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JUL 79 H K HILLE
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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) The F-106B is a USAF all-weather fighter. This report provides measured data defining the bioacoustic environments at the pilot's location inside this aircraft for 22 flight conditions. 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		

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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, Volume 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 723108, Crew Safety In Operational Noise Environments.

The author acknowledges the efforts of Mr. John N. Cole who established the data analysis requirements, Mr. Henry Mohlman and Mr. Fred Lampley of the University of Dayton who assisted in the mechanics of data processing and Mrs. Norma Peachey who typed this report and prepared it for publication.

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INTRODUCTION

The F-106B is a USAF all-weather fighter manufactured by the Convair Division of General Dynamics. This aircraft is powered by one J75-P-11 turbojet engine rated at 24,500 lbs. maximum takeoff thrust with afterburner. The engine is manufactured by the United Aircraft Corporation, Pratt and Whitney Aircraft Division.

This volume provides measured data defining the bioacoustic environments produced inside the 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 F-106B 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 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. 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.

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 F-106B aircraft during typical speed, altitude, and flight maneuver conditions. These levels describe the standard F-106B 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 inside the cockpit at the pilot's location. 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, etc.

The microphone was attached to the pilot's helmet by means of a lightweight boom. This arrangement enabled adjustment of the microphone close to the ear level at a distance of 0.1 meter with its diaphragm parallel and facing away from the helmet's surface. In the analysis, microphone corrections for random incidence were applied to the overall systems response. The recorded samples were analyzed using a four or eight second integration time to obtain a power-averaged level which 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 F-106B aircraft at the specified location. This table includes the overall, $\frac{1}{3}$ 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 LOCATIONS AND TEST CONDITIONS
 F-106B, Tyndall AFB FL, 8 June 78
 Tail #904

<i>Location</i>	<i>Position</i>	<i>Height above Deck</i>
1	Pilot, Front Seat	Seated Head Level
<i>Condition</i>	<i>Description</i>	
A	Ground Runup - Engine Idle - Canopy Open	
B	Ground Runup - Engine Idle - Canopy Closed	
C	Taxi - Engine Idle - Canopy Open	
D	Taxi - Engine Idle - Canopy Closed	
E	Takeoff	
F	Cruise - 10,000' PA - 325 KIAS	
G	Cruise - 14,000' PA - 340 KIAS	
H	Cruise - 25,000' PA - 375 KIAS, 0.95M	
I	Intercept - 27,000' PA - 375 KIAS	
J	Reattack - 31,000' PA - 375 KIAS	
K	Cruise - 28,000' PA - Engine A/B, 300 KIAS	
L	Cruise - 27,000' PA, 0.95M, IR Seeker Head Up	
M	Cruise - 31,000' PA, 1M, IR Seeker Head Up	
N	Descent To 21,000' PA - 385 KIAS	
O	Descent To 21,000', Speed Brakes Out - 385 KIAS	
P	Cruise - 9,000' - 275 KIAS	
Q	Cruise - 3,000' - 275 KIAS, IR Seeker Head Up	
R	Cruise - 3,000' - 275 KIAS, IR Seeker Head Down	
S	Initial	
T	Gear Down - 225 KIAS	
U	Touchdown	
V	Roll - 100 KIAS	

TABLE: MEASURED SOUND PRESSURE LEVEL (DB)												
1/3 OCTAVE BAND												
NOISE SOURCE/SUBJECT: (OPERATION:)												
F-106B AIRCRAFT ()												
IN-FLIGHT CREW NOISE ()												
LOCATION/CONDITION												
FREQ (HZ)	1/A	1/B	1/C	1/D	1/E	1/F	1/G	1/H	1/I	1/J	1/K	
25	96	79	97	84	94	78	80	76	74	73	72	
31.5	98	79	91	89	99	80	80	77	76	76	77	
40	98	80	91	91	102	84	82	79	77	77	80	
50	99	75	96	84	96	82	77	73	74	71	76	
63	97	76	92	84	113	78	75	75	69	70	73	
80	96	87	93	88	107	90	88	87	83	83	84	
100	96	93	93	97	105	98	97	97	98	97	100	
125	94	88	88	91	102	96	96	97	85	86	86	
160	93	81	89	82	97	87	86	89	86	85	79	
200	93	82	90	82	95	87	86	85	79	80	80	
250	94	83	91	82	96	90	92	87	81	82	79	
315	97	85	96	85	97	97	104	90	85	86	84	
400	99	84	98	85	96	94	104	92	84	82	83	
500	98	84	95	82	94	98	94	93	86	83	85	
630	95	79	93	77	89	97	90	91	85	81	84	
800	99	80	97	79	87	91	89	90	84	82	84	
1000	100	81	100	78	86	86	85	90	85	82	83	
1250	103	81	105	79	84	87	86	88	84	80	83	
1600	98	79	162	77	81	85	85	88	82	80	81	
2000	100	78	101	78	81	83	83	88	80	76	81	
2500	96	74	97	76	79	81	82	86	80	76	80	
3150	99	79	100	77	78	79	81	85	80	76	79	
4000	100	77	101	74	78	78	79	85	80	78	81	
5000	99	72	99	69	74	75	76	82	78	77	79	
6300	100	71	101	69	76	77	77	84	85	86	89	
8000	96	71	98	66	74	76	76	79	78	79	80	
10000	95	67	95	67	73	76	78	80	79	80	82	
12500	90	64	91	63	69	74	76	78	78	79	80	
OVERALL	112	97	112	101	115	105	108	104	100	99	102	

LEVEL CORRECTED TO REMOVE BACKGROUND/ELECTRONIC NOISE.

TABLE: MEASURED SOUND PRESSURE LEVEL (DB)		IDENTIFICATION:										
3		OMEGA 3.2										
		TEST AD-079-002										
		RUN 01										
		23 JUL 79										
		PAGE J1										
NOISE SOURCE/SUBJECT:		OPERATION:										
F-106B AIRCRAFT												
IN-FLIGHT CREW NOISE												
		LOCATION/CONDITION										
FREQ (HZ)		1/A	1/B	1/C	1/D	1/E	1/F	1/G	1/H	1/I	1/J	1/K
31.5	102	84	98	93	104	86	85	82	31	83	82	
63	102	88	98	90	114	91	89	87	84	84	85	
125	99	94	95	98	107	100	100	100	98	98	100	
250	99	89	98	88	101	98	104	93	87	88	86	
500	102	87	100	87	99	101	105	97	90	87	89	
1000	105	85	107	83	91	93	91	94	39	85	88	
2000	103	82	105	82	85	88	88	92	86	82	85	
4000	104	81	105	79	81	83	84	89	84	82	84	
8000	102	75	103	72	79	81	82	86	86	88	90	
OVERALL	112	97	112	101	115	105	108	104	100	99	102	

TABLE: MEASURED SOUND PRESSURE LEVEL (DB)		IDENTIFICATION:											
OCTAVE BAND													
3		OMEGA 3.2											
		TEST AD-079-002											
		RUN 02											
		23 JUL 79											
		PAGE J2											
NOISE SOURCE/SUBJECT:		OPERATION:											
F-106B AIRCRAFT													
IN-FLIGHT CREW NOISE													
		LOCATION/CONDITION											
FREQ (HZ)		1/L	1/H	1/N	1/O	1/P	1/Q	1/R	1/S	1/T	1/U	1/V	
31.5	89	86	76	83	86	86	86	87	87	131	101	99	
63	100	98	81	87	87	91	89	89	89	129	112	98	
125	111	110	92	96	95	109	94	94	93	105	104	102	
250	106	183	81	88	92	101	96	97	97	107	96	92	
500	104	105	86	91	88	99	93	95	95	99	94	90	
1000	99	99	83	88	86	93	89	90	90	91	87	85	
2000	95	95	81	87	84	86	86	86	86	87	84	83	
4000	91	90	80	85	77	80	81	81	81	82	80	78	
8000	89	90	83	83	76	78	79	79	79	79	78	75	
OVERALL	114	112	95	99	99	106	100	101	101	120	113	105	

MEASURES OF HUMAN NOISE EXPOSURE										IDENTIFICATION:					
										UMEGA	3.2				
										TEST AD-079-002					
										OPERATION:	RUN	01			
										F-106B AIRCRAFT	23	JUL	79		
										IN-FLIGHT CREW NOISE	PAGE	H1			
										LOCATION/CONDITION					
1/A	1/B	1/C	1/D	1/E	1/F	1/G	1/H	1/I	1/J	1/K					
HAZARD/PROTECTION															
C-WEIGHTED OVERALL SOUND LEVEL (OASLC IN DB) AT EAR															
A-WEIGHTED OVERALL SOUND LEVEL (OASLA IN DB) AT EAR															
MAXIMUM PERMISSIBLE TIME (T IN MINUTES) FOR ONE EXPOSURE PER DAY (AFR 161-35, JULY 73)															
NO PROTECTION															
OASLC	111	97	111	100	114	105	108	103	100	99	101				
OASLA	111	90	112	90	99	101	103	99	94	92	95				
T	4.5	170	3.8	170	36	25	18	36	85	120	71				
HGU-2A/P HELMET WITH H-154															
OASLA*	96	82	96	83	95	92	97	89	84	84	85				
T	60	679	60	571	71	120	50	202	480	480	404				
HGU-2A/P HELMET WITH H-154(A)															
OASLA*	90	78	90	79	92	88	93	84	80	79	80				
T	170	960	170	960	120	240	101	480	960	960	960				
HGU-2A/P HELMET WITH CUSTOM LINER															
OASLA*	103	86	104	86	97	97	101	94	89	87	88				
T	18	339	15	339	50	50	25	85	202	285	246				
COMMUNICATION															
PREFERRED SPEECH INTERFERENCE LEVEL (PSIL IN DB)															
PSIL	103	85	104	84	91	94	95	94	88	85	87				
ANNoyANCE															
PERCEIVED NOISE LEVEL, TONE CORRECTED (PNLT IN PND9)															
TONE CORRECTION (C IN DB)															
PNLT	120	106	126	106	115	113	115	113	111	110	112				
C	1	1	1	1	1	1	1	1	2	2	3				

* BASED ON CALCULATED SPL SPECTRUM UNDER PROTECTIVE DEVICE.

MEASURES OF HUMAN NOISE EXPOSURE										IDENTIFICATION:	
1/L	1/M	1/N	1/O	1/P	1/Q	1/R	1/S	1/T	1/U	1/V	
HAZARD/PROTECTION											
C-WEIGHTED OVERALL SOUND LEVEL (OASLC IN DB) AT EAR											
A-WEIGHTED OVERALL SOUND LEVEL (OASLA IN DB) AT EAR											
MAXIMUM PERMISSIBLE TIME (T IN MINUTES) FOR ONE EXPOSURE PER DAY (AFR 161-35, JULY 73)											
NO PROTECTION											
OASLC	113	112	94	99	98	105	100	101	119	113	104
OASLA	105	105	90	94	92	99	95	96	102	96	92
T	11	13	173	85	120	36	71	60	21	60	120
HGU-2A/P HELMET WITH H-154											
OASLC*	100	98	79	83	85	93	88	89	100	92	87
T	30	42	960	571	404	101	240	202	30	123	285
HGU-2A/P HELMET WITH H-154(A)											
OASLC*	95	93	74	79	81	89	84	85	98	90	84
T	71	101	960	960	807	202	480	404	42	170	460
HGU-2A/P HELMET WITH CUSTOM LINER											
OASLC*	103	102	84	89	88	97	92	93	101	94	90
T	18	21	483	202	240	50	120	101	25	85	170
COMMUNICATION											
PREFERRED SPEECH INTERFERENCE LEVEL (PSIL IN DB)											
PSIL	100	100	83	89	86	93	89	90	92	88	86
ANNOYANCE											
PERCEIVED NOISE LEVEL, TONE CORRECTED (PNLT IN PNOB)											
TONE CORRECTION (C IN DB)											
PNLT	120	120	106	109	107	113	109	110	121	114	109
C	1	1	2	1	2	1	1	1	1	0	1

* BASED ON CALCULATED SPL SPECTRUM UNDER PROTECTIVE DEVICE.