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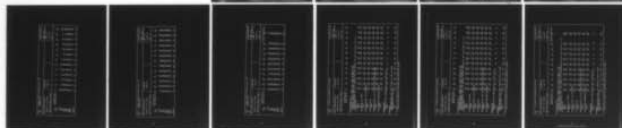
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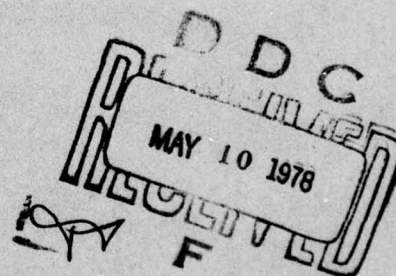


USAF BIOENVIRONMENTAL NOISE DATA HANDBOOK

Volume 110

**A/M27T-2 Test Stand, Aircraft System,
Electric Motor-Driven**

NOVEMBER 1977



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

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FOR THE COMMANDER



HENNING E. VON GIERKE

Director

**Biodynamics and Bioengineering Division
Aerospace Medical Research Laboratory**

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) The 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 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.

SECURITY CLASSIFICATION OF THIS PAGE(When Data Entered)

PREFACE

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

The author acknowledges the efforts of Mr. Robert G. Powell who assisted 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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NEAR-FIELD NOISE

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INTRODUCTION

The A/M27T-2 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 A/M27T-2 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, 70% 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) 255-3675 or (513) 255-3664.

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1. 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.
 2. 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, WPAFB, OH, 1975.

NEAR-FIELD NOISE

MEASUREMENTS

A standard A/M27T-2 test stand was operated inside and approximately in the center of a large aircraft hanger (190.5 m long x 95.1 m wide x 18.3 m high) on a concrete floor at a normal rated condition of the system pressurized at 3000 PSI, no flow. No far-field acoustic data were acquired because of the relatively close proximity of the hanger walls.

Figure 1 identifies 36 noise measurement locations at a height of 1.5 meters above the concrete apron (nominal ear level of ground crew). The 0 degree reference direction passes through the tow bar. These locations are in the acoustic near-field of the source where the sound wave fronts generally do not spherically diverge and the source appears to be spatially distributed (i.e., not a point source). Consequently, these near-field data cannot be extrapolated to longer distances but do properly define the levels at locations close to the unit.

Near-field measurements were also made at ear level at the operator control panel. Table 1 lists the numeric/alphabetic designator used on the data pages in this report to identify the operator measurement location and test condition. The designator 1/A means operator location 1 and test condition A. Such a descriptor is essential in many handbook volumes that involve multiple combinations of location conditions. It is used in this report to maintain format consistency.

RESULTS

The measured data presented in Table 2 define the sound pressure levels (SPL) produced by the A/M27T-2 unit at the 37 specified, near-field locations. This table includes the overall, 1/3 octave band, and octave band levels. From these data one can calculate the variety of measures in Table 3 which are widely used to assess the effects of noise on personnel and their performance.

For data at other intermediate near-field locations (i.e., for radial distances less than 4 meters) you can interpolate between the 36 measured data points.

TABLE 1

MEASUREMENT LOCATION AND TEST CONDITION FOR OPERATOR NOISE MEASUREMENTS

A/M27T-2 Test Stand, Aircraft Hydraulic System, Electric Motor-Driven
Edwards AFB, 10 May 1977

Measurement Location

1

Operator Control Panel

AGE Operation

A

*System Pressurized at
3000 PSI, No Flow*

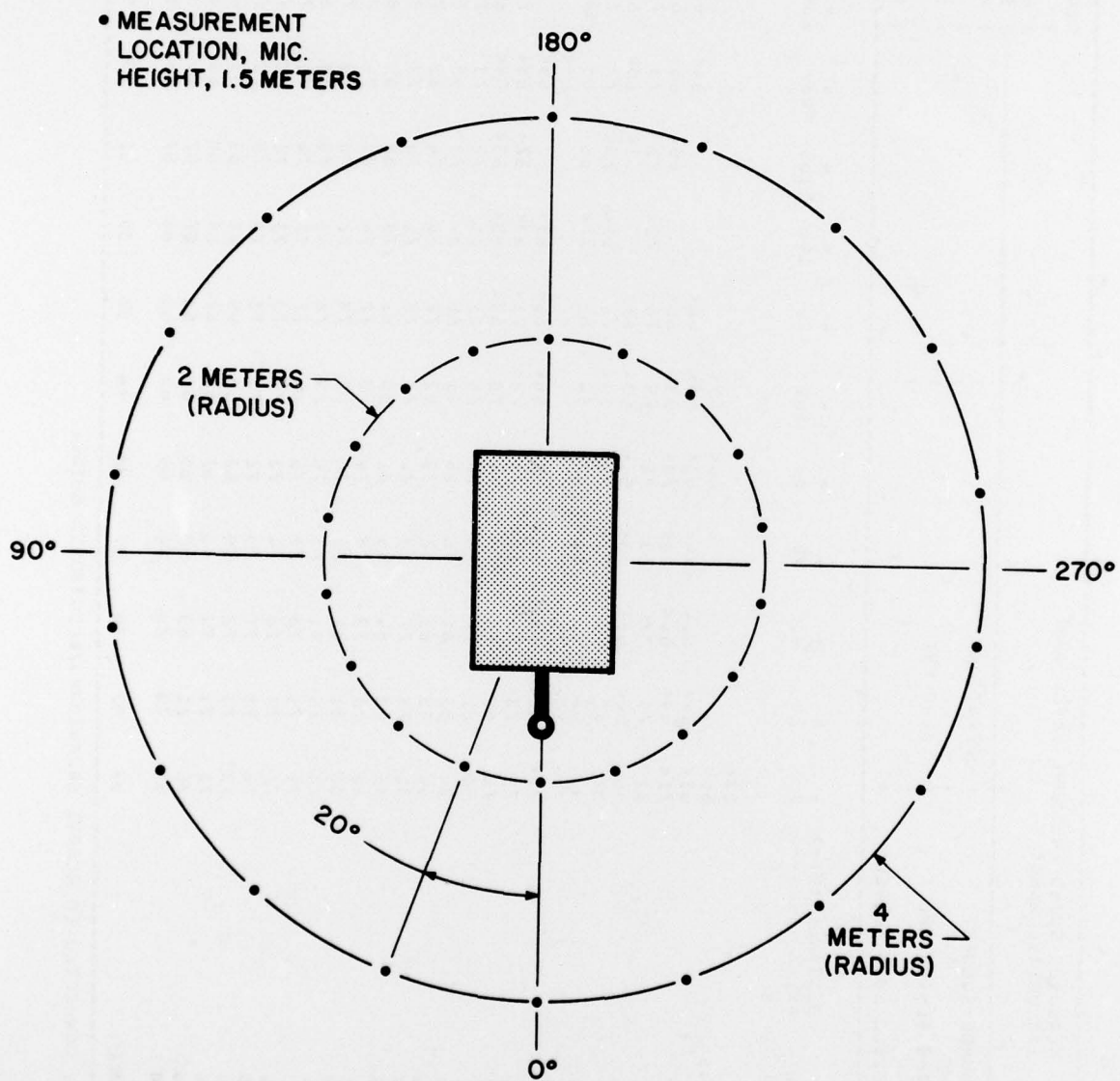


Figure 1. Measurement Locations

TABLE 2		MEASURED SOUND PRESSURE LEVEL (DB)										IDENTIFICATION:					
OCTAVE BAND												OMEGA 3.2					
NOISE SOURCE/SUBJECT:		(OPERATION:										TEST 77-006-001					
A/M27T-2 TEST STAND		(3000 PSI										RUN 02					
NEAR FIELD NOISE LEVELS		(10 MAY 77					
		(PAGE J2					
		4	4	4	4	4	4	4	4	4	4	2	2	2	2	2	2
		260	280	300	320	340	0	20	40	60	80	100	120	140			
		4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
		78	79	80	81	82	88	88	85	83	82	80	79	82	70	69	70
		74	78	83	89	92	98	98	94	91	81	83	84	75	70	80	79
		72	75	79	80	84	85	85	83	78	80	77	76	75	70	77	76
		69	93	91	99	104	94	104	91	91	93	93	92	91	91	93	92
		80	78	79	96	85	92	92	87	86	87	84	83	88	84	87	83
		79	81	82	86	80	89	90	87	84	85	86	89	85	85	86	89
		76	76	77	79	80	86	83	82	82	82	81	80	81	82	81	80
		68	69	71	73	73	79	76	80	76	76	75	75	77	76	75	77
		90	94	93	100	104	101	106	96	96	95	95	95	94	95	95	94
		OVERALL															

MEASURES OF HUMAN NOISE EXPOSURE													IDENTIFICATION:
3													OMEGA 3.2
NOISE SOURCE/SUBJECT: (OPERATION:)													TEST 77-006-001
A/M27T-2 TEST STAND (3000 PSI)													RUN 01
NEAR FIELD NOISE LEVELS ()													10 MAY 77
()													PAGE H1
DISTANCE (M)--> 4 4 4 4 4 4 4 4 4 4 4 4 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													200 220 240
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	97	97	95	37	91	94	92	90	92	95	90	94	92
OASLA	94	93	91	94	89	92	90	89	90	92	89	92	91
T	85	101	143	85	202	120	170	202	170	120	202	120	143
MINIMUM QPL EAR MUFFS													
OASLA*	74	75	72	74	68	70	68	64	67	71	65	70	66
T	960	960	960	960	960	960	960	960	960	960	960	960	960
AMERICAN OPTICAL 1700 EAR MUFFS													
OASLA*	68	69	67	68	62	64	63	59	62	66	60	64	60
T	960	960	960	960	960	960	960	960	960	960	960	960	960
V-51R EAR PLUGS													
OASLA*	70	70	65	72	65	67	65	62	65	68	64	69	66
T	960	960	960	960	960	960	960	960	960	960	960	960	960
AMERICAN OPTICAL 1700 EAR MUFFS PLUS V-51R EAR PLUGS													
OASLA*	56	55	53	56	50	52	52	48	53	52	51	53	53
T	960	960	960	960	960	960	960	960	960	960	960	960	960
H-133 GROUND COMMUNICATION UNIT													
OASLA*	67	65	64	63	60	62	63	61	64	62	62	61	64
T	960	960	960	960	960	960	960	960	960	960	960	960	960
COMMUNICATION													
PREFERRED SPEECH INTERFERENCE LEVEL (PSIL IN DB)													
PSIL	89	88	85	87	84	86	85	84	84	80	84	86	86
ANNNOYANCE													
PERCEIVED NOISE LEVEL, TONE CORRECTED (PNLT IN PNOB)													
TONE CORRECTION (C IN DB)													
PNLT	108	109	106	110	104	106	105	105	105	108	105	108	106
C	3	3	3	5	4	4	4	3	4	5	4	5	4

* BASED ON CALCULATED SPL SPECTRUM UNDER PROTECTIVE DEVICE.

MEASURES OF HUMAN NOISE EXPOSURE										IDENTIFICATION:										
3																				
NOISE SOURCE/SUBJECT: (OPERATION:)										OMEGA 3.2										
A/M27T-2 TEST STAND (3000 PSI)										TEST 77-006-001										
NEAR FIELD NOISE LEVELS ()										RUN 02										
										10 MAY 77										
										PAGE H2										

UISTANCE (M)-->	4	4	4	4	4	4	2	2	2	2	2	2	2	2	2	2	2	2	2	2
ANGLE (DEG)-->	260	280	300	320	340	0	20	40	60	80	100	120	140							
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	90	94	93	100	104	101	102	97	95	95	95	95	94	94	94	94	94	94	94	94
OASLA	88	91	90	97	101	97	102	93	92	93	93	93	93	93	93	93	93	93	93	93
T	240	143	170	50	25	50	21	101	120	101	101	101	101	101	101	101	101	101	101	101
MINIMUM QPL EAR MUFFS																				
OASLA*	66	70	70	70	81	79	83	75	72	71	71	71	70	69	69	69	69	69	69	69
T	960	960	960	960	807	960	571	960	960	960	960	960	960	960	960	960	960	960	960	960
AMERICAN OPTICAL 1700 EAR MUFFS																				
OASLA*	61	64	64	71	75	73	77	70	67	65	65	64	63	63	63	63	63	63	63	63
T	960	960	960	960	960	960	960	960	960	960	960	960	960	960	960	960	960	960	960	960
V-51R EAR PLUGS																				
OASLA*	65	68	67	74	79	72	80	68	58	58	59	59	58	58	58	58	58	58	58	58
T	960	960	960	960	960	960	960	960	960	960	960	960	960	960	960	960	960	960	960	960
AMERICAN OPTICAL 1700 EAR MUFFS PLUS V-51R EAR PLUGS																				
OASLA*	49	52	51	58	62	59	64	55	54	54	54	53	54	54	54	54	54	54	54	54
T	960	960	960	960	960	960	960	960	960	960	960	960	960	960	960	960	960	960	960	960
H-133 GROUND COMMUNICATION UNIT																				
OASLA*	58	59	60	65	66	70	71	66	54	54	54	54	54	54	54	54	54	54	54	54
T	960	960	960	960	960	960	960	960	960	960	960	960	960	960	960	960	960	960	960	960
COMMUNICATION																				
PREFERRED SPEECH INTERFERENCE LEVEL (PSIL IN DB)																				
PSIL	83	84	84	90	91	92	96	88	87	88	88	88	88	88	88	88	88	88	88	88
ANNOYANCE																				
PERCEIVED NOISE LEVEL, TONE CORRECTED (PNLT IN PNOB)																				
TONE CORRECTION (C IN DB)																				
PNLT	103	106	106	113	112	112	110	109	108	109	109	109	109	108	108	108	108	108	108	108
C	3	4	4	5	4	3	4	3	3	4	4	4	4	4	4	4	4	4	4	4

* BASED ON CALCULATED SPL SPECTRUM UNDER PROTECTIVE DEVICE.

MEASURES OF HUMAN NOISE EXPOSURE													IDENTIFICATION:
3													OMEGA 3.2
NOISE SOURCE/SUBJECT: (OPERATION:)													TEST 77-006-U01
A/M271-2 TEST STAND (3000 PSI)													RUN 03
NEAR FIELD NOISE LEVELS ()													10 MAY 77
DISTANCE (M)--> 2 2 2 2 2 2 2 2 2 2 2 2 2													PAGE H3
ANGLE (DEG)--> 160 180 200 220 240 260 280 300 320 340													OPERATOR POSITION 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													
MINIMUM QPL EAR MUFFS													
OASLC	95	97	98	96	93	95	96	97	99	103	105		105
OASLA	94	96	97	96	92	93	95	95	95	99	105		105
T	85	60	50	60	120	101	71	71	71	36	13		13
OASLA*	71	72	73	70	60	70	72	73	76	80	79		79
T	960	960	960	960	960	960	960	960	960	960	960		960
OASLA*	65	66	67	65	63	64	66	67	70	74	74		74
T	960	960	960	960	960	960	960	960	960	960	960		960
V-51R EAR PLUGS													
OASLA*	68	70	72	70	67	69	70	71	72	77	78		78
T	960	960	960	960	960	960	960	960	960	960	960		960
AMERICAN OPTICAL 1700 EAR MUFFS PLUS V-51R EAR PLUGS													
OASLA*	53	56	58	56	52	54	56	57	56	61	64		64
T	960	960	960	960	960	960	960	960	960	960	960		960
H-133 GROUND COMMUNICATION UNIT													
OASLA*	66	69	69	68	63	64	66	67	66	68	76		76
T	960	960	960	960	960	960	960	960	960	960	960		960
COMMUNICATION													
PREFERRED SPEECH INTERFERENCE LEVEL (PSIL IN DB)	89	91	91	87	88	90	90	90	90	92	99		99
ANNOYANCE													
PERCEIVED NOISE LEVEL, TONE CORRECTED (PNLT IN PNDB)													
TONE CORRECTION (C IN DB)	110	113	113	111	106	108	109	110	110	114	121		121
PNLT	4	4	5	4	3	4	4	4	3	3	4		4
C													

* BASED ON CALCULATED SPL SPECTRUM UNDER PROTECTIVE DEVICE.