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USAF BIOENVIRONMENTAL NOISE DATA HANDBOOK

VOLUME 60 UH-1N 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
Biodynamics and Bionics Division
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AIR FORCE - JULY 1964

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) The UH-1N is a USAF Utility helicopter configured as a gunship. This report provides measured data defining the bioacoustic environments at flight crew locations inside this helicopter during normal flight operations. Data are reported for one location 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 for total daily exposure of personnel with and without		

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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 UH-1N is a USAF utility helicopter configured as a gunship and manufactured by the Bell Helicopter Company. Power is provided by two T400-CP-400 (PT6T-3) turboshaft engines rated at 1,800 shp at 6,600 rpm maximum take-off power. Both engines drive a two-blade 14.69 m main rotor and a two-blade 2.59 m diameter tail rotor. The engines are manufactured by the United Aircraft Corporation, United Aircraft of Canada, Ltd.

This volume provides measured data defining the bioacoustic environments produced inside this helicopter. Such data are essential to evaluate ear protection requirements, limiting personnel exposure times, voice communication capabilities, and annoyance problems associated with operations of the UH-1N helicopter.

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.

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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 UH-1N helicopter during typical speed, altitude, and flight maneuver conditions. These levels describe the standard UH-1N 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 one flight crew location with the right and left rear doors open. Table 1 lists the measurement location 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 was randomly moved external to the headgear in a region 0.2-0.3 meter from the head 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.

RESULTS

The measured data presented in Table 2 define the sound pressure levels (SPL) produced inside the UH-1N helicopter at the specified location. This table includes the overall, 1/3 octave band, 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 measures are widely used to assess the effects of noise on personnel and their performance.

TABLE 1
MEASUREMENT LOCATION AND TEST CONDITIONS

UH-1N, Eglin AFB, 4 Aug 1971
Serial # 69-6605

LOCATION	POSITION	HEIGHT ABOVE DECK
1	Between Pilot and Copilot	Seated Head Level
CONDITION *	DESCRIPTION	
A	Ground power unit operating.	
B	#1 engine start, ground power unit operating.	
C	#2 engine start, #1 engine running, ground power unit operating.	
D	Engine RPM — 80%, Engine torque 10%, transmission torque 20% (will be shown as 10/20).	
E	Taxi (in ground effect) — 90% RPM, 25/50.	
F	Takeoff — 92% RPM, 35/70.	
G	Cruise — 90 KIAS, 90%, 25/50, 600' Altitude.	
H	Cruise (blade slap) — 70 KIAS, 90%, 20/40, 800' altitude.	
I	Cruise (blade slap) — 80 KIAS, 88%, 22/44, 800' altitude.	
J	Gunnery (7.62 mm minigun) — 2000 rounds/min — 80 KIAS, 90%, 30/60.	
K	Left rocket pod firing (2 rockets) — 110 KIAS, 70%, 0/0, Descent to target.	
L	Left rocket pod firing — same conditions as K.	
M	Gunnery (7.62 mm minigun) — 100 KIAS, 90%, 30/60.	
*	Right and left rear door open during all measurements.	

TABLE 1 (Continued)

MEASUREMENT LOCATION AND TEST CONDITIONS

UH-1N, Eglin AFB, 4 Aug 1971
Serial # 69-6605

CONDITION*	DESCRIPTION
N	Right rocket pod firing — 90 KIAS, 90%, 30/60.
P	Right rocket pod firing (2 rockets)— gunnery (7.62 mm minigun), 80 KIAS, 90%, 25/50.
Q	Gunnery (7.62 mm minigun) — firing rate 2000 rounds/min., 90 KIAS, 90%, 25/50, 300' altitude.
R	Same as Q — firing rate 4000 rounds/min.
S	Gunnery pass (7.62 mm minigun) — Forward to aft gun swing, 90 KIAS, 90%, 25/50.
T	Rocket and gunnery pass (3 rockets) — firing rate 2000 rounds/min., 100-120 KIAS, 90%, 30/60.
U	Descent and Landing, 90%, 30/60.

* Right and left rear door open during all measurements.

TABLE: MEASURED SOUND PRESSURE LEVEL (DB)													IDENTIFICATION:	
2													OMEGA 3.2	
													TEST 71-014-061	
NOISE SOURCE/SUBJECT: (OPERATION:)													RUN 01	
UM-1N HELICOPTER ()													10 JAN 75	
INFLIGHT NOISE LEVELS ()													PAGE F1	

LEVEL CORRECTED TO REMOVE BACKGROUND/ELECTRONIC NOISE.

TABLE: MEASURED SOUND PRESSURE LEVEL (DB)											IDENTIFICATION:
2											OMEGA 3.2
NOISE SOURCE/SUBJECT: (OPERATION:)											TEST 71-014-061
UM-1M HELICOPTER ()											RUN 02
INFLIGHT NOISE LEVELS ()											10 JAN 75
()											PAGE F2
LOCATION/CONDITION											
FREQ (HZ)	1/K	1/L	1/M	1/N	1/P	1/Q	1/R	1/S	1/T	1/U	
25	112	114	117	110	110	113	114	112	113	107	
31.5	110	114	115	107	108	117	109	115	112	107	
40	105	108	111	104	103	115	109	113	105	102	
50	103	104	104	105	101	103	105	103	104	98	
63	104	109	111	104	105	110	119	111	107	101	
80	108	111	110	107	107	110	114	112	108	101	
100	103	106	111	100	107	116	115	118	113	96	
125	98	105	106	99	101	111	121	112	106	90	
160	98	105	111	100	102	114	115	114	105	93	
200	100	106	113	105	105	115	123	117	108	96	
250	98	105	112	107	107	116	118	113	108	90	
315	101	110	114	107	106	117	117	115	111	89	
400	102	109	117	109	108	120	119	116	113	88	
500	102	113	117	108	108	120	117	116	113	89	
630	108	115	117	113	109	121	123	117	115	88	
800	107	116	116	113	106	123	123	120	114	87	
1000	111	119	115	114	109	116	123	119	113	86	
1250	106	120	117	112	106	120	120	117	113	84	
1600	113	123	117	114	109	119	124	116	116	85	
2000	110	121	117	116	110	121	124	119	116	83	
2500	110	122	115	116	110	116	121	116	115	81	
3150	108	120	114	116	108	117	118	116	114	82	
4000	109	122	115	117	107	119	119	116	114	79	
5000	109	121	113	115	105	114	117	114	112	76	
6300	110	121	112	115	106	115	117	113	111	76	
8000	111	122	112	115	108	114	116	113	112	83	
10000	107	119	109	111	103	111	113	111	106	79	
12500	107	120	109	112	99	111	112	110	108	79	
16000	105	116	107	111	100	109	110	106	107	77	
OVERALL	122	132	129	127	121	132	134	130	126	112	
LEVEL CORRECTED TO REMOVE BACKGROUND/ELECTRONIC NOISE.											

TABLE: MEASURED SOUND PRESSURE LEVEL (DB)											
OCTAVE BAND											
NOISE SOURCE/SUBJECT: (OPERATION:)											
UH-1H HELICOPTER											
INFLIGHT NOISE LEVELS											
IDENTIFICATION:)											
OMEGA 3.2											
TEST 71-014-061											
RUN 01											
10 JAN 75											
PAGE J1											
LOCATION/CONDITION											
1/A 1/B 1/C 1/D 1/E 1/F 1/G 1/H 1/I 1/J											
FREQ (HZ)											
MIN MAX											
31.5	76	79	100	103	104	108	110	116	113	113	117
63	84	80	95	98	101	104	103	105	105	104	115
125	87	84	88	90	100	99	96	98	101	97	115
250	81	82	87	89	97	98	92	93	99	93	121
500	73	82	85	87	95	95	91	93	93	92	120
1000	69	75	88	91	91	92	89	92	89	90	121
2000	67	71	80	85	92	91	89	92	88	90	124
4000	61	69	79	83	86	85	83	86	83	85	121
8000	56	67	86	89	89	88	87	84	84	85	118
16000	48	62	70	76	88	83	82	82	82	83	113
OVERALL	90	89	102	105	108	111	111	116	114	114	130

TABLE 2		MEASURED SOUND PRESSURE LEVEL (DB) OCTAVE BAND										IDENTIFICATION:
NOISE SOURCE/SUBJECT:		OPERATION:										OMEGA 3.2
UH-1N HELICOPTER												TEST 71-014-051
INFLIGHT NOISE LEVELS												RUN 02
												10 JAN 75
												PAGE J2
		LOCATION/CONDITION										
		1/K	1/L	1/M	1/N	1/P	1/Q	1/R	1/S	1/T	1/U	
FREQ (HZ)												
31.5		114	117	119	113	112	120	116	118	116	111	
63		110	113	114	110	109	113	120	115	111	105	
125		105	111	115	104	109	119	123	120	114	98	
250		104	112	118	111	111	121	125	120	114	98	
500		109	118	122	115	113	125	125	122	118	93	
1000		113	124	121	118	112	125	127	123	118	90	
2000		116	127	121	120	114	124	127	123	120	88	
4000		113	126	119	121	111	121	123	120	118	84	
8000		114	125	116	119	111	119	120	117	115	85	
16000		109	121	111	115	102	113	114	112	110	81	
OVERALL		122	132	129	127	121	132	134	130	126	112	

MEASURES OF HUMAN NOISE EXPOSURE										IDENTIFICATION:	
3											
NOISE SOURCE/SUBJECT:	(OPERATION:)									OMEGA 3.2	
	()									TEST 71-014-061	
	()									RUN 01	
UH-1N HELICOPTER	()									28 APR 76	
INFLIGHT NOISE LEVELS	()									PAGE H1	
	()										

