REPORT NO. DOT-TSC-OST-72-2

MEASUREMENT OF AMBIENT NOISE LEVELS IN THE FLORIDA EVERGLADES

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TECHNICAL NOTE

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16. Abstract

Noise data recorded in and around a 100-square mile area of southern Florida during the period 16-22 March 1971 have been analyzed in the Noise Abatement Laboratory, Transportation Systems Center, Cambridge, Massachusetts. Nine locations were selected for measurement to obtain representative ambient noise levels in the area.

Tabulated data display a summary of the measured noise levels at each location, and include calculated values including the A-weighted noise levels exceeded 10%, 50%, and 90% of the measurement periods at each location.

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PREFACE

This technical note documents noise measurements made in southern Florida.

The Transportation Systems Center of the Department of Transportation gratefully acknowledges the assistance provided by personnel of the National Park Service, Department of Interior, during the conduct of the measurement program.

Other than the author, the following personnel of the Noise Abatement Group in the Technology Directorate of the Transportation Systems Center contributed to the measurement effort and report thereon: G. E. Byron, R. L. Mason, E. J. Rickley, S. C. Skeiber, J. E. Wesler.

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SUMMARY

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Table 1 contains a summary of the measured noise levels at each location, expressed as the noise level value exceeded for 10, 50, and 90 percent of the time, in A-weighted decibels.

Table 1. Summary Data

Run No. E	Loc. No.	Date	Time	Temp. °F.	Rel. Humid. %	Atmosph. Pressure MM Hg	Wind Direc.	Wind Veloc.	Sky	Noise Level[1] dBA L10	L50	L90	Noise Range dBA
1	1	3/16/71	1000	94	57	717	S	3 MPH	Sunny	47.3	41.1	39.1	31
8	1	3/19/71	2000	75	62	752	S	2-4 MPH	Clear	46.0	42.2	39.7	28
3	3	3/17/71	1000	76	51	756	NNE	10-15 Gusts to 20 MPH	Sunny	56.9	51.9	49.3	42
4	4	3/17/71	1200	86	33	743	N	2-10 MPH	Sunny	51.4	46.8	43.8	22
5	5	3/17/71	1600	85	40	751	N	5-10 MPH	Sunny	No Statistical Analysis[2]			47
6	6	3/18/71	1100	78	56	747	NE	4-10 MPH	Sunny	44.7	41.2	38.6	27
6A										No Statistical Analysis[2]			83
7	7	3/19/71	1500	87	46	748	SSE	2-6 MPH	Sunny	51.8	44.7	41.3	50
10	8	3/22/71	1000	75	70	755	E	6 MPH	P/Cldy w/smoke	51.9	44.5	38.4	36
11	9	3/22/71	1130	77	50	751	S	7 MPH	Cld/w/ smoke	No Statistical Analysis[2]			55

Runs No. 2 and No. 9 were not analyzed because high winds during the measurement period affected the accuracy of the data.

(1) Noise level exceeded for 10, 50, 90 percent of the time (L10, L50, L90 respectively) using "A" weighted Sound Pressure Levels relative to 20 micronewtons per square meter.

(2) Refer to section on Site Selection and Data Analysis

INTRODUCTION

This report documents measurements of representative ambient noise levels in an area of approximately 100 square miles, located in Southern Florida about 50 miles west of Miami, known as The Everglades. Test sites included segments of the "Everglades National Park," the "Big Cypress Swamp," "Water Conservation Area No. 3," and the "Seminole Indian Reservation".

Data were obtained from broad-band tape recordings of sound levels made at each of nine locations. Portable equipment was used to obtain readings at locations which were representative of the area, but which were difficult to reach. National Park Service rangers provided special transportation for those areas most difficult to negotiate.

MEASUREMENT SYSTEMS

Two different systems of instrumentation were used for the tests, depending on the location of the microphone and its distance from the tape recorder. Diagrams of the systems are shown in figures 1 and 2. The interconnection cable from the measurement point to the data recording instrumentation was 100 feet in System A and 18 feet in System B. A preamplifier was required to drive the 100 feet of cable in System A, but was not required in System B. A photograph of the actual equipment used is shown in Appendix C, Figure C-1 of this report.

Both systems were capable of making tape recordings with essentially flat frequency response from 30 Hz to 15 KHz. The tape recorder was operated at a speed of 3-3/4 inches per second in the direct mode to yield the desired results.

A calibration signal was recorded on the tape before and after each run to provide a reference for the analyzing instrumentation and to insure system stability. The calibration signal was a mechanically generated signal of 250 Hz at a level of 124 decibels re. 20 micronewtons per square meter.

Most of the time, a sedan type vehicle was used for transporting and setting up the noise measurement equipment. The recorder was securely strapped, transported and operated from the rear seat facing the left rear door. In System A, the sound level meter was placed on the trunk lid with the microphone placed 100 feet away. With this arrangement,

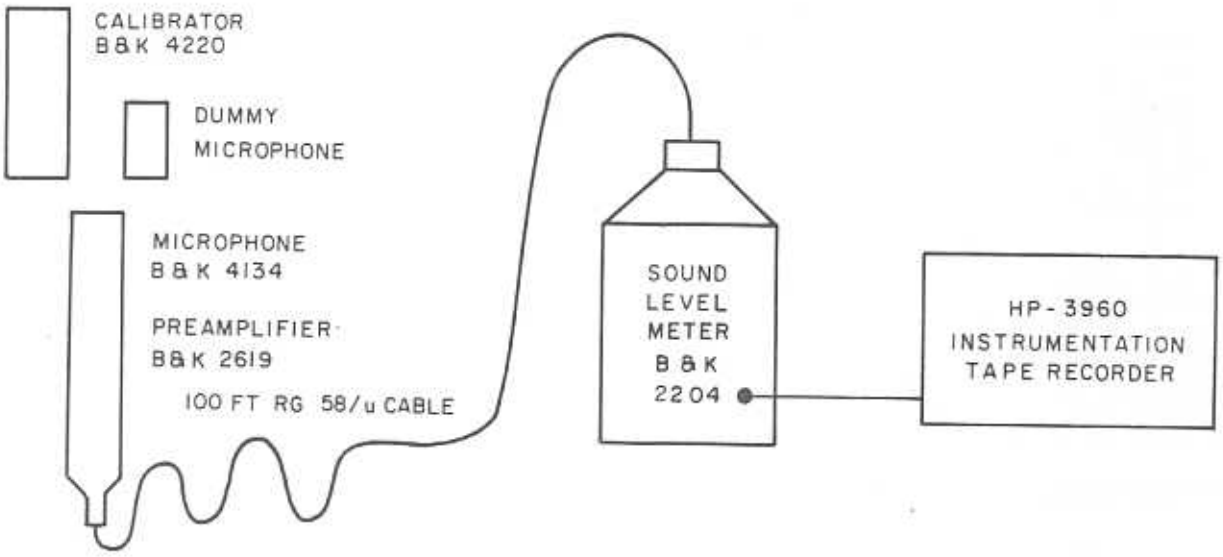

Figure 1. Data Gathering Instrumentation (System A)

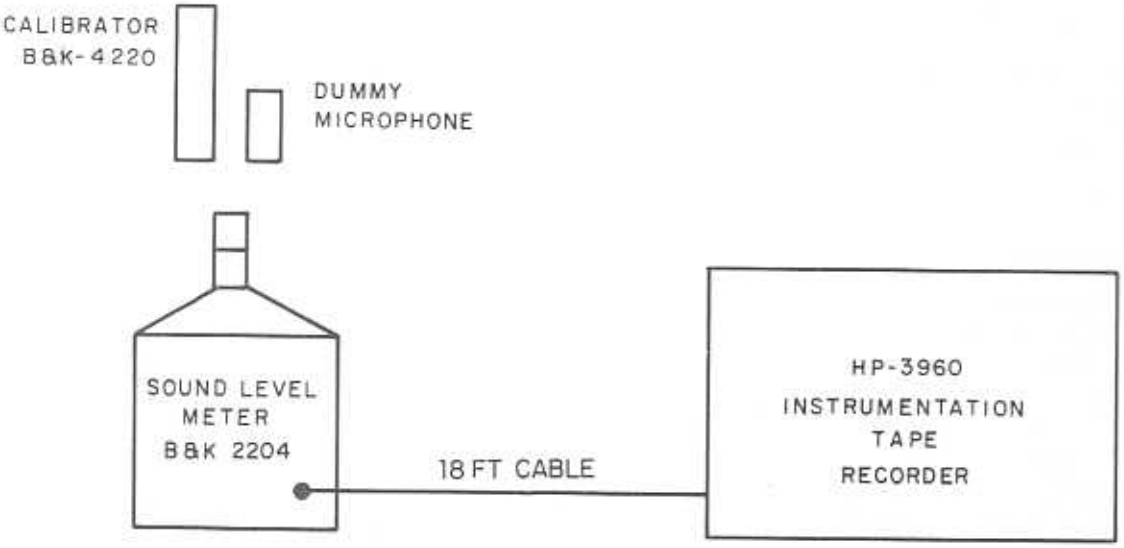

Figure 2. Data Gathering Instrumentation (System B)

the operator was able to wear earphones, monitor the peak level meter on the recorder, and, at the same time, observe the environment from his vantage point outside the left side of the vehicle. For System B, the setup was the same, except that the sound level meter was mounted on the tripod with the microphone installed directly on it, all 18 feet from the recorder.

Before calibrating and checking the system base level, a short verbal annotation was recorded on the tape giving the following information: run number, location number, date, time, brief description of the location, and the gain setting expected to be used.

A stop watch was started at the beginning of each run. Special events such as aircraft flyovers, vehicle passings, etc., were time-noted in a log book for future analysis. Somewhere near the middle of each run, weather data were collected and noted in the log. Temperature and humidity were obtained from a sling psychrometer, barometric pressure from an aneroid barometer, and wind speed from a small air velocity meter. A magnetic compass was used to determine wind direction.

At the end of each run, the calibration signal was again recorded, and the weather data dictated onto the tape, together with any other pertinent information such as gain changes from the originally announced expected gain setting.

When the sedan could not reach certain areas, special truck transportation was provided by the National Park Service rangers. The equipment was set up in the back of the truck as shown in Appendix C, figure C-1. Operational procedures were the same as previously described.

DATA REDUCTION INSTRUMENTATION AND PROCEDURES

The configuration of the data reduction system is shown in figure 3. The magnetic tapes containing the data recordings and calibration signals taken at the test sites were played into a GR 1921 Real Time Analyzing System made up of a GR 1925 Multifilter and a GR 1926 Multichannel RMS Detector. The necessary gain adjustments were made in the Multifilter and graphic Level Recorder using the prerecorded calibration signals. The GR Multifilter contains a set of 30 parallel 1/3 octave band filter channels ranging from 25 Hz to 20 KHz, plus three additional channels with standard "A", "B" and "C" sound-level meter weighting networks and a fourth unfiltered channel with a flat frequency response. The output of any channel could be selected and fed through

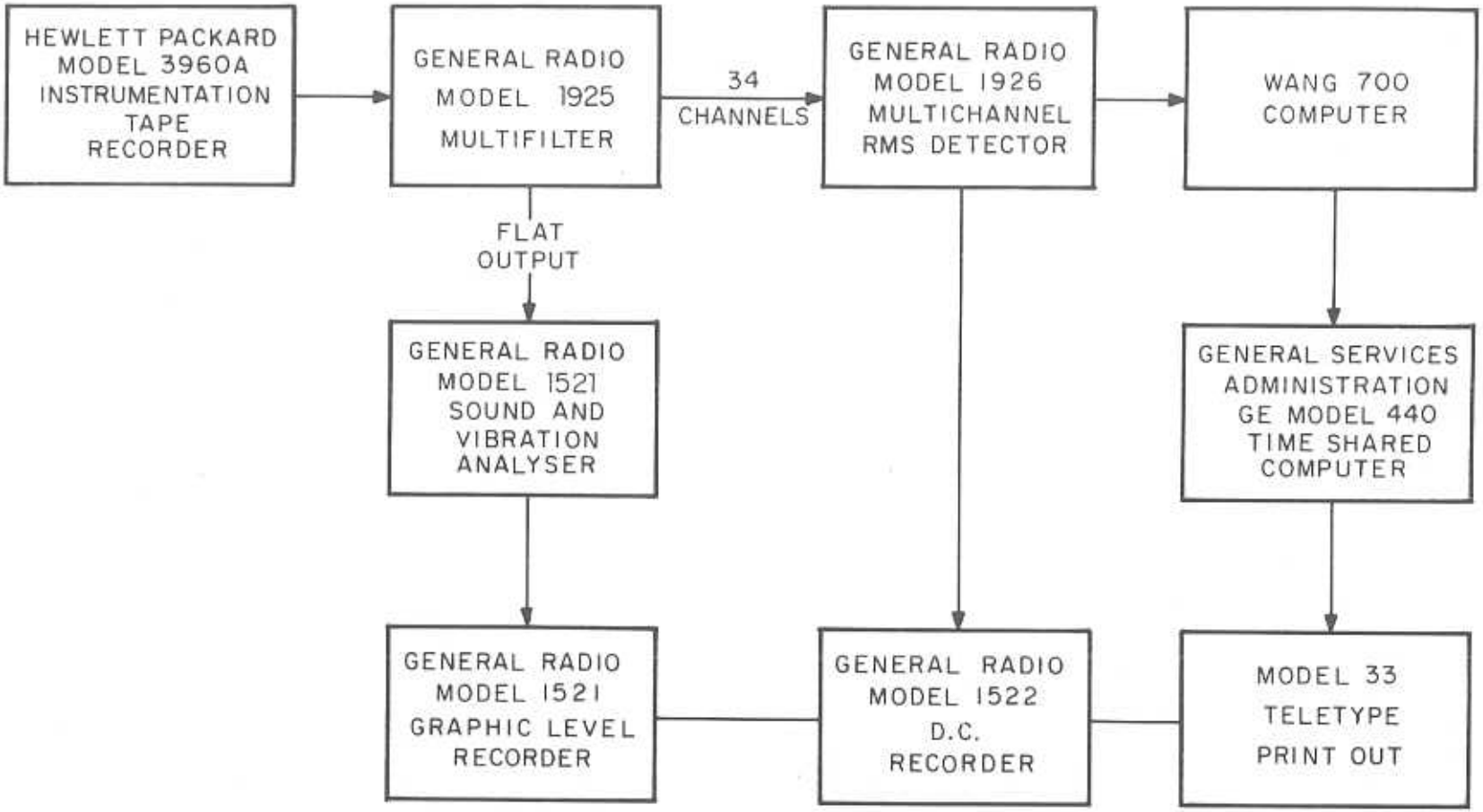

Figure 3. Data Reduction System

the GR Sound and Vibration Analyzer to the Graphic Level Recorder to produce a chart of time history vs. sound level for that channel. Both the "A" weighted channel and the flat channel were used in analyzing the data obtained and time history charts made.

All 34 outputs from the Multifilter were fed into the Multichannel Detector. The detector simultaneously computed the RMS level for each channel or selected channels and converted this level to dB for digital output presentation. Single integration or measurement periods were adjustable from 1/8 to 32 seconds. For most of the analyses, the detector was programmed to integrate for 1/8th second, compute the dB value of the "A" weighted filter output, and provide a binary coded decimal signal to the Wang Computing Calculator four times every second. The computer counted and totaled the number of samples at each decibel level at the above rate for a selected time period and displayed the results. These data were programmed into a time-shared computer which provided a statistical analysis printout showing graphically the cumulative noise level distribution and a bargraph of normal distribution.

Some of the special events, such as aircraft noise and wildlife noise, were analyzed in detail for their 1/3 octave band frequency distribution, using the same equipment described above. The Multichannel Detector was programmed to integrate for the time interval of the special event, compute the dB level for all 34 channels and provide the information to the DC Recorder which provided a hard copy (dB level vs. 1/3 octave bands) of the analysis of the sounds which occurred during the integration period. The graphic Level Recorder simultaneously provided a time history of the special event, and time marks were placed on the graphic recording to show the start and end of the integration period.

CALIBRATION PROCEDURES

Acoustic calibration of the data-gathering instrumentation was accomplished in the field using the same calibration procedure for both systems. A B&K Model 4220 Pistonphone was used as a sound source to provide a 250-Hertz signal at a sound pressure level of 124 decibels re. 20 micronewtons per square meter. The Pistonphone was placed on the microphone before and after each run, and the calibration signal was recorded on the tape. At the same time, the signal was monitored by the Sound Level Meter, which was calibrated on the 120-decibel range.

All other calibration tests were made on both systems in the Noise Abatement Laboratory at the Transportation Systems Center, Cambridge, Mass., because portability and mobility requirements precluded additional calibration instrumentation in the field. Frequency response tests were made using the instrumentation as shown in figure 4. "Pink Noise" (constant energy per octave bandwidth) was introduced into each system using a GR Model 1382 Random Noise Generator. A 1/3 octave band analysis was performed using a GR 1564 Sound and Vibration Analyzer and a GR 1521 Graphic Level Recorder. The results indicated that both System A and System B had a flat response from 30 Hz to 15 KHz. Copies of the frequency analysis printouts are not included in this report but are available upon request.

Tests to determine the minimum discernible sound level for each system were performed on each range of both systems by substituting a passive microphone simulator into each system and recording the noise levels for these ranges on magnetic tape (figure 5). Signals from the tapes were analyzed using the GR 1921 Real Time Analyzer System.

To determine the overload level of both systems, a H.P. 652A Test Oscillator and a H.P. 140A Oscilloscope were used (figure 6). A signal was introduced into each system by the test oscillator. The signal was recorded on tape and the tape recorder output was monitored by the oscilloscope. The signal was adjusted to the maximum level that the system would reproduce without distortion at 1KHz. Then the frequency of the signal was adjusted through the operating range of the system (30 Hz to 15 KHz) and the system gain adjusted to ensure that no distortion was introduced by the system. The results of this test indicated that the overload level was 10 decibels above full scale reading on the B&K 2204 Sound Level Meter for all operating ranges for both System A and System B. This allowed a 10-decibel safety factor for both systems.

The resulting upper and lower limits, and the dynamic ranges of each system, are tabulated on Table 2.

SITE SELECTION AND DATA ANALYSES

GENERAL

Measurement points were selected to yield a representative number of ambient noise levels in and around a 100-square mile area of southern Florida made up of segments in the Everglades National Park, the Big Cypress Swamp, Water Conservation Area No. 3 and the Seminole Indian Reservation. Table D-1 along with the maps and the overlay in Appendix D locate the measurement points. Appendix C contains photo-

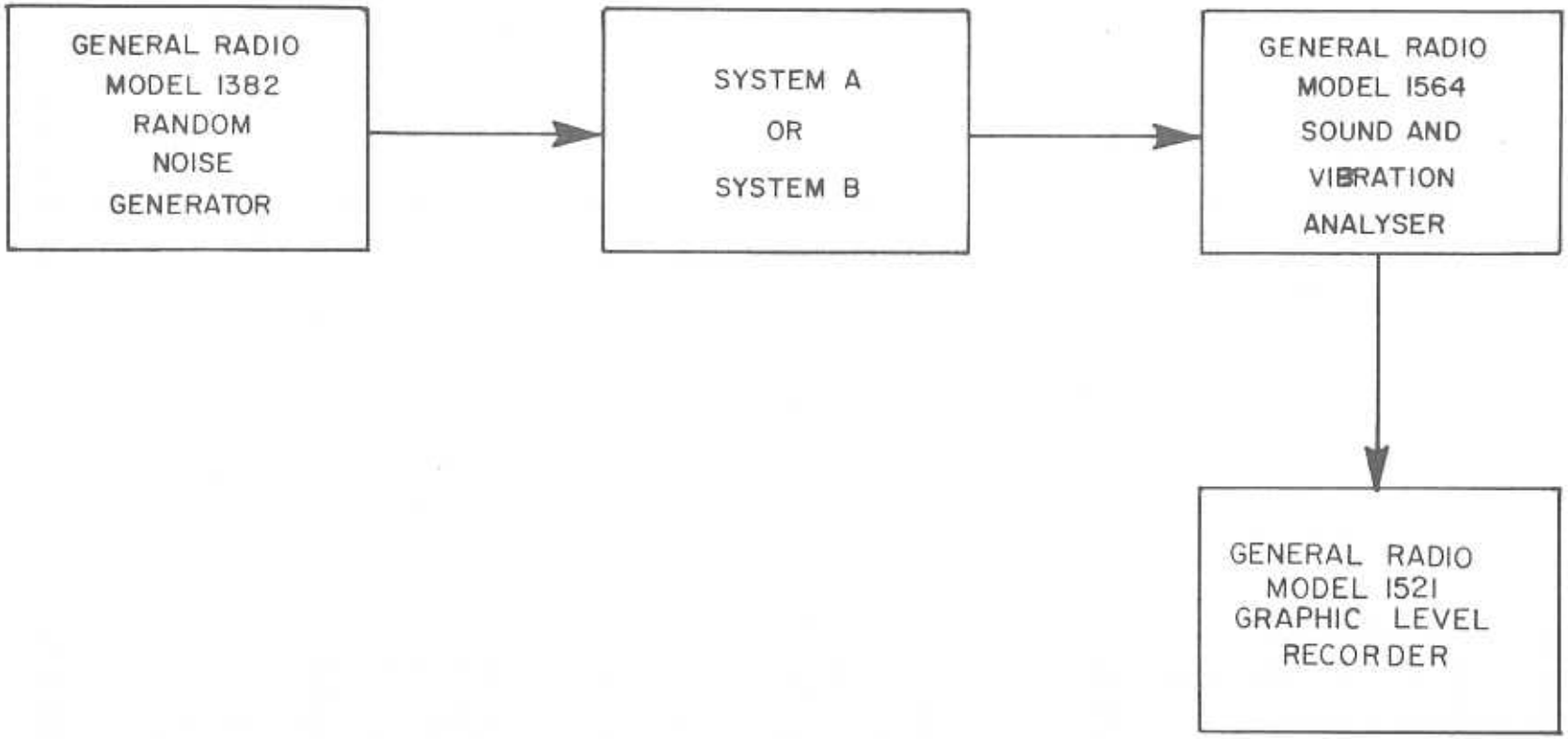

Figure 4. Frequency Response Test Instrumentation

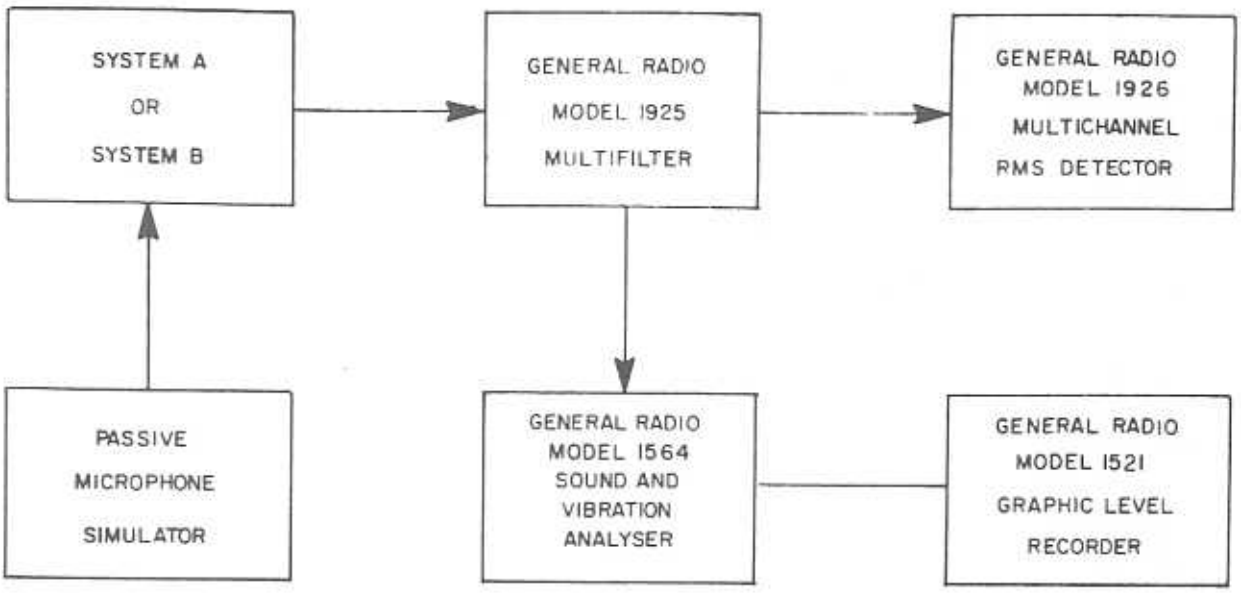

Figure 5. Inherent System Noise Test Instrumentation

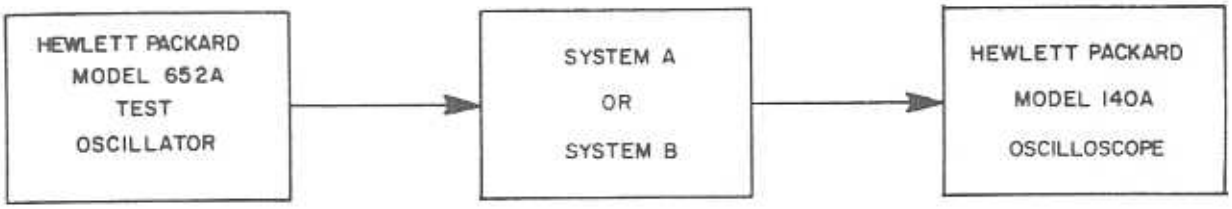

Figure 6. Overload Level Test Instrumentation

Table 2. Measurement System Dynamic Range

	System A			System B		
SLM Range dBA	Max. dBA	Min. dBA	Dynamic Range dBA	Max. dBA	Min. dBA	Dynamic Range dBA
120	130	79	51	130	79	51
110	120	69	51	120	69	51
100	110	59	51	110	59	51
90	100	49	51	100	49	51
80	90	39	51	90	39	51
70	80	33	47	80	33	47
60	70	29	41	70	26	44

graphs taken of some of the measurement sites. Selected microphone locations were free from any obstruction so that the data recorded were a true representation of the noise in that area.

Table 1 contains a summary of the measured noise levels expressed as the A-weighted noise level exceeded for 10, 50, and 90 per cent of the time (L10, L50 and L90 levels), and the total range of noise level recorded at each location.

Computer printouts of the statistical analyses of the data are provided in Appendix A showing graphically the noise level vs. distribution (per cent), and a tabulation of pertinent values such as standard deviation, energy mean, and noise pollution level.

The data recordings of each location were analyzed in accordance with procedures described in the section on "Data Reduction." Where pertinent, a time history chart recording and a frequency analysis chart is provided in the report to describe unique events affecting the noise environment. The following comments are made regarding each location during the time the noise recordings were made.

LOCATION NO. 1

This site was near the "Shark Valley" fire tower approximately seven miles south of Highway 41 and was the only site selected that was located inside the Everglades National Park. The water level at this location had not reached the dangerously low point that most of the northern areas were experiencing at that time. Much of the wild life was still in the area and probably some migration from other drought affected areas.

Run No. E1 began at 1000 on March 16, 1971 and lasted approximately one hour. The sky was sunny, temperature was 94 degrees Fahrenheit, relative humidity 57 percent, wind 3 miles per hour from the south.

There was a constant chatter of animal noises during the entire run. Several aircraft could be heard in the distance, although only one was sighted, a Coast Guard amphibian. In addition, an air boat was skimming across the water for a short period of time approximately 500 feet away. The median noise level during this period was 41.1 dBA.

A third-octave frequency analysis and a time-history chart recording were made of a 32-second segment of the data containing mostly animal noise. These are provided in

Appendix B, figure B-1 and figure B-2. The analysis indicates that the animal noise contains mostly low frequency and very high frequency components. The sound pressure levels of the middle frequencies are very low. The shape of the frequency analysis curve approximates the inverse of the "A" weight curve.

Run No. E8A began at 2000 on March 19, 1971 at the same location and lasted approximately one hour. The sky was clear, temperature was 75 degrees Fahrenheit, relative humidity 62 percent, wind 3 miles per hour from the south.

Again, the constant chatter of animals was heard. There was also a continuous popping sound caused by fish jumping out of the water to get oxygen. During the daytime run, the jumping fish sounded like little splashes, but at night each one sounded like a hand clap and they were much more frequent. At one point, two alligators were heard entering the water just as an aircraft was heard in the distance. Two aircraft were heard far in the distance during the run, but were not sighted. The median noise level was 42.2 dBA, slightly higher than measured during the morning at this location.

There were frequent alligator bellows during the run, and one was selected for third-octave frequency analysis. A short time-history and third-octave analysis recording are provided in Appendix B, figure 3 and figure 4. Most of the sound during the one-half second integration period is contained in the very low frequency range.

Alligator bellows were infrequent during the daytime (Run No. E1) at this location, but whenever an aircraft approached, their vocal activity increased substantially. A short time-history showing the "A" weighted sound level of the approach of an aircraft is provided in Appendix B, figure 5. The time-history chart has been marked to indicate points at which alligator bellows were heard, showing the increased vocal reaction to the approaching aircraft.

LOCATION NO. 2

This site was in the southwestern corner of Water Conservation Area No. 3, about one mile north of Highway 41, two miles west of "Forty Mile Bend." The surrounding area showed signs of the drought. There were some flying birds such as red-shouldered hawks and Everglades kites, but no wading birds and very few other animals were seen.

Data taken at this location were affected by high winds

and appeared to be of questionable accuracy. Therefore, no analysis of the tapes was made.

LOCATION NO. 3

This site was near the western edge of "Water Conservation Area No. 3" about nine miles north of Highway 41, and two miles west of Forty Mile Bend. The surrounding area showed signs of the drought. There were very few flying birds, mostly turkey buzzards and red-shouldered hawks, and no wading birds. Other animals were sighted such as a deer and an otter. There seemed to be plenty of fish and some turtles in the canal, but no alligators. There were many large cypress hammocks in the area and the trees had some green foliage on them. The swamp areas were dry and the mud was beginning to crack.

Run No. E3A began at 1009 on March 17, 1971 and lasted approximately one hour. The sky was sunny, temperature was 76 degrees Fahrenheit, relative humidity 51 percent, wind 10 miles-per-hour from the north northeast. There were seven aircraft flybys during the run, resulting in noise levels over 80 dBA for very brief periods. The aircraft were continually flying in circles and making practice approaches, landings, takeoffs, and possibly other maneuvers in connection with the training runway five miles southwest. These aircraft activities continued throughout the entire run and were the cause of the increase in the ambient noise level. The median noise level was 51.9 dBA at this location. Two small outboard motor boats passed by in the canal during the run, one heading up and one down stream. Bird and animal noise contributed very little to the overall noise level in the area.

LOCATION NO. 4

This site was in the southwest corner of the Seminole Indian Reservation about 19 miles north of Highway 41, almost on the county line between Collier and Broward Counties.

The surrounding area showed signs of the drought about equal to those at Location #3. There were more birds than at Location #3, but no other animals were sighted.

Run No. E4A began at 1211 on March 17, 1971 and lasted approximately one hour. The sky was sunny, temperature was 86 degrees Fahrenheit, relative humidity 33 percent, wind five miles per hour from the north. There were no aircraft flybys or motor boats in the immediate vicinity of the microphone or any other man-made noises distinguishable, except very

distant aircraft could be weakly heard during periods of quiet. The overall noise level during the period of measurement was primarily that due to birds. The median noise level measured was 46.8 dBA.

LOCATION NO. 5

This site was north of Highway 41 between the highway and the Tamiami Canal about three miles east of Forty Mile Bend. Airboats were passing by in the canal about 70 feet from the microphone.

Run No. 5 began at 1530 on March 17, 1971 and lasted approximately one-half hour. The sky was sunny, temperature was 85 degrees Fahrenheit, relative humidity 40 percent, wind five miles per hour from the north. Four third-octave frequency analyses and a time-history recording of a 32-second segment of the data containing the noise of a swamp airboat are provided in Appendix B, figure B-6 and figure B-7. The airboat in the Canal approached from the east to a point about 70 feet north of the microphone, turned to the north and pushed through the sawgrass directly away from the microphone into the swamp. The analysis indicates that most of the noise is to the side and behind the airboat because the approach sound levels are comparatively low. The maximum sound level recorded was 82 dBA. The photograph of Location 5 in Appendix C, figure C-2 shows the position of the airboat at the start of the 16-second integration period for the frequency analysis (Appendix B, figure B-6).

This site was selected mainly to obtain data on airboats, and no ambient noise level data were recorded for statistical analysis.

LOCATION NO. 6

This site was in the southeast corner of the Big Cypress Swamp about 1.4 miles north of Highway 41 and 3.3 miles west of the county line between Collier and Dade Counties. The surrounding area was extremely dry and the trees were turning brown. There were very few flying birds and no other wild life was sighted.

Run No. E6 began at 1213 on March 18, 1971 and lasted approximately 12 minutes. The sky was sunny, temperature was 78 degrees Fahrenheit, relative humidity 56 percent, wind five miles per hour from the northeast.

In order to obtain information about the ambient noise level unaffected by aircraft, a 12-minute segment of data

was analyzed when there were no aircraft flyovers. During this quiet period, the only noise that could be heard was the distant traffic noise from Highway 41, and the occasional sound of a passing bird. The median noise level was 41.2 dBA. No statistical analysis was made of data taken during periods of aircraft flyovers.

A total of 12 aircraft flyovers occurred during the one and one-half hours of recorded data at this site. The maximum sound level of the flyovers was as high as 120 dBA with most of them over 110 dBA. The time-history chart for a portion of time that includes aircraft flyovers is provided in Appendix B, figure B-8.

LOCATION NO. 7

This site was 4-1/2 miles directly west of Forty Mile Bend on the "Old Loop Road," Route 94 (dirt road). The surrounding area was covered with thick underbrush and trees. The area did not seem to show any adverse effects from the drought. There were flying birds, a few wading birds, and some other small animals in the brush. There were widely separated camps and camp sites set into the forest on either side of the road.

Run No. E7A began at 1512 on March 19, 1971 and lasted approximately one hour. The sky was sunny, temperature was 87 degrees Fahrenheit, relative humidity 46 percent, wind four miles per hour from the south southeast.

During the run, there were four aircraft flybys, resulting in noise levels of up to 70 dBA.

Twelve automotive vehicles passed by on the bumpy dirt road about 15 feet from the microphone, resulting in noise levels recorded up to 85 dBA. There was considerable bird and animal noise during the run. The median noise level was 44.7 dBA.

LOCATION NO. 8

This site was near the "Miccosukee Indian School" and the "Miccosukee Indian Village." It was about 1.9 miles east of Forty Mile Bend, and 285 feet south of the center of Highway 41. There was a small canal running by 10 feet from the microphone. The surrounding area was green with growing underbrush. The school grounds, which started about 20 feet from the microphone, were covered with planted palm trees and well cared for grass and shrubbery.

Run No. E10 began at 1000 on March 22, 1971 and lasted approximately one hour. The sky was partly cloudy and smoky, temperature was 75 degrees Fahrenheit, relative humidity 70 percent, wind six miles per hour from the east. There was only one aircraft flyby during the run. Approximately 330 vehicles passed by on Highway 41, and five passed by on the school road. Most of the noise during the run was caused by the traffic on Highway 41. The five vehicles on the school road and the aircraft flyby caused the highest sound levels. Other noises also heard were birds, water noise from jumping fish, and school children playing. The median noise level was 44.5 dBA.

LOCATION NO. 9

This site was in the southeast corner of the Big Cypress Swamp about 1.5 miles north of Highway 41 and 1.6 miles west of the county line between Collier and Dade Counties. The surrounding area was extremely dry and the trees were turning brown. There were very few flying birds, and no other wildlife.

The recorded data for Run No. 11 did not contain sufficient data to get a true analysis of the low level ambient noise at this location; therefore, no statistical analysis is provided. Since Location No. 6 has similar physical characteristics, is about the same distance from Highway 41 and is less than two miles from Location No. 9, the low level ambient noise information from Run No. 6 can be applied to Location No. 9. This value was used in calculating the range of noise level for this area. A time-history chart recording of a segment of the recorded data from Location No. 9 is provided in Appendix B, figure B-9. It shows the effect of four aircraft flybys and some ground activity on the training runway.

CONCLUSIONS

Of the six locations at which measurements were satisfactory for statistical analyses, four (locations #1, 4, 6, and 7) were representative of areas in The Everglades relatively unspoiled by civilized activity. The average values of L90, L50, and L10 for these four locations were 40.5 dBA, 43.2 dBA, and 48.2 dBA respectively. Location #8 was selected close to highway and inhabited activity. The same values measured here (38.4 dBA, 44.5 dBA, and 51.9 dBA respectively) were not substantially different from those for the remote sites. Location #3 was selected near an airport runway, used primarily for training flights with commercial airliners. The noise values here were significantly affected by the aircraft noise (49.3 dBA, 51.9 dBA, and 56.9 dBA respectively),

averaging 8.7 dBA above the corresponding values at the remote sites. Although only seven aircraft flyovers raised the noise level drastically (over 80 dBA) during the approximately one-hour measurement period, the continuous flight activity in the general area was the cause of the increased levels.

In a similar manner to the L90, L50, and L10 levels noted above, the "range" or difference between maximum and minimum levels measured during an observation period varied according to the proximity of the measurement point to aircraft flight paths. For three periods of measurement which were relatively unaffected by aircraft flyovers (Locations #1, 4, and 6 during its non-flyover analysis), the average range was 27 dBA. For three locations affected by aircraft operations (Locations # 7, 9, and 6 during flyovers), the average range was 63 dBA. The extreme instance was measured at Location #6, caused by the position of the microphone near the training runway but in the direct path of landing aircraft (figure C-3).

APPENDIX A

Statistical Analyses

US DEPARTMENT OF TRANSPORTATION
TRANSPORTATION SYSTEMS CENTER
NOISE ABATEMENT GROUP

NOISE DATA FROM RUN NO. E1 (D) OF THE PORTABLE NOISE LAB. ON
MARCH 16 1971 FROM 10:07 TO 10:43 AT EVERGLADES GRID LOCATION NO. 1

DISTRIBUTION	DBA*	
1	66	+
0	65	+
3	64	+
7	63	+
11	62	+
21	61	+
22	60	+
39	59	+
37	58	+
37	57	+
29	56	+
32	55	+
31	54	+
40	53	+
63	52	+
66	51	+
80	50	+
123	49	+
153	48	+
195	47	+
237	46	+
331	45	+
395	44	+
551	43	+
893	42	+
1409	41	+
1998	40	+
1766	39	+
574	38	+
143	37	+
10	36	+
1	35	+
0	34	+

SAMPLES=	9298
AVERAGE=	41.9 DBA*
STANDARD DEVIATION=	4.1 DBA*
ENERGY MEAN=	46 DB**
NOISE POLLUTION LEVEL=	56.5
1% PERCENTILE=	59.3 DBA*
10% DECILE=	47.3 DBA*
MEDIAN=	41.1 DBA*
90% DECILE=	39.1 DBA*
99% PERCENTILE=	37.6 DBA*
RANGE=	31 DB

0 20 40 60 80 100

LEVEL(DBA*) VS CUMULATIVE DISTRIBUTION (PERCENT)

NOISE DATA FROM RUN NO. E1 (D) OF THE PORTABLE NOISE LAB. ON
MARCH 16 1971 FROM 10:07 TO 10:43 AT EVERGLADES GRID LOCATION NO. 1

```
  1     66  0
  0     65  0
  3     64  0
  7     63  0
 11     62  0
 21     61  0
 22     60  0
 39     59  00
 37     58  00
 37     57  00
 29     56  00
 32     55  00
 31     54  00
 40     53  00
 63     52  00
 66     51  00
 80     50  00
123     49  000
153     48  0000
195     47  0000
237     46  00000
331     45  000000
395     44  0000000
551     43  0000000000
893     42  0000000000000000
1409     41 00000000000000000000000000
1998     40 00000000000000000000000000000000000
1766     39 000000000000000000000000000000
574     38  0000000000
143     37  000
 10     36  0
  1     35  0
DIST. DBA*0              10              20              30
            LEVEL(DBA*) VS DISTRIBUTION (PERCENT)
```

*-A WEIGHTED DECIBELS-RE. 20 MICRONEWTONS PER SQUARE METER

**-DBA RE. 20 MICRONEWTONS PER SQUARE METER FROM AN AVERAGE OF THE SQUARES OF THE SOUND PRESSURES.

US DEPARTMENT OF TRANSPORTATION
TRANSPORTATION SYSTEMS CENTER
NOISE ABATEMENT GROUP

NOISE DATA FROM RUN NO. E8A (D) OF THE PORTABLE NOISE LAB. ON MARCH 19 1971 FROM 19:22 TO 20:06 AT EVERGLADES GRID LOCATION NO. 1

DISTRIBUTION	DBA*	
3	62	+
1	61	+
2	60	+
4	59	+
6	58	+
5	57	+
12	56	+
16	55	+
17	54	+
38	53	+
40	52	+
58	51	+
79	50	+
123	49	+
206	48	+
246	47	+
327	46	+
625	45	+
1002	44	+
1484	43	+
2005	42	+
2292	41	+
1895	40	+
947	39	+
379	38	+
132	37	+
24	36	+
2	35	+
1	34	+
0	33	+

SAMPLES=	11971
AVERAGE=	42.1 DBA*
STANDARD DEVIATION=	2.8 DBA*
ENERGY MEAN=	43.6 DB**
NOISE POLLUTION LEVEL=	50.8
1% PERCENTILE=	52.6 DBA*
10% DECILE=	46 DBA*
MEDIAN=	42.2 DBA*
90% DECILE=	39.7 DBA*
99% PERCENTILE=	37.7 DBA*
RANGE=	28 DB

0 20 40 60 80 100

LEVEL(DBA*) VS CUMULATIVE DISTRIBUTION (PERCENT)

NOISE DATA FROM RUN NO. E8A (D) OF THE PORTABLE NOISE LAB. ON MARCH 19 1971 FROM 19:22 TO 20:06 AT EVERGLADES GRID LOCATION NO. 1

```
  3     62  0
  1     61  0
  2     60  0
  4     59  0
  6     58  0
  5     57  0
 12     56  0
 16     55  0
 17     54  0
 38     53  00
 40     52  00
 58     51  00
 79     50  00
123     49  000
206     48  0000
246     47  0000
327     46  00000
625     45  000000000
1002     44 00000000000000
1484     43 000000000000000000
2005     42 00000000000000000000000000
2292     41 0000000000000000000000000000000
1895     40 000000000000000000000000
947   39    0000000000000
379   38    000000
132   37    000
 24   36    0
  2   35    0
  1   34    0
DIST. DBA*0              10              20              30
            LEVEL(DBA*) VS DISTRIBUTION (PERCENT)
```

*-A WEIGHTED DECIBELS-RE. 20 MICRONEWTONS PER SQUARE METER

**-DBA RE. 20 MICRONEWTONS PER SQUARE METER FROM AN AVERAGE OF THE SQUARES OF THE SOUND PRESSURES.

US DEPARTMENT OF TRANSPORTATION
TRANSPORTATION SYSTEMS CENTER
NOISE ABATEMENT GROUP

NOISE DATA FROM RUN NO. E3A (D) OF THE PORTABLE NOISE LAB. ON
MARCH 17 1971 FROM 10:09 TO 11:01 AT EVERGLADES GRID LOCATION NO. 3

DISTRIBUTION	DBA*	
1	85	+
2	84	+
3	83	+
2	82	+
7	81	+
7	80	+
10	79	+
8	78	+
9	77	+
11	76	+
9	75	+
7	74	+
18	73	+
20	72	+
22	71	+
21	70	+
32	69	+
40	68	+
29	67	+
33	66	+
41	65	+
38	64	+
54	63	+
68	62	+
85	61	+
99	60	+
131	59	+
162	58	+
196	57	+
258	56	+
509	55	+
741	54	+
1227	53	+
1738	52	+
2490	51	+
1915	50	+
1052	49	+
665	48	+
84	47	+
84	46	+
59	45	+
3	44	+
3	43	+
0	42	+

SAMPLES=	11993
AVERAGE=	52.3 DBA*
STANDARD DEVIATION=	4.3 DBA*
ENERGY MEAN=	59.4 DB**
NOISE POLLUTION LEVEL=	70.4
1% PERCENTILE=	71.7 DBA*
10% DECILE=	56.9 DBA*
MEDIAN=	51.9 DBA*
90% DECILE=	49.3 DBA*
99% PERCENTILE=	46.7 DBA*
RANGE=	42 DB

0 20 40 60 80 100

LEVEL(DBA*) VS CUMULATIVE DISTRIBUTION (PERCENT)

NOISE DATA FROM RUN NO. E3A (D) OF THE PORTABLE NOISE LAB. ON
MARCH 17 1971 FROM 10:09 TO 11:01 AT EVERGLADES GRID LOCATION NO. 3

```
 1     85  0
 2     84  0
 3     83  0
 2     82  0
 7     81  0
 7     80  0
 10    79  0
 8     78  0
 9     77  0
 11    76  0
 9     75  0
 7     74  0
 18    73  0
 20    72  0
 22    71  0
 21    70  0
 32    69  00
 40    68  00
 29    67  0
 33    66  00
 41    65  00
 38    64  00
 54    63  00
 68    62  00
 85    61  00
 99    60  00
 131   59  000
 162   58  000
 196   57  0000
 258   56  0000
 509   55  0000000
 741   54  0000000000
 1227   53 00000000000000000
 1738   52 000000000000000000000000
 2490   51 00000000000000000000000000000000000
 1915   50 0000000000000000000000000
 1052   49 0000000000000
 665   48  000000000
 84    47  00
 84    46  00
 59    45  00
 3     44  0
 3     43  0
DIST. DBA*0              10              20              30
            LEVEL(DBA*) VS DISTRIBUTION (PERCENT)
```

*-A WEIGHTED DECIBELS-RE. 20 MICRONEWTONS PER SQUARE METER
**-DBA RE. 20 MICRONEWTONS PER SQUARE METER FROM AN AVERAGE OF
THE SQUARES OF THE SOUND PRESSURES.

US DEPARTMENT OF TRANSPORTATION
TRANSPORTATION SYSTEMS CENTER
NOISE ABATEMENT GROUP

NOISE DATA FROM RUN NO. E4A (D) OF THE PORTABLE NOISE LAB. ON MARCH 17 1971 FROM 12:11 TO 1303 AT EVERGLADES GRID LOCATION NO. 4

DISTRIBUTION	DBA*
5	60
7	59
12	58
24	57
56	56
81	55
138	54
203	53
339	52
535	51
702	50
959	49
1218	48
1448	47
1703	46
1859	45
1319	44
825	43
428	42
83	41
51	40
4	39
2	38
0	37

SAMPLES=	12001
AVERAGE=	46.8 DBA*
STANDARD DEVIATION=	3 DBA*
ENERGY MEAN=	48 DB**
NOISE POLLUTION LEVEL=	55.7
1% PERCENTILE=	55.8 DBA*
10% DECILE=	51.4 DBA*
MEDIAN=	46.8 DBA*
90% DECILE=	43.8 DBA*
99% PERCENTILE=	41.8 DBA*
RANGE=	22 DB

LEVEL(DBA*) VS CUMULATIVE DISTRIBUTION (PERCENT)

NOISE DATA FROM RUN NO. E4A (D) OF THE PORTABLE NOISE LAB. ON MARCH 17 1971 FROM 12:11 TO 1303 AT EVERGLADES GRID LOCATION NO. 4

```
  5     60  0
  7     59  0
 12     58  0
 24     57  0
 56     56  00
 81     55  00
138     54  000
203     53  0000
339     52  00000
535     51  00000000
702     50  000000000
959     49  0000000000000
1218    48  00000000000000000
1448    47  000000000000000000
1703    46  0000000000000000000000
1859    45  00000000000000000000000000
1319    44  0000000000000000000
825     43  00000000000
428     42  000000
83      41  00
51      40  00
4       39  0
2       38  0
DIST. DBA*0                10                  20                  30
                LEVEL(DBA*) VS DISTRIBUTION (PERCENT)
```

*-A WEIGHTED DECIBELS-RE. 20 MICRONEWTONS PER SQUARE METER
**-DBA RE. 20 MICRONEWTONS PER SQUARE METER FROM AN AVERAGE OF THE SQUARES OF THE SOUND PRESSURES.

US DEPARTMENT OF TRANSPORTATION
TRANSPORTATION SYSTEMS CENTER
NOISE ABATEMENT GROUP

NOISE DATA FROM RUN NO. E6 (D) OF THE PORTABLE NOISE LAB. ON MARCH 18 1971 FROM 12:13 TO 12:25 AT EVERGLADES GRID LOCATION NO. 6

DISTRIBUTION	DBA*	
1	60	+
0	59	+
1	58	+
0	57	+
2	56	+
2	55	+
3	54	+
1	53	+
5	52	+
8	51	+
8	50	+
11	49	+
18	48	+
28	47	+
42	46	+
110	45	+
151	44	+
226	43	+
322	42	+
592	41	+
522	40	+
417	39	+
270	38	+
49	37	+
49	36	+
35	35	+
2	34	+
2	33	+
0	32	+

SAMPLES=	2877
AVERAGE=	40.9 DBA*
STANDARD DEVIATION=	2.7 DBA*
ENERGY MEAN=	42.1 DB**
NOISE POLLUTION LEVEL=	49
1% PERCENTILE=	50.3 DBA*
10% DECILE=	44.7 DBA*
MEDIAN=	41.2 DBA*
90% DECILE=	38.6 DBA*
99% PERCENTILE=	35.7 DBA*
RANGE=	27 DB

0 20 40 60 80 100

LEVEL(DBA*) VS CUMULATIVE DISTRIBUTION (PERCENT)

DISTRI

NOISE DATA FROM RUN NO. E6 (D) OF THE PORTABLE NOISE LAB. ON
MARCH 18 1971 FROM 12:13 TO 12:25 AT EVERGLADES GRID LOCATION NO. 6

```
  1     60  0
  0     59  0
  1     58  0
  0     57  0
  2     56  0
  2     55  0
  3     54  0
  1     53  0
  5     52  0
  8     51  00
  8     50  00
 11     49  00
 18     48  00
 28     47  000
 42     46  000
110     45  0000000
151     44  000000000
226     43  0000000000000
322     42  00000000000000000
592     41  0000000000000000000000000000000000
522     40  000000000000000000000000000000
417     39  00000000000000000000000
270     38  000000000000000
 49     37  0000
 49     36  0000
 35     35  000
  2     34  0
  2     33  0
DIST.  DBA*0              10              20              30
              LEVEL(DBA*) VS DISTRIBUTION (PERCENT)
```

*-A WEIGHTED DECIBELS-RE. 20 MICRONEWTONS PER SQUARE METER
**-DBA RE. 20 MICRONEWTONS PER SQUARE METER FROM AN AVERAGE OF
THE SQUARES OF THE SOUND PRESSURES.

US DEPARTMENT OF TRANSPORTATION
TRANSPORTATION SYSTEMS CENTER
NOISE ABATEMENT GROUP

NOISE DATA FROM RUN NO. E7A (D) OF THE PORTABLE NOISE LAB. ON MARCH 19 1971 FROM 15:12 TO 16:06 AT EVERGLADES GRID LOCATION NO. 7

SAMPLES=	12000
AVERAGE=	45.5 DBA*
STANDARD DEVIATION=	5.4 DBA*
ENERGY MEAN=	57.1 DB**
NOISEPOLLUTION LEVEL=	70.9
1% PERCENTILE=	67.4 DBA*
10% DECILE=	51.8 DBA*
MEDIAN=	44.7 DBA*
90% DECILE=	41.3 DBA*
99% PERCENTILE=	38.9 DBA*
RANGE=	50 DB

DISTRIBUTION	DBA*	
1	85	+
0	84	+
3	83	+
2	82	+
5	81	+
6	80	+
7	79	+
7	78	+
8	77	+
5	76	+
8	75	+
4	74	+
7	73	+
8	72	+
4	71	+
10	70	+
11	69	+
15	68	+
14	67	+
15	66	+
26	65	+
22	64	+
41	63	+
41	62	+
49	61	+
43	60	+
43	59	+
65	58	+
79	57	+
96	56	+
103	55	+
115	54	+
123	53	+
169	52	+
181	51	+
246	50	+
385	49	+
556	48	+
755	47	+
1020	46	+
1293	45	+
1498	44	+
1568	43	+
1518	42	+
898	41	+
611	40	+
182	39	+
112	38	+
8	37	+
8	36	+
6	35	+
0	34	+

0 20 40 60 80 100

LEVEL(DBA*) VS CUMULATIVE DISTRIBUTION (PERCENT)

NOISE DATA FROM RUN NO. E7A (D) OF THE PORTABLE NOISE LAB. ON MARCH 19 1971 FROM 15:12 TO 16:06 AT EVERGLADES GRID LOCATION NO. 7

1	85	0
0	84	0
3	83	0
2	82	0
5	81	0
6	80	0
7	79	0
7	78	0
8	77	0
5	76	0
8	75	0
4	74	0
7	73	0
8	72	0
4	71	0
10	70	0
11	69	0
15	68	0
14	67	0
15	66	0
26	65	0
22	64	0
41	63	00
41	62	00
49	61	00
43	60	00
43	59	00
65	58	00
79	57	00
96	56	00
103	55	00
115	54	000
123	53	000
169	52	000
181	51	000
246	50	0000
385	49	000000
556	48	00000000
755	47	000000000000
1020	46	0000000000000000
1293	45	00000000000000000000
1498	44	000000000000000000000000
1568	43	000000000000000000000000
1518	42	000000000000000000000
898	41	000000000000
611	40	000000000
182	39	000
112	38	00
8	37	0
8	36	0
6	35	0

DIST. DBA*0 10 20 30

LEVEL(DBA*) VS DISTRIBUTION (PERCENT)

*-A WEIGHTED DECIBELS-RE. 20 MICRONEWTONS PER SQUARE METER

**-DBA RE. 20 MICRONEWTONS PER SQUARE METER FROM AN AVERAGE OF THE SQUARES OF THE SOUND PRESSURES.

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NOISE ABATEMENT GROUP

NOISE DATA FROM RUN NO. E10 (D) OF THE PORTABLE NOISE LAB. ON MARCH 22 1971 FROM 10:00 TO 11:00 AT EVERGLADES GRID LOCATION NO. 8

DISTRIBUTION	DBA*	
1	69	+
0	68	+
4	67	+
12	66	+
10	65	+
21	64	+
28	63	+
29	62	+
24	61	+
30	60	+
46	59	+
55	58	+
63	57	+
57	56	+
113	55	+
133	54	+
205	53	+
296	52	+
399	51	+
454	50	+
548	49	+
613	48	+
657	47	+
777	46	+
916	45	+
904	44	+
883	43	+
858	42	+
811	41	+
751	40	+
662	39	+
513	38	+
289	37	+
289	36	+
227	35	+
83	34	+
83	33	+
0	32	+

SAMPLES=	11844	
AVERAGE=	44.4	DBA*
STANDARD DEVIATION=	5.5	DBA*
ENERGY MEAN=	49.1	DB**
NOISE POLLUTION LEVEL=	63.2	
1% PERCENTILE=	61.4	DBA*
10% DECILE=	51.9	DBA*
MEDIAN=	44.5	DBA*
90% DECILE=	38.4	DBA*
99% PERCENTILE=	34.4	DBA*
RANGE=	36	DB

0 20 40 60 80 100

LEVEL(DBA*) VS CUMULATIVE DISTRIBUTION (PERCENT)

NOISE DATA FROM RUN NO. E10 (D) OF THE PORTABLE NOISE LAB. ON
MARCH 22 1971 FROM 10:00 TO 11:00 AT EVERGLADES GRID LOCATION NO. 8

```
  1     69  0
  0     68  0
  4     67  0
 12     66  0
 10     65  0
 21     64  0
 28     63  0
 29     62  0
 24     61  0
 30     60  0
 46     59  00
 55     58  00
 63     57  00
 57     56  00
113     55  000
133     54  000
205     53  0000
296     52  00000
399     51  000000
454     50  0000000
548     49  00000000
613     48  000000000
657     47  000000000
777     46  00000000000
916     45  0000000000000
904     44  0000000000000
883     43  000000000000
858     42  000000000000
811     41  00000000000
751     40  00000000000
662     39  000000000
513     38  00000000
289     37  00000
289     36  00000
227     35  0000
 83     34  00
 83     33  00
DIST. DBA*0              10              20              30
```

LEVEL(DBA*) VS DISTRIBUTION (PERCENT)

*-A WEIGHTED DECIBELS-RE. 20 MICRONEWTONS PER SQUARE METER

**-DBA RE. 20 MICRONEWTONS PER SQUARE METER FROM AN AVERAGE OF THE SQUARES OF THE SOUND PRESSURES.

APPENDIX B

Frequency Analyses & Time Histories

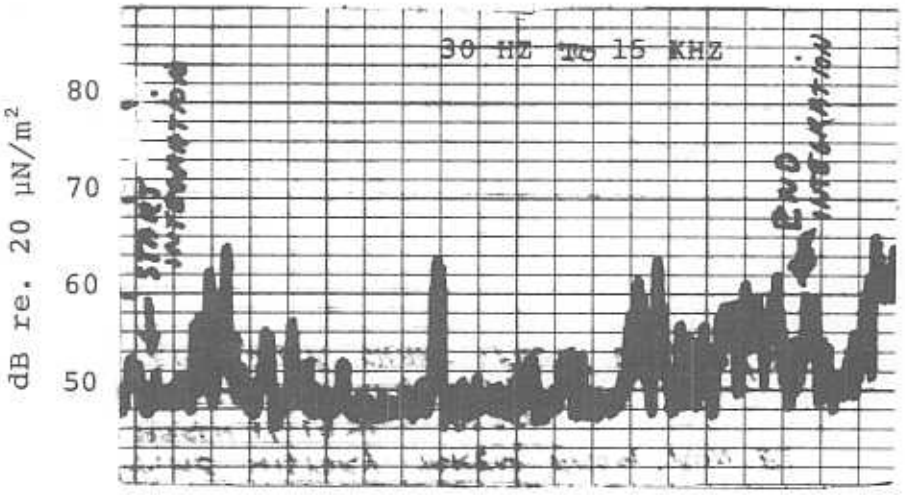


Figure B-1. Time History of Animal Noise - 32 Second Period

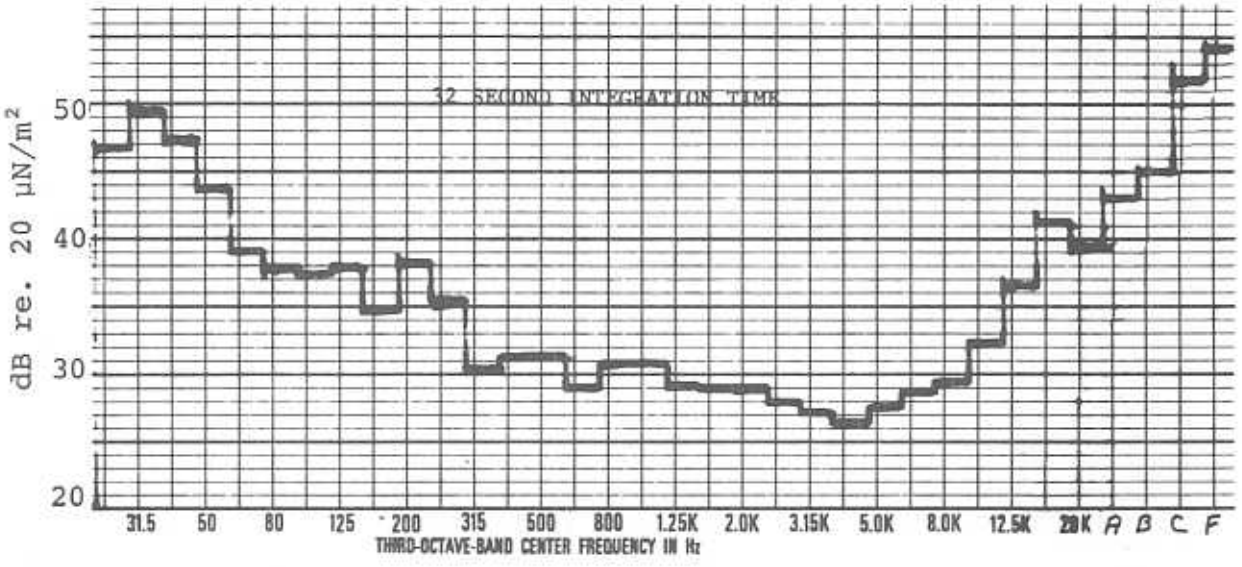


Figure B-2. 1/3 Octave Analysis of Animal Noise

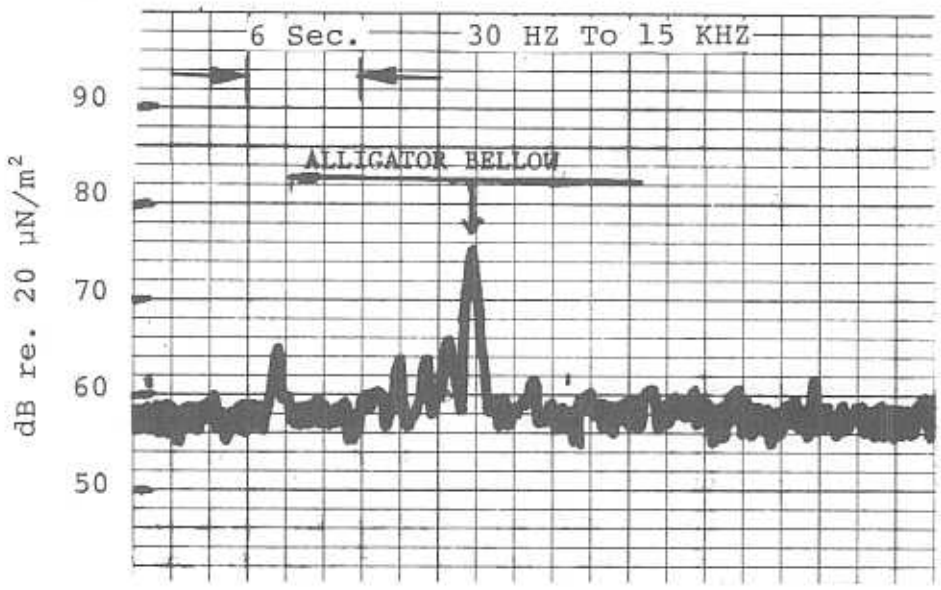


Figure B-3. Time History Showing Alligator Bellow

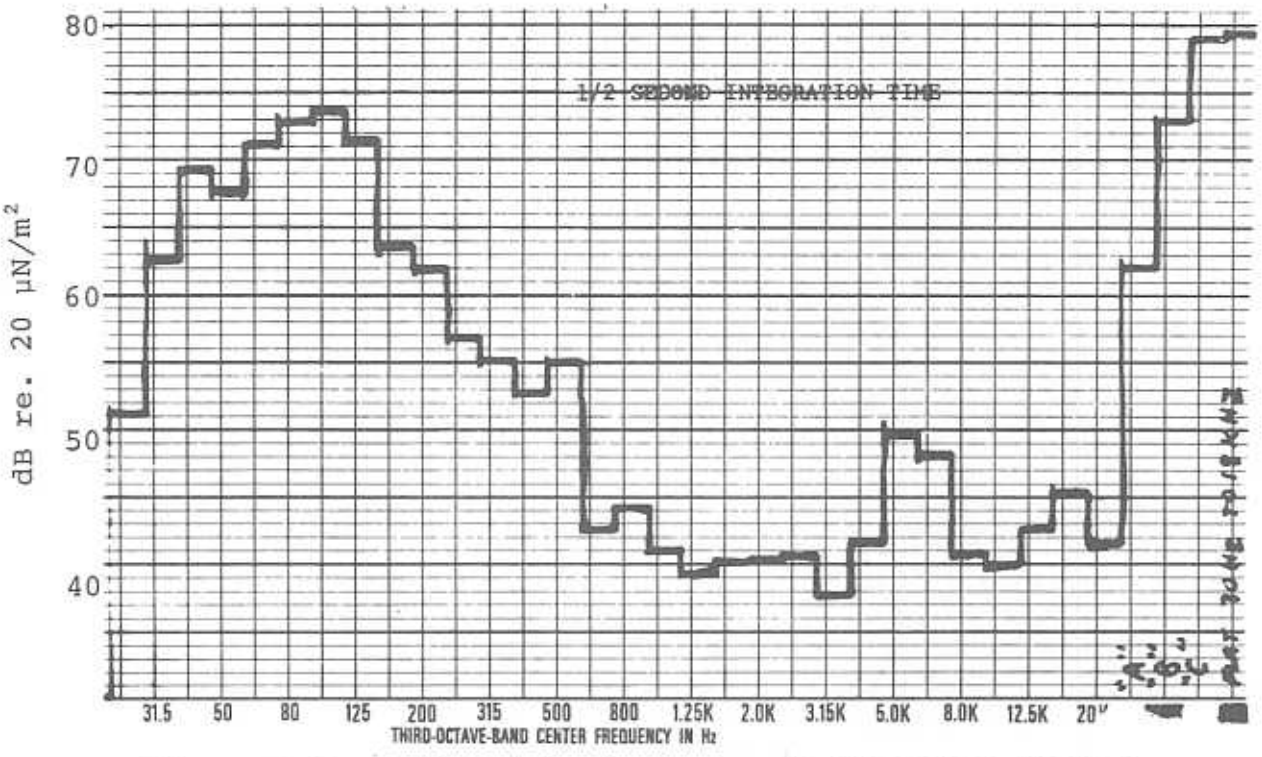


Figure B-4. 1/3 Octabe Analysis of Alligator Bellow

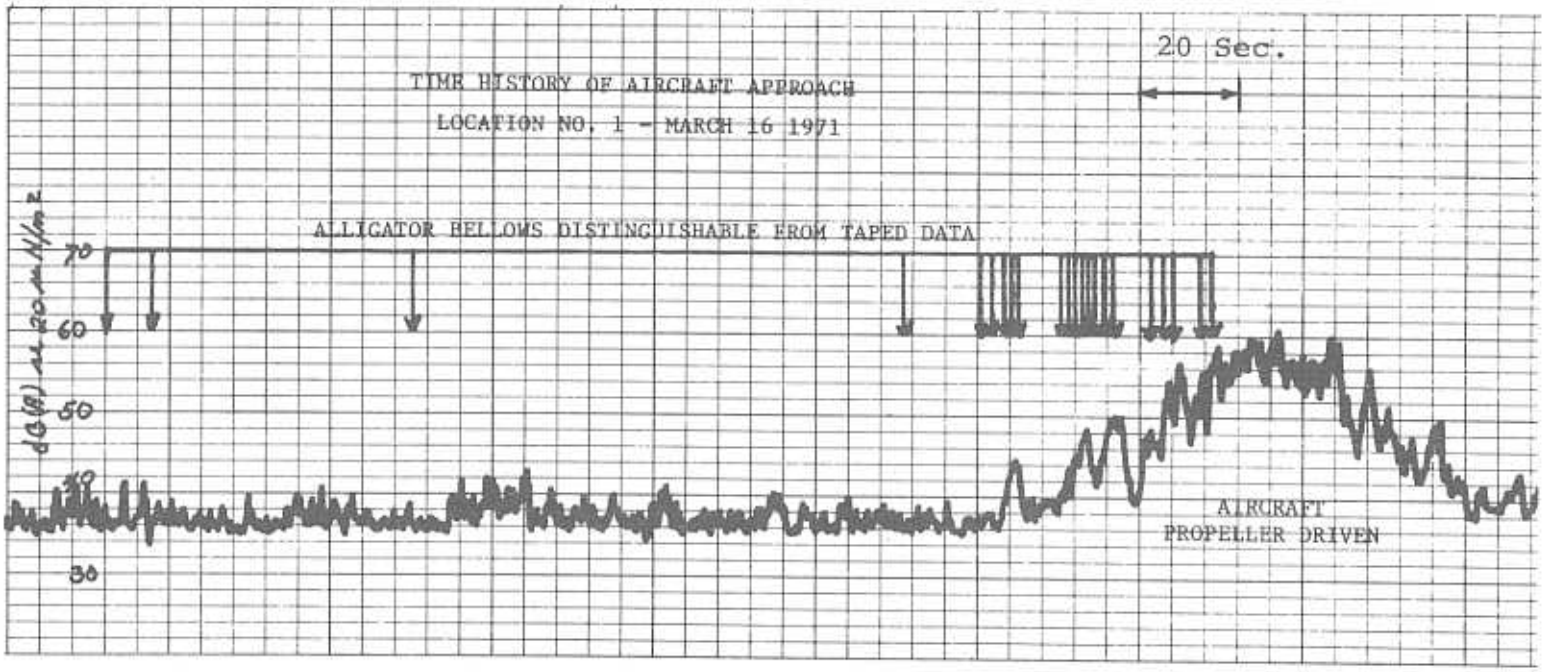


Figure B-5. Time History of Aircraft Approaching

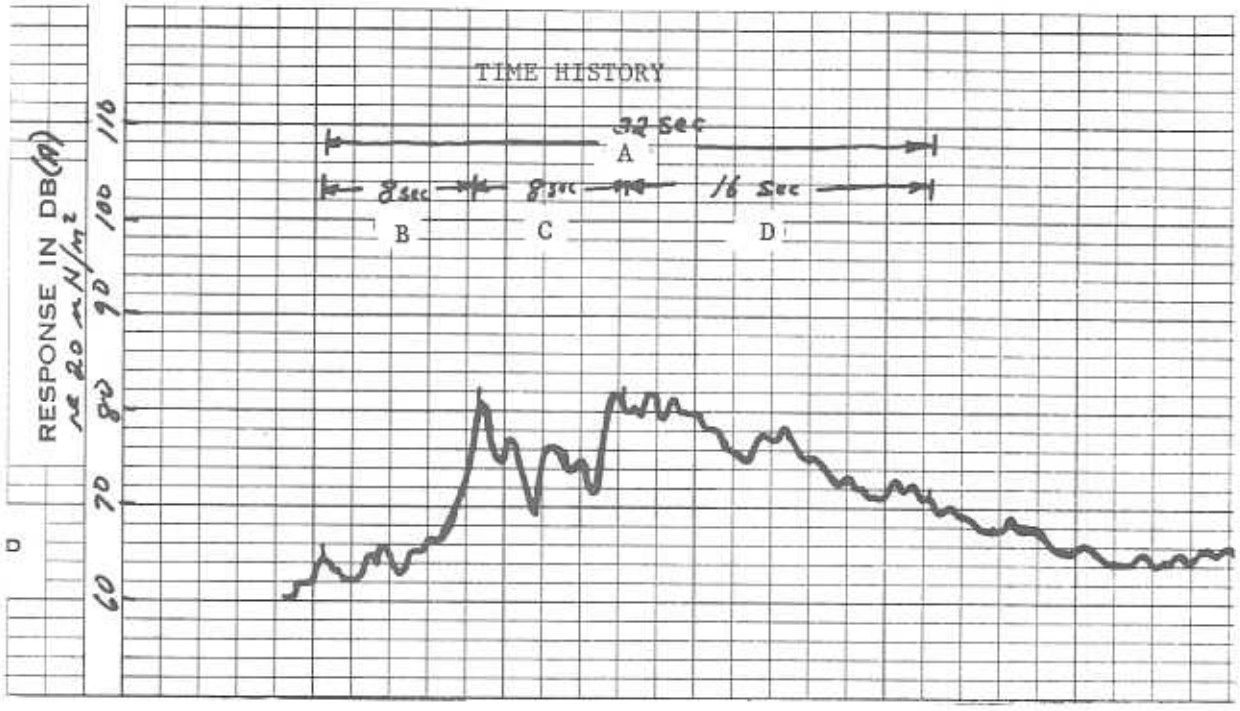


Figure B-6. Time History Airboat

A-Composite approach, maneuver and departure of airboat.
For analysis see figure B-7A.

B-Airboat in canal approaching the microphone.
For analysis see figure B-7B.

C-Airboat maneuvering for a turn in front of the microphone.
For analysis see figure B-7C.

D-Airboat driving away through saw grass.
For analysis see figure B-7D.

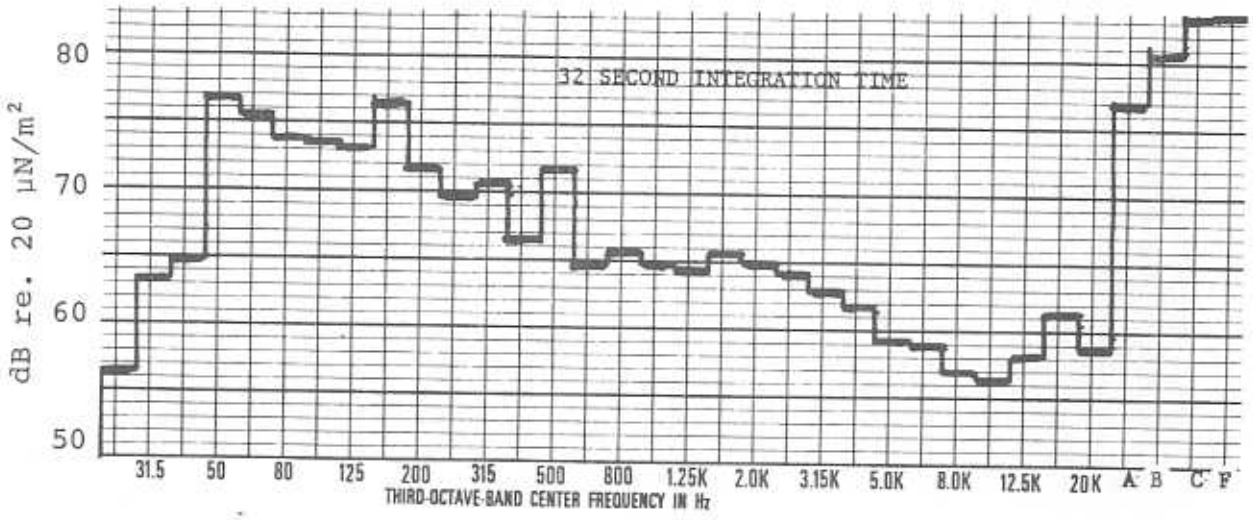


Figure B-7A. 1/3 Octave Analysis
Composite approach, maneuver and departure of airboat.

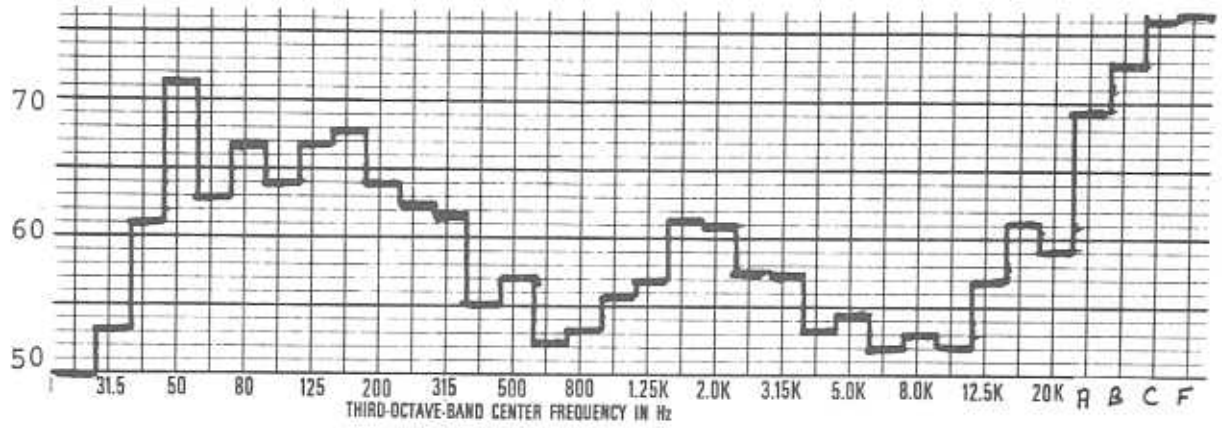


Figure B-7B. 1/3 Octave Analysis - Airboat in
Canal Approaching Microphone

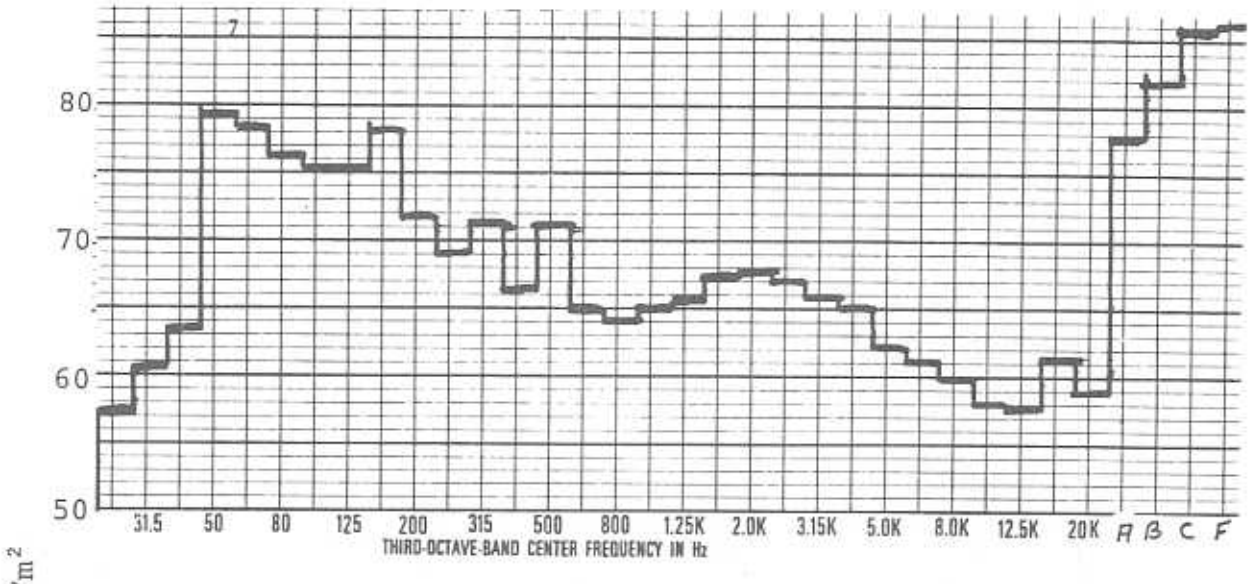


Figure B-7C. 1/3 Octave Analysis - Airboat maneuvering for Turn in Front of Microphone

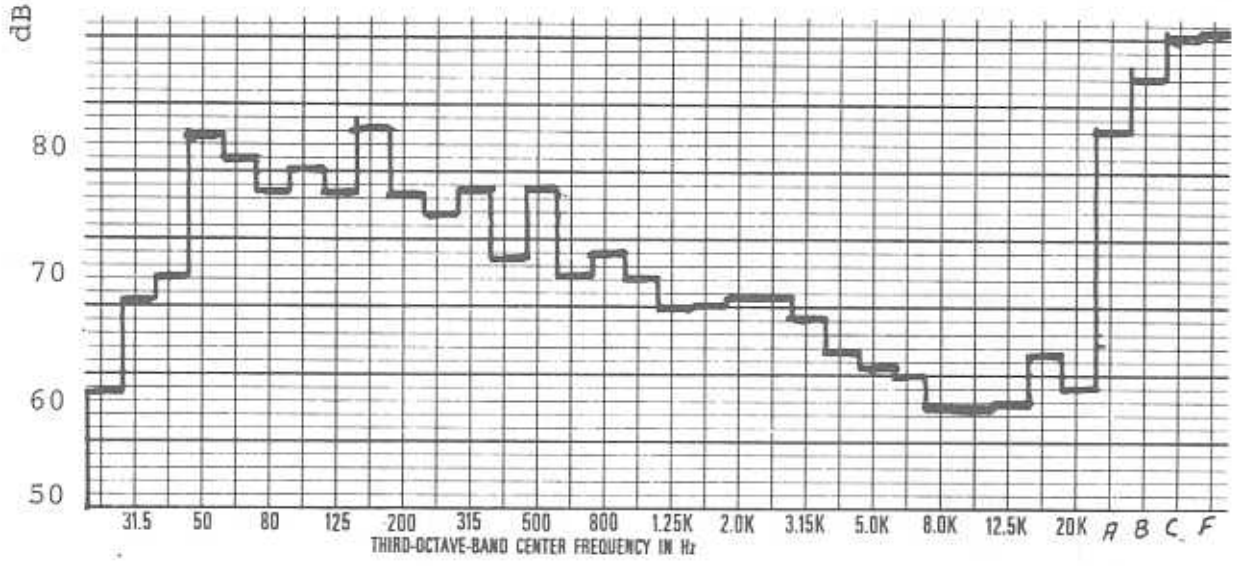


Figure B-7D. 1/3 Octave Analysis - Airboat Driving Away Through Saw Grass

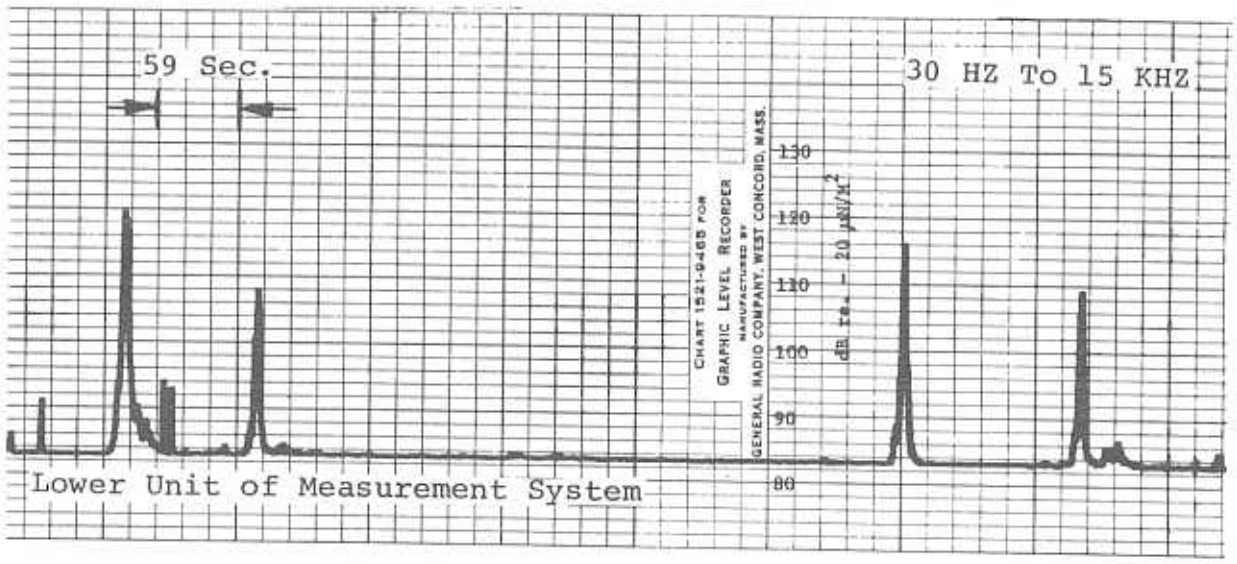


Figure B-8. Time History of Aircraft Flyovers at Location No. 6

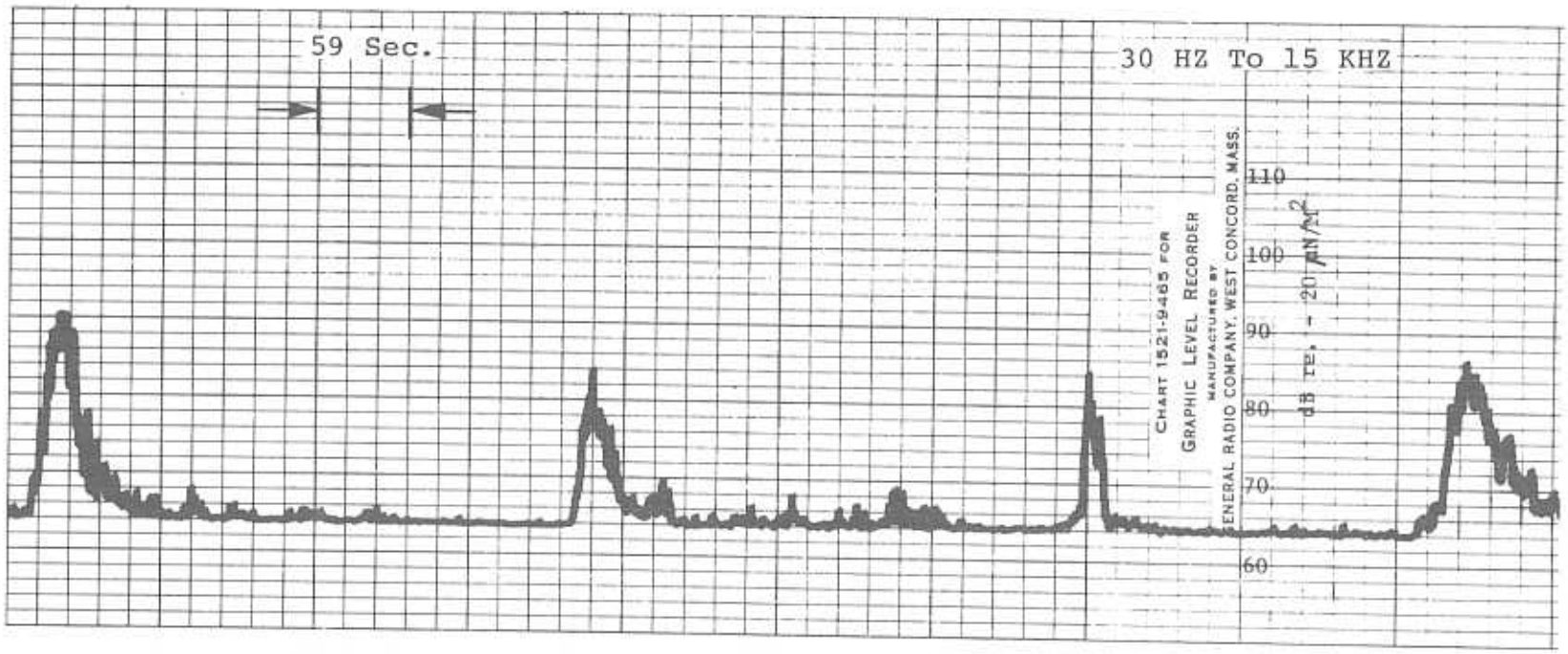


Figure B-9. Time History of Aircraft Flybys at Location No. 9

APPENDIX C

Photographs

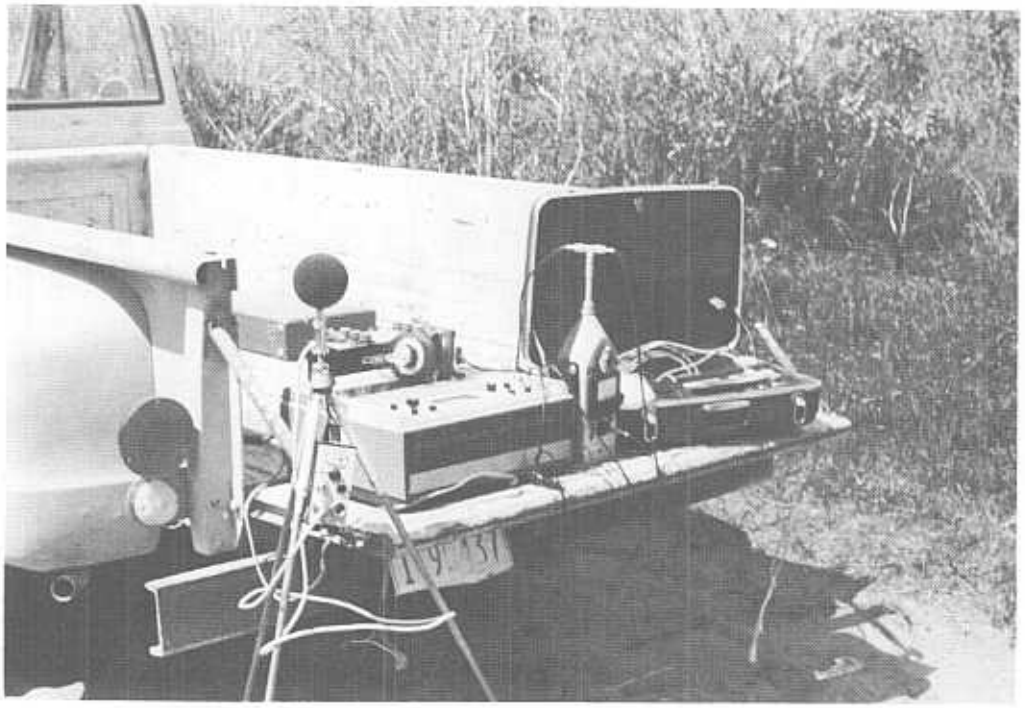


Figure C-1. Equipment Set up in National Park Service Trucks

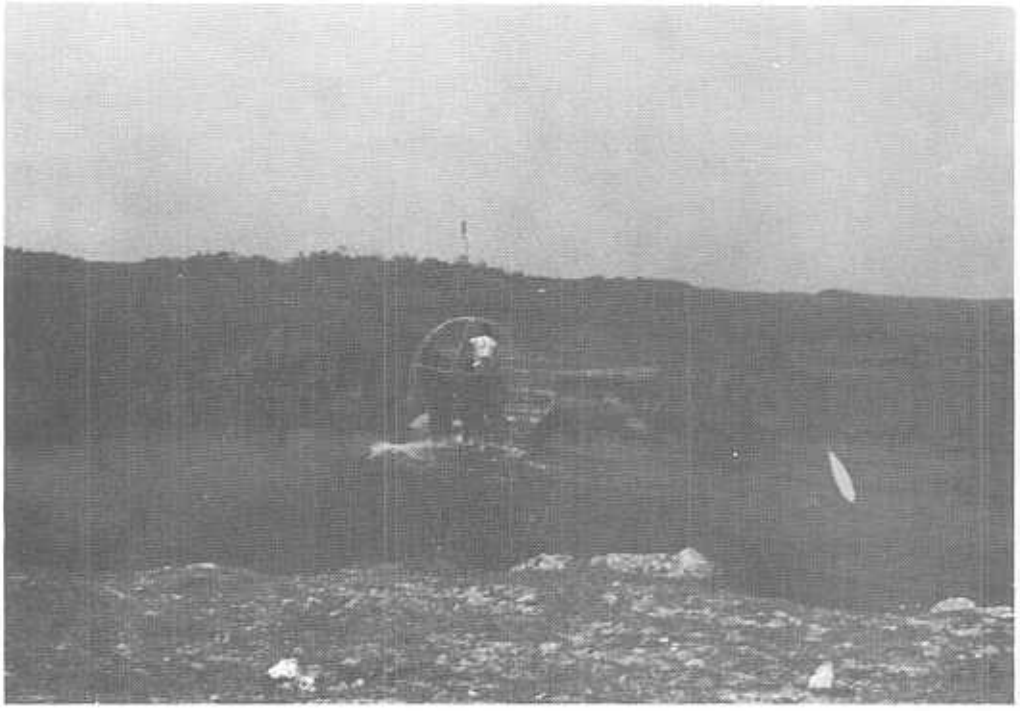


Figure C-2. Airboat at Location No. 5

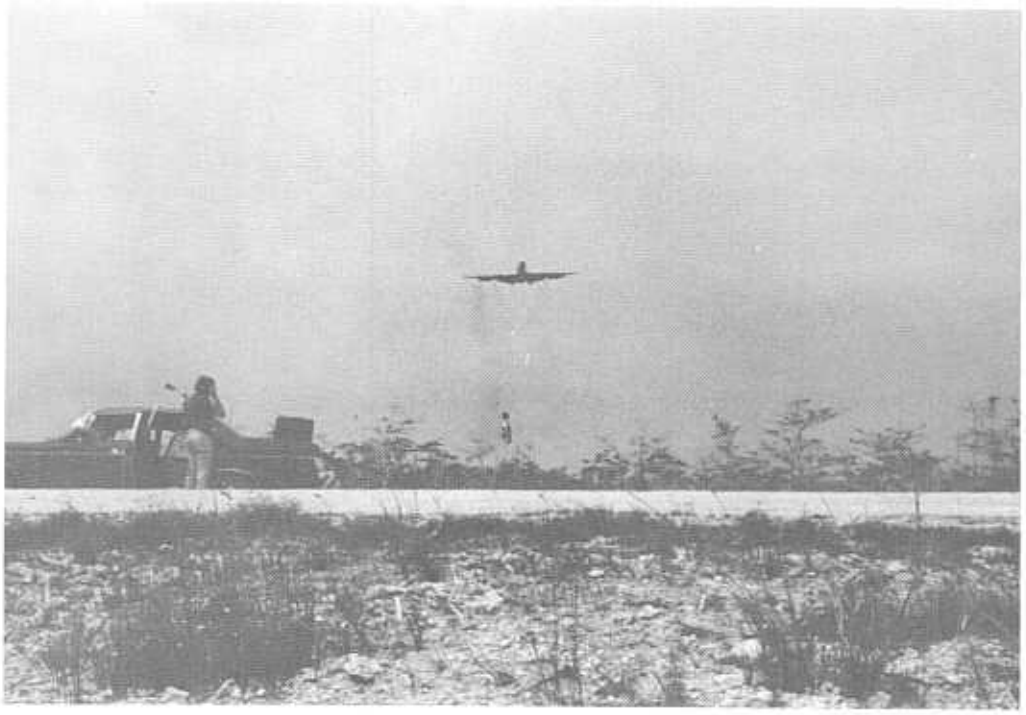


Figure C-3. Location No. 6

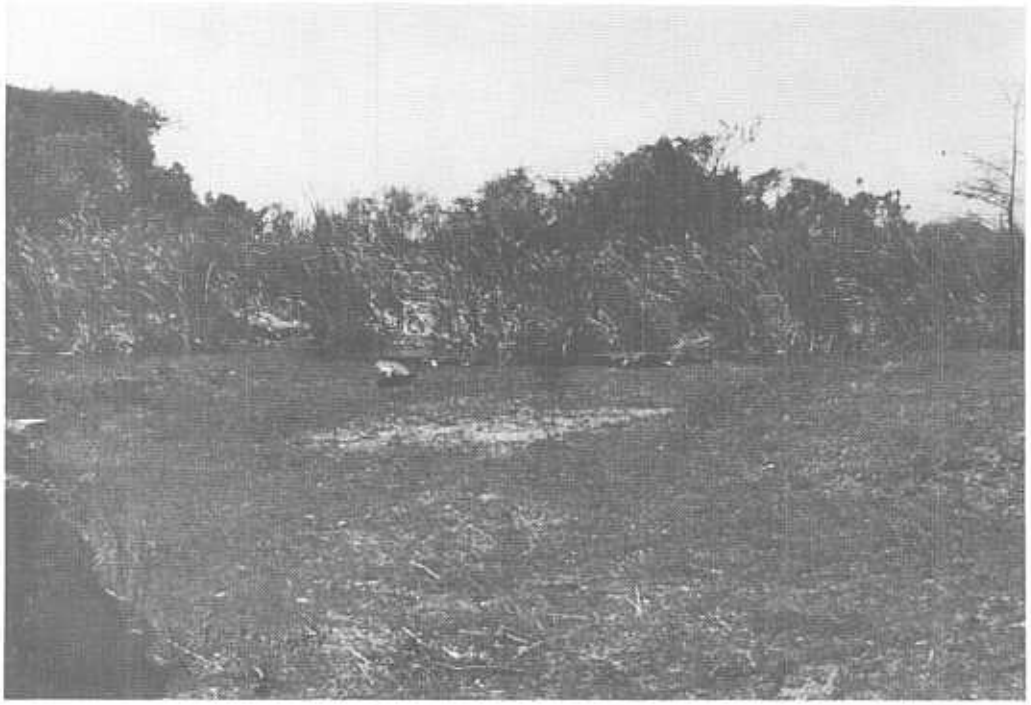


Figure C-4. Location No. 1

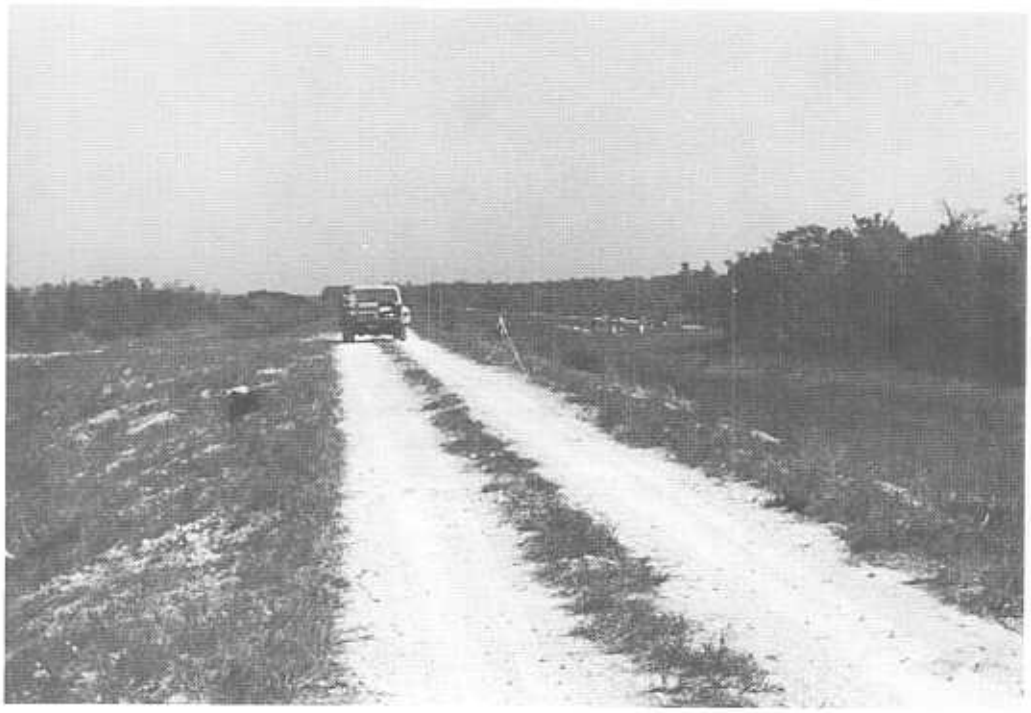


Figure C-5. Location No. 3

Figure C-6. Location No. 8

Figure C-7. Location No. 9

APPENDIX D

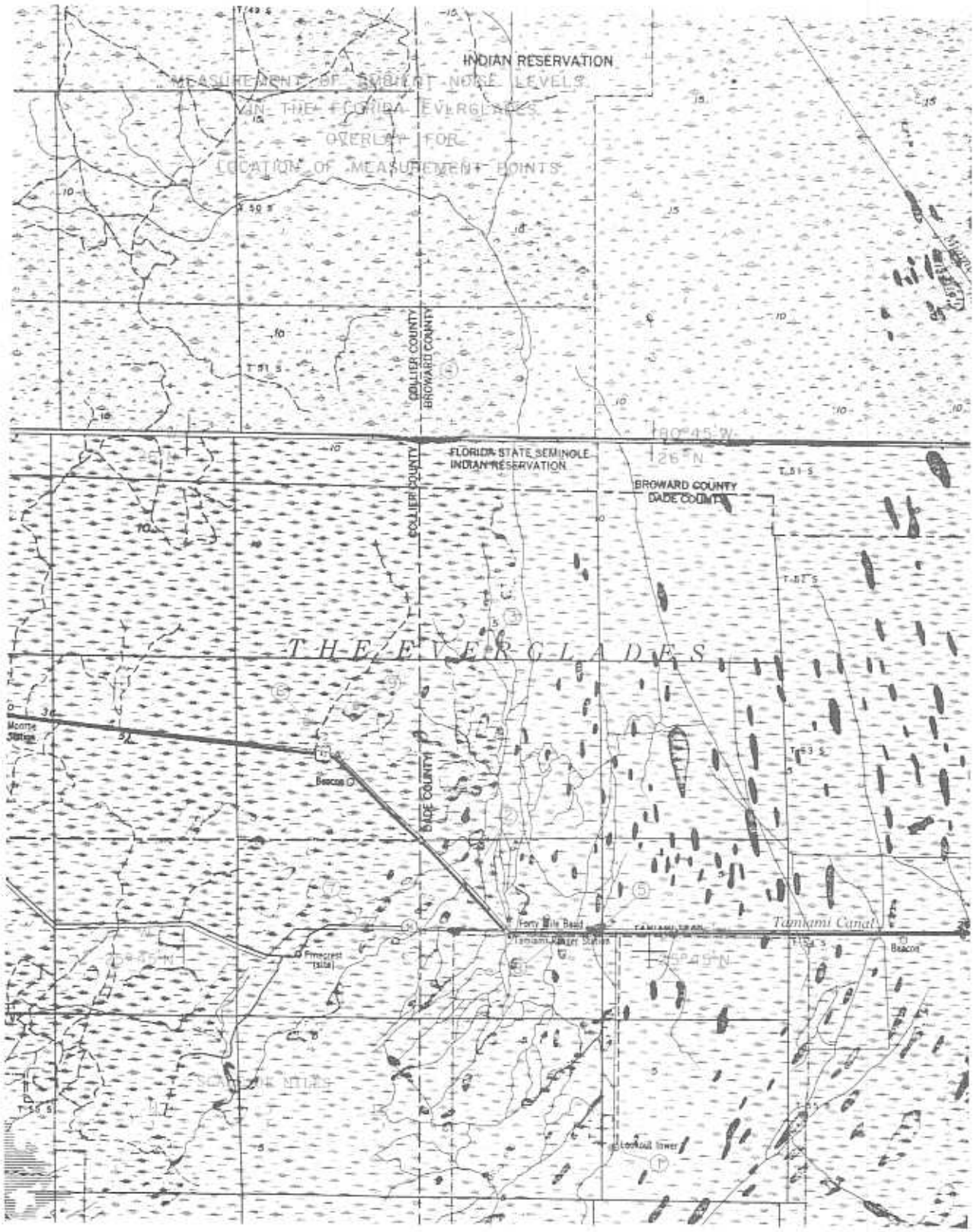
Site Locations and Maps

TABLE D-1. MEASUREMENT OF AMBIENT NOISE LEVELS IN THE FLORIDA EVERGLADES

Location of Measurement points*

Location No.	N-Latitude	W-Longitude
1	25° 38' 50"	80° 46' 10"
2	25° 47' 20"	80° 50' 30"
3	25° 53' 45"	80° 50' 15"
4	26° 01' 30"	80° 52' 40"
5	25° 45' 30"	80° 46' 30"
6	25° 51' 30"	80° 56' 00"
7	25° 45' 30"	80° 54' 10"
8	25° 45' 15"	80° 47' 50"
9	25° 52' 00"	80° 54' 30"

* Map, U. S. Geological Survey; Miami, Florida, No. NG17-8 and West Palm Beach, Florida, NG17-5


MEASUREMENT OF PROJECT NOISE LEVELS
IN THE FLORIDA EVERGLADES
OVERLAY FOR
LOCATION OF MEASUREMENT POINTS
INDIAN RESERVATION
COLLIER COUNTY
BROWARD COUNTY
FLORIDA STATE SEMINOLE
INDIAN RESERVATION
BROWARD COUNTY
DADE COUNTY
THE EVERGLADES
DADE COUNTY
Tamiami Canal
Forty Mile Bend
Tamiami Ranger Station
Beacon
Lookout Tower
T.49 S.
T.51 S.
T.53 S.
T.55 S.