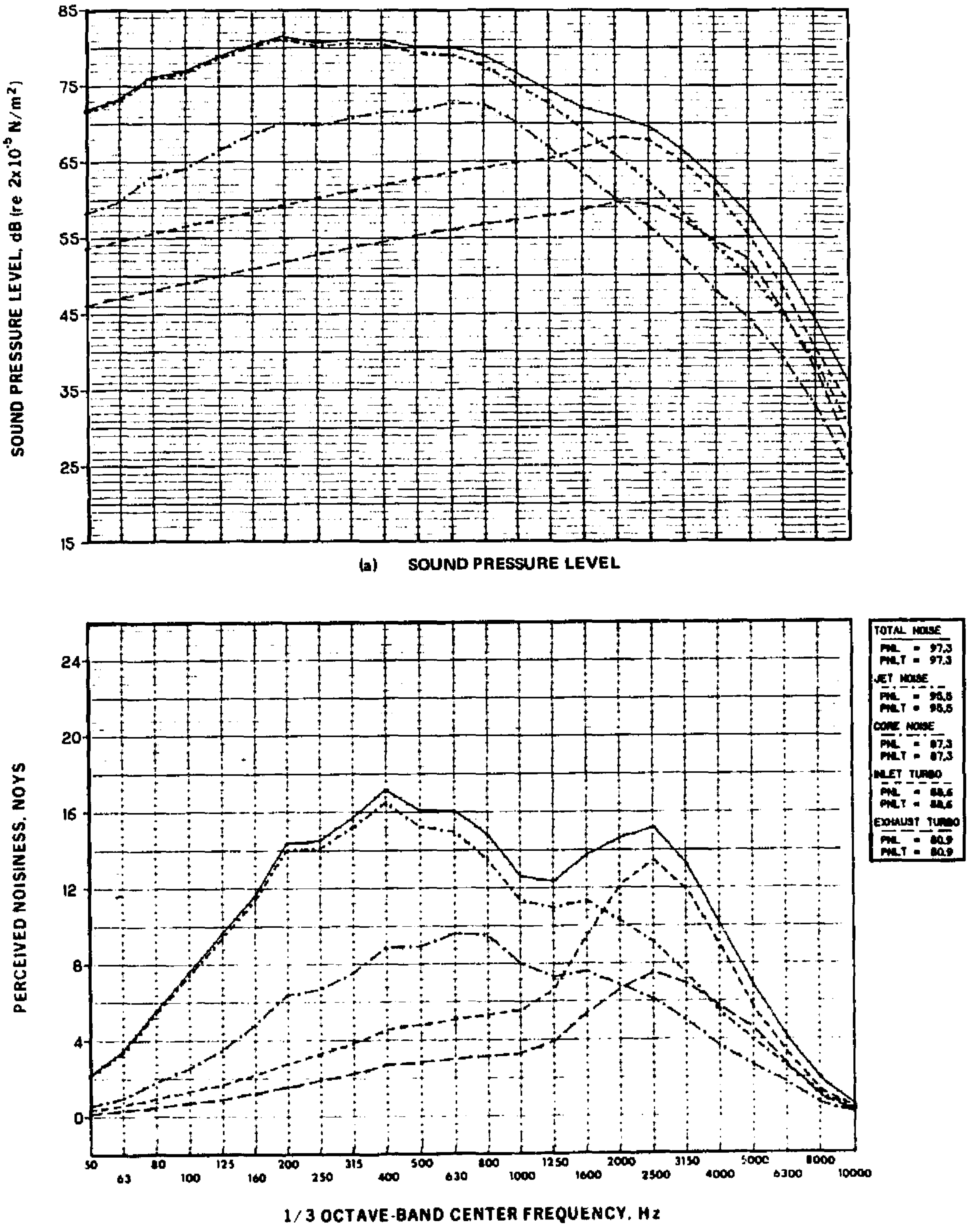


FIGURE 98. NOISE SOURCE SPECTRA FROM DC-9 REFAN AIRCRAFT AT TAKEOFF POWER, 1026-FOOT (312.7-M) HEIGHT AND 59 DEGREES (1.0 RAD) FROM ENGINE INLET

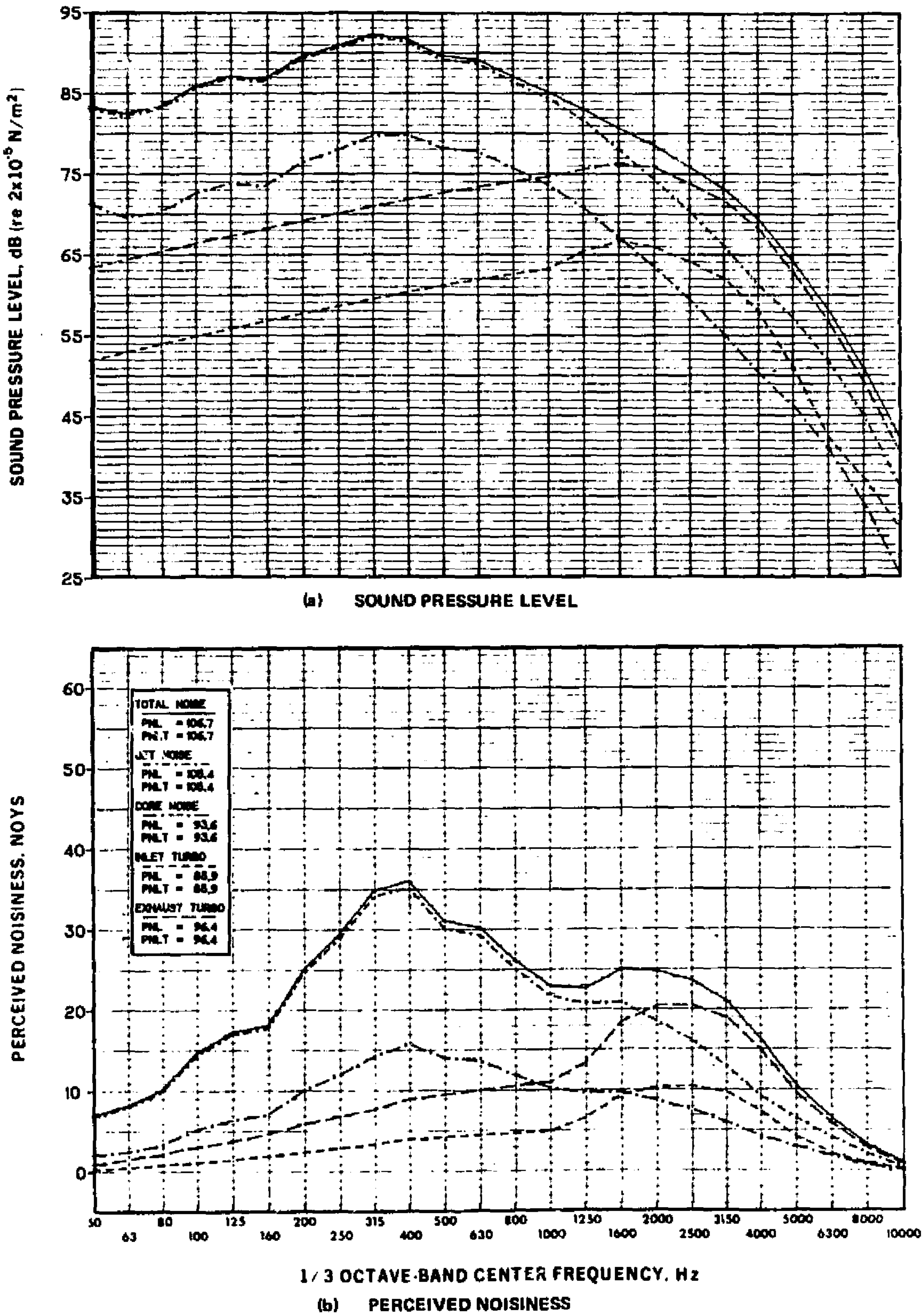


FIGURE 99. NOISE SOURCE SPECTRA FROM DC-9 REFAN AIRCRAFT AT TAKEOFF POWER, 1026-FOOT (312.7-M) HEIGHT AND 119 DEGREES (2.1 RAD) FROM ENGINE INLET

Flight Effects on Jet and Core Noise

The static-to-flight comparison plots presented here had turbomachinery noise removed from the spectra using the procedures described earlier. The broadband noise from 50 to 1000 Hz was determined to be primarily jet and core noise and hence was identical to the measured data. All static-to-flight comparisons were normalized to single-engine/45.7 m (150 foot) radius conditions with "averaged" data selected to have very nearly the same absolute primary jet velocity.

Comparisons of static and flight jet plus core OASPLs and SPL spectra are presented in figures 100, 101, and 102 for three ranges of jet velocity corresponding to approach [(226 m/sec)(740 ft/sec)], cutback [(399 m/sec) (1310 ft/sec)], and a takeoff [(466 m/sec) (1530 ft/sec)] power settings respectively. The most interesting observation from these data is the lack of reduction in forward quadrant [(0.5 to 1.4 radians) (30 to 80 degrees)] flyover noise levels and the increasingly larger reduction in aft quadrant [(1.57 to 2.8 radians) (90 to 160 degrees)] flight noise.

At 0.87 and 1.57 radians (50 and 90 degrees) from the inlet, OASPLs were controlled by the SPLs in the 630 and 800 Hz bands; for frequency bands from 50 to 500 Hz, flight SPLs were reduced by 2 to 3 dB. At 2.1 radians (120 degrees) the flight spectra were reduced approximately 2 to 5 dB from 50 to 10 000 Hz.

At a jet velocity of 399 m/sec (1310 ft/sec), flight data were consistently lower than projected static data at all angular locations (figure 101). Results from use of the flyover noise source separation procedure showed flight data to be dominated by jet noise with core noise levels 6 to 7 dB below jet noise levels. These static-to-flight characteristics were contrary to those reported by Bushell (ref. 21). For example, reference 21 indicated that inflight jet and core noise (1) increased for inlet angles less than 1.57 rad (90 degrees), (2) remained the same at 1.57 rad (90 degrees), and (3) decreased for inlet angles greater than 1.57 rad (90 degrees). The difference between the trends reported here and those reported in reference 21 may be due to:

1. Differences in the procedures used for correcting spectral irregularities due to ground reflection, aircraft flight path, engine inlet angle, atmospheric conditions and airplane installation effects.

2. Differences in aircraft engine and nozzle configurations which may have introduced additional noise sources.

3. Differences in the static and flyover-noise measurement data - reduction systems.

Figure 102 compares static and flight OASPLs and SPL spectra at 2.6 radians (150 degrees) for jet velocities corresponding to takeoff thrust. The static-to-flight trends observed for these high jet velocities were similar to those observed at a jet velocity of 399 m/sec (1310 ft/sec).

For primary jet velocities of 399 and 466 m/sec (1310 and 1530 ft/sec) both the static and flight spectra at 2.6 radians (150 degrees) contained "double peaks". The reduction in level across the spectrum due to relative velocity effects indicate that the SPL in the 400 Hz band is controlled by jet noise, and not core noise.

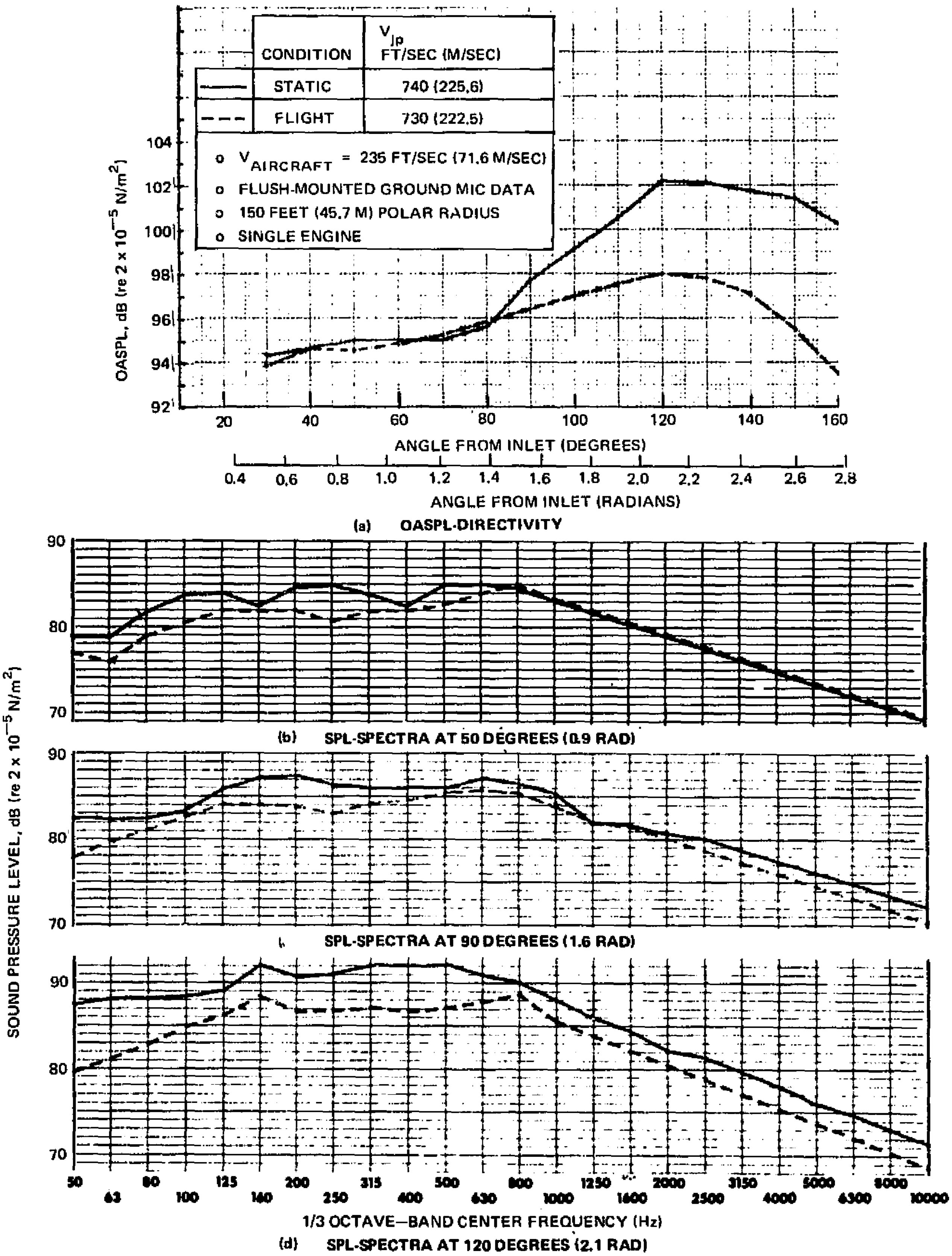


FIGURE 100. COMPARISON OF STATIC AND FLIGHT JET PLUS CORE OASPL-DIRECTIVITY AND SPL-SPECTRA FOR A NOMINAL ABSOLUTE PRIMARY JET VELOCITY OF 740 FT/SEC (225.6M/SEC)

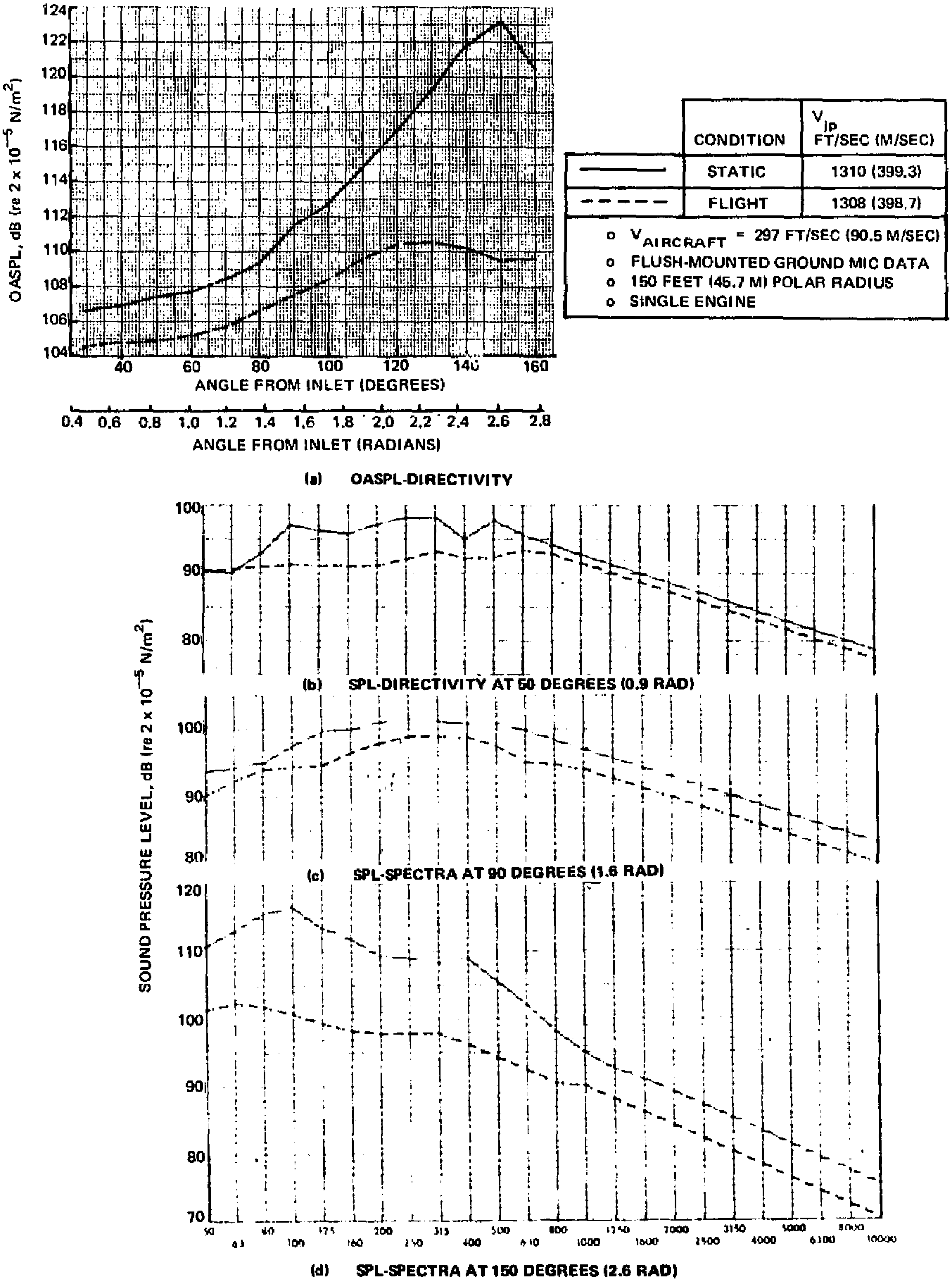
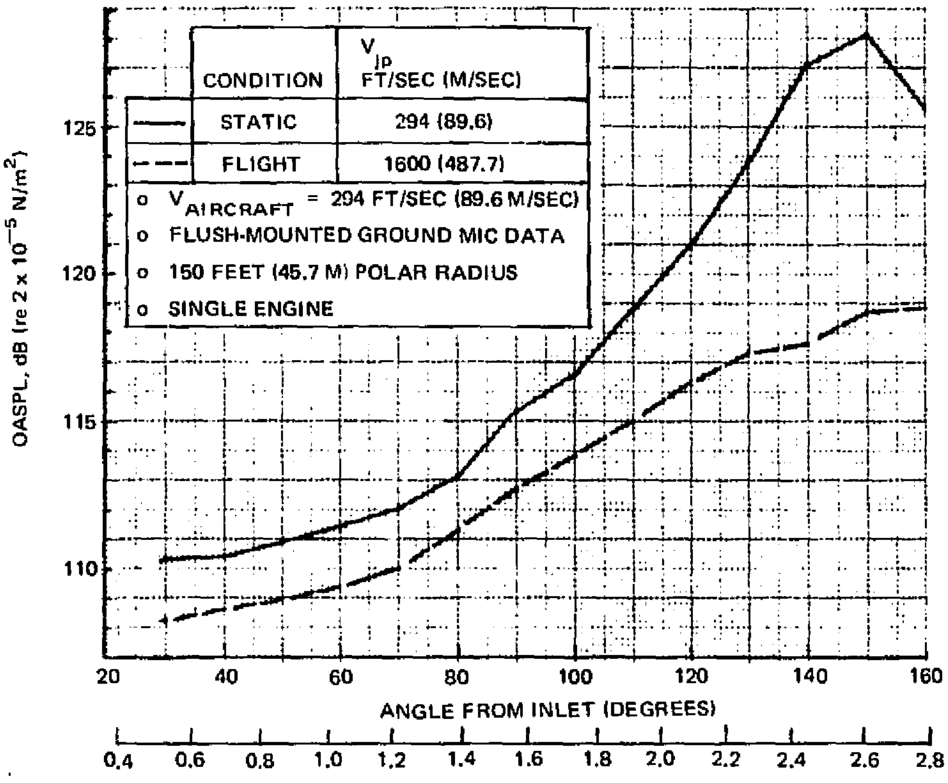
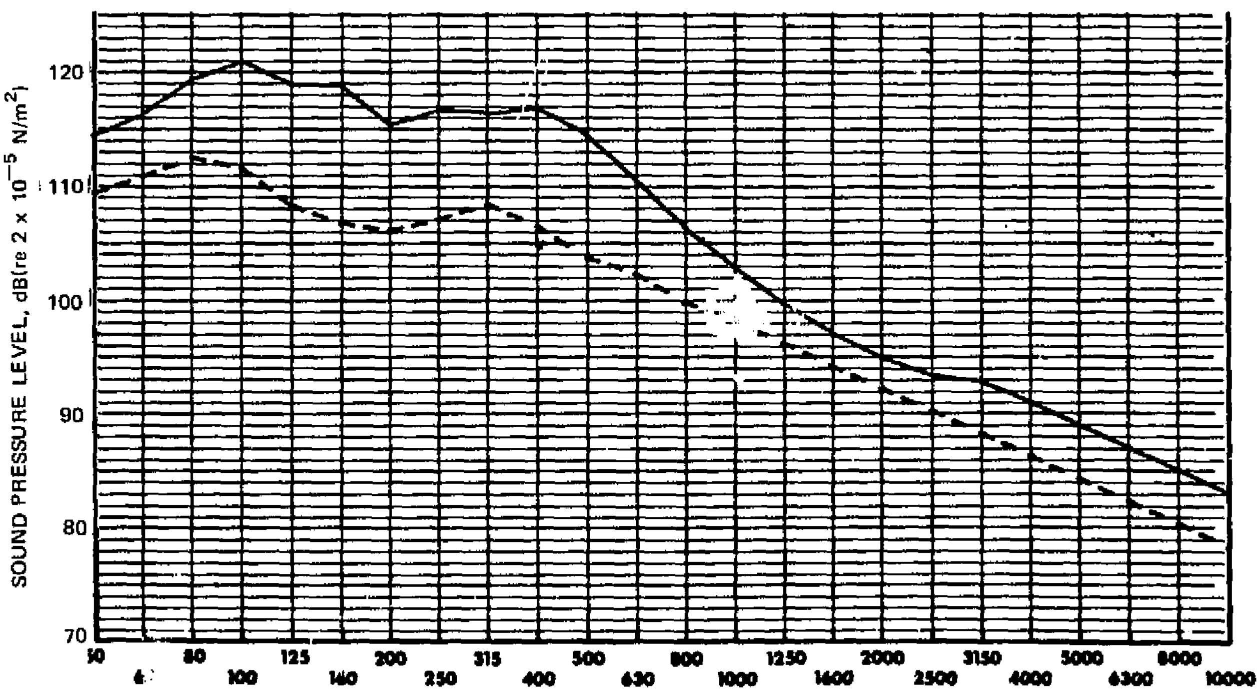


FIGURE 101. COMPARISON OF STATIC AND FLIGHT JET PLUS CORE OASPL-DIRECTIVITY AND SPL-SPECTRA FOR A NOMINAL ABSOLUTE PRIMARY JET VELOCITY OF 1310 FT/SEC (399M/SEC)



(a) OASPL-DIRECTIVITY



(b) SPL-SPECTRA AT 150 DEGREES (2.6 RAD)

FIGURE 102. COMPARISON OF STATIC AND FLIGHT JET AND CORE OASPL-DIRECTIVITY AND SPL-SPECTRA FOR A NOMINAL ABSOLUTE PRIMARY JET VELOCITY OF 1530 FT/SEC (466.3M/SEC)

Comparison of Static Predicted and Measured Flyover Noise Levels

Comparison of static predicted and measured flyover noise spectra are presented in figures 103 and 104 for approach and takeoff operations. The approach tests used a 0.05 rad (3 degree) glide slope and 0.87 rad (50 degree) flap setting, and had a minimum slant range distance of 37 m (400 ft). The takeoff tests had a minimum slant range distance of 701 m (2300 ft).

Predicted low frequency jet plus core noise levels for approach operation agreed fairly well for most angles except those around 1.4 rad (80 degrees) where the predicted levels in the mid frequency range (630/800 Hz) were lower than the measured levels by 2 to 3 dB. The reason the predicted 630/800 mid frequency approach noise levels were lower than the measured levels is that they were dominated by core noise and not jet noise.

Predictions of high frequency turbomachinery noise levels for approach operation were significantly improved by incorporating the methodology used in determining engine installation effects on predicting flyover noise levels from ground static data. Figures 103(a) and 103(b) show the improvement for the shallow inlet noise angles of 0.52 and 0.87 radians (30 and 50 degrees) from wing shielding (results include a 5 dB octave recovery factor for 0.52 radians (30 degrees), see Equation 6(a), and the effect of the wake sound scattering for 0.9 radians (50 degrees). The wing shielding however underpredicted the noise reduction for the much less important very high frequencies (8000 and 10 000 Hz) where low level measurements are difficult to achieve. Noise reduction of high frequency fan inlet, fan exhaust and turbine noise by wake sound scattering are shown in figures 103(c) and 103(d). Estimated static and flight velocity profiles used in the jet sound scattering analysis indicated that the jet sound scattering produced no noise reduction in either static or flight condition. This was because the fan exhaust shear layer was estimated to be too thin [(0.03 meters)(0.1 ft)] to attenuate the frequency range of interest (i.e. 2000 to 10 000 Hz). The table below compares the predicted and measured flyover noise levels for DC-9 Refan aircraft on approach showing improvements from use of shielding analysis.

	Maximum Tone Corrected Perceived Noise Level PNdB	Effective Perceived Noise Level, EPNdB
Measured Flyover Noise Level	103.5	97.7
Prediction without Shielding	105.3	100.0
Prediction with Shielding	104.5	98.0

Predicted noise levels for takeoff operation agreed fairly well over the entire frequency range (50 to 10 000 Hz) for most angles from 1.0 through 2.1 radians (60 through 120 degrees) as shown in figure 104.

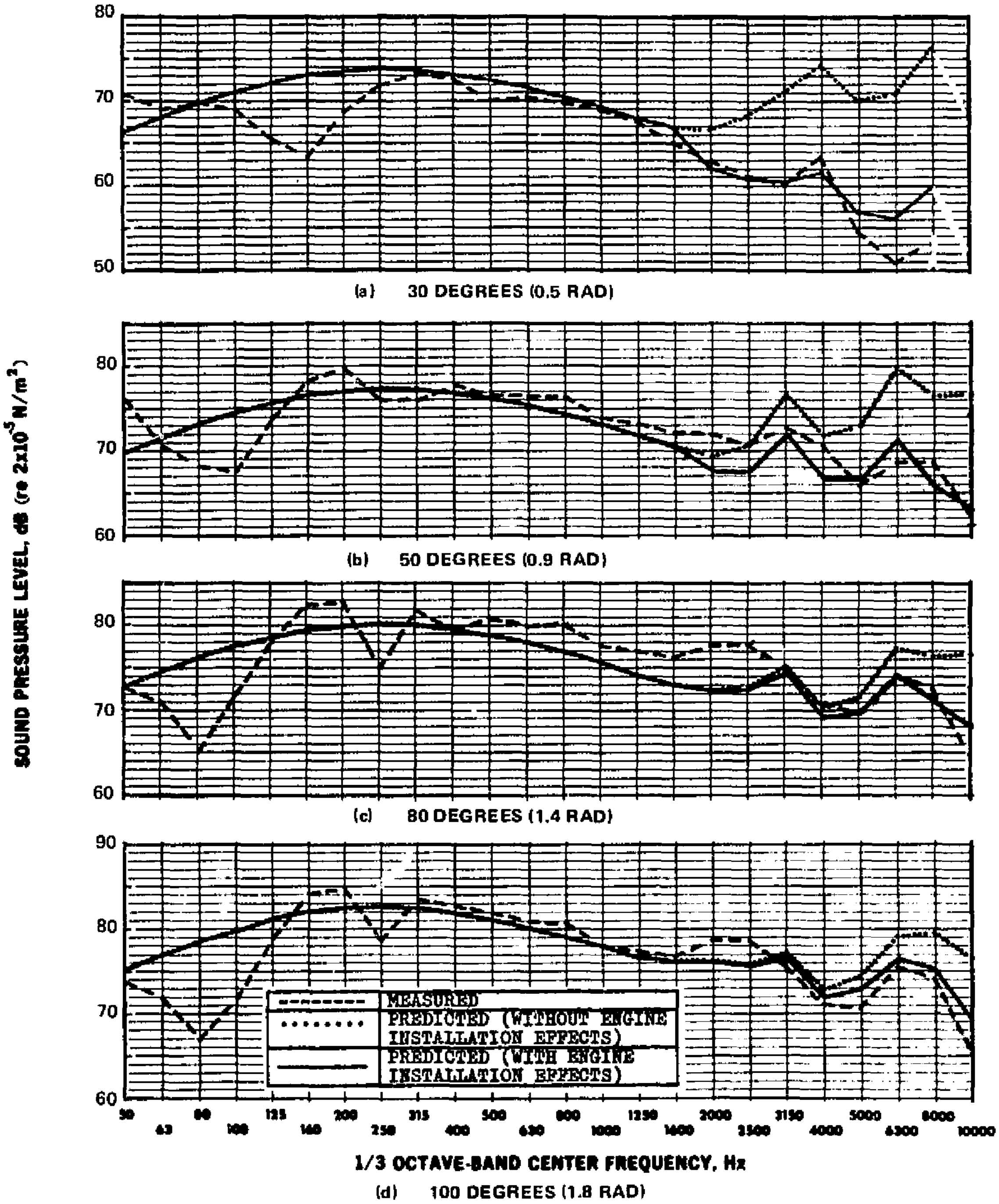


FIGURE 103. COMPARISON OF MEASURED AND PREDICTED APPROACH FLYOVER-NOISE SPECTRA AT 400-FOOT (121.8-M) HEIGHT

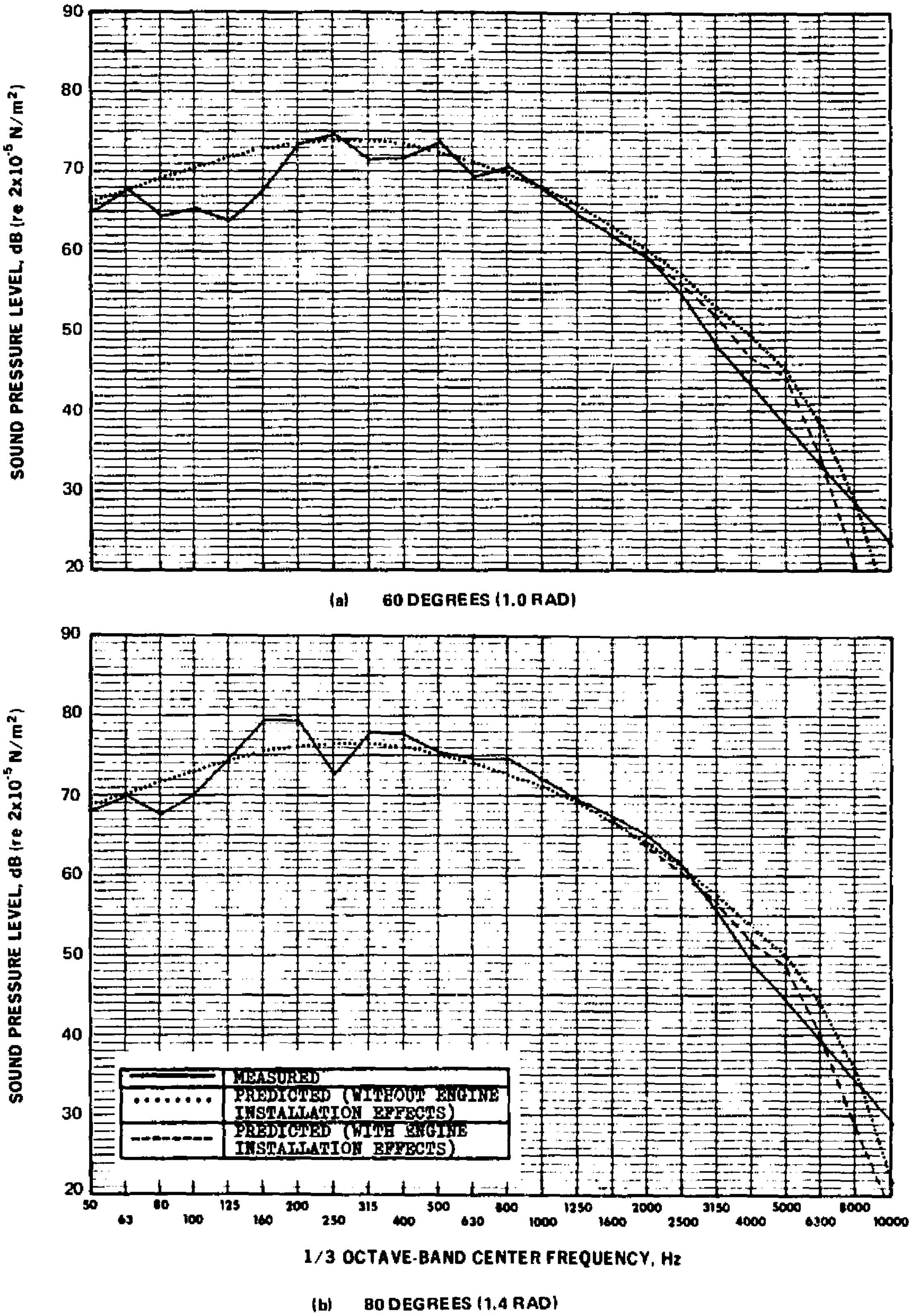
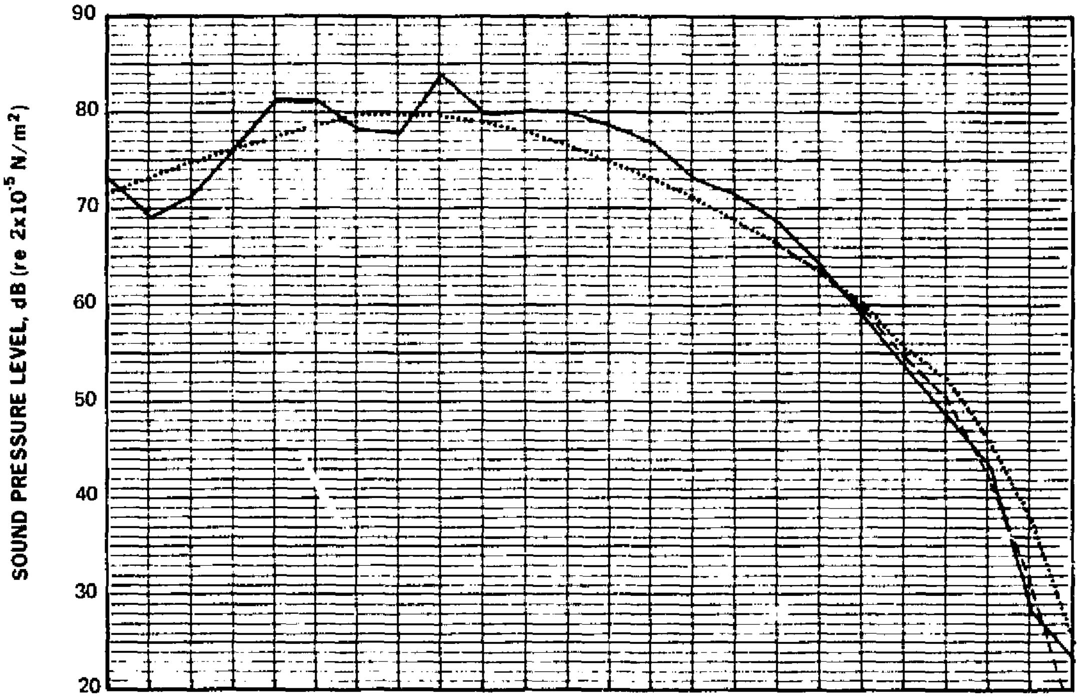
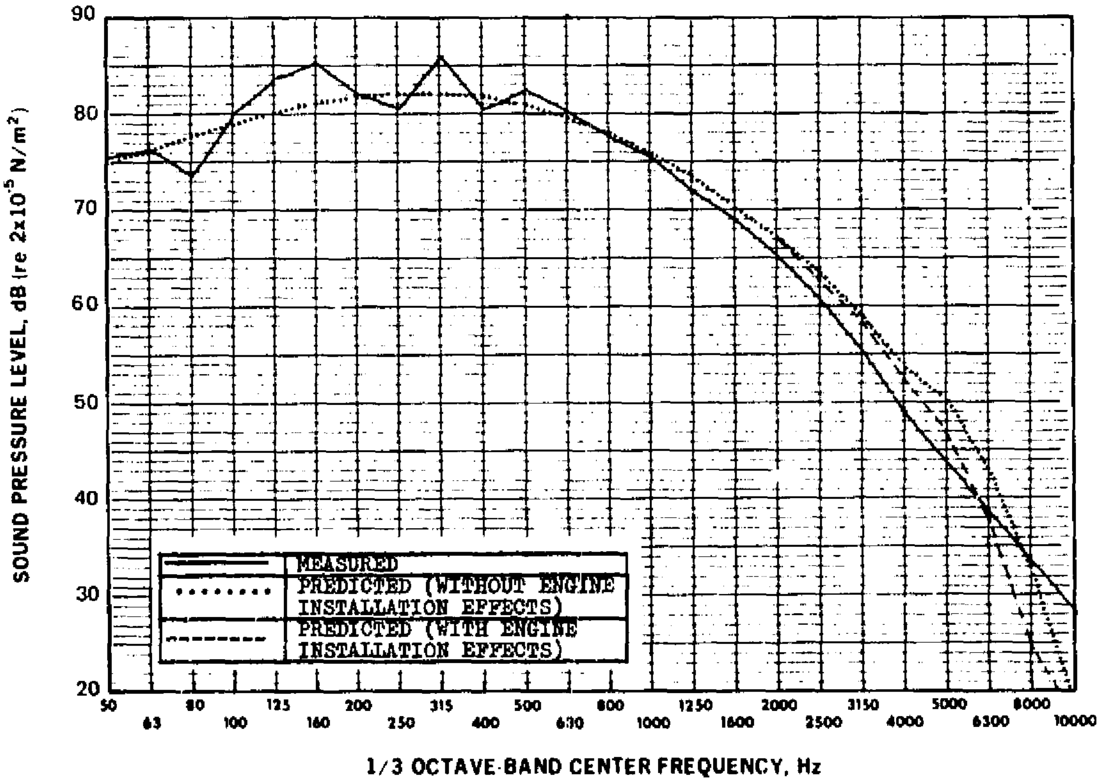


FIGURE 104. COMPARISON OF MEASURED AND PREDICTED TAKEOFF FLYOVER-NOISE SPECTRA AT 2300-FOOT (701-M) HEIGHT



(c) 100 DEGREES (1.8 RAD)



(d) 120 DEGREES (2.1 RAD)

FIGURE 104. CONCLUDED

Estimates of DC-9 Refan flyover noise levels based on the static-to-flight prediction procedures described here have agreed with measured flyover noise levels within ±1 EPNdB at the reference FAR Part 36 conditions (see table 25).

TABLE 25

COMPARISON OF STATIC-PREDICTED AND MEASURED FLYOVER NOISE LEVELS OF THE DC-9 REFAN AIRCRAFT AT FAR PART 36 CONDITIONS

MTOGW = 108,000 LBS (480 408 N)

MLGW = 99,000 LBS (440 374 N)

	EFFECTIVE PERCEIVED NOISE LEVEL, EPNdB				
	SIDELINE	TAKEOFF (Without Cutback)	TAKEOFF (Without Cutback)	APPROACH 50 Degree (0.9 RAD) Flaps	APPROACH 35 Degree (0.6 RAD) Flaps
MEASURED	95.3	96.2	87.5	97.4	95.7
PREDICTED	94.4	95.3	87.2	97.0	96.2

DISCUSSION OF RESULTS

The detailed analysis of the data from the flight test phase of the Refan Program provided information to permit the determination of FAR Part 36 noise levels, EPNL- and dB(A)-distance maps, community noise contours, lateral noise attenuation, effects of air turbulence on sound propagation, and ground reflection effects on the spectra of measured flyover noise. Also, studied were the noise source levels, static-to-flight predictions, and engine/nacelle acoustical characteristics of the DC-9-31/JT8D-109 Refan aircraft.

The principal results obtained from the FAR Part 36 noise level analysis for DC-9-30 airplanes were:

	Refan (JT8D-109	Baseline (C9A) (JT8D-9(H/W))	Baseline (Oct'74) (JT8D-9(H/W)
Effective Perceived Noise Levels (EPNdB)			
Sideline	95.3	N/A	99.8
Takeoff	96.2	N/A	102.7
Takeoff with Cutback	87.5	95.7	97.4
Approach			
$_f$ = 0.873 rad (50°)	97.4	106.1	103.0
$_f$ = 0.611 rad (35°)	95.7	N/A	100.9

N/A = Not Available H/W = Hardwall

The 90 percent confidence limits for the Refan FAR Part 36 noise levels were ± 0.6 EPNdB, well within the requirement of ± 1.5 EPNdB.

A large quantity of data were obtained over a wide range of engine power settings and distances, which permitted an accurate determination of EPNL and dB(A) level variations versus distance and referred net thrust (F_N/δ). Because of the extent of the data the 90 percent confidence limits for all centerline microphone data were within ± 0.8 EPNdB.

The principal results obtained from the community noise exposure contour comparison of the hardwall nacelle DC-9 and the Refan DC-9 show that:

- The DC-9 Refan reduced the 90 EPNdB contour area for takeoff with and without cutback by 40 percent for the maximum gross weight airplane and 19 percent for takeoff with cutback and 34 percent for takeoff without cutback for the typical mission airplane.
- The DC-9 Refan reduced the 95 EPNdB contour area by 50 percent for takeoff without cutback for both the maximum-gross-weight and typical-mission airplanes.

- The DC-9 Refan reduced the 95 EPNdB contour area for takeoff with cutback about 30 percent for both the maximum-gross-weight and typical-mission airplanes.

The result of the lateral noise attenuation analysis shows that the elevation angle is the significant parameter with thrust and slant range having only secondary effects. A plot of lateral noise attenuation as a function of elevation angle was developed.

Measured noise spectra showed agreement with ground reflection theory with 10 meter (33 foot) and flush-mounted microphone data displaying predicted pseudotone characteristics.

From measurements made with a Universal Indicated Turbulence System, levels were obtained of the parameter R, which is the level of dissipation in the atmosphere. The parameter R is related to the integral scale of turbulence, L. Two typical cases were chosen for analysis, one with light turbulence and the other with moderate turbulence.

The light dissipation case [low values of R ($0.2 \leq R \leq 0.8$) corresponding to high values of L ($60 \leq L \leq 120$ m)] show attenuation of nearly 8 dB at 2500 Hz. The moderate dissipation case [moderate values of R ($1.2 \leq R \leq 4$) corresponding to low values of L ($12 \leq L \leq 30$ m)] showed attenuation values of 1.5 dB at 2500 Hz.

The principal results obtained from the noise source separation and prediction procedures were:

- Low frequency (50 to 1000 Hz) noise levels based on 45.7 m (150 ft) static test data from the Refan engine were dominated by core noise for absolute primary jet exhaust velocities below 213 m/sec (700 ft/sec) and by jet noise for velocities above 305 m/sec (1000 ft/sec).

- Ground static test and flyover noise data showed that the frequency of peak core noise varied with engine inlet angle from 630/800 Hz for angles up to 2.1 radians (120 degrees), and from 400/500 Hz for angles greater than 2.1 radians (120 degrees). Analysis indicated the frequency of peak strut/obstruction noise also occurred in the 630/800 Hz bands.

- For power settings where low frequency noise was controlled by core noise, forward motion reduced aft noise by 1 to 7 PNdB from 1.6 to 2.8 radians (90 to 160 degrees) respectively, but had no effect on forward radiated noise. For high power settings where low frequency noise was controlled by jet noise, forward motion reduced forward as well as aft noise with noise reductions increasing with increasing inlet angle.

- For takeoff power settings corresponding to a primary jet velocity of 466 m/s (1530 ft/sec), SPL spectra for angles aft of 2.3 rad (130 degrees) contained "double peaks" in both the static and flight test data indicating that the higher 400 Hz peak was jet and not core noise.

- Inlet and tailpipe treatment noise reductions of 8.0 and 3.3 PNdB were obtained from projecting static test data on a noise source basis, to the FAR Part 36 approach [(0.9 rad)(50 degree) flap] condition for which the nacelle acoustic treatment was designed.

- Approach flyover noise tests demonstrated the nacelle acoustic treatment to be a "balanced configuration".

- Incorporation of methodology to account for engine installation effects (i.e., wing shielding and wing/flap/wheel sound scattering) in the flyover noise prediction program significantly increased the accuracy of predicting approach turbomachinery noise levels from ground static test data.

- Estimates of DC-9 Refan flyover noise levels based on ground static test data agreed with measured flyover noise levels within ± 1 EPNdB for the following five FAR Part 36 conditions: takeoff, takeoff (cutback), sideline and approach [(0.873 rad)(50 degree)flaps and (0.611 rad) (35 degree) flaps].

The principal results obtained from ground static test measurements were:

- Peak forward 61 m (200 ft) sideline PNLs from the Refan engine were 6 to 9 PNdB below the PNLs from the baseline (JT8D-15) engine for static thrusts from 17 792 to 71 172 N (4000 to 16,000 pounds)

- Inlet acoustic treatment reduced total forward radiated 61 m (200 ft) sideline PNLs from the Refan engine by 5 to 7 PNdB for static test thrusts from 26 689 to 44 482 N (6000 to 10,000 pounds).

- Maximum inlet treatment attenuation was 14 dB at cutback thrust and 4000 Hz, the band containing fan fundamental BPF.

- Peak aft 61 m (200 ft) sideline PNLs from the Refan engine were 8 to 10 PNdB below those from the baseline engine for static thrusts from 17 793 to 71 172 N (4000 to 16,000 pounds).

- Tailpipe treatment reduced turbine noise at approach power by 6 dB at 8000 Hz, the band containing turbine fundamental BPF.

CONCLUSIONS

The purpose of the Refan Program was to determine the technical and economic feasibility of reducing community noise of JT8D powered aircraft through modification of existing engines and nacelles. This report presents FAR Part 36 noise levels, EPNL- and dB(A)-distance maps, and community noise contours. Studies were made of lateral noise attenuation, effects of air turbulence on sound propagation, and ground reflection, effects on the spectra of measured flyover noise. Also studied were the noise source levels, static-to-flight predictions, and engine/nacelle acoustical characteristics of the DC-9-31/JT8D-109 Refan aircraft.

The JT8D-109 Refan engine with acoustically treated nacelles installed on a DC-9 Series 30 airplane reduced the FAR Part 36 noise levels when compared to a C9A airplane (military version of DC-9 Series 30) with JT8D-9 engines and hardwall nacelles by 8.2 EPNdB during takeoff with cutback and by 8.7 EPNdB during approach. The sideline noise levels were reduced by 4.5 EPNdB compared to the October 1974 baseline airplane.

The use of Refan engines on the DC-9 Series 30 reduced the 90 EPNdB community noise contours by 40 percent for takeoff with and without cutback for the maximum-gross-weight airplane, 19 percent for takeoff with cutback for a typical-mission airplane, and 34 percent for takeoff without cutback for a typical-mission airplane.

The 95 EPNdB community noise contours were reduced by 50 percent for takeoff without cutback and 30 percent for takeoff with cutback for both the maximum-gross-weight and typical-mission airplanes. The two segment approach provided very little reduction in contour area for either the 90 or the 95 EPNdB contours.

Methodology was developed to separate noise source levels, spectra and directivity based on ground static test and flyover noise data and to predict its flyover-noise levels based on ground static test data.

To further reduce DC-9 Refan flyover noise levels on approach at about 244 m (800 ft) height would require reducing jet, core, fan exhaust and fan inlet noise. Each source had peak noise values within a range of ± 1.5 PNdB.

DC-9 noise levels on takeoff, at about 305 m (1000 ft) altitude where the source noise analysis was made, are dominated by jet noise with core and turbomachinery noise 8 to 10 PNdB below jet noise.

APPENDIX A

Data Acquisition Validity

The flyover-noise measurement runs attempted for the DC-9 Refan flight test program are listed in table 1. The exact space positioning of all microphones is listed in table A-1. Noise data were recorded for all runs. However, only the data indicated as valid in table A-2 were reduced and used in this report.

All microphone data for Runs 1 through 3, 26, 63, and 64 were not analyzed because of missing MALT space positioning data. The presence of military jet and other air traffic noise during Runs 14, 45, 68, 89, 81, 88, and 89 made the noise measurements from these runs invalid. Runs 58, 71, 76, and 93 were aborted due to incorrect test conditions. In addition, certain individual microphone data were affected by system noise or signal drop outs. Therefore, none of these data were used in the analyses reported in Sections 4 and 5.

The acoustic data from the microphone located 1677 m (5,503 ft) to the sideline were severely limited by the levels of ambient and microphone system noise, the system noise consisting of extraneous high frequency signals. Wherever possible, the extraneous high frequency content was eliminated, and care was taken to use the lowest possible levels of valid ambient noise for each run. However, the only acoustic data used from this location were for the higher power setting higher altitude runs.

The amount of invalid flyover-noise data from the test program was anticipated, and a considerable amount of useful information was obtained. Consequently, the objective of the test was well satisfied.

TABLE A-1
DC-9 REFAN FLYOVER NOISE TESTING MICROPHONE LOCATION COORDINATES

MEASUREMENT LOCATION	MICROPHONE LOCATION COORDINATES*		
	X FEET (METERS)	Y FEET (METERS)	Z FEET (METERS)
C4	−2802 (−854.0)	−16 (−4.9)	−7 (−2.1)
C6	−7301 (−2225.2)	0 (0)	−81 (−24.7)
C6 (MIC 2F) FLUSH	−7291 (−2222.3)	0 (0)	−85 (−25.9)
C6 (MIC 2P) 10 METERS	−7336 (−2236.0)	−35 (−10.7)	−55 (−16.8)
C6 (MIC 3P) 10 METERS	−7101 (−2164.4)	0 (0)	−58 (−17.7)
C10	22 (6.7)	198 (60.4)	−1 (−0.3)
C10 (MIC 7F) FLUSH	32 (6.7)	198 (60.4)	−5 (−1.5)
C10 (MIC 4P) 10 METERS	−28 (−8.5)	178 (54.3)	25 (7.62)
C10 (MIC 5P) 10 METERS	172 (52.4)	178 (54.3)	25 (7.62)
C11	2805 (855.0)	185 (56.4)	2 (0.6)
S0	4090 (1246.6)	−1457 (−444.1)	7 (2.1)
S16	538 (164.0)	−1461 (−445.3)	4 (1.2)
S16 (MIC 7F) FLUSH	538 (164.0)	−1471 (−448.4)	0 (0)
S18	−3042 (−927.2)	−1467 (−447.1)	0 (0)
S19	3444 (1050.0)	−1449 (−441.7)	10 (3.1)
S20	555 (169.2)	1464 (446.2)	−9 (−2.7)
3N	−41 (−12.5)	2639 (804.4)	−37 (−11.3)
6N	3558 (1084.5)	5503 (1677.3)	−7 (−2.1)

*RELATIVE TO ℄ AT WEST END OF YUMA RUNWAY 21R

TABLE A-2
MATRIX OF FLYOVER NOISE TESTS
29 AND 31 JANUARY AND 1, 2, 3, AND 5 FEBRUARY 1975

FLIGHT CONDITIONS		RUN NO.	MICROPHONE LOCATIONS										
			C4	C6	C10	C11	S0	S16	S18	S19	S20	3N	6N
TAKEOFF	(THRUST/ENG = 13,500 LB)	4		1						9	10		
	= 13,500 LB)	5		1						9	10		
TAKEOFF WITH CUTBACK	(THRUST/ENG = 9,500 LB)	6		1						9	10		
	= 9,500 LB)	7		1						9	10		
TAKEOFF CORRECTION	(THRUST/ENG = 13,500 LB)	8		1						9	10		
	= 13,500 LB)	9		1			12	9	7	11	10		
	= 13,500 LB)	10		1			12	9	7	11	10		
TAKEOFF WITH CUTBACK	(THRUST/ENG = 9,500 LB)	11		1			12	9	7	11	10		
	(THRUST/ENG = 9,500 LB)	12		1			12	9	7	11	10		
TAKEOFF CORRECTION	(THRUST/ENG = 13,500 LB)	13		1			12	9	7	11	10		
	= 13,500 LB)	15		1			12	9	7	11	10		
TAKEOFF WITH CUTBACK	(THRUST/ENG = 9,500 LB)	16		1			12	9	7	11	10		
	= 9,500 LB)	17		1			12	9	7	11	10		
	= 9,500 LB)	18		1			12	9	7	11	10		
	= 9,500 LB)	19		1			12	9	7	11	10		
CUTBACK CORRECTION	(THRUST/ENG = 9,500 LB)	20		1			12	9	7	11	10		
	= 9,500 LB)	21		1			12	9	7	11	10		
	= 9,500 LB)	22		1			12	9	7	11	10		
	= 9,500 LB)	23		1			12	9	7	11	10		
APPROACH CORRECTION	(THRUST/ENG = 6,900 LB)	24	4	1, 2P, 3P	6, 7F			I	5		I	11	
	= 5,300 LB)	25	4	1, 2P, 3P	6, 7F			9	5		10	11	
50-DEG FLAP APPROACH	(THRUST/ENG = 5,500 LB)	27	4	1	6, 7F			9	5		10	NP	
	= 5,100 LB)	28	4	1	6, 7F			9	5		10	11	
	= 5,300 LB)	29	4	1	6, 7F			9	5		10	11	
	= 5,600 LB)	30	4	1	6, 7F			9	5		10	11	
	= 5,200 LB)	31	4	1	6, 7F			9	5		10	11	
	= 5,600 LB)	32	4	1	6, 7F			9	5		10	I	
APPROACH CORRECTION	(THRUST/ENG = 4,700 LB)	33	4	1	6, 7F			9	5		10	NP	
	= 4,500 LB)	34	4	1	6, 7F			9	5		10	11	
	= 4,300 LB)	35	4	1	6, 7F			9	5		10	11	
	= 3,400 LB)	36	4	1	6, 7F			9	5		10	I	
	= 3,200 LB)	37	4	1	6, 7F			9	5		10	11	
	= 2,800 LB)	38	4	1	6, 7F			9	5		10	11	
APPROACH CORRECTION	(THRUST/ENG = 6,500 LB)	39	NP	NP	6, 7F			I	3		10	11	
	= 6,900 LB)	40	2	1	6, 7F			9	3		10	11	
	= 6,100 LB)	41	2	1	6, 7F			9	3		10	11	
35-DEG FLAP APPROACH	(THRUST/ENG = 3,200 LB)	42	2	1	6, 7F			9	3		10	NP	
	= 4,600 LB)	43	2	NP	6, 7F			9	3		10		
	= 3,800 LB)	44	2	1	6, 7F			9	3		10	11	
	= 3,800 LB)	46	2	1	6, 7F			9	3		10	11	
	= 3,800 LB)	47	2	1	I			NP	NP		NP	11	
	= 3,800 LB)	48	2	1	6, 7F			9	3		10	NP	
	= 4,000 LB)	49	2	1	6, 7F			9	3		10	11	
	= 4,100 LB)	50	2	1	6, 7F			9	3		10	11	
APPROACH CORRECTION	(THRUST/ENG = 5,400 LB)	51	2	1	6, 7F			9	3		10	NP	
	= 3,100 LB)	52	2	1	6, 7F			9	3		10	I	

TABLE A-2 (CONTINUED)
MATRIX OF FLYOVER NOISE TESTS
29 AND 31 JANUARY AND 1, 2, 3 AND 5 FEBRUARY 1975

FLIGHT CONDITIONS		RUN NO.	MICROPHONE LOCATIONS										
			C4	C6	C10	C11	S0	S16	S18	S19	S20	3N	6N
TAKEOFF CORRECTION	(THRUST/ENG = 13,700 LB)	53		1	6	3		9, 7F			10	11	12
	= 13,700 LB)	54		1, 2F	6	3		9, 7F			10	11	12
	= 13,700 LB)	55		1, 2F	6	3		9, 7F			10	11	12
	= 12,700 LB)	56		1, 2F	6	3		9, 7F			10	11	12
	= 12,700 LB)	57		1, 2F	6	3		9, 7F			10	11	12
	= 11,700 LB)	59		1, 2F	6	3		7F			10	11	12
	= 11,700 LB)	60		1, 2F	6	3		9, 7F			10	11	12
	= 10,700 LB)	61		1, 2F	6	3		9, 7F			10	11	12
	= 10,700 LB)	62		1, 2F	6	3		9, 7F			10	11	12
	= 13,500 LB)	65		1	6	3		9, 7F			10	11	12
	= 13,500 LB)	66		1	6	3		9, 7F			10	11	12
	= 13,500 LB)	67		1	6	3		9, 7F			10	11	12
	= 13,500 LB)	69		1	6	3		9, 7F			10	11	12
	= 9,500 LB)	70		1	6	3		9, 7F			10	11	12
	= 8,000 LB)	72		1	6	3		9, 7F			10	11	12
	= 9,500 LB)	73		1	6	3		9, 7F			10	11	12
	= 8,000 LB)	74		1	6	3		9, 7F			10	11	12
	= 13,500 LB)	75		1	6	3		9, 7F			10	11	12
	= 8,000 LB)	77		1, 2F	6	3		9, 7F			10		
	= 8,000 LB)	78		1	6, 5P	3		9, 7F			10	11	12
TAKEOFF CORRECTION	(THRUST/ENG = 7,000 LB)	79		1	6	3		9, 7F			10	11	12
	= 7,000 LB)	82		1, 2F	6	3		9, 7F			10	11	12
	= 7,000 LB)	83		1, 2F	6	3		9, 7F			10	11	12
	= 13,500 LB)	84		2F	6, 5P	3		9, 7F			10	NP	12
400-FT LEVEL FLIGHT	(THRUST/ENG = 13,500 LB)	85		1, 2F	6	3		9, 7F			10	NP	12
	= 13,500 LB)	86		1, 2F	6	3		9, 7F			10	11	12
	= 9,500 LB)	87		1, 2F	6	3		9, 7F			10	NP	NP
	= 9,500 LB)	90		1, 2F	6	3		9, 7F			10	11	NP
	= 9,500 LB)	91		1, 2F	6	3		9, 7F			10	11	12
APPROACH SURVEY	(THRUST/ENG = 6,000 LB)	95	2	1	6, 5P			9			NP	11	
	= 6,000 LB)	96	2	1	6			9			10	11	
	= 5,400 LB)	97	2	1	6			9			10	11	
	= 5,400 LB)	98	2	1	6			9			10	11	
50-DEG FLAP 5.5-DEG APPROACH	(THRUST/ENG = 3,900 LB)	100	2	1	6, 4P, 5P			9			10	11	
	= 3,500 LB)	101	2	1	6, 4P, 5P			9			10		
	= 3,100 LB)	102	2	1	6			9			NP	11	
	= 2,900 LB)	103	2	1	6			9			10	11	
	= 3,100 LB)	104	2	1	6			9				11	
	= 3,100 LB)	105	2	1	6			9			NP	11	
5.5-DEG APPROACH CORRECTION	(THRUST/ENG = 3,200 LB)	106	2	1	6			9			10	11	
	= 2,000 LB)	107	2	1	6			9			10	11	
	= 3,200 LB)	108	2	1	6			9			10	11	
	= 2,000 LB)	109	2	1	6			9			10	11	
	= 1,500 LB)	110	2	1	6			9			10	11	
	= 1,500 LB)	111	2	NP	6			9			10	NP	
	= 2,000 LB)	112	2	1	6			9			10	NP	

NOTES: 1. NP = NOT PROCESSED, I = INVALID DATA
2. FOR EACH RUN THE NUMBERS BENEATH EACH MICROPHONE LOCATION ARE MICROPHONE NUMBERS AND INDICATE A PROCESSED RECORDING.

APPENDIX B

Test Site Meteorological Data

The dry-bulb temperature, relative humidity, and wind speed and direction weather conditions were recorded at ground level (10 meters) during the flyover-noise testing. Upper-air soundings of these conditions, plus air turbulence, were obtained by Meteorology Research, Inc. with the following techniques:

1. Temperature, relative humidity, and air turbulence were obtained from continuous recordings from an instrumented Cessna 180 light aircraft
2. Wind speed and direction were obtained from theodolite tracking of weather balloons.

The test day surface and sound path weather conditions are summarized as follows:

TABLE B-1
MOBILE ATMOSPHERIC RECORDING TOWER WEATHER DATA
33-FOOT (10-METER) HEIGHT

FLIGHT &	RUN NO.	TIME OF DAY	AMB TEMP (°F)	RELATIVE HUMIDITY (%)	ABSOLUTE HUMIDITY (GM/m³)	WIND DIR (DEG)	WIND VEL (MPH)	STATION PRESS (IN.-HG)
FLIGHT 15 (1-29-75)	4	0744	36.0	60.7	3.3	240	4	N/A
	5	0755	36.3	61.1	3.4	240	2	N/A
	6	0804	36.9	56.0	3.2	230	2	N/A
	7	0814	38.1	60.9	3.6	240	2	N/A
	8	0823	38.8	58.4	3.6	275	2	N/A
FLIGHT 16 (1-29-75)	9	0932	48.8	41.4	3.7	330	2	29.81
	10	0948	50.4	34.5	3.3	335	2	29.81
	11	0956	51.2	36.0	3.5	245	2	29.81
	12	1003	52.1	34.0	3.4	255	3	29.81
	13	1011	52.5	36.1	3.7	100	2	29.81
	15	1034	52.8	33.4	3.4	260	4	29.81
	16	1043	52.5	35.1	3.6	260	4	29.81
	17	1050	53.6	35.5	3.8	280	4	29.81
	18	1100	55.4	32.8	3.7	220	3	29.80
	19	1118	56.5	30.4	3.6	220	3	29.80
	20	1125	56.3	27.3	3.2	305	3	29.80
	21	1134	56.4	27.5	3.2	240	3	29.80
	22	1142	56.7	27.4	3.2	280	5	29.80
	23	1149	56.9	25.8	3.1	280	5	29.80
FLIGHT 19 (1-31-75)	24	0929	52.2	57.8	5.8	155	5	29.96
	25	0940	51.8	59.8	5.9	180	5	29.96
	27	1014	53.1	49.7	5.2	360	10	29.96
	28	1033	54.1	51.7	5.6	360	7	29.96
	29	1042	54.3	51.4	5.6	200	6	29.96
	30	1052	55.9	45.7	5.2	330	4	29.96
	31	1102	56.0	46.8	5.4	335	7	29.93
	32	1110	56.0	46.8	5.4	335	7	29.93
	33	1120	56.5	43.3	5.1	300	4	29.93
	34	1129	56.8	43.1	5.1	310	5	29.93
	35	1137	57.5	45.2	5.5	260	7	29.92
	36	1143	58.0	41.5	5.1	225	4	29.92
	37	1151	60.5	38.4	5.1	180	2	29.92
	38	1157	58.7	44.4	5.6	180	3	29.91
FLIGHT 20 (2-1-75)	39	0932	52.7	51.5	5.3	35	7	30.06
	40	0940	53.9	51.0	5.4	20	7	30.06
	41	0948	54.9	46.6	5.2	10	7	30.06
	42	0956	55.8	45.0	5.1	25	7	30.07
	43	1004	56.0	46.2	5.3	15	7	30.07
	44	1013	56.1	45.3	5.2	20	8	30.07
	46	1031	57.2	40.5	4.9	20	9	30.07
	47	1040	57.4	38.8	4.7	360	7	30.07
	48	1049	57.8	40.7	5.0	360	7	30.07
	49	1100	58.4	38.0	4.7	350	4	30.07
	50	1110	58.2	37.8	4.7	360	2	30.07
	51	1119	58.0	35.8	4.4	25	5	30.07
	52	1129	57.8	37.4	4.6	360	10	30,07

TABLE B-1 (CONTINUED)
MOBILE ATMOSPHERIC RECORDING TOWER WEATHER DATA
33-FOOT (10-METER) HEIGHT

FLIGHT	RUN NO.	TIME OF DAY	AMB TEMP (°F)	RELATIVE HUMIDITY (%)	ABSOLUTE HUMIDITY (GM/m³)	WIND DIR (DEG)	WIND VEL (MPH)	STATION PRESS (IN.-HG)
FLIGHT 21 (2-2-75)	53	0939	55.1	41.8	4.7	20	5	30.00
	54	0946	55.3	42.5	4.8	45	4	30.00
	55	0953	56.6	41.9	4.9	350	5	30.00
	56	1001	56.1	44.8	5.2	40	5	30.01
	57	1008	56.5	45.2	5.3	20	7	30.01
	59	1021	57.2	43.9	5.3	40	6	30.01
	60	1030	57.4	43.6	5.3	20	7	30.01
	61	1037	58.5	39.6	4.9	30	6	30.01
FLIGHT 22 (2-3-75)	62	1047	59.1	39.7	5.1	25	7	30.01
	65	1105	59.6	40.3	5.2	190	5	29.90
	66	1115	59.5	37.1	4.8	175	4	29.90
	67	1123	59.6	37.6	4.9	165	3	29.89
	69	1140	60.5	36.8	4.9	185	2	29.89
	70	1149	60.5	36.3	4.9	205	4	29.89
	72	1209	60.9	32.9	4.5	75	3	29.88
	73	1218	59.3	37.8	4.9	65	5	29.87
	74	1226	60.4	35.8	4.8	100	4	29.86
	75	1241	60.3	33.2	4.4	170	4	29.85
	77	1302	60.8	30.7	4.2	130	5	29.84
	78	1319	61.1	29.4	4.0	145	4	29.84
	79	1327	61.2	29.5	4.0	140	3	29.84
	82	1348	60.3	31.4	4.2	155	6	29.84
	83	1358	60.1	31.7	4.2	155	4	29.83
FLIGHT 23 (2-3-75)	84	1504	61.8	28.6	4.0	140	3	29.82
	85	1513	61.8	30.6	4.3	250	2	29.82
	86	1521	61.7	30.9	4.3	305	3	29.82
	87	1528	61.3	38.4	5.3	290	4	29.82
	90	1546	61.8	26.6	3.7	270	3	29.82
	91	1553	61.8	26.6	3.7	310	2	29.82
FLIGHT 25 (2-3-75)	92	0857	N/A	N/A	N/A	N/A	N/A	N/A
	94	0914	N/A	N/A	N/A	N/A	N/A	N/A
	95	0923	59.0	54.2	6.9	155	2	29.99
	96	0932	59.1	54.3	6.9	115	2	29.99
	97	0940	59.9	53.5	7.0	130	2	29.99
	98	0947	60.2	51.8	6.9	165	2	29.99
	99	1008	N/A	N/A	N/A	N/A	N/A	N/A
	100	1015	62.4	46.4	6.6	225	3	30.00
	101	1023	62.3	45.9	6.5	245	4	30.00
	102	1030	63.3	44.6	6.6	250	3	30.00
	103	1038	63.3	44.2	6.5	165	2	30.00
	104	1046	63.0	44.8	6.5	265	3	30.00
	105	1053	63.1	45.3	6.6	275	3	30.00
	106	1102	63.2	46.2	6.8	315	3	30.00
FLIGHT 26 (2-3-75)	107	1115	63.1	46.2	6.7	325	3	30.00
	108	1157	63.9	46.8	7.0	310	5	30.00
	109	1205	64.8	45.9	7.1	260	6	29.99
	110	1213	64.3	45.9	7.0	305	8	29.99
	111	1220	64.3	45.9	7.0	280	5	29.99
	112	1227	65.2	45.4	7.7	290	5	29.99

N/A = NOT AVAILABLE

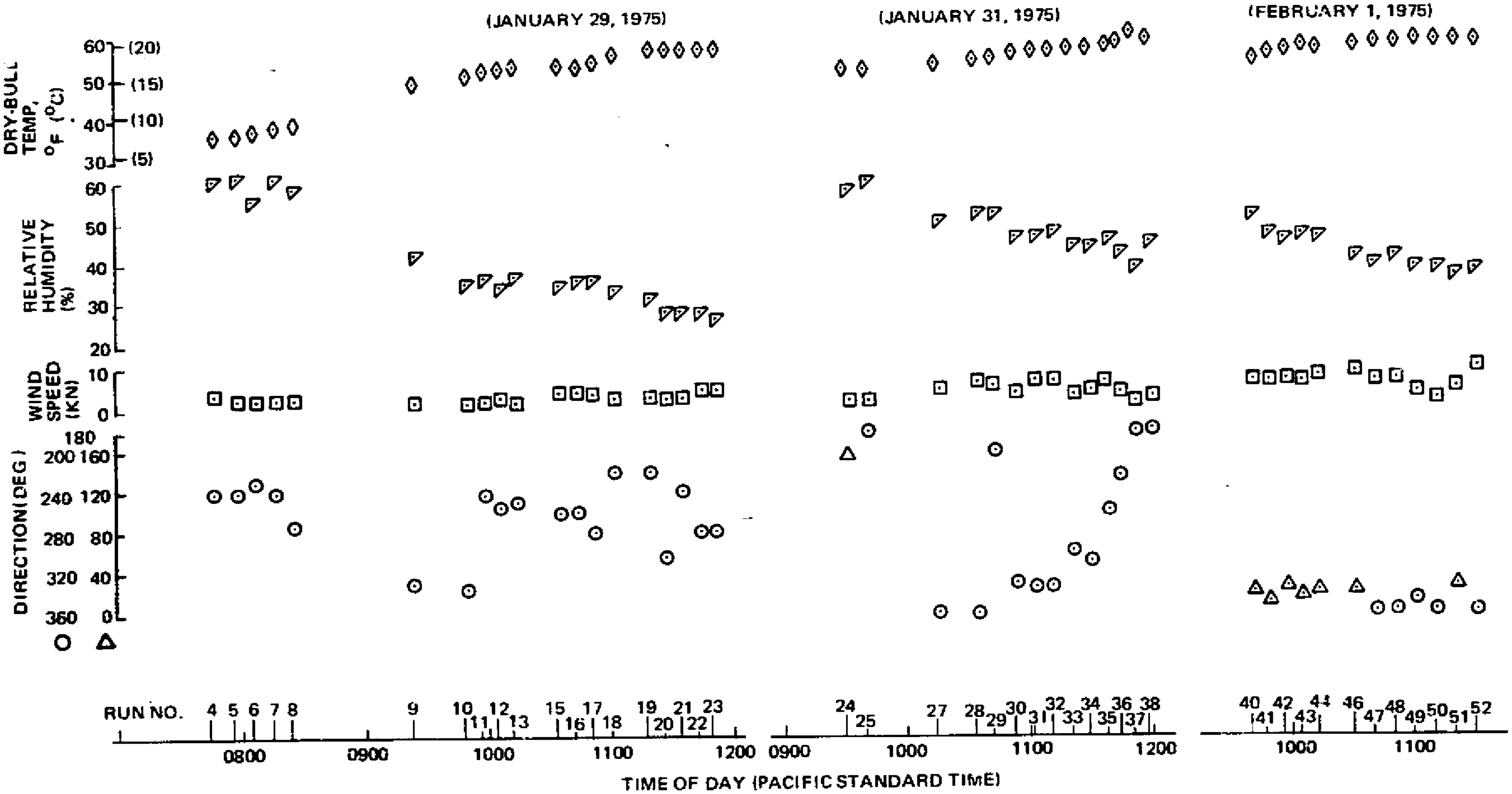


FIGURE B-1. SURFACE WEATHER HISTORY YUMA TEST SITE

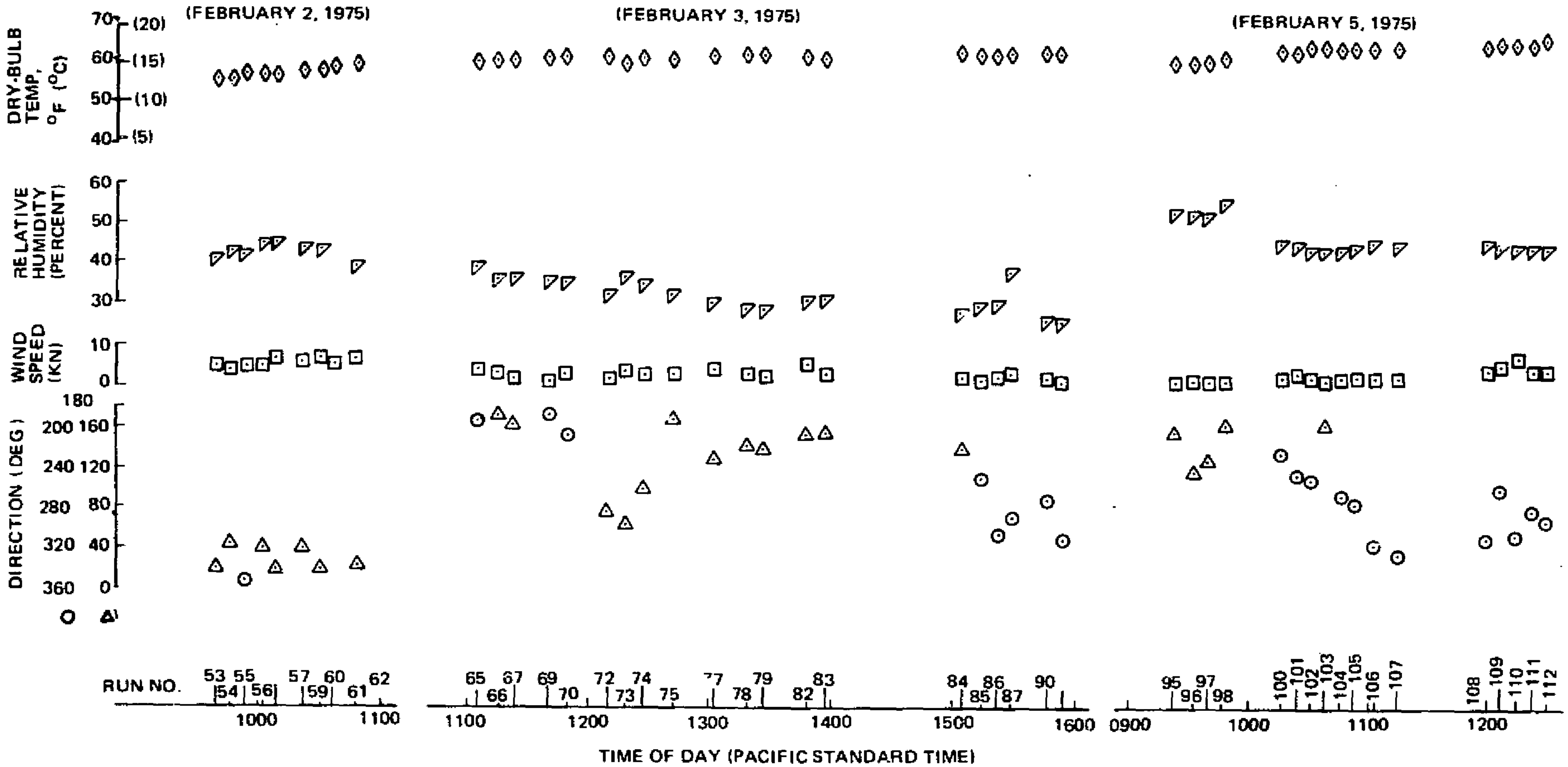


FIGURE B-1. SURFACE WEATHER HISTORY YUMA TEST SITE (CONTINUED)

AIRPLANE MODEL DC-9-31 REG. NO. N54638 TEST SITE YUMA, ARIZONA

DATA SOURCE METEOROLOGY RESEARCH INC. DATE JANUARY 29, 1975

MEASUREMENT TIMES (PST): TEMP/RH 0913 WIND 0900

Wind direction is heading from which wind is blowing referenced to magnetic North.

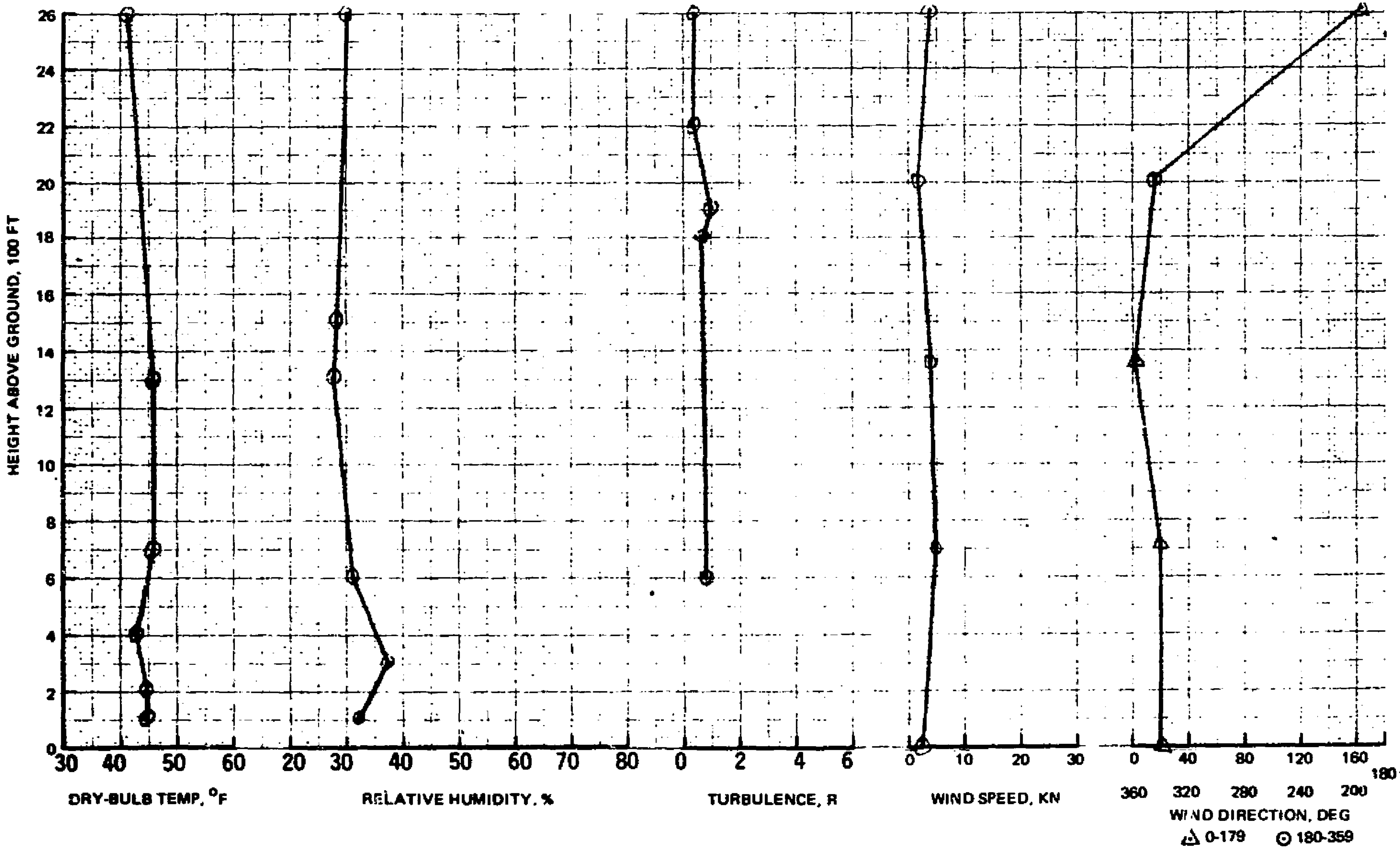


FIGURE B-2.1. SOUND-PATH WEATHER DURING FLYOVER NOISE TESTS

AIRPLANE MODEL DC-9-31 REG. NO. N54638 TEST SITE YUMA, ARIZONA

DATA SOURCE METEOROLOGY RESEARCH INC. DATE JANUARY 29, 1975

MEASUREMENT TIMES (PST): TEMP/RH 0924 WIND 0930

Wind direction is heading from which wind is blowing referenced to magnetic North.

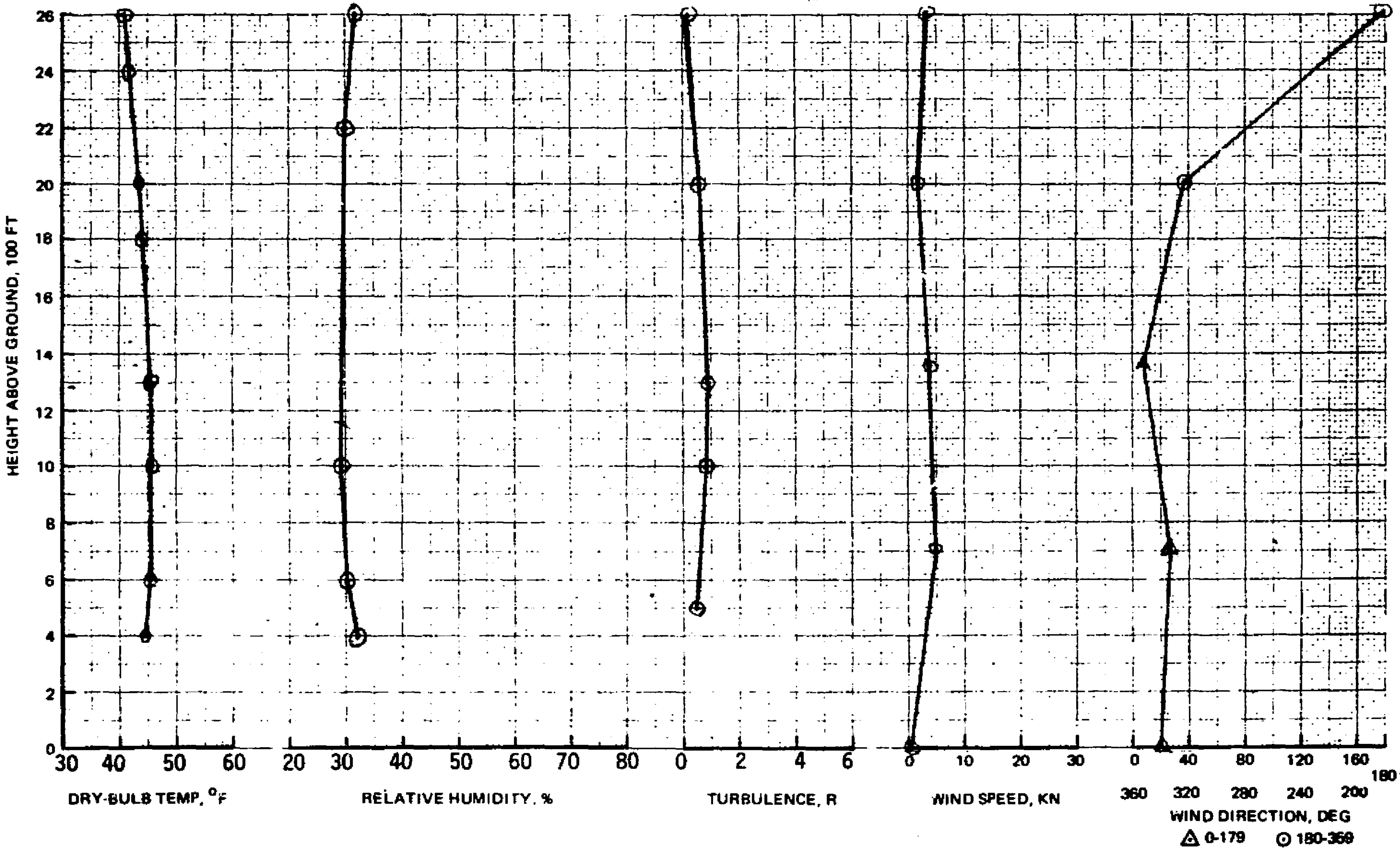


FIGURE B-2.2. SOUND-PATH WEATHER DURING FLYOVER NOISE TESTS (CONT)

AIRPLANE MODEL DC-9-31 REG. NO. N54638 TEST SITE YUMA, ARIZONA

DATA SOURCE METEOROLOGY RESEARCH INC. DATE JANUARY 29, 1975

MEASUREMENT TIMES (PST): TEMP/RH 0948 WIND 0930

Wind direction is heading from which wind is blowing referenced to magnetic North.

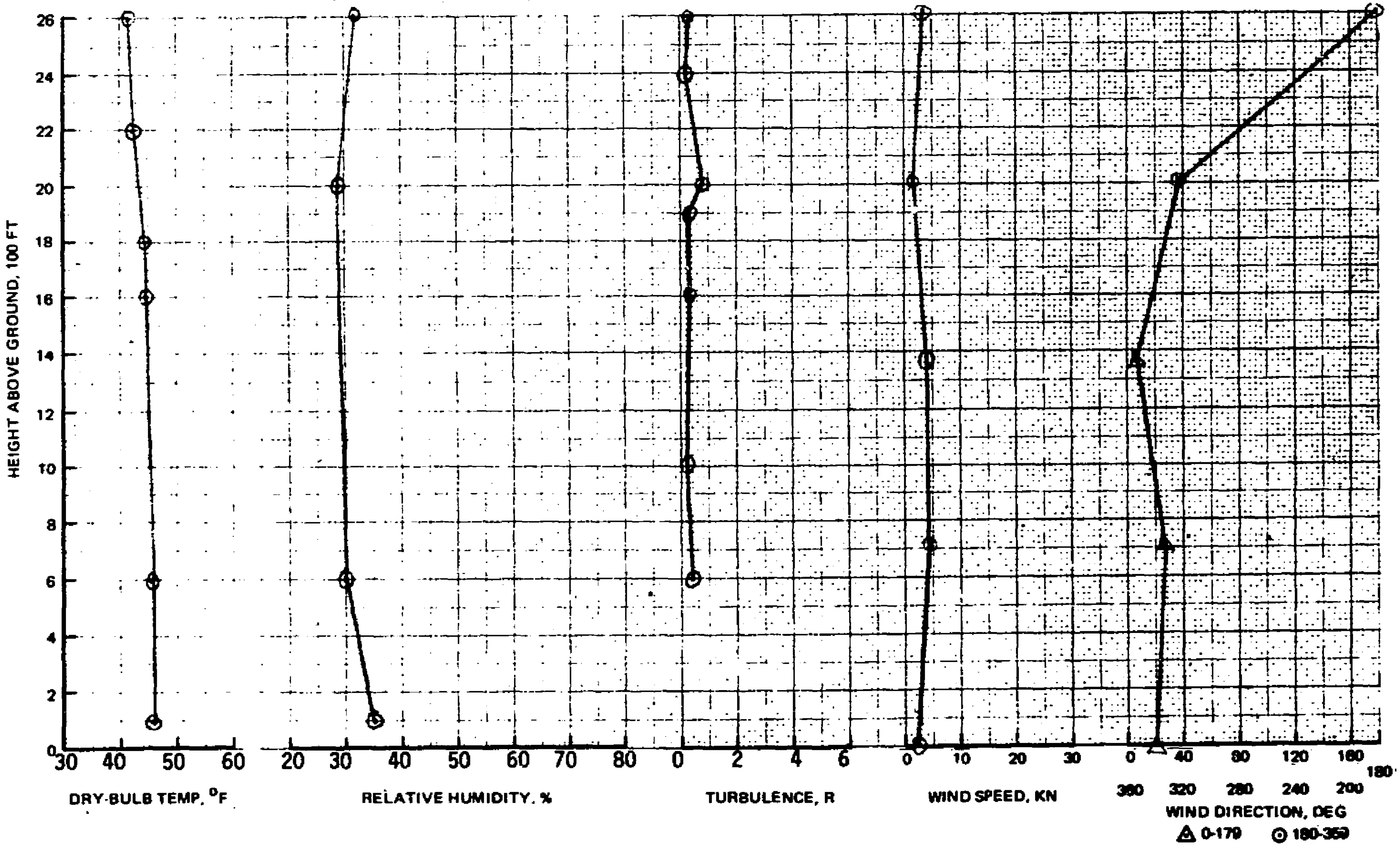


FIGURE B-2.3. SOUND-PATH WEATHER DURING FLYOVER NOISE TESTS (CONT)

AIRPLANE MODEL DC-9-31 REG. NO. N54638 TEST SITE YUMA, ARIZONA

DATA SOURCE METEOROLOGY RESEARCH INC. DATE JANUARY 29, 1975

MEASUREMENT TIMES (PST): TEMP/RH 1006 WIND 1000

Wind direction is heading from which wind is blowing referenced to magnetic North.

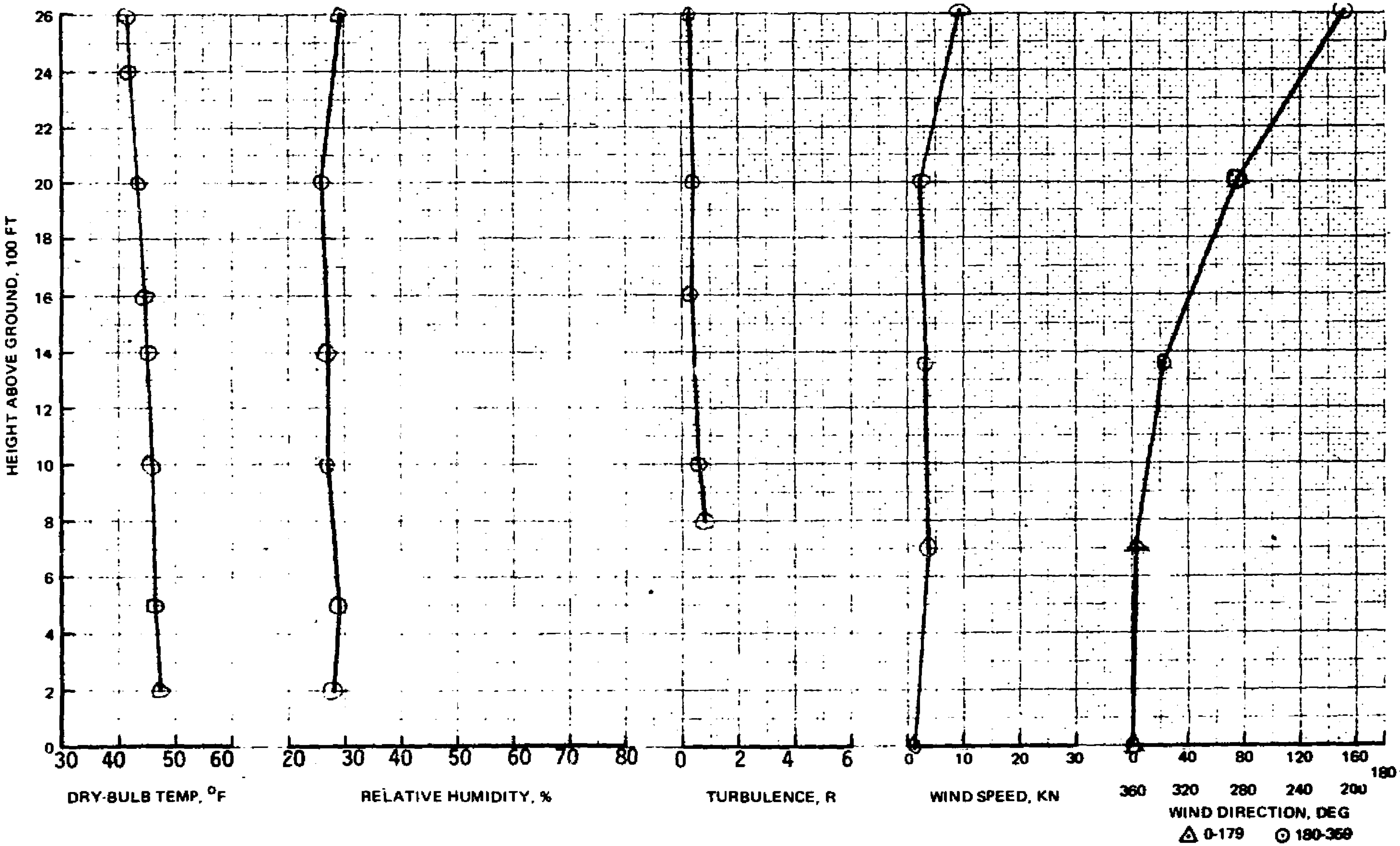


FIGURE B-2.4. SOUND-PATH WEATHER DURING FLYOVER NOISE TESTS (CONT)

AIRPLANE MODEL DC-9-31 REG. NO. N54638 TEST SITE YUMA, ARIZONA

DATA SOURCE METEOROLOGY RESEARCH INC. DATE JANUARY 29, 1975

MEASUREMENT TIMES (PST): TEMP/RH 1022 WIND 1035

Wind direction is heading from which wind is blowing referenced to magnetic North.

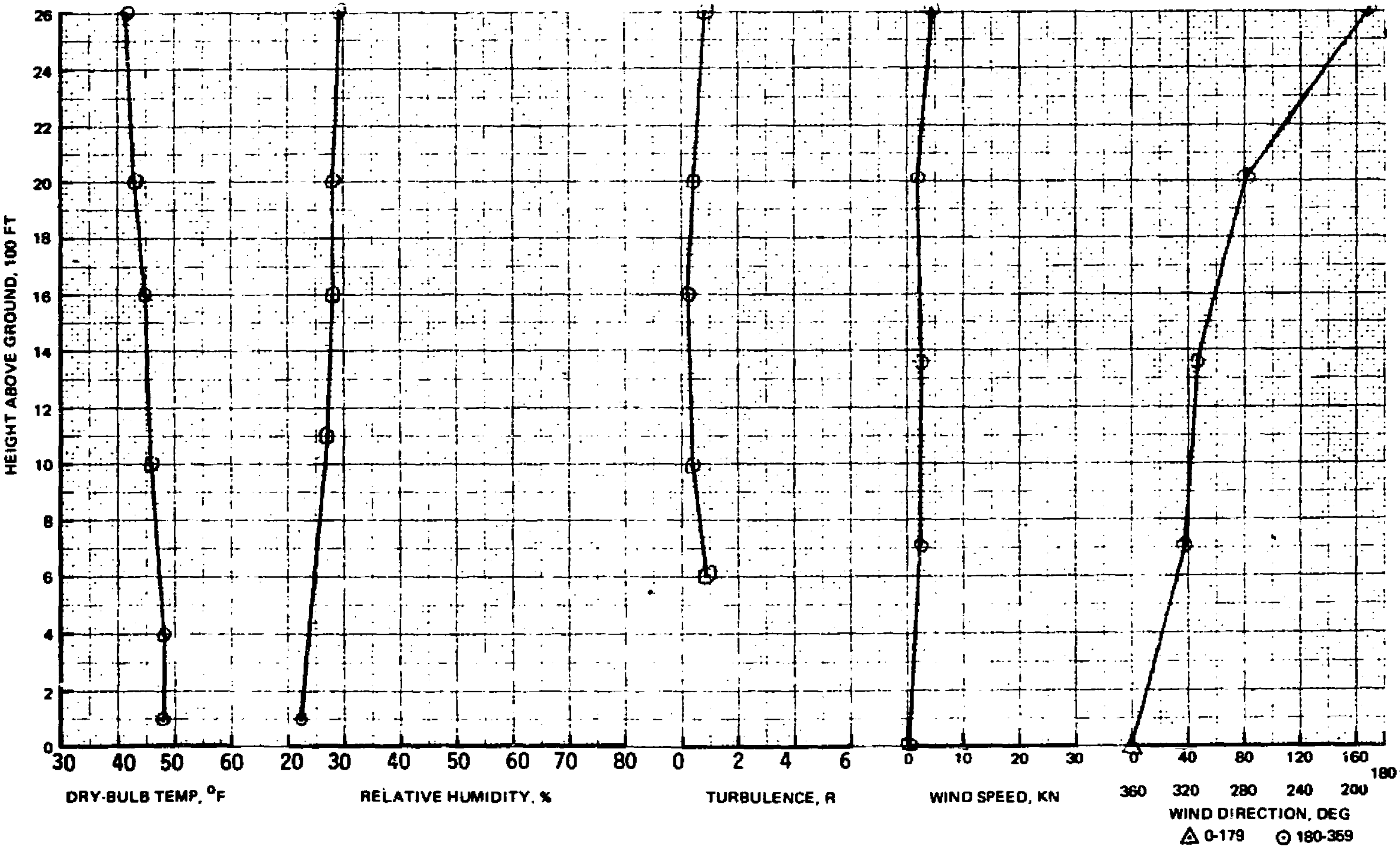


FIGURE B-2.5. SOUND-PATH WEATHER DURING FLYOVER NOISE TESTS (CONT)

AIRPLANE MODEL DC-9-31 REG. NO. N54638 TEST SITE YUMA, ARIZONA

DATA SOURCE METEOROLOGY RESEARCH INC. DATE JANUARY 29, 1975

MEASUREMENT TIMES (PST): TEMP/RH 1044 WIND 1100

Wind direction is heading from which wind is blowing referenced to magnetic North.

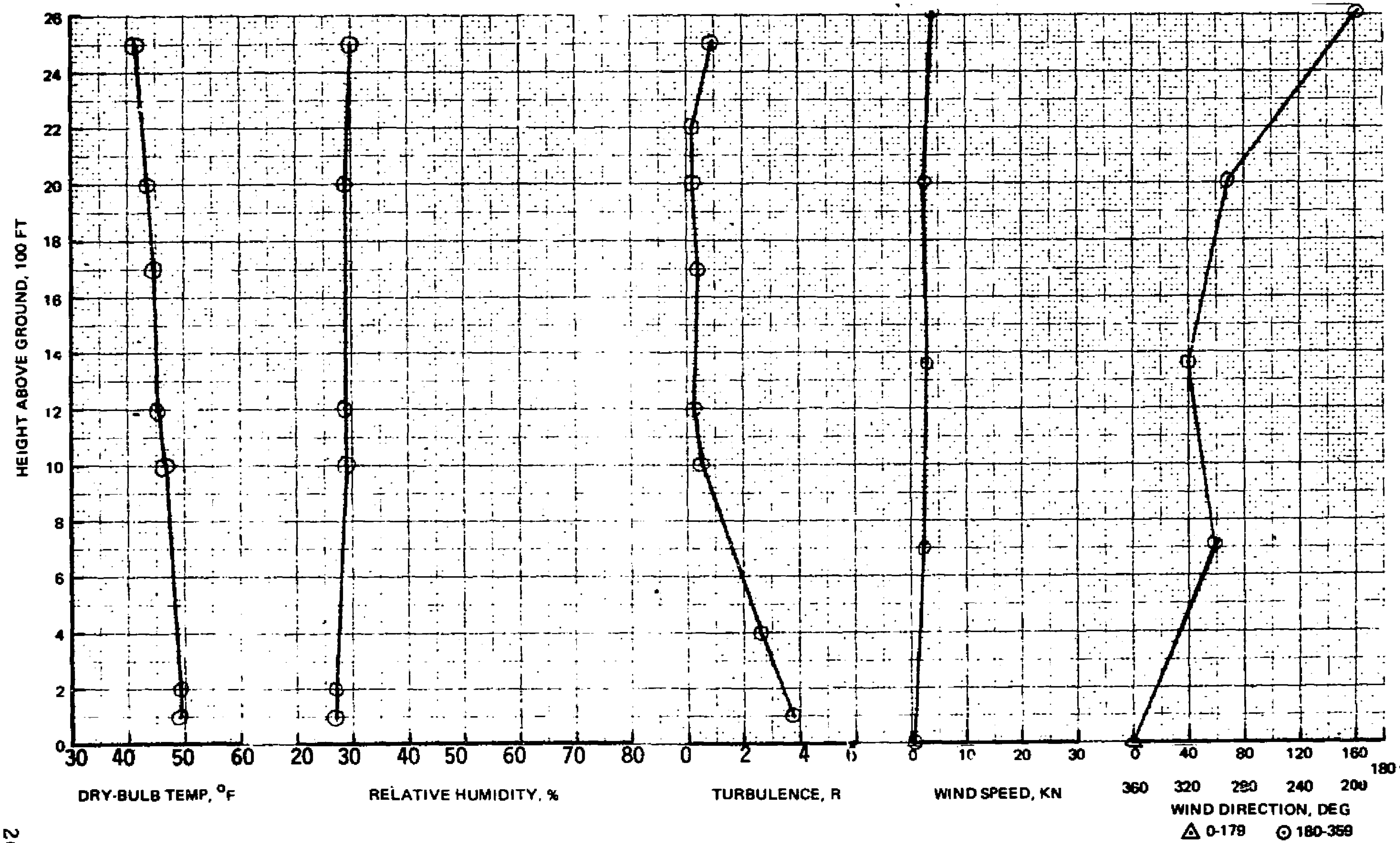


FIGURE B-2.6. SOUND-PATH WEATHER DURING FLYOVER NOISE TESTS (CONT)

AIRPLANE MODEL DC-9-31 REC. NO. N54638 TEST SITE YUMA, ARIZONA

DATA SOURCE METEOROLOGY RESEARCH INC. DATE JANUARY 29, 1975

MEASUREMENT TIMES (PST): TEMP/RH 1121 WIND 1130

Wind direction is heading from which wind is blowing referenced to magnetic North.

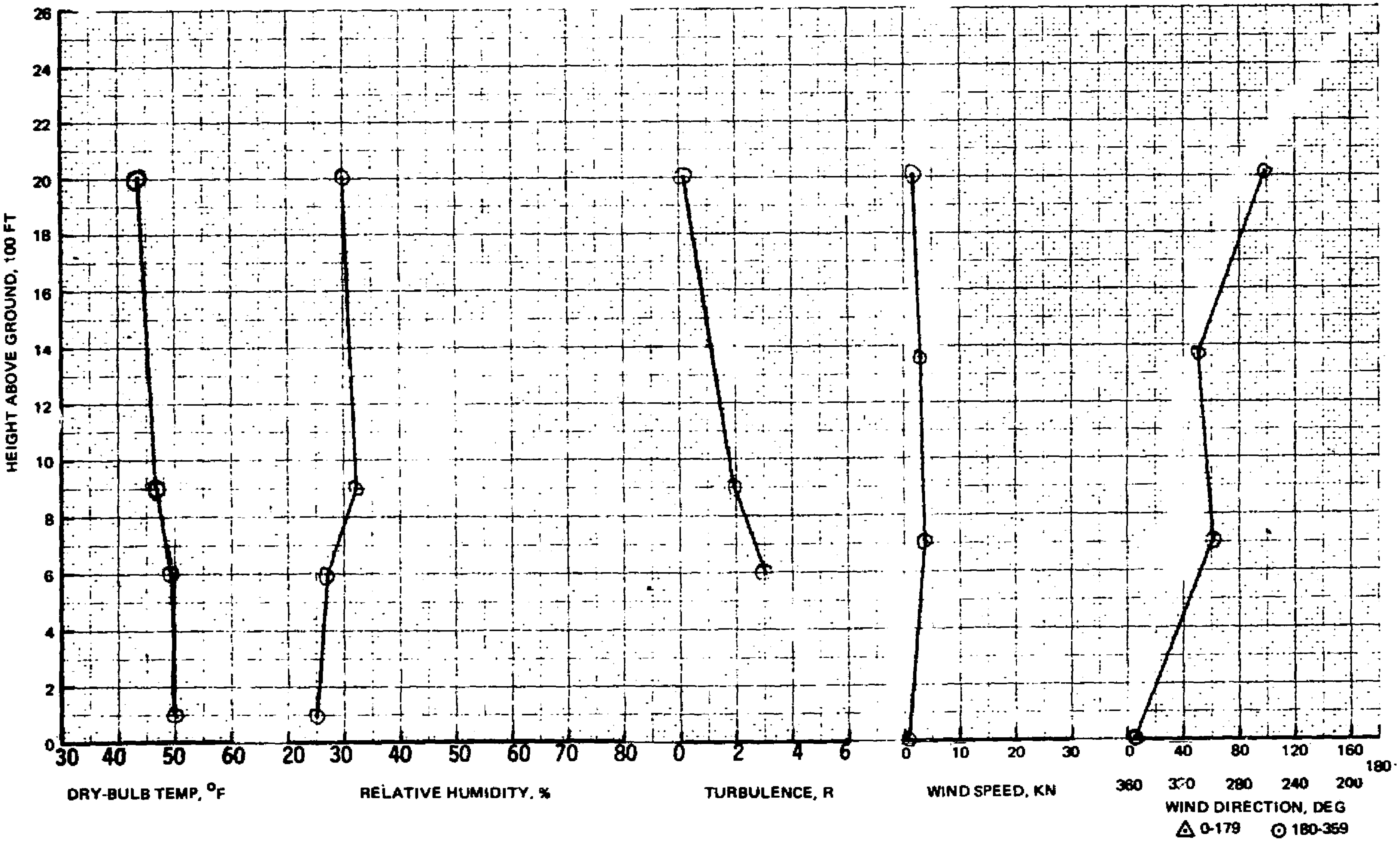


FIGURE B-2.7. SOUND-PATH WEATHER DURING FLYOVER NOISE TESTS (CONT)

AIRPLANE MODEL DC-9-31 REG. NO. N54638 TEST SITE YUMA, ARIZONA

DATA SOURCE METEOROLOGY RESEARCH INC. DATE JANUARY 29, 1975

MEASUREMENT TIMES (PST): TEMP/RH 1135 WIND 1130

Wind direction is heading from which wind is blowing referenced to magnetic North.

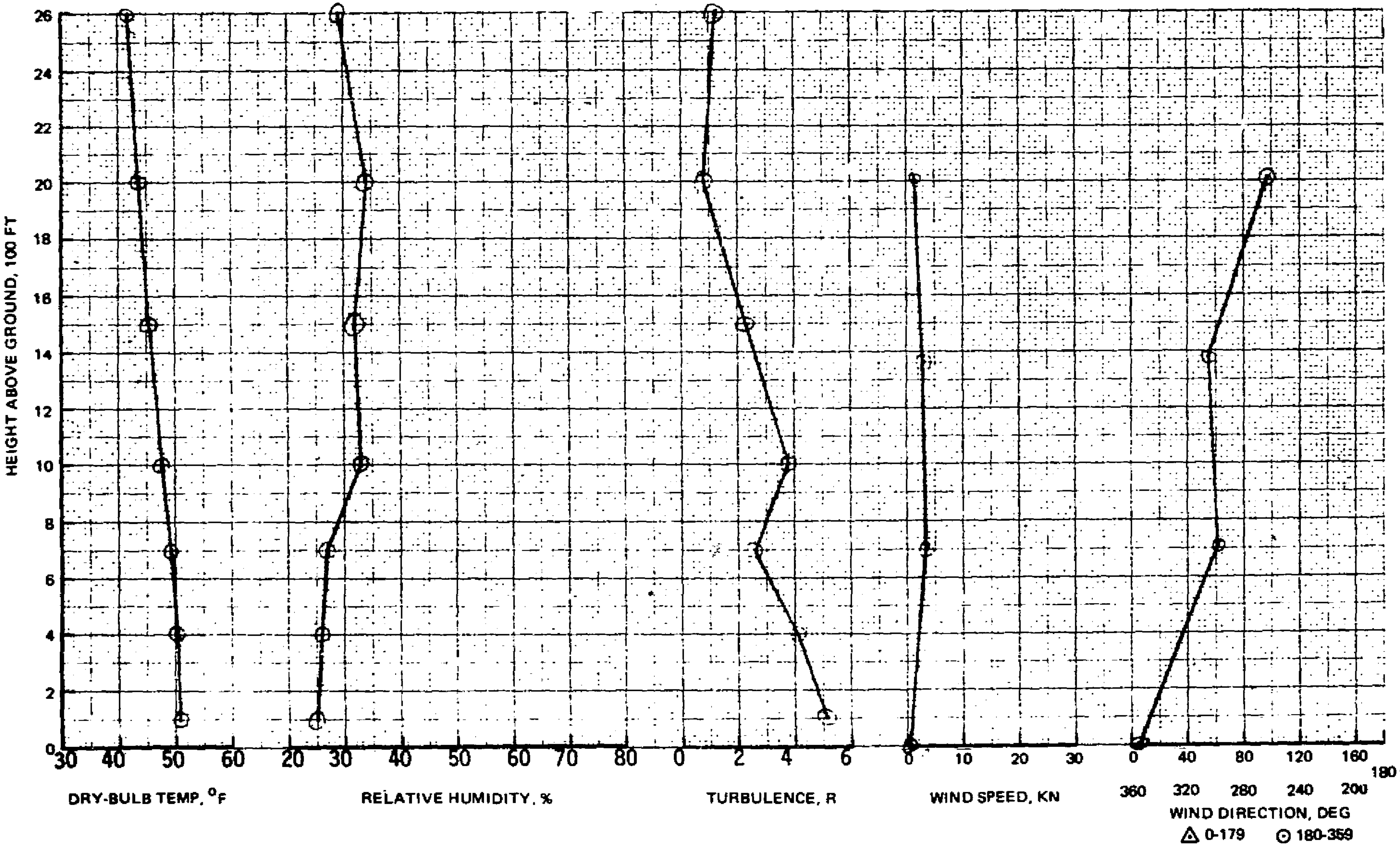


FIGURE B-2.8. SOUND-PATH WEATHER DURING FLYOVER NOISE TESTS (CONT)

AIRPLANE MODEL DC-9-31 REG. NO. N54638 TEST SITE YUMA, ARIZONA

DATA SOURCE METEOROLOGY RESEARCH INC. DATE JANUARY 30, 1975

MEASUREMENT TIMES (PST): TEMP/RH 0706 WIND 0715

Wind direction is heading from which wind is blowing referenced to magnetic North.

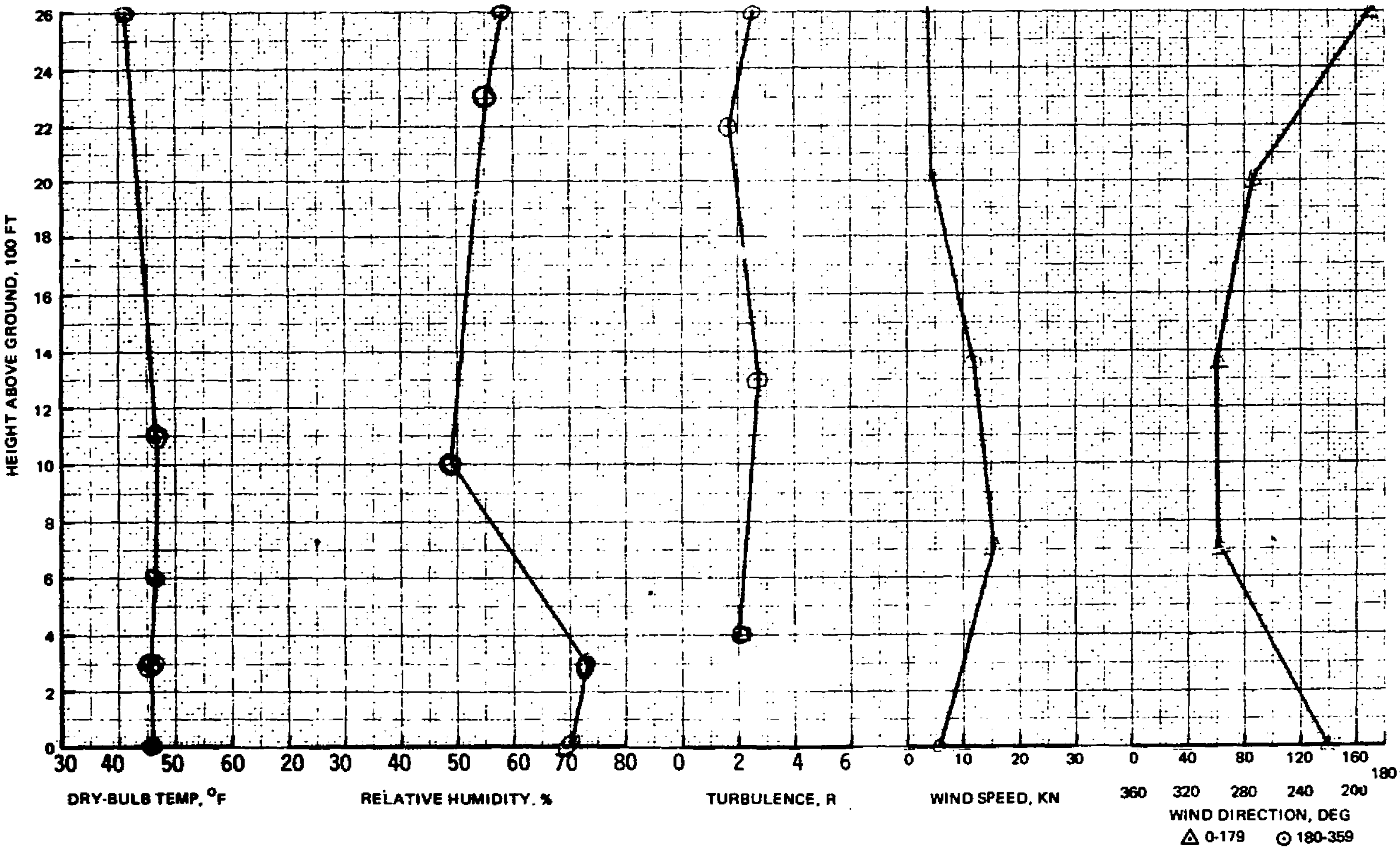


FIGURE B-2.9. SOUND-PATH WEATHER DURING FLYOVER NOISE TESTS (CONT)

AIRPLANE MODEL DC-9-31 REG. NO. N54638 TEST SITE YUMA, ARIZONA

DATA SOURCE METEOROLOGY RESEARCH INC. DATE JANUARY 30, 1975

MEASUREMENT TIMES (PST): TEMP/RH 1037 WIND 1035

Wind direction is heading from which wind is blowing referenced to magnetic North.

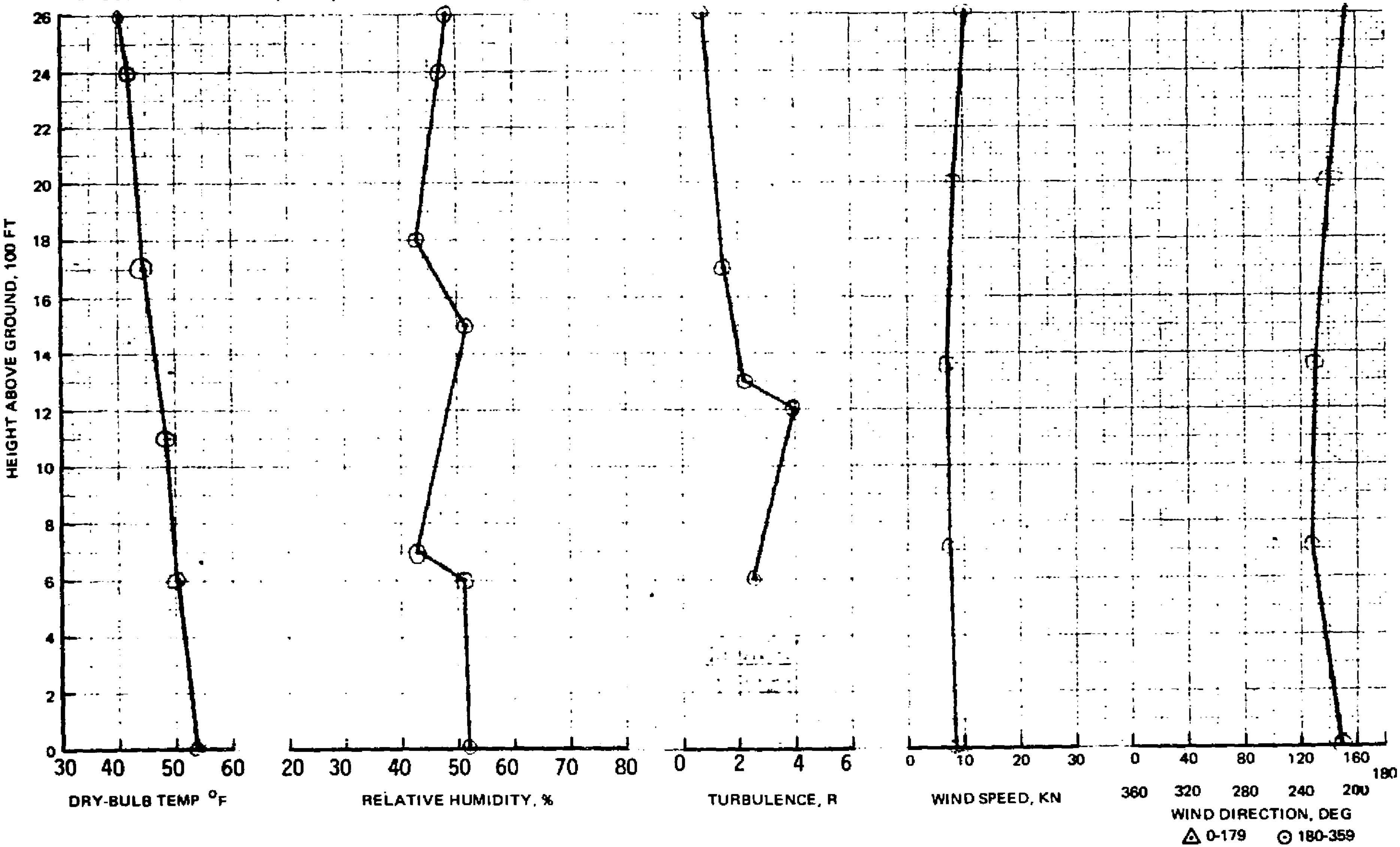


FIGURE B-2.10. SOUND-PATH WEATHER DURING FLYOVER NOISE TESTS (CONT)

AIRPLANE MODEL DC-9-31 REG. NO. N54638 TEST SITE YUMA, ARIZONA

DATA SOURCE METEOROLOGY RESEARCH INC. DATE JANUARY 31, 1975

MEASUREMENT TIMES (PST): TEMP/RH 0701 WIND 0710

Wind direction is heading from which wind is blowing referenced to magnetic North.

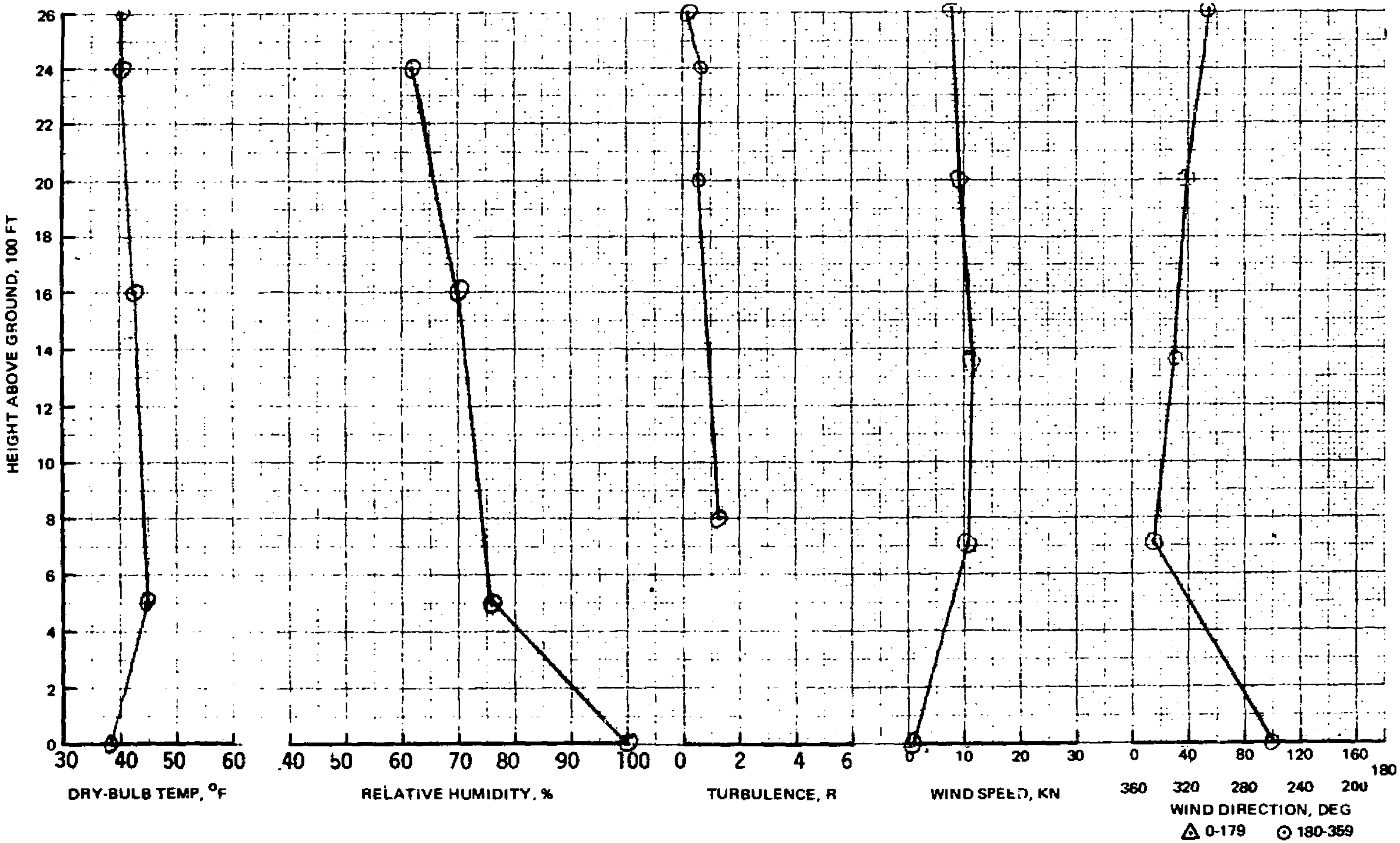


FIGURE B-2.11. SOUND-PATH WEATHER DURING FLYOVER NOISE TESTS (CONT)

AIRPLANE MODEL DC-9-31 REG. NO. N54638 TEST SITE YUMA, ARIZONA

DATA SOURCE METEOROLOGY RESEARCH INC. DATE JANUARY 31, 1975

MEASUREMENT TIMES (PST): TEMP/RH 0828 WIND 0830

Wind direction is heading from which wind is blowing referenced to magnetic North.

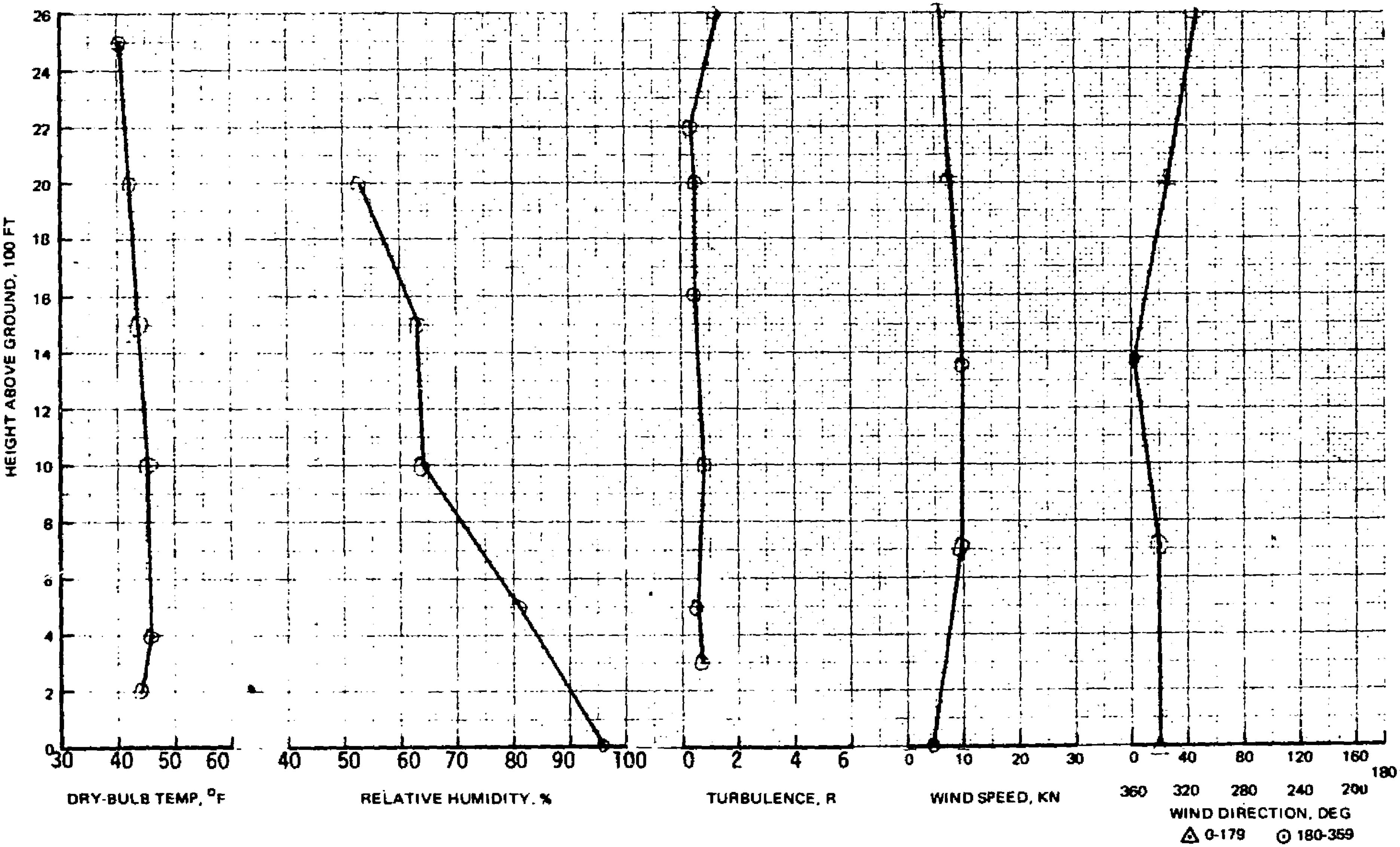


FIGURE B-2.12. SOUND-PATH WEATHER DURING FLYOVER NOISE TESTS (CONT)

AIRPLANE MODEL DC-9-31 REG. NO. N54638 TEST SITE YUMA, ARIZONA

DATA SOURCE METEOROLOGY RESEARCH INC. DATE JANUARY 31, 1975

MEASUREMENT TIMES (PST): TEMP/RH 0846 WIND 0910

Wind direction is heading from which wind is blowing referenced to magnetic North.

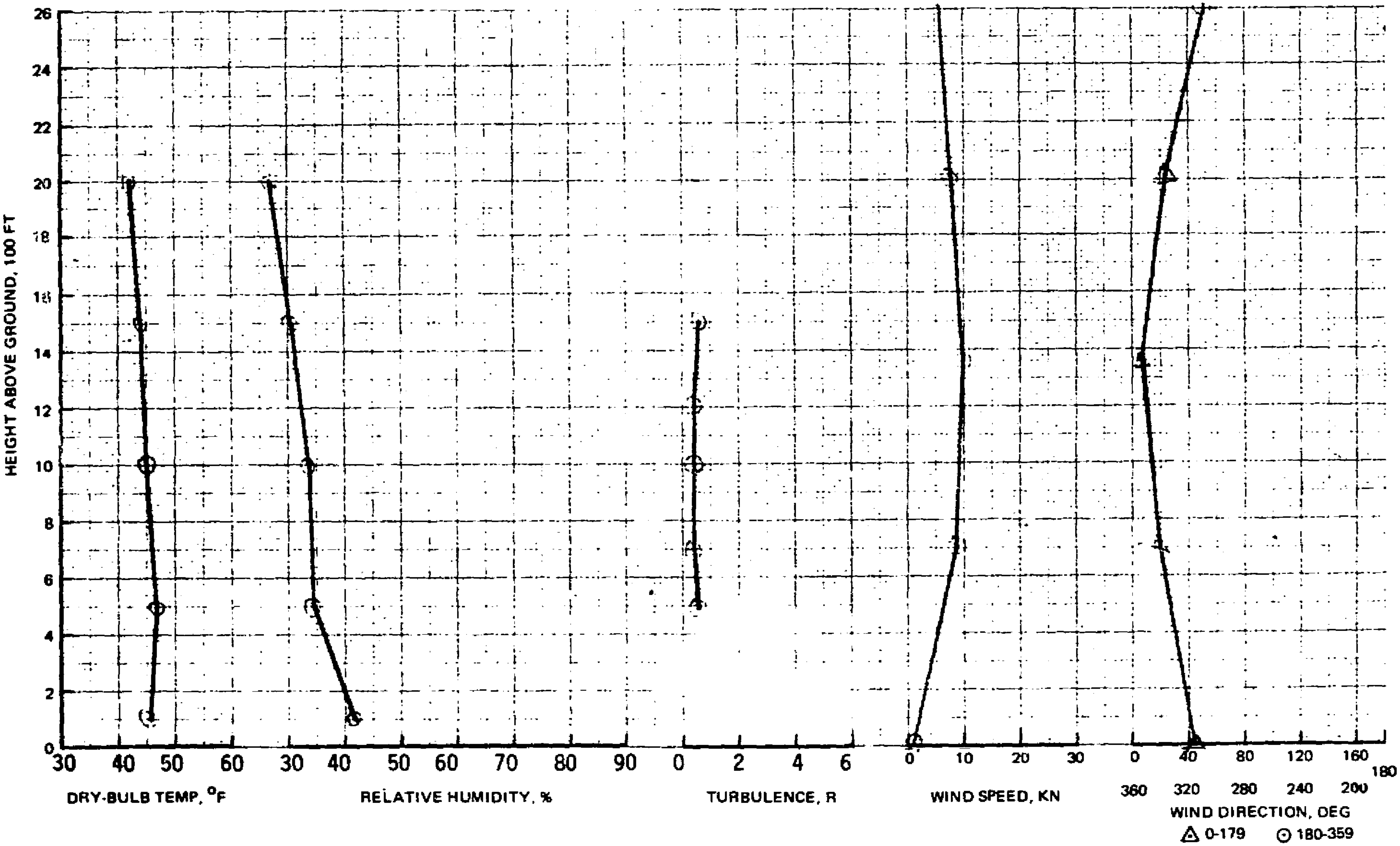


FIGURE B-2.13. SOUND-PATH WEATHER DURING FLYOVER NOISE TESTS (CONT)

AIRPLANE MODEL DC-9-31 REG. NO. N54638 TEST SITE YUMA, ARIZONA

DATA SOURCE METEOROLOGY RESEARCH INC. DATE JANUARY 31, 1975

MEASUREMENT TIMES (PST): TEMP/RH 0930 WIND 0935

Wind direction is heading from which wind is blowing referenced to magnetic North.

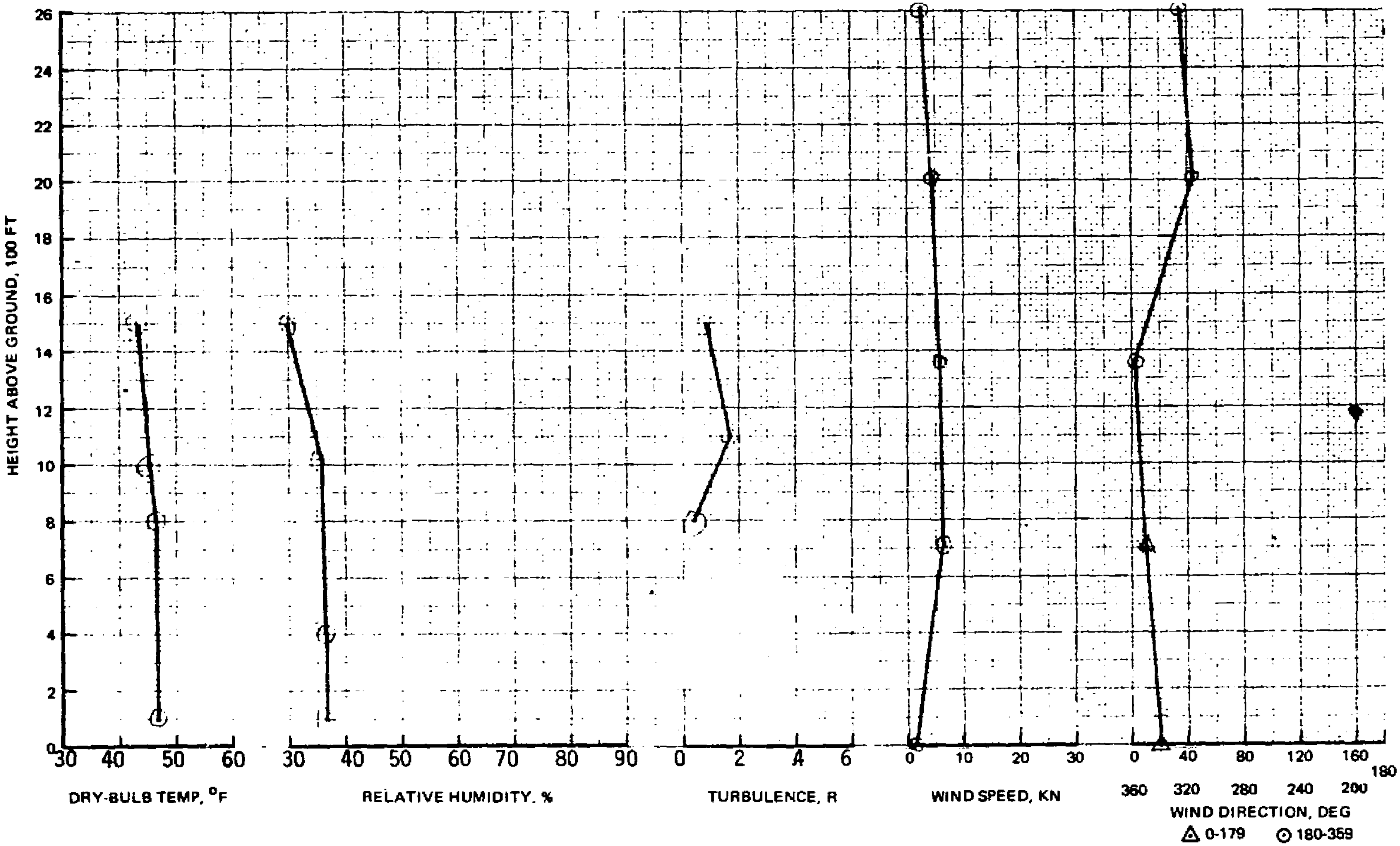


FIGURE B-2.14. SOUND-PATH WEATHER DURING FLYOVER NOISE TESTS (CONT)

AIRPLANE MODEL DC-9-31 REG. NO. N54638 TEST SITE YUMA, ARIZONA

DATA SOURCE METEOROLOGY RESEARCH INC. DATE JANUARY 31, 1975

MEASUREMENT TIMES (PST): TEMP/RH 1000 WIND 1000

Wind direction is heading from which wind is blowing referenced to magnetic North.

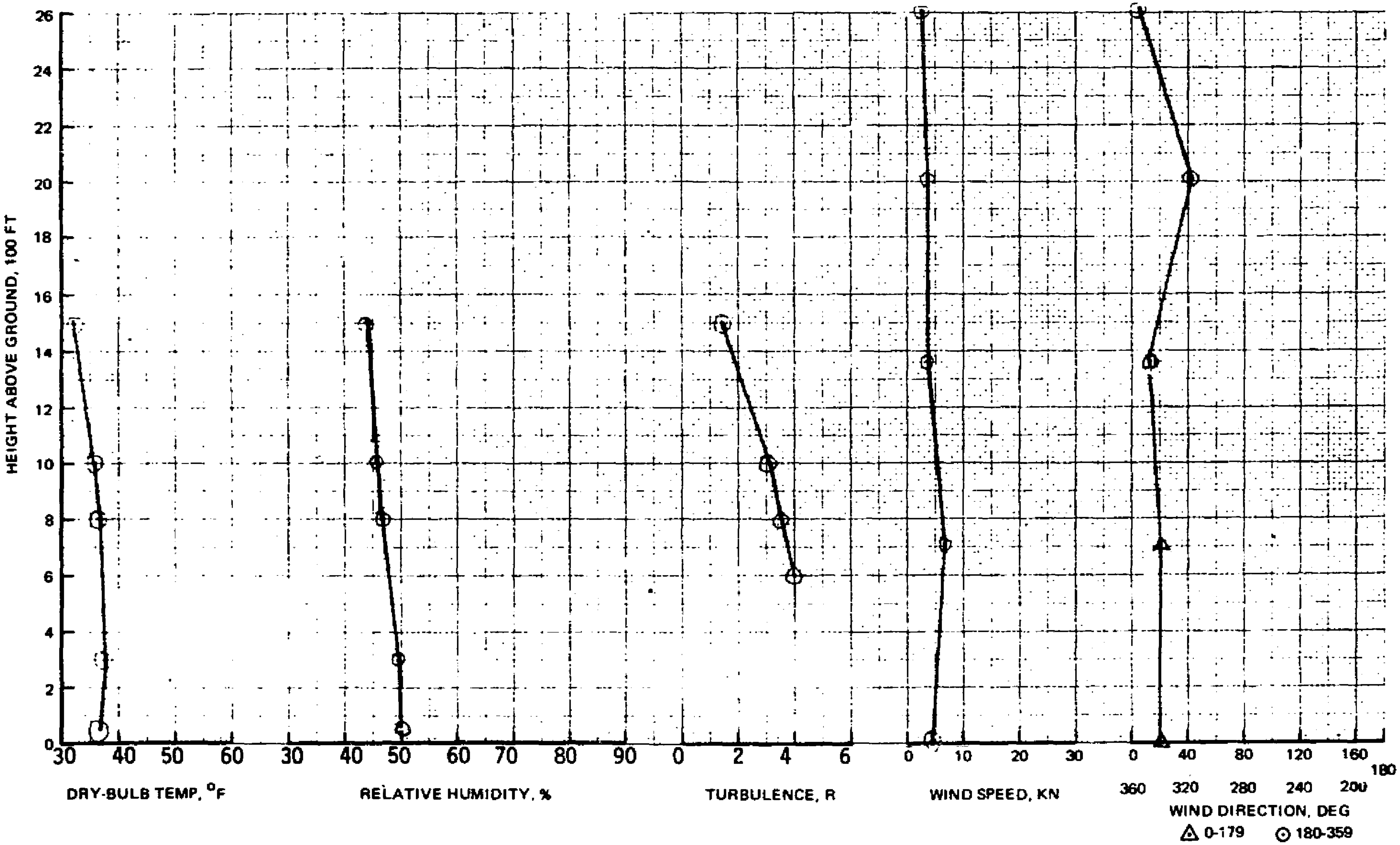


FIGURE B-2.15. SOUND-PATH WEATHER DURING FLYOVER NOISE TESTS (CONT)

AIRPLANE MODEL DC-9-31 REG. NO. N54638 TEST SITE YUMA, ARIZONA

DATA SOURCE METEOROLOGY RESEARCH INC. DATE JANUARY 31, 1975

MEASUREMENT TIMES (PST): TEMP/RH 1107 WIND 1130

Wind direction is heading from which wind is blowing referenced to magnetic North.

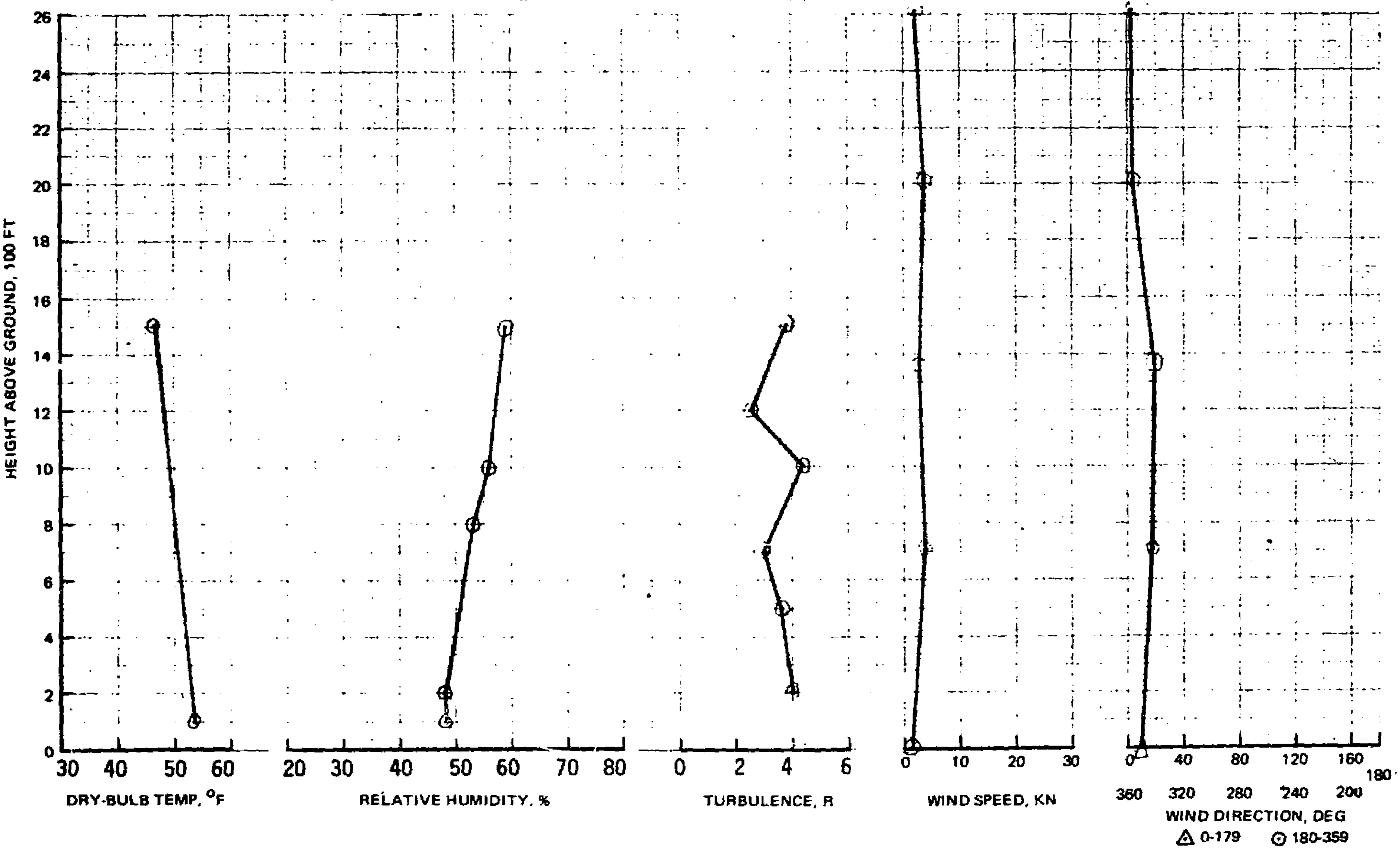


FIGURE B-2.16. SOUND-PATH WEATHER DURING FLYOVER NOISE TESTS (CONT)

AIRPLANE MODEL DC-9-31 REG. NO. N54638 TEST SITE YUMA, ARIZONA

DATA SOURCE METEOROLOGY RESEARCH INC. DATE JANUARY 31, 1975

MEASUREMENT TIMES (PST): TEMP/RH 1134 WIND 1130

Wind direction is heading from which wind is blowing referenced to magnetic North.

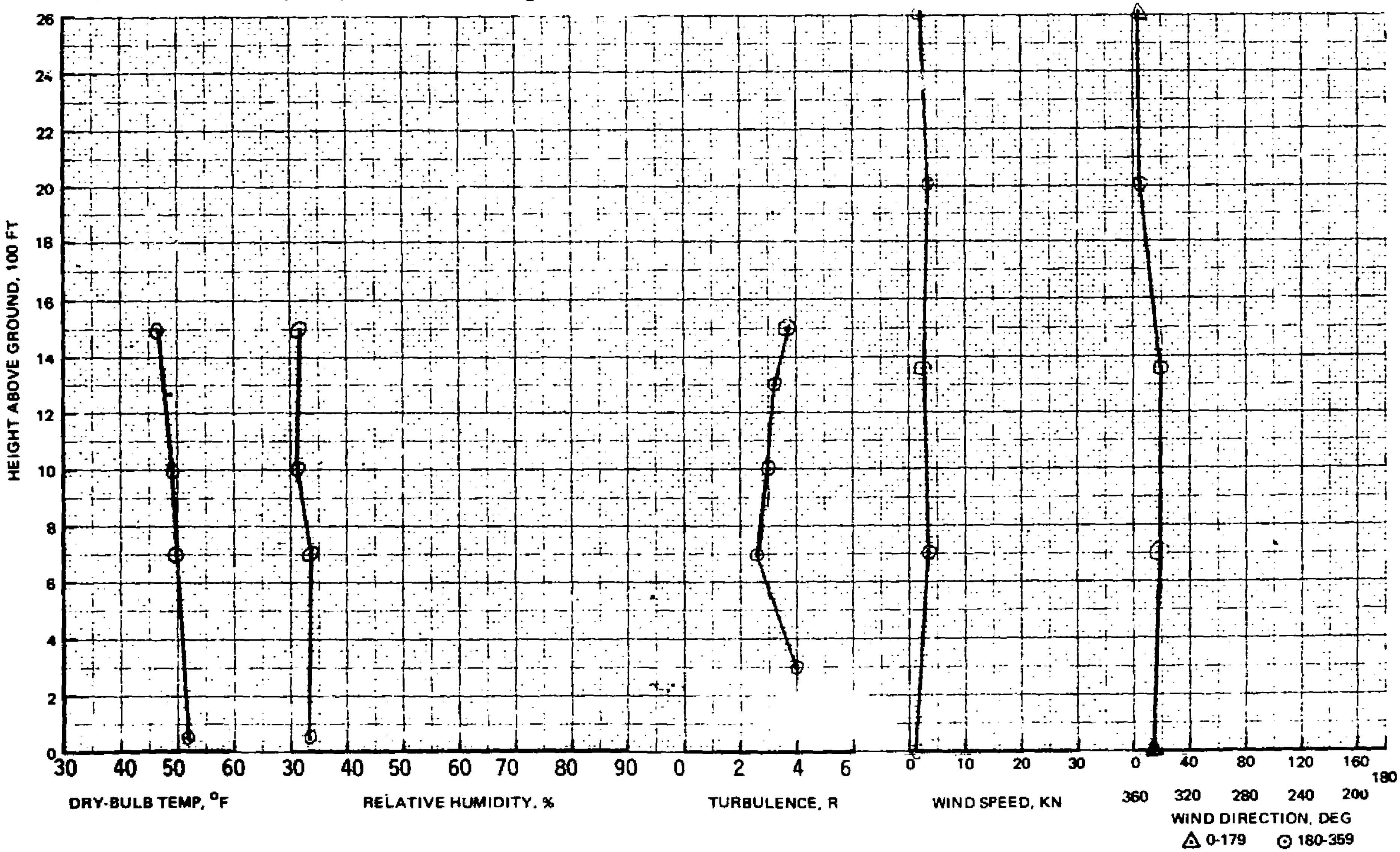


FIGURE B-2.17. SOUND-PATH WEATHER DURING FLYOVER NOISE TESTS (CONT)

AIRPLANE MODEL DC-9-31 REG. NO. N54638 TEST SITE YUMA, ARIZONA

DATA SOURCE METEOROLOGY RESEARCH INC. DATE JANUARY 31, 1975

MEASUREMENT TIMES (PST): TEMP/RH 1152 WIND 1200

Wind direction is heading from which wind is blowing referenced to magnetic North.

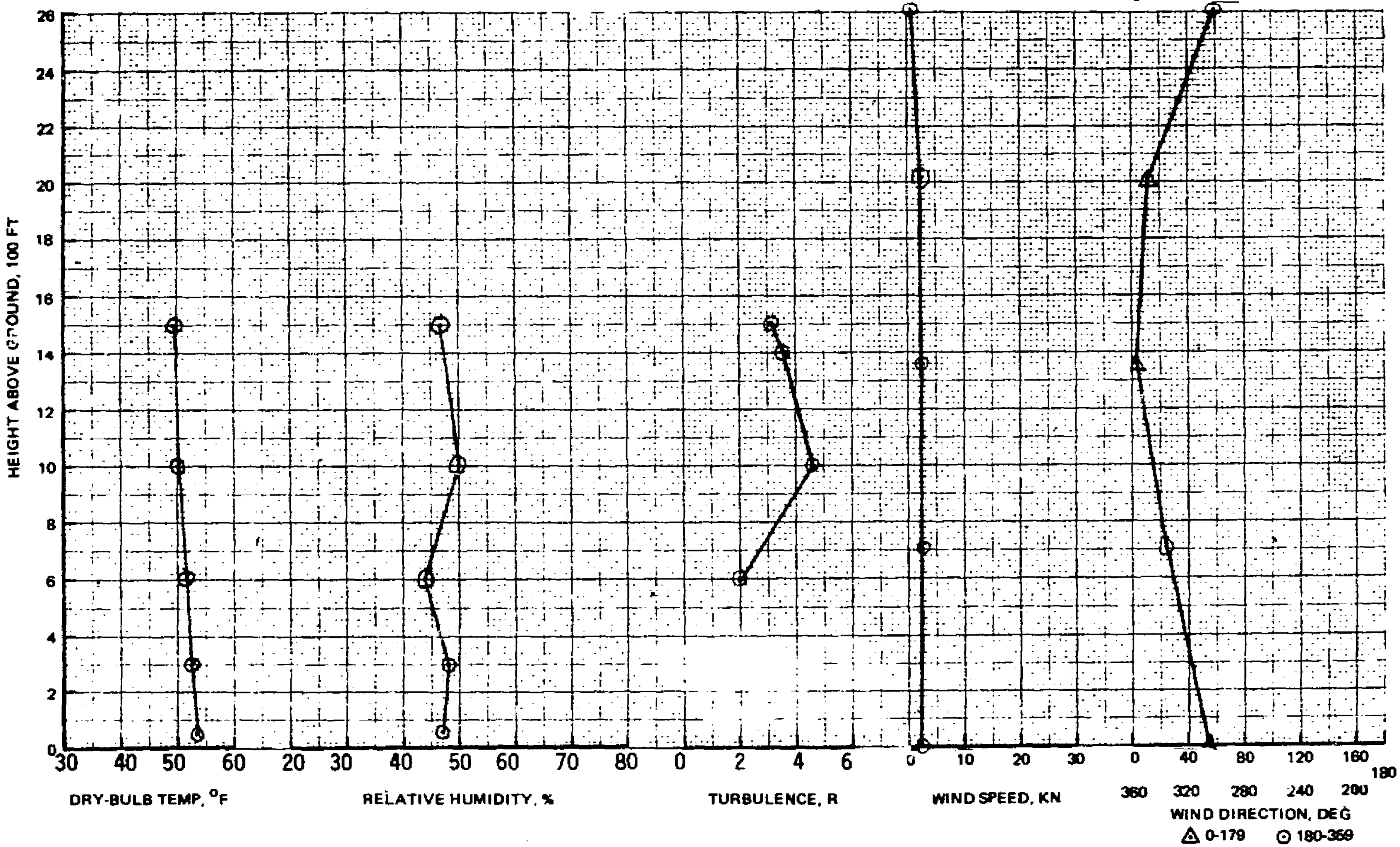


FIGURE B-2.18. SOUND-PATH WEATHER DURING FLYOVER NOISE TESTS (CONT)

AIRPLANE MODEL DC-9-31 REG. NO. N54638 TEST SITE YUMA, ARIZONA

DATA SOURCE METEOROLOGY RESEARCH INC. DATE FEBRUARY 1, 1975

MEASUREMENT TIMES (PST): TEMP/RH 0648 WIND 0650

Wind direction is heading from which wind is blowing referenced to magnetic North.

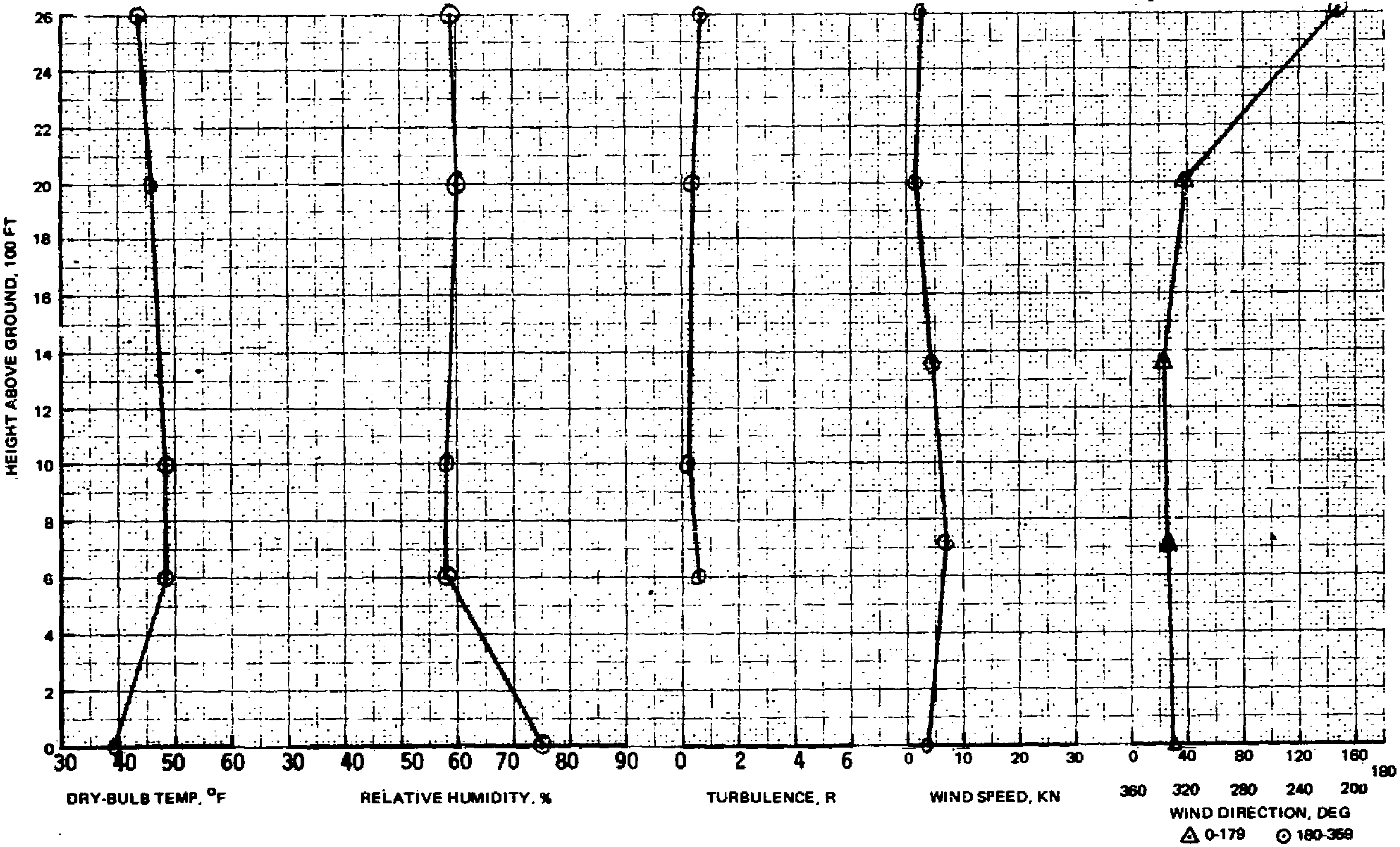


FIGURE B-2.19. SOUND-PATH WEATHER DURING FLYOVER NOISE TESTS (CONT)

AIRPLANE MODEL DC-9-31 REG. NO. N54638 TEST SITE YUMA, ARIZONA

DATA SOURCE METEOROLOGY RESEARCH INC. DATE FEBRUARY 1, 1975

MEASUREMENT TIMES (PST): TEMP/RH 0843 WIND 0842

Wind direction is heading from which wind is blowing referenced to magnetic North.

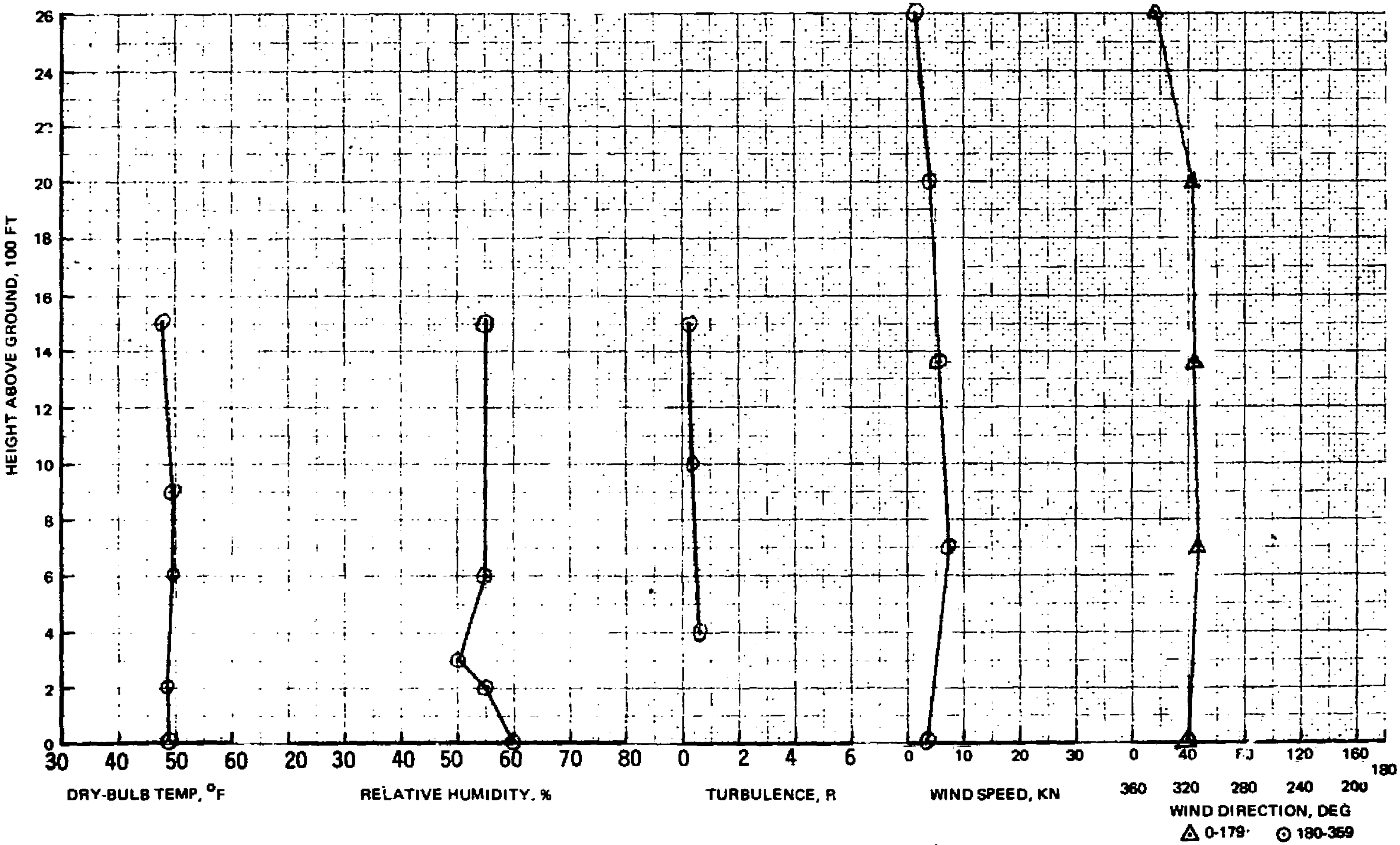


FIGURE B-2.20. SOUND-PATH WEATHER DURING FLYOVER NOISE TESTS (CONT)

AIRPLANE MODEL DC-9-31 REG. NO. N54638 TEST SITE YUMA, ARIZONA

DATA SOURCE METEOROLOGY RESEARCH INC. DATE FEBRUARY 1, 1975

MEASUREMENT TIMES (PST): TEMP/RH 0857 WIND 0842

Wind direction is heading from which wind is blowing referenced to magnetic North.

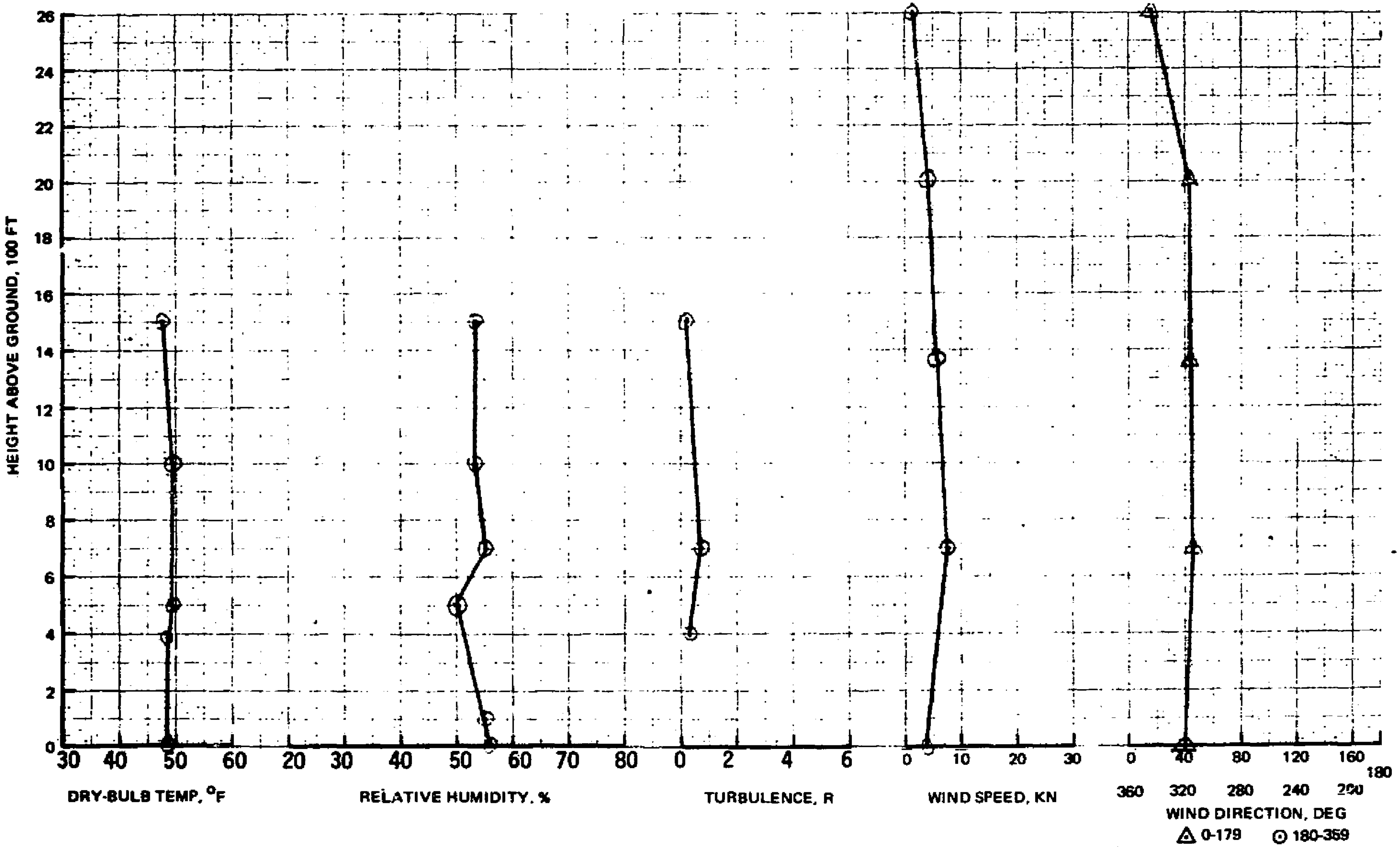


FIGURE B-2.21. SOUND-PATH WEATHER DURING FLYOVER NOISE TESTS (CONT)

AIRPLANE MODEL DC-9-31 REG. NO. N54638 TEST SITE YUMA, ARIZONA

DATA SOURCE METEOROLOGY RESEARCH INC. DATE FEBRUARY 1, 1975

MEASUREMENT TIMES (PST): TEMP/RH 0917 WIND 0920

Wind direction is heading from which wind is blowing referenced to magnetic North.

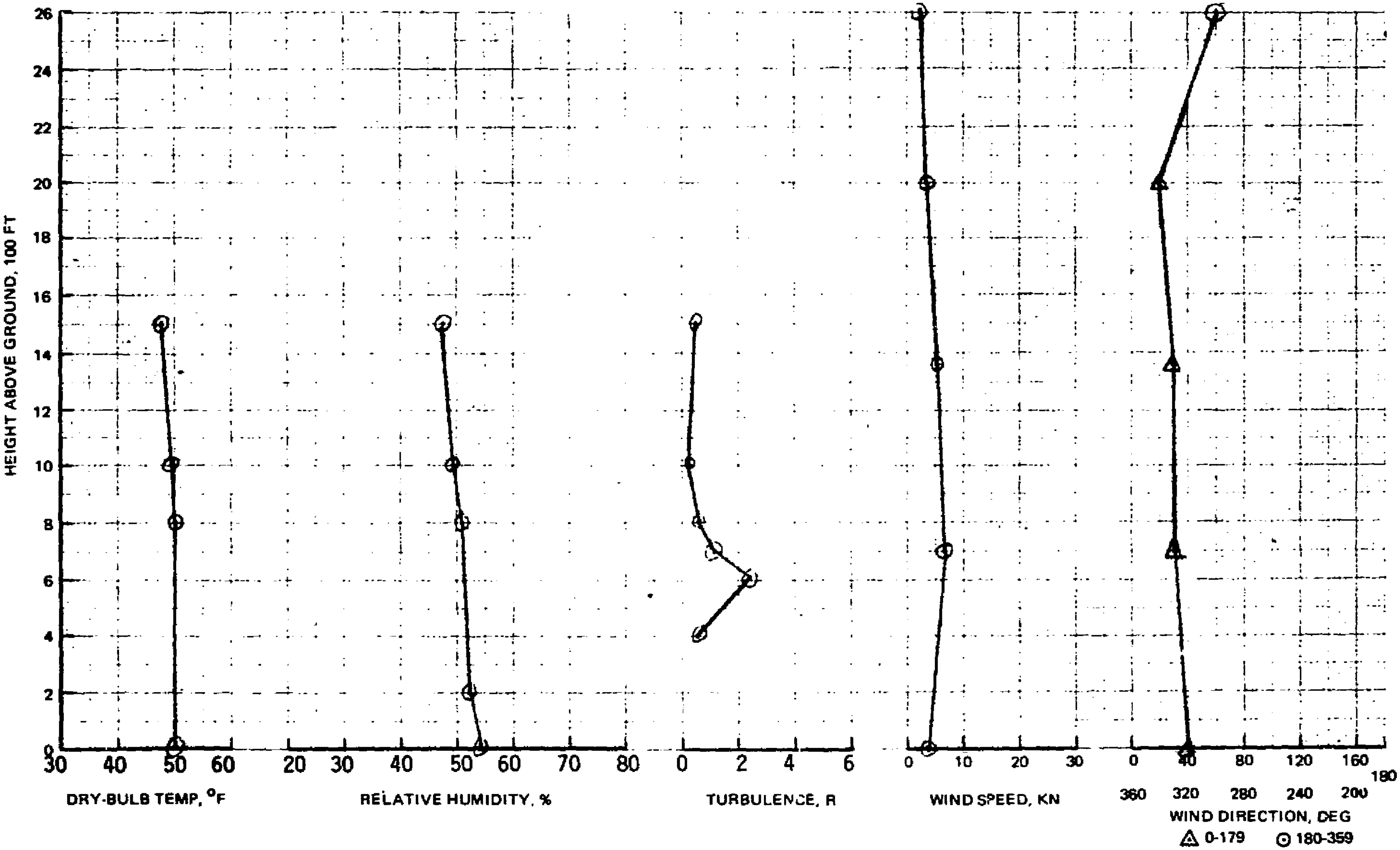


FIGURE B-2.22. SOUND-PATH WEATHER DURING FLYOVER NOISE TESTS (CONT)

AIRPLANE MODEL DC-9-31 REG. NO. N54638 TEST SITE YUMA, ARIZONA

DATA SOURCE METEOROLOGY RESEARCH INC. DATE FEBRUARY 1, 1975

MEASUREMENT TIMES (PST): TEMP/RH 0940 WIND 0950

Wind direction is heading from which wind is blowing referenced to magnetic North.

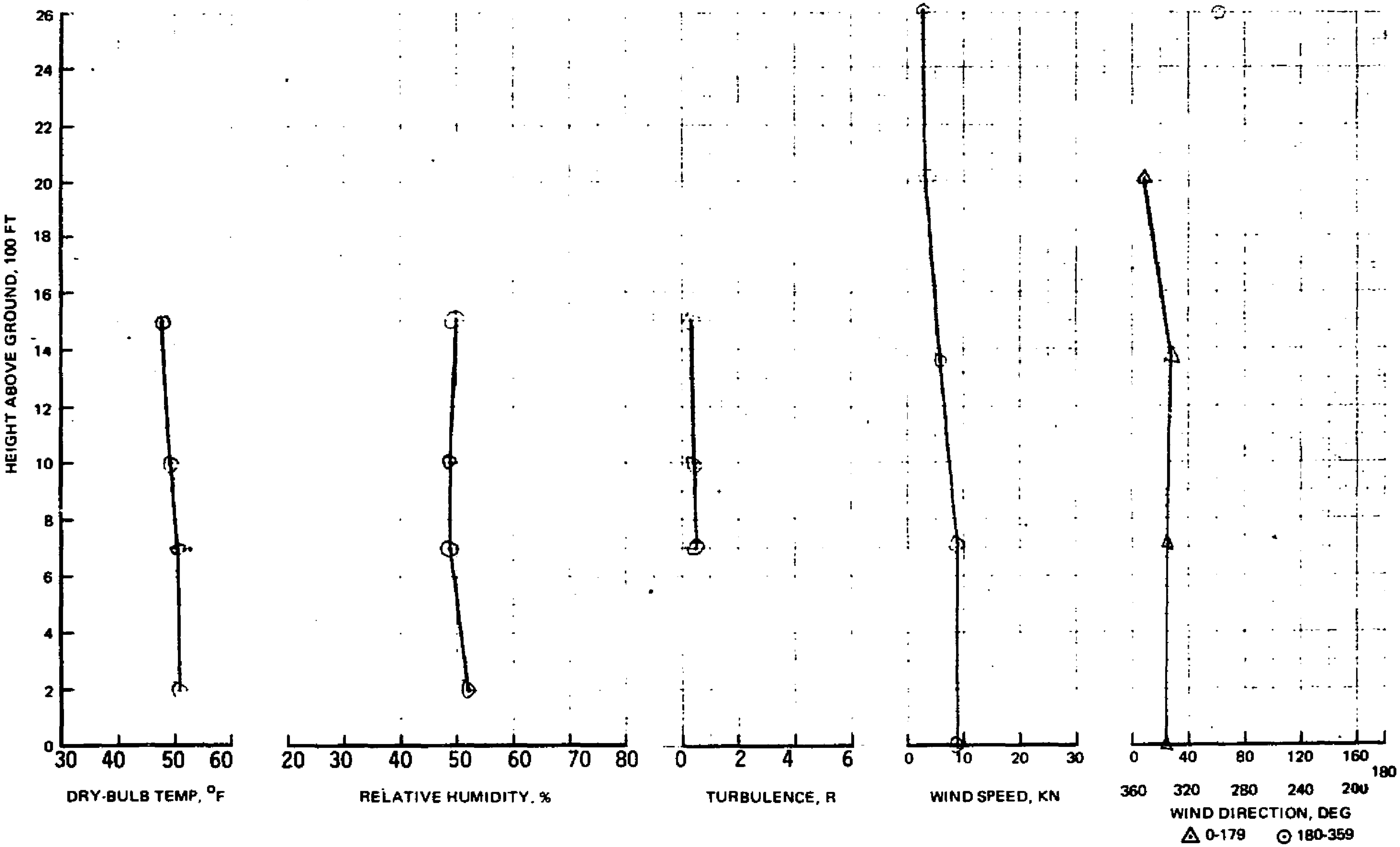


FIGURE B-2.23. SOUND-PATH WEATHER DURING FLYOVER NOISE TESTS (CONT)

AIRPLANE MODEL DC-9-31 REG. NO. N54638 TEST SITE YUMA, ARIZONA

DATA SOURCE METEOROLOGY RESEARCH INC. DATE FEBRUARY 1, 1975

MEASUREMENT TIMES (PST): TEMP/RH 0952 WIND 0950

Wind direction is heading from which wind is blowing referenced to magnetic North.

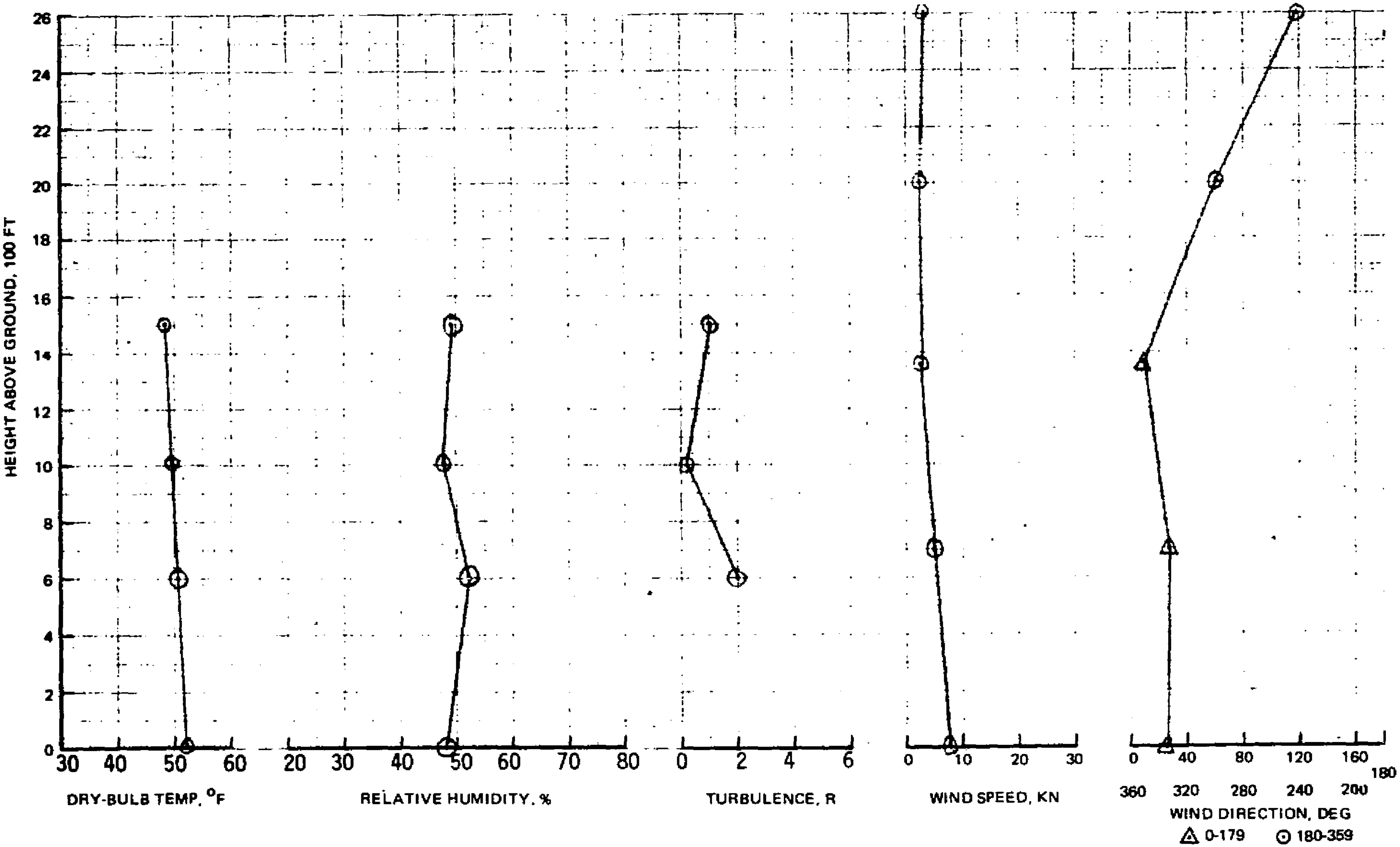


FIGURE B-2.24. SOUND-PATH WEATHER DURING FLYOVER NOISE TESTS (CONT)

AIRPLANE MODEL DC-9-31 REG. NO. N54638 TEST SITE YUMA, ARIZONA
DATA SOURCE METEOROLOGY RESEARCH INC. DATE FEBRUARY 1, 1975
MEASUREMENT TIMES (PST): TEMP/RH 1016 WIND 1030

Wind direction is heading from which wind is blowing referenced to magnetic North.

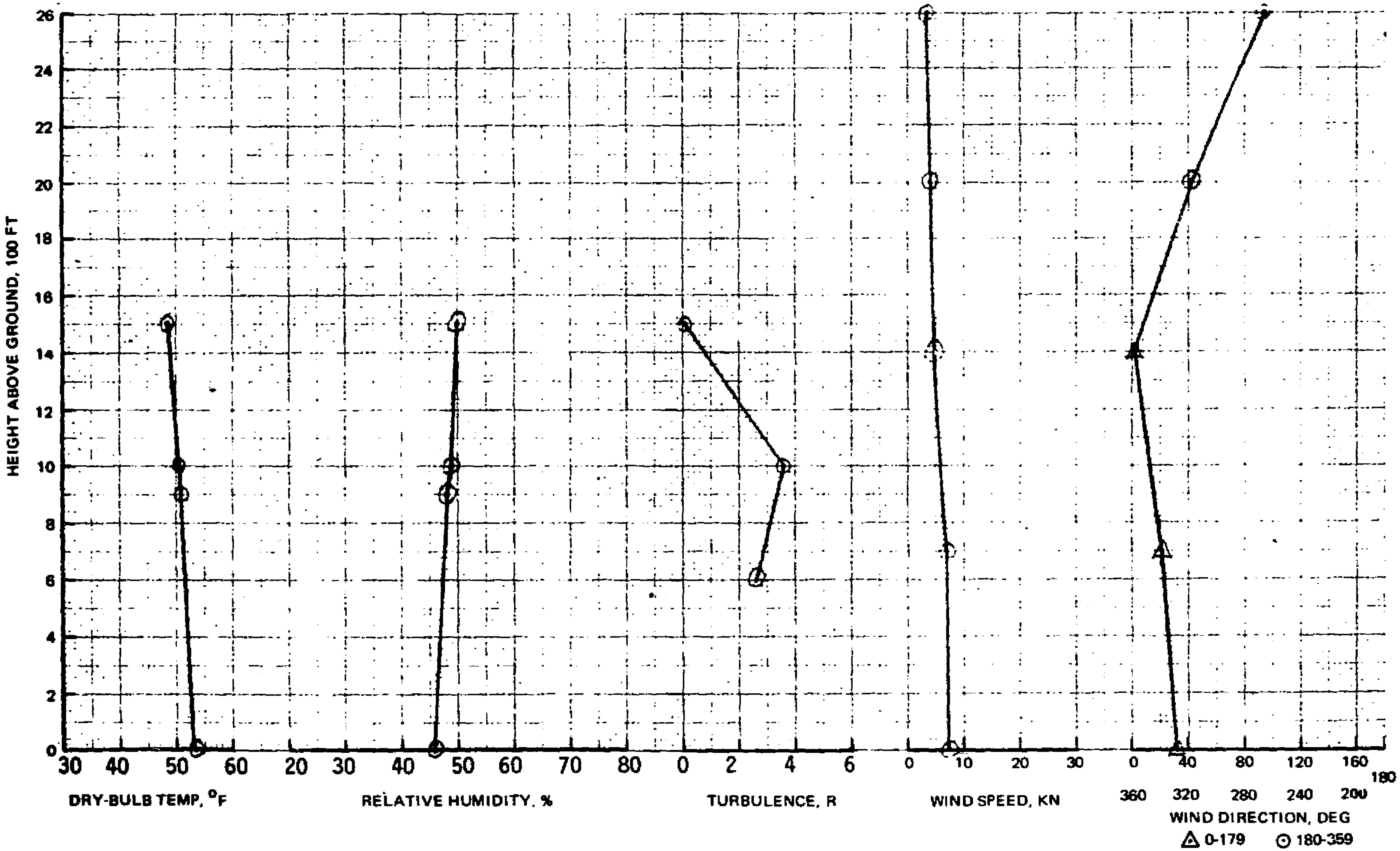


FIGURE B-2.25. SOUND-PATH WEATHER DURING FLYOVER NOISE TESTS (CONT)

AIRPLANE MODEL DC-9-31 REG. NO. N54638 TEST SITE YUMA, ARIZONA

DATA SOURCE METEOROLOGY RESEARCH INC. DATE FEBRUARY 1, 1975

MEASUREMENT TIMES (PST): TEMP/RH 1035 WIND 1030

Wind direction is heading from which wind is blowing referenced to magnetic North.

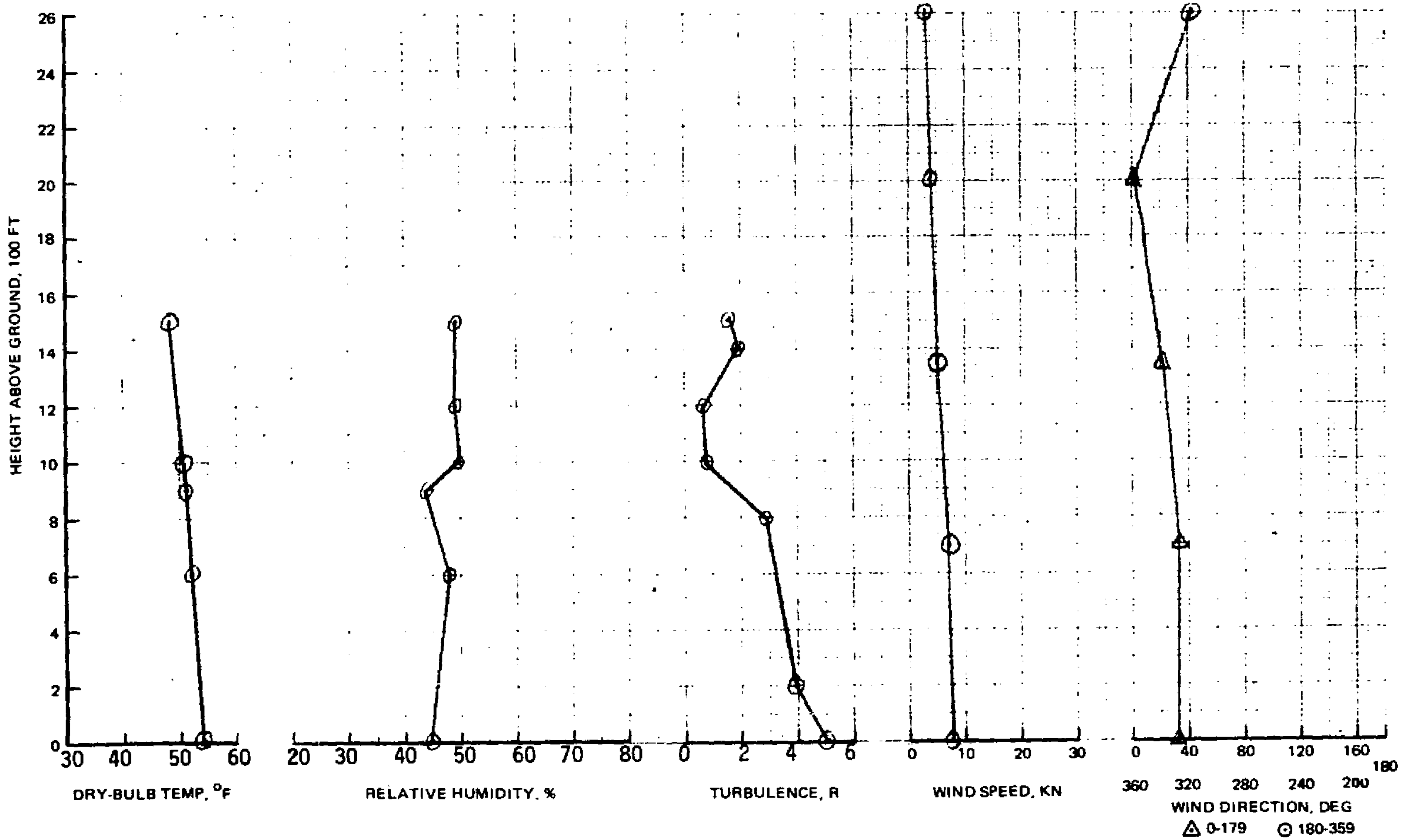


FIGURE B-2.26. SOUND-PATH WEATHER DURING FLYOVER NOISE TESTS (CONT)

AIRPLANE MODEL DC-9-31 REG. NO. N54638 TEST SITE YUMA, ARIZONA

DATA SOURCE METEOROLOGY RESEARCH INC. DATE FEBRUARY 1, 1975

MEASUREMENT TIMES (PST): TEMP/RH 1057 WIND 1100

Wind direction is heading from which wind is blowing referenced to magnetic North.

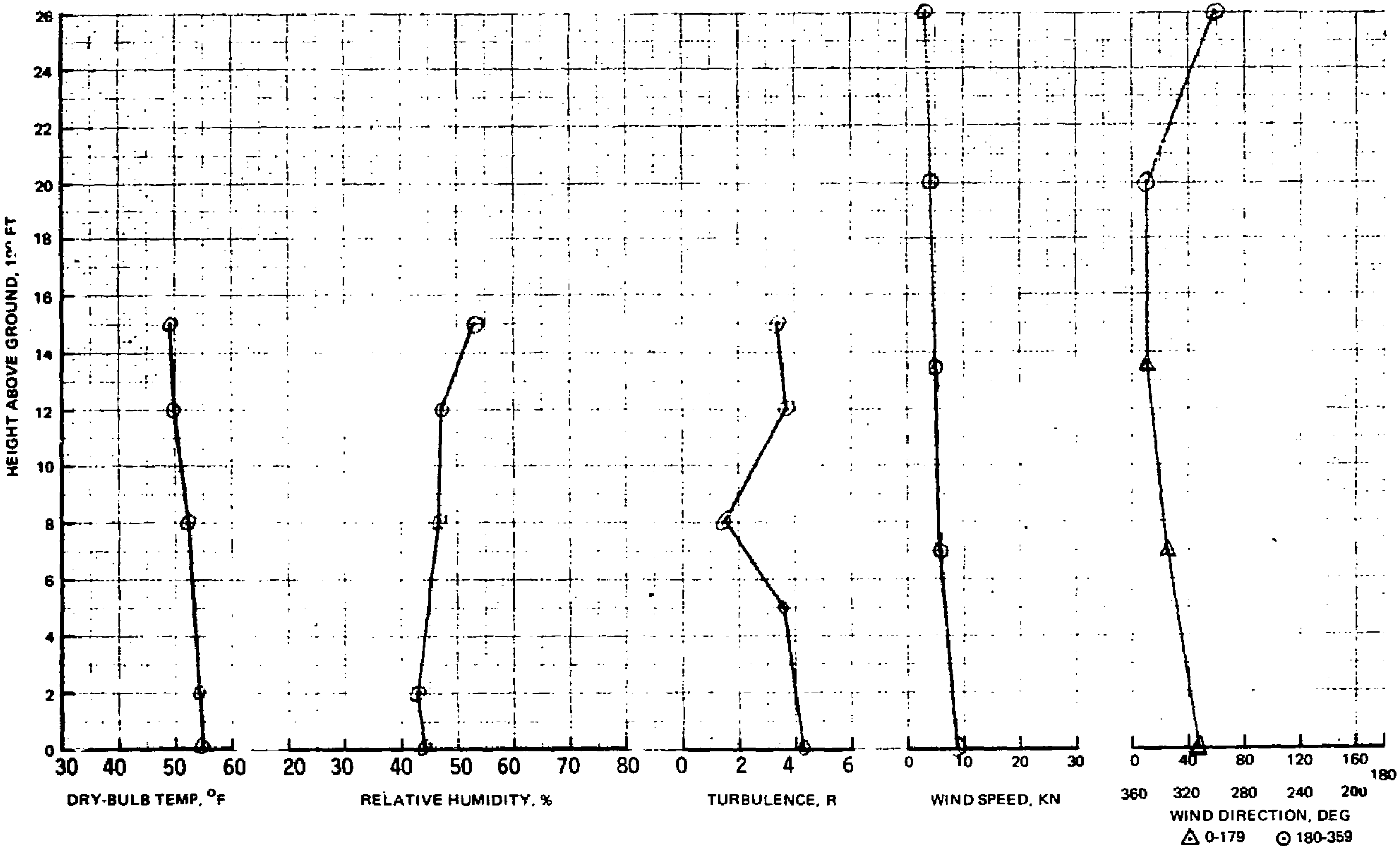


FIGURE B-2.27. SOUND-PATH WEATHER DURING FLYOVER NOISE TESTS (CONT)

AIRPLANE MODEL DC-9-31 REG. NO. N54638 TEST SITE YUMA, ARIZONA

DATA SOURCE METEOROLOGY RESEARCH INC. DATE FEBRUARY 1, 1975

MEASUREMENT TIMES (PST): TEMP/RH 1117 WIND 1100

Wind direction is heading from which wind is blowing referenced to magnetic North.

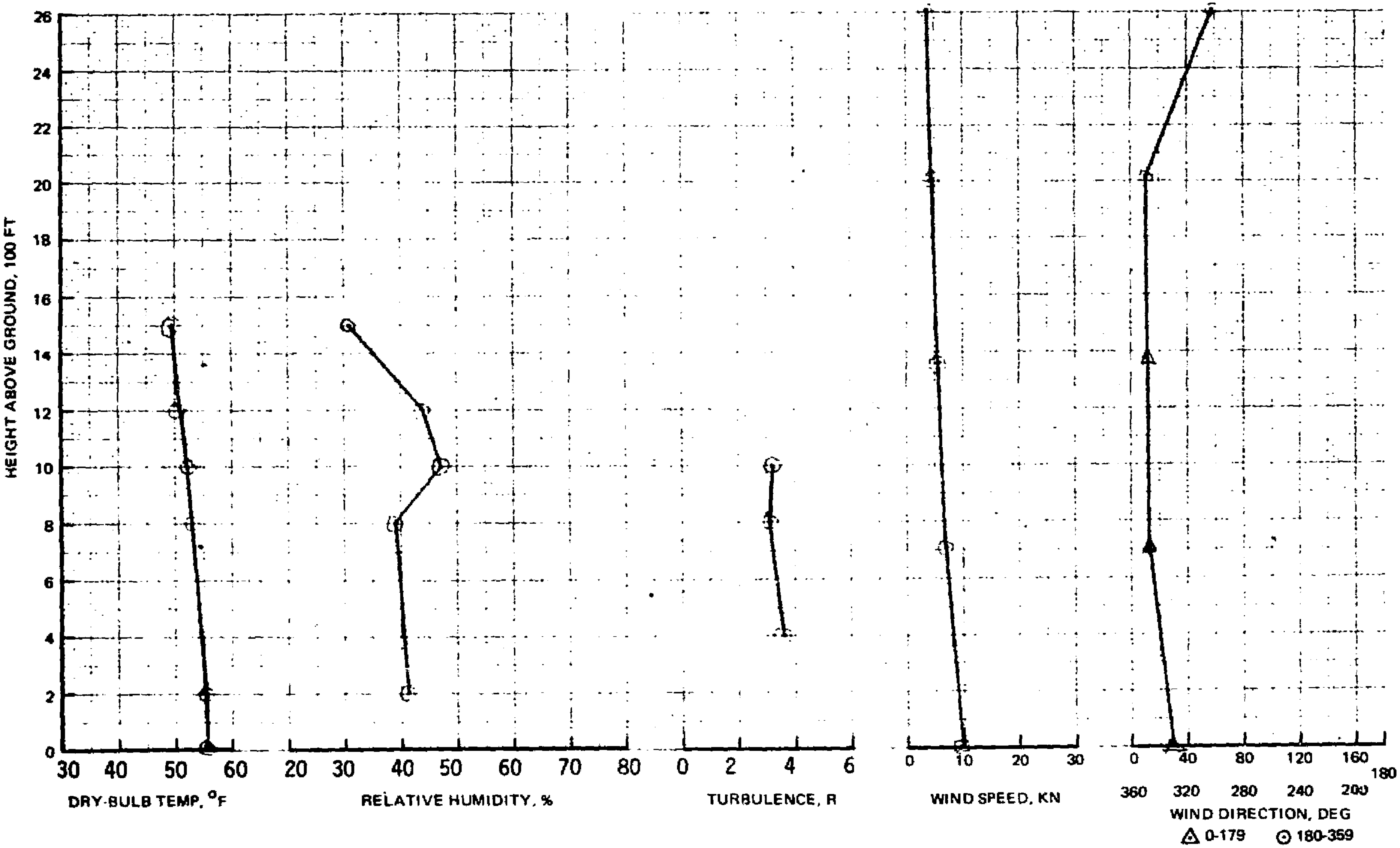


FIGURE B-2.28. SOUND-PATH WEATHER DURING FLYOVER NOISE TESTS (CONT)

AIRPLANE MODEL DC-9-31 REG. NO. N54638 TEST SITE YUMA, ARIZONA

DATA SOURCE METEOROLOGY RESEARCH INC. DATE FEBRUARY 1, 1975

MEASUREMENT TIMES (PST): TEMP/RH 1132 WIND 1130

Wind direction is heading from which wind is blowing referenced to magnetic North.

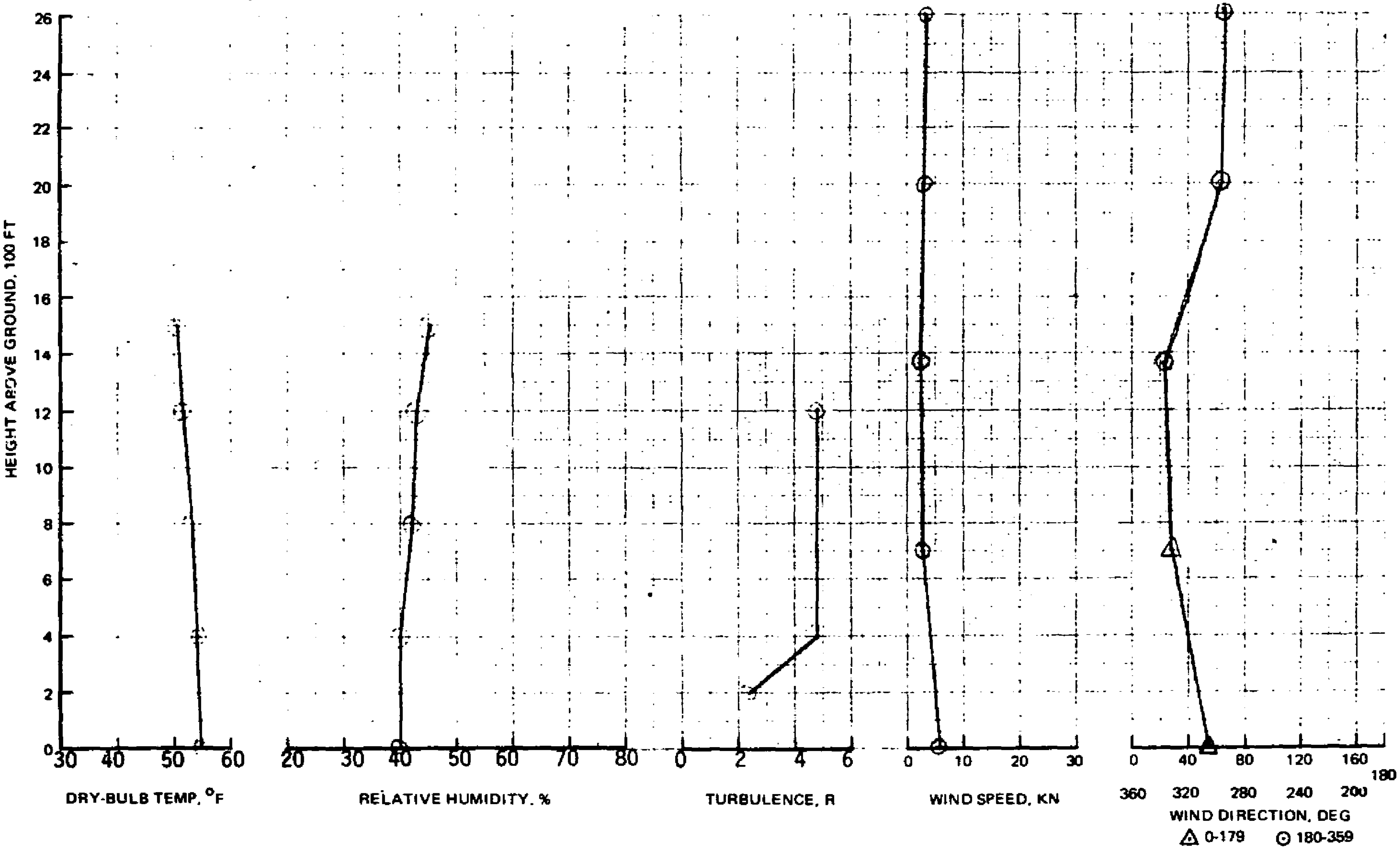


FIGURE B-2.29. SOUND-PATH WEATHER DURING FLYOVER NOISE TESTS (CONT)

AIRPLANE MODEL DC-9-31 REG. NO. N54638 TEST SITE YUMA, ARIZONA

DATA SOURCE METEOROLOGY RESEARCH INC. DATE FEBRUARY 2, 1975

MEASUREMENT TIMES (PST): TEMP/RH 0751 WIND 0750

Wind direction is heading from which wind is blowing referenced to magnetic North.

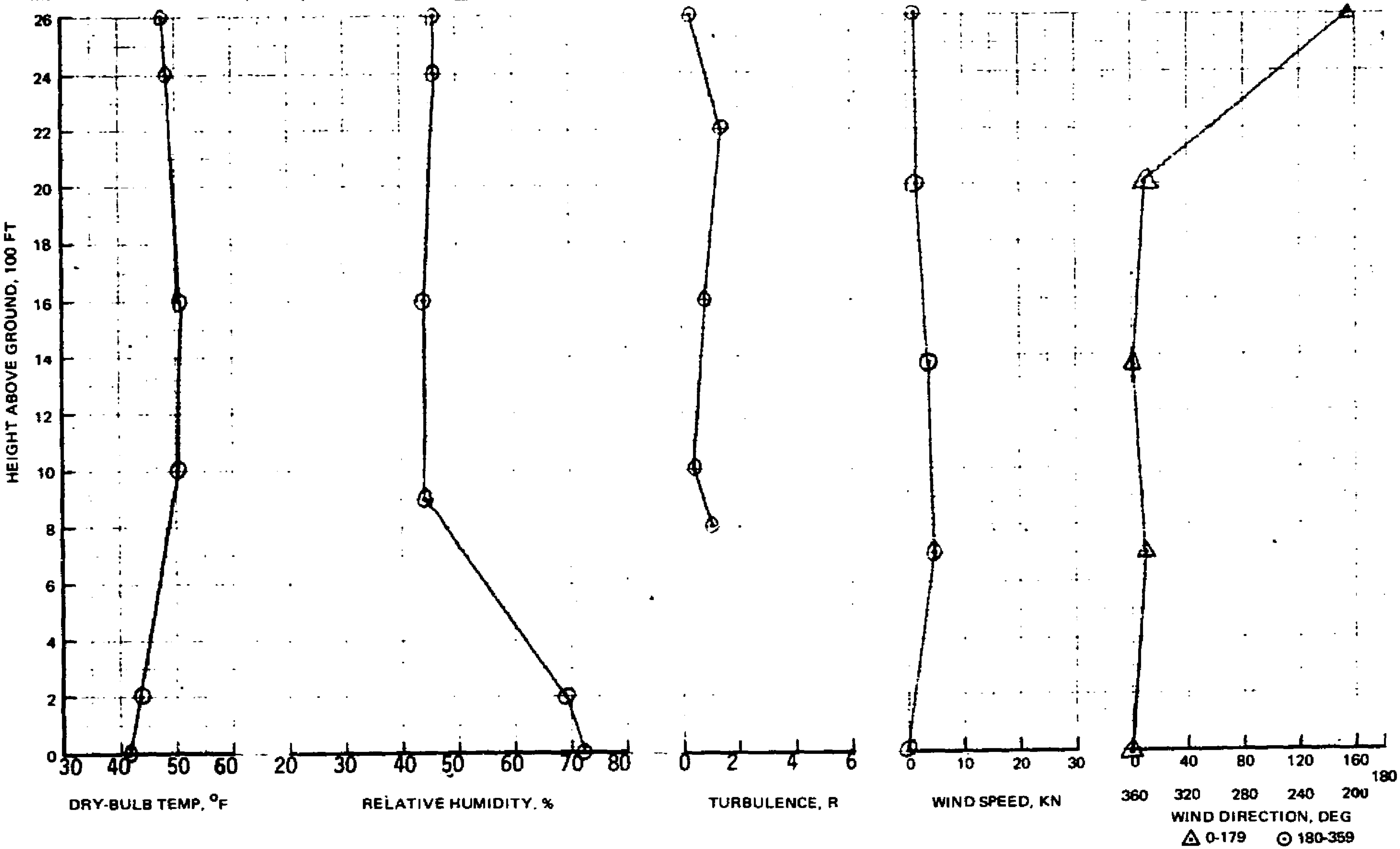


FIGURE B-2.30. SOUND-PATH WEATHER DURING FLYOVER NOISE TESTS (CONT)

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AIRPLANE MODEL DC-9-31 REG. NO. N54638 TEST SITE YUMA, ARIZONA

DATA SOURCE METEOROLOGY RESEARCH INC. DATE FEBRUARY 2, 1975

MEASUREMENT TIMES (PST): TEMP/RH 0929 WIND 0910

Wind direction is heading from which wind is blowing referenced to magnetic North.

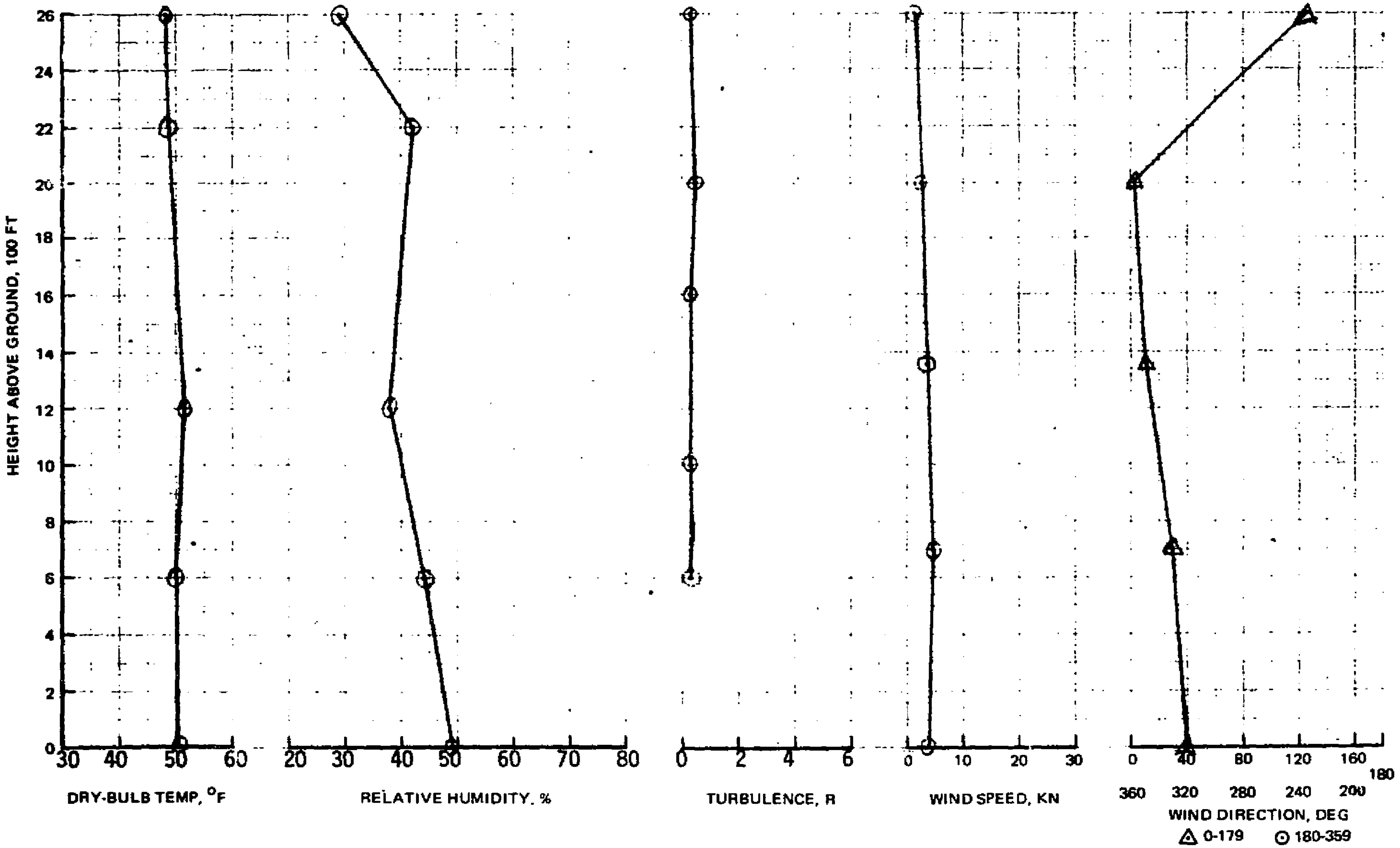

FIGURE B-2.31. SOUND-PATH WEATHER DURING FLYOVER NOISE TESTS (CONT)

AIRPLANE MODEL DC-9-31 REG. NO. N54638 TEST SITE YUMA, ARIZONA

DATA SOURCE METEOROLOGY RESEARCH INC. DATE FEBRUARY 2, 1975

MEASUREMENT TIMES (PST): TEMP/RH 0942 WIND 0950

Wind direction is heading from which wind is blowing referenced to magnetic North.

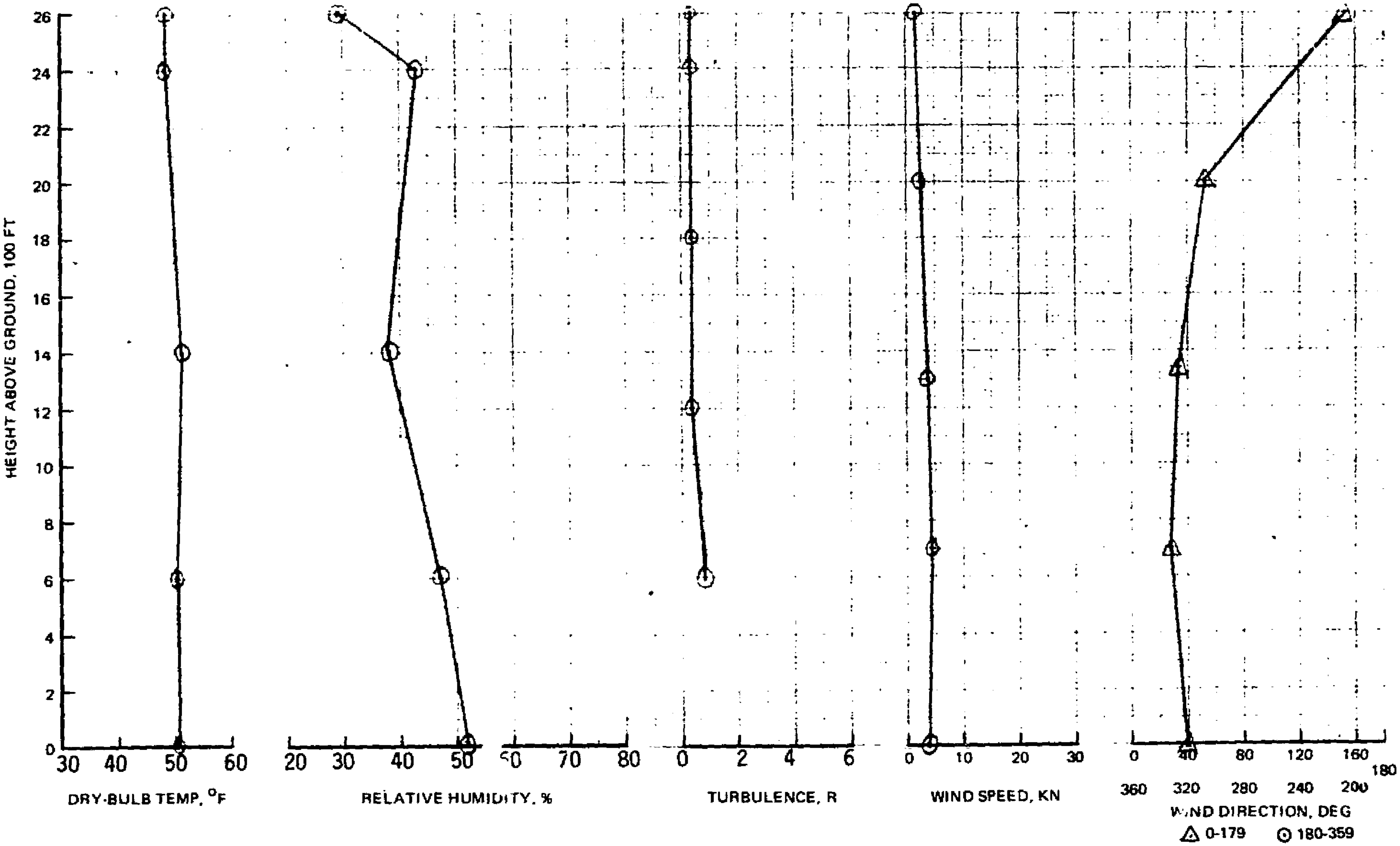

FIGURE B-2.32. SOUND-PATH WEATHER DURING FLYOVER NOISE TESTS (CONT)

AIRPLANE MODEL DC-9-31 REG. NO. N54638 TEST SITE YUMA, ARIZONA

DATA SOURCE METEOROLOGY RESEARCH INC. DATE FEBRUARY 2, 1975

MEASUREMENT TIMES (PST): TEMP/RH 1004 WIND 1020

Wind direction is heading from which wind is blowing referenced to magnetic North.

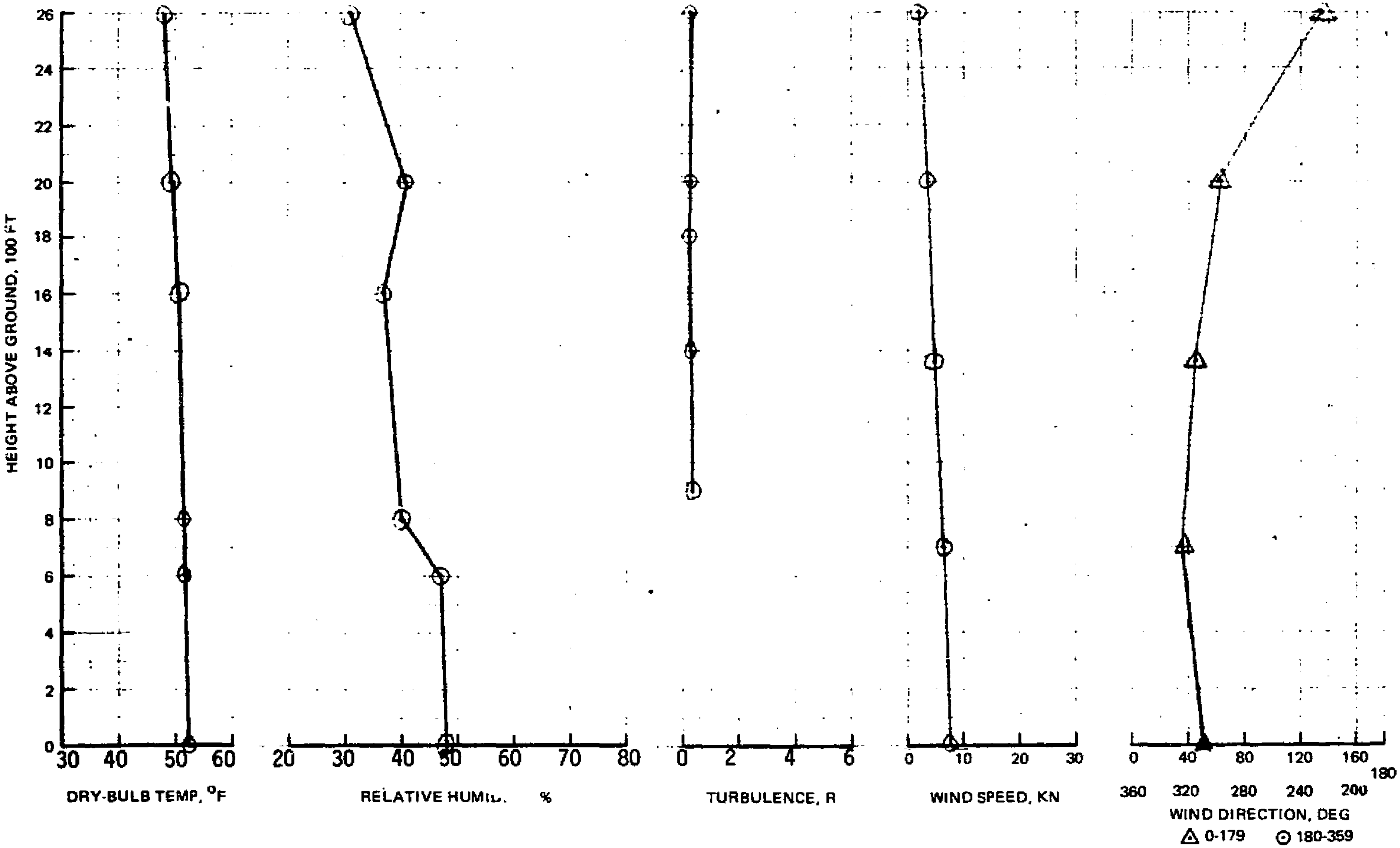

FIGURE B-2.33. SOUND-PATH WEATHER DURING FLYOVER NOISE TESTS (CONT)

AIRPLANE MODEL DC-9-31 REG. NO. N54638 TEST SITE YUMA, ARIZONA

DATA SOURCE METEOROLOGY RESEARCH INC. DATE FEBRUARY 2, 1975

MEASUREMENT TIMES (PST): TEMP/RH 1036 WIND 1020

Wind direction is heading from which wind is blowing referenced to magnetic North.

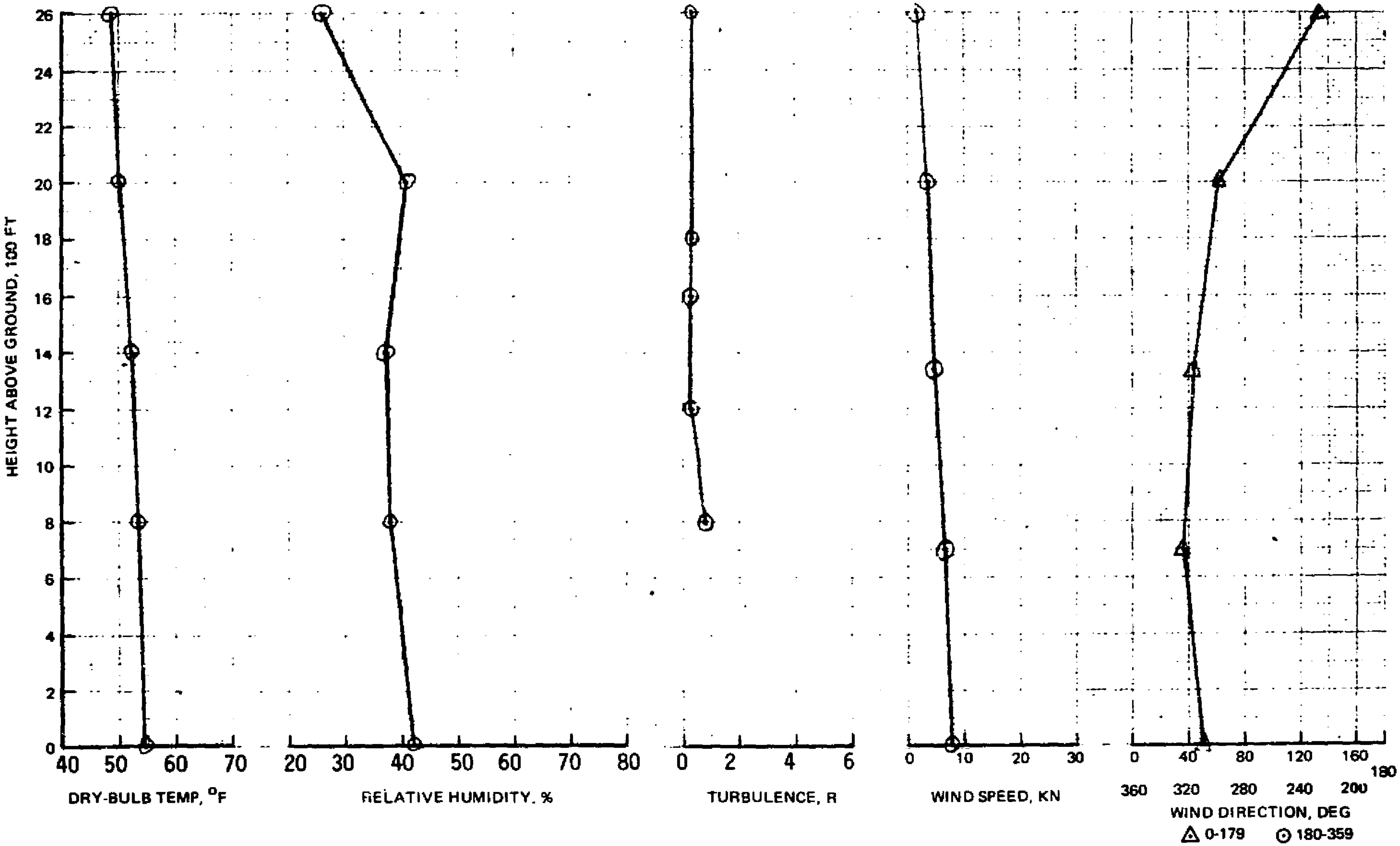

FIGURE B-2.34. SOUND-PATH WEATHER DURING FLYOVER NOISE TESTS (CONT).

AIRPLANE MODEL DC-9-31 REG. NO. N54638 TEST SITE YUMA, ARIZONA

DATA SOURCE METEOROLOGY RESEARCH INC. DATE FEBRUARY 2, 1975

MEASUREMENT TIMES (PST): TEMP/RH 1103 WIND 1100

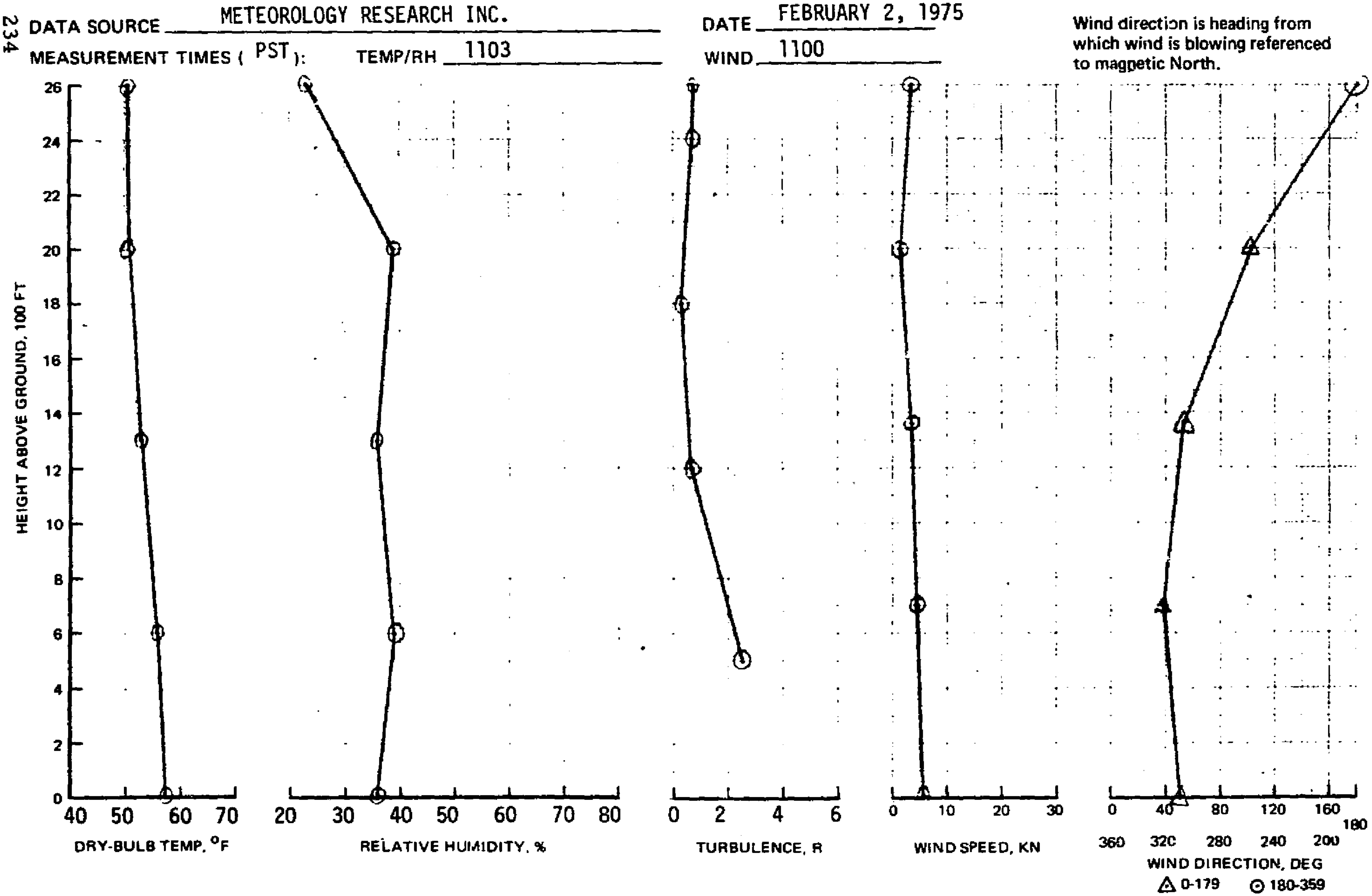

FIGURE B-2.35. SOUND-PATH WEATHER DURING FLYOVER NOISE TESTS (CONT)

AIRPLANE MODEL DC-9-31 REG. NO. N54638 TEST SITE YUMA, ARIZONA

DATA SOURCE METEOROLOGY RESEARCH INC. DATE FEBRUARY 3, 1975

MEASUREMENT TIMES (PST): TEMP/RH 0753 WIND 0800

Wind direction is heading from which wind is blowing referenced to magnetic North.

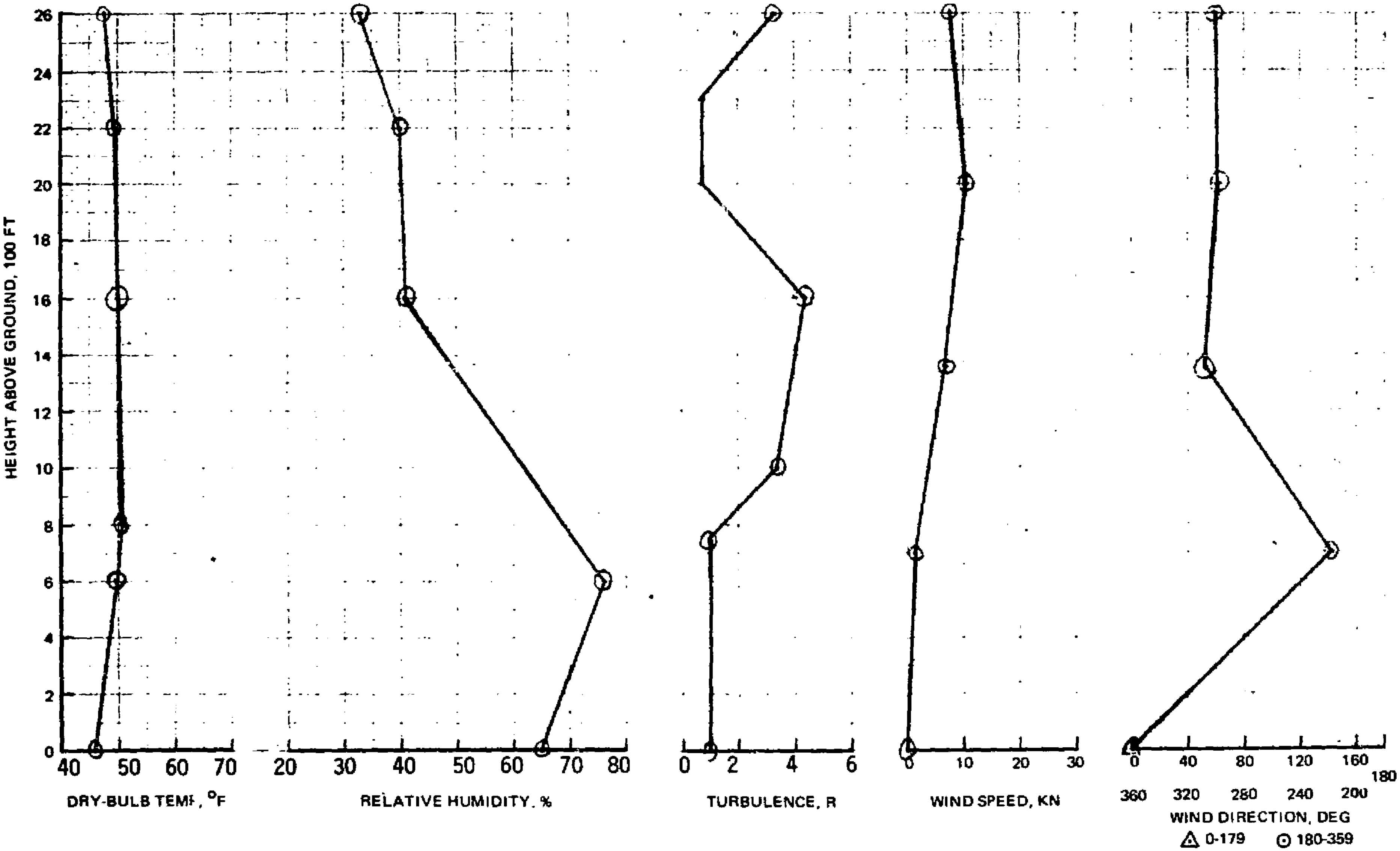

FIGURE B-2.36. SOUND-PATH WEATHER DURING FLYOVER NOISE TESTS (CONT)

AIRPLANE MODEL DC-9-31 REG. NO. N54638 TEST SITE YUMA, ARIZONA

DATA SOURCE METEOROLOGY RESEARCH INC. DATE FEBRUARY 3, 1975

MEASUREMENT TIMES (PST): TEMP/RH 0917 WIND 0915

Wind direction is heading from which wind is blowing referenced to magnetic North.

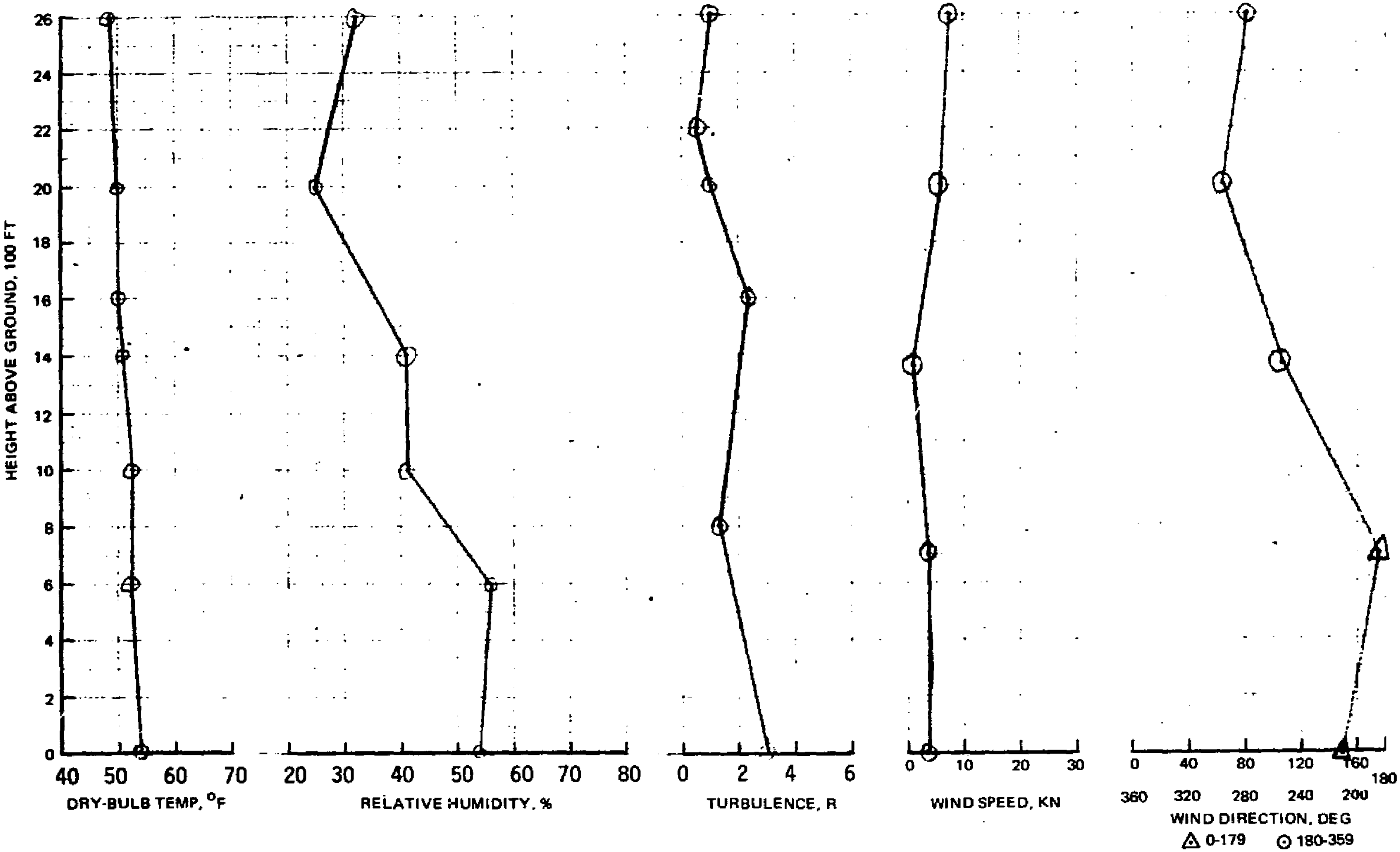

FIGURE B-2.37. SOUND-PATH WEATHER DURING FLYOVER NOISE TESTS (CONT)

AIRPLANE MODEL DC-9-31 REG. NO. N54638 TEST SITE YUMA, ARIZONA

DATA SOURCE METEOROLOGY RESEARCH INC. DATE FEBRUARY 3, 1975

MEASUREMENT TIMES (PST): TEMP/RH 0934 WIND 0945

Wind direction is heading from which wind is blowing referenced to magnetic North.

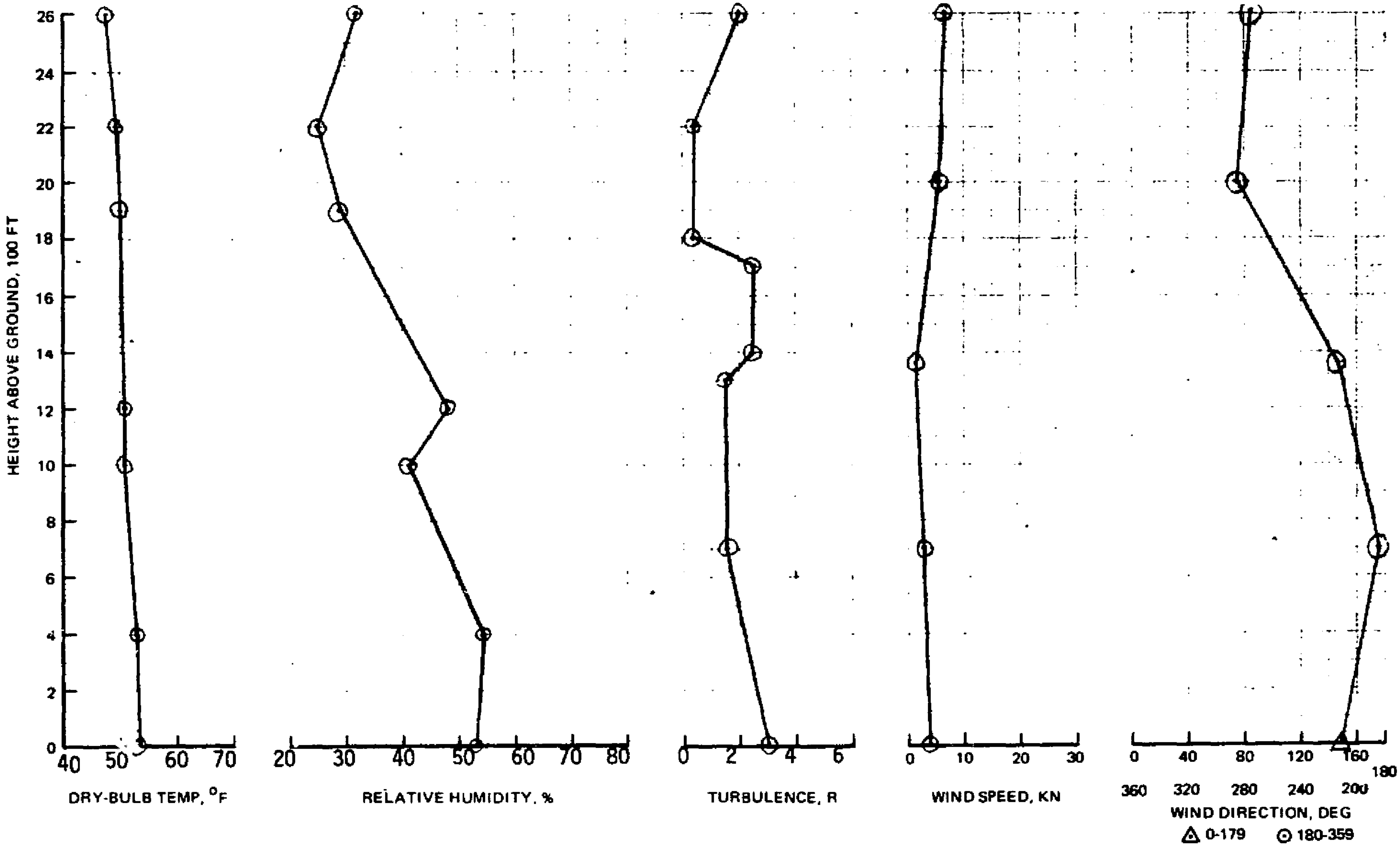

FIGURE B-2.38. SOUND-PATH WEATHER DURING FLYOVER NOISE TESTS (CONT)

AIRPLANE MODEL DC-9-31 REG. NO. N54638 TEST SITE YUMA, ARIZONA

DATA SOURCE METEOROLOGY RESEARCH INC. DATE FEBRUARY 3, 1975

MEASUREMENT TIMES (PST): TEMP/RH 1051 WIND 1115

Wind direction is heading from which wind is blowing referenced to magnetic North.

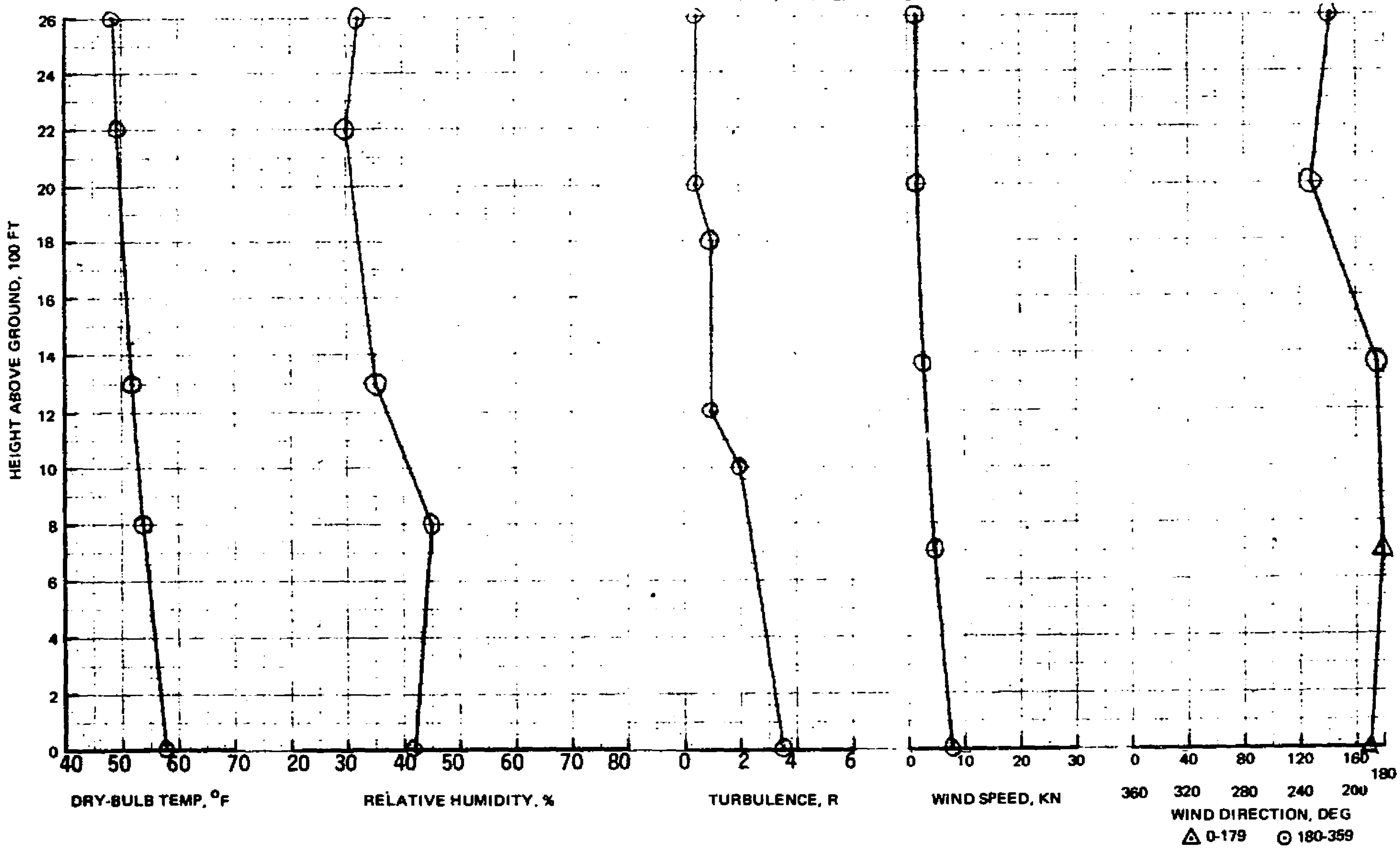

FIGURE B-2.39. SOUND-PATH WEATHER DURING FLYOVER NOISE TESTS (CONT)

AIRPLANE MODEL DC-9-31 REG. NO. N54638 TEST SITE YUMA, ARIZONA

DATA SOURCE METEOROLOGY RESEARCH INC. DATE FEBRUARY 3, 1975

MEASUREMENT TIMES (PST): TEMP/RH 1122 WIND 1115

Wind direction is heading from which wind is blowing referenced to magnetic North.

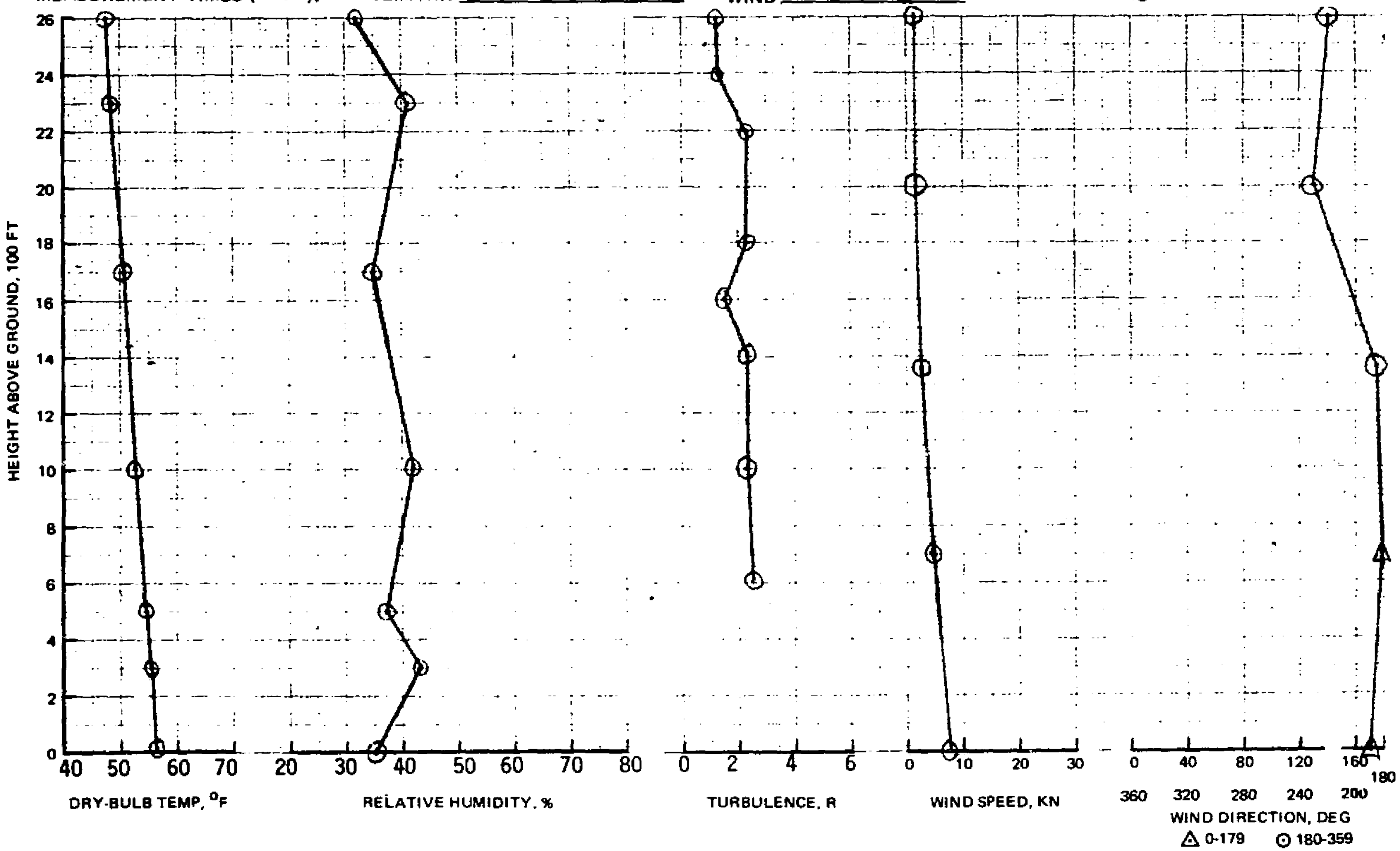

FIGURE B-2.40. SOUND-PATH WEATHER DURING FLYOVER NOISE TESTS (CONT)

AIRPLANE MODEL DC-9-31 REG. NO. N54638 TEST SITE YUMA, ARIZONA

DATA SOURCE METEOROLOGY RESEARCH INC. DATE FEBRUARY 3, 1975

MEASUREMENT TIMES (PST): TEMP/RH 1143 WIND 1145

Wind direction is heading from which wind is blowing referenced to magnetic North.

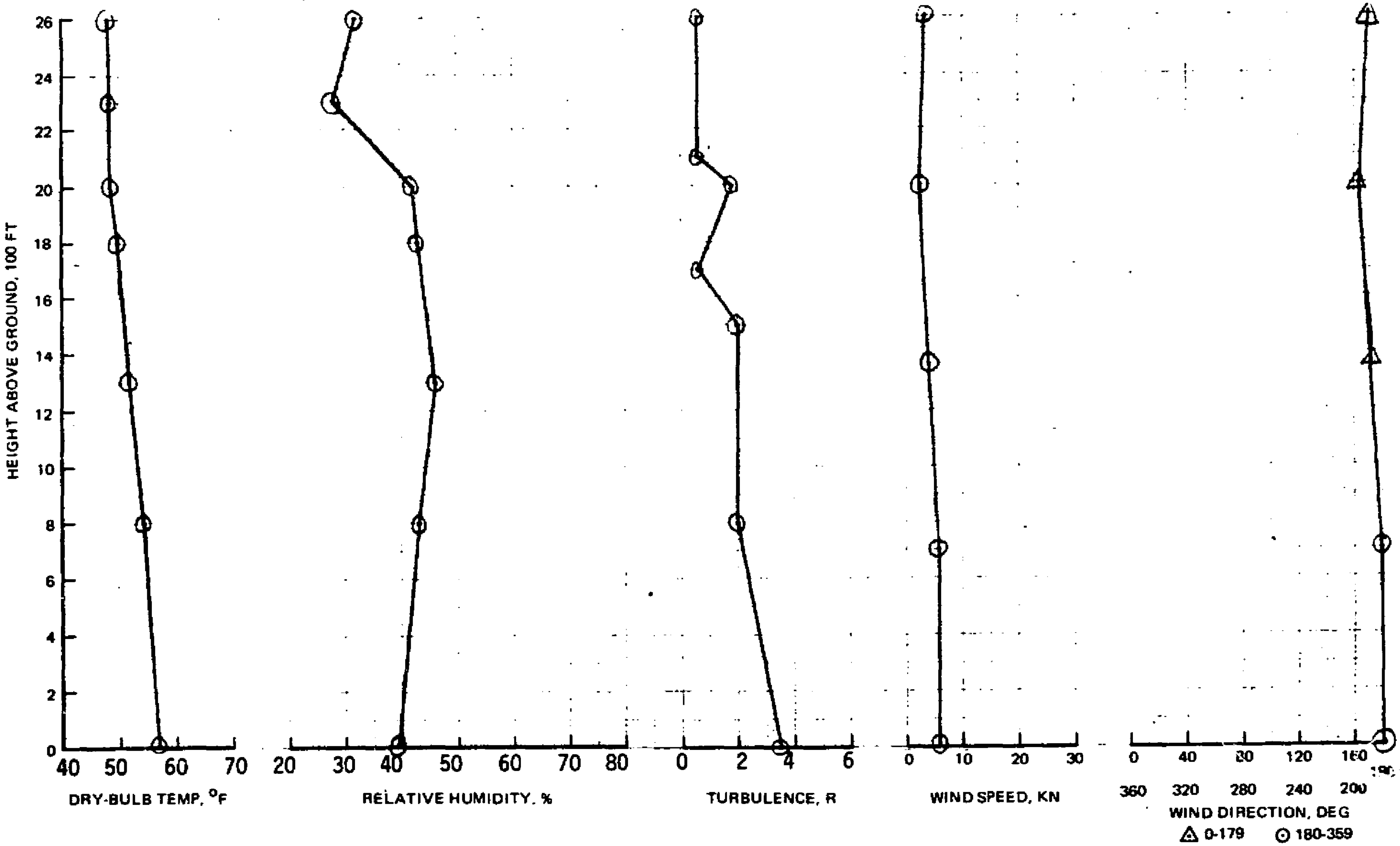

FIGURE B-2.41. SOUND-PATH WEATHER DURING FLYOVER NOISE TESTS (CONT)

AIRPLANE MODEL DC-9-31 REG. NO. N54638 TEST SITE YUMA, ARIZONA

DATA SOURCE METEOROLOGY RESEARCH INC. DATE FEBRUARY 3, 1975

MEASUREMENT TIMES (PST): TEMP/RH 1219 WIND 1215

Wind direction is heading from which wind is blowing referenced to magnetic North.

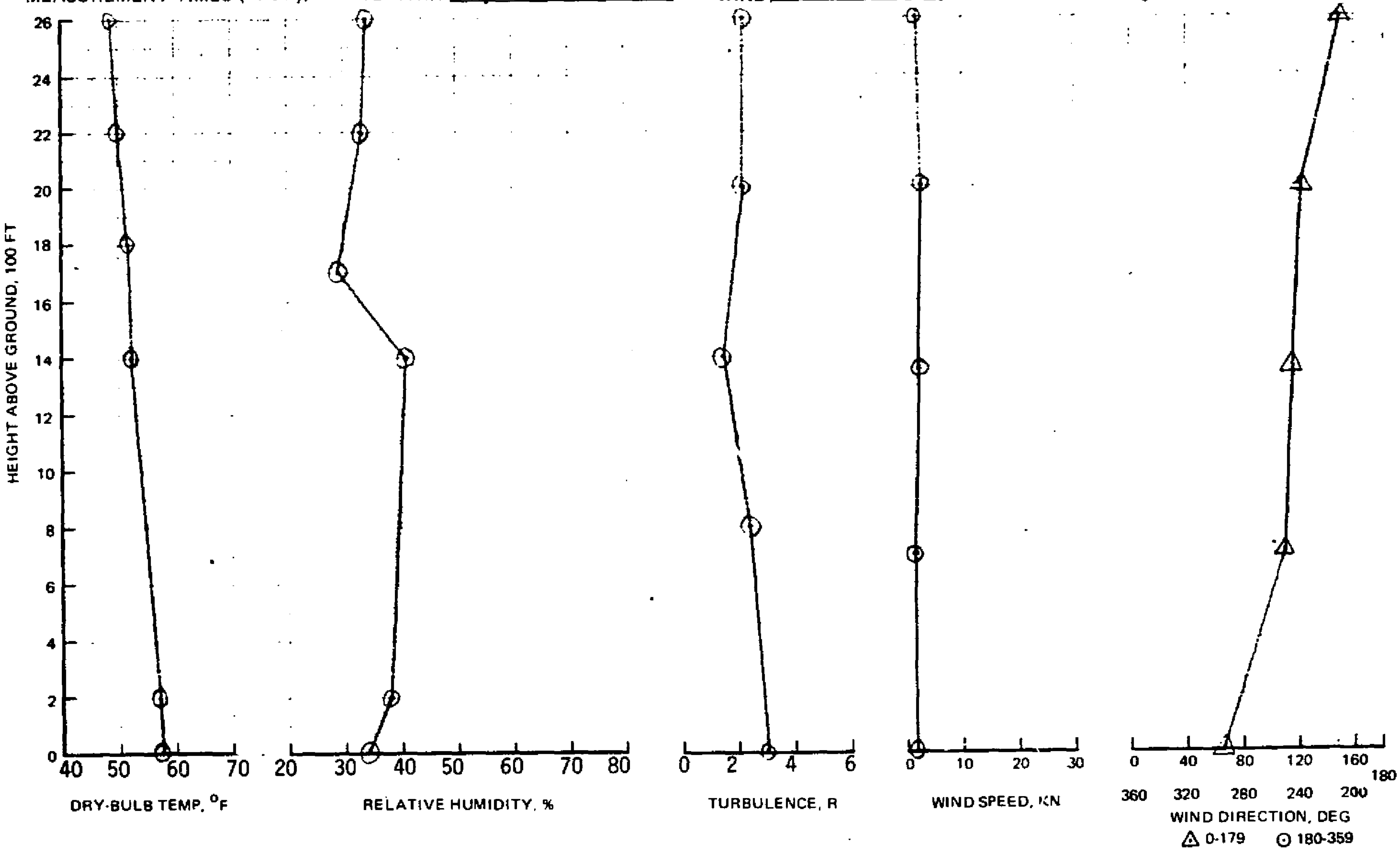

FIGURE B-2.42. SOUND-PATH WEATHER DURING FLYOVER NOISE TESTS (CONT)

AIRPLANE MODEL DC-9-31 REG. NO. N54638 TEST SITE YUMA, ARIZONA

DATA SOURCE METEOROLOGY RESEARCH INC. DATE FEBRUARY 3, 1975

MEASUREMENT TIMES (PST): TEMP/RH 1407 WIND 1405

Wind direction is heading from which wind is blowing referenced to magnetic North.

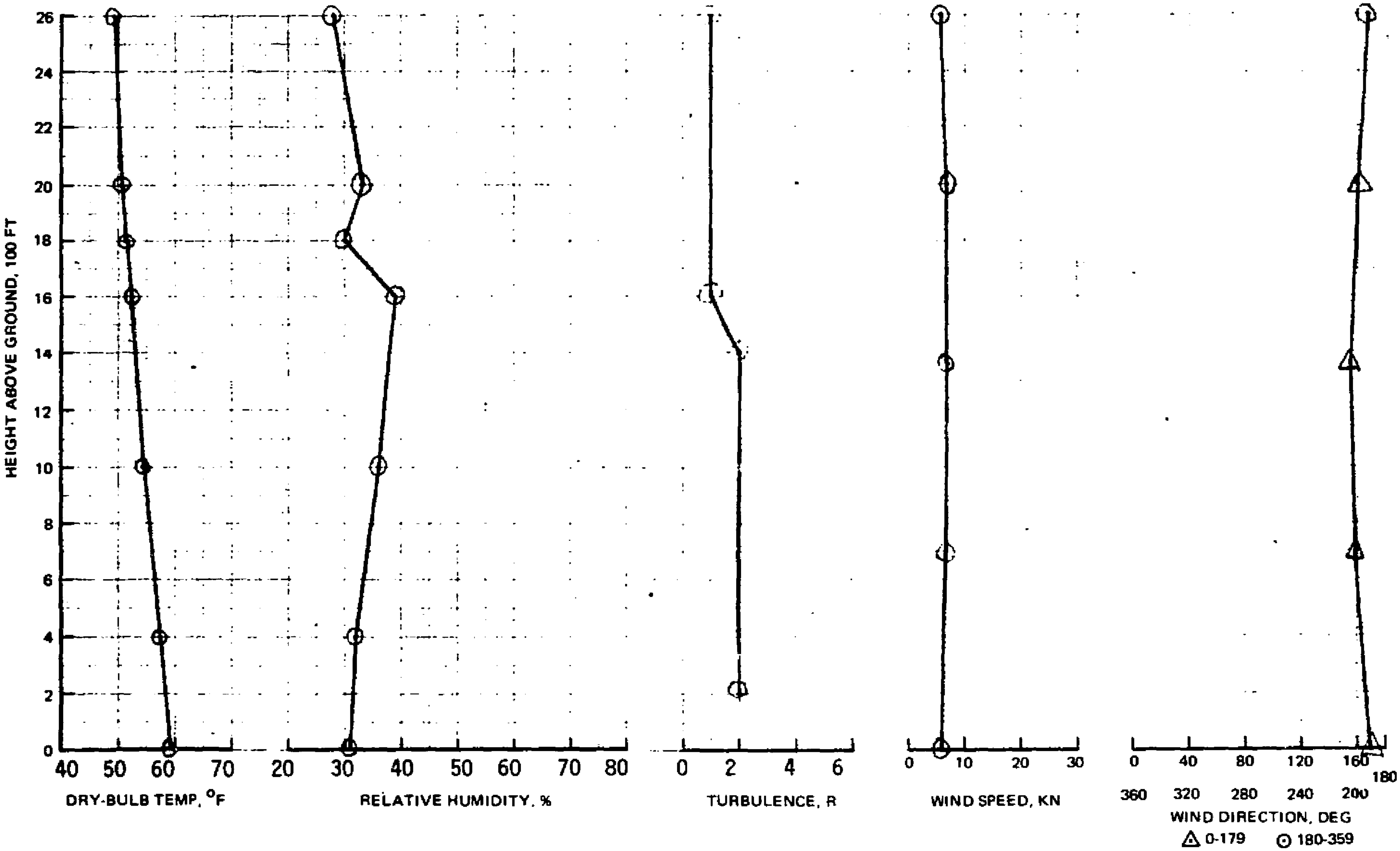

FIGURE B-2.43. SOUND-PATH WEATHER DURING FLYOVER NOISE TESTS (CONT)

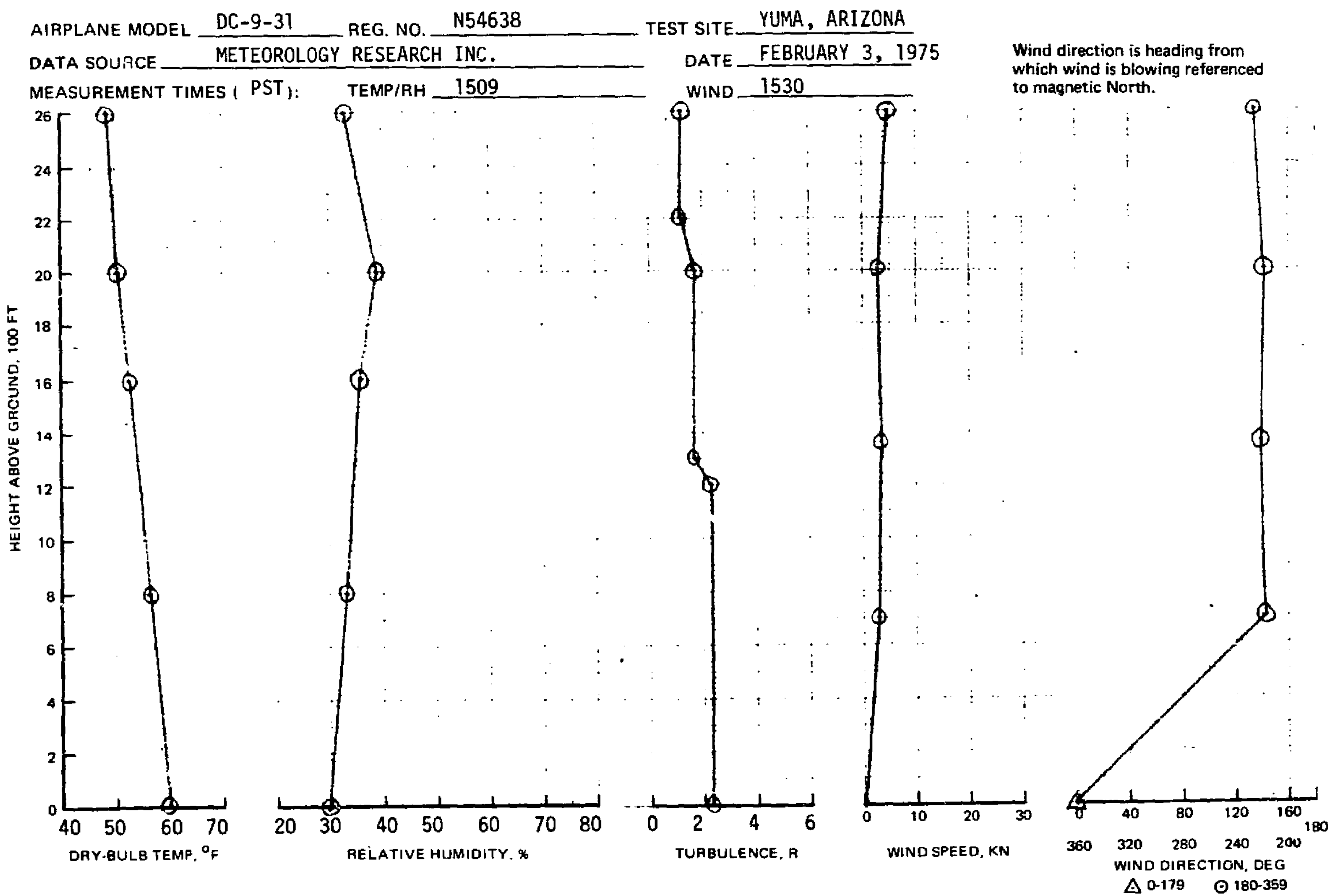

FIGURE B-2.44. SOUND-PATH WEATHER DURING FLYOVER NOISE TESTS (CONT)

AIRPLANE MODEL DC-9-31 REG. NO. N54638 TEST SITE YUMA, ARIZONA

DATA SOURCE METEOROLOGY RESEARCH INC. DATE FEBRUARY 3, 1975

MEASUREMENT TIMES (PST): TEMP/RH 1528 WIND 1530

Wind direction is heading from which wind is blowing referenced to magnetic North.

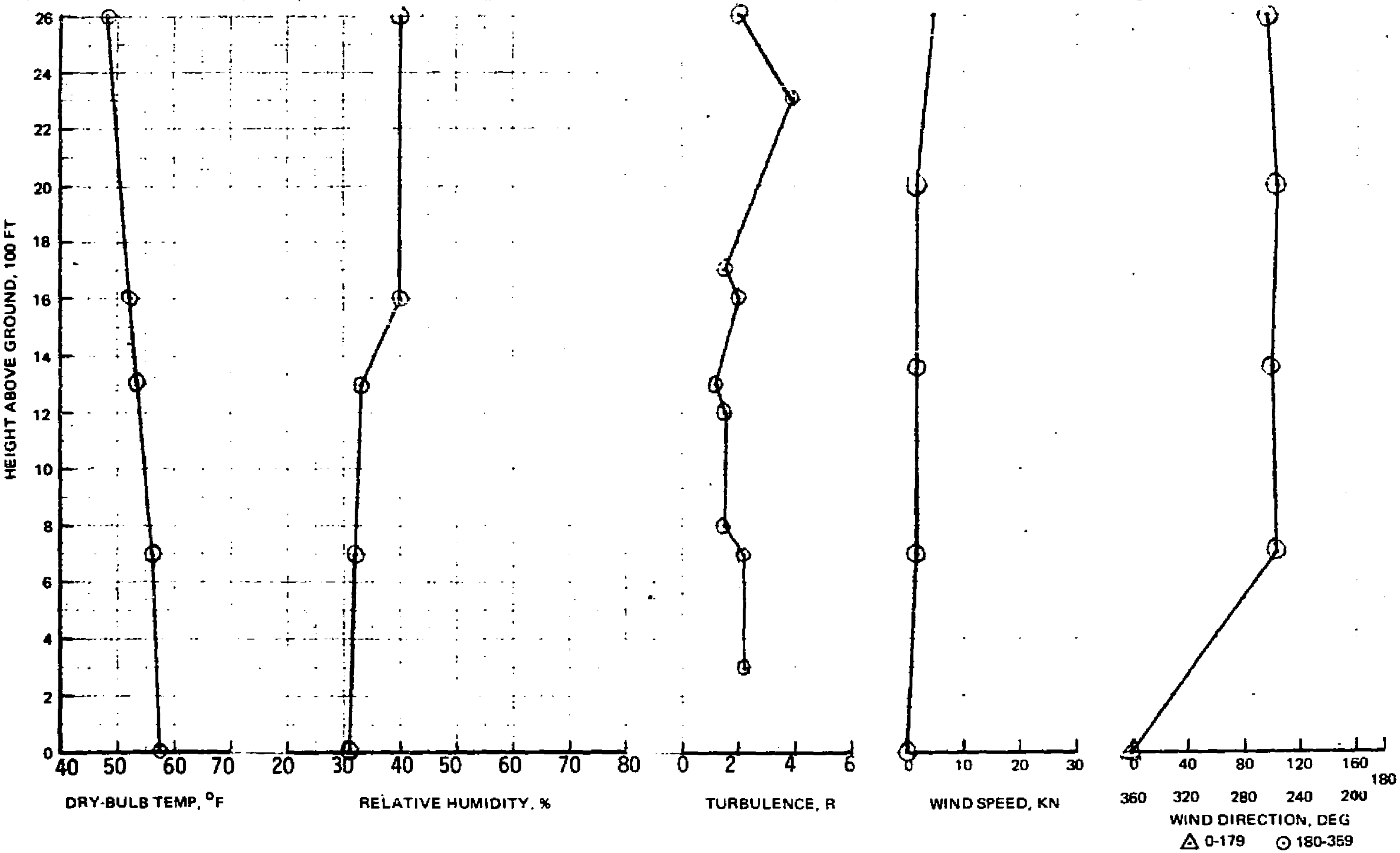

FIGURE B-2.45. SOUND-PATH WEATHER DURING FLYOVER NOISE TESTS (CONT)

AIRPLANE MODEL DC-9-31 REG. NO. N54638 TEST SITE YUMA, ARIZONA

DATA SOURCE METEOROLOGY RESEARCH INC. DATE FEBRUARY 3, 1975

MEASUREMENT TIMES (PST): TEMP/RH 1548 WIND 1530

Wind direction is heading from which wind is blowing referenced to magnetic North.

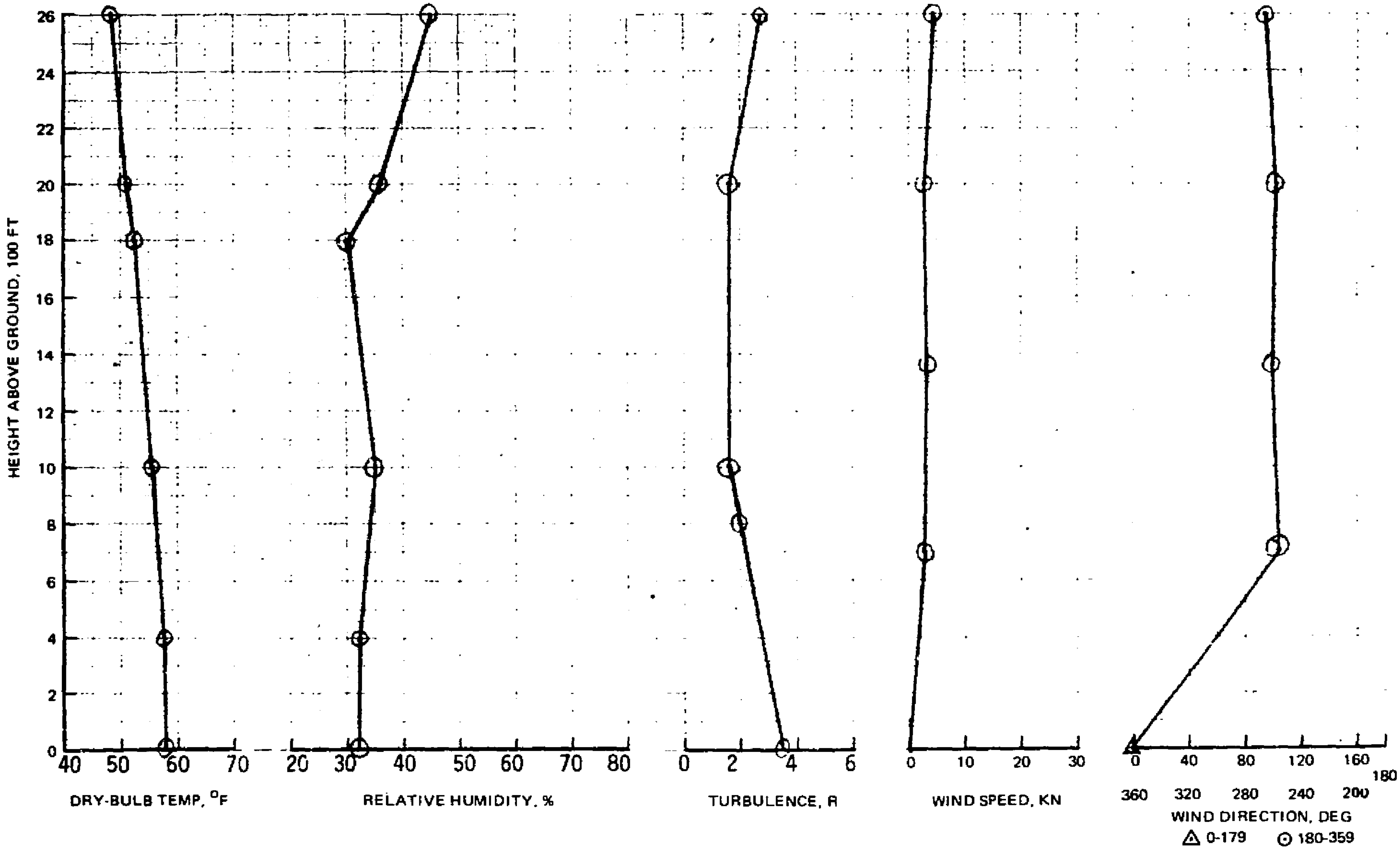

FIGURE B-2.46. SOUND-PATH WEATHER DURING FLYOVER NOISE TESTS (CONT)

AIRPLANE MODEL DC-9-31 REG. NO. N54638 TEST SITE YUMA, ARIZONA

DATA SOURCE METEOROLOGY RESEARCH INC. DATE FEBRUARY 4, 1975

MEASUREMENT TIMES (PST): TEMP/RH 0732 WIND 0730

Wind direction is heading from which wind is blowing referenced to magnetic North.

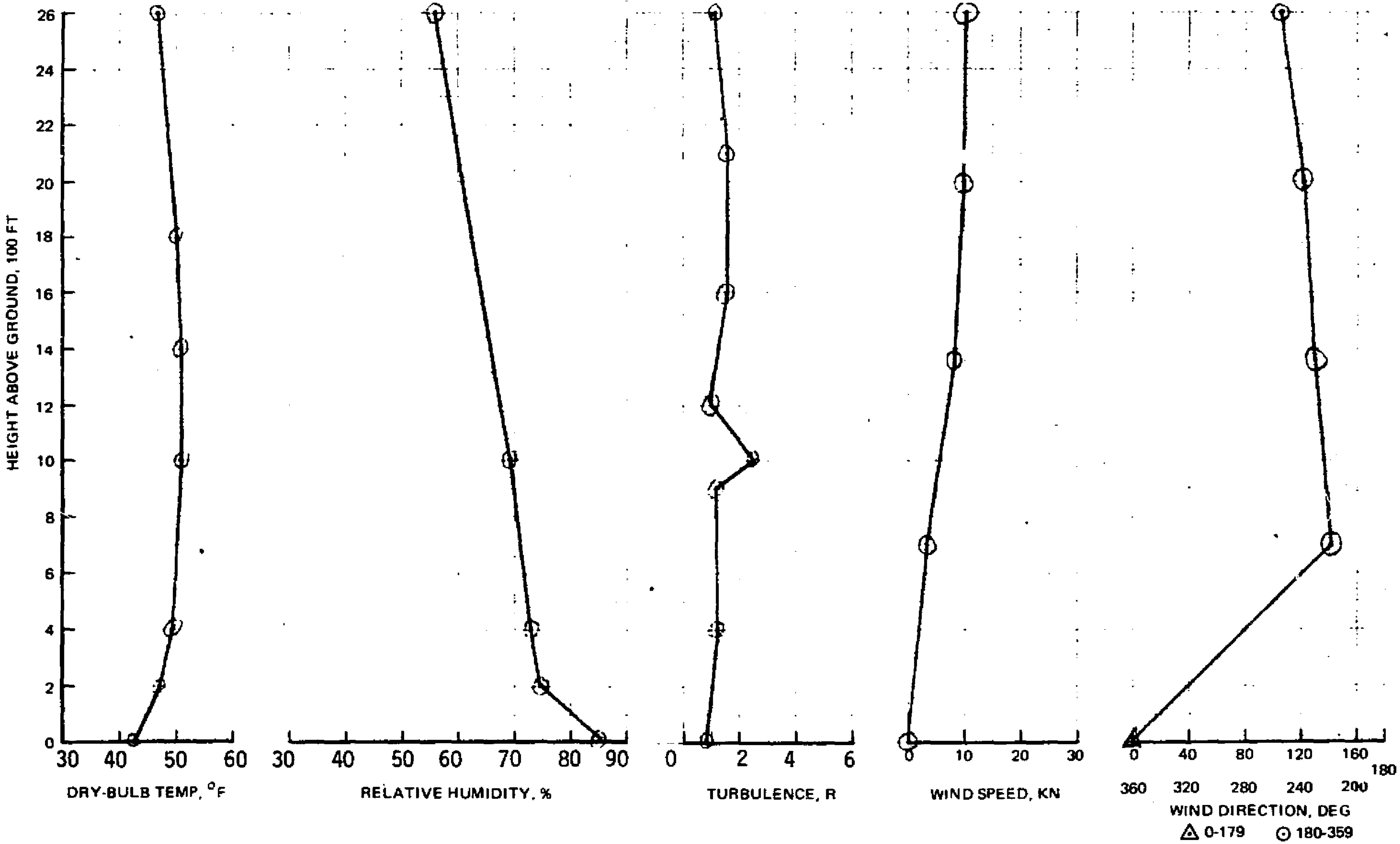

FIGURE B-2.47. SOUND-PATH WEATHER DURING FLYOVER NOISE TESTS (CONT)

AIRPLANE MODEL DC-9-31 REG. NO. N54638 TEST SITE YUMA, ARIZONA

DATA SOURCE METEOROLOGY RESEARCH INC. DATE FEBRUARY 5, 1975

MEASUREMENT TIMES (PST): TEMP/RH 0726 WIND 0725

Wind direction is heading from which wind is blowing referenced to magnetic North.

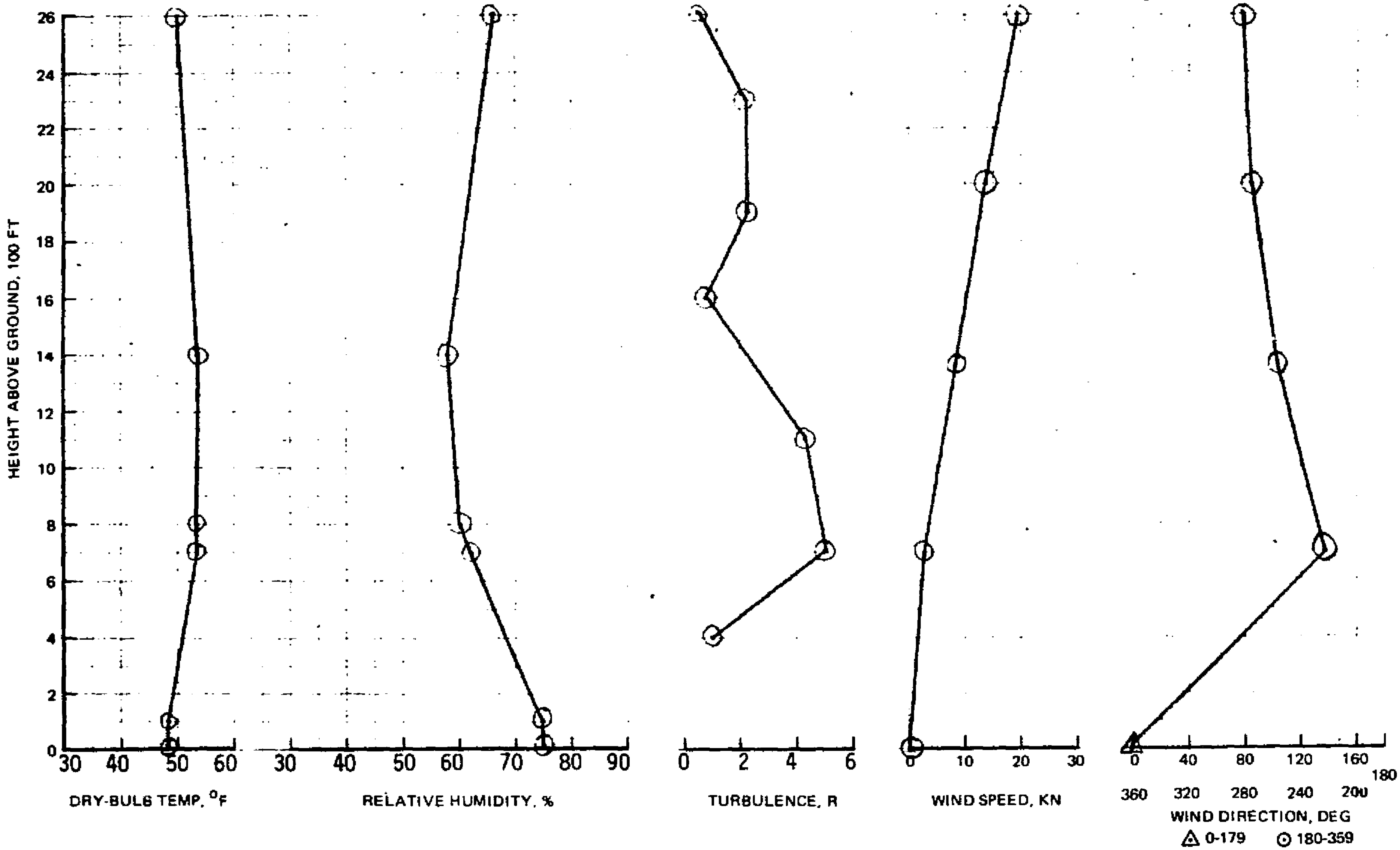

FIGURE B-2.48. SOUND-PATH WEATHER DURING FLYOVER NOISE TESTS (CONT)

AIRPLANE MODEL DC-9-31 REG. NO. N54638 TEST SITE YUMA, ARIZONA

DATA SOURCE METEOROLOGY RESEARCH INC. DATE FEBRUARY 5, 1975

MEASUREMENT TIMES (PST): TEMP/RH 0844 WIND 0845

Wind direction is heading from which wind is blowing referenced to magnetic North.

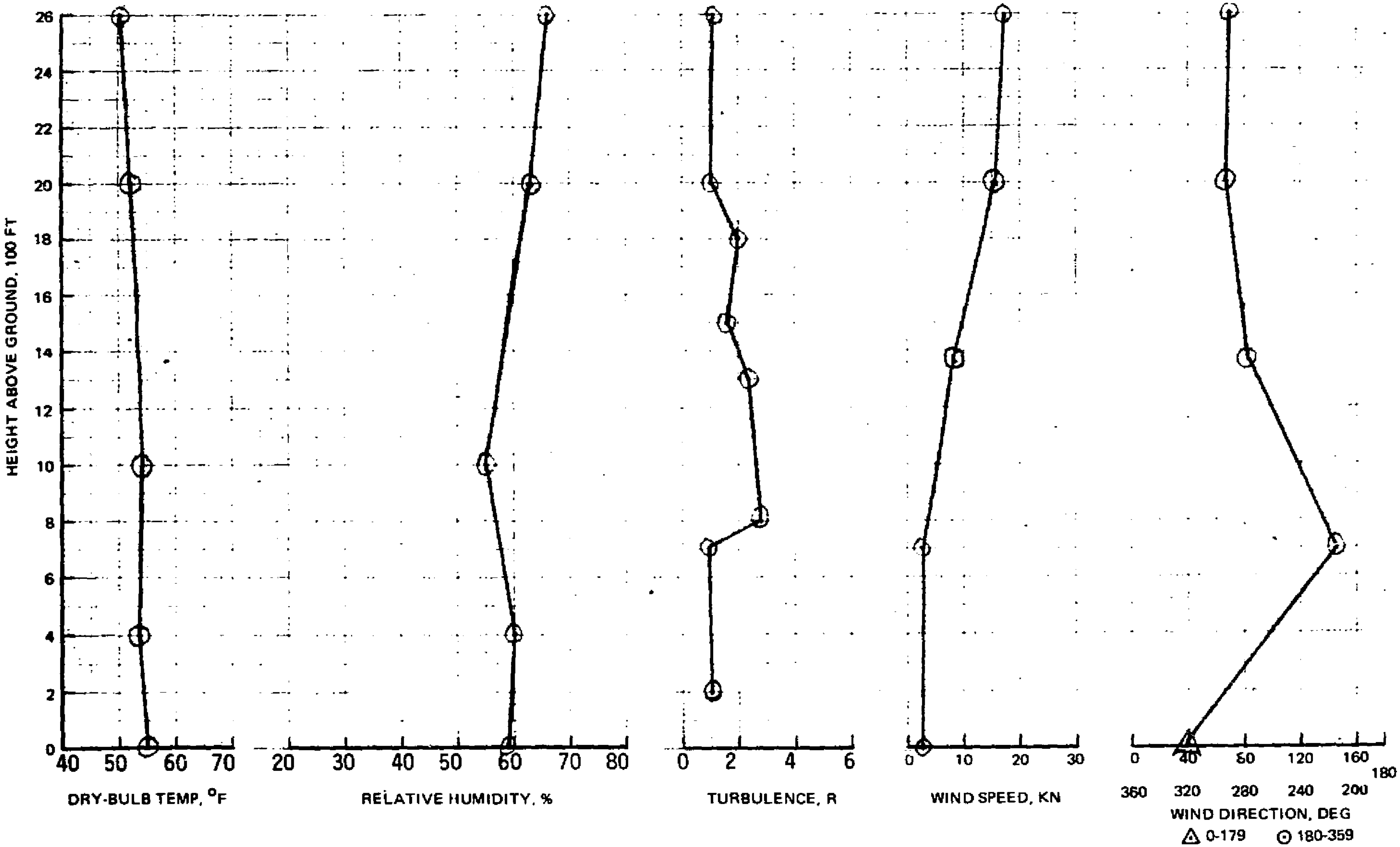

FIGURE B-2.49. SOUND-PATH WEATHER DURING FLYOVER NOISE TESTS (CONT)

AIRPLANE MODEL DC-9-31 REG. NO. N54638 TEST SITE YUMA, ARIZONA

DATA SOURCE METEOROLOGY RESEARCH INC. DATE FEBRUARY 5, 1975

MEASUREMENT TIMES (PST): TEMP/RH 0852 WIND 0845

Wind direction is heading from which wind is blowing referenced to magnetic North.

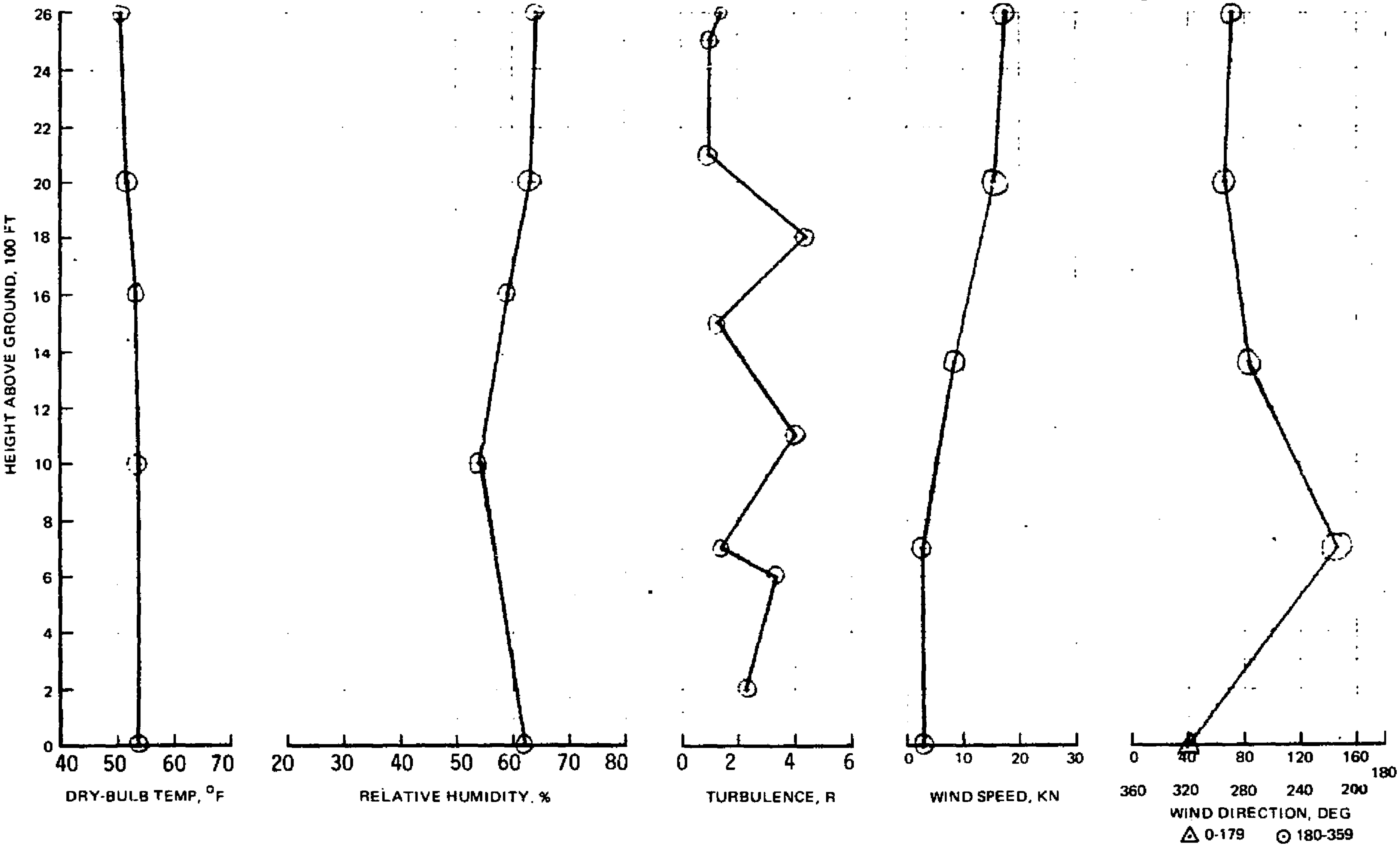

FIGURE B-2.50. SOUND-PATH WEATHER DURING FLYOVER NOISE TESTS (CONT)

AIRPLANE MODEL DC-9-31 REG. NO. N54638 TEST SITE YUMA, ARIZONA

DATA SOURCE METEOROLOGY RESEARCH INC. DATE FEBRUARY 5, 1975

MEASUREMENT TIMES (PST): TEMP/RH 0919 WIND 0915

Wind direction is heading from which wind is blowing referenced to magnetic North.

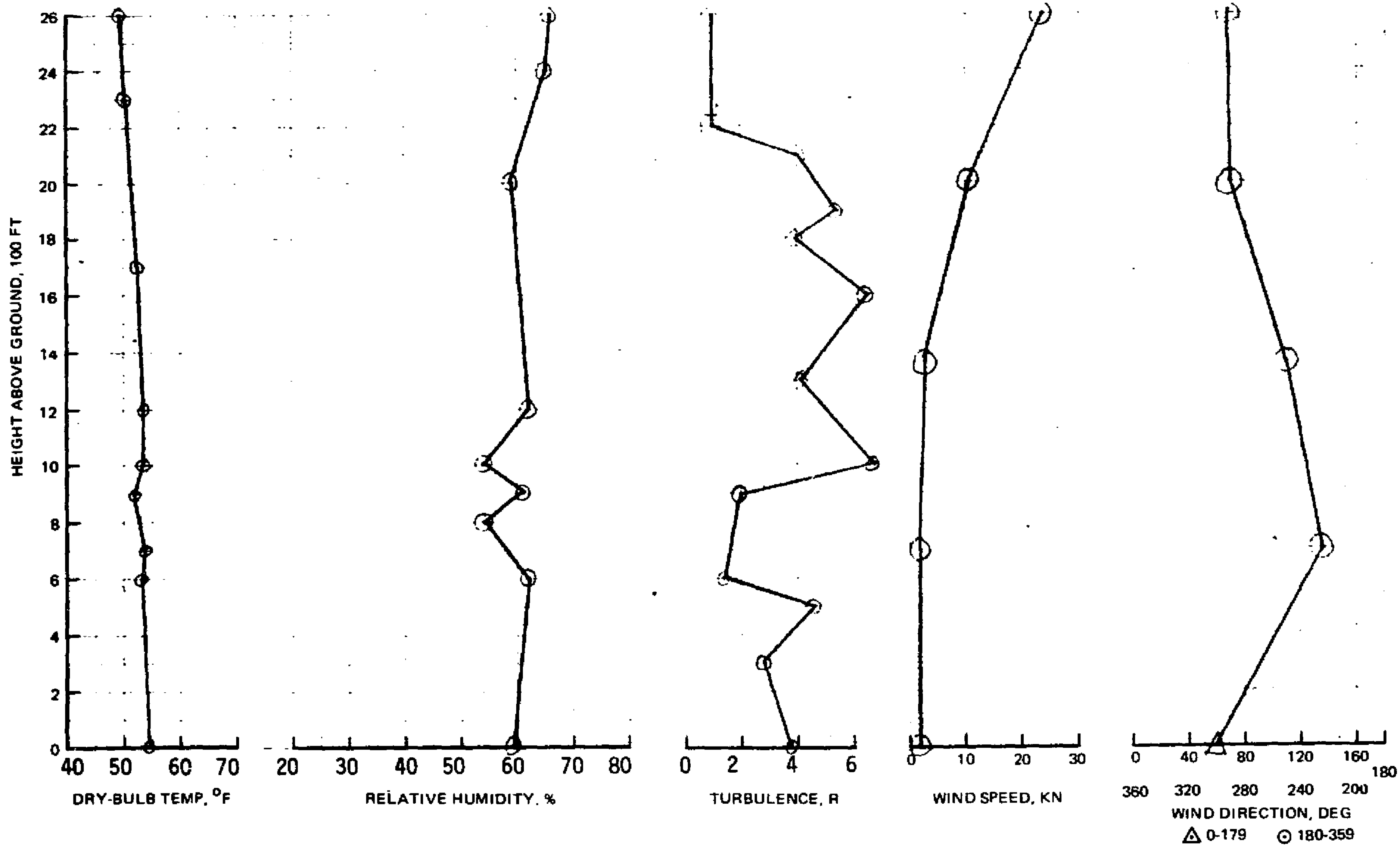

FIGURE B-2.51. SOUND-PATH WEATHER DURING FLYOVER NOISE TESTS (CONT)

AIRPLANE MODEL DC-9-31 REG. NO. N54638 TEST SITE YUMA, ARIZONA

DATA SOURCE METEOROLOGY RESEARCH INC. DATE FEBRUARY 5, 1975

MEASUREMENT TIMES (PST): TEMP/RH 0946 WIND 0945

Wind direction is heading from which wind is blowing referenced to magnetic North.

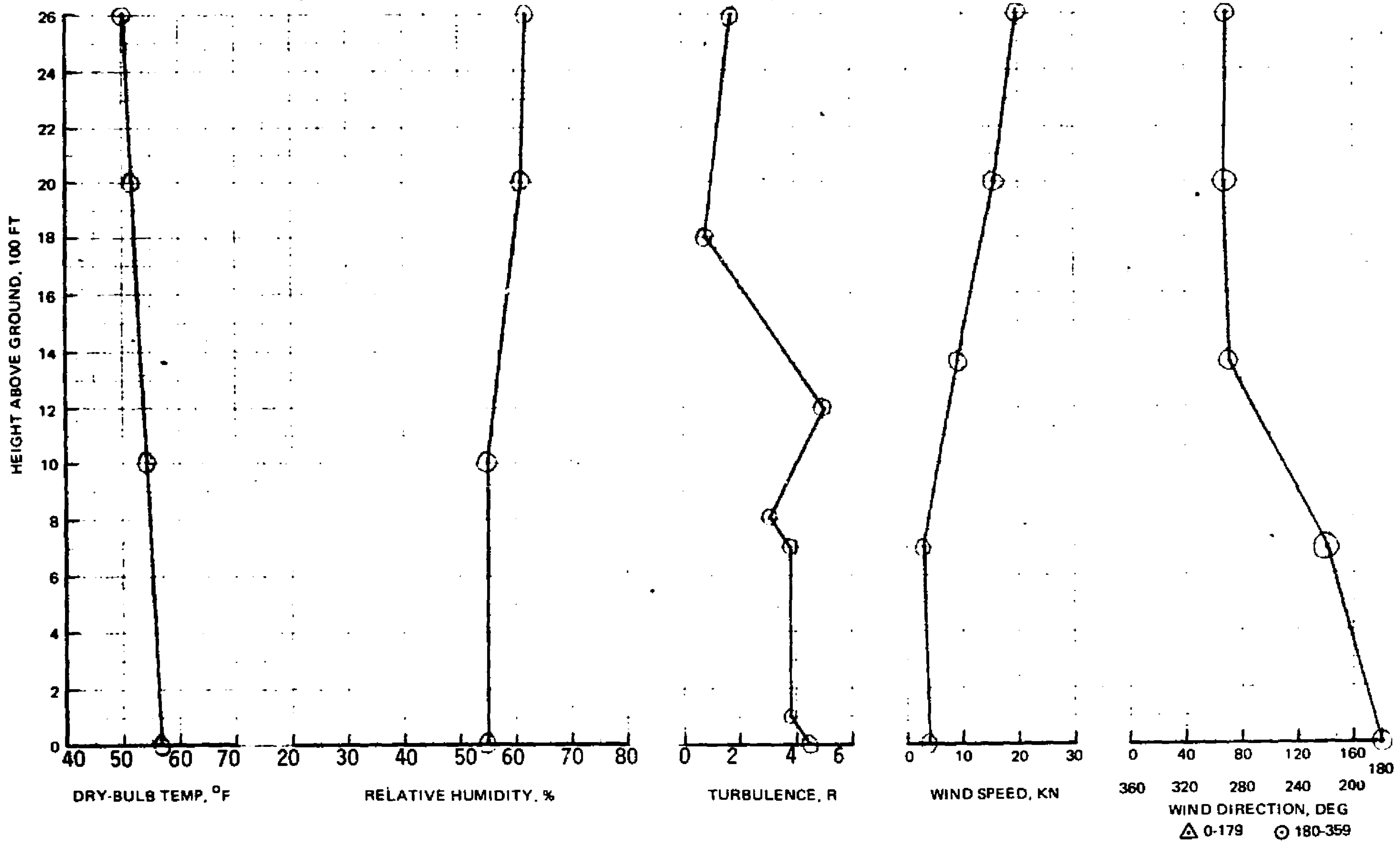

FIGURE B-2.52. SOUND-PATH WEATHER DURING FLYOVER NOISE TESTS (CONT)

AIRPLANE MODEL DC-9-31 REG. NO. N54638 TEST SITE YUMA, ARIZONA

DATA SOURCE METEOROLOGY RESEARCH INC. DATE FEBRUARY 5, 1975

MEASUREMENT TIMES (PST): TEMP/RH 1031 WIND 1015

Wind direction is heading from which wind is blowing referenced to magnetic North.

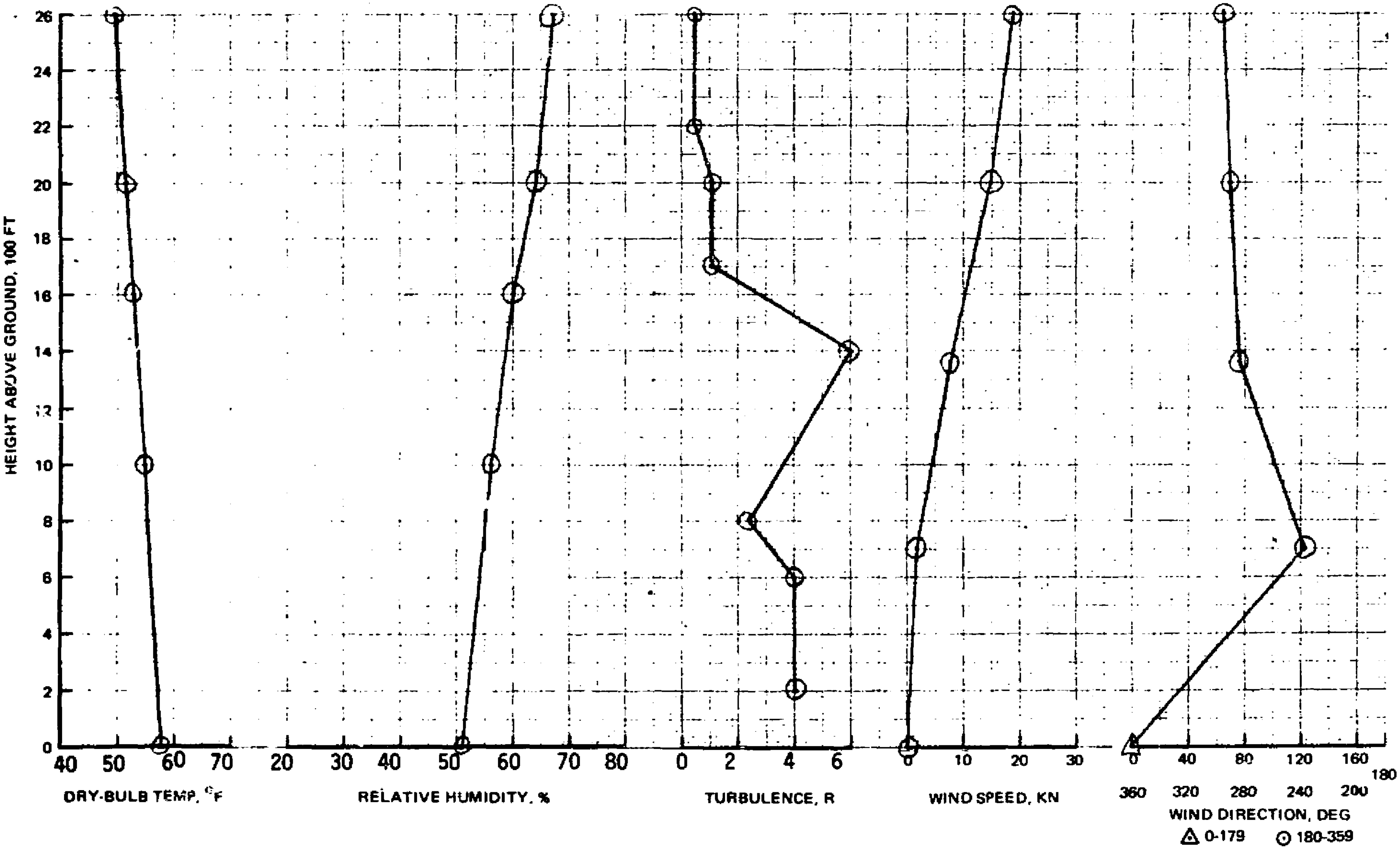

FIGURE B-2.53. SOUND-PATH WEATHER DURING FLYOVER NOISE TESTS (CONT)

AIRPLANE MODEL DC-9-51 REG. NO. N54638 TEST SITE YUMA, ARIZONA

DATA SOURCE METEOROLOGY RESEARCH INC. DATE FEBRUARY 5, 1975

MEASUREMENT TIMES (PST): TEMP/RH 1051 WIND 1045

Wind direction is heading from which wind is blowing referenced to magnetic North.

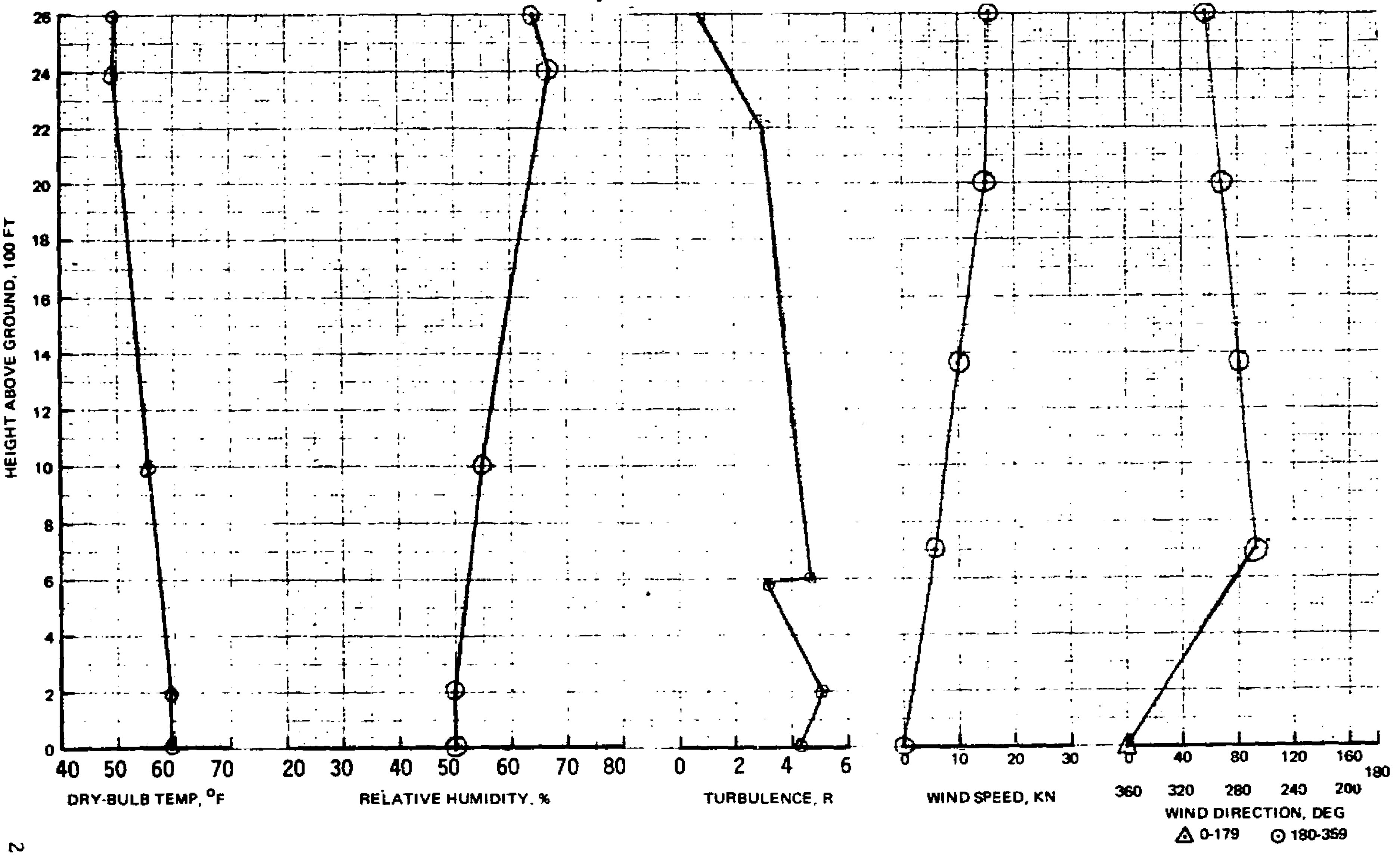

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FIGURE B-2.54. SOUND-PATH WEATHER DURING FLYOVER NOISE TESTS (CONT)

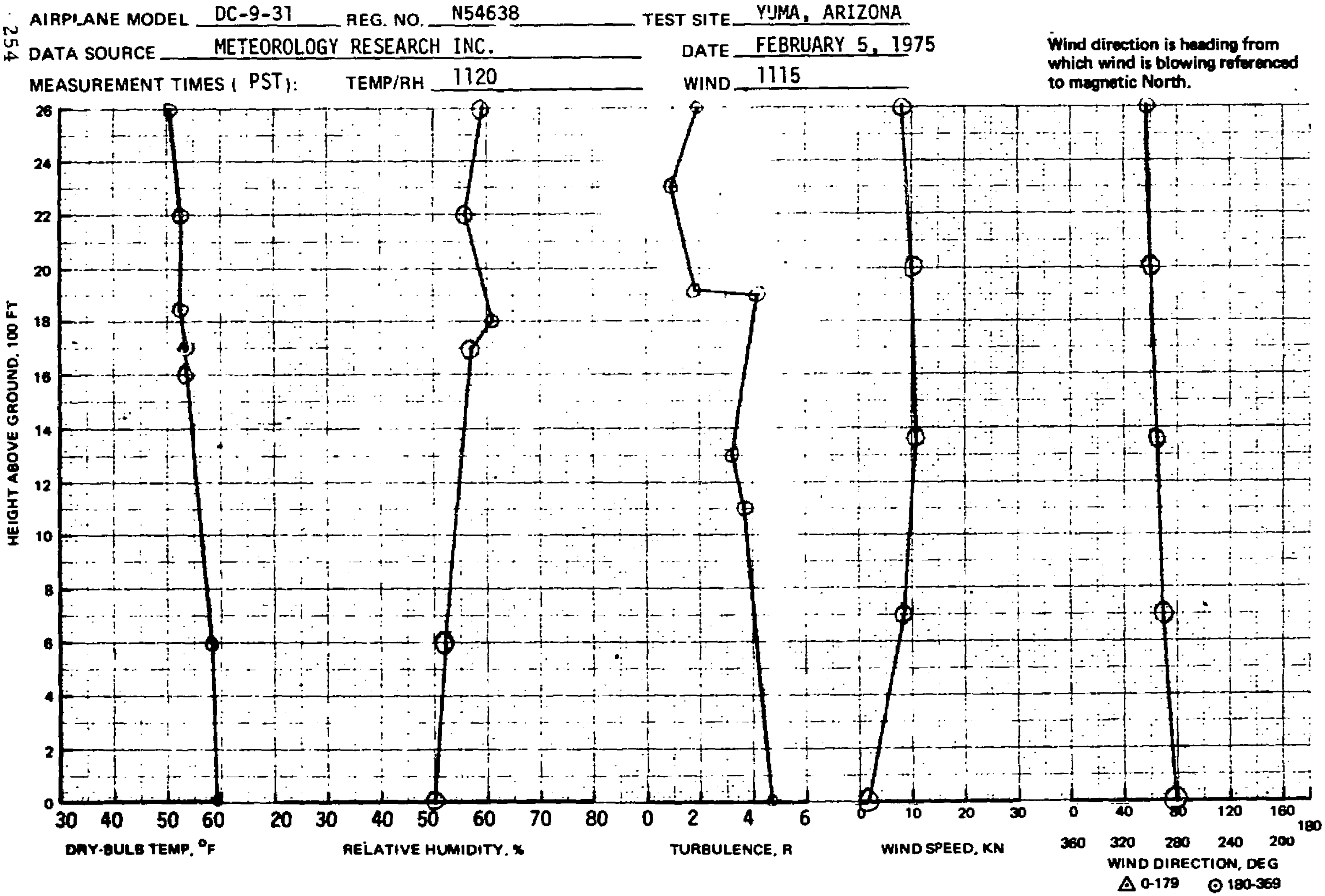

FIGURE B-2.55. SOUND-PATH WEATHER DURING FLYOVER NOISE TESTS (CONT)

AIRPLANE MODEL DC-9-31 REG. NO. N54638 TEST SITE YUMA, ARIZONA

DATA SOURCE METEOROLOGY RESEARCH INC. DATE FEBRUARY 5, 1975

MEASUREMENT TIMES (PST): TEMP/RH 1152 WIND 1200

Wind direction is heading from which wind is blowing referenced to magnetic North.

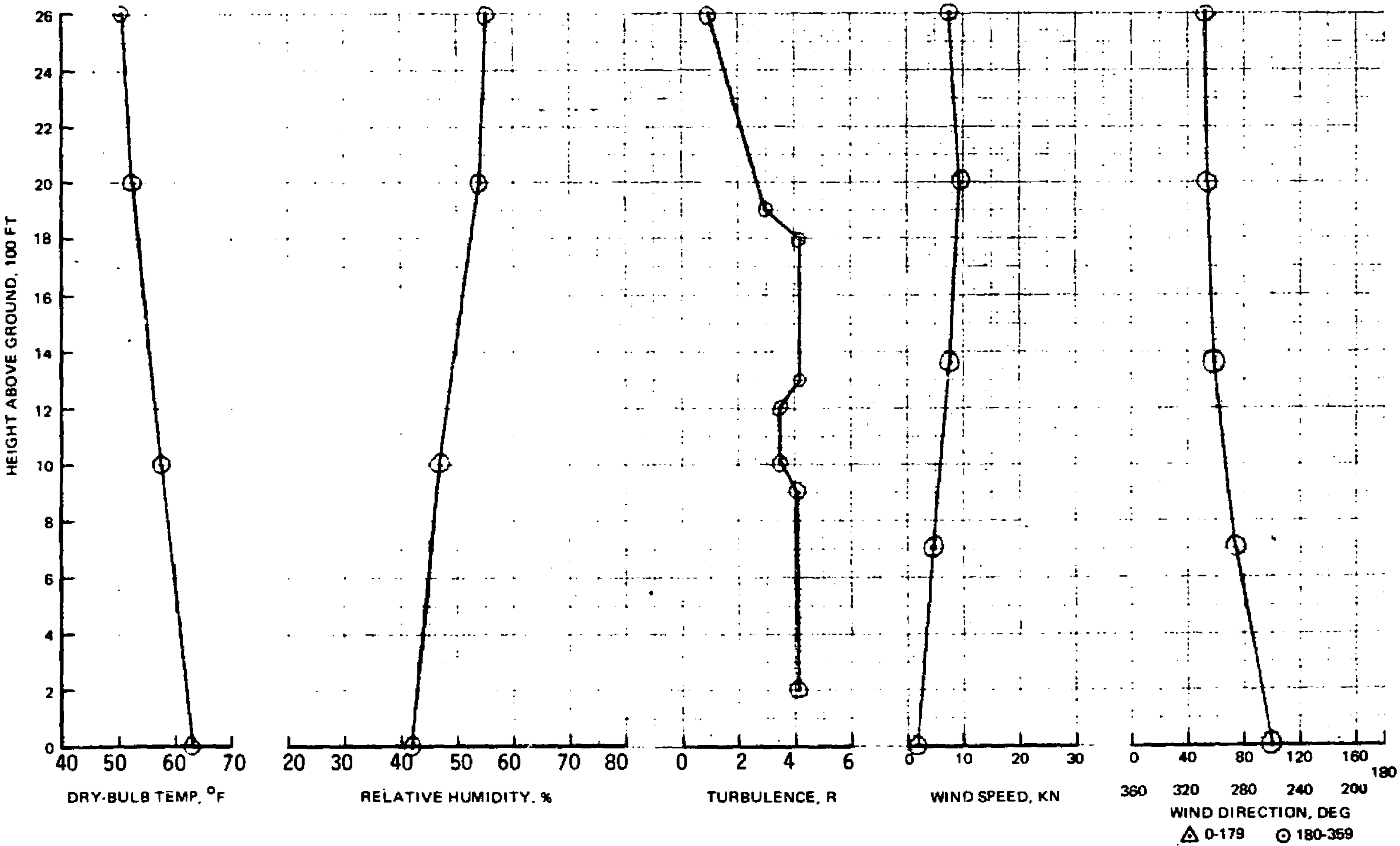

FIGURE B-2.56. SOUND-PATH WEATHER DURING FLYOVER NOISE TESTS (CONT)

AIRPLANE MODEL DC-9-31 REG. NO. N54638 TEST SITE YUMA, ARIZONA

DATA SOURCE METEOROLOGY RESEARCH INC. DATE FEBRUARY 5, 1975

MEASUREMENT TIMES (PST): TEMP/RH 1216 WIND 1200

Wind direction is heading from which wind is blowing referenced to magnetic North.

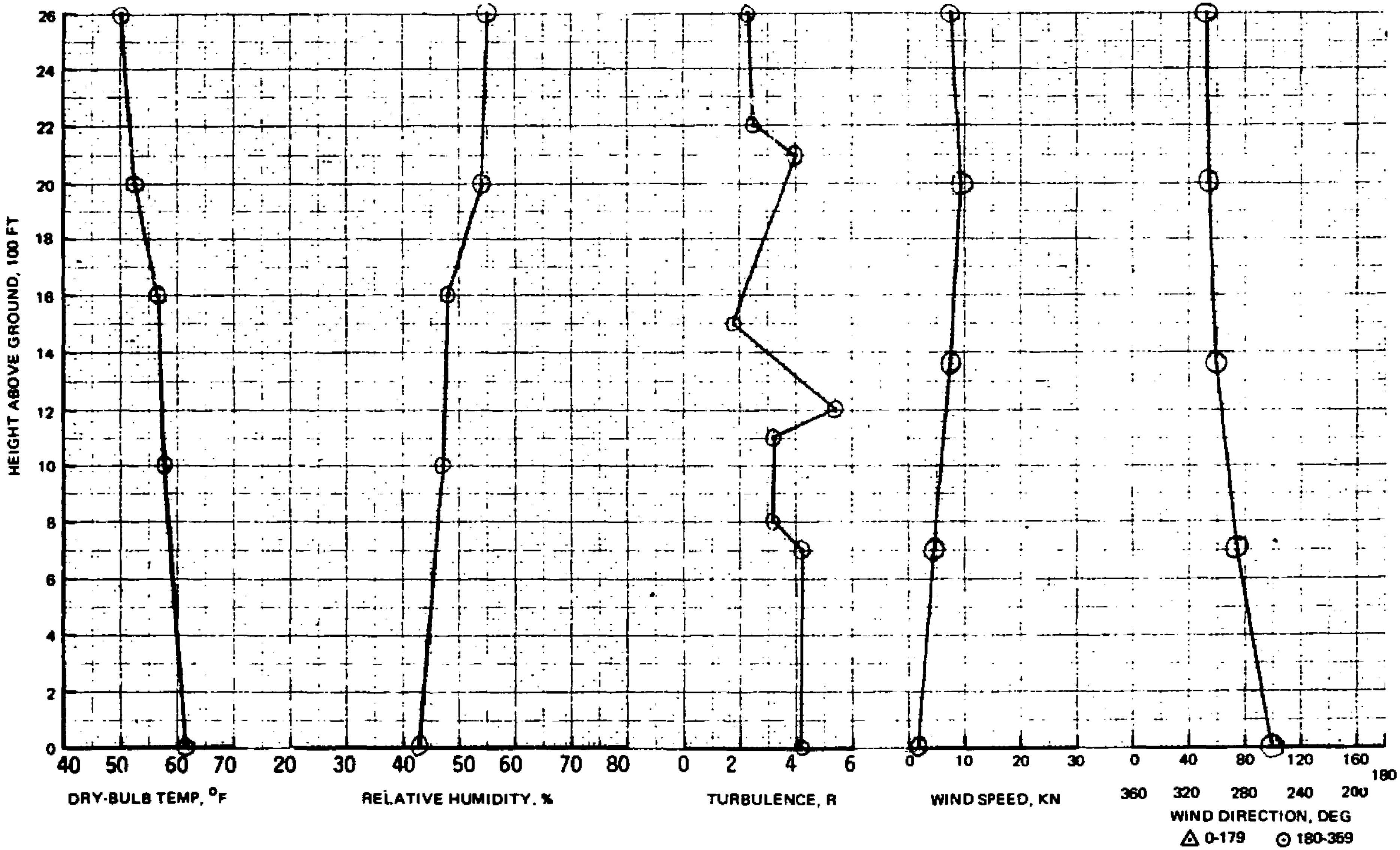

FIGURE B-2.57. SOUND-PATH WEATHER DURING FLYOVER NOISE TESTS (CONT)

AIRPLANE MODEL DC-9-31 REG. NO. N54638 TEST SITE YUMA, ARIZONA

DATA SOURCE METEOROLOGY RESEARCH INC. DATE FEBRUARY 5, 1975

MEASUREMENT TIMES (PST): TEMP/RH 1236 WIND 1230

Wind direction is heading from which wind is blowing referenced to magnetic North.

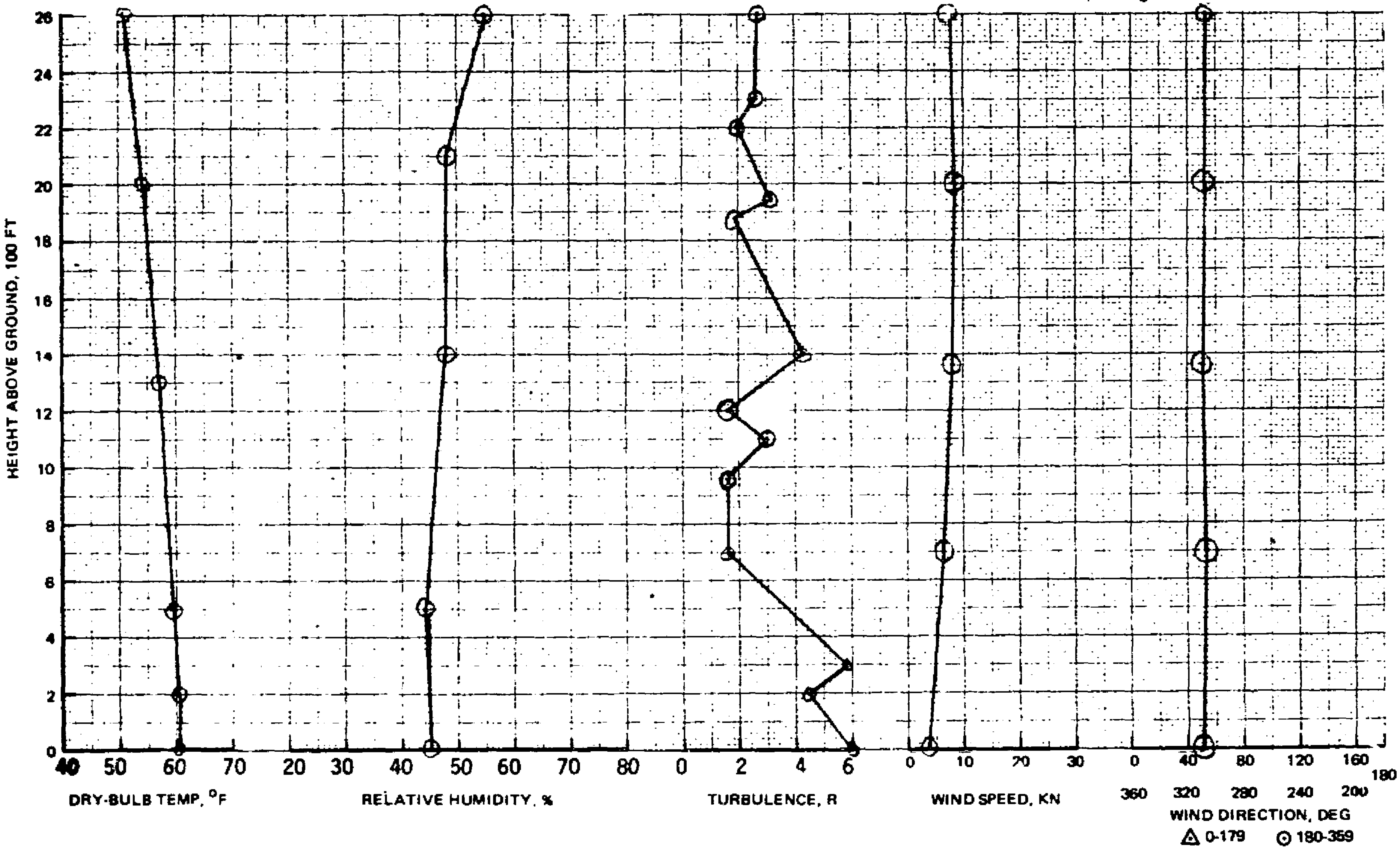

FIGURE B-2.58. SOUND-PATH WEATHER DURING FLYOVER NOISE TESTS (CONCLUDED)

APPENDIX C

Summaries of Acoustic and Aircraft Operational Data

The printed output data from the computer program analyses of the measured acoustic and aircraft operation parameters are summarized and presented in tables C-1 through C-7.

Table C-1 is a summary of the measured aircraft operation parameters used in analyzing the flyover-noise data. The data are presented as follows:

Table C-1.1	DC-9 Refan Performance Summaries - Sideline
Table C-1.2	DC-9 Refan Performance Summaries - Takeoff
Table C-1.3	DC-9 Refan Performance Summaries - Takeoff with Cutback
Table C-1.4	DC-9 Refan Performance Summaries - Landing Approach, 50 Degree Flaps
Table C-1.5	DC-9 Refan Performance Summaries - Landing Approach, 35 Degree Flaps

Table C-2 presents computer program flyover-noise test condition summaries for the test runs used to determine the FAR Part 36 reference sideline noise level (Runs 11, 12, 16, 17, 18, and 19).

Table C-3 presents computer program flyover-noise test condition summaries for the test runs used to determine the FAR Part 36 reference takeoff noise level (Runs 9, 10, 13, 53, 54, and 55).

Table C-4 presents computer program flyover-noise test condition summaries for the test runs used to determine the FAR Part 36 reference takeoff with cutback noise level (Runs 11, 12, 16, 17, 18, and 19).

Table C-5 presents computer program flyover-noise test condition summaries for the test runs used to determine the FAR Part 36 reference landing approach with 50 degree flap setting noise level (Runs 27 through 32).

Table C-6 presents computer program flyover-noise test condition summaries for the test runs used to determine the FAR Part 36 reference landing approach with 35 degree flap setting noise level (Runs 42, 43, 44, 46, 48, 49, and 50).

Table C-7 presents a representative computer program flyover-noise analysis for each of the FAR Part 36 reference noise level determinations. These outputs provide listings of the aircraft, weather, and test site parameters used in each analysis. Also shown in table C-7.1 (as an example) are the following:

1. 1/3-octave band SPL's at 0.5 second intervals

2. 1/3-octave band center frequency of tone correction adjustment

3. Time history of overall SPL's at 0.5 second intervals

4. Time history of A-weighted sound levels at 0.5 second intervals

5. Time history of PNL values at 0.5 second intervals

6. Time history of PNLT values at 0.5 second intervals

7. Time history of acoustic range for noise levels at 0.5 second intervals (sound path distance)

8. Time history of optical range for noise levels at 0.5 second intervals (slant range of aircraft at time flyover-noise reached microphone)

9. Noise levels at time of PNLTM.

TABLE C-1.1

DC-9 REFAN PERFORMANCE SUMMARIES – SIDELINE

MODEL DC-9-31 FUSELAGE NO. 741 REGISTRATION NO. N54638 TEST DATE 1-29-75

ITEM / CASE	1	2	3	4	5	6
FLIGHT NUMBER	16	16	16	16	16	16
RUN NUMBER	11	11	12	12	16	16
MICROPHONE LOCATION	16	20	20	16	16	20
MICROPHONE NUMBER	9	10	10	9	9	10
GROSS WEIGHT (1000 LBS)	106	106	105	105	100	100
FLAP ANGLE (DEG)	UP2.1	UP2.1	UP2.1	UP2.1	UP2.1	UP2.1
CALCULATED EPR	1.731	1.731	1.724	1.726	1.729	1.732
AIRCRAFT PATH SPEED (KNOTS)	176.1	176.1	176.5	176.3	175.0	175.0
AIRPLANE HEIGHT (FEET)	940.	951.	976.	966.	958.	968.
AVE. MEASURED FN (LBS)	12934.	12934.	12775.	12836.	12895.	12889.
AVE. MEAS REFERRED FN (LBS)	13521.	13521.	13404.	13420.	13485.	13503.
AVE. EXIT PRESSURE (PSIA)	25.594	25.594	25.406	25.469	25.539	25.484
AVE. INLET PRESSURE (PSIA)	0.0	0.0	0.0	0.0	0.0	0.0
AVE. EXHAUST TEMP (DEG F)	495.3	495.3	492.9	492.9	494.1	494.8
PITCH ATTITUDE (DEG)	20.57	20.57	19.51	19.51	18.81	19.25
ROLL ATTITUDE (DEG)	-0.45	-0.45	-1.88	-1.56	-2.23	-1.92
INBOARD FLAP POS.(RH) (DEG)	0.0	0.0	0.0	0.0	0.0	0.0
INBOARD FLAP POS.(LH) (DEG)	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL AIR TEMP. (DEG C)	12.50	12.50	12.38	12.62	12.50	12.38
PRESSURE ALTITUDE (FEET)	1228.0	1228.0	1326.0	1228.0	1232.0	1284.0
MEAS AIRSPEED (PILOTS) (KN)	175.4	175.4	175.6	175.1	173.8	174.0
MEASURED MACH NUMBER	0.0	0.0	0.0	0.0	0.0	0.0
CENTER OF GRAVITY (%MAC)	20.2	20.2	20.5	20.5	20.4	20.4
AVE. ENGINE FAN SPEED (RPM)	86.6	86.6	86.3	86.3	86.3	86.4
AVE. ENGINE CORE SPEED (RPM)	91.3	91.3	91.1	91.1	91.1	91.1
HEADING (DEG)	0.0	0.0	0.0	0.0	0.0	0.0
AVE. FAN INLET TEMP. (DEG R)	12.5	12.5	12.4	12.6	12.5	12.4
CORR. PRESSURE ALTITUDE (FT)	1224.	1224.	1325.	1226.	1232.	1283.
CORRECTED AIRSPEED (KNOTS)	175.7	175.7	175.9	175.2	174.2	174.3
CORRECTED MACH NUMBER	0.271	0.271	0.272	0.271	0.269	0.270
AMBIENT PRESSURE (PSIA)	14.058	14.058	14.006	14.056	14.053	14.027
AMBIENT TEMPERATURE (DEG R)	506.7	506.7	506.5	506.9	506.8	506.7
AVE FAN DUCT PRESSURE (PSIA)	23.152	23.152	23.010	23.074	23.086	23.048
AVE FAN DUCT TEMP. (DEG R)	611.4	611.4	610.6	610.9	611.1	611.0
AVE CORR ENG FAN SPEED (RPM)	7475.8	7475.8	7451.4	7446.9	7462.8	7465.8
AVE DUCT EXIT VEL. (FT/SEC)	496.5	496.5	491.7	491.2	492.4	492.6
AVE EXIT AIRFLOW (LB/SEC)	328.3	328.3	326.9	327.7	327.7	327.2
AVE CORE AIRFLOW (LB/SEC)	153.1	153.1	151.9	152.2	152.5	152.4
AVE INLET FLOW RATE (LB/SEC)	481.4	481.4	478.8	479.9	480.2	479.6
AVE NOZZLE EXH. AREA (SQ FT)	8.291	8.291	8.291	8.291	8.291	8.291
PRODUCTION EPR	1.729	1.729	1.722	1.721	1.726	1.726

TABLE C-1.1 (CONTINUED)
DC-9 REFAN PERFORMANCE SUMMARIES – SIDELINE

MODEL DC-9-31 FUSELAGE NO. 741 REGISTRATION NO. N54638 TEST DATE 1-29-75

ITEM / CASE	7	8	9	10	11	12
FLIGHT NUMBER	16	16	16	16	16	16
RUN NUMBER	17	17	18	18	19	19
MICROPHONE LOCATION	16	20	16	20	16	20
MICROPHONE NUMBER	9	10	9	10	9	10
GROSS WEIGHT (1000 LBS)	99	99	98	98	97	97
FLAP ANGLE (DEG)	UP2.1	UP2.1	UP2.1	UP2.1	UP1.9	UP1.9
CALCULATED EPR	1.730	1.730	1.737	1.736	1.747	1.748
AIRCRAFT PATH SPEED (KNOTS)	173.6	174.0	173.5	173.5	173.4	173.6
AIRPLANE HEIGHT (FEET)	912.	922.	872.	882.	814.	827.
AVE. MEASURED FN (LBS)	12938.	12900.	13015.	13005.	13205.	13204.
AVE. MEAS REFERRED FN (LBS)	13506.	13490.	13586.	13589.	13736.	13762.
AVE. EXIT PRESSURE (PSIA)	25.559	25.588	25.695	25.650	25.895	25.886
AVE. INLET PRESSURE (PSIA)	0.0	0.0	0.0	0.0	0.0	0.0
AVE. EXHAUST TEMP (DEG F)	495.4	495.4	496.0	496.6	499.0	500.3
PITCH ATTITUDE (DEG)	19.34	19.51	20.92	20.92	19.86	20.04
ROLL ATTITUDE (DEG)	-0.13	-0.13	-1.52	-1.16	-2.63	-1.20
INBOARD FLAP POS.(RH) (DEG)	0.0	0.0	0.0	0.0	0.0	0.0
INBOARD FLAP POS.(LH) (DEG)	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL AIR TEMP. (DEG C)	12.50	12.50	12.62	12.50	12.86	12.62
PRESSURE ALTITUDE (FEET)	1185.0	1234.0	1187.0	1212.0	1086.0	1141.0
MEAS AIRSPEED (PILOTS) (KN)	173.5	173.9	173.9	174.0	173.4	173.8
MEASURED MACH NUMBER	0.0	0.0	0.0	0.0	0.0	0.0
CENTER OF GRAVITY (%MAC)	20.2	20.2	20.1	20.1	19.9	19.9
AVE. ENGINE FAN SPEED (RPM)	86.5	86.5	86.8	86.8	87.3	87.3
AVE. ENGINE CORE SPEED (RPM)	91.2	91.2	91.4	91.4	91.6	91.6
HEADING (DEG)	0.0	0.0	0.0	0.0	0.0	0.0
AVE. FAN INLET TEMP. (DEG R)	12.5	12.5	12.6	12.5	12.9	12.6
CORR. PRESSURE ALTITUDE (FT)	1184.	1233.	1183.	1212.	1086.	1141.
CORRECTED AIRSPEED (KNOTS)	174.0	174.2	174.2	174.4	173.8	173.8
CORRECTED MACH NUMBER	0.269	0.269	0.269	0.269	0.268	0.268
AMBIENT PRESSURE (PSIA)	14.078	14.053	14.078	14.064	14.128	14.100
AMBIENT TEMPERATURE (DEG R)	506.9	506.8	507.1	506.8	507.5	507.2
AVE FAN DUCT PRESSURE (PSIA)	23.136	23.092	23.176	23.165	23.324	23.298
AVE FAN DUCT TEMP. (DEG R)	611.2	611.1	611.7	611.6	612.9	612.6
AVE CORR ENG FAN SPEED (RPM)	7473.6	7475.8	7495.8	7497.4	7533.7	7536.1
AVE DUCT EXIT VEL. (FT/SEC)	492.7	492.8	494.4	494.6	497.7	498.0
AVE EXIT AIRFLOW (LB/SEC)	328.3	327.9	328.7	328.5	330.1	329.6
AVE CORE AIRFLOW (LB/SEC)	153.1	152.9	153.7	153.6	155.3	155.1
AVE INLET FLOW RATE (LB/SEC)	481.4	480.8	482.4	482.1	485.3	484.7
AVE NOZZLE EXH. AREA (SQ FT)	8.291	8.291	8.291	8.291	8.291	8.291
PRODUCTION EPR	1.727	1.729	1.734	1.734	1.744	1.744

TABLE C-1.2

DC-9 REFAN PERFORMANCE SUMMARIES – TAKEOFF

MODEL DC-9-31 FUSELAGE NO. 741 REGISTRATION NO. N54638 TEST DATE 2-02-75

ITEM / CASE	1	2	3			
FLIGHT NUMBER	21	21	21	16	16	16
RUN NUMBER	53	54	55	13	9	10
MICROPHONE LOCATION	C6	C6	C6	C6	C6	C6
MICROPHONE NUMBER	1	1	1	1	1	1
GROSS WEIGHT (1000 LBS)	109	107	106	104	109	106
FLAP ANGLE (DEG)	UP1.7	UP2.0	UP2.1	UP2.1	UP2.1	UP2.1
CALCULATED EPR	1.745	1.737	1.735	1.758	1.749	1.757
AIRCRAFT PATH SPEED (KNOTS)	181.3	179.8	179.4	177.1	179.6	178.3
AIRPLANE HEIGHT (FEET)	2062.	2117.	2208.	2382.	2316.	2428.
AVE. MEASURED FN (LBS)	12724.	12666.	12543.	12517.	12484.	12538.
AVE. MEAS REFERRED FN (LBS)	13782.	13661.	13631.	13859.	13750.	13876.
AVE. EXIT PRESSURE (PSIA)	24.946	24.919	24.689	24.646	24.589	24.625
AVE. INLET PRESSURE (PSIA)	0.0	0.0	0.0	0.0	0.0	0.0
AVE. EXHAUST TEMP (DEG F)	503.3	500.9	499.7	500.3	495.3	497.2
PITCH ATTITUDE (DEG)	18.63	20.21	19.60	20.21	18.63	18.98
ROLL ATTITUDE (DEG)	0.0	-0.85	-2.06	-2.45	-0.36	-0.85
INBOARD FLAP POS.(RH) (DEG)	0.0	0.0	0.0	0.0	0.0	0.0
INBOARD FLAP POS.(LH) (DEG)	2.10	2.10	2.10	0.0	0.0	0.0
TOTAL AIR TEMP. (DEG C)	12.98	13.21	12.86	9.76	9.63	9.39
PRESSURE ALTITUDE (FEET)	2195.0	2075.0	2290.0	2791.0	2649.0	2784.0
MEAS AIRSPEED (PILOTS) (KN)	175.4	173.8	172.5	176.8	175.3	175.9
MEASURED MACH NUMBER	0.0	0.0	0.0	0.0	0.0	0.0
CENTER OF GRAVITY ((MAC)	19.6	19.6	19.9	20.6	19.7	20.0
AVE. ENGINE FAN SPEED (RPM)	87.6	87.1	87.0	87.6	87.3	87.5
AVE. ENGINE CORE SPEED (RPM)	92.1	91.8	91.8	91.8	91.7	91.7
HEADING (DEG)	0.0	0.0	0.0	0.0	0.0	0.0
AVE. FAN INLET TEMP. (DEG R)	13.0	13.2	12.9	9.8	9.6	9.4
CORR. PRESSURE ALTITUDE (FT)	2192.	2077.	2284.	2791.	2649.	2779.
CORRECTED AIRSPEED (KNOTS)	175.7	173.9	172.7	177.2	175.6	176.2
CORRECTED MACH NUMBER	0.276	0.273	0.272	0.282	0.278	0.280
AMBIENT PRESSURE (PSIA)	13.568	13.626	13.523	13.273	13.343	13.279
AMBIENT TEMPERATURE (DEG R)	507.2	507.9	507.3	501.3	501.3	500.7
AVE FAN DUCT PRESSURE (PSIA)	22.571	22.552	22.358	22.134	22.167	22.144
AVE FAN DUCT TEMP. (DEG R)	613.8	613.7	612.9	607.1	606.4	606.5
AVE CORR ENG FAN SPEED (RPM)	7563.1	7511.8	7510.0	7607.4	7570.0	7599.3
AVE DUCT EXIT VEL. (FT/SEC)	499.4	497.0	497.6	498.0	496.0	498.2
AVE EXIT AIRFLOW (LB/SEC)	318.5	318.5	316.2	314.6	315.4	314.6
AVE CORE AIRFLOW (LB/SEC)	150.3	149.2	148.1	149.2	148.9	149.1
AVE INLET FLOW RATE (LB/SEC)	468.8	467.8	464.3	463.9	464.3	463.8
AVE NOZZLE EXH. AREA (SQ FT)	8.291	8.291	8.291	8.291	8.290	8.290
PRODUCTION EPR	1.742	1.734	1.735	1.757	1.747	1.755

TABLE C-1.3

DC-9 REFAN PERFORMANCE SUMMARIES – TAKEOFF WITH CUTBACK

MODEL DC-9-31 FUSELAGE NO. 741 REGISTRATION NO. N54638 TEST DATE 1-29-75

ITEM / CASE	1	2	3	4	5	6
FLIGHT NUMBER	16	16	16	16	16	16
RUN NUMBER	12	11	16	17	18	19
MICROPHONE LOCATION	C6	C6	C6	C6	C6	C6
MICROPHONE NUMBER	1	1	1	1	1	1
GROSS WEIGHT (1000 LBS)	105	106	100	99	98	97
FLAP ANGLE (DEG)	UP2.1	UP2.1	UP2.1	UP2.1	UP2.1	UP1.8
CALCULATED EPR	1.466	1.442	1.446	1.447	1.442	1.438
AIRCRAFT PATH SPEED (KNOTS)	175.3	175.4	174.4	176.8	175.0	174.7
AIRPLANE HEIGHT (FEET)	2248.	2322.	2288.	2163.	2206.	2175.
AVE. MEASURED FN (LBS)	8626.	8241.	8342.	8349.	8269.	8214.
AVE. MEAS REFERRED FN (LBS)	9426.	9026.	9111.	9080.	9019.	8949.
AVE. EXIT PRESSURE (PSIA)	20.750	20.316	20.457	20.593	20.437	20.421
AVE. INLET PRESSURE (PSIA)	0.0	0.0	0.0	0.0	0.0	0.0
AVE. EXHAUST TEMP (DEG F)	430.5	429.3	425.5	427.4	424.9	426.2
PITCH ATTITUDE (DEG)	14.68	13.89	13.18	14.77	13.98	15.12
ROLL ATTITUDE (DEG)	1.47	-0.44	0.11	0.54	1.74	-2.50
INBOARD FLAP POS.(RH) (DEG)	0.0	0.0	0.0	0.0	0.0	0.0
INBOARD FLAP POS.(LH) (DEG)	0.0	0.0	0.0	0.0	0.0	0.0
TOTAL AIR TEMP. (DEG C)	9.88	9.63	9.88	10.36	10.12	10.48
PRESSURE ALTITUDE (FEET)	2439.0	2500.0	2426.0	2306.0	2387.0	2354.0
MEAS AIRSPEED (PILOTS) (KN)	171.9	169.4	170.6	173.3	172.5	172.1
MEASURED MACH NUMBER	0.0	0.0	0.0	0.0	0.0	0.0
CENTER OF GRAVITY (MAC)	20.5	20.2	20.4	20.2	20.1	19.9
AVE. ENGINE FAN SPEED (RPM)	75.6	74.5	74.8	74.9	74.6	74.5
AVE. ENGINE CORE SPEED (RPM)	86.5	86.6	86.0	86.1	86.1	86.1
HEADING (DEG)	0.0	0.0	0.0	0.0	0.0	0.0
AVE. FAN INLET TEMP. (DEG R)	9.9	9.6	9.9	10.4	10.1	10.5
CORR. PRESSURE ALTITUDE (FT)	2434.	2495.	2422.	2304.	2385.	2353.
CORRECTED AIRSPEED (KNOTS)	172.1	169.7	170.9	173.7	172.8	172.5
CORRECTED MACH NUMBER	0.272	0.268	0.270	0.274	0.273	0.272
AMBIENT PRESSURE (PSIA)	13.449	13.418	13.455	13.513	13.473	13.489
AMBIENT TEMPERATURE (DEG R)	502.1	501.8	502.2	502.9	502.4	503.0
AVE FAN DUCT PRESSURE (PSIA)	20.063	19.757	19.884	19.974	19.884	19.858
AVE FAN DUCT TEMP. (DEG R)	586.2	583.3	584.4	585.3	584.4	584.5
AVE CORR ENG FAN SPEED (RPM)	6564.5	6469.7	6490.7	6488.9	6477.1	6460.7
AVE DUCT EXIT VEL. (FT/SEC)	439.1	427.6	430.8	431.0	433.8	432.7
AVE EXIT AIRFLOW (LB/SEC)	292.7	288.1	289.8	291.2	289.9	289.3
AVE CORE AIRFLOW (LB/SEC)	119.8	116.5	117.5	118.0	117.3	116.8
AVE INLET FLOW RATE (LB/SEC)	412.5	404.6	407.3	409.3	407.2	406.2
AVE NOZZLE EXH. AREA (SQ FT)	8.290	8.290	8.290	8.290	8.290	8.290
PRODUCTION EPR	1.464	1.441	1.445	1.445	1.439	1.438

TABLE C-1.4

DC-9 REFAN PERFORMANCE SUMMARIES – LANDING APPROACH, 50-DEGREE FLAPS

MODEL DC-9-31 FUSELAGE NO. 741 REGISTRATION NO. N54638 TEST DATE 1-31-75

ITEM / CASE	1	2	3	4	5	6
FLIGHT NUMBER	19	19	19	19	19	19
RUN NUMBER	30	27	28	29	31	32
MICROPHONE LOCATION	10	10	10	10	10	10
MICROPHONE NUMBER	6	6	6	6	6	6
GROSS WEIGHT (1000 LBS)	94	98	96	95	93	92
FLAP ANGLE (DEG)	49.3	49.3	49.5	49.7	49.5	49.5
CALCULATED EPR	1.238	1.235	1.213	1.218	1.220	1.235
AIRCRAFT PATH SPEED (KNOTS)	140.2	135.9	134.8	125.3	134.1	137.1
AIRPLANE HEIGHT (FEET)	369.	344.	292.	354.	366.	379.
AVE. MEASURED FN (LBS)	5495.	5451.	5016.	5170.	5150.	5451.
AVE. MEAS REFERRED FN (LBS)	5558.	5507.	5059.	5225.	5209.	5517.
AVE. EXIT PRESSURE (PSIA)	18.590	18.558	18.227	18.205	18.275	18.517
AVE. INLET PRESSURE (PSIA)	0.0	0.0	0.0	0.0	0.0	0.0
AVE. EXHAUST TEMP (DEG F)	375.9	374.1	366.6	367.8	369.6	375.9
PITCH ATTITUDE (DEG)	1.41	1.76	1.41	1.67	1.41	0.0
ROLL ATTITUDE (DEG)	-0.87	-0.40	-2.06	-1.20	-2.12	-2.50
INBOARD FLAP POS.(RH) (DEG)	-49.91	-49.91	-49.98	-50.22	-50.04	-50.04
INBOARD FLAP POS.(LH) (DEG)	-49.28	-49.35	-49.49	-49.62	-49.49	-49.49
TOTAL AIR TEMP. (DEG C)	13.10	12.74	12.86	12.62	13.10	13.33
PRESSURE ALTITUDE (FEET)	292.0	259.0	214.0	275.0	291.0	310.0
MEAS AIRSPEED (PILOTS) (KN)	141.3	141.4	136.8	129.1	136.1	139.6
MEASURED MACH NUMBER	0.0	0.0	0.0	0.0	0.0	0.0
CENTER OF GRAVITY (MAC)	19.6	20.5	20.0	19.8	19.4	19.3
AVE. ENGINE FAN SPEED (RPM)	63.6	63.3	61.6	61.8	62.1	63.3
AVE. ENGINE CORE SPEED (RPM)	81.1	80.9	80.1	80.2	80.3	81.0
HEADING (DEG)	0.0	0.0	0.0	0.0	0.0	0.0
AVE. FAN INLET TEMP. (DEG R)	13.1	12.7	12.9	12.6	13.1	13.3
CORR. PRESSURE ALTITUDE (FT)	318.	283.	237.	294.	314.	333.
CORRECTED AIRSPEED (KNOTS)	143.8	143.4	138.9	130.5	138.5	142.0
CORRECTED MACH NUMBER	0.219	0.218	0.211	0.198	0.211	0.216
AMBIENT PRESSURE (PSIA)	14.528	14.546	14.570	14.540	14.530	14.520
AMBIENT TEMPERATURE (DEG R)	510.4	509.8	510.3	510.5	510.7	510.9
AVE FAN DUCT PRESSURE (PSIA)	18.777	18.762	18.459	18.429	18.497	18.719
AVE FAN DUCT TEMP. (DEG R)	565.8	564.7	561.7	562.0	563.1	565.9
AVE CORR ENG FAN SPEED (RPM)	5487.8	5463.1	5317.4	5338.5	5358.3	5463.9
AVE DUCT EXIT VEL. (FT/SEC)	347.6	344.1	336.2	332.7	337.3	346.6
AVE EXIT AIRFLOW (LB/SEC)	251.3	250.5	242.4	241.5	243.7	249.5
AVE CORE AIRFLOW (LB/SEC)	94.0	93.6	90.0	90.2	90.7	93.3
AVE INLET FLOW RATE (LB/SEC)	345.4	344.0	332.5	331.7	334.5	342.8
AVE NOZZLE EXH. AREA (SQ FT)	8.290	8.290	8.290	8.290	8.290	8.290
PRODUCTION EPR	1.233	1.231	1.207	1.214	1.214	1.229

TABLE C-1.5

DC-9 REFAN PERFORMANCE SUMMARIES – LANDING APPROACH, 35-DEGREE FLAPS

MODEL DC-9-31 FUSELAGE NO. 741 REGISTRATION NO. N54638 TEST DATE 2-01-75

ITEM / CASE	1	2	3	4	5	6	7
FLIGHT NUMBER	20	20	20	20	20	20	20
RUN NUMBER	44	46	49	43	48	42	50
MICROPHONE LOCATION	10	10	10	10	10	10	10
MICROPHONE NUMBER	6	6	6	6	6	6	6
GROSS WEIGHT (1000 LBS)	102	100	96	103	98	104	95
FLAP ANGLE (DEG)	34.7	34.7	34.1	34.6	34.7	34.9	33.7
CALCULATED EPR	1.153	1.152	1.164	1.193	1.151	1.125	1.166
AIRCRAFT PATH SPEED (KNOTS)	137.5	137.8	138.8	150.8	135.1	131.5	142.5
AIRPLANE HEIGHT (FEET)	363.	377.	368.	368.	356.	356.	387.
AVE. MEASURED FN (LBS)	3736.	3722.	3963.	4567.	3729.	3181.	4001.
AVE. MEAS REFERRED FN (LBS)	3764.	3753.	3994.	4604.	3756.	3205.	4038.
AVE. EXIT PRESSURE (PSIA)	17.425	17.394	17.561	18.109	17.361	16.934	17.616
AVE. INLET PRESSURE (PSIA)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AVE. EXHAUST TEMP (DEG F)	345.8	345.2	352.1	362.1	351.5	333.9	352.1
PITCH ATTITUDE (DEG)	2.81	2.46	1.76	1.58	3.69	5.19	2.37
ROLL ATTITUDE (DEG)	0.16	0.19	-1.52	0.19	0.47	0.0	0.42
INBOARD FLAP POS.(RH) (DEG)	-34.92	-34.92	-34.41	-34.92	-34.78	-35.37	-34.07
INBOARD FLAP POS.(LH) (DEG)	-34.66	-34.66	-34.08	-34.58	-34.66	-34.91	-33.74
TOTAL AIR TEMP. (DEG C)	14.29	14.40	15.36	14.52	14.88	13.81	15.36
PRESSURE ALTITUDE (FEET)	184.0	205.0	199.0	197.0	187.0	191.0	232.0
MEAS AIRSPEED (PILOTS) (KN)	145.5	145.1	144.3	156.3	141.3	137.6	149.1
MEASURED MACH NUMBER	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CENTER OF GRAVITY ((MAC)	20.9	20.3	19.7	21.0	19.9	20.8	19.6
AVE. ENGINE FAN SPEED (RPM)	56.4	56.3	57.6	60.6	56.3	52.7	58.0
AVE. ENGINE CORE SPEED (RPM)	77.4	77.5	78.1	79.6	77.7	75.4	78.2
HEADING (DEG)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
AVE. FAN INLET TEMP. (DEG R)	14.3	14.4	15.4	14.5	14.9	13.8	15.4
CORR. PRESSURE ALTITUDE (FT)	203.	224.	217.	220.	201.	204.	252.
CORRECTED AIRSPEED (KNOTS)	147.5	147.1	146.2	158.4	143.2	139.3	151.1
CORRECTED MACH NUMBER	0.224	0.223	0.222	0.240	0.217	0.211	0.229
AMBIENT PRESSURE (PSIA)	14.589	14.577	14.581	14.580	14.589	14.588	14.563
AMBIENT TEMPERATURE (DEG R)	512.3	512.6	514.3	511.9	513.7	512.0	513.9
AVE FAN DUCT PRESSURE (PSIA)	17.753	17.732	17.878	18.410	17.707	17.308	17.938
AVE FAN DUCT TEMP. (DEG R)	555.6	555.9	559.3	562.7	556.7	550.2	559.9
AVE CORR ENG FAN SPEED (RPM)	4854.3	4846.3	4950.5	5211.6	4831.5	4541.6	4984.9
AVE DUCT EXIT VEL. (FT/SEC)	299.9	310.4	312.1	330.8	299.2	281.8	312.1
AVE EXIT AIRFLOW (LB/SEC)	221.1	220.4	224.7	240.6	218.9	205.2	227.1
AVE CORE AIRFLOW (LB/SEC)	78.9	78.6	80.8	87.6	78.2	71.7	81.6
AVE INLET FLOW RATE (LB/SEC)	300.0	299.0	305.6	328.2	297.1	276.9	308.7
AVE NOZZLE EXH. AREA (SQ FT)	8.290	8.290	8.290	8.290	8.290	8.290	8.290
PRODUCTION EPR	1.149	1.149	1.160	1.188	1.148	1.123	1.161

TABLE C-2.1

DC-9 REFAN SIDELINE FLYOVER-NOISE TEST CONDITION SUMMARY

FAR PART 36 FLYOVER NOISE LEVELS

DATA IDENTIFICATION INFORMATION

DATA DIGITIZED 2-1-75 DATA PROCESSED 06/28/75 14140628 PAGE 1

MODEL DC-9-31 REG. NO. N54638

DC-9-31 REFAN FLYOVER NOISE TEST

FAR PART 36 NOISE LEVELS

ENGINE/NACELLE CONFIGURATION -- P&WA JT8D-109 ENGINES WITH ACOUSTICALLY TREATED NACELLES

TYPE OF FLYOVER -- SIMULATED T.O. CLIMB DATA CLASS -- FN/DLT = 9500 LBS
MEASUREMENT TYPE -- .25 NMI SIDELINE, 4 FEET ABOVE SANDY DIRT
RECORDING AT X = 538.0, Y =-1461.0, Z = 4.0 FEET FROM WEST-MOST END OF RUNWAY
REFERENCE RECORDING LOCATION X = 538.0, Y =-1519.0, Z = .0 FEET

MEASUREMENT INFO	AIRPLANE AND ENGINE DATA		WEATHER DATA
MIC. NUMBER 9	FUSE. NO. 741	AVG. N1RT = 7475. RPM	AMB. TEMP. = 51.2 F
MIC. LOCATION 16	FLIGHT 16	AVG. EPR = 1.729	REL. HUM. = 36.0 PCT
MIC. ORIENT GRAZING	RUN 11	A/P HEADING = 210. DEG	ABS. HUM. = 3.5 GM/M3
TEST SITE YUMA	HEIGHT = 940.7 FT	FLAP POS. = UP 2.1 DEG	WIND SPEED = 2. KN
TEST DATE 1-29-75	LAT. DEV. = 1516.0 FT	PATH ANG. = 9.9 DEG	WIND DIR. = 245. DEG
TEST NUMBER JOB 511	SLNT.RNG. = 1784.1 FT	PITCH ANG. = 20.5 DEG	STA. PRESS = 29.81 IN HG
JOB REEL A5282	PATH SPD. = 176.1 KN	GR. WEIGHT = 105500. LB	RT. THETA = .9957

AIRPLANE SPACE POSITIONING IS RELATIVE TO MIC FOR TIME AT MIC OF 9-55-35.9
OTHER PERFORMANCE DATA IS FOR TIME OF PNLTM OF 9-55-40.0
TIME OF AIRCRAFT AT MINIMUM DISTANCE FROM MICROPHONE LOCATION 9-55-35.3

REFERENCE SURFACE WEATHER CONDITIONS TEMP = 77.0 F & REL. HUM. = 70.0 PCT

DESCRIPTION OF ACOUSTICAL DATA PROCESSING

ANALYZER TYPE / RESOLUTION GR1921(CISA) / 0.25 DB
CISA MODE 1 PASS WITH AUTO-START
SAMPLE INTERVAL FOR BASIC DATA = .500 SECONDS
AVERAGING TIME = 1.500 SECONDS

ATMOSPHERIC ATTENUATION SAE ARP866(REV)
BASIC UNIT SOUND PRESSURE LEVEL (DB REL. 0.0002 MICROBAR)
DATA TYPES 1/3 OCTAVE, OVERALL, A-WTD, PNL, PNLT & EPNL

TABLE C-2.1 (CONTINUED)

DC-9 REFAN SIDELINE FLYOVER-NOISE TEST CONDITION SUMMARY

FAR PART 36 CALCULATED NOISE LEVELS   14140628   PAGE = 2

MODEL DC-9-31   FUSELAGE NO. 741   REGISTRATION NO. N54638   TEST DATE 1-29-75
FLIGHT NO. 16   TEST RUN NO 11   MICROPHONE NO. 9   MIC. LOCATION 16

REFERENCE CONDITIONS-DC-9 REFAN SIDELINE REFERENCE CONDITION CHANGE

SUMMARY OF MEASURED NOISE LEVELS.

PNLTM= 98.9 PNDB   DCF= -2.3 DB   EPNL= 96.6 EPNDB

SUMMARY OF DELTA1 CALCULATIONS

FREQUENCY (HZ)	MEASURED SPL (DB)	MEASURED NOISINESS (NOYS)	ADJUSTED SPL (DB)	ADJUSTED NOISINESS (NOYS)
50	76.2	3.4	76.2	3.4
63	76.7	4.8	76.7	4.7
80	75.6	5.3	75.6	5.2
100	73.9	5.9	73.8	5.9
125	68.3	4.1	68.2	4.1
160	79.0	10.5	78.9	10.4
200	83.8	17.0	83.7	16.8
250	85.4	20.3	85.2	20.0
315	86.9	23.9	86.7	23.5
400	77.9	13.8	77.6	13.6
500	85.1*	22.9	84.9*	22.5
630	78.7	14.6	78.5	14.4
800	78.3	14.3	78.4	14.4
1000	74.7	11.1	75.3	11.5
1250	70.7	9.6	72.0	10.6
1600	65.3	8.6	68.0	10.5
2000	58.9	6.4	63.6	8.9
2500	50.5	4.1	58.2	7.0
3150	39.9	2.1	52.2	5.0
4000	28.6	0.0	47.8	3.7
5000				
6300				
8000				
10000				
PNL	96.6 PNDB		97.1 PNDB	
PNLTM	98.9 PNDB		99.4 PNDB	

* BAND PRODUCING TONE CORRECTION

NOISE ADJUSTMENT PARAMETERS

	REF.	TEST
WEATHER		
AMB. TEMP. (DEG F)	77.0	51.2
REL. HUM. (PCT)	70.0	36.0
PERFORMANCE		
PATH SPEED (KN)	176.8	176.1
AVE FN/D (LBS)	13721.0	13521.3
FLIGHT PROFILE GEOMETRY		
MINIMUM DISTANCE (FT)	1789.	1784.
NOISE PATH DIST. (FT)	1896.	1898.

CALCULATED NOISE LEVELS

MEASURED EPNL	=	96.6 EPNDB
DELTA 1 (ARP866)	=	0.5 EPNDB
DELTA 2	=	0.0 EPNDB
DELTA S	=	-0.0 EPNDB
DELTA FN/D	=	0.2 EPNDB
REF. EPNL FN/D	=	97.3 EPNDB

TABLE C-2.2
DC-9 REFAN SIDELINE FLYOVER-NOISE TEST CONDITION SUMMARY

ORIGINAL PAGE IS OF POOR QUALITY

FAR PART 36 FLYOVER NOISE LEVELS

DATA IDENTIFICATION INFORMATION

DATA DIGITIZED 2-1-75 DATA PROCESSED 06/28/75 14140628 PAGE 1

MODEL DC-9-31 REG. NO. N54638

DC-9-31 REFAN FLYOVER NOISE TEST

FAR PART 36 NOISE LEVELS

ENGINE/NACELLE CONFIGURATION -- P&WA JT8D-109 ENGINES WITH ACOUSTICALLY TREATED NACELLES

TYPE OF FLYOVER -- SIMULATED T.O. CLIMB DATA CLASS -- FN/DLT = 9500 LBS
MEASUREMENT TYPE -- .25 NMI SIDELINE, 4 FEET ABOVE SANDY DIRT
RECORDING AT X = 555.0, Y = 1464.0, Z = -9.0 FEET FROM WEST-MOST END OF RUNWAY
REFERENCE RECORDING LOCATION X = 538.0, Y = 1519.0, Z = .0 FEET

MEASUREMENT INFO		AIRPLANE AND ENGINE DATA				WEATHER DATA	
MIC. NUMBER	10	FUSE. NO.	741	AVG. N1RT =	7475. RPM	AMB. TEMP. =	51.2 F
MIC. LOCATION	20	FLIGHT	16	AVG. EPR =	1.729	REL. HUM. =	36.0 PCT
MIC. ORIENT	GRAZING	RUN	11	A/P HEADING =	210. DEG	ABS. HUM. =	3.5 GM/M3
TEST SITE	YUMA	HEIGHT =	951.1 FT	FLAP POS. = UP	2.1 DEG	WIND SPEED =	2. KN
TEST DATE	1-29-75	LAT. DEV. =	-1409.4 FT	PATH ANG. =	9.9 DEG	WIND DIR. =	245. DEG
TEST NUMBER	JOB 511	SLNT.RNG. =	1700.3 FT	PITCH ANG. =	20.5 DEG	STA. PRESS =	29.81 IN HG
JOB REEL	A5282	PATH SPD. =	176.1 KN	GR. WEIGHT =	105500. LB	RT. THETA =	.9957

AIRPLANE SPACE POSITIONING IS RELATIVE TO MIC FOR TIME AT MIC OF 9-55-35.8
OTHER PERFORMANCE DATA IS FOR TIME OF PNLTM OF 9-55-40.0
TIME OF AIRCRAFT AT MINIMUM DISTANCE FROM MICROPHONE LOCATION 9-55-35.4

REFERENCE SURFACE WEATHER CONDITIONS TEMP = 77.0 F & REL. HUM. = 70.0 PCT

DESCRIPTION OF ACOUSTICAL DATA PROCESSING

ANALYZER TYPE / RESOLUTION GR1921(CISA) / 0.25 DB
CISA MODE 1 PASS WITH AUTO-START
SAMPLE INTERVAL FOR BASIC DATA = .500 SECONDS
AVERAGING TIME = 1.500 SECONDS

ATMOSPHERIC ATTENUATION SAE ARP866(REV)
BASIC UNIT SOUND PRESSURE LEVEL (DB REL. 0.0002 MICROBAR)
DATA TYPES 1/3 OCTAVE, OVERALL, A-WTD, PNL, PNLT & EPNL

TABLE C-2.2 (CONTINUED)
DC-9 REFAN SIDELINE FLYOVER-NOISE TEST CONDITION SUMMARY

FAR PART 36 CALCULATED NOISE LEVELS 14140628 PAGE = 2

MODEL DC-9-31 FUSELAGE NO. 741 REGISTRATION NO. N54638 TEST DATE 1-29-75
FLIGHT NO. 15 TEST RUN NO 11 MICROPHONE NO. 10 MIC. LOCATION 20

REFERENCE CONDITIONS-DC-9 REFAN SIDELINE-REFERENCE CONDITION CHANGE

SUMMARY OF MEASURED NOISE LEVELS.

PNLTM= 99.4 PNDB DCF= -2.5 DB EPNL= 96.9 EPNDB

SUMMARY OF DELTA1 CALCULATIONS

FREQUENCY (HZ)	MEASURED SPL (DB)	MEASURED NOISINESS (NOYS)	ADJUSTED SPL (DB)	ADJUSTED NOISINESS (NOYS)
50	72.3	2.3	71.9	2.2
63	74.7	4.0	74.3	3.8
80	75.0	5.0	74.6	4.8
100	70.8	4.5	70.4	4.4
125	72.4	5.7	71.9	5.5
160	80.7	11.9	80.2	11.5
200	85.4	18.9	84.9	18.2
250	87.9	24.1	87.4	23.2
315	83.8	19.2	83.2	18.4
400	83.1	19.8	82.4	18.9
500	86.3*	24.7	85.6*	23.6
630	79.6	15.6	79.0	15.0
800	79.2	15.1	78.8	14.7
1000	77.7	13.6	77.7	13.6
1250	73.2	11.5	74.0	12.1
1600	69.1	11.3	71.2	13.0
2000	61.7	7.7	65.5	10.1
2500	53.5	5.1	60.2	8.0
3150	42.7	2.6	53.6	5.5
4000	33.4	1.4	50.8	4.5
5000				
6300				
8000				
10000				
PNL	97.7 PNDB		97.7 PNDB	
PNLTM	99.4 PNDB		99.4 PNDB	

* BAND PRODUCING TONE CORRECTION

NOISE ADJUSTMENT PARAMETERS

	REF.	TEST
WEATHER		
AMB. TEMP. (DEG F)	77.0	51.2
REL. HUM. (PCT)	70.0	36.0
PERFORMANCE		
PATH SPEED (KN)	176.8	176.1
AVE FN/D (LBS)	13721.0	13521.3
FLIGHT PROFILE GEOMETRY		
MINIMUM DISTANCE (FT)	1789.	1700.
NOISE PATH DIST. (FT)	1896.	1819.

CALCULATED NOISE LEVELS

MEASURED EPNL	=	96.9 EPNDB
DELTA 1 (ARP866)	=	0.0 EPNDB
DELTA 2	=	0.2 EPNDB
DELTA S	=	-0.0 EPNDB
DELTA FN/D	=	0.2 EPNDB
REF. EPNL FN/D	=	97.3 EPNDB

TABLE C-2.3

DC-9 REFAN SIDELINE FLYOVER-NOISE TEST CONDITION SUMMARY

FAR PART 36 FLYOVER NOISE LEVELS

DATA IDENTIFICATION INFORMATION

DATA DIGITIZED 2-1-75 DATA PROCESSED 06/28/75 14140628 PAGE 1

MODEL DC-9-31 REG. NO. N54638

DC-9-31 REFAN FLYOVER NOISE TEST

FAR PART 36 NOISE LEVELS

ENGINE/NACELLE CONFIGURATION -- P&WA JT8D-109 ENGINES WITH ACOUSTICALLY TREATED NACELLES

TYPE OF FLYOVER -- SIMULATED T.O. CLIMB DATA CLASS -- FN/DLT = 9500 LBS
MEASUREMENT TYPE -- .25 NMI SIDELINE, 4 FEET ABOVE SANDY DIRT
RECORDING AT X = 538.0, Y =-1461.0, Z = 4.0 FEET FROM WEST-MOST END OF RUNWAY
REFERENCE RECORDING LOCATION X = 538.0, Y =-1519.0, Z = .0 FEET

MEASUREMENT INFO		AIRPLANE AND ENGINE DATA			WEATHER DATA
MIC. NUMBER	9	FUSE. NO. 741	AVG. N1RT = 7448. RPM	AMB. TEMP. = 52.1 F	
MIC. LOCATION	16	FLIGHT 16	AVG. EPR = 1.721	REL. HUM. = 34.0 PCT	
MIC. ORIENT	GRAZING	RUN 12	A/P HEADING = 210. DEG	ABS. HUM. = 3.4 GM/M3	
TEST SITE	YUMA	HEIGHT = 966.3 FT	FLAP POS. = UP 2.1 DEG	WIND SPEED = 3. KN	
TEST DATE	1-29-75	LAT. DEV. = 1543.4 FT	PATH ANG. = 9.6 DEG	WIND DIR. = 255. DEG	
TEST NUMBER	JOB 511	SLNT.RNG. = 1820.9 FT	PITCH ANG. = 19.5 DEG	STA. PRESS = 29.81 IN HG	
JOB REEL	45282	PATH SPD. = 176.3 KN	GR. WEIGHT = 104600. LB	RT. THETA = .9957	

AIRPLANE SPACE POSITIONING IS RELATIVE TO MIC FOR TIME AT MIC OF 10- 3-26.6
OTHER PERFORMANCE DATA IS FOR TIME OF PNLTM OF 10- 3-33.5
TIME OF AIRCRAFT AT MINIMUM DISTANCE FROM MICROPHONE LOCATION 10- 3-26.0

REFERENCE SURFACE WEATHER CONDITIONS TEMP = 77.0 F & REL. HUM. = 70.0 PCT

DESCRIPTION OF ACOUSTICAL DATA PROCESSING

ANALYZER TYPE / RESOLUTION GR1921(CISA) / 0.25 DB
CISA MODE 1 PASS WITH AUTO-START
SAMPLE INTERVAL FOR BASIC DATA = .500 SECONDS
AVERAGING TIME = 1.500 SECONDS

ATMOSPHERIC ATTENUATION SAE ARP866(REV)
BASIC UNIT SOUND PRESSURE LEVEL (DB REL. 0.0002 MICROBAR)
DATA TYPES 1/3 OCTAVE, OVERALL, A-WTD, PNL, PNLT & EPNL

TABLE C-2.3 (CONTINUED)
DC-9 REFAN SIDELINE FLYOVER-NOISE TEST CONDITION SUMMARY

FAR PART 36 CALCULATED NOISE LEVELS   14140628   PAGE = 2

MODEL DC-9-31   FUSELAGE NO. 741   REGISTRATION NO. N54638   TEST DATE 1-29-75
FLIGHT NO. 16   TEST RUN NO 12   MICROPHONE NO. 9   MIC. LOCATION 16

REFERENCE CONDITIONS-DC-9 REFAN SIDELINE REFERENCE CONDITION CHANGE

SUMMARY OF MEASURED NOISE LEVELS.

PNLTM= 98.7 PNDB   DCF= -2.8 DB   EPNL= 95.9 EPNDB

SUMMARY OF DELTA1 CALCULATIONS

FREQUENCY (HZ)	MEASURED SPL (DB)	MEASURED NOISINESS (NOYS)	ADJUSTED SPL (DB)	ADJUSTED NOISINESS (NOYS)
50	74.8	2.9	74.8	3.0
63	77.2	5.0	77.2	5.0
80	75.9	5.4	76.0	5.4
100	73.7	5.8	73.7	5.8
125	69.3	4.4	69.3	4.4
160	77.8	9.7	77.8	9.7
200	83.4	16.4	83.3	16.3
250	86.4	21.9	86.3	21.6
315	86.3	22.9	86.2	22.7
400	78.0	13.9	77.9	13.8
500	85.2*	23.0	85.1*	22.9
630	79.6	15.5	79.6	15.6
800	79.2	15.2	79.5	15.5
1000	75.0	11.3	75.8	11.9
1250	71.2	10.0	72.9	11.2
1600	65.1	8.5	68.3	10.6
2000	59.5	6.7	64.9	9.7
2500	50.3	4.1	58.8	7.3
3150	40.4	2.2	53.7	5.5
4000	29.8	1.1	50.4	4.4
5000				
6300				
8000				
10000				
PNL	96.6 PNDB		97.2 PNDB	
PNLTM	98.7 PNDB		99.4 PNDB	

* BAND PRODUCING TONE CORRECTION

NOISE ADJUSTMENT PARAMETERS

	REF.	TEST
WEATHER		
AMB. TEMP. (DEG F)	77.0	52.1
REL. HUM. (PCT)	70.0	34.0
PERFORMANCE		
PATH SPEED (KN)	176.8	176.3
AVE FN/D (LBS)	13721.0	13420.0
FLIGHT PROFILE GEOMETRY		
MINIMUM DISTANCE (FT)	1802.	1821.
NOISE PATH DIST. (FT)	1885.	1905.

CALCULATED NOISE LEVELS
- MEASURED EPNL = 95.9 EPNDB
- DELTA 1 (ARP866) = 0.6 EPNDB
- DELTA 2 = -0.0 EPNDB
- DELTA S = -0.0 EPNDB
- DELTA FN/D = 0.3 EPNDB
- REF. EPNL FN/D = 96.7 EPNDB

TABLE C-2.4

DC-9 REFAN SIDELINE FLYOVER-NOISE TEST CONDITION SUMMARY

FAR PART 36 FLYOVER NOISE LEVELS

DATA IDENTIFICATION INFORMATION

DATA DIGITIZED 2-1-75 DATA PROCESSED 06/28/75 14140628 PAGE 1

MODEL DC-9-31 REG. NO. N54638

DC-9-31 REFAN FLYOVER NOISE TEST

FAR PART 36 NOISE LEVELS

ENGINE/NACELLE CONFIGURATION -- P&WA JT8D-109 ENGINES WITH ACOUSTICALLY TREATED NACELLES

TYPE OF FLYOVER -- SIMULATED T.O. CLIMB DATA CLASS -- FN/DLT = 9500 LBS
MEASUREMENT TYPE -- .25 NMI SIDELINE, 4 FEET ABOVE SANDY DIRT
RECORDING AT X = 555.0, Y = 1464.0, Z = -9.0 FEET FROM WEST-MOST END OF RUNWAY
REFERENCE RECORDING LOCATION X = 538.0, Y = 1519.0, Z = .0 FEET

MEASUREMENT INFO		AIRPLANE AND ENGINE DATA			WEATHER DATA
MIC. NUMBER	10	FUSE. NO. 741	AVG. N1RT = 7450. RPM		AMB. TEMP. = 52.1 F
MIC. LOCATION	20	FLIGHT 16	AVG. EPR = 1.722		REL. HUM. = 34.0 PCT
MIC. ORIENT	GRAZING	RUN 12	A/P HEADING = 210. DEG		ABS. HUM. = 3.4 GM/M3
TEST SITE	YUMA	HEIGHT = 976.6 FT	FLAP POS. = UP 2.1 DEG		WIND SPEED = 3. KN
TEST DATE	1-29-75	LAT. DEV. =-1381.8 FT	PATH ANG. = 9.6 DEG		WIND DIR. = 255. DEG
TEST NUMBER	JOB 511	SLNT.RNG. = 1692.1 FT	PITCH ANG. = 19.6 DEG		STA. PRESS = 29.81 IN HG
JOB REEL	A5282	PATH SPD. = 176.5 KN	GR. WEIGHT = 104600. LB		RT. THETA = .9954

AIRPLANE SPACE POSITIONING IS RELATIVE TO MIC FOR TIME AT MIC OF 10- 3-26.6
OTHER PERFORMANCE DATA IS FOR TIME OF PNLTM OF 10- 3-32.5
TIME OF AIRCRAFT AT MINIMUM DISTANCE FROM MICROPHONE LOCATION 10- 3-26.1

REFERENCE SURFACE WEATHER CONDITIONS TEMP = 77.0 F & REL. HUM. = 70.0 PCT

DESCRIPTION OF ACOUSTICAL DATA PROCESSING

ANALYZER TYPE / RESOLUTION GR1921(CISA) / 0.25 DB
CISA MODE 1 PASS WITH AUTO-START
SAMPLE INTERVAL FOR BASIC DATA = .500 SECONDS
AVERAGING TIME = 1.500 SECONDS

ATMOSPHERIC ATTENUATION SAE ARP866(REV)
BASIC UNIT SOUND PRESSURE LEVEL (DB REL. 0.0002 MICROBAR)
DATA TYPES 1/3 OCTAVE, OVERALL, A-WTD, PNL, PNLT & EPNL

TABLE C-2.4 (CONTINUED)
DC-9 REFAN SIDELINE FLYOVER-NOISE TEST CONDITION SUMMARY

FAR PART 36 CALCULATED NOISE LEVELS   14140628   PAGE = 2

MODEL DC-9-31   FUSELAGE NO. 741   REGISTRATION NO. N54638   TEST DATE 1-29-75
FLIGHT NO. 16   TEST RUN NO 12   MICROPHONE NO. 10   MIC. LOCATION 20

REFERENCE CONDITIONS-DC-9 REFAN SIDELINE REFERENCE CONDITION CHANGE

SUMMARY OF MEASURED NOISE LEVELS.

PNLTM= 98.5 PNDB   DCF= -1.2 DB   EPNL= 97.3 EPNDB

SUMMARY OF DELTA1 CALCULATIONS

FREQUENCY (HZ)	MEASURED SPL (DB)	MEASURED NOISINESS (NOYS)	ADJUSTED SPL (DB)	ADJUSTED NOISINESS (NOYS)
50	79.7	4.8	79.3	4.6
63	78.7	5.7	78.3	5.5
80	80.7	8.2	80.3	7.9
100	74.1	6.0	73.7	5.8
125	73.6	6.3	73.1	6.1
160	83.1	14.0	82.6	13.6
200	87.6	22.0	87.1	21.2
250	88.2	24.6	87.7	23.7
315	82.8	17.9	82.2	17.1
400	82.6	19.2	82.0	18.4
500	83.8*	20.8	83.2*	19.9
630	78.7	14.7	78.2	14.2
800	76.7	12.7	76.4	12.5
1000	73.7	10.4	74.0	10.6
1250	69.3	8.8	70.5	9.5
1600	66.4	9.3	69.1	11.3
2000	58.4	6.2	63.3	8.7
2500	48.9	3.7	57.1	6.5
3150	37.2	1.8	50.4	4.4
4000				
5000				
6300				
8000				
10000				
PNL	97.4 PNDB		97.4 PNDB	
PNLTM	98.5 PNDB		98.4 PNDB	

* BAND PRODUCING TONE CORRECTION

NOISE ADJUSTMENT PARAMETERS

	REF.	TEST
WEATHER		
AMB. TEMP. (DEG F)	77.0	52.1
REL. HUM. (PCT)	70.0	34.0
PERFORMANCE		
PATH SPEED (KN)	176.8	176.5
AVE FN/P (LBS)	13721.0	13404.[illegible]
FLIGHT PROFILE GEOMETRY		
MINIMUM DISTANCE (FT)	1802.	1692.
NOISE PATH DIST. (FT)	2111.	2033.

CALCULATED NOISE LEVELS

MEASURED EPNL	=	97.3 EPNDB
DELTA 1 (ARP866)	=	-0.1 EPNDB
DELTA 2	=	0.3 EPNDB
DELTA S	=	-0.0 EPNDB
DELTA FN/P	=	0.3 EPNDB
REF. EPNL FN/P	=	97.8 EPNDB

ORIGINAL PAGE IS OF POOR QUALITY

TABLE C-2.5

DC-9 REFAN SIDELINE FLYOVER-NOISE TEST CONDITION SUMMARY

FAR PART 36 FLYOVER NOISE LEVELS

DATA IDENTIFICATION INFORMATION

DATA DIGITIZED 2-1-75 DATA PROCESSED 06/28/75 14140628 PAGE 1

MODEL DC-9-31 REG. NO. N54638

DC-9-31 REFAN FLYOVER NOISE TEST

FAR PART 36 NOISE LEVELS

ENGINE/NACELLE CONFIGURATION -- P&WA JT8D-109 ENGINES WITH ACOUSTICALLY TREATED NACELLES

TYPE OF FLYOVER -- SIMULATED T.O. CLIMB DATA CLASS -- FN/DLT = 9500 LBS
MEASUREMENT TYPE -- .25 NMI SIDELINE, 4 FEET ABOVE SANDY DIRT
RECORDING AT X = 538.0, Y =-1461.0, Z = 4.0 FEET FROM WEST-MOST END OF RUNWAY
REFERENCE RECORDING LOCATION X = 538.0, Y =-1519.0, Z = .0 FEET

MEASUREMENT INFO		AIRPLANE AND ENGINE DATA				WEATHER DATA	
MIC. NUMBER	9	FUSE. NO.	741	AVG. N1RT =	7463. RPM	AMB. TEMP. =	52.5 F
MIC. LOCATION	16	FLIGHT	16	AVG. EPR =	1.726	REL. HUM. =	35.1 PCT
MIC. ORIENT	GRAZING	RUN	16	A/P HEADING =	210. DEG	ABS. HUM. =	3.6 GM/M3
TEST SITE	YUMA	HEIGHT =	958.4 FT	FLAP POS. = UP	2.1 DEG	WIND SPEED =	4. KN
TEST DATE	1-29-75	LAT. DEV. =	1498.5 FT	PATH ANG. =	10.5 DEG	WIND DIR. =	260. DEG
TEST NUMBER	JOB 511	SLNT.RNG. =	1778.7 FT	PITCH ANG. =	19.0 DEG	STA. PRESS =	29.81 IN HG
JOB REEL	A5282	PATH SPD. =	175.0 KN	GR. WEIGHT =	99900. LB	RT. THETA =	.9956

AIRPLANE SPACE POSITIONING IS RELATIVE TO MIC FOR TIME AT MIC OF 10-42-22.8
OTHER PERFORMANCE DATA IS FOR TIME OF PNLTM OF 10-42-26.5
TIME OF AIRCRAFT AT MINIMUM DISTANCE FROM MICROPHONE LOCATION 10-42-22.1

REFERENCE SURFACE WEATHER CONDITIONS TEMP = 77.0 F & REL. HUM. = 70.0 PCT

DESCRIPTION OF ACOUSTICAL DATA PROCESSING

ANALYZER TYPE / RESOLUTION GR1921(CISA) / 0.25 DB
CISA MODE 1 PASS WITH AUTO-START
SAMPLE INTERVAL FOR BASIC DATA = .500 SECONDS
AVERAGING TIME = 1.500 SECONDS

ATMOSPHERIC ATTENUATION SAE ARP866(REV)
BASIC UNIT SOUND PRESSURE LEVEL (DB REL. 0.0002 MICROBAR)
DATA TYPES 1/3 OCTAVE, OVERALL, A-WTD, PNL, PNLT & EPNL

TABLE C-2.5 (CONTINUED)
DC-9 REFAN SIDELINE FLYOVER-NOISE TEST CONDITION SUMMARY

FAR PART 36 CALCULATED NOISE LEVELS 14140628 PAGE = 2

MODEL DC-9-31 FUSELAGE NO. 741 REGISTRATION NO. N54638 TEST DATE 1-29-75
FLIGHT NO. 16 TEST RUN NO 16 MICROPHONE NO. 9 MIC. LOCATION 16

REFERENCE CONDITIONS-DC-9 REFAN SIDELINE REFERENCE CONDITION CHANGE

SUMMARY OF MEASURED NOISE LEVELS.

PNLTM= 98.5 PNDB DCF= -2.2 DB EPNL= 96.3 EPNDB

SUMMARY OF DELTA1 CALCULATIONS

FREQUENCY (HZ)	MEASURED SPL (DB)	MEASURED NOISINESS (NOYS)	ADJUSTED SPL (DB)	ADJUSTED NOISINESS (NOYS)
50	73.4	2.6	73.3	2.5
63	76.9	4.9	76.8	4.8
80	75.4	5.2	75.2	5.1
100	69.5	4.1	69.3	4.0
125	66.4	3.5	66.2	3.4
160	78.2	10.0	78.0	9.8
200	83.0	16.0	82.8	15.7
250	85.2	20.0	85.0	19.6
315	84.9	20.7	84.6	20.2
400	78.4	14.3	78.0	14.0
500	85.2*	22.9	84.8*	22.4
630	77.3	13.3	77.1	13.0
800	78.9	14.8	78.8	14.7
1000	74.3	10.8	74.7	11.1
1250	70.7	9.7	71.9	10.5
1600	65.2	8.6	67.7	10.2
2000	59.8	6.8	64.2	9.2
2500	51.0	4.3	58.3	7.0
3150	41.2	2.3	52.8	5.2
4000	31.1	1.2	49.4	4.1
5000				
6300				
8000				
10000				
PNL	96.1 PNDB		96.4 PNDB	
PNLTM	98.5 PNDB		98.9 PNDB	

* BAND PRODUCING TONE CORRECTION

NOISE ADJUSTMENT PARAMETERS

	REF.	TEST
WEATHER		
AMB. TEMP. (DEG F)	77.0	52.5
REL. HUM. (PCT)	70.0	35.1
PERFORMANCE		
PATH SPEED (KN)	176.8	175.0
AVE FN/D (LBS)	13721.0	13485.2
FLIGHT PROFILE GEOMETRY		
MINIMUM DISTANCE (FT)	1798.	1779.
NOISE PATH DIST. (FT)	1874.	1856.

CALCULATED NOISE LEVELS

MEASURED EPNL	=	96.3 EPNDB
DELTA 1 (ARP866)	=	0.3 EPNDB
DELTA 2	=	0.0 EPNDB
DELTA S	=	-0.0 EPNDB
DELTA FN/D	=	0.2 EPNDB
REF. EPNL FN/D	=	96.9 EPNDB

TABLE C-2.6
DC-9 REFAN SIDELINE FLYOVER-NOISE TEST CONDITION SUMMARY

FAR PART 36 FLYOVER NOISE LEVELS

DATA IDENTIFICATION INFORMATION

DATA DIGITIZED 2-1-75 DATA PROCESSED 06/28/75 14140628 PAGE 1

MODEL DC-9-31 REG. NO. N54638

DC-9-31 REFAN FLYOVER NOISE TEST

FAR PART 36 NOISE LEVELS

ENGINE/NACELLE CONFIGURATION -- P&WA JT8D-109 ENGINES WITH ACOUSTICALLY TREATED NACELLES

TYPE OF FLYOVER -- SIMULATED T.O. CLIMB DATA CLASS -- FN/DLT = 9500 LBS
MEASUREMENT TYPE -- .25 NMI SIDELINE, 4 FEET ABOVE SANDY DIRT
RECORDING AT X = 555.0, Y = 1464.0, Z = -9.0 FEET FROM WEST-MOST END OF RUNWAY
REFERENCE RECORDING LOCATION X = 538.0, Y = 1519.0, Z = .0 FEET

MEASUREMENT INFO		AIRPLANE AND ENGINE DATA				WEATHER DATA	
MIC. NUMBER	10	FUSE. NO.	741	AVG. N1RT =	7464. RPM	AMB. TEMP. =	52.5 F
MIC. LOCATION	20	FLIGHT	16	AVG. EPR =	1.726	REL. HUM. =	35.1 PCT
MIC. ORIENT	GRAZING	RUN	16	A/P HEADING =	210. DEG	ABS. HUM. =	3.6 GM/M3
TEST SITE	YUMA	HEIGHT =	968.2 FT	FLAP POS. = UP	2.1 DEG	WIND SPEED =	4. KN
TEST DATE	1-29-75	LAT. DEV. =	-1426.5 FT	PATH ANG. =	10.4 DEG	WIND DIR. =	260. DEG
TEST NUMBER	JOB 511	SLNT.RNG. =	1724.0 FT	PITCH ANG. =	19.3 DEG	STA. PRESS =	29.81 IN HG
JOB REEL	A5282	PATH SPD. =	175.0 KN	GR. WEIGHT =	99900. LB	RT. THETA =	.9955

AIRPLANE SPACE POSITIONING IS RELATIVE TO MIC FOR TIME AT MIC OF 10-42-22.7
OTHER PERFORMANCE DATA IS FOR TIME OF PNLTM OF 10-42-27.5
TIME OF AIRCRAFT AT MINIMUM DISTANCE FROM MICROPHONE LOCATION 10-42-22.0

REFERENCE SURFACE WEATHER CONDITIONS TEMP = 77.0 F & REL. HUM. = 70.0 PCT

DESCRIPTION OF ACOUSTICAL DATA PROCESSING

ANALYZER TYPE / RESOLUTION GR1921(CISA) / 0.25 DB
CISA MODE 1 PASS WITH AUTO-START
SAMPLE INTERVAL FOR BASIC DATA = .500 SECONDS
AVERAGING TIME = 1.500 SECONDS

ATMOSPHERIC ATTENUATION SAE ARP866(REV)
BASIC UNIT SOUND PRESSURE LEVEL (DB REL. 0.0002 MICROBAR)
DATA TYPES 1/3 OCTAVE, OVERALL, A-WTD, PNL, PNLT & EPNL

TABLE C-2.6 (CONTINUED)
DC-9 REFAN SIDELINE FLYOVER-NOISE TEST CONDITION SUMMARY.

FAR PART 36 CALCULATED NOISE LEVELS 14140628 PAGE = 2

MODEL DC-9-31	FUSELAGE NO. 741	REGISTRATION NO. N54638	TEST DATE 1-29-75
FLIGHT NO. 16	TEST RUN NO 16	MICROPHONE NO. 10	MIC. LOCATION 20

REFERENCE CONDITIONS-DC-9 REFAN SIDELINE REFERENCE CONDITION CHANGE

SUMMARY OF MEASURED NOISE LEVELS.

PNLTM= 99.0 PNDB DCF= -1.9 DB EPNL= 97.1 EPNDB

SUMMARY OF DELTA1 CALCULATIONS

FREQUENCY (HZ)	MEASURED SPL (DB)	MEASURED NOISINESS (NOYS)	ADJUSTED SPL (DB)	ADJUSTED NOISINESS (NOYS)
50	76.9	3.6	76.6	3.5
63	78.7	5.8	78.5	5.6
80	77.6	6.2	77.3	6.1
100	69.9	4.2	69.5	4.1
125	72.1	5.6	71.8	5.4
160	81.3	12.4	80.9	12.1
200	86.0	19.7	85.6	19.1
250	88.6	25.2	88.1	24.5
315	83.8	19.2	83.3	18.5
400	81.2	17.4	80.7	16.8
500	84.2*	21.4	83.7*	20.7
630	77.2	13.2	76.8	12.8
800	75.8	12.0	75.6	11.8
1000	73.8	10.4	74.0	10.5
1250	71.2	10.0	72.2	10.7
1600	67.1	9.8	69.5	11.6
2000	59.9	6.9	64.2	9.2
2500	52.4	4.7	59.7	7.8
3150	41.1	2.3	52.8	5.2
4000	29.5	1.0	48.1	3.7
5000				
6300				
8000				
10000				
PNL	97.3 PNDB		97.5 PNDB	
PNLTM	99.0 PNDB		99.1 PNDB	

* BAND PRODUCING TONE CORRECTION

NOISE ADJUSTMENT PARAMETERS

	REF.	TEST
WEATHER		
AMB. TEMP. (DEG F)	77.0	52.5
REL. HUM. (PCT)	70.0	35.1
PERFORMANCE		
PATH SPEED (KN)	176.8	175.0
AVE FN/D (LBS)	13721.0	13503.4
FLIGHT PROFILE GEOMETRY		
MINIMUM DISTANCE (FT)	1798.	1724.
NOISE PATH DIST. (FT)	1970.	1919.

CALCULATED NOISE LEVELS

MEASURED EPNL	=	97.1 EPNDB
DELTA 1 (ARP866)	=	0.2 EPNDB
DELTA 2	=	0.2 EPNDB
DELTA S	=	-0.0 EPNDB
DELTA FN/D	=	0.2 EPNDB
REF. EPNL FN/D	=	97.6 EPNDB

TABLE C-2.7
DC-9 REFAN SIDELINE FLYOVER-NOISE TEST CONDITION SUMMARY

FAR PART 36 FLYOVER NOISE LEVELS

DATA IDENTIFICATION INFORMATION

DATA DIGITIZED 2-1-75 DATA PROCESSED 06/28/75 14140628 PAGE 1

MODEL DC-9-31 REG. NO. N54638

DC-9-31 REFAN FLYOVER NOISE TEST

FAR PART 36 NOISE LEVELS

ENGINE/NACELLE CONFIGURATION -- P&WA JT8D-109 ENGINES WITH ACOUSTICALLY TREATED NACELLES

TYPE OF FLYOVER -- SIMULATED T.O. CLIMB DATA CLASS -- FN/DLT = 9500 LBS
MEASUREMENT TYPE -- .25 NMI SIDELINE, 4 FEET ABOVE SANDY DIRT
RECORDING AT X = 538.0, Y =-1461.0, Z = 4.0 FEET FROM WEST-MOST END OF RUNWAY
REFERENCE RECORDING LOCATION X = 538.0, Y =-1519.0, Z = .0 FEET

MEASUREMENT INFO	AIRPLANE AND ENGINE DATA		WEATHER DATA
MIC. NUMBER 9	FUSE. NO. 741	AVG. N1CT = 7473. RPM	AMB. TEMP. = 53.6 F
MIC. LOCATION 16	FLIGHT 16	AVG. EPR = 1.728	REL. HUM. = 35.5 PCT
MIC. ORIENT GRAZING	RUN 17	A/P HEADING = 210. DEG	ABS. HUM. = 3.8 GM/M3
TEST SITE YUMA	HEIGHT = 912.1 FT	FLAP POS. = UP 2.1 DEG	WIND SPEED = 4. KN
TEST DATE 1-29-75	LAT. DEV. = 1516.7 FT	PATH ANG. = 10.1 DEG	WIND DIR. = 280. DEG
TEST NUMBER JOB 511	SLNT.RNG. = 1769.8 FT	PITCH ANG. = 19.5 DEG	STA. PRESS = 29.81 IN HG
JOB REEL A5282	PATH SPD. = 173.6 KN	GR. WEIGHT = 99100. LB	RT. THETA = .9957

AIRPLANE SPACE POSITIONING IS RELATIVE TO MIC FOR TIME AT MIC OF 10-49-39.6
OTHER PERFORMANCE DATA IS FOR TIME OF PNLTM OF 10-49-43.5
TIME OF AIRCRAFT AT MINIMUM DISTANCE FROM MICROPHONE LOCATION 10-49-39.0

REFERENCE SURFACE WEATHER CONDITIONS TEMP = 77.0 F & REL. HUM. = 70.0 PCT

DESCRIPTION OF ACOUSTICAL DATA PROCESSING

ANALYZER TYPE / RESOLUTION GR1921(CISA) / 0.25 DB
CISA MODE 1 PASS WITH AUTO-START
SAMPLE INTERVAL FOR BASIC DATA = .500 SECONDS
AVERAGING TIME = 1.500 SECONDS

ATMOSPHERIC ATTENUATION SAE ARP866(REV)
BASIC UNIT SOUND PRESSURE LEVEL
(DB REL. 0.0002 MICROBAR)
DATA TYPES 1/3 OCTAVE, OVERALL, A-WTD, PNL, PNLT & EPNL

TABLE C-2.7 (CONTINUED)
DC-9 REFAN SIDELINE FLYOVER-NOISE TEST CONDITION SUMMARY

FAR PART 36 CALCULATED NOISE LEVELS 14140628 PAGE = 2

MODEL DC-9-31 FUSELAGE NO. 741 REGISTRATION NO. N54638 TEST DATE 1-29-75
FLIGHT NO. 16 TEST RUN NO 17 MICROPHONE NO. 9 MIC. LOCATION 16

REFERENCE CONDITIONS-DC-9 REFAN SIDELINE REFERENCE CONDITION CHANGE

SUMMARY OF MEASURED NOISE LEVELS.

PNLTM= 98.8 PNDB DCF= -2.7 DB EPNL= 96.1 EPNDB

SUMMARY OF DELTA1 CALCULATIONS

FREQUENCY (HZ)	MEASURED SPL (DB)	MEASURED NOISINESS (NOYS)	ADJUSTED SPL (DB)	ADJUSTED NOISINESS (NOYS)
50	75.0	3.0	74.9	3.0
63	75.7	4.3	75.7	4.3
80	76.6	5.8	76.6	5.7
100	71.6	4.8	71.5	4.8
125	68.2	4.0	68.1	4.0
160	76.4	8.8	76.3	8.7
200	82.9	15.9	82.7	15.7
250	85.9	20.9	85.7	20.7
315	86.1	22.5	85.8	22.1
400	77.1	13.1	76.8	12.9
500	85.1*	22.9	84.9*	22.5
630	79.2	15.2	79.0	15.0
800	79.7	15.7	79.7	15.7
1000	75.1	11.4	75.5	11.7
1250	71.7	10.3	72.7	11.1
1600	66.5	9.4	68.8	11.1
2000	61.9	7.8	65.9	10.4
2500	54.0	5.2	60.8	8.4
3150	44.2	2.8	55.2	6.1
4000	34.5	1.5	52.0	4.9
5000				
6300				
8000				
10000				
PNL	96.5 PNDB		97.0 PNDB	
PNLTM	98.8 PNDB		99.3 PNDB	

* BAND PRODUCING TONE CORRECTION

NOISE ADJUSTMENT PARAMETERS

	REF.	TEST
WEATHER		
AMB. TEMP. (DEG F)	77.0	53.6
REL. HUM. (PCT)	70.0	35.5
PERFORMANCE		
PATH SPEED (KN)	176.8	173.6
AVE FN/D (LBS)	13721.0	13506.0
FLIGHT PROFILE GEOMETRY		
MINIMUM DISTANCE (FT)	1774.	1770.
NOISE PATH DIST. (FT)	1860.	1861.

CALCULATED NOISE LEVELS

MEASURED EPNL	=	96.1 EPNDB
DELTA 1 (ARP866)	=	0.5 EPNDB
DELTA 2	=	0.0 EPNDB
DELTA S	=	-0.1 EPNDB
DELTA FN/D	=	0.2 EPNDB
REF. EPNL FN/D	=	96.7 EPNDB

TABLE C-2.8

DC-9 REFAN SIDELINE FLYOVER-NOISE TEST CONDITION SUMMARY

FAR PART 36 FLYOVER NOISE LEVELS

DATA IDENTIFICATION INFORMATION

DATA DIGITIZED 2-1-75 DATA PROCESSED 06/28/75 14140628 PAGE 1

MODEL DC-9-31 REG. NO. N54638

DC-9-31 REFAN FLYOVER NOISE TEST

FAR PART 36 NOISE LEVELS

ENGINE/NACELLE CONFIGURATION -- P&WA JT8D-109 ENGINES WITH ACOUSTICALLY TREATED NACELLES

TYPE OF FLYOVER -- SIMULATED T.O. CLIMB DATA CLASS -- FN/DLT = 9500 LBS
MEASUREMENT TYPE -- .25 NMI SIDELINE, 4 FEET ABOVE SANDY DIRT
RECORDING AT X = 555.0, Y = 1464.0, Z = -9.0 FEET FROM WEST-MOST END OF RUNWAY
REFERENCE RECORDING LOCATION X = 538.0, Y = 1519.0, Z = .0 FEET

MEASUREMENT INFO		AIRPLANE AND ENGINE DATA				WEATHER DATA	
MIC. NUMBER	10	FUSE. NO.	741	AVG. N1PT =	7472. RPM	AMB. TEMP. =	53.6 F
MIC. LOCATION	20	FLIGHT	16	AVG. EPR =	1.728	REL. HUM. =	35.5 PCT
MIC. ORIENT	GRAZING	RUN	17	A/P HEADING =	210. DEG	ABS. HUM. =	3.8 GM/M3
TEST SITE	YUMA	HEIGHT =	922.2 FT	FLAP POS. = UP	2.1 DEG	WIND SPEED =	4. KN
TEST DATE	1-29-75	LAT. DEV. =	-1408.6 FT	PATH ANG. =	10.0 DEG	WIND DIR. =	280. DEG
TEST NUMBER	JOB 511	SLNT.RNG. =	1683.6 FT	PITCH ANG. =	19.6 DEG	STA. PRESS =	29.81 IN HG
JOB REEL	A5282	PATH SPD. =	174.0 KN	GR. WEIGHT =	99100. LB	RT. THETA =	.9956

AIRPLANE SPACE POSITIONING IS RELATIVE TO MIC FOR TIME AT MIC OF 10-49-39.6
OTHER PERFORMANCE DATA IS FOR TIME OF PNLTM OF 10-49-44.5
TIME OF AIRCRAFT AT MINIMUM DISTANCE FROM MICROPHONE LOCATION 10-49-39.1

REFERENCE SURFACE WEATHER CONDITIONS TEMP = 77.0 F & REL. HUM. = 70.0 PCT

DESCRIPTION OF ACOUSTICAL DATA PROCESSING

ANALYZER TYPE / RESOLUTION GR1921(CISA) / 0.25 DB
CISA MODE 1 PASS WITH AUTO-START
SAMPLE INTERVAL FOR BASIC DATA = .500 SECONDS
AVERAGING TIME = 1.500 SECONDS

ATMOSPHERIC ATTENUATION SAE ARP866(REV)
BASIC UNIT SOUND PRESSURE LEVEL (DB REL. 0.0002 MICROBAR)
DATA TYPES 1/3 OCTAVE, OVERALL, A-WTD, PNL, PNLT & EPNL

TABLE C-2.8 (CONTINUED)

DC-9 REFAN SIDELINE FLYOVER-NOISE TEST CONDITION SUMMARY

FAR PART 36 CALCULATED NOISE LEVELS   14140628   PAGE = 2

MODEL DC-9-31	FUSELAGE NO. 741	REGISTRATION NO. N54638	TEST DATE 1-29-75
FLIGHT NO. 16	TEST RUN NO. 17	MICROPHONE NO. 10	MIC. LOCATION 20

REFERENCE CONDITIONS-DC-9 REFAN SIDELINE REFERENCE CONDITION CHANGE

SUMMARY OF MEASURED NOISE LEVELS.

PNLTM= 99.4 PNDB   DCF= -2.1 DB   EPNL= 97.3 EPNDB

SUMMARY OF DELTA1 CALCULATIONS

FREQUENCY (HZ)	MEASURED SPL (DB)	MEASURED NOISINESS (NOYS)	ADJUSTED SPL (DB)	ADJUSTED NOISINESS (NOYS)
50	78.0	4.1	77.6	3.9
63	79.0	5.9	78.6	5.7
80	78.4	6.7	78.0	6.4
100	71.4	4.8	71.0	4.6
125	70.5	4.9	70.1	4.7
160	79.8	11.2	79.4	10.8
200	86.3	20.1	85.8	19.4
250	88.3	24.7	87.7	23.8
315	83.7	19.0	83.1	18.2
400	80.7	16.8	80.0	16.0
500	85.5*	23.4	84.9*	22.4
630	77.7	13.6	77.1	13.1
800	78.2	14.1	77.8	13.7
1000	74.3	10.8	74.2	10.7
1250	70.3	9.4	70.8	9.7
1600	66.6	9.4	68.4	10.7
2000	59.8	6.9	63.3	8.7
2500	53.1	4.9	59.4	7.6
3150	42.1	2.5	52.5	5.0
4000	30.5	1.1	47.3	3.5
5000				
6300				
8000				
10000				
PNL	97.3 PNDB		97.3 PNDB	
PNLTM	99.4 PNDB		99.4 PNDB	

* BAND PRODUCING TONE CORRECTION

NOISE ADJUSTMENT PARAMETERS

	REF.	TEST
WEATHER		
AMB. TEMP. (DEG F)	77.0	53.6
REL. HUM. (PCT)	70.0	35.5
PERFORMANCE		
PATH SPEED (KN)	176.8	174.0
AVE FN/D (LBS)	13721.0	13490.4
FLIGHT PROFILE GEOMETRY		
MINIMUM DISTANCE (FT)	1774.	1684.
NOISE PATH DIST. (FT)	1959.	1886.

CALCULATED NOISE LEVELS

MEASURED EPNL	=	97.3 EPNDB
DELTA 1 (ARP866)	=	-0.0 EPNDB
DELTA 2	=	0.2 EPNDB
DELTA S	=	-0.1 EPNDB
DELTA FN/D	=	0.2 EPNDB
REF. EPNL FN/D	=	97.7 EPNDB

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TABLE C-2.9

DC-9 REFAN SIDELINE FLYOVER-NOISE TEST CONDITION SUMMARY

FAR PART 36 FLYOVER NOISE LEVELS

DATA IDENTIFICATION INFORMATION

DATA DIGITIZED 2-1-75 DATA PROCESSED 06/28/75 14140628 PAGE 1

MODEL DC-9-31 REG. NO. N54638

DC-9-31 REFAN FLYOVER NOISE TEST

FAR PART 36 NOISE LEVELS

ENGINE/NACELLE CONFIGURATION -- P&WA JT8D-109 ENGINES WITH ACOUSTICALLY TREATED NACELLES

TYPE OF FLYOVER -- SIMULATED T.O. CLIMB DATA CLASS -- FN/DLT = 9500 LBS
MEASUREMENT TYPE -- .25 NMI SIDELINE, 4 FEET ABOVE SANDY DIRT
RECORDING AT X = 538.0, Y =-1461.0, Z = 4.0 FEET FROM WEST-MOST END OF RUNWAY
REFERENCE RECORDING LOCATION X = 538.0, Y =-1519.0, Z = .0 FEET

MEASUREMENT INFO		AIRPLANE AND ENGINE DATA				WEATHER DATA	
MIC. NUMBER	9	FUSE. NO.	741	AVG. N1RT =	7496. RPM	AMB. TEMP. =	55.4 F
MIC. LOCATION	16	FLIGHT	16	AVG. EPR =	1.734	REL. HUM. =	32.8 PCT
MIC. ORIENT	GRAZING	RUN	18	A/P HEADING =	210. DEG	ABS. HUM. =	3.7 GM/M3
TEST SITE	YUMA	HEIGHT =	872.4 FT	FLAP POS. = UP	2.1 DEG	WIND SPEED =	3. KN
TEST DATE	1-29-75	LAT. DEV. =	1514.5 FT	PATH ANG. =	11.0 DEG	WIND DIR. =	220. DEG
TEST NUMBER	JOB 511	SLNT.RNG. =	1747.8 FT	PITCH ANG. =	20.9 DEG	STA. PRESS =	29.80 IN HG
JOB REEL	45282	PATH SPD. =	173.5 KN	GR. WEIGHT =	98000. LB	RT. THETA =	.9957

AIRPLANE SPACE POSITIONING IS RELATIVE TO MIC FOR TIME AT MIC OF 11- 0- 4.8
OTHER PERFORMANCE DATA IS FOR TIME OF PNLTM OF 11- 0- 9.0
TIME OF AIRCRAFT AT MINIMUM DISTANCE FROM MICROPHONE LOCATION 11- 0- 4.1

REFERENCE SURFACE WEATHER CONDITIONS TEMP = 77.0 F & REL. HUM. = 70.0 PCT

DESCRIPTION OF ACOUSTICAL DATA PROCESSING

ANALYZER TYPE / RESOLUTION GR1921(CISA) / 0.25 DB
CISA MODE 1 PASS WITH AUTO-START
SAMPLE INTERVAL FOR BASIC DATA = .500 SECONDS
AVERAGING TIME = 1.500 SECONDS

ATMOSPHERIC ATTENUATION SAE ARP866(REV)
BASIC UNIT SOUND PRESSURE LEVEL (DB REL. 0.0002 MICROBAR)
DATA TYPES 1/3 OCTAVE, OVERALL, A-WTD, PNL, PNLT & EPNL

TABLE C-2.9 (CONTINUED)
DC-9 REFAN SIDELINE FLYOVER-NOISE TEST CONDITION SUMMARY

FAR PART 36 CALCULATED NOISE LEVELS   14140628   PAGE = 2

MODEL DC-9-31   FUSELAGE NO. 741   REGISTRATION NO. N54638   TEST DATE 1-29-75
FLIGHT NO. 16   TEST RUN NO 18   MICROPHONE NO. 9   MIC. LOCATION 16

REFERENCE CONDITIONS-DC-9 REFAN SIDELINE REFERENCE CONDITION CHANGE

SUMMARY OF MEASURED NOISE LEVELS.

PNLTM= 97.9 PNDB   DCF= -1.6 DB   EPNL= 96.3 EPNDB

SUMMARY OF DELTA1 CALCULATIONS

FREQUENCY (HZ)	MEASURED SPL (DB)	MEASURED NOISINESS (NOYS)	ADJUSTED SPL (DB)	ADJUSTED NOISINESS (NOYS)
50	76.2	3.4	76.2	3.4
63	77.3	5.0	77.3	5.0
80	75.8	5.4	75.8	5.3
100	72.2	5.1	72.2	5.1
125	66.1	3.4	66.0	3.4
160	75.0	8.0	74.9	7.9
200	81.3	14.2	81.1	14.1
250	85.6	20.5	85.4	20.3
315	86.5	23.3	86.3	22.9
400	76.2	12.3	76.0	12.1
500	83.5*	20.3	83.3*	20.0
630	78.9	14.9	78.8	14.7
800	77.1	13.1	77.2	13.1
1000	73.4	10.1	73.8	10.4
1250	69.9	9.1	71.1	9.9
1600	65.2	8.6	67.8	10.3
2000	58.5	6.2	63.0	8.5
2500	50.4	4.1	57.8	6.8
3150	40.7	2.2	52.5	5.1
4000	30.2	1.1	48.9	3.9
5000				
6300				
8000				
10000				
PNL	95.9 PNDB		96.4 PNDB	
PNLTM	97.9 PNDB		98.3 PNDB	

* BAND PRODUCING TONE CORRECTION

NOISE ADJUSTMENT PARAMETERS

	REF.	TEST
WEATHER		
AMB. TEMP. (DEG F)	77.0	55.4
REL. HUM. (PCT)	70.0	32.8
PERFORMANCE		
PATH SPEED (KN)	176.8	173.5
AVE FN/D (LBS)	13721.0	13585.5
FLIGHT PROFILE GEOMETRY		
MINIMUM DISTANCE (FT)	1754.	1748.
NOISE PATH DIST. (FT)	1874.	1874.

CALCULATED NOISE LEVELS

MEASURED EPNL	=	96.3 EPNDB
DELTA 1 (ARP866)	=	0.4 EPNDB
DELTA 2	=	0.0 EPNDB
DELTA S	=	-0.1 EPNDB
DELTA FN/D	=	0.1 EPNDB
REF. EPNL FN/D	=	96.8 EPNDB

TABLE C-2.10
DC-9 REFAN SIDELINE FLYOVER-NOISE TEST CONDITION SUMMARY

FAR PART 36 FLYOVER NOISE LEVELS

DATA IDENTIFICATION INFORMATION

DATA DIGITIZED 2-1-75 DATA PROCESSED 06/28/75 14140628 PAGE 1

MODEL DC-9-31 REG. NO. N54638

DC-9-31 REFAN FLYOVER NOISE TEST

FAR PART 36 NOISE LEVELS

ENGINE/NACELLE CONFIGURATION -- P&WA JT8D-109 ENGINES WITH ACOUSTICALLY TREATED NACELLES

TYPE OF FLYOVER -- SIMULATED T.O. CLIMB DATA CLASS -- FN/DLT = 9500 LBS
MEASUREMENT TYPE -- .25 NMI SIDELINE, 4 FEET ABOVE SANDY DIRT
RECORDING AT X = 555.0, Y = 1464.0, Z = -9.0 FEET FROM WEST-MOST END OF RUNWAY
REFERENCE RECORDING LOCATION X = 538.0, Y = 1519.0, Z = .0 FEET

MEASUREMENT INFO		AIRPLANE AND ENGINE DATA				WEATHER DATA	
MIC. NUMBER	10	FUSE. NO.	741	AVG. N1RT =	7496. RPM	AMB. TEMP. =	55.4 F
MIC. LOCATION	20	FLIGHT	16	AVG. EPR =	1.734	REL. HUM. =	32.8 PCT
MIC. ORIENT	GRAZING	RUN	18	A/P HEADING =	210. DEG	ABS. HUM. =	3.7 GM/M3
TEST SITE	YUMA	HEIGHT =	882.2 FT	FLAP POS. = UP	2.1 DEG	WIND SPEED =	3. KN
TEST DATE	1-29-75	LAT. DEV. =	-1410.8 FT	PATH ANG. =	11.1 DEG	WIND DIR. =	220. DEG
TEST NUMBER	JOB 511	SLNT.RNG. =	1663.9 FT	PITCH ANG. =	20.9 DEG	STA. PRESS =	29.80 IN HG
JOB REEL	A5282	PATH SPD. =	173.5 KN	GR. WEIGHT =	98000. LB	RT. THETA =	.9957

AIRPLANE SPACE POSITIONING IS RELATIVE TO MIC FOR TIME AT MIC OF 11- 0- 4.7
OTHER PERFORMANCE DATA IS FOR TIME OF PNLTM OF 11- 0- 9.5
TIME OF AIRCRAFT AT MINIMUM DISTANCE FROM MICROPHONE LOCATION 11- 0- 4.2

REFERENCE SURFACE WEATHER CONDITIONS TEMP = 77.0 F & REL. HUM. = 70.0 PCT

DESCRIPTION OF ACOUSTICAL DATA PROCESSING

ANALYZER TYPE / RESOLUTION GR1921(CISA) / 0.25 DB
CISA MODE 1 PASS WITH AUTO-START
SAMPLE INTERVAL FOR BASIC DATA = .500 SECONDS
AVERAGING TIME = 1.500 SECONDS

ATMOSPHERIC ATTENUATION SAE ARP866(REV)
BASIC UNIT SOUND PRESSURE LEVEL (0.0002 MICROBAR)
DATA TYPES 1/3 OCTAVE, OVERALL, A-WTD, PNL, PNLT & EPNL

TABLE C-2.10 (CONTINUED)
DC-9 REFAN SIDELINE FLYOVER-NOISE TEST CONDITION SUMMARY

FAR PART 36 CALCULATED NOISE LEVELS 14140628 PAGE = 2

MODEL DC-9-31	FUSELAGE NO. 741	REGISTRATION NO. N54638	TEST DATE 1-29-75
FLIGHT NO. 16	TEST RUN NO 18	MICROPHONE NO. 10	MIC. LOCATION 20

REFERENCE CONDITIONS-DC-9 REFAN SIDELINE REFERENCE CONDITION CHANGE

SUMMARY OF MEASURED NOISE LEVELS.

PNLTM= 99.9 PNDB DCF= -2.8 DB EPNL= 97.1 EPNDB

SUMMARY OF DELTA1 CALCULATIONS

FREQUENCY (HZ)	MEASURED SPL (DB)	MEASURED NOISINESS (NOYS)	ADJUSTED SPL (DB)	ADJUSTED NOISINESS (NOYS)
50	76.6	3.5	76.3	3.4
63	76.3	4.6	76.0	4.4
80	77.0	5.9	76.6	5.7
100	72.5	5.2	72.1	5.1
125	71.3	5.2	70.9	5.1
160	80.4	11.7	80.0	11.3
200	86.2	20.0	85.7	19.3
250	89.1	26.2	88.6	25.2
315	85.0	20.9	84.4	20.0
400	80.7	16.8	80.1	16.2
500	85.5*	23.5	84.9*	22.5
630	77.7	13.6	77.1	13.1
800	78.3	14.2	77.9	13.9
1000	75.0	11.3	75.1	11.4
1250	71.3	10.1	72.0	10.6
1600	66.8	9.6	68.9	11.1
2000	60.0	6.9	63.8	9.0
2500	54.0	5.2	60.7	8.3
3150	42.8	2.6	53.8	5.5
4000	31.9	1.2	49.5	4.1
5000				
6300				
8000				
10000				
PNL	97.8 PNDB		97.9 PNDB	
PNLTM	99.9 PNDB		100.0 PNDB	

* BAND PRODUCING TONE CORRECTION

NOISE ADJUSTMENT PARAMETERS

	REF.	TEST
WEATHER		
AMB. TEMP. (DEG F)	77.0	55.4
REL. HUM. (PCT)	70.0	32.8
PERFORMANCE		
PATH SPEED (KN)	176.8	173.5
AVE FN/D (LBS)	13721.0	13589.4
FLIGHT PROFILE GEOMETRY		
MINIMUM DISTANCE (FT)	1754.	1664.
NOISE PATH DIST. (FT)	1927.	1856.

CALCULATED NOISE LEVELS

MEASURED EPNL	=	97.1 EPNDB
DELTA 1 (APP866)	=	0.1 EPNDB
DELTA 2	=	0.2 EPNDB
DELTA S	=	-0.1 EPNDB
DELTA FN/D	=	0.1 EPNDB
REF. EPNL FN/D	=	97.4 EPNDB

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TABLE C-2.11

DC-9 REFAN SIDELINE FLYOVER-NOISE TEST CONDITION SUMMARY

FAR PART 36 FLYOVER NOISE LEVELS

DATA IDENTIFICATION INFORMATION

DATA DIGITIZED 2-1-75 DATA PROCESSED 06/28/75 14140628 PAGE 1

MODEL DC-9-31 REG. NO. N54638

DC-9-31 REFAN FLYOVER NOISE TEST

FAR PART 36 NOISE LEVELS

ENGINE/NACELLE CONFIGURATION -- P&WA JT8D-109 ENGINES WITH ACOUSTICALLY TREATED NACELLES

TYPE OF FLYOVER -- SIMULATED T.O. CLIMB DATA CLASS -- FN/DLT = 9500 LBS
MEASUREMENT TYPE -- .25 NMI SIDELINE, 4 FEET ABOVE SANDY DIRT
RECORDING AT X = 538.0, Y =-1461.0, Z = 4.0 FEET FROM WEST-MOST END OF RUNWAY
REFERENCE RECORDING LOCATION X = 538.0, Y =-1519.0, Z = .0 FEET

MEASUREMENT INFO		AIRPLANE AND ENGINE DATA				WEATHER DATA	
MIC. NUMBER	9	FUSE. NO.	741	AVG. N1RT =	7533. RPM	AMB. TEMP. =	56.5 F
MIC. LOCATION	16	FLIGHT	16	AVG. EPR =	1.744	REL. HUM. =	30.4 PCT
MIC. ORIENT	GRAZING	RUN	19	A/P HEADING =	210. DEG	ABS. HUM. =	3.6 GM/M3
TEST SITE	YUMA	HEIGHT =	814.0 FT	FLAP POS. = UP	1.9 DEG	WIND SPEED =	3. KN
TEST DATE	1-29-75	LAT. DEV. =	1501.3 FT	PATH ANG. =	11.1 DEG	WIND DIR. =	220. DEG
TEST NUMBER	JOB 511	SLNT.RNG. =	1707.8 FT	PITCH ANG. =	19.9 DEG	STA. PRESS =	29.80 IN HG
JOB REEL	A4916	PATH SPD. =	173.4 KN	GR. WEIGHT =	97030. LB	RT. THETA =	.9963

AIRPLANE SPACE POSITIONING IS RELATIVE TO MIC FOR TIME AT MIC OF 11-17-24.5
OTHER PERFORMANCE DATA IS FOR TIME OF PNLTM OF 11-17-27.5
TIME OF AIRCRAFT AT MINIMUM DISTANCE FROM MICROPHONE LOCATION 11-17-24.5

REFERENCE SURFACE WEATHER CONDITIONS TEMP = 77.0 F & REL. HUM. = 70.0 PCT

DESCRIPTION OF ACOUSTICAL DATA PROCESSING

ANALYZER TYPE / RESOLUTION GR1921(CISA) / 0.25 DB
CISA MODE 1 PASS WITH AUTO-START
SAMPLE INTERVAL FOR BASIC DATA = .500 SECONDS
AVERAGING TIME = 1.500 SECONDS

ATMOSPHERIC ATTENUATION SAE ARP866(REV)
BASIC UNIT SOUND PRESSURE LEVEL (DB REL. 0.0002 MICROBAR)
DATA TYPES 1/3 OCTAVE, OVERALL, A-WTD, PNL, PNLT & EPNL

TABLE C-2.11 (CONTINUED)
DC-9 REFAN SIDELINE FLYOVER-NOISE TEST CONDITION SUMMARY

FAR PART 36 CALCULATED NOISE LEVELS 14140628 PAGE = 2

MODEL DC-9-31 FUSELAGE NO. 741 REGISTRATION NO. N54638 TEST DATE 1-29-75
FLIGHT NO. 16 TEST RUN NO 19 MICROPHONE NO. 9 MIC. LOCATION 16

REFERENCE CONDITIONS-DC-9 REFAN SIDELINE REFERENCE CONDITION CHANGE

SUMMARY OF MEASURED NOISE LEVELS.

PNLTM= 99.9 PNDB DCF= -2.8 DB EPNL= 97.1 EPNDB

SUMMARY OF DELTA1 CALCULATIONS

FREQUENCY (HZ)	MEASURED SPL (DB)	MEASURED NOISINESS (NOYS)	ADJUSTED SPL (DB)	ADJUSTED NOISINESS (NOYS)
50	75.1	3.0	75.0	3.0
63	76.2	4.5	76.1	4.5
80	77.6	6.2	77.5	6.2
100	74.0	5.9	73.9	5.9
125	69.3	4.4	69.1	4.4
160	74.8	7.8	74.6	7.7
200	83.1	16.2	82.9	15.9
250	87.1	22.8	86.9	22.4
315	88.0	25.9	87.8	25.4
400	79.4	15.4	79.2	15.1
500	85.7*	23.8	85.5*	23.4
630	81.6	17.8	81.4	17.6
800	79.9	15.9	80.0	16.0
1000	77.5	13.5	78.0	14.0
1250	75.1	13.1	76.4	14.3
1600	70.6	12.5	73.3	15.0
2000	63.5	8.8	68.1	12.1
2500	56.7	6.3	64.3	10.6
3150	46.7	3.4	58.7	7.8
4000	36.7	1.7	55.4	6.2
5000				
6300				
8000				
10000				
PNL	98.2 PNDB		98.8 PNDB	
PNLTM	99.9 PNDB		100.5 PNDB	

* BAND PRODUCING TONE CORRECTION

NOISE ADJUSTMENT PARAMETERS

	REF.	TEST
WEATHER		
AMB. TEMP. (DEG F)	77.0	56.5
REL. HUM. (PCT)	70.0	30.4
PERFORMANCE		
PATH SPEED (KN)	176.8	173.4
AVE FN/D (LBS)	13721.0	13735.7
FLIGHT PROFILE GEOMETRY		
MINIMUM DISTANCE (FT)	1725.	1708.
NOISE PATH DIST. (FT)	1763.	1749.

CALCULATED NOISE LEVELS

MEASURED EPNL	=	97.1 EPNDB
DELTA 1 (ARP866)	=	0.6 EPNDB
DELTA 2	=	0.0 EPNDB
DELTA S	=	-0.1 EPNDB
DELTA FN/D	=	-0.0 EPNDB
REF. EPNL FN/D	=	97.7 EPNDB

TABLE C-2.12
DC-9 REFAN SIDELINE FLYOVER-NOISE TEST CONDITION SUMMARY

FAR PART 36 FLYOVER NOISE LEVELS

DATA IDENTIFICATION INFORMATION

DATA DIGITIZED 2-1-75 DATA PROCESSED 06/28/75 14140628 PAGE 1

MODEL DC-9-31 REG. NO. N54638

DC-9-31 REFAN FLYOVER NOISE TEST

FAR PART 36 NOISE LEVELS

ENGINE/NACELLE CONFIGURATION -- P&WA JT8D-109 ENGINES WITH ACOUSTICALLY TREATED NACELLES

TYPE OF FLYOVER -- SIMULATED T.O. CLIMB DATA CLASS -- FN/DLT = 9500 LBS
MEASUREMENT TYPE -- .25 NMI SIDELINE, 4 FEET ABOVE SANDY DIRT
RECORDING AT X = 555.0, Y = 1464.0, Z = -9.0 FEET FROM WEST-MOST END OF RUNWAY
REFERENCE RECORDING LOCATION X = 538.0, Y = 1519.0, Z = .0 FEET

MEASUREMENT INFO	AIRPLANE AND ENGINE DATA		WEATHER DATA
MIC. NUMBER 10	FUSE. NO. 741	AVG. N1RT = 7536. RPM	AMB. TEMP. = 56.5 F
MIC. LOCATION 20	FLIGHT 16	AVG. EPR = 1.745	REL. HUM. = 30.4 PCT
MIC. ORIENT GRAZING	RUN 19	A/P HEADING = 210. DEG	ABS. HUM. = 3.6 GM/M3
TEST SITE YUMA	HEIGHT = 827.6 FT	FLAP POS. = UP 1.9 DEG	WIND SPEED = 3. KN
TEST DATE 1-29-75	LAT. DEV. =-1423.8 FT	PATH ANG. = 11.1 DEG	WIND DIR. = 220. DEG
TEST NUMBER JOB 511	SLNT.RNG. = 1646.9 FT	PITCH ANG. = 20.1 DEG	STA. PRESS = 29.80 IN HG
JOB REEL 14916	PATH SPD. = 173.6 KN	GR. WEIGHT = 97000. LB	RT. THETA = .9960

AIRPLANE SPACE POSITIONING IS RELATIVE TO MIC FOR TIME AT MIC OF 11-17-24.4
OTHER PERFORMANCE DATA IS FOR TIME OF PNLTM OF 11-17-28.5
TIME OF AIRCRAFT AT MINIMUM DISTANCE FROM MICROPHONE LOCATION 11-17-24.5

REFERENCE SURFACE WEATHER CONDITIONS TEMP = 77.0 F & REL. HUM. = 70.0 PCT

DESCRIPTION OF ACOUSTICAL DATA PROCESSING

ANALYZER TYPE / RESOLUTION GR1921(CISA) / 0.25 DB
CISA MODE 1 PASS WITH AUTO-START
SAMPLE INTERVAL FOR BASIC DATA = .500 SECONDS
AVERAGING TIME = 1.500 SECONDS

ATMOSPHERIC ATTENUATION SAE ARP866(REV)
BASIC UNIT SOUND PRESSURE LEVEL (DB REL. 0.0002 MICROBAR)
DATA TYPES 1/3 OCTAVE, OVERALL, A-WTD, PNL, PNLT & EPNL

TABLE C-2.12 (CONTINUED)

DC-9 REFAN SIDELINE FLYOVER-NOISE TEST CONDITION SUMMARY

FAR PART 36 CALCULATED NOISE LEVELS 14140628 PAGE = 2

MODEL DC-9-31 FUSELAGE NO. 741 REGISTRATION NO. N54638 TEST DATE 1-29-75
FLIGHT NO. 16 TEST RUN NO 19 MICROPHONE NO. 10 MIC. LOCATION 20

REFERENCE CONDITIONS-DC-9 REFAN SIDELINE REFERENCE CONDITION CHANGE

SUMMARY OF MEASURED NOISE LEVELS.

PNLTM= 99.7 PNDB DCF= -2.6 DB EPNL= 97.2 EPNDB

SUMMARY OF DELTA1 CALCULATIONS

FREQUENCY (HZ)	MEASURED SPL (DB)	MEASURED NOISINESS (NOYS)	ADJUSTED SPL (DB)	ADJUSTED NOISINESS (NOYS)
50	77.8	4.0	77.5	3.9
63	78.7	5.7	78.3	5.5
80	78.1	6.5	77.7	6.3
100	74.8	6.3	74.4	6.1
125	69.4	4.5	69.0	4.3
160	79.9	11.3	79.5	10.9
200	86.0	19.7	85.5	19.0
250	88.2	24.6	87.7	23.7
315	87.5	24.9	87.0	24.0
400	79.2	15.1	78.6	14.5
500	85.6*	23.6	85.1*	22.7
630	79.9	15.9	79.5	15.4
800	79.2	15.1	79.0	14.9
1000	74.4	10.9	74.7	11.1
1250	71.0	9.9	71.9	10.5
1600	65.9	9.0	68.3	10.6
2000	60.4	7.1	64.6	9.5
2500	54.0	5.2	61.2	8.6
3150	42.7	2.6	54.3	5.7
4000	32.2	1.3	50.6	4.4
5000				
6300				
8000				
10000				
PNL	97.7 PNDB		97.9 PNDB	
PNLTM	99.7 PNDB		99.9 PNDB	

* BAND PRODUCING TONE CORRECTION

NOISE ADJUSTMENT PARAMETERS

	REF.	TEST
WEATHER		
AMB. TEMP. (DEG F)	77.0	56.5
REL. HUM. (PCT)	70.0	30.4
PERFORMANCE		
PATH SPEED (KN)	176.8	173.6
AVE FN/D (LBS)	13721.0	13761.9
FLIGHT PROFILE GEOMETRY		
MINIMUM DISTANCE (FT)	1725.	1647.
NOISE PATH DIST. (FT)	1838.	1773.

CALCULATED NOISE LEVELS
MEASURED EPNL = 97.2 EPNDB
DELTA 1 (ARP866) = 0.1 EPNDB
DELTA 2 = 0.2 EPNDB
DELTA S = -0.1 EPNDB
DELTA FN/D = -0.0 EPNDB
REF. EPNL FN/D = 97.4 EPNDB

TABLE C-3.1

DC-9 REFAN TAKEOFF FLYOVER-NOISE TEST CONDITION SUMMARY

FAR PART 36 FLYOVER NOISE LEVELS

DATA IDENTIFICATION INFORMATION

DATA DIGITIZED 2-1-75 DATA PROCESSED 07/01/75 12280701 PAGE 1

MODEL DC-9-31 REG. NO. N54638

DC-9-31 REFAN FLYOVER NOISE TEST

FAR PART 36 NOISE LEVELS

ENGINE/NACELLE CONFIGURATION -- P&WA JT8D-109 ENGINES WITH ACOUSTICALLY TREATED NACELLES

TYPE OF FLYOVER -- TAKEOFF CORR FLYOVER DATA CLASS -- POWER
MEASUREMENT TYPE -- BENEATH FLT PATH, 4 FEET ABOVE SANDY DIRT
RECORDING AT X = -7301.0, Y = .0, Z =-81.0 FEET FROM WEST-MOST END OF RUNWAY
REFERENCE RECORDING LOCATION X = -7966.0, Y = .0, Z = .0 FEET

MEASUREMENT INFO		AIRPLANE AND ENGINE DATA				WEATHER DATA	
MIC. NUMBER	1	FUSE. NO.	741	AVG. NIRT =	7567. RPM	AMB. TEMP. =	48.8 F
MIC. LOCATION	C6	FLIGHT	16	AVG. EPR =	1.745	REL. HUM. =	41.4 PCT
MIC. ORIENT	GRAZING	RUN	9	A/P HEADING =	210. DEG	ABS. HUM. =	3.7 GM/M3
TEST SITE	YUMA	HEIGHT =	2316.1 FT	FLAP POS. =	UP 2.1 DEG	WIND SPEED =	2. KN
TEST DATE	1-29-75	LAT. DEV. =	-134.5 FT	PATH ANG. =	8.8 DEG	WIND DIR. =	330. DEG
TEST NUMBER	JOB 511	SLNT.RNG. =	2320.0 FT	PITCH ANG. =	18.6 DEG	STA. PRESS =	29.81 IN HG
JOB REEL	A5282	PATH SPD. =	179.6 KN	GR. WEIGHT =	108600. LB	RT. THETA =	.9909

AIRPLANE SPACE POSITIONING IS RELATIVE TO MIC FOR TIME AT MIC OF 9-32-33.3
OTHER PERFORMANCE DATA IS FOR TIME OF PNLTM OF 9-32-40.5
TIME OF AIRCRAFT AT MINIMUM DISTANCE FROM MICROPHONE LOCATION 9-32-32.2

REFERENCE SURFACE WEATHER CONDITIONS TEMP = 77.0 F & REL. HUM. = 70.0 PCT

DESCRIPTION OF ACOUSTICAL DATA PROCESSING

ANALYZER TYPE / RESOLUTION GR1921(CISA) / 0.25 DB
CISA MODE 1 PASS WITH AUTO-START
SAMPLE INTERVAL FOR BASIC DATA = .500 SECONDS
AVERAGING TIME = 1.500 SECONDS

ATMOSPHERIC ATTENUATION SAE ARP866(REV)
BASIC UNIT SOUND PRESSURE LEVEL (DB REL. 0.0002 MICROBAR)
DATA TYPES 1/3 OCTAVE, OVERALL, A-WTD, PNL, PNLT & EPNL

TABLE C-3.1 (CONTINUED)

DC-9 REFAN TAKEOFF FLYOVER-NOISE TEST CONDITION SUMMARY

FAR PART 36 CALCULATED NOISE LEVELS 12280701 PAGE = 2

MODEL DC-9-31 FUSELAGE NO. 741 REGISTRATION NO. N54638 TEST DATE 1-29-75
FLIGHT NO. 16 TEST RUN NO 9 MICROPHONE NO. 1 MIC. LOCATION C6

REFERENCE CONDITIONS-DC-9 REFAN TAKEOFF WITHOUT CUTBACK SLOPE FROM FINAL CORR CURVE

SUMMARY OF MEASURED NOISE LEVELS.

PNLTM= 96.1 PNDB DCF= 0.6 DB EPNL= 96.7 EPNDB

SUMMARY OF DELTA1 CALCULATIONS

FREQUENCY (HZ)	MEASURED SPL (DB)	MEASURED NOISINESS (NOYS)	ADJUSTED SPL (DB)	ADJUSTED NOISINESS (NOYS)
50	79.5	4.7	78.9	4.4
63	78.9	5.9	78.3	5.5
80	76.0	5.4	75.3	5.1
100	80.8	10.4	80.1	9.9
125	83.5	13.5	82.8	12.8
160	86.8	18.1	86.0	17.1
200	83.8	16.9	82.9	15.9
250	79.7	13.7	78.8	12.8
315	85.2*	21.2	84.2*	19.7
400	79.6	15.6	78.5	14.4
500	79.4	15.3	78.2	14.2
630	76.8	12.8	75.6	11.8
800	73.0	9.9	72.1	9.2
1000	70.4	8.2	69.9	8.0
1250	64.3	6.2	64.6	6.3
1600	54.8	4.2	56.8	4.8
2000	46.4	2.7	50.7	3.6
2500	34.4	1.4	42.4	2.4
3150				
4000				
5000				
6300				
8000				
10000				
PNL	95.2 PNDB		94.4 PNDB	
PNLTM	96.1 PNDB		95.3 PNDB	

* BAND PRODUCING TONE CORRECTION

NOISE ADJUSTMENT PARAMETERS

	REF.	TEST
WEATHER		
AMB. TEMP. (DEG F)	77.0	48.8
REL. HUM. (PCT)	70.0	41.4
PREFORMANCE		
PATH SPEED (KN)	180.3	179.6
AVE FN/D (LBS)	13891.0	13750.0
FLIGHT PROFILE GEOMETRY		
MINIMUM DISTANCE (FT)	2443.	2295.
NOISE PATH DIST. (FT)	2935.	2757.

CALCULATED NOISE LEVELS

MEASURED EPNL	=	96.7 EPNDB
DELTA 1 (ARP866)	=	-0.8 EPNDB
DELTA 2	=	0.3 EPNDB
DELTA S	=	-0.0 EPNDB
DELTA FN/D	=	0.1 EPNDB
REF. EPNL FN/D	=	96.3 EPNDB

TABLE C-3.2

DC-9 REFAN TAKEOFF FLYOVER-NOISE TEST CONDITION SUMMARY

FAR PART 36 FLYOVER NOISE LEVELS

DATA IDENTIFICATION INFORMATION

DATA DIGITIZED 2-1-75 DATA PROCESSED 07/01/75 12280701 PAGE 1

MODEL DC-9-31 REG. NO. N54638

DC-9-31 REFAN FLYOVER NOISE TEST

FAR PART 36 NOISE LEVELS

ENGINE/NACELLE CONFIGURATION -- P&WA JT8D-109 ENGINES WITH ACOUSTICALLY TREATED NACELLES

TYPE OF FLYOVER -- TAKEOFF CORR FLYOVER DATA CLASS -- POWER
MEASUREMENT TYPE -- BENEATH FLT PATH, 4 FEET ABOVE SANDY DIRT
RECORDING AT X = -7301.0, Y = .0, Z =-81.0 FEET FROM WEST-MOST END OF RUNWAY
REFERENCE RECORDING LOCATION X = -7966.0, Y = .0, Z = .0 FEET

MEASUREMENT INFO		AIRPLANE AND ENGINE DATA				WEATHER DATA	
MIC. NUMBER	1	FUSE. NO.	741	AVG. N1RT =	7598. RPM	AMB. TEMP. =	50.4 F
MIC. LOCATION	C6	FLIGHT	16	AVG. EPR =	1.755	REL. HUM. =	34.5 PCT
MIC. ORIENT	GRAZING	RUN	10	A/P HEADING =	210. DEG	ABS. HUM. =	3.3 GM/M3
TEST SITE	YUMA	HEIGHT	= 2428.8 FT	FLAP POS. = UP	2.1 DEG	WIND SPEED =	2. KN
TEST DATE	1-29-75	LAT. DEV. =	-82.9 FT	PATH ANG. =	9.1 DEG	WIND DIR. =	335. DEG
TEST NUMBER	JOB 511	SLNT.RNG. =	2430.2 FT	PITCH ANG. =	18.9 DEG	STA. PRESS =	29.81 IN HG
JOB REEL	A5282	PATH SPD. =	178.3 KN	GR. WEIGHT =	106400. LB	RT. THETA =	.9902

AIRPLANE SPACE POSITIONING IS RELATIVE TO MIC FOR TIME AT MIC OF 9-48-34.2
OTHER PERFORMANCE DATA IS FOR TIME OF PNLTM OF 9-48-42.0
TIME OF AIRCRAFT AT MINIMUM DISTANCE FROM MICROPHONE LOCATION 9-48-32.9

REFERENCE SURFACE WEATHER CONDITIONS TEMP = 77.0 F & REL. HUM. = 70.0 PCT

DESCRIPTION OF ACOUSTICAL DATA PROCESSING

ANALYZER TYPE / RESOLUTION GR1921(CISA) / 0.25 DB
CISA MODE 1 PASS WITH AUTO-START
SAMPLE INTERVAL FOR BASIC DATA = .500 SECONDS
AVERAGING TIME = 1.500 SECONDS

ATMOSPHERIC ATTENUATION SAE ARP866(REV)
BASIC UNIT SOUND PRESSURE LEVEL (DB REL. 0.0002 MICROBAR)
DATA TYPES 1/3 OCTAVE, OVERALL, A-WTD, PNL, PNLT & EPNL

TABLE C-3.2 (CONTINUED)

DC-9 REFAN TAKEOFF FLYOVER-NOISE TEST CONDITION SUMMARY

FAR PART 36 CALCULATED NOISE LEVELS 12280701 PAGE = 2

MODEL DC-9-31	FUSELAGE NO. 741	REGISTRATION NO. N54638	TEST DATE 1-29-75
FLIGHT NO. 16	TEST RUN NO 10	MICROPHONE NO. 1	MIC. LOCATION C6

REFERENCE CONDITIONS-DC-9 REFAN TAKEOFF WITHOUT CUTBACK SLOPE FROM FINAL CORR CURVE

SUMMARY OF MEASURED NOISE LEVELS.

PNLTM= 96.2 PNDB DCF= 0.4 DB EPNL= 96.6 EPNDB

SUMMARY OF DELTA1 CALCULATIONS

FREQUENCY (HZ)	MEASURED SPL (DB)	MEASURED NOISINESS (NOYS)	ADJUSTED SPL (DB)	ADJUSTED NOISINESS (NOYS)
50	80.2	5.1	80.0	5.0
63	78.0	5.4	77.8	5.3
80	74.9	5.0	74.6	4.9
100	79.1	9.1	78.8	8.9
125	83.8	13.8	83.5	13.5
160	87.7	19.2	87.3	18.8
200	84.9	18.3	84.5	17.7
250	80.5	14.4	80.0	13.9
315	85.4*	21.4	84.8*	20.6
400	80.2	16.2	79.7	15.7
500	79.5	15.5	79.0	15.0
630	77.3	13.3	77.1	13.1
800	72.7	9.7	72.9	9.8
1000	69.9	7.9	70.9	8.5
1250	63.7	5.9	66.2	7.0
1600	54.7	4.2	59.5	5.8
2000	44.7	2.4	53.0	4.2
2500	32.1	1.2	45.[illegible]	2.8
3150				
4000				
5000				
6300				
8000				
10000				
PNL	95.4 PNDB		95.3 PNDB	
PNLTM	96.2 PNDB		96.1 PNDB	

* BAND PRODUCING TONE CORRECTION

NOISE ADJUSTMENT PARAMETERS

	REF.	TEST
WEATHER		
AMB. TEMP. (DEG F)	77.0	50.4
REL. HUM. (PCT)	70.0	34.5
PREFORMANCE		
PATH SPEED (KN)	180.3	178.3
AVE FN/D (LBS)	13891.0	13876.4
FLIGHT PROFILE GEOMETRY		
MINIMUM DISTANCE (FT)	2443.	2403.
NOISE PATH DIST. (FT)	2968.	2919.

CALCULATED NOISE LEVELS

MEASURED EPNL	=	96.6 EPNDB
DELTA 1 (ARP866)	=	-0.1 EPNDB
DELTA 2	=	0.1 EPNDB
DELTA S	=	-0.0 EPNDB
DELTA FN/D	=	0.0 EPNDB
REF. EPNL FN/D	=	96.5 EPNDB

TABLE C-3.3

DC-9 REFAN TAKEOFF FLYOVER-NOISE TEST CONDITION SUMMARY

FAR PART 36 FLYOVER NOISE LEVELS

DATA IDENTIFICATION INFORMATION

DATA DIGITIZED 2-6-75 DATA PROCESSED 07/01/75 12280701 PAGE 1

MODEL DC-9-31 REG. NO. N54638

DC-9-31 REFAN FLYOVER NOISE TEST

FAR PART 36 NOISE LEVELS

ENGINE/NACELLE CONFIGURATION -- P&WA JT8D-109 ENGINES WITH ACOUSTICALLY TREATED NACELLES

TYPE OF FLYOVER -- TAKEOFF CORR FLYOVER DATA CLASS -- POWER
MEASUREMENT TYPE -- BENEATH FLT PATH, 4 FEET ABOVE SANDY DIRT
RECORDING AT X = -7301.0, Y = .0, Z =-81.0 FEET FROM WEST-MOST END OF RUNWAY
REFERENCE RECORDING LOCATION X = -7966.0, Y = .0, Z = .0 FEET

MEASUREMENT INFO		AIRPLANE AND ENGINE DATA				WEATHER DATA	
MIC. NUMBER	1	FUSE. NO.	741	AVG. N1RT =	7603. RPM	AMB. TEMP. =	52.5 F
MIC. LOCATION	C6	FLIGHT	16	AVG. EPR =	1.757	REL. HUM. =	36.1 PCT
MIC. ORIENT	GRAZING	RUN	13	A/P HEADING =	210. DEG	ABS. HUM. =	3.7 GM/M3
TEST SITE	YUMA	HEIGHT	= 2382.5 FT	FLAP POS. = UP	2.1 DEG	WIND SPEED =	2. KN
TEST DATE	1-29-75	LAT. DEV.	= 29.4 FT	PATH ANG. =	10.5 DEG	WIND DIR. =	100. DEG
TEST NUMBER	JOB 511	SLNT.RNG.	= 2382.7 FT	PITCH ANG. =	20.2 DEG	STA. PRESS =	29.81 IN HG
JOB REEL	A5282	PATH SPD.	= 177.1 KN	GR. WEIGHT =	103800. LB	RT. THETA =	.9908

AIRPLANE SPACE POSITIONING IS RELATIVE TO MIC FOR TIME AT MIC OF 10-11-33.9
OTHER PERFORMANCE DATA IS FOR TIME OF PNLTM OF 10-11-41.5
TIME OF AIRCRAFT AT MINIMUM DISTANCE FROM MICROPHONE LOCATION 10-11-32.6

REFERENCE SURFACE WEATHER CONDITIONS TEMP = 77.0 F & REL. HUM. = 70.0 PCT

DESCRIPTION OF ACOUSTICAL DATA PROCESSING

ANALYZER TYPE / RESOLUTION GR1921(CISA) / 0.25 DB
CISA MODE 1 PASS WITH AUTO-START
SAMPLE INTERVAL FOR BASIC DATA = .500 SECONDS
AVERAGING TIME = 1.500 SECONDS

ATMOSPHERIC ATTENUATION SAE ARP866(REV)
BASIC UNIT SOUND PRESSURE LEVEL (DB REL. 0.0002 MICROBAR)
DATA TYPES 1/3 OCTAVE, OVERALL, A-WTD, PNL, PNLT & EPNL

TABLE C-3.3 (CONTINUED)

DC-9 REFAN TAKEOFF FLYOVER-NOISE TEST CONDITION SUMMARY

FAR PART 36 CALCULATED NOISE LEVELS   12280701   PAGE = 2

MODEL DC-9-31   FUSELAGE NO. 741   REGISTRATION NO. N54638   TEST DATE 1-29-75
FLIGHT NO. 16   TEST RUN NO 13   MICROPHONE NO. 1   MIC. LOCATION C6

REFERENCE CONDITIONS-DC-9 REFAN TAKEOFF WITHOUT CUTBACK   SLOPE FROM FINAL CORR CURVE

SUMMARY OF MEASURED NOISE LEVELS.

PNLTM= 96.7 PNDB   DCF= 0.2 DB   EPNL= 96.9 EPNDB

SUMMARY OF DELTA1 CALCULATIONS

FREQUENCY (HZ)	MEASURED SPL (DB)	MEASURED NOISINESS (NOYS)	ADJUSTED SPL (DB)	ADJUSTED NOISINESS (NOYS)
50	80.4	5.2	80.0	5.0
63	78.5	5.6	78.1	5.4
80	72.4	4.0	72.0	3.9
100	79.6	9.5	79.1	9.2
125	83.8	13.8	83.3	13.3
160	87.6	19.2	87.1	18.5
200	84.8	18.1	84.2	17.4
250	80.3	14.2	79.6	13.5
315	86.1*	22.5	85.3*	21.3
400	79.7	15.6	78.8	14.8
500	79.8	15.8	79.0	14.9
630	77.2	13.2	76.5	12.5
800	73.0	9.8	72.5	9.5
1000	69.9	8.0	70.0	8.0
1250	62.9	5.6	64.0	6.1
1600	55.2	4.3	58.3	5.3
2000	46.9	2.8	52.7	4.2
2500	39.7	1.9	49.7	3.9
3150				
4000				
5000				
6300				
8000				
10000				
PNL	95.7 PNDB		95.3 PNDB	
PNLTM	96.7 PNDB		96.3 PNDB	

* BAND PRODUCING TONE CORRECTION

NOISE ADJUSTMENT PARAMETERS

	REF.	TEST
WEATHER		
AMB. TEMP. (DEG F)	77.0	52.5
REL. HUM. (PCT)	70.0	36.1
PREFORMANCE		
PATH SPEED (KN)	180.3	177.1
AVE FN/D (LBS)	13891.0	13858.9
FLIGHT PROFILE GEOMETRY		
MINIMUM DISTANCE (FT)	2443.	2352.
NOISE PATH DIST. (FT)	3011.	2899.

CALCULATED NOISE LEVELS
MEASURED EPNL = 96.9 EPNDB
DELTA 1 (ARP866) = -0.4 EPNDB
DELTA 2 = 0.2 EPNDB
DELTA S = -0.1 EPNDB
DELTA FN/D = 0.0 EPNDB
REF. EPNL FN/D = 96.6 EPNDB

TABLE C-3.4

DC-9 REFAN TAKEOFF FLYOVER-NOISE TEST CONDITION SUMMARY

FAR PART 36 FLYOVER NOISE LEVELS

DATA IDENTIFICATION INFORMATION

DATA DIGITIZED 2-5-75 DATA PROCESSED 07/01/75 12280701 PAGE 1

MODEL DC-9-31 REG. NO. N54638

DC-9-31 REFAN FLYOVER NOISE TEST

FAR PART 36 NOISE LEVELS

ENGINE/NACELLE CONFIGURATION -- P&WA JT8D-109 ENGINES WITH ACOUSTICALLY TREATED NACELLES

TYPE OF FLYOVER -- TAKEOFF CORR FLYOVER DATA CLASS -- POWER
MEASUREMENT TYPE -- BENEATH FLT PATH, 4 FEET ABOVE SANDY DIRT
RECORDING AT X = -7301.0, Y = .0, Z =-81.0 FEET FROM WEST-MOST END OF RUNWAY
REFERENCE RECORDING LOCATION X = -7966.0, Y = .0, Z = .0 FEET

MEASUREMENT INFO		AIRPLANE AND ENGINE DATA		WEATHER DATA
MIC. NUMBER	1	FUSE. NO. 741	AVG. NIRT = 7564. RPM	AMB. TEMP. = 55.1 F
MIC. LOCATION	C6	FLIGHT 21	AVG. EPR = 1.742	REL. HUM. = 41.8 PCT
MIC. ORIENT	GRAZING	RUN 53	A/P HEADING = 210. DEG	ABS. HUM. = 4.7 GM/M3
TEST SITE	YUMA	HEIGHT = 2062.1 FT	FLAP POS. = UP 1.7 DEG	WIND SPEED = 5. KN
TEST DATE	2-02-75	LAT. DEV. = -145.0 FT	PATH ANG. = 8.6 DEG	WIND DIR. = 20. DEG
TEST NUMBER	JOB 511	SLNT.RNG. = 2067.2 FT	PITCH ANG. = 18.7 DEG	STA. PRESS = 30.00 IN HG
JOB REEL	A5342	PATH SPD. = 181.3 KN	GR. WEIGHT = 108900. LB	RT. THETA = .9965

AIRPLANE SPACE POSITIONING IS RELATIVE TO MIC FOR TIME AT MIC OF 9-38-56.1
OTHER PERFORMANCE DATA IS FOR TIME OF PNLTM OF 9-39- 3.5
TIME OF AIRCRAFT AT MINIMUM DISTANCE FROM MICROPHONE LOCATION 9-38-55.0

REFERENCE SURFACE WEATHER CONDITIONS TEMP = 77.0 F & REL. HUM. = 70.0 PCT

DESCRIPTION OF ACOUSTICAL DATA PROCESSING

ANALYZER TYPE / RESOLUTION GR1921(CISA) / 0.25 DB
CISA MODE 1 PASS WITH AUTO-START
SAMPLE INTERVAL FOR BASIC DATA = .500 SECONDS
AVERAGING TIME = 1.500 SECONDS

ATMOSPHERIC ATTENUATION SAE ARP866(REV)
BASIC UNIT SOUND PRESSURE LEVEL (DB REL. 0.0002 MICROBAR)
DATA TYPES 1/3 OCTAVE, OVERALL, A-WTD, PNL, PNLT & EPNL

TABLE C-3.4 (CONTINUED)

DC-9 REFAN TAKEOFF FLYOVER-NOISE TEST CONDITION SUMMARY

FAR PART 36 CALCULATED NOISE LEVELS 12280701 PAGE = 2

MODEL DC-9-31 FUSELAGE NO. 741 REGISTRATION NO. N54638 TEST DATE 2-02-75
FLIGHT NO. 21 TEST RUN NO 53 MICROPHONE NO. 1 MIC. LOCATION C6

REFERENCE CONDITIONS-DC-9 REFAN TAKEOFF WITHOUT CUTBACK SLOPE FROM FINAL CORR CURVE

SUMMARY OF MEASURED NOISE LEVELS.

PNLTM= 99.0 PNDB DCF= -0.3 DB EPNL= 98.8 EPNDB

SUMMARY OF DELTA1 CALCULATIONS

FREQUENCY (HZ)	MEASURED SPL (DB)	MEASURED NOISINESS (NOYS)	ADJUSTED SPL (DB)	ADJUSTED NOISINESS (NOYS)
50	84.5	7.8	82.9	6.6
63	82.6	8.3	81.0	7.1
80	78.9	7.0	77.2	6.0
100	79.4	9.3	77.6	8.1
125	84.0	14.0	82.2	12.3
160	88.5	20.4	86.6	17.9
200	89.4*	24.9	87.5*	21.8
250	80.0	13.9	78.0	12.1
315	85.3	21.2	83.1	18.3
400	84.9	22.5	82.6	19.1
500	81.8	18.1	79.3	15.2
630	79.5	15.5	76.9	12.9
800	77.3	13.3	74.5	10.9
1000	73.3	10.0	70.5	8.3
1250	69.1	8.6	66.5	7.2
1600	64.5	8.2	62.5	7.2
2000	58.4	6.2	57.7	5.9
2500	49.6	3.9	51.1	4.3
3150	38.1	1.9	43.1	2.6
4000				
5000				
6300				
8000				
10000				
PNL	98.2 PNDB		96.2 PNDB	
PNLTM	99.0 PNDB		97.0 PNDB	

* BAND PRODUCING TONE CORRECTION

NOISE ADJUSTMENT PARAMETERS

	REF.	TEST
WEATHER		
AMB. TEMP. (DEG F)	77.0	55.1
REL. HUM. (PCT)	70.0	41.8
PREFORMANCE		
PATH SPEED (KN)	180.3	181.3
AVE FN/D (LBS)	13891.0	13781.5
FLIGHT PROFILE GEOMETRY		
MINIMUM DISTANCE (FT)	2443.	2040.
NOISE PATH DIST. (FT)	3124.	2609.

CALCULATED NOISE LEVELS

MEASURED EPNL	=	98.8 EPNDB
DELTA 1 (ARP866)	=	-2.0 EPNDB
DELTA 2	=	0.8 EPNDB
DELTA S	=	0.0 EPNDB
DELTA FN/D	=	0.1 EPNDB
REF. EPNL FN/D	=	97.7 EPNDB

TABLE C-3.5

DC-9 REFAN TAKEOFF FLYOVER-NOISE TEST CONDITION SUMMARY

FAR PART 36 FLYOVER NOISE LEVELS

DATA IDENTIFICATION INFORMATION

DATA DIGITIZED 2-5-75 DATA PROCESSED 07/01/75 L2280701 PAGE 1

MODEL DC-9-31 REG. NO. N54638

DC-9-31 REFAN FLYOVER NOISE TEST

FAR PART 36 NOISE LEVELS

ENGINE/NACELLE CONFIGURATION -- P&WA JT8D-109 ENGINES WITH ACOUSTICALLY TREATED NACELLES

TYPE OF FLYOVER -- TAKEOFF CORR FLYOVER DATA CLASS -- POWER
MEASUREMENT TYPE -- BENEATH FLT PATH, 4 FEET ABOVE SANDY DIRT
RECORDING AT X = -7301.0, Y = .0, Z =-81.0 FEET FROM WEST-MOST END OF RUNWAY
REFERENCE RECORDING LOCATION X = -7966.0, Y = .0, Z = .0 FEET

MEASUREMENT INFO		AIRPLANE AND ENGINE DATA			WEATHER DATA	
MIC. NUMBER	1	FUSE. NO. 741	AVG. NIRT =	7512. RPM	AMB. TEMP. =	55.3 F
MIC. LOCATION	C6	FLIGHT 21	AVG. EPR =	1.734	REL. HUM. =	42.5 PCT
MIC. ORIENT	GRAZING	RUN 54	A/P HEADING =	210. DEG	ABS. HUM. =	4.8 GM/M3
TEST SITE	YUMA	HEIGHT = 2117.1 FT	FLAP POS. = UP	2.0 DEG	WIND SPEED =	4. KN
TEST DATE	2-02-75	LAT. DEV. = 11.6 FT	PATH ANG. =	8.9 DEG	WIND DIR. =	45. DEG
TEST NUMBER	JOB 511	SLNT.RNG. = 2117.1 FT	PITCH ANG. =	20.3 DEG	STA. PRESS =	30.00 IN HG
JOB REEL	A5342	PATH SPD. = 179.8 KN	GR. WEIGHT =	107400. LB	RT. THETA =	.9969

AIRPLANE SPACE POSITIONING IS RELATIVE TO MIC FOR TIME AT MIC OF 9-46- 6.2
OTHER PERFORMANCE DATA IS FOR TIME OF PNLTM OF 9-46- 9.5
TIME OF AIRCRAFT AT MINIMUM DISTANCE FROM MICROPHONE LOCATION 9-46- 5.1

REFERENCE SURFACE WEATHER CONDITIONS TEMP = 77.0 F & REL. HUM. = 70.0 PCT

DESCRIPTION OF ACOUSTICAL DATA PROCESSING

ANALYZER TYPE / RESOLUTION GR 1921(CISA) / 0.25 DB
CISA MODE 1 PASS WITH AUTO-START
SAMPLE INTERVAL FOR BASIC DATA = .500 SECONDS
AVERAGING TIME = 1.500 SECONDS

ATMOSPHERIC ATTENUATION SAE ARP866(REV)
BASIC UNIT SOUND PRESSURE LEVEL (DB REL. 0.0002 MICROBAR)
DATA TYPES 1/3 OCTAVE, OVERALL, A-WTD, PNL, PNLT & EPNL

TABLE C-3.5 (CONTINUED)

DC-9 REFAN TAKEOFF FLYOVER-NOISE TEST CONDITION SUMMARY

FAR PART 36 CALCULATED NOISE LEVELS 12280701 PAGE = 2

MODEL DC-9-31 FUSELAGE NO. 741 REGISTRATION NO. N54638 TEST DATE 2-02-75
FLIGHT NO. 21 TEST RUN NO 54 MICROPHONE NO. 1 MIC. LOCATION C6

REFERENCE CONDITIONS-DC-9 REFAN TAKEOFF WITHOUT CUTBACK SLOPE FROM FINAL CORR CURVE

SUMMARY OF MEASURED NOISE LEVELS.

PNLTM= 99.3 PNDB DCF= -0.4 DB EPNL= 98.8 EPNDB

SUMMARY OF DELTA1 CALCULATIONS

FREQUENCY (HZ)	MEASURED SPL (DB)	MEASURED NOISINESS (NOYS)	ADJUSTED SPL (DB)	ADJUSTED NOISINESS (NOYS)
50	75.9	3.3	74.5	2.9
63	76.2	4.5	74.7	4.0
80	72.2	3.9	70.7	3.5
100	79.5	9.4	78.0	8.3
125	83.5	13.4	82.0	12.1
160	84.9	15.9	83.3	14.2
200	81.0	13.9	79.3	12.4
250	81.7	15.7	80.0	13.9
315	87.8*	25.3	86.0*	22.3
400	81.9	18.3	80.0	16.0
500	84.3	21.6	82.3	18.7
630	81.8	18.1	79.6	15.5
800	79.1	15.0	76.8	12.8
1000	76.0	12.2	73.7	10.3
1250	71.9	10.5	69.7	9.0
1600	68.4	10.7	66.7	9.6
2000	64.2	9.2	63.5	8.8
2500	58.3	7.1	59.5	7.6
3150	50.6	4.4	54.6	5.8
4000	40.1	2.2	49.0	4.0
5000				
6300				
8000				
10000				
PNL	98.3 PNDB		96.6 PNDB	
PNLTM	99.3 PNDB		97.6 PNDB	

* BAND PRODUCING TONE CORRECTION

NOISE ADJUSTMENT PARAMETERS

	REF.	TEST
WEATHER		
AMB. TEMP. (DEG F)	77.0	55.3
REL. HUM. (PCT)	70.0	42.5
PREFORMANCE		
PATH SPEED (KN)	180.3	179.8
AVE FN/D (LBS)	13891.0	13660.9
FLIGHT PROFILE GEOMETRY		
MINIMUM DISTANCE (FT)	2443.	2090.
NOISE PATH DIST. (FT)	2519.	2156.

CALCULATED NOISE LEVELS

MEASURED EPNL	=	98.8 EPNDB
DELTA 1 (ARP866)	=	-1.6 EPNDB
DELTA 2	=	0.7 EPNDB
DELTA S	=	-0.0 EPNDB
DELTA FN/D	=	0.2 EPNDB
REF. EPNL FN/D	=	98.1 EPNDB

TABLE C-3.6

DC-9 REFAN TAKEOFF FLYOVER-NOISE TEST CONDITION SUMMARY

FAR PART 36 FLYOVER NOISE LEVELS

DATA IDENTIFICATION INFORMATION

DATA DIGITIZED 2-5-75 DATA PROCESSED 07/01/75 12280701 PAGE 1

MODEL DC-9-31 REG. NO. N54638

DC-9-31 REFAN FLYOVER NOISE TEST

FAR PART 36 NOISE LEVELS

ENGINE/NACELLE CONFIGURATION -- P&WA JT8D-109 ENGINES WITH ACOUSTICALLY TREATED NACELLES

TYPE OF FLYOVER -- TAKEOFF CORR FLYOVER DATA CLASS -- POWER
MEASUREMENT TYPE -- BENEATH FLT PATH, 4 FEET ABOVE SANDY DIRT
RECORDING AT X = -7301.0, Y = .0, Z =-81.0 FEET FROM WEST-MOST END OF RUNWAY
REFERENCE RECORDING LOCATION X = -7966.0, Y = .0, Z = .0 FEET

MEASUREMENT INFO		AIRPLANE AND ENGINE DATA				WEATHER DATA	
MIC. NUMBER	1	FUSE. NO.	741	AVG. NIRT =	7505. RPM	AMB. TEMP. =	56.6 F
MIC. LOCATION	C6	FLIGHT	21	AVG. EPR =	1.734	REL. HUM. =	41.9 PCT
MIC. ORIENT	GRAZING	RUN	55	A/P HEADING =	210. DEG	ABS. HUM. =	4.9 GM/M3
TEST SITE	YUMA	HEIGHT =	2208.0 FT	FLAP POS. =	UP 2.1 DEG	WIND SPEED =	5. KN
TEST DATE	2-02-75	LAT. DEV. =	-156.5 FT	PATH ANG. =	9.1 DEG	WIND DIR. =	350. DEG
TEST NUMBER	JOB 511	SLNT.RNG. =	2213.6 FT	PITCH ANG. =	19.6 DEG	STA. PRESS =	30.00 IN HG
JOB REEL	A5342	PATH SPD. =	179.4 KN	GR. WEIGHT =	106400. LB	RT. THETA =	.9963

AIRPLANE SPACE POSITIONING IS RELATIVE TO MIC FOR TIME AT MIC OF 9-53-26.2
OTHER PERFORMANCE DATA IS FOR TIME OF PNLTM OF 9-53-32.0
TIME OF AIRCRAFT AT MINIMUM DISTANCE FROM MICROPHONE LOCATION 9-53-25.1

REFERENCE SURFACE WEATHER CONDITIONS TEMP = 77.0 F & REL. HUM. = 70.0 PCT

DESCRIPTION OF ACOUSTICAL DATA PROCESSING

ANALYZER TYPE / RESOLUTION GR1921(CISA) / 0.25 DB
CISA MODE 1 PASS WITH AUTO-START
SAMPLE INTERVAL FOR BASIC DATA = .500 SECONDS
AVERAGING TIME = 1.500 SECONDS

ATMOSPHERIC ATTENUATION SAE ARP866(REV)
BASIC UNIT SOUND PRESSURE LEVEL (DB REL. 0.0002 MICROBAR)
DATA TYPES 1/3 OCTAVE, OVERALL, A-WTD, PNL, PNLT & EPNL

TABLE C-3.6 (CONTINUED)

DC-9 REFAN TAKEOFF FLYOVER-NOISE TEST CONDITION SUMMARY

FAR PART 36 CALCULATED NOISE LEVELS   12280701   PAGE = 2

MODEL DC-9-31	FUSELAGE NO. 741	REGISTRATION NO. N54638	TEST DATE 2-02-75
FLIGHT NO. 21	TEST RUN NO 55	MICROPHONE NO. 1	MIC. LOCATION C6

REFERENCE CONDITIONS-DC-9 REFAN TAKEOFF WITHOUT CUTBACK   SLOPE FROM FINAL CORR CURVE

SUMMARY OF MEASURED NOISE LEVELS.

PNLTM= 97.7 PNDB   DCF= 0.1 DB   EPNL= 97.8 EPNDB

SUMMARY OF DELTA1 CALCULATIONS

FREQUENCY (HZ)	MEASURED SPL (DB)	MEASURED NOISINESS (NOYS)	ADJUSTED SPL (DB)	ADJUSTED NOISINESS (NOYS)
50	78.0	4.1	77.0	3.7
63	77.9	5.3	76.9	4.8
80	75.8	5.3	74.7	4.9
100	78.2	8.4	77.1	7.7
125	83.9	13.9	82.8	12.8
160	87.6	19.2	86.4	17.7
200	83.6	16.7	82.3	15.3
250	78.9	12.9	77.6	11.8
315	85.7*	21.9	84.3*	19.8
400	80.3	16.4	78.8	14.7
500	82.1	18.5	80.5	16.5
630	80.2	16.2	78.4	14.3
800	77.2	13.2	75.3	11.6
1000	74.5	10.9	72.6	9.6
1250	70.0	9.2	68.4	8.2
1600	66.2	9.2	65.1	8.5
2000	59.8	6.8	59.9	6.8
2500	51.2	4.3	53.4	5.0
3150	42.4	2.5	48.1	3.7
4000	29.1	1.0	40.3	2.2
5000				
6300				
8000				
10000				
PNL	96.7 PNDB		95.5 PNDB	
PNLTM	97.7 PNDB		96.5 PNDB	

* BAND PRODUCING TONE CORRECTION

NOISE ADJUSTMENT PARAMETERS

	REF.	TEST
WEATHER		
AMB. TEMP. (DEG F)	77.0	56.6
REL. HUM. (PCT)	70.0	41.9
PREFORMANCE		
PATH SPEED (KN)	180.3	179.4
AVE FN/D (LBS)	13891.0	13631.3
FLIGHT PROFILE GEOMETRY		
MINIMUM DISTANCE (FT)	2443.	2187.
NOISE PATH DIST. (FT)	2790.	2497.

CALCULATED NOISE LEVELS

MEASURED EPNL	=	97.8 EPNDB
DELTA 1 (ARP866)	=	-1.2 EPNDB
DELTA 2	=	0.5 EPNDB
DELTA S	=	-0.0 EPNDB
DELTA FN/D	=	0.3 EPNDB
REF. EPNL FN/D	=	97.3 EPNDB

C.4

TABLE C-4.1
DC-9 REFAN TAKEOFF WITH CUTBACK FLYOVER-NOISE TEST CONDITION SUMMARY

FAR PART 36 FLYOVER NOISE LEVELS

DATA IDENTIFICATION INFORMATION

DATA DIGITIZED 2-1-75 DATA PROCESSED 06/27/75 14000627 PAGE 1

MODEL DC-9-31 REG. NO. N54638

DC-9-31 REFAN FLYOVER NOISE TEST

FAR PART 36 NOISE LEVELS

ENGINE/NACELLE CONFIGURATION -- P&WA JT8D-109 ENGINES WITH ACOUSTICALLY TREATED NACELLES

TYPE OF FLYOVER -- SIMULATED T.O. CLIMB DATA CLASS -- FN/DLT = 9500 LBS
MEASUREMENT TYPE -- BENEATH FLT PATH, 4 FEET ABOVE SANDY DIRT
RECORDING AT X = -7301.0, Y = .0, Z =-81.0 FEET FROM WEST-MOST END OF RUNWAY
REFERENCE RECORDING LOCATION X = -7966.0, Y = .0, Z = .0 FEET

MEASUREMENT INFO		AIRPLANE AND ENGINE DATA				WEATHER DATA	
MIC. NUMBER	1	FUSE. NO.	741	AVG. N1RT =	6469. RPM	AMB. TEMP. =	51.2 F
MIC. LOCATION	C6	FLIGHT	16	AVG. EPR =	1.441	REL. HUM. =	36.0 PCT
MIC. ORIENT	GRAZING	RUN	11	A/P HEADING =	210. DEG	ABS. HUM. =	3.5 GM/M3
TEST SITE	YUMA	HEIGHT =	2322.6 FT	FLAP POS. =	UP 2.1 DEG	WIND SPEED =	2. KN
TEST DATE	1-29-75	LAT. DEV. =	-8.6 FT	PATH ANG. =	4.6 DEG	WIND DIR. =	245. DEG
TEST NUMBER	JOB 511	SLNT.RNG. =	2322.6 FT	PITCH ANG. =	13.9 DEG	STA. PRESS =	29.81 IN HG
JOB REEL	A5282	PATH SPD. =	175.4 KN	GR. WEIGHT =	105500. LB	RT. THETA =	.9907

AIRPLANE SPACE POSITIONING IS RELATIVE TO MIC FOR TIME AT MIC OF 9-56- 2.7
OTHER PERFORMANCE DATA IS FOR TIME OF PNLTM OF 9-56- 8.5
TIME OF AIRCRAFT AT MINIMUM DISTANCE FROM MICROPHONE LOCATION 9-56- 1.8

REFERENCE SURFACE WEATHER CONDITIONS TEMP = 77.0 F & REL. HUM. = 70.0 PCT

DESCRIPTION OF ACOUSTICAL DATA PROCESSING

ANALYZER TYPE / RESOLUTION GR1921(CISA) / 0.25 DB
CISA MODE 1 PASS WITH AUTO-START
SAMPLE INTERVAL FOR BASIC DATA = .500 SECONDS
AVERAGING TIME = 1.500 SECONDS

ATMOSPHERIC ATTENUATION SAE ARP866(REV)
BASIC UNIT SOUND PRESSURE LEVEL (DB REL. 0.0002 MICROBAR)
DATA TYPES 1/3 OCTAVE, OVERALL, A-WTD, PNL, PNLT & EPNL

TABLE C-4.1 (CONTINUED)

DC-9 REFAN TAKEOFF WITH CUTBACK FLYOVER-NOISE TEST CONDITION SUMMARY

FAR PART 36 CALCULATED NOISE LEVELS   14000627   PAGE = 2

MODEL DC-9-31   FUSELAGE NO. 741   REGISTRATION NO. N54638   TEST DATE 1-29-75
FLIGHT NO. 16   TEST RUN NO 11   MICROPHONE NO. 1   MIC. LOCATION C6

REFERENCE CONDITIONS-DC-9 REFAN TAKEOFF WITH CUTBACK   REFERENCE CONDITIONS CHANGE

SUMMARY OF MEASURED NOISE LEVELS.

PNLTM= 87.8 PNDB   DCF= 0.1 DB   EPNL= 87.9 EPNDB

SUMMARY OF DELTA1 CALCULATIONS

FREQUENCY (HZ)	MEASURED SPL (DB)	MEASURED NOISINESS (NOYS)	ADJUSTED SPL (DB)	ADJUSTED NOISINESS (NOYS)
50	68.6	1.6	68.8	1.6
63	67.6	2.0	67.8	2.1
80	64.5	2.1	64.7	2.1
100	71.3	4.7	71.4	4.8
125	74.8	6.9	75.0	7.0
160	76.5	8.9	76.6	8.9
200	72.8	7.8	72.9	7.9
250	75.7	10.3	75.7	10.4
315	78.0*	12.7	78.0*	12.7
400	73.4	10.1	73.4	10.1
500	71.9	9.1	71.9	9.1
630	69.5	7.7	69.7	7.8
800	65.8	6.0	66.3	6.2
1000	62.4	4.7	63.6	5.1
1250	56.0	3.5	58.3	4.1
1600	49.4	2.9	53.6	3.9
2000	42.5	2.1	49.3	3.3
2500	32.2	1.2	43.1	2.5
3150				
4000				
5000				
6300				
8000				
10000				
PNL	87.2 PNDB		87.7 PNDB	
PNLTM	87.8 PNDB		88.2 PNDB	

* BAND PRODUCING TONE CORRECTION

NOISE ADJUSTMENT PARAMETERS

	REF.	TEST
WEATHER		
AMB. TEMP. (DEG F)	77.0	51.2
REL. HUM. (PCT)	70.0	36.0
PREFORMANCE		
PATH SPEED (KN)	179.7	175.4
AVE FN/D (LBS)	9451.0	9026.1
FLIGHT PROFILE GEOMETRY		
MINIMUM DISTANCE (FT)	2237.	2309.
NOISE PATH DIST. (FT)	2447.	2526.

CALCULATED NOISE LEVELS
MEASURED EPNL = 87.9 EPNDB
DELTA 1 (ARP866) = 0.4 EPNDB
DELTA 2 = -0.1 EPNDB
DELTA S = -0.1 EPNDB
DELTA FN/D = 0.6 EPNDB
REF. EPNL FN/D = 88.7 EPNDB

TABLE C-4.2

DC-9 REFAN TAKEOFF WITH CUTBACK FLYOVER-NOISE TEST CONDITION SUMMARY

FAR PART 36   FLYOVER NOISE LEVELS

DATA IDENTIFICATION INFORMATION

DATA DIGITIZED 2-1-75   DATA PROCESSED 06/27/75   14000627 PAGE 1

MODEL DC-9-31   REG. NO. N54638

DC-9-31 REFAN FLYOVER NOISE TEST

FAR PART 36 NOISE LEVELS

ENGINE/NACELLE CONFIGURATION -- P&WA JT8D-109 ENGINES WITH ACOUSTICALLY TREATED NACELLES

TYPE OF FLYOVER -- SIMULATED T.O. CLIMB   DATA CLASS -- FN/DLT = 9500 LBS
MEASUREMENT TYPE -- BENEATH FLT PATH, 4 FEET ABOVE SANDY DIRT
RECORDING AT X = -7301.0, Y = .0, Z =-81.0 FEET FROM WEST-MOST END OF RUNWAY
REFERENCE RECORDING LOCATION X = -7966.0, Y = .0, Z = .0 FEET

MEASUREMENT INFO		AIRPLANE AND ENGINE DATA		WEATHER DATA
MIC. NUMBER	1	FUSE. NO. 741	AVG. N1RT = 6558. RPM	AMB. TEMP. = 52.1 F
MIC. LOCATION	C6	FLIGHT 16	AVG. EPR = 1.463	REL. HUM. = 34.0 PCT
MIC. ORIENT	GRAZING	RUN 12	A/P HEADING = 210. DEG	ABS. HUM. = 3.4 GM/M3
TEST SITE	YUMA	HEIGHT = 2248.4 FT	FLAP POS. = UP 2.1 DEG	WIND SPEED = 3. KN
TEST DATE	1-29-75	LAT. DEV. = -95.1 FT	PATH ANG. = 5.2 DEG	WIND DIR. = 255. DEG
TEST NUMBER	JOB 511	SLNT.RNG. = 2250.4 FT	PITCH ANG. = 14.8 DEG	STA. PRESS = 29.81 IN HG
JOB REEL	A5282	PATH SPD. = 175.3 KN	GR. WEIGHT = 104600. LB	RT. THETA = .9914

AIRPLANE SPACE POSITIONING IS RELATIVE TO MIC FOR TIME AT MIC OF 10- 3-53.4
OTHER PERFORMANCE DATA IS FOR TIME OF PNLTM OF 10- 4- 0.0
TIME OF AIRCRAFT AT MINIMUM DISTANCE FROM MICROPHONE LOCATION 10- 3-52.6

REFERENCE SURFACE WEATHER CONDITIONS   TEMP = 77.0 F & REL. HUM. = 70.0 PCT

DESCRIPTION OF ACOUSTICAL DATA PROCESSING

ANALYZER TYPE / RESOLUTION GR1921(CISA) / 0.25 DB
CISA MODE 1 PASS WITH AUTO-START
SAMPLE INTERVAL FOR BASIC DATA = .500 SECONDS
AVERAGING TIME = 1.500 SECONDS

ATMOSPHERIC ATTENUATION SAE ARP866(REV)
BASIC UNIT SOUND PRESSURE LEVEL (DB REL. 0.0002 MICROBAR)
DATA TYPES 1/3 OCTAVE, OVERALL, A-WTD, PNL, PNLT & EPNL

TABLE C-4.2 (CONTINUED)
DC-9 REFAN TAKEOFF WITH CUTBACK FLYOVER-NOISE TEST CONDITION SUMMARY

FAR PART 36 CALCULATED NOISE LEVELS 14000627. PAGE = 2

MODEL DC-9-31 FUSELAGE NO. 741 REGISTRATION NO. N54638 TEST DATE 1-29-75
FLIGHT NO. 16 TEST RUN NO 12 MICROPHONE NO. 1 MIC. LOCATION C6

REFERENCE CONDITIONS-DC-9 REFAN TAKEOFF WITH CUTBACK REFERENCE CONDITIONS CHANGE

SUMMARY OF MEASURED NOISE LEVELS.

PNLTM= 87.8 PNDB DCF= 0.0 DB EPNL= 87.8 EPNDB

SUMMARY OF DELTA1 CALCULATIONS

FREQUENCY (HZ)	MEASURED SPL (DB)	MEASURED NOISINESS (NOYS)	ADJUSTED SPL (DB)	ADJUSTED NOISINESS (NOYS)
50	71.1	2.0	71.1	2.0
63	68.3	2.2	68.2	2.2
80	65.9	2.3	65.8	2.3
100	71.3	4.7	71.2	4.7
125	74.7	6.9	74.6	6.8
160	77.7	9.6	77.5	9.5
200	76.3	10.1	76.1	9.9
250	74.1	9.2	73.8	9.0
315	77.3*	12.1	77.0*	11.9
400	71.9	9.1	71.6	8.9
500	71.7	9.0	71.4	8.8
630	70.1	8.0	70.0	8.0
800	65.2	5.7	65.5	5.9
1000	62.5	4.8	63.4	5.1
1250	57.8	4.0	60.0	4.6
1600	50.2	3.0	54.3	4.1
2000	43.1	2.2	50.2	3.5
2500	32.8	1.2	44.0	2.6
3150				
4000				
5000				
6300				
8000				
10000				
PNL	87.1 PNDB		87.3 PNDB	
PNLTM	87.8 PNDB		88.0 PNDB	

* BAND PRODUCING TONE CORRECTION

NOISE ADJUSTMENT PARAMETERS

	REF.	TEST
WEATHER		
AMB. TEMP. (DEG F)	77.0	52.1
REL. HUM. (PCT)	70.0	34.0
PREFORMANCE		
PATH SPEED (KN)	179.7	175.3
AVE FN/D (LBS)	9451.0	9426.4
FLIGHT PROFILE GEOMETRY		
MINIMUM DISTANCE (FT)	2237.	2240.
NOISE PATH DIST. (FT)	2564.	2567.

CALCULATED NOISE LEVELS

MEASURED EPNL	=	87.8 EPNDB
DELTA 1 (ARP866)	=	0.2 EPNDB
DELTA 2	=	-0.0 EPNDB
DELTA S	=	-0.1 EPNDB
DELTA FN/D	=	0.0 EPNDB
REF. EPNL FN/D	=	88.0 EPNDB

TABLE C-4.3

DC-9 REFAN TAKEOFF WITH CUTBACK FLYOVER-NOISE TEST CONDITION SUMMARY

FAR PART 36 FLYOVER NOISE LEVELS

DATA IDENTIFICATION INFORMATION

DATA DIGITIZED 2-1-75 DATA PROCESSED 06/27/75 14000627 PAGE 1

MODEL DC-9-31 REG. NO. N54638

DC-9-31 REFAN FLYOVER NOISE TEST

FAR PART 36 NOISE LEVELS

ENGINE/NACELLE CONFIGURATION -- P&WA JT8D-109 ENGINES WITH ACOUSTICALLY TREATED NACELLES

TYPE OF FLYOVER -- SIMULATED T.O. CLIMB DATA CLASS -- FN/DLT = 9500 LBS
MEASUREMENT TYPE -- BENEATH FLT PATH, 4 FEET ABOVE SANDY DIRT
RECORDING AT X = -7301.0, Y = .0, Z =-81.0 FEET FROM WEST-MOST END OF RUNWAY
REFERENCE RECORDING LOCATION X = -7966.0, Y = .0, Z = .0 FEET

MEASUREMENT INFO		AIRPLANE AND ENGINE DATA				WEATHER DATA	
MIC. NUMBER	1	FUSE. NO.	741	AVG. N1RT =	6490. RPM	AMB. TEMP. =	52.5 F
MIC. LOCATION	C6	FLIGHT	16	AVG. EPR =	1.445	REL. HUM. =	35.1 PCT
MIC. ORIENT	GRAZING	RUN	16	A/P HEADING =	210. DEG	ABS. HUM. =	3.6 GM/M3
TEST SITE	YUMA	HEIGHT	= 2288.0 FT	FLAP POS. = UP	2.1 DEG	WIND SPEED =	4. KN
TEST DATE	1-29-75	LAT. DEV.	= -134.8 FT	PATH ANG. =	4.0 DEG	WIND DIR. =	260. DEG
TEST NUMBER	JOB 511	SLNT.RNG.	= 2292.0 FT	PITCH ANG. =	11.4 DEG	STA. PRESS =	29.81 IN HG
JOB REEL	A5282	PATH SPD.	= 174.4 KN	GR. WEIGHT =	99900. LB	RT. THETA =	.9911

AIRPLANE SPACE POSITIONING IS RELATIVE TO MIC FOR TIME AT MIC OF 10-42-49.9
OTHER PERFORMANCE DATA IS FOR TIME OF PNLTM OF 10-42-56.0
TIME OF AIRCRAFT AT MINIMUM DISTANCE FROM MICROPHONE LOCATION 10-42-49.3

REFERENCE SURFACE WEATHER CONDITIONS TEMP = 77.0 F & REL. HUM. = 70.0 PCT

DESCRIPTION OF ACOUSTICAL DATA PROCESSING

ANALYZER TYPE / RESOLUTION GR1921(CISA) / 0.25 DB
CISA MODE 1 PASS WITH AUTO-START
SAMPLE INTERVAL FOR BASIC DATA = .500 SECONDS
AVERAGING TIME = 1.500 SECONDS

ATMOSPHERIC ATTENUATION SAE ARP866(REV)
BASIC UNIT SOUND PRESSURE LEVEL (DB REL. 0.0002 MICROBAR)
DATA TYPES 1/3 OCTAVE, OVERALL, A-WTD, PNL, PNLT & EPNL

TABLE C-4.3 (CONTINUED)

DC-9 REFAN TAKEOFF WITH CUTBACK FLYOVER-NOISE TEST CONDITION SUMMARY

FAR PART 36 CALCULATED NOISE LEVELS 14000627 PAGE = 2

MODEL DC-9-31 FUSELAGE NO. 741 REGISTRATION NO. N54638 TEST DATE 1-29-75
FLIGHT NO. 16 TEST RUN NO 16 MICROPHONE NO. 1 MIC. LOCATION C6

REFERENCE CONDITIONS-DC-9 REFAN TAKEOFF WITH CUTBACK REFERENCE CONDITIONS CHANGE

SUMMARY OF MEASURED NOISE LEVELS.

PNLTM= 87.6 PNDB DCF= -0.5 DB EPNL= 87.2 EPNDB

SUMMARY OF DELTA1 CALCULATIONS

FREQUENCY (HZ)	MEASURED SPL (DB)	MEASURED NOISINESS (NOYS)	ADJUSTED SPL (DB)	ADJUSTED NOISINESS (NOYS)
50	69.9	1.8	70.1	1.8
63	67.1	1.9	67.2	2.0
80	64.3	2.0	64.4	2.0
100	72.8	5.4	72.9	5.4
125	75.7	7.4	75.8	7.5
160	75.8	8.5	75.9	8.5
200	73.6	8.3	73.6	8.3
250	74.8	9.7	74.7	9.7
315	77.5*	12.3	77.4*	12.2
400	73.9	10.5	73.8	10.4
500	73.1	9.9	73.0	9.9
630	69.9	7.9	70.0	8.0
800	64.8	5.6	65.1	5.7
1000	60.3	4.1	61.3	4.4
1250	56.1	3.5	58.1	4.0
1600	50.0	3.0	53.9	3.9
2000	42.0	2.0	48.5	3.1
2500	32.1	1.2	42.6	2.4
3150	21.7	0.0	38.2	1.9
4000				
5000				
6300				
8000				
10000				
PNL	87.1 PNDB		87.6 PNDB	
PNLTM	87.6 PNDB		88.1 PNDB	

* BAND PRODUCING TONE CORRECTION

NOISE ADJUSTMENT PARAMETERS

	REF.	TEST
WEATHER		
AMB. TEMP. (DEG F)	77.0	52.5
REL. HUM. (PCT)	70.0	35.1
PREFORMANCE		
PATH SPEED (KN)	179.7	174.4
AVE FN/D (LBS)	9451.0	9111.2
FLIGHT PROFILE GEOMETRY		
MINIMUM DISTANCE (FT)	2237.	2287.
NOISE PATH DIST. (FT)	2451.	2505.

CALCULATED NOISE LEVELS

MEASURED EPNL	=	87.2 EPNDB
DELTA 1 (ARP866)	=	0.5 EPNDB
DELTA 2	=	-0.1 EPNDB
DELTA S	=	-0.1 EPNDB
DELTA FN/D	=	0.5 EPNDB
REF. EPNL FN/D	=	87.9 EPNDB

TABLE C-4.4

DC-9 REFAN TAKEOFF WITH CUTBACK FLYOVER-NOISE TEST CONDITION SUMMARY

FAR PART 36 FLYOVER NOISE LEVELS

DATA IDENTIFICATION INFORMATION

DATA DIGITIZED 2-1-75 DATA PROCESSED 06/27/75 14000627 PAGE 1

MODEL DC-9-31 REG. NO. N54638

DC-9-31 REFAN FLYOVER NOISE TEST

FAR PART 36 NOISE LEVELS

ENGINE/NACELLE CONFIGURATION -- P&WA JT8D-109 ENGINES WITH ACOUSTICALLY TREATED NACELLES

TYPE OF FLYOVER -- SIMULATED T.O. CLIMB DATA CLASS -- FN/DLT = 9500 LBS
MEASUREMENT TYPE -- BENEATH FLT PATH, 4 FEET ABOVE SANDY DIRT
RECORDING AT X = -7301.0, Y = .0, Z =-81.0 FEET FROM WEST-MOST END OF RUNWAY
REFERENCE RECORDING LOCATION X = -7966.0, Y = .0, Z = .0 FEET

MEASUREMENT INFO		AIRPLANE AND ENGINE DATA				WEATHER DATA	
MIC. NUMBER	1	FUSE. NO.	741	AVG. N1RT =	6489. RPM	AMB. TEMP. =	53.6 F
MIC. LOCATION	C6	FLIGHT	16	AVG. EPR =	1.445	REL. HUM. =	35.5 PCT
MIC. ORIENT	GRAZING	RUN	17	A/P HEADING =	210. DEG	ABS. HUM. =	3.8 GM/M3
TEST SITE	YUMA	HEIGHT	= 2163.0 FT	FLAP POS. = UP	2.1 DEG	WIND SPEED =	4. KN
TEST DATE	1-29-75	LAT. DEV.	= -91.7 FT	PATH ANG. =	4.3 DEG	WIND DIR. =	280. DEG
TEST NUMBER	JOB 511	SLNT.RNG.	= 2164.9 FT	PITCH ANG. =	14.7 DEG	STA. PRESS =	29.81 IN HG
JOB REEL	A5282	PATH SPD.	= 176.8 KN	GR. WEIGHT =	99100. LB	RT. THETA =	.9920

AIRPLANE SPACE POSITIONING IS RELATIVE TO MIC FOR TIME AT MIC OF 10-50- 6.6
OTHER PERFORMANCE DATA IS FOR TIME OF PNLTM OF 10-50-11.5
TIME OF AIRCRAFT AT MINIMUM DISTANCE FROM MICROPHONE LOCATION 10-50- 6.0

REFERENCE SURFACE WEATHER CONDITIONS TEMP = 77.0 F & REL. HUM. = 70.0 PCT

DESCRIPTION OF ACOUSTICAL DATA PROCESSING

ANALYZER TYPE / RESOLUTION GR1921(CISA) / 0.25 DB
CISA MODE 1 PASS WITH AUTO-START
SAMPLE INTERVAL FOR BASIC DATA = .500 SECONDS
AVERAGING TIME = 1.500 SECONDS

ATMOSPHERIC ATTENUATION SAE ARP866(REV)
BASIC UNIT SOUND PRESSURE LEVEL (DB REL. 0.0002 MICROBAR)
DATA TYPES 1/3 OCTAVE, OVERALL, A-WTD, PNL, PNLT & EPNL

TABLE C-4.4 (CONTINUED)

DC-9 REFAN TAKEOFF WITH CUTBACK FLYOVER-NOISE TEST CONDITION SUMMARY

FAR PART 36 CALCULATED NOISE LEVELS 14000627 PAGE = 2

MODEL DC-9-31 FUSELAGE NO. 741 REGISTRATION NO. N54638 TEST DATE 1-29-75
FLIGHT NO. 16 TEST RUN NO 17 MICROPHONE NO. 1 MIC. LOCATION C6

REFERENCE CONDITIONS-DC-9 REFAN TAKEOFF WITH CUTBACK REFERENCE CONDITIONS CHANGE

SUMMARY OF MEASURED NOISE LEVELS.

PNLTM= 87.7 PNDB DCF= -0.7 DB EPNL= 87.0 EPNDB

SUMMARY OF DELTA1 CALCULATIONS

FREQUENCY (HZ)	MEASURED SPL (DB)	MEASURED NOISINESS (NOYS)	ADJUSTED SPL (DB)	ADJUSTED NOISINESS (NOYS)
50	67.5	1.4	67.1	1.4
63	68.2	2.1	67.8	2.1
80	67.1	2.6	66.7	2.5
100	71.8	4.9	71.3	4.7
125	75.0	7.0	74.6	6.8
160	76.1*	8.6	75.6*	8.3
200	70.3	6.4	69.7	6.2
250	75.7	10.3	75.1	9.9
315	77.3	12.1	76.7	11.6
400	74.2	10.7	73.5	10.2
500	71.8	9.1	71.1	8.6
630	71.6	8.9	71.0	8.6
800	65.6	5.9	65.2	5.7
1000	60.9	4.3	60.9	4.2
1250	57.5	3.9	58.3	4.1
1600	53.0	3.7	55.2	4.3
2000	46.3	2.7	50.7	3.6
2500	38.1	1.7	45.8	3.0
3150	27.8	0.0	40.5	2.2
4000				
5000				
6300				
8000				
10000				
PNL	87.2 PNDB		87.0 PNDB	
PNLTM	87.7 PNDB		87.6 PNDB	

* BAND PRODUCING TONE CORRECTION

NOISE ADJUSTMENT PARAMETERS

	REF.	TEST
WEATHER		
AMB. TEMP. (DEG F)	77.0	53.6
REL. HUM. (PCT)	70.0	35.5
PREFORMANCE		
PATH SPEED (KN)	179.7	176.8
AVE FN/D (LBS)	9451.0	9080.1
FLIGHT PROFILE GEOMETRY		
MINIMUM DISTANCE (FT)	2237.	2159.
NOISE PATH DIST. (FT)	2381.	2298.

CALCULATED NOISE LEVELS

MEASURED EPNL	=	87.0 EPNDB
DELTA 1 (ARP866)	=	-0.1 EPNDB
DELTA 2	=	0.2 EPNDB
DELTA S	=	-0.1 EPNDB
DELTA FN/D	=	0.5 EPNDB
PEF. EPNL FN/D	=	87.5 EPNDB

TABLE C-4.5
DC-9 REFAN TAKEOFF WITH CUTBACK FLYOVER-NOISE TEST CONDITION SUMMARY

FAR PART 36 FLYOVER NOISE LEVELS

DATA IDENTIFICATION INFORMATION

DATA DIGITIZED 2-1-75 DATA PROCESSED 06/27/75 14000627 PAGE 1

MODEL DC-9-31 REG. NO. N54638

DC-9-31 REFAN FLYOVER NOISE TEST

FAR PART 36 NOISE LEVELS

ENGINE/NACELLE CONFIGURATION -- P&WA JT8D-109 ENGINES WITH ACOUSTICALLY TREATED NACELLES

TYPE OF FLYOVER -- SIMULATED T.O. CLIMB DATA CLASS -- FN/DLT = 9500 LBS
MEASUREMENT TYPE -- BENEATH FLT PATH, 4 FEET ABOVE SANDY DIRT
RECORDING AT X = -7301.0, Y = .0, Z =-81.0 FEET FROM WEST-MOST END OF RUNWAY
REFERENCE RECORDING LOCATION X = -7966.0, Y = .0, Z = .0 FEET

MEASUREMENT INFO		AIRPLANE AND ENGINE DATA				WEATHER DATA	
MIC. NUMBER	1	FUSE. NO.	741	AVG. N1RT =	6474. RPM	AMB. TEMP. =	55.4 F
MIC. LOCATION	C6	FLIGHT	16	AVG. EPR =	1.440	REL. HUM. =	32.8 PCT
MIC. ORIENT	GRAZING	RUN	18	A/P HEADING =	210. DEG	ABS. HUM. =	3.7 GM/M3
TEST SITE	YUMA	HEIGHT	= 2206.4 FT	FLAP POS. =	UP 2.1 DEG	WIND SPEED =	3. KN
TEST DATE	1-29-75	LAT. DEV.	= -49.5 FT	PATH ANG. =	4.7 DEG	WIND DIR. =	220. DEG
TEST NUMBER	JOB 511	SLNT.RNG.	= 2207.0 FT	PITCH ANG. =	14.8 DEG	STA. PRESS =	29.80 IN HG
JOB REEL	A5282	PATH SPD.	= 175.0 KN	GR. WEIGHT =	98000. LB	RT. THETA =	.9916

AIRPLANE SPACE POSITIONING IS RELATIVE TO MIC FOR TIME AT MIC OF 11- 0-32.1
OTHER PERFORMANCE DATA IS FOR TIME OF PNLTM OF 11- 0-38.5
TIME OF AIRCRAFT AT MINIMUM DISTANCE FROM MICROPHONE LOCATION 11- 0-31.5

REFERENCE SURFACE WEATHER CONDITIONS TEMP = 77.0 F & REL. HUM. = 70.0 PCT

DESCRIPTION OF ACOUSTICAL DATA PROCESSING

ANALYZER TYPE / RESOLUTION GR1921(CISA) / 0.25 DB
CISA MODE 1 PASS WITH AUTO-START
SAMPLE INTERVAL FOR BASIC DATA = .500 SECONDS
AVERAGING TIME = 1.500 SECONDS

ATMOSPHERIC ATTENUATION SAE ARP866(REV)
BASIC UNIT SOUND PRESSURE LEVEL (DB REL. 0.0002 MICROBAR)
DATA TYPES 1/3 OCTAVE, OVERALL, A-WTD, PNL, PNLT & EPNL

TABLE C-4.5 (CONTINUED)

DC-9 REFAN TAKEOFF WITH CUTBACK FLYOVER-NOISE TEST CONDITION SUMMARY

FAR PART 36 CALCULATED NOISE LEVELS 14000627 PAGE = 2

MODEL DC-9-31	FUSELAGE NO. 741	REGISTRATION NO. N54638	TEST DATE 1-29-75
FLIGHT NO. 16	TEST RUN NO 18	MICROPHONE NO. 1	MIC. LOCATION C6

REFERENCE CONDITIONS-DC-9 REFAN TAKEOFF WITH CUTBACK. REFERENCE CONDITIONS CHANGE

SUMMARY OF MEASURED NOISE LEVELS.

PNLTM= 88.7 PNDB DCF= -1.1 DB EPNL= 87.6 EPNDB

SUMMARY OF DELTA1 CALCULATIONS

FREQUENCY (HZ)	MEASURED SPL (DB)	MEASURED NOISINESS (NOYS)	ADJUSTED SPL (DB)	ADJUSTED NOISINESS (NOYS)
50	70.6	1.9	70.4	1.9
63	68.9	2.3	68.7	2.3
80	66.3	2.4	66.1	2.4
100	71.5	4.8	71.2	4.7
125	76.2	7.8	75.9	7.6
160	78.8	10.4	78.5	10.2
200	77.3	10.8	76.9	10.5
250	75.8	10.4	75.5	10.2
315	78.3*	12.9	77.8*	12.5
400	73.4	10.1	72.9	9.8
500	72.6	9.6	72.1	9.3
630	70.3	8.2	70.0	8.0
800	65.3	5.8	65.1	5.7
1000	62.3	4.7	62.7	4.8
1250	58.0	4.0	59.4	4.4
1600	52.3	3.5	55.6	4.4
2000	44.5	2.4	50.2	3.5
2500	36.2	1.5	45.8	3.0
3150	26.5	0.0	41.9	2.4
4000				
5000				
6300				
8000				
10000				
PNL	88.1 PNDB		88.2 PNDB	
PNLTM	88.7 PNDB		88.8 PNDB	

* BAND PRODUCING TONE CORRECTION

NOISE ADJUSTMENT PARAMETERS

	REF.	TEST
WEATHER		
AMB. TEMP. (DEG F)	77.0	55.4
REL. HUM. (PCT)	70.0	32.8
PREFORMANCE		
PATH SPEED (KN)	179.7	175.0
AVE FN/D (LBS)	9451.0	9019.2
FLIGHT PROFILE GEOMETRY		
MINIMUM DISTANCE (FT)	2237.	2201.
NOISE PATH DIST. (FT)	2537.	2496.

CALCULATED NOISE LEVELS

MEASURED EPNL	=	87.6 EPNDB
DELTA 1 (ARP866)	=	0.1 EPNDB
DELTA 2	=	0.1 EPNDB
DELTA S	=	-0.1 EPNDB
DELTA FN/D	=	0.6 EPNDB
REF. EPNL FN/D	=	88.3 EPNDB

TABLE C-4.6
DC-9 REFAN TAKEOFF WITH CUTBACK FLYOVER-NOISE TEST CONDITION SUMMARY

FAR PART 36 FLYOVER NOISE LEVELS

DATA IDENTIFICATION INFORMATION

DATA DIGITIZED 2-1-75 DATA PROCESSED 06/27/75 14000627 PAGE 1

MODEL DC-9-31 REG. NO. N54638

DC-9-31 REFAN FLYOVER NOISE TEST

FAR PART 36 NOISE LEVELS

ENGINE/NACELLE CONFIGURATION -- P&WA JT8D-109 ENGINES WITH ACOUSTICALLY TREATED NACELLES

TYPE OF FLYOVER -- SIMULATED T.O. CLIMB DATA CLASS -- FN/DLT = 9500 LBS
MEASUREMENT TYPE -- BENEATH FLT PATH, 4 FEET ABOVE SANDY DIRT
RECORDING AT X = -7301.0, Y = .0, Z =-81.0 FEET FROM WEST-MOST END OF RUNWAY
REFERENCE RECORDING LOCATION X = -7966.0, Y = .0, Z = .0 FEET

MEASUREMENT INFO		AIRPLANE AND ENGINE DATA				WEATHER DATA	
MIC. NUMBER	1	FUSE. NO.	741	AVG. N1RT =	6462. RPM	AMB. TEMP. =	56.5 F
MIC. LOCATION	C6	FLIGHT	16	AVG. EPR =	1.437	REL. HUM. =	30.4 PCT
MIC. ORIENT	GRAZING	RUN	19	A/P HEADING =	210. DEG	ABS. HUM. =	3.6 GM/M3
TEST SITE	YUMA	HEIGHT	= 2175.8 FT	FLAP POS. =	UP 1.8 DEG	WIND SPEED =	3. KN
TEST DATE	1-29-75	LAT. DEV.	= -43.3 FT	PATH ANG. =	5.8 DEG	WIND DIR. =	220. DEG
TEST NUMBER	JOB 511	SLNT.RNG.	= 2176.2 FT	PITCH ANG. =	15.2 DEG	STA. PRESS =	29.80 IN HG
JOB REEL	A4916	PATH SPD.	= 174.7 KN	GR. WEIGHT =	97000. LB	RT. THETA =	.9920

AIRPLANE SPACE POSITIONING IS RELATIVE TO MIC FOR TIME AT MIC OF 11-17-51.5
OTHER PERFORMANCE DATA IS FOR TIME OF PNLTM OF 11-17-56.5
TIME OF AIRCRAFT AT MINIMUM DISTANCE FROM MICROPHONE LOCATION 11-17-50.8

REFERENCE SURFACE WEATHER CONDITIONS TEMP = 77.0 F & REL. HUM. = 70.0 PCT

DESCRIPTION OF ACOUSTICAL DATA PROCESSING

ANALYZER TYPE / RESOLUTION GR1921(CISA) / 0.25 DB
CISA MODE 1 PASS WITH AUTO-START
SAMPLE INTERVAL FOR BASIC DATA = .500 SECONDS
AVERAGING TIME = 1.500 SECONDS

ATMOSPHERIC ATTENUATION SAE ARP866(REV)
BASIC UNIT SOUND PRESSURE LEVEL (DB REL. 0.0002 MICROBAR)
DATA TYPES 1/3 OCTAVE, OVERALL, A-WTD, PNL, PNLT & EPNL

TABLE C-4.6 (CONTINUED)
DC-9 REFAN TAKEOFF WITH CUTBACK FLYOVER-NOISE TEST CONDITION SUMMARY

FAR PART 36 CALCULATED NOISE LEVELS   14000627   PAGE = 2

MODEL DC-9-31   FUSELAGE NO. 741   REGISTRATION NO. N54638   TEST DATE 1-29-75
FLIGHT NO. 16   TEST RUN NO 19   MICROPHONE NO. 1   MIC. LOCATION C6

REFERENCE CONDITIONS-DC-9 REFAN TAKEOFF WITH CUTBACK   REFERENCE CONDITIONS CHANGE

SUMMARY OF MEASURED NOISE LEVELS.

PNLTM= 88.1 PNDB   DCF= -0.8 DB   EPNL= 87.3 EPNDB

SUMMARY OF DELTA1 CALCULATIONS

FREQUENCY (HZ)	MEASURED SPL (DB)	MEASURED NOISINESS (NOYS)	ADJUSTED SPL (DB)	ADJUSTED NOISINESS (NOYS)
50	67.2	1.4	66.9	1.3
63	65.3	1.6	65.0	1.6
80	66.9	2.5	66.6	2.4
100	70.7	4.5	70.4	4.4
125	74.7	6.9	74.3	6.7
160	76.7*	9.0	76.3*	8.7
200	72.0	7.4	71.6	7.1
250	76.1	10.6	75.6	10.3
315	78.0	12.7	77.4	12.2
400	74.2	10.7	73.6	10.3
500	72.8	9.7	72.2	9.3
630	70.9	8.5	70.4	8.3
800	66.7	6.4	66.5	6.3
1000	61.8	4.5	62.3	4.7
1250	57.1	3.8	58.6	4.2
1600	51.9	3.4	55.2	4.3
2000	45.0	2.4	50.7	3.6
2500	35.5	1.5	45.1	2.8
3150	24.4	0.0	39.8	2.1
4000				
5000				
6300				
8000				
10000				
PNL	87.5 PNDB		87.5 PNDB	
PNLTM	88.1 PNDB		88.1 PNDB	

* BAND PRODUCING TONE CORRECTION

NOISE ADJUSTMENT PARAMETERS

	REF.	TEST
WEATHER		
AMB. TEMP. (DEG F)	77.0	56.5
REL. HUM. (PCT)	70.0	30.4
PERFORMANCE		
PATH SPEED (KN)	179.7	174.7
AVE FN/D (LBS)	9451.0	8949.0
FLIGHT PROFILE GEOMETRY		
MINIMUM DISTANCE (FT)	2237.	2166.
NOISE PATH DIST. (FT)	2401.	2325.

CALCULATED NOISE LEVELS

MEASURED EPNL	=	87.3 EPNDB
DELTA 1 (ARP866)	=	0.0 EPNDB
DELTA 2	=	0.1 EPNDB
DELTA S	=	-0.1 EPNDB
DELTA FN/D	=	0.7 EPNDB
REF. EPNL FN/D	=	88.0 EPNDB

TABLE C-5.1

DC-9 REFAN LANDING APPROACH (δ_F = 50°) FLYOVER-NOISE TEST CONDITION SUMMARY

FAR PART 36 FLYOVER NOISE LEVELS

DATA IDENTIFICATION INFORMATION

DATA DIGITIZED 2-3-75 DATA PROCESSED 06/27/75 14590627 PAGE 1

MODEL DC-9-31 REG. NO. N54638

DC-9-31 REFAN FLYOVER NOISE TEST

FAR PART 36 NOISE LEVELS

ENGINE/NACELLE CONFIGURATION -- P&WA JT8D-109 ENGINES WITH ACOUSTICALLY TREATED NACELLES

TYPE OF FLYOVER -- LANDING APPROACH DATA CLASS -- H POWER
MEASUREMENT TYPE -- BENEATH FLT PATH, 4 FEET ABOVE SANDY DIRT
RECORDING AT X = -6978.0, Y = 198.0, Z = -1.0 FEET FROM THRESHOLD
REFERENCE RECORDING LOCATION X = -6076.0, Y = .0, Z = .0 FEET

MEASUREMENT INFO		AIRPLANE AND ENGINE DATA				WEATHER DATA	
MIC. NUMBER	6	FUSE. NO.	741	AVG. N1RT =	5488. RPM	AMB. TEMP. =	55.9 F
MIC. LOCATION	10	FLIGHT	19	AVG. EPR =	1.233	REL. HUM. =	45.7 PCT
MIC. ORIENT	GRAZING	RUN	33	A/P HEADING =	33. DEG	ABS. HUM. =	5.2 GM/M3
TEST SITE	YUMA	HEIGHT =	369.5 FT	FLAP POS. =	49.3 DEG	WIND SPEED =	4. KN
TEST DATE	1-31-75	LAT. DEV. =	-183.1 FT	PATH ANG. =	-2.6 DEG	WIND DIR. =	330. DEG
TEST NUMBER	JOB 511	SLNT.RNG. =	412.4 FT	PITCH ANG. =	1.4 DEG	STA. PRESS =	29.96 IN HG
JOB REEL	A5283	PATH SPD. =	140.2 KN	GR. WEIGHT =	93800. LB	RT. THETA =	.9967

AIRPLANE SPACE POSITIONING IS RELATIVE TO MIC FOR TIME AT MIC OF 10-52-43.8
OTHER PERFORMANCE DATA IS FOR TIME OF PNLTM OF 10-52-45.5
TIME OF AIRCRAFT AT MINIMUM DISTANCE FROM MICROPHONE LOCATION 10-52-43.8

REFERENCE SURFACE WEATHER CONDITIONS TEMP = 77.0 F & REL. HUM. = 70.0 PCT

DESCRIPTION OF ACOUSTICAL DATA PROCESSING

ANALYZER TYPE / RESOLUTION GR1921(CISA) / 0.25 DB
CISA MODE 1 PASS WITH AUTO-START
SAMPLE INTERVAL FOR BASIC DATA = .500 SECONDS
AVERAGING TIME = 1.500 SECONDS

ATMOSPHERIC ATTENUATION SAE ARP866(REV)
BASIC UNIT SOUND PRESSURE LEVEL
(DB REL. 0.0002 MICROBAR)
DATA TYPES 1/3 OCTAVE, OVERALL, A-WTD,
PNL, PNLT & EPNL

TABLE C-5.1 (CONTINUED)

DC-9 REFAN LANDING APPROACH (δ_F = 50°) FLYOVER-NOISE TEST CONDITION SUMMARY

FAR PART 36 CALCULATED NOISE LEVELS 14590627 PAGE = 2

MODEL DC-9-31 FUSELAGE NO. 741 REGISTRATION NO. N54638 TEST DATE 1-31-75
FLIGHT NO. 19 TEST RUN NO 30 MICROPHONE NO. 6 MIC. LOCATION 10

REFERENCE CONDITIONS-DC-9 REFAN 50 DEG APPROACH REFERENCE CONDITION CHANGE

SUMMARY OF MEASURED NOISE LEVELS.

PNLTM= 102.7 PNDB DCF= -5.8 DB EPNL= 96.8 EPNDB

SUMMARY OF DELTA1 CALCULATIONS

FREQUENCY (HZ)	MEASURED SPL (DB)	MEASURED NOISINESS (NOYS)	ADJUSTED SPL (DB)	ADJUSTED NOISINESS (NOYS)
50	72.3	2.3	73.3	2.5
63	71.0	2.8	72.0	3.1
80	66.7	2.5	67.7	2.7
100	71.2	4.7	72.2	5.1
125	79.6	10.2	80.5	11.0
160	84.6	15.5	85.5	16.6
200	85.1	18.5	86.1	19.8
250	79.7	13.7	80.7	14.6
315	84.1	19.5	85.0	20.8
400	82.5	19.0	83.4	20.3
500	81.6	17.9	82.5	19.1
630	80.6	16.7	81.5	17.8
800	80.4	16.4	81.3	17.5
1000	77.7	13.6	78.6	14.5
1250	77.3	15.3	78.3	16.4
1600	76.4	18.6	77.5	20.1
2000	77.8	23.6	79.1	25.9
2500	77.8	27.0	79.5	30.4
3150	74.2	22.6	76.6	26.6
4000	68.9	15.7	72.3	19.8
5000	67.3	13.1	71.3	17.3
6300	70.4	15.1	76.2	22.6
8000	67.2*	9.9	75.5*	17.6
10000	55.4	3.6	67.2	8.0
PNL	102.0 PNDB		104.0 PNDB	
PNLTM	102.7 PNDB		104.6 PNDB	

* BAND PRODUCING TONE CORRECTION

NOISE ADJUSTMENT PARAMETERS

	REF.	TEST
WEATHER		
AMB. TEMP. (DEG F)	77.0	55.9
REL. HUM. (PCT)	70.0	45.7
PREFORMANCE		
PATH SPEED (KN)	141.4	140.2
AVE FN/D (LBS)	5362.0	5558.4
FLIGHT PROFILE GEOMETRY		
MINIMUM DISTANCE (FT)	369.	412.
NOISE PATH DIST. (FT)	383.	428.

CALCULATED NOISE LEVELS

MEASURED EPNL	=	96.8 EPNDB
DELTA 1 (ARP866)	=	1.9 EPNDB
DELTA 2	=	-0.5 EPNDB
DELTA S	=	-0.0 EPNDB
DELTA FN/D	=	-0.4 EPNDB
REF. EPNL FN/D	=	97.9 EPNDB

TABLE C-5.2

DC-9 REFAN LANDING APPROACH (δ_F = 50°) FLYOVER-NOISE TEST CONDITION SUMMARY

FAR PART 36 FLYOVER NOISE LEVELS

DATA IDENTIFICATION INFORMATION

DATA DIGITIZED 2-3-75 DATA PROCESSED 06/27/75 14590627 PAGE 1

MODEL DC-9-31 REG. NO. N54638

DC-9-31 REFAN FLYOVER NOISE TEST

FAR PART 36 NOISE LEVELS

ENGINE/NACELLE CONFIGURATION -- P&WA JT8D-109 ENGINES WITH ACOUSTICALLY TREATED NACELLES

TYPE OF FLYOVER -- LANDING APPROACH DATA CLASS -- H POWER
MEASUREMENT TYPE -- BENEATH FLT PATH, 4 FEET ABOVE SANDY DIRT
RECORDING AT X = -6978.0, Y = 198.0, Z = -1.0 FEET FROM THRESHOLD
REFERENCE RECORDING LOCATION X = -6076.0, Y = .0, Z = .0 FEET

MEASUREMENT INFO		AIRPLANE AND ENGINE DATA				WEATHER DATA	
MIC. NUMBER	6	FUSE. NO.	741	AVG. N1RT =	5463. RPM	AMB. TEMP. =	53.1 F
MIC. LOCATION	1J	FLIGHT	19	AVG. EPR =	1.231	REL. HUM. =	49.7 PCT
MIC. ORIENT	GRAZING	RUN	27	A/P HEADING =	30. DEG	ABS. HUM. =	5.2 GM/M3
TEST SITE	YUMA	HEIGHT =	344.5 FT	FLAP POS. =	49.3 DEG	WIND SPEED =	10. KN
TEST DATE	1-31-75	LAT. DEV. =	-193.7 FT	PATH ANG. =	-3.1 DEG	WIND DIR. =	360. DEG
TEST NUMBER	JOB 511	SLNT.RNG. =	395.2 FT	PITCH ANG. =	1.8 DEG	STA. PRESS =	29.96 IN HG
JOB REEL	A5283	PATH SPD. =	135.9 KN	GR. WEIGHT =	98400. LB	RT. THETA =	.9961

AIRPLANE SPACE POSITIONING IS RELATIVE TO MIC FOR TIME AT MIC OF 10-14-49.9
OTHER PERFORMANCE DATA IS FOR TIME OF PNLTM OF 10-14-51.5
TIME OF AIRCRAFT AT MINIMUM DISTANCE FROM MICROPHONE LOCATION 10-14-50.0

REFERENCE SURFACE WEATHER CONDITIONS TEMP = 77.0 F & REL. HUM. = 70.0 PCT

DESCRIPTION OF ACOUSTICAL DATA PROCESSING

ANALYZER TYPE / RESOLUTION GR1921(CISA) / 0.25 DB
CISA MODE 1 PASS WITH AUTO-START
SAMPLE INTERVAL FOR BASIC DATA = .500 SECONDS
AVERAGING TIME = 1.500 SECONDS

ATMOSPHERIC ATTENUATION SAE ARP866(REV)
BASIC UNIT SOUND PRESSURE LEVEL
(DB REL. 0.0002 MICROBAR)
DATA TYPES 1/3 OCTAVE, OVERALL, A-WTD, PNL, PNLT & EPNL

TABLE C-5.2 (CONTINUED)

DC-9 REFAN LANDING APPROACH ($\delta_F = 50^0$) FLYOVER-NOISE TEST CONDITION SUMMARY

FAR PART 36 CALCULATED NOISE LEVELS 14590627 PAGE = 2

MODEL DC-9-31 FUSELAGE NO. 741 REGISTRATION NO. N54638 TEST DATE 1-31-75
FLIGHT NO. 19 TEST RUN NO 27 MICROPHONE NO. 6 MIC. LOCATION 10

REFERENCE CONDITIONS-DC-9 REFAN 50 DEG APPROACH REFERENCE CONDITION CHANGE

SUMMARY OF MEASURED NOISE LEVELS.

PNLTM= 103.6 PNDB DCF= -6.2 DB EPNL= 97.4 EPNDB

SUMMARY OF DELTA1 CALCULATIONS

FREQUENCY (HZ)	MEASURED SPL (DB)	MEASURED NOISINESS (NOYS)	ADJUSTED SPL (DB)	ADJUSTED NOISINESS (NOYS)
50	74.9	3.0	75.5	3.1
63	73.1	3.4	73.7	3.6
80	69.3	3.1	69.9	3.3
100	72.3	5.1	72.9	5.4
125	78.6	9.4	79.1	9.9
160	83.8	14.7	84.4	15.3
200	85.5	19.0	86.0	19.7
250	80.8	14.7	81.3	15.3
315	84.1	19.6	84.6	20.3
400	84.2	21.4	84.7	22.2
500	82.1	18.5	82.6	19.1
630	80.7	16.8	81.2	17.4
800	80.7	16.8	81.2	17.4
1000	78.0	13.9	78.5	14.4
1250	77.0	14.9	77.5	15.5
1600	76.4	18.6	77.1	19.5
2000	78.7	25.0	79.5	26.6
2500	79.2	29.7	80.4	32.3
3150	75.8	25.2	77.6	28.5
4000	69.9	16.8	72.6	20.2
5000	68.6	14.4	71.9	18.0
6300	72.0	17.0	76.9	23.7
8000	68.9*	11.1	76.1*	18.2
10000	57.4	4.1	67.6	8.3
PNL	103.0 PNDB		104.4 PNDB	
PNLTM	103.6 PNDB		105.0 PNDB	

* BAND PRODUCING TONE CORRECTION

NOISE ADJUSTMENT PARAMETERS

	REF.	TEST
WEATHER		
AMB. TEMP. (DEG F)	77.0	53.1
REL. HUM. (PCT)	70.0	49.7
PREFORMANCE		
PATH SPEED (KN)	141.4	135.9
AVE FN/D (LBS)	5362.0	5507.0
FLIGHT PROFILE GEOMETRY		
MINIMUM DISTANCE (FT)	369.	395.
NOISE PATH DIST. (FT)	379.	405.

CALCULATED NOISE LEVELS
MEASURED EPNL = 97.4 EPNDB
DELTA 1 (ARP866) = 1.4 EPNDB
DELTA 2 = -0.3 EPNDB
DELTA S = -0.2 EPNDB
DELTA FN/D = -0.3 EPNDB
REF. EPNL FN/D = 98.1 EPNDB

TABLE C-5.3

DC-9 REFAN LANDING APPROACH (δ_F = 50°) FLYOVER-NOISE TEST CONDITION SUMMARY

FAR PART 36   FLYOVER NOISE LEVELS

DATA IDENTIFICATION INFORMATION

DATA DIGITIZED 2-3-75   DATA PROCESSED 06/27/75   14590627 PAGE 1

MODEL DC-9-31   REG. NO. N54638

DC-9-31 REFAN FLYOVER NOISE TEST

FAR PART 36 NOISE LEVELS

ENGINE/NACELLE CONFIGURATION -- P&WA JT8D-109 ENGINES WITH ACOUSTICALLY TREATED NACELLES

TYPE OF FLYOVER -- LANDING APPROACH   DATA CLASS --   H POWER
MEASUREMENT TYPE -- BENEATH FLT PATH, 4 FEET ABOVE SANDY DIRT
RECORDING AT X = -6978.0, Y = 198.0, Z = -1.0 FEET FROM THRESHOLD
REFERENCE RECORDING LOCATION X = -6076.0, Y = .0, Z = .0 FEET

MEASUREMENT INFO		AIRPLANE AND ENGINE DATA				WEATHER DATA	
MIC. NUMBER	6	FUSE. NO.	741	AVG. N1PT =	5315. RPM	AMB. TEMP. =	54.1 F
MIC. LOCATION	10	FLIGHT	19	AVG. EPR =	1.207	REL. HUM. =	51.7 PCT
MIC. ORIENT	GRAZING	RUN	28	A/P HEADING =	30. DEG	ABS. HUM. =	5.6 GM/M3
TEST SITE	YUMA	HEIGHT =	292.8 FT	FLAP POS. =	49.5 DEG	WIND SPEED =	7. KN
TEST DATE	1-31-75	LAT. DEV. =	-157.8 FT	PATH ANG. =	-2.6 DEG	WIND DIR. =	360. DEG
TEST NUMBER	JOB 511	SLNT.RNG. =	332.6 FT	PITCH ANG. =	1.5 DEG	STA. PRESS =	29.96 IN HG
JOB REEL	A5283	PATH SPD. =	134.8 KN	GR. WEIGHT =	96300. LB	RT. THETA =	.9963

AIRPLANE SPACE POSITIONING IS RELATIVE TO MIC FOR TIME AT MIC OF 10-33-31.1
OTHER PERFORMANCE DATA IS FOR TIME OF PNLTM OF 10-33-33.0
TIME OF AIRCRAFT AT MINIMUM DISTANCE FROM MICROPHONE LOCATION 10-33-31.1

REFERENCE SURFACE WEATHER CONDITIONS   TEMP = 77.0 F & REL. HUM. = 70.0 PCT

DESCRIPTION OF ACOUSTICAL DATA PROCESSING

ANALYZER TYPE / RESOLUTION   GR1921(CISA) / 0.25 DB
CISA MODE 1 PASS WITH AUTO-START
SAMPLE INTERVAL FOR BASIC DATA = .500 SECONDS
AVERAGING TIME = 1.500 SECONDS

ATMOSPHERIC ATTENUATION   SAE ARP866(REV)
BASIC UNIT   SOUND PRESSURE LEVEL (DB REL. 0.0002 MICROBAR)
DATA TYPES   1/3 OCTAVE, OVERALL, A-WTD, PNL, PNLT & EPNL

TABLE C-5.3 (CONTINUED)
DC-9 REFAN LANDING APPROACH (δ_F = 50°) FLYOVER-NOISE TEST CONDITION SUMMARY

FAR PART 36 CALCULATED NOISE LEVELS   14590627   PAGE = 2

MODEL DC-9-31   FUSELAGE NO. 741   REGISTRATION NO. N54638   TEST DATE 1-31-75
FLIGHT NO. 19   TEST RUN NO 28   MICROPHONE NO. 6   MIC. LOCATION 10

REFERENCE CONDITIONS-DC-9 REFAN 50 DEG APPROACH REFERENCE CONDITION CHANGE

SUMMARY OF MEASURED NOISE LEVELS.

PNLTM= 103.7 PNDB   DCF= -6.2 DB   EPNL= 97.5 EPNDB

SUMMARY OF DELTA1 CALCULATIONS

FREQUENCY (HZ)	MEASURED SPL (DB)	MEASURED NOISINESS (NOYS)	ADJUSTED SPL (DB)	ADJUSTED NOISINESS (NOYS)
50	73.1	2.5	72.1	2.3
63	73.4	3.5	72.5	3.2
80	72.4	4.0	71.4	3.7
100	71.9	5.0	71.0	4.6
125	78.8	9.6	77.9	8.9
160	85.1	16.1	84.2	15.1
200	85.5	19.1	84.6	17.8
250	82.2	16.2	81.2	15.2
315	83.8	19.2	82.9	17.9
400	85.2	22.9	84.2	21.4
500	82.1	18.5	81.1	17.3
630	81.8	18.2	80.8	16.9
800	81.0	17.2	79.9	15.9
1000	78.2	14.1	77.1	13.1
1250	77.4	15.4	76.3	14.2
1600	77.0	19.4	75.9	18.1
2000	78.8	25.2	77.8	23.5
2500	78.2	27.8	77.4	26.4
3150	74.4	22.9	74.0	22.2
4000	70.0	16.9	70.2	17.2
5000	70.9	16.8	71.5	17.5
6300	74.8	20.8	76.7	23.4
8000	71.4*	13.2	75.0*	16.9
10000	59.6	4.7	65.4	7.1
PNL	103.0 PNDB		102.5 PNDB	
PNLTM	103.7 PNDB		103.2 PNDB	

* BAND PRODUCING TONE CORRECTION

NOISE ADJUSTMENT PARAMETERS

	REF.	TEST
WEATHER		
AMB. TEMP. (DEG F)	77.0	54.1
REL. HUM. (PCT)	70.0	51.7
PERFORMANCE		
PATH SPEED (KN)	141.4	134.8
AVE FN/D (LBS)	5362.0	5058.8
FLIGHT PROFILE GEOMETRY		
MINIMUM DISTANCE (FT)	369.	332.
NOISE PATH DIST. (FT)	419.	378.

CALCULATED NOISE LEVELS

MEASURED EPNL	=	97.5 EPNDB
DELTA 1 (ARP866)	=	-0.5 EPNDB
DELTA 2	=	0.5 EPNDB
DELTA S	=	-0.2 EPNDB
DELTA FN/D	=	0.5 EPNDB
REF. EPNL FN/D	=	97.7 EPNDB

TABLE C-5.4

DC-9 REFAN LANDING APPROACH (δ_F = 50°) FLYOVER-NOISE TEST CONDITION SUMMARY

FAR PART 36 FLYOVER NOISE LEVELS

DATA IDENTIFICATION INFORMATION

DATA DIGITIZED 2-3-75 DATA PROCESSED 06/27/75 14590627 PAGE 1

MODEL DC-9-31 REG. NO. N54638

DC-9-31 REFAN FLYOVER NOISE TEST

FAR PART 36 NOISE LEVELS

ENGINE/NACELLE CONFIGURATION -- P&WA JT8D-109 ENGINES WITH ACOUSTICALLY TREATED NACELLES

TYPE OF FLYOVER -- LANDING APPROACH DATA CLASS -- H POWER
MEASUREMENT TYPE -- BENEATH FLT PATH, 4 FEET ABOVE SANDY DIRT
RECORDING AT X = -6978.0, Y = 198.0, Z = -1.0 FEET FROM THRESHOLD
REFERENCE RECORDING LOCATION X = -6076.0, Y = .0, Z = .0 FEET

MEASUREMENT INFO		AIRPLANE AND ENGINE DATA			WEATHER DATA
MIC. NUMBER	6	FUSE. NO. 741	AVG. N1RT = 5335. RPM	AMB. TEMP. =	54.3 F
MIC. LOCATION	13	FLIGHT 19	AVG. EPR = 1.193	REL. HUM. =	51.4 PCT
MIC. ORIENT	GRAZING	RUN 29	A/P HEADING = 30. DEG	ABS. HUM. =	5.6 GM/M3
TEST SITE	YUMA	HEIGHT = 354.7 FT	FLAP POS. = 49.7 DEG	WIND SPEED =	6. KN
TEST DATE	1-31-75	LAT. DEV. = -171.4 FT	PATH ANG. = -3.5 DEG	WIND DIR. =	200. DEG
TEST NUMBER	JOB 511	SLNT.RNG. = 394.0 FT	PITCH ANG. = 1.8 DEG	STA. PRESS =	29.96 IN HG
JOB REEL	A5283	PATH SPD. = 125.3 KN	GR. WEIGHT = 95100. LB	RT. THETA =	.9959

AIRPLANE SPACE POSITIONING IS RELATIVE TO MIC FOR TIME AT MIC OF 10-42-25.3
OTHER PERFORMANCE DATA IS FOR TIME OF PNLTM OF 10-42-27.0
TIME OF AIRCRAFT AT MINIMUM DISTANCE FROM MICROPHONE LOCATION 10-42-25.4

REFERENCE SURFACE WEATHER CONDITIONS TEMP = 77.0 F & REL. HUM. = 70.0 PCT

DESCRIPTION OF ACOUSTICAL DATA PROCESSING

ANALYZER TYPE / RESOLUTION GR1921(CISA) / 0.25 DB
CISA MODE 1 PASS WITH AUTO-START
SAMPLE INTERVAL FOR BASIC DATA = .500 SECONDS
AVERAGING TIME = 1.500 SECONDS

ATMOSPHERIC ATTENUATION SAE ARP866(REV)
BASIC UNIT SOUND PRESSURE LEVEL (DB REL. 0.0002 MICROBAR)
DATA TYPES 1/3 OCTAVE, OVERALL, A-WTD, PNL, PNLT & EPNL

TABLE C-5.4 (CONTINUED)

DC-9 REFAN LANDING APPROACH (δ_F = 50°) FLYOVER-NOISE TEST CONDITION SUMMARY

FAR PART 36 CALCULATED NOISE LEVELS 14590627 PAGE = 2

MODEL DC-9-31 FUSELAGE NO. 741 REGISTRATION NO. N54638 TEST DATE 1-31-75
FLIGHT NO. 19 TEST RUN NO 29 MICROPHONE NO. 6 MIC. LOCATION 10

REFERENCE CONDITIONS-DC-9 REFAN 50 DEG APPROACH REFERENCE CONDITION CHANGE

SUMMARY OF MEASURED NOISE LEVELS.

PNLTM= 102.2 PNDB DCF= -5.8 DB EPNL= 96.4 EPNDB

SUMMARY OF DELTA1 CALCULATIONS

FREQUENCY (HZ)	MEASURED SPL (DB)	MEASURED NOISINESS (NOYS)	ADJUSTED SPL (DB)	ADJUSTED NOISINESS (NOYS)
50	74.9	3.0	75.5	3.2
63	69.8	2.5	70.4	2.6
80	63.5	1.9	64.1	2.0
100	72.3	5.2	72.9	5.4
125	78.2	9.1	78.7	9.6
160	83.7	14.6	84.2	15.2
200	83.1	16.1	83.7	16.7
250	74.3	9.3	74.8	9.7
315	82.5*	17.5	83.0*	18.1
400	80.1	16.1	80.6	16.7
500	81.9	18.2	82.4	18.9
630	80.4	16.5	80.9	17.1
800	79.8	15.8	80.3	16.4
1000	77.5	13.5	78.0	13.9
1250	77.0	15.0	77.5	15.5
1600	76.8	19.2	77.4	20.0
2000	78.0	24.0	78.8	25.2
2500	76.9	25.5	77.9	27.3
3150	73.0	20.8	74.5	23.1
4000	68.7	15.5	71.1	18.2
5000	68.1	13.9	71.0	16.9
6300	71.9	16.8	76.2	22.6
8000	68.2	10.6	74.6	16.5
10000	56.4	3.8	65.6	7.2
PNL	101.4 PNDB		102.6 PNDB	
PNLTM	102.2 PNDB		103.5 PNDB	

* BAND PRODUCING TONE CORRECTION

NOISE ADJUSTMENT PARAMETERS

	REF.	TEST
WEATHER		
AMB. TEMP. (DEG F)	77.0	54.3
REL. HUM. (PCT)	70.0	51.4
PERFORMANCE		
PATH SPEED (KN)	141.4	125.3
AVE FN/D (LBS)	5362.0	5225.0
FLIGHT PROFILE GEOMETRY		
MINIMUM DISTANCE (FT)	369.	393.
NOISE PATH DIST. (FT)	380.	405.

CALCULATED NOISE LEVELS

MEASURED EPNL	=	96.4 EPNDB
DELTA 1 (ARP866)	=	1.3 EPNDB
DELTA 2	=	-0.3 EPNDB
DELTA S	=	-0.5 EPNDB
DELTA FN/D	=	0.2 EPNDB
REF. EPNL FN/D	=	97.2 EPNDB

TABLE C-5.5

DC-9 REFAN LANDING APPROACH (δ_F = 50^0) FLYOVER-NOISE TEST CONDITION SUMMARY

FAR PART 36 FLYOVER NOISE LEVELS

DATA IDENTIFICATION INFORMATION

DATA DIGITIZED 2-3-75 DATA PROCESSED 06/27/75 14590627 PAGE 1

MODEL DC-9-31 REG. NO. N54638

DC-9-31 REFAN FLYOVER NOISE TEST

FAR PART 36 NOISE LEVELS

ENGINE/NACELLE CONFIGURATION -- P&WA JT8D-109 ENGINES WITH ACOUSTICALLY TREATED NACELLES

TYPE OF FLYOVER -- LANDING APPROACH DATA CLASS -- H POWER
MEASUREMENT TYPE -- BENEATH FLT PATH, 4 FEET ABOVE SANDY DIRT
RECORDING AT X = -6978.0, Y = 198.0, Z = -1.0 FEET FROM THRESHOLD
REFERENCE RECORDING LOCATION X = -6976.0, Y = .0, Z = .0 FEET

MEASUREMENT INFO		AIRPLANE AND ENGINE DATA				WEATHER DATA	
MIC. NUMBER	6	FUSE. NO.	741	AVG. N1RT =	5357. RPM	AMB. TEMP. =	56.0 F
MIC. LOCATION	10	FLIGHT	19	AVG. EPR =	1.214	REL. HUM. =	46.8 PCT
MIC. ORIENT	GRAZING	RUN	31	A/P HEADING =	30. DEG	ABS. HUM. =	5.4 GM/M3
TEST SITE	YUMA	HEIGHT =	366.4 FT	FLAP POS. =	49.5 DEG	WIND SPEED =	7. KN
TEST DATE	1-31-75	LAT. DEV. =	-199.8 FT	PATH ANG. =	-3.0 DEG	WIND DIR. =	335. DEG
TEST NUMBER	JOB 511	SLNT.RNG. =	417.4 FT	PITCH ANG. =	1.2 DEG	STA. PRESS =	29.93 IN HG
JOB REEL	A5283	PATH SPD. =	134.1 KN	GR. WEIGHT =	92700. LB	RT. THETA =	.9966

AIRPLANE SPACE POSITIONING IS RELATIVE TO MIC FOR TIME AT MIC OF 11- 2- 0.0
OTHER PERFORMANCE DATA IS FOR TIME OF PNLTM OF 11- 2- 2.0
TIME OF AIRCRAFT AT MINIMUM DISTANCE FROM MICROPHONE LOCATION 11- 2- 0.1

REFERENCE SURFACE WEATHER CONDITIONS TEMP = 77.0 F & REL. HUM. = 70.0 PCT

DESCRIPTION OF ACOUSTICAL DATA PROCESSING

ANALYZER TYPE / RESOLUTION	GR1921(CISA) / 0.25 DB
CISA MODE 1	PASS WITH AUTO-START
SAMPLE INTERVAL FOR BASIC DATA =	.500 SECONDS
AVERAGING TIME =	1.500 SECONDS
ATMOSPHERIC ATTENUATION	SAE ARP866(REV)
BASIC UNIT	SOUND PRESSURE LEVEL (DB REL. 0.0002 MICROBAR)
DATA TYPES	1/3 OCTAVE, OVERALL, A-WTD, PNL, PNLT & EPNL

TABLE C-5.5 (CONTINUED)

DC-9 REFAN LANDING APPROACH ($\delta_F = 50^0$) FLYOVER-NOISE TEST CONDITION SUMMARY

FAR PART 36 CALCULATED NOISE LEVELS   14590627   PAGE = 2

MODEL DC-9-31   FUSELAGE NO. 741   REGISTRATION NO. N54638   TEST DATE 1-31-75
FLIGHT NO. 19   TEST RUN NO 31   MICROPHONE NO. 6   MIC. LOCATION 10

REFERENCE CONDITIONS-DC-9 REFAN 50 DEG APPROACH REFERENCE CONDITION CHANGE

SUMMARY OF MEASURED NOISE LEVELS.

PNLTM= 101.7 PNDB   DCF= -5.8 DB   EPNL= 95.9 EPNDB

SUMMARY OF DELTA1 CALCULATIONS

FREQUENCY (HZ)	MEASURED SPL (DB)	MEASURED NOISINESS (NOYS)	ADJUSTED SPL (DB)	ADJUSTED NOISINESS (NOYS)
50	73.7	2.6	74.8	2.9
63	71.4	2.9	72.4	3.2
80	65.9	2.3	67.0	2.5
100	69.5	4.1	70.6	4.4
125	77.7	8.8	78.7	9.5
160	83.8	14.8	84.9	15.9
200	84.5	17.8	85.6	19.1
250	78.6	12.6	79.6	13.6
315	81.2	15.9	82.2	17.1
400	82.5	19.1	83.6	20.5
500	81.2	17.3	82.2	18.6
630	80.1	16.1	81.1	17.3
800	79.4	15.4	80.4	16.5
1000	77.2	13.2	78.2	14.1
1250	76.5	14.4	77.6	15.5
1600	75.2	17.2	76.4	18.7
2000	76.9	22.1	78.3	24.4
2500	76.9	25.3	78.7	28.7
3150	72.6	20.2	75.0	23.9
4000	67.2	13.9	70.6	17.7
5000	66.8	12.6	70.9	16.8
6300	69.9	14.7	75.9	22.1
8000	65.8*	9.0	74.3*	16.1
10000	52.6	2.9	64.6	6.7
PNL	101.0 PNDB		103.1 PNDB	
PNLTM	101.7 PNDB		103.7 PNDB	

* BAND PRODUCING TONE CORRECTION

NOISE ADJUSTMENT PARAMETERS

	REF.	TEST
WEATHER		
AMB. TEMP. (DEG F)	77.0	56.0
REL. HUM. (PCT)	70.0	46.8
PERFORMANCE		
PATH SPEED (KN)	141.4	134.1
AVE FN/D (LBS)	5362.0	5209.1
FLIGHT PROFILE GEOMETRY		
MINIMUM DISTANCE (FT)	369.	417.
NOISE PATH DIST. (FT)	396.	447.

CALCULATED NOISE LEVELS

MEASURED EPNL	=	95.9 EPNDB
DELTA 1 (ARP866)	=	2.0 EPNDB
DELTA 2	=	-0.5 EPNDB
DELTA S	=	-0.2 EPNDB
DELTA FN/D	=	0.3 EPNDB
REF. EPNL FN/D	=	97.4 EPNDB

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TABLE C-5.6

DC-9 REFAN LANDING APPROACH (δ_F = 50°) FLYOVER-NOISE TEST CONDITION SUMMARY

FAR PART 36 FLYOVER NOISE LEVELS

DATA IDENTIFICATION INFORMATION

DATA DIGITIZED 2-3-75 DATA PROCESSED 06/27/75 14590627 PAGE 1

MODEL DC-9-31 REG. NO. N54638

DC-9-31 REFAN FLYOVER NOISE TEST

FAR PART 36 NOISE LEVELS

ENGINE/NACELLE CONFIGURATION -- P&WA JT8D-109 ENGINES WITH ACOUSTICALLY TREATED NACELLES

TYPE OF FLYOVER -- LANDING APPROACH DATA CLASS -- H POWER
MEASUREMENT TYPE -- BENEATH FLT PATH, 4 FEET ABOVE SANDY DIRT
RECORDING AT X = -6978.0, Y = 198.0, Z = -1.0 FEET FROM THRESHOLD
REFERENCE RECORDING LOCATION X = -6076.0, Y = .0, Z = .0 FEET

MEASUREMENT INFO		AIRPLANE AND ENGINE DATA				WEATHER DATA	
MIC. NUMBER	6	FUSE. NO.	741	AVG. N1RT =	5464. RPM	AMB. TEMP. =	56.0 F
MIC. LOCATION	10	FLIGHT	19	AVG. EPR =	1.230	REL. HUM. =	46.8 PCT
MIC. ORIENT	GRAZING	RUN	32	A/P HEADING =	30. DEG	ABS. HUM. =	5.4 GM/M3
TEST SITE	YUMA	HEIGHT =	379.7 FT	FLAP POS. =	49.5 DEG	WIND SPEED =	7. KN
TEST DATE	1-31-75	LAT. DEV. =	-201.5 FT	PATH ANG. =	-3.6 DEG	WIND DIR. =	335. DEG
TEST NUMBER	JOB 511	SLNT.RNG. =	429.9 FT	PITCH ANG. =	.0 DEG	STA. PRESS =	29.93 IN HG
JOB REEL	A5283	PATH SPD. =	137.1 KN	GR. WEIGHT =	91700. LB	RT. THETA =	.9971

AIRPLANE SPACE POSITIONING IS RELATIVE TO MIC FOR TIME AT MIC OF 11-10-32.7
OTHER PERFORMANCE DATA IS FOR TIME OF PNLTM OF 11-10-34.5
TIME OF AIRCRAFT AT MINIMUM DISTANCE FROM MICROPHONE LOCATION 11-10-32.8

REFERENCE SURFACE WEATHER CONDITIONS TEMP = 77.0 F & REL. HUM. = 70.0 PCT

DESCRIPTION OF ACOUSTICAL DATA PROCESSING

ANALYZER TYPE / RESOLUTION GR1921(CISA) / 0.25 DB
CISA MODE 1 PASS WITH AUTO-START
SAMPLE INTERVAL FOR BASIC DATA = .500 SECONDS
AVERAGING TIME = 1.500 SECONDS

ATMOSPHERIC ATTENUATION SAE ARP866(REV)
BASIC UNIT SOUND PRESSURE LEVEL (DB REL. 0.0002 MICROBAR)
DATA TYPES 1/3 OCTAVE, OVERALL, A-WTD, PNL, PNLT & EPNL

TABLE C-5.6 (CONTINUED)

DC-9 REFAN LANDING APPROACH (δ_F = 50°) FLYOVER-NOISE TEST CONDITION SUMMARY

FAR PART 36 CALCULATED NOISE LEVELS 14590627 PAGE = 2

MODEL DC-9-31 FUSELAGE NO. 741 REGISTRATION NO. N54638 TEST DATE 1-31-75
FLIGHT NO. 19 TEST RUN NO 32 MICROPHONE NO. 6 MIC. LOCATION 10

REFERENCE CONDITIONS-DC-9 REFAN 50 DEG APPROACH REFERENCE CONDITION CHANGE

SUMMARY OF MEASURED NOISE LEVELS.

PNLTM= 101.9 PNDB DCF= -5.7 DB EPNL= 96.3 EPNDB

SUMMARY OF DELTA1 CALCULATIONS

FREQUENCY (HZ)	MEASURED SPL (DB)	MEASURED NOISINESS (NOYS)	ADJUSTED SPL (DB)	ADJUSTED NOISINESS (NOYS)
50	72.8	2.4	74.1	2.7
63	72.3	3.2	73.6	3.6
80	67.4	2.6	68.7	2.9
100	71.9	5.0	73.2	5.6
125	78.3	9.2	79.6	10.2
160	83.1	14.0	84.4	15.3
200	83.8	17.0	85.1	18.6
250	77.7	11.9	79.0	13.0
315	83.0	18.1	84.3	19.9
400	81.5	17.8	82.8	19.5
500	81.5	17.8	82.8	19.4
630	80.3	16.4	81.6	17.9
800	80.3	16.3	81.6	17.8
1000	77.8	13.8	79.2	15.1
1250	76.9	14.8	78.3	16.3
1600	75.7	17.7	77.2	19.7
2000	77.6	23.2	79.3	26.2
2500	77.3	26.1	79.4	30.2
3150	73.5	21.5	76.3	26.1
4000	67.7	14.4	71.5	18.8
5000	65.3	11.4	69.8	15.5
6300	68.2	13.0	74.5	20.1
8000	64.2*	8.0	73.1*	14.9
10000	51.7	2.7	64.2	6.5
PNL	101.3 PNDB		103.6 PNDB	
PNLTM	101.9 PNDB		104.2 PNDB	

* BAND PRODUCING TONE CORRECTION

NOISE ADJUSTMENT PARAMETERS

	REF.	TEST
WEATHER		
AMB. TEMP. (DEG F)	77.0	56.0
REL. HUM. (PCT)	70.0	46.8
PERFORMANCE		
PATH SPEED (KN)	141.4	137.1
AVE FN/D (LBS)	5362.0	5516.7
FLIGHT PROFILE GEOMETRY		
MINIMUM DISTANCE (FT)	369.	429.
NOISE PATH DIST. (FT)	386.	449.

CALCULATED NOISE LEVELS

MEASURED EPNL	=	96.3 EPNDB
DELTA 1 (ARP866)	=	2.2 EPNDB
DELTA 2	=	-0.7 EPNDB
DELTA S	=	-0.1 EPNDB
DELTA FN/D	=	-0.3 EPNDB
REF. EPNL FN/D	=	97.4 EPNDB

TABLE C-6.1

DC-9 REFAN LANDING APPROACH (δ_F = 35°) FLYOVER-NOISE TEST CONDITION SUMMARY

FAR PART 36 FLYOVER NOISE LEVELS

DATA IDENTIFICATION INFORMATION

DATA DIGITIZED 2-17-75 DATA PROCESSED 07/01/75 PAGE 1

MODEL DC-9-31 REG. NO. N54638

DC-9-31 REFAN FLYOVER NOISE TEST

FAR PART 36 NOISE LEVELS

ENGINE/NACELLE CONFIGURATION -- P&WA JT8D-109 ENGINES WITH ACOUSTICALLY TREATED NACELLES

TYPE OF FLYOVER -- LANDING APPROACH DATA CLASS -- H POWER
MEASUREMENT TYPE -- BENEATH FLT PATH, 4 FEET ABOVE SANDY DIRT
RECORDING AT X = -6978.0, Y = 198.0, Z = -1.0 FEET FROM THRESHOLD
REFERENCE RECORDING LOCATION X = -6076.0, Y = .0, Z = .0 FEET

MEASUREMENT INFO		AIRPLANE AND ENGINE DATA				WEATHER DATA	
MIC. NUMBER	6	FUSE. NO.	741	AVG. N1RT =	4542. RPM	AMB. TEMP. =	55.8 F
MIC. LOCATION	10	FLIGHT	20	AVG. EPR =	1.123	REL. HUM. =	45.0 PCT
MIC. ORIENT	GRAZING	RUN	42	A/P HEADING =	30. DEG	ABS. HUM. =	5.1 GM/M3
TEST SITE	YUMA	HEIGHT =	356.7 FT	FLAP POS. =	34.9 DEG	WIND SPEED =	7. KN
TEST DATE	2-01-75	LAT. DEV. =	-192.3 FT	PATH ANG. =	-2.8 DEG	WIND DIR. =	25. DEG
TEST NUMBER	JOB 511	SLNT.RNG. =	405.2 FT	PITCH ANG. =	5.1 DEG	STA. PRESS =	30.07 IN HG
JOB REEL	A5359	PATH SPD. =	131.5 KN	GR. WEIGHT =	104000. LB	RT. THETA =	.9979

AIRPLANE SPACE POSITIONING IS RELATIVE TO MIC FOR TIME AT MIC OF 9-56-37.6
OTHER PERFORMANCE DATA IS FOR TIME OF PNLTM OF 9-56-39.0
TIME OF AIRCRAFT AT MINIMUM DISTANCE FROM MICROPHONE LOCATION 9-56-37.6

REFERENCE SURFACE WEATHER CONDITIONS TEMP = 77.0 F & REL. HUM. = 70.0 PCT

DESCRIPTION OF ACOUSTICAL DATA PROCESSING

ANALYZER TYPE / RESOLUTION GR1921(CISA) / 0.25 DB
CISA MODE 1 PASS WITH AUTO-START
SAMPLE INTERVAL FOR BASIC DATA = .500 SECONDS
AVERAGING TIME = 1.500 SECONDS

ATMOSPHERIC ATTENUATION SAE ARP866(REV)
BASIC UNIT SOUND PRESSURE LEVEL (DB REL. 0.0002 MICROBAR)
DATA TYPES 1/3 OCTAVE, OVERALL, A-WTD. PNL, PNLT & EPNL

TABLE C-6.1 (CONTINUED)

DC-9 REFAN LANDING APPROACH ($\delta_F = 35^0$) FLYOVER-NOISE TEST CONDITION SUMMARY

FAR PART 36 CALCULATED NOISE LEVELS PAGE = 2

MODEL DC-9-31 FUSELAGE NO. 741 REGISTRATION NO. N54638 TEST DATE 2-01-75
FLIGHT NO. 20 TEST RUN NO 42 MICROPHONE NO. 6 MIC. LOCATION 10

REFERENCE CONDITIONS-DC-9 REFAN 35 DEG APPROACH USING FINAL CORR CURVE SLOPE

SUMMARY OF MEASURED NOISE LEVELS.

PNLTM= 99.7 PNDB DCF= -6.2 DB EPNL= 93.5 EPNDB

SUMMARY OF DELTA1 CALCULATIONS

FREQUENCY (HZ)	MEASURED SPL (DB)	MEASURED NOISINESS (NOYS)	ADJUSTED SPL (DB)	ADJUSTED NOISINESS (NOYS)
50	70.6	1.9	71.4	2.1
63	65.6	1.7	66.4	1.8
80	62.4	1.7	63.2	1.8
100	67.3	3.4	68.1	3.6
125	74.4	6.7	75.2	7.2
160	79.8	11.2	80.6	11.8
200	79.4	12.5	80.2	13.2
250	71.1	7.4	71.9	7.8
315	79.8	14.5	80.6	15.3
400	77.4	13.4	78.2	14.1
500	78.3	14.2	79.1	15.0
630	77.6	13.6	78.4	14.3
800	78.3	14.2	79.1	15.0
1000	77.0	13.0	77.8	13.7
1250	75.8	13.8	76.7	14.6
1600	76.7	19.1	77.7	20.4
2000	74.9	19.2	76.0	20.9
2500	72.0	18.1	73.5	20.[illegible]
3150	68.1	14.9	70.3	17.3
4000	65.3	12.2	68.4	15.2
5000	70.8*	16.7	74.6*	21.7
6300	71.0	15.8	76.5	23.1
8000	59.9	6.0	67.8	10.3
10000	52.4	2.9	63.6	6.3
PNL	98.2 PNDB		100.4 PNDB	
PNLTM	99.7 PNDB		101.7 PNDB	

* BAND PRODUCING TONE CORRECTION

NOISE ADJUSTMENT PARAMETERS

	REF.	TEST
WEATHER		
AMB. TEMP. (DEG F)	77.0	55.8
REL. HUM. (PCT)	70.0	45.0
PREFORMANCE		
PATH SPEED (KN)	146.9	131.5
AVE FN/D (LBS)	3810.0	3204.8
FLIGHT PROFILE GEOMETRY		
MINIMUM DISTANCE (FT)	369.	405.
NOISE PATH DIST. (FT)	371.	407.

CALCULATED NOISE LEVELS

MEASURED EPNL	=	93.5 EPNDB
DELTA 1 (ARP866)	=	1.9 EPNDB
DELTA 2	=	-0.4 EPNDB
DELTA S	=	-0.5 EPNDB
DELTA FN/D	=	0.5 EPNDB
REF. EPNL FN/D	=	95.0 EPNDB

TABLE C-6.2

DC-9 REFAN LANDING APPROACH (δ_F = 35°) FLYOVER-NOISE TEST CONDITION SUMMARY

FAR PART 36 FLYOVER NOISE LEVELS

DATA IDENTIFICATION INFORMATION

DATA DIGITIZED 2-3-75 DATA PROCESSED 07/01/75 PAGE 1

MODEL DC-9-31 REG. NO. N54638

DC-9-31 REFAN FLYOVER NOISE TEST

FAR PART 36 NOISE LEVELS

ENGINE/NACELLE CONFIGURATION -- P&WA JT8D-109 ENGINES WITH ACOUSTICALLY TREATED NACELLES

TYPE OF FLYOVER -- LANDING APPROACH DATA CLASS -- H POWER
MEASUREMENT TYPE -- BENEATH FLT PATH, 4 FEET ABOVE SANDY DIRT
RECORDING AT X = -6978.0, Y = 198.0, Z = -1.0 FEET FROM THRESHOLD
REFERENCE RECORDING LOCATION X = -6076.0, Y = .0, Z = .0 FEET

MEASUREMENT INFO		AIRPLANE AND ENGINE DATA				WEATHER DATA	
MIC. NUMBER	6	FUSE. NO.	741	AVG. NIRT =	5210. RPM	AMB. TEMP. =	56.0 F
MIC. LOCATION	10	FLIGHT	20	AVG. EPR =	1.187	REL. HUM. =	46.2 PCT
MIC. ORIENT	GRAZING	RUN	43	A/P HEADING =	30. DEG	ABS. HUM. =	5.3 GM/M3
TEST SITE	YUMA	HEIGHT =	368.5 FT	FLAP POS. =	34.6 DEG	WIND SPEED =	7. KN
TEST DATE	2-01-75	LAT. DEV. =	-194.9 FT	PATH ANG. =	-2.3 DEG	WIND DIR. =	15. DEG
TEST NUMBER	JOB 511	SLNT.RNG. =	416.9 FT	PITCH ANG. =	1.7 DEG	STA. PRESS =	30.07 IN HG
JOB REEL	A5359	PATH SPD. =	150.8 KN	GR. WEIGHT =	103000. LB	RT. THETA =	.9991

AIRPLANE SPACE POSITIONING IS RELATIVE TO MIC FOR TIME AT MIC OF 10- 4-29.2
OTHER PERFORMANCE DATA IS FOR TIME OF PNLTM OF 10- 4-31.0
TIME OF AIRCRAFT AT MINIMUM DISTANCE FROM MICROPHONE LOCATION 10- 4-29.2

REFERENCE SURFACE WEATHER CONDITIONS TEMP = 77.0 F & REL. HUM. = 70.0 PCT

DESCRIPTION OF ACOUSTICAL DATA PROCESSING

ANALYZER TYPE / RESOLUTION GR1921(CISA) / 0.25 DB
CISA MODE 1 PASS WITH AUTO-START
SAMPLE INTERVAL FOR BASIC DATA = .500 SECONDS
AVERAGING TIME = 1.500 SECONDS

ATMOSPHERIC ATTENUATION SAE ARP866(REV)
BASIC UNIT SOUND PRESSURE LEVEL (DB REL. 0.0002 MICROBAR)
DATA TYPES 1/3 OCTAVE, OVERALL, A-WTD, PNL, PNLT & EPNL

TABLE C 8.2 (CONTINUED)

DC-9 REFAN LANDING APPROACH ($\delta_F = 35^o$) FLYOVER-NOISE TEST CONDITION SUMMARY

FAR PART 36 CALCULATED NOISE LEVELS PAGE = 2

MODEL DC-9-31 FUSELAGE NO. 741 REGISTRATION NO. N54638 TEST DATE 2-01-75
FLIGHT NO. 20 TEST RUN NO 43 MICROPHONE NO. 6 MIC. LOCATION 10

REFERENCE CONDITIONS—DC-9 REFAN 35 DEG APPROACH USING FINAL CORR CURVE SLOPE

SUMMARY OF MEASURED NOISE LEVELS.

PNLTM= 101.6 PNDB DCF= -5.9 DB EPNL= 95.7 EPNDB

SUMMARY OF DELTA1 CALCULATIONS

FREQUENCY (HZ)	MEASURED SPL (DB)	MEASURED NOISINESS (NOYS)	ADJUSTED SPL (DB)	ADJUSTED NOISINESS (NOYS)
50	72.8	2.4	73.9	2.7
63	69.7	2.5	70.7	2.7
80	63.7	1.9	64.8	2.1
100	71.4	4.8	72.5	5.2
125	79.2	9.9	80.2	10.7
160	83.0	14.0	84.1	15.0
200	82.1	15.0	83.1	16.2
250	74.7	9.6	75.7	10.4
315	82.6*	17.5	83.6*	18.9
400	80.7	16.8	81.8	18.1
500	81.5	17.7	82.5	19.0
630	79.3	15.3	80.4	16.4
800	78.7	14.6	79.7	15.7
1000	77.5	13.5	78.6	14.5
1250	76.8	14.7	77.8	15.8
1600	77.1	19.5	78.3	21.3
2000	78.0	23.8	79.4	26.3
2500	76.4	24.5	78.2	27.8
3150	72.5	20.1	75.0	23.8
4000	68.2	15.0	71.7	19.1
5000	68.3	14.0	72.4	18.7
6300	69.9	14.7	76.0	22.2
8000	64.5	8.2	73.1	14.8
10000	51.9	2.8	64.0	6.5
PNL	100.8 PNDB		102.9 PNDB	
PNLTM	101.6 PNDB		103.7 PNDB	

* BAND PRODUCING TONE CORRECTION

NOISE ADJUSTMENT PARAMETERS

	REF.	TEST
WEATHER		
AMB. TEMP. (DEG F)	77.0	56.0
REL. HUM. (PCT)	70.0	46.2
PREFORMANCE		
PATH SPEED (KN)	146.9	150.8
AVE FN/D (LBS)	3810.0	4603.6
FLIGHT PROFILE GEOMETRY		
MINIMUM DISTANCE (FT)	369.	417.
NOISE PATH DIST. (FT)	394.	445.

CALCULATED NOISE LEVELS
MEASURED EPNL = 95.7 EPNDB
DELTA 1 (ARP866) = 2.1 EPNDB
DELTA 2 = -0.5 EPNDB
DELTA S = 0.1 EPNDB
DELTA FN/D = -0.6 EPNDB
REF. EPNL FN/D = 96.7 EPNDB

TABLE C-6.3

DC-9 REFAN LANDING APPROACH (δ_F = 35°) FLYOVER-NOISE TEST CONDITION SUMMARY

FAR PART 36 FLYOVER NOISE LEVELS

DATA IDENTIFICATION INFORMATION

DATA DIGITIZED 2-3-75 DATA PROCESSED 07/01/75 PAGE 1

MODEL DC-9-31 REG. NO. N54638

DC-9-31 REFAN FLYOVER NOISE TEST

FAR PART 36 NOISE LEVELS

ENGINE/NACELLE CONFIGURATION -- P&WA JT8D-109 ENGINES WITH ACOUSTICALLY TREATED NACELLES

TYPE OF FLYOVER -- LANDING APPROACH DATA CLASS -- H POWER
MEASUREMENT TYPE -- BENEATH FLT PATH, 4 FEET ABOVE SANDY DIRT
RECORDING AT X = -6978.0, Y = 198.0, Z = -1.0 FEET FROM THRESHOLD
REFERENCE RECORDING LOCATION X = -6076.0, Y = .0, Z = .0 FEET

MEASUREMENT INFO		AIRPLANE AND ENGINE DATA				WEATHER DATA	
MIC. NUMBER	6	FUSE. NO.	741	AVG. N1RT =	4854. RPM	AMB. TEMP. =	56.1 F
MIC. LOCATION	10	FLIGHT	20	AVG. EPR =	1.149	REL. HUM. =	45.3 PCT
MIC. ORIENT	GRAZING	RUN	44	A/P HEADING =	30. DEG	ABS. HUM. =	5.2 GM/M3
TEST SITE	YUMA	HEIGHT =	363.6 FT	FLAP POS. =	34.7 DEG	WIND SPEED =	8. KN
TEST DATE	2-01-75	LAT. DEV. =	-195.5 FT	PATH ANG. =	-2.7 DEG	WIND DIR. =	20. DEG
TEST NUMBER	JOB 511	SLNT.RNG. =	412.8 FT	PITCH ANG. =	2.8 DEG	STA. PRESS =	30.07 IN HG
JOB REEL	A5359	PATH SPD. =	137.5 KN	GR. WEIGHT =	102000. LB	RT. THETA =	.9988

AIRPLANE SPACE POSITIONING IS RELATIVE TO MIC FOR TIME AT MIC OF 10-13- 5.3
OTHER PERFORMANCE DATA IS FOR TIME OF PNLTM OF 10-13- 7.5
TIME OF AIRCRAFT AT MINIMUM DISTANCE FROM MICROPHONE LOCATION 10-13- 5.4

REFERENCE SURFACE WEATHER CONDITIONS TEMP = 77.0 F & REL. HUM. = 70.0 PCT

DESCRIPTION OF ACOUSTICAL DATA PROCESSING

ANALYZER TYPE / RESOLUTION GR1921(CISA) / 0.25 DB
CISA MODE 1 PASS WITH AUTO-START
SAMPLE INTERVAL FOR BASIC DATA = .500 SECONDS
AVERAGING TIME = 1.500 SECONDS

ATMOSPHERIC ATTENUATION SAE ARP866(REV)
BASIC UNIT SOUND PRESSURE LEVEL (DB REL. 0.0002 MICROBAR)
DATA TYPES 1/3 OCTAVE, OVERALL, A-WTD, PNL, PNLT & EPNL

TABLE C-6.3 (CONTINUED)

DC-9 REFAN LANDING APPROACH (δ_F = 35°) FLYOVER-NOISE TEST CONDITION SUMMARY

FAR PART 36 CALCULATED NOISE LEVELS — PAGE = 2

MODEL DC-9-31 FUSELAGE NO. 741 REGISTRATION NO. N54638 TEST DATE 2-01-75
FLIGHT NO. 20 TEST RUN NO 44 MICROPHONE NO. 6 MIC. LOCATION 10

REFERENCE CONDITIONS-DC-9 REFAN 35 DEG APPROACH USING FINAL CORR CURVE SLOPE

SUMMARY OF MEASURED NOISE LEVELS.

PNLTM= 99.9 PNDB DCF= -5.8 DB EPNL= 94.1 EPNDB

SUMMARY OF DELTA1 CALCULATIONS

FREQUENCY (HZ)	MEASURED SPL (DB)	MEASURED NOISINESS (NOYS)	ADJUSTED SPL (DB)	ADJUSTED NOISINESS (NOYS)
50	70.3	1.9	71.2	2.1
63	68.6	2.2	69.6	2.4
80	64.4	2.0	65.4	2.2
100	68.2	3.6	69.2	3.9
125	75.7	7.5	76.7	8.1
160	81.0	12.1	81.9	12.9
200	79.9	12.9	80.9	13.8
250	75.2	10.0	76.1	10.6
315	80.1	14.7	81.0	15.7
400	80.7	16.8	81.7	18.0
500	80.4	16.5	81.4	17.6
630	79.4	15.3	80.3	16.4
800	78.1	14.0	79.0	14.9
1000	76.4	12.5	77.4	13.4
1250	75.2	13.1	76.2	14.1
1600	76.3	18.5	77.4	20.0
2000	74.9	19.4	76.3	21.3
2500	73.6	20.3	75.4	22.9
3150	69.0	15.8	71.5	18.8
4000	65.8	12.7	69.4	16.2
5000	68.9	14.7	73.2	19.7
6300	70.6*	15.4	76.9*	23.6
8000	61.7	6.7	70.6	12.5
10000	50.7	2.6	63.4	6.2
PNL	98.9 PNDB		101.1 PNDB	
PNLTM	99.9 PNDB		102.0 PNDB	

* BAND PRODUCING TONE CORRECTION

NOISE ADJUSTMENT PARAMETERS

	REF.	TEST
WEATHER		
AMB. TEMP. (DEG F)	77.0	56.1
REL. HUM. (PCT)	70.0	45.3
PREFORMANCE		
PATH SPEED (KN)	146.9	137.5
AVE FN/D (LBS)	3810.0	3763.5
FLIGHT PROFILE GEOMETRY		
MINIMUM DISTANCE (FT)	369.	412.
NOISE PATH DIST. (FT)	413.	462.

CALCULATED NOISE LEVELS

MEASURED EPNL	=	94.1 EPNDB
DELTA 1 (ARP866)	=	2.1 EPNDB
DELTA 2	=	-0.5 EPNDB
DELTA S	=	-0.3 EPNDB
DELTA FN/D	=	0.0 EPNDB
REF. EPNL FN/D	=	95.5 EPNDB

TABLE C-6.4

DC-9 REFAN LANDING APPROACH ($\delta_F = 35^o$) FLYOVER-NOISE TEST CONDITION SUMMARY

FAR PART 36 FLYOVER NOISE LEVELS

DATA IDENTIFICATION INFORMATION

DATA DIGITIZED 2-3-75 DATA PROCESSED 07/01/75 PAGE 1

MODEL DC-9-31 REG. NO. N54638

DC-9-31 REFAN FLYOVER NOISE TEST

FAR PART 36 NOISE LEVELS

ENGINE/NACELLE CONFIGURATION -- P&WA JT8D-109 ENGINES WITH ACOUSTICALLY TREATED NACELLES

TYPE OF FLYOVER -- LANDING APPROACH DATA CLASS -- H POWER
MEASUREMENT TYPE -- BENEATH FLT PATH, 4 FEET ABOVE SANDY DIRT
RECORDING AT X = -6978.0, Y = 198.0, Z = -1.0 FEET FROM THRESHOLD
REFERENCE RECORDING LOCATION X = -6076.0, Y = .0, Z = .0 FEET

MEASUREMENT INFO		AIRPLANE AND ENGINE DATA				WEATHER DATA	
MIC. NUMBER	6	FUSE. NO.	741	AVG. N1RT =	4851. RPM	AMB. TEMP. =	57.2 F
MIC. LOCATION	10	FLIGHT	20	AVG. EPR =	1.149	REL. HUM. =	40.5 PCT
MIC. ORIENT	GRAZING	RUN	46	A/P HEADING =	30. DEG	ABS. HUM. =	4.9 GM/M3
TEST SITE	YUMA	HEIGHT =	377.8 FT	FLAP POS. =	34.7 DEG	WIND SPEED =	9. KN
TEST DATE	2-01-75	LAT. DEV. =	-202.7 FT	PATH ANG. =	-2.6 DEG	WIND DIR. =	20. DEG
TEST NUMBER	JOB 511	SLNT.RNG. =	428.7 FT	PITCH ANG. =	2.5 DEG	STA. PRESS =	30.07 IN HG
JOB REEL	A5359	PATH SPD. =	137.8 KN	GR. WEIGHT =	99600. LB	RT. THETA =	.9990

AIRPLANE SPACE POSITIONING IS RELATIVE TO MIC FOR TIME AT MIC OF 10-31-41.6
OTHER PERFORMANCE DATA IS FOR TIME OF PNLTM OF 10-31-43.5
TIME OF AIRCRAFT AT MINIMUM DISTANCE FROM MICROPHONE LOCATION 10-31-41.7

REFERENCE SURFACE WEATHER CONDITIONS TEMP = 77.0 F & REL. HUM. = 70.0 PCT

DESCRIPTION OF ACOUSTICAL DATA PROCESSING

ANALYZER TYPE / RESOLUTION GR1921(CISA) / 0.25 DB
CISA MODE 1 PASS WITH AUTO-START
SAMPLE INTERVAL FOR BASIC DATA = .500 SECONDS
AVERAGING TIME = 1.500 SECONDS

ATMOSPHERIC ATTENUATION SAE ARP866(REV)
BASIC UNIT SOUND PRESSURE LEVEL
(DB REL. 0.0002 MICROBAR)
DATA TYPES 1/3 OCTAVE, OVERALL, A-WTD, PNL, PNLT & EPNL

TABLE C-6.4 (CONTINUED)

DC-9 REFAN LANDING APPROACH ($\delta_F = 35^0$) FLYOVER-NOISE TEST CONDITION SUMMARY

FAR PART 36 CALCULATED NOISE LEVELS PAGE = 2

MODEL DC-9-31	FUSELAGE NO. 741	REGISTRATION NO. N54638	TEST DATE 2-01-75
FLIGHT NO. 20	TEST RUN NO 46	MICROPHONE NO. 6	MIC. LOCATION 10

REFERENCE CONDITIONS-DC-9 REFAN 35 DEG APPROACH USING FINAL CORR CURVE SLOPE

SUMMARY OF MEASURED NOISE LEVELS.

PNLTM= 99.9 PNDB DCF= -5.7 DB EPNL= 94.2 EPNDB

SUMMARY OF DELTA1 CALCULATIONS

FREQUENCY (HZ)	MEASURED SPL (DB)	MEASURED NOISINESS (NOYS)	ADJUSTED SPL (DB)	ADJUSTED NOISINESS (NOYS)
50	70.2	1.9	71.5	2.1
63	66.0	1.7	67.2	2.0
80	61.9	1.7	63.2	1.8
100	68.7	3.8	70.0	4.2
125	75.8	7.5	77.1	8.4
160	80.0	11.3	81.3	12.3
200	80.5	13.5	81.8	14.7
250	72.8	8.4	74.0	9.2
315	80.6*	15.3	81.9*	16.8
400	77.8	13.7	79.0	15.0
500	79.4	15.3	80.7	16.8
630	78.7	14.6	80.0	16.0
800	77.9	13.8	79.2	15.1
1000	76.9	12.9	78.2	14.1
1250	75.7	13.6	77.1	15.1
1600	76.3	18.5	77.9	20.7
2000	75.4	20.0	77.3	22.8
2500	74.7	21.8	77.1	25.6
3150	69.6	16.5	72.9	20.7
4000	65.4	12.3	69.9	16.8
5000	67.8	13.6	73.2	19.7
6300	69.5	14.2	77.0	23.8
8000	61.0	6.4	71.6	13.4
10000	49.4	2.3	64.2	6.5
PNL	99.0 PNDB		101.7 PNDB	
PNLTM	99.9 PNDB		102.6 PNDB	

* BAND PRODUCING TONE CORRECTION

NOISE ADJUSTMENT PARAMETERS

	REF.	TEST
WEATHER		
AMB. TEMP. (DEG F)	77.0	57.2
REL. HUM. (PCT)	70.0	40.5
PREFORMANCE		
PATH SPEED (KN)	146.9	137.8
AVE FN/D (LBS)	3810.0	3752.5
FLIGHT PROFILE GEOMETRY		
MINIMUM DISTANCE (FT)	369.	428.
NOISE PATH DIST. (FT)	392.	454.

CALCULATED NOISE LEVELS

MEASURED EPNL	=	94.2 EPNDB
DELTA 1 (ARP866)	=	2.7 EPNDB
DELTA 2	=	-0.6 EPNDB
DELTA S	=	-0.3 EPNDB
DELTA FN/D	=	0.0 EPNDB
REF. EPNL FN/D	=	96.0 EPNDB

TABLE C-6.5

DC-9 REFAN LANDING APPROACH ($\delta_F = 35^o$) FLYOVER-NOISE TEST CONDITION SUMMARY

FAR PART 36 FLYOVER NOISE LEVELS

DATA IDENTIFICATION INFORMATION

DATA DIGITIZED 2-3-75 DATA PROCESSED 07/01/75 PAGE 1

MODEL DC-9-31 REG. NO. N54638

DC-9-31 REFAN FLYOVER NOISE TEST

FAR PART 36 NOISE LEVELS

ENGINE/NACELLE CONFIGURATION -- P&WA JT8D-109 ENGINES WITH ACOUSTICALLY TREATED NACELLES

TYPE OF FLYOVER -- LANDING APPROACH DATA CLASS -- H POWER
MEASUREMENT TYPE -- BENEATH FLT PATH, 4 FEET ABOVE SANDY DIRT
RECORDING AT X = -6978.0, Y = 198.0, Z = -1.0 FEET FROM THRESHOLD
REFERENCE RECORDING LOCATION X = -6076.0, Y = .0, Z = .0 FEET

MEASUREMENT INFO	AIRPLANE AND ENGINE DATA		WEATHER DATA
MIC. NUMBER 6	FUSE. NO. 741	AVG. NIRT = 4836. RPM	AMB. TEMP. = 57.8 F
MIC. LOCATION 10	FLIGHT 20	AVG. EPR = 1.149	REL. HUM. = 40.7 PCT
MIC. ORIENT GRAZING	RUN 48	A/P HEADING = 30. DEG	ABS. HUM. = 5.0 GM/M3
TEST SITE YUMA	HEIGHT = 356.4 FT	FLAP POS. = 34.7 DEG	WIND SPEED = 7. KN
TEST DATE 2-01-75	LAT. DEV. = -195.7 FT	PATH ANG. = -2.7 DEG	WIND DIR. = 360. DEG
TEST NUMBER JOB 511	SLNT.RNG. = 406.6 FT	PITCH ANG. = 3.8 DEG	STA. PRESS = 30.07 IN HG
JOB REEL A5359	PATH SPD. = 135.1 KN	GR. WEIGHT = 97600. LB	RT. THETA = .9998

AIRPLANE SPACE POSITIONING IS RELATIVE TO MIC FOR TIME AT MIC OF 10-49- 9.6
OTHER PERFORMANCE DATA IS FOR TIME OF PNLTM OF 10-49-11.5
TIME OF AIRCRAFT AT MINIMUM DISTANCE FROM MICROPHONE LOCATION 10-49- 9.6

REFERENCE SURFACE WEATHER CONDITIONS TEMP = 77.0 F & REL. HUM. = 70.0 PCT

DESCRIPTION OF ACOUSTICAL DATA PROCESSING

ANALYZER TYPE / RESOLUTION GR1921(CISA) / 0.25 DB
CISA MODE 1 PASS WITH AUTO-START
SAMPLE INTERVAL FOR BASIC DATA = .500 SECONDS
AVERAGING TIME = 1.500 SECONDS

ATMOSPHERIC ATTENUATION SAE ARP866(REV)
BASIC UNIT SOUND PRESSURE LEVEL (DB REL. 0.0002 MICROBAR)
DATA TYPES 1/3 OCTAVE, OVERALL, A-WTD, PNL, PNLT & EPNL

TABLE C-6.5 (CONTINUED)

DC-9 REFAN LANDING APPROACH ($\delta_F = 35^o$) FLYOVER-NOISE TEST CONDITION SUMMARY

FAR PART 36 CALCULATED NOISE LEVELS PAGE = 2

MODEL DC-9-31 FUSELAGE NO. 741 REGISTRATION NO. N54638 TEST DATE 2-01-75
FLIGHT NO. 20 TEST RUN NO 48 MICROPHONE NO. 6 MIC. LOCATION 10

REFERENCE CONDITIONS-DC-9 REFAN 35 DEG APPROACH USING FINAL CORR CURVE SLOPE

SUMMARY OF MEASURED NOISE LEVELS.

PNLTM= 100.2 PNDB DCF= -5.8 DB EPNL= 94.4 EPNDB

SUMMARY OF DELTA1 CALCULATIONS

FREQUENCY (HZ)	MEASURED SPL (DB)	MEASURED NOISINESS (NOYS)	ADJUSTED SPL (DB)	ADJUSTED NOISINESS (NOYS)
50	70.5	1.9	71.3	2.1
63	68.8	2.3	69.6	2.5
80	62.9	1.8	63.7	1.9
100	68.1	3.6	68.9	3.9
125	76.6	8.1	77.5	8.6
160	81.9	12.9	82.7	13.6
200	80.7	13.7	81.5	14.5
250	73.2	8.6	74.0	9.2
315	80.8	15.5	81.6*	16.4
400	79.3	15.3	80.1	16.2
500	79.8	15.7	80.6	16.6
630	78.9	14.9	79.7	15.7
800	79.1	15.1	79.9	15.9
1000	76.6	12.7	77.4	13.4
1250	75.9	13.8	76.8	14.7
1600	77.2	19.7	78.3	21.2
2000	75.8	20.6	77.2	22.6
2500	74.6	21.7	76.4	24.6
3150	69.9	16.8	72.4	20.0
4000	65.6	12.5	69.2	16.0
5000	68.3	14.0	72.7	19.0
6300	69.8*	14.5	76.2	22.5
8000	61.8	6.8	71.0	12.8
10000	50.6	2.5	63.6	6.2
PNL	99.3 PNDB		101.4 PNDB	
PNLTM	100.2 PNDB		102.1 PNDB	

* BAND PRODUCING TONE CORRECTION

NOISE ADJUSTMENT PARAMETERS

	REF.	TEST
WEATHER		
AMB. TEMP. (DEG F)	77.0	57.8
REL. HUM. (PCT)	70.0	40.7
PREFORMANCE		
PATH SPEED (KN)	146.9	135.1
AVE FN/D (LBS)	3810.0	3756.1
FLIGHT PROFILE GEOMETRY		
MINIMUM DISTANCE (FT)	369.	406.
NOISE PATH DIST. (FT)	396.	435.

CALCULATED NOISE LEVELS

MEASURED EPNL	=	94.4 EPNDB
DELTA 1 (ARP866)	=	2.0 EPNDB
DELTA 2	=	-0.4 EPNDB
DELTA S	=	-0.4 EPNDB
DELTA FN/D	=	0.0 EPNDB
REF. EPNL FN/D	=	95.6 EPNDB

TABLE C-6.6

DC-9 REFAN LANDING APPROACH (δ_F = 35°) FLYOVER-NOISE TEST CONDITION SUMMARY

FAR PART 36 FLYOVER NOISE LEVELS

DATA IDENTIFICATION INFORMATION

DATA DIGITIZED 2-3-75 DATA PROCESSED 07/01/75 PAGE 1

MODEL DC-9-31 REG. NO. N54638

DC-9-31 REFAN FLYOVER NOISE TEST

FAR PART 36 NOISE LEVELS

ENGINE/NACELLE CONFIGURATION -- P&WA JT8D-109 ENGINES WITH ACOUSTICALLY TREATED NACELLES

TYPE OF FLYOVER -- LANDING APPROACH DATA CLASS -- H POWER
MEASUREMENT TYPE -- BENEATH FLT PATH, 4 FEET ABOVE SANDY DIRT
RECORDING AT X = -6978.0, Y = 198.0, Z = -1.0 FEET FROM THRESHOLD
REFERENCE RECORDING LOCATION X = -6076.0, Y = .0, Z = .0 FEET

MEASUREMENT INFO		AIRPLANE AND ENGINE DATA				WEATHER DATA	
MIC. NUMBER	6	FUSE. NO.	741	AVG. N1RT =	4948. RPM	AMB. TEMP. =	58.4 F
MIC. LOCATION	10	FLIGHT	20	AVG. EPR =	1.160	REL. HUM. =	38.0 PCT
MIC. ORIENT	GRAZING	RUN	49	A/P HEADING =	30. DEG	ABS. HUM. =	4.7 GM/M3
TEST SITE	YUMA	HEIGHT =	368.0 FT	FLAP POS. =	34.1 DEG	WIND SPEED =	4. KN
TEST DATE	2-01-75	LAT. DEV. =	-189.8 FT	PATH ANG. =	-3.1 DEG	WIND DIR. =	350. DEG
TEST NUMBER	JOB 511	SLNT.RNG. =	414.0 FT	PITCH ANG. =	1.8 DEG	STA. PRESS =	30.07 IN HG
JOB REEL	A5359	PATH SPD. =	138.8 KN	GR. WEIGHT =	96300. LB	RT. THETA =	1.0006

AIRPLANE SPACE POSITIONING IS RELATIVE TO MIC FOR TIME AT MIC OF 11- 0-26.2
OTHER PERFORMANCE DATA IS FOR TIME OF PNLTM OF 11- 0-28.0
TIME OF AIRCRAFT AT MINIMUM DISTANCE FROM MICROPHONE LOCATION 11- 0-26.2

REFERENCE SURFACE WEATHER CONDITIONS TEMP = 77.0 F & REL. HUM. = 70.0 PCT

DESCRIPTION OF ACOUSTICAL DATA PROCESSING

ANALYZER TYPE / RESOLUTION GR1921(CISA) / 0.25 DB
CISA MODE 1 PASS WITH AUTO-START
SAMPLE INTERVAL FOR BASIC DATA = .500 SECONDS
AVERAGING TIME = 1.500 SECONDS

ATMOSPHERIC ATTENUATION SAE ARP866(REV)
BASIC UNIT SOUND PRESSURE LEVEL (DB REL. 0.0002 MICROBAR)
DATA TYPES 1/3 OCTAVE, OVERALL, A-WTD, PNL, PNLT & EPNL

TABLE C-6.6 (CONTINUED)

DC-9 REFAN LANDING APPROACH (δ_F = 35°) FLYOVER-NOISE TEST CONDITION SUMMARY

FAR PART 36 CALCULATED NOISE LEVELS PAGE = 2

MODEL DC-9-31 FUSELAGE NO. 741 REGISTRATION NO. N54638 TEST DATE 2-01-75
FLIGHT NO. 20 TEST RUN NO 49 MICROPHONE NO. 6 MIC. LOCATION 10

REFERENCE CONDITIONS-DC-9 REFAN 35 DEG APPROACH USING FINAL CORR CURVE SLOPE

SUMMARY OF MEASURED NOISE LEVELS.

PNLTM= 100.2 PNDB DCF= -5.3 DB EPNL= 94.9 EPNDB

SUMMARY OF DELTA1 CALCULATIONS

FREQUENCY (HZ)	MEASURED SPL (DB)	MEASURED NOISINESS (NOYS)	ADJUSTED SPL (DB)	ADJUSTED NOISINESS (NOYS)
50	71.5	2.1	72.5	2.3
63	71.8	3.0	72.8	3.3
80	73.7	4.5	74.7	4.9
100	77.0	7.6	78.0	8.3
125	79.9	10.5	80.8	11.2
160	82.7	13.7	83.7	14.6
200	81.4	14.3	82.3	15.3
250	74.2	9.3	75.2	10.0
315	80.4	15.1	81.4	16.2
400	78.5	14.4	79.4	15.4
500	80.1	16.1	81.1	17.2
630	78.8	14.7	79.7	15.7
800	77.9	13.9	78.9	14.9
1000	77.1	13.1	78.2	14.1
1250	75.1	13.1	76.3	14.2
1600	76.4	18.6	77.7	20.4
2000	75.2	19.6	76.8	22.0
2500	74.1	20.9	76.2	24.3
3150	70.0	16.9	72.9	20.7
4000	65.5	12.4	69.7	16.6
5000	67.3	13.1	72.3	18.5
6300	69.1*	13.9	76.3*	22.7
8000	60.9	6.4	71.1	12.9
10000	49.1	2.2	63.4	6.2
PNL	99.4 PNDB		101.7 PNDB	
PNLTM	100.2 PNDB		102.4 PNDB	

* BAND PRODUCING TONE CORRECTION

NOISE ADJUSTMENT PARAMETERS

	REF.	TEST
WEATHER		
AMB. TEMP. (DEG F)	77.0	58.4
REL. HUM. (PCT)	70.0	38.0
PREFORMANCE		
PATH SPEED (KN)	146.9	138.8
AVE FN/D (LBS)	3810.0	3994.2
FLIGHT PROFILE GEOMETRY		
MINIMUM DISTANCE (FT)	369.	414.
NOISE PATH DIST. (FT)	389.	436.

CALCULATED NOISE LEVELS

MEASURED EPNL	=	94.9 EPNDB
DELTA 1 (ARP866)	=	2.2 EPNDB
DELTA 2	=	-0.5 EPNDB
DELTA S	=	-0.2 EPNDB
DELTA FN/D	=	-0.1 EPNDB
REF. EPNL FN/D	=	96.2 EPNDB

TABLE C-6.7

DC-9 REFAN LANDING APPROACH ($\delta_F = 35^o$) FLYOVER-NOISE TEST CONDITION SUMMARY

FAR PART 36 FLYOVER NOISE LEVELS

DATA IDENTIFICATION INFORMATION

DATA DIGITIZED 2-17-75 DATA PROCESSED 07/01/75 PAGE 1

MODEL DC-9-31 REG. NO. N54638

DC-9-31 REFAN FLYOVER NOISE TEST

FAR PART 36 NOISE LEVELS

ENGINE/NACELLE CONFIGURATION -- P&WA JT8D-109 ENGINES WITH ACOUSTICALLY TREATED NACELLES

TYPE OF FLYOVER -- LANDING APPROACH DATA CLASS -- H POWER
MEASUREMENT TYPE -- BENEATH FLT PATH, 4 FEET ABOVE SANDY DIRT
RECORDING AT X = -6978.0, Y = 198.0, Z = -1.0 FEET FROM THRESHOLD
REFERENCE RECORDING LOCATION X = -6076.0, Y = .0, Z = .0 FEET

MEASUREMENT INFO		AIRPLANE AND ENGINE DATA				WEATHER DATA	
MIC. NUMBER	6	FUSE. NO.	741	AVG. N1RT =	4982. RPM	AMB. TEMP. =	58.2 F
MIC. LOCATION	10	FLIGHT	20	AVG. EPR =	1.161	REL. HUM. =	37.8 PCT
MIC. ORIENT	GRAZING	RUN	50	A/P HEADING =	30. DEG	ABS. HUM. =	4.7 GM/M3
TEST SITE	YUMA	HEIGHT =	387.4 FT	FLAP POS. =	33.7 DEG	WIND SPEED =	2. KN
TEST DATE	2-01-75	LAT. DEV. =	-183.4 FT	PATH ANG. =	-2.4 DEG	WIND DIR. =	360. DEG
TEST NUMBER	JOB 511	SLNT.RNG. =	428.6 FT	PITCH ANG. =	2.4 DEG	STA. PRESS =	30.07 IN HG
JOB REEL	A5359	PATH SPD. =	142.5 KN	GR. WEIGHT =	95100. LB	RT. THETA =	1.0006

AIRPLANE SPACE POSITIONING IS RELATIVE TO MIC FOR TIME AT MIC OF 11-11- 5.3
OTHER PERFORMANCE DATA IS FOR TIME OF PNLTM OF 11-11- 6.5
TIME OF AIRCRAFT AT MINIMUM DISTANCE FROM MICROPHONE LOCATION 11-11- 5.3

REFERENCE SURFACE WEATHER CONDITIONS TEMP = 77.0 F & REL. HUM. = 70.0 PCT

DESCRIPTION OF ACOUSTICAL DATA PROCESSING

ANALYZER TYPE / RESOLUTION GR1921(CISA) / 0.25 DB
CISA MODE 1 PASS WITH AUTO-START
SAMPLE INTERVAL FOR BASIC DATA = .500 SECONDS
AVERAGING TIME = 1.500 SECONDS

ATMOSPHERIC ATTENUATION SAE ARP866(REV)
BASIC UNIT SOUND PRESSURE LEVEL (DB REL. 0.0002 MICROBAR)
DATA TYPES 1/3 OCTAVE, OVERALL, A-WTD, PNL, PNLT & EPNL

TABLE C-6.7 (CONTINUED)

DC-9 REFAN LANDING APPROACH (δ_F = 35°) FLYOVER-NOISE TEST CONDITION SUMMARY

FAR PART 36 CALCULATED NOISE LEVELS PAGE = 2

MODEL DC-9-31 FUSELAGE NO. 741 REGISTRATION NO. N54638 TEST DATE 2-01-75
FLIGHT NO. 20 TEST RUN NO 50 MICROPHONE NO. 6 MIC. LOCATION 10

REFERENCE CONDITIONS—DC-9 REFAN 35 DEG APPROACH USING FINAL CORR CURVE SLOPE

SUMMARY OF MEASURED NOISE LEVELS.

PNLTM= 99.6 PNDB DCF= -5.6 DB EPNL= 94.0 EPNDB

SUMMARY OF DELTA1 CALCULATIONS

FREQUENCY (HZ)	MEASURED SPL (DB)	MEASURED NOISINESS (NOYS)	ADJUSTED SPL (DB)	ADJUSTED NOISINESS (NOYS)
50	78.1	4.1	79.4	4.7
63	76.9	4.8	78.2	5.5
80	74.8	4.9	76.1	5.5
100	74.8	6.4	76.1	7.1
125	76.5	7.9	77.8	8.8
160	79.7	11.1	81.0	12.1
200	78.4	11.6	79.7	12.7
250	71.2	7.5	72.5	8.2
315	79.7	14.4	81.0	15.7
400	75.8	11.9	77.0	13.0
500	80.0*	16.0	81.3*	17.5
630	77.3	13.3	78.6	14.5
800	76.8	12.8	78.1	14.1
1000	76.1	12.2	77.5	13.4
1250	75.0	13.0	76.5	14.4
1600	75.2	17.2	76.9	19.3
2000	74.7	19.0	76.7	21.9
2500	73.6	20.3	76.2	24.2
3150	69.1	15.9	72.4	20.0
4000	65.1	12.1	69.8	16.6
5000	65.4	11.5	70.8	16.7
6300	66.9	11.9	74.4	20.0
8000	58.7	5.5	69.4	11.5
10000	47.6	1.9	62.4	5.8
PNL	98.4 PNDB		101.1 PNDB	
PNLTM	99.6 PNDB		102.3 PNDB	

* BAND PRODUCING TONE CORRECTION

NOISE ADJUSTMENT PARAMETERS

	REF.	TEST
WEATHER		
AMB. TEMP. (DEG F)	77.0	58.2
REL. HUM. (PCT)	70.0	37.8
PREFORMANCE		
PATH SPEED (KN)	146.9	142.5
AVE FN/D (LBS)	3810.0	4038.0
FLIGHT PROFILE GEOMETRY		
MINIMUM DISTANCE (FT)	369.	428.
NOISE PATH DIST. (FT)	369.	428.

CALCULATED NOISE LEVELS

MEASURED EPNL	=	94.0 EPNDB
DELTA 1 (ARP866)	=	2.7 EPNDB
DELTA 2	=	-0.6 EPNDB
DELTA S	=	-0.1 EPNDB
DELTA FN/D	=	-0.2 EPNDB
REF. EPNL FN/D	=	95.7 EPNDB

ORIGINAL PAGE IS OF POOR QUALITY

TABLE C-7.1
TYPICAL SIDELINE FLYOVER-NOISE DATA

FAR PART 36 FLYOVER NOISE LEVELS

CATA IDENTIFICATICN INFCRMATICN

CATA CIGITIZEC 2-1-75 DATA PROCESSEC 04/15/75 PAGE 1

MOCEL DC-9-31 REG. NC. N54638

CC-9-31 REFAN FLYOVER NCISE TEST

MEASLREC NOISE LEVELS

ENGINE/NACELLE CCNFIGURATICN -- P&WA JT8D-109 ENGINES WITH ACOUSTICALLY TREATED NACELLES

TYPE CF FLYCVER -- SIMULATED T.C. CLIMB CATA CLASS -- FN/DLT = 9500 LBS
MEASUREMENT TYPE -- .25 NMI SIDELINE, 4 FEET ABOVE SANDY DIRT
RECCRDING AT X = 538.C, Y =-1461.0, Z = 4.0 FEET FROM WEST-MCST END OF RUNWAY

MEASUREMENT INFO		AIRPLANE AND ENGINE CATA		WEATHER DATA
MIC. NUMBER 9	FUSE. NO. 741		AVG. NIRT = 7463. RPM	AMB. TEMP. = 52.5 F
MIC. LCCATICN 16	FLIGHT 16		AVG. EPR = 1.726	REL. HUM. = 35.1 PCT
MIC. CRIENT GRAZING	RUN 16		A/P HEADING = 210. DEG	ABS. HUM. = 3.6 GM/M3
TEST SITE YUMA	HEIGHT = 958.4 FT		FLAP PCS. = UP 2.1 DEG	WIND SPEED = 4. KN
TEST CATE 1-29-75	LAT. DEV. = 1498.5 FT		PATH ANG. = 10.5 DEG	WIND DIR. = 260. DEG
TEST NUMBER JOB 511	SLNT.RNG. = 1778.7 FT		PITCH ANG. = 19.0 DEG	STA. PRESS = 29.81 IN HG
JOB REEL A5282	PATH SPD. = 175.0 KN		GR. WEIGHT = 99900. LB	RT. THETA = .9956

AIRPLANE SPACE POSITICNING IS RELATIVE TO MIC FCR TIME AT MIC OF 10-42-22.8
OTHER PERFORMANCE DATA IS FOR TIME OF PNLTM CF 10-42-26.5
TIME OF AIRCRAFT AT MINIMUM DISTANCE FROM MICROPHCNE LOCATION 10-42-22.1

DESCRIPTICN OF ACOUSTICAL CATA PRCCESSING

ANALYZER TYPE / RESCLUTICN GR1921(CISA) / 0.25 CB
CISA MOCE 1 PASS WITH AUTO-START
SAMPLE INTERVAL FCR BASIC CATA = .500 SECCNDS
AVERAGING TIME = 1.500 SECCNDS

BASIC UNIT SOUNC PRESSURE LEVEL (CB REL. 0.0002 MICROBAR)
CATA TYPES 1/3 OCTAVE, OVERALL, A-WTD, PNL, PNLT & EPNL

TABLE C-7.1 (CONTINUED)
TYPICAL SIDELINE FLYOVER-NOISE DATA

MEASURED SPL HISTORY   MODEL DC-9-31   FLT 16   MIC 9   (1)   TEST DATE 1-29-75
START TIME 10 42 19.000   REG. N54638   RUN 16   LOC 16   PAGE 2

1/3 O.B. CNF (HZ)	AMB SPL	0.0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0
50	52.4	65.2	65.2	65.1	67.7	68.9	69.5	69.4	69.9	70.9	70.7	70.8	72.0	72.5
63	57.1	67.1	68.2	69.0	68.7	68.8	70.1	70.4	71.5	71.1	71.6	71.3	72.1	72.5
80	50.9	67.7	68.5	68.8	69.5	70.0	71.0	72.0	73.1	73.9	73.0	72.6	72.0	73.5
(2) — 100	49.3	68.4	69.4	70.1	70.9	71.9	71.7	71.6	71.2	71.1	70.2	69.8	69.2	71.7
125	49.0	69.9	71.0	70.7	71.1	71.0	70.1	69.7	69.2	69.3	68.0	66.3	64.4	64.9
160	47.5	69.9	71.1	70.9	69.9	69.2	68.6	67.5	65.2	65.7	67.3	69.3	71.7	73.7
200	46.2	66.6	67.1	66.1	64.0	62.5	63.9	66.6	71.1	73.5	75.6	77.5	79.4	81.2
250	44.4	64.9	64.7	61.9	61.2	65.2	70.5	73.6	77.4	79.1	80.7	80.8	82.1	82.8
315	42.3	60.7	61.2	63.2	68.6	72.6	75.6	77.4	79.5	80.2	81.0	81.1	81.7	82.8
400	39.8	63.3	68.5	71.6	73.5	76.7*	78.6	79.4*	79.0	77.8	77.0	75.7	74.9	75.2
500	37.2	66.4	70.3	73.0	74.0	74.1	73.1	72.5	72.4	74.3	75.8	78.0	79.8*	82.0*
630	35.5	68.3	71.2	71.8	71.4	69.6	70.5	74.1	77.2*	78.2*	78.1*	77.2	76.7	77.3
800	35.0	67.8	68.1	66.3	66.6	71.7	73.3*	74.2	73.5	72.9	72.9	74.2	76.0	77.5
1000	34.6	61.9	64.8	66.8	67.9*	69.0	69.4	70.5	71.9	72.0	71.9	71.4	73.0	74.2
1250	30.9	58.1	61.1	62.3	62.6	66.2	67.4	68.0	68.0	68.5	69.1	69.1	70.4	71.4
1600	26.8	53.2	55.6	56.9	57.5	60.1	62.7	63.6	64.5	64.7	65.3	66.0	66.8	67.5
2000	25.7	45.9	49.2	50.3	51.3	53.8	56.0	57.3	58.8	59.8	60.1	60.5	61.5	62.1
2500	22.7	36.9	40.8	42.1	43.6	46.1	48.2	49.2	51.0	52.2	52.6	53.0	53.8	54.3
3150	21.5		20.6	28.4	30.6	34.2	36.5	38.1	41.7	42.8	43.3	43.3	44.0	45.0
4000	19.9						23.8	25.5	28.6	30.9	32.0	33.4	34.3	34.9
5000	20.0													
6300	19.3													
8000	19.7													
(3) 10000	21.2													
(3) OVERALL	60.6	78.6	80.2	80.9	81.6	82.9	84.1	85.1	86.3	86.9	87.4	87.6	88.6	89.9
(4) — A-WTD	45.5	72.2	74.7	75.7	76.5	78.2	79.4	80.6	81.6	82.0	82.4	82.5	83.5	84.8
(5) — PNL	44.2	81.1	83.5	84.6	85.5	87.6	89.2	90.2	90.8	91.2	91.8	92.0	92.8	94.1
(6) — PNLT	44.2	81.1	83.5	84.6	86.6	88.2	90.3	90.9	92.2	92.8	93.0	92.0	94.2	96.0
ACC RNG (7)		2522	2358	2281	2176	2081	1998	1928	1871	1827	1795	1776	1770	1776
OPT RNG (8)		2100	2026	1959	1901	1854	1817	1790	1774	1770	1779	1796	1829	1871

TABLE C-7.1 (CONTINUED)

TYPICAL SIDELINE FLYOVER-NOISE DATA

MEASURED SPL HISTORY   MODEL DC-9-31   FLT 16   MIC 9   TEST DATE 1-29-75
START TIME 10 42 19.000   REG. N54638   RUN 16   LOC 16   PAGE 3

1/3 O.B. GMF (HZ)	6.5	7.0	7.5	8.0	8.5	9.0	9.5	10.0	10.5	11.0	11.5	12.0	12.5	13.0
50	72.9	71.6	73.4	73.9	75.8	75.6	76.1	75.9	79.0	80.6	81.6	80.4	81.4	81.1
63	73.5	75.7	76.9	77.7	77.7	78.5	79.0	79.0	80.0	81.4	81.7	82.3	82.0	83.0
80	73.1	74.6	75.4	75.6	74.7	73.4	75.5	77.2	79.7	82.2	82.9	83.2	82.2	81.9
100	71.4	71.2	69.5	70.1	72.0	73.0	73.8	73.9	74.9	76.3	77.3	77.8	78.3	78.2
125	65.4	66.5	66.4	66.2	66.7	67.2	68.4	67.8	68.3	69.6	69.9	70.9	70.9	72.0
160	75.6	76.5	78.2	78.2	78.8	77.7	77.4	76.9	76.5	76.5	74.8	73.6	71.6	70.9
200	82.0	82.6	83.0	83.4	83.4	83.4	83.4	82.9	82.7	82.5	81.8	80.8	79.5	79.0
250	84.1	84.2	85.2	85.8	86.1	85.8	85.0	84.7	84.1	84.5	83.6	83.6	82.2	82.2
315	83.9	84.4	84.9	85.2	85.6	85.4	34.5	82.8	81.8	81.8	81.9	81.9	81.9	82.1
400	76.0	77.4	78.4	78.4	78.3	77.3	76.9	75.3	74.3	74.9	75.0	75.8	74.8	74.8
500	83.7*	84.5*	85.2*	84.8*	84.9*	83.6*	82.6*	80.3*	79.0*	78.9*	78.2	78.2	75.8	74.8
630	77.2	77.3	77.3	77.3	78.5	78.0	77.9	75.6	75.4	76.1	76.4	76.5	74.3	72.9
800	78.3	78.4	78.9	78.3	78.7	77.9	77.3	75.6	74.9	74.4	73.7	72.4	70.5	69.1
1000	74.9	74.3	74.3	73.7	74.1	73.4	72.6	70.6	69.5	69.3	69.0	67.3	65.2	63.7
1250	71.9	71.1	70.7	69.9	70.1	69.0	68.0	65.9	65.3	64.7	64.2	63.0	61.0	59.6
1600	66.9	65.8	65.2	64.7	64.6	63.4	62.7	61.0	59.7	59.1	58.6	56.8	54.5	52.1
2000	61.9	60.4	59.8	58.6	58.2	56.9	56.4	54.6	52.9	51.8	50.7	49.6	45.7	43.5
2500	53.6	52.2	51.0	50.2	49.3	48.5	47.5	44.8	42.8	41.5	40.4	39.2	36.0	33.6
3150	44.2	43.1	41.2	40.6	39.6	37.9	35.8	32.8	30.3	28.8	27.0			
4000	34.2	32.8	31.1	29.3	28.2	26.8	24.4							
5000														
6300														
8000														
10000														
OVERALL	90.9	91.4	92.1	92.2	92.5	92.0	91.6	90.7	90.6	91.2	91.1	91.0	90.4	90.3
A-WTD	85.8	86.1	86.6	86.5	86.8	86.1	85.4	83.7	32.9	83.0	82.6	82.4	81.1	80.6
PNL	95.2	95.6	96.1	95.9	96.1	95.4	94.9	93.8	93.4	93.7	93.2	93.0	91.9	91.7
PNLT	97.5	98.0	98.5	98.2	98.2	97.4	96.6	95.4	94.8	94.9	93.2	93.0	91.9	91.7
ACC RNG	1793	1820	1856	1900	1951	2009	2074	[illegible]	2216	2294	2375	2461	2548	2637
CPT RNG	1923	1984	2054	2132	2216	2307	2403	2505	2610	2720	2834	2950	3069	3191

(9)

TABLE C-7.1 (CONTINUED)
TYPICAL SIDELINE FLYOVER-NOISE DATA

MEASURED SPL HISTORY MODEL DC-9-31 FLT 16 MIC 9 TEST DATE 1-29-75
START TIME 10 42 19.000 REG. N54638 RUN 16 LOC 16 PAGE 4

1/3 O.B. CMF (HZ)	13.5	14.0	14.5	15.0	15.5	16.0	16.5	17.0	17.5	18.0	18.5	19.0	19.5	20.0
50	81.6	81.2	81.7	81.3	81.2	81.5	82.3	81.6	81.8	82.0	81.6	80.3	79.7	80.1
63	82.0	82.1	81.0	81.7	81.7	81.7	81.9	81.8	81.8	81.2	80.6	80.3	79.9	79.1
80	81.7	81.7	81.8	82.2	81.8	81.6	80.7	80.0	78.8	77.9	78.3	77.6	77.1	77.6
100	78.2	77.5	78.4	78.6	78.8	78.0	77.5	76.7	75.5	74.4	75.5	75.9	77.2	76.9
125	71.8	71.5	71.6	72.1	73.3	73.7	74.0	72.8	71.8	70.3	71.5	71.3	71.3	70.3
160	70.1	68.4	67.4	66.7	66.7	66.3	65.7	65.4	64.8	64.3	64.6	64.9	64.6	63.6
200	77.7	75.9	75.3	74.3	74.3	74.1	74.2	73.3	70.9	67.5	65.0	65.1	64.4	63.6
250	80.1	79.5	79.4	79.4	79.0	78.8	78.9	78.2	76.4	73.3	72.7	73.1	72.2	71.8
315	81.6	80.2	80.1	80.8	81.5	82.3	82.1	81.5	79.5*	77.1*	77.6*	78.6*	78.5*	78.1*
400	74.9	75.3	76.3	77.2	78.1	78.5	79.0	78.0	75.8	72.1	73.3	74.7	75.1	75.0
500	71.4	70.7	71.2	69.9	70.0	69.4	68.9	68.0	65.8	63.4	64.2	64.6	64.9	64.6
630	71.9*	71.5*	72.3*	70.9*	72.2*	72.0*	71.3*	69.6*	66.2	64.0	63.5	63.8	62.8	61.7
800	65.1	63.7	64.0	63.5	65.1	65.5	65.4	64.2	61.6	58.7	58.4	58.6	58.4	57.9
1000	61.8	60.7	61.5	60.9	62.1	61.4	60.3	57.8	54.1	51.7	50.6	50.6	48.9	48.1
1250	55.8	54.7	54.5	52.5	53.4	52.6	51.6	49.1	47.0	43.9	43.3	43.5	42.6	42.4
1600	47.9	45.8	45.4	43.6	44.3	43.3	42.6	40.3	38.4	34.6	34.2	33.8	32.1	30.8
2000	39.2	37.1	36.4	33.6	34.1	32.1	30.8							
2500	28.2													
3150														
4000														
5000														
6300														
8000														
10000														
OVERALL	89.6	89.1	89.1	89.3	89.4	89.6	89.5	88.9	88.0	86.9	87.0	86.6	86.4	86.3
A-WTD	79.3	78.5	78.8	78.9	79.5	79.9	79.7	78.9	76.7	74.0	74.4	75.3	75.3	75.0
PNL	90.7	89.6	89.7	89.9	90.4	90.7	90.5	89.7	87.7	85.5	85.7	86.2	86.0	85.6
PNLT	91.9	91.1	91.2	91.3	92.0	92.2	91.9	90.8	88.3	86.2	86.6	87.1	86.9	86.5
ACC RNG	2729	2823	2919	3016	3115	3216	3317	3420	3523	3628	3733	3839	3945	4052
CPT RNG	3315	3440	3568	3698	3828	3960	4093	4227	4363	4499	4636	4773	4911	5049

TABLE C-7.1 (CONTINUED)

TYPICAL SIDELINE FLYOVER-NOISE DATA

MEASURED SPL HISTORY   MODEL DC-9-31   FLT 16   MIC 9   TEST DATE 1-29-75
START TIME 10 42 19.000   REG. N54631   RUN 16   LOC 16

PAGE 5

1/3 O.B. CMF(HZ)	20.5	21.0	21.5	22.0	22.5	23.0	23.5	24.0
50	79.8	78.7	77.9	78.0	79.1	79.2	79.0	77.9
63	80.3	80.4	80.2	78.9	78.8	79.7	79.9	78.9
80	78.4	78.6	78.2	78.8	78.8	78.1	78.0	77.4
100	76.6	75.1	74.5	74.2	74.3	74.4	75.4	75.3
125	70.6	70.8	69.8	69.0	68.2	69.8	70.5	70.5
160	64.1	64.1	64.7	64.3	64.4	63.6	62.8	62.2
200	63.6	64.4	65.7	65.6	64.8	62.5	61.1	59.1
250	71.1	72.1	72.0	71.1	69.7	68.6	68.1	66.2
315	78.3	79.5	79.2	77.9	75.7	75.0	74.8	72.9
400	76.7	78.1	78.4	77.7	76.1	75.7*	74.8*	73.3
500	66.4	67.7	69.4	69.3	68.5	66.7	65.8	64.6
630	61.4	61.8	62.3	61.0	59.4	56.5	55.3	53.0
800	59.6*	60.8*	61.6*	60.1*	57.8*	54.1	53.2	51.9*
1000	47.9	48.0	48.1	46.5	44.9	42.8	42.6	41.5
1250	43.0	43.6	43.5	41.5	38.2	36.3	37.7	36.8
1600	30.2							
2000								
2500								
3150								
4000								
5000								
6300								
8000								
10000								
OVERALL	86.7	86.9	86.6	86.1	85.7	85.6	85.6	84.6
A-WTD	75.8	77.0	77.1	76.3	74.6	73.9	73.3	71.7
PNL	86.0	86.9	87.0	86.3	85.0	84.3	83.7	82.3
PNLT	87.1	-88.2	88.4	87.7	86.2	85.1	84.4	83.4
ACC RNG	4160	4269	4378	4487	4596	4707	4817	4927
OPT RNG	5188	5327	5466	5604	5742	5879	6016	6154

TABLE C-7.1 (CONCLUDED)
TYPICAL SIDELINE FLYOVER-NOISE DATA

DATA DIGITIZED 2-1-75   DATA PROCESSED 04/15/75   PAGE 6

MODEL DC-9-31   REG. NO. N54638
FLIGHT 16   RUN 16   MIC 9   LOC 16   TEST DATE 1-29-75
HIGHLIGHTS OF MEASURED FLYOVER NOISE LEVELS FOR SIMULATED T.O. CLIMB
PATH SPEED 175.0 KN, SLANT RANGE 1770.1 FT. FOR TIME AT MIC 10 42 22.8
AVERAGE THRUST 12855.4 LBS

FREQUENCY (HZ)	SPL'S FOR PNLM (TIME 10 42 26.5) SPL (DB)	NOISINESS (NOYS)	SPL'S FOR PNLTM (TIME 10 42 26.5) SPL (DB)	NOISINESS (NOYS)	MAX SPL'S 1/3 O.B. (DB)	MAX 1/1 O.B. SPL'S FOR COMPOSITE PNL SPL (DB)	NOISINESS (NOYS)
50	73.4	2.6	73.4	2.6	82.2		
63	76.9	4.9	76.9	4.9	83.0	86.9	12.0
80	75.4	5.2	75.4	5.2	83.2		
100	69.5	4.1	69.5	4.1	78.8		
125	66.4	3.5	66.4	3.5	74.0	80.1	10.6
160	78.2	10.0	78.2	10.0	78.8		
200	83.0	16.0	83.0	16.0	83.4		
250	85.2	20.0	85.2	20.0	86.1	90.0	27.8
315	84.9	20.7	84.9	20.7	85.6		
400	78.4	14.3	78.4	14.3	79.4		
500	85.2	22.9	85.2*	22.9	85.2	86.5	25.2
630	77.3	13.3	77.3	13.3	78.5		
800	78.9	14.8	78.9	14.8	78.9		
1000	74.3	10.8	74.3	10.8	74.9	80.6	16.7
1250	70.7	9.7	70.7	9.7	71.9		
1600	65.2	8.6	65.2	8.6	67.5		
2000	59.8	6.8	59.8	6.8	62.1	68.8	12.6
2500	51.0	4.3	51.0	4.3	54.3		
3150	41.2	2.3	41.2	2.3	45.0		
4000	31.1	1.2	31.1	1.2	34.9	45.4	3.1
5000							
6300							
8000							
10000							

* BAND PRODUCING TONE CORRECTION

PNLC = 97.0 PNDB
LAM = 86.8 DBA
PNLM = 96.1 PNDB
PNLTM = 98.5 PNDB

DURATION FACTOR = -2.2 DB
INTEGRATION TIME = 14.0 SECONDS (FAR PART 36 TO 1.0 SECOND)
MEASURED EFFECTIVE PERCEIVED NOISE LEVEL, EPNL = 96.3 EPNDB

TABLE C-7.2

TYPICAL TAKEOFF FLYOVER-NOISE DATA

FAR PART 36 FLYOVER NOISE LEVELS

DATA IDENTIFICATION INFORMATION

DATA DIGITIZED 2-1-75 DATA PROCESSED 04/10/75 PAGE 1

MODEL DC-9-31 REG. NO. N54638

DC-9-31 REFAN FLYOVER NOISE TEST

MEASURED NOISE LEVELS

ENGINE/NACELLE CONFIGURATION -- P&WA JT8D-109 ENGINES WITH ACOUSTICALLY TREATED NACELLES

TYPE OF FLYOVER -- TAKEOFF CORR FLYOVER DATA CLASS -- POWER
MEASUREMENT TYPE -- BENEATH FLT PATH, 4 FEET ABOVE SANDY DIRT
RECORDING AT X = -7301.0, Y = .0, Z =-81.0 FEET FROM WEST-MOST END OF RUNWAY

MEASUREMENT INFO		AIRPLANE AND ENGINE DATA				WEATHER DATA	
MIC. NUMBER	1	FUSE. NO.	741	AVG. N1RT =	7598. RPM	AMB. TEMP. =	50.4 F
MIC. LOCATION	C6	FLIGHT	16	AVG. EPR =	1.755	REL. HUM. =	34.5 PCT
MIC. ORIENT	GRAZING	RUN	10	A/P HEADING =	210. DEG	ABS. HUM. =	3.3 GM/M3
TEST SITE	YUMA	HEIGHT	= 2428.8 FT	FLAP POS. = UP	2.1 DEG	WIND SPEED =	2. KN
TEST DATE	1-29-75	LAT. DEV. =	-82.9 FT	PATH ANG. =	9.1 DEG	WIND DIR. =	335. DEG
TEST NUMBER	JOB 511	SLNT.RNG. =	2430.2 FT	PITCH ANG. =	18.9 DEG	STA. PRESS =	29.81 IN HG
JOB REEL	A5282	PATH SPD. =	178.3 KN	GR. WEIGHT =	106400. LB	RT. THETA =	.9902

AIRPLANE SPACE POSITIONING IS RELATIVE TO MIC FOR TIME AT MIC OF 9-48-34.2
OTHER PERFORMANCE DATA IS FOR TIME OF PNLTM OF 9-48-42.0
TIME OF AIRCRAFT AT MINIMUM DISTANCE FROM MICROPHONE LOCATION 9-48-32.9

DESCRIPTION OF ACOUSTICAL DATA PROCESSING

ANALYZER TYPE / RESOLUTION GR1921(CISA) / 0.25 DB
CISA MODE 1 PASS WITH AUTO-START
SAMPLE INTERVAL FOR BASIC DATA = .500 SECONDS
AVERAGING TIME = 1.500 SECONDS

BASIC UNIT SOUND PRESSURE LEVEL (DB REL. 0.0002 MICROBAR)
DATA TYPES 1/3 OCTAVE, OVERALL, A-WTD, PNL, PNLT & EPNL

TABLE C-7.2 (CONTINUED)

TYPICAL TAKEOFF FLYOVER-NOISE DATA

MEASURED SPL HISTORY MODEL DC-9-31 FLT 16 MIC 1 TEST DATE 1-29-75
START TIME 9 48 27.500 REG. N54638 RUN 10 LOC C6 PAGE 2

1/3 O.B. GMF(HZ)	AMB SPL	0.0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0
50	51.6	58.6	59.0	60.0	62.8	64.4	65.1	66.8	67.5	68.4	67.9	67.6	65.9	65.6
63	52.9	61.5	63.0	64.6	64.8	65.2	64.8	65.0	63.5	61.6	60.3	64.8	68.1	69.0
80	55.3	65.8	65.5	64.5	61.9	59.5			62.1	63.9	65.8	67.1	67.3	67.0
100	56.1	66.2	63.6	61.7	61.6	61.3	63.0	64.7	65.3	65.0	64.9	66.2	67.1	70.0
125	53.7	62.1	63.8	63.9	63.9	62.7	62.9	64.7	65.7	69.0	73.3*	76.0*	76.2	76.9
160	52.5	61.9	64.3	65.4	65.6	66.7	69.1	71.3	72.9	74.2	75.6	76.6	77.6	78.2
200	53.6	66.8	68.2	69.2	69.7	71.4	72.6	74.6	75.5	76.4	76.7	76.8	77.2	76.7
250	43.7	71.8*	71.8	71.8	70.9	71.6	72.4	73.3	73.5	73.3	72.0	71.1	70.6	71.6
315	43.1	70.4	69.6	68.6	67.3	66.9	66.6	67.2	68.2	70.9	72.9	75.5	76.9*	77.8*
400	42.6	64.5	64.1	65.4	67.6	70.1	72.6	74.4	75.0*	75.7*	75.1	75.1	74.0	74.4
500	40.8	66.4	67.2*	68.1*	68.8	70.3	70.5	70.1	69.5	69.9	71.6	73.1	73.7	74.4
630	35.7	65.1	64.0	63.5	64.2	66.5	68.4	69.9	70.5	70.5	70.4	71.2	71.8	72.8
800	35.4	62.4	62.9	63.4	64.3	65.2	66.1	67.0	67.7	68.8	69.1	70.0	70.1	70.5
1000	39.3	57.2	56.9	57.3	59.2	60.7	62.0	62.2	63.1	64.0	64.9	65.6	66.1	66.9
1250	35.4	51.6	52.0	51.9	53.0	54.6	56.2	57.1	58.0	59.6	60.1	61.0	60.7	61.8
1600	31.4	43.7	44.7	44.9	46.3	48.0	49.4	50.0	50.2	51.9	52.9	54.8	55.0	55.9
2000	30.2		33.8	34.7	36.4	38.0	39.2	40.4	41.1	42.3	43.3	45.1	46.4	48.9
2500	27.9										31.4	33.4	35.1	38.2
3150	33.0													
4000	32.8													
5000	27.4													
6300	21.3													
8000	20.6													
10000	21.8													
OVERALL	62.6	77.6	77.6	77.8	77.9	78.9	80.1	81.4	82.1	82.9	83.5	84.5	85.0	85.5
A-WTD	49.4	70.9	70.9	71.1	71.6	73.1	74.3	75.3	75.8	76.5	76.9	77.8	78.1	78.8
PNL	57.2	79.9	80.2	80.3	80.2	81.6	83.1	84.6	85.3	86.2	86.4	87.1	87.6	88.4
PNLT	58.5	80.4	81.2	81.5	80.2	81.6	83.1	84.6	86.3	87.0	86.9	87.9	88.3	89.2
ACO RNG		3712	3577	3447	3321	3200	3086	2978	2878	2786	2704	2631	2569	2516
OPT RNG		3033	2945	2862	2784	2712	2647	2588	2537	2493	2458	2432	2413	2404

TABLE C-7.2 (CONTINUED)

TYPICAL TAKEOFF FLYOVER-NOISE DATA

MEASURED SPL HISTORY   MODEL DC-9-31   FLT 16   MIC 1   TEST DATE 1-29-75
START TIME 9 48 27.500   REG. N54638   RUN 10   LOC C6   PAGE 3

1/3 O.B. GMF(HZ)	6.5	7.0	7.5	8.0	8.5	9.0	9.5	10.0	10.5	11.0	11.5	12.0	12.5	13.0
50	65.4	68.3	70.5	72.4	73.2	72.3	71.9	71.7	73.3	73.0	73.5	74.1	76.1	76.6
63	69.2	68.7	68.1	67.7	66.8	67.1	68.0	70.2	71.6	71.7	71.9	73.2	75.7	76.0
80	64.6	65.6	66.5	68.2	69.4	69.6	70.8	71.3	72.3	72.1	74.6	74.9	75.7	74.4
100	73.1	74.2	75.2	74.7	76.1	75.9	77.0	78.1	79.1	80.2	80.1	80.1	78.8	79.7
125	76.2	77.2	77.3	79.5	79.5	80.7*	80.8	82.4*	82.5	82.5	82.6	83.5	84.4	84.8
160	78.3	78.8	78.5	78.4	78.0	78.3	79.3	79.9	80.9	81.1	81.7	82.2	85.4*	86.4*
200	76.7	75.5	75.2	74.1	74.2	74.1	74.4	76.2	76.4	77.2	77.1	77.6	78.9	80.8
250	72.7	74.4	75.4	76.8	77.6	78.7	79.2	80.6	81.9	82.4	83.0	82.7	82.8	82.2
315	78.5*	80.0*	80.8*	81.0*	80.8	80.5	81.1	81.9	83.3	83.7	84.3	84.1	84.1	84.1
400	74.7	76.0	76.8	77.9	78.5	79.2	80.0	80.5	80.8	80.8	81.1	81.4	81.4	80.8
500	75.1	75.9	76.1	76.9	77.4	77.4	77.8	79.0	80.0	80.1	79.6	79.4	79.2	79.3
630	74.3	75.5	76.4	76.7	76.9	76.8	77.5	77.8	78.1	78.1	78.2	78.3	77.9	77.4
800	71.5	72.0	73.6	74.6	75.4	75.5	75.3	75.2	74.7	74.7	75.0	75.3	75.2	74.6
1000	68.2	68.9	69.8	70.1	70.5	70.4	70.3	70.0	69.5	69.3	69.2	69.3	70.1	70.6
1250	62.6	63.6	64.7	65.8	66.7	66.9	66.9	66.5	65.9	65.1	64.4	64.0	63.9	63.8
1600	57.2	58.6	59.5	60.1	61.2	61.6	61.6	60.7	59.5	58.6	57.8	57.9	56.9	56.1
2000	51.0	51.9	52.5	53.3	53.9	53.9	52.5	51.4	50.2	50.0	49.5	49.1	48.5	48.2
2500	40.0	41.2	41.9	42.5	42.9	42.3	41.3	40.7	40.6	40.3	39.2	38.2	36.2	35.3
3150														
4000														
5000														
6300														
8000														
10000														
OVERALL	85.9	86.8	87.3	87.9	88.2	88.5	89.0	90.0	90.7	91.0	91.3	91.5	92.2	92.5
A-WTD	79.6	80.5	81.3	82.0	82.3	82.5	82.9	83.5	84.0	84.2	84.3	84.4	84.5	84.4
PNL	89.1	90.3	91.0	91.5	91.7	91.7	92.3	92.9	93.7	94.0	94.4	94.4	94.6	94.7
PNLT	89.9	91.1	91.8	92.0	91.7	92.3	92.3	93.5	93.7	94.0	94.4	94.4	95.2	95.3
ACO RNG	2474	2442	2419	2406	2403	2409	2423	2445	2475	2511	2553	2601	2655	2715
OPT RNG	2404	2413	2431	2457	2492	2534	2585	2643	2708	2781	2859	2943	3033	3128

TABLE C-7.2 (CONTINUED)

TYPICAL TAKEOFF FLYOVER-NOISE DATA

MEASURED SPL HISTORY   MODEL DC-9-31   FLT 16   MIC 1   TEST DATE 1-29-75
START TIME 9 48 27.500   REG. N54638   RUN 10   LOC C6   PAGE 4

1/3 O.B. GMF(HZ)	13.5	14.0	14.5	15.0	15.5	16.0	16.5	17.0	17.5	18.0	18.5	19.0	19.5	20.0
50	76.4	76.8	80.2	80.8	80.2	77.9	78.5	79.0	79.6	79.7	81.3	81.5	81.6	81.5
63	76.0	74.7	78.0	79.9	81.9	81.9	81.3	79.9	82.3	82.7	83.6	82.0	82.8	82.1
80	74.9	74.7	74.9	74.9	75.5	76.0	76.5	76.5	76.9	77.9	80.1	81.4	81.5	80.8
100	79.9	80.6	79.1	78.0	76.3	75.7	74.4	74.2	73.2	73.2	72.8	73.5	73.9	74.4
125	84.6	84.1	83.8	83.4	82.8	81.5	80.4	79.9	79.2	78.9	78.1	77.2	75.7	74.2
160	87.1*	87.3	87.7	87.9	87.2	86.3	84.8	84.1	83.1	82.8	81.4	80.4	80.0	79.6
200	82.9	84.1	84.9	86.6	87.3	87.4	86.4	85.6*	85.4*	84.8	84.1	83.5	83.3	82.9
250	82.1	81.7	80.5	79.0	77.2	76.7	77.3	78.2	79.2	80.1	80.6	81.0	81.2	81.0
315	84.5	85.0*	85.4*	85.4*	85.4*	84.9*	84.5*	83.6	82.6	81.3	80.5	79.2	78.3	77.7
400	80.3	80.3	80.2	80.0	79.3	80.0	80.6	81.3	82.0	82.2*	83.1*	83.3*	83.6*	82.7*
500	79.2	80.0	79.5	79.6	78.9	80.1	79.8	79.2	77.8	76.5	75.9	75.2	74.6	73.6
630	77.7	77.5	77.3	76.0	75.2	74.8	74.2	73.5	72.8	73.3	73.9	75.0	75.0	74.2
800	74.3	73.6	72.7	71.8	71.3	72.0	71.6	71.3	70.2	70.0	70.4	69.8	69.7	67.8
1000	71.2	70.6	69.9	68.8	68.0	67.4	66.7	65.7	64.5	63.3	63.5	63.2	63.0	61.2
1250	64.0	64.2	63.7	62.4	61.0	60.5	60.6	60.1	59.0	57.5	57.5	56.9	56.2	53.1
1600	55.4	55.0	54.7	53.6	52.7	52.0	51.9	51.7	50.6	49.1	47.4	46.[illegible]	45.5	43.1
2000	47.5	46.3	44.7	43.4	42.4	41.3	40.4	39.5	38.4	36.7	35.4			
2500	34.6	33.7	32.1											
3150														
4000														
5000														
6300														
8000														
10000														
OVERALL	92.9	93.1	93.3	93.6	93.4	93.1	92.4	91.8	91.7	91.5	91.7	91.3	91.3	90.8
A-WTD	84.5	84.7	84.6	84.5	84.2	84.2	83.8	83.4	83.0	82.6	82.7	82.5	82.5	81.7
PNL	95.0	95.2	95.4	95.2	95.0	94.9	94.2	93.6	93.4	93.1	93.5	93.3	93.4	92.5
PNLT	95.5	95.9	96.2	96.2	96.1	96.0	95.1	94.4	94.1	93.7	94.3	94.3	94.6	93.7
ACO RNG	2779	2847	2919	2995	3075	3157	3240	3327	3416	3507	3601	3696	3792	3890
OPT RNG	3226	3328	3435	3545	3659	3775	3893	4014	4137	4262	4389	4518	4648	4779

TABLE C-7.2 (CONTINUED)
TYPICAL TAKEOFF FLYOVER-NOISE DATA

MEASURED SPL HISTORY   MODEL DC-9-31   FLT 16   MIC 1   TEST DATE 1-29-75
START TIME 9 48 27.500   REG. N54638   RUN 10   LOC C6   PAGE 5

1/3 O.B. GMF(HZ)	20.5	21.0	21.5	22.0	22.5	23.0	23.5	24.0	24.5	25.0	25.5	26.0	26.5	27.0
50	81.1	80.9	79.9	79.1	77.5	75.5	74.8	75.9	77.2	78.5	78.0	76.2	74.0	74.8
63	82.1	80.9	80.3	79.9	78.7	78.2	77.3	78.0	77.4	76.7	77.3	76.8	77.0	75.3
80	79.7	80.5	82.1	82.8	82.9	81.6	80.3	79.7	79.2	79.6	78.4	77.9	77.1	77.1
100	74.8	75.0	77.3	78.7	80.1	80.2	80.3*	80.4*	80.4*	80.3	79.4	78.2	77.6	77.4
125	73.0	71.9	71.4	71.4	72.2	72.7	72.8	73.3	73.6	75.5	76.7	77.4	76.8	76.2
160	79.0	77.3	77.1	76.6	76.7	75.4	75.9	75.3	75.4	74.5	74.4	73.7	73.5	73.0
200	81.4	79.4	78.6	78.4	77.8	76.7	76.9	76.3	76.0	75.8	76.5	77.7	78.5	79.2
250	80.7	80.5	79.9	79.2	78.2	78.7	79.0	78.3	77.4	76.3	76.0	75.6	75.8	76.7
315	76.7	75.9	74.3	73.7	74.5	75.1	75.9	75.9	76.2	76.5	77.0	76.9	76.2	75.1
400	81.5*	79.7*	78.8*	77.4*	76.8*	75.9	76.0	74.8	73.4	71.5	70.4	69.4	68.1	67.4
500	72.7	73.5	73.4	73.4	72.7	73.5	74.1	74.1	73.4	72.4*	72.2*	71.3*	70.2*	68.3*
630	72.3	70.8	70.0	69.4	68.3	67.4	66.7	65.8	64.7	63.4	62.7	62.2	61.3	60.7
800	66.9	64.9	63.5	62.4	61.4	61.2	62.1	61.7	61.2	59.3	58.6	57.8	57.2	56.3
1000	59.8	58.5	58.1	57.2	55.8	55.0	55.4	54.6	53.2	50.7	48.8	47.5	46.3	45.2
1250	51.3	49.1	48.1	47.3	46.5	46.0	46.7	45.6	43.9	40.6	39.1			
1600	42.2	40.2	38.9	37.4	35.6									
2000														
2500														
3150														
4000														
5000														
6300														
8000														
10000														
OVERALL	90.0	89.2	89.0	88.8	88.6	88.0	87.8	87.6	87.4	87.3	87.1	86.7	86.3	86.1
A-WTD	80.6	79.5	78.8	78.0	77.5	77.3	77.6	77.1	76.5	75.8	75.8	75.5	75.1	74.7
PNL	91.5	90.2	89.6	88.8	88.3	87.9	88.1	87.6	87.0	86.6	86.7	86.3	85.9	86.0
PNLT	92.6	91.0	90.4	89.4	88.9	87.9	88.7	88.3	87.7	88.2	88.6	88.1	87.7	87.4
ACO RNG	3989	4090	4191	4293	4396	4501	4606	4712	4819	4926	5034	5142	5251	5361
OPT RNG	4912	5046	5182	5318	5455	5593	5732	5872	6012	6152	6293	6434	6575	6717

TABLE C-7.2 (CONTINUED)
TYPICAL TAKEOFF FLYOVER-NOISE DATA

MEASURED SPL HISTORY MODEL DC-9-31 FLT 16 MIC 1 TEST DATE 1-29-75
START TIME 9 48 27.500 REG. N54638 RUN 10 LOC C6 PAGE 6

1/3 O.B. GMF(HZ)	27.5	28.0	28.5	29.0	29.5	30.0	30.5	31.0	31.5	32.0	32.5	33.0	33.5
50	75.0	74.3	74.5	74.4	75.1	74.0	75.2	74.2	74.0	73.6	74.1	74.7	73.8
63	75.0	74.5	74.7	74.7	73.4	71.5	72.0	72.8	73.9	73.8	73.4	72.3	70.9
80	76.5	75.6	74.2	73.8	73.0	72.1	70.5	69.8	70.1	71.4	72.5	72.0	70.8
100	77.7	77.0	76.0	75.8	75.9	75.6	74.4	73.0	72.9	71.9	71.4	70.9	70.8
125	75.3	75.6	74.8	75.0	74.8	74.3	74.2	73.6	73.5	72.5	71.2	70.6	69.4
160	72.6	72.2	72.2	71.5	70.3	68.7	67.1	66.6	66.1	66.6	66.1	65.4	64.5
200	79.5*	79.2*	78.5*	78.0*	76.7*	76.0	73.6	72.7	71.8	71.1	70.4	69.0	68.2
250	77.5	77.5	76.8	76.3	77.1	77.3*	77.0*	75.9*	76.1*	76.3*	76.2*	74.8*	73.1*
315	74.3	73.8	73.1	72.6	71.8	71.7	71.9	72.3	72.7	72.7	72.8	71.9	71.4
400	67.5	68.4	68.0	67.3	65.4	65.4	65.8	66.3	66.6	66.8	67.7	67.0	66.2
500	67.3	67.1	66.4	65.6	64.0	63.4	62.3	61.7	61.6	61.6	61.6	60.3	58.7
630	60.6	61.4	60.6	60.4	58.7	59.1	58.2	57.5	57.3	57.2	57.3	56.6	55.7
800	55.1	54.5	53.5	53.3	52.1	50.9	49.7	48.6	49.1	48.1	48.1	46.1	44.9
1000	44.0	43.8	43.5	43.4	42.7								
1250													
1600													
2000													
2500													
3150													
4000													
5000													
6300													
8000													
10000													
OVERALL	86.1	85.7	85.1	84.8	84.4	83.9	83.3	82.7	82.7	82.6	82.5	81.8	80.7
A-WTD	74.6	74.5	73.8	73.3	72.8	72.7	72.1	71.6	71.7	71.7	71.7	70.6	69.6
PNL	86.0	85.8	85.0	84.6	84.2	83.9	83.4	82.6	82.6	82.7	82.5	81.4	79.9
PNLT	86.7	86.5	85.7	85.3	84.9	84.7	84.2	83.2	83.3	83.4	83.2	82.0	80.5
ACO RNG	5471	5582	5693	5804	5916	6027	6139	6252	6364	6476	6589	6702	6815
OPT RNG	6859	7000	7142	7284	7426	7569	7711	7854	7996	8139	8282	8424	8567

TABLE C-7.2 (CONCLUDED)
TYPICAL TAKEOFF FLYOVER-NOISE DATA

DATA DIGITIZED 2-1-75 DATA PROCESSED 04/10/75 PAGE 7

MODEL DC-9-31 REG. NO. N54638
FLIGHT 16 RUN 10 MIC 1 LOC C6 TEST DATE 1-29-75
HIGHLIGHTS OF MEASURED FLYOVER NOISE LEVELS FOR TAKEOFF CORR FLYOVER
PATH SPEED 178.3 KN, SLANT RANGE 2402.7 FT. FOR TIME AT MIC 9 48 34.2
AVERAGE THRUST 12538.1 LBS

FREQUENCY (HZ)	SPL'S FOR PNLM (TIME 9 48 42.0) SPL (DB)	NOISINESS (NOYS)	SPL'S FOR PNLTM (TIME 9 48 42.0) SPL (DB)	NOISINESS (NOYS)	MAX SPL'S 1/3 O.B. (DB)	MAX 1/1 O.B. SPL'S FOR COMPOSITE PNL SPL (DB)	NOISINESS (NOYS)
50	80.2	5.1	80.2	5.1	81.6		
63	78.0	5.4	78.0	5.4	83.6	86.8	11.9
80	74.9	5.0	74.9	5.0	82.9		
100	79.1	9.1	79.1	9.1	80.6		
125	83.8	13.8	83.8	13.8	84.8	89.6	20.5
160	87.7	19.2	87.7	19.2	87.9		
200	84.9	18.3	84.9	18.3	87.4		
250	80.5	14.4	80.5	14.4	83.0	89.7	27.2
315	85.4	21.4	85.4*	21.4	85.4		
400	80.2	16.2	80.2	16.2	83.6		
500	79.5	15.5	79.5	15.5	80.1	84.7	22.1
630	77.3	13.3	77.3	13.3	78.3		
800	72.7	9.7	72.7	9.7	75.5		
1000	69.9	7.9	69.9	7.9	71.2	77.1	13.1
1250	63.7	5.9	63.7	5.9	66.9		
1600	54.7	4.2	54.7	4.2	61.6		
2000	44.7	2.4	44.7	2.4	53.9	62.3	8.1
2500	32.1	1.2	32.1	1.2	42.9		
3150							
4000							
5000							
6300							
8000							
10000							

* BAND PRODUCING TONE CORRECTION

PNLC = 96.4 PNDB
LAM = 84.7 DBA
PNLM = 95.4 PNDB
PNLTM = 96.2 PNDB

DURATION FACTOR = 0.4 DB
INTEGRATION TIME = 24.0 SECONDS (FAR PART 36 TO 1.0 SECOND)
MEASURED EFFECTIVE PERCEIVED NOISE LEVEL, EPNL = 96.6 EPNDB

TABLE C-7.3

TYPICAL TAKEOFF WITH CUTBACK FLYOVER-NOISE DATA

FAR PART 36 FLYOVER NOISE LEVELS

DATA IDENTIFICATION INFORMATION

DATA DIGITIZED 2-1-75 DATA PROCESSED 04/10/75 PAGE 1

MODEL DC-9-31 REG. NO. N54638

DC-9-31 REFAN FLYOVER NOISE TEST

MEASURED NOISE LEVELS

ENGINE/NACELLE CONFIGURATION -- P&WA JT8D-109 ENGINES WITH ACOUSTICALLY TREATED NACELLES

TYPE OF FLYOVER -- SIMULATED T.O. CLIMB DATA CLASS -- FN/DLT = 9500 LBS
MEASUREMENT TYPE -- BENEATH FLT PATH, 4 FEET ABOVE SANDY DIRT
RECORDING AT X = -7301.0, Y = .0, Z =-81.0 FEET FROM WEST-MOST END OF RUNWAY

MEASUREMENT INFO		AIRPLANE AND ENGINE DATA				WEATHER DATA	
MIC. NUMBER	1	FUSE. NO.	741	AVG. N1RT =	6490. RPM	AMB. TEMP. =	52.5 F
MIC. LOCATION	C6	FLIGHT	16	AVG. EPR =	1.445	REL. HUM. =	35.1 PCT
MIC. ORIENT	GRAZING	RUN	16	A/P HEADING =	210. DEG	ABS. HUM. =	3.6 GM/M3
TEST SITE	YUMA	HEIGHT	= 2288.0 FT	FLAP POS. = UP	2.1 DEG	WIND SPEED =	4. KN
TEST DATE	1-29-75	LAT. DEV.	= -134.8 FT	PATH ANG. =	4.0 DEG	WIND DIR. =	260. DEG
TEST NUMBER	JOB 511	SLNT.RNG.	= 2292.0 FT	PITCH ANG. =	11.4 DEG	STA. PRESS =	29.81 IN HG
JOB REEL	A5282	PATH SPD.	= 174.4 KN	GR. WEIGHT =	99900. LB	RT. THETA =	.9911

AIRPLANE SPACE POSITIONING IS RELATIVE TO MIC FOR TIME AT MIC OF 10-42-49.9
OTHER PERFORMANCE DATA IS FOR TIME OF PNLTM OF 10-42-56.0
TIME OF AIRCRAFT AT MINIMUM DISTANCE FROM MICROPHONE LOCATION 10-42-49.3

DESCRIPTION OF ACOUSTICAL DATA PROCESSING

ANALYZER TYPE / RESOLUTION GR1921(CISA) / 0.25 DB
CISA MODE 1 PASS WITH AUTO-START
SAMPLE INTERVAL FOR BASIC DATA = .500 SECONDS
AVERAGING TIME = 1.500 SECONDS

BASIC UNIT SOUND PRESSURE LEVEL (DB REL. 0.0002 MICROBAR)
DATA TYPES 1/3 OCTAVE, OVERALL, A-WTD, PNL, PNLT & EPNL

TABLE C-7.3 (CONTINUED)

TYPICAL TAKEOFF WITH CUTBACK FLYOVER-NOISE DATA

MEASURED SPL HISTORY MODEL DC-9-31 FLT 16 MIC 1 TEST DATE 1-29-75
START TIME 10 42 44.000 REG. N54638 RUN 16 LOC C6 PAGE 2

1/3 O.B. GMF(HZ)	AMB SPL	0.0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0
50	47.4	55.6	57.7	58.8	59.6	60.7	60.6	61.0	61.2	61.2	61.5	59.7	60.9	61.4
63	51.5	57.0	59.6	61.1	62.0	60.0	58.2	55.9	56.4	57.9	59.6	60.8	63.7	65.4
80	51.2	58.8	58.7	57.4	55.3	54.6	55.6	56.6	57.5	57.6	58.0	57.8	57.0	56.6
100	55.2						58.8	59.4		59.4	60.8	63.9	65.9	66.6
125	45.9	56.9	56.4	56.5	58.1	59.7	59.9	61.9	63.6	68.0	69.6*	70.2	69.8	69.8
160	42.9	55.1	57.9	59.7	61.7	63.3	64.4	65.9	66.7	68.3	69.7	71.0	71.3	71.0
200	41.0	60.4	61.4	63.5	65.0	67.2	68.4	69.8*	69.9	70.6*	70.1	69.9	68.7	67.9
250	37.1	63.5	63.3	64.4	65.2	65.7	66.0	65.5	64.5	63.5	63.0	64.3	65.7	66.7
315	33.3	61.0	60.2	60.4	59.9	59.7	61.1	65.7	67.5	68.4	68.9	69.6*	70.4*	70.7*
400	30.2	56.7	59.9	62.5	64.5	66.8	68.3*	69.6	69.3	68.5	67.1	66.5	66.5	66.8
500	31.3	58.9	61.4	62.5	63.2*	62.8	62.9	65.4	66.2	67.0	66.9	67.3	67.6	68.1
630	28.2	55.9	56.9	58.8	61.4	62.8	63.8	64.8	64.7	65.1	65.7	66.5	67.0	67.2
800	27.9	57.0	58.0	58.3	59.4	60.8*	62.7	64.6	64.6*	64.1	63.0	64.0	64.9	65.0
1000	30.5	50.9	52.6	53.5	54.6	55.8	57.5	59.[illegible]	60.0	60.0	59.6	60.4	61.9	61.9
1250	27.5	45.7	47.2	47.7	49.4	50.7	52.3	54.3	54.3	54.3	54.0	55.5	57.0	57.3
1600	24.7	39.4	40.4	41.1	42.6	44.2	45.6	48.0	48.3	48.7	48.6	50.9	52.8	53.0
2000	21.9	30.7	32.2	32.7	34.3	35.6	37.5	39.3	39.3	39.4	41.3	44.7	46.5	46.8
2500	19.7				25.0	25.9	27.9	28.7	28.7	29.1	31.1	35.1	36.7	37.3
3150	18.1											22.4	24.7	25.3
4000	17.7													
5000	18.3													
6300	18.8													
8000	19.3													
10000	19.7													
OVERALL	58.7	69.7	70.6	71.9	73.0	74.1	75.1	76.6	76.8	77.5	77.8	78.4	78.7	78.9
A-WTD	41.5	63.2	64.4	65.6	67.0	68.2	69.4	71.1	71.2	71.4	71.1	71.7	72.3	72.5
PNL	42.7	71.2	72.4	73.7	75.1	76.6	78.1	79.9	79.7	79.9	79.7	80.7	81.4	81.7
PNLT	43.8	71.2	72.4	73.7	76.4	78.6	79.2	80.6	82.2	80.7	80.4	81.4	82.1	82.3
ACO RNG		3393	3270	3153	3042	2937	2840	2749	2665	2590	2522	2462	2411	2369
OPT RNG		2830	2752	2679	2611	2548	2492	2441	2397	2359	2329	2308	2293	2287

TABLE C-7.3 (CONTINUED)

TYPICAL TAKEOFF WITH CUTBACK FLYOVER-NOISE DATA

MEASURED SPL HISTORY   MODEL DC-9-31   FLT 16   MIC 1   TEST DATE 1-29-75
START TIME 10 42 44.000   REG. N54638   RUN 16   LOC C6   PAGE 3

1/3 O.B. GMF(HZ)	6.5	7.0	7.5	8.0	8.5	9.0	9.5	10.0	10.5	11.0	11.5	12.0	12.5	13.0
50	62.9	64.0	64.6	66.5	66.9	67.1	65.9	65.3	66.2	66.6	68.7	69.9	70.7	71.2
63	65.5	63.9	60.8	59.6	63.0	64.3	65.6	66.0	66.9	66.3	66.4	67.1	67.6	69.0
80	61.6	62.7	64.8	65.1	65.3	64.5	63.4	64.9	65.9	66.0	64.9	64.3	63.6	65.1
100	68.3	68.7	70.8	70.9	72.2	71.7	72.4*	72.6	72.3	72.7	72.1	72.8	71.9	71.4
125	71.6	72.4	73.1	72.8	73.9	73.9	74.8	74.4	74.8	74.2	74.8	75.7	76.0	75.1
160	71.5	72.2	72.2	71.6	71.4	71.4	71.7	73.4	74.5	75.4	75.4	75.8	76.6	76.6
200	68.2	68.1	68.0	67.0	67.0	67.5	68.1	68.9	69.8	71.0	72.3	73.6	74.9	76.2
250	69.1	70.7	71.5	70.9	71.0	71.8	73.5	74.6	74.7	75.0	74.6	74.8	73.7	72.4
315	72.7*	73.6*	73.8*	73.1	73.1	73.5	74.6	75.9	76.2	76.6	76.9	77.5*	77.2*	76.6*
400	68.4	70.0	70.5	71.0	71.1	71.6	72.5	73.6	74.0	74.4	73.9	73.9	72.3	71.2
500	69.5	70.7	70.4	70.0	70.7	71.1	72.1	72.1	72.5	72.7	72.9	73.1	71.9	70.2
630	69.0	70.1	70.2	69.1	69.7	70.1	71.5	71.1	70.4	70.1	69.5	69.9	67.9	66.8
800	65.7	67.5	67.8	67.8	67.3	67.9	67.7	66.9	65.7	65.5	65.0	64.8	63.3	61.5
1000	62.7	64.5	64.7	64.4	62.8	63.3	63.2	62.7	61.5	61.1	60.1	60.3	60.4	59.7
1250	57.8	59.9	60.0	60.1	58.6	60.0	59.7	59.5	57.3	56.9	55.7	56.1	55.9	54.8
1600	53.1	54.8	55.3	55.2	53.9	54.6	54.7	54.9	53.5	52.7	50.1	50.0	49.6	49.0
2000	47.5	48.5	48.8	48.0	46.7	47.3	48.0	48.3	47.1	45.6	42.7	42.0	41.8	41.1
2500	37.5	38.1	38.3	37.7	37.9	39.4	40.3	40.3	38.7	36.6	32.9	32.1	31.6	31.0
3150	27.1	29.2	29.7	29.4	29.4	30.3	30.6	29.9	28.5	26.3	23.4	21.7		
4000														
5000														
6300														
8000														
10000														
OVERALL	80.3	81.2	81.6	81.3	81.7	81.9	82.7	83.3	83.6	83.9	84.0	84.5	84.3	84.0
A-WTD	73.9	75.2	75.4	75.0	75.0	75.5	76.4	76.7	76.6	76.8	76.7	77.0	76.2	75.3
PNL	83.3	84.5	84.9	84.3	84.4	84.8	85.7	86.4	86.4	86.6	86.6	87.1	86.7	86.1
PNLT	84.0	85.1	85.4	84.3	84.4	84.8	86.2	86.4	86.4	86.6	86.6	87.6	87.4	86.9
ACO RNG	2335	2311	2295	2287	2289	2298	2315	2340	2372	2410	2454	2505	2561	2621
OPT RNG	2290	2300	2319	2347	2382	2426	2477	2536	2602	2675	2754	2838	2928	3022

TABLE C-7.3 (CONTINUED)

TYPICAL TAKEOFF WITH CUTBACK FLYOVER-NOISE DATA

MEASURED SPL HISTORY   MODEL DC-9-31   FLT 16   MIC 1   TEST DATE 1-29-75
START TIME 10 42 44.000   REG. N54638   RUN 16   LOC C6   PAGE 4

1/3 O.B. CMF(HZ)	13.5	14.0	14.5	15.0	15.5	16.0	16.5	17.0	17.5	18.0	18.5	19.0	19.5	20.0
50	70.7	71.7	71.5	72.9	72.0	71.1	69.6	72.1	72.6	73.0	71.9	71.4	70.4	70.4
63	68.9	69.9	69.9	71.1	71.9	71.9	71.8	71.3	70.9	70.4	69.9	69.9	69.4	69.2
80	65.4	66.3	65.7	65.3	65.0	64.3	65.3	65.9	67.2	67.6	70.3	70.9	71.3	70.6
100	70.5	69.5	68.4	66.4	63.8	60.8			58.8	62.4	66.1	66.9	66.7	66.0
125	74.3	74.4	74.5	73.4	71.0	68.9	67.2	66.3	64.5	63.2	62.9	62.1	60.8	59.1
160	77.2	77.8	78.6	78.5	77.2*	75.3	73.4	71.7	70.7	70.8	71.2	70.9	69.8*	68.7*
200	77.0	77.6	77.4	77.6	77.0	76.4*	74.8	73.3	71.9	72.1	71.9	71.8	70.8	70.4
250	71.0	69.8	70.8	71.0	71.4	71.4	70.7	69.9	68.7	70.6	71.1	71.8	71.3	71.0
315	76.5*	76.8*	77.1*	76.0*	74.3	71.8	70.7	69.3	66.1	65.7	65.5	66.1	66.3	66.6
400	70.8	70.8	72.2	71.1	71.2	70.5	71.1*	70.3*	68.7*	68.1*	68.5*	69.4*	69.3	68.4
500	70.9	71.3	72.0	70.0	68.3	64.3	63.2	62.5	59.3	60.9	62.6	64.4	64.5	64.3
630	66.8	66.9	67.0	64.7	62.8	61.6	60.8	61.2	60.3	60.8	60.5	61.0	60.7	60.9
800	62.6	63.1	64.0	62.2	60.9	59.1	58.0	58.2	56.4	56.4	56.0	55.1	54.2	53.9
1000	60.5	60.0	60.5	58.6	56.9	55.6	54.1	53.6	51.7	51.4	50.8	50.0	48.7	48.8
1250	54.6	53.8	54.7	53.1	51.8	50.1	48.9	48.2	46.1	45.6	44.7	42.9	42.0	41.9
1600	48.6	48.2	48.8	47.3	45.5	43.2	41.1	40.0	38.0	37.6	36.7	35.8	34.9	33.9
2000	40.2	39.1	39.3	37.1	35.1	33.3	32.1	30.8	27.5	26.7				
2500	29.9	28.6	28.8	27.2	24.7									
3150														
4000														
5000														
6300														
8000														
10000														
OVERALL	84.1	84.4	84.7	84.3	83.4	82.2	81.0	80.3	79.5	79.7	79.9	80.1	79.6	79.2
A-WTD	75.4	75.7	76.2	75.1	74.0	72.5	71.7	70.8	69.0	69.3	69.6	70.2	69.9	69.5
PNL	86.0	86.1	86.5	85.5	84.5	83.4	81.9	80.7	79.4	79.6	79.9	80.3	79.9	79.2
PNLT	86.9	87.2	87.4	86.3	85.1	83.9	82.9	81.5	80.4	80.4	80.6	81.0	80.6	79.9
ACO RNG	2687	2756	2829	2906	2986	3068	3154	3237	3324	3423	3515	3611	3707	3806
OPT RNG	3122	3221	3323	3442	3554	3670	3789	3910	4034	4160	4287	4415	4546	4678

TABLE C-7.3 (CONTINUED)

TYPICAL TAKEOFF WITH CUTBACK FLYOVER-NOISE DATA

MEASURED SPL HISTORY MODEL DC-9-31 FLT 16 MIC 1 TEST DATE 1-29-75
START TIME 10 42 44.000 REG. N54638 RUN 16 LOC C6

PAGE 5

1/3 O.B.	20.5	21.0	21.5	22.0	22.5
GMF(HZ)					
50	71.0	71.5	70.8	70.5	70.8
63	69.8	70.5	70.1	69.5	68.5
80	70.2	71.1	71.3	71.4	70.7
100	66.9	68.9	69.3	68.9	67.8
125	59.9	61.3	62.5	62.5	61.8
160	67.5	65.5	64.3	61.6	58.5
200	69.8	70.0	69.2	67.6	63.0
250	70.1	69.1	68.4	66.5	64.9
315	66.3	66.3	65.5	64.6	61.3
400	65.6	61.9	59.0	57.5	54.9
500	62.2	61.4	60.3*	59.8*	57.9*
630	58.1	56.6	53.0	52.4	51.6
800	51.2	50.7	49.1	48.9	47.8
1000	45.1	44.5	42.2	41.7	39.5
1250	37.9	36.5	34.3	33.5	31.4
1600	29.1				
2000					
2500					
3150					
4000					
5000					
6300					
8000					
10000					
OVERALL	78.7	78.9	78.4	77.8	76.7
A-WTD	67.8	66.9	65.8	64.6	62.3
PNL	78.0	77.3	76.4	75.0	72.8
PNLT	78.0	77.3	77.8	76.6	74.4
ACO RNG	3905	4006	4108	4211	4315
OPT RNG	4810	4944	5079	5215	5352

TABLE C-7.3 (CONCLUDED)

TYPICAL TAKEOFF WITH CURBACK FLYOVER-NOISE DATA

DATA DIGITIZED 2-1-75 DATA PROCESSED 04/10/75 PAGE 6

MODEL DC-9-31 REG. NO. N54638
FLIGHT 16 RUN 16 MIC 1 LOC C6 TEST DATE 1-29-75
HIGHLIGHTS OF MEASURED FLYOVER NOISE LEVELS FOR SIMULATED T.O. CLIMB
PATH SPEED 174.4 KN. SLANT RANGE 2286.8 FT. FOR TIME AT MIC 10 42 49.9
AVERAGE THRUST 8341.5 LBS

FREQUENCY (HZ)	SPL'S FOR PNLM (TIME 10 42 56.0) SPL (DB)	NOISINESS (NOYS)	SPL'S FOR PNLTM (TIME 10 42 56.0) SPL (DB)	NOISINESS (NOYS)	MAX SPL'S 1/3 O.B. (DB)	MAX 1/1 O.B. SPL'S FOR COMPOSITE PNL SPL (DB)	NOISINESS (NOYS)
50	69.9	1.8	69.9	1.8	73.0		
63	67.1	1.9	67.1	1.9	71.9	75.8	4.4
80	64.3	2.0	64.3	2.0	71.4		
100	72.8	5.4	72.8	5.4	72.8		
125	75.7	7.4	75.7	7.4	76.0	80.3	10.8
160	75.8	8.5	75.8	8.5	78.6		
200	73.6	8.3	73.6	8.3	77.6		
250	74.8	9.7	74.8	9.7	75.0	80.7	14.6
315	77.5	12.3	77.5*	12.3	77.5		
400	73.9	10.5	73.9	10.5	74.4		
500	73.1	9.9	73.1	9.9	73.1	77.5	13.5
630	69.9	7.9	69.9	7.9	71.5		
800	64.8	5.6	64.8	5.6	67.9		
1000	60.3	4.1	60.3	4.1	64.7	70.0	8.0
1250	56.1	3.5	56.1	3.5	60.1		
1600	50.0	3.0	50.0	3.0	55.3		
2000	42.0	2.0	42.0	2.0	48.8	56.2	5.3
2500	32.1	1.2	32.1	1.2	40.3		
3150	21.7	0.0	21.7	0.0	30.6		
4000						30.6	1.1
5000							
6300							
8000							
10000							

* BAND PRODUCING TONE CORRECTION

PNLC = 87.8 PNDB
LAM = 77.0 DBA
PNLM = 87.1 PNDB
PNLTM = 87.6 PNDB

DURATION FACTOR = -0.5 DB
INTEGRATION TIME = 19.0 SECONDS (FAR PART 36 TO 1.0 SECOND)
MEASURED EFFECTIVE PERCEIVED NOISE LEVEL, EPNL = 87.2 EPNDB

TABLE C-7.4

TYPICAL LANDING APPROACH ($\delta_F = 50^0$) FLYOVER-NOISE DATA

FAR PART 36 FLYOVER NOISE LEVELS

DATA IDENTIFICATION INFORMATION

DATA DIGITIZED 2-3-75 DATA PROCESSED 04/10/75 PAGE 1

MODEL DC-9-31 REG. NO. N54638

DC-9-31 REFAN FLYOVER NOISE TEST

MEASURED NOISE LEVELS

ENGINE/NACELLE CONFIGURATION -- P&WA JT8D-109 ENGINES WITH ACOUSTICALLY TREATED NACELLES

TYPE OF FLYOVER -- LANDING APPROACH DATA CLASS -- H POWER
MEASUREMENT TYPE -- BENEATH FLT PATH, 4 FEET ABOVE SANDY DIRT
RECORDING AT X = -6978.0, Y = 198.0, Z = -1.0 FEET FROM THRESHOLD

MEASUREMENT INFO		AIRPLANE AND ENGINE DATA				WEATHER DATA	
MIC. NUMBER	6	FUSE. NO.	741	AVG. N1RT =	5463. RPM	AMB. TEMP. =	53.1 F
MIC. LOCATION	10	FLIGHT	19	AVG. EPR =	1.231	REL. HUM. =	49.7 PCT
MIC. ORIENT	GRAZING	RUN	27	A/P HEADING =	30. DEG	ABS. HUM. =	5.2 GM/M3
TEST SITE	YUMA	HEIGHT =	344.5 FT	FLAP POS. =	49.3 DEG	WIND SPEED =	10. KN
TEST DATE	1-31-75	LAT. DEV. =	-193.7 FT	PATH ANG. =	-3.1 DEG	WIND DIR. =	360. DEG
TEST NUMBER	JOB 511	SLNT.RNG. =	395.2 FT	PITCH ANG. =	1.8 DEG	STA. PRESS =	[illegible] IN HG
JOB REEL	A5283	PATH SPD. =	135.9 KN	GR. WEIGHT =	98400. LB	RT. THETA =	[illegible]61

AIRPLANE SPACE POSITIONING IS RELATIVE TO MIC FOR TIME AT MIC OF 10-14-49.9
OTHER PERFORMANCE DATA IS FOR TIME OF PNLTM OF 10-14-51.5
TIME OF AIRCRAFT AT MINIMUM DISTANCE FROM MICROPHONE LOCATION 10-14-50.0

DESCRIPTION OF ACOUSTICAL DATA PROCESSING

ANALYZER TYPE / RESOLUTION GR1921(CISA) / 0.25 DB
CISA MODE 1 PASS WITH AUTO-START
SAMPLE INTERVAL FOR BASIC DATA = .500 SECONDS
AVERAGING TIME = 1.500 SECONDS

BASIC UNIT SOUND PRESSURE LEVEL (DB REL. 0.0002 MICROBAR)
DATA TYPES 1/3 OCTAVE, OVERALL, A-WTD, PNL, PNLT & EPNL

TABLE C-7.4 (CONTINUED)

TYPICAL LANDING APPROACH ($\delta_F = 50^0$) FLYOVER-NOISE DATA

MEASURED SPL HISTORY   MODEL DC-9-31   FLT 19   MIC 6   TEST DATE 1-31-75
START TIME 10 14 47.500   REG. N54638   RUN 27   LOC 10   PAGE 2

1/3 O.B. GMF(HZ)	AMB SPL	0.0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0
50	59.4	71.1	72.5	72.3	74.2	73.7	74.0	73.2	74.2	74.9	76.7	76.9	77.7	77.9
63	61.1	69.4	69.4	69.9	71.2	71.9	72.3	71.6	71.8	73.1	75.3	76.4	77.7	77.9
80	59.9	69.4	70.0	70.6	68.9	68.9	67.6	67.6	67.1	69.3	73.3	76.6	78.0	79.0
100	55.6	68.5	69.1	69.1	67.9	66.7	66.6	70.0	71.6	72.3	71.4	71.4	72.5	73.2
125	57.4	66.8	65.7	65.3	63.7	67.9	73.2	76.3	78.1	78.6	77.7	75.7	72.6	71.1
160	54.4	61.3	60.4	63.4	70.2	74.2	78.4	81.0	83.0	83.8	84.1	83.2	81.0	76.7
200	54.0	62.8	67.6	72.3	76.4	78.4	79.9	81.2	82.9	85.5	87.0	87.1	85.3	81.4
250	53.8	68.4	71.5	75.6	77.0	77.9	76.7	75.9	75.9	80.8	84.1	85.9	85.9*	84.1*
315	52.5	71.2	73.3	74.7	74.3	73.6	74.4	78.0	81.9*	84.1	84.1	82.9	80.1	80.1
400	48.9	72.6	72.8	71.5	71.6	75.7	77.8	78.6	80.6	84.2	85.1	84.5	80.6	76.7
500	47.8	67.8	69.0	71.9	73.9	74.2	75.7	77.9	80.8	82.1	82.4	81.9	80.1	77.4
630	48.7	67.1	70.3	71.7	72.8	74.0	76.4	78.2	79.7	80.7	80.7	79.7	77.8	75.4
800	43.0	69.0	70.3	71.8	72.8	74.1	76.4	78.9	80.5	80.7	79.5	77.0	73.9	71.5
1000	41.7	65.8	68.8	70.6	71.8	72.7	74.4	76.3	77.7	78.0	76.9	74.8	71.2	69.3
1250	40.5	65.2	67.5	69.5	70.7	71.6	72.9	74.7	76.5	77.0	76.0	73.5	69.7	67.1
1600	39.2	62.4	64.9	66.8	68.7	70.2	72.2	74.2	76.0	76.4	75.4	72.7	68.7	66.2
2000	35.1	60.0	62.1	64.3	66.8	68.7	71.6	74.8	78.0	78.7	77.8	74.1	69.2	67.0
2500	30.9	57.3	59.6	62.8	65.5	67.8	70.1	74.5	78.3	79.2	78.3	74.6	70.3	67.9
3150	24.5	53.0	56.3	60.0	64.2	68.9	71.3	73.4	75.4	75.8	75.1	72.1	68.7	65.2
4000	24.3	55.1*	57.6*	61.0*	65.2*	67.9	68.8	69.2	69.7	69.9	69.0	66.2	62.5	59.2
5000	23.8	44.6	48.9	52.4	56.6	60.3	63.0	65.3	67.7	68.6	68.2	66.0	62.5	59.4
6300	23.2	39.0	45.1	47.6	53.3	59.5	63.8	67.6	70.7	72.0	71.5	69.1	64.3	59.8
8000	22.3	38.7	43.9	46.5	53.3	59.2*	61.7	64.2	67.4	68.9*	68.8*	66.3*	61.5	56.2
10000	24.4	35.5	44.5	44.7	45.6	48.3	52.4	55.3	56.9	57.4	56.4	54.0	50.3	46.2
OVERALL	67.2	80.6	82.1	83.6	85.0	86.3	87.9	89.7	91.8	93.4	93.9	93.5	91.9	89.9
A-WTD	54.7	75.6	77.5	79.3	80.8	82.3	84.2	86.4	88.6	89.7	89.4	87.9	85.2	82.8
PNL	65.0	86.7	88.4	90.2	92.4	94.9	97.1	99.2	101.9	103.0	102.7	100.5	98.4	96.1
PNLT	66.1	88.9	90.1	91.7	94.0	95.5	97.1	99.2	102.5	103.6	103.4	101.2	98.9	96.7
ACQ RNG		1035	907	783	667	563	477	419	395	406	443	498	565	640
OPT RNG		842	743	648	561	486	430	398	399	433	491	567	654	749

TABLE C-7.4 (CONTINUED)

TYPICAL LANDING APPROACH (δ_F = 50^0) FLYOVER-NOISE DATA

MEASURED SPL HISTORY   MODEL DC-9-31   FLT 19   MIC 6   TEST DATE 1-31-75
START TIME 10 14 47.500   REG. N54638   RUN 27   LOC 10

1/3 O.B. GMF(HZ)	6.5	7.0	7.5
50	77.9	77.3	75.5
63	77.9	77.2	76.9
80	79.0	79.4	78.5
100	74.0	73.8	74.3
125	71.8	73.3	73.8
160	70.9	69.5	70.1
200	75.5	71.3	67.3
250	80.7	75.0	70.3
315	78.7	77.3	72.5
400	76.4	76.6	75.7*
500	71.6	68.7	69.2
630	73.6*	70.2	66.6
800	69.4	67.7	66.8
1000	67.5	66.2	63.8
1250	64.7	62.7	61.4
1600	64.1	62.2	60.6
2000	64.8	62.4	60.1
2500	65.6	63.5	61.3
3150	61.4	59.4	57.5
4000	56.4	53.6	50.8
5000	56.4	53.2	50.6
6300	55.4	50.8	46.7
8000	49.6	43.5	37.9
10000	45.0	36.9	
OVERALL	87.7	86.3	85.0
A-WTD	80.2	78.1	76.1
PNL	93.3	91.1	89.4
PNLT	94.3	91.1	90.2
ACO RNG	721	804	889
OPT RNG	849	951	1056

TABLE C-7.4 (CONCLUDED)
TYPICAL LANDING APPROACH (δ_F = 50°) FLYOVER-NOISE DATA

DATA DIGITIZED 2-3-75 DATA PROCESSED 04/10/75 PAGE 4

MODEL DC-9-31 REG. NO. N54638
FLIGHT 19 RUN 27 MIC 6 LOC 10 TEST DATE 1-31-75
HIGHLIGHTS OF MEASURED FLYOVER NOISE LEVELS FOR LANDING APPROACH
PATH SPEED 135.9 KN. SLANT RANGE 394.6 FT. FOR TIME AT MIC 10 14 49.9
AVERAGE THRUST 5451.0 LBS

FREQUENCY (HZ)	SPL'S FOR PNLM (TIME 10 14 51.5) SPL (DB)	NOISINESS (NOYS)	SPL'S FOR PNLTM (TIME 10 14 51.5) SPL (DB)	NOISINESS (NOYS)	MAX SPL'S 1/3 O.B. (DB)	MAX 1/1 O.B. SPL'S FOR COMPOSITE PNL SPL (DB)	NOISINESS (NOYS)
50	74.9	3.0	74.9	3.0	77.9		
63	73.1	3.4	73.1	3.4	77.9	83.1	8.6
80	69.3	3.1	69.3	3.1	79.4		
100	72.3	5.1	72.3	5.1	74.3		
125	78.6	9.4	78.6	9.4	78.6	85.2	15.1
160	83.8	14.7	83.8	14.7	84.1		
200	85.5	19.0	85.5	19.0	87.1		
250	80.8	14.7	80.8	14.7	85.9	90.4	28.6
315	84.1	19.6	84.1	19.6	84.1		
400	84.2	21.4	84.2	21.4	85.1		
500	82.1	18.5	82.1	18.5	82.4	87.9	27.7
630	80.7	16.8	80.7	16.8	80.7		
800	80.7	16.8	80.7	16.8	80.7		
1000	78.0	13.9	78.0	13.9	78.0	83.6	20.5
1250	77.0	14.9	77.0	14.9	77.0		
1600	76.4	18.6	76.4	18.6	76.4		
2000	78.7	25.0	78.7	25.0	78.7	83.0	33.8
2500	79.2	29.7	79.2	29.7	79.2		
3150	75.8	25.2	75.8	25.2	75.8		
4000	69.9	16.8	69.9	16.8	69.9	77.4	28.2
5000	68.6	14.4	68.6	14.4	68.6		
6300	72.0	17.0	72.0	17.0	72.0		
8000	68.9	11.1	68.9*	11.1	68.9	73.9	15.7
10000	57.4	4.1	57.4	4.1	57.4		

* BAND PRODUCING TONE CORRECTION

PNLC = 102.7 PNDB
LAM = 89.7 DBA
PNLM = 103.0 PNDB
PNLTM = 103.6 PNDB

DURATION FACTOR = -6.2 DB
INTEGRATION TIME = 5.0 SECONDS (FAR PART 36 TO 1.0 SECOND)
MEASURED EFFECTIVE PERCEIVED NOISE LEVEL, EPNL = 97.4 EPNDB

TABLE C-7.5
TYPICAL LANDING APPROACH (δ_F = 35^0) FLYOVER-NOISE DATA

FAR PART 36 FLYOVER NOISE LEVELS

DATA IDENTIFICATION INFORMATION

DATA DIGITIZED 2-3-75 DATA PROCESSED 04/04/75 PAGE 1

MODEL DC-9-31 REG. NO. N54638

DC-9-31 REFAN FLYOVER NOISE TEST

REFERENCE-WEATHER AND FAR PART 36 NOISE LEVELS

ENGINE/NACELLE CONFIGURATION -- P&WA JT8D-109 ENGINES WITH ACOUSTICALLY TREATED NACELLES

TYPE OF FLYOVER -- LANDING APPROACH DATA CLASS -- H POWER
MEASUREMENT TYPE -- BENEATH FLT PATH, 4 FEET ABOVE SANDY DIRT
RECORDING AT X = -6976.0, Y = 198.0, Z = -1.0 FEET FROM THRESHOLD
REFERENCE RECORDING LOCATION X = -6076.0, Y = .0, Z = .0 FEET

MEASUREMENT INFO	AIRPLANE AND ENGINE DATA		WEATHER DATA
MIC. NUMBER 6	FUSE. NO. 741	AVG. N1RT = 4854. RPM	AMB. TEMP. = 56.1 F
MIC. LOCATION 10	FLIGHT 20	AVG. EPR = 1.149	REL. HUM. = 45.3 PCT
MIC. ORIENT GRAZING	RUN 44	A/P HEADING = 30. DEG	ABS. HUM. = 5.2 GM/M3
TEST SITE YUMA	HEIGHT = 363.6 FT	FLAP POS. = 34.7 DEG	WIND SPEED = 8. KN
TEST DATE 2-01-75	LAT. DEV. = -195.5 FT	PATH ANG. = -2.7 DEG	WIND DIR. = 20. DEG
TEST NUMBER JOB 511	SLNT.RNG. = 412.8 FT	PITCH ANG. = 2.8 DEG	STA. PRESS = 30.07 IN HG
JOB REEL A5359	PATH SPD. = 137.5 KN	GR. WEIGHT = 102000. LB	RT. THETA = .9988

AIRPLANE SPACE POSITIONING IS RELATIVE TO MIC FOR TIME AT MIC OF 10-13- 5.3
OTHER PERFORMANCE DATA IS FOR TIME OF PNLTM OF 10-13- 7.5
TIME OF AIRCRAFT AT MINIMUM DISTANCE FROM MICROPHONE LOCATION 10-13- 5.4

REFERENCE SURFACE WEATHER CONDITIONS TEMP = 77.0 F & REL. HUM. = 70.0 PCT

DESCRIPTION OF ACOUSTICAL DATA PROCESSING

ANALYZER TYPE / RESOLUTION GR1921(CISA) / 0.25 DB
CISA MODE 1 PASS WITH AUTO-START
SAMPLE INTERVAL FOR BASIC DATA = .500 SECONDS
AVERAGING TIME = 1.500 SECONDS

ATMOSPHERIC ATTENUATION SAE ARP866(REV)
BASIC UNIT SOUND PRESSURE LEVEL (DB REL. 0.0002 MICROBAR)
DATA TYPES 1/3 OCTAVE, OVERALL, A-WTD, PNL, PNLT & EPNL

TABLE C-7.5 (CONTINUED)

TYPICAL LANDING APPROACH ($\delta_F = 35^0$) FLYOVER-NOISE DATA

REF-WEA. SPL HISTORY MODEL DC-9-31 FLT 20 MIC 6 TEST DATE 2-01-75
START TIME 10 13 3.000 REG. N54638 RUN 44 LOC 10 PAGE 2

1/3 O.B. CMF(HZ)	0.0	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5
50	66.6	67.3	67.2	67.8	67.1	68.5	68.3	69.6	69.8	70.3	69.7	72.8	72.8	72.9
63	66.6	66.6	67.5	68.8	68.7	68.3	67.3	68.2	68.7	68.6	69.0	71.4	72.0	71.8
80	65.7	66.1	65.9	66.7	66.5	65.9	63.9	62.5	61.2	64.4	66.9	70.0	72.0	72.2
100	65.4	65.5	65.7	65.5	64.9	64.1	64.5	66.9	68.6	68.2	67.0	65.9	67.7	68.8
125	65.4	64.6	63.8	63.2	65.7	69.2	72.1	74.1	75.6	75.7	74.8	71.7	68.0	66.1
160	61.0	61.2	62.3	65.2	69.5	73.9	76.2	78.3	79.8	80.9	81.1	79.5	76.4	70.0
200	58.9	62.6	66.3	69.9	73.0	75.0	75.9	76.8	77.9	79.9	80.7	80.8	79.1	76.4
250	62.5	66.9	70.2	72.6	74.0	74.1	73.0	71.3	71.0	75.1	77.8	79.0	78.4	76.3
315	66.5	68.9	70.4	70.8	70.7	72.7	75.1	77.9	79.3*	80.0	78.7	77.4	75.4	75.9
400	69.2	69.6	68.5	69.0	71.8	74.2	75.0	75.1	77.6	80.7	81.9	81.0	77.9	71.9
500	66.3	66.1	67.0	69.4	71.1	72.9	74.7	76.3	78.7	80.3	80.2	79.3	76.6	75.2
630	62.6	66.1	67.9	69.0	70.1	72.3	74.6	76.7	77.8	79.3	78.8	77.8	74.5	72.9
800	65.9	66.8	68.6	69.9	71.4	73.1	74.8	76.5	77.6	78.0	76.9	75.1	72.1	70.7
1000	64.2	65.2	67.6	69.1	70.4	71.8	73.1	74.8	75.7	76.3	75.2	73.5	69.9	68.6
1250	63.9	64.9	65.9	68.2	69.8	71.1	72.3	73.5	74.9	75.1	74.2	71.5	68.0	65.7
1600	61.4	62.5	63.9	66.0	67.9	69.3	71.3	73.9	76.1	76.3	75.0	71.3	67.2	64.9
2000	59.7	60.5	61.3	63.7	66.2	68.8	70.9	73.4	75.1	75.2	73.7	70.4	66.9	64.8
2500	57.7	58.6	59.4	62.2	65.0	67.5	69.3	72.4	74.1	74.2	72.5	68.9	66.2	64.2
3150	55.8	57.7	59.2	63.0	68.9*	70.6*	71.2*	70.6	70.6	70.3	68.8	66.0	63.2	61.0
4000	52.8	54.5	57.5	60.4	63.9	66.0	66.7	67.4	67.9	68.0	67.0	64.8	62.0	59.7
5000	46.2	49.4	52.9	56.4	60.6	63.8	65.7	67.8	70.6	71.8	71.9	69.9	66.7	63.4
6300	40.7	46.0	51.0	58.8	65.6	69.9	70.9	72.1*	73.9	75.4*	75.6*	74.0*	70.5*	66.6*
8000		44.4	49.9	58.1*	63.5	65.7	65.8	66.1	67.6	69.0	69.2	67.3	63.4	58.7
10000				46.2	53.2	56.4	57.6	58.9	60.3	61.5	61.5	59.9	55.2	50.2
OVERALL	77.4	78.4	79.5	81.1	82.9	84.7	86.0	87.5	89.0	90.2	90.1	89.2	87.0	84.9
A-WTD	73.2	74.3	75.8	77.7	79.9	81.8	83.3	84.9	86.4	87.3	86.7	85.0	82.0	79.8
PNL	84.1	85.5	86.8	89.7	93.5	95.5	96.5	97.6	99.1	99.9	99.6	98.0	95.0	92.2
PNLT	84.1	85.5	86.3	90.4	95.0	96.8	97.6	98.5	100.0	100.7	100.5	98.9	96.0	93.1
ACO RNG	1040	909	785	670	569	487	433	412	424	462	510	585	661	742
OPT RNG	844	745	652	567	495	441	414	418	453	513	569	678	774	875

TABLE C-7.5 (CONTINUED)

TYPICAL LANDING APPROACH (δ_F = 35^0) FLYOVER-NOISE DATA

REF-WEA. SPL HISTORY MODEL DC-9-31 FLT 20 MIC 6 TEST DATE 2-01-75
START TIME 10 13 3.000 REG. N54638 RUN 44 LOC 10

PAGE 3

1/3 O.B. GMF(HZ)	7.0	7.5	8.0	8.5
50	69.9	69.5	68.8	67.1
63	71.0	70.4	71.8	70.9
80	72.2	71.4	71.8	70.8
100	70.0	71.0	70.9	69.9
125	67.3	68.8	68.8	68.9
160	67.8	66.8	67.8	68.5
200	71.1	66.7	65.7	64.9
250	73.4	69.5	66.7	64.0
315	74.5	73.0	70.0	67.0
400	70.7	71.3	72.0	71.2
500	70.6	66.5	66.8	67.7
630	71.5	69.1	64.5	61.9
800	67.6	66.1	65.6	64.2*
1000	66.3	64.9	62.7	60.0
1250	63.2	61.8	60.6	59.6
1600	61.9	60.1	58.8	57.5
2000	61.7	59.7	58.7	57.4
2500	60.9	59.6	57.6	56.5
3150	56.5	55.0	53.4	52.3
4000	56.0	54.6	52.8	51.3
5000	59.6	57.9	55.7	53.8
6300	61.5*	58.7*	55.8*	53.4
8000	53.0	50.2	44.5	
10000				
OVERALL	82.6	81.3	80.6	79.7
A-WTD	77.0	75.2	73.7	72.5
PNL	89.3	87.7	86.7	85.4
PNLT	90.1	88.5	87.7	86.5
ACC RNG	826	912	1001	1091
OPT RNG	979	1086	1194	1303

TABLE C-7.5 (CONCLUDED)

TYPICAL LANDING APPROACH (δ_F = 35°) FLYOVER-NOISE DATA

DATA DIGITIZED 2-3-75 DATA PROCESSED 04/04/75 PAGE 4

MODEL DC-9-31 REG. NO. N54638

FLIGHT 20 RUN 44 MIC 6 LOC 10 TEST DATE 2-01-75

HIGHLIGHTS OF REF-WEA. FLYOVER NOISE LEVELS FOR LANDING APPROACH

PATH SPEED 137.5 KN. SLANT RANGE 412.3 FT. FOR TIME AT MIC 10 13 5.3

AVERAGE THRUST 3736.0 LBS

FREQUENCY (HZ)	SPL'S FOR PNLM (TIME 10 13 7.5) SPL (DB)	NOISINESS (NOYS)	SPL'S FOR PNLTM (TIME 10 13 7.5) SPL (DB)	NOISINESS (NOYS)	MAX SPL'S 1/3 O.B. (DB)	MAX 1/1 O.B. SPL'S FOR COMPOSITE PNL SPL (DB)	NOISINESS (NOYS)	ACU RNG (FEET)
50	70.3	1.9	70.3	1.9	72.9			
63	68.6	2.2	68.6	2.2	72.0	77.1	5.0	742
80	64.4	2.0	64.4	2.0	72.2			
100	68.2	3.6	68.2	3.6	71.0			
125	75.7	7.5	75.7	7.5	75.7	82.2	12.3	462
160	80.9	12.1	80.9	12.1	81.1			
200	79.9	12.9	79.9	12.9	80.8			
250	75.1	9.9	75.1	9.9	79.0	84.1	18.5	585
315	80.0	14.6	80.0	14.6	80.0			
400	80.7	16.8	80.7	16.8	81.9			
500	80.3	16.4	80.3	16.4	80.3	85.3	23.1	518
630	79.3	15.2	79.3	15.2	79.3			
800	78.0	13.9	78.0	13.9	78.0			
1000	76.3	12.4	76.3	12.4	76.3	81.4	17.6	462
1250	75.1	13.1	75.1	13.1	75.1			
1600	76.3	18.5	76.3	18.5	76.3			
2000	75.2	19.7	75.2	19.7	75.2	80.1	27.6	462
2500	74.2	21.1	74.2	21.1	74.2			
3150	70.3	17.3	70.3	17.3	71.2			
4000	68.0	14.8	68.0	14.8	68.0	75.1	24.0	462
5000	71.8	17.9	71.8	17.9	71.9			
6300	75.4	21.3	75.4*	21.3	75.6			
8000	69.0	11.2	69.0	11.2	69.2	76.7	19.0	518
10000	61.5	5.4	61.5	5.4	61.5			

* BAND PRODUCING TONE CORRECTION

PNLC = 99.9 PNDB
LAM = 87.3 DBA
PNLM = 99.9 PNDB
PNLTM = 100.7 PNDB

DURATION FACTOR = -5.6 DB
INTEGRATION TIME = 4.0 SECONDS (FAR PART 36 TO 1.0 SECOND)
REF-WEA. EFFECTIVE PERCEIVED NOISE LEVEL, EPNL = 95.1 EPNDB

APPENDIX D

Summary of Data Analyses

The data resulting from the processing and noise exposure analysis of the flyover-noise measurements are summarized in table D-1. The data resulting from the processing and lateral noise attenuation analysis of the flyover-noise measurements are summarized in table D-2. For the microphone locations not listed, data analyses were not performed because of unacceptable recorded noise or aircraft operational performance measurements.

Table D-1 is a listing of the measured data, the applied corrections and adjustments, and the resultant reference-day noise levels for the analyzed noise exposure flyover data.

The columns contain the following information:

a. Flight Number

b. Run Number

c. Microphone Number

d. Microphone Location

e. Slant range, (ft) - from measurement location to closest point of aircraft (CPA)

f. Reference Weather (EPNdB) - adjusted to reference day conditions (77°F and 70 percent relative humidity)

g. Reference Weather Tone Correction (EPNdB) - determined by FAR Part 36, Appendix B

h. Tone Correction Frequency (Hz) - center frequency of 1/3-octave band containing tone

i. True Airspeed (kn) - measured airspeed

j. Reference Airspeed (KNOTS) - airspeed to which data are normalized for plotting

k. Airspeed Correction (EPNdB) - EPNL adjustment to reference airspeed

l. Average F_N/δ (LB) - average thrust of two engines at time of PNLTM

m. EPNL (adjusted) = f + g + k

n. Reference Weather dB(A) - measured dB(A) adjusted to reference - day conditions (77°F and 70 percent relative humidity).

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Table D-2 is a listing of the measured data and the determined lateral noise attenuation for the flyover data analyzed.

The columns contain the same flyover and measurement information as table D-1, and the following additional data:

a. Height (ft) - altitude of the aircraft above the ground surface at time of CPA

b. Elevation Angle (β) - Angle between ground surface and aircraft at CPA

c. Sideline EPNL (EPNdB) - EPNL as measured at sideline location

d. Overhead EPNL (EPNdB) - EPNL measured beneath a flyover at the same distance and power setting as the Sideline EPNL

e. Lateral Attenuation (EPNdB) - difference between overhead EPNL and Sideline EPNL.

Presented in table D-3 is a summary of the aircraft performance, space-positioning, and ambient conditions at the flyover CPA for the 10-meter pole-mounted microphone data. This information was used to prepare an engine cycle deck for analysis of the acoustic data. Both 0.5 second and 1.5 second digital time averaging data are listed.

Table D-4 is a listing of the pseudotone adjustments made to the FAR Part 36 reference noise levels.

TABLE D-1
SUMMARY OF DC-9 REFAN AIRCRAFT NOISE EXPOSURE ANALYSIS

FLIGHT NO.	RUN NO.	MICROPHONE NO.	MICROPHONE LOCATION	SLANT RANGE (ft)	REFERENCE WEATHER EPNL (EPNdB)	REFERENCE WEATHER TONE CORRECTION (EPNdB)	TONE CORRECTION FREQUENCY (HZ)	TRUE AIRSPEED (KNOTS)	REFERENCE AIRSPEED (KNOTS)	AIRSPEED CORRECTION (KNOTS)	AVERAGE F_N/δ (LB)	ADJUSTED REFERENCE WEATHER EPNL (EPNdB)	REFERENCE WEATHER (dBA)
16	12	1	C6	2270	87.8	0.8	315	175.3	180	−0.1	9,426	87.0	76.5
	13	1	C6	2270	97.1	1.0	315	177.1	180	−0.1	13,869	96.1	84.9
	9	1	C6	2270	96.7	0.9	315	179.6	180	0	13,750	95.8	84.1
	10	1	C6	2270	97.0	0.8	315	178.3	180	0	13,876	96.2	85.1
	11	1	C6	2270	88.0	0.6	315	175.4	180	−0.1	9,026	87.4	76.9
	16	1	C6	2270	87.3	0.5	315	174.4	180	−0.1	9,111	86.8	76.9
	17	1	C6	2270	86.9	0.6	160	176.8	180	−0.1	9,080	86.3	76.4
	18	1	C6	2270	87.6	0.6	315	175.0	180	−0.1	9,019	87.0	77.1
	19	1	C6	2270	87.2	0.5	160	174.7	180	−0.1	8,949	86.7	76.9
	20	1	C6	2270	86.8	0.6	315	176.1	180	−0.1	8,929	86.2	76.8
	21	1	C6	2270	87.5	0.6	315	175.5	180	−0.1	9,154	86.9	76.9
	22	1	C6	2270	88.7	0.8	315	176.4	180	−0.1	8,933	87.9	78.7
	23	1	C6	2270	88.9	1.0	315	178.5	180	0	9,071	87.9	78.0
19	24	4	C4	550	97.0	0.5	8000	152.6	140	0.4	6,756	96.5	87.0
	25	4	C4	550	94.1	0.6	8000	132.9	140	−0.2	5,514	93.5	84.4
	27	4	C4	550	94.5	0.6	8000	136.4	140	−0.1	5,521	93.9	84.7
	28	4	C4	550	94.0	0.6	8000	138.3	140	−0.1	5,067	93.4	84.0
	29	4	C4	550	93.4	0.6	8000	126.2	140	−0.5	5,256	92.8	84.0
	31	4	C4	550	94.2	0.6	8000	136.1	140	−0.1	5,196	93.6	84.1
	32	4	C4	550	94.4	0.6	315	136.5	140	−0.1	5,566	93.8	85.0
	33	4	C4	550	92.6	0.6	8000	135.6	140	−0.1	4,500	92.0	83.2
	34	4	C4	550	92.3	0.7	6300	138.1	140	−0.1	4,331	92.3	82.8
	35	4	C4	550	92.0	0.8	6300	142.8	140	0.1	3,963	92.0	83.1
	36	4	C4	550	91.5	1.0	6300	138.3	140	−0.1	3,543	91.5	82.2
	37	4	C4	550	92.2	1.3	5000	141.0	140	0	3,174	92.2	82.8
	30	4	C4	550	94.7	0.6	8000	140.3	140	0	5,571	94.1	84.6
	38	4	C4	550	91.0	1.3	5000	137.4	140	−0.1	2,746	91.0	81.6
	30	6	10	400	97.8	0.6	8000	140.2	140	0	5,558	97.2	89.7
	25	6	10	400	97.9	0.7	8000	132.1	140	−0.3	5,483	97.2	90.0
	27	6	10	400	97.9	0.6	8000	135.9	140	−0.1	5,507	97.3	89.9
	28	6	10	400	96.7	0.6	8000	134.8	140	−0.2	5,059	96.1	88.5
	29	6	10	400	96.5	0.9	315	125.3	140	−0.5	5,225	95.6	88.7
	31	6	10	400	96.7	0.7	8000	134.1	140	−0.2	5,209	96.0	88.9
	32	6	10	400	97.3	0.6	8000	137.1	140	−0.1	5,517	96.7	89.5
	33	6	10	400	95.5	0.7	6300	137.6	140	−0.1	4,461	95.5	87.8
	34	6	10	400	95.4	0.7	6300	139.6	140	0	4,285	95.4	87.8
	35	6	10	400	94.8	0.8	6300	138.3	140	−0.1	3,973	94.8	87.3
	36	6	10	400	94.9	1.2	5000	138.1	140	−0.1	3,522	94.9	86.6
	37	6	10	400	95.1	1.8	5000	138.9	140	0	3,199	95.1	85.6
	24	6	10	400	100.1	0	–	152.6	140	0.4	6,706	100.1	91.8
	38	6	10	400	93.1	1.4	5000	136.1	140	−0.1	2,737	93.1	84.4
	29	7F	10	400	99.6	0.6	8000	125.4	140	−0.5	5,217	99.0	91.6
	30	7F	10	400	101.2	0.8	8000	140.2	140	0	5,558	100.4	92.7
	24	7F	10	400	104.5	0.9	8000	152.6	140	0.4	6,706	103.6	94.9
	25	7F	10	400	101.3	0.9	8000	132.1	140	−0.3	5,483	100.4	92.9
	27	7F	10	400	100.9	0.5	8000	135.7	140	−0.1	5,508	100.4	92.5

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TABLE D-1 (CONTINUED)
SUMMARY OF DC-9 REFAN AIRCRAFT NOISE EXPOSURE ANALYSIS

FLIGHT NO.	RUN NO.	MICROPHONE NO.	MICROPHONE LOCATION	SLANT RANGE (ft)	REFERENCE WEATHER EPNL (EPNdB)	REFERENCE WEATHER TONE CORRECTION (EPNdB)	TONE CORRECTION FREQUENCY (Hz)	TRUE AIRSPEED (KNOTS)	REFERENCE AIRSPEED (KNOTS)	AIRSPEED CORRECTION (KNOTS)	AVERAGE F_N/δ (LB)	ADJUSTED REFERENCE WEATHER EPNL (EPNdB)	REFERENCE WEATHER (dBA)
19	28	7F	10	400	100.4	0.6	8000	134.8	140	−0.2	5,059	99.8	91.4
	31	7F	10	400	100.0	0.5	8000	134.1	140	−0.2	5,209	99.5	91.9
	32	7F	10	400	100.4	0.5	8000	137.1	140	−0.1	5,513	99.9	92.3
	33	7F	10	400	98.8	0.7	8000	137.6	140	−0.1	4,460	98.1	91.1
	34	7F	10	400	98.7	1.0	2500	139.7	140	0	4,278	98.7	90.5
	35	7F	10	400	97.6	0.7	6300	138.3	140	−0.1	3,973	97.6	90.2
	36	7F	10	400	97.1	1.1	5000	138.1	140	−0.1	3,522	97.1	89.3
	37	7F	10	400	97.9	1.4	5000	138.9	140	0	3,199	97.9	88.8
	38	7F	10	400	96.5	1.5	5000	136.1	140	−0.1	2,737	96.5	87.5
	30	1	C6	800	92.2	0.8	315	140.9	140	0	5,628	91.4	81.8
	24	1	C6	800	95.1	0.7	315	150.5	140	0.3	6,766	94.4	83.7
	25	1	C6	800	92.1	0.7	315	135.6	140	−0.1	5,522	91.4	81.6
	28	1	C6	800	91.2	0.7	315	138.8	140	0	5,090	90.5	81.3
	29	1	C6	800	90.7	0.7	315	128.7	140	−0.4	5,269	90.0	80.8
	31	1	C6	800	91.1	1.3	500	137.9	140	−0.1	5,236	89.8	80.9
	32	1	C6	800	93.4	0.5	315	132.3	140	−0.2	5,683	92.9	83.2
	33	1	C6	800	89.0	1.0	2500	138.9	140	0	4,544	89.0	79.4
	34	1	C6	800	90.5	1.0	500	142.2	140	0.1	4,307	89.5	80.3
	35	1	C6	800	89.4	0.7	6300	140.3	140	0	4,036	89.4	79.5
	36	1	C6	800	87.9	0.8	315	132.7	140	−0.2	3,653	87.1	78.6
	37	1	C6	800	88.1	1.1	500	135.9	140	−0.1	3,244	87.0	78.6
	27	1	C6	800	92.5	0.7	315	138.1	140	−0.1	5,559	91.8	80.8
	38	1	C6	800	86.3	0.9	6300	134.7	140	−0.2	2,770	86.3	76.5
20	46	2	C4	550	92.6	0.8	6300	141.4	140	0	3,753	92.6	83.9
	47	2	C4	550	92.8	0.8	315	138.8	140	0	3,858	92.0	84.4
	51	2	C4	550	94.8	0.7	160	145.8	140	0.2	5,427	94.1	85.0
	43	2	C4	550	93.8	0.8	315	151.7	140	0.3	4,583	93.0	85.3
	48	2	C4	550	92.0	0.9	6300	134.0	140	−0.2	3,776	92.0	83.8
	49	2	C4	550	92.9	0.7	6300	138.4	140	−0.1	4,030	92.9	84.1
	52	2	C4	550	92.1	1.1	6300	143.4	140	0.1	3,041	92.1	82.8
	50	2	C4	550	92.8	0.8	315	144.6	140	0.1	4,064	92.0	84.6
	40	1	C6	800	94.7	0.6	315	154.7	140	0.4	6,847	94.1	83.5
	41	1	C6	800	93.5	0.6	315	146.7	140	0.2	6,123	92.9	82.3
	42	1	C6	800	89.4	1.0	6300	141.6	140	0	3,163	89.4	79.4
	44	1	C6	800	89.6	0.7	6300	140.2	140	0	3,792	89.6	79.9
	46	1	C6	800	90.1	0.8	315	141.2	140	0	3,785	89.3	80.2
	47	1	C6	800	90.4	0.7	315	139.9	140	0	3,852	89.7	81.0
	49	1	C6	800	90.5	0.8	315	140.0	140	0	4,084	89.7	80.8
	50	1	C6	800	90.7	0.8	315	143.9	140	0.1	4,067	89.9	81.2
	51	1	C6	800	92.3	0.7	315	145.3	140	0.2	5,487	91.6	82.4
	52	1	C6	800	89.0	0.8	315	149.7	140	0.3	3,023	88.2	79.8
	48	1	C6	800	89.2	0.8	6300	137.1	140	−0.1	3,798	89.2	80.5
	40	2	C4	550	97.0	0.6	315	154.2	140	0.4	6,933	96.4	87.1
	41	2	C4	550	95.5	0.7	315	144.5	140	0.1	6,082	94.8	86.1

TABLE D-1 (CONTINUED)
SUMMARY OF DC-9 REFAN AIRCRAFT NOISE EXPOSURE ANALYSIS

FLIGHT NO.	RUN NO.	MICROPHONE NO.	MICROPHONE LOCATION	SLANT RANGE (ft)	REFERENCE WEATHER EPNL (EPNdB)	REFERENCE WEATHER TONE CORRECTION (EPNdB)	TONE CORRECTION FREQUENCY (HZ)	TRUE AIRSPEED (KNOTS)	REFERENCE AIRSPEED (KNOTS)	AIRSPEED CORRECTION (KNOTS)	AVERAGE F_N/δ (LB)	ADJUSTED REFERENCE WEATHER EPNL (EPNdB)	REFERENCE WEATHER (dBA)
20	42	2	C4	550	91.6	1.3	5000	136.5	140	−0.1	3,168	91.6	82.8
	44	2	C4	550	92.3	0.8	6300	139.8	140	0	3,792	92.3	83.6
	39	6	10	400	100.0	0.6	160	151.7	140	0.3	6,440	99.4	91.4
	40	6	10	400	100.9	1.0	315	152.5	140	0.4	6,931	99.9	92.0
	41	6	10	400	99.1	0.6	315	143.5	140	0.1	6,068	98.5	91.1
	44	6	10	400	95.1	0.8	6300	137.5	140	−0.1	3,763	95.1	87.6
	46	6	10	400	95.7	0.9	315	137.8	140	−0.1	3,753	94.8	87.9
	49	6	10	400	96.1	0.8	6300	138.8	140	0	3,994	96.1	87.6
	43	6	10	400	97.1	0.8	315	150.8	140	0.3	4,604	96.3	88.9
	48	6	10	400	95.3	0.8	315	135.1	140	−0.2	3,756	94.5	87.7
	42	6	10	400	94.2	1.3	5000	131.5	140	−0.3	3,205	94.2	86.9
	51	6	10	400	97.7	0.6	200	141.9	140	0.1	5,441	97.1	89.6
	52	6	10	400	93.8	1.1	5000	139.9	140	0	3,059	93.8	85.4
	50	6	10	400	95.6	1.1	500	142.5	140	0.1	4,038	94.5	87.0
	39	7F	10	400	102.6	0	–	151.7	140	0.3	6,440	102.6	94.7
	40	7F	10	400	104.0	0	–	152.5	140	0.4	6,928	104.0	95.5
	41	7F	10	400	101.9	0	–	143.5	140	0.1	6,066	101.9	94.3
	44	7F	10	400	98.7	0.8	6300	137.5	140	−0.1	3,764	98.7	91.0
	46	7F	10	400	98.7	0.8	6300	137.9	140	−0.1	3,739	98.7	91.0
	49	7F	10	400	99.3	0.6	6300	139.0	140	0	3,990	99.3	90.9
	51	7F	10	400	100.7	0	–	141.9	140	0.1	5,434	100.7	92.8
	52	7F	10	400	97.1	1.1	5000	139.9	140	0	3,064	97.1	88.9
	43	7F	10	400	100.0	0.6	6300	150.8	140	0.3	4,604	100.0	91.6
	48	7F	10	400	98.6	0.7	6300	135.1	140	−0.2	3,756	98.6	91.0
	42	7F	10	400	97.3	1.2	5000	131.4	140	−0.3	3,195	97.3	89.7
	50	7F	10	400	98.3	0.7	6300	142.5	140	0.1	4,030	98.3	90.5
21	53	6	10	1000	104.2	0.5	315	180.7	180	0	13,602	103.7	95.3
	54	6	10	1000	104.3	0.6	315	181.8	180	0	13,507	103.7	94.7
	55	6	10	1000	103.9	0.5	160	179.7	180	0	13,467	103.4	95.0
	56	6	10	1000	102.3	0.5	160	180.0	180	0	12,643	101.8	92.9
	57	6	10	1000	101.9	0.6	160	178.6	180	0	12,593	101.3	93.5
	59	6	10	1000	100.5	0.7	160	178.5	180	0	11,860	99.8	91.6
	60	6	10	1000	100.3	0.6	315	179.5	180	0	11,924	99.7	91.3
	61	6	10	1000	98.7	0.6	315	179.2	180	0	11,024	98.1	89.9
	62	6	10	1000	97.3	0.6	160	179.4	180	0	10,640	96.7	88.1
	60	2F	C6	2200	97.6	0	–	181.2	180	0	12,100	97.6	87.4
	53	1	C6	2200	98.3	0.9	200	181.3	180	0	13,781	97.4	85.9
	56	1	C6	2200	96.3	0.9	315	180.2	180	0	12,827	95.4	85.0
	59	1	C6	2200	94.2	1.1	500	180.1	180	0	12,034	93.1	83.7
	60	1	C6	2200	94.8	1.0	315	181.2	180	0	12,102	93.8	84.3
	61	1	C6	2200	93.3	1.1	500	180.7	180	0	11,191	92.2	81.2
	62	1	C6	2200	92.3	1.1	315	179.3	180	0	10,763	91.2	81.6
	54	1	C6	2200	98.7	0.9	315	179.8	180	0	13,660	97.8	87.0
	55	1	C6	2200	97.8	1.0	315	179.4	180	0	13,631	96.8	85.8
	57	1	C6	2200	95.7	1.0	315	179.8	180	0	12,704	94.7	84.4

TABLE D-1 (CONTINUED)
SUMMARY OF DC-9 REFAN AIRCRAFT NOISE EXPOSURE ANALYSIS

FLIGHT NO.	RUN NO.	MICROPHONE NO.	MICROPHONE LOCATION	SLANT RANGE (ft)	REFERENCE WEATHER EPNL (EPNdB)	REFERENCE WEATHER TONE CORRECTION (EPNdB)	TONE CORRECTION FREQUENCY (HZ)	TRUE AIRSPEED (KNOTS)	REFERENCE AIRSPEED (KNOTS)	AIRSPEED CORRECTION (KNOTS)	AVERAGE F_N/δ (LB)	ADJUSTED REFERENCE WEATHER EPNL (EPNdB)	REFERENCE WEATHER (dBA)
21	53	3	11	500	108.4	0.6	125	178.3	180	0	13,717	107.8	100.7
	54	3	11	500	107.6	0.6	200	182.1	180	0	13,539	107.0	100.3
	55	3	11	500	108.3	0.6	315	180.0	180	0	13,497	107.7	100.5
	56	3	11	500	106.5	0.8	315	181.8	180	0	12,657	105.7	99.0
	57	3	11	500	106.5	0.8	315	181.2	180	0	12,581	105.7	99.8
	59	3	11	500	105.4	0.7	315	181.2	180	0	11,814	104.7	100.0
	60	3	11	500	104.8	0.8	315	180.1	180	0	11,865	104.0	98.2
	61	3	11	500	103.1	0.6	315	181.7	180	0	10,957	102.5	97.5
	62	3	11	500	102.0	0.5	160	177.2	180	−0.1	10,583	101.5	96.2
22	65	2F	C6	2200	101.9	0	–	176.7	180	−0.1	14,074	101.9	–
	65	1	C6	2200	98.4	1.1	500	176.7	180	−0.1	14,052	97.3	87.3
	67	2F	C6	5350	93.1	0	–	179.3	180	0	14,046	93.1	–
	69	2F	C6	5750	91.9	0	–	180.0	180	0	14,179	91.9	–
	70	1	C6	4700	81.7	1.3	500	174.1	180	−0.1	9,767	80.4	71.6
	70	2F	C6	4700	85.6	0.5	315	173.8	180	−0.2	9,774	85.1	–
	72	1	C6	3900	80.7	3.0	500	174.3	180	−0.1	8,357	80.7	69.5
	74	2F	C6	3900	85.3	1.0	–	173.3	180	−0.2	8,091	84.1	–
	73	1	C6	3800	84.6	1.1	500	176.0	180	−0.1	9,712	83.5	74.8
	75	2F	C6	4100	98.1	1.6	3150	173.0	180	−0.2	13,871	98.1	–
	75	1	C6	4100	91.8	1.2	315	173.0	180	−0.2	13,879	90.6	82.3
	77	1	C6	2500	87.0	1.2	315	175.6	180	−0.1	8,642	85.8	76.5
	77	2F	C6	2500	90.3	1.0	800	175.6	180	−0.1	8,647	90.3	–
	65	3	11	500	109.1	0.6	315	172.2	180	−0.2	13,787	108.5	102.0
	65	6	10	1000	105.1	1.0	315	175.6	180	−0.1	13,848	104.1	95.9
	77	3	11	1400	92.2	0.5	315	174.5	180	−0.1	8,470	91.7	84.0
	77	6	10	1800	90.8	0.6	315	174.8	180	−0.1	8,576	90.2	80.3
	79	6	10	1500	88.8	1.0	315	175.2	180	−0.1	6,981	87.8	79.3
	82	3	11	1500	88.8	0.5	160	173.1	180	−0.2	7,060	88.3	80.6
	79	3	11	1200	90.	0.6	315	174.6	180	−0.1	6,945	90.1	82.7
	79	1	C6	2200	85.3	1.1	315	177.4	180	−0.1	7,011	84.2	76.8
	82	6	10	1700	88.3	1.0	4000	175.0	180	−0.1	7,096	88.3	78.9
	82	1	C6	2300	85.2	1.2	315	173.6	180	−0.2	7,157	84.0	74.7
	82	2F	C6	2300	88.8	1.3	800	173.9	180	−0.1	7,175	88.8	–
	83	1	C6	2500	83.8	0.9	315	173.1	180	−0.2	7,277	82.9	74.9
	66	1	C6	6000	87.4	1.3	500	180.0	180	0	13,995	86.1	74.1
	69	1	66	5750	88.2	1.0	400	180.0	180	0	14,216	87.2	75.3
	67	1	C6	5350	91.3	1.1	315	180.0	180	0	13,933	90.2	75.4
	66	6	10	4500	91.5	1.2	315	180.0	180	0	13,897	90.3	77.4
	69	6	10	4500	92.0	1.0	315	180.0	180	0	14,006	91.0	78.7
	66	3	11	4000	92.4	0.7	315	180.0	180	0	13,881	91.7	78.5
	69	3	11	4000	92.9	1.0	315	180.0	180	0	13,954	91.9	79.5
	70	6	10	4000	84.8	0.8	160	180.0	180	0	9,725	84.0	73.5
	72	6	10	3900	82.4	0.9	315	180.0	180	0	8,219	81.5	71.1
	74	1	C6	3900	81.7	1.3	500	180.0	180	0	8,090	80.4	70.5
	74	6	10	3900	81.2	0	–	180.0	180	0	8,028	81.2	66.2
	67	6	10	3850	93.2	1.1	315	180.0	180	0	13,956	92.1	79.5

TABLE D-1 (CONTINUED)
SUMMARY OF DC-9 REFAN AIRCRAFT NOISE EXPOSURE ANALYSIS

FLIGHT NO.	RUN NO.	MICROPHONE NO.	MICROPHONE LOCATION	SLANT RANGE (ft)	REFERENCE WEATHER EPNL (EPNdB)	REFERENCE WEATHER TONE CORRECTION (EPNdB)	TONE CORRECTION FREQUENCY (HZ)	TRUE AIRSPEED (KNOTS)	REFERENCE AIRSPEED (KNOTS)	AIRSPEED CORRECTION (KNOTS)	AVERAGE F_N/δ (LB)	ADJUSTED REFERENCE WEATHER EPNL (EPNdB)	REFERENCE WEATHER (dBA)
22	70	3	11	3800	89.5	0.7	315	180.0	180	0	9,738	88.8	78.7
	67	1	C6	3350	95.1	1.1	315	180.0	180	0	13,933	94.0	81.1
	72	3	11	3250	88.4	0.7	315	180.0	180	0	8,191	87.7	78.4
	74	3	11	3250	82.8	0	–	180.0	180	0	7,992	82.8	69.7
23	87	3	11	350	102.4	0.6	160	184.6	180	0.1	9,355	101.8	96.7
	86	3	11	350	110.3	0.5	125	159.5	180	–0.5	13,636	109.8	104.4
	85	3	11	400	109.0	0.8	160	160.5	180	–0.5	13,561	108.2	101.7
	85	6	10	400	108.8	0.9	315	171.4	180	–0.2	13,435	107.9	101.2
	86	6	10	400	108.9	0.6	400	167.7	180	–0.3	13,581	108.3	101.6
	87	6	10	400	101.5	0.8	400	187.7	180	0.2	9,306	100.7	95.5
	90	3	11	400	102.4	0.8	315	172.7	180	–0.2	9,368	101.6	95.7
	90	6	10	400	102.6	0.7	315	174.1	180	–0.1	9,383	101.9	95.4
	91	3	11	400	102.5	0.9	315	166.5	180	–0.3	9,474	101.6	96.2
	91	6	10	450	101.0	0	–	175.0	180	–0.1	9,498	101.0	94.6
	90	1	C6	500	101.3	1.0	315	175.4	180	–0.1	9,367	100.3	93.6
	90	2F	C6	500	104.8	0	–	175.4	180	–0.1	9,358	104.8	97.2
	84	3	11	540	108.0	0	–	172.9	180	–0.2	13,756	108.0	101.2
	91	1	C6	580	100.7	1.1	500	176.4	180	–0.1	9,439	99.6	91.5
	91	2F	C6	580	103.0	0	–	176.4	180	–0.1	9,413	103.0	95.3
	87	1	C6	600	98.5	0.8	315	176.8	180	–0.1	9,475	97.7	91.6
	87	2F	C6	600	101.6	0	–	176.8	180	–0.1	9,475	101.6	94.9
	85	1	C6	800	102.6	1.1	315	174.6	180	–0.1	13,418	101.5	93.6
	85	2F	C6	800	105.5	0	–	174.6	180	–0.1	13,440	105.5	97.1
	86	1	C6	800	102.5	0.9	315	173.9	180	–0.2	13,545	101.6	94.0
	86	2F	C6	800	106.0	0	–	173.9	180	–0.2	13,545	106.0	97.8
	84	6	10	1000	105.2	0.7	315	174.9	180	–0.1	13,891	104.5	96.1
25	95	1	C6	2400	84.0	0.8	400	148.8	140	0.3	5,919	83.2	70.8
	96	1	C6	2400	83.5	1.1	2000	151.2	140	0.3	5,872	83.5	70.4
	97	1	C6	2400	83.0	1.1	315	150.3	140	0.3	5,580	81.9	70.7
	98	1	C6	2400	82.1	0.5	200	150.5	140	0.3	5,347	81.6	70.6
	101	1	C6	1810	82.5	0.8	400	148.4	140	0.3	3,455	81.7	70.2
	102	1	C6	1810	82.0	0.7	315	143.3	140	0.1	3,092	81.3	70.1
	103	1	C6	1810	81.0	0	–	139.7	140	0	2,957	81.0	69.9
	104	1	C6	1810	81.6	1.3	400	143.5	140	0.1	3,173	80.3	70.0
	105	1	C6	1810	81.1	0.6	200	146.1	140	0.2	3,119	80.5	70.5
	107	1	C6	1810	80.8	2.5	5000	144.8	140	0.1	2,127	80.8	70.8
	100	1	C6	1810	83.3	0.8	315	151.8	140	0.4	3,926	82 5	70.6
	107	2	C4	1220	84.0	0	–	145.9	140	0.2	2,084	84.0	74.9
	101	2	C4	1220	85.5	0.5	250	149.3	140	0.3	3,514	85.0	74.4
	100	2	C4	1220	86.6	0.5	250	151.6	140	0.3	3,892	86.1	75.1
	102	2	C4	1220	85.5	0.8	315	144.0	140	0.1	3,055	84.7	73.3
	103	2	C4	1220	83.5	0	–	139.7	140	0	2,918	83.5	73.2
	104	2	C4	1220	84.7	2.3	630	145.5	140	0.2	3,133	84.7	71.4
	105	2	C4	1220	85.1	0.5	160	[illegible]	140	0.2	3,066	84.6	74.1
	106	2	C4	1220	84.6	0.5	250	[illegible]	140	0.3	3,173	84.1	74.2

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TABLE D-1 (CONCLUDED)

SUMMARY OF DC-9 REFAN AIRCRAFT NOISE EXPOSURE ANALYSIS

FLIGHT NO.	RUN NO.	MICROPHONE NO.	MICROPHONE LOCATION	SLANT RANGE (ft)	REFERENCE WEATHER EPNL (EPNdB)	REFERENCE WEATHER TONE CORRECTION (EPNdB)	TONE CORRECTION FREQUENCY (HZ)	TRUE AIRSPEED (KNOTS)	REFERENCE AIRSPEED (KNOTS)	AIRSPEED CORRECTION (KNOTS)	AVERAGE F_N/δ (LB)	ADJUSTED REFERENCE WEATHER EPNL (EPNdB)	REFERENCE WEATHER (dBA)
25	107	6	10	1060	85.9	1.5	5000	145.6	140	0.2	2,045	85.9	77.2
	100	6	10	1060	88.6	0.8	315	151.5	140	0.3	3,871	87.8	77.9
26	112	2	C4	1220	84.3	1.5	10,000	142.1	140	0.1	2,260	84.3	72.6
	109	2	C4	1220	82.9	0	–	144.8	140	0.1	1,391	82.9	72.5
	110	2	C4	1220	84.1	1.2	5000	142.0	140	0.1	1,876	84.1	73.1
	108	2	C4	1220	85.0	0.5	125	147.3	140	0.2	3,183	84.5	73.9
	112	1	C6	1810	80.3	2.6	800	142.4	140	0.1	2,257	80.3	67.7
	108	1	C6	1810	81.0	0.7	315	147.0	140	0.2	3,467	80.3	71.2
	109	1	C6	1810	79.2	3.4	500	144.8	140	0.1	1,399	79.2	68.7
	110	1	C6	1810	79.7	2.9	800	141.4	140	0	1,894	79.7	68.4
	112	6	10	1060	84.8	1.3	5000	144.4	140	0.1	2,231	84.8	75.8
	108	6	10	1060	86.8	1.2	5000	148.5	140	0.3	3,033	86.8	75.1
	109	6	10	1060	85.3	1.4	4000	145.2	140	0.2	1,368	85.3	74.6
	110	6	10	1060	85.8	2.0	5000	144.5	140	0.1	1,870	85.8	76.4

TABLE D-2
SUMMARY OF LATERAL NOISE ATTENUATION ANALYSIS

FLIGHT	RUN	MIC	LOCATION	F_N/δ (LB)	SLANT RANGE (ft)	HEIGHT (ft)	β (DEG)	SIDELINE EPNL (EPNdB)	OVERHEAD EPNL (EPNdB)	LATERAL ATTENUATION EPNdB)
16	21	7	S18	13,762	2204	1597	46.4	95.2	96.6	1.4
	9	7	S18	13,641	2154	1527	45.2	94.2	96.5	2.3
	11	7	S18	13,620	2203	1595	46.4	94.8	96.3	1.5
	9	9	S16	13,476	1775	915	31.0	93.1	97.8	4.7
	9	10	S20	13,449	1775	926	31.5	95.5	97.8	2.3
	10	9	S16	13,746	1811	982	32.8	95.5	98.1	2.6
	10	10	S20	13,756	1811	993	33.3	96.0	98.1	2.1
	11	9	S16	13,521	1789	941	31.7	94.7	97.8	3.1
	11	10	S20	13,521	1789	951	32.1	95.4	97.8	2.4
	12	10	S20	13,404	1802	977	32.8	96.4	97.6	1.2
	12	9	S16	13,420	1802	966	32.4	94.3	97.6	3.3
	13	9	S16	13,764	1796	954	32.1	94.9	98.2	3.3
	13	10	S20	13,770	1796	964	32.5	96.7	98.2	1.5
	15	9	S16	13,605	1876	1098	35.8	95.4	97.6	2.2
	15	10	S20	13,552	1876	1108	36.2	96.6	97.5	0.9
	16	9	S16	13,485	1798	958	32.2	94.2	97.7	3.5
	16	10	S20	13,503	1798	968	32.6	95.6	97.7	2.1
	17	9	S16	13,506	1774	912	30.9	94.1	97.9	3.8
	17	10	S20	13,490	1774	922	31.3	95.3	97.8	2.5
	18	9	S16	13,586	1754	872	29.8	94.6	98.1	3.5
	18	10	S20	13,589	1754	882	30.2	95.1	98.1	3.0
	19	9	S16	13,736	1725	814	28.2	95.9	98.4	2.5
	19	10	S20	13,762	1725	828	28.7	95.4	98.5	3.1
	20	9	S16	13,670	1773	910	30.9	95.4	98.1	2.7
	20	10	S20	13,673	1773	919	31.2	97.1	98.1	1.0
	21	9	S16	13,706	1766	897	30.5	94.2	98.2	4.0
	21	10	S20	13,706	1766	907	30.9	96.1	98.2	2.1
	22	9	S16	13,670	1706	772	26.9	96.6	98.4	1.8
	22	10	S20	13,670	1706	782	27.3	95.8	98.4	2.6
	23	9	S16	13,668	1665	678	24.0	96.3	98.6	2.3
	23	10	S20	13,674	1665	688	24.4	96.2	98.6	2.4
	9	11	S19	13,639	1618	546	19.7	96.9	98.8	1.9
	9	12	S0	13,724	1584	442	16.2	94.5	99.1	4.6
	10	7	S18	13,835	2239	1645	47.3	97.0	96.6	−0.4
	10	12	S0	13,769	1560	346	12.8	94.8	99.3	4.5
	10	11	S19	13,762	1592	467	17.1	97.2	99.1	1.9
	11	11	S19	13,590	1588	454	16.6	96.4	98.8	2.4
	11	12	S0	13,608	1558	337	12.5	94.5	98.9	4.4
	12	7	S18	9,917	2193	1582	46.2	92.7	88.6	−5.9*
	12	11	S19	13,433	1584	440	16.1	95.5	98.6	3.1
	12	12	S0	13,392	1554	318	11.8	92.8	98.7	5.9
	13	7	S18	13,852	2197	1587	46.3	96.1	96.7	0.6
	13	11	S19	13,789	1580	424	15.6	94.2	99.2	5.0
	13	12	S0	13,720	1550	302	11.2	91.7	99.2	7.5
	15	7	S18	13,648	2319	1752	49.1	96.2	96.0	0.2
	15	11	S19	13,556	1612	530	19.2	95.9	98.7	2.8
	15	12	S0	13,537	1571	394	14.5	92.4	98.8	6.4
	16	7	S18	11,579	2208	1603	46.6	92.8	92.4	−0.4
	16	11	S19	13,407	1568	379	14.0	93.6	98.6	5.0
	16	12	S0	13,329	1544	268	10.0	92.3	98.6	6.3
	17	7	S18	9,367	2166	1544	45.5	91.5	87.8	6.3*
	17	11	S19	13,411	1560	344	12.7	93.9	98.7	4.8
	17	12	S0	13,277	1537	226	8.5	90.3	98.6	8.3
	18	7	S18	13,679	2193	1582	46.2	91.8	96.5	4.7

*DATA OF DOUBTFUL VALIDITY

TABLE D-2 (CONTINUED)
SUMMARY OF LATERAL NOISE ATTENUATION ANALYSIS

FLIGHT	RUN	MIC	LOCATION	F_N/δ (LB)	SLANT RANGE (ft)	HEIGHT (ft)	β (DEG)	SIDELINE EPNL (EPNdB)	OVERHEAD EPNL (EPNdB)	LATERAL ATTENUATION (EPNdB)
16	18	12	S0	13,360	1535	216	8.1	90.6	98.7	8.1
	19	7	S18	9,699	2169	1548	45.5	93.5	88.3	−5.2*
	19	11	S19	13,556	1552	309	11.5	94.7	99.0	4.3
	19	12	S0	13,488	1536	220	8.2	91.8	98.9	7.1
	20	7	S18	9,187	2211	1607	46.6	92.2	87.2	−5.0*
	20	11	S19	13,454	1550	299	11.1	94.2	98.8	4.6
	20	12	S0	13,390	1531	182	6.8	92.9	98.8	5.9
	21	11	S19	13,485	1547	287	10.7	95.2	98.9	3.7
	21	12	S0	13,523	1530	177	6.6	92.0	99.0	7.0
	22	7	S18	13,717	2096	1444	43.6	94.7	96.9	2.2
	22	11	S19	13,486	1532	186	7.0	93.1	98.9	5.8
	22	12	S0	13,313	1524	119	4.5	92.0	98.7	6.7
	23	7	S18	9,188	2090	1436	43.4	95.3	87.8	−7.5*
	23	11	S19	13,606	1526	137	5.2	92.9	99.2	6.3
	23	12	S0	13,446	1522	88	3.3	92.2	98.9	6.7
19	25	5	S18	5,479	1598	496	18.1	82.0	85.7	3.7
	27	5	S18	5,544	1603	513	18.7	83.8	85.8	2.0
	27	10	S20	5,517	1551	322	12.0	83.8	86.0	2.2
	34	9	S16	4,266	1560	351	13.0	78.4	84.4	6.0
	34	10	S20	4,269	1560	363	13.5	79.1	84.4	5.3
	35	5	S18	3,972	1608	529	19.2	79.9	83.7	3.8
	36	9	S16	3,528	1565	372	13.8	77.7	83.5	5.8
	24	5	S18	6,753	1605	517	18.8	86.8	87.4	0.6
	25	10	S20	5,500	1554	334	12.4	80.9	86.0	5.1
	28	5	S18	5,034	1588	463	17.0	81.4	85.2	3.8
	28	9	S16	5,056	1543	265	9.9	79.9	85.5	5.6
	28	10	S20	5,071	1543	277	10.3	81.2	85.5	4.3
	29	5	S18	5,265	1599	499	18.2	80.4	85.4	5.0
	29	9	S16	5,258	1553	320	11.9	79.6	85.7	6.1
	29	10	S20	5,244	1553	331	12.3	79.2	85.7	6.5
	31	5	S18	5,183	1614	546	19.8	80.3	85.2	4.9
	31	9	S16	5,213	1556	333	12.4	80.1	85.6	5.5
	31	10	S20	5,176	1556	345	12.8	79.9	85.6	5.7
	33	5	S18	4,521	1616	552	20.0	79.3	84.4	5.1
	33	9	S16	4,454	1559	349	12.9	79.8	84.6	4.8
	33	10	S20	4,473	1559	361	13.4	78.7	84.7	6.0
	35	9	S16	3,946	1562	358	13.3	77.9	84.0	6.1
	35	10	S20	3,956	1562	370	13.7	76.5	84.0	7.5
	36	5	S18	3,541	1630	591	21.3	79.7	83.1	3.4
	36	10	S20	3,546	1565	384	14.2	77.9	83.5	5.6
	37	5	S18	3,174	1582	442	16.2	77.5	82.9	5.4
	37	9	S16	3,180	1540	248	9.3	76.0	83.2	7.2
	37	10	S20	3,180	1540	261	9.8	75.0	83.2	8.2
	34	5	S18	4,347	1609	531	19.3	80.6	84.2	3.6
	25	9	S16	5,331	1554	322	12.0	80.4	85.8	5.4
	38	5	S18	2,755	1591	474	17.3	76.8	82.4	5.6
	38	9	S16	2,753	1548	292	10.9	74.8	82.7	7.9
	38	10	S20	2,726	1548	304	11.3	75.3	82.6	7.3
	28	11	3N	5,081	2617	332	7.3	74.3	80.3	6.0
	31	11	3N	5,194	2626	406	8.9	75.9	80.4	4.5
	29	11	3N	5,288	2624	395	8.7	72.2	80.6	8.4
	34	11	3N	4,280	2628	418	9.2	73.5	79.1	5.6
	35	11	3N	4,009	2629	426	9.3	72.1	78.7	6.6

*DATA OF DOUBTFUL VALIDITY

TABLE D-2 (CONTINUED)
SUMMARY OF LATERAL NOISE ATTENUATION ANALYSIS

FLIGHT	RUN	MIC	LOCATION	F_N/δ (LB)	SLANT RANGE (ft)	HEIGHT (ft)	β (DEG)	SIDELINE EPNL (EPNdB)	OVERHEAD EPNL (EPNdB)	LATERAL ATTENUATION (EPNdB)
19	37	11	3N	3,193	2615	317	7.0	69.6	77.7	8.1
	30	11	3N	5,555	2626	408	8.9	76.2	80.9	4.7
	24	11	3N	6,694	2623	386	8.5	82.6	82.6	0
	25	11	3N	5,491	2624	394	8.6	75.5	80.8	5.3
	30	5	S18	5,555	1610	535	19.4	82.3	85.7	3.4
	30	9	S16	5,572	1557	338	12.5	81.5	86.1	4.6
	30	10	S20	5,546	1557	350	13.0	81.5	86.0	4.5
	27	9	S16	5,511	1551	310	11.5	82.9	86.0	3.1
	38	11	3N	2,753	2619	352	7.7	69.4	77.1	7.7
20	44	3	S18	3,792	1600	502	18.3	80.4	83.6	3.2
	44	9	S16	3,778	1556	332	12.3	78.9	83.8	4.9
	44	10	S20	3,795	1556	344	12.8	78.8	83.8	5.0
	46	3	S18	3,752	1601	505	18.4	81.1	83.5	2.4
	46	9	S16	3,730	1559	349	12.9	78.8	83.8	5.0
	46	10	S20	3,736	1559	361	13.4	78.3	83.8	5.5
	50	3	S18	4,075	1602	508	18.5	82.3	83.9	1.6
	50	9	S16	4,048	1562	362	13.4	79.2	84.1	4.9
	50	10	S20	4,043	1562	374	13.9	79.8	84.1	4.3
	43	3	S18	4,582	1606	527	19.2	83.0	84.5	1.5
	43	9	S16	4,568	1558	342	12.7	80.4	84.8	4.4
	43	10	S20	4,555	1558	355	13.2	79.6	84.8	5.2
	48	3	S18	3,776	1604	517	18.8	80.6	83.5	2.9
	48	9	S16	3,771	1554	325	12.1	77.1	83.8	6.7
	48	10	S20	3,775	1554	337	12.5	77.9	83.8	5.9
	47	11	3N	3,798	2627	412	9.0	72.9	78.5	5.6
	49	11	3N	3,990	2626	408	8.9	76.8	78.7	1.9
	50	11	3N	4,054	2629	426	9.3	71.3	78.8	7.5
	40	11	3N	6,899	2627	412	9.0	82.8	82.9	0.1
	39	11	3N	6,463	2626	403	8.8	77.6	82.3	4.7
	46	11	3N	3,751	2628	417	9.1	72.6	78.4	5.8
	44	11	3N	3,785	2626	403	8.8	73.2	78.5	5.3
	41	11	3N	6,051	2627	413	9.1	77.3	81.6	4.3
	39	3	S18	6,443	1605	520	18.9	85.5	87.0	1.5
	41	9	S16	6,090	1557	338	12.5	81.2	86.7	5.5
	39	10	S20	6,465	1554	338	12.6	83.7	87.3	3.6
	40	3	S18	6,931	1602	509	18.5	85.9	87.7	1.8
	40	9	S16	6,909	1559	346	12.8	86.7	87.9	1.2
	40	10	S20	6,801	1559	358	13.3	86.1	87.7	1.6
	41	3	S18	6,076	1602	510	18.6	82.8	86.5	3.7
	41	10	S20	6,065	1557	351	13.0	81.3	86.7	5.4
	42	3	S18	3,167	1595	486	17.7	79.4	82.9	3.5
	42	9	S16	3,209	1554	326	12.1	77.3	83.2	5.9
	42	10	S20	3,201	1554	338	12.6	77.1	83.2	6.1
21	53	11	3N	13,588	2705	784	16.9	92.6	94.6	2.0
	54	11	3N	13,533	2723	846	18.1	91.7	94.5	2.8
	55	11	3N	13,434	2753	942	20.0	91.8	94.2	2.4
	56	11	3N	12,689	2733	878	18.7	91.1	92.9	1.8
	57	11	3N	12,591	2779	1019	21.5	88.3	92.6	4.3
	59	11	3N	11,919	2828	1149	24.0	88.1	91.0	2.9
	60	11	3N	11,982	2790	1049	22.1	88.4	91.3	2.9
	61	11	3N	11,026	2832	1159	24.2	86.1	88.9	2.8
	62	11	3N	10,667	2884	1285	26.5	86.0	87.8	1.8

TABLE D-2 (CONTINUED)
SUMMARY OF LATERAL NOISE ATTENUATION ANALYSIS

FLIGHT	RUN	MIC	LOCATION	F_N/δ (LB)	SLANT RANGE (ft)	HEIGHT (ft)	β (DEG)	SIDELINE EPNL (EPNdB)	OVERHEAD EPNL (EPNdB)	LATERAL ATTENUATION (EPNdB)
21	56	12	6N	12,699	5507	292	3.0	76.8	86.4	9.6
	62	12	6N	10,575	5551	757	7.8	74.7	80.7	6.0
	55	12	6N	13,432	5509	318	3.3	80.0	87.8	7.8
	57	12	6N	12,591	5514	397	4.1	77.8	86.1	8.3
	60	12	6N	11,871	5518	453	4.7	78.0	84.4	6.4
	54	12	6N	13,511	5504	229	2.4	82.9	88.0	5.1
	53	12	6N	13,706	5504	222	2.3	82.6	88.4	5.8
	59	12	6N	11,920	5526	539	5.6	80.4	84.5	4.1
	61	12	6N	11,000	5528	559	5.8	81.1	81.9	0.8
	53	9	S16	13,604	1656	655	23.3	96.3	98.5	2.2
	53	10	S20	13,604	1656	666	23.7	96.2	98.5	2.3
	54	9	S16	13,510	1678	708	25.0	96.6	98.3	1.7
	54	10	S20	13,510	1678	718	25.3	95.8	98.3	2.5
	55	9	S16	13,467	1719	801	27.8	95.3	98.0	2.7
	55	10	S20	13,467	1719	811	28.2	95.7	98.0	2.3
	56	9	S16	12,627	1697	753	26.3	95.3	96.7	1.4
	56	10	S20	12,660	1697	763	26.7	95.3	96.7	1.4
	57	9	S16	12,593	1758	881	30.1	93.4	96.3	2.9
	57	10	S20	12,593	1758	892	30.5	94.3	96.3	2.0
	59	10	S20	11,860	1825	1019	33.9	93.4	94.6	1.2
	60	9	S16	11,924	1781	926	31.3	92.5	94.9	2.4
	60	10	S20	11,928	1781	937	31.7	92.8	94.9	2.1
	61	9	S16	11,024	1837	1029	34.1	92.0	92.7	0.7
	61	10	S20	11,009	1837	1040	34.5	91.9	92.6	0.7
	62	9	S16	10,651	1925	1179	37.8	89.7	91.4	1.7
	62	10	S20	10,659	1925	1190	38.2	92.5	91.4	−1.1
22	66	12	6N	13,919	6653	3750	34.3	84.0	86.8	2.8
	73	11	3N	9,634	4120	3233	51.7	80.0	81.8	1.8
	73	12	6N	9,627	6276	3030	28.9	76.4	76.6	0.2
	74	12	6N	7,997	6305	3090	29.4	75.0	73.0	−2.0
	67	11	3N	13,933	5153	4486	60.5	88.5	89.4	0.9
	67	12	6N	13,938	6733	3691	35.3	85.8	86.7	0.9
	69	10	S20	13,945	5016	4787	72.6	78.9	89.7	10.8*
	69	11	3N	14,003	5530	4918	62.8	88.3	88.9	0.6
	70	11	3N	9,728	4958	4258	59.2	80.4	79.8	−0.6
	70	12	6N	9,711	6772	3958	35.8	74.8	75.8	1.0
	69	12	6N	14,005	6974	4295	38.0	83.9	86.5	2.6
	75	12	6N	13,672	5913	2177	21.6	85.3	87.6	2.3
	66	9	S16	13,923	4509	4241	70.2	90.7	90.7	0
	66	10	S20	13,892	4509	4252	70.6	78.9	90.6	11.7*
	66	11	3N	13,919	5061	4379	59.9	89.2	89.6	0.4
	72	11	3N	8,230	4305	3469	53.7	79.2	78.5	−0.7
	72	12	6N	8,131	6347	3175	30.0	72.1	73.2	1.1
	69	9	S16	13,958	5016	4777	72.2	90.0	89.7	−0.3
	75	10	S20	13,738	3158	2774	61.5	94.3	93.6	−0.7
	74	9	S16	8,035	3579	3237	64.8	81.8	80.3	−1.5
	70	9	S16	9,740	4454	4183	69.9	82.9	81.1	−1.8
	72	9	S16	8,176	3691	3360	65.6	76.2	80.2	4.0
	72	10	S20	8,176	3691	3372	65.0	76.4	80.2	3.8
	73	9	S16	9,612	3507	3158	64.2	85.1	83.5	−1.6
	73	10	S20	9,607	3507	3169	64.6	84.6	83.5	−1.1
	74	10	S20	8,056	3579	3249	65.2	81.1	80.4	0.7
	75	9	S16	13,729	3158	2765	61.1	94.0	93.5	0.5

*DATA OF DOUBTFUL VALIDITY

TABLE D-2 (CONTINUED)
SUMMARY OF LATERAL NOISE ATTENUATION ANALYSIS

FLIGHT	RUN	MIC	LOCATION	F_N/δ (LB)	SLANT RANGE (ft)	HEIGHT (ft)	β (DEG)	SIDELINE EPNL (EPNdB)	OVERHEAD EPNL (EPNdB)	LATERAL ATTENUATION (EPNdB)
22	78	9	S16	8,253	2094	1437	43.3	84.9	86.2	1.3
	78	10	S20	8,256	2094	1449	43.8	86.9	86.2	−0.7
	74	9	S16	8,035	3574	3232	64.7	81.8	80.4	−1.4
	65	9	S16	13,853	1797	956	32.1	97.0	98.3	1.3
	65	10	S20	13,903	1797	966	32.5	97.5	98.4	0.9
	73	10	S20	9,607	3393	3042	63.7	84.6	83.8	−0.8
	77	10	S20	8,576	2237	1650	47.5	87.3	86.1	−1.2
	79	9	S16	6,983	2267	1679	47.8	84.7	83.4	−1.3
	79	10	S20	6,959	2267	1691	48.2	85.4	83.4	−2.0
	82	9	S16	7,099	2242	1644	47.2	84.0	83.6	−0.4
	82	10	S20	7,099	2242	1657	47.7	85.1	83.6	−1.5
	70	9	S16	9,721	4799	4548	71.4	87.9	80.2	−7.7*
	74	10	S20	8,056	3574	3243	65.2	81.0	80.4	−0.6
	75	9	S16	13,729	3170	2778	61.2	93.9	93.5	−0.4
	77	9	S16	8,572	2237	1639	47.1	87.3	86.1	−1.2
	65	11	3N	13,974	2803	1084	22.8	93.7	95.0	1.3
	77	12	6N	8,585	5661	1347	13.8	73.8	75.7	1.9
	77	11	3N	8,585	3101	1727	33.8	83.1	82.9	−0.2
	79	11	3N	6,992	3118	1758	34.3	80.0	80.1	0.1
	82	12	6N	7,072	5691	1470	15.0	72.8	72.7	−0.1
	78	11	3N	8,347	2997	1527	30.6	82.7	82.8	0.1
23	84	9	S16	13,881	1784	932	31.5	97.0	98.4	1.4
	85	9	S16	13,469	1587	454	16.6	94.5	98.6	4.1
	86	9	S16	13,588	1581	436	16.0	95.1	98.9	3.8
	87	9	S16	9,306	1572	400	14.7	88.0	90.5	2.5
	85	12	6N	13,309	5515	411	4.3	77.5	87.6	10.1
	86	11	3N	13,490	2640	497	10.9	88.2	94.6	6.4
	86	12	6N	13,624	5512	369	3.8	79.7	88.2	8.5
	84	10	S20	13,885	1784	942	31.8	98.0	98.4	0.4
	85	10	S20	13,435	1587	467	17.1	92.9	98.6	5.7
	86	10	S20	13,585	1581	448	16.5	92.0	98.9	6.9
	90	11	3N	9,383	2632	445	9.7	83.8	85.9	2.1
	91	11	3N	9,463	2642	504	11.0	82.8	86.1	3.3
	91	12	6N	9,465	5514	404	4.2	76.4	77.9	1.5
	90	9	S16	9,383	1574	410	15.1	87.0	90.6	3.6
	90	10	S20	9,383	1574	423	15.6	88.0	90.6	2.6
	91	9	S16	9,498	1593	476	17.4	89.1	90.7	1.6
	91	10	S20	9,490	1593	490	17.9	88.4	90.7	2.3
	84	12	6N	13,862	5517	435	4.5	81.4	88.6	7.2
	87	10	S20	9,306	1572	413	15.2	86.9	90.5	3.6
25	96	9	S16	5,767	2520	2007	52.8	82.3	81.7	−0.6
	100	9	S16	3,856	1808	976	32.7	79.1	82.5	3.4
	100	10	S20	3,839	1808	987	33.1	82.1	82.4	0.3
	103	9	S16	2,881	1847	1047	34.5	78.1	81.0	2.9
	104	9	S16	3,065	1846	1045	34.5	79.9	81.3	1.4
	106	9	S16	3,128	1857	1064	35.0	80.3	81.3	1.0
	106	10	S20	3,138	1857	1075	35.4	79.4	81.3	1.9
	98	11	3N	5,311	3301	2071	38.9	76.1	78.0	1.9
	106	11	3N	3,124	2829	1152	24.0	74.6	76.7	2.1
	95	11	3N	5,883	3246	1981	37.6	78.7	79.1	0.4
	101	10	S20	3,455	1850	1064	35.1	81.2	81.7	0.5
	105	9	S16	3,048	1855	1061	34.9	79.8	81.2	1.4

*DATA OF DOUBTFUL VALIDITY

TABLE D-2 (CONCLUDED)
SUMMARY OF LATERAL NOISE ATTENUATION ANALYSIS

FLIGHT	RUN	MIC	LOCATION	F_N/δ (LB)	SLANT RANGE (ft)	HEIGHT (ft)	β (DEG)	SIDELINE EPNL (EPNdB)	OVERHEAD EPNL (EPNdB)	LATERAL ATTENUATION (EPNdB)
25	96	10	S20	5,774	2520	2019	53.2	84.0	81.7	−2.3
	97	9	S16	5,518	2533	2024	53.0	79.8	81.3	1.5
	97	10	S20	5,511	2533	2036	53.5	81.5	81.2	−0.3
	98	9	S16	5,288	2516	2002	52.7	79.9	81.0	1.1
	98	10	S20	5,295	2516	2014	53.2	82.8	81.0	−1.8
26	110	9	S16	1,863	1839	1033	34.2	75.9	79.8	3.9
	110	10	S20	1,862	1839	1044	34.6	77.8	79.8	2.0
	111	10	S20	1,702	1856	1073	35.2	78.5	79.5	1.0
	112	9	S16	2,205	1847	1047	34.5	77.9	80.2	2.3
	112	10	S20	2,214	1847	1058	35.0	74.3	80.2	5.9
	108	10	S20	3,019	1851	1065	35.1	80.2	81.2	1.0
	111	9	S16	1,716	1856	1062	34.9	77.0	79.6	2.6
	108	9	S16	3,028	1851	1053	34.7	80.1	81.2	1.1
	109	9	S16	1,324	1853	1057	34.8	77.2	79.1	1.9
	109	10	S20	1,359	1853	1068	35.2	73.1	79.1	6.0

TABLE D-3.1
SUMMARY OF 33-FOOT (10-METER) POLE-MOUNTED MICROPHONE DATA 0.5-SEC DIGITAL AVERAGING TIME

TEST COND	RUN	TYPE	TARGET THRUST LB (N)	MICROPHONE LOC/NO.	HEIGHT OVER MICROPHONE – H_{GEO} ft	m	PRESSURE ALT – H_P ft	(m)	AMBIENT PRESS. (PSIA)	M	$N_1/\sqrt{\theta_t}$ (RPM)	AMBIENT TEMP (°R)
1	100	5.5-DEG APPROACH OPTIMUM FLAP	3900 (17,347)	C10/4P C10/5P	[1038] [987]	[316.4] [300.3]	902 851	(274.9) (259.4)	14.22 14.25	0.23 0.23	4919.4 4914.1	514.2 514.3
	101	5.5-DEG APPROACH OPTIMUM FLAP	3500 (15,563)	C10/4P C10/5P	[1092] [1074]	[332.3] [327.4]	957 927	(291.7) (282.5)	14.19 14.21	0.23 0.23	4720.1 4726.1	514.2 514.2
2	25	3-DEG APPROACH 50-DEG FLAP	5800 (25,793)	C6/2P C6/3P	[788] [778]	[240.1] [237.1]	677 667	(206.3) (203.3)	14.34 14.35	0.22 0.22	5473.8 5473.2	506.5 506.6
	27	3-DEG APPROACH 50-DEG FLAP	5500 (24,464)	C6/2P C6/3P	[775] [760]	[236.2] [231.6]	667 652	(203.3) (198.7)	14.35 14.35	0.22 0.22	5485.4 5487.5	507.5 507.5
3	95	3-DEG APPROACH 50-DEG FLAP	6000 (26,688)	C10/4P C10/5P	[2041] [2027]	[622.1] [617.8]	1780 1766	(542.5) (538.3)	13.77 13.78	0.22 0.22	5603.9 5602.7	511.0 511.2
4	39	3-DEG APPROACH 50-DEG FLAP	6500 (28,912)	C10/6 C10/4P C10/5P	[370] 339 227	[112.8] 103.3 69.2	219 219 211	(66.7) (66.7) (64.3)	14.58 14.58 14.58	0.24 0.24 0.24	5788.1 5788.1 5785.9	510.3 510.3 510.3
	41	3-DEG APPROACH 50-DEG FLAP	6100 (27,133)	C10/6 C10/4P C10/5P	[380] 350 338	[115.3] 106.7 103.0	232 232 217	(70.7) (70.7) (66.1)	14.57 14.57 14.58	0.23 0.23 0.23	5653.3 5653.3 5653.3	511.2 511.2 511.2
5	44	3-DEG APPROACH 35-DEG FLAP	3800 (16,902)	C10/6 C10/4P C10/5P	[369] 340 329	[112.5] 103.6 100.3	209 209 203	(63.7) (63.7) (61.9)	14.59 14.59 14.59	0.22 0.22 0.22	4852.1 4852.1 4854.3	512.2 512.2 512.3
	46	3-DEG APPROACH 35-DEG FLAP	3800 (16,902)	C10/6 C10/4P C10/5P	381 354 344	116.1 107.9 104.9	228 228 220	(69.5) (69.5) (67.1)	14.58 14.58 14.58	0.22 0.22 0.22	4851.1 4851.1 4841.5	512.5 512.5 512.7
6	65	TAKEOFF	13,500 (60,043)	C10/4P C10/5P	[946] [966]	[288.3] [294.4]	1108 1128	(337.7) (343.8)	14.12 14.11	0.27 0.27	7597.9 7584.4	511.5 511.3
	84	TAKEOFF	13,500 (60,043)	C10/4P C10/5P	[940] 968	[286.5] 295.0	1145 1167	(349.0) (355.7)	14.10 14.09	0.27 0.27	7566.3 7564.9	514.1 514.0
7	77	TAKEOFF WITH CUTBACK	8000 (35,584)	C10/4P C10/5P	[1626] [1641]	[495.6] [500.2]	1804 1819	(549.9) (554.4)	13.76 13.76	0.27 0.27	6371.6 6371.6	509.4 509.4
	78	TAKEOFF WITH CUTBACK	8000 (35,584)	C10/4P C10/5P	[1456] [1456]	[443.8] [443.8]	1640 1640	(499.9) (499.9)	13.85 13.85	0.27 0.27	6308.4 6308.4	510.4 510.4
8	9	TAKEOFF	13,500 (60,043)	C6/2P C6/3P	[2220] [2220]	[676.7] [676.7]	2583 2583	(787.3) (787.3)	13.37 13.37	0.28 0.28	7570.0 7570.0	501.4 501.4

NOTE: H_{GEO} VALUES IN [ ] CALCULATED

TABLE D-3.2
SUMMARY OF 33-FOOT (10-METER) POLE-MOUNTED MICROPHONE DATA 1.5-SEC DIGITAL AVERAGING TIME

TEST COND	RUN	TYPE	TARGET THRUST (LB) (N)	MICROPHONE LOC/NO.	HEIGHT OVER MICROPHONE – H_{GEO} ft	HEIGHT OVER MICROPHONE – H_{GEO} m	PRESSURE ALT – H_P ft	PRESSURE ALT – H_P (m)	AMBIENT PRESS. (PSIA)	M	$N_1/\sqrt{\theta_t}$ (RPM)	AMBIENT TEMP (°R)
1	100	5.5-DEG	3900	C10/6	1030	313.9	864	(263.3)	14.24	0.23	4916.8	514.2
		APPROACH	(17,347)	C10/4P	[1038]	[316.4]	902	(274.9)	14.22	0.23	4919.4	514.2
		OPTIMUM FLAP		C10/5P	[987]	[300.3]	851	(259.4)	14.25	0.23	4914.1	514.3
	101	5.5-DEG	3500	C10/6	[1037]	[316.1]	897	(273.4)	14.23	0.23	4724.6	514.5
		APPROACH	(15,563)	C10/4P	[1082]	[329.8]	947	(288.6)	14.20	0.23	4717.5	514.3
		OPTIMUM FLAP		C10/5P	[1065]	[324.6]	918	(279.8)	14.22	0.23	4725.6	514.3
2	25	3-DEG	5800	C6/1	808	246.3	667	(203.3)	14.35	0.22	5473.8	506.5
		APPROACH	(25,793)	C6/2P	[783]	[238.7]	672	(204.8)	14.34	0.22	5473.8	506.5
		50-DEG FLAP		C6/3P	[771]	[235.0]	660	(201.2)	14.35	0.22	5473.2	506.6
	27	3-DEG	5500	C6/1	800	243.8	662	(201.8)	14.35	0.22	5487.5	507.5
		APPROACH	(24,464)	C6/2P	[770]	[234.7]	662	(201.8)	14.35	0.22	5487.5	507.5
		50-DEG FLAP		C6/3P	[755]	[230.1]	647	(197.2)	14.36	0.22	5485.4	507.5
3	95	3-DEG	6000	C10/6	[2071]	[631.2]	1780	(542.5)	13.77	0.22	5603.9	511.0
		APPROACH	(26,688)	C10/4P	[2034]	[620.0]	1773	(540.4)	13.78	0.22	5603.3	511.1
		50-DEG FLAP		C10/5P	[2027]	[617.8]	1766	(538.3)	13.78	0.22	5602.7	511.2
4	39	3-DEG	6500	C10/6	362	110.3	211	(64.3)	14.58	0.24	5785.9	510.3
		APPROACH	(28,912)	C10/4P	370	112.8	219	(66.7)	14.58	0.24	5788.1	510.3
		50-DEG FLAP		C10/5P	354	107.9	203	(61.9)	14.59	0.24	5783.8	510.3
	41	3-DEG	6100	C10/6	373	113.7	225	(68.6)	14.58	0.23	5653.3	511.2
		APPROACH	(27,133)	C10/4P	343	104.5	225	(68.6)	14.58	0.23	5653.3	511.2
		50-DEG FLAP		C10/5P	330	100.6	209	(63.7)	14.59	0.23	5652.7	511.3
5	44	3-DEG	3800	C10/6	363	110.6	203	(61.9)	14.58	0.22	4854.3	512.3
		APPROACH	(16,902)	C10/4P	340	103.6	209	(63.7)	14.59	0.22	4852.1	512.2
		35-DEG FLAP		C10/5P	323	98.5	197	(60.0)	14.59	0.22	4856.4	512.3
	46	3-DEG	3800	C10/6	377	114.9	224	(68.3)	14.58	0.22	4846.3	512.6
		APPROACH	(16,902)	C10/4P	350	106.7	224	(68.3)	14.58	0.22	4846.3	512.6
		35-DEG FLAP		C10/5P	340	103.6	216	(65.8)	14.58	0.22	4841.0	512.7
6	65	TAKEOFF	13,500	C10/6	1038	316.4	1170	(356.6)	14.09	0.27	7585.2	511.2
			(60,043)	C10/4P	[987]	[300.8]	1149	(350.2)	14.10	0.27	7580.9	511.2
				C10/5P	[966]	[294.4]	1128	(343.8)	14.11	0.27	7584.4	511.3
	84	TAKEOFF	13,500	C10/6	1017	310.0	1192	(363.3)	14.07	0.27	7568.6	513.8
			(60,043)	C10/4P	[987]	[300.8]	1192	(363.3)	14.07	0.27	7568.6	513.8
				C10/5P	[987]	[300.8]	1192	(363.3)	14.07	0.27	7568.6	513.8
7	77	TAKEOFF	8000	C10/6	1685	513.6	1833	(558.7)	13.75	0.27	6371.6	509.4
		WITH	(35,584)	C10/4P	[1655]	[504.4]	1833	(558.7)	13.75	0.27	6371.6	509.4
		CUTBACK		C10/5P	[1641]	[500.2]	1819	(554.4)	13.76	0.27	6371.6	509.4
	78	TAKEOFF	8000	C10/6	[1486]	[452.9]	1640	(499.9)	13.85	0.27	6308.4	510.4
		WITH	(35,584)	C10/4P	[1472]	[448.7]	1656	(504.7)	13.84	0.27	6313.3	510.3
		CUTBACK		C10/5P	[1456]	[443.8]	1640	(499.9)	13.85	0.27	6308.4	510.4
8	9	TAKEOFF	13,500	C6/1	2316	705.9	2649	(807.4)	13.34	0.28	7570.0	501.3
			(60,043)	C6/2P	[2264]	[690.1]	2627	(800.7)	13.35	0.28	7570.0	501.3
				C6/3P	[2264]	[690.1]	2627	(800.7)	13.35	0.28	7570.0	501.3

NOTE: H_{GEO} VALUES IN [ ] CALCULATED

TABLE D-4
SUMMARY OF PSEUDOTONE ADJUSTMENTS TO FAR PART 36 NOISE LEVELS

MEASUREMENT	MICROPHONE LOCATION	RUN	TONE CORRECTION S16	TONE CORRECTION S20	TONE CORRECTION C6	TONE CORRECTION C10	TONE CORRECTION FREQUENCY S16	TONE CORRECTION FREQUENCY S20	TONE CORRECTION FREQUENCY C6	TONE CORRECTION FREQUENCY C10
TAKEOFF WITH CUTBACK/SIDELINE	S16, S20, C6	11	2.3	1.6	0.6		500	500	315	
		12	2.1	1.0	0.7		500	500	315	
		16	2.4	1.7	0.5		500	500	315	
		17	2.3	2.1	0.6		500	500	160	
		18	2.0	2.1	0.6		500	500	315	
		19	1.7	2.0	0.5		500	500	160	
TAKEOFF	C6	9			0.9				315	
		10			0.8				315	
		13			1.0				315	
		53			0.9				200	
		54			1.0				315	
		55			1.0				315	
APPROACH – 50° FLAP	C10	27				0.5				8000
		28				0.5				8000
		29				0.6				315
		30				0.5				8000
		31				0.6				8000
		32				0.6				8000
TAKEOFF/SIDELINE CORRECTIONS	S16, S20, C6	9	2.0	1.6	0.9		500	500	315	
		10	2.0	1.7	0.8		500	500	315	
		13	1.9	0.5	1.0		500	250	315	
		15	1.7	0.7	NP		500	400		
		53	1.6	1.8	0.9		630	630	200	
		54	1.2	1.6	1.0		630	630	315	
		55	1.8	2.0	1.0		500	500	315	
		56	0.9	0.6	0.9		315	315	315	
		57	2.1	1.8	1.0		500	500	315	
		51	NP	1.2	1.1			500	500	
		60	2.0	2.3	1.0		500	500	315	
		61	1.2	1.1	1.1		500	500	500	
		62	1.2	0.8	1.1		500	400	315	
		65	2.0	2.3	0.9		500	500	500	
		75	0.5	1.0	1.2		315	315	315	
		77	1.4	0.5	1.2		2000	400	315	
		78	1.7	1.4	0.8		500	500	315	
		79	0.5	0.0	1.1		200		315	
		82	0.9	0.7	1.2		400	400	315	
		83	NP	NP	1.1				2500	
APPROACH CORRECTIONS	C10	24				0.5				8000
		25				0.7				8000
		33				0.7				6300
		34				0.8				6300
		35				0.9				6300
		36				0.7				6300
		37				1.4				5000
		38				1.6				5000
		39				0.0				160
		40				0.0				315
		41				0.0				315
		51				0.0				8000
		52				0.8				6300

NOTE: TONE CORRECTIONS IN TERMS OF EPNdB
TONE CORRECTION FREQUENCY IN TERMS OF Hz

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APPENDIX E

C4 and C6 Microphone Location Evaluation

The C6 microphone location is about 21.35 m (70 ft) lower in elevation than microphone C4 which is at the runway elevation and a fairly abrupt declivity lies between C6 and C4. Five level flyovers were devoted to an evaluation of the data from these microphone locations. Noise measurements were made at C4 and C6 during these level flyovers at cutback thrust. Both sets of recordings were adjusted to common cutback reference aerodynamic conditions using the procedure specified in FAR Part 36 to provide a direct comparison of the data.

Only 3 of the 5 test runs produced valid noise data (flight 48, runs 10R, 11R, and 13R). Two microphones were used at each location and were within 3.05 m (10 ft) of each other. Table E1 lists the noise levels and some of the significant information related to these tests. It will be seen that, for the reference conditions shown, the average noise level at C6 was 0.8 EPNdB higher than at C4. It can also be observed that at the same location and for the same run, differences as great as 0.5 EPNdB occurred between adjacent microphones. No account has been taken of terrain differences at the two locations. Therefore, the observed average noise level differences may be considered to be due to experimental data scatter and local terrain effects.

TABLE E1 - COMPARISON OF MICROPHONE LOCATIONS C4 AND C6

Flight 48, Level Flyover, 2245 feet (684 meters) 180 knots (92.6 m/sec)

Run Number	Mic Number	Mic Location	Flap Angle deg. (rad)	F_N/δ lb (N)	C6 EPNL	C4 EPNL
10R	2	C6	40.5 (0.709)	9075 (40 364)	88.5	
10R	4	C6	40.6 (0.710)	9072 (40 351)	89.0	
10R	9	C4	42.0 (0.735)	9041 (40 212)		87.9
10R	11	C4	42.0 (0.735)	9041 (40 212)		87.4
11R	2	C6	42.5 (0.744)	9242 (41 107)	88.8	
11R	4	C6	42.5 (0.744)	9239 (41 093)	89.2	
11R	9	C4	41.5 (0.727)	9236 (41 080)		88.5
13R	2	C6	43.2 (0.756)	9349 (41 583)	89.0	
13R	4	C6	43.2 (0.756)	9349 (41 583)	89.1	
13R	9	C4	42.7 (0.748)	9364 (41 650)		88.4
13R	11	C4	42.7 (0.748)	9364 (41 650)		88.5
				Average	88.9	88.1

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ABBREVIATIONS AND SYMBOLS

a	Coefficient of spreading term
A	$\sqrt{h\delta^2_F + L\delta^2_F}$
ADDS	Airborne Digital Data System
ADM	Automated Drafting Machine
A_p	Primary nozzle area, ft^2
APP	Approach
A_s	Accumulated excess attenuation, dB
ATA	Air Transport Association
b	Coefficient of atmospheric attenuation term, EPNdB/1000 ft.
BPF	Blade Passing Frequency
c	Speed of sound, m/sec
C	Flap chord length or OASPL directivity correction term
CISA	Controlled Integrating Spectrum Analyzer
CPA	Closest point of Aircraft
C_T	Temperature structure constant, $°C/m^{1/3}$
C_V	Wind structure constant, $m^{2/3}/sec$
c_o	Speed of sound in ambient air, ft/sec
°C	Degrees centigrade
d	Direct path length from source to receiver, meters
dB	Decibel
dB(A)	A-weighted sound level, dB
D_p	Diameter of primary nozzle, ft.
EGA	Extra ground attenuation, EPNdB
E(K)	Spectral density of velocity fluctuations = $0.061\ C_v^2\ K^{-11/3}$
EPNdB	Unit of effective perceived noise level
EPNL	Effective perceived noise level, EPNdB
$EPNL_R$	Reference EPNL = $EPNL_T + \Delta 1 + \Delta 2 + \Delta thrust$, EPNdB

$EPNL_T$	Test EPNL, EPNdB
f	Frequency, Hz
FAR	Federal Aviation Regulation
FDC	Flight Data Center
F_N	Net Thrust
F_N/δ	Referred net thrust, pounds
°F	Degrees Farenheit
G	Mean temperature gradient, T/L_0
GR	General Radio
h_{Geo}	Geometric altitude, feet
h_p	Pressure altitude, feet
h_{δ_F}	Vertical distance from the reference source point to edge of deflected flap, meters
Hz	Hertz
ILS	Instrument landing system
k	Acoustic wave number, 1/m
κ	Von Karman constant
kg	Kilogram(s)
KTAS	True airspeed, knots
ℓ	Scattering length
L	Outer scale of turbulence
L/H	Treated duct-length to duct-height ratio
L_N	Noise level at distance x, EPNdB
L_o	Noise level at reference distance, EPNdB
L_T	Turbulence scale of the longest connection or correlation distance between the velocities of two points of the flow field
L_{δ_F}	Horizontal distance from the reference source point to edge of deflected flap, meters

M	Mach number
M_a	Aircraft Mach number
M_c	Eddy Mach number corresponding to static jet
M_d	Deficit Mach number, $(U_\infty - \Delta\bar{u})/c$
M_r	Eddy Mach number corresponding to inflight jet
MALT	Mobile Automatic Laser Tracking
MART	Mobile Atmospheric Recording Tower
MRI	Meteorology Research, Inc.
N	Newton
$N_{Tone(s)}$	Number of discrete tone(s) in a given band
NR	Noise reduction, dB
N_1	Engine rotor speed
N. Mi.	Nautical mile
PLVLA	Pulsed Light Visual Landing Aid
PNdB	Unit of perceived noise level or tone corrected perceived noise level
PNL	Perceived noise level, PNdB
PNLT	Tone corrected perceived noise level, PNdB
PNLTM	Maximum tone corrected perceived noise level, PNdB
Pref	Reference sound pressure (2×10^{-5} N/m^2)
$P_{Tone(s)}$	Sound pressure corresponding to the discrete tone(s) in a given band
R	Scale of turbulence value, m$^{2/3}$/sec
r	Wake thickness
R_{eL}	Reynolds number, based on $L = \frac{u'}{\nu}$
R_e	Reynolds number, based on $q = \frac{u'L}{\nu}$
rpm	Revolutions per minute

s	90 percent confidence limit sample standard deviation defined by $\sqrt{\frac{(X_1 - \bar{X})^2 + (X_2 - \bar{X})^2 + (X_n - \bar{X})^2}{(n-1)}}$
$SPL_{Broadband}$	Broadband turbomachinery sound pressure level
$SPL_{j/c}$	Jet plus core sound pressure level
SPL_{Total}	Total noise sound pressure level
$SPL_{Turbomachinery}$	Total turbomachinery sound pressure level
ΔS	$10 \log \frac{V_{True\ (test)}}{V_{True\ (ref)}}$
SAE ARP 866	Society of Automotive Engineers Aircraft Recommended Procedure Number 866
SL	Sideline
SPL	Sound pressure level, decibels or dB
$t_{(.05)}$	90 percent confidence level distribution factor
T	Temperature, °F or °C
T*	Temperature constant (°C)
T_j	Primary jet temperature, ° Rankine
TO	Takeoff without cutback
TOCB	Takeoff with cutback
T_o	Sea level standard day temperature, ° Rankine
Δ thrust	Noise adjustment for difference between reference F_N/δ and test F_N/δ, EPNdB
u*	Friction velocity, m/sec
u'	Fluctuating component of the wind velocity in the direction of propagation, m/sec
$\Delta\bar{u}$	Velocity deficit, ft/sec
U	Jet velocity, ft/sec
UITS	Universal Indicated Turbulence System
U_∞	Free stream flight velocity, ft/sec

V_a	Aircraft speed, ft/sec
V_{jp}	Primary jet velocity, ft/sec
$V_{j\ rel}$	Primary jet velocity relative to the speed of the aircraft $(V_{jp} - V_a)$, ft/sec
$V_{True(ref)}$	Reference, airspeed, KTAS
$V_{True(test)}$	Test airspeed, KTAS
x	Distance, feet
X	90 percent confidence limit sample, EPNdB
$\bar{X}$	Average of 90 percent confidence limit samples, EPNdB
x_o	Reference distance of 250 feet
y_o	Initial wing/wheel wake thickness, ft.
$\bar{y}(X)$	$(y(X^{1/2}) + y(X^{1/3}))/2$, ft.
Y	$y_o + \bar{y}\ (X)$, ft.
Z	Inboard wing chord thickness, meters
$\Delta 1$	Correction for atmospheric absorption and acoustic path differences, EPNdB
$\Delta 2$	Duration correction, EPNdB
a	Excess attenuation due to turbulence, nepers/304.8m
β	Elevation angle, degrees
α	Flight path angle, degrees
γ	Glideslope, degrees
δ	Typical mixing-layer thickness of jet exhaust or difference in path length between source and receiver, meters
δ_{Amb}	Ratio of ambient pressure to standard sea level reference pressure
δ_f	Flap setting, degree(s)
Δ	Relative difference between jet and core noise peak SPLs
ϵ	Dissipation rate, m^2/sec^2

η	Engine cant angle, degrees
θ	Angle from inlet or scattering angle
θ_c	Difference between true scattering angle and the Bragg scattering angle, degree(s)
θ_{Inlet}	Angle from inlet
θ_s	Shadow zone, degrees
λ_g	Micro scale of turbulence
μ	90 percent confidence limit, EPNdB
ν	Kinematic viscosity, m^2/sec
ξ	Mean rate of energy dissipation per unit mass
π	3.1416
ρ	Density of the air, kg/m^3
ρ_o	Sea level density of the air, kg/m^3
σ	Scattering cross section
$\Phi(\kappa)$	Spectral density of temperature fluctuations = $0.033\ C_T^2\ K^{-11/3}$