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USAF BIOENVIRONMENTAL NOISE DATA HANDBOOK: D-4 TEST STAND, AIRC--ETC(U)  
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**USAF BIOENVIRONMENTAL NOISE DATA  
HANDBOOK**

**Volume 115**

**D-4 Test Stand, Aircraft Hydraulic System**

DECEMBER 1976

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Approved for public release; distribution unlimited.

AEROSPACE MEDICAL RESEARCH LABORATORY  
AEROSPACE MEDICAL DIVISION  
AIR FORCE SYSTEMS COMMAND  
WRIGHT-PATTERSON AIR FORCE BASE, OHIO 45433

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) The D-4 Hydraulic Test Stand is an electric motor-driven unit designed to test aircraft hydraulic systems. This report provides measured data defining the bioacoustic environments produced by this unit operating inside a large aircraft hanger at normal rated/loaded conditions. Near-field data are reported for 37 locations in a wide variety of physical and psychoacoustic measures: overall and band sound pressure levels, C-weighted and A-weighted sound levels, preferred speech interference level, perceived noise level, and limiting times		

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→ for total daily exposure of personnel with and without standard Air Force ear protectors. Refer to Volume 1 of this handbook, "USAF Bioenvironmental Noise Data Handbook, Vol. 1: Organization, Content and Application", AMRL-TR-75-50(1) 1975, for discussion of the objective and design of the handbook, the types of data presented, measurement procedures, instrumentation, data processing, definitions of quantities, symbols, equations, applications, limitations, etc. ↗

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## PREFACE

This report was prepared by the Biodynamic Environment Branch, Aerospace Medical Research Laboratory, under Project/Task 723104, Measurement and Prediction of Noise Environments of Air Force Operations.

The author acknowledges the efforts of Mr. Robert T. England and Mr. Robert G. Powell who conducted the field measurements, and Mr. John N. Cole who established the data analysis requirements and assisted in the preparation of this report. Mr. Henry Mohlman and Mr. David Eilerman of the University of Dayton assisted in the mechanics of data processing, and Mrs. Norma Peachey typed and prepared the graphics.

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## INTRODUCTION

The D-4 Hydraulic Test Stand is an electric motor-driven unit designed to test aircraft hydraulic systems.

This volume provides measured data defining the bioacoustic environments produced by this unit. Such data are essential to evaluate ear protection requirements, limiting personnel exposure times, voice communication capabilities, and annoyance problems associated with operations of the D-4 test stand.

This volume is one of a series published by the Aerospace Medical Research Laboratory (AMRL) under the same report number (AMRL-TR-75-50) as a multi-volume handbook that quantifies the noise environments produced at flight/ground crew locations and in surrounding communities by operations of Air Force aircraft and ground support equipment. The far-field, community-type, noise data in the handbook describe the noise produced during *ground operations* of aircraft, ground support equipment, and other ground-based equipment or facilities.

Volume 1 of this handbook discusses the objectives and design of the handbook, the types of data presented, measurement procedures, instrumentation, data processing, definitions of quantities, symbols, equations, applications, limitations, etc. Volume 2 provides a method and data for adjusting the handbook's far-field noise data, which are for standard meteorological conditions (15C temperature, 0% rel humidity, 0.760 meters Hg barometric pressure) to derive comparable data for other meteorological conditions. Refer to *Volumes 1 and 2* (references 1 and 2) for such information because it is not repeated in other handbook volumes.

A cumulative index lists those aerospace systems contained in the handbook, and identifies the specific volumes containing each type of environmental noise data available (i.e., inflight/flight crew and passenger noise, near-field/ground crew noise, far-field/community noise). Volume numbers are assigned sequentially as individual volumes are published. This index is periodically updated as individual volumes are published, and is available upon request from AMRL/BBE, Wright-Patterson AFB, OH 45433. Organizations on the distribution list for the handbook will automatically receive a copy of the updated index as it is generated.

Direct any questions concerning the technical data in this report and other handbook volumes to: AMRL/BBE, Wright-Patterson AFB, OH 45433; Autovon 78-53675 or 78-53664; Commercial (513) 55-3675 or (513) 255-3664.

. Cole, John N., *USAF Bioenvironmental Noise Data Handbook, Volume 1: Organization, Content and Application*, AMRL-TR-75-50 (1), Aerospace Medical Research Laboratory, Wright-Patterson Air Force Base, Ohio, 1975.

. Cole, John N., *USAF Bioenvironmental Noise Data Handbook, Volume 2: Procedure to Evaluate Effects of Non-standard Meteorological Conditions on Far-Field Noise*, AMRL-TR-75-50 (2), AMRL, VPAFB, OH, 1975.





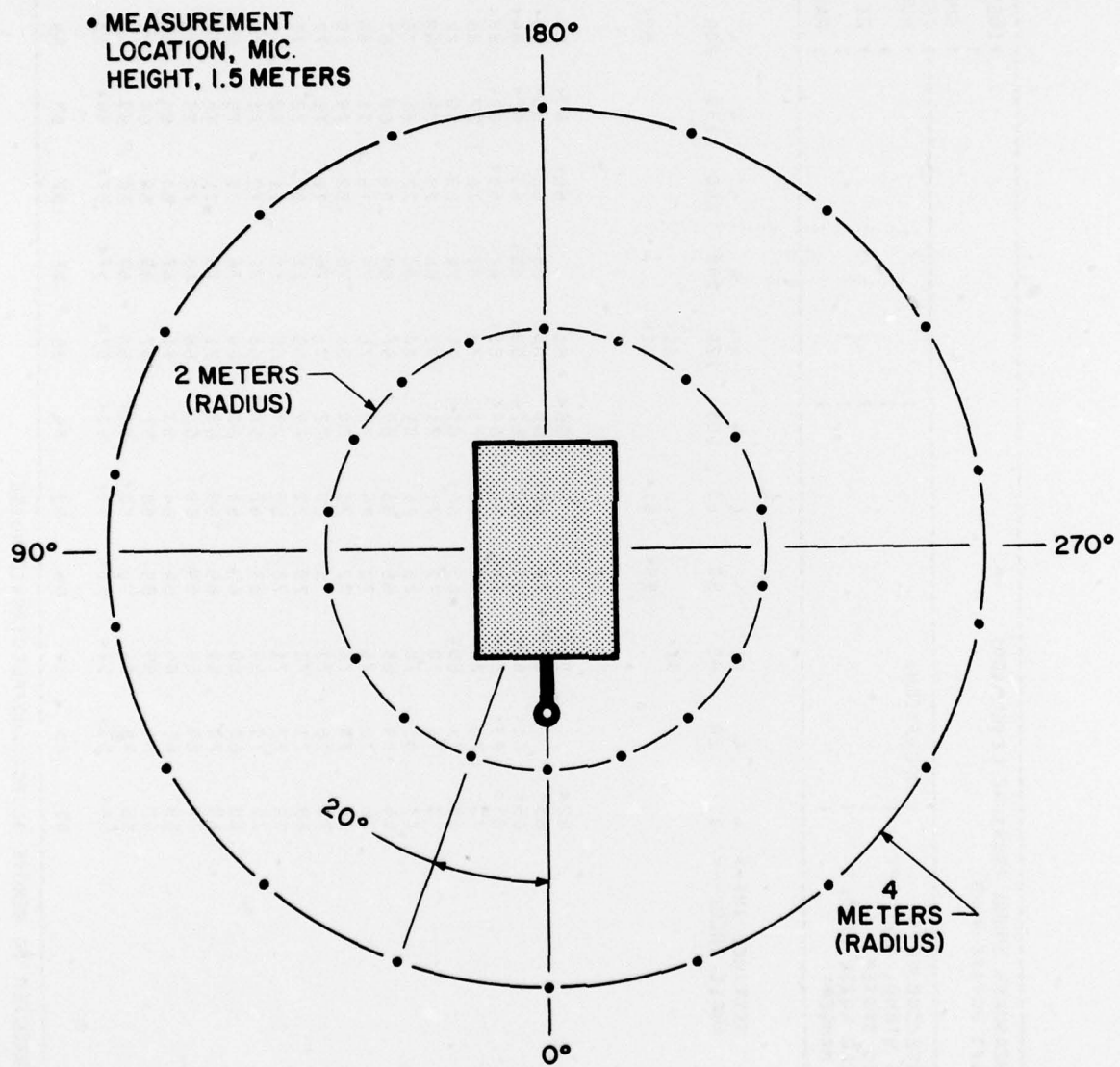


Figure 1. Measurement Locations

TABLE 2		MEASURED SOUND PRESSURE LEVEL (DB) 1/3 OCTAVE BAND										IDENTIFICATION:				
NOISE SOURCE/SUBJECT:		( OPERATION:										OMEGA 3.2				
D-4 TEST STAND, AIRCRAFT		(										TEST 71-020-400				
HYDRAULIC SYSTEM		(										RUN 01				
NEAR FIELD NOISE LEVELS		(										20 AUG 74				
(INSIDE HANGER)		(										PAGE F1				
FREQ (HZ)	DISTANCE (M) ->	4	20	40	4	60	80	100	120	140	160	180	200	220	240	
25				57<		59<	61<		61<							59<
31.5																
40																
50																
63																
80																
100		62<	65<	67<	70	70	66<	69	61<	68<	56<	58<	60<	56<	58<	
125		65<	61<	63<	62<	63<	63<	62<	59<	60<	69	66<	68<	66<	66<	
160		63<	63<	59<	60<	60<	59<	60<	61<	62<	63<	62<	64<	62<	61<	
200		73	74	76	79	79	73	71	79	83	76	77	85	79	81	
250		68	71	66<	69	69	66<	65<	71	71	69	69	74	68	71	
315		73	70	70	72	71	71	71	72	68	70	75	69	73	70	
400		77	81	78	75	75	75	81	80	80	77	81	75	82	80	
500		64	69	68	66	66	66	69	68	69	66	69	67	71	71	
630		76	72	75	73	74	74	75	76	74	78	76	80	79	82	
800		75	73	75	72	72	71	70	68	76	82	72	79	80	79	
1000		78	76	73	71	73	73	72	71	76	76	76	77	80	78	
1250		69	71	73	70	70	70	70	69	71	69	72	73	73	74	
1600		70	72	71	70	69	69	70	65	71	71	72	74	73	74	
2000		70	70	69	68	67	67	67	68	71	72	71	73	73	71	
2500		69	68	69	69	69	68	68	69	74	71	75	68	76	71	
3150		69	70	69	69	69	69	68	71	70	71	74	72	76	75	
4000		70	69	69	69	69	69	68	68	72	70	71	72	72	74	
5000		68	65	64	64	64	64	63	66	67	68	68	68	69	70	
6300		62	61	59	59	58	58	57	62	65	64	65	64	65	66	
8000		56	56	55	54	52<	52<	53<	58	60	60	59	60	60	62	
10000		54<	53<	52<	50<	49<	49<	50<	57<	57<	57<	58<	58<	60	60	
OVERALL		85	85	84	84	83	83	84	85	87	87	87	89	89	88	

< LEVEL CORRECTED TO REMOVE BACKGROUND/ELECTRONIC NOISE.

TABLE 1		MEASURED SOUND PRESSURE LEVEL (DB)										IDENTIFICATION:				
2		1/3 OCTAVE BAND														
		NOISE SOURCE/SUBJECT:										TEST 71-020-400				
		( OPERATION:										OMEGA 3.2				
		( D-4 TEST STAND, AIRCRAFT (										RUN 02				
		( HYDRAULIC SYSTEM (										20 AUG 74				
		( NEAR FIELD NOISE LEVELS (										PAGE F2				
		( (INSIDE HANGER) (														
FREQ (HZ)	DISTANCE (M)-->	4	260	280	300	320	340	4	2	20	40	60	80	100	120	140
25																
31.5									60<							59<
40																
50																
63																
80																
100		58<	60<	59<	59<	59<	66<	61<	61<	58<	57<	58<	58<	58<	58<	58<
125		67<	60<	59<	59<	60<	61<	65<	64<	70	75	74	70	68<	70	62<
160		61<	59<	61<	59<	61<	62<	69	68	64<	64<	63<	62<	63<	60<	60<
200		78	72	77	77	68	81	87	83	83	83	83	81	70	68	82
250		70	68	69	69	64<	71	76	73	73	72	71	71	67<	66<	71
315		78	73	74	73	73	71	78	74	74	73	71	70	70	76	74
400		81	77	76	76	80	75	82	79	76	82	79	76	85	84	80
500		65	67	65	65	69	64	70	68	71	67	67	73	72	72	69
630		74	74	78	78	70	72	78	76	76	76	70	75	72	74	79
800		75	83	77	77	78	79	78	77	80	80	74	74	74	70	78
1000		78	77	78	78	81	76	78	78	74	74	72	72	75	78	75
1250		73	74	72	72	73	72	75	74	72	72	71	73	73	72	76
1600		71	76	73	70	69	69	74	75	75	75	70	71	71	71	74
2000		71	72	71	72	72	72	75	76	76	73	69	69	68	68	72
2500		73	72	75	74	74	71	73	74	71	69	69	70	68	70	76
3150		75	71	75	74	74	73	72	76	69	70	68	67	73	75	
4000		72	72	71	73	72	72	72	72	72	72	71	69	69	72	73
5000		68	69	68	68	68	68	68	69	69	69	65	65	65	68	69
6300		64	64	63	64	64	63	64	65	64	64	63	61	61	62	67
8000		61	62	61	60	58	58	59	61	59	57	58	57	57	57	63
10000		59	59	59	59	58<	57<	58<	58<	56<	56<	54<	53<	53<	55<	61
OVERALL		87	87	86	87	87	86	90	88	88	88	86	85	87	87	88

< LEVEL CORRECTED TO REMOVE BACKGROUND/ELECTRONIC NOISE.

TABLE: MEASURED SOUND PRESSURE LEVEL (DB) 1/3 OCTAVE BAND		OPERATION:										IDENTIFICATION:		
FREQ (HZ)	ANGLE (DEG)-->	160	180	200	220	240	260	280	300	320	340	360	TEST CONDITION	1/A
25														
31.5														
40														
50														
63														
80														
100														
125														
160														
200														
250														
315														
400														
500														
630														
800														
1000														
1250														
1600														
2000														
2500														
3150														
4000														
5000														
6300														
8000														
10000														
OVERALL		90	91	94	93	93	94	93	93	93	90	90	95	95

< LEVEL CORRECTED TO REMOVE BACKGROUND/ELECTRONIC NOISE.

NOISE SOURCE/SUBJECT: ( OPERATION: )  
D-4 TEST STAND, AIRCRAFT ( )  
HYDRAULIC SYSTEM ( )  
NEAR FIELD NOISE LEVELS ( )  
(INSIDE HANGER) ( )

OMEGA 3.2  
TEST 71-020-400  
RUN 03  
20 AUG 74  
PAGE F3

TABLE: MEASURED SOUND PRESSURE LEVEL (DB)		IDENTIFICATION:													
OCTAVE BAND		OMEGA 3.2													
		TEST 71-020-400													
		RUN 01													
		20 AUG 74													
		PAGE J1													
NOISE SOURCE/SUBJECT: ( OPERATION:															
D-4 TEST STAND, AIRCRAFT ( (															
HYDRAULIC SYSTEM ( (															
NEAR FIELD NOISE LEVELS ( (															
( (INSIDE HANGER) ( (															
FREQ (HZ)	DISTANCE (M) -->	4	4	4	4	4	4	4	4	4	4	4	4	4	4
	ANGLE (DEG) -->	0	20	40	60	80	100	120	140	160	180	200	220	240	
		69	65	69	71	68	70	67	70	68	68	70	69	69	
125		76	77	77	80	76	75	80	83	78	80	85	80	82	
250		79	82	80	78	78	82	82	81	81	83	81	84	84	
500		80	79	78	76	76	75	74	80	83	78	82	83	82	
1000		74	75	75	74	73	73	72	77	76	78	77	79	77	
2000		74	73	73	73	73	72	74	73	75	76	75	78	78	
4000		64	63	61	60	59	59	64	66	66	67	66	67	68	
8000		85	85	84	84	83	84	85	87	87	87	89	89	88	
OVERALL															

65





MEASURES OF HUMAN NOISE EXPOSURE											IDENTIFICATION:	
3											OMEGA 3.2	
NOISE SOURCE/SUBJECT: ( OPERATION: )											TEST 71-020-400	
D-4 TEST STAND, AIRCRAFT ( )											RUN 01	
HYDRAULIC SYSTEM ( )											20 AUG 74	
NEAR FIELD NOISE LEVELS ( )											PAGE H1	
( INSIDE HANGER) ( )												
HAZARD/PROTECTION												
C-WEIGHTED OVERALL SOUND LEVEL (OASLC IN DBC) AT EAR												
A-WEIGHTED OVERALL SOUND LEVEL (OASLA IN DBA) AT EAR												
MAXIMUM PERMISSIBLE TIME (T IN MINUTES) FOR ONE EXPOSURE PER DAY (AFR 161-35, JULY 73)												
NO PROTECTION												
OASLC	84	85	84	84	83	84	85	87	86	86	89	88
OASLA	83	83	82	81	81	82	82	84	85	85	86	86
T	571	571	679	807	807	679	679	480	404	404	339	339
MINIMUM QPL EAR MUFFS												
OASLA*	59	61	60	60	58	60	61	63	61	62	64	63
T	960	960	960	960	960	960	960	960	960	960	960	960
AMERICAN OPTICAL 1700 EAR MUFFS												
OASLA*	54	55	54	55	52	55	56	58	55	57	60	58
T	960	960	960	960	960	960	960	960	960	960	960	960
V-51R EAR PLUGS												
OASLA*	59	59	58	56	56	58	58	60	61	60	61	63
T	960	960	960	960	960	960	960	960	960	960	960	960
AMERICAN OPTICAL 1700 EAR MUFFS PLUS V-51R EAR PLUGS												
OASLA*	45	44	43	42	42	43	42	45	47	45	47	48
T	960	960	960	960	960	960	960	960	960	960	960	960
H-133 GROUND COMMUNICATION UNIT												
OASLA*	55	55	55	54	53	53	54	57	57	57	58	58
T	960	960	960	960	960	960	960	960	960	960	960	960
COMMUNICATION												
PREFERRED SPEECH INTERFERENCE LEVEL (PSIL IN DB)												
PSIL	78	78	78	76	76	77	76	79	80	79	80	81
ANNoyANCE												
PERCEIVED NOISE LEVEL, TONE CORRECTED (PNLT IN PNOB)												
TONE CORRECTION (C IN DB)												
PNLT	97	98	96	96	95	96	97	99	98	100	100	101
C	2	3	2	2	2	2	3	2	2	2	3	2

\* BASED ON CALCULATED SPL SPECTRUM UNDER PROTECTIVE DEVICE.





TABLE: MEASURES OF HUMAN NOISE EXPOSURE													IDENTIFICATION#
3													
NOISE SOURCE/SUBJECT# ( OPERATION# )													
D-4 TEST STAND, AIRCRAFT ( )													OMEGA 3.2
HYDRAULIC SYSTEM ( )													TEST 71-020-400
NEAR FIELD NOISE LEVELS ( )													RUN 03
( INSIDE HANGER ) ( )													20 AUG 74
													PAGE H3
DISTANCE (M)--> 2 2 2 2 2 2 2 2 2 2 2 2 2													OPERATOR LOCATION
ANGLE (DEG)--> 160 180 200 220 240 260 280 300 320 340													TEST CONDITION
													1/A
HAZARD/PROTECTION													
C-WEIGHTED OVERALL SOUND LEVEL (OASLC IN DBC) AT EAR													
A-WEIGHTED OVERALL SOUND LEVEL (OASLA IN DBA) AT EAR													
MAXIMUM PERMISSIBLE TIME (T IN MINUTES) FOR ONE EXPOSURE PER DAY (AFR 161-35, JULY 73)													
NO PROTECTION													
OASLC													
OASLA													
T													
MINIMUM QPL EAR MUFFS													
OASLA*													
T													
AMERICAN OPTICAL 1700 EAR MUFFS													
OASLA*													
T													
V-51R EAR PLUGS													
OASLA*													
T													
AMERICAN OPTICAL 1700 EAR MUFFS PLUS V-51R EAR PLUGS													
OASLA*													
T													
H-133 GROUND COMMUNICATION UNIT													
OASLA*													
T													
COMMUNICATION													
PREFERRED SPEECH INTERFERENCE LEVEL (PSIL IN DB)													
PSIL													
84													
ANNOUNCE													
PERCEIVED NOISE LEVEL, TONE CORRECTED (PMLT IN PNDB)													
TONE CORRECTION (C IN DB)													
PMLT													
C													
103 104 106 106 106 106 105 106 106 104 102 107													
2 2 2 2 2 2 3 2 2 2 2													
* BASED ON CALCULATED SPL SPECTRUM UNDER PROTECTIVE DEVICE.													