

AMRL-TR-75-50
VOLUME 55

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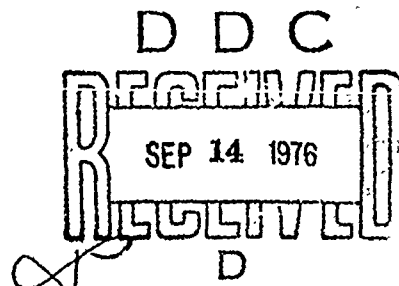
**USAF BIOENVIRONMENTAL NOISE DATA
HANDBOOK**

**VOLUME 55
AC-130A IN-FLIGHT CREW NOISE**

NOVEMBER 1975

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AEROSPACE MEDICAL RESEARCH LABORATORY
AEROSPACE MEDICAL DIVISION
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FOR THE COMMANDER


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Director
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limiting times 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 72310418, Measurement of Noise and Vibration Environments of Air Force Operations. Col Justus F. Rose, Jr. conducted the field measurements and performed the data analysis; Capt Nick Farinacci prepared this report.

The authors acknowledge the efforts of Mr. John N. Cole who established the data analysis requirements and assisted in the preparation of this report, and Mr. Henry Mohlman and Mr. David Eilerman of the University of Dayton who assisted in the mechanics of data processing.

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INTRODUCTION

The AC-130A is a USAF close-support conversion of the C-130A medium-range combat transport aircraft manufactured by the Lockheed Aircraft Corporation, Lockheed-Georgia Company. Power is provided by four T56-A-9 turboprop engines rated at 3,750 eshp at 13,820 rpm maximum take-off power. Each engine drives an Aeroproducts three-blade constant speed, 4.6 m diameter propeller through a 0.074 gear reduction. The engines are manufactured by the General Motors Corporation, Allison Division.

This volume provides measured data defining the bioacoustic environments produced inside this aircraft. Such data are essential to evaluate ear protection requirements, limiting personnel exposure times, voice communication capabilities, and annoyance problems associated with operations of the AC-130A aircraft.

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 aerospace ground equipment. The far-field, community-type, noise data in the handbook describe the noise produced during *ground operations* of aircraft, aerospace ground 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. Refer to *Volume 1* (reference 1) 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., in-flight/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.

IN-FLIGHT NOISE

MEASUREMENTS

All noise measurements were made on-board a standard-configured AC-130A aircraft during typical speed, altitude, and flight maneuver conditions. These levels describe the standard AC-130A environments, but may not be representative of those levels encountered if the aircraft has been configured differently (e.g., major equipment or structural changes).

Acoustic measurements were made at various flight crew and passenger locations, with the front door removed, the rear ramp down, the overhead door up, and all internal insulating material removed. However, the rear ramp was up and the overhead door was down when data were collected at No. 5 seat, Forward Compartment. The "doors open" condition (normal flight condition), coupled with the openings in the side of the aircraft where each weapon protrudes, creates airflow of up to 10 knots in velocity inside the cargo compartment at various locations. The wind direction is random and is affected partially by the attitude of the aircraft. A windscreen was used for all data runs to significantly eliminate the turbulence that normally would be generated around the microphone and would otherwise appear in the data as relatively low frequency noise. Table 1 lists the measurement locations and test conditions as numeric/alphabetic designators which are used on the data pages. The designator 1/A means measurement location 1 and test condition A.

The microphone position was at ear level external to headgear in a region 0.2-0.3 meters from the head when an individual was present. At unoccupied locations, measurements were made at ear level throughout a volume where the head would normally be located. In both cases, the microphone was randomly moved throughout a spherical volume approximately 0.3 meter in diameter and the resultant samples analyzed using a 4- or 8-second integration time to obtain a power-averaged level that effectively smooths out short-duration fluctuations and best describes the exposure.

Although the presence of a crew member or passenger at a measurement location affects the resultant sound field, the magnitude of such effects is generally small and not significant in determining exposure limits or voice communication capabilities. Consequently, no distinction is made in this report between occupied and unoccupied measurement locations.

RESULTS

The measured data presented in Table 2 define the sound pressure levels (SPL) produced inside the AC-130A aircraft at the 15 specified locations. This table includes the overall and octave band levels. From these data, C-weighted and A-weighted sound levels, maximum permissible time for one exposure per day (AFR 161-35) with and without standard Air Force ear protectors, preferred speech interference level, and perceived noise level are calculated and presented in Table 3. These variety of measures are widely used to assess the effects of noise on personnel and their performance.

TABLE 1

MEASUREMENT LOCATIONS AND TEST CONDITIONS

AC-130A, Rickenbacker AFB, 18 Sep 1968, Serial #54-1623/
Eglin AFB, 23 Sep 1968, Serial #54-1625

LOCATION	POSITION	HEIGHT ABOVE DECK
1	Pilot's Station	Seated Head Level
2	Navigator's Station	Seated Head Level
3	NOD Operator's Station	Seated Head Level
4	Scanner's Station	Seated Head Level
5	Scanner's Station, Hatch Removed	Seated Head Level
6	#2 Seat in Forward Compartment	Seated Head Level
7	#3 Seat in Forward Compartment, Scanner's Hatch Removed	Seated Head Level
8	#5 Seat in Forward Compartment	Seated Head Level
9	Forward Gunner's Station	1.5 Meters
10	Aft Gunner's Station	1.5 Meters
11	Aisle Adjacent to #1 and #2 7.62 mm Miniguns	1.5 Meters
12	Adjacent to Rear Door	1.5 Meters
13	Illuminator Operator's Station	1.5 Meters
14	Radar Operator's Station, Inside Booth, Door Open	Seated Head Level
15	Radar Operator's Station, Inside Booth, Door closed	Seated Head Level

CONDITION*

DESCRIPTION

A	Taxi Power
B	Takeoff Power
C	Climb Power
D	Cruise — 150 KIAS, 2500 ft PA.
E	Cruise — 150 KIAS, 2500 ft PA, #2 Minigun Firing.
F	Cruise — 150 KIAS, 2500 ft PA, #1 and #2 Miniguns Firing.
G	Cruise — 150 KIAS, 2500 ft PA, #1 and #2 Miniguns Firing at Fast Rate.
H	Cruise — 150 KIAS, 2500 ft PA, #1 and #2 Vulcan Guns, and #1 and #2 Miniguns Firing.
I	Cruise — 150 KIAS, 2500 ft PA, #4 Vulcan Gun Firing.
J	Cruise — 150 KIAS, 2500 ft PA, #4 Vulcan Gun and #2 Minigun Firing
K	Cruise — 150 KIAS, 2500 ft PA, #4 Vulcan Gun, and #3 and #4 Miniguns Firing
L	Cruise — 150 KIAS, 2500 ft PA, All Weapons Firing.

*

Aircraft flown with the front door removed, the rear ramp down, overhead door up, and all internal insulating material removed. This applies to all measurement locations except Location 8 at which the rear ramp was up and the overhead door was down.

Firing Rates:

7.62 mm Minigun — 3000 rounds/min except Condition G which was at 6000 rounds/min

20 mm Vulcan Gun — 2500 rounds/min

TABLE: MEASURED SOUND PRESSURE LEVEL (DB)		IDENTIFICATION:										
2		OMEGA 3.2										
NOISE SOURCE/SUBJECT:		TEST 68-015-001										
AG-130A GUNSHIP		RUN 01										
INFLIGHT NOISE LEVELS		12 DEC 74										
		PAGE F1										
		LOCATION/CONDITION										
FREQ (HZ)	1/D	2/D	3/D	3/H	4/D	5/D	6/F	7/D	8/A	8/B	8/C	9/H
31.5	109	106	109	124	112	115	106	108	97	107	110	110
63	104	111	122	128	122	128	111	113	109	118	120	117
125	103	104	111	125	109	120	123	113	101	113	112	124
250	98	98	105	129	103	110	121	102	101	105	108	122
500	91	94	101	131	98	104	129	99	98	98	103	129
1000	87	88	97	125	95	103	127	97	98	97	99	128
2000	86	85	93	123	92	104	126	96	91	93	95	124
4000	85	81	89	120	90	104	121	96	88	89	91	121
6000	80	82	89	118	87	109	119	97	92	89	87	119
16000			85	118	86	101	119	89	93	88	86	119
OVERALL	111	113	123	136	123	129	134	117	111	120	121	134

LEVEL CORRECTED TO REMOVE BACKGROUND/ELECTRONIC NOISE.

