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FOR HEALTH & ENVIRONMENT

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Community Noise Survey of AF37/T-10 Hush Houses, Langley AFB VA

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This report provides results of the survey of the AF37/T-10 Hush Houses at Langley AFB performed on 27-31 Jan 89 by AFOEHL. The base Bioenvironmental Engineering Service, 1 Medical Group/SGPB, requested this noise study to confirm their tentative conclusion that T-10 hush house operations are the cause of complaints of a civilian. The civilian contends hush house operations are vibrating his house and thus disturbing him and his wife, as well as causing damage to his house. The condition of the two T-10 hush houses, as well as the background of problems with their installation, is discussed. The results of noise measurements taken at selected points 250 feet from each hush house under various operating conditions show the hush houses did not meet the design noise criteria. Measurements taken at the complainant's property and at another house in the community showed the wind is causing the low frequency energy to be directed downwind to produce an intermittent problem in the community. Recommendations are made to operate in the short term under wind conditions which do not create community problems. The long term solution is to repair the hush houses.

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Illustrations

1. INTRODUCTION

A. Purpose: This report provides results of the survey of the two AF37/T-10 Hush Houses at Langley AFB performed on 27-31 Jan 89 by AFOEHL. The base Bioenvironmental Engineering Service, 1 Medical Group/SGPB, requested this noise study to confirm their tentative conclusion that T-10 hush house operations are the cause of complaints by Mr Miller, a civilian. The base requested we define and provide a solution to the problem.

B. Problem: Mr Miller contends Hush House operations are vibrating his house. Not only is this disturbing him and his wife, but he claims this has caused damage to his house. Aircraft maintenance operations are under a restricted work schedule to reduce night time complaints, creating a maintenance backlog.

C. Scope: The condition of the two T-10 hush houses, as well as the background of problems with their installation, is discussed. The results of noise measurements taken at selected points 250 feet from each Hush House under various operating conditions are reported. Measurements taken at the complainants property and at another house in the community are also examined. Recommendations are made for both a short term and long term solution to abate the problem.

II. DISCUSSION

A. Standards.

1. T-10 Hush Houses. Acceptance testing for noise on T-10 hush houses consists of performing measurements at 20 locations on two 250 foot semi-circular arcs as shown in Figure 1. The A-weighted sound level should not exceed 80 dB at any of these positions. It is necessary to control not only audible noise, but low-frequencies which may induce vibrations in surrounding structures. Hush houses reduce audible noise by transferring considerable energy from the audible to the subaudible frequency range. Infrasound, frequencies below 30 Hz, are not perceived well by the human ear and people do not usually notice these frequencies unless the levels are very high. These low frequencies produce no adverse health effects below 145 dB. However, when sufficient energy is transmitted it may be felt directly or the vibrating material may produce audible sounds. The adverse effects of this low frequency energy are controlled by the use of siting criteria to ensure buildings are not within the zone of influence of these effects. The zones of influence, or guidelines for minimum distances, are as shown in Table 1. These zones of influence are based upon a worst case comparison of vibration analyses and a survey of base complaints and are not blanket criteria.

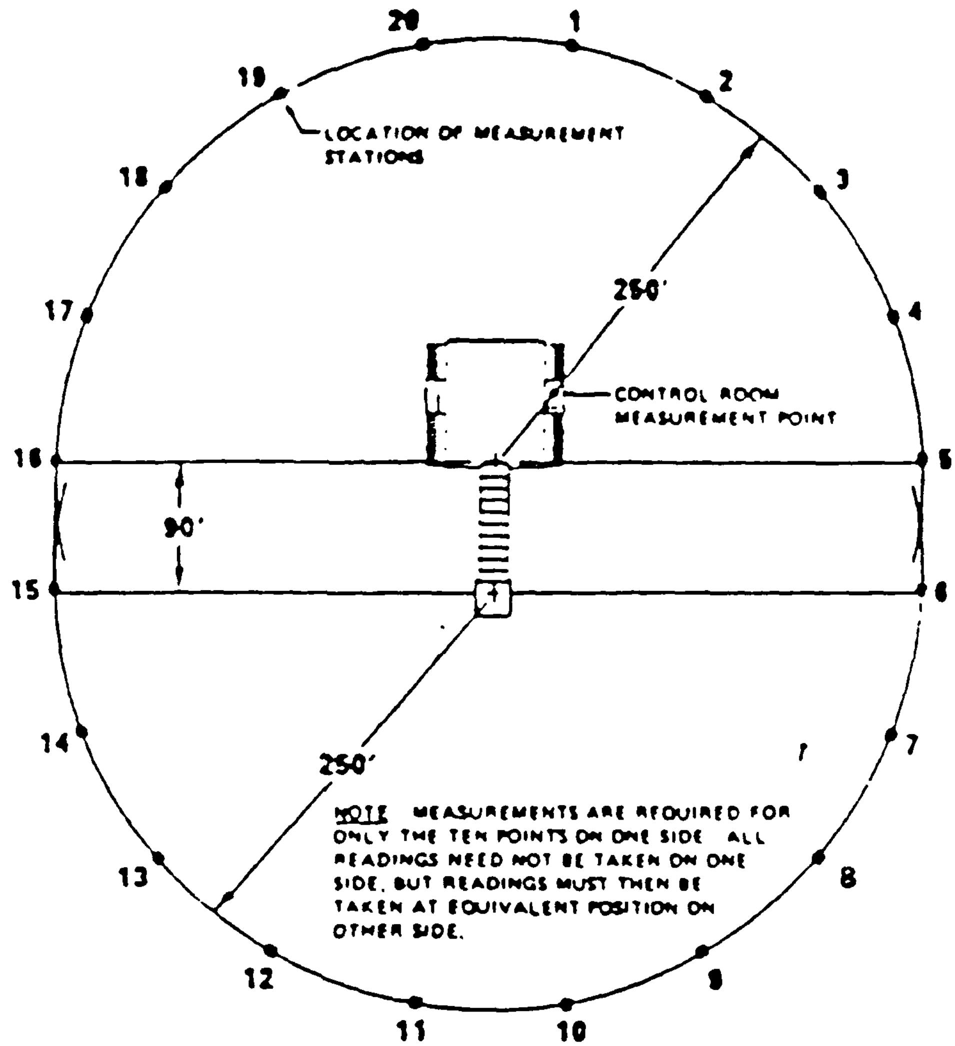


Figure 1. Acceptance Test Noise Measurement Points

Table 1. Zones of Influence (1:118)

Building Function	Distance (ft)*
Workshop (full-time occupancy) - Masonry with 15-25% door and window openings **	550
Prefabricated steel buildings single story	500
Office - masonry with 15-25% door and window openings **	
single story	500
multi-story	1000
Vibration sensitive equipment (e.g., optical microscopes, photo interpretation light tables)	
single story/concrete block	500-1000
single story/prefab steel	1000
multi-story/prefab steel	2000
Residential/Community ***	
community	1000-3000
housing	2000
medical	3000

* Radial distance as measured from both ends of exhaust tube
** Using a weighting factor of 1 to adjust for different building functions per ANSI S3.29-1983.
*** HQ AFLC/DEPV, "Interim Site Planning Guidance for Aircraft Jet Engine Hush House Facilities," 10 July 1984.

2. Community Noise. The Environmental Protection Agency published a report (1) which outlines equivalent sound levels to protect public health and welfare. A summary of these recommendations is shown at Table 2. The table identifies a 24-hour equivalent A-weighted sound level (Leq) of 70 dB to protect public health (primarily to prevent hearing loss) and a day-night average sound level (Ldn) of 55 dB(A) outdoors to prevent activity interference in residential areas with outside space and farm residences. Table 3 shows the exclusion distances based on human effects for maximum sound pressure levels.

Table 2. Yearly Average Sound Levels Identified to Protect the Public Health and Welfare with an Adequate Margin of Safety (2:29)

	Measure	Indoor Activity Interference	Indoor Hearing Loss Consideration	Indoor To Protect Against Both Effects (b)	Outdoor Activity Interference	Outdoor Hearing Loss Consideration	Outdoor To Protect Against Both Effects (b)
Residential with Outside Space and Farm Residences	L_{dn}	45		45	55		55
	$L_{eq(24)}$		70			70	
Residential with No Outside Space	L_{dn}	45		45			
	$L_{eq(24)}$		70				
Commercial	$L_{eq(24)}$	(a)	70	70(c)	(a)	70	70(c)
Inside Transportation	$L_{eq(24)}$	(a)	70	(a)			
Industrial	$L_{eq(24)}$(d)	(a)	70	70(c)	(a)	70	70(c)
Hospitals	L_{dn}	45		45	55		55
	$L_{eq(24)}$		70			70	
Educational	$L_{eq(24)}$	45		45	55		55
	$L_{eq(24)}$(d)		70			70	
Recreational Areas	$L_{eq(24)}$	(a)	70	70(c)	(a)	70	70(c)
Farm Land and General Unpopulated Land	$L_{eq(24)}$				(a)	70	70(c)

Code:

a. Since different types of activities appear to be associated with different levels, identification of a maximum level for activity interference may be difficult except in those circumstances where speech communication is a critical activity. (See Figure D-2 for noise levels as a function of distance which allow satisfactory communication.)

b. Based on lowest level.

c. Based only on hearing loss.

d. An $L_{eq(8)}$ of 75 dB may be identified in these situations so long as the exposure over the remaining 16 hours per day is low enough to result in a negligible contribution to the 24-hour average, i.e., no greater than an L_{eq} of 60 dB.

Note: Explanation of identified level for hearing loss: The exposure period which results in hearing loss at the identified level is a period of 40 years.

*Refers to energy rather than arithmetic averages.

Table 3. Exclusion Distances Based on Human Effects for Maximum Sound Pressure Levels (1:117)

Source/Health Effect	Target Noise Level (Outside)	Exclusion Distance * (ft)
Infrasound (15 Hz)		
Chronic	95 dB	4000 Assuming no building attenuation
Acute	120 dB	250 Assuming no building attenuation
Noise		
Hearing Loss	80 dB(A)	250 Open work area
	95 dB(A)	200 Inside building (assuming 15 dB Attenuation)
Speech Interference	80 dB(A) (assume 15 dB Attenuation)	800 95% indoor sentence intelligibility
	65 dB(A)	4000 95% sentence intelligibility at 2 meters raised voice

* Directly behind augmentor tube.

B. Methodology. A microphone with windscreen on a 1.6 meter pole was swept up and down directly over the test point from approximately 0.3 to 3 meters elevation with the microphone axis pointed directly at the hush house. During the approximately 30 second period of the sweep, tape recording was performed and the tapes were later analyzed using a real time analyzer. Spot checks with a hand held sound level meter were accomplished to compare with analyzed results to ensure operational errors had not occurred during data collection. Calibration tapes were made both before and after the survey to verify system performance and produce frequency response curves used to correct the data. Microphone calibration curves were also used to correct the data. Calibration signals, produced by an acoustic calibrator, were recorded before and after each series of readings. A complete list of equipment is shown at Appendix A.

Weather conditions, including temperature, relative humidity, wind speed and direction, and barometric pressure, were monitored at each measurement location by a local weather observer. These data were used to ensure weather conditions did not interfere with measurements and to correct readings to standard conditions as appropriate.

Recordings were made on 28 Jan 89 to determine if the hush houses still met the acceptance criteria. Both hush houses, designated T-10/1 and

T-10/2, were assessed independently at both military and afterburner power levels. T-10/1, installed in March 1986, is configured to test engines installed in the F-15 aircraft. T-10/2, installed in March 1988, is configured to test bare F-100-PW-100 engines in a test stand. Only points 7 through 11 for T-10/1 and 6 through 11 for T-10/2 (see Figure 1) were tested since these included the loudest points for each configuration and were the most likely to create problems at Mr Miller's property (Figure 2). Recordings were made on Mr Miller's property on 28 Jan 89 during the day and night. These tests were performed with T-10/1 and T-10/2 running both individually and together in both military and afterburner power. Readings were also taken at night on his daughter's property, located in another neighborhood (1919 Seward Drive), with T-10/2 in afterburner. Background levels were recorded for each series of tests for comparison to hush house noise levels.

C. Findings:

A discussion with Mr Art Woytek, Hush House Program Office, Kelly AFB, prior to our visit revealed previous hush house problems had been experienced at Langley. At the time of installation of the second hush house (T-10/2) the Corps of Engineers allowed the contractor to install a sand foundation under and around the augmentor tube and deflector instead of the 3/4" aggregate required. This was in spite of the recommendation to the contrary by the Hush House Program Office at Kelly AFB. Appendix B contains the documentation concerning the foundation. The report shows that at initial fire up a cloud of sand was ejected from the deflector. After a foreign object damage (FOD) hazard was ruled out, testing showed the cell did not pass the acoustic criteria. Removal and inspection of the insulation disclosed the sand had packed the insulation, decreasing its ability to attenuate the noise. After insulation replacement, the test cell passed acoustic testing. The presumption appears to have been the sand was no longer present in quantities sufficient to create a problem. Our visual inspection of the test cells on 28 Jan 89 revealed not only had the insulation become packed down in T-10/2, but T-10/1 had the same problem and also appeared not to have the required aggregate foundation. Both hush houses had sand and small gravel deposited inside the augmentor and deflector areas.

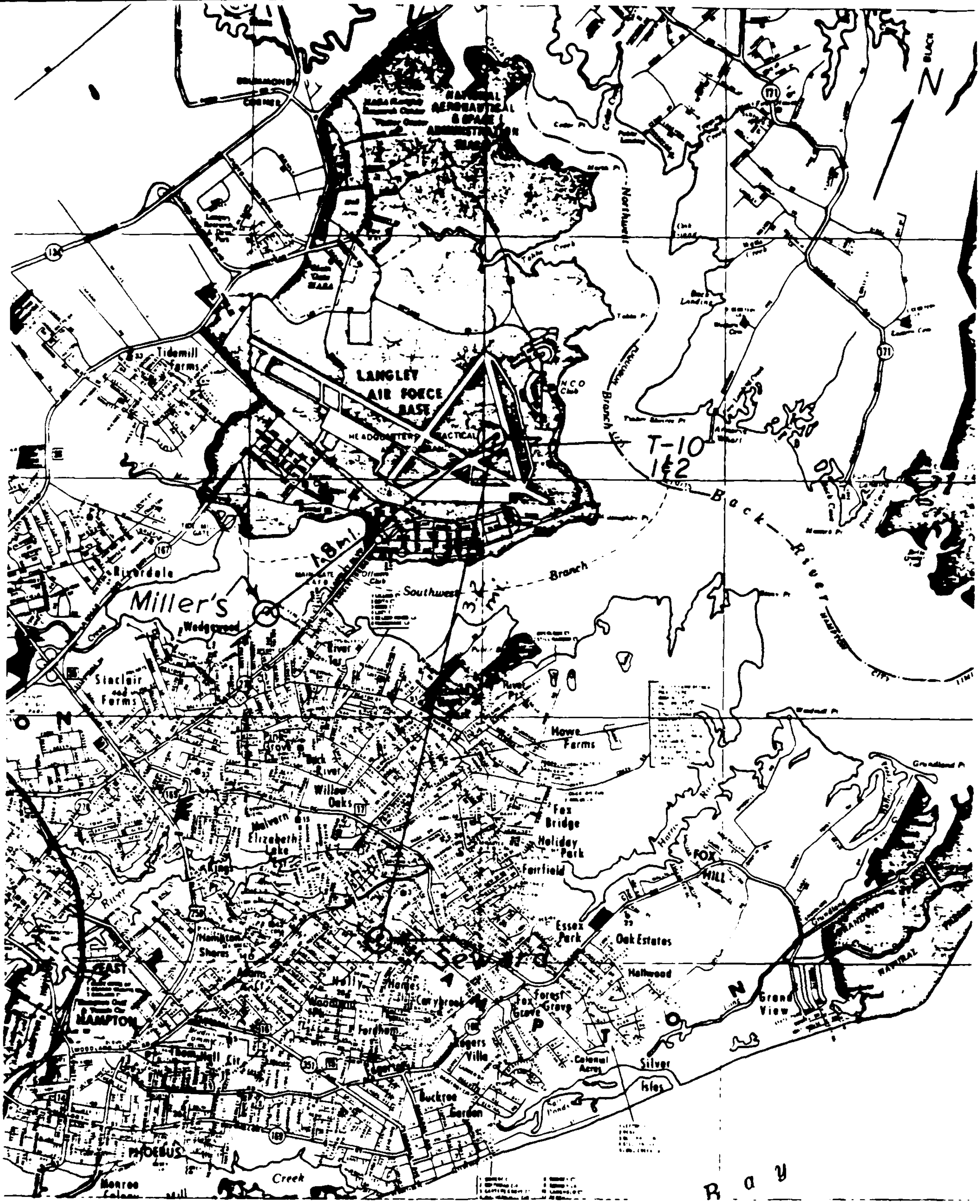


Figure 2. Map of Langley AFB and Local Area.

As summarized in Table 4, acoustic tests performed at 250 feet on both hush houses revealed T-10/1 just met the 80 dB(A) criteria, but T-10/2 did not. One-third octave band sound pressure levels for all points measured are given in tabular and graphic form in Appendix C. Even when properly working, hush houses testing bare engines produce higher noise levels than when testing engines installed in aircraft.

Table 4. Acceptance Test on T-10 Hush Houses in Afterburner Langley AFB, 28 Jan 89

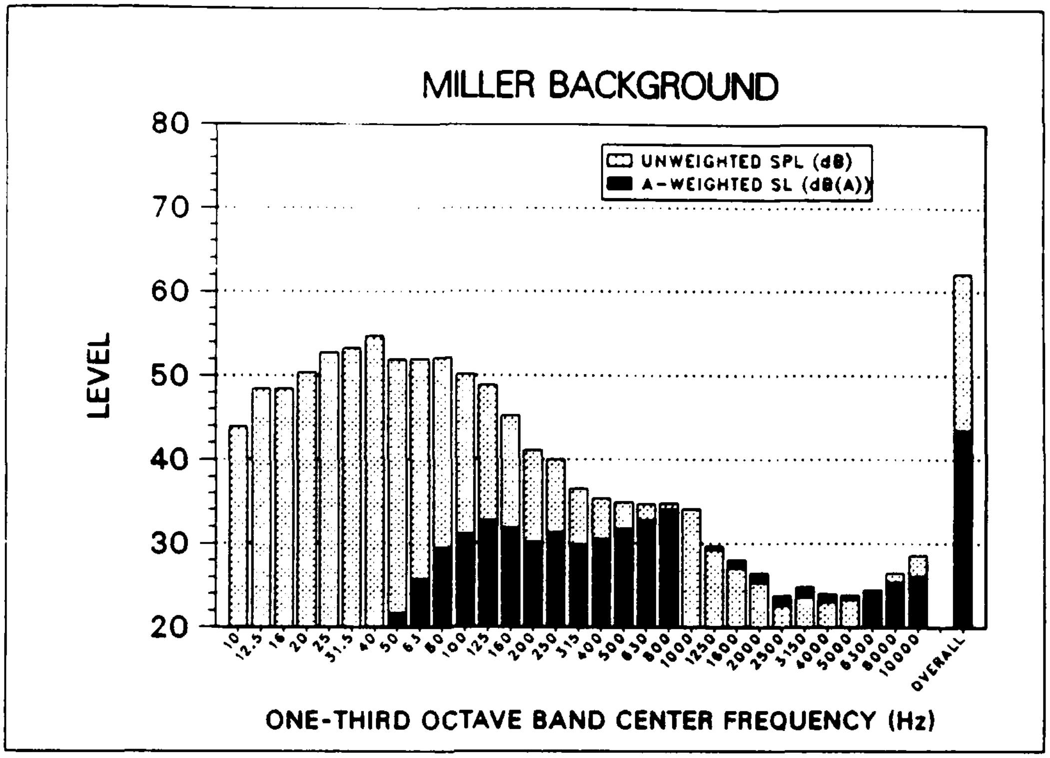
Hush House	Overall A-Weighted Sound Pressure Level [dB(A)]					
Position ->	6	7	8	9	10	11
T-10/1 (F-15 Aircraft w/F-100 Engines)	*	78.1	77.9	79.1	78.6	78.9
T-10/2 (F-100, Bare Engine)	79.8	79.5	79.5	80.5	81.1	81.5

* Not measured - in the shadow of T-10/2

Noise tests at Mr Miller's property on the afternoon and evening of 28 Jan 89 showed no appreciable difference between background noise levels and noise produced by aircraft being tested in the hush houses, either by measurement or subjectively. The test results are shown at Table 5 and Figure 3. As the tests at Mr Miller's property were coming to a close at 2230, his daughter called him to say she was experiencing effects similar to those he had described to her. She named the exact times the hush houses had been running in afterburner. Measurements taken on her property at 1919 Seward Drive (see Table 6 and Figure 4) later in the evening confirmed the presence of increased low frequency energy during operation of T-10/2 in afterburner. The effect was also evident subjectively through both vibration sensations and audible house vibrations. Complaints from others in the same area during this period confirmed the existence of a problem.

D. Observations:

The degradation of the ability of the T-10 to attenuate noise resulting from the improper foundation material allowing sand and small rocks to be drawn in by the jet engine intake and exhaust will continue unless measures are taken to correct the problem. Both hush houses suffer from this problem. The effect is worse in T-10/2, since it is used to test bare engines which produce more noise than installed engines. Inspection of both hush houses revealed gravel and sand had accumulated where the augmentor meets the deflector section. About 50 percent of the insulation had been moved away from the screen, seriously degrading the attenuation.



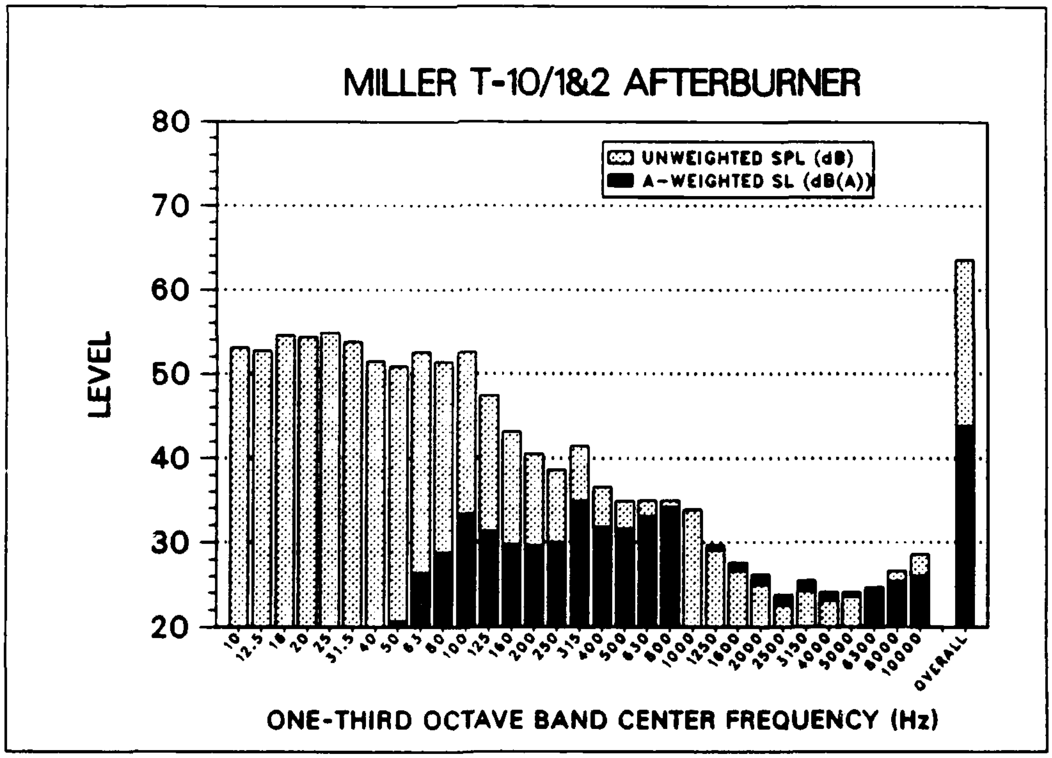
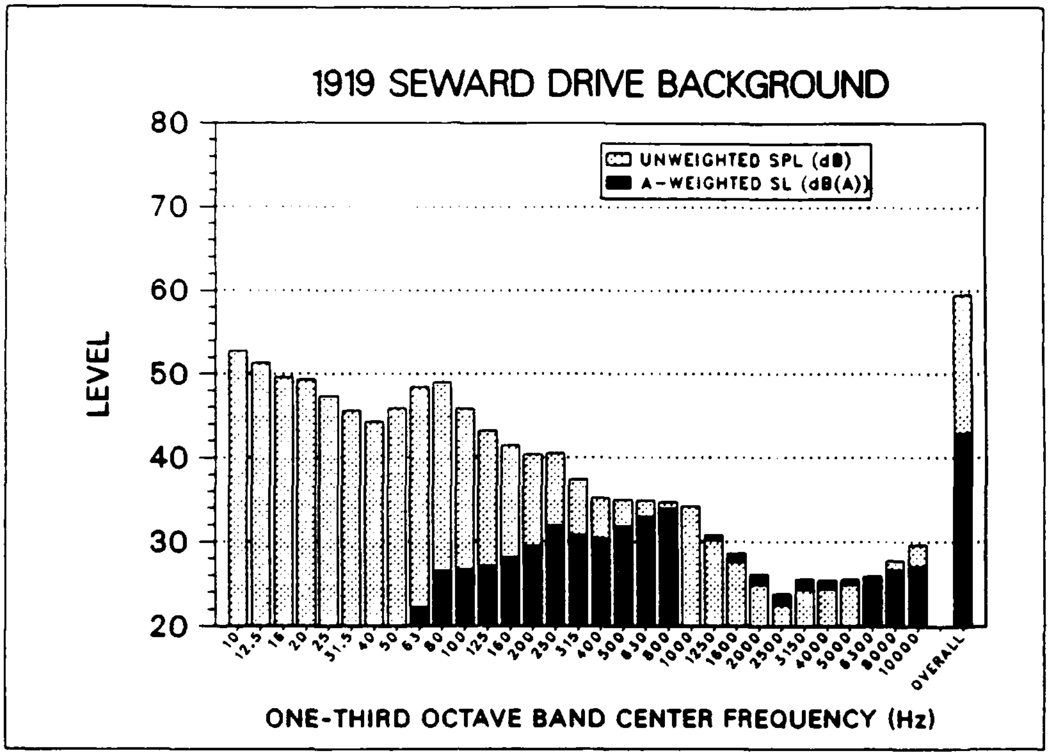


Figure 3. Measurements at the Millers' Property with Both T-10/1 & 2 in Afterburner, 2200 Hrs, 28 Jan 1989

Table 5. **Measurements at the Millers' Property with Both T-10/1 & 2 in Afterburner, 2200 Hrs, 28 Jan 89**

One Third Octave Band Frequency (Hz)	Background Sound Pressure Level (dB)	T-10/1 & 2 AB Sound Pressure Level (dB)	T-10/1 & 2 AB Minus Background (dB)
10	43.9	53.1	9.2
12.5	48.4	52.7	4.3
16	48.4	54.6	6.2
20	50.4	54.6	4.2
25	52.8	54.9	2.1
31.5	53.3	53.8	0.5
40	54.7	51.5	- 3.2
50	51.9	50.9	- 1.0
63	52.0	52.6	0.6
80	52.1	51.4	- 0.7
100	50.2	52.6	2.4
125	48.8	47.4	- 1.6
160	45.2	43.1	- 2.1
200	41.1	40.5	- 0.6
250	40.0	38.6	- 1.4
315	36.5	41.5	5.0
400	35.3	36.6	1.3
500	34.9	34.9	0.0
630	34.7	35.0	0.3
800	34.8	35.0	0.2
1,000	34.1	33.9	- 0.2
1,250	29.2	29.1	- 0.1
1,600	27.1	26.6	- 0.5
2,000	25.3	25.0	- 0.3
2,500	22.6	22.6	0.0
3,150	23.6	24.3	0.7
4,000	23.0	23.1	0.1
5,000	23.3	23.6	0.3
6,300	24.5	24.7	0.2
8,000	26.5	26.6	0.1
10,000	28.6	28.6	0.0

Overall A-weighted	43.5	43.8	0.3



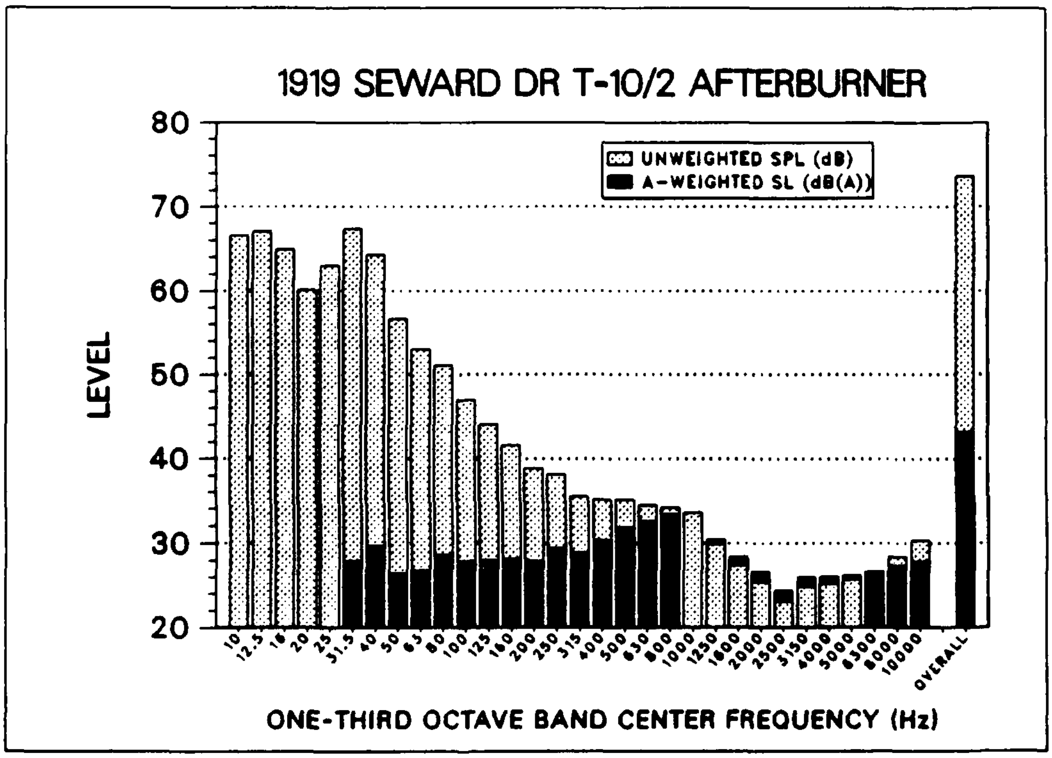


Figure 4. Measurements at 1919 Seward Drive with T-10/2 in Afterburner, 2300 Hrs, 28 Jan 1989

Table 6. Measurements at 1919 Seward Drive with T-10/2 in Afterburner, 2300 Hrs, 28 Jan 89

One-Third Octave Band Frequency (Hz)	Background Sound Pressure Level (dB)	T-10/2 AB Sound Pressure Level (dB)	T-10/2 AB Minus Background (dB)
10	52.8	66.6	13.8
12.5	51.3	67.1	15.8
16	49.6	64.9	15.3
20	49.3	60.1	10.8
25	47.3	63.0	15.7
31.5	45.6	67.4	21.8
40	44.3	64.3	20.0
50	45.9	56.6	10.7
63	48.4	53.0	4.6
80	49.0	51.1	2.1
100	45.8	47.0	1.2
125	43.2	44.1	0.9
160	41.4	41.6	0.2
200	40.3	38.8	- 1.5
250	40.5	38.1	- 2.4
315	37.4	35.5	- 1.9
400	35.2	35.1	- 0.1
500	35.0	35.1	0.1
630	34.9	34.5	- 0.4
800	34.7	34.2	- 0.5
1,000	34.2	33.6	- 0.6
1,250	30.2	29.9	- 0.3
1,600	27.6	27.4	- 0.2
2,000	24.9	25.4	0.5
2,500	22.5	23.1	0.6
3,150	24.3	24.8	0.5
4,000	24.4	25.3	0.9
5,000	24.9	25.7	0.8
6,300	25.9	26.6	0.7
8,000	27.7	28.4	0.7
10,000	29.6	30.3	0.7
Overall A-weighted	42.9	43.2	0.3

AB - Afterburner

Data collected the night of 28 Jan 89 at the Miller property is represented graphically in Figure 3. The background level is 42.9 dB(A). With both hush houses running in afterburner the level is 43.8 dB(A), an insignificant difference, especially since these readings were collected at different times. The low frequency data, below about 50 Hz, show very little difference, with all frequencies indicating readings in the low 50 dB range. No audible difference existed and no rattling of the house occurred. Figure 4 shows direct evidence of the problem collected at 1919 Seward Drive after Mr Miller's daughter called. The background level of 42.9 dB(A) versus the level of 43.2 dB(A) with T-10/2 in afterburner is again not meaningful. However, at 50 Hz and below the change is dramatic. Differences of 14 to 22 dB (equal to levels 25 to 158 times higher) make apparent the effect the wind has on shifting this effect. The wind was 11 degrees at less than 5 knots. This location is at 191 degrees relative to the hush houses. Therefore, it was directly downwind from the hush houses. Thus, the wind directs the noise, particularly at low frequencies, causing an intermittent problem at any one particular location.

The A-weighted sound pressure level caused by hush house operations does not exceed background levels by any significant amount. The measured afterburner noise level of less than 45 dB(A) would not contribute to the Ldn enough to cause the EPA recommended Ldn level of 55 dB(A) to be exceeded. Thus, technically there is no audible community noise problem created by operation of the hush houses even in their presently degraded condition. The exclusion distance levels for human effects are also not exceeded.

III. CONCLUSIONS

A. Both T-10 Hush Houses are out of specification and must be repaired. The first T-10 would probably not pass if a bare engine was installed. The visual evidence of packed insulation accompanied by the presence of sand and small gravel in T-10/1 and 2 indicates the same problem with both hush houses. The performance of both will continue to degrade, creating more widespread problems and complaints.

B. The low frequency energy, increased because of the degradation of the hush houses (primarily T-10/2 at present), is being channeled by the wind to create problems downwind of the hush houses. The problem is intermittent since only at certain times is a particular populated area downwind of the hush houses. The Environmental Protection Agency recommendation of an Ldn of 55 dB(A) is not exceeded by hush house operation.

C. The complaints by Mr Miller of the rattling of windows and other objects were validated during a visit by the base bioenvironmental engineering and public affairs offices. Recordings taken during this AFOEHL survey at Mr Miller's daughter's house objectively confirm the presence of low frequency noise concurrent with hush house operations. We do not believe it is likely the cracks in Mr Miller's house were caused by hush house operations. However, we are not structural damage experts.

IV. RECOMMENDATIONS

A. Long Term

1. Repair the hush houses by submitting an emergency request to SA-ALC as outlined in T.O. 00-25-107. The foundation problem must be resolved to ensure the situation does not recur.

2. Perform acoustic testing after the repairs to ensure the criterion is met and low frequencies have been reduced.

B. Short Term

1. Restrict the operation of the hush houses to times when the wind is not blowing in the direction of highly populated areas. Winds up to about 5 to 7 knots may be tolerable, but if complaints occur this constraint may have to be made more restrictive.

2. Continue to maintain the log of complaints already started. Correlate this log with wind speed and direction to relax or tighten the weather restriction as appropriate.

3. Inform the community, and particularly Mr Miller, of the results of the survey and its conclusions. Explain the problem is the result of malfunctioning equipment which will take some time to repair. The weather restriction will allow the base to accomplish its mission while minimizing, but possibly not eliminating, the adverse impact on the community. The base should explain the plan and work with the community (and especially the Millers) to modify weather restrictions to this end.

REFERENCES

1. "Preliminary Final of Hush House Site Planning Bulletin", HQ AFLC/DEPR Ltr, 4 Aug 1987.

2. Information on Levels of Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety, EPA Report 550/9-74-004, Environmental Protection Agency (March, 1974)

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APPENDIX A

Measurement System Equipment List

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RECORDING SYSTEM EQUIPMENT

Equipment	Manufacturer	Model/Type	Serial Number
Tape Recorder	Bruel & Kjaer	7006	130751
Microphone Power Supply	Bruel & Kjaer	2804	1338144
Microphone Preamplifier	Bruel & Kjaer	2639	1334751
Microphone	Larson Davis	2541	1070
Frequency Modulation Units (4 each)	Bruel & Kjaer	ZM0053	N/A

CALIBRATION EQUIPMENT

Equipment	Manufacturer	Model/Type	Serial Number
Acoustic Calibrator	Larson Davis	CA 250	0338
Synthesizer/Function Generator	Hewlett Packard	3325A	2512A22219
Distortion Analyzer	Hewlett Packard	334A	1140A11082

DATA ANALYSIS EQUIPMENT

Equipment	Manufacturer	Model/Type	Serial Number
Real Time Analyzer	Norwegian Electronics	830	11530

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APPENDIX B

T-10/2 Installation Documentation

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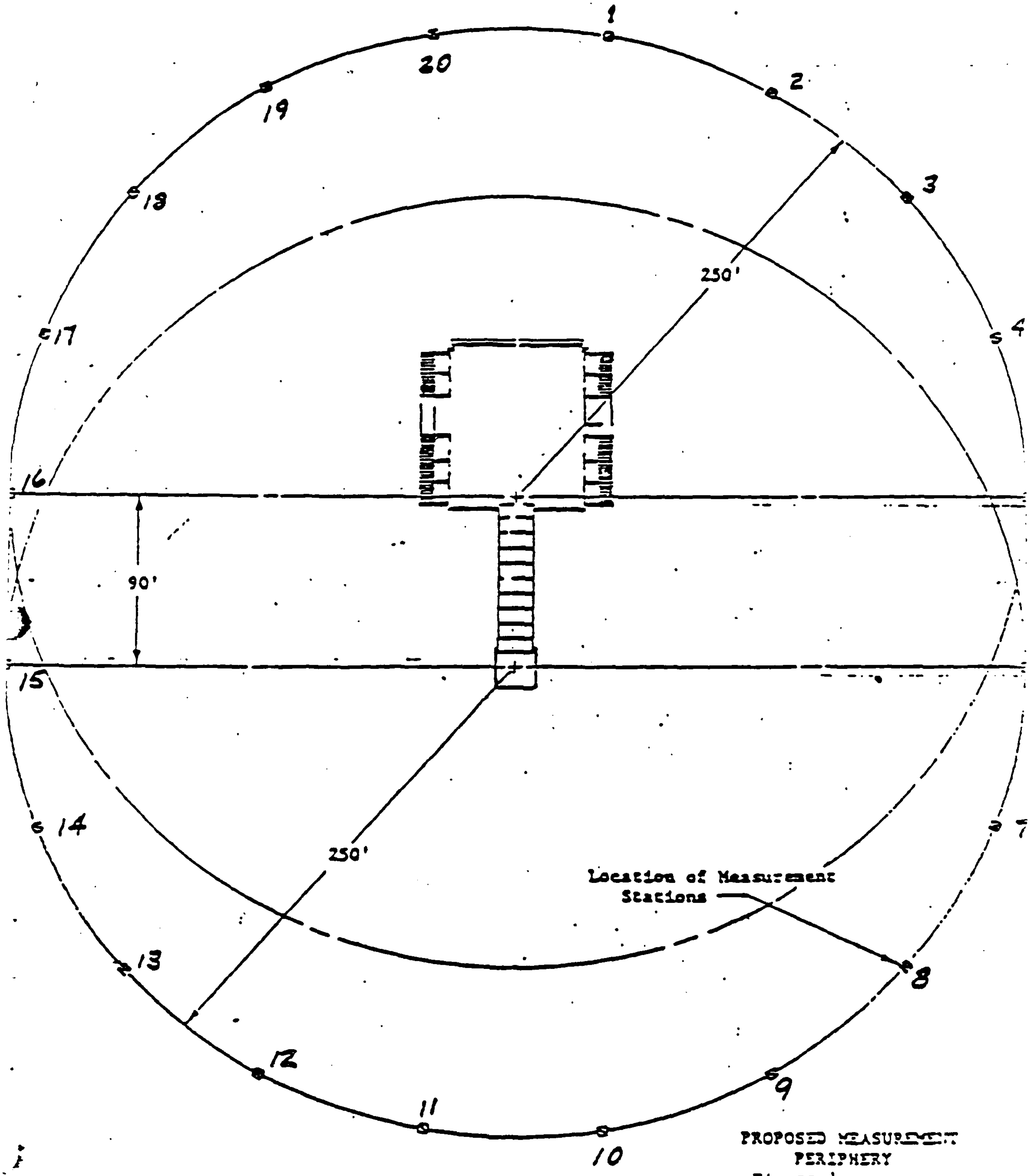

PROPOSED MEASUREMENT
PERIPHERY
Figure 1

TEST REPORT

ACOUSTICAL EVALUATION

Test conducted before replacement of deflector

Contract No. F41608-82-C-1960

Date 3-24-88 Location Langley AFB

Noise Suppressor Model A/F37T-10 Serial No. F100-PW100 #P681071

Test Conducted By Richard Herbin Industrial Acoustics Company

Test Witnessed Dahlen Gardner USAF Representative/Office

ACOUSTICAL MEASUREMENT EQUIPMENT

DESCRIPTION	MANUFACTURER	TYPE	SERIAL NO.
Sound Level Meter			
Octave Band Analyzer			
Acoustical Calibrator			
Microhpones (for use with 50' cable)			

OPERATING CONDITIONS

Aircraft/Engine ______

Serial No. ______

☐ R.H. Eng. @ ______ Pwr.

☐ L.H. Eng. @ ______ Pwr.

☐ SGL. Eng. @ ______ Pwr.

☐ Bare Eng. @ MIL / AB Pwr.

Cell Depression 1.8 / 2.0 in H_2O

METEOROLOGICAL DATA

Ambient Temperature ____ °F ______

Barometric Pressure ____ in. HG.

Relative Humidity ____ %

Surface Wind Velocity MPH 10-15, gusts 22

Surface Wind Direction Az W/SW

Precipitation ______ Fog ______

Time of Day ______

MEASUREMENTS

POSITION & DISTANCE	SOUND LEVEL dBA MIL	AB
1 250'	76	82
2	80 ⇄	76
3	74	80
4	71	77
5	70	76
6	72	80
7	72	82
8	74	82
9	74	83
10	73	82
11	73	82
12	73	82
13	74	81
14	75	82
15		
16		
17		
18	76	78
19	74	77
20 250'	77	81
CONTROL ROOM	63	69

TEST REPORT

ACOUSTICAL EVALUATION — Test conducted before replacement of deflector

Contract No. F41608-82-C-1960

Date Fri 3-24-88 Location Langley

Noise Suppressor Model A/F37T-10 Serial No. F16C #2018

Test Conducted By R Herbin Industrial Acoustics Company

Test Witnessed D Gardner USAF Representative/Office

ACOUSTICAL MEASUREMENT EQUIPMENT

DESCRIPTION	MANUFACTURER	TYPE	SERIAL NO.
Sound Level Meter			
Octave Band Analyzer			
Acoustical Calibrator			
Microhpones (for use with 50' cable)			

OPERATING CONDITIONS

Aircraft/Engine ________

Serial No. ________

☐ R.H. Eng. @ ______ Pwr.

☐ L.H. Eng. @ ______ Pwr.

☐ SGL. Eng. @ ______ Pwr.

☐ Bare Eng. @ ______ Pwr.

Cell Depression 1.6 / 1.8 in H_2O
MIL / AB

METEOROLOGICAL DATA

Ambient Temperature ___ °F ______

Barometric Pressure ___ in. HG.

Relative Humidity ___ %

Surface Wind Velocity MPH 25-28 knot

Surface Wind Direction Az 25- W/SW

Precipitation ______ Fog ______

Time of Day ______

MEASUREMENTS

POSITION & DISTANCE	SOUND LEVEL dBA MIL	AB
1 250'	73	80
2	70	78
3	70	78
4	68	75
5	65	73
6	70	80
7	72	80
8	70	80
9	68	78
10	69	79
11	72	79
12	73	81
13	74	81
14	74	82
15		
16		
17		
18	71	77
19	68	76
20 250'	72	82
CONTROL ROOM	64	

TEST REPORT

ACOUSTICAL EVALUATION

Contract No. F41608-86-C-1400

Date 29 March 1988 Location Langley AFB

Noise Suppressor Model A/F37T-10 Serial No. ____

Test Conducted By R Herbin Industrial Acoustics Company

Test Witnessed D Gardner USAF Representative/Office

ACOUSTICAL MEASUREMENT EQUIPMENT

DESCRIPTION	MANUFACTURER	TYPE	SERIAL NO.
Sound Level Meter	B&K 2215		
Octave Band Analyzer	and SA-ALC Digital readout B&K meter		
Acoustical Calibrator			
Microhpones (for use with 50' cable)			

OPERATING CONDITIONS

Aircraft/Engine F-15C

Serial No. 3025

☐ R.H. Eng. @ ____ Pwr.

☐ L.H. Eng. @ ____ Pwr.

☐ SGL. Eng. @ ____ Pwr.

☐ Bare Eng. @ ____ Pwr.

Cell Depression ____ in H_2O

METEOROLOGICAL DATA

Ambient Temperature 70 ° F ____

Barometric Pressure ____ in. HG.

Relative Humidity ____ %

Surface Wind Velocity MPH 5-8

Surface Wind Direction Az Southeast

Precipitation clear Fog ____

Time of Day ____

Data transcribed by R Herbin on 4-27-88

MEASUREMENTS

POSITION & DISTANCE	SOUND LEVEL MIL dBA	AB
1 250'	74	79.5
2	71	77.5
3	71	78
4	69	76
5	66	75
6	74.5	83
7	75	83
8	74.5	82
9	75.5	82.5
10	75	81
11	75.5	82
12	76	84
13	74	83
14		
15		
16		
17		
18	71	77
19	70	76
20 250'	72.5	79
CONTROL ROOM	65	72

(5)

j. Compare recorded data with prototype data on Figure VII.

k. Should deficiencies exist, obtain close-in data to determine cause and corrective action required.

5. CERTIFICATION

The Noise Suppressor System meets the requirements of the documents listed under Paragraph B above and as defined herein except as noted.

Industrial Acoustics Company Representative — Richard Herbin

USAF Representative/Office — Dahlen Gardner 3/30/88

D. COMMENTS (Reference by paragraph no.)

NOISE LEVELS ARE NOT ACCEPTABLE AT REAR OF BUILDING (POINTS 6-15). LEVELS RANGE FROM 81 DB(A) TO 84 DB(A) BY TAKING OCTIVE BAND READINGS, IT WAS DETERMINED THAT MOST OF THE NOISE WAS COMING FROM THE LOWER FREQUANCY BANDS (NOISE FROM DEFLECTOR AREA). AFTER CLOSELY INSPECTING THE DEFLECTOR AREA, IT WAS DETERMINED THAT THE ACCOUSTICAL PANELS WERE NOT INSULATED PROPERLY (1/2 OF THE INSULATION IS MISSING FROM INSIDE ALL PANELS IN THE DEFLECTOR AREA. PANELS WILL HAVE TO BE REMOVED AND REPLACED WITH PROPERLY INSULATED PANELS.

Above per Dahlen Gardner, 3/29/88

Refer to Test Data of 4/20/88 and explanation which follows in Section VI, Page VI-4.

Richard Herbin 4/27/88

VI EXPLANATION OF ACOUSTICAL DATA AND CONDITION OF DEFLECTOR PANELS

During construction of subject Noise Suppressor, IAC noted that the sand fill which had been noted in the IAC foundation inspection report was still present under the augmentor tube and blast deflector. (The correct fill for these areas is coarse stone aggregate.) When the first engine run was attempted during acceptance testing of the completed Hush House, it became apparent that large quantities of this sand were being blown out of the exhaust from the area under the deflector. Since the prevailing winds were depositing this sand around the air intakes and front main doors, testing was halted to allow base personnel to verify that no F.O.D. hazard existed. Acoustical readings subsequently taken during engine and aircraft runs on 23 and 24 March exceeded specification by 2-3 dBA; therefore, it was decided to repeat the tests during the week of 27 March, when the effects of the 20-30 knot winds which had been present during the original tests would be eliminated.

Acoustical readings obtained on 29 March showed higher noise levels than those originally measured, and the augmentor and deflector were inspected for possible causes. The deflector ramp and sidewall panels were then observed to have empty void space in approximately the top 50% of the volume which is normally packed with Basalt Wool insulation.

The IAC South Carolina manufacturing plant was immediately requested to inspect in-process and completed deflector panels to detect similar cases. All panels checked were found to be properly filled. Arrangements were made to ship panels to Langley to replace the apparently defective panels.

Installation of the replacement panels was completed on 20 April. An engine run conducted on that date resulted in satisfactory acoustical readings. At the same time, the defective panels were returned to the factory for inspection.

Inspection of the returned panels indicated that, while they did indeed contain the correct quantity of Basalt Wool insulation, it had been compressed and forced to the bottom by large amounts of sand which had entered, and remained inside, the panels. Therefore, the apparent insulation defects were actually a consequence of an abnormally abusive sand storm environment in the deflector. The causes, as previously noted, were not under the control of IAC, and had been reported by IAC as requiring correction.

Most of the loose sand seems to have been blown out of the deflector, but further undesirable consequences of this condition cannot be ruled out until the proper coarse aggregate is installed.

INDUSTRIAL ACOUSTICS COMPANY
INCORPORATED

DEPARTMENT OF THE AIR FORCE
HEADQUARTERS SAN ANTONIO AIR LOGISTICS CENTER (AFLC)
KELLY AIR FORCE BASE, TEXAS 78241-5000

NOV 03 1987

REPLY TO ATTN OF: PMZSB

SUBJECT: T-10 #2 Foundation at Langley AFB, VA

TO: Army Corps of Engineers
Attn: Mr. Grady Wesson
Drawer K
Langley AFB
Hampton, VA 23665

1. Industrial Acoustics Co., Inc. surveyed the above subject foundation on 8 Oct 1987. Items which your foundation contractor must correct are:

(a) Augmentor area trench must have soil removed and brought to correct elevation with large coarse aggregate (greater than 3/4" in size). The deflector area abutting the end of the augmentor must have soil fill removed and replaced with large coarse aggregate also.

(b) Length of each rail trench in the main front sliding door area must be extended 2" beyond the last set of trench anchor bolts outward of gridlines 4A & 1A.

2. Anchor plates J, L, N & P for the ramp assembly will not require modification location-wise.

3. If you have any questions please call Mr. Arthur Woytek at autovon 945-4281 or Mr. Arturo Gaytan at commercial 512/922-2545.

Thomas Tamez
Thomas Tamez
Contracting Officer

cc: SA-ALC/MMIEM/A. Woytek/J. Garner
SSAI/R. Diggs/A. Gaytan/D. Gardner

AFLC—Lifeline of the Aerospace Team

TEST DATA AFTER REPLACEMENT OF DEFLECTOR

TEST REPORT

ACOUSTICAL EVALUATION

Contract No. F41608-8?-C-1960

Date 20 April 88 Location Langley

Noise Suppressor Model A/F37T-10 Serial No. 219

Test Conducted By G J Sessions Industrial Acoustics Company

Test Witnessed 2Lt O'Toole / [illegible] USAF Representative/Office

ACOUSTICAL MEASUREMENT EQUIPMENT

DESCRIPTION	MANUFACTURER	TYPE	SERIAL NO.
Sound Level Meter	Gen Rad	1982	A56P3/HHB074
Octave Band Analyzer	Gen Rad	1982	A56P3/HHB034
Acoustical Calibrator			
Microhpones (for use with 50' cable)	N/A	N/A	N/A

OPERATING CONDITIONS

Aircraft/Engine F100

Serial No. P68 2050

☐ R.H. Eng. @ ______ Pwr.

☐ L.H. Eng. @ ______ Pwr.

☐ SGL. Eng. @ ______ Pwr.

☑ Bare Eng. @ Mil/AB Pwr.

Cell Depression ______ in H_2O

METEOROLOGICAL DATA

Ambient Temperature ____ °F ______

Barometric Pressure ____ in. HG.

Relative Humidity ____ %

Surface Wind Velocity MPH ______

Surface Wind Direction Az ______

Precipitation ______ Fog ______

Time of Day ______

MEASUREMENTS

POSITION & DISTANCE	SOUND LEVEL dBA	
1 250'	Mil	AB
2		
3		
4		
5	71	77
6	71	76
7	72	78
8	72	79
9	72	80
10	70	79
11	70	79
12	71	79
13		
14		
15		
16		
17		
18		
19		
20 250'		
CONTROL ROOM		

(4)

APPENDIX C

One-Third Octave Band Data

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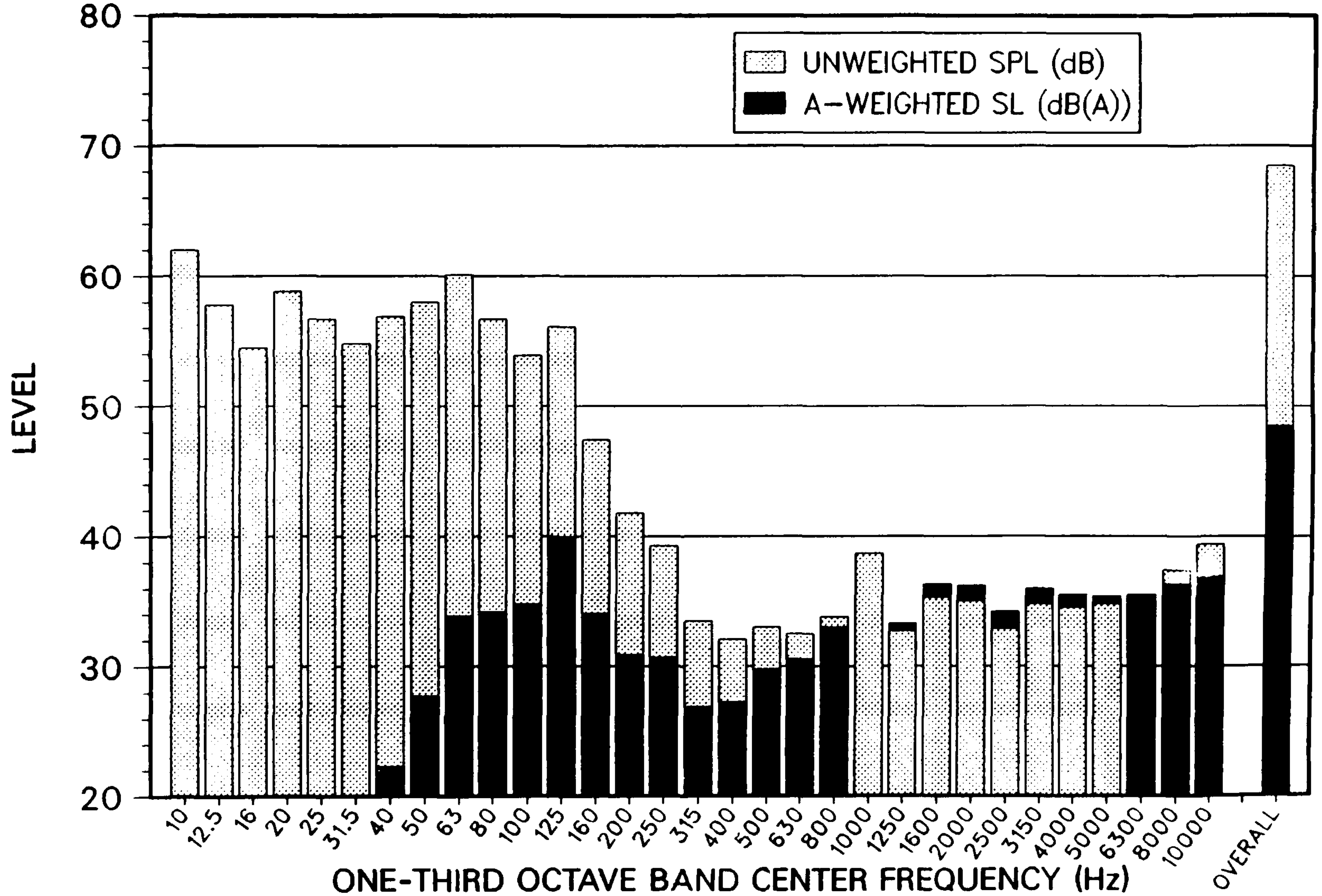
TITLE: LAFB T-10 BACKGROUND

FREQ (Hz)	SOUND PRESSURE LEVEL (dB)	OCTAVE BAND SPL (dB)	A-WEIGHTED SOUND LEVEL [dB(A)]	A-WEIGHTED OCTAVE BAND SL [dB(A)]
10	62		0	
12.5	57.8		0	
16	54.5	62	0	8.7
20	58.8		8.4	
25	56.7		12	
31.5	54.8	60.8	15.4	23.2
40	56.9		22.3	
50	58		27.7	
63	60.1	63.1	33.9	37.4
80	56.7		34.2	
100	53.9		34.8	
125	56.1	58.3	40	41.8
160	47.4		34.1	
200	41.8		30.9	
250	39.3	43.9	30.7	34.4
315	33.5		26.9	
400	32.1		27.3	
500	33	37.1	29.8	34
630	32.5		30.6	
800	33.8		33	
1,000	38.7	40.5	38.7	40.5
1,250	32.7		33.3	
1,600	35.3		36.3	
2,000	35	39.1	36.2	40.2
2,500	32.9		34.2	
3,150	34.8		36	
4,000	34.5	39.3	35.5	40.2
5,000	34.8		35.4	
6,300	35.5		35.4	
8,000	37.4	42.3	36.3	40.8
10,000	39.4		36.9	

*** OVERALL LEVELS (10 - 10000 Hz) ***

OASPL = 68.5 dB OASLA = 48.5 dB(A)

TITLE: LAFB T-10 BACKGROUND

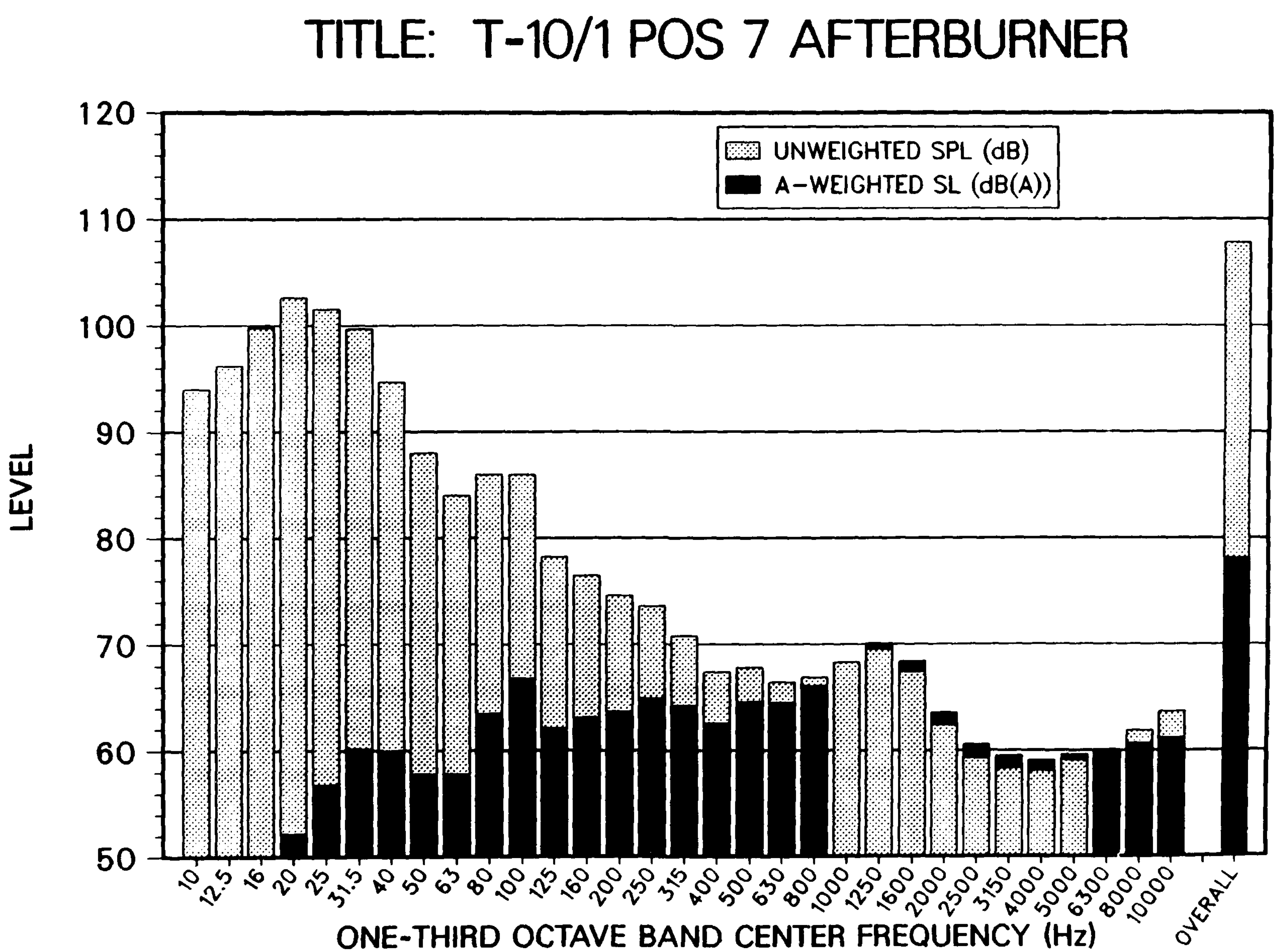


TITLE: T-10/1 POS 7 AFTERBURNER

FREQ (Hz)	SOUND PRESSURE LEVEL (dB)	OCTAVE BAND SPL (dB)	A-WEIGHTED SOUND LEVEL [dB(A)]	A-WEIGHTED OCTAVE BAND SL [dB(A)]
10	94		23.5	
12.5	96.2		32.8	
16	99.8	104.9	43.1	52.5
20	102.6		52.2	
25	101.5		56.8	
31.5	99.7	104	60.2	63.9
40	94.7		60	
50	88		57.8	
63	84	90.9	57.8	65.2
80	86		63.5	
100	86		66.8	
125	78.2	86.8	62.1	69.1
160	76.5		63.1	
200	74.6		63.7	
250	73.6	77.8	64.9	68.9
315	70.8		64.2	
400	67.4		62.6	
500	67.8	71.8	64.6	68.6
630	66.4		64.5	
800	66.9		66.1	
1,000	68.3	73	68.3	73
1,250	69.5		70.1	
1,600	67.4		68.4	
2,000	62.4	68.9	63.6	70
2,500	59.3		60.6	
3,150	58.3		59.5	
4,000	58.1	63.1	59.1	64
5,000	59.1		59.6	
6,300	60.1		60	
8,000	61.9	66.7	60.7	65.3
10,000	63.7		61.2	

*** OVERALL LEVELS (10 - 10000 Hz) ***

OASPL = 107.8 dB OASLA = 78.1 dB(A)

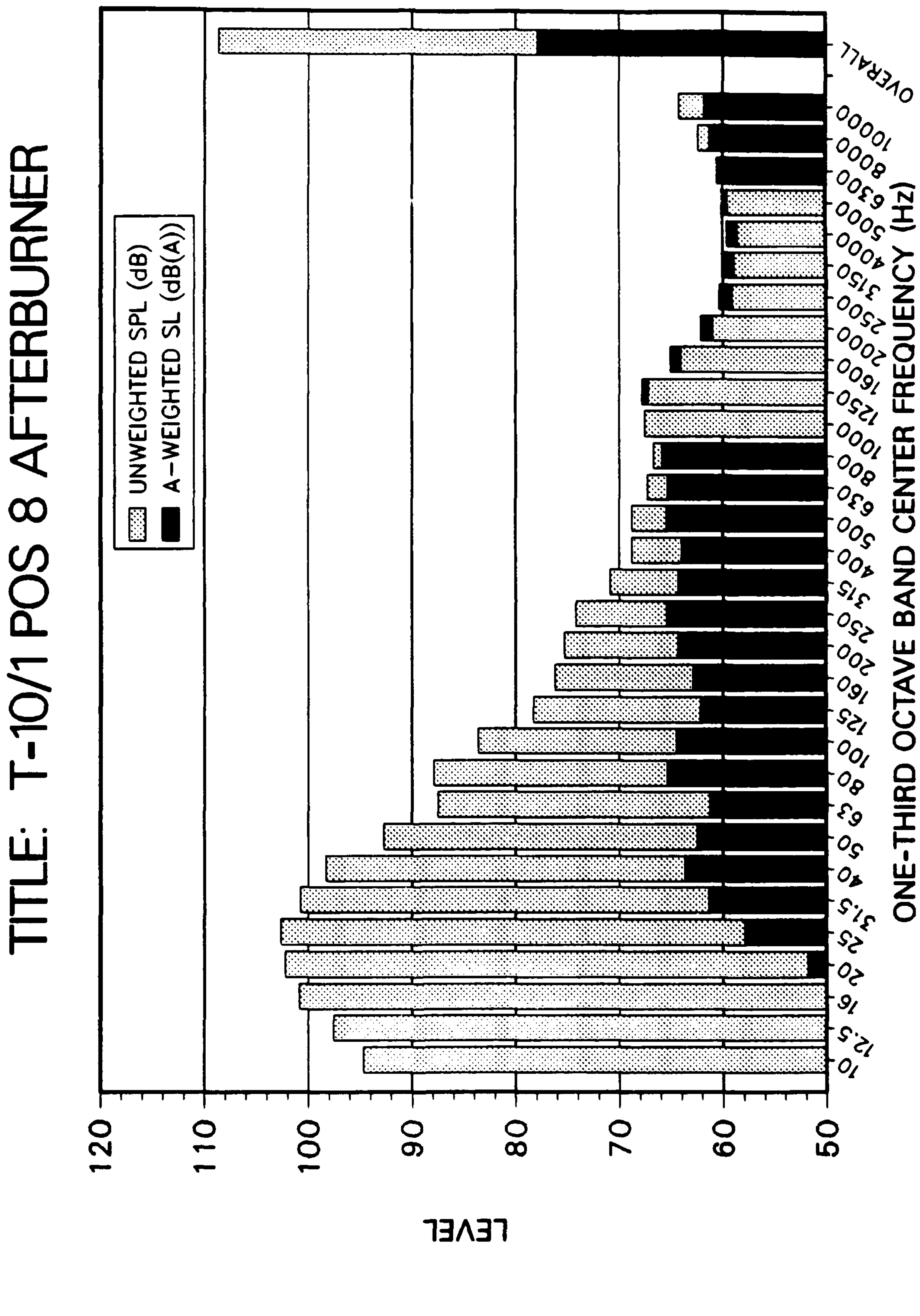

TITLE: T-10/1 POS 7 AFTERBURNER
UNWEIGHTED SPL (dB)
A-WEIGHTED SL (dB(A))
LEVEL
120
110
100
90
80
70
60
50
10 12.5 16 20 25 31.5 40 50 63 80 100 125 160 200 250 315 400 500 630 800 1000 1250 1600 2000 2500 3150 4000 5000 6300 8000 10000 OVERALL
ONE-THIRD OCTAVE BAND CENTER FREQUENCY (Hz)

TITLE: T-10/1 POS 8 AFTERBURNER

FREQ (Hz)	SOUND PRESSURE LEVEL (dB)	OCTAVE BAND SPL (dB)	A-WEIGHTED SOUND LEVEL [dB(A)]	A-WEIGHTED OCTAVE BAND SL [dB(A)]
10	94.7		24.2	
12.5	97.6		34.2	
16	100.9	105.2	44.2	52.3
20	102.2		51.8	
25	102.6		57.9	
31.5	100.8	105.5	61.4	66.2
40	98.3		63.7	
50	92.7		62.5	
63	87.5	94.7	61.3	68
80	87.9		65.4	
100	83.6		64.5	
125	78.3	85.1	62.2	67.9
160	76.2		62.9	
200	75.3		64.4	
250	74.2	78.4	65.5	69.4
315	70.9		64.3	
400	68.8		64	
500	68.8	72.9	65.5	69.6
630	67.3		65.4	
800	66.7		65.9	
1,000	67.5	71.7	67.5	71.7
1,250	67.2		67.8	
1,600	64.1		65.1	
2,000	61	66.5	62.2	67.6
2,500	59.1		60.4	
3,150	58.9		60.1	
4,000	58.6	63.6	59.6	64.5
5,000	59.5		60.1	
6,300	60.6		60.5	
8,000	62.4	67.2	61.3	65.8
10,000	64.2		61.8	

*** OVERALL LEVELS (10 - 10000 Hz) ***

OASPL = 108.7 dB   OASLA = 77.9 dB(A)

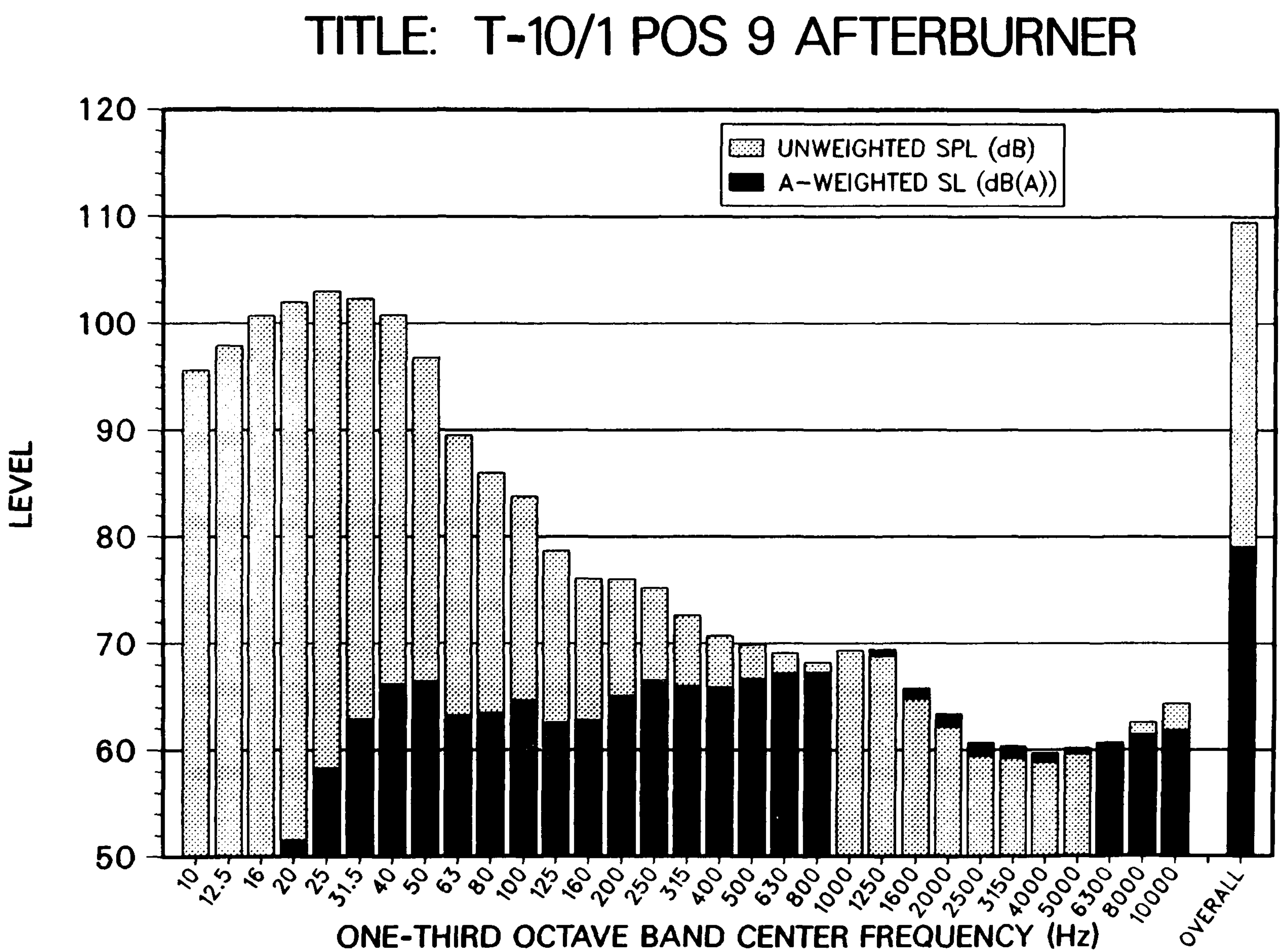

TITLE: T-10/1 POS 8 AFTERBURNER
UNWEIGHTED SPL (dB)
A-WEIGHTED SL (dB(A))
LEVEL
120
110
100
90
80
70
60
50
10
12.5
16
20
25
31.5
40
50
63
80
100
125
160
200
250
315
400
500
630
800
1000
1250
1600
2000
2500
3150
4000
5000
6300
8000
10000
OVERALL
ONE-THIRD OCTAVE BAND CENTER FREQUENCY (Hz)

TITLE: T-10/1 POS 9 AFTERBURNER

FREQ (Hz)	SOUND PRESSURE LEVEL (dB)	OCTAVE BAND SPL (dB)	A-WEIGHTED SOUND LEVEL [dB(A)]	A-WEIGHTED OCTAVE BAND SL [dB(A)]
10	95.6		25.1	
12.5	97.9		34.5	
16	100.7	105.1	44	52.2
20	102		51.6	
25	103		58.3	
31.5	102.3	106.7	62.9	68.1
40	100.8		66.2	
50	96.8		66.5	
63	89.5	97.6	63.3	69.3
80	86		63.5	
100	83.8		64.7	
125	78.7	85.3	62.6	68
160	76.1		62.8	
200	76		65.1	
250	75.2	79.4	66.6	70.5
315	72.6		66	
400	70.7		65.9	
500	69.9	74.5	66.7	71.2
630	69.1		67.2	
800	68.2		67.3	
1,000	69.3	73.4	69.3	73.4
1,250	68.8		69.4	
1,600	64.8		65.8	
2,000	62.2	67.3	63.4	68.4
2,500	59.4		60.7	
3,150	59.2		60.4	
4,000	58.8	63.8	59.7	64.7
5,000	59.6		60.2	
6,300	60.7		60.6	
8,000	62.6	67.4	61.5	65.9
10,000	64.4		61.9	

*** OVERALL LEVELS (10 - 10000 Hz) ***

OASPL = 109.5 dB   OASLA = 79.1 dB(A)



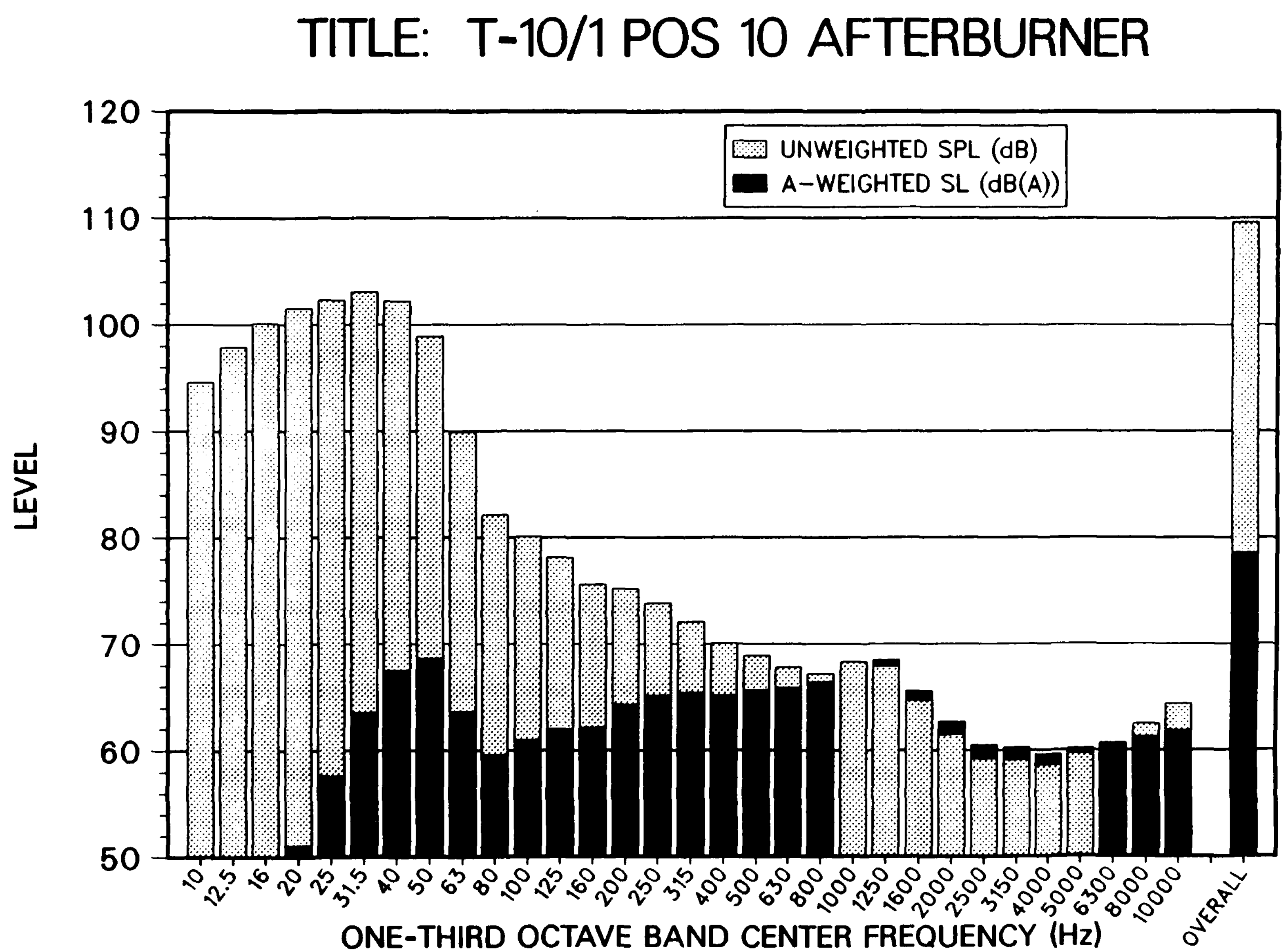
TITLE: T-10/1 POS 9 AFTERBURNER
UNWEIGHTED SPL (dB)
A-WEIGHTED SL (dB(A))
LEVEL
120
110
100
90
80
70
60
50
10
12.5
16
20
25
31.5
40
50
63
80
100
125
160
200
250
315
400
500
630
800
1000
1250
1600
2000
2500
3150
4000
5000
6300
8000
10000
OVERALL
ONE-THIRD OCTAVE BAND CENTER FREQUENCY (Hz)

TITLE: T-10/1 POS 10 AFTERBURNER

FREQ (Hz)	SOUND PRESSURE LEVEL (dB)	OCTAVE BAND SPL (dB)	A-WEIGHTED SOUND LEVEL [dB(A)]	A-WEIGHTED OCTAVE BAND SL [dB(A)]
10	94.6		24.2	
12.5	97.9		34.5	
16	100.1	104.7	43.5	51.7
20	101.5		51.1	
25	102.3		57.6	
31.5	103.1	107.1	63.6	69.1
40	102.2		67.5	
50	98.9		68.7	
63	89.9	99.3	63.7	70.1
80	82.1		59.6	
100	80.1		61	
125	78.1	82.9	62	66.3
160	75.6		62.2	
200	75.2		64.4	
250	73.8	78.5	65.2	69.6
315	72.1		65.5	
400	70.1		65.2	
500	68.9	73.6	65.7	70.2
630	67.8		65.9	
800	67.2		66.4	
1,000	68.3	72.4	68.3	72.4
1,250	67.9		68.5	
1,600	64.7		65.6	
2,000	61.5	66.9	62.7	68
2,500	59.2		60.5	
3,150	59.1		60.3	
4,000	58.6	63.7	59.6	64.6
5,000	59.7		60.2	
6,300	60.7		60.6	
8,000	62.5	67.4	61.3	65.9
10,000	64.4		61.9	

*** OVERALL LEVELS (10 - 10000 Hz) ***

OASPL = 109.6 dB   OASLA = 78.6 dB(A)



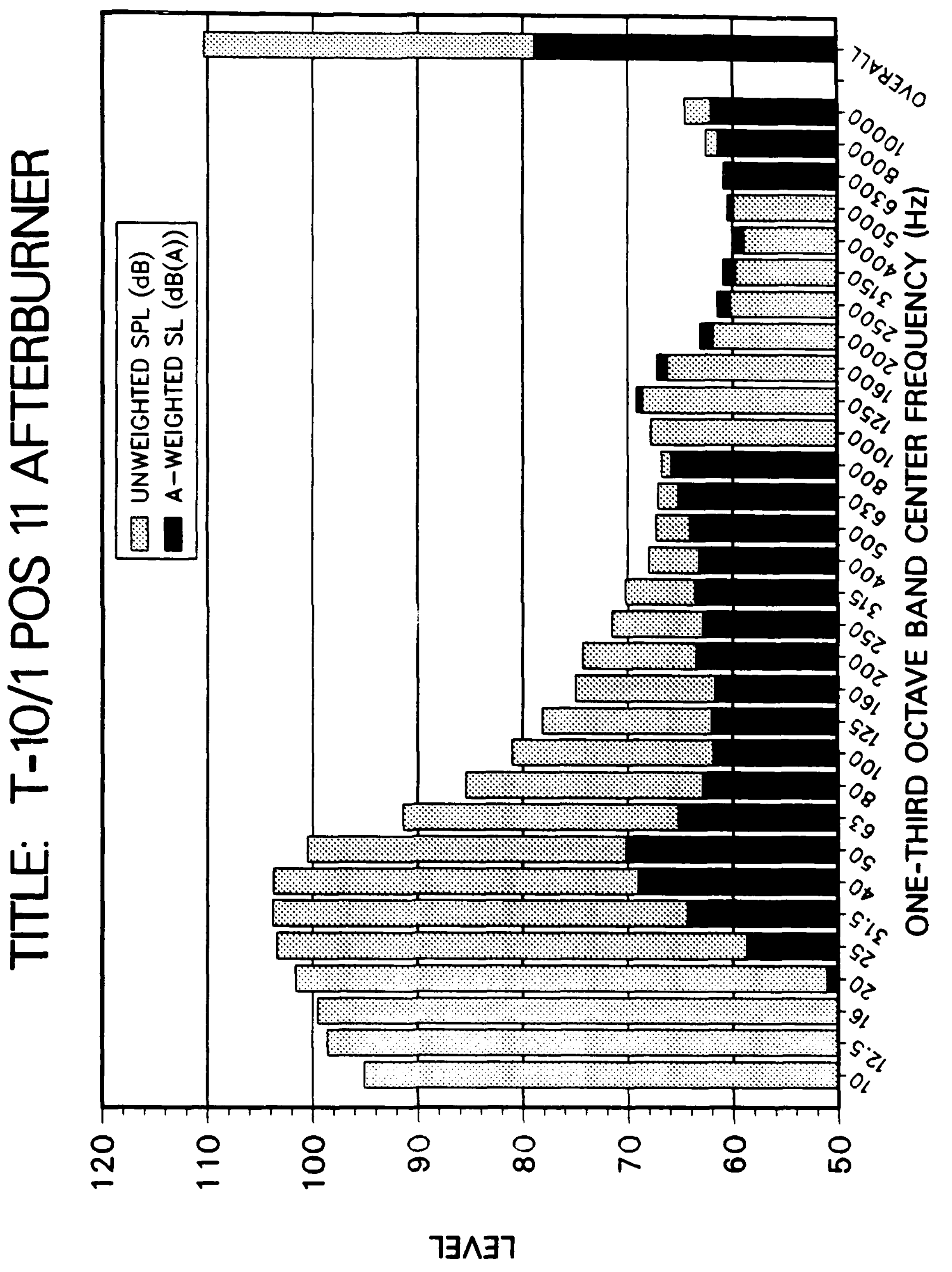
TITLE: T-10/1 POS 10 AFTERBURNER
UNWEIGHTED SPL (dB)
A-WEIGHTED SL (dB(A))
LEVEL
120
110
100
90
80
70
60
50
10
12.5
16
20
25
31.5
40
50
63
80
100
125
160
200
250
315
400
500
630
800
1000
1250
1600
2000
2500
3150
4000
5000
6300
8000
10000
OVERALL
ONE-THIRD OCTAVE BAND CENTER FREQUENCY (Hz)

TITLE: T-10/1 POS 11 AFTERBURNER

FREQ (Hz)	SOUND PRESSURE LEVEL (dB)	OCTAVE BAND SPL (dB)	A-WEIGHTED SOUND LEVEL [dB(A)]	A-WEIGHTED OCTAVE BAND SL [dB(A)]
10	95.1		24.7	
12.5	98.6		35.3	
16	99.5	104.7	42.8	51.6
20	101.6		51.1	
25	103.4		58.7	
31.5	103.8	108.2	64.4	70.4
40	103.7		69	
50	100.5		70.2	
63	91.4	100.9	65.2	71.8
80	85.4		62.9	
100	81		61.9	
125	78.1	83.3	62	66.4
160	75		61.7	
200	74.3		63.5	
250	71.5	76.9	62.9	67.9
315	70.2		63.6	
400	68		63.2	
500	67.3	72.1	64.1	68.8
630	67.1		65.2	
800	66.8		65.9	
1,000	67.8	72.4	67.8	72.4
1,250	68.6		69.2	
1,600	66.2		67.2	
2,000	61.9	68.1	63.1	69.2
2,500	60.2		61.5	
3,150	59.7		60.9	
4,000	58.9	64.1	59.8	65
5,000	59.9		60.5	
6,300	60.9		60.7	
8,000	62.6	67.5	61.5	66.1
10,000	64.6		62.1	

***** OVERALL LEVELS (10 - 10000 Hz) *****

OASPL = 110.4 dB OASLA = 78.9 dB(A)


TITLE: T-10/1 POS 11 AFTERBURNER
UNWEIGHTED SPL (dB)
A-WEIGHTED SL (dB(A))
LEVEL
120
110
100
90
80
70
60
50
10
12.5
16
20
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
ONE-THIRD OCTAVE BAND CENTER FREQUENCY (Hz)

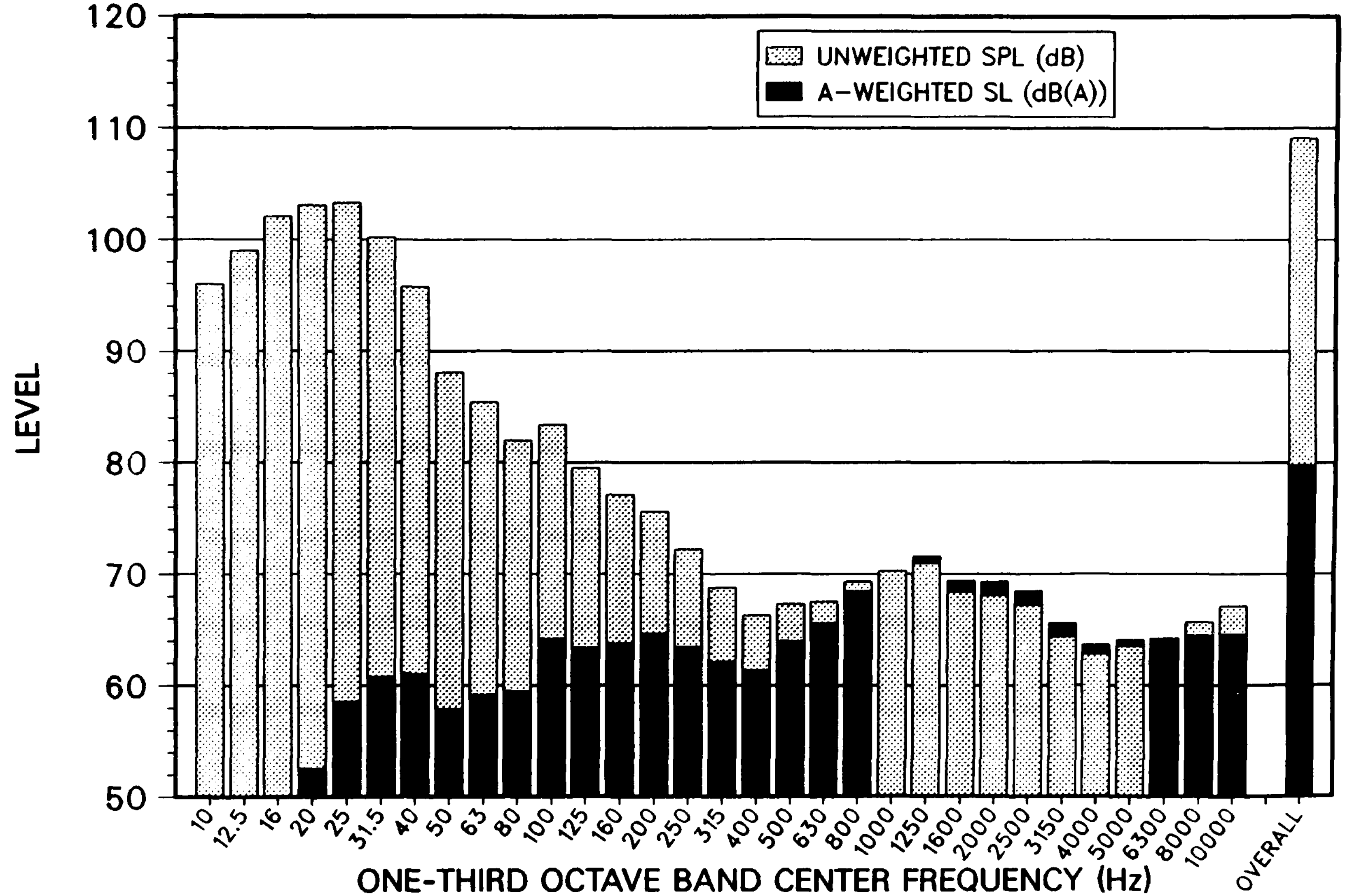
TITLE: T-10/2 POS 6 AFTERBURNER

FREQ (Hz)	SOUND PRESSURE LEVEL (dB)	OCTAVE BAND SPL (dB)	A-WEIGHTED SOUND LEVEL [dB(A)]	A-WEIGHTED OCTAVE BAND SL [dB(A)]
10	96		25.6	
12.5	99		35.6	
16	102.1	106.3	45.4	53.3
20	103.1		52.6	
25	103.3		58.6	
31.5	100.2	105.3	60.8	64.9
40	95.8		61.1	
50	88.1		57.9	
63	85.4	90.4	59.2	63.5
80	82		59.5	
100	83.4		64.2	
125	79.5	85.3	63.4	68.4
160	77.1		63.8	
200	75.6		64.7	
250	72.2	77.6	63.5	68.2
315	68.8		62.2	
400	66.3		61.4	
500	67.3	71.6	64	68.6
630	67.5		65.6	
800	69.3		68.5	
1,000	70.3	74.8	70.3	74.9
1,250	71		71.6	
1,600	68.4		69.4	
2,000	68.1	72.5	69.3	73.6
2,500	67.2		68.5	
3,150	64.4		65.6	
4,000	62.8	68.2	63.7	69.1
5,000	63.5		64.1	
6,300	64.2		64.1	
8,000	65.7	70.4	64.5	69
10,000	67.1		64.6	

*** OVERALL LEVELS (10 - 10000 Hz) ***

OASPL = 109.1 dB OASLA = 79.8 dB(A)

TITLE: T-10/2 POS 6 AFTERBURNER

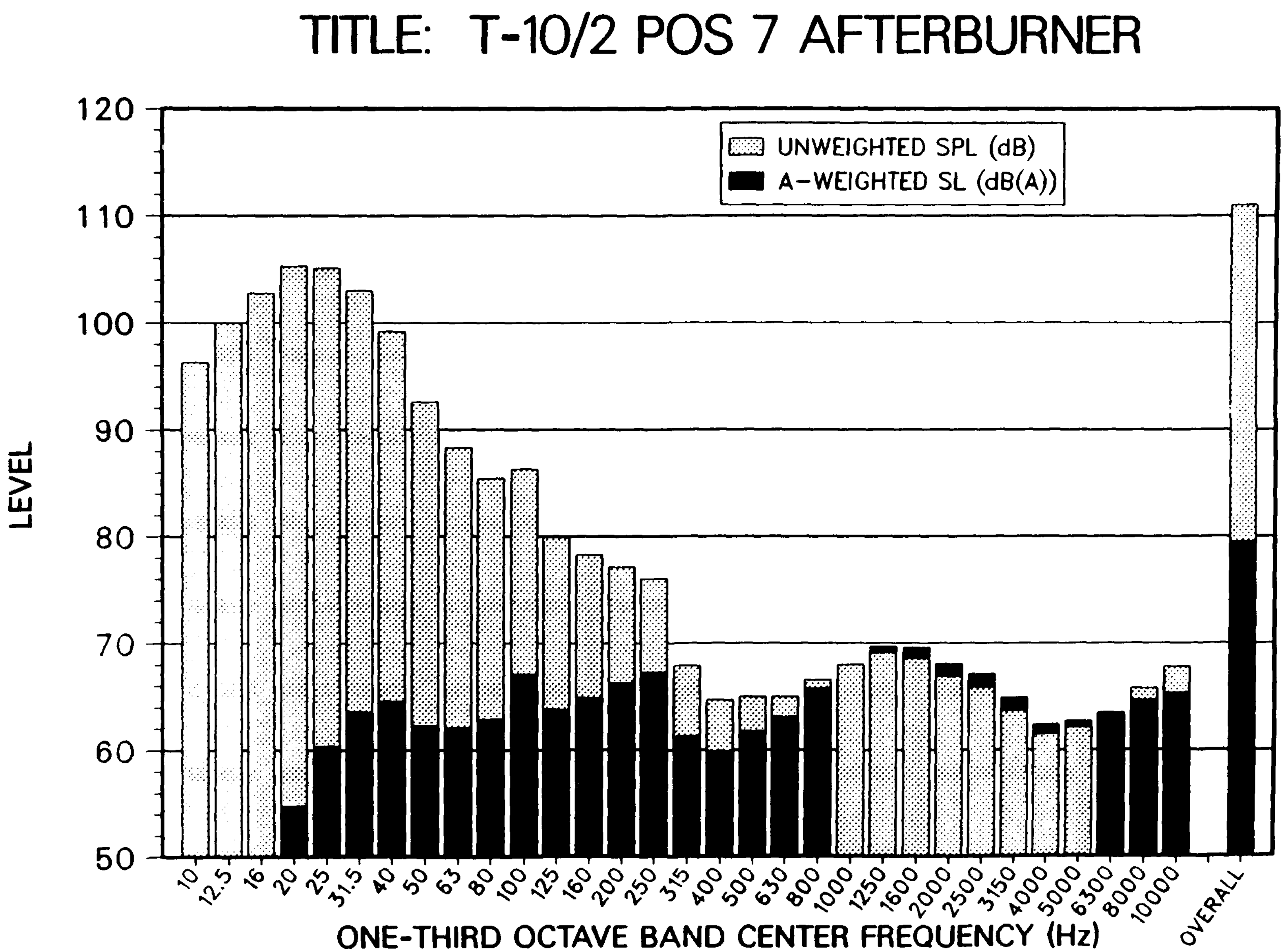


TITLE: T-10/2 POS 7 AFTERBURNER

FREQ (Hz)	SOUND PRESSURE LEVEL (dB)	OCTAVE BAND SPL (dB)	A-WEIGHTED SOUND LEVEL [dB(A)]	A-WEIGHTED OCTAVE BAND SL [dB(A)]
10	96.3		25.9	
12.5	100		36.6	
16	102.8	107.8	46.1	55.2
20	105.3		54.8	
25	105.1		60.4	
31.5	103	107.6	63.6	67.8
40	99.2		64.6	
50	92.6		62.3	
63	88.3	94.3	62.1	67
80	85.4		62.9	
100	86.3		67.1	
125	79.9	87.5	63.8	70.1
160	78.3		64.9	
200	77.1		66.3	
250	76	79.7	67.3	70.2
315	67.9		61.3	
400	64.7		59.9	
500	65	69.5	61.8	66.4
630	65		63.1	
800	66.6		65.8	
1,000	68	72.6	68	72.7
1,250	69.1		69.7	
1,600	68.6		69.6	
2,000	66.9	71.8	68.1	73
2,500	65.9		67.1	
3,150	63.7		64.9	
4,000	61.5	67.1	62.4	68
5,000	62.1		62.7	
6,300	63.5		63.4	
8,000	65.8	70.6	64.7	69.1
10,000	67.8		65.3	

*** OVERALL LEVELS (10 - 10000 Hz) ***

OASPL = 111 dB OASLA = 79.5 dB(A)


TITLE: T-10/2 POS 7 AFTERBURNER
UNWEIGHTED SPL (dB)
A-WEIGHTED SL (dB(A))
120
110
100
90
80
70
60
50
LEVEL
10
12.5
16
20
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
ONE-THIRD OCTAVE BAND CENTER FREQUENCY (Hz)

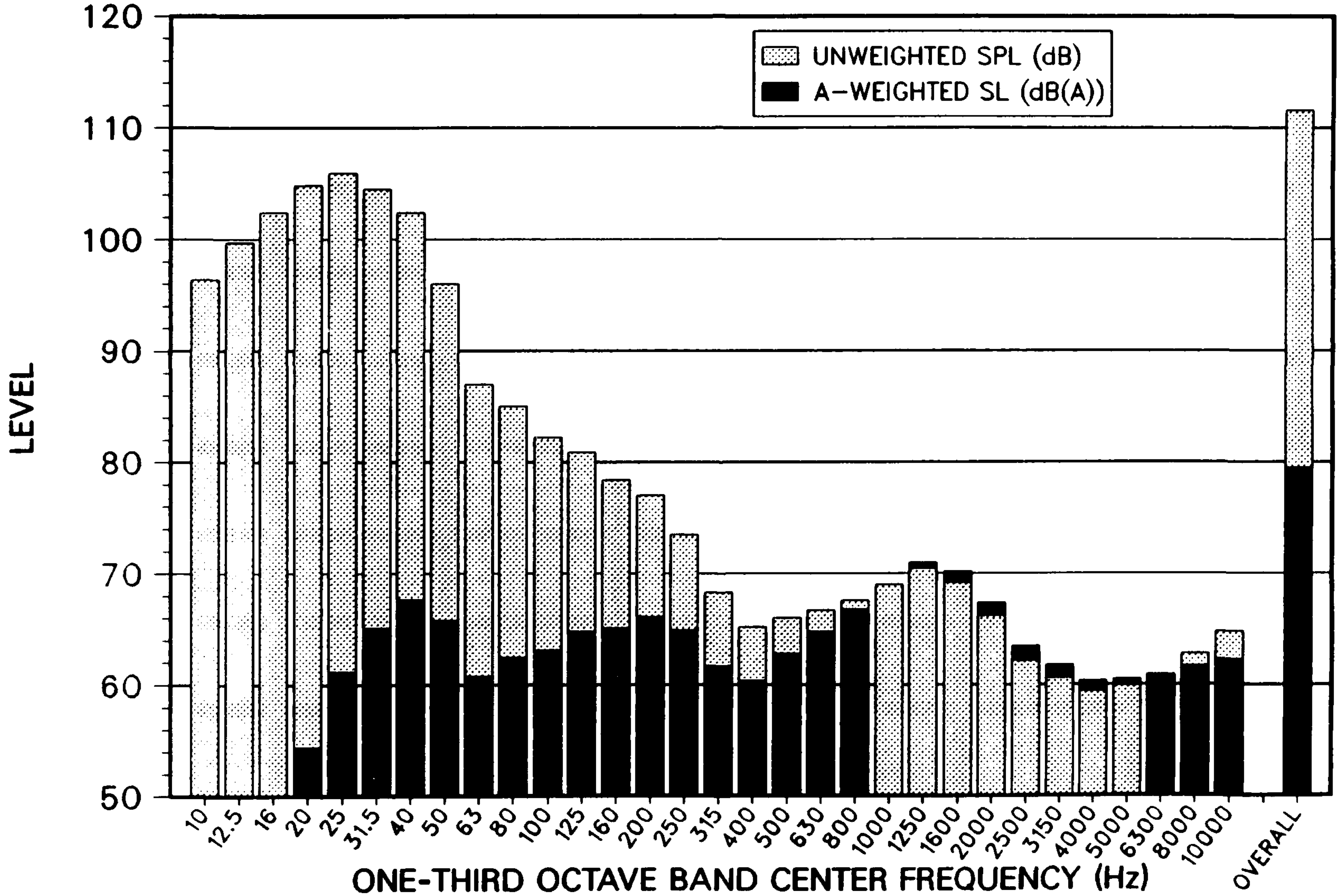
TITLE: T-10/2 POS 8 AFTERBURNER

FREQ (Hz)	SOUND PRESSURE LEVEL (dB)	OCTAVE BAND SPL (dB)	A-WEIGHTED SOUND LEVEL [dB(A)]	A-WEIGHTED OCTAVE BAND SL [dB(A)]
10	96.4		25.9	
12.5	99.7		36.3	
16	102.4	107.4	45.8	54.8
20	104.8		54.4	
25	105.9		61.2	
31.5	104.5	109.1	65.1	70
40	102.4		67.7	
50	96		65.8	
63	87	96.6	60.8	68.1
80	85		62.5	
100	82.2		63.1	
125	80.9	85.3	64.8	69
160	78.4		65.1	
200	77		66.1	
250	73.5	78.8	64.9	69.2
315	68.3		61.7	
400	65.2		60.4	
500	66	70.6	62.8	67.6
630	66.7		64.8	
800	67.6		66.8	
1,000	69	73.8	69	73.9
1,250	70.4		71	
1,600	69.2		70.2	
2,000	66.2	71.3	67.4	72.4
2,500	62.2		63.5	
3,150	60.6		61.8	
4,000	59.4	64.6	60.4	65.5
5,000	59.9		60.5	
6,300	60.9		60.8	
8,000	62.8	67.7	61.7	66.2
10,000	64.8		62.3	

*** OVERALL LEVELS (10 - 10000 Hz) ***

OASPL = 111.6 dB OASLA = 79.5 dB(A)

TITLE: T-10/2 POS 8 AFTERBURNER

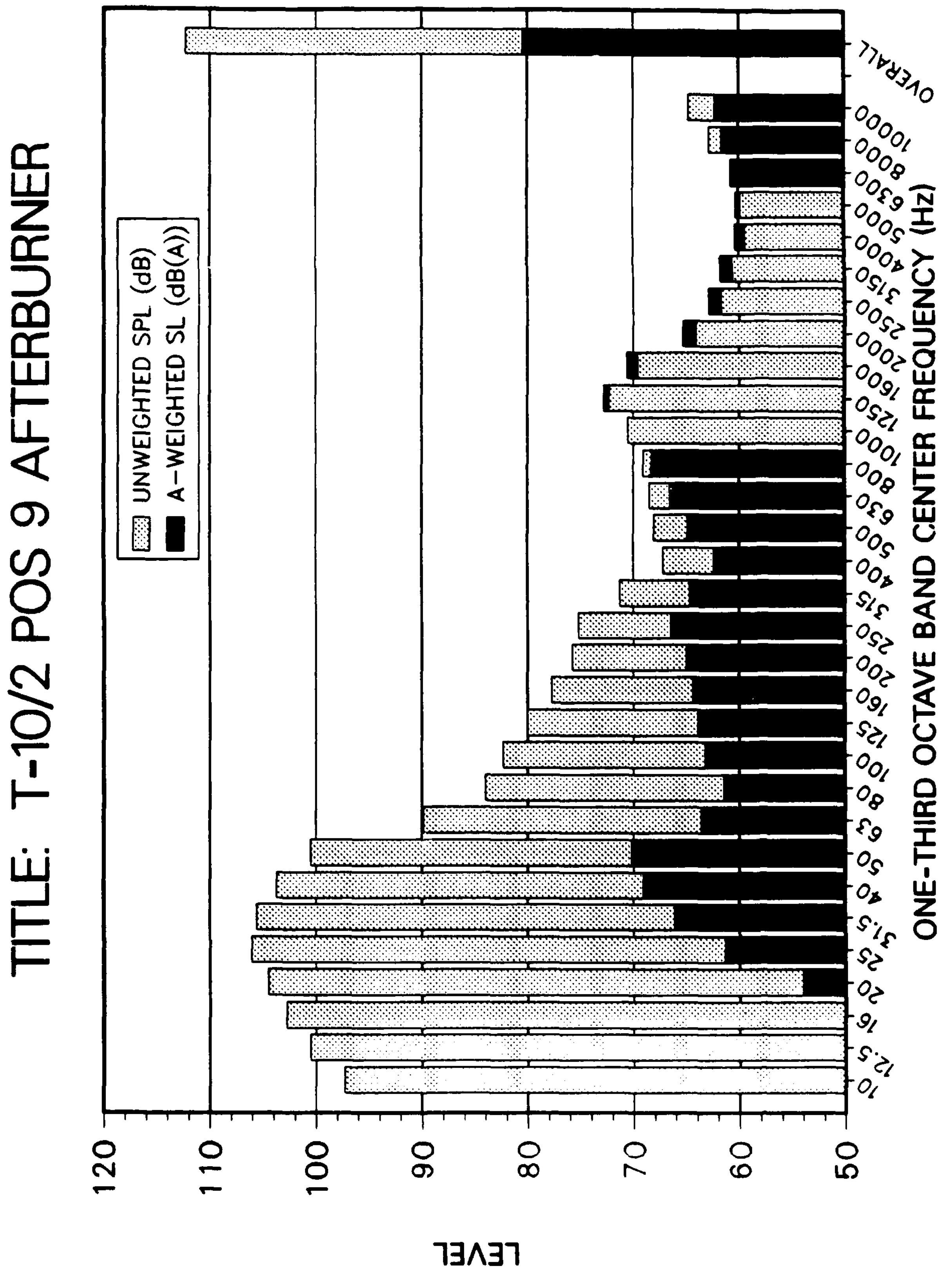


TITLE: T-10/2 POS 9 AFTERBURNER

FREQ (Hz)	SOUND PRESSURE LEVEL (dB)	OCTAVE BAND SPL (dB)	A-WEIGHTED SOUND LEVEL [dB(A)]	A-WEIGHTED OCTAVE BAND SL [dB(A)]
10	97.3		26.9	
12.5	100.5		37.2	
16	102.8	107.5	46.1	54.6
20	104.5		54	
25	106.1		61.4	
31.5	105.6	109.8	66.1	71.2
40	103.7		69.1	
50	100.5		70.2	
63	89.8	100.7	63.6	71.4
80	84		61.5	
100	82.3		63.2	
125	80	85	63.9	68.4
160	77.7		64.4	
200	75.8		65	
250	75.2	79.1	66.5	70.1
315	71.3		64.7	
400	67.2		62.4	
500	68.1	72.6	64.9	69.6
630	68.5		66.6	
800	69.1		68.3	
1,000	70.5	75.4	70.5	75.5
1,250	72.3		72.8	
1,600	69.6		70.6	
2,000	64.1	71	65.3	72.1
2,500	61.7		62.9	
3,150	60.6		61.8	
4,000	59.4	64.5	60.4	65.5
5,000	59.8		60.3	
6,300	60.8		60.7	
8,000	62.8	67.7	61.6	66.2
10,000	64.8		62.3	

*** OVERALL LEVELS (10 - 10000 Hz) ***

OASPL = 112.3 dB   OASLA = 80.5 dB(A)



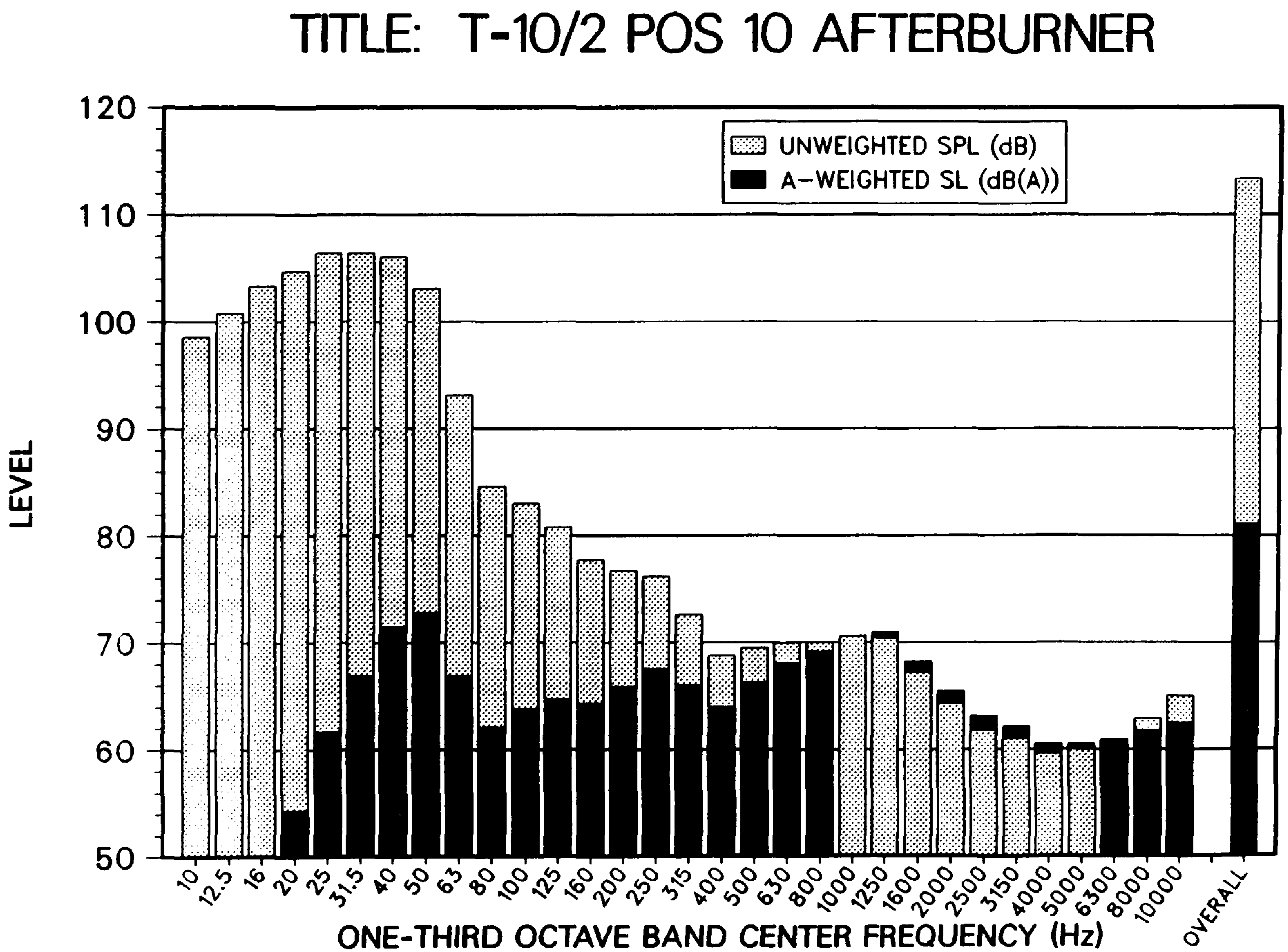
TITLE: T-10/2 POS 9 AFTERBURNER
UNWEIGHTED SPL (dB)
A-WEIGHTED SL (dB(A))
LEVEL
120
110
100
90
80
70
60
50
ONE-THIRD OCTAVE BAND CENTER FREQUENCY (Hz)
10
12.5
16
20
25
31.5
40
50
63
80
100
125
160
200
250
315
400
500
630
800
1000
1250
1600
2000
2500
3150
4000
5000
6300
8000
10000
OVERALL

TITLE: T-10/2 POS 10 AFTERBURNER

FREQ (Hz)	SOUND PRESSURE LEVEL (dB)	OCTAVE BAND SPL (dB)	A-WEIGHTED SOUND LEVEL [dB(A)]	A-WEIGHTED OCTAVE BAND SL [dB(A)]
10	98.6		28.2	
12.5	100.8		37.4	
16	103.3	107.8	46.7	54.9
20	104.7		54.3	
25	106.4		61.7	
31.5	106.4	110.9	66.9	72.9
40	106.1		71.5	
50	103.1		72.8	
63	93.1	103.4	66.9	73.9
80	84.6		62.1	
100	83		63.8	
125	80.8	85.6	64.7	68.9
160	77.7		64.3	
200	76.7		65.9	
250	76.2	80.1	67.6	71.1
315	72.6		66	
400	68.8		64	
500	69.5	74.1	66.3	71.1
630	70		68.1	
800	70		69.2	
1,000	70.6	74.9	70.6	74.9
1,250	70.4		71	
1,600	67.2		68.2	
2,000	64.3	69.6	65.5	70.7
2,500	61.8		63.1	
3,150	61		62.2	
4,000	59.6	64.8	60.5	65.7
5,000	60		60.5	
6,300	60.9		60.7	
8,000	62.9	67.8	61.8	66.3
10,000	65		62.5	

*** OVERALL LEVELS (10 - 10000 Hz) ***

OASPL = 113.3 dB OASLA = 81.1 dB(A)

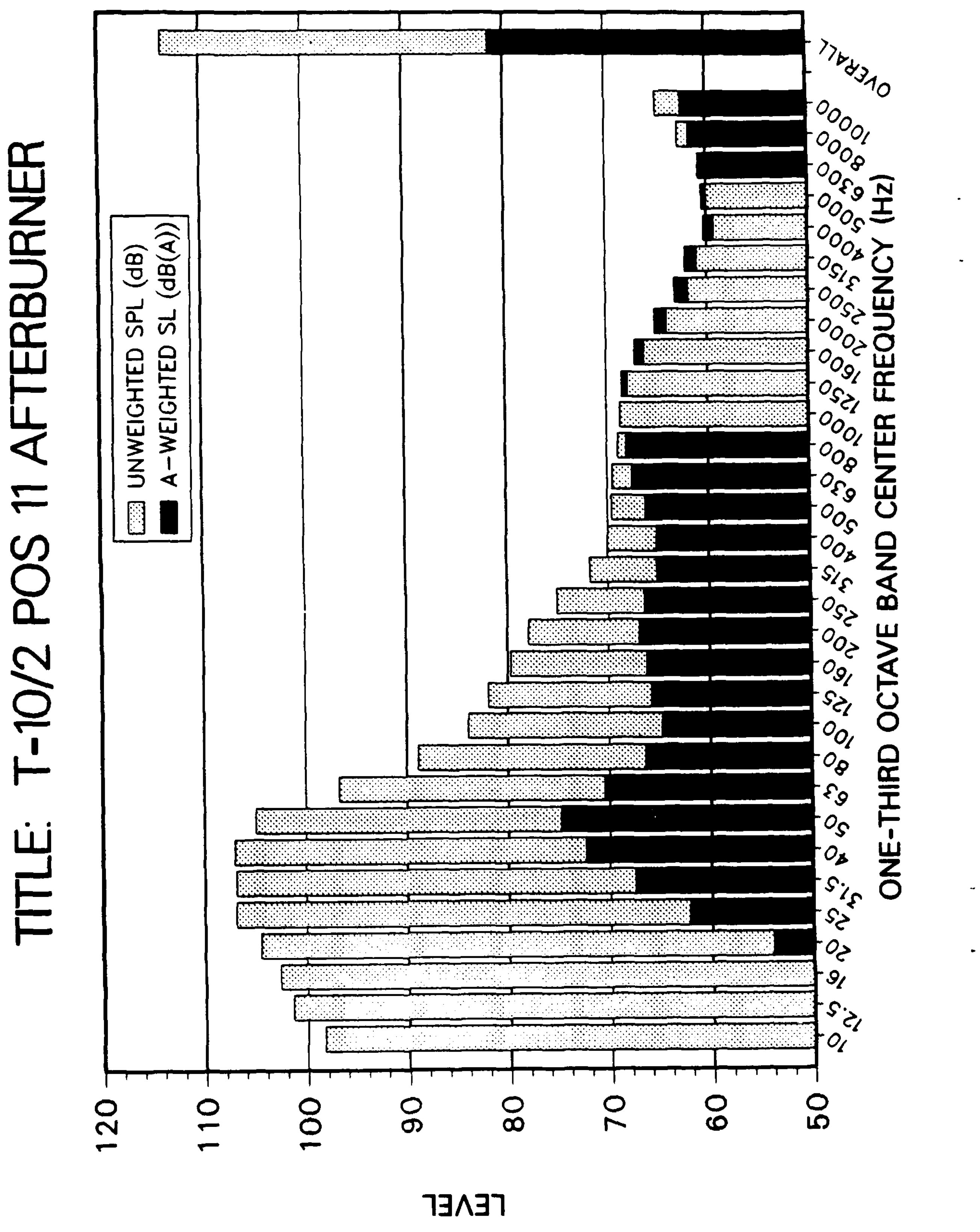

TITLE: T-10/2 POS 10 AFTERBURNER
UNWEIGHTED SPL (dB)
A-WEIGHTED SL (dB(A))
LEVEL
120
110
100
90
80
70
60
50
10 12.5 16 20 25 31.5 40 50 63 80 100 125 160 200 250 315 400 500 630 800 1000 1250 1600 2000 2500 3150 4000 5000 6300 8000 10000 OVERALL
ONE-THIRD OCTAVE BAND CENTER FREQUENCY (Hz)

TITLE: T-10/2 POS 11 AFTERBURNER

FREQ (Hz)	SOUND PRESSURE LEVEL (dB)	OCTAVE BAND SPL (dB)	A-WEIGHTED SOUND LEVEL [dB(A)]	A-WEIGHTED OCTAVE BAND SL [dB(A)]
10	98.3		27.9	
12.5	101.4		38.1	
16	102.6	107.6	45.9	54.5
20	104.5		54	
25	106.9		62.2	
31.5	106.9	111.5	67.5	73.7
40	107		72.4	
50	105		74.8	
63	96.7	105.5	70.5	76.4
80	88.9		66.4	
100	83.9		64.8	
125	81.9	86.8	65.8	70.3
160	79.7		66.3	
200	77.9		67	
250	75.1	80.2	66.5	70.9
315	71.8		65.2	
400	70		65.2	
500	69.6	74.3	66.3	71
630	69.5		67.6	
800	68.9		68.1	
1,000	68.7	73.1	68.7	73
1,250	67.9		68.5	
1,600	66.3		67.2	
2,000	64	69	65.2	70.1
2,500	61.9		63.2	
3,150	61		62.2	
4,000	59.3	64.7	60.3	65.7
5,000	60		60.5	
6,300	60.8		60.7	
8,000	62.8	67.8	61.7	66.3
10,000	65		62.5	

*** OVERALL LEVELS (10 - 10000 Hz) ***

OASPL = 113.8 dB OASLA = 81.5 dB(A)

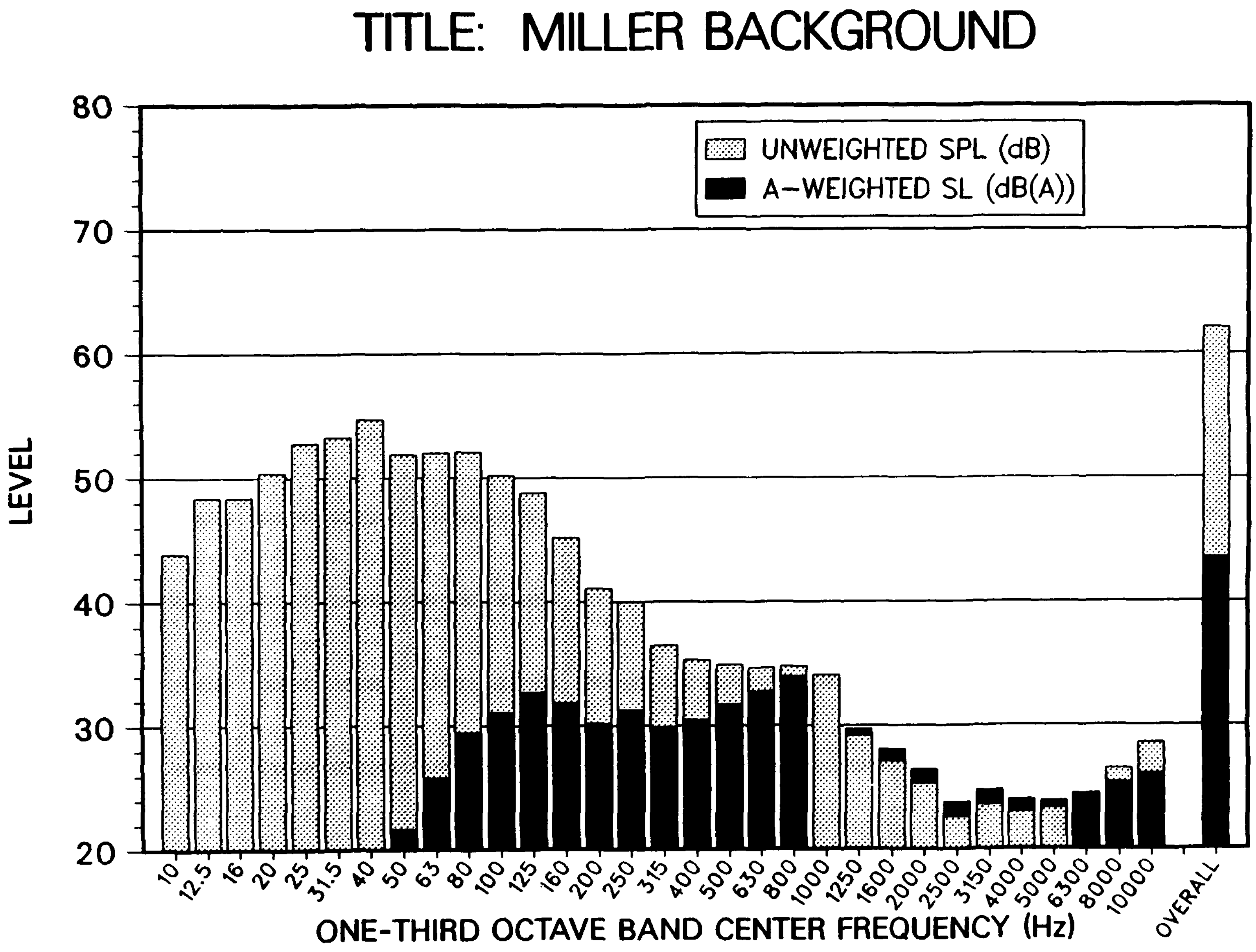

TITLE: T-10/2 POS 11 AFTERBURNER
UNWEIGHTED SPL (dB)
A-WEIGHTED SL (dB(A))
LEVEL
120
110
100
90
80
70
60
50
ONE-THIRD OCTAVE BAND CENTER FREQUENCY (Hz)
10
12.5
16
20
25
31.5
40
50
63
80
100
125
160
200
250
315
400
500
630
800
1000
1250
1600
2000
2500
3150
4000
5000
6300
8000
10000
OVERALL

TITLE: MILLER BACKGROUND

FREQ (Hz)	SOUND PRESSURE LEVEL (dB)	OCTAVE BAND SPL (dB)	A-WEIGHTED SOUND LEVEL [dB(A)]	A-WEIGHTED OCTAVE BAND SL [dB(A)]
10	43.9		0	
12.5	48.4		0	
16	48.4	53.7	0	0.5
20	50.4		0	
25	52.8		8.1	
31.5	53.3	58.3	13.8	21
40	54.7		20.1	
50	51.9		21.7	
63	52	56.6	25.8	31.4
80	52.1		29.5	
100	50.2		31.1	
125	48.8	53.1	32.7	36.5
160	45.2		31.9	
200	41.1		30.2	
250	40	44.2	31.3	35.1
315	36.5		29.9	
400	35.3		30.5	
500	34.9	39.6	31.7	36.4
630	34.7		32.8	
800	34.8		34	
1,000	34.1	37.9	34.1	37.6
1,250	29.2		29.7	
1,600	27.1		28.1	
2,000	25.3	29.9	26.5	31.1
2,500	22.6		23.8	
3,150	23.6		24.8	
4,000	23	27.9	24	28.8
5,000	23.3		23.9	
6,300	24.5		24.4	
8,000	26.5	31.4	25.4	29.9
10,000	28.6		26.1	

*** OVERALL LEVELS (10 - 10000 Hz) ***

OASPL = 62.1 dB OASLA = 43.5 dB(A)


TITLE: MILLER BACKGROUND
UNWEIGHTED SPL (dB)
A-WEIGHTED SL (dB(A))
LEVEL
80
70
60
50
40
30
20
10
12.5
16
20
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
ONE-THIRD OCTAVE BAND CENTER FREQUENCY (Hz)

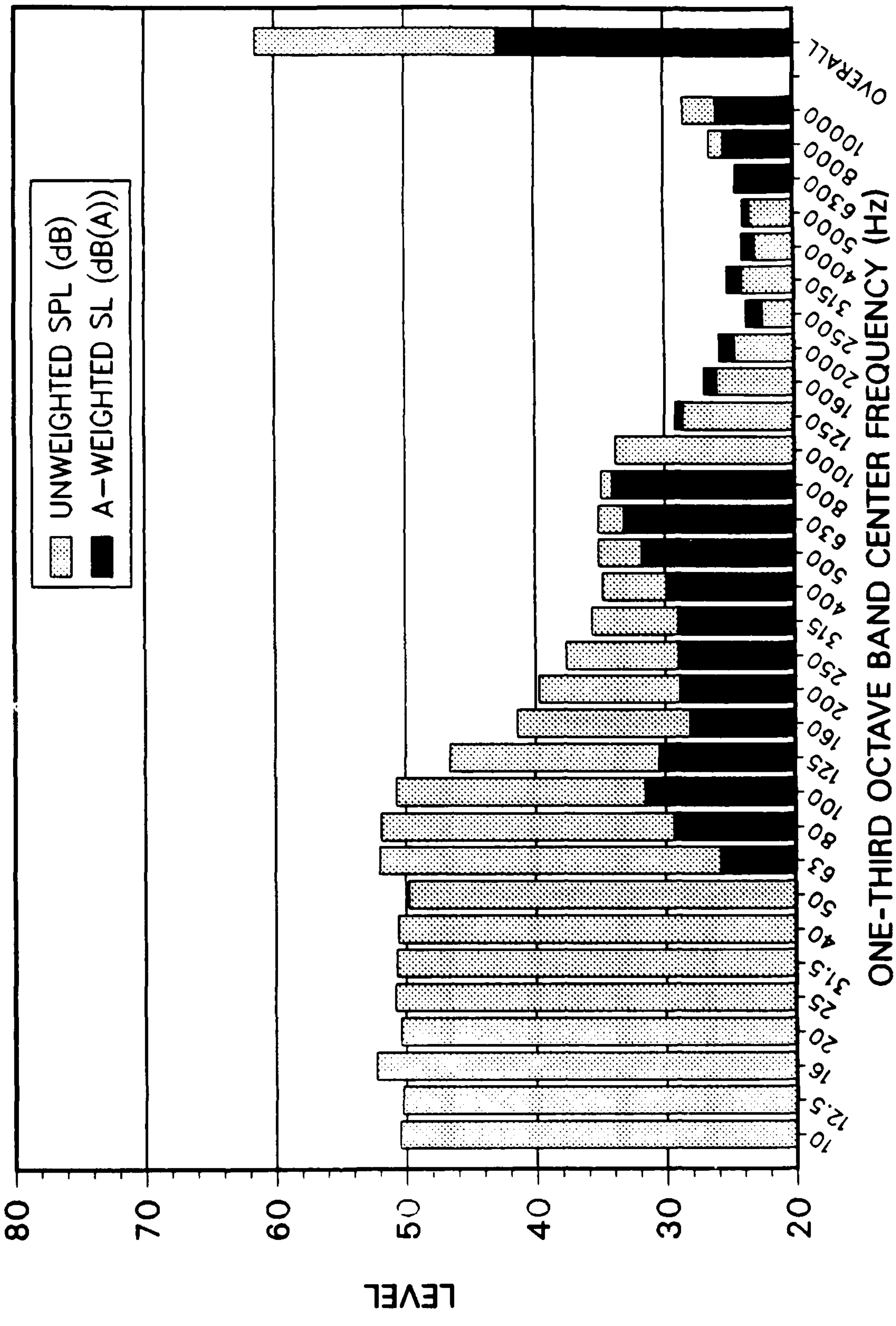
TITLE: MILLER T-10/1 AFTERBURNER

FREQ (Hz)	SOUND PRESSURE LEVEL (dB)	OCTAVE BAND SPL (dB)	A-WEIGHTED SOUND LEVEL [dB(A)]	A-WEIGHTED OCTAVE BAND SL [dB(A)]
10	50.5		0	
12.5	50.3		0	
16	52.3	55.7	0	1.3
20	50.4		0	
25	50.8		6.1	
31.5	50.7	55.3	11.3	17.3
40	50.6		15.9	
50	49.8		19.5	
63	52	55.9	25.8	31.1
80	51.9		29.4	
100	50.7		31.6	
125	46.6	52.3	30.5	34.8
160	41.4		28.1	
200	39.7		28.9	
250	37.6	42.6	29	33.5
315	35.6		29	
400	34.8		29.9	
500	35.1	39.5	31.8	36.4
630	35.1		33.2	
800	34.9		34.1	
1,000	33.8	37.7	33.8	37.4
1,250	28.6		29.2	
1,600	26		27	
2,000	24.6	29.2	25.8	30.3
2,500	22.4		23.7	
3,150	24		25.2	
4,000	23	28	24	29
5,000	23.3		23.9	
6,300	24.5		24.4	
8,000	26.5	31.4	25.4	29.9
10,000	28.5		26	

*** OVERALL LEVELS (10 - 10000 Hz) ***

OASPL = 61.5 dB   OASLA = 42.9 dB(A)

TITLE: MILLER T-10/1 AFTERBURNER



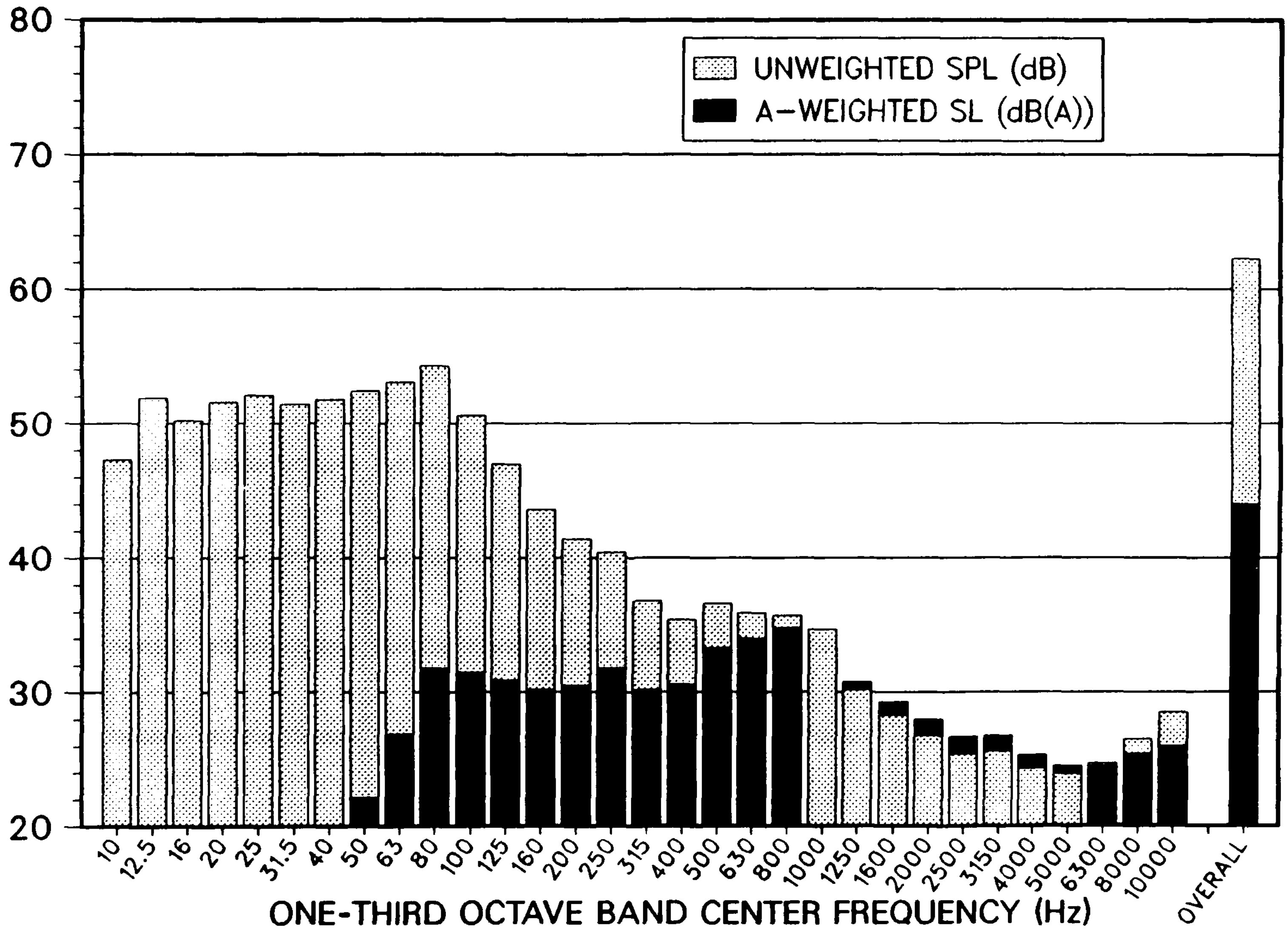
TITLE: MILLER T-10/2 AFTERBURNER

FREQ (Hz)	SOUND PRESSURE LEVEL (dB)	OCTAVE BAND SPL (dB)	A-WEIGHTED SOUND LEVEL [dB(A)]	A-WEIGHTED OCTAVE BAND SL [dB(A)]
10	47.3		0	
12.5	51.9		0	
16	50.2	55.9	0	1.9
20	51.6		1.2	
25	52.1		7.4	
31.5	51.4	56.3	12	18.5
40	51.8		17.2	
50	52.4		22.2	
63	53.1	57.9	26.9	33.1
80	54.3		31.8	
100	50.6		31.5	
125	47	52.5	30.9	35.5
160	43.6		30.2	
200	41.4		30.5	
250	40.4	44.5	31.8	35.5
315	36.8		30.2	
400	35.4		30.6	
500	36.6	40.5	33.3	37.4
630	35.9		34	
800	35.7		34.8	
1,000	34.7	38.6	34.7	38.4
1,250	30.2		30.8	
1,600	28.3		29.3	
2,000	26.8	31.6	28	32.7
2,500	25.4		26.7	
3,150	25.6		26.8	
4,000	24.3	29.2	25.3	30.2
5,000	23.9		24.5	
6,300	24.7		24.5	
8,000	26.5	31.4	25.4	29.9
10,000	28.5		26	

***** OVERALL LEVELS (10 - 10000 Hz) *****

OASPL = 62.3 dB   OASLA = 44 dB(A)

TITLE: MILLER T-10/2 AFTERBURNER



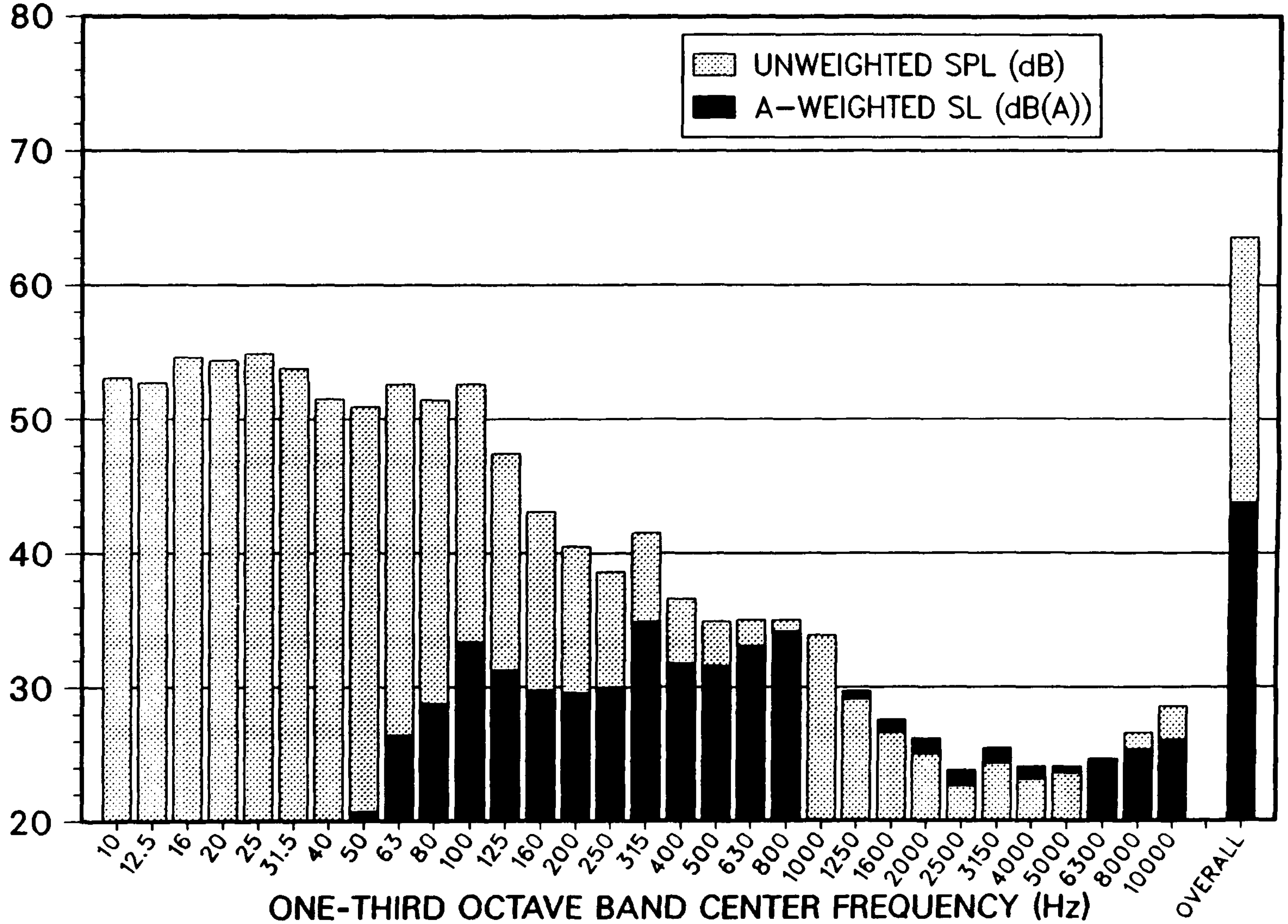
TITLE: MILLER T-10/1&2 AFTERBURNER

FREQ (Hz)	SOUND PRESSURE LEVEL (dB)	OCTAVE BAND SPL (dB)	A-WEIGHTED SOUND LEVEL [dB(A)]	A-WEIGHTED OCTAVE BAND SL [dB(A)]
10	53.1		0	
12.5	52.7		0	
16	54.6	58.5	0	4.8
20	54.4		3.9	
25	54.9		10.2	
31.5	53.8	58.2	14.3	19.1
40	51.5		16.8	
50	50.9		20.7	
63	52.6	56.3	26.4	31
80	51.4		28.8	
100	52.6		33.4	
125	47.4	53.9	31.3	36.3
160	43.1		29.8	
200	40.5		29.6	
250	38.6	44.9	30	36.8
315	41.5		34.9	
400	36.6		31.8	
500	34.9	40.1	31.6	36.8
630	35		33.1	
800	35		34.2	
1,000	33.9	37.9	33.9	37.6
1,250	29.1		29.7	
1,600	26.6		27.6	
2,000	25	29.6	26.2	30.7
2,500	22.6		23.8	
3,150	24.3		25.5	
4,000	23.1	28.2	24.1	29.2
5,000	23.6		24.1	
6,300	24.7		24.5	
8,000	26.6	31.5	25.4	30
10,000	28.6		26.1	

*** OVERALL LEVELS (10 - 10000 Hz) ***

OASPL = 63.6 dB   OASLA = 43.8 dB(A)

TITLE: MILLER T-10/1&2 AFTERBURNER



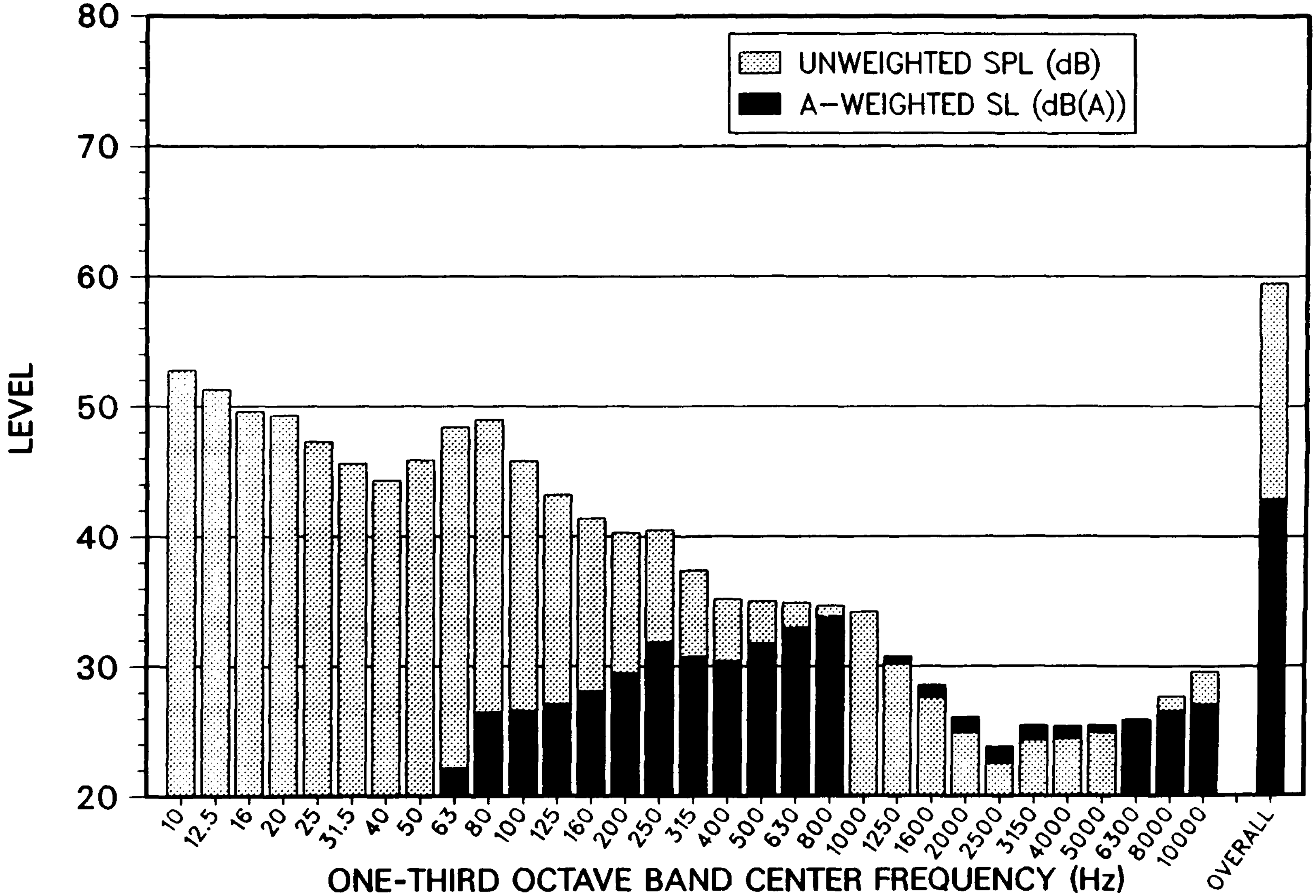
TITLE: 1919 SEWARD DRIVE BACKGROUND

FREQ (Hz)	SOUND PRESSURE LEVEL (dB)	OCTAVE BAND SPL (dB)	A-WEIGHTED SOUND LEVEL [dB(A)]	A-WEIGHTED OCTAVE BAND SL [dB(A)]
10	52.8		0	
12.5	51.3		0	
16	49.6	54.7	0	0
20	49.3		0	
25	47.3		2.6	
31.5	45.6	50.5	6.1	11.6
40	44.3		9.7	
50	45.9		15.7	
63	48.4	52.5	22.2	27.9
80	49		26.5	
100	45.8		26.6	
125	43.2	48.4	27.1	31.9
160	41.4		28.1	
200	40.3		29.5	
250	40.5	44.2	31.9	35.4
315	37.4		30.8	
400	35.2		30.4	
500	35	39.6	31.8	36.4
630	34.9		33	
800	34.7		33.9	
1,000	34.2	38	34.2	37.8
1,250	30.2		30.8	
1,600	27.6		28.6	
2,000	24.9	30.1	26.1	31.2
2,500	22.5		23.8	
3,150	24.3		25.5	
4,000	24.4	29.1	25.4	30
5,000	24.9		25.5	
6,300	25.9		25.7	
8,000	27.7	32.6	26.6	31.1
10,000	29.6		27.1	

*** OVERALL LEVELS (10 - 10000 Hz) ***

OASPL = 59.5 dB OASLA = 42.9 dB(A)

TITLE: 1919 SEWARD DRIVE BACKGROUND



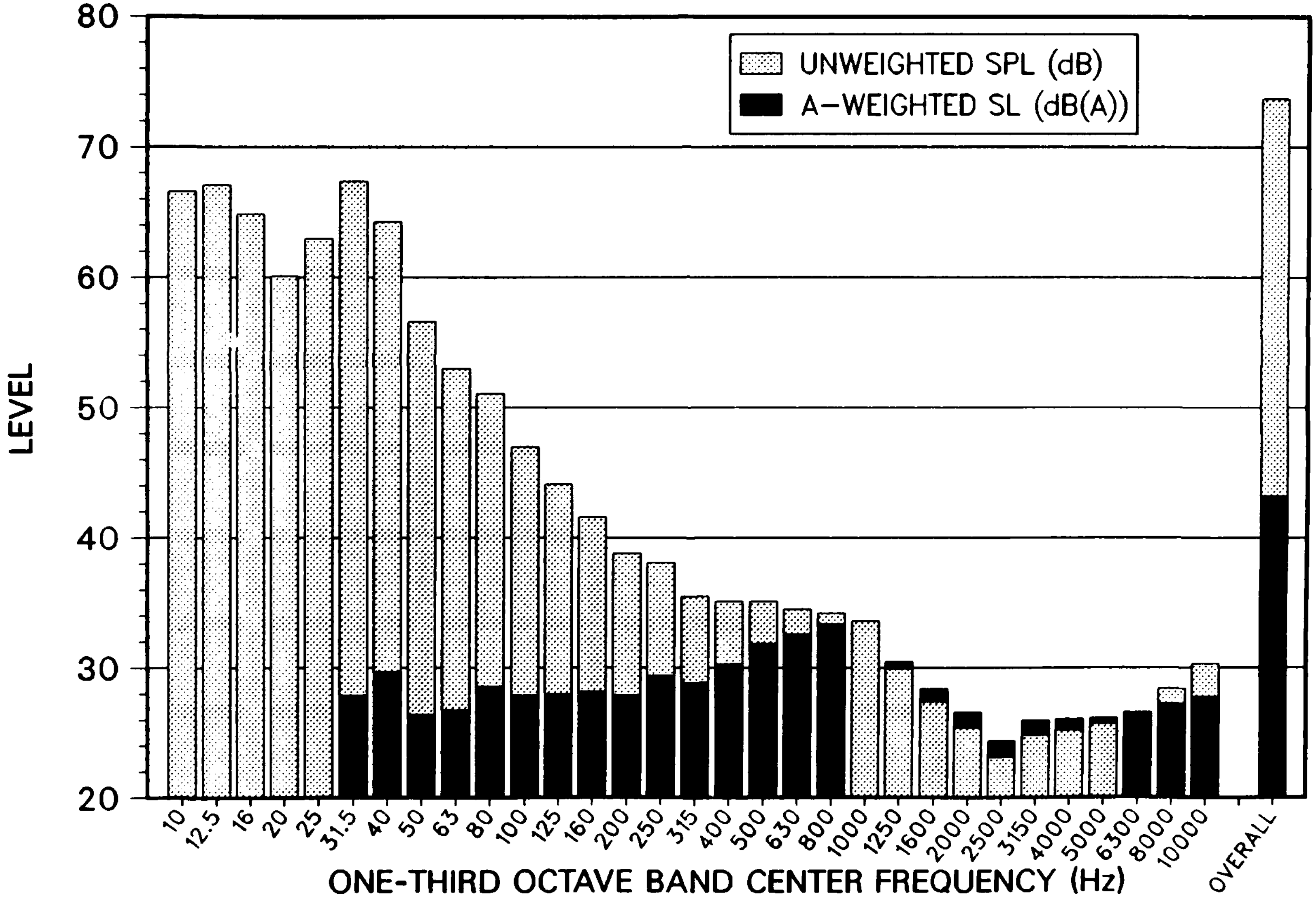
TITLE: 1919 SEWARD DRIVE T-10/2 AFTERBURNER

FREQ (Hz)	SOUND PRESSURE LEVEL (dB)	OCTAVE BAND SPL (dB)	A-WEIGHTED SOUND LEVEL [dB(A)]	A-WEIGHTED OCTAVE BAND SL [dB(A)]
10	66.6		0	
12.5	67.1		3.7	
16	64.9	69.5	8.2	12.4
20	60.1		9.6	
25	63		18.3	
31.5	67.4	69.9	27.9	31.9
40	64.3		29.7	
50	56.6		26.4	
63	53	58.8	26.8	32
80	51.1		28.6	
100	47		27.9	
125	44.1	49.4	28	32.6
160	41.6		28.2	
200	38.8		27.9	
250	38.1	42.3	29.4	33.4
315	35.5		28.9	
400	35.1		30.3	
500	35.1	39.5	31.9	36.3
630	34.5		32.6	
800	34.2		33.4	
1,000	33.6	37.5	33.6	37.3
1,250	29.9		30.5	
1,600	27.4		28.4	
2,000	25.4	30.2	26.6	31.3
2,500	23.1		24.4	
3,150	24.8		26	
4,000	25.2	29.8	26.1	30.7
5,000	25.7		26.2	
6,300	26.6		26.5	
8,000	28.4	33.3	27.3	31.8
10,000	30.3		27.8	

*** OVERALL LEVELS (10 - 10000 Hz) ***

OASPL = 73.7 dB OASLA = 43.2 dB(A)

TITLE: 1919 SEWARD DR T-10/2 AFTERBURNER



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