NASA
Technical
Paper
3053

January 1991

J-85 Jet Engine Noise Measured in the ONERA S1 Wind Tunnel and Extrapolated to Far Field

Ames
IN-71
1583
P181

Paul T. Soderman,
Alain Julienne,
and Adolph Atencio, Jr.

NASA

NASA
Technical
Paper
3053

1991

J-85 Jet Engine Noise Measured in the ONERA S1 Wind Tunnel and Extrapolated to Far Field

Paul T. Soderman
Ames Research Center
Moffett Field, California

Alain Julienne
Office National d'Études et de Recherches Aérospatiales
Châtillon (Hauts-de-Seine), France

Adolph Atencio, Jr.
Ames Research Center
Moffett Field, California

NASA
National Aeronautics and
Space Administration
Office of Management
Scientific and Technical
Information Division

J-85 JET ENGINE NOISE MEASURED IN THE ONERA S1 WIND TUNNEL AND EXTRAPOLATED TO FAR FIELD

Paul T. Soderman, Alain Julienne,[1] and Adolph Atencio, Jr.

Ames Research Center

SUMMARY

Noise from a J-85 turbojet with a conical, convergent nozzle was measured in simulated flight in the ONERA S1 Wind Tunnel. Data are presented for several flight speeds up to 130 m/sec and for radiation angles of 40° to 160° relative to the upstream direction. The jet was operated with subsonic and sonic exhaust speeds. A moving microphone on a 2-m sideline was used to survey the radiated sound field in the acoustically treated, closed test section. The data were extrapolated to a 122-m sideline by means of a multiple-sideline source-location method, which was used to identify the acoustic source regions, directivity patterns, and near field effects. The source-location method is described along with its advantages and disadvantages.

Results indicate that the effects of simulated flight on J-85 noise are significant. At the maximum forward speed of 130 m/sec, the peak overall sound levels in the aft quadrant were attenuated approximately 10 dB relative to sound levels of the engine operated statically. As expected, the simulated flight and static data tended to merge in the forward quadrant as the radiation angle approached 40°. There is evidence that internal engine or shock noise was important in the forward quadrant. The data are compared with published predictions for flight effects on pure jet noise and internal engine noise. A new empirical prediction is presented that relates the variation of internally generated engine noise or broadband shock noise to forward speed. Measured near field noise extrapolated to far field agrees reasonably well with data from similar engines tested statically outdoors, in flyover, in a wind tunnel, and on the Bertin Aerotrain. Anomalies in the results for the forward quadrant and for angles above 140° are discussed.

The multiple-sideline method proved to be cumbersome in this application, and it did not resolve all of the uncertainties associated with measurements of jet noise close to the jet. The simulation was complicated by wind-tunnel background noise and the propagation of low-frequency sound around the circuit.

[1]Research Engineer, ONERA (Office National d'Études et de Recherches Aérospatiales).

INTRODUCTION

In the fall of 1979, a NASA/ONERA joint research study of jet noise was conducted in the ONERA S1 Wind Tunnel at Modane-Avrieux, France. The objective of the program was to measure the near-field noise of a General Electric J-85 jet engine at flight speeds greater than those previously attained in the NASA Ames 40- by 80-Foot Wind Tunnel and to extrapolate the data to the far field in order to identify forward speed effects on the jet noise. The data were to be compared to existing flight data. At the same time, ONERA desired to know (1) if the closed test section of the S1 Wind Tunnel could be adequately treated with acoustic linings to provide the proper acoustic environment for this type of research, and (2) which of several experimental techniques properly identified the noise source locations in the jet exhaust. The source-location techniques evaluated were (1) traversing sideline microphones, (2) acoustic antennas, and (3) infrared detectors; only the first technique is described in this report. Reference 1 describes the results of the infrared detector measurements.

The J-85 engine was chosen for this study because an extensive data base has been acquired for it by independent researchers over several years. The J-85 jet noise was measured statically (refs. 2 and 3), in flight (refs. 4–7), on a low-noise train (refs. 8–10), and in the Ames 40- by 80-Foot Wind Tunnel (refs. 11–14) before the acoustic treatment of the test section. This data base was important for checking the results of the present study because, despite the satisfactory extrapolation, in a number of studies, of near field to far field jet noise from scale models (refs. 15–18), the analysis and extrapolation of full-scale engine noise with its multiplicity of sources is a difficult task. Furthermore, the near field data were acquired only 2.0 m from the jet axis, thus data interpretation is difficult.

Strout and Atencio (refs. 19–21) found good agreement between extrapolated near field data and far field data for a JT8D jet engine using the multiple-sideline source-location technique. However, their methods required manual fairing and extrapolation of the data at stages in the data processing, which required some knowledge of probable results gained from experience with jet noise. Our study involves an extension of Strout and Atencio's techniques in which the data reduction is completely automated in a consistent manner and does not require manipulation of the data at various steps in the algorithm.

The S1 Wind Tunnel was used for this study because of its large speed range (0 to Mach 1) and large (8-m-diameter) test section. It was hoped that if the various difficulties with near field effects, background noise, and reflections could be dealt with, the advantages of high windspeed would lead to a better simulation of forward-speed effects than was possible in the lower-speed Ames 40- by 80-Foot Wind Tunnel (ref. 11). To cope with the anticipated acoustical problems, ONERA developed an elaborate test-section lining based on NASA's recommendation; that lining is described in this report. NASA provided the computer software developed for jet noise source location and extrapolation based on multiple-sideline noise measurements. (This software was subsequently improved by ONERA.) This report concentrates on the source-location technique and its results. The technique is based on the hypothesis that by mapping jet noise along two lines parallel to the jet it is possible, with certain manipulations of the data, to extrapolate to the jet and identify the apparent noise source regions at each frequency, as well as the radiation direction of the sources. Assumptions must be made about propagation decay and so-called near field effects. The noise can then be extrapolated to the far field. This report describes the techniques used, their advantages and disadvantages, and forward-speed effects on the jet and engine noise.

NOMENCLATURE

c	sound speed in ambient air, m/sec
d	ejector exhaust-nozzle diameter, 0.44 m
f	frequency, Hz
Lp	sound pressure level, dB re 2×10^{-5} N/m^2
M	jet relative Mach number, $0.62(V_j - V_a)/c$
M_o	flight Mach number, V_a/c
R	distance from noise source location to observer, m
St_o	Strouhal number (static case), fd/V_j
St	Strouhal number with wind, $fd/(V_j - V_a)$
T_t	jet total temperature at primary exhaust nozzle, °C
V_a	windspeed in test section or free stream, m/sec
Ve	effective jet exhaust speed, $Vj(1 - V_a/V_j)^{2/3}$, m/sec
V_j	jet exhaust speed at the primary nozzle exit (fig. 1), m/sec
X	distance along the jet centerline from exhaust nozzle to acoustic source, without wind, m
X′	distance along the jet centerline from exhaust nozzle to acoustic source, with wind, m
Y_1	perpendicular distance from shear layer to near sideline, m (shear layer assumed to be at exhaust nozzle radius)
Y_2	perpendicular distance from shear layer to far sideline, m
ΔLp	difference or change in jet noise level, dB
ΔLp_i	difference or change in internal engine noise level, dB
ΔLp_k	kinematic effect on jet noise due to motion of airplane relative to observer, dB
α	normal incidence absorption coefficient
λ	acoustic wavelength, m
ψ_1	angle between jet axis and line connecting exhaust nozzle center and observer on near sideline, with wind, deg
ψ_2	angle between jet axis and line connecting exhaust nozzle center and observer on far sideline, with wind, deg
ψ_s	angle between jet axis and acoustic radiation vector connecting acoustic source and observer, with wind, deg
θ_1	angle between jet axis and line connecting exhaust nozzle center and observer on near sideline, without wind, deg

θ_2 angle between jet axis and line connecting exhaust nozzle center and observer on far sideline, without wind, deg

θ_s angle between jet axis and acoustic radiation vector connecting acoustic source and observer, without wind, deg

ρ_a density of ambient air, kg/m^3

ρ_j density of fully expanded jet, kg/m^3

Subscripts

1 near sideline microphone traverse, or condition 1 flight and jet speed

2 far sideline microphone traverse, or condition 2 flight and jet speed

TEST EQUIPMENT AND METHODS

Jet Engine

The General Electric J-85 engine is a small turbojet with a maximum net thrust of 12,100 N, a maximum mass flow rate of 20 kg/sec, a maximum exhaust pressure ratio of 2.4, and an exhaust diameter of 0.44 m. The engine was operated with four nozzles: (1) a conical nozzle with ejector; (2) a variable flap ejector; (3) a 104-tube mixer suppressor nozzle; and (4) a 104-tube mixer suppressor nozzle with ejector. Only the conical nozzle with ejector made sufficient noise at all frequencies to dominate the wind tunnel background noise at the windspeeds used in this study; therefore data for the other nozzles will not be shown.

Figures 1(a)–1(c) show the engine geometry, including the convergent, primary exhaust nozzle and secondary cylindrical ejector. The cylindrical ejector had a blunt base, which was used in previous studies in which external pressure drag could be measured accurately (ref. 4). The ejector was designed to pump ambient air equal to only 5% of the primary flow for cooling purposes, and had no thrust augmentation; nor could the ejector be considered a mixing nozzle for enhanced jet decay and noise reduction. Moreover, the conical ejector nozzle diameter of 444 mm was used as the reference dimension for normalization of the distances used in the acoustic study. The primary exhaust nozzle was used as the reference for computation of jet thrust and velocity.

A flight inlet was used for both static and forward flight operation of the engine, because even in the static case a low-speed airflow in the wind tunnel was induced by the engine.

Table 1 shows typical jet exhaust velocities, temperatures, momentum thrust, and pressure ratios used in this study. The jet was operated both subsonically and with sonic conditions at the primary exhaust nozzle. The jet pressure ratio was calculated from the ratio of total pressure in the jet to test-section static pressure. (The flow conditions at the primary nozzle were extrapolated from measurements made upstream (ref. 5).) At pressure ratios greater than 1.85, the flow at the primary exhaust reached sonic speeds. At higher pressure ratios, it is probable that a shock system existed downstream from the primary exhaust.

Although it was equipped with an afterburning duct, the engine was operated without afterburning.

S1 Wind Tunnel

The S1 Wind Tunnel at Modane-Avrieux (ref. 22) is a closed-circuit, continuous-operation, sonic wind tunnel with a test section speed range to Mach 1. Figure 2 is a schematic of the wind tunnel. The interchangeable, closed test section used in this study was 8 m in diameter and 14 m long. Two counterrotating fans are located in the crossleg downstream of the primary diffuser. There are no acoustic silencers in the wind tunnel circuit. The altitude of the wind tunnel is 1100 m.

Test Section Lining

The entire cylindrical test section was lined for this test with a 125-mm-thick absorbent lining composed of 75-mm polyurethane foam and a 50-mm air space as shown in figure 3. The outer 20 mm of foam was treated with chemical fire retardant. The foam was supported by a porous metal screen embedded 60 mm from the flow surface, and was backed by a perforated plastic film which improved the mid-frequency absorption. The air gap between the foam and the wall contributed to the low-frequency absorption illustrated in figure 4, which shows the acoustic absorption of the composite lining with 30- and 50-mm air gaps. The data were acquired with a standing-wave tube. The absorption was very good above 300 Hz. During the initial checkout in the wind tunnel, some of the panels started to vibrate badly when the windspeed reached 130 m/sec An improved fastening technique solved this problem.

Model Installation

Figure 1(a) is a photograph of the J-85 engine and ceiling-mounted support strut in the test section. Figures 5(a) and 5(b) show the installation geometry. The center of the engine was 1.5 m above the center of, and on the vertical centerplane of, the test section.

Acoustic Instrumentation

Figures 5(a) and 5(b) illustrate the moving microphone traverse parallel to the jet axis. Two carriages were used, each equipped with two pairs of microphones. One microphone of each pair was the primary data microphone; the other was a backup. Four microphones (1, 2, 3, and 4) were traversed 2.0 m from the jet centerline, and four microphones (5, 6, 7, and 8) were traversed 3.5 m from the jet centerline. The two rails were in line such that the upstream carriage with microphones 1, 2, 5, and 6 traversed 6.7 m from the J-85 inlet to a point just downstream of the exhaust nozzle, and the second carriage with microphones 3, 4, 7, and 8 continued along the jet exhaust another 6.7 m. This arrangement allowed a sweep of the jet noise radiation relative to the exhaust center of 40° to 165° at the 2.0-m sideline and 56° to 155° at the 3.5-m sideline, 0° being the upstream direction. The microphone carriage and rail were streamlined and curved for minimum acoustic reflection, but they were not acoustically treated. The microphones with nose cones were pointed upstream and were essentially omnidirectional. The carriages moved simultaneously and took approximately three minutes to complete the traverse. An optical device tracked the carriage position to the nearest millimeter.

The guy wires shown in figure 5(b) were used to secure the microphone arrays. They generated a tone near 2.5 kHz, but the tone is not visible in the third-octave band spectra.

Also shown in figure 5(a)–5(c) is the fixed array of 48 microphones, 3.2 m from the jet axis, used by ONERA to locate acoustic sources by means of antenna signal processing. In addition, eight of the microphones with 15-cm spacing and eight microphones with 30-cm spacing were connected to an electronic time-delay system developed at Ames to create two eight-channel broadside antennas (ref. 23). A broadside antenna parallel to a jet can be focused on a region of the jet and reject sound arriving from upstream or downstream, to varying degrees, depending on the number of array elements. The antenna cannot, however, discriminate in the vertical plane to reject floor or ceiling reflections. The antennas were focused on various parts of the jet exhaust for on-line analysis of the jet noise. (The data for this analysis are not reported here.) The other data systems were processed off line.

The moving microphone data were recorded on analog recorders with appropriate time-code signals so that analysis in third-octave bands could be made of the sound as a function of position. Amplifier gain for each channel was set automatically and then locked just before a traverse. Gain was recorded on each channel using a frequency code. Test number, run number, date, microphone number, and wind tunnel identification were recorded on each data channel as a pulse code interpreted as binary numbers. The third-octave band data were digitized after the test and input to the source-location/extrapolation computer program to be described.

Engine Instrumentation

Knowledge of the engine performance was required to evaluate the acoustic data. The J-85 was instrumented for (1) total pressures upstream and downstream of the compressor, (2) temperatures downstream of the compressor, (3) fuel flow rate, and (4) engine rotational speed. The instruments provided fluid mechanics data sufficient for the computation of thrust, mass-flow rate, and jet exhaust velocity. The instrumentation is described in reference 5.

Test Procedure and Limits of Variables

The first data sets were obtained during static operation of the engine in the wind tunnel. Because of temperature limitations of certain engine components, the maximum engine speed attained was 16,170 rpm (98% of the maximum rated rpm), which produced a maximum jet exit velocity of 545 m/sec during static operation and 606 m/sec at forward speed. Operation of the engine induced a relatively small but significant airflow in the wind tunnel of 16 m/sec maximum. Acoustic data were taken at several windspeeds, up to a maximum of 130 m/sec. The windspeed was limited by the allowable loads on the acoustic lining. Nonetheless, the maximum speed was significantly greater than the maximum speed of 91 m/sec previously attained in the Ames 40- by 80-Foot Wind Tunnel. (Since these tests, the maximum speed in the 40- by 80-Foot Wind Tunnel has been increased to 155 m/sec.)

The general procedure was to set the wind tunnel and engine speed, take data while the microphones were traversing downstream, and then increase the engine speed while moving the microphones back to their starting positions upstream. Background noise was measured with the engine in the test section but not operating.

Data Analysis

Extrapolation to the far field of noise levels measured close to a large distribution of noise sources such as a jet exhaust would be hopeless without some knowledge of the source regions and their directional properties as functions of frequency. Different researchers have employed a variety of experimental techniques for identifying the source regions of jets, including use of acoustic antennas, focusing reflectors, cross correlation, infrared detectors, and in-flow probes. The multiple-sideline source-location technique (ref. 16) was developed on the premise that a proper map of the acoustic field at two distances from a jet contains enough information to describe how and from where the sound is propagating. Once this information is known, a single map of the sound field can be used to extrapolate the jet noise to any distance. To apply the method to this project, the following steps were taken.

1. The jet noise was recorded along two lines parallel to the jet axis, at locations 2.0 m and 3.5 m from the jet axis, as shown in figures 5 and 6. The traverse lines and the jet were nearly in the same plane. The 2.0-m and 3.5-m sideline data from the S1 Wind Tunnel study could have been used for determination of source locations had it not been for a small acoustic interference resulting, we suspect, from low-frequency propagation around the circuit. The acoustic lining did not absorb well at low frequencies, and low-frequency sound propagates well in wind tunnels. Consequently, low-frequency noise measured upstream of the jet was louder than it should have been. Because of this problem, noise data from the same engine operated statically at the Ames outdoor test site (ref. 2), recorded at 2.0-m and 12.0-m sidelines (measured from the jet centerline), were used for the source-location part of the analysis. The data were acquired with slowly traversing microphones. Details of the engine and microphone data acquisition are given in reference 2.

Despite the small amplification in the S1 Wind Tunnel, the S1 data and the Ames outdoor data agree fairly well, as illustrated in figure 7, which shows overall sound levels measured on a 2-m sideline at ONERA and at Ames. The figure also shows the Ames data corrected to the same jet speed and forward velocity condition (from wind-tunnel flow induced by the engine) as in the S1, using the method of reference 24. (This method will be discussed further in the Results and Discussion section.) The S1 data rise above the Ames data at small radiation angles, to a maximum of 3 dB at 40°. This same trend was seen in data obtained by other experimenters. At large angles, the jet was strong and it dominated most contaminations. At small radiation angles, upstream of the exhaust, the low-level sound at low frequencies was contaminated by the jet noise which radiated downstream and traveled around the circuit. In any case, this effect would be generally similar with wind or without wind, so that the measured *change* in jet noise caused by flight (i.e., flight noise minus static noise) should be relatively unaffected.

The difference between the S1 and Ames data shown in figure 7 was subtracted from certain S1 directivity plots (figs. 21–24) (see Results and Discussion). This correction ranged from 0 dB at $\psi_2 = 135°$ to 3 dB at $\psi_2 = 40°$ for overall sound levels. Similar comparisons in third-octave bands showed somewhat larger differences at low frequencies and somewhat smaller differences at high frequencies (see table 2). The source of the high-frequency amplification in the S1 is unknown. The third-octave band plots in figures 21(a)–2(f) were corrected for the amplifications listed in table 2.

2. The acoustic data were averaged and converted to third-octave band spectra at specific angles relative to the engine exhaust. Because the microphones were continuously moving, the maximum averaging time was 2 sec for a particular angle, leaving some scatter in the spectra (e.g., third-octave analysis of stationary Gaussian noise at 250-Hz and 2-sec integration time results in ±1 dB accuracy for 99% confidence; scatter is less for higher frequencies, more for lower frequencies or nonstationary noise). The data were also corrected for microphone frequency response by increasing the measured sound level where the response was low, and vice versa. Next, the spectra were smoothed by fitting an 8th-degree polynomial to the data. Figure 8 shows typical data at the 2.0-m sideline before and after the curve fit.

3. The acoustic spectra were then replotted as third-octave band levels versus exhaust-microphone angle at each frequency. It was again necessary to smooth the curves with an 8th-degree polynomial, because the source-location method requires well defined peaks in the noise–directivity plots. Any anomalous peaks resulting from data scatter complicated the extrapolation, especially since the operation was done automatically by the computer.

From static data acquired at Ames (ref. 2), such as those plotted in figures 9(a) and 9(b), pairs of angles were found which define the propagation direction at each frequency. That is, it is assumed that the far field peak in the directivity plot was generated by the same acoustic ray that passed through the near field peak. Similarly, it is assumed that each segment of the far field plot is related to a particular segment of the near field plot by the same noise difference that was found for the peaks. This is illustrated graphically in figures 9(a) and 9(b). Thus, for each third-octave frequency band and each far field angle there is a corresponding near field angle through which the sound ray at that frequency passes. In other words, a sound ray propagating from the jet would pass through the near and far sidelines at two points along that ray which can be described by a specific pair of angles θ_1 and θ_2.

This procedure can break down, however, if the far field and near field curves tend to converge, which sometimes happens at high frequencies and low directivity angles as shown in figure 9(b). In this case, one cannot find an appropriate noise difference at low angles equal to peak noise difference, as one can in figure 9(a). The anomalous rise in the far field curve (fig. 9(b)) would cause the computer to find a noise difference for an illogical angle pair, which would result in an incorrect source location. It would be tempting to refair the lower curve of figure 9(b) at low angles to force the angle pairs to some "appropriate" values, but this adjustment is not justified by the data and was not done.

Figure 10 illustrates the peak noise radiation angle plotted versus Strouhal number as measured at Ames and in the S1 Wind Tunnel. There was reasonably good agreement between the Ames and S1 data at similar jet exhaust speeds. As expected, there was a tendency for the higher frequency sound to radiate at smaller angles than the low frequency sound did.

4. Tracing the acoustic ray at each frequency back to the jet defines static source locations shown, for example, in figures 11(a) and 11(b) for two Strouhal numbers. Figures 11(a) and 11(b) are from the Ames static test of reference 2. It was assumed that the sources were located in the near shear layer, one nozzle radius from the centerline. This arbitrary definition of a source center is an obvious simplification of a complicated phenomenon because it says nothing about source distribution or multiple locations in the jet radiating noise to the same point in space.

The source-location method does not require that all sound at a given frequency must originate from the same point in the jet. The data show that a range of source locations at one Strouhal number (or frequency) radiate sound at different angles. Note that in most cases, lower frequency sound and sound radiated at large angles tend to originate farther downstream than high-frequency or low-angle sound do, which is consistent with results in reference 16. Figures 12(a) and 12(b) are a comparison of source locations measured at Ames and in the S1 Wind Tunnel for the static case. At radiation angles $\theta_s > 60°$ and frequencies above 500 Hz, the agreement is reasonably good. At low frequencies and low radiation angles, the suspected S1 acoustic contamination distorted the computation of the source locations. For this reason, the Ames data were used for this phase of the data analysis.

5. Once the source locations and radiation angles for a given frequency or Strouhal number are found, the data measured anywhere in the field, usually in the near field, can then be extrapolated to any far field distance. This extrapolation, however, is the weakest part of the method because, as experience has shown, the near field noise levels are always less than one would get by measuring in the far field and extrapolating back to the near field point using spherical radiation (6 dB per double distance plus correction for atmospheric effects). This deficiency may be a large-scale-jet effect; Ahuja et al. (ref. 15) reported no near field effect for a small-scale jet (2.54-cm-diameter nozzle) when the source locations and noise directivities were identified. However, the near field effect is consistent with the concept of distributed or finite line sources with sound fields that decay at 3 dB per double distance out to a particular radius and 6 dB per double distance beyond that, neglecting atmospheric absorption.

Without information on the extent of the distributed sources, the decay rate cannot be known even if the source center is known. To extrapolate the sound to a specific point, one must develop a so-called near-field correction. This near field correction is simply the difference at the near sideline between the measured levels and the levels extrapolated from a far field sideline using spherical decay and atmospheric absorption. The correction requires the operation of the engine outside the wind tunnel to get far field data.

Figure 13 illustrates typical near field correction curves measured with the conical nozzle and various jet velocities acquired at Ames in the study described in reference 2. The data collapse to a single curve when plotted versus the nondimensional parameter $(R/\lambda)(V_j/c)$, in which R is the distance to the near field measurement point. The correction should change with nozzle type. It is not known if these near field corrections found statically hold true for the jet in flight. Since the jet core probably stretches in flight, the noise source distributions possibly change enough to affect the near field correction.

6. The source location, X, and radiation angles, θ_s, acquired statically must be corrected for convection effects in the wind tunnel (ref. 2), as illustrated in figure 14. The notations for the static parameters X, θ_s, θ_1, and θ_2 become, with wind, X′, ψ_s, ψ_1, and ψ_2, respectively. It is assumed that the wind causes the jet core to

stretch, moving the noise sources downstream. This effect is handled by redefining the Strouhal number of each source location plot so that (ref. 16)

$$St = fd/\left(V_j - V_a\right) \tag{1}$$

Equation (1) is somewhat arbitrary in that it implies that the movement of noise sources downstream in the jet (or stretch) because of ambient wind is equivalent to increasing the source frequency (or Strouhal number) at any fixed point in a coordinate system fixed to the engine. This is probably based on evidence that high-frequency sources are closer to jet exhaust nozzles than low-frequency sources are. Hence, at a given location in the jet, increasing forward speed will cause high-frequency sources to move downstream and to displace the lower frequency source that was there. Equation (1), therefore, is an estimate of how those source frequencies (or Strouhal numbers) change.

In the source-location method, it is assumed that as wind increases, the static plots of source location versus radiation angle are perfectly valid for wind-on conditions, at the appropriate Strouhal numbers given by equation (1). Although this reasoning agrees with experimental trends, the exact relationships between forward speed, source movement, source radiation, and source Strouhal number have not been verified except by the comparisons between the final extrapolated noise field and far field data (as will be discussed). Furthermore, these source convection effects are valid only for pure jet noise sources and are not valid for other sources fixed to the engine such as combustion noise, turbomachinery noise, or (possibly) shock noise.

In the wind tunnel, sound waves generated during simulated flight are swept downstream and the new source radiation angle is defined as (ref. 13)

$$\psi_s = \tan^{-1}\left\{\left[\sin\left(\theta_s - 90°\right) + V_a/c\right] / \left[\cos\left(\theta_s - 90°\right)\right]\right\} + 90° \tag{2}$$

Convection of sound waves in a wind tunnel relative to the engine is equivalent, with respect to direction, to the movement of the aircraft in flight away from the propagating sound waves. So, for a coordinate system fixed to the aircraft, the acoustic field directivity pattern is the same in both cases.

Figures 15(a)–15(d) show jet noise source locations with wind that were deduced from static source locations by means of the above equations. Those results indicate that, at a given Strouhal number, a range of source locations radiate sound over a range of angles.

7. With the above information, it was then possible to correct the S1 Wind Tunnel data for near field effects, and then extrapolate to far field. For a given frequency and location along the 2.0-m sideline, the convected source locations and radiation angles were examined until a source location and radiation angle were found that corresponded to an acoustic ray propagating through the measurement point. The corrected wind-tunnel data were then extrapolated to the desired far field sideline along that ray using spherical decay and atmospheric decay. Table 3 shows typical data, corrections, and extrapolations. Figures 16(a) and 16(b) illustrate typical 2.0-m data and extrapolated results at the 122-m sideline. The accuracy of the extrapolation is very sensitive to the accuracy of the source location. A source position error equal to one nozzle diameter can lead to a far field radiation angle (θ_S or ψ_S) error of up to 12° for that source.

The computer code developed to perform all the corrections, curve fits, calculations, extrapolations, and plotting is complex. Figure 17 illustrates the flow of information required to carry out the numerous operations automatically. Reference 25 describes the function of each module of the code as it was developed to operate on the ONERA computer systems. Appendixes A and B contain the computer code listings for the main programs, NOISE3 and NOISE4. NOISE3 calculates the source location with the wind off, and NOISE4 calculates the far field directivity and wind effects.

RESULTS AND DISCUSSION

Background Noise

Figures 18(a)–18(c) show typical background noise levels measured at the 2.0-m sideline in the S1 Wind Tunnel for windspeeds of 87, 113, and 130 m/sec. The data are presented as sound pressure level in third-octave bands versus angle relative to the nozzle exit center (0° is upstream, 180° is downstream). This is the typical format for this report. Sound pressure level peaks at around 114 dB. The noise levels appear to be dominated by flow interaction with the microphones and support fairings. These levels are sufficiently below the jet noise levels as to be negligible. Since the 3.5-m-sideline jet noise data were contaminated by background noise at high windspeeds, none of the 3.5-m data are presented in this report.

Extrapolation to Far Field

Figures 19(a)–19(j) show the 2.0-m-sideline jet noise levels in the S1 Wind Tunnel and the corresponding extrapolated noise at the 122-m sideline for windspeeds of 49, 72, 88, 113, and 130 m/sec. The 2.0-m data show peak noise levels at 400–630 Hz and peak radiation angles of 155°–160°. At 122 m the noise peaks at 400–500 Hz and radiation angles of 142°–160°, which is appropriate for source locations about two nozzle diameters downstream of the exhaust (see fig. 15(b)). In other words, a sound ray originating in the shear layer two nozzle diameters downstream of the exhaust and passing through the 2.0-m sideline with an angle, ψ_1, of 155°–160° will arrive at a 122-m sideline with an angle, ψ_2, of 149°–156°, according to the geometry (see fig. 14).

The data in figures 19(a)–19(j) are plotted directly from the automatic data-reduction program and have obvious discontinuities which appear at some high frequencies and high angles. The discontinuities are the result of rapid, fictitious changes in apparent source locations. For example, the discontinuity in the 8-kHz curve in figure 19(f) can be traced to the scattered source locations at 8 kHz in figure 15(d). These abnormal source locations are created by anomalies in the spectra used to find the angle pairs (figure 9(b), for example), which the computer code treats impartially. However, the resulting error in the extrapolations of figure 19 have a negligible effect on the overall noise levels.

Internal Engine or Shock Noise

It is important to note that at the higher jet speeds, there is evidence that internal engine noise or broadband shock noise is dominating the near field jet noise at low directivity angles and midfrequencies, but it is not clear which of the two noise sources is dominant. Figures 19(g) and 19(i), for example, show peaks, or lobes, in the near field directivity pattern between 60° and 120° that are obviously not caused by pure jet noise. When these noise lobes are extrapolated to far field, only the lobe at around 120° is clearly visible (figs. 19(h) and 19(j)).

The changes in noise with jet speed for 1.0 kHz and 1.2 kHz are plotted in figure 20, which illustrates the rapid growth of internal or shock noise in the near field and the slower growth in the far field. Although the data set is limited, the curves indicate that in this operating regime, the near field or shock noise increased with jet speed (neglecting differences in forward speed), as

$$\Delta Lp_i = 10 \log\left(V_{j2} / V_{j1}\right)^{24} \qquad (3)$$

and the far field internal and jet noise increased, as

$$\Delta Lp = 10 \log\left(V_{j2} / V_{j1}\right)^{5} \qquad (4)$$

This apparent contradiction in growth rates can only be possible if the near field microphone was dominated by a nearby internal or shock noise source when the microphone passed upstream of the exhaust nozzle. In that region, the jet turbulence noise is relatively weak and the internal or shock source strength grows rapidly with jet speed. In the far field, however, the microphone is about equidistant from sources throughout the jet, and the radiation angle is larger so that jet noise is strong, yet growing at a slower rate than internal noise. As jet speed increases, however, the proportion of far field noise caused by internal or shock sources must increase. When one type of source dominates both the near and far acoustic fields, the near field and far field growth rates with increase in jet speed will be identical.

Thus, the J-85 far field directivity pattern at midfrequencies tends to have two major lobes, one near 160°, caused by pure jet noise, and one near 120°, which appears to be influenced by internal or shock noise. This latter observation is supported by Stone's plot in reference 26 of internally generated noise directivity from many full-size jet engines. This plot shows a broad peak that reaches 120° and has a shape very similar to the mid- to high-frequency data plotted in figure 19. Internally generated noise could also be important at angles lower than 120°, where the jet noise is relatively weak. These two lobes are not clearly seen in the overall sound-level directivity plots.

Forward Speed Effects

We can now compare the data of figures 16 and 19 to show the effects of forward speed on jet noise. Figures 21(a)–21(e) show the flight effects on the overall sound pressure levels at the 122-m sideline for speeds of 49, 72, 88, 113, and 130 m/sec.

Corrections

All curves in figures 21(a)–21(e) were corrected equally for the 0–3-dB amplification in the S1 Wind Tunnel described in the data analysis section. Because the static data were recorded with an induced windspeed of 16 m/sec in the wind tunnel and a jet speed of 545 m/sec, it was also necessary to correct the far field static data to zero windspeed and to the correct flight jet speeds noted in figures 21(a)–21(e). Both original and corrected curves are shown. These corrections were taken from the semi-empirical jet noise prediction of Stone et al. in reference 24, and ranged from less than 1 dB in figure 21(a) to a maximum of 6.6 dB at 140° in figure 21(e). The change in jet noise due to a change in jet and/or flight speed is given by

$$\Delta Lp = Lp_2 - Lp_1 = 10\log\left(\rho_{j2}/\rho_a\right)^{w_2} - 10\log\left(\rho_{j1}/\rho_a\right)^{w_1}$$
$$+10\log\left(V_{e2}/V_{e1}\right)^{7.5} - 15\log\left(K_2/K_1\right) \qquad (5)$$

where ΔLp is the change in noise for any change in flight speed or jet speed, represented by "condition 1" (Lp_1) or "condition 2" (Lp_2). For each condition, the following parameters are computed.

$$V_e = V_j\left(1 - V_a V_j\right)^{2/3} \qquad (6)$$

$$w = 3\left(V_e c\right)^{3.5} / \left[0.6 + \left(V_e/c\right)^{3.5}\right] - 1 \qquad (7)$$

$$K = \left[1 + M\cos(\psi_2)\right]^2 + 0.04M^2 \qquad (8)$$

$$M = 0.62\left(V_j - V_a\right)/c \qquad (9)$$

Equation (5) gives the change in overall noise due to the change in jet speed and flight speed of a simple isolated jet parallel to the flight direction. Internal engine or shock noise sources are not included. The dynamic effect on sound amplitude of the change in relative motion between the source and the propagation medium is included, but the kinematic effect of relative motion between aircraft and observer is not included since there is no such motion in the wind tunnel. The kinematic effect is small; an estimation of it is given in the section "Comparisons with Predictions". It was deduced from the results of reference 24 that, to a first approximation, equation (5) is also valid for third-octave band frequencies greater than or equal to 500 Hz. However, ΔLp should be reduced by 25% at 250 Hz and by 50% at 125 Hz, according to reference 24.

Because the high-speed jet noise in figures 21(d) and 21(e) was affected by internal or shock noise as discussed above, corrections based entirely on equation (5) would be inappropriate in that case. So, for angles equal to or less than 90°, equation (4) was used to correct the mix of internal and jet noise in the forward quadrant. For larger directivity angles where jet noise dominates, equation (5) was used for the corrections. As before, the magnitude of the correction is indicated by the difference between the dashed line and the circles in figures 21(d) and 21(e). This procedure does not entirely resolve the uncertainty inherent in figures 21(d) and 21(e), which show comparisons of static (nearly pure) jet noise with forward speed jet/internal noise. Because of engine temperature limitations, the static data were acquired at jet speeds low enough that internal noise was not evident. Thus, the static and forward speed noise sources are not identical despite the attempt to correct the static data for equivalent conditions.

Discussion

At a forward speed of 49 m/sec (fig. 21(a)), the simulated flight noise is less than the static noise at large radiation angles, as would be expected from the smaller relative velocity between the jet and the ambient air. At low radiation angles, the flight effect on jet noise decreases to around zero at 50°, as reported by many researchers. Stone (ref. 26) attributes this effect primarily to internally generated noise which dominates as jet noise decreases with forward speed. Internally generated noise can arise from many sources, such as combustion and turbomachinery. As forward speed increases, the peak flight noise near 140° decreased relative to the static case by a maximum of 10.5 dB at a forward speed of 130 m/sec (fig. 21(e)). In all cases, the flight and static data tend to converge as the radiation angle decreases to 40°. Amplification or crossover of jet noise due to flight was noted at small angles in figures 21(a), 21(d), and 21(e).

Equation (5) indicates that, in flight, pure jet noise should decrease in the forward quadrant (low directivity angles) relative to the static case. On the other hand, internal noise should increase in the forward quadrant because of source motion relative to the medium (dynamic effect) and source motion relative to the observer (kinematic effect). Following Stone's reasoning (ref. 26), the dynamic effect on internal noise relative to the the static case can be estimated by

$$\Delta Lp_i = -30\log\left[1 - M_o\cos(\psi_2)\right] \qquad (10)$$

(Stone uses a –40 multiplication factor because he lumps the dynamic and kinematic effects, but the latter is not present in the wind tunnel). Thus, if the data in figures 21(a)–21(e) had been generated by pure jet sources, the separation of the curves in the forward quadrant would be greater, according to theory. Conversely, if both sets of data had contained strong internal noise, the curves would cross in the forward quadrant, which they do slightly in some cases. This is an example of the difficulties of working with jet engines rather than pneumatic nozzles. Full-scale jet engines have jet and internal noise sources that are difficult to distinguish in the far field except with forward speed, when the two types of noises react differently.

The attenuation of J-85 aft-quadrant noise ($\psi_2 > 90°$) in flight and amplification of the forward-quadrant noise ($\psi_2 < 90°$) in flight simulations using the Bertin Aerotrain were reported by Drevet et al. (ref. 8). (The Bertin Aerotrain is a French air-cushion vehicle that moves along an inverted "T" track.) The J-85 was modified with an inlet duct lining to suppress compressor noise that might have affected jet noise measurements in the forward direction. At a flight speed of 82 m/sec and a jet speed of 505 m/sec, there was an aft-quadrant attenuation of 8 dB and a forward-quadrant amplification of 1 dB. Both static and flight directivity patterns peaking near 140° were shown. For the S1 data in figure 21(c), the attenuation of peak noise levels due to forward speed is 6 dB and the attenuation at 40° is less than 1 dB. These numbers go to 7 dB and 0 dB if the wind tunnel data are corrected for kinematic effects present in the Aerotrain test, as will be explained in a later section. Hence, the two data sets are in reasonably good agreement with regard to peak noise attenuation.

From the Aerotrain data of reference 8, Hoch (ref. 7) proposes that forward speed effects on jet noise can be explained using the concept of shear noise and self noise in the jet. The aft-quadrant noise is dominated by jet shear which becomes weaker as the relative speed between the jet and the ambient flow decreases. The forward-quadrant noise, according to Hoch, is dominated by excited turbulence or self noise in the jet interior which is less affected by the external flow speed. Hence, the aft-quadrant noise decreases with forward speed, but the forward-quadrant noise does not. The results of the present study cannot disprove Hoch's ideas of internal jet turbulence noise with respect to pure jets, but the data (e.g., figs. 19(g) and 19(i)) support Stone's arguments about internal sources dominating forward-quadrant noise in flight. The forward-quadrant noise in figures 19(g) and 19(i) looks quite unlike jet or turbulence noise, as if a new source were developing, such as might be produced by turbomachinery, combustion, or shocks.

The third-octave-band noise levels, wind on, are compared to the zero wind data in figures 22(a)–22(i), which illustrate 122-m-sideline data at zero and 130 m/sec windspeeds for third-octave bands at 125, 250, 500, and 800 Hz and 1.25, 2.5, 5.0 and 8.0 kHz. As before, both curves were corrected for S1 amplifications as listed in table 2, and the static data were corrected to the appropriate wind and jet speeds using equation (4) for $\psi_2 < 90°$ and equation (5) for $\psi_2 \geq 90°$. The static data are plotted with and without the wind/jet correction. The low-frequency data (125 and 250 Hz) show a reduction of jet noise due to forward speed at all angles. At other frequencies, crossover of forward-quadrant noise occurred. The 500- and 800-Hz data dominate the overall sound levels (see fig. 19(j)), which explains why the overall sound levels converged at small angles.

Comparisons with Published Data

In figures 23(a)–23(c), comparisons are shown between the S1 Wind Tunnel results and J-85 data acquired in other flight tests or simulations with respect to overall sound levels. The curves labeled Aerotrain were taken from reference 6, which describes a joint General Electric/SNECMA test of a J-85 engine on the Bertin Aerotrain. The curves labeled Learjet are also from reference 6 and represent tests of the Gates Learjet powered by two J-85 engines. All three sets of data in figures 23(a)–23(c) correspond to noise on a 122-m sideline. In all cases, the flight and train data were corrected to a common forward speed and jet velocity using equation (5) plus the following correction for kinematic effect of the relative motion between the source and the observer (this effect is not present in wind tunnel data) from reference 24.

$$\Delta Lp_k = -10 \log(1 - M_{o2} \cos \psi_2) + 10 \log(1 - M_{o1} \cos \psi_2) \tag{11}$$

The agreement among the data is fair, considering the differences in the experimental methods and the potential errors inherent in each. For example, the Aerotrain J-85 had treated inlet ducts, and the Learjet J-85 noise directivity was affected by wing and fuselage reflections. Furthermore, the accuracy of flyover noise tests are often poor due to variations in source position, short sampling times, ground reflections, and atmospheric effects. At angles of less than 90°, the S1 Wind Tunnel data are consistently higher than the Aerotrain data. Since internal noise plays an important role in J-85 forward-quadrant noise, as previously discussed, the Aerotrain duct treatment may have suppressed that noise to some extent. From 90° to 140°, the S1 and Aerotrain data agree fairly well. The largest differences are for angles above 140°. The S1 peak levels are around 2 dB higher and at a greater angle by about 5° than the Aerotrain peak levels. Considering the variety of experimental methods and corrections employed, the data agreement is reasonable.

Figure 24 is a comparison of overall sound levels of the J-85 engine measured in the S1 Wind Tunnel with those measured by Atencio (ref. 11) in the Ames 40- by 80-Foot Wind Tunnel before the present acoustic wall lining was installed (ref. 27). There were important differences between the two studies. The Ames data were measured 4.3 m directly below the engine, which was mounted below an aircraft model wing; the engine was 6.1 m above the hard floor. The data were extrapolated to 30.5-m flyover distance by means of an early version of the source-location technique. Furthermore, the Ames data contains corrections for wind tunnel reverberations and near field effects. Because the 40 by 80 test section was unlined, the reverberation corrections intended to correct the data to free field conditions are quite large, ranging from -9 to +12 dB. The 40 by 80 data as published also contain a wind correction factor so that the results simulate static noise propagation. This correction was removed for the comparison in figure 24 so that the S1 and 40 by 80 wind effects are similar. The S1 far field noise levels were extrapolated from 122-m sideline to 30.5-m sideline by means of spherical radiation. The agreement is difficult to evaluate in detail because of the limited number of data points in the 40 by 80 data, and because of possible errors in the large corrections of the Ames data. It appears that the S1 sound levels are about 1–5 dB higher than the 40 by 80 levels. The 40 by 80 data appear to lack the peak noise.

Comparisons with Predictions

By plotting the difference of jet noise measured in simulated flight and that measured statically, $Lp_{flight} - Lp_{static}$, one can compare the experimental results with the flight effect predictions given by equations (5) and (10). Flight effects on jet mixing noise (eq. (5)) account for two factors: (1) source strength alteration resulting from the external flow around the jet plume, and (2) the dynamic effect of the relative velocity between the jet and the ambient air. Because there is no relative motion between the airplane and the microphone in a wind tunnel, the kinematic effect is not present in wind tunnel data, nor in equation (5). Since internal engine noise is an important component of J-85 noise at small angles, the flight effects on internal noise can also be compared with the experimental results.

Predicted flight effects from equation (5) (jet noise) and equation (10) (internal noise) were compared to the data of figures 21(a)–21(e) as shown in figures 25(a)–25(e). The difference between flight and static noise, measured and predicted, are plotted. The curves all have similar trends (slope) with respect to direction. The levels, however, differ. At directivity angles of less than 90°, the measured change in noise due to forward speed falls between that predicted for internal noise, which is positive, and for jet mixing noise, which is negative. Since the near field data indicate that the J-85 generates a mixture of internal and jet noise in the forward quadrant, these results are reasonable. At lower jet speeds, where internal noise is not strongly evident, the measured results ($\psi_2 <$ 150°) are within 2 dB of the prediction for pure jet noise (eq. (5)). At jet speeds greater than 577 m/sec, where the near field data indicate strong levels of internal noise ($\psi_2 \leq 90°$), the measured flight effects are closer to the predictions of equation (10) for internal-noise flight effects. Between 90° and 140°, the measured and predicted jet-noise flight effects (eq. (5)) agree reasonably well. This is also consistent with fact that jet noise dominates internal noise in the aft quadrant. Beyond 140° there is a discrepancy between measured and predicted flight effects. This is evident in figure 15, which shows that the source locations change rapidly in the negative direction above 140°; that is, they appear to disappear into the engine, and are poorly defined. Thus, the source location method fails at high radiation angles.

To summarize, the prediction of the change in pure jet noise due to forward speed given by equation (5) agrees within 2 dB of measured flight effects for jet speeds equal to or below 577 m/sec (excluding the faulty data above 140°). The data are consistently weaker (closer to zero) in the forward quadrant and stronger in the aft quadrant than predicted by equation (5). At higher jet speeds, the data in the forward quadrant approach, but do not reach, the internal noise prediction of equation (10). For this type of jet engine, a reasonable approach for predicting flight effects would be to split the difference between equations (5) and (10) for the forward quadrant, and to use equation (5) for the aft quadrant.

No prediction of absolute noise levels of the J-85 is presented, because that would require information on the engine internal noise sources not available in the literature. Attempts to use the pure jet prediction method of Stone et al. (ref. 24) proved unsuccessful because the internal sources are important on the J-85.

Figures 26(a) and 26(b) compare the S1 and Aerotrain data (ref. 6) with the flight effect predictions at forward speeds of 41 and 82 m/sec, respectively. Three prediction curves are shown—one for internal noise only (eq. (10)), one for jet noise without kinematic effect (eq. (5)), and one for jet noise with kinematic effect added (eq. (5) plus eq. (11)). This last prediction is incorporated because the Aerotrain data should show a kinematic effect of relative motion between the source and the receiver, whereas the S1 data should not. This results in a small predicted amplification of pure jet noise caused by the motion between the aircraft and observer (the kinematic effect), as illustrated. Again, all curves have similar slopes. Unfortunately, the two data sets are not consistent enough to confirm the existence of the kinematic effect. As before, the S1 data fall between the predicted internal and jet noise curves at most angles because of the mixture of jet and internal noise in the data. The S1 and Aerotrain data agree within a few dB, out to 140°. Above that angle the S1 data are in error because of the shortcoming of the source location/extrapolation method. Thus, the total S1 flight-effect results, which include source strength alteration and the dynamic effects of jet/ambient relative velocity, have the proper trend with regard to flight velocity and radiation angle, according to theory and to comparison with Aerotrain data, except at angles above 140°.

CONCLUDING REMARKS

A study of flight effects on noise from a J-85 turbojet engine with a conical, convergent nozzle tested in the ONERA S1 Wind Tunnel has confirmed the strong effect of forward speed on noise from a full-scale engine. At the top simulated flight speed of 130 m/sec, the peak overall noise levels in the aft quadrant were attenuated approximately 10 dB relative to noise generated statically, and the forward quadrant noise increased slightly at 40° directivity angle.

The data indicated that internal engine and broadband shock noise make an important contribution to J-85 noise, particularly at high jet speeds, but it was unclear which of the two sources was dominant. The internal and shock noise components vary with changes in jet speed and forward speed in a different manner than does pure jet noise. A new empirical equation was presented that relates changes in internal or shock noise to changes in jet speed. The data were also compared with Stone's jet noise predictions. The comparison indicates that, in general, J-85 flight effects can be predicted to within 2 dB using equations for pure jets, except for the case of forward-quadrant noise ($\psi < 90°$) from high-speed exhausts. In that case, estimates of internal-noise flight effects must be incorporated in the prediction. Kinematic amplification caused by aircraft motion relative to the observer (not present in wind tunnel data) could not be confirmed by comparing these results with other published data.

The S1 data were also compared with published data from studies of J-85 noise in an outdoor static test, a flight test, a wind tunnel test, and a moving train test. In general, the trends in the data were reasonably similar, considering the variety of test techniques used. Nonetheless, there were anomalies in the S1 data. At low frequencies and low angles (forward quadrant), there was a 0- to 3-dB contamination of S1 data as a result of sound propagation around the circuit. This effect was quantified by comparing S1 data with free-field data to arrive at suitable correction factors. At directivity angles greater than 140°, however, the data deviated greatly from predictions and from other data sets because of the breakdown of the source-location/extrapolation technique. This breakdown might have been alleviated if flow noise had not prevented the use of sideline data measured 3.5 m from the jet axis. All results of this study are based on acoustic data acquired 2.0 m from the jet, which is a sideline distance that necessitated a substantial correction for near field propagation effects.

One of the objectives of the program was to automate the Ames version of the multiple-sideline source-location method to create an efficient, operational data-reduction system for jet noise studies that would not require intermediate manipulation of the data during processing. That objective was not achieved. The data reduction was automated, but the computer codes were complex and were so difficult to debug that the data-reduction system was not efficient. The only way the output could be checked was by comparing the final results with other published data, as discussed in this report. It could not be determined whether the anomalies in the results were due to errors in the computer code, or to the experimental method used, or to physical uncertainties related to the problem of measuring sound in the near field of distributed sources. Furthermore, for the near field effect, a correction factor had to be found during static operation of the engine and applied to flight data—a technique that has not been verified.

These experimental difficulties could be alleviated if large-scale jet noise studies such as this were done in the recently modified 40- by 80-Foot Wind Tunnel. The large test section, acoustic wall treatment, long circuit, and acoustically treated corner vane set (refs. 28 and 29) would allow collection of acoustic data of sufficient quality that it would not be necessary to push the multiple-sideline technique to its limits. At high speeds, background noise in the 40 × 80 is only a few dB quieter than in the S1, because the high-speed noise in both facilities is dominated by flow noise in the test section. However, acoustic antennas could reduce the effective background noise (ref. 23) and permit sideline traverses in the 40 × 80 that are farther from the jet than is possible in the S1. The problems encountered in the S1 with near field effects and noise propagation around the circuit would be reduced in the 40 × 80, if not eliminated. Furthermore, the 40 × 80 airspeed has been increased from 103 m/sec to 155 m/sec since the study described here was accomplished.

The multiple-sideline source-location method applied to this wind-tunnel study required substantial commitments of time and effort such as (1) static, far field noise surveys of the engine outside the wind tunnel, (2) acoustic treatment of the test section walls, and (3) development of a complicated data-reduction scheme. Although a larger test section with a good acoustic environment should reduce these requirements, evaluation of alternative methods is recommended. Hoglund, for example, proposed a simple method using cross correlation for source location (ref. 29). Nonetheless, the source-location method described here does work, within the limits discussed above. The method used in this study resulted in a better understanding of the complicated roles played by jet and internal-engine noise sources during aircraft flight.

Ames Research Center
National Aeronautics and Space Administration
Moffett Field, CA 94035-1000, June 26, 1990

REFERENCES

1. Elias, G.: Essais du Motor J85 a S1 MA. Analyse de la Turbulence du Jet par Radiometrie Infrarouge et Correlations Infrarouge-Son. (Test of the J85 Engine at S1 MA. Analysis of Jet Turbulence by Infrared Radiometer and Infrared/Sound Correlations). In French. ONERA Rapport Technique No. 4/3353 PN, 25 June 1980.

2. Hoglund, L. E.: Static Source Locations for Four Nozzles Mounted on a J85 Engine. NASA CR-152401, 1979.

3. Elias, G.; and Schmidt, C.: Aerodynamic and Acoustic Comparisons of Scaled-Down and Actual Engine Jets. AIAA Paper 79-0574. AIAA 5th Aeroacoustics Conference, Mar. 1979.

4. Burley, R. R.; Karabinus, F. J.; and Freedman, R. J.: Flight Investigation of Acoustic and Thrust Characteristics of Several Exhaust Nozzles Installed on Underwing Nacelles on an F106 Airplane. NASA TM X-2854, 1973.

5. Antl, R. J.; and Burley, R. R.: Steady-State Airflow and Afterburning Performance Characteristics of Four J85-GE-13 Turbojet Engines. NASA TM X-1742, 1969.

6. Clapper, W. S.; and Stringas, E. J.: High Velocity Jet Noise Source Location and Reduction. Task 4-Development/Evaluation of Techniques for "Inflight" Investigation. FAA-RD-76-79, IV, Feb. 1977.

7. Hoch, R. G.: Some Thoughts on the Effects of Flight on Jet Noise as Observed in Actual Flight and in Wind Tunnels. J. Sound Vib., vol. 72, no. 3, 1980, pp. 379-389.

8. Drevet, P.; Duponchel, J. P.; and Jacques, J.: R. The Effect of Flight on Jet Noise as Observed on the Bertin Aerotrain. J. Sound Vib., vol. 54, no. 2, 1977, pp. 173-201. Also AIAA Paper 76-557, July 1976.

9. Hoch, R. G. and Berthelot, M.: Use of the Bertin Aerotrain for the Investigation of Flight Effects on Aircraft Engine Exhaust Noise. AIAA Paper 76-534. AIAA 3rd Aeroacoustics Conference, July 1976.

10. Duponchel, J. P. and Thomas, P. : Impact of Flight Effects on Multitube Suppressor Design. AIAA Paper 80-1029. AIAA 6th Aeroacoustics Conference, June 1980.

11. Atencio, A. Jr.: The Effect of Forward Speed on J85 Engine Noise from Suppressor Nozzles as Measured in the NASA Ames 40-by 80-Foot Wind Tunnel. NASA TND-8426, 1977.

12. Atencio, A. Jr.: Wind Tunnel Measurements of Forward Speed Effects on Jet Noise from Suppressor Nozzles and Comparison with Flight Test Data. AIAA Paper 75-870. AIAA 8th Fluid and Plasma Dynamics Conference, June 1975.

13. Beulke, M. R.; Clapper, W. S.; McCann, E. O.; and Morozumi, H. M.: A Forward Speed Effects Study on Jet Noise from Several Suppressor Nozzles in the NASA/Ames 40- by 80-Foot Wind Tunnel. NASA CR-114741, 1974.

14. Stone, J. R.; Miles, J. H.; and Sargent, N. B.: Effects of Forward Velocity on Noise for a J85 Turbojet Engine with Multi-Tube Suppressor from Wind Tunnel and Flight Tests. NASA TM X-73542, 1976.

15. Ahuja, K. K.; Tester, B. J.; and Tanna, H. K.: Calculation of Far-Field Jet Noise Spectra from Near-Field Measurements Using True Source Location. AIAA Paper 78-1153. AIAA 11th Fluid and Plasma Dynamics Conference, July 1978.

16. Jaeck, C. L.: Static and Wind Tunnel Near-Field/Far-Field Jet Noise Measurements from Model Scale Single-Flow Baseline and Suppressor Nozzles. Volume 1: Noise Source Locations and Extrapolation of Static Free-Field Jet Noise Data. NASA CR-137913, 1976.

17. Jaeck, C. L.: Static and Wind Tunnel Near-Field/Far-Field Jet Noise Measurements from Model Scale Single-Flow Baseline and Suppressor Nozzles. Volume 2: Forward Speed Effects. NASA CR-137914, 1976.

18. Jaeck, C. L.: Static and Wind Tunnel Near-Field/Far-Field Jet Noise Measurements from Model Scale Single-Flow Baseline and Suppressor Nozzles. Summary Report --- conducted in the Boeing Large Anechoic Test Chamber and the NASA Ames 40- by 80-Foot Wind Tunnel. NASA CR-2841, 1977

19. Strout, F. G.; and Atencio, A., Jr.: Flight Effects on JT8D Engine Jet Noise as Measured in the NASA Ames 40- by 80-Foot Wind Tunnel. AIAA Paper 76-556. AIAA 3rd Aeroacoustics Conference, July 1976.

20. Strout, F. G.; and Atencio, A., Jr.: Flight Effects on Noise Generated by a JT8D Engine with Inverted Primary/Fan Flow. J Aircraft, vol. 17, no. 1, Jan. 1980, pp. 13-19. Also AIAA Paper 79-0614, Mar. 1979.

21. Strout, F. G. : Flight Effects on Noise Generated by the JT8D-17 Engine in a Quiet Nacelle and a Conventional Nacelle as Measured in the NASA Ames 40- by 80-Foot Wind Tunnel. NASA CR-2576, 1976.

22. Christophe, J.: The ONERA Wind Tunnels at Modane Centre and at Le Fauga Centre and Their Utilization in Subsonic Range. ONERA TP 1983-28, presented at 19th Subsonic Aerodynamic Testing Association Meeting, Apr. 1983.

23. Soderman, P. T.; and Noble, S. C.: Directional Microphone Array for Acoustic Studies of Wind Tunnel Models. J. Aircraft, vol. 12, no. 3, Mar. 1975, pp. 168-173.

24. Stone, J. R.; Groesbeck, D. E.; and Zola, C. L.: Conventional Profile Coaxial Jet Noise Prediction. AIAA Journal, vol. 21, no. 3, Mar. 1983, pp. 336-342.

25. Couratin, J.: Mesures Acoustiques en Soufflerie a Veine Guidee: Convention NASA-Ames/ONERA- 1ere Partie- Mise en Oeuvre des Logicels d'Exploitation. (Acoustic Measurements in a Closed Test Section Wind Tunnel: NASA Ames/ONERA Cooperative Program -1st Part- Operation of the Data Reduction Programs). In French. ONERA Rapport Technique No. 23/3408 PN, 16 Dec. 1981.

26. Stone, J. R.: Prediction of In-Flight Exhaust Noise for Turbojet and Turbofan Engines. Noise Control Eng., vol. 10, no. 1, pp. 40-46, Jan.-Feb. 1978.

27. Olson, L. E; Zell, P. T.; Soderman, P. T.; Falarski, M. D.; Corsiglia, V. R.; and Edenborough, H. K.: Aerodynamic Flow Quality and Acoustic Characteristics of the 40- by 80-Foot Test Section Circuit of the National Full-Scale Aerodynamic Complex. SAE TP 872328, Intl.. Powered Lift Conf. & Expos., Santa Clara, CA, Dec. 1987.

28. Soderman, P. T.: Sources and Levels of Background Noise in the NASA Ames 40- by 80-Foot Wind Tunnel - A Status Report. NASA TM-100077, 1988.

29. Hoglund, L. E.: The Use of Cross-Correlations in Place of Multiple Sidelines for Source Location in Jet Noise Measurement. AIAA Paper 79-0618. AIAA 5th Aeroacoustics Conference, Mar. 1979.

Table 1. Jet exhaust conditions at the exit of the primary nozzle.[a]

Wind speed V_a, m/sec	Jet exhaust speed V_j, m/sec	Jet total temperature T_o, °C	Engine rotation speed, rev/min	Jet pressure[b] ratio, P_t/P_a	Ideal[c] jet thrust, N
0	545	680	16,137	1.82	11,336
49	522	622	16,087	1.78	10,727
72	555	648	16,137	1.91	11,941
88	577	660	16,170	2.0	12,661
113	597	670	16,170	2.10	13,205
130	607	675	16,170	2.14	13,208

[a]Jet conditions computed from fluid mechanic measurements of pressure and temperature. Parameters correspond to conditions at altitude of S1 Wind Tunnel (1100 m).
[b]Ratio of jet total pressure to wind tunnel static pressure.
[c]Momentum or ideal thrust equals net thrust plus ram drag. The maximum rated net thrust is 12,100 N.

Table 2. Correction factors added to S1 data to account for amplification caused by propagation around the circuit.[a]

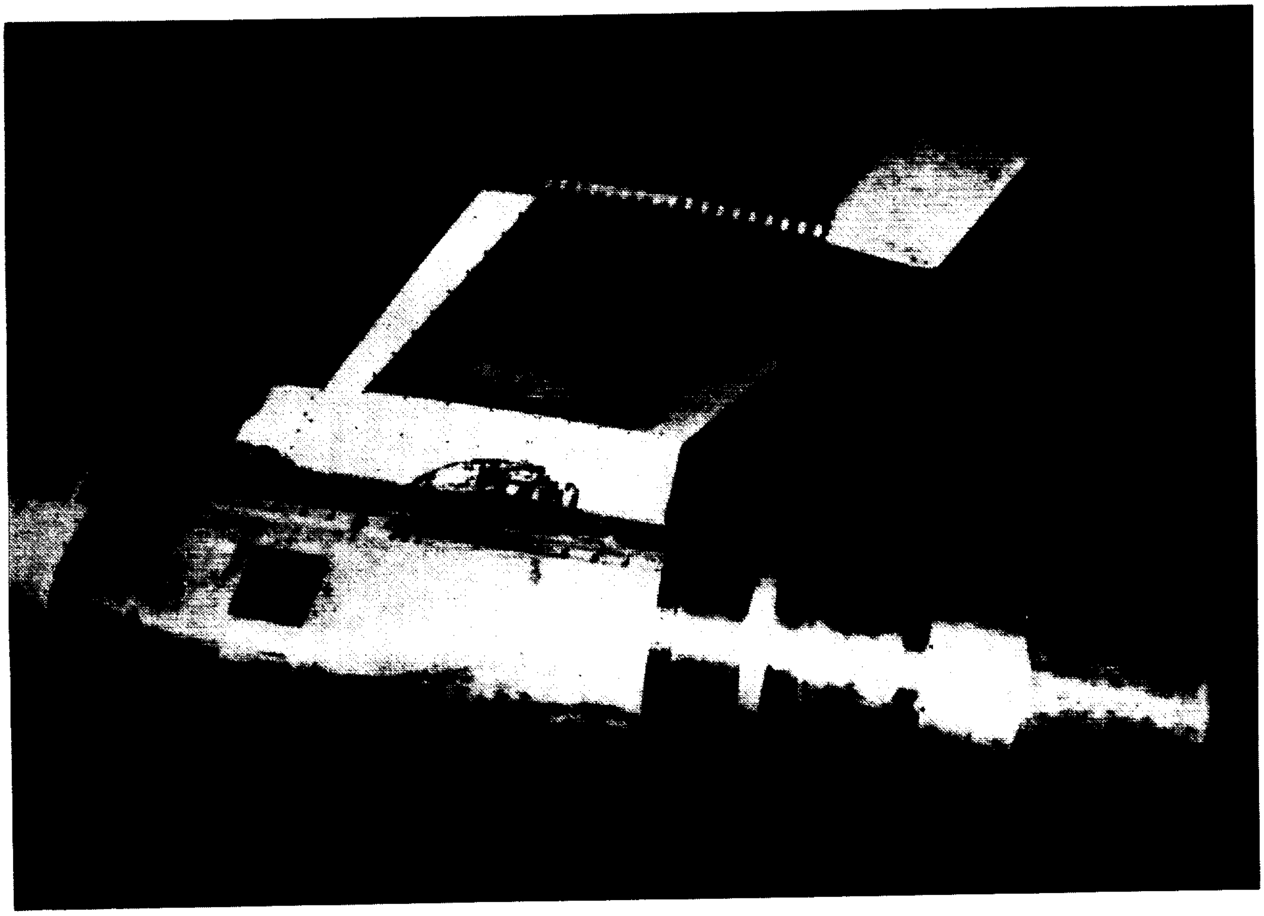
		ΔL_p, dB					
θ, deg	Overall	125 Hz	250 Hz	500 Hz	1250 Hz	2500 Hz	5000 Hz
40	-3.0	-8.0	-7.5	-2.5	-1.8	-1.7	-0.9
50	-2.9	-6.0	-7.0	-2.0	-1.7	-1.7	-0.9
60	-2.3	-5.0	-5.0	-1.6	-1.7	-1.7	-0.9
70	-2.0	-4.5	-3.5	-1.5	-1.6	-1.7	-0.9
80	-1.7	-4.0	-3.0	-1.5	-1.6	-1.7	-0.9
90	-1.3	-3.0	-2.3	-1.5	-1.6	-1.7	-0.9
100	-1.3	-2.0	-1.8	-1.0	-1.5	-2.0	-0.9
110	-1.3	-1.0	-1.5	-0.7	-1.5	-2.0	-1.5
120	-1.1	0	-1.0	-0.3	-1.0	-2.0	-2.7
130	-0.5	0	0	0	-1.0	-2.0	-4.3
135	0	0	0	0	-1.0	-2.0	-4.2
140	0	0	0	0	-1.0	-2.5	-4.1
145	0	0	0	0	-1.0	-3.0	-4.0
150	0	0	0	0	-1.0	-3.0	-4.0
155	0	0	0	0	-1.0	-3.0	-4.0
160	0	0	0	0	-1.0	-3.0	-3.0

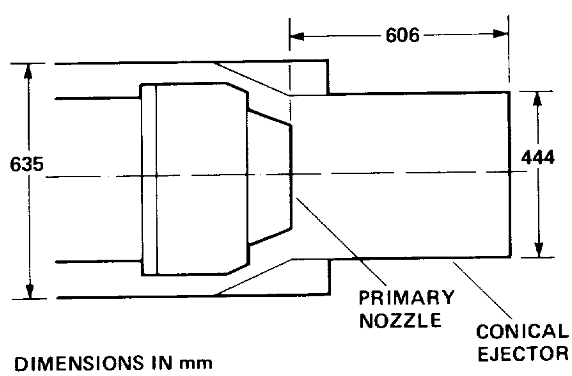
[a]Factors are tabulated by direction and frequency. Interpolation was used for intermediate frequencies.

Table 3. Typical data on 2.0-m sideline with corrections and extrapolation to 122-m sideline; static case (induced wind = 16 m/sec).

No.	θ_s	X/D	$\theta_1;\psi_1$	$\theta_2;\psi_2$	Near field (2 m) L_p at θ_s	Absorption correction	Near field correction	Corrected far field (122 m) L_p at ψ_s
1	40.00	0.98	45.66	40.08	115.63	0.12	1.70	81.50
2	42.40	1.08	49.42	42.50	116.35	0.12	1.83	82.35
3	44.80	1.67	57.38	44.97	117.48	0.11	1.93	83.59
4	47.20	2.10	65.10	47.43	117.80	0.11	2.03	84.02
5	49.60	2.17	69.49	49.86	117.89	0.10	2.11	84.19
6	52.00	2.11	72.44	52.27	117.99	0.10	2.23	84.41
7	54.40	2.01	74.71	54.68	118.11	0.10	2.34	84.65
8	56.80	1.89	76.62	57.07	118.24	0.09	2.45	84.89
9	59.20	1.77	78.35	59.47	118.38	0.09	2.56	85.14
10	61.60	1.66	80.06	61.87	118.54	0.09	2.66	85.40
11	64.00	1.57	81.87	64.26	118.73	0.09	2.75	85.68
12	66.40	1.49	83.82	66.66	118.95	0.09	2.83	85.99
13	68.80	1.45	86.07	69.06	119.22	0.08	2.87	86.30
14	71.20	1.44	88.71	71.47	119.55	0.08	2.91	86.67
15	73.60	1.49	91.92	73.88	119.95	0.08	2.93	87.09
16	76.00	1.64	96.30	76.32	120.43	0.08	2.95	87.60
17	78.40	1.93	102.33	78.78	120.96	0.08	2.97	88.14
18	80.80	2.18	107.63	81.24	121.32	0.08	2.98	88.52
19	83.20	2.27	110.78	83.66	121.55	0.08	2.99	88.76
20	85.60	2.27	112.85	86.07	121.73	0.08	3.00	88.95
21	88.00	2.22	114.34	88.46	121.89	0.08	3.00	89.10
22	90.40	2.14	115.55	90.84	122.03	0.08	3.00	89.25
23	92.80	2.05	116.60	93.22	122.17	0.08	3.00	89.39
24	95.20	1.97	117.65	95.60	122.33	0.08	3.00	89.54
25	97.60	1.87	118.62	97.98	122.49	0.08	2.99	89.69
26	100.00	1.79	119.70	100.36	122.68	0.08	2.98	89.88
27	102.40	1.72	120.90	102.74	122.93	0.08	2.97	90.11
28	104.80	1.66	122.19	105.12	123.22	0.08	2.95	90.38
29	107.20	1.62	123.64	107.50	123.60	0.08	2.92	90.73
30	109.60	1.59	125.22	109.89	124.05	0.08	2.90	91.16
31	112.00	1.58	126.94	112.28	124.61	0.08	2.86	91.68
32	114.40	1.59	128.78	114.67	125.28	0.09	2.80	92.30
33	116.80	1.62	130.73	117.07	126.07	0.09	2.72	92.99
34	119.20	1.66	132.77	119.46	126.95	0.09	2.62	93.78
35	121.60	1.73	134.88	121.86	127.92	0.09	2.52	94.64
36	124.00	1.81	137.03	124.26	128.94	0.10	2.42	95.56
37	126.40	1.92	139.23	126.66	129.98	0.10	2.30	96.48
38	128.80	2.05	141.43	129.06	130.97	0.10	2.19	97.35
39	131.20	2.20	143.64	131.46	131.85	0.10	2.09	98.13
40	133.60	2.37	145.83	133.86	132.57	0.11	2.00	98.75
41	136.00	2.56	147.99	136.25	133.05	0.11	1.90	99.13
42	138.40	2.78	150.09	138.65	133.26	0.12	1.79	99.22
43	140.80	3.02	152.12	141.05	133.17	0.12	1.65	98.98
44	143.20	3.25	154.01	143.44	132.78	0.13	1.48	98.43
45	145.60	3.45	155.75	145.83	132.15	0.14	1.31	97.62
46	148.00	3.57	157.26	148.21	131.39	0.15	1.12	96.65
47	150.40	3.61	158.63	150.58	130.52	0.16	0.91	95.56
48	152.80	3.57	159.90	152.95	129.56	0.17	0.70	94.38
49	155.20	3.45	161.12	155.32	128.52	0.19	0.54	93.16
50	157.60	3.25	162.34	157.70	127.36	0.21	0.37	91.81

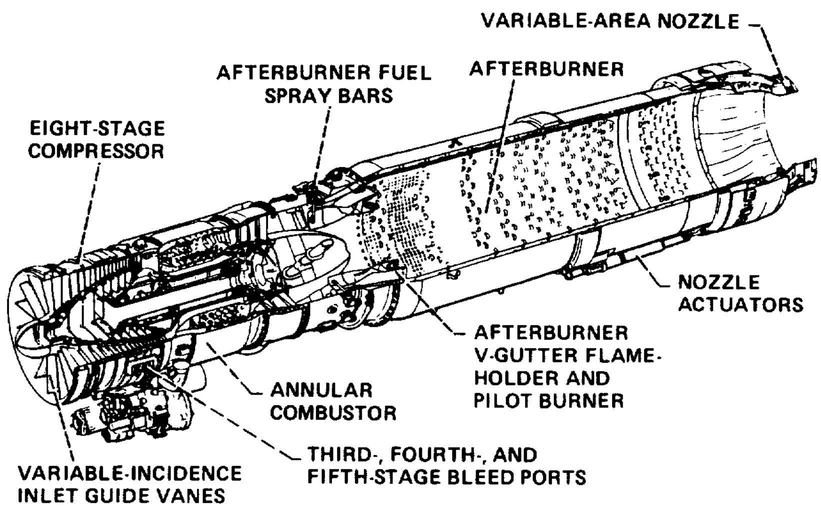
f = 500 Hz	St_o = 0.404 St = 0.416	Radial distance correction 20*log(YY/AN) = 35.71





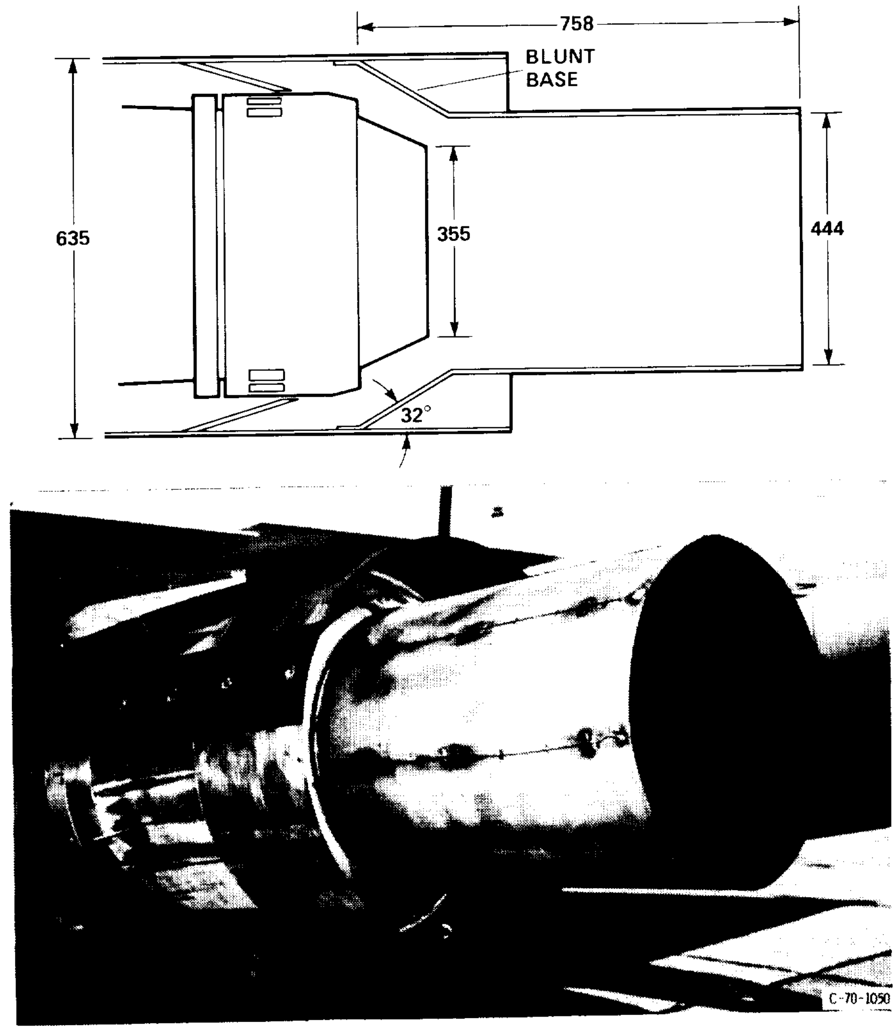
(a) Engine mounted in the S1 Wind Tunnel test section.

Figure 1. J-85 engine.



(b) Cutaway drawing of J-85-GE-13 afterburning turbojet engine (ref. 5).

Figure 1. Continued.



(c) Cylindrical ejector nozzle dimensions (above) and photo (below).

Figure 1. Concluded.

ORIGINAL PAGE
BLACK AND WHITE PHOTOGRAPH

ORIGINAL PAGE IS
OF POOR QUALITY

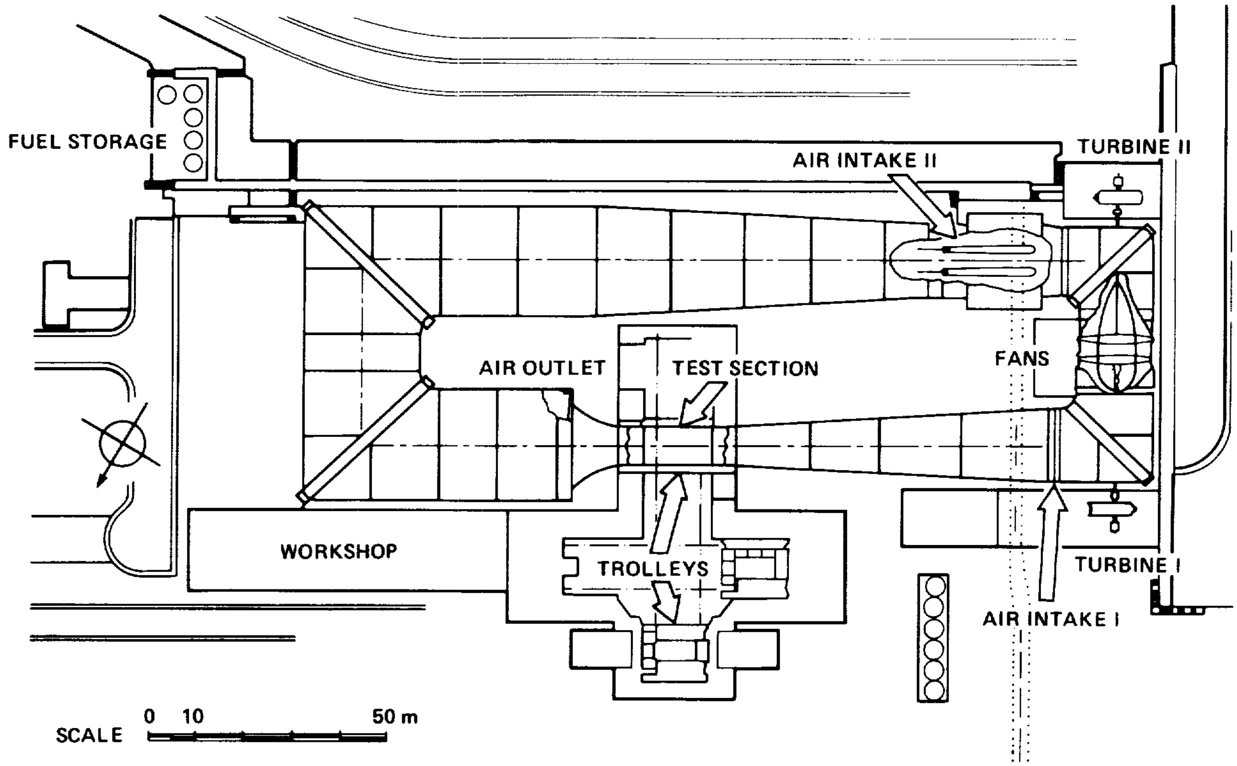


Figure 2. General layout of the S1 Wind Tunnel.

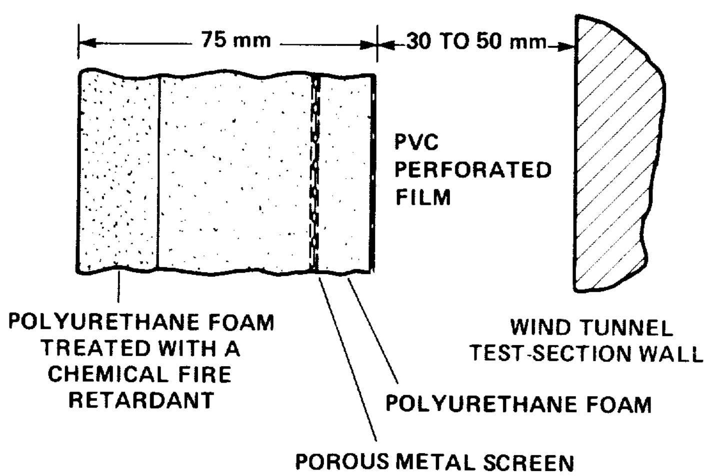


Figure 3. Cross section of the absorbent lining on the test section walls.

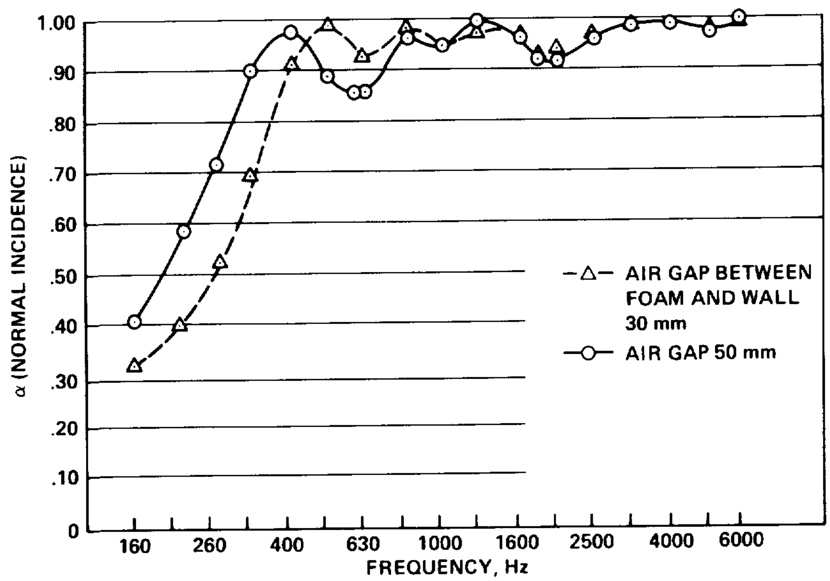
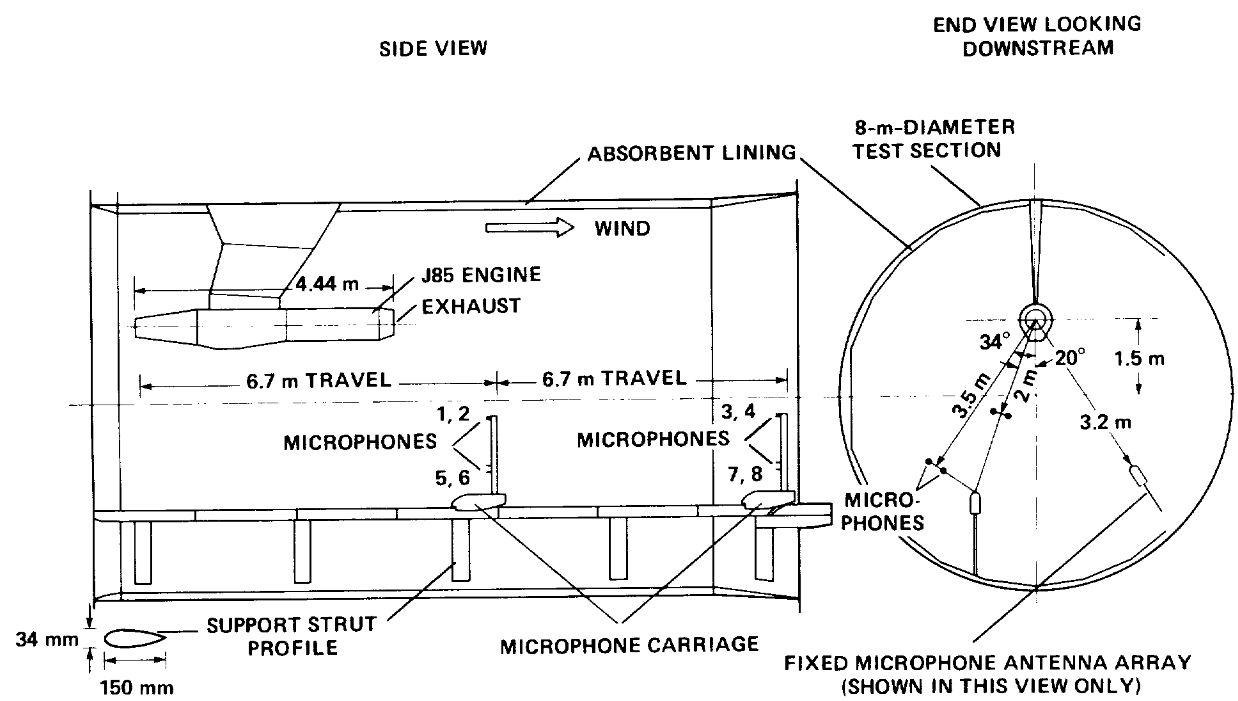


Figure 4. Acoustic absorption coefficients of the composite lining material (75 mm thick) plus air gap as measured in a standing wave tube.

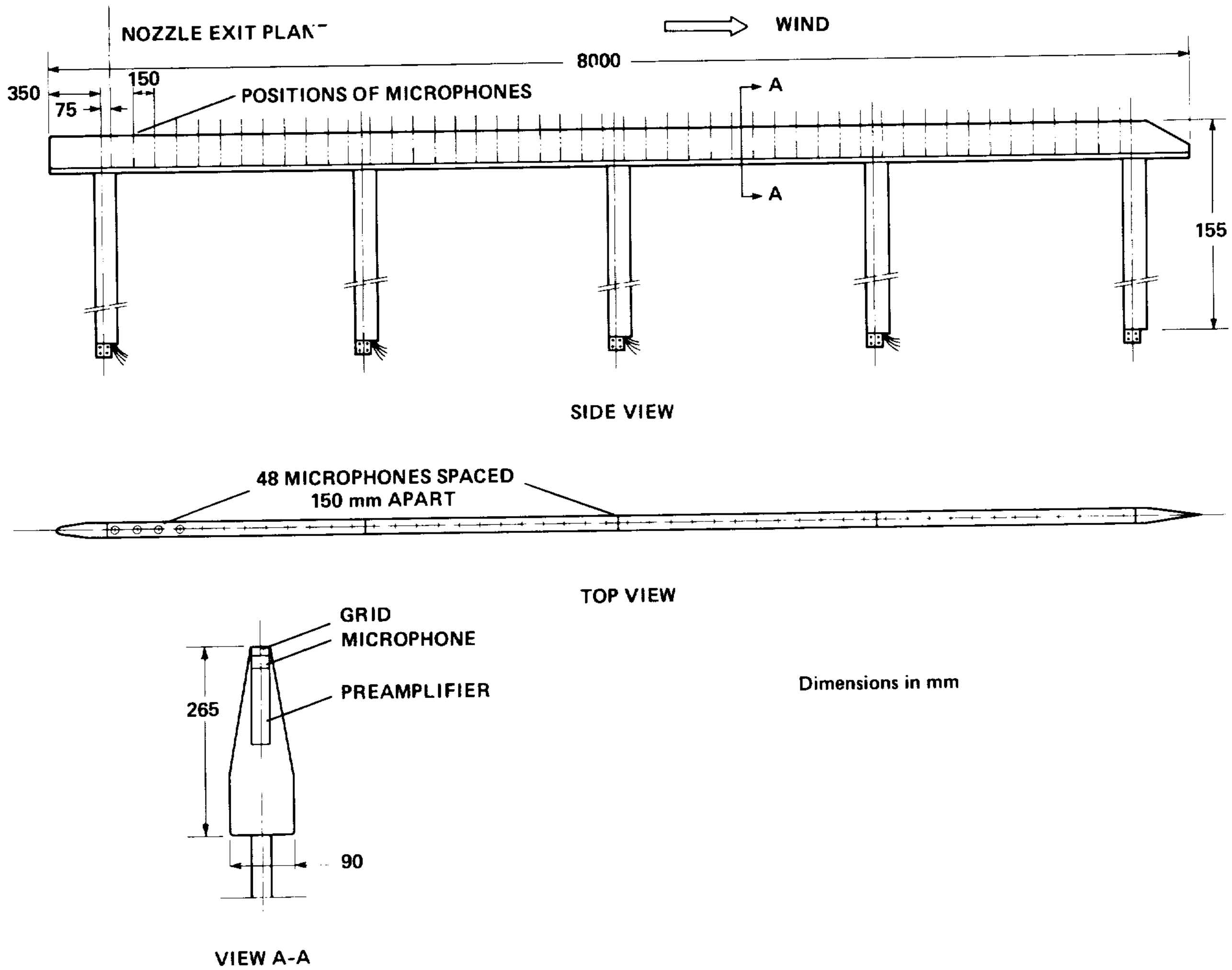


(a) Assembly schematic.

Figure 5. Model and microphone systems in the S1 test section.

(b) Assembly photograph (traverse support strut fairings not installed yet).

Figure 5. Continued.



(c) Schematic of fixed microphone antenna array.

Figure 5. Concluded.

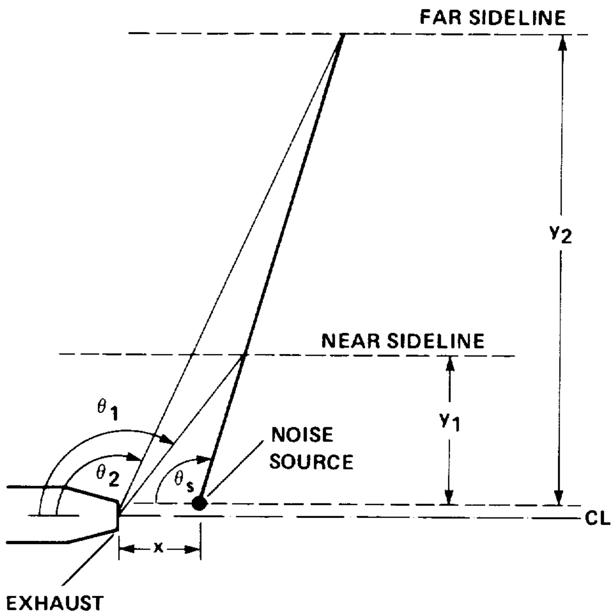


Figure 6. Source location geometry (static case).

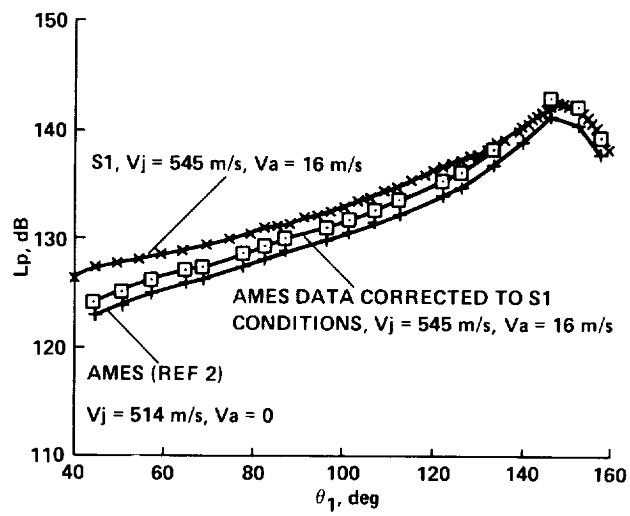


Figure 7. A comparison of J-85 noise on 2.0-m sideline measured in S1 Wind Tunnel and at NASA Ames outdoor test site (static case); overall sound levels.

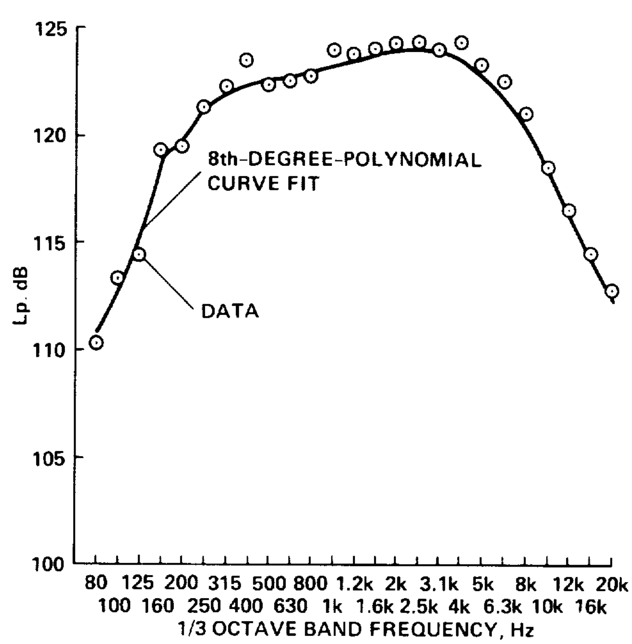
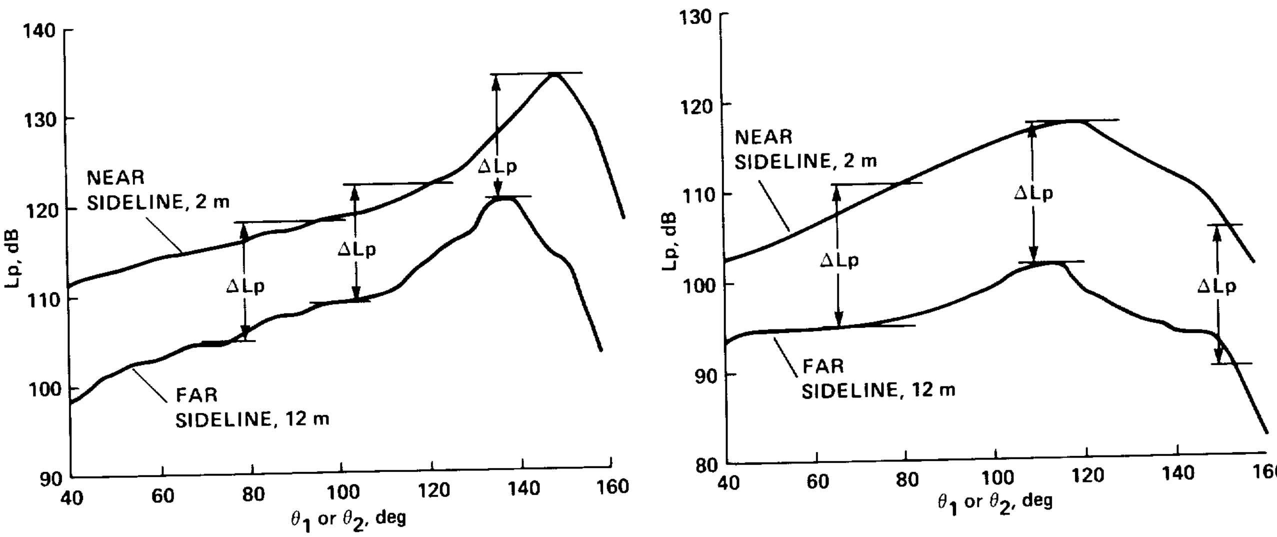


Figure 8. An example of 2.0-m sideline raw data and curve fit (static case); θ_1 = 119°.



(a) f = 500-Hz third-octave band.

(b) 8-kHz third-octave band.

Figure 9. Typical angle pairs with the same noise difference as that for the peak levels (ref. 2).

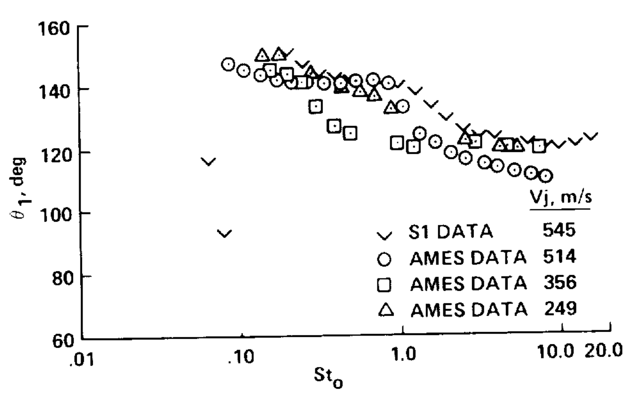
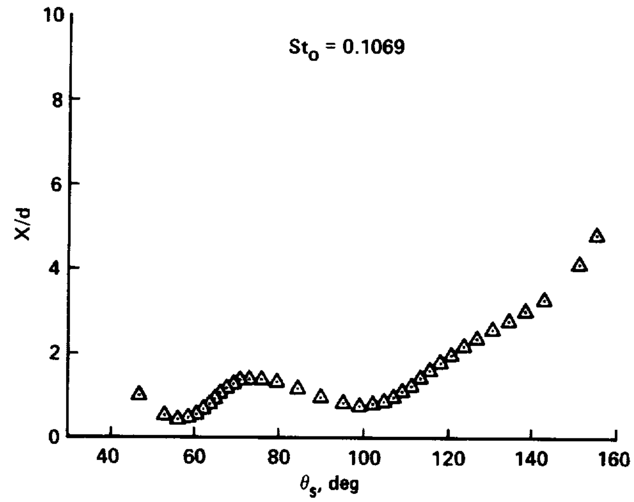
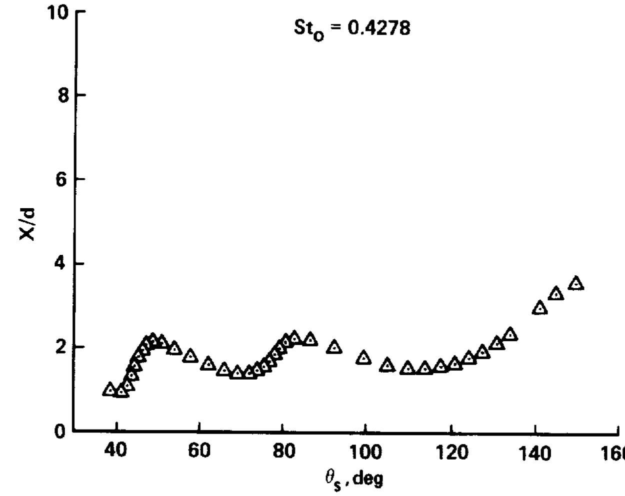


Figure 10. Angle of peak radiation versus Strouhal number St_o (static case) measured at S1 and at Ames (ref. 2).

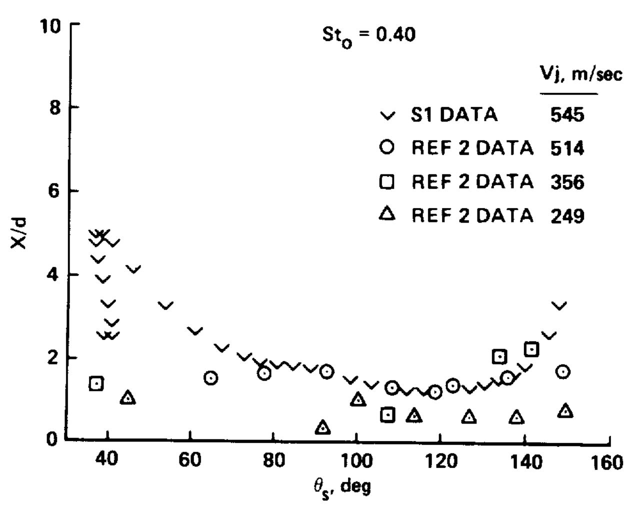


(a) f = 125 Hz.

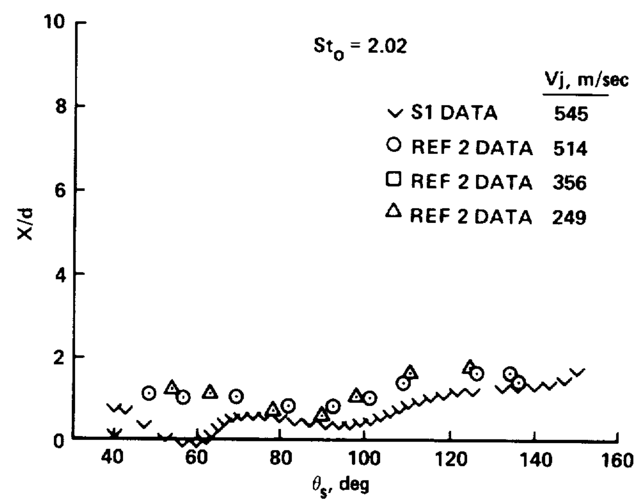


(b) f = 500 Hz.

Figure 11. Typical source locations versus radiation angle for the static case (ref. 2); V_j = 514 m/sec.



(a) f = 500 Hz.



(b) f = 2500 Hz.

Figure 12. A comparison of source locations measured statically (ref. 2) at Ames and in the S1 Wind Tunnel.

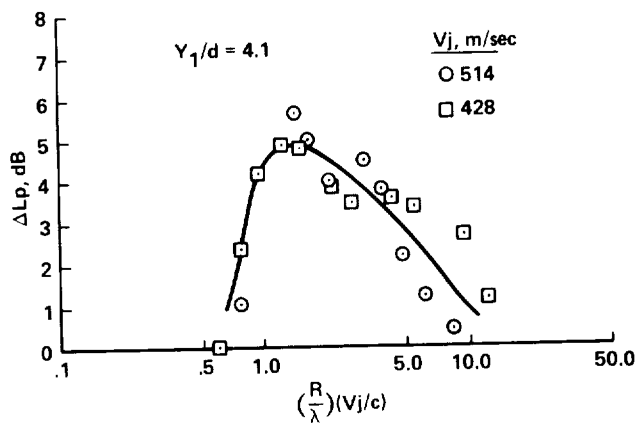


Figure 13. Near field corrections (ref. 2).

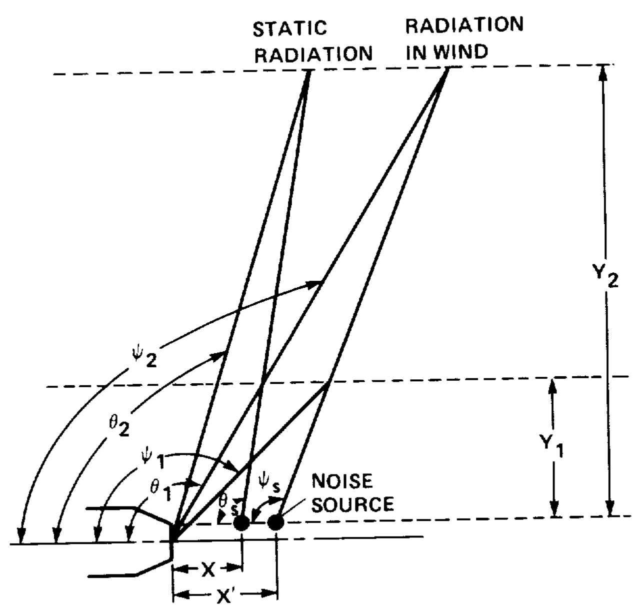
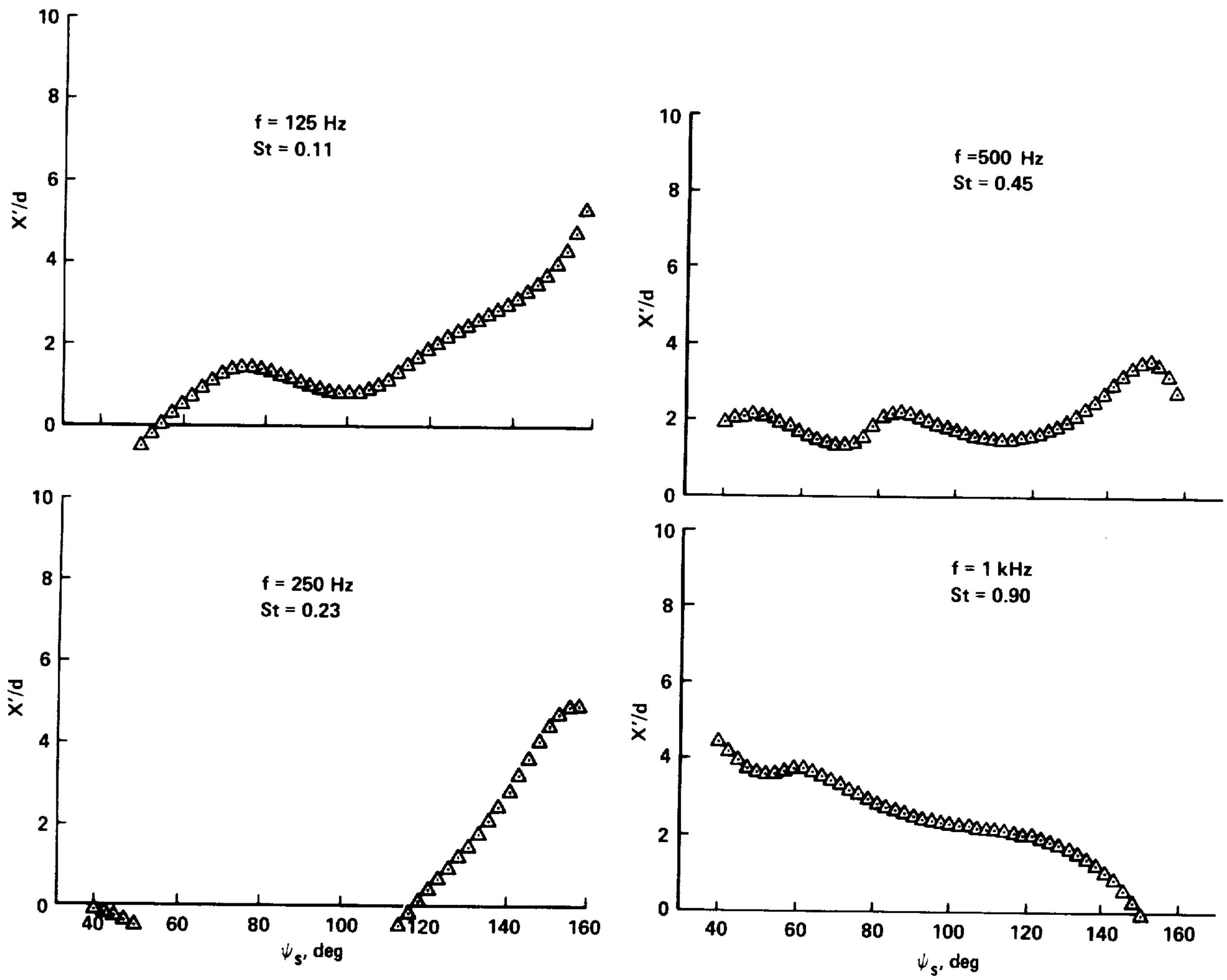


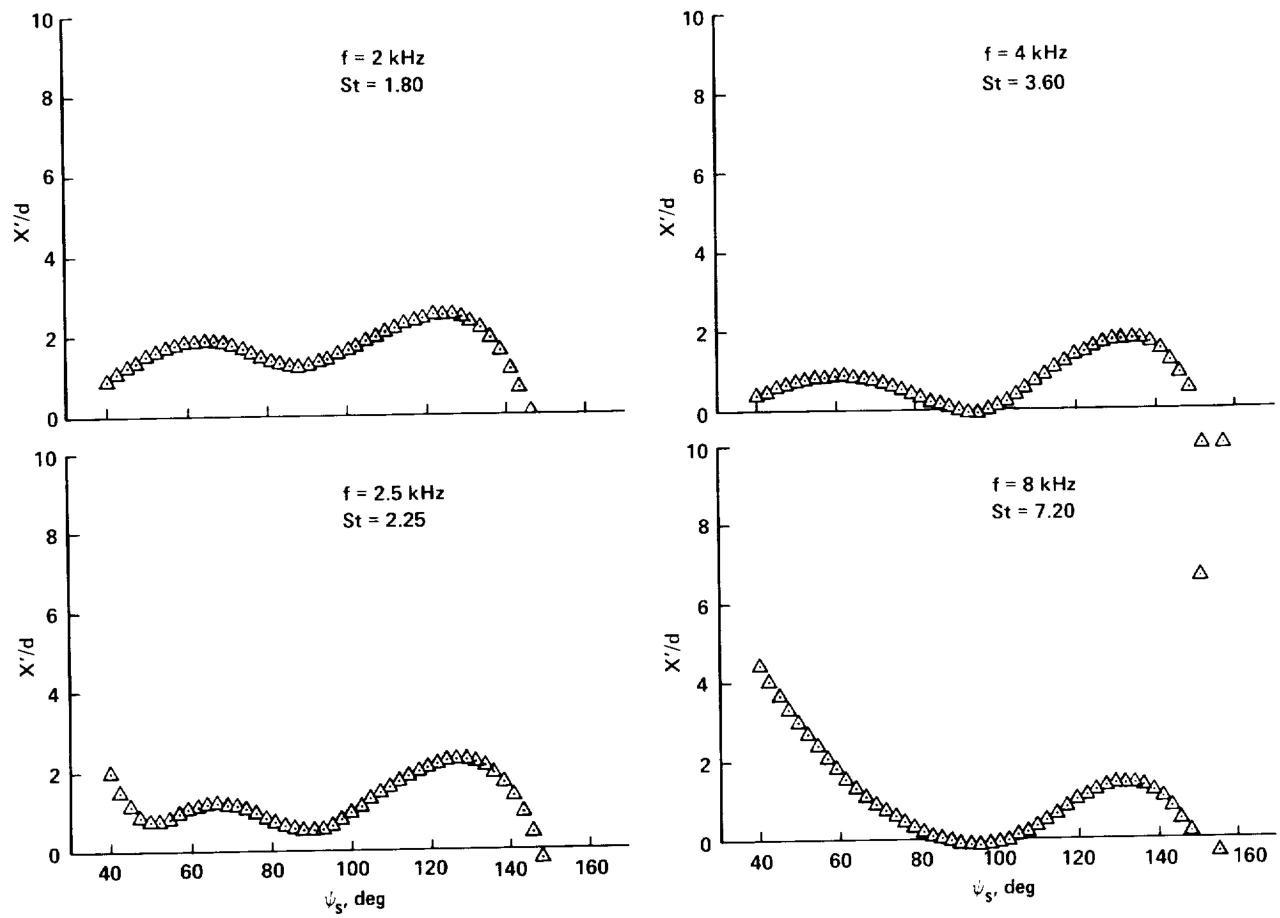
Figure 14. Nomenclature for source location and radiation with and without wind.



(a) f = 125 and 250 Hz.

(b) f = 500 and 1 kHz.

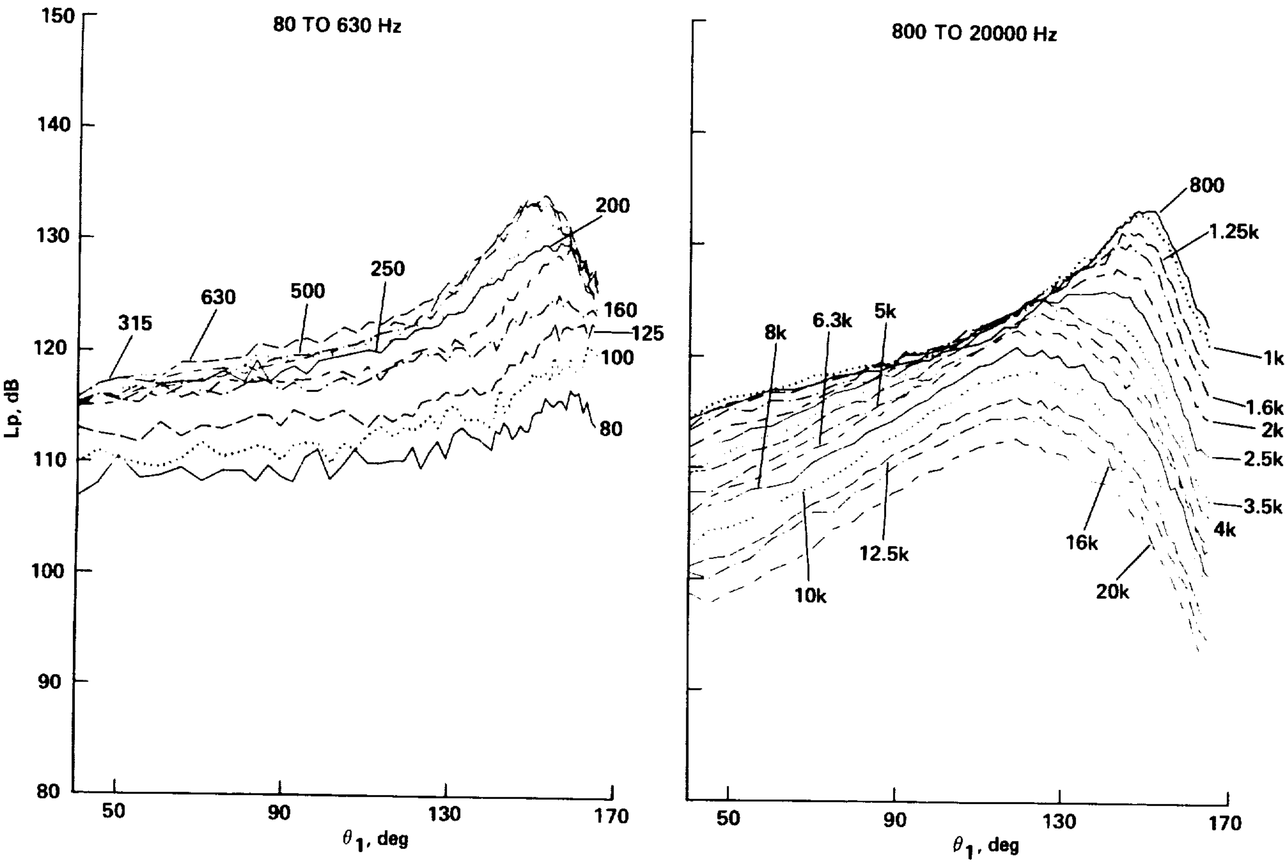
Figure 15. Typical source locations versus radiation angle as transformed from static data using equations 1 and 2; V_a = 88 m/sec, V_j = 577 m/sec.



(c) f = 2 kHz and 2.5 kHz.

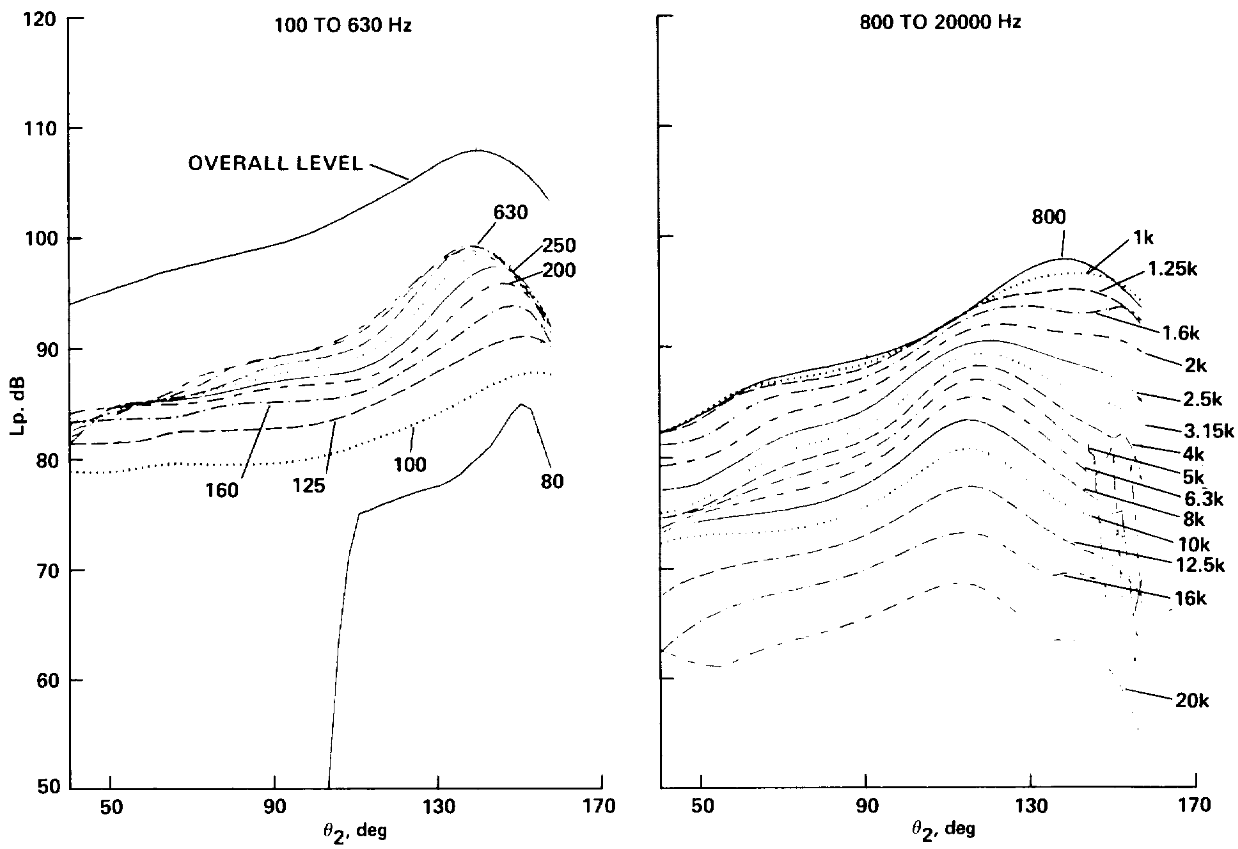
(d) f = 4 kHz and 8 kHz.

Figure 15. Concluded.



(a) 2.0 m data.

Figure 16. Static spectra at 2.0 m and extrapolated to 122-m sideline; $V_a = 16$ m/sec, $V_j = 545$ m/sec.



(b) Extrapolation to 122 m.

Figure 16. Concluded.

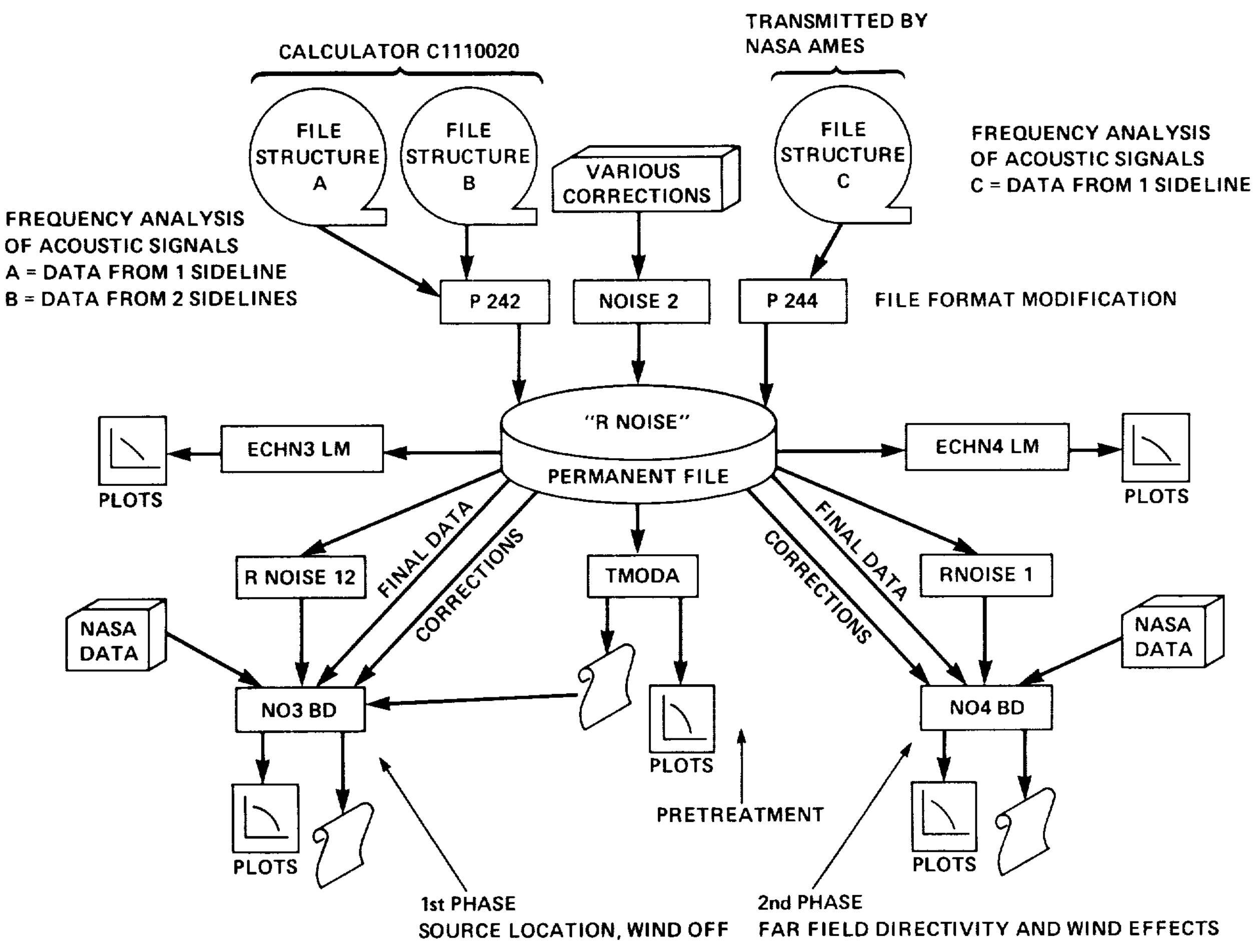
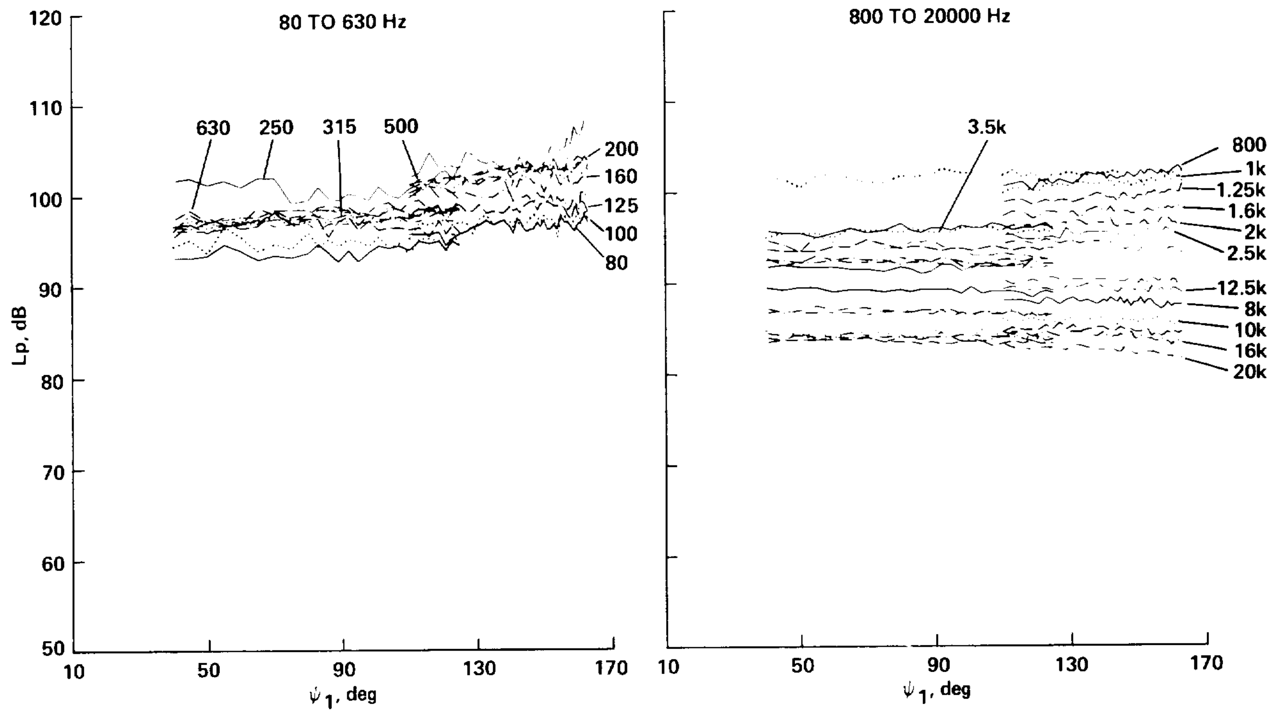
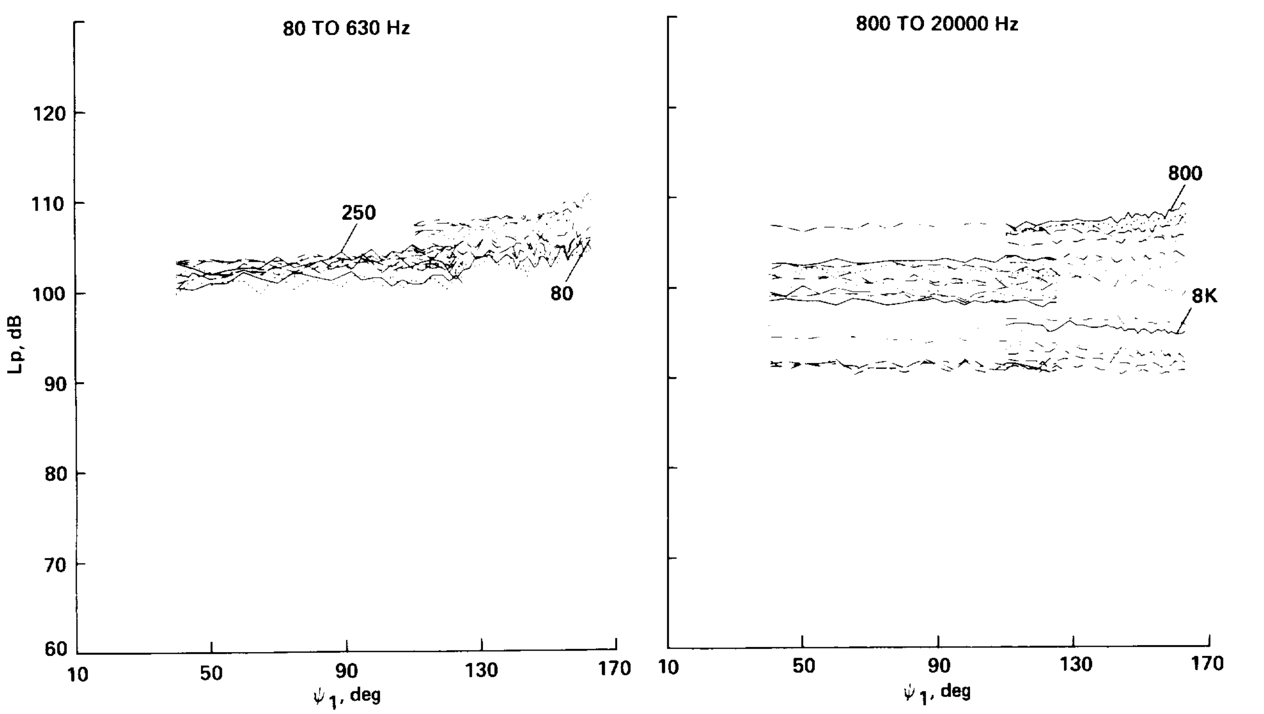


Figure 17. Schematic of data reduction procedures (ref. 23).

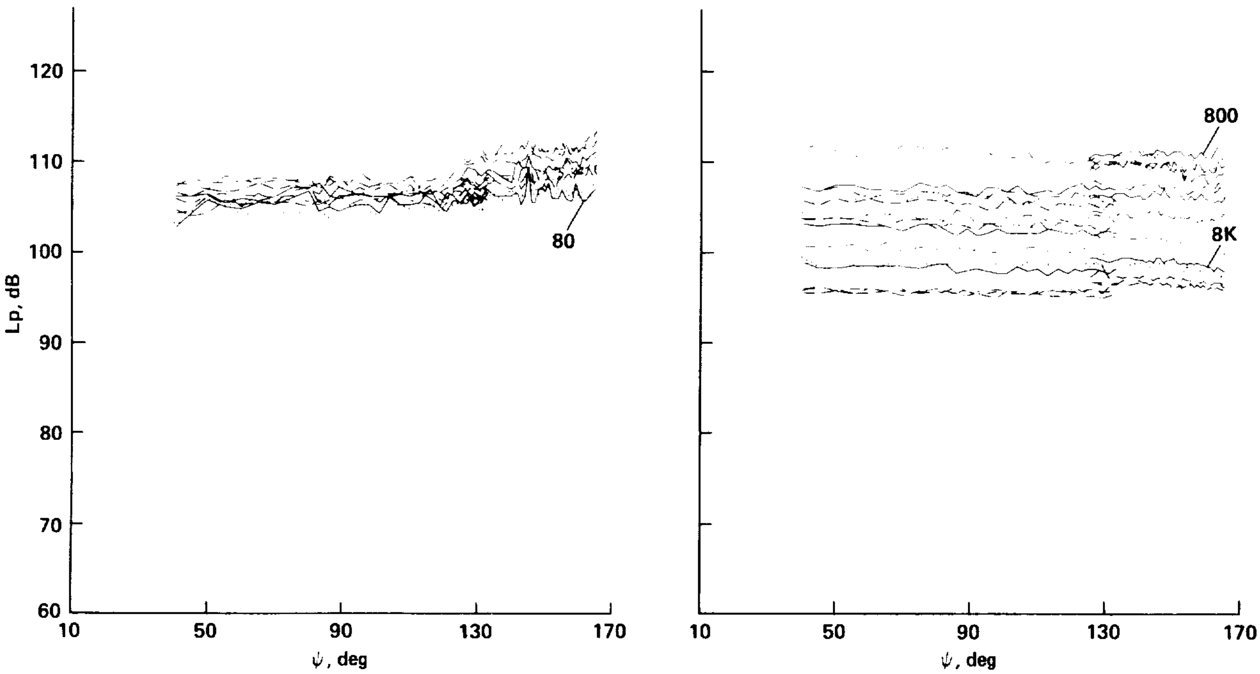


(a) V_a = 87 m/sec.



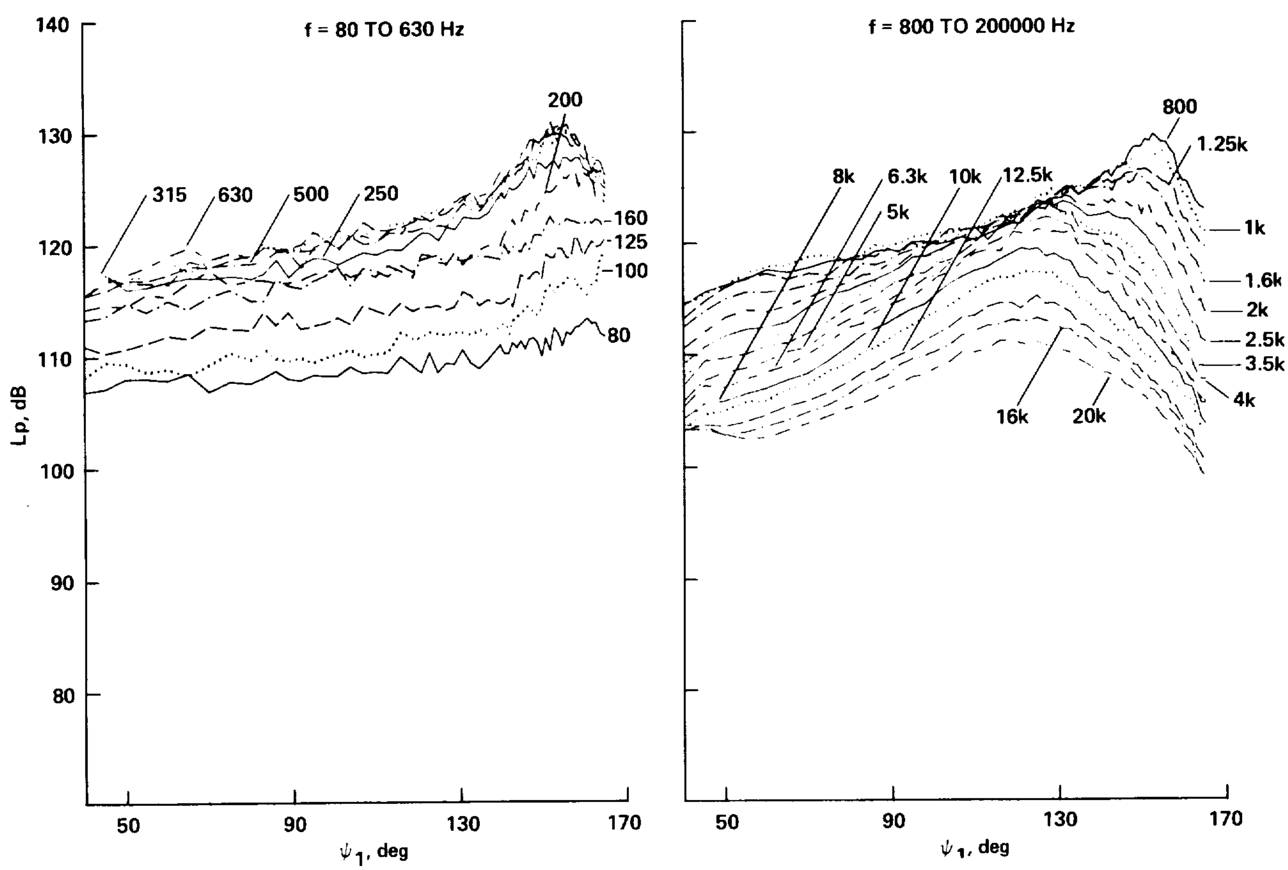
(b) V_a = 113 m/sec.

Figure 18. Background noise in S1 Wind Tunnel on 2.0-m sideline. J-85 in test section, but not operating.



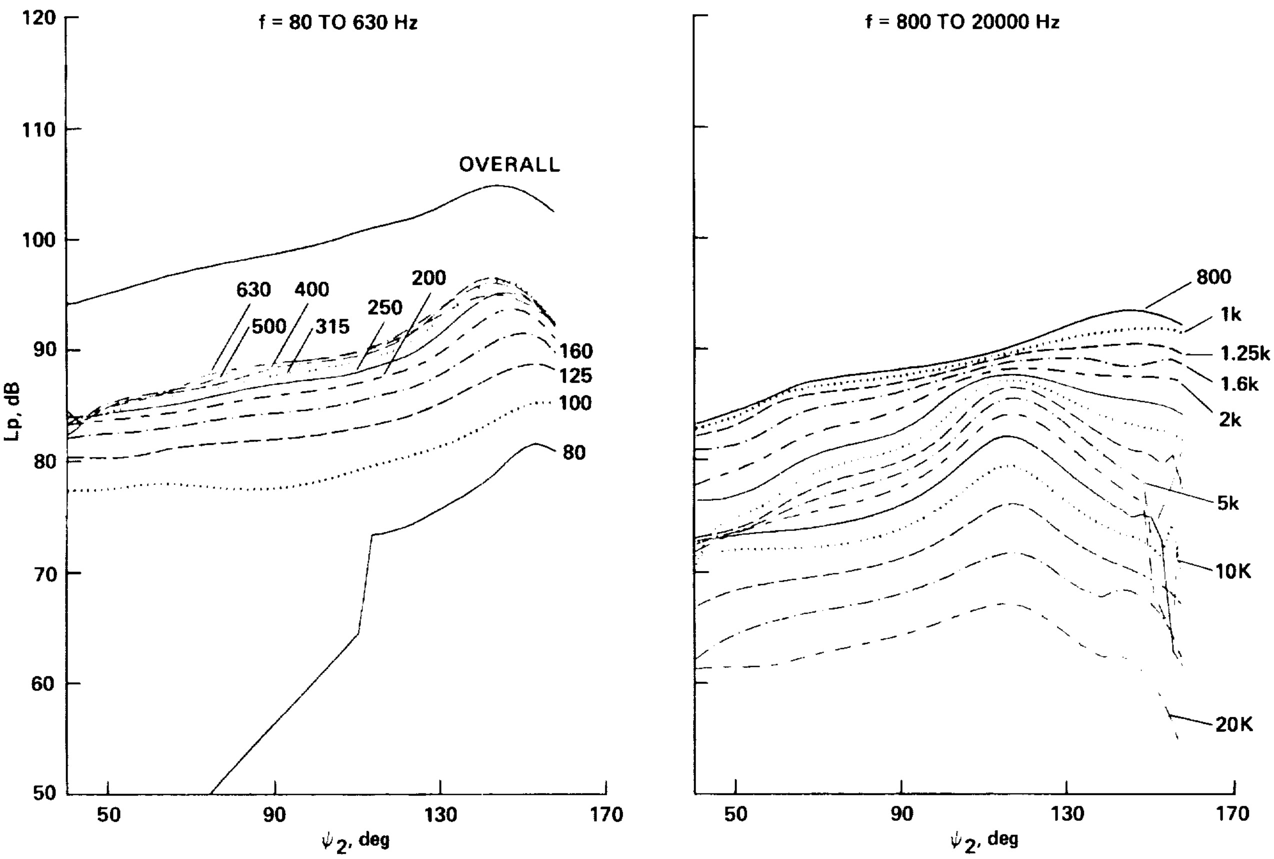
(c) V_a = 130 m/sec.

Figure 18. Concluded.



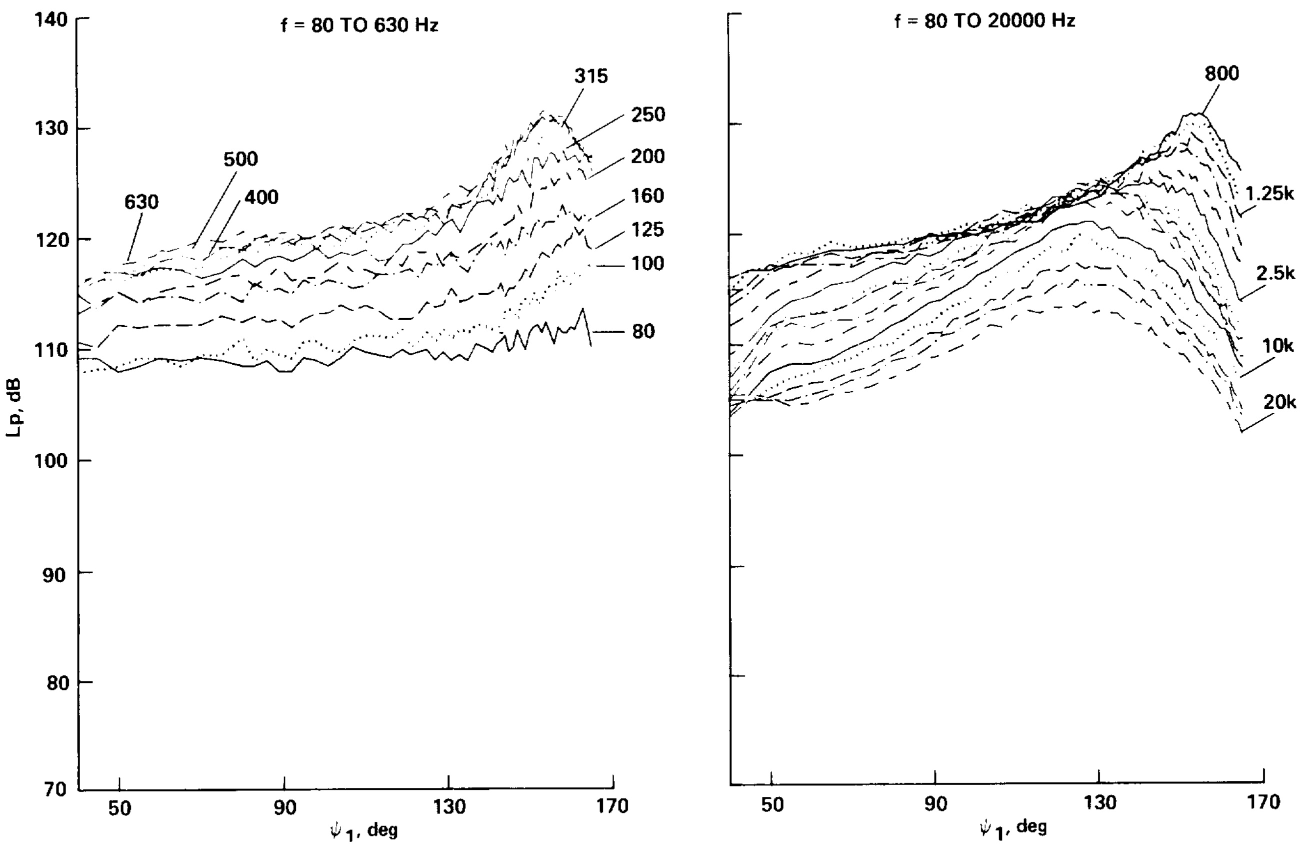
(a) $V_a = 49$ m/sec, $V_j = 522$ m/sec; 2.0-m sideline.

Figure 19. Acoustic spectra on 2.0-m sideline with extrapolations to 122-m sideline for several forward speeds.



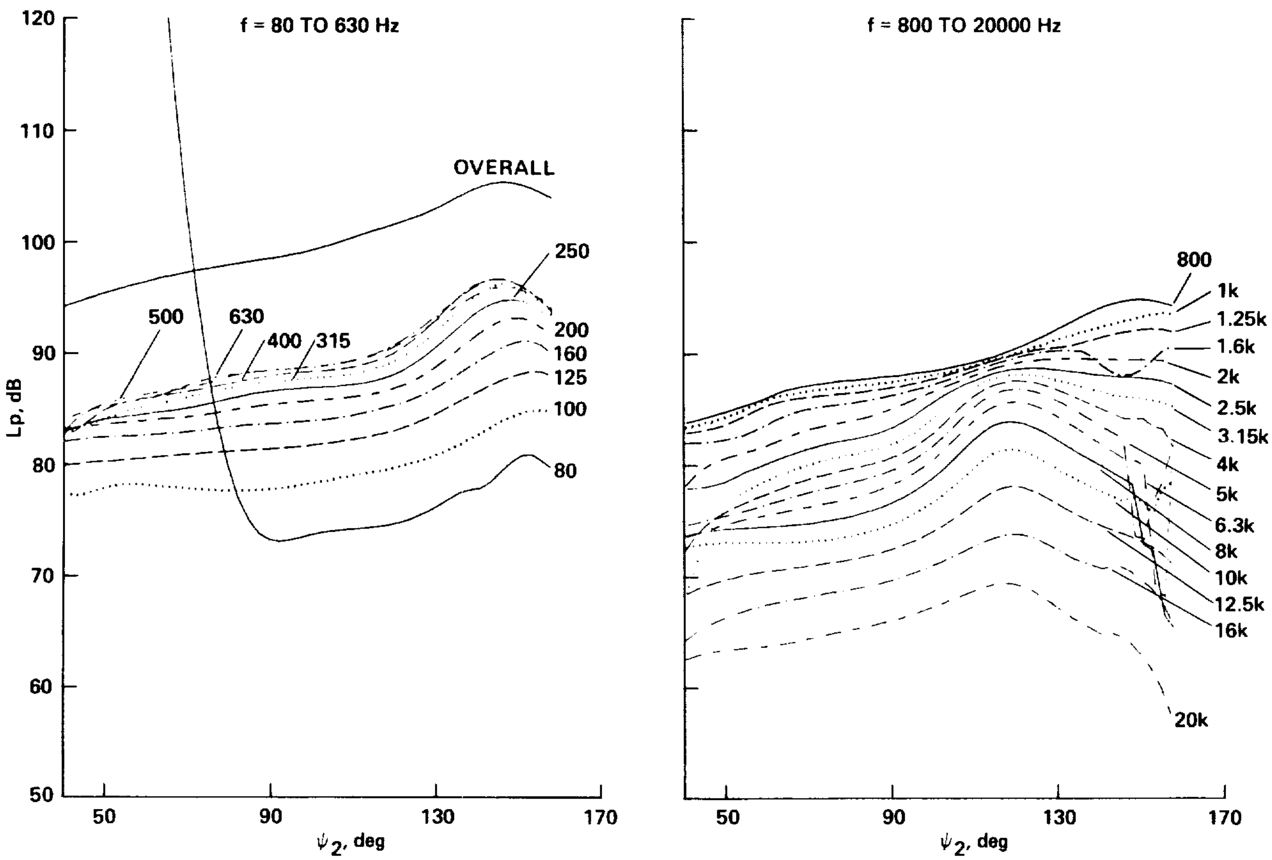
(b) V_a = 49 m/sec, V_j = 522 m/sec; 122-m sideline.

Figure 19. Continued.



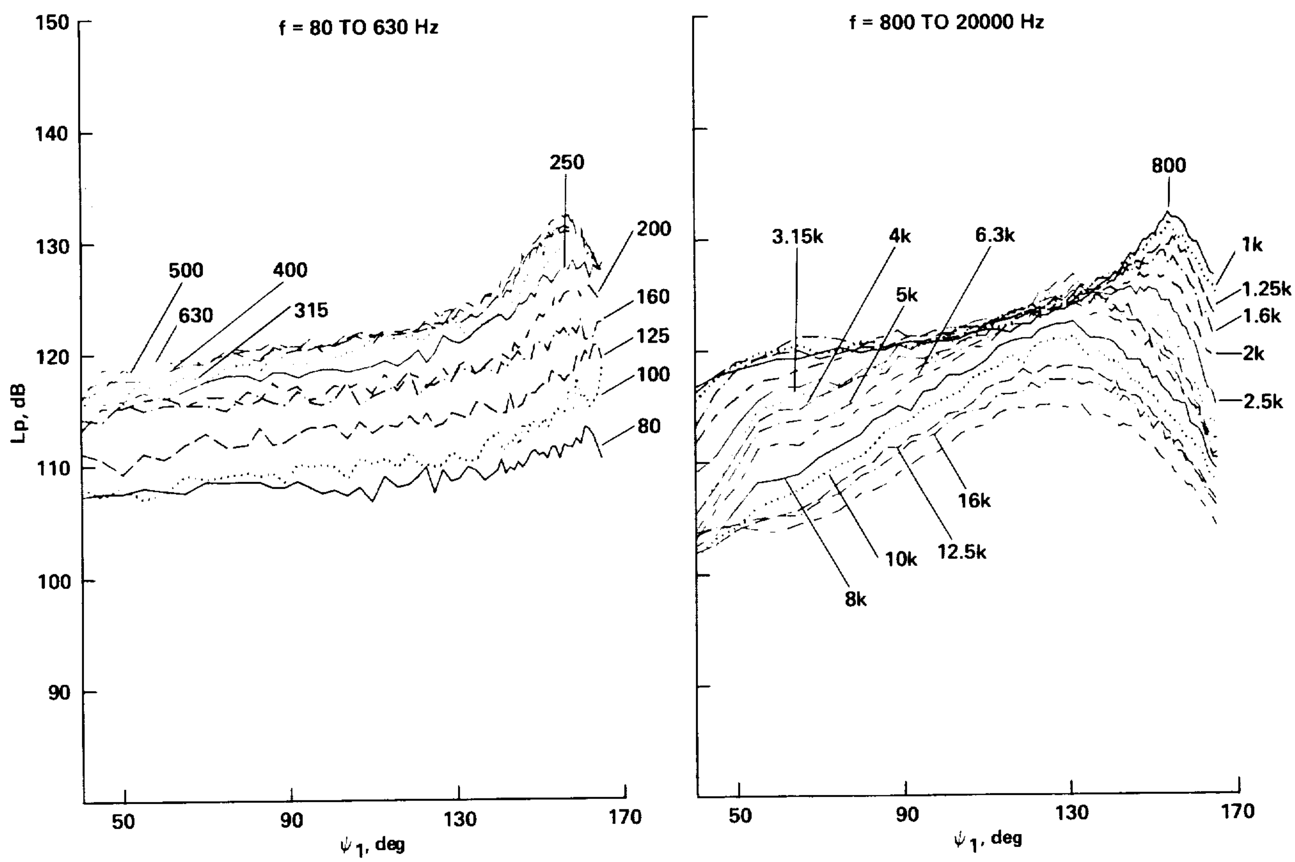
(c) V_a = 72 m/sec, V_j = 555 m/sec; 2.0-m sideline.

Figure 19. Continued.



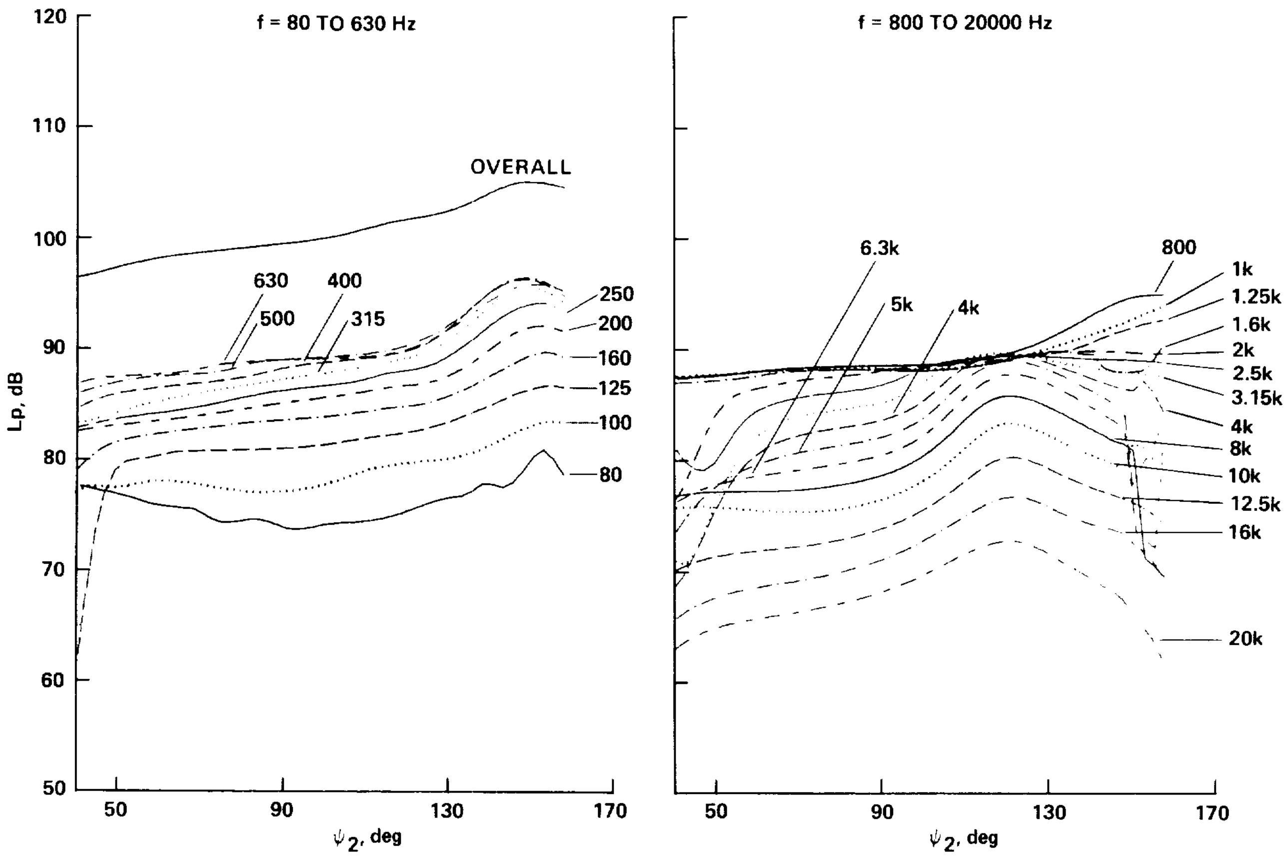
(d) V_a = 72 m/sec, V_j = 555 m/sec; 122-m sideline.

Figure 19. Continued.



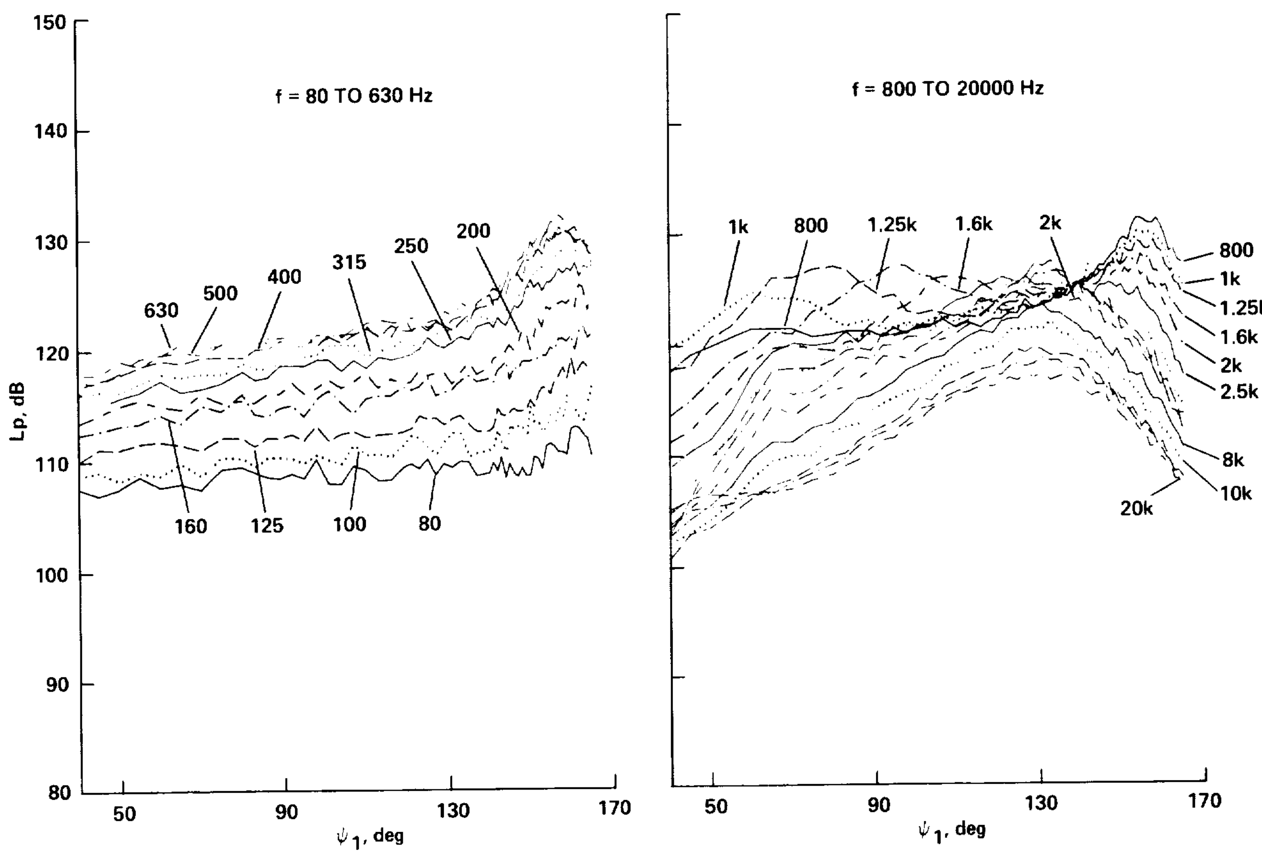
(e) V_a = 88 m/sec, V_j = 577 m/sec; 2.0-m sideline.

Figure 19. Continued.



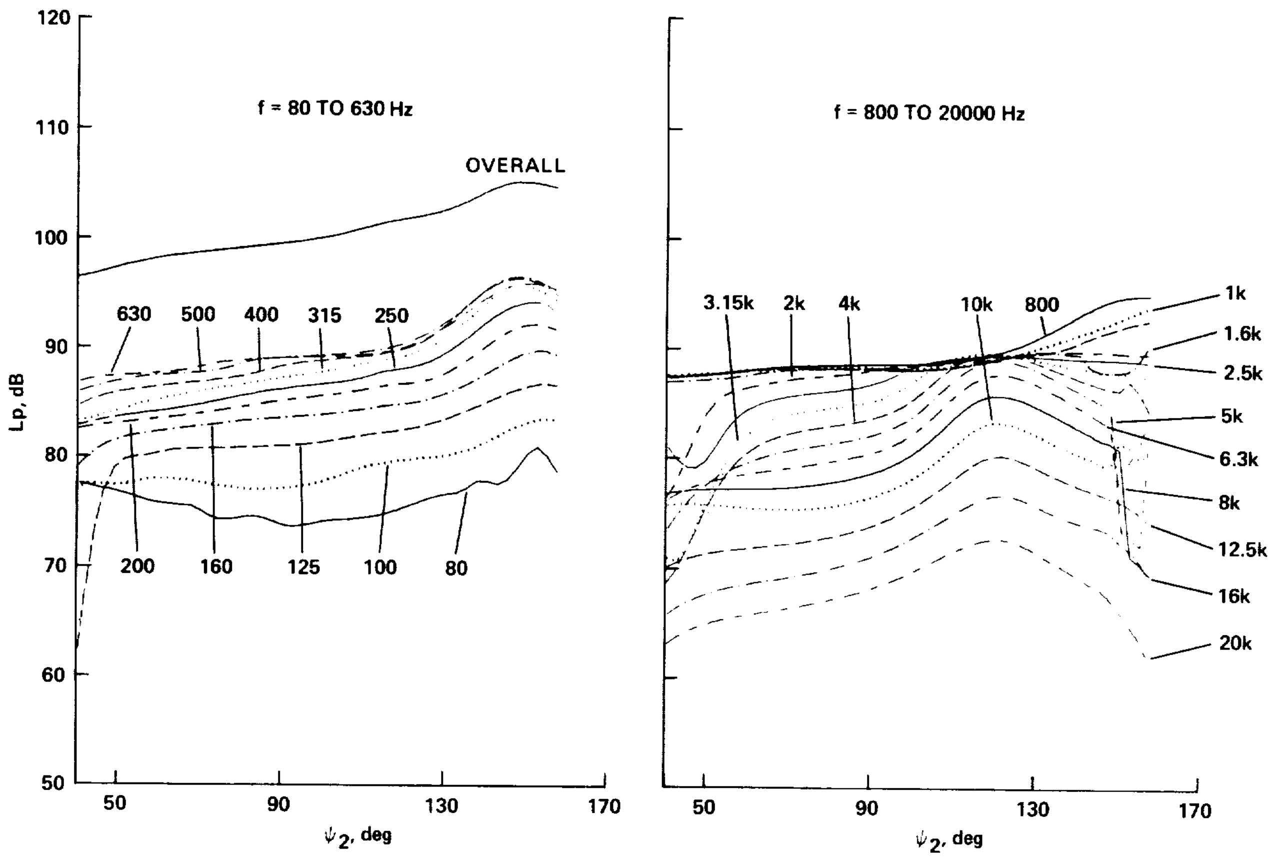
(f) V_a = 88 m/sec, V_j = 577 m/sec; 122-m sideline.

Figure 19. Continued.



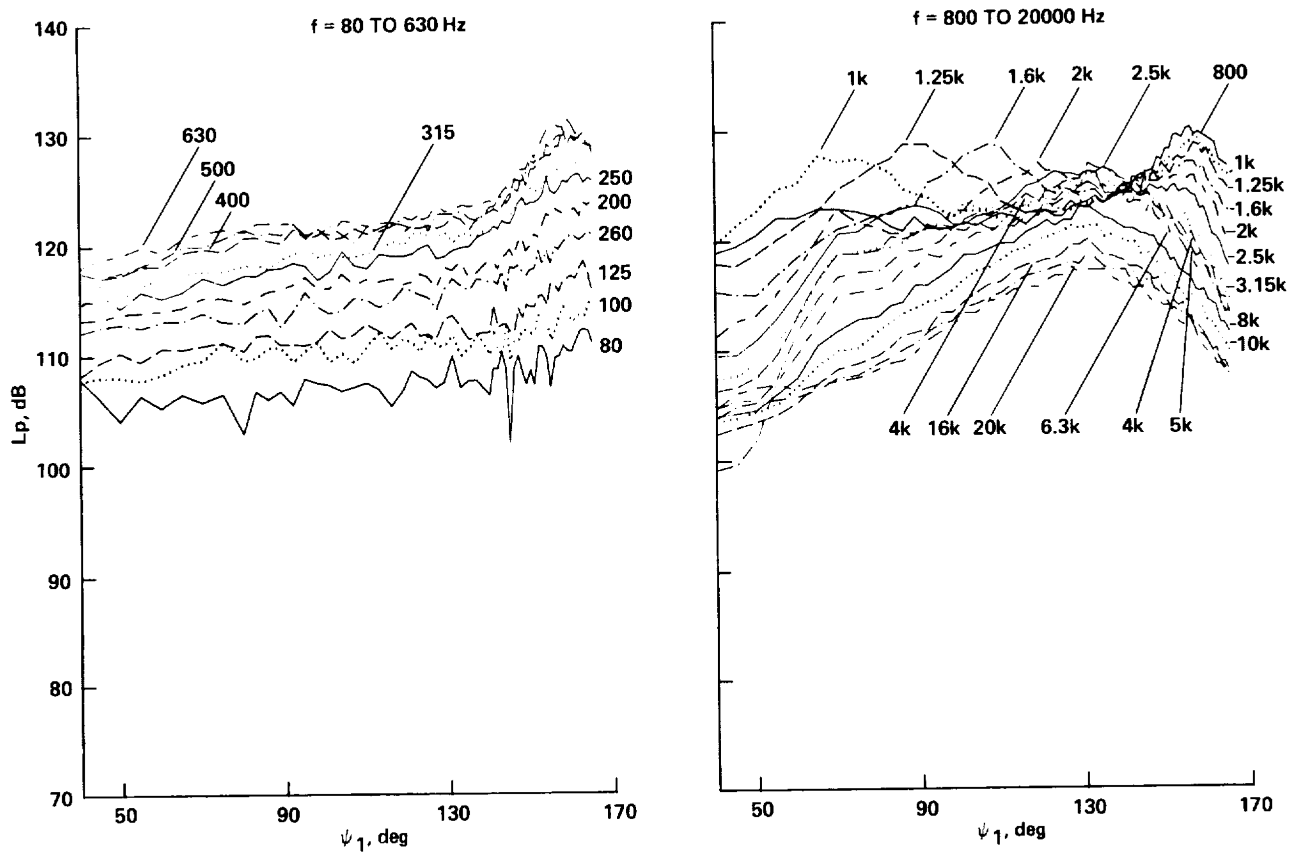
(g) $V_a = 113$ m/sec, $V_j = 597$ m/sec; 2.0-m sideline.

Figure 19. Continued.



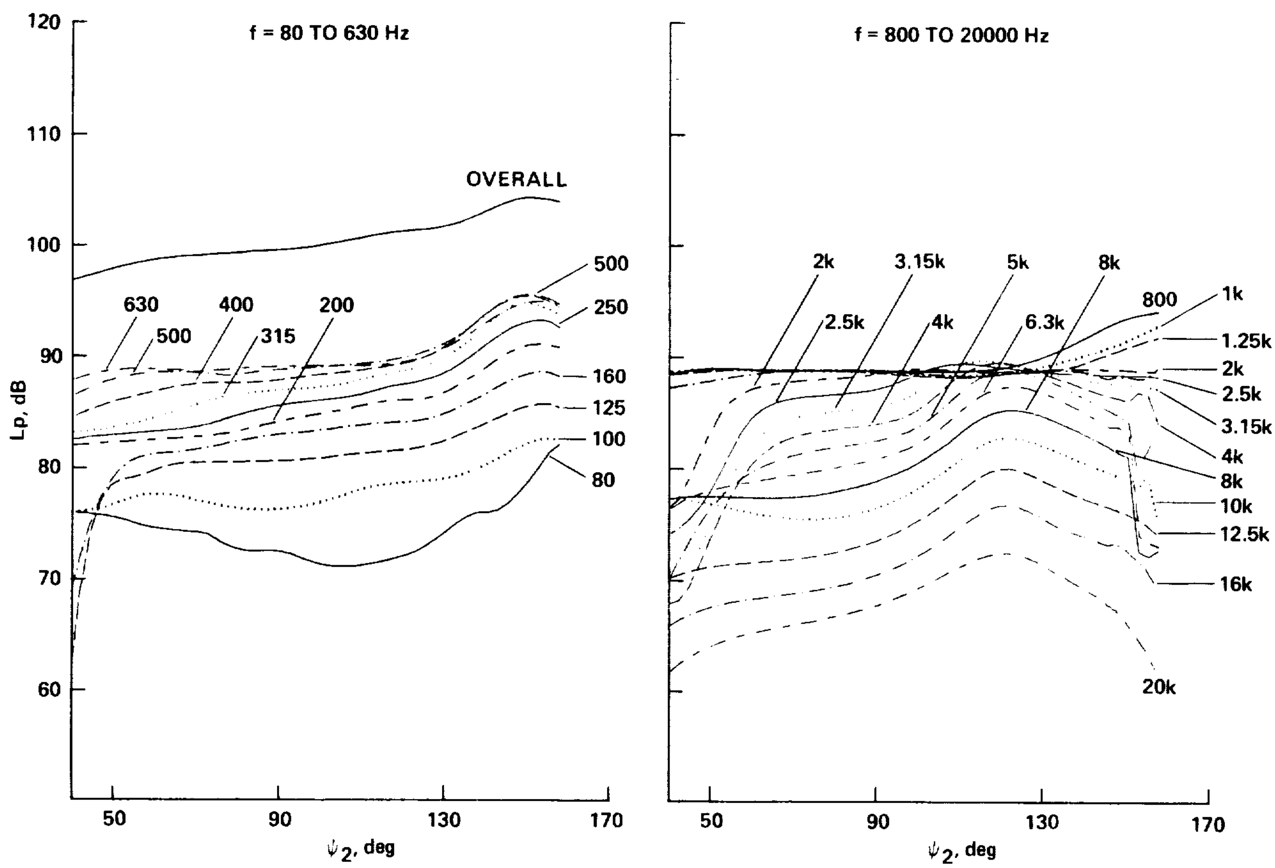
(h) V_a = 113 m/sec, V_j = 597 m/sec; 122-m sideline.

Figure 19. Continued.



(i) $V_a = 130$ m/sec, $V_j = 607$ mm/sec; 2.0-m sideline.

Figure 19. Continued.



(j) V_a = 130 m/sec, V_j = 607 m/sec; 122-m sideline.

Figure 19. Concluded.

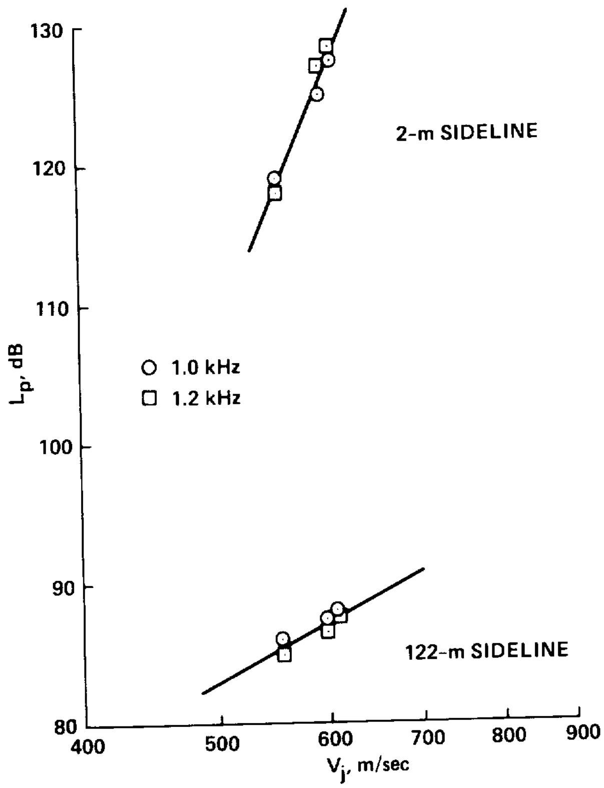
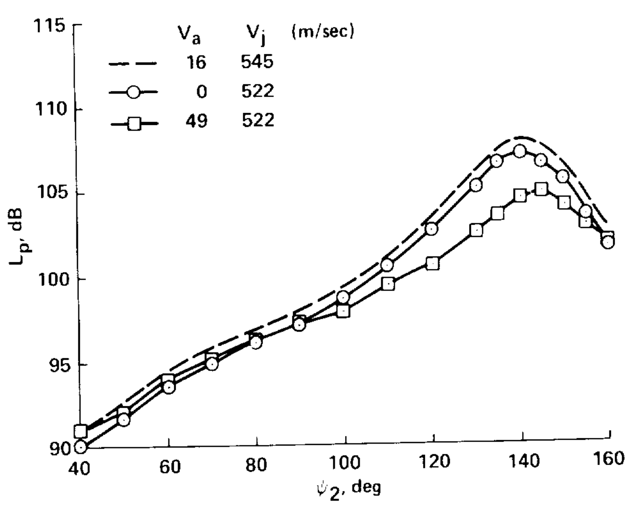
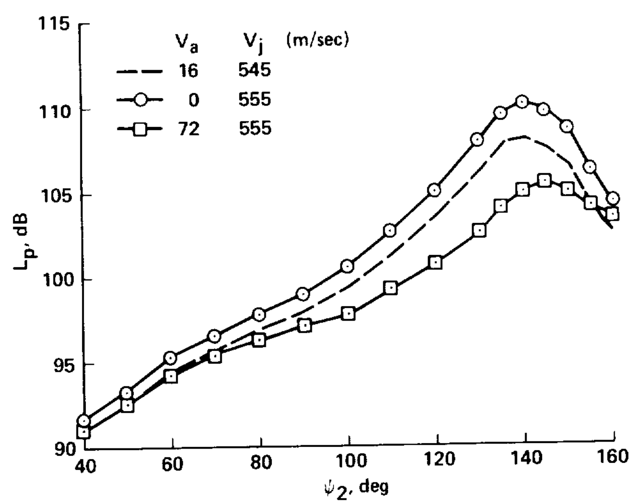


Figure 20. Variation of near field internal or shock noise (upper curve) and far field jet/internal noise (lower curve) versus jet speed from figs. 19(c)–19(j) at two frequencies where internal noise is strong. The data are peak levels between 60° and 90° radiation angles.

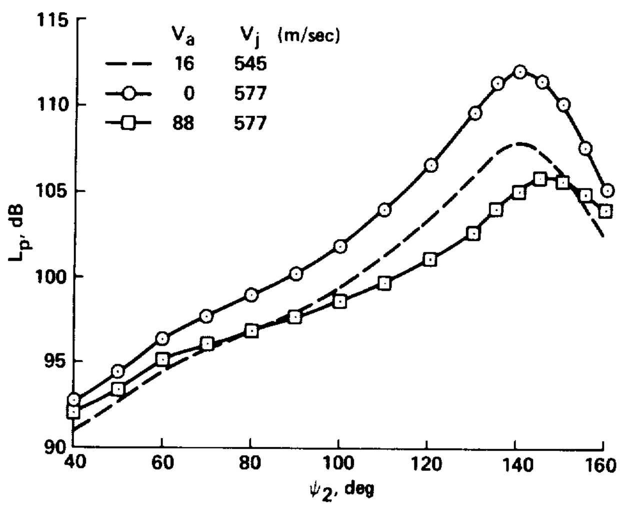


(a) $V_a = 0$ and 49 m/sec.

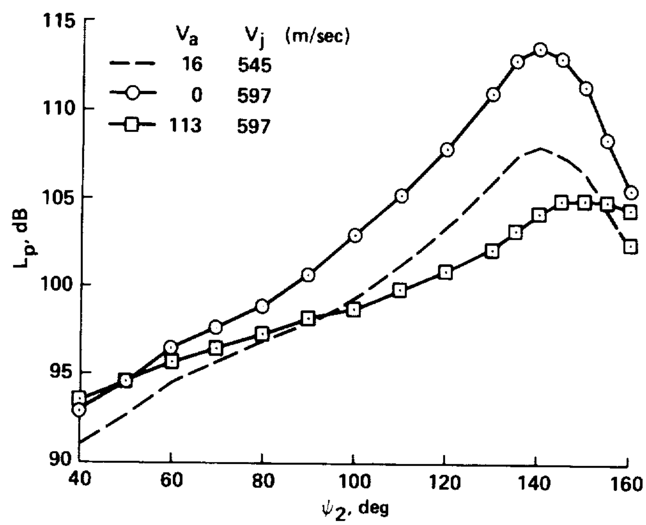


(b) $V_a = 0$ and 72 m/sec.

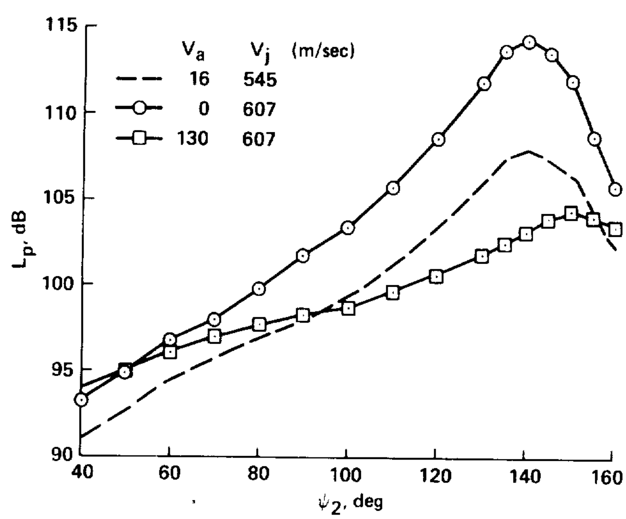
Figure 21. Comparisons of J-85 static and S1 simulated-flight overall sound levels at 122-m sideline. All data corrected for S1 amplification listed in table 1. The nominally static data (dashed curve) were corrected to zero windspeed and the proper jet speed (circles).



(c) $V_a = 0$ and 88 m/sec.

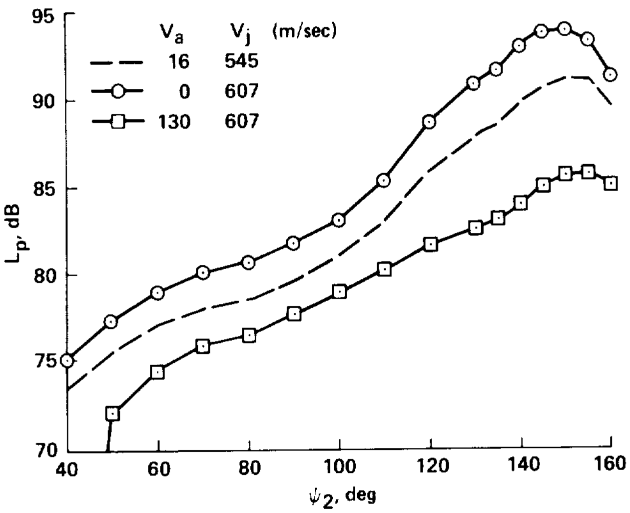


(d) $V_a = 0$ and 113 m/sec.

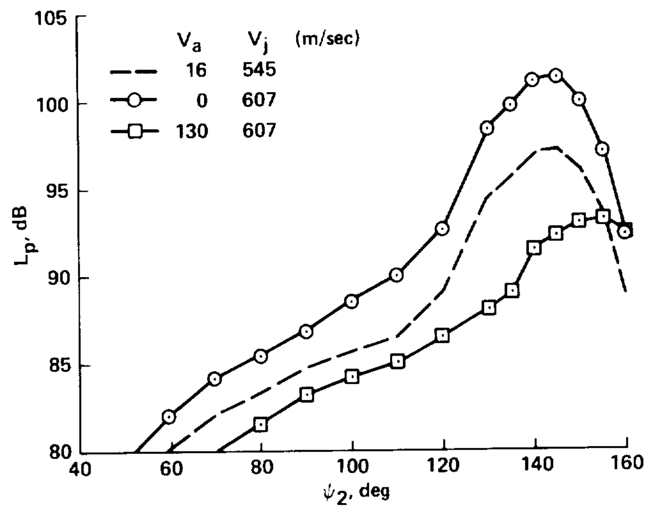


(e) $V_a = 0$ and 130 m/sec.

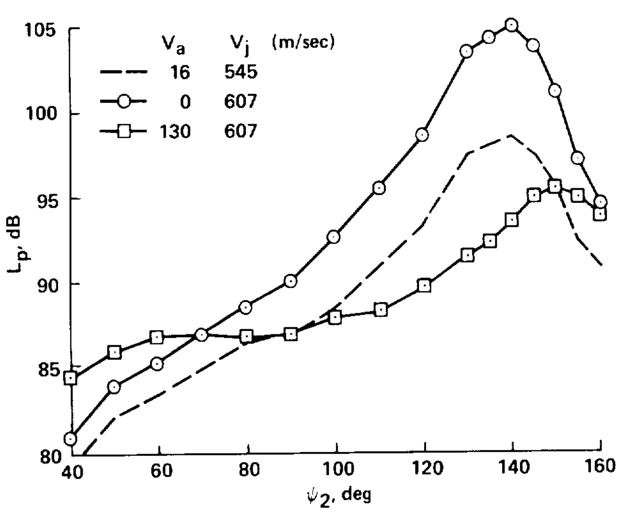
Figure 21. Concluded.



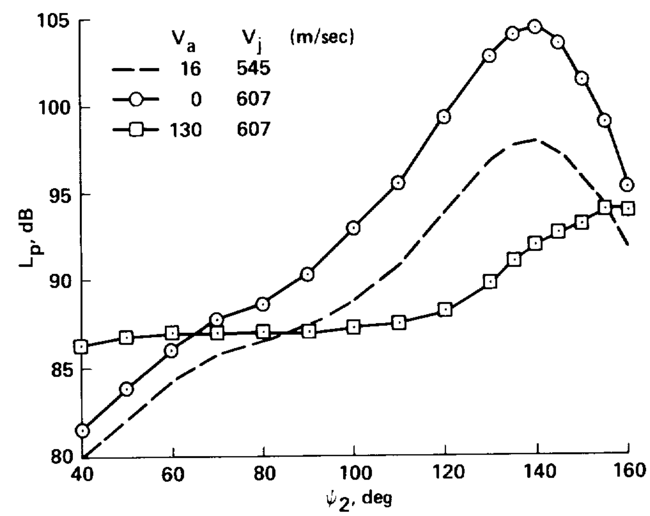
(a) f = 125 Hz.



(b) f = 250 Hz.

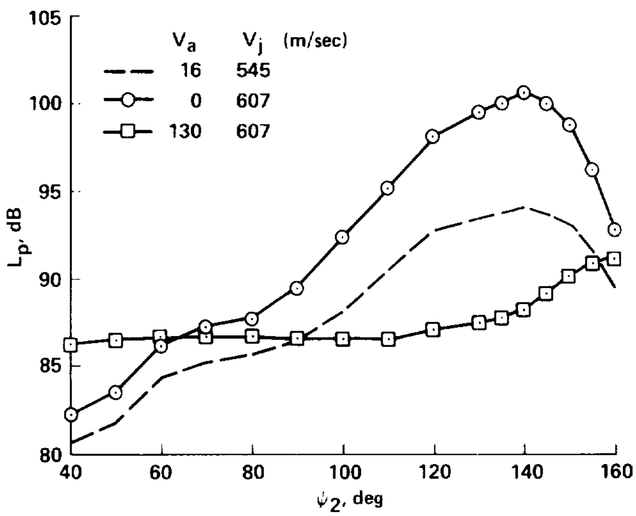


(c) f = 500 Hz.

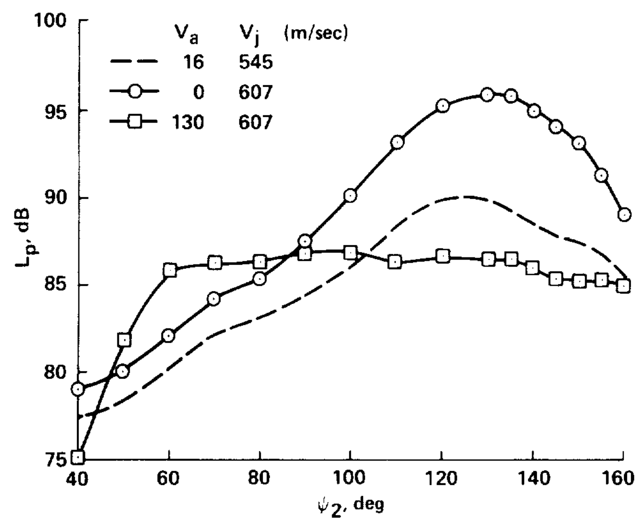


(d) f = 800 Hz.

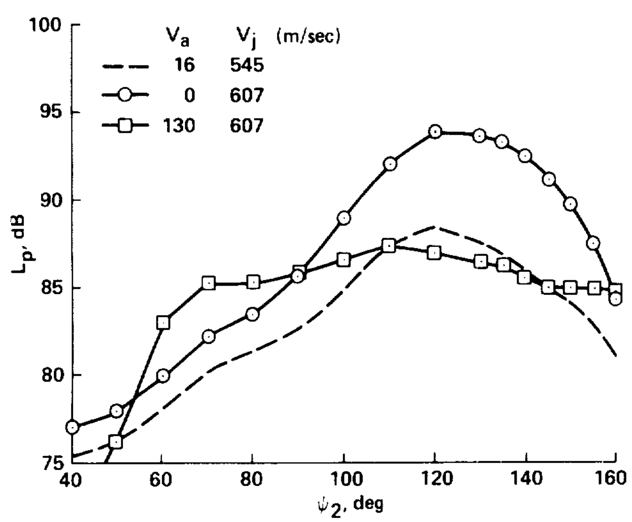
Figure 22. Comparisons of J-85 static and S1 simulated flight noise in third-octave bands at 122-m sideline; $V_a = 0$ and 130 m/sec. All data corrected for S1 amplification listed in table 1. The nominally static data (dashed curve) were corrected to zero windspeed and the proper jet speed (circles).



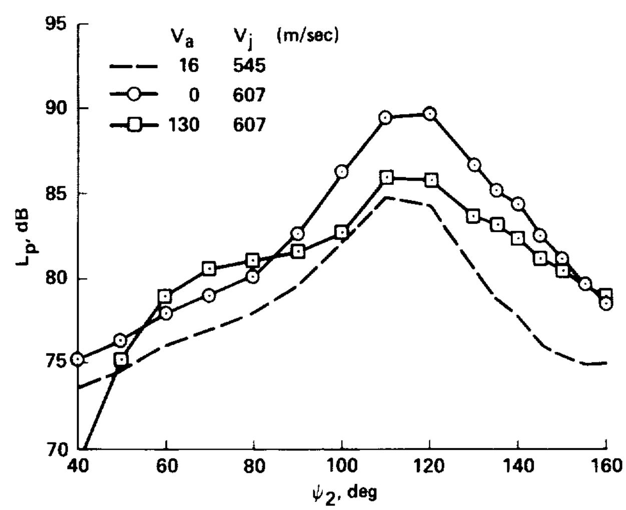
(e) f = 1250 Hz.



(f) f = 2000 Hz.

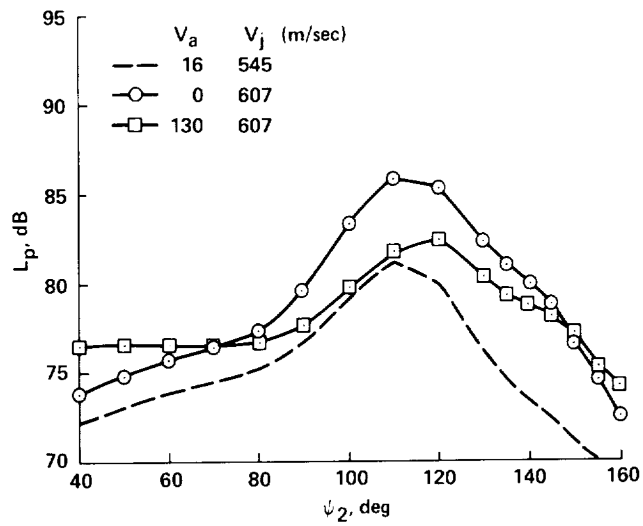


(g) f = 2500 Hz.



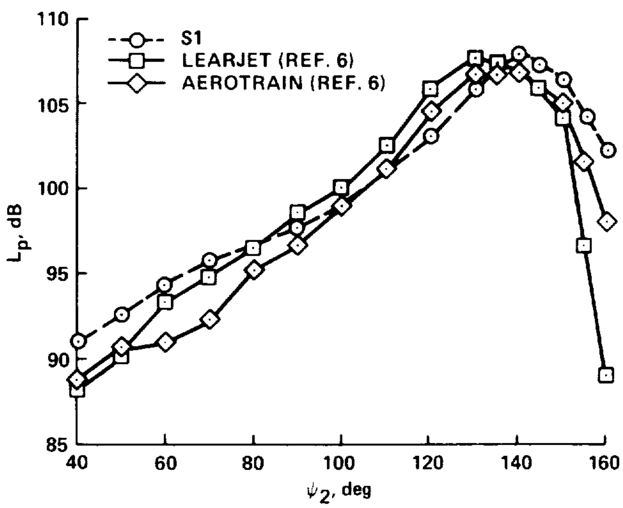
(h) f = 5000 Hz.

Figure 22. Continued.

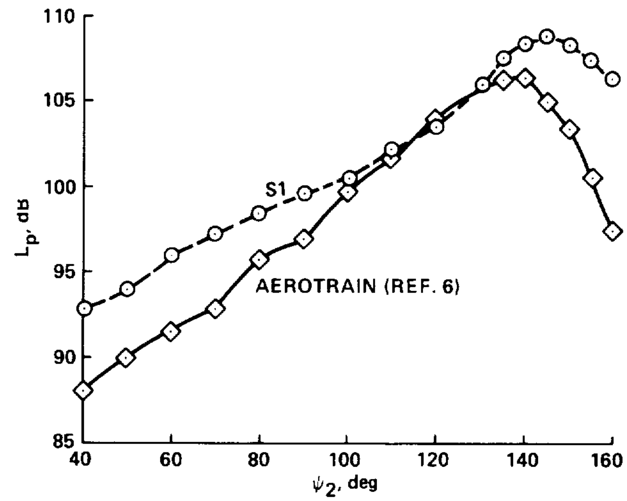


(i) f = 8000 Hz.

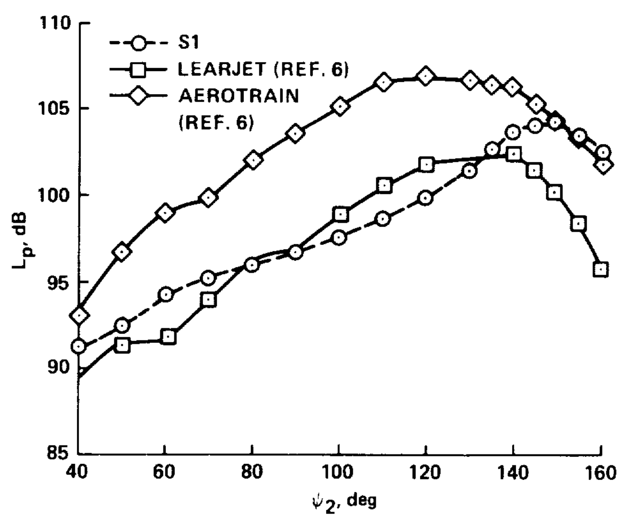
Figure 22. Concluded.



(a) $V_a = 0$, $V_j = 545$ m/sec.



(b) $V_a = 43$ m/sec, $V_j = 558$ m/sec.



(c) $V_a = 82$m/sec, $V_j = 558$ m/sec.

Figure 23. Comparisons of S1 Wind Tunnel, flyover, and moving train overall sound levels of J-85 at 122-m sideline. S1 data corrected for wind tunnel amplification (table 1). Aerotrain and Lear Jet data corrected to S1 windspeed and J-85 jet speed using equation (5).

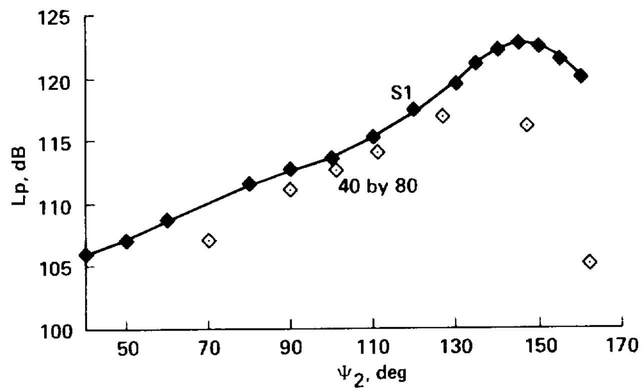
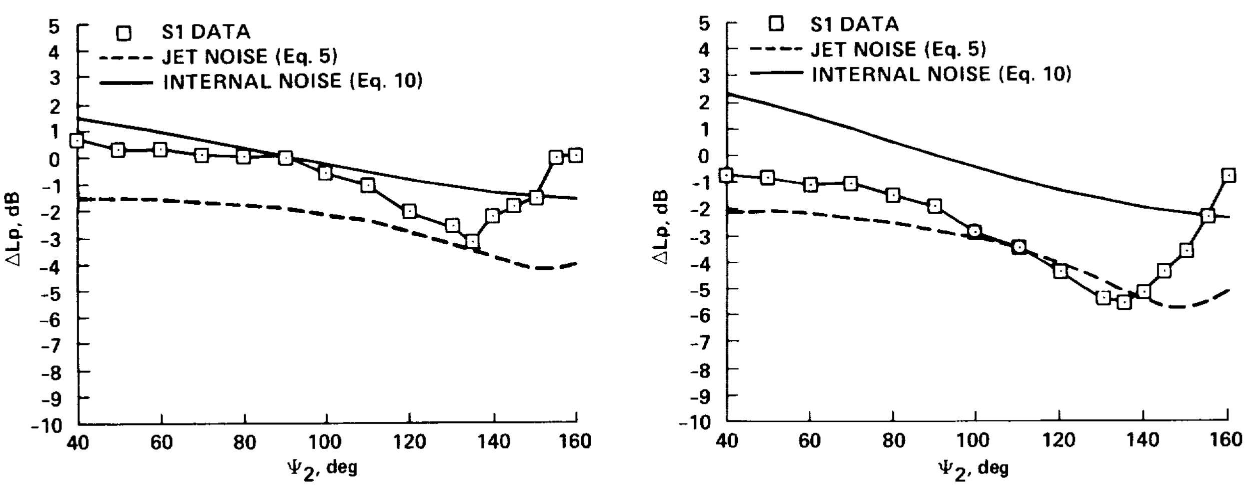


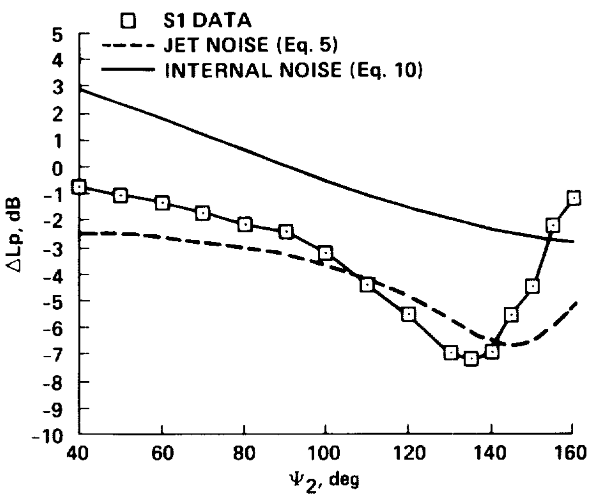
Figure 24. J-85 overall sound levels as measured in the S1 Wind Tunnel and the Ames 40- by 80-Ft Wind Tunnel (V_a = 52 m/sec; V_j = 582 m/sec). The S1 data were corrected to the 40 by 80 wind and jet speed, and then extrapolated from 122 m to 30.5 m. The 40 by 80 data (ref. 10) were corrected for near field effects and wind tunnel reverberations, and extrapolated from 4.3 m to 30.5 m.



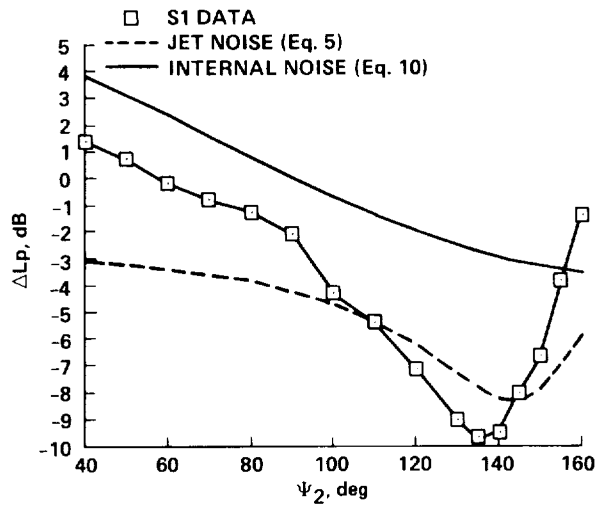
(a) V_a = 49 m/sec, V_j = 522 m/sec.

(b) V_a = 72 m/sec, V_j = 555 m/sec.

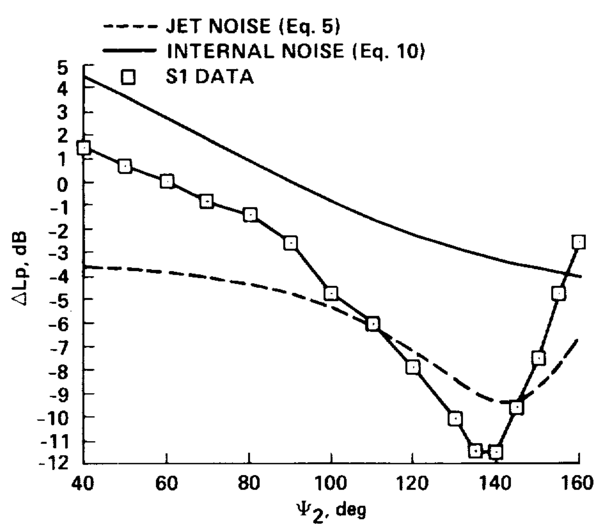
Figure 25. A comparison of measured and predicted flight effects in S1 Wind Tunnel. The difference between measured flight and static noise of figures 21(a)–21(e) is compared with predicted flight effects for pure jet noise (eq. 5) and internal engine noise (eq. 10).



(c) $V_a = 88$ m/sec, $V_j = 577$ m/sec.

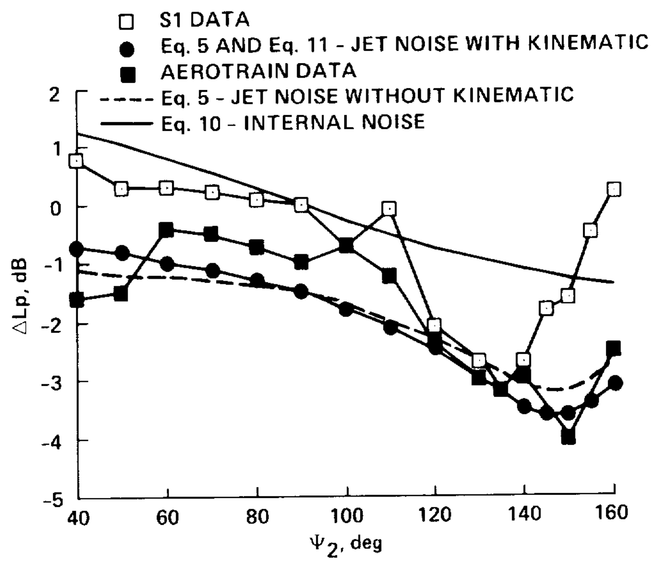


(d) $V_a = 113$ m/sec, $V_j = 597$ m/sec.

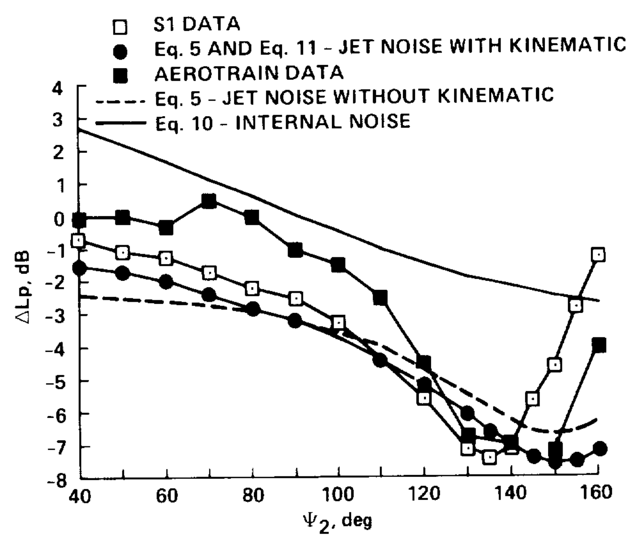


(e) $V_a = 130$ m/sec, $V_j = 607$ m/sec.

Figure 25. Concluded.



(a) $V_a = 41$ m/sec.



(b) $V_a = 82$ m/sec.

Figure 26. S1 and Aerotrain flight effects (difference between forward speed and static J-85 noise) compared with predictions for pure jet and internal noise sources. The pure jet noise predictions were made with and without kinematic effects. $V_j = 546$ m/sec.

APPENDIX A

NOISE 3

```
*
CPROGRAMME SOURCE N03BD
C
C     ------------------------------------------------------------------
C
C     MAIN PROGRAM FOR FIRST PHASE OF ANALYSIS
C
C     LOGICAL UNIT ASSIGNMENTS --
C
C        UNIT          FILE
C         05       INPUT FILE FOR ENGINEER SUPPLIED PARAMETERS(IUN)
C         06       OUTPUT FILE (PRINT OUTPUT)
C         07       BINARY OUTPUT FILE
C         08       CORRECTION FILE INPUTS
C         10       SPL DATA FILE(LUN)
C
C     ------------------------------------------------------------------
C
C*****
      REAL*8 DECB,ANGLES,XDIS,HTMIKE,HTSRCE,SDHUM,SDTEMP,V8,UNITS,
     1       THETAM,ADEL,BDEL,AN,YF,YY,ANHI,ANLO,AFHI,AFLO,
     2       COFA,COFB,TR,R2D,D2R,SDTEMF,TTEMP,TTEMPF,VJET,
     3       FREQ,THETAS,XOVERD,XDMAX,THETSM,RNZDIA
C*****
      REAL*8 ABDBM,DISTME,FTOM,PRESS,RTOK,TEMPK
      REAL*8 STR,DFMAX,XPEAKN,XPEAKF,DUMP1(132)
C*****
      REAL*8 JETN(130,33),DUMP(3446)
      COMMON /SUB/ MIKES,MIKEA,MIKEB,ICALL,DECB(130,35),
     1             ANGLES(130),XDIS(130,2),HTMIKE(130),HTSRCE,SDHUM,
     2             SDTEMP,V8,UNITS,KFIT(2),IWTB,IWTE,
     3             THETAM(33),ADEL,BDEL,AN,IGRC,NRUN,
     4             YF,YY,ANHI,ANLO,AFHI,AFLO,COFA(16,35),COFB(16,35),
     5             TR,R2D,D2R,SDTEMF,TTEMP,TTEMPF,
     6             IBIDO,IMRC,IBNC,IRC,IAAC,IDATE,
     7             VJET,FREQ(33),THETAS(50,33),XOVERD(50,33),NTAB(33),
     8             NTEST,XDMAX(33),THETSM(33),RNZDIA,NZTYPE(10),NFREQ
C
      COMMON /OUTFLG/ IPFRQC,IPANGL,IPFNDM,IPROOT,IPFNDY
C
C*****
      COMMON /TRAFLG/KTRAC,KTDECB,KTDIFF,KTXSD,KTPEAK
C*****
      COMMON /TABD/STR(33),DFMAX(33),XPEAKN(33),XPEAKF(33)
C*****
      COMMON /IDENT/NPOI,KMIC,NPOI2
      COMMON /TITRE/LIB(10),IDAT(3),DB1(8,4),IPI(8)
C*****
      DIMENSION ITIT(20),XMOD(44),LIB1(20),LIB2(20)
C
      EQUIVALENCE (DUMP(1),VJET)
      EQUIVALENCE (DUMP1(1),STR(1))
      DATA PRESS,RTOK,FTOM,D2R  /1.0, 0.5555556, 0.3048, 0.017453293/
C
C     KODT 0  TRAITEMENT BANDE MODANE
C     KODT 1  TRAITEMENT DONNEES AMES SUR CARTES
C     KODT 2  TRAITEMENT DONNEES AMES SUR BANDES
      READ(5,101)KODT
  101 FORMAT(I5)
C***** MISE A ZERO DU TABLEAU DECB
```

```
      DO 10 J=1,130
      DO 10 I=1,35
      DECB(J,I)=0.
   10 CONTINUE
C*****
      R2D = 1.0/D2R
C     LECTURE BANDE ECRITURE DISQUE
      ND=2
      CALL READIN(KODT,KLISF,ITIT,LIB1,LIB2)
C***** PREPARATION DU TRACE
      IF(KTRAC.EQ.0) GO TO 150
      DO 160 I=1,44
      XMOD(I)=0.
  160 CONTINUE
      KPLANC=0
      CALL OPENTR(69,XMOD)
  150 CONTINUE
C*****
      CALL OSPL (DECB,MIKES,NFREQ)
      CALL SUBPDB (MIKES,DECB,NFREQ)
      WRITE (6,1001)
 1001 FORMAT(1H1,30X,55HSOUND PRESSURE LEVELS READ AS INPUTS FOR THIS EX
     *ECUTION /)
      CALL OUTPUT (XDIS,DECB,ANGLES,FREQ,MIKES,NFREQ,HTMIKE)
C
      IF ( IMRC .NE. 1 ) GO TO 40
      ICALL = 1
      CALL CORECT
   40 CONTINUE
      IF ( IBNC .NE. 1 ) GO TO 50
      ICALL = 2
      CALL CORECT
   50 CONTINUE
      IF (  IRC .NE. 1 ) GO TO 60
      ICALL = 3
      CALL CORECT
   60 CONTINUE
      IF (  IAAC.NE. 1 ) GO TO 80
C
C     APPLY ATMOSPHERIC ABSORBTION CORRECTION TO EACH SPL. USE SUBRT. AIFAB.
C     PRESS = ATMMOSPHERES
C     RTOK = DEG R TO DEG K CONVERSION
C     FTOM = FEET TO METERS CONVERSION
C
C
      TEMPK = TTEMP * RTOK
      DO 200 NF = 1 , NFREQ
      CALL AIFAB(PRESS,TEMPK,SDHUM,FREQ(NF),ABDBM )
      DO 220 NM = 1 , MIKES
      DISTME = XDIS(NM, 2) * FTOM
      DECB(NM,NF) = DECB(NM,NF) + ABDBM*DISTME
  220 CONTINUE
  200 CONTINUE
C
C     APPLY JET NOISE GROUND REFLECTION CORRECTIONS
C
C
   80 IF (IGRC.EQ.0.) GOTO 70
      DO 77 NM = 1,MIKES
      DO 77 NF = 1,NFREQ
```

```
   77 JETN(NM,NF) = 0.0
      CALL GRNOIS (XDIS(1,2),HTMIKE,JETN,HTSRCE,TTEMPF,MIKES,FREQ,NFREQ)
      WRITE(6,71)
   71 FORMAT(1H1,10X,35HGROUND NOISE REFLECTION CORRECTIONS /)
      CALL OUTCOR (JETN,MIKEA,MIKEB,NFREQ)
      DO 75 NM = 1,MIKES
      DO 75 NF = 1,NFREQ
      DECB(NM,NF) = DECB(NM,NF)-JETN(NM,NF)
   75 CONTINUE
   70 CONTINUE
C
      IF(IMRC.EQ.0.AND.IBNC.EQ.0.AND.IRC.EQ.0.AND.IAAC.EQ.0)GOTO 90
      CALL OSPL (DECB,MIKES,NFREQ)
      CALL SUBPDB (MIKES,DECB,NFREQ)
C
C
      WRITE(6,1002)
 1002 FORMAT(1H1,30X,22HDATA AFTER CORRECTIONS /)
      CALL OUTPUT (XDIS,DECB,ANGLES,FREQ,MIKES,NFREQ,HTMIKE)
C
   90 CONTINUE
C
C***** SAUVEGARDE DE DECB AVANT LISSAGE
      IF(KTDIFF.EQ.0) GO TO 130
      CALL SAVDECB(DECB)
  130 CONTINUE
C*****
C***** TRACE DES MESURES
      IF(KTDECB.EQ.0) GO TO 170
      NCAR=17
      CALL TDECB(KPLANC,DECB,ANGLES,FREQ,NFREQ,MIKEA,MIKEB,
     1'FIG.      MESURES.',NCAR,XMOD)
  170 CONTINUE
      CALL KURVFT(KLISF)
C***** TRACE DES POLYNOMES D INTERPOLATION
      IF(KTDECB.EQ.0) GO TO 180
      NCAR=35
      CALL TDECB(KPLANC,DECB,ANGLES,FREQ,NFREQ,MIKEA,MIKEB,
     1'FIG.      POLYNOMES D INTERPOLATION.',NCAR,XMOD)
  180 CONTINUE
C***** TRACE DES DIFFERENCES
      IF(KTDIFF.EQ.0) GO TO 140
      NCAR=80
      CALL TDIFF(KPLANC,DECB,ANGLES,FREQ,NFREQ,MIKEA,MIKEB,
     1ITIT,NCAR,XMOD)
  140 CONTINUE
C*****
      WRITE(6,1003)
 1003 FORMAT(1H1,30X,24HDATA AFTER CURVE FITTING /)
      CALL OUTPUT (XDIS,DECB,ANGLES,FREQ,MIKES,NFREQ,HTMIKE)
C
C
C
  110 CALL DIRECT
      CALL STAB(NFREQ,FREQ,THETSM,XDMAX)
C***** TRACE X/D=F(THETA-S)
      IF(KTXSD.EQ.0) GO TO 230
      CALL TXSD(KPLANC,XOVERD,THETAS,NTAB,NFREQ,XDMAX,THETSM,
     1RNZDIA,VJET,FREQ,LIB1,LIB2,XMOD)
  230 CONTINUE
```

```
C***** TRACE DE THETA-S DU PIC=F(STROUHAL)
      IF(KTPEAK.EQ.0) GO TO 240
      CALL TPEAK(KPLANC,THETSM,STR,NFREQ,RNZDIA,VJET,LIB1,LIB2
     1,XMOD)
  240 CONTINUE
C*****
C
C
C
C     DUMP COMMON TO DISK FILE AND SAVE THE CORRECTED
C     DATA FOR PHASE 2 ANALYSIS . . .
C     FILE IS WRITTEN IN UNFORMATTED BINARY
C
  120 CONTINUE
C     ECRITURE SUR BANDE
      WRITE(7)DUMP
      WRITE(7)DUMP1
      WRITE(7)NPOI
      WRITE(7) LIB
      WRITE(7) IDAT
      WRITE(7) LIB1
      WRITE(7) LIB2
      REWIND 7
C
C***** FIN DE TRACE
      IF(KTRAC.EQ.0) STOP
      CALL CLOSTR(XMOD)
      WRITE(6,1004) KPLANC
 1004 FORMAT(1H1///3X,'NOMBRE DE PLANCHES=',I3////)
C*****
      STOP
      END
*DECK READIN
      SUBROUTINE READIN(KODT,KLISF,ITIT,LIB1,LIB2)
C
C     ------------------------------------------------------------
C
C     SUBROUTINE READIN IS RESPONSIBLE FOR READING AND STORING INTO
C     COMMON THE DATA AND PARAMETERS TO BE USED FOR PROCESSING.
C     AS THE DATA IS READ IT IS ALSO PRINTED TO THE LINE PRINTER
C     RESULTS FILE (UNIT 06).
C
C     ENGINEERS INPUTS AND PARAMETERS ARE READ FROM LOGICAL UNIT
C     ASSIGNED TO VARIABLE LUN, USUALLY 5.
C
C     ANGLES AND DECIBEL READINGS FOR EACH MIKE ARE READ FROM
C     LOGICAL UNIT NUMBER IUN WHICH MAY OR MAY NOT BE THE SAME
C     AS LUN DEPENDING ON THE CONFIGUARATION CHOSEN BY THE PROGRAMMER.
C
C     ------------------------------------------------------------
C
C*****
      REAL*8 DECB,ANGLES,XDIS,HTMIKE,HTSRCE,SDHUM,SDTEMP,V8,UNITS,
     1       THETAM,ADEL,BDEL,AN,YF,YY,ANHI,ANLO,AFHI,AFLO,
     2       COFA,COFB,TR,R2D,D2R,SDTEMF,TTEMP,TTEMPF,VJET,
     3       FREQ,THETAS,XOVERD,XDMAX,THETSM,RNZDIA
C*****
      REAL*8 RFACT,THUM,RNZDIN,HTMIK,ALPHA,H,D
C*****
      COMMON /SUB/ MIKES,MIKEA,MIKEB,ICALL,DECB(130,35),
```

```
     1                ANGLES(130),XDIS(130,2),HTMIKE(130),HTSRCE,SDHUM,
     2                SDTEMP,V8,UNITS,KFIT(2),IWTB,IWTE,
     3                THETAM(33),ADEL,BDEL,AN,IGRC,NRUN,
     4                YF,YY,ANHI,ANLO,AFHI,AFLO,COFA(16,35),COFB(16,35),
     5                TR,R2D,D2R,SDTEMF,TTEMP,TTEMPF,
     6                IBIDO,IMRC,IBNC,IRC,IAAC,IDATE,
     7                VJET,FREQ(33),THETAS(50,33),XOVERD(50,33),NTAB(33),
     8                NTEST,XDMAX(33),THETSM(33),RNZDIA,NZTYPE(10),NFREQ
C
      COMMON /OUTFLG/ IPFRQC,IPANGL,IPFNDM,IPROOT,IPFNDY
C
C*****
      COMMON /TRAFLG/KTRAC,KTDECB,KTDIFF,KTXSD,KTPEAK
      COMMON /IDENT/NPOI,KMIC,NPOI2
      DIMENSION ITIT(1),LIB1(1),LIB2(1)
C*****
      DATA IUN,LUN /5,5/
      DATA RFACT   /459.6/
C
      WRITE(6,800)
      READ(IUN,910)NPOI,KMIC,NPOI2
  910 FORMAT(I5,1X,I1,I5)
      READ (IUN,901) NTEST,NRUN,NZTYPE
      WRITE (6,801)  NZTYPE,NTEST,NRUN,NPOI,KMIC,NPOI2
C
      READ (IUN,902) IPFRQC,IPANGL,IPFNDM,IPROOT,IPFNDY
      WRITE (6,802)  IPFRQC,IPANGL,IPFNDM,IPROOT,IPFNDY
C
      READ (IUN,902)  IMRC,IBNC,IRC,IAAC,IGRC,KLISF
      WRITE (6,807)   IMRC,IBNC,IRC,IAAC,IGRC,KLISF
C
C***** LECTURE DES FLAGS DE TRACE
      READ(IUN,902) KTRAC,KTDECB,KTDIFF,KTXSD,KTPEAK
      READ(IUN,1910)(ITIT(I),I=1,20)
      READ(IUN,1910)(LIB1(I),I=1,20)
      READ(IUN,1910)(LIB2(I),I=1,20)
      WRITE(6,810)KTRAC,KTDECB,KTDIFF,KTXSD,KTPEAK
C*****
      READ (IUN,903) MIKEA,MIKEB,MIKES,KFIT(1),KFIT(2),IWTB,IWTE
C
      READ (IUN,904) AN,YF,YY,ANHI,ANLO,AFHI,AFLO,ADEL,BDEL
      AN=AN*3.2808
      YF=YF*3.2808
      YY=YY*3.2808
      WRITE (6,804)  AN,YF,YY,ANLO,AFLO,ANHI,AFHI,ADEL,BDEL
C
      READ (IUN,902) ITMPTP
C
      IF (ITMPTP.NE.0.AND.ITMPTP.NE.1) STOP 3
      IF (ITMPTP.NE.1) GOTO 200
      READ (IUN,905) V8,THUM,TTEMPF,SDHUM,SDTEMF,RNZDIN
      TTEMP  = TTEMPF+RFACT
      SDTEMP = SDTEMF+RFACT
      GOTO 210
  200 READ (IUN,905) V8,THUM,TTEMP,SDHUM,SDTEMP,RNZDIN
      TTEMPF = TTEMP-RFACT
      SDTEMF = SDTEMP-RFACT
C     RNZDIN IS IN METRES, SWITCH TO RNZDIA IN FEET FOR
C     CALCULATIONS TO BE DONE IN SUBROUTINE DIRECT
  210 RNZDIA = RNZDIN*3.2808
```

```
      WRITE (6,806) V8,THUM,SDHUM,RNZDIN,RNZDIA,TTEMPF,TTEMP,
     *                SDTEMF,SDTEMP
C
C
C     THESE VARIABLES ARE SET EQUAL DUE TO NUMEROUS PROGRAM CHANGES.
C
      VJET = V8
C
      READ (IUN,908) HTSRCE,HTMIK
C
      IF(KODT.NE.0)GO TO 100
C     LECTURE 2 LIGNES DE MICROS
C     RECHERCHE DES ANGLES DE LA LIGNE 2 EN TOTALITE
C     RECHERCHE DES ANGLES DE LA LIGNE 1 EGAUX A CEUX DE LA LIGNE 2
      CALL RECHPOIN(NFREQ,MIKES,MIKEA,MIKEB,DECB,FREQ,ANGLES)
      GO TO 300
  100 IF(KODT.EQ.1)CALL LCART
      IF(KODT.EQ.2)CALL RECHNASA(NFREQ,MIKES,MIKEA,MIKEB,DECB,FREQ,ANGLE
     *S)
  300 WRITE (6,803)  MIKEA,MIKEB,MIKES,KFIT(1),KFIT(2),IWTB,IWTE
      IF (MIKES.NE.(MIKEA+MIKEB)) STOP 1
      DO 101 J=1,MIKES
  101 HTMIKE(J)=HTMIK
      WRITE (6,809)  HTSRCE,(HTMIKE(I),I=1,MIKES)
  809 FORMAT( / 1X,20HSOURCE HEIGHT (FT) =, F6.2 /
     *  1X,20HMICROPHONE HEIGHT =, 15F6.2 / 2(21X,15F6.2/) 21X,5F6.2)
C
C
C     CALCULATION OF MIKE DISTANCES BASED ON
C     MIKE HEIGHT AND ANGLE    ...    SEE PROGRAM DOCUMENTATION
C     FOR REFERENCE ON METHOD USED (GEOMETRY)
C
      DO 110 L=1,MIKES
      IF (L.GT.MIKEA) GOTO 111
      IF (HTSRCE.EQ.HTMIKE(L)) GOTO 112
      XDIS(L,2) = AN/DSIN((180.-ANGLES(L))*D2R)
      XDIS(L,1) = XDIS(L,2)*DCOS((180.-ANGLES(L))*D2R)
      GOTO 110
  112 IF (ANGLES(L).GT.90.) ALPHA=90.-ANGLES(L)
      IF (ANGLES(L).LT.90.) ALPHA=ANGLES(L)-90.
      H = HTSRCE-HTMIKE(L)
      IF (ANGLES(L).EQ.90.) GOTO 113
      D = AN/DCOS(ALPHA*D2R)
      XDIS(L,1) = DSQRT(AN*AN+D*D)
      XDIS(L,2) = DSQRT(D*D+H*H)
      GOTO 110
  113 XDIS(L,1) = 0.0
      XDIS(L,2) = DSQRT(AN**2+H**2)
      GOTO 110
  111 IF (HTSRCE.EQ.HTMIKE(L)) GOTO 114
      XDIS(L,2) = YF/DSIN((180.-ANGLES(L))*D2R)
      XDIS(L,1) = XDIS(L,2)*DCOS((180.-ANGLES(L))*D2R)
      GOTO 110
  114 IF (ANGLES(L).GT.90.) ALPHA=90.-ANGLES(L)
      IF (ANGLES(L).LT.90.) ALPHA=ANGLES(L)-90.
      H = HTSRCE-HTMIKE(L)
      IF (ANGLES(L).EQ.90.) GOTO 115
      D = YF/DCOS(ALPHA*D2R)
      XDIS(L,1) = DSQRT(YF**2+D**2)
      XDIS(L,2) = DSQRT(D*D+H*H)
```

```
      GOTO 110
  115 XDIS(L,1) = 0.0
      XDIS(L,2) = DSQRT(YF**2+H**2)
  110 CONTINUE
      WRITE (6,805) (XDIS(L,1),L=1,MIKES)
      WRITE (6,808) (XDIS(L,2),L=1,MIKES)
C
C*****INPUT FORMATS
C
  901 FORMAT (I3,I2,10A4)
  902 FORMAT (6I1)
  903 FORMAT (7I2)
  904 FORMAT (10F6.2)
  905 FORMAT (5F10.1,F10.2)
  908 FORMAT (16F5.0)
  909 FORMAT (16F5.2)
 1910 FORMAT(20A4)
C
C*****OUTPUT FORMATS
C
  800 FORMAT(1H1,37HSOURCE LOCATION PROGRAM - STATIC CASE // 1X,
     * 40HINPUT PARAMETERS READ FOR THIS EXECUTION /)
  801 FORMAT(1X,16HIDENTIFICATION =,1X, 10A4,5X,4HTEST,I4,5H RUN ,
     *  I3,30X,I4,4H  M ,I1,I5)
  802 FORMAT(1X,16HOUTPUT FLAGS   =,1X,6I1)
  803 FORMAT(/ 1X,19HNEAR FIELD MIKES = ,I2,10X,
     *18HFAR FIELD MIKES = ,I2,10X,14HTOTAL MIKES = ,I3 /
     *1X,10HKFIT(1) = ,I2,19X,10HKFIT(2) = ,I2,/1X,
     *10HIWTB    = ,I2,19X,10HIWTE    = ,I2)
  804 FORMAT(// 12X,10HNEAR FIELD, 6X,9HFAR FIELD /
     *1X,8HDISTANCE,F11.3,5X,F11.3,5X,F11.3 / 1X,3HLOW,
     *F16.3,5X,F11.3 / 1X,2HHI,F17.3,5X,F11.3,5X,5HDELTA,F14.3,5X,F11.3)
  806 FORMAT(/ 1X,8HV(INF) =,F8.2 /
     * 1X,8HTHUM   =,F8.2,10X,7HSDHUM =,F8.2,10X,12HNOZZLE DIA =,
     *F8.4,9H METRES =,F8.4,5H FEET,
     *              //  21X,5HDEG F,10X,5HDEG R / 1X,11HTUNNEL TEMP,7X,
     *F7.1,8X,F7.1 / 1X,12HSTD DAY TEMP,6X,F7.1,8X,F7.1)
  805 FORMAT(// 1X,14HMIKE DISTANCES /
     *1X,13HCENTER LINE =,10F10.3,/ 3(14X,10F10.3 /))
  807 FORMAT(1X,19HCORRECTION FLAGS  =,1X,6I1)
  808 FORMAT(/ 1X,13HSOURCE DIST =,10F10.3 / 3(14X,10F10.3 /))
  810 FORMAT(1X,'PLOT FLAGS    =',5I1)
      END
*DECK OSPL
      SUBROUTINE OSPL (DECB,MIKES,NFREQ)
C*****
      REAL*8 DECB(130,35)
      REAL*8 D,DDB,S
C*****
      DO 400 II=1,MIKES
      S = DECB(II,1)
      DO 390 L=2,NFREQ
      D=DECB(II,L)
      IF (D.LT.40.) GO TO 390
      DDB=DABS(S-D)
      IF (DDB.GT.7.5) GO TO 380
      S=DEXP(1.1115)*DEXP(-.19077*DDB)+DMAX1(S,D)
      GO TO 390
  380 S=DEXP(1.1406)*DEXP(-.20172*DDB)+DMAX1(S,D)
  390 CONTINUE
```

```
      DECB(II,34) = S
  400 CONTINUE
      RETURN
      END
*DECK PNDP
      SUBROUTINE PNDB(LP,NF,PLDB,DL,ALO,ANN,ANO)
C
C     THIS SUBROUTINE HAS BEEN MODIFIED TO WORK ONLY FOR ONE-THIRD
C     OCTAVE BAND WIDTH.
C
C*****
      REAL*8 SUMN,PLDB
C*****
      REAL*8  DL(24,2),ALO(24,2),ANN(24,2),ANO(24,2)
      REAL*8 LP(27),LB(24),NOY(24),NMAX,NBAR
      N=NF
      IF(N.GT.24)N=24
      DO 21 I=1,24
   21 LB(I)=LP(I)
      NMAX=0.0
      SUMN=0.0
      DO 13 I=1,N
      NOY(I)=DMIN1(ANO(I,1)*ANN(I,1)**((LB(I)-ALO(I,1))/DL(I,1)),
     1          ANO(I,2)*ANN(I,2)**((LB(I)-ALO(I,2))/DL(I,2)))
      IF(NOY(I).GE.NMAX)NMAX=NOY(I)
   13 SUMN=SUMN+NOY(I)
      NBAR = NMAX+0.15*(SUMN-NMAX)
      PLDB=40.0+10.0*DLOG10(NBAR)/DLOG10(2.0)
      IF(PLDB.LT.0.0)PLDB=0.0
      RETURN
      END
*DECK SUBPDB
      SUBROUTINE SUBPDB (MIKES,DECIBL,NFREQ)
      REAL*8 PDB
      REAL*8 DECIBL(130,35),LP(27)
      REAL*8 DL(24,2),ALO(24,2),ANN(24,2),ANO(24,2)
      DATA DL/15*10.,9*110.,30.,25.,2*26.
     1     ,28.,2*27.,30.,51.,6*10.,7*110.,6.,9./
      DATA ALO/52.,51.,49.,47.,46.,45.,43.,42.,41.,5*40.,38.,34.
     1       ,32.,30.,2*29.,30.,31.,34.,37.,64.,60.,56.,53.,51.,48.
     2       ,46.,44.,42.,5*40.,38.,34.,32.,30.,2*29.,30.,31.,37.,41./
      DATA ANN/15*2.,9*1975.,13.5,10.3,2*9.07,9.76,2*7.94,9.15,
     1       136.7,6*2.,7*1975.,1.79,2.4/
      DATA ANO/48*1.0/
C
      L24 = 24
      IF ( NFREQ .LT. 24 ) L24 = NFREQ
      DO 280 II = 1,MIKES
      KSW=0
      DO 260 L=1,L24
      LP(L) = DECIBL(II,L+6)
      IF (LP(L).GT.0.0) KSW = 1
      IF (LP(L).LT.0.0) LP(L) = 0.0
  260 CONTINUE
      IF (KSW.GT.0) GO TO 270
      PDB=0.
      GO TO 280
  270 CONTINUE
      NF = L24
      CALL PNDB(LP,NF,PDB,DL,ALO,ANN,ANO)
```

```
C
      IF ( DABS( YM1 ) .LT. EPS ) GO  TO 190
C
      KNTBI = 0
C
      X1 = XM1
      X2 = XM2
C
C*************************************************
C
C
C     USE FOR DEBUGGING .
C
C     IF(IPRINT.EQ.1) WRITE(6,97) X1,X2,YM1,YM2
C  97 FORMAT(2X,26HSTART WITH X1,X2,YM1,YM2  , 4E16.8 )
C
C*************************************************
C
   99 CONTINUE
C
      KNTBI = KNTBI + 1
      IF ( KNTBI .GE.ITER ) GO TO 1500
C     DIVIDE THE INTERVAL , (X1,X2)  AND CHECK BOTH HALVES FOR THE ROOT.
C     THE TWO HALVES ARE (X1,XBAR) , (XBAR,X2)
C
       XBAR = ( X1 + X2 ) / 2.
      IF ( DABS(X2-X1) .LE. EPS ) GO TO 150
  120 CONTINUE
       Y1 = POLYX ( COEF,N,X1 )
       YBAR = POLYX ( COEF,N,XBAR )
C
C     CHECK FOR THE ROOT IN THE 1ST HALF .
C
       CHECK = Y1*YBAR
       IF ( CHECK .LE. 0.0 ) X2 = XBAR
       IF ( CHECK .LE. 0.0 ) GO TO 99
C
C
C     CHECK FOR THE ROOT IN THE 2ND HALF .
C
       X1 = XBAR
       GO TO 99
C
  150 CONTINUE
C
       YY = POLYX ( COEF,N,XBAR )
       IF ( DABS(YY) .GT. EPS ) GO TO 120
       KNTR = KNTR + 1
       ROOTS(KNTR) = XBAR
       YROOTS(KNTR) = YY
      XM2 = XBAR
      YM2 = 0.0
C
      IF(IPRINT.EQ.1)WRITE(6,170) KNTR,KNTBI
  170 FORMAT ( 1X, 9HROOT NUM. , I3,5H USED , I3,11H ITERATIONS )
C
C
C
      GO TO 190
 1500 CONTINUE
```

```
      IERR = 1
      IF ( IPRINT .NE. 1 ) GO TO 190
      WRITE ( 6,1600)ITER,EPS
 1600 FORMAT (1X,I2,45H ITERATIONS FAILED TO GIVE DESIRED ACCURACY(   ,   -
     2E14.7,2H ) / )
      WRITE(6,1700) X1,X2
 1700 FORMAT ( 1X, 7HX1,X2 = , 2E18.9 / )
  190 CONTINUE
      XM1 = XM2
      YM1 = YM2
C
C
  200 CONTINUE
C
  250 CONTINUE
C
      IF ( KNTR .LT. 1 ) GO TO 600
      GO TO 900
C
  300 CONTINUE
C
C
C     IF N=2 , WE HAVE THE 2ND DEGREE EQ. , QUADRATIC FORMULA WILL BE USED.
C
      IF ( N .LT. 2 ) GO TO 400
      DISCRM = COEF(N)**2 - 4. * COEF(N+1) * COEF(1)
      IF ( DISCRM .LT. 0.0 ) GO TO 600
      ROOTS(1) = (-COEF(N) + DSQRT(DISCRM) ) / ( 2.*COEF(N+1) )
      ROOTS(2) = (-COEF(N) - DSQRT(DISCRM) ) / ( 2.*COEF(N+1) )
      KNTR = 2
C
      YROOTS(1) = POLYX(COEF,N,ROOTS(1) )
      YROOTS(2) = POLYX(COEF,N,ROOTS(2) )
C
      GO TO 900
C
  400 CONTINUE
C
      KNTR = 1
      ROOTS(1) = -COEF(1)/COEF(2)
      YROOTS(1) = POLYX ( COEF,N,ROOTS(1) )
      GO TO 900
C
C
  600 CONTINUE
C
      IF(IPRINT.EQ.1)WRITE(6,650) N
  650 FORMAT ( 1X,14HNO REAL ROOTS. , 5X,I3,19H DEGREE POLYNOMIAL. / )
      IERR = 1
      GO TO 2000
C
  900 CONTINUE
C
      IF ( IPRINT .NE. 1 ) GO TO 2000
C
      WRITE ( 6,920) N
  920 FORMAT ( 1X,15HROOT(S) OF THE  , I3, 18H DEGREE POLYNOMIAL   )
C
      IF ( KNTR .GT. 8 ) GO TO 1000
C
```

```
      WRITE ( 6,950) ( ROOTS(I) , I = 1 , KNTR )
  950 FORMAT ( 1X,8E16.8 )
      WRITE ( 6,960 )
  960 FORMAT ( 1X,16HTHE Y-VALUES ARE   )
      WRITE(6,950) (YROOTS(I),I = 1,KNTR )
      GO TO 2000
  980 FORMAT ( 1X,/ )
C
 1000 CONTINUE
C
C
      KNTR1 = KNTR/2
      KNTR2 = KNTR - KNTR1
C
      WRITE ( 6,950) ( ROOTS(I) , I = 1 , KNTR1)
      KNTR1 = KNTR1 + 1
      WRITE ( 6,950) ( ROOTS(I) , I = KNTR1 , KNTR2 )
C
      WRITE(6,980)
      KNTR1 = KNTR1 - 1
      WRITE ( 6,960 )
      WRITE(6,950) (YROOTS(I),I = 1,KNTR1)
      KNTR1 = KNTR1 + 1
      WRITE(6,950) (YROOTS(I),I =KNTR1 ,KNTR2)
C
C
 2000 CONTINUE
C
      WRITE( 6,25 )
      NROOTS = KNTR
      RETURN
      END
*DECK OUTPUT
      SUBROUTINE OUTPUT (XDIS,DECB,ANGLES,FREQ,MIKES,NFREQ,HTMIKE)
C
C*****
      REAL*8  XDIS(130,2),DECB(130,35),ANGLES(130).FREQ(33)
      REAL*8 HTMIKE(130)
C
      LC = MIKES / 15
      IF(MOD(MIKES,15).NE.0) LC = LC + 1
      IST = 1
      DO 375 J = 1,LC
      ISTP = IST + 14
      IF (ISTP.GT.MIKES) ISTP=MIKES
C
      WRITE (6,610) ((K),K=IST,ISTP)
      WRITE (6,620) (ANGLES(K),K=IST,ISTP)
      WRITE (6,625) (HTMIKE(K),K=IST,ISTP)
      WRITE (6,630) (XDIS(K,1),K=IST,ISTP)
      WRITE (6,640) (XDIS(K.2),K=IST,ISTP)
      WRITE (6,650)
      DO 350 L=1,NFREQ
  350 WRITE(6,670) FREQ(L), (DECB(K,L),K=IST,ISTP)
      WRITE(6,710) (DECB(K,34),K=IST,ISTP)
      WRITE(6,720) (DECB(K,35),K=IST,ISTP)
C
      WRITE (6,730)
      IST = ISTP + 1
  375 CONTINUE
```

```
C
  610 FORMAT (12H MICROPHONE:,14X,15(1X,I3,2X))
  620 FORMAT (12H ANGLE(DEG):,14X,15F6.1)
  625 FORMAT (13H HEIGHT (FT):,13X,15F6.1)
  630 FORMAT (14H CL  DIST(FT):,12X,15F6.1)
  640 FORMAT (14H REF DIST(FT):,12X,15F6.1)
  650 FORMAT (12H FREQ(HERTZ))
  670 FORMAT (2X,F9.0,15X,15F6.1)
  710 FORMAT (12H0OVERALL SPL,14X,15F6.1)
  720 FORMAT (5H PNDB,21X,15F6.1)
  730 FORMAT (1H1)
      RETURN
      END
*     DECK LCART
      SUBROUTINE LCART
C*****
      REAL*8 DECB,ANGLES,XDIS,HTMIKE,HTSRCE,SDHUM,SDTEMP,V8,UNITS,
     1       THETAM,ADEL,BDEL,AN,YF,YY,ANHI,ANLO,AFHI,AFLO,
     2       COFA,COFB,TR,R2D,D2R,SDTEMF,TTEMP,TTEMPF,VJET,
     3       FREQ,THETAS,XOVERD,XDMAX,THETSM,RNZDIA
C*****
      IUN=LUN=5
      COMMON /SUB/ MIKES,MIKEA,MIKEB,ICALL,DECB(130,35),
     1             ANGLES(130),XDIS(130,2),HTMIKE(130),HTSRCE,SDHUM,
     2             SDTEMP,V8,UNITS,KFIT(2),IWTB,IWTE,
     3             THETAM(33),ADEL,BDEL,AN,IGRC,NRUN,
     4             YF,YY,ANHI,ANLO,AFHI,AFLO,COFA(16,35),COFB(16,35),
     5             TR,R2D,D2R,SDTEMF,TTEMP,TTEMPF,
     6             IBIDO,IMRC,IBNC,IRC,IAAC,IDATE,
     7             VJET,FREQ(33),THETAS(50,33),XOVERD(50,33),NTAB(33),
     8             NTEST,XDMAX(33),THETSM(33),RNZDIA,NZTYPE(10),NFREQ
      READ (IUN,903) NFREQ
  903 FORMAT (7I2)
      READ (IUN,905) (FREQ(I),I=1,NFREQ)
  905 FORMAT (8F10.1)
      DO 101 J=1,MIKES
      READ (LUN,909)ANGLES(J),(DECB(J,L),L=1,NFREQ)
  909 FORMAT (16F5.2)
  101 CONTINUE
      RETURN
      END
*     DECK RECHNASA
      SUBROUTINE RECHNASA(NFREQ,MIKES,MIKEA,MIKEB,DECB,FREQ,ANGLES)
      COMMON/IDENT/IPT1,KBNSA,IPT2
      COMMON/TITRE/LIB(10),IDATE(3),DB1(8,4)
      REAL*8 DECB(130,35),FREQ(33),ANGLES(130)
      DIMENSION ANG(30),SPE(30),IPAR(2),PAR(8),NZTYP(3),FQ(30)
      DIMENSION TAB1(13),TAB2(30),TAB3(31),TAB4(31),TAB5(31)
      EQUIVALENCE (TAB1(1),IPAR(1)),(TAB1(3),PAR(1)),(TAB1(11),NZTYP(1))
      EQUIVALENCE (TAB2(1),FQ(1))
      EQUIVALENCE (TAB3(1),ANG(1))
      EQUIVALENCE (TAB5(1),SPE(1))
      DATA ND1,ND2/2,3/,NDFQ/5/,LIBO/4H
      IF(KBNSA.EQ.1)NFREQ=25
      IF(KBNSA.EQ.2)NFREQ=23
C     LECTURE DU POINT CONTENANT LA LIGNE 1
      READ(ND1,101,END=601)(TAB1(I),I=1,13)
      IF(IPT1.NE.IPAR(1))WRITE(6,104)IPAR(1);STOP
  104 FORMAT(' ERREUR POINT LU =',I5)
      NPOI=IPAR(1)
```

```
      N=IPAR(2)
      MIKEA=N
  101 FORMAT(31A4)
      DB1(1,1)=0.
      DB1(1,2)=PAR(5)/3.2808
      READ(ND1,101)(TAB2(I),I=1,30)
      DO 10 I=1,NFREQ
   10 FREQ(I)=FQ(I+NDFQ)
      READ(ND1,101)(TAB3(I),I=1,N)
      DO 20 I=1,N
   20 ANGLES(I)=ANG(I)
      READ(ND1,101)(TAB4(I),I=1,N)
      DO 30 IA=1,N
      READ(ND1,101)(TAB5(I),I=1,31)
      DO 40 IDB=1,NFREQ
   40 DECB(IA,IDB)=SPE(IDB+NDFQ)
   30 CONTINUE
C     LECTURE DU FICHIER CONTENANT LA LIGNE 2
      READ(ND2,101,END=602)(TAB1(I),I=1,13)
      IF(IPT2.NE.IPAR(1))WRITE(6,104)IPAR(1);STOP
      N=IPAR(2)
      MIKEB=N
      DB1(3,1)=0.
      DB1(3,2)=PAR(5)/3.2808
      DO 5 I=1,3
    5 LIB(I)=NZTYP(I)
      DO 6 I=4,10
    6 LIB(I)=LIBO
      DO 7 I=1,3
    7 IDATE(I)=0
      READ(ND2,101)(TAB2(I),I=1,30)
      READ(ND2,101)(TAB3(I),I=1,30)
      DO 50 I=1,N
   50 ANGLES(MIKEA+I)=ANG(I)
      READ(ND2,101)(TAB4(I),I=1,30)
      DO 60 IA=1,N
      READ(ND2,101)(TAB5(I),I=1,31)
      DO 70 IDB=1,NFREQ
   70 DECB(MIKEA+IA,IDB)=SPE(IDB+NDFQ)
   60 CONTINUE
      MIKES=MIKEA+MIKEB
      GO TO 900
  601 WRITE(6,102)ND1
  102 FORMAT(' FIN DE FICHIER ETIQ. LOGIQUE ',I2)
      STOP
  602 WRITE(6,103)ND2
  103 FORMAT(' FIN DE FICHIER ETIQ. LOGIQUE ',I2)
      STOP
  900 RETURN
      END
      SUBROUTINE RECHPOIN(NFREQ,MIKES,MIKEA,MIKEB,DECB,FREQ,
     *ANGLES)
C
C     INTERFACE PROG AMES ET PROG ONERA
C                                            NO MICROS
C     IPI(1)=0- 7M,LIGNE 1,MICRO 1              1
C     IPI(2)=0- 7M,LIGNE 1,MICRO 2              2
C     IPI(3)=0- 7M,LIGNE 2,MICRO 1              3
C     IPI(4)=0- 7M,LIGNE 2,MICRO 2              4
C     IPI(5)=7-14M,LIGNE 1,MICRO 1              5
```

```
C      IPI(6)=7-14M,LIGNE 1,MICRO 2      6
C      IPI(7)=7-14M,LIGNE 2,MICRO 1      7
C      IPI(8)=7-14M,LIGNE 2,MICRO 2      8
C
C*****
       COMMON /IDENT/NPOI,KMIC
       COMMON /TITRE/LIB(10),IDATE(3),DB1(8,4),IPI(8)
C*****
       REAL*8 OMEGA(8,40),DECB(130,35),FREQ(33),ANGLES(130),AMI,AMA
       REAL*8 AUX(130,30)
       DIMENSION LTT(10),JFR(44),IRG(2)
       DIMENSION IDB1(8,6),TETA(8,40),SDB(8,40,50)
       DIMENSION TAB1(050),TAB2(050),ITAB(6),TAB(4),ANG(40),SPE(45)
       EQUIVALENCE(TAB1(1),TITR)
       EQUIVALENCE (TAB1(2),ITAB(1))
       EQUIVALENCE (TAB1(8),TAB(1))
       EQUIVALENCE (TAB1(12),LTT(1))
       EQUIVALENCE (TAB1(22),ANG(1))
       EQUIVALENCE(TAB2(1),ANGLE)
       EQUIVALENCE(TAB2(2),SPE(1))
C
       DATA IPI/1,2,3,4,5,6,7,8/
C
       DATA JFR/3,4,5,6,8,10,12,16,20,25,31,40,50,63,80,100,125,160,200,
      *250,315,400,500,630,800,1000,1250,1600,2000,2500,3150,4000,5000,
      *6300,8000,10000,12500,16000,20000,25000,31500,40000,50000,63000/
       DATA IUN/5/
C
C      FREQUENCE 80 A 20000HZ
C
       ND=2
       NUMER =1
       REWIND ND
   50  KODR=0
  600  CONTINUE
       READ(ND,105,END=610)(TAB1(I),I=1,50)
  105  FORMAT(50A4)
       IF(ITAB(1).NE.NPOI    )GO TO 500
C               NOUVELLE INDEXATION
       INDEX=ITAB(4)
C               MISE EN TABLEAU DU TITRE
C*****
       DO 12 I=1,10
   12  LIB(I)=LTT(I)
       IDJ=ITAB(2)/4096
       IDF=ITAB(2)-IDJ*4096
       IUJ=IDF/256
       IDF=IDF-IUJ*256
       IDATE(1)=IDJ*10+IUJ
       IDM=IDF/16
       IUM=IDF-IDM*16
       IDATE(2)=IDM*10+IUM
       IDATE(3)=79
       DO 20 I=1,6
   20  IDB1(INDEX,I)=ITAB(I)
       DO 22 I=1,4
   22  DB1(INDEX,I)=TAB(I)
       DO 24 I=1,ITAB(5)
   24   TETA(INDEX,I)=ANG(I)
C               REMISE EN ORDRE DES SPECTRESB SI BANDE EN SENS INVERSE
```

```
      DO 250 LA=1,ITAB(5)
      IF(ITAB(6).GT.1) IA=ITAB(5)+1-LA;GO TO 170
      IA=LA
C               LECTURE DES SPECTRES
  170 CONTINUE
      READ(ND,105,END=630)(TAB2(I),I=1,50)
C               RANGEMENT DES ANGLES ET DES SPECTRES
      OMEGA(INDEX,IA)=ANGLE
      DO 250 IDB=1,45
  250 SDB(INDEX,IA,IDB)=SPE(IDB)
      NUMER=NUMER+1
      IF(NUMER.LE.8) GO TO 50
      GO TO 700
  500 DO 25 J=1,ITAB(5)
      READ(ND,105,END=620)(TAB2(I),I=1,50)
   25 CONTINUE
      GO TO 600
  610 KODR=1
      GO TO 650
  620 KODR=2
      GO TO 650
  630 KODR=3
  650 WRITE(6,104)KODR;STOP
  104 FORMAT(' ERREUR EN LECTURE BANDE KODR=',I5)
  700 CONTINUE
C     MISE EN TABLEAU DES FREQ   DES ANGLES ET SPECTRES DE 0A14 METRES
C     COEFFICIENTS DE CALIBRATION LIGNE 1:C11 C12 ,LIGNE 2:C21 C22
C     RANG DU PREMIER ANGLE  LIGNE 1 ET LIGNE 2
      READ(IUN,901)C11,C12,C21,C22,IRG(1),IRG(2)
  901 FORMAT(4F5.1,2I2)
      WRITE(6,801)C11,C12,C21,C22
  801 FORMAT(/' CALIBRATION L1 L2 =',4F6.1)
C     RANG-1 DE LA PREMIERE FREQ TRAITEE
      NFDEC=14
      NFREQ=25
      DO 5 IDB=1,NFREQ
    5 FREQ(IDB)= JFR(IDB+NFDEC)
C     CHOIX DU TRAITEMENT
C     KMIC=0  MICROS A+ B MOYENNES
C     KMIC=1  MICRO A
C     KMIC=2  MICRO B
C
C
      IA=IB=0
C     BOUCLE SUR LES LIGNES
      DO 800 KLIG=1,2
      IF(KMIC.NE.0.AND.KMIC.NE.1)GO TO 1000
C     MICRO A
      IF(KLIG.EQ.1)M1=IPI(1);M2=IPI(5);NT1=IDB1(M1,5)
      IF(KLIG.EQ.2)M1=IPI(3);M2=IPI(7);NT2=IDB1(M1,5)
      I=1
      LEGAL=0
      DO 10 K=1,IDB1(M1,5)
      K1=INT(OMEGA(M1,K)+0.5)
      K2=INT(OMEGA(M2,I)+0.5)
      IF(K1.EQ.K2) I=I+1;LEGAL=LEGAL+1
   10 CONTINUE
      DO 30 I=IRG(KLIG),IDB1(M1,5)
      IA=IA+1
      ANGLES(IA)=OMEGA(M1,I)
```

```
      DO 30 IDB=1,NFREQ
   30 DECB (IA,IDB)=SDB(M1,I  ,IDB+NFDEC)
      DO 40 J=LEGAL    +1,IDB1(M2,5)
      IA=IA+1
      ANGLES(IA)=OMEGA(M2,J)
      DO 40 IDB=1,NFREQ
   40 DECB (IA,IDB)=SDB(M2,J,IDB+NFDEC)
      IF(KMIC.NE.0)GO TO 2000
C     MICRO B
 1000 IF(KLIG.EQ.1)M1=IPI(2);M2=IPI(6);NT1=IDB1(M1,5)
      IF(KLIG.EQ.2)M1=IPI(4);M2=IPI(8);NT2=IDB1(M1,5)
      I=1
      LEGAL=0
      DO 11 K=1,IDB1(M1,5)
      K1=INT(OMEGA(M1,K)+0.5)
      K2=INT(OMEGA(M2,I)+0.5)
      IF(K1.EQ.K2) I=I+1;LEGAL=LEGAL+1
   11 CONTINUE
      DO 31 I=IRG(KLIG),IDB1(M1,5)
      IB=IB+1
      ANGLES(IB)=OMEGA(M1,I)
      DO 31 IDB=1,NFREQ
   31 AUX(IB,IDB)=SDB(M1,I,IDB+NFDEC)
      DO 41 J=LEGAL+1,IDB1(M2,5)
      IB=IB+1
      ANGLES(IB)=OMEGA(M2,J)
      DO 41 IDB=1,NFREQ
   41 AUX(IB,IDB)=SDB(M2,J,IDB+NFDEC)
      IF(KMIC.NE.0)GO TO 3000
      IF(KLIG.EQ.1)MIKEA=IA;GO TO 800
      MIKES=IA
      MIKEB=MIKES-MIKEA
C     MOYENNE MICRO A + MICRO B
      DO 70 I=1,MIKES
      DO 70 IDB=1,NFREQ
   70 DECB(I,IDB)=(DECB(I,IDB)+AUX(I  ,IDB))/2.
      GO TO 5000
 2000 IF(KLIG.EQ.1)MIKEA=IA;GO TO 800
      MIKES=IA
      MIKEB=MIKES-MIKEA
      GO TO 5000
 3000 IF(KLIG.EQ.1)MIKEA=IB;GO TO 800
      MIKES=IB
      MIKEB=MIKES-MIKEA
      DO 72 I=1,MIKES
      DO 72 IDB=1,NFREQ
   72 DECB(I,IDB)=AUX(I,IDB)
  800 CONTINUE
 5000 IF(MIKES.GT.130)WRITE(6,106)MIKES;STOP
  106 FORMAT(' TROP D  ANGLES LIGNE 1 + LIGNE 2 =',I5)
C     CORRECTION DES SPECTRES
      DO 73 I=1,NT1
      DO 73 IDB=1,NFREQ
   73 DECB(I,IDB)=DECB(I,IDB)+C11
      DO 74 I=NT1+1,MIKEA
      DO 74 IDB=1,NFREQ
   74 DECB(I,IDB)=DECB(I,IDB)+C12
      DO 75 I=MIKEA+1,MIKEA+NT2
      DO 75 IDB=1,NFREQ
   75 DECB(I,IDB)=DECB(I,IDB)+C21
```

```
      DO 76 I=MIKEA+NT2+1,MIKES
      DO 76 IDB=1,NFREQ
   76 DECB(I,IDB)=DECB(I,IDB)+C22
      RETURN
      END
*DECK CORECT
      SUBROUTINE CORECT
C
C     ICALL = 1  FOR MIKE RESPONSE CORRECTIONS
C     ICALL = 2  FOR REVERBERATION CORRECTIONS
C     ICALL = 3  FOR BACKGROUND NOISE CORRECTIONS
C
C
C*****
      REAL*8 DECB,ANGLES,XDIS,HTMIKE,HTSRCE,SDHUM,SDTEMP,V8,UNITS,
     1       THETAM,ADEL,BDEL,AN,YF,YY,ANHI,ANLO,AFHI,AFLO,
     2       COFA,COFB,TR,R2D,D2R,SDTEMF,TTEMP,TTEMPF,VJET,
     3       FREQ,THETAS,XOVERD,XDMAX,THETSM,RNZDIA
C*****
      REAL*8 CORVAL,DUMMY1,DUMMY2
C*****
      COMMON /SUB/ MIKES,MIKEA,MIKEB,ICALL,DECB(130,35),
     1             ANGLES(130),XDIS(130,2),HTMIKE(130),HTSRCE,SDHUM,
     2             SDTEMP,V8,UNITS,KFIT(2),IWTB,IWTE,
     3             THETAM(33),ADEL,BDEL,AN,IGRC,NRUN,
     4             YF,YY,ANHI,ANLO,AFHI,AFLO,COFA(16,35),COFB(16,35),
     5             TR,R2D,D2R,SDTEMF,TTEMP,TTEMPF,
     6             IBIDO,IMRC,IBNC,IRC,IAAC,IDATE,
     7             VJET,FREQ(33),THETAS(50,33),XOVERD(50,33),NTAB(33),
     8             NTEST,XDMAX(33),THETSM(33),RNZDIA,NZTYPE(10),NFREQ
C
      REAL*8  CORR(130,33)
C
C
C     INITIALIZE ARRAY OF CORRECTION VALUES
C
      DO 100 J=1,33
      DO 100 K=1,50
  100 CORR(K,J) = 0.0
C
      REWIND 8
      GOTO (200,400,600),ICALL
C
C
C     THIS SECTION IS USED FOR MIKE RESPONSE CORRECTIONS
C
C
  200 READ (8) IRUN,ICHAN,IBAND,CORVAL,DUMMY1,DUMMY2
      IF (IRUN.EQ.0.AND.ICHAN.EQ.0) GOTO 300
      IF (ICHAN.LT.1.OR.ICHAN.GT.50) GOTO 200
      IF (IBAND.LT.1.OR.IBAND.GT.NFREQ) GOTO 200
      CORR(ICHAN,IBAND) = CORVAL
      IF ((ICHAN+MIKEA).GT.50) GOTO 200
      IM = ICHAN+MIKEA
      CORR(IM,IBAND) = CORVAL
      GOTO 200
C
  300 WRITE(6,801)
  801 FORMAT (1H1,10X,31HMIKE RESPONSE CORRECTION VALUES /)
      CALL OUTCOR(CORR,MIKEA,MIKEB,NFREQ)
```

```
C
C     APPLY CORRECTIONS
C
  250 DO 225 J=1,NFREQ
      DO 225 K=1,MIKES
  225 DECB(K,J) = DECB(K,J)-CORR(K,J)
      GOTO 900
C
C
C     THIS SECTION APPLIES REVERBERATION CORRECTIONS
C
C
  400 READ (8) IRUN,ICHAN,IBAND,DUMMY1,CORVAL,DUMMY2
      IF (IRUN.EQ.0.AND.ICHAN.EQ.0) GOTO 500
      IF (ICHAN.LT.1.OR.ICHAN.GT.50) GOTO 400
      IF (IBAND.LT.1.OR.IBAND.GT.NFREQ) GOTO 400
      CORR(ICHAN,IBAND) = CORVAL
      IF ((ICHAN+MIKEA).GT.50) GOTO 400
      IM = ICHAN+MIKEA
      CORR(IM,IBAND) = CORVAL
      GOTO 400
C
  500 WRITE(6,802)
  802 FORMAT (1H1,10X,31HREVERBERATION CORRECTION VALUES /)
      CALL OUTCOR(CORR,MIKEA,MIKEB,NFREQ)
      GOTO 250
C
C
C     APPLY BACKGOUND NOISE CORRECTIONS HERE
C
C
  600 READ (8) IRUN,ICHAN,IBAND,DUMMY1,DUMMY2,CORVAL
      IF (IRUN.EQ.0.AND.ICHAN.EQ.0) GOTO 700
      IF (ICHAN.LT.1.OR.ICHAN.GT.50) GOTO 600
      IF (IBAND.LT.1.OR.IBAND.GT.NFREQ) GOTO 600
      CORR(ICHAN,IBAND) = CORVAL
      IF ((ICHAN+MIKEA).GT.50) GOTO 600
      IM = ICHAN+MIKEA
      CORR(IM,IBAND) = CORVAL
      GOTO 600
C
  700 WRITE (6,803)
  803 FORMAT (1H1,10X,34HBACKGROUND NOISE CORRECTION VALUES /)
      CALL OUTCOR(CORR,MIKEA,MIKEB,NFREQ)
      GOTO 250
C
C     SUBROUTINE EXIT
C
  900 RETURN
      END
*DECK AIFAB
      SUBROUTINE AIFAB (P,T,RH,CF,ABDBM)
C
C     ----------------------------------------------------------------
C     THIS PROGRAM CALCULATES THE ABSORBTION OF SOUND IN AIR AS A
C     FUNCTION OF TEMPERATURE, HUMIDITY, PRESSURE AND FREQUENCY.
C     THE PROGRAM SHOULD NOT BE USED FOR CALCULATIONS OUTSIDE
C     THE TEMPERATURE RANGE OF 0 DEG F (-20 DEG C) THROUGH 104 DEG F
C     (40 DEG C)
C
```

```
C       ABDBM = AMPLITUDE ABSORBTION COEFFICIENT IN DB/METER
C       ABDBSC = AMPLITUDE ABSORBTION COEFFICIENT IN DB/SECONDS
C       ABDBTF = AMPLITUDE ABSORBTION COEFFICIENT IN DB/1000FT
C       ABDAM = AMPLITUDE ABSORBTION COEFFICIENT PER WAVELENGTH
C       ALPHA = AMPLITUDE ABSORBTION COEFFICIENT IN NEPERS PER METER
C
C       CF = ACOUSTIC FREQUENCY
C       P  = AMBIENT PRESSURE IN ATM
C       PS = SATURATED VAPOR PRESSURE FOR WATER IN ATMOSPHERES
C       T  = TEMPERATURE IN DEGREES KELVIN
C       TC = TEMPERATURE IN DEGREES CENTIGRADE
C       TF = TEMPERATURE IN DEGREES FAHRENHEIT
C       WAVEL = WAVELENGTH OF SOUND WAVE
C       -------------------------------------------------------------
C
C*****
        REAL*8 P,T,RH,CF,ABDBM
        REAL*8 PI,T1,TC,TF,VEL,VELFPS,T01,PS,H,FRO2,FRN2,
       1       ALPHA,WAVEL,ABDAM,ABDBTF,ABDBSC
C*****
        PI = 3.14159
        T1 = T/293.
        TC = T-273.
        TF = TC*1.8+32.
        VEL = 343.4*DSQRT(T1)
        VELFPS = VEL*3.28
        T01 = 273.16
C
        PS = 10.79586*(1.-T01/T)-5.02808*DLOG10(T/T01)+1.50474E-4*(1.-10.
       C**(-8.29692*((T/T01)-1.)))+0.42873E-3*(10.**(4.76955*
       C(1.-(T01/T)))-1.)-2.2195983
        PS = 10.**PS
        H = PS/P*RH
        FRO2 = P*(24.+4.41E04*H*(0.05+H)/(0.391+H))
        FRN2 = P/DSQRT(T1)*(9.+350.*H*DEXP(-6.142*((1./T1)**.331-1.)))
        ALPHA = 1.84E-11+2.1913E-4/T1*P*(2239.1/T)**2*DEXP(-2239.1/T)
       C /(FRO2+(CF**2/FRO2))
        ALPHA = ALPHA+8.1619E-4/T1*P*(3352./T)**2*DEXP(-3352./T)
       C /(FRN2+(CF**2/FRN2))
        ALPHA = ALPHA*DSQRT(T1)*CF**2/P
        WAVEL = VEL/CF
        ABDAM = ALPHA*WAVEL
        ABDBTF = ALPHA*2647.
        ABDBM = ALPHA*8.6860
        ABDBSC = ALPHA*VEL*8.686
        CONTINUE
        RETURN
        END
*DECK GRNOIS
        SUBROUTINE GRNOIS (XDIST,HDIST,JETN,H,TF,MIKES,FI,NFREQ)
C
C       CORRECTIONS FOR EACH MIKE DISTANCE AND FREQUENCY
C       SUBROUTINE TO COMPUTE GROUND REFLECTIONS
C
C*****
        REAL*8 PI2,DFFI,TT,A,B,C,X,HMIKE,RPRIME,RSMALL,Z,DR,R
C*****
        REAL*8 L1
        REAL*8 JETN(130,35),XDIST(130),HDIST(130),FI(33),L(24)
        REAL*8 TF,H
```

```
C*****
C
      DATA PI2,DFFI/6.2831853071796,0.115/
C
C     C = SPEED OF SOUND
C     DR = DIFFERENCE BETWEEN DIRECT PATH AND REFLECTED PATH FOR SOUND
C     H = SOURCE HEIGHT ABOVE GROUND
C     HMIKE = MIKE HEIGHT ABOVE GROUND (HDIST)
C     JETN IS ARRAY CONTAINING REFLECTION INDEX
C     L1 = CENTER FREQUENCY WAVE LENGTH
C     R IS THE RATIO OF AVERAGE QUADRATIC VALUE OF THE RESULTING
C     SIGNAL AND THAT OF THE MAIN SIGNAL.
C     TF = TEMPERATURE, DEGREES FARENHEIT
C     TT = TEMPERATURE, DEGREES RANKINE
C     X = GROUND DISTANCE BETWEEN SOURCE AND MICROPHONE
C     Z = RATIO OF REFLECTED PATH TO DIRECT PATH OF SOUND WAVE
C     WHEN FI(I) = CENTER FREQUENCY OF 1/3 OCTAVE BAND THEN THE BAND
C     WIDTH IS .23 TIMES THE CENTER FREQUENCY.  FOR INSTANCE THE BAND
C     WIDTH FOR 50 HZ WOULD BE 11.5.  OLD EQUATION WAS DF = .23 * FI(I)
C     DFFI = DF/(I. * FI(I)   WHICH SIMPLIFIES TO DFFI = 0.115
C
      TT = TF + 459.7
      A = PI2 * DFFI
      B = PI2 * DSQRT(1.0 + DFFI * DFFI)
      C = 49.01* DSQRT(TT)
      DO 10 I=1,NFREQ
   10 L(I) = C/FI(I)
C
      DO 100 M = 1,MIKES
      X = XDIST(M)
      HMIKE = HDIST(M)
      RPRIME = DSQRT((H + HMIKE)**2  +  X**2)
      RSMALL = DSQRT((H - HMIKE)**2  +  X**2)
      Z = RPRIME/RSMALL
      DR = RPRIME - RSMALL
      IF (DR.EQ.0.0) DR=0.001
      IF (Z.EQ.0.0) Z = 0.001
      DO 50 I=1,NFREQ
      L1 = L(I)
      R = 1.+(1/Z**2) + 2*DSIN(A*(DR/L1)) *DCOS(B*(DR/L1))/(Z*(A*(DR/L1)
     *))
      IF (R.LT.0.0) GOTO 50
      JETN(M,I) = 10.0*DLOG10(R)
   50 CONTINUE
  100 CONTINUE
C
      RETURN
      END
*DECK OUTCOR
      SUBROUTINE OUTCOR(CORR,MIKEA,MIKEB,NFREQ)
C
C     THIS SUBROUTINE PRINTS OUT THE ARRAY 'CORR' FOR NEAR AND FAR FIELDS .
C
C*****
      REAL*8 CORR(130,33)
C
  400 FORMAT(1H1)
C
      MIC = MIKEA
C
```

```
C
C     J=1 FOR NEAR-SIDELINE MIKES (MIKEA).
C     J=2 FOR  FAR-SIDELINE MIKES (MIKEB).
C
      IF ( MIC .GT. 13 ) MIC = 13
      MICADD = MIC
      MICNUM = MIC
      M1 = 1
C
      DO 2000 J = 1 , 2
C
C
      IF ( J .EQ. 1 ) WRITE ( 6,430)
  430 FORMAT (1H0,50X,23HNEAR FIELD MICROPHONES. /)
      IF ( J .EQ. 2 ) WRITE ( 6,460)
  460 FORMAT ( 1H1,50X,23H FAR FIELD MICROPHONES. / )
C
      N1 = 1
      MICNUM = MICADD
C
C     L=1 FOR THE 1ST 13 MIKES.
C     L=2 FOR THE REST OF THE MIKES.
C
      DO 1500 L = 1 , 2
C
      IF(L.EQ.1)WRITE(6,500) (I,I = N1 , MICNUM )
  500 FORMAT(5X,8HMIKE     , 8(I1,8X),I1,04(7X,I2) )
      IF(L.EQ.2)WRITE(6, 550) (I,I = N1 , MICNUM )
  550 FORMAT ( 5X,7HMIKE    , I2,11(7X,I2) )
      WRITE(6,600)
  600 FORMAT(1X,4HBAND , / )
C
C
C     'K' REFERS TO THE MIKE NUMBER.
C     'I' REFERS TO THE BAND NUMBER.
C
      DO 1000 I = 1 , NFREQ
C
      WRITE(6,900) I , (CORR(K,I) , K = M1,MIC )
  900 FORMAT(2X,I2,4X,F7.2,12(2X,F7.2) )
 1000 CONTINUE
C
      IF ( MIKEA .EQ. MICADD ) GO TO 1700
      M1 = MIC + 1
      N1 = MICNUM + 1
      MIC = MIKEA * J
      MICNUM = MIKEA
C
C
      WRITE(6,400)
C
 1500 CONTINUE
C
 1700 CONTINUE
C
      N1 = 1
      M1 = MIKEA + 1
      MIC = MIKEA + MICADD
C
 2000 CONTINUE
```

```
      WRITE(6,400)
C
      RETURN
      END
*DECK POLYX
      REAL*8 FUNCTION POLYX(COF,KFIT,X)
C
C          EVALUATE POLYNOMIAL OF ARBITRARY ORDER
C          USING HORNER'S RULE.
C
C          COF  - COFFICIENTS OF POLYNOMIAL
C                 POLYX = COF(1) + COF(2)*X + COF(3)*X**2 + .........
C                 (KFIT + 1 = NUMBER OF COEFFIFICENTS.)
C
C          KFIT - HIGHEST POWER OF POLYNOMIAL
C
C          X    - VALUE OF INDEPENDENT VARIABLE AT WHICH
C                 POLYNOMIAL IS TO BE EVALUATED.C
C*****
      REAL*8 COF(16)
      REAL*8 SUM,X
C*****
C
      NP1=KFIT + 1
      SUM = COF(NP1)
      IF (KFIT.EQ.0) GOTO 20
C
      DO 10 I=1,KFIT
      J=NP1-I
      SUM=COF(J)+SUM*X
   10 CONTINUE
C
   20 POLYX = SUM
      RETURN
      END
*DECK COMP
      SUBROUTINE COMP (Y1,Y2,TI1,TI2,TS,X1)
C
C*****
      REAL*8 D2R,TERM1,TERM2,TERM3,P2,P1,ADD
      REAL*8 TI1,TI2,TS,X1,Y1,Y2
C*****
      DATA D2R /0.017453293/
C
C
      TERM1 = DTAN((180.-TI2)*D2R)
      TERM2 = DTAN((180.-TI1)*D2R)
      IF (TERM1.EQ.0..OR.TERM2.EQ.0.) GOTO 999
      P2 = (Y2/TERM1)-(Y1/TERM2)
      TERM3 = (Y2/Y1)-1.0
      IF (TERM3.EQ.0.) GOTO 999
      P1 = P2/TERM3
      X1 = (Y1/TERM2)-P1
      IF (P1.LT.0.) ADD=0.
      IF (P1.GE.0.) ADD=180.
      TS = -1.0*(DATAN(Y1/P1)/D2R) + ADD
      RETURN
C
  999 X1 = 0.0
      TS = 0.0
```

```
      RETURN
      END
*DECK DIRECT
      SUBROUTINE DIRECT
C
C
C          DETERMINE THE NEAR FIELD/FAR FIELD
C          DIRECTIVITY RELATIONSHIP
C
C*****
      REAL*8 DECB,ANGLES,XDIS,HTMIKE,HTSRCE,SDHUM,SDTEMP,V8,UNITS,
     1       THETAM,ADEL,BDEL,AN,YF,YY,ANHI,ANLO,AFHI,AFLO,
     2       COFA,COFB,TR,R2D,D2R,SDTEMF,TTEMP,TTEMPF,VJET,
     3       FREQ,THETAS,XOVERD,XDMAX,THETSM,RNZDIA
C*****
      REAL*8 STR,DFMAX,XPEAKN,XPEAKF
      REAL*8 XMAXN,YMAXN,XMAXF,YMAXF,TS,X1,DIFMAX,S,XNEAR,
     1      XFAR,FACT,XGUESS,YNEAR,YFAR
C*****
      COMMON /SUB/ MIKES,MIKEA,MIKEB,ICALL,DECB(130,35),
     1             ANGLES(130),XDIS(130,2),HTMIKE(130),HTSRCE,SDHUM,
     2             SDTEMP,V8,UNITS,KFIT(2),IWTB,IWTE,
     3             THETAM(33),ADEL,BDEL,AN,IGRC,NRUN,
     4             YF,YY,ANHI,ANLO,AFHI,AFLO,COFA(16,35),COFB(16,35),
     5             TR,R2D,D2R,SDTEMF,TTEMP,TTEMPF,
     6             IBIDO,IMRC,IBNC,IRC,IAAC,IDATE,
     7             VJET,FREQ(33),THETAS(50,33),XOVERD(50,33),NTAB(33),
     8             NTEST,XDMAX(33),THETSM(33),RNZDIA,NZTYPE(10),NFREQ
      COMMON/TABD/STR(33),DFMAX(33),XPEAKN(33),XPEAKF(33)
C
      REAL*8 XTF(50,2),XTN(50,2)
      DIMENSION NANGT(2)
C
C     NFREQ = NUMBER OF FREQUENCIES UNDER CONSIDERATION
C
      NANGT(1) = 0
      NANGT(2) = 0
      DO 2000 N=1,NFREQ
      M = 0
C
C         FIND PEAK SPL'S FOR A GIVEN FREQUENCY
C         FOR BOTH NEAR FIELD AND FAR FIELD.P
C         (CONSIDER OASPL AND PNL JUST ANOTHER SET OF
C         FREQUENCY DATA)
C
      CALL FNDMAX(COFA(1,N),KFIT(2),ANHI,ANLO,XMAXN,YMAXN,NOMAX)
      IF (NOMAX.EQ.1) GOTO 1800
      CALL FNDMAX(COFB(1,N),KFIT(2),AFHI,AFLO,XMAXF,YMAXF,NOMAX)
      IF (NOMAX.EQ.1) GOTO 1800
C
C     COMPUTE X/D AND THETAS MAX VALUES FOR
C     PEAKS OF CURVES OF N-TH FREQUENCY
C
      CALL COMP(AN,YF,XMAXN,XMAXF,TS,X1)
      XDMAX(N) = X1/RNZDIA
      THETSM(N) = TS
      DIFMAX=YMAXN-YMAXF
      S = FREQ(N)*RNZDIA/V8
      DFMAX(N)=DIFMAX
      STR(N)=S
```

```
      XPEAKN(N)=XMAXN
      XPEAKF(N)=XMAXF
      WRITE (6,1002) S,FREQ(N),DIFMAX,AN,ADEL,YF,BDEL,XMAXN,XMAXF,
     1               THETSM(N),XDMAX(N)
C
C         GO THROUGH THIS PROCESS TWICE.
C         L = 1 TO RIGHT OF PEAK
C         L = 2 TO LEFT OF PEAK.
C
      DO 1000 L=1,2
      XNEAR=XMAXN
      XFAR=XMAXF
      NANG=0
      FACT=1.0
      IF(L.EQ.2)FACT=-1.0
  200 CONTINUE
C
C         TAKE A STEP IN THE NEAR FIELD
C         AWAY FROM THE PEAK
C
      XNEAR=XNEAR + FACT*ADEL
      IF(XNEAR.GT.ANHI.OR.XNEAR.LT.ANLO)GO TO 500
      XGUESS=XFAR + FACT*BDEL
C
C         FIND THE CORRESPONDING NEAR FIELD SPL
C
      YNEAR=POLYX(COFA(1,N),KFIT(2),XNEAR)
C
C         FIND THE FAR FIELD ANGLE WHICH GIVES
C         THE PROPER NEAR FIELD/FAR FIELD SPL DIFFERENCE
C
      YFAR=YNEAR-DIFMAX
      CALL FINDY(COFB(1,N),KFIT(2),XFAR,YFAR,XGUESS,XMAXF,
     1   AFLO,AFHI,FACT,KO)
      IF(KO.EQ.0)GO TO 500
C
C         IF KO .NE. 0 WE FOUND THE PROPER ANGLE.
C
      NANG=NANG+1
C
C         SAVE ANGLES IN TEMPORARY ARRAYS BECAUSE
C         THEY ARE IN THE WRONG ORDER FOR PLOTTING,
C         REARRANGE THEM LATER.
C
      XTF(NANG,L)=XFAR
      XTN(NANG,L)=XNEAR
      NANGT(L)=NANG
      IF (NANG.EQ.50) GOTO 1000
      GO TO 200
  500 CONTINUE
C
C         KO = 0 THEREFORE WE EITHER RAN OUT OF ANGLES OR COULDNT FIND ONE
C         OR NEAR FIELD ANGLE REQUESTED WAS OUT OF RANGE.
C
 1000 CONTINUE
C
C         REARRANGE ANGLE ARRAYS TO PUT IN PROPER ORDER
C
      N1=NANGT(2)
      IF(N1.EQ.0)GO TO 1600
```

```
C
C          DO LEFT OF PEAK FIRST
C
      DO 1500 J=1,N1
      K=N1+1-J
      M=M+1
C     COMPUTE X/D AND THETAS AND STORE
      CALL COMP(AN,YF,XTN(K,2),XTF(K,2),TS,X1)
      XOVERD(M,N) = X1/RNZDIA
      THETAS(M,N) = TS
      WRITE(6,1004) M,XTN(K,2),XTF(K,2),TS,XOVERD(M,N)
      IF (M.EQ.50) GOTO 1800
 1500 CONTINUE
 1600 CONTINUE
C
C          DO RIGHT OF PEAK NEXT
      N2=NANGT(1)
      IF(N2.EQ.0)GO TO 1800
      DO 1700 J=1,N2
      M=M+1
C     COMPUTE X/D AND THETAS AND STORE
      CALL COMP(AN,YF,XTN(J,1),XTF(J,1),TS,X1)
      XOVERD(M,N) = X1/RNZDIA
      THETAS(M,N) = TS
      WRITE(6,1004) M,XTN(J,1),XTF(J,1),TS,XOVERD(M,N)
      IF (M.EQ.50) GOTO 1800
 1700 CONTINUE
 1800 CONTINUE
      NTAB(N)=M
      IF (M.EQ.0) WRITE(6,1001) FREQ(N)
      IF (M.NE.0) WRITE(6,1003) M
 2000 CONTINUE
C
      RETURN
C
 1001 FORMAT(1H0,27HNO PEAK FOUND FOR FREQUENCY,F9.0)
 1002 FORMAT(1H1  /  10X,14HSTROUHAL NO. = , F7.2 /10X,11HFREQUENCY =,
     1  F10.1//10X,17HDIFFERENCE MAX = ,F6.2// 10X,
     2  15HNEAR SIDELINE =,F6.1,3H FT,16X,6HADEL =,F6.2 / 10X,
     3  15HFAR  SIDELINE =,F6.1,3H FT,16X,6HBDEL =,F6.2 // 26X,4HNEAR,
     4  10X,3HFAR / 10X,10HPEAK (DEG),F11.2,2X,F11.2 / / 10X,7HTHETA-S,
     5  3X,F11.2,          / 10X,3HX/D,7X,F11.2,          // 1X,
     6  33HRESULTS OF TABULATED ANGLE PAIRS //20X,4HNEAR,8X,3HFAR /
     7  10X,3HNO.,1X,2(6X,5HTHETA),6X,7HTHETA-S,8X,3HX/D / 9X,
     8  4(1H-),2(5X,7(1H-)),4X,9(1H-),6X,5(1H-) /)
 1003 FORMAT( // 5X,6HNTAB =,I3)
 1004 FORMAT(10X,I2,6X,F7.2,5X,F7.2,5X,F6.2,7X,F6.2)

C
      END
      SUBROUTINE STAB(NFREQ,FREQ,THETSM,XDMAX)
C*****
      REAL*8 STR,DFMAX,XPEAKN,XPEAKF
C*****
      COMMON/TABD/STR(33),DFMAX(33),XPEAKN(33),XPEAKF(33)
      REAL*8 FREQ(1),THETSM(1),XDMAX(1)
C     ECRITURE RESULTATS
      WRITE(6,105)
      DO 10 I=1,NFREQ
   10 WRITE(6,101)STR(I),FREQ(I),THETSM(I),XDMAX(I),DFMAX(I),
```

```
     1XPEAKN(I),XPEAKF(I)
  105 FORMAT(1H1,' STROUHAL FREQUENCE  THETAS     X/D    DIFMAX   PEAKN
     1  PEAKF (DEG)')
  101 FORMAT(1X,7F9.2)
      RETURN
      END
*DECK FINDY
      SUBROUTINE FINDY(COF,KFIT,XFIND,YFIND,XGUESS,XMAX,XLO,XHI,
     -                 DRCTN,KO)
C
C
C     ------------------------------------------------------------------
C
C     GIVEN A POLYNOMIAL OF ORDER KFIT IN 1 INDEPENDENT VARIABLE, THIS
C     SUBROUTINE WILL DETERMINE THE VALUE OF THE INDEPENDENT VARIABLE (X)
C     CORRESPONDING TO A KNOWN VALUE OF THE DEPENDENT VARIABLE (Y).  X IS
C     FOUND VIA ITERATION USING THE NEWTON-RAPHSON METHOD OF FINDING
C     ROOTS OF EQUATIONS IN ONE VARIABLE.
C
C     COF = ARRAY OF COEFFICIENTS OF X IN INCREASING ORDER
C     KFIT = HIGHEST DEGREE (ORDER) OF X
C     XFIND = THE VALUE FOUND FOR X
C     YFIND = THE VALUE OF Y FOR WHICH X IS TO BE DETERMINED
C     XGUESS = INITIAL GUESS FOR X (MAY OR MAY NOT CONVERGE)
C     XLO = LOWER LIMIT VALUE FOR X
C     XHI = HIGHER LIMIT VALUE FOR X
C     XMAX = LARGEST VALUE OF X OVER THE INTERVAL XLO,XHI
C     DRCTN = POSITIVE IF SLOPE OF CURVE IS POS & NEG IF SLOPE IS NEG
C     KO = 1  IF THE VALUE OF X IS SUCCESSFULLY FOUND
C          0  IF THE ITERATION DIVERGES & NO X VALUE IS FOUND
C
C     ------------------------------------------------------------------
C
C*****
      REAL*8 XFIND,YFIND,XGUESS,XMAX,XLO,XHI,DRCTN
      REAL*8 XN,DELTA,C1,FX,FXD,XN1,DEL,XB,XE,FXD2,AGUESS
C*****
      COMMON /OUTFLG/ IPFRQC,IPANGL,IPFNDM,IPROOT,IPFNDY
C
      REAL*8 COF(16),COFD(16),COFD2(16)
C
C     INITIALIZE PROGRAM VARIABLES
      KO = 1
      IFLAG = 0
      XN = XGUESS
      I1 = KFIT+1
      KFITD = KFIT-1
      DELTA = 1.0E-6
      DO 50 K=1,2
      COFD(K) = 0.0
   50 COFD2(K) = 0.0
C
C     FIND THE FIRST DERIVATIVE OF F(X) AND PLACE THE CALCULATED
C     COEFFICEIENTS INTO COFD ARRAY IN ASCENDING ORDER OF POWERS
C     OF THE INDEPENDENT VARIABLE.
C
      DO 100 I=2,I1
      COFD(I-1) = COF(I)*(I-1)
  100 CONTINUE
      C1 = COF(1)
```

```
      COF(1) = COF(1)-YFIND
C
C     ITERATE FOR NEW APPROXIMATIONS OF XFIND.  ITERATE A LIMIT OF 20
C     TIMES OR UNTIL NEW & OLD APPROXIMATIONS AGREE TO 6 DECIMAL
C     PLACES.  IF THE NEW VALUES DIVERGE, GOTO 600 AND COMPUTE A NEW
C     INITIAL GUESS FOR XGUESS.
C
  150 DO 200 J=1,20
      FX = POLYX(COF,KFIT,XN)
      FXD = POLYX(COFD,KFITD,XN)
      XN1 = XN-(FX/FXD)
      IF (XN1.GT.XHI.OR.XN1.LT.XLO) GOTO 600
      IF (XN1.GT.XMAX.AND.DRCTN.LT.0) GOTO 600
      IF (XN1.LT.XMAX.AND.DRCTN.GT.0) GOTO 600
      DEL = XN1-XN
      IF (DABS(DEL).LE.DELTA) GOTO 300
      XN = XN1
  200 CONTINUE
      GOTO 400
  300 XFIND = XN1
      GOTO 500
C
C
C     FIND A NEW INITIAL GUESS FOR XGUESS.  USE SECOND DERIVATIVE
C     TEST ON SUCCESSIVE INTERVALS OF X-RANGE UNTIL FIRST X VALUE TO
C     PASS THE TEST IS FOUND.  THEN BEGIN ITERATION OVER AGAIN.
C
C        THE ITERATION WILL CONVERGE WHEN:
C
C                          DABS( (F(X)*F''(X))/F'(X)**2 ) < 1.0
C
  600 IF (IFLAG.EQ.1) GOTO 400
      IFLAG = 1
      KFITD2 = KFITD-1
      I2=KFIT
      IF (I2.LT.1) GOTO 400
      IF (I2.EQ.1) I2=2
      DO 605 I=2,I2
      COFD2(I-1) = COFD(I)*(I-1)
  605 CONTINUE
      IF (DRCTN) 610,400,620
  610 XB = XLO
      XE = XMAX
      GOTO 625
  620 XB = XMAX
      XE = XHI
  625 MOVE = DABS(XE-XB)/20.0
      DO 650 K=1,20
      XB = XB+MOVE
      FX = POLYX(COF,KFIT,XB)
      FXD = POLYX(COFD,KFITD,XB)
      FXD2 = POLYX(COFD2,KFITD2,XB)
      AGUESS = (FX*FXD2)/(FXD*FXD)
      IF (DABS(AGUESS).LT.1.0) GOTO 660
  650 CONTINUE
      GOTO 400
  660 XN = AGUESS
      GOTO 150
C
  400 KO = 0
```

```
  500 COF(1) = C1
      IF (IPFNDY.EQ.0) GOTO 800
      WRITE(6,700) XFIND,YFIND,KO
  700 FORMAT(1X,9HSUB FINDY,6X,7HXFIND =,F11.6,4X,7HYFIND =,F11.6,4X,
     -        4HKO =,I4)
  800 RETURN
      END
*DECK FNDMAX
      SUBROUTINE FNDMAX(COF,KFIT,XHI,XLO,XMAX,YMAX,NOMAX)
C
C     --------------------
C     GIVEN A POLYNOMIAL OF ARBITRARY ORDER, THIS SUBROUTINE WILL FIND THE
C     VALUE OF THE INDEPENDENT VARIABLE (X) WHICH, WHEN EVALUATED, GIVES
C     THE MAXIMUM POSITIVE VALUE OF THE DEPENDENT VARIABLE (Y) OVER THE
C     SPECIFIED INTERVAL  (XLO <= X <= XHI).
C
C
C     COF = POLYNOMIAL COEFFICIENTS IN ASCENDING ORDER
C     KFIT = DEGREE OF FIT OF POLYNOMIAL (ORDER)
C     XHI  = HIGHEST VALUE WHICH X CAN TAKE ON
C     XLO  = LOWEST VALUE WHICH X CAN TAKE ON
C     XMAX = MAXIMUM VALUE OF X OVER THE INTERVAL SPECIFIED BY XLO,XHI
C     YMAX = HIGHEST VALUE OF Y OVER THE INTERVAL FOR X
C     NOMAX = FLAG - 1 = NO MAX VALUE FOUND FOR X, 0 = MAX VALUE FOUND OK
C     D  =  COEFFICIENTS OF THE 1ST DERIVATIVE (ASCENDING ORDER)
C     ROOT = ROOTS OF THE 1ST DERIVATIVE
C     --------------------
C
C*****
      REAL*8 XHI,XLO,XMAX,YMAX
      REAL*8 R,Y
C*****
      COMMON /OUTFLG/ IPFRQC,IPANGL,IPFNDM,IPROOT,IPFNDY
      REAL*8 COF(16),D(16),ROOT(16)
      NOMAX = 0
      J1 = KFIT+1
C
C
C     GENERATE 1ST DERIV FOR THE GIVEN POLYNOMIAL
C
      L = 0
      DO 200 J = 2,J1
      L = L + 1
      D(L) = L * COF(J)
  200 CONTINUE
C
C     FIND ALL THE ROOTS OF THE DERIVATIVE
C
      N = KFIT-1
      CALL ZEROS(N,D,XLO,XHI,ROOT,NROOTS,IER,IPROOT )
      IF (IER.NE.0) GOTO 700
C
C     FOR EACH ROOT IN THE INTERVAL , TEST FOR MAXIMUM Y VALUE
C
      XMAX = -1E5
      YMAX = -1E5
       DO 300 I=1,N
C
      R = ROOT(I)
C
```

```
      IF (R.GT.XHI.OR.R.LT.XLO) GOTO 300
      Y = POLYX(COF,KFIT,R)
      IF (Y.LT.YMAX) GOTO 300
      XMAX = R
      YMAX = Y
  300 CONTINUE
C
C     TEST THE ENDPOINTS OF THE INTERVAL.  IF NO ROOTS OF THE
C     DERIVATIVE FALL WITHIN THE INTERVAL, THEN ONE OF THE ENDPOINTS
C     CAN BE A LOCAL MAXIMUM, OR IF THE CURVE IS INCREASING ON THE
C     INTERVAL AFTER A LOCAL MAX, THE ENDPOINT MAY BE A MAX FOR THE INTERVAL.
C
      Y = POLYX(COF,KFIT,XLO)
      IF (Y.LT.YMAX) GOTO 400
      XMAX = XLO
      YMAX = Y
  400 Y = POLYX(COF,KFIT,XHI)
      IF (Y.LT.YMAX) GOTO 500
      XMAX = XHI
      YMAX = Y
  700 NOMAX = 1
  500 CONTINUE
      IF (IPFNDM.EQ.0) GOTO 600
      WRITE(6,501) XMAX,YMAX,NOMAX
  501 FORMAT(1X,10HSUB FNDMAX,5X,6HXMAX =,F10.5,4X,6HYMAX =,F10.5,4X,
     -       7HNOMAX =,I4)
  600 RETURN
      END
*DECK KURVFT
      SUBROUTINE KURVFT(KLISF)
C
C*****
      REAL*8 DECB,ANGLES,XDIS,HTMIKE,HTSRCE,SDHUM,SDTEMP,V8,UNITS,
     1       THETAM,ADEL,BDEL,AN,YF,YY,ANHI,ANLO,AFHI,AFLO,
     2       COFA,COFB,TR,R2D,D2R,SDTEMF,TTEMP,TTEMPF,VJET,
     3       FREQ,THETAS,XOVERD,XDMAX,THETSM,RNZDIA
C*****
      COMMON /SUB/ MIKES,MIKEA,MIKEB,ICALL,DECB(130,35),
     1             ANGLES(130),XDIS(130,2),HTMIKE(130),HTSRCE,SDHUM,
     2             SDTEMP,V8,UNITS,KFIT(2),IWTB,IWTE,
     3             THETAM(33),ADEL,BDEL,AN,IGRC,NRUN,
     4             YF,YY,ANHI,ANLO,AFHI,AFLO,COFA(16,35),COFB(16,35),
     5             TR,R2D,D2R,SDTEMF,TTEMP,TTEMPF,
     6             IBIDO,IMRC,IBNC,IRC,IAAC,IDATE,
     7             VJET,FREQ(33),THETAS(50,33),XOVERD(50,33),NTAB(33),
     8             NTEST,XDMAX(33),THETSM(33),RNZDIA,NZTYPE(10),NFREQ
      REAL*8 TEMP(70),TFRQC(70),U(16),C(70),TOL(2),U2(16)
C*****
      REAL*8 PCT,FI
C*****
C
      COMMON /OUTFLG/ IPFRQC,IPANGL,IPFNDM,IPROOT,IPFNDY
      DATA TOL /6.0,4.0/
      IPRINT = 0
      IF(KLISF.NE.0)GO TO 1000
C
C     BEGIN BY CURVE-FITTING DECIBELS VS FREQUENCY FOR EACH MIKE.
C     OBTAIN NEW Y VALUES (DECIBELS) FOR EACH CURVE AND STORE THEM
C     IN PLACE OF THE OLD UNCORRECTED DECIBEL VALUES FOR EACH MIKE.
C
```

```
      DO 20 J=1,MIKES
C
      IF( IWTB.EQ.0 .AND. IWTE.EQ.0 ) GO TO 34
C
C
C     SET UP THE ARRAYS WITH WEIGHTED POINTS
C
      IWTBS1 = IWTB - 1
      DO 25 K=1,IWTBS1
      TEMP(K)=DECB(J,K)
      TFRQC(K)=DFLOAT(K)
   25 CONTINUE
      MM = IWTB
C
      DO 28 L = IWTB , NFREQ
      DO 30 M=1,2
      IF(L.GT.IWTE.AND.M.EQ.2) GO TO 30
      TEMP(MM) = DECB(J,L)
      TFRQC(MM) = DFLOAT(L)
      MM = MM+1
   30 CONTINUE
   28 CONTINUE
      MM = MM-1
      GO TO 40
C
C
   34 CONTINUE
      MM = 0
C
      DO 35 L = 1 , NFREQ
      MM = MM + 1
      TEMP(MM) = DECB(J,L)
      TFRQC(MM) = DFLOAT(L)
   35 CONTINUE
C
   40 CONTINUE
C
      IF (IPFRQC.GT.0) IPRINT = 1
      CALL POLFIT(TFRQC,TEMP,MM,KFIT(1),U,C,IPRINT)
      KONE = KFIT(1)+1
      DO 92 LB=1,KONE
   92 U2(LB) = U(LB)
C
C     THROW OUT BAD POINTS (DEVIATION > 5%) AND REFIT WHATS LEFT
C
      MCOUNT=MM
      MINPTS = MM-(MM/3)
      IF (IPFRQC.NE.2) IPRINT = 0
      DO 32 II=1,2
      ICH = 0
C
C     PASS THRU THE LIST OF X,Y PAIRS
C     ZERO OUT THE POINTS WHICH EXCEED THE DEVIATION TOLERANCE
C     BUT DON'T DELETE MORE THAN 6 POINTS
C
      DO 44 IJ=1,MM
      PCT = (TEMP(IJ)-C(IJ))*100.0/C(IJ)
      IF (ABS(PCT).LT.TOL(II)) GOTO 44
      MCOUNT = MCOUNT - 1
      IF (MCOUNT.LE.MINPTS) GOTO 42
```

```
      TEMP(IJ) = 0.0
      TFRQC(IJ) = 0.0
      ICH = 1
   44 CONTINUE
      IB=1
   42 IF (ICH.EQ.0) GOTO 33
C
C     DELETE THE BAD POINTS & MOVE THE ARRAY CONTENTS UP
C
C
C
      LAST = MM
      KNT = 0
  220 KNT = KNT + 1
      IF ( KNT .GT. LAST ) GOTO 225
      IF ( TEMP(KNT) .NE. 0.0 ) GO TO 220
      LAST = LAST - 1
C
      DO 230 KK = KNT , LAST
      TEMP(KK) = TEMP(KK+1)
  230 TFRQC(KK) = TFRQC(KK+1)
C
      GOTO 220
  225 CONTINUE
      MM = LAST
C
C
      CALL POLFIT (TFRQC,TEMP,LAST,KFIT(1),U,C,IPRINT)
      DO 96 LB=1,KONE
   96 U2(LB) = U(LB)
   32 CONTINUE
   33 DO 60 I=1,NFREQ
      FI = DFLOAT(I)
      DECB(J,I) = POLYX(U2,KFIT(1),FI)
   60 CONTINUE
   20 CONTINUE
 1000 CONTINUE
C
C     CALL SUBROUTINES TO CALCULATE NEW PNL & OASPL VALUES
C
      CALL SUBPDB (MIKES,DECB,NFREQ)
      CALL OSPL (DECB,MIKES,NFREQ)
C
C
C
C     FIT THE CURVE SPL VS. ANGLES FOR BOTH SIDELINEA AND SIDELINEB
C     MIKES.  STORE THE COEFFICIENTS IN COFA & COFB ARRAYS BY COLUMN.
C     REPLACE THE UNCORRECTED DECIBEL VALUES IN SDLNA & SDLNB
C
      K = MIKEA+1
      K2 = KFIT(2)+1
      DO 120 I=1,NFREQ
      IPRINT = 0
      IF (MIKEA.EQ.0) GOTO 155
      IF (IPANGL.EQ.1.OR.IPANGL.EQ.3) IPRINT = 1
      CALL POLFIT(ANGLES, DECB(1,I),MIKEA,KFIT(2),U,C,IPRINT)
      DO 140 J=1,MIKEA
      DECB(J,I) = C(J)
  140 CONTINUE
      DO 200 L=1,K2
```

```
      COFA(L,I) = U(L)
  200 CONTINUE
  155 IF (MIKEB.EQ.0) GOTO 120
      IPRINT = 0
      IF (IPANGL.EQ.2.OR.IPANGL.EQ.3) IPRINT = 1
      CALL POLFIT(ANGLES(K), DECB(K,I),MIKEB,KFIT(2),U,C,IPRINT)
      DO 160 J=1,MIKEB
      J2 = J + MIKEA
      DECB(J2,I) = C(J)
  160 CONTINUE
      DO 180 L=1,K2
      COFB(L,I) = U(L)
  180 CONTINUE
  120 CONTINUE
      CALL SUBPDB (MIKES,DECB,NFREQ)
      CALL OSPL (DECB,MIKES,NFREQ)
      RETURN
      END
*DECK POLFIT
      SUBROUTINE POLFIT(X,Y,M,N,U,C,IP)
C
C     ---------------------------------------------------------------
C
C     PURPOSE:  TO PERFORM A LEAST SQUARES POLYNOMIAL
C     CURVE FIT OF DEGREE N USING M GIVEN POINTS.
C
C         X    THE ARRAY CONTAINING THE X COORDINATES
C         Y    THE ARRAY CONTAINING THE Y COORDINATES
C         M    THE NUMBER OF POINTS TO BE FIT  (LIMIT IS 100)
C         N    THE DEGREE OF FIT (LIMIT IS 15)
C         U    ON RETURN THE ARRAY OF N+1 COEFFICIENTS
C         C    ON RETURN THE ARRAY OF CORRECTED Y COORDINATES
C         IP   PRINT FLAG  --  1=ON (RESULTS ARE PRINTED),0=OFF(NO OUTPUT)
C
C     THIS DECK IS INTENDED FOR USE ON THE CDC 7600.  IF THIS PROGRAM
C     IS BEING USED ON TSS/360, REPLACE THE DIMENSION ARRAY1(13),
C     ARRAY2(12) CARD WITH :
C     DOUBLE PRECISION ARRAY1(13),ARRAY2(12)
C
C     ---------------------------------------------------------------
C
C*****
      REAL*8 X(35),Y(35),Q(100),P(100),C(35)
      REAL*8 A(16),ALPH(12),B(16),S(16),G(16),U(16)
      REAL*8 ARRAY1(13),ARRAY2(12)
C*****
      REAL*8 D,XMEA,YMEA,HUH,XMEAN,YMEAN,ERR,YSTDER,E1,F1,
     1        W1,W,V,S1,T,T3,T5,ROOT,Q7,POS,Q8,PCT
C*****
      DATA ALPH/5H  A   ,5H + B ,5H + C ,5H + D ,5H + E ,5H + F ,
     *5H + G ,5H + H ,5H + I ,5H + J ,5H + K ,5H + L /
      DATA ARRAY1/5H      ,5H X    ,5H X**2,5H X**3,5H X**4,5H X**5,
     *5H X**6,5H X**7,5H X**8,5H X**9,5HX**10,5HX**11,5HX**12/
      DATA ARRAY2/5HFIRST,6HSECOND,5HTHIRD,6HFOURTH,5HFIFTH,5HSIXTH,
     *7HSEVENTH,6HEIGHTH,5HNINTH,5HTENTH,8HELEVENTH,7HTWELFTH/
      D=DFLOAT(M)
      G(1)=0.0
      N=N+1
      IF (N.GT.12) GO TO 230
      IF (M.LT.N) GO TO 240
```

```
      XMEA=0.0
      YMEA=0.0
      HUH=0
      DO 10 I=1,M
      XMEA=XMEA+X(I)
      YMEA=YMEA+Y(I)
   10 HUH=HUH+Y(I)**2
      XMEAN=XMEA/D
      YMEAN=YMEA/D
      ERR=(D*HUH-YMEA**2)/(D**2-D)
      IF (IP.EQ.0) GOTO 500
      YSTDER=DSQRT(ERR)
      WRITE (6,250) M
      WRITE (6,260) XMEAN,YMEAN
      WRITE (6,270) YSTDER
  500 DO 20 I=1,M
      P(I)=0.0
   20 Q(I)=1.0
      DO 30 I=1,11
      A(I)=0.0
      B(I)=0.0
   30 S(I)=0.0
      E1=0.0
      F1=0.0
      W1=D
      N4=12
      I=1
   40 W=0.0
      DO 50 L=1,M
   50 W=W+Y(L)*Q(L)
      S(I)=W/W1
      IF (I-N4.GE.0) GO TO 80
      IF (I-M.GE.0) GO TO 80
      E1=0.0
      DO 60 L=1,M
   60 E1=E1+X(L)*Q(L)*Q(L)
      E1=E1/W1
      A(I+1)=E1
      W=0.0
      DO 70 L=1,M
      V=(X(L)-E1)*Q(L)-F1*P(L)
      P(L)=Q(L)
      Q(L)=V
   70 W=W+V*V
      F1=W/W1
      B(I+2)=F1
      W1=W
      I=I+1
      GO TO 40
   80 DO 90 L=3,12
   90 G(L)=0.0
      G(2)=1.0
      LL=2
      DO 130 J=1,N
      S1=0.0
      DO 110 L=1,N
      IF (L.EQ.1) GO TO 100
      LL=L+1
      G(LL)=G(LL)-A(L)*G(LL-1)-B(L)*G(LL-2)
  100 S1=S1+S(L)*G(LL)
```

```
110 CONTINUE
    U(J)=S1
    L=N+1
    DO 120 I2=2,N
    G(L)=G(L-1)
120 L=L-1
    LL=2
130 G(2)=0.0
    T=0.0
    DO 150 L=1,M
    C(L)=0.0
    J=N
    DO 140 I2=1,N
    C(L)=C(L)*X(L)+U(J)
140 J=J-1
    T3=Y(L)-C(L)
150 T=T+T3**2
    IF (M.NE.N) GO TO 160
    T5=0.0
    GO TO 170
160 T5=T/(D-DFLOAT(N))
    ROOT=DSQRT(T5)
    IF (IP.EQ.1) WRITE(6,280) ROOT
170 IF (DABS(ERR).LT.0.00001) ERR = 0.001
    Q7 = 1.0-T/(ERR*(D-1.0))
    LESS=N-1
    IF (IP.EQ.0) GOTO 501
    WRITE (6,290) LESS
    WRITE (6,300) Q7
    WRITE (6,310)
    DO 180 J=1,N
    I2=J-1
180 WRITE (6,320) I2,ALPH(J),U(J)
    N1 = N-1
    WRITE(6,330) ARRAY2(N1)
    N1 = N
    IF (N1.GT.9) N1=9
    WRITE(6,340) ALPH(1),ALPH(2),ARRAY1(2),(ALPH(I),ARRAY1(I),I=3,N1)
    IF (N.LE.9) GOTO 191
    WRITE(6,350) (ALPH(I),ARRAY1(I),I=10,N)
191 WRITE(6,360)
501 KOUNT = 0
    DO 220 L=1,M
    POS=DABS(Y(L)-C(L))
    IF (POS.LT.0.1E-08) Y(L)=C(L)
    Q8=Y(L)-C(L)
    IF (C(L).EQ.0.0) GO TO 200
    PCT=100.0*Q8/C(L)
    IF (IP.EQ.1) WRITE(6,370) X(L),Y(L),C(L),Q8,PCT
    GO TO 210
200 IF (IP.EQ.1) WRITE(6,380) X(L),Y(L),C(L),Q8
210 KOUNT=KOUNT+1
    IF (KOUNT.LT.42) GO TO 220
    IF (IP.EQ.1) WRITE(6,360)
    IF (KOUNT.EQ.42) KOUNT=0
220 CONTINUE
    N=N-1
    RETURN
230 WRITE (6,390)
    STOP
```

```
  240 LESS=N-1
      WRITE (6,400) LESS
      RETURN
C
  250 FORMAT (1H1,6X,18HNUMBER OF POINTS =,I4)
  260 FORMAT (7X,17HMEAN VALUE OF X =,F10.4 / 7X,17HMEAN VALUE OF Y =,
     -            F10.4)
  270 FORMAT (7X,21HSTANDARD ERROR OF Y =,F10.4)
  280 FORMAT (1H0,6X,35HSTANDARD ERROR OF ESTIMATE FOR Y =,F9.4 //)
  290 FORMAT (7X,16HDEGREE OF FIT = ,I2)
  300 FORMAT (7X,23HINDEX OF DETERMINATE = ,F9.7 /)
  310 FORMAT (7X,4HTERM,4X,6HLETTER,10X,11HCOEFFICIENT/)
  320 FORMAT (8X,I2,6X,A3,7X,E23.16)
  330 FORMAT (1H0,6X,12HEQUATION IS ,A8,18H DEGREE POLYNOMIAL /)
  340 FORMAT (7X,3HY =,2A3,A1,1X,7(A3,A4,1X))
  350 FORMAT (//1X,3(3H + ,A2,A5//))
  360 FORMAT (1H1,9X,8HX-ACTUAL,7X,8HY-ACTUAL,8X,6HY-CALC,5X,
     -           10HDIFFERENCE,5X,8HPCT-DIFF /)
  370 FORMAT (7X,F12.6,3X,F12.6,3X,F12.6,3X,F10.6,5X,F8.4)
  380 FORMAT (7X,F12.6,3X,F12.6,3X,F12.6,3X,F10.6,5X,8HINFINITE)
  390 FORMAT (1X,38HERROR-----ELEVENTH DEGREE IS THE LIMIT)
  400 FORMAT (1X,44HERROR------TOO FEW POINTS FOR FITTING DEGREE,I3)
      END
```

APPENDIX B

NOISE 4

```
CPROGRAMME SOURCE NO4BD
C
C     ------------------------------------------------------------------
C
C     MAIN PROGRAM (DRIVER) FOR PHASE 2 OF
C     ACOUSTICS DATA ANALYSIS.
C
C     LOGICAL UNIT ASSIGNMENTS -
C
C        05 = USER PROGRAM INPUTS
C        06 = OUTPUT (LINE PRINTER) FILE
C        07 = BINARY DUMP FROM PHASE 1 ANALYSIS (SAVED IN DISK FILE)
C         9 = ECRITURE SUR RNOISE DE PSIVAL-XDVAL
C        08 = CORRECTION DATA
C        10 = NEAR FIELD SPL READINGS AND MIKE ANGLES
C        69 = TRACES : MESURES-POLYNOMES-DIRECTIVITE CHAMP LOINTAIN
C
C     ------------------------------------------------------------------
C
      REAL*8 DUMP,DUMP1,DUMP2,DUMP3
      REAL*8 PRESS,RTOK,FTOM,TEMPK,ABDBM,DISTME
      REAL*8 VJ,FREQ,THETAS,XOVERD,XDMAX,THETSM,RNZDIA
      REAL*8 PSIS,XDN,PSI1,FFSPL,ST,STP,PSI2,VAMB,VJET,SDHUM,SDTEMP,
     *TTEMP,THUM,PSILO,PSIHI,ANGLES,DECB2,HTSRCE,HTMIKE,PSIVAL,XDVAL,
     *COFNR,AN,YY,R2D,D2R,XDIS
      COMMON /SUB1/ VJ,    FREQ(33),THETAS(50,33),XOVERD(50,33),
     *                NTAB(33),NTEST,XDMAX(33),THETSM(33),RNZDIA,
     *                NZTYPE(10),NFREQ
C
      COMMON /SUB2/   PSIS(50,35),XDN(50,35),PSI1(50,35),PSI2(50,35),
     1                FFSPL(50,35),ST(35),STP(35),
     3                IWT1,IWT2,VAMB,VJET,KFIT(2),SDHUM,
     4                SDTEMP,TTEMP,THUM,PSILO,PSIHI,MIKEA,IBIDON,
     5                ANGLES(70),DECB2(70,35),HTSRCE,HTMIKE(70),
     6                PSIVAL(50),XDVAL(50,35),COFNR(11,35),AN,YY,
     7                R2D,D2R,       XDIS(70,2),IMRC,IBNC,IRC,IAAC,
     8                IPFRQC,IPANGL,ICALL,NTYPE
C
      COMMON/TST/ITEST(70,30),NOFR(30)
      COMMON/TRAFLG/KTRAC,KTFFSPL,KTDECBM,KTDECBP
      COMMON/IDENT/NPOI,KMIC,NPOIF,KLIG,IGLDEB,IGLFIN
      COMMON/TITRE/LIB(10),IDATE(3),DB1(8,4),IPI(8),LIB1(20),LIB2(20)
      DIMENSION ITIT(20),XMOD(44)
      DIMENSION    DUMP(3446),DUMP1(74),DUMP2(1800),DUMP3(132),LIBID
     *(10),IDATBID(3)
      EQUIVALENCE (DUMP(1),VJ)
      EQUIVALENCE (DUMP1(1),ST(1))
      EQUIVALENCE (DUMP2(1),PSIVAL(1))
C
      DATA PRESS,RTOK,FTOM,D2R  /1.0, 0.55555556, 0.3048, 0.017453293/
C*****CODE DE TRAITEMENT
C      KODT 0  TRAITEMENT BANDE MODANE
C      KODT 1  TRAITEMENT DONNEES AMES
C      KODT 2  TRAITEMENT DONNEES AMES BANDES
      READ(5,101)KODT
  101 FORMAT(I5)
C*****MISE A ZERO DU TABLEAU DECB2
      DO 10 I=1,70
      DO 10 J=1,30
   10 DECB2(I,J)=0.
```

```
      R2D = 1.0/D2R
C
C
C     READ UNFORMATTED DATA FROM PHASE 1 PROGRAM
C
      NW=7
      READ(NW,END=92)DUMP
      READ(NW,END=92)DUMP3
      READ(NW,END=92)NBID
      READ(NW,END=92)LIBID
      READ(NW,END=92)IDATBID
      READ(NW,END=92)LIB1
      READ(NW,END=92)LIB2
      GO TO 100
   92 WRITE(6,91);STOP
   91 FORMAT (1H1,64HEOF ENCOUNTERED WHILE READING DATA FROM PHASE 1, LO
     *GICAL UNIT 07  /)
C
C
  100 CALL READIN(LIST,KPF,KODT,ITIT)
      IF(KPF.EQ.0)GO TO 300
      CALL STEST(MIKEA,NFREQ,ANGLES,FREQ)
  300 CONTINUE
C***** PREPARATION DU TRACE
      IF(KTRAC.EQ.0) GO TO 150
      DO 160 I=1,44
      XMOD(I)=0.
  160 CONTINUE
      KPLANC=0
      CALL OPENTR(69,XMOD)
  150 CONTINUE
      CALL OSPL(DECB2,MIKEA,NFREQ)
      CALL SUBPDB (MIKEA,DECB2,NFREQ)
      WRITE(6,1001)
 1001 FORMAT(1H1,30X,55HSOUND PRESSURE LEVELS READ AS INPUTS FOR THIS EX
     *ECUTION  /)
      CALL OUTPUT (XDIS,DECB2,ANGLES,FREQ,MIKEA,NFREQ,HTMIKE)
      IF(LIST.EQ.1)GO TO 201
C
      IF (IMRC.NE.1) GOTO 40
      ICALL = 1
      CALL CORECT
   40 IF (IBNC.NE.1) GOTO 50
      ICALL = 2
      CALL CORECT
   50 IF (IRC .NE.1) GOTO 60
      ICALL = 3
   60 IF (IAAC.NE.1) GOTO 80
C
C
C     ATMOSPHERIC ABSORBTION CORRECTIONS
C        PRESS = ATMOSPHERES
C        RTOK = RANKIN TO KELVIN CONV FACTOR
C        FTOM = FEET TO METERS CONV FACTOR
C
      TEMPK = TTEMP*RTOK
      DO 200 NF=1,NFREQ
      CALL AIFAB (PRESS,TEMPK,THUM ,FREQ(NF),ABDBM)
      DO 220 MIC=1,MIKEA
      DISTME = XDIS(MIC,2)*FTOM
```

```
      DECB2(MIC,NF) = DECB2(MIC,NF) + ABDBM*DISTME
  220 CONTINUE
  200 CONTINUE
C
   80 IF(IMRC.EQ.0.AND.IBNC.EQ.0.AND.IRC.EQ.0.AND.IAAC.EQ.0)GOTO 90
      CALL OSPL (DECB2,MIKEA,NFREQ)
      CALL SUBPDB(MIKEA,DECB2,NFREQ)
      WRITE(6,1002)
 1002 FORMAT(1H1,30X,22HDATA AFTER CORRECTIONS  /)
      CALL OUTPUT (XDIS,DECB2,ANGLES,FREQ,MIKEA,NFREQ,HTMIKE)
C
   90 CONTINUE
      CALL THMERG
      CALL COMP2
      CALL NEWPSI
C*****
C***** TRACE DES MESURES
      IF(KTDECBM.EQ.0) GO TO 190
      NCAR=17
      CALL TDECB1(KPLANC,DECB2,ANGLES,FREQ,NFREQ,MIKEA,
     1'FIG.      MESURES.',NCAR,XMOD)
  190 CONTINUE
      CALL CURVFT
C***** TRACE DES POLYNOMES D INTERPOLATION
      IF(KTDECBP.EQ.0) GO TO 180
      NCAR=35
      CALL TDECB1(KPLANC,DECB2,ANGLES,FREQ,NFREQ,MIKEA,
     1'FIG.      POLYNOMES D INTERPOLATION.',NCAR,XMOD)
  180 CONTINUE
C
      WRITE(6,1003)
 1003 FORMAT(1H1,30X,20HDATA AFTER SMOOTHING / )
      CALL OUTPUT(XDIS,DECB2,ANGLES,FREQ,MIKEA,NFREQ,HTMIKE )
      CALL OSPL(DECB2,MIKEA,NFREQ )
      CALL SUBPDB (MIKEA,DECB2,NFREQ)
C
C
C
      CALL SPCTRA
C*****TRACE DU CHAMP LOINTAIN
      IF(KTFFSPL.EQ.0)GO TO 170
      NCAR=25
      MIKEA=50
      CALL OSPL1(FFSPL,MIKEA,NFREQ)
      CALL TDECB2(KPLANC,FFSPL,PSI2,PSIVAL,FREQ,NFREQ,MIKEA,YY,
     *'FIG.      CHAMP LOINTAIN. ',NCAR,XMOD)
  170 CONTINUE
C
C
C     ECRITURE SUR DISQUE (TRACE PSI-X2 ECH NASA)
      WRITE(9)DUMP1
      WRITE(9)DUMP2
      WRITE(9)NPOI
      WRITE(9)LIB
      WRITE(9)IDATE
      REWIND 9
C
C***** FIN DE TRACE
      IF(KTRAC.EQ.0) STOP
      CALL CLOSTR(XMOD)
```

```
      WRITE(6,1004) KPLANC
 1004 FORMAT(1H1///3X,'NOMBRE DE PLANCHES=',I3////)
C*****
  201 CONTINUE
      STOP
      END
*DECK AIFAB
      SUBROUTINE AIFAB (P,T,RH,CF,ABDBM)
C
C     ------------------------------------------------------------------
C     THIS PROGRAM CALCULATES THE ABSORBTION OF SOUND IN AIR AS A
C     FUNCTION OF TEMPERATURE, HUMIDITY, PRESSURE AND FREQUENCY.
C     THE PROGRAM SHOULD NOT BE USED FOR CALCULATIONS OUTSIDE
C     THE TEMPERATURE RANGE OF 0 DEG F (-20 DEG C) THROUGH 104 DEG F
C     (40 DEG C)
C
C     ABDBM = AMPLITUDE ABSORBTION COEFFICIENT IN DB/METER
C     ABDBSC = AMPLITUDE ABSORBTION COEFFICIENT IN DB/SECONDS
C     ABDBTF = AMPLITUDE ABSORBTION COEFFICIENT IN DB/1000FT
C     ABDAM = AMPLITUDE ABSORBTION COEFFICIENT PER WAVELENGTH
C     ALPHA = AMPLITUDE ABSORBTION COEFFICIENT IN NEPERS PER METER
C
C     CF = ACOUSTIC FREQUENCY
C     P  = AMBIENT PRESSURE IN ATM
C     PS = SATURATED VAPOR PRESSURE FOR WATER IN ATMOSPHERES
C     T  = TEMPERATURE IN DEGREES KELVIN
C     TC = TEMPERATURE IN DEGREES CENTIGRADE
C     TF = TEMPERATURE IN DEGREES FAHRENHEIT
C     WAVEL = WAVELENGTH OF SOUND WAVE
C     ------------------------------------------------------------------
C
      REAL*8 ABDBM,CF,P,RH,T
      REAL*8 PI,T1,TC,TF,VEL,VELFPS,T01,PS,H,FRO2,FRN2,ALPHA,WAVEL,
     *ABDAM,ABDBTF,ABDBSC
      PI = 3.14159
      T1 = T/293.
      TC = T-273.
      TF = TC*1.8+32.
      VEL = 343.4*DSQRT(T1)
      VELFPS = VEL*3.28
      T01 = 273.16
C
      PS = 10.79586*(1.-T01/T)-5.02808*DLOG10(T/T01)+1.50474E-4*(1.-10.  -
     C**(-8.29692*((T/T01)-1.)))+0.42873E-3*(10.**(4.76955*             -
     C(1.-(T01/T)))-1.)-2.2195983
      PS = 10.**PS
      H = PS/P*RH
      FRO2 = P*(24.+4.41E04*H*(0.05+H)/(0.391+H))
      FRN2 = P/DSQRT(T1)*(9.+350.*H*DEXP(-6.142*((1./T1)**.331-1.)))
      ALPHA = 1.84E-11+2.1913E-4/T1*P*(2239.1/T)**2*DEXP(-2239.1/T)     -
     C /(FRO2+(CF**2/FRO2))
      ALPHA = ALPHA+8.1619E-4/T1*P*(3352./T)**2*DEXP(-3352./T)          -
     C /(FRN2+(CF**2/FRN2))
      ALPHA = ALPHA*DSQRT(T1)*CF**2/P
      WAVEL = VEL/CF
      ABDAM = ALPHA*WAVEL
      ABDBTF = ALPHA*2647.
      ABDBM = ALPHA*8.6860
      ABDBSC = ALPHA*VEL*8.686
      CONTINUE
```

C-2

```
      RETURN
      END
*DECK ATMAT
      SUBROUTINE ATMAT(T,RH,DIST,FREQ,ATT)
C
C     ------------------------------------------------------------
C
C     ATMAT STANDS FOR ATMOSPHERIC ATTENUATION
C
C     COMPUTES EXCESS ATMOSPHERIC ATTENUATION IN DECIBELS FOR GIVEN
C     TEMPERATURE, RELATIVE HUMIDITY, DISTANCE, AND FREQUENCY.
C     USES EMPIRICAL CURVE FITS OF DATA CONTAINED IN SOCIETY OF
C     AUTOMOTIVE ENGINEERS AEROSPACE RECOMMENDED PRACTICE NO. 266,
C     AUGUST, 1964
C
C     T       TEMPERATURE (DEGREES FAHRENHEIT)
C     RH      RELATIVE HUMIDITY
C     DIST    DISTANCE(FEET)
C     FREQ    FREQUENCY (HERTZ)
C     ATT     ATTENUATION (DECIBELS)
C
C     ------------------------------------------------------------
C
      REAL*8 ATT,DIST,FREQ,RH,T
      REAL*8 A,AC,AMM,HA,HMM,HH,AA,HTEST
      DIMENSION A(22)
      DATA A/0.870,0.750,0.652,0.570,0.505,0.452,0.406,0.369,0.335,     -
     10.308,0.286,0.268,0.253,0.240,0.231,0.225,0.220,0.215,0.210,      -
     20.208,0.202,0.200/
C
      AC = (0.1*(FREQ/1000.0)**2.05)/(1.651-.00103*T)**2.05
      AMM = (10.0*(FREQ/1000.0)**1.003)/10.0**(0.52-.00504*(T+          -
     1DSQRT(256.0-( 10.0-T/5.0)**2)))
      HA = 0.25 * RH/10.0**(1.493-.01638*T-.02*DSQRT(128.2 -            -
     1(10.0-T/5.00)**2))
      HMM = 10.0**(0.4973*DLOG10(FREQ)-1.4894)
      HH = HA / HMM
      IF(HH.GT.0.25) GO TO 1
      AA = 1.2 * HH
      GO TO 8
    1 IF(HH.GT.0.60) GO TO 2
      AA = 1.543 * HH - .086
      GO TO 8
    2 IF(HH.GT.0.95) GO TO 3
      AA = 0.84 + 0.16 * DSIN(3.14159/2.0*(HH-0.6) / 0.35)
      GO TO 8
    3 IF(HH.GT.1.25) GO TO 4
      AA = 0.87 + 0.13 * DCOS(3.14159/2.0*(HH-0.95) / 0.3)
      GO TO 8
    4 IF(HH.GT.6.5) GO TO 7
      HTEST = 1.25
      DO 5 I = 2,22
      HTEST = HTEST + 0.25
      IF(HH.LE.HTEST) GO TO 6
    5 CONTINUE
    6 AA = A(I) + ((HTEST-HH) / 0.25) * (A(I-1)-A(I))
      GO TO 8
    7 AA = 0.2
    8 CONTINUE
      ATT = (AMM*AA+AC)*(DIST*0.001)
```

```
      RETURN
      END
*DECK COMP2
      SUBROUTINE COMP2
C
      REAL*8 C,TRM,F1,VDIF,F2,TH1,TH2,D
      REAL*8 VJ,FREQ,THETAS,XOVERD,XDMAX,THETSM,RNZDIA
      REAL*8 PSIS,XDN,PSI1,FFSPL,ST,STP,PSI2,VAMB,VJET,SDHUM,SDTEMP,
     *TTEMP,THUM,PSILO,PSIHI,ANGLES,DECB2,HTSRCE,HTMIKE,PSIVAL,XDVAL,
     *COFNR,AN,YY,R2D,D2R,XDIS
      COMMON /SUB1/ VJ,        FREQ(33),THETAS(50,33),XOVERD(50,33),
     *                 NTAB(33),NTEST,XDMAX(33),THETSM(33),RNZDIA,
     *                 NZTYPE(10),NFREQ
C
      COMMON /SUB2/   PSIS(50,35),XDN(50,35),PSI1(50,35),PSI2(50,35),
     1                 FFSPL(50,35),ST(35),STP(35),
     3                 IWT1,IWT2,VAMB,VJET,KFIT(2),SDHUM,
     4                 SDTEMP,TTEMP,THUM,PSILO,PSIHI,MIKEA,IBIDON,
     5                 ANGLES(70),DECB2(70,35),HTSRCE,HTMIKE(70),
     6                 PSIVAL(50),XDVAL(50,35),COFNR(11,35),AN,YY,
     7                 R2D,D2R,       XDIS(70,2),IMRC,IBNC,IRC,IAAC,
     8                 IPFRQC,IPANGL,ICALL,NTYPE
C
C
C     DATA STATEMENT DEFINES ACOUSTIC VELOCITY, C IN FEET PER SEC
      DATA C /1115.0/
C
      TRM = VAMB/C
      F1 = RNZDIA/VJET
      VDIF = VJET - VAMB
      IF ( VDIF .EQ. 0.0 ) VDIF = VJET
      F2 = RNZDIA/VDIF
C
      DO 1000 I = 1 , NFREQ
C
      ST(I) = FREQ(I) * F1
      STP(I) = FREQ(I) * F2
C
      NJ = NTAB(I)
      IF (NJ.EQ.0) GO TO 1000
C
C     TRANSFORM EACH THETA-S TO PSI-S FOR THIS FREQUENCY
C
      DO 500 J = 1 , NJ
      TH1 = DSIN(D2R * (THETAS(J,I) - 90.) ) + TRM
      TH2 = DCOS(D2R * (THETAS(J,I) - 90.) )
      IF ( TH1 .EQ.0.0 .OR. TH2 .EQ. 0.0 ) GO TO 450
      PSIS(J,I) = DATAN(TH1/TH2)*R2D + 90.
      GO TO 500
  450 CONTINUE
      PSIS(J,I) = 0.0
  500 CONTINUE
C
C     FOR EACH NEW PSIS OF THIS FREQUENCY, CONVERT X1 TO X2
C     (XOVERD TO XDN) FOR EACH NEW PSIS VALUE
C
      D = 0.0
      DO 600 J=1,NJ
      IF (PSIS(J,I).EQ.0.0) GOTO 650
      CALL TAINT (THETAS(1,I),XOVERD(1,I),PSIS(J,I),XDN(J,I),NJ,3,NER,D)
```

```
      IF (NER.NE.1) GOTO 650
      GOTO 600
  650 XDN(J,I) = 0.0
  600 CONTINUE
C
 1000 CONTINUE
C
      RETURN
      END
*DECK CORECT
      SUBROUTINE CORECT
C
C     ICALL = 1  FOR MIKE RESPONSE CORRECTIONS
C     ICALL = 2  FOR REVERBERATION CORRECTIONS
C     ICALL = 3  FOR BACKGROUND NOISE CORRECTIONS
C
C
      REAL*8 CORVAL,DUMMY1,DUMMY2
      REAL*8 VJ,FREQ,THETAS,XOVERD,XDMAX,THETSM,RNZDIA
      REAL*8 PSIS,XDN,PSI1,FFSPL,ST,STP,PSI2,VAMB,VJET,SDHUM,SDTEMP,
     *TTEMP,THUM,PSILO,PSIHI,ANGLES,DECB2,HTSRCE,HTMIKE,PSIVAL,XDVAL,
     *COFNR,AN,YY,R2D,D2R,XDIS
      COMMON /SUB1/ VJ,       FREQ(33),THETAS(50,33),XOVERD(50,33),
     *                NTAB(33),NTEST,XDMAX(33),THETSM(33),RNZDIA,
     *                NZTYPE(10),NFREQ
C
      COMMON /SUB2/  PSIS(50,35),XDN(50,35),PSI1(50,35),PSI2(50,35),
     1               FFSPL(50,35),ST(35),STP(35),
     3               IWT1,IWT2,VAMB,VJET,KFIT(2),SDHUM,
     4               SDTEMP,TTEMP,THUM,PSILO,PSIHI,MIKEA,IBIDON,
     5               ANGLES(70),DECB2(70,35),HTSRCE,HTMIKE(70),
     6               PSIVAL(50),XDVAL(50,35),COFNR(11,35),AN,YY,
     7               R2D,D2R,      XDIS(70,2),IMRC,IBNC,IRC,IAAC,
     8               IPFRQC,IPANGL,ICALL,NTYPE
C
      DIMENSION  CORR(50,33)
C
      EQUIVALENCE  (CORR(1,1),XOVERD(1,1))
C     EQUIVALENCE STATEMENT TO SAVE CORE SPACE
C
      MIKEB = 0
C
C     INITIALIZE ARRAY OF CORRECTION VALUES
C
      DO 100 J=1,33
      DO 100 K=1,50
  100 CORR(K,J) = 0.0
C
      REWIND 8
      GOTO (200,400,600),ICALL
C
C
C     THIS SECTION IS USED FOR MIKE RESPONSE CORRECTIONS
C
C
  200 READ (8) IRUN,ICHAN,IBAND,CORVAL,DUMMY1,DUMMY2
      IF (IRUN.EQ.0.AND.ICHAN.EQ.0) GOTO 300
      IF (ICHAN.LT.1.OR.ICHAN.GT.50) GOTO 200
      IF (IBAND.LT.1.OR.IBAND.GT.NFREQ) GOTO 200
      CORR(ICHAN,IBAND) = CORVAL
```

```
      GOTO 200
C
  300 WRITE(6,801)
  801 FORMAT (1H1,10X,31HMIKE RESPONSE CORRECTION VALUES /)
      CALL OUTCOR(CORR,MIKEA,MIKEB,NFREQ)
C
C     APPLY CORRECTIONS
C
  250 DO 225 J=1,NFREQ
      DO 225 K=1,MIKEA
  225 DECB2(K,J) = DECB2(K,J)-CORR(K,J)
      GOTO 900
C
C
C     THIS SECTION APPLIES REVERBERATION CORRECTIONS
C
C
  400 READ (8) IRUN,ICHAN,IBAND,DUMMY1,CORVAL,DUMMY2
      IF (IRUN.EQ.0.AND.ICHAN.EQ.0) GOTO 500
      IF (ICHAN.LT.1.OR.ICHAN.GT.50) GOTO 400
      IF (IBAND.LT.1.OR.IBAND.GT.NFREQ) GOTO 400
      CORR(ICHAN,IBAND) = CORVAL
      GOTO 400
C
  500 WRITE(6,802)
  802 FORMAT (1H1,10X,31HREVERBERATION CORRECTION VALUES /)
      CALL OUTCOR(CORR,MIKEA,MIKEB,NFREQ)
      GOTO 250
C
C
C     APPLY BACKGOUND NOISE CORRECTIONS HERE
C
C
  600 READ (8) IRUN,ICHAN,IBAND,DUMMY1,DUMMY2,CORVAL
      IF (IRUN.EQ.0.AND.ICHAN.EQ.0) GOTO 700
      IF (ICHAN.LT.1.OR.ICHAN.GT.50) GOTO 600
      IF (IBAND.LT.1.OR.IBAND.GT.NFREQ) GOTO 600
      CORR(ICHAN,IBAND) = CORVAL
      GOTO 600
C
  700 WRITE (6,803)
  803 FORMAT (1H1,10X,34HBACKGROUND NOISE CORRECTION VALUES /)
      CALL OUTCOR(CORR,MIKEA,MIKEB,NFREQ)
      GOTO 250
C
C     SUBROUTINE EXIT
C
  900 RETURN
      END
*DECK CURVFT
      SUBROUTINE CURVFT
C
      REAL*8 TEMP,XCNT,COEF,YNEW,TOL,PCT,FJ
      REAL*8 VJ,FREQ,THETAS,XOVERD,XDMAX,THETSM,RNZDIA
      REAL*8 PSIS,XDN,PSI1,FFSPL,ST,STP,PSI2,VAMB,VJET,SDHUM,SDTEMP,
     *TTEMP,THUM,PSILO,PSIHI,ANGLES,DECB2,HTSRCE,HTMIKE,PSIVAL,XDVAL,
     *COFNR,AN,YY,R2D,D2R,XDIS
      COMMON /SUB1/ VJ,       FREQ(33),THETAS(50,33),XOVERD(50,33),
     *                 NTAB(33),NTEST,XDMAX(33),THETSM(33),RNZDIA,
     *                 NZTYPE(10),NFREQ
```

```
C
       COMMON /SUB2/  PSIS(50,35),XDN(50,35),PSI1(50,35),PSI2(50,35),
      1               FFSPL(50,35),ST(35),STP(35),
      3               IWT1,IWT2,VAMB,VJET,KFIT(2),SDHUM,
      4               SDTEMP,TTEMP,THUM,PSILO,PSIHI,MIKEA,IBIDON,
      5               ANGLES(70),DECB2(70,35),HTSRCE,HTMIKE(70),
      6               PSIVAL(50),XDVAL(50,35),COFNR(11,35),AN,YY,
      7               R2D,D2R,       XDIS(70,2),IMRC,IBNC,IRC,IAAC,
      8               IPFRQC,IPANGL,ICALL,NTYPE
C
       DIMENSION   TEMP(65),XCNT(65),COEF(11),YNEW(65)
C
       DATA TOL /6.0/
C
       IPRINT = 0
C
C
C      FIRST CURVE FIT (SMOOTH DATA) FOR EACH ANGLE ACROSS
C      BAND NO. VS SPL.  USE THE WIEGHTING PARAMS ENTERED BY
C      THE USER.  DO NOT SAVE THE COEFFICIENTS FOR THIS PASS.
C
C
       IF (IWT1.EQ.0) IWT1=NFREQ
       DO 200 MIC = 1,MIKEA
C
       DO 100 K=1,IWT1
       XCNT(K) = DFLOAT(K)
   100 TEMP(K) = DECB2(MIC,K)
C
       NEXT = IWT1+1
       LAST = IWT2
       KNT = IWT1
       IF (IWT1.EQ.NFREQ) GOTO 108
C
       DO 102 K=NEXT,LAST
       DO 103 L=1,2
       KNT = KNT+1
       XCNT(KNT) = DFLOAT(KNT)
       TEMP(KNT) = DECB2(MIC,K)
   103 CONTINUE
   102 CONTINUE
C
       DO 104 K=IWT2,NFREQ
       KNT = KNT+1
       XCNT(KNT) = DFLOAT(KNT)
       TEMP(KNT) = DECB2(MIC,K)
   104 CONTINUE
C
C
   108 IF (IPFRQC.GT.0) IPRINT=1
       CALL POLFIT (XCNT,TEMP,KNT,KFIT(1),COEF,YNEW,IPRINT)
C
C
C
C      DELETE BAD PTS (.GT.TOL)  .. BUT NOT MORE THAN 1/5-TH OF THEM
C      MOVE ARRAY CONTENTS UP AND REFIT DATA
C
       MINPTS = KNT-(KNT/5)
       MSUB = KNT-MINPTS
       MCNT = 0
```

```
C
      DO 44 IJ = 1,KNT
      PCT = ((TEMP(IJ)-YNEW(IJ))/YNEW(IJ))*100.0
      IF (DABS(PCT).LT.TOL) GOTO 44
      IF (MCNT.GT.MSUB) GOTO 44
      TEMP(IJ) = 0.0
   44 CONTINUE
C
      LAST = KNT
      K = 0
  220 K = K+1
      IF (K.GT.LAST) GOTO 225
      IF (TEMP(K).NE.0.0) GOTO 220
      LAST = LAST-1
C
      DO 230 KK=K,LAST
      TEMP(KK) = TEMP(KK+1)
  230 XCNT(KK) = XCNT(KK+1)
      TEMP(LAST+1) = 0.
      XCNT(LAST+1) = 0.
      GOTO 220
  225 IPRINT=0
      IF (IPFRQC.EQ.2) IPRINT=1
      CALL POLFIT (XCNT,TEMP,LAST,KFIT(1),COEF,YNEW,IPRINT)
C
C
      DO 120 J=1,NFREQ
      FJ = DFLOAT(J)
  120 DECB2(MIC,J) = POLYX(COEF,KFIT(1),FJ)
C
  200 CONTINUE
C
C
C     NOW CURVE FIT ANGLES VS DECIBELS FOR EACH FREQUENCY
C     AND SAVE THE KFIT(2)+1 COEFFICIENTS IN ARRAY COFNR FOR
C     EACH CURVE FIT PERFORMED
C
C
      IPRINT = 0
      IF (IPANGL.NE.0) IPRINT=1
      DO 390 K=1,MIKEA
  390 XCNT(K) = ANGLES(K)
C
      DO 400 NF = 1,NFREQ
C
      CALL POLFIT (XCNT,DECB2(1,NF),MIKEA,KFIT(2),COFNR(1,NF),
     *             YNEW,IPRINT)
C
      DO 450 K=1,MIKEA
  450 DECB2(K,NF) = YNEW(K)
  400 CONTINUE
C
      RETURN
      END
*DECK NEWPSI
      SUBROUTINE NEWPSI
C
      REAL*8 PSIINC,FN,DMON
      REAL*8 VJ,FREQ,THETAS,XOVERD,XDMAX,THETSM,RNZDIA
      REAL*8 PSIS,XDN,PSI1,FFSPL,ST,STP,PSI2,VAMB,VJET,SDHUM,SDTEMP,
```

```
      *TTEMP,THUM,PSILO,PSIHI,ANGLES,DECB2,HTSRCE,HTMIKE,PSIVAL,XDVAL,
      *COFNR,AN,YY,R2D,D2R,XDIS
       COMMON /SUB1/ VJ,        FREQ(33),THETAS(50,33),XOVERD(50,33),
      *                 NTAB(33),NTEST,XDMAX(33),THETSM(33),RNZDIA,
      *                 NZTYPE(10),NFREQ
       COMMON /SUB2/  PSIS(50,35),XDN(50,35),PSI1(50,35),PSI2(50,35),
      1                 FFSPL(50,35),ST(35),STP(35),
      3                 IWT1,IWT2,VAMB,VJET,KFIT(2),SDHUM,
      4                 SDTEMP,TTEMP,THUM,PSILO,PSIHI,MIKEA,IBIDON,
      5                 ANGLES(70),DECB2(70,35),HTSRCE,HTMIKE(70),
      6                 PSIVAL(50),XDVAL(50,35),COFNR(11,35),AN,YY,
      7                 R2D,D2R,        XDIS(70,2),IMRC,IBNC,IRC,IAAC,
      8                 IPFRQC,IPANGL,ICALL,NTYPE
C
       K=3
       PSIINC = (PSIHI-PSILO)/50.0
C
       PSIVAL(1) = PSILO
       KNT = 2
       FN = 1.0
C
   120 PSIVAL(KNT) = FN*PSIINC+PSILO
       KNT = KNT+1
       IF (KNT.GT.50) GOTO 100
       FN = FN+1.0
       GOTO 120
C
C
   100 DO 200 ICOL=1,NFREQ
       DMON = 0.0
       ICNT = NTAB(ICOL)
       IF (ICNT.EQ.0) GOTO 200
C
       DO 300 IROW = 1,50
       CALL TAINT (PSIS(1,ICOL),XDN(1,ICOL),PSIVAL(IROW),
      *            XDVAL(IROW,ICOL),ICNT,K,NER,DMON)
       IF (NER.EQ.1) GOTO 300
       XDVAL(IROW,ICOL) = 0.0
   300 CONTINUE
C
   200 CONTINUE
C
C
       RETURN
       END
*DECK NFCORR
C
       SUBROUTINE NFCORR ( NTYPE,SLD,R,F,DV,DELDB )
C
C
C      SUBROUTINE NFCORR IS USED TO COMPUTE NEAR FIELD CORRECTION VALUES FOR
C      PHASE 2 EXTRAPOLATIONS TO THE FAR FIELD.
C      THE CORRECTION VALUES ARE COMPUTED FROM TABLE INTERPOLATIONS USING
C      SUBROUTINE TAINT.
C      FOUR TABLES OF VALUES ARE PROVIDED , ONE FOR EACH NOZZLE TYPE AND
C      SIDELINE DISTANCE.
C      IF Y VALUES ARE TO BE EXTRAPOLATED , THEY(XOUT) WILL BE SET TO 0.0
C
C      NTYPE = 1    FOR   VFE NOZZLE
C      NTYPE = 2    FOR   STOVEPIPE NOZZLE
```

```
C       NTYPE = 3     FOR    104 TUBE NOZZLE
C       NTYPE = 4     FOR    104 TUBE NOZZLE WITH SHROUD NOZZLE
C
C       THE VALUES 0.,1.3 OR 1.19 WILL BE SUBTRACTED FROM THE INTERPOLATED DELDB ,
C       DEPENDING ON THE SLD VALUE .
C       IF THE SLD IS NOT WITHIN 10 PERCENT OF 4.86,4.49,8.5 OR 7.86 , DELDB WILL
C       BE SET EQUAL TO 0.0
C
C
        REAL*8 DELDB,DV,F,R,SLD
        REAL*8 SUBTR,SLD4,SLD1,DIF1,DIF2,PERC1,PERC2,A,SUB,XOUT,XIN,D
        REAL*8 X1,X,X2,X3,X4
        REAL*8 Y1,Y,Y2,Y3,Y4
        COMMON/TBX/X1(25),X2(25),X3(25),X4(25)
        COMMON/TBY/Y1(25),Y2(25),Y3(25),Y4(25)
        DIMENSION X(25,4),Y(25,4)
        DIMENSION SUBTR(4),SLD4(4),KTAB(4),SLD1(4)
        EQUIVALENCE ( X(1,1) , X1(1)),(Y(1,1),Y1(1))
C
        DATA X1/.3,.4,.5,.6,.7,.8,.9,1.,1.5,1.9,2.,3.,4.,5.,7.,9.,11.,12.,
       2        7*0.0/
        DATA Y1/2*0.,.0001,.9,3.15,4.65,2*4.9,4.1,3.75,3.65,2.65,2.05,
       2        1.45,.8,.25,9*0.0/
        DATA X2/.4,.5,.6,.7,.8,.9,1.,1.4,1.5,1.6,1.9,2.,3.,4.,5.,6.,7.,
       2        10.,16.,20.,5*0.0/
        DATA Y2/2*0.,.08,1.05,2.38,3.68,4.1,4.58,4.68,4.65,4.58,4.48,3.8,
       2        3.12,2.83,2.12,1.75,.7,7*0.0/
        DATA X3/.4,.5,.6,.7,.8,.9,1.,1.4,1.6,1.8,2.,3.,3.5,4.,5.,6.,7.,8.,
       2        10.,14.,20.,29.,50.,2*0.0/
        DATA Y3/2*0.,.5,1.28,1.88,2.3,2.75,3.3,3.5,3.8,3.8,4.15,4.2,4.15,
       2        4.03,3.9,3.66,3.45,2.9,1.83,.7,4*0.0/
        DATA X4/.5,.7,.8,.9,1.,1.2,1.4,1.6,2.,3.,4.,5.,6.,7.,8.,10.,15.,
       2        20.,30.,40.,50.,58.,60.,2*0.0/
        DATA Y4/2*0.,.9,1.68,2.13,3.,3.48,4.,4.48,5.05,5.2,5.3,5.25,5.2,
       2        5.19,4.95,4.48,4.0,3.0,2.05,.9,4*0.0/
C
        DATA KTAB/18,20,23,23/
        DATA SUBTR/1.3,1.19,1.19,1.19/
        DATA SLD1 / 4.86,3*4.49 /
        DATA SLD4/8.5,7.86,7.86,7.86/
C
        DIF1 = DABS ( SLD - SLD1(NTYPE) )
        DIF2 = DABS ( SLD - SLD4(NTYPE) )
        PERC1 = SLD1(NTYPE)/10.
        PERC2 = SLD4(NTYPE)/10.
        IF ( DIF1 .GT. PERC1 .AND. DIF2 .GT. PERC2 ) GO TO 800
C
        KFT = 2
        NPT = KTAB(NTYPE)
        A = 1115.
        SUB = 0.0
        XOUT = 0.0
C
        IF ( DIF2 .LE. PERC2 ) SUB = SUBTR(NTYPE)
C
        XIN = R*F*DV/(A*A)
        IF(XIN.LT.X(2,NTYPE).OR.XIN.GT.X(NPT-1,NTYPE)) GO TO 700
C
        D = 0.0
        CALL TAINT(X(1,NTYPE),Y(1,NTYPE),XIN,XOUT,NPT,KFT,NER,D )
```

```
C
  700 CONTINUE
      DELDB = XOUT - SUB
C
      GO TO 900
  800 CONTINUE
      DELDB = 0.0
  900 CONTINUE
C
      RETURN
      END
*DECK OSPL
      SUBROUTINE OSPL (DECB,MIKES,NFREQ)
      REAL*8 DECB
      REAL*8 S,D,DDB
      DIMENSION DECB(70,35)
      DO 400 II=1,MIKES
      S = DECB(II,1)
      DO 390 L=2,NFREQ
      D=DECB(II,L)
      IF (D.LT.40.) GO TO 390
      DDB=DABS(S-D)
      IF (DDB.GT.7.5) GO TO 380
      S=DEXP(1.1115)*DEXP(-.19077*DDB)+DMAX1(S,D)
      GO TO 390
  380 S=DEXP(1.1406)*DEXP(-.20172*DDB)+DMAX1(S,D)
  390 CONTINUE
      DECB(II,34) = S
  400 CONTINUE
      RETURN
      END
*DECK OSPL1
      SUBROUTINE OSPL1 (DECB,MIKES,NFREQ)
      REAL*8 DECB
      REAL*8 S,D,DDB
      COMMON/IDENT/NPOI,KMIC,NPOIF,KLIG,IGLDEB,IGLFIN
      DIMENSION DECB(50,35)
      DO 400 II=1,MIKES
      IF(IGLDEB.EQ.0) IGLDEB=1
      IF(IGLFIN.EQ.0) IGLFIN=NFREQ
      S = DECB(II,IGLDEB)
      DO 390 L=IGLDEB+1,IGLFIN
      D=DECB(II,L)
      IF (D.LT.40.) GO TO 390
      DDB=DABS(S-D)
      IF (DDB.GT.7.5) GO TO 380
      S=DEXP(1.1115)*DEXP(-.19077*DDB)+DMAX1(S,D)
      GO TO 390
  380 S=DEXP(1.1406)*DEXP(-.20172*DDB)+DMAX1(S,D)
  390 CONTINUE
      DECB(II,34) = S
  400 CONTINUE
      RETURN
      END
*DECK OUTCOR
      SUBROUTINE OUTCOR(CORR,MIKEA,MIKEB,NFREQ)
C
C     THIS SUBROUTINE PRINTS OUT THE ARRAY 'CORR' FOR NEAR AND FAR FIELDS .
C
      REAL*8 CORR
```

```
      DIMENSION CORR(50,33)
C
  400 FORMAT(1H1)
C
      MIC = MIKEA
C
C
C     J=1 FOR NEAR-SIDELINE MIKES (MIKEA).
C     J=2 FOR  FAR-SIDELINE MIKES (MIKEB).
C
      IF ( MIC .GT. 13 ) MIC = 13
      MICADD = MIC
      MICNUM = MIC
      M1 = 1
C
      DO 2000 J = 1 , 2
C
C
      IF ( J .EQ. 1 ) WRITE ( 6,430)
  430 FORMAT (1H0,50X,23HNEAR FIELD MICROPHONES. /)
      IF ( J .EQ. 2 ) WRITE ( 6,460)
  460 FORMAT ( 1H1,50X,23H FAR FIELD MICROPHONES. / )
C
      N1 = 1
      MICNUM = MICADD
C
C     L=1 FOR THE 1ST 13 MIKES.
C     L=2 FOR THE REST OF THE MIKES.
C
      DO 1500 L = 1 , 2
C
      IF(L.EQ.1)WRITE(6,500) (I,I = N1 , MICNUM )
  500 FORMAT(5X,8HMIKE     , 8(I1,8X),I1,04(7X,I2) )
      IF(L.EQ.2)WRITE(6, 550) (I,I = N1 , MICNUM )
  550 FORMAT ( 5X,7HMIKE    , I2,11(7X,I2) )
      WRITE(6,600)
  600 FORMAT(1X,4HBAND , / )
C
C
C     'K' REFERS TO THE MIKE NUMBER.
C     'I' REFERS TO THE BAND NUMBER.
C
      DO 1000 I = 1 , NFREQ
C
      WRITE(6,900) I , (CORR(K,I) , K = M1,MIC )
  900 FORMAT(2X,I2,4X,F7.2,12(2X,F7.2) )
 1000 CONTINUE
C
      IF ( MIKEA .EQ. MICADD ) GO TO 1700
      M1 = MIC + 1
      N1 = MICNUM + 1
      MIC = MIKEA * J
      MICNUM = MIKEA
C
C
      WRITE(6,400)
C
 1500 CONTINUE
C
 1700 CONTINUE
```

```
C
      N1 = 1
      M1 = MIKEA + 1
      MIC = MIKEA + MICADD
C
 2000 CONTINUE
      WRITE(6,400)
C
      RETURN
      END
*DECK OUTPUT
      SUBROUTINE OUTPUT (XDIS,DECB,ANGLES,FREQ,MIKES,NFREQ,HTMIKE)
C
      REAL*8 ANGLES,DECB,FREQ,HTMIKE,XDIS
      DIMENSION  XDIS(70,2),DECB(70,35),ANGLES(70),FREQ(33),HTMIKE(70)
C
      LC = MIKES / 15
      IF(MOD(MIKES,15).NE.0) LC = LC + 1
      IST = 1
      DO 375 J = 1,LC
      ISTP = IST + 14
      IF (ISTP.GT.MIKES) ISTP=MIKES
C
      WRITE (6,610) ((K),K=IST,ISTP)
      WRITE (6,620) (ANGLES(K),K=IST,ISTP)
      WRITE (6,625) (HTMIKE(K),K=IST,ISTP)
      WRITE (6,630) (XDIS(K,1),K=IST,ISTP)
      WRITE (6,640) (XDIS(K,2),K=IST,ISTP)
      WRITE (6,650)
      DO 350 L=1,NFREQ
  350 WRITE(6,670) FREQ(L), (DECB(K,L),K=IST,ISTP)
      WRITE(6,710) (DECB(K,34),K=IST,ISTP)
      WRITE(6,720) (DECB(K,35),K=IST,ISTP)
C
      WRITE (6,730)
      IST = ISTP + 1
  375 CONTINUE
C
  610 FORMAT (12H MICROPHONE:,14X,15(2X,I2,2X))
  620 FORMAT (12H ANGLE(DEG):,14X,15F6.1)
  625 FORMAT (13H HEIGHT (FT):,13X,15F6.1)
  630 FORMAT (14H CL  DIST(FT):,12X,15F6.1)
  640 FORMAT (14H REF DIST(FT):,12X,15F6.1)
  650 FORMAT (12H FREQ(HERTZ))
  670 FORMAT (2X,F9.0,15X,15F6.1)
  710 FORMAT (12H0OVERALL SPL,14X,15F6.1)
  720 FORMAT (5H PNDB,21X,15F6.1)
  730 FORMAT (1H1)
      RETURN
      END
*DECK POLFIT
      SUBROUTINE POLFIT(X,Y,M,N,U,C,IP)
C
C     ----------------------------------------------------------------
C
C     PURPOSE:  TO PERFORM A LEAST SQUARES POLYNOMIAL
C     CURVE FIT OF DEGREE N USING M GIVEN POINTS.
C
C        X   THE ARRAY CONTAINING THE X COORDINATES
C        Y   THE ARRAY CONTAINING THE Y COORDINATES
```

```
C        M   THE NUMBER OF POINTS TO BE FIT  (LIMIT IS 100)
C        N   THE DEGREE OF FIT (LIMIT IS 15)
C        U   ON RETURN THE ARRAY OF N+1 COEFFICIENTS
C        C   ON RETURN THE ARRAY OF CORRECTED Y COORDINATES
C        IP  PRINT FLAG  --  1=ON (RESULTS ARE PRINTED),0=OFF(NO OUTPUT)
C
C     THIS DECK IS INTENDED FOR USE ON THE CDC 7600.  IF THIS PROGRAM
C     IS BEING USED ON TSS/360, REPLACE THE DIMENSION ARRAY1(13),
C     ARRAY2(12) CARD WITH :
C     DOUBLE PRECISION ARRAY1(13),ARRAY2(12)
C
C     -----------------------------------------------------------------
C
      REAL*8 C,U,X,Y
      REAL*8 Q,P,A,ALPH,B,S,G,ARRAY1,ARRAY2,D,XMEA,YMEA,HUH,XMEAN,YMEAN,
     *ERR,YSTDER,E1,F1,W1,W,V,S1,T,T3,T5,ROOT,Q7,POS,Q8,PCT
      DIMENSION X(35),Y(35),Q(100),P(100),C(35)
      DIMENSION A(16),ALPH(12),B(16),S(16),G(16),U(16)
      DIMENSION ARRAY1(13),ARRAY2(12)
      DATA ALPH/5H  A  ,5H + B ,5H + C ,5H + D ,5H + E ,5H + F ,
     *5H + G ,5H + H ,5H + I ,5H + J ,5H + K ,5H + L /
      DATA ARRAY1/5H     ,5H X   ,5H X**2,5H X**3,5H X**4,5H X**5,
     *5H X**6,5H X**7,5H X**8,5H X**9,5HX**10,5HX**11,5HX**12/
      DATA ARRAY2/5HFIRST,6HSECOND,5HTHIRD,6HFOURTH,5HFIFTH,5HSIXTH,
     *7HSEVENTH,6HEIGHTH,5HNINTH,5HTENTH,8HELEVENTH,7HTWELFTH/
      D=DFLOAT(M)
      G(1)=0.0
      N=N+1
      IF (N.GT.12) GO TO 230
      IF (M.LT.N) GO TO 240
      XMEA=0.0
      YMEA=0.0
      HUH=0
      DO 10 I=1,M
      XMEA=XMEA+X(I)
      YMEA=YMEA+Y(I)
   10 HUH=HUH+Y(I)**2
      XMEAN=XMEA/D
      YMEAN=YMEA/D
      ERR=(D*HUH-YMEA**2)/(D**2-D)
      IF (IP.EQ.0) GOTO 500
      YSTDER=DSQRT(ERR)
      WRITE (6,250) M
      WRITE (6,260) XMEAN,YMEAN
      WRITE (6,270) YSTDER
  500 DO 20 I=1,M
      P(I)=0.0
   20 Q(I)=1.0
      DO 30 I=1,11
      A(I)=0.0
      B(I)=0.0
   30 S(I)=0.0
      E1=0.0
      F1=0.0
      W1=D
      N4=12
      I=1
   40 W=0.0
      DO 50 L=1,M
   50 W=W+Y(L)*Q(L)
```

```
      S(I)=W/W1
      IF (I-N4.GE.0) GO TO 80
      IF (I-M.GE.0) GO TO 80
      E1=0.0
      DO 60 L=1,M
   60 E1=E1+X(L)*Q(L)*Q(L)
      E1=E1/W1
      A(I+1)=E1
      W=0.0
      DO 70 L=1,M
      V=(X(L)-E1)*Q(L)-F1*P(L)
      P(L)=Q(L)
      Q(L)=V
   70 W=W+V*V
      F1=W/W1
      B(I+2)=F1
      W1=W
      I=I+1
      GO TO 40
   80 DO 90 L=3,12
   90 G(L)=0.0
      G(2)=1.0
      LL=2
      DO 130 J=1,N
      S1=0.0
      DO 110 L=1,N
      IF (L.EQ.1) GO TO 100
      LL=L+1
      G(LL)=G(LL)-A(L)*G(LL-1)-B(L)*G(LL-2)
  100 S1=S1+S(L)*G(LL)
  110 CONTINUE
      U(J)=S1
      L=N+1
      DO 120 I2=2,N
      G(L)=G(L-1)
  120 L=L-1
      LL=2
  130 G(2)=0.0
      T=0.0
      DO 150 L=1,M
      C(L)=0.0
      J=N
      DO 140 I2=1,N
      C(L)=C(L)*X(L)+U(J)
  140 J=J-1
      T3=Y(L)-C(L)
  150 T=T+T3**2
      IF (M.NE.N) GO TO 160
      T5=0.0
      GO TO 170
  160 T5=T/(D-DFLOAT(N))
      ROOT=DSQRT(T5)
      IF (IP.EQ.1) WRITE(6,280) ROOT
  170 IF (DABS(ERR).LT.0.00001) ERR = 0.001
      Q7 = 1.0-T/(ERR*(D-1.0))
      LESS=N-1
      IF (IP.EQ.0) GOTO 501
      WRITE (6,290) LESS
      WRITE (6,300) Q7
      WRITE (6,310)
```

```
      DO 180 J=1,N
      I2=J-1
  180 WRITE (6,320) I2,ALPH(J),U(J)
      N1 = N-1
      WRITE(6,330) ARRAY2(N1)
      N1 = N
      IF (N1.GT.9) N1=9
      WRITE(6,340) ALPH(1),ALPH(2),ARRAY1(2),(ALPH(I),ARRAY1(I),I=3,N1)
      IF (N.LE.9) GOTO 191
      WRITE(6,350) (ALPH(I),ARRAY1(I),I=10,N)
  191 WRITE(6,360)
  501 KOUNT = 0
      DO 220 L=1,M
      POS=DABS(Y(L)-C(L))
      IF (POS.LT.0.1E-08) Y(L)=C(L)
      Q8=Y(L)-C(L)
      IF (C(L).EQ.0.0) GO TO 200
      PCT=100.0*Q8/C(L)
      IF (IP.EQ.1) WRITE(6,370) X(L),Y(L),C(L),Q8,PCT
      GO TO 210
  200 IF (IP.EQ.1) WRITE(6,380) X(L),Y(L),C(L),Q8
  210 KOUNT=KOUNT+1
      IF (KOUNT.LT.42) GO TO 220
      IF (IP.EQ.1) WRITE(6,360)
      IF (KOUNT.EQ.42) KOUNT=0
  220 CONTINUE
      N=N-1
      RETURN
  230 WRITE (6,390)
      STOP
  240 LESS=N-1
      WRITE (6,400) LESS
      RETURN
C
  250 FORMAT (1H1,6X,18HNUMBER OF POINTS =,I4)
  260 FORMAT (7X,17HMEAN VALUE OF X =,F10.4 / 7X,17HMEAN VALUE OF Y =,
     *         F10.4)
  270 FORMAT (7X,21HSTANDARD ERROR OF Y =,F10.4)
  280 FORMAT (1H0,6X,35HSTANDARD ERROR OF ESTIMATE FOR Y =,F9.4 //)
  290 FORMAT (7X,16HDEGREE OF FIT = ,I2)
  300 FORMAT (7X,23HINDEX OF DETERMINATE = ,F9.7 /)
  310 FORMAT (7X,4HTERM,4X,6HLETTER,10X,11HCOEFFICIENT/)
  320 FORMAT (8X,I2,6X,A3,7X,E23.16)
  330 FORMAT (1H0,6X,12HEQUATION IS ,A8,18H DEGREE POLYNOMIAL /)
  340 FORMAT (7X,3HY =,2A3,A1,1X,7(A3,A4,1X))
  350 FORMAT (//1X,3(3H + ,A2,A5//))
  360 FORMAT (1H1,9X,8HX-ACTUAL,7X,8HY-ACTUAL,8X,6HY-CALC,5X,
     -         10HDIFFERENCE,5X,8HPCT-DIFF /)
  370 FORMAT (7X,F12.6,3X,F12.6,3X,F12.6,3X,F10.6,5X,F8.4)
  380 FORMAT (7X,F12.6,3X,F12.6,3X,F12.6,3X,F10.6,5X,8HINFINITE)
  390 FORMAT (1X,38HERROR-----ELEVENTH DEGREE IS THE LIMIT)
  400 FORMAT (1X,44HERROR------TOO FEW POINTS FOR FITTING DEGREE,I3)
      END
*DECK PNDB
      SUBROUTINE PNDB(LP,NF,PLDB,DL,ALO,ANN,ANO)
C
C     THIS SUBROUTINE HAS BEEN MODIFIED TO WORK ONLY FOR ONE-THIRD
C     OCTAVE BAND WIDTH.
C
      REAL*8 ALO,ANN,ANO,DL,PLDB
```

```
      REAL*8 SUMN
      DIMENSION  DL(24,2),ALO(24,2),ANN(24,2),ANO(24,2)
      REAL*8  LP(27),LB(24),NOY(24),NMAX,NBAR
      N=NF
      IF(N.GT.24)N=24
      DO 21 I=1,24
   21 LB(I)=LP(I)
      NMAX=0.0
      SUMN=0.0
      DO 13 I=1,N
      NOY(I)=DMIN1(ANO(I,1)*ANN(I,1)**((LB(I)-ALO(I,1))/DL(I,1)),
     1             ANO(I,2)*ANN(I,2)**((LB(I)-ALO(I,2))/DL(I,2)))
      IF(NOY(I).GE.NMAX)NMAX=NOY(I)
   13 SUMN=SUMN+NOY(I)
      NBAR = NMAX+0.15*(SUMN-NMAX)
      PLDB=40.0+10.0*DLOG10(NBAR)/DLOG10(2.0)
      IF(PLDB.LT.0.0)PLDB=0.0
      RETURN
      END
*DECK POLYX
      REAL*8 FUNCTION POLYX(COF,KFIT,X)
C
C          EVALUATE POLYNOMIAL OF ARBITRARY ORDER
C          USING HORNER'S RULE.
C
C          COF   - COFFICIENTS OF POLYNOMIAL
C                  POLYX = COF(1) + COF(2)*X + COF(3)*X**2 + .........
C                  (KFIT + 1 = NUMBER OF COEFFIFICENTS.)
C
C          KFIT - HIGHEST POWER OF POLYNOMIAL
C
C          X    -  VALUE OF INDEPENDENT VARIABLE AT WHICH
C                  POLYNOMIAL IS TO BE EVALUATED.C
      REAL*8 COF,X
      REAL*8 SUM
      DIMENSION COF(15)
C
      NP1=KFIT + 1
      SUM = COF(NP1)
      IF (KFIT.EQ.0) GOTO 20
C
      DO 10 I=1,KFIT
      J=NP1-I
      SUM=COF(J)+SUM*X
   10 CONTINUE
C
   20 POLYX = SUM
      RETURN
      END
*DECK READIN
      SUBROUTINE READIN(LIST,KPF,KODT,ITIT)
C
C     ------------------------------------------------------------------
C
C     SUBROUTINE READIN IS RESPONSIBLE FOR READING AND STORING INTO
C     COMMON THE DATA AND PARAMETERS TO BE USED FOR PROCESSING.
C     AS THE DATA IS READ IT IS ALSO PRINTED TO THE LINE PRINTER
C     RESULTS FILE (UNIT 06).
C
C     ENGINEERS INPUTS AND PARAMETERS ARE READ FROM LOGICAL UNIT
```

```
C     ASSIGNED TO VARIABLE LUN, USUALLY 5.
C
C     ANGLES AND DECIBEL READINGS FOR EACH MIKE ARE READ FROM
C     LOGICAL UNIT NUMBER IUN WHICH MAY OR MAY NOT BE THE SAME
C     AS LUN DEPENDING ON THE CONFIGUARATION CHOSEN BY THE PROGRAMMER.
C
C     ------------------------------------------------------------------
C
      REAL*8 RFACT,V8,TTEMPF,SDTEMF,VTUN,RNZDIN,HTMIK,ALPHA,H,D
      REAL*8 VJ,FREQ,THETAS,XOVERD,XDMAX,THETSM,RNZDIA
      REAL*8 PSIS,XDN,PSI1,FFSPL,ST,STP,PSI2,VAMB,VJET,SDHUM,SDTEMP,
     *TTEMP,THUM,PSILO,PSIHI,ANGLES,DECB2,HTSRCE,HTMIKE,PSIVAL,XDVAL,
     *COFNR,AN,YY,R2D,D2R,XDIS
      COMMON /SUB1/ VJ,       FREQ(33),THETAS(50,33),XOVERD(50,33),
     *               NTAB(33),NTEST,XDMAX(33),THETSM(33),RNZDIA,
     *               NZTYPE(10),NFREQ
C
      COMMON /SUB2/  PSIS(50,35),XDN(50,35),PSI1(50,35),PSI2(50,35),
     1               FFSPL(50,35),ST(35),STP(35),
     3               IWT1,IWT2,VAMB,VJET,KFIT(2),SDHUM,
     4               SDTEMP,TTEMP,THUM,PSILO,PSIHI,MIKEA,IBIDON,
     5               ANGLES(70),DECB2(70,35),HTSRCE,HTMIKE(70),
     6               PSIVAL(50),XDVAL(50,35),COFNR(11,35),AN,YY,
     7               R2D,D2R,      XDIS(70,2),IMRC,IBNC,IRC,IAAC,
     8               IPFRQC,IPANGL,ICALL,NTYPE
      COMMON/TRAFLG/KTRAC,KTFFSPL,KTDECBM,KTDECBP
      COMMON/IDENT/NPOI,KMIC,NPOIF,KLIG,IGLDEB,IGLFIN
      DIMENSION ITIT(1)
C
      DATA IUN,LUN /5,5/
      DATA RFACT   /459.6/
C
      WRITE(6,800)
      READ(IUN,910)NPOIF,KMICF,NPOI,KMIC,KLIG,LIST
      KPF=NPOIF
  910 FORMAT(2(I5,1X,I1),2I2)
      READ (IUN,901) NRUN,NTYPE
      WRITE  (6,801)  NZTYPE,NTEST,NRUN,NTYPE,NPOI,KMIC,NPOIF,KMICF
C
      READ (IUN,902) IPFRQC,IPANGL
      WRITE (6,802)  IPFRQC,IPANGL
C
      READ (IUN,902)  IMRC,IBNC,IRC,IAAC
      WRITE (6,807)   IMRC,IBNC,IRC,IAAC
C
C     LECTURE DES FLAG DE TRACE
      READ(IUN,902)KTRAC,KTFFSPL,KTDECBM,KTDECBP
      READ(IUN,1910)(ITIT(I),I=1,20)
      WRITE(6,810)KTRAC,KTFFSPL,KTDECBM,KTDECBP
      READ (IUN,903) MIKEA,KFIT(1),KFIT(2),IWT1,IWT2,IGLDEB,IGLFIN
C
      READ (IUN,904) AN,YY,PSILO,PSIHI
      WRITE (6,804)  AN,YY,PSILO,PSIHI
      AN=AN*3.2808
      YY=YY*3.2808
C
      READ (IUN,902) ITMPTP
C
      IF (ITMPTP.NE.0.AND.ITMPTP.NE.1) STOP 3
      IF (ITMPTP.NE.1) GOTO 200
```

```
      READ (IUN,905) V8,VAMB,THUM,TTEMPF,SDHUM,SDTEMF
C
C     THESE VARIABLES ARE SET EQUAL DUE TO NUMEROUS PROGRAM CHANGES.
C
      VJET = V8
      VTUN = VAMB
C
C
      TTEMP  = TTEMPF+RFACT
      SDTEMP = SDTEMF+RFACT
      GOTO 210
  200 READ (IUN,905) V8,VAMB,THUM,TTEMP,SDHUM,SDTEMP
      TTEMPF = TTEMP-RFACT
      SDTEMF = SDTEMP-RFACT
  210 RNZDIN = RNZDIA*12.0
C
      WRITE (6,806) V8,VTUN,THUM,SDHUM,RNZDIN,RNZDIA,TTEMPF,TTEMP,
     *              SDTEMF,SDTEMP
      READ (IUN,908) HTSRCE,HTMIK
      IF(KODT.NE.0)GO TO 100
C     LECTURE LIGNE 1 -BRUIT DE FOND ET MESURE
      IF(KPF.EQ.0)GO TO 300
      KPT=1
      CALL RECHPOIN(KPT,NPOIF,KBID,NFREQ,MIKEA,KMICF,KLIG,DECB2,FREQ,
     *ANGLES)
      KPT=2
  300 CALL RECHPOIN(KPT,NPOI,KPF,NFREQ,MIKEA,KMIC,KLIG,DECB2,FREQ,
     *ANGLES)
      GO TO 400
  100 IF(KODT.EQ.1)CALL LCART
      IF(KODT.EQ.2)CALL RECHNASA(NFREQ,MIKEA,DECB2,FREQ,ANGLES)
  400 WRITE(6,803)MIKEA,KFIT(1),KFIT(2),IWT1,IWT2
      DO 101 J=1,MIKEA
  101 HTMIKE(J)=HTMIK
      WRITE (6,809)  HTSRCE,(HTMIKE(I),I=1,MIKEA)
  809 FORMAT( / 1X,20HSOURCE HEIGHT (FT) =, F6.2 /
     *  1X,20HMICROPHONE HEIGHT =, 15F6.2 / 2(21X,15F6.2/) 21X,15F6.2)
C
C
C
C     CALCULATION OF MIKE DISTANCES BASED ON
C     MIKE HEIGHT AND ANGLE   ...   SEE PROGRAM DOCUMENTATION
C     FOR REFERENCE ON METHOD USED (GEOMETRY)
C
      DO 110 L=1,MIKEA
      IF (HTSRCE.EQ.HTMIKE(L)) GOTO 112
      XDIS(L,2) = AN/DSIN((180.-ANGLES(L))*D2R)
      XDIS(L,1) = XDIS(L,2)*DCOS((180.-ANGLES(L))*D2R)
      GOTO 110
  112 IF (ANGLES(L).GT.90.) ALPHA=90.-ANGLES(L)
      IF (ANGLES(L).LT.90.) ALPHA=ANGLES(L)-90.
      H = HTSRCE-HTMIKE(L)
      IF (ANGLES(L).EQ.90.) GOTO 113
      D = AN/DCOS(ALPHA*D2R)
      XDIS(L,1) = DSQRT(AN*AN+D*D)
C***** ECRITURE YY
      XDIS(L,2) = DSQRT(D*D+H*H)
      GOTO 110
  113 XDIS(L,1) = 0.0
      XDIS(L,2) = DSQRT(AN**2+H**2)
```

```
  110 CONTINUE
      WRITE (6,805) (XDIS(L,1),L=1,MIKEA)
      WRITE (6,808) (XDIS(L,2),L=1,MIKEA)
C
C*****INPUT FORMATS
C
  901 FORMAT(2I3)
  902 FORMAT (6I1)
  903 FORMAT (7I2)
  904 FORMAT (4F6.2)
  905 FORMAT (8F10.1)
  908 FORMAT (16F5.0)
  909 FORMAT (16F5.2)
 1910 FORMAT(20A4)
C
C*****OUTPUT FORMATS
C
  800 FORMAT(1H1,47HSOURCE LOCATION PROGRAM - AMBIENT VELOCITY CASE
     *  // 1X,
     * 40HINPUT PARAMETERS READ FOR THIS EXECUTION /)
  801 FORMAT(1X,16HIDENTIFICATION =,1X, 10A4,5X,4HTEST,I4,5H RUN ,
     *  I3/1X,13HNOZZLE TYPE =,I2,60X,6HPOINT ,I4,4H  M ,I1,5X,7HB DE F
     *,I4,4H  M ,I1)
  802 FORMAT(1X,16HOUTPUT FLAGS   =,1X,6I1)
  803 FORMAT(/ 1X,19HNEAR FIELD MIKES = ,I2 /
     *1X,10HKFIT(1) = ,I2,19X,10HKFIT(2) = ,I2,/1X,
     *10HIWT1    = ,I2,19X,10HIWT2    = ,I2)
  804 FORMAT(// 12X,10HNEAR FIELD, 6X,9HFAR FIELD /
     *1X,8HDISTANCE,F11.3,5X,F11.3,5X,7HPSILO =,F8.2,3X,7HPSIHI =,F8.2)
  806 FORMAT(/ 1X,8HV JET  =,F8.2,10X,7HV AMB =,F8.2 /
     * 1X,8HTHUM   =,F8.2,10X,7HSDHUM =,F8.2,10X,12HNOZZLE DIA =,
     *F8.4,9H INCHES =,F8.4,5H FEET,
     *          //  21X,5HDEG F,10X,5HDEG R / 1X,11HTUNNEL TEMP,7X,
     *F7.1,8X,F7.1 / 1X,12HSTD DAY TEMP,6X,F7.1,8X,F7.1)
  805 FORMAT(// 1X,14HMIKE DISTANCES /
     *1X,13HCENTER LINE =,10F10.3,/ 3(14X,10F10.3 /))
  807 FORMAT(1X,19HCORRECTION FLAGS  =,1X,5I1)
  808 FORMAT(/ 1X,13HSOURCE DIST =,10F10.3 / 3(14X,10F10.3 /))
  810 FORMAT(' PLOT FLAGS = ',5I1)
      END
*DECK LCART
      SUBROUTINE LCART
      REAL*8 VJ,FREQ,THETAS,XOVERD,XDMAX,THETSM,RNZDIA
      REAL*8 PSIS,XDN,PSI1,FFSPL,ST,STP,PSI2,VAMB,VJET,SDHUM,SDTEMP,
     *TTEMP,THUM,PSILO,PSIHI,ANGLES,DECB2,HTSRCE,HTMIKE,PSIVAL,XDVAL,
     *COFNR,AN,YY,R2D,D2R,XDIS
      COMMON /SUB1/ VJ,    FREQ(33),THETAS(50,33),XOVERD(50,33),
     *                 NTAB(33),NTEST,XDMAX(33),THETSM(33),RNZDIA,
     *                 NZTYPE(10),NFREQ
C
      COMMON /SUB2/  PSIS(50,35),XDN(50,35),PSI1(50,35),PSI2(50,35),
     1               FFSPL(50,35),ST(35),STP(35),
     3               IWT1,IWT2,VAMB,VJET,KFIT(2),SDHUM,
     4               SDTEMP,TTEMP,THUM,PSILO,PSIHI,MIKEA,IBIDON,
     5               ANGLES(70),DECB2(70,35),HTSRCE,HTMIKE(70),
     6               PSIVAL(50),XDVAL(50,35),COFNR(11,35),AN,YY,
     7               R2D,D2R,       XDIS(70,2),IMRC,IBNC,IRC,IAAC,
     8               IPFRQC,IPANGL,ICALL,NTYPE
C
      IUN=LUN=5
```

```
      READ (IUN,903) NFREQ
  903 FORMAT (7I2)
      READ (IUN,905) (FREQ(I),I=1,NFREQ)
  905 FORMAT (8F10.1)
      DO 101 J=1,MIKEA
      READ (LUN,909)ANGLES(J),(DECB2(J,L),L=1,NFREQ)
  909 FORMAT (16F5.2)
  101 CONTINUE
      RETURN
      END
*     DECK RECHNASA
      SUBROUTINE RECHNASA(NFREQ,MIKEA,DECB,FREQ,ANGLES)
      COMMON/IDENT/IPT1,KBNSA
      COMMON/TITRE/LIB(10),IDATE(3),DB1(8,4)
      REAL*8 DECB(70,35),FREQ(33),ANGLES(70)
      DIMENSION ANG(30),SPE(30),IPAR(2),PAR(8),NZTYP(3),FQ(30)
      DIMENSION TAB1(13),TAB2(30),TAB3(31),TAB4(31),TAB5(31)
      EQUIVALENCE (TAB1(1),IPAR(1)),(TAB1(3),PAR(1)),(TAB1(11),NZTYP(1))
      EQUIVALENCE (TAB2(1),FQ(1))
      EQUIVALENCE (TAB3(1),ANG(1))
      EQUIVALENCE (TAB5(1),SPE(1))
      DATA ND1,ND2/2,3/,NDFQ/5/,LIBO/4H    /
      IF(KBNSA.EQ.1)NFREQ=25
      IF(KBNSA.EQ.2)NFREQ=23
C     LECTURE DU POINT CONTENANT LA LIGNE 1
      READ(ND1,101,END=601)(TAB1(I),I=1,13)
      IF(IPT1.NE.IPAR(1))WRITE(6,104)IPAR(1);STOP
  104 FORMAT(' ERREUR POINT LU =',I5)
      NPOI=IPAR(1)
      N=IPAR(2)
      MIKEA=N
  101 FORMAT(31A4)
      DB1(1,1)=0.
      DB1(1,2)=PAR(5)/3.2808
      READ(ND1,101)(TAB2(I),I=1,30)
      DO 10 I=1,NFREQ
   10 FREQ(I)=FQ(I+NDFQ)
      READ(ND1,101)(TAB3(I),I=1,N)
      DO 20 I=1,N
   20 ANGLES(I)=ANG(I)
      READ(ND1,101)(TAB4(I),I=1,N)
      DO 30 IA=1,N
      READ(ND1,101)(TAB5(I),I=1,31)
      DO 40 IDB=1,NFREQ
   40 DECB(IA,IDB)=SPE(IDB+NDFQ)
   30 CONTINUE
      DO 5 I=1,3
    5 LIB(I)=NZTYP(I)
      DO 6 I=4,10
    6 LIB(I)=LIBO
      DO 7 I=1,3
    7 IDATE(I)=0
      GO TO 900
  601 WRITE(6,102)ND1
  102 FORMAT(' FIN DE FICHIER ETIQ. LOGIQUE ',I2)
      STOP
  900 RETURN
      END
*DECK RECHPOIN
      SUBROUTINE RECHPOIN(KPT,NPOI,KF,NFREQ,MIKEA,KMIC,KLIG,DECB,FREQ,
```

```
     *ANGLES)
C
C     INTERFACE PROG AMES ET PROG ONERA
C     PAS DE CALIBRATION SUR LES MESURES BRUTES
C     RETRAIT DU BRUIT DE FOND SUIVANT CODAGE
C     LECTURE BRUIT DE FOND AVANT MESURE
C                                    NO MICROS
C     IPI(1)=0- 7M,LIGNE 1,MICRO 1      1
C     IPI(2)=0- 7M,LIGNE 1,MICRO 2      2
C     IPI(3)=0- 7M,LIGNE 2,MICRO 1      3
C     IPI(4)=0- 7M,LIGNE 2,MICRO 2      4
C     IPI(5)=7-14M,LIGNE 1,MICRO 1      5
C     IPI(6)=7-14M,LIGNE 1,MICRO 2      6
C     IPI(7)=7-14M,LIGNE 2,MICRO 1      7
C     IPI(8)=7-14M,LIGNE 2,MICRO 2      8
C
      REAL*8 OMEGA(8,40),DECB(70,35),FREQ(33),ANGLES(70)
      REAL*8 AUX(70,30),DECBF(70,30),TM,TF
      COMMON/TST/ITEST(70,30),NOFR(30)
      COMMON/TITRE/LIB(10),IDATE(3),DB1(8,4),IPI(8)
      DIMENSION LTT(10),JFR(44),IRG(2)
      DIMENSION IDB1(8,6),TETA(8,40),SDB(8,40,50)
      DIMENSION TAB1(050),TAB2(050),ITAB(6),TAB(4),ANG(40),SPE(45)
      EQUIVALENCE(TAB1(1),TITR)
      EQUIVALENCE (TAB1(2),ITAB(1))
      EQUIVALENCE (TAB1(8),TAB(1))
      EQUIVALENCE (TAB1(12),LTT(1))
      EQUIVALENCE (TAB1(22),ANG(1))
      EQUIVALENCE(TAB2(1),ANGLE)
      EQUIVALENCE(TAB2(2),SPE(1))
C
      DATA IPI/1,2,3,4,5,6,7,8/,NBPIST/4/
C
      DATA JFR/3,4,5,6,8,10,12,16,20,25,31,40,50,63,80,100,125,160,200,
     *250,315,400,500,630,800,1000,1250,1600,2000,2500,3150,4000,5000,
     *6300,8000,10000,12500,16000,20000,25000,31500,40000,50000,63000/
      DATA IUN/5/
C
C     FREQUENCE 80 A 20000HZ
C
      ND=2
      NUMER =1
      REWIND ND
   50 KODR=0
  600 CONTINUE
      READ(ND,105,END=610)(TAB1(I),I=1,50)
  105 FORMAT(50A4)
      IF(ITAB(1).NE.NPOI    )GO TO 500
C              NOUVELLE INDEXATION
      INDEX=ITAB(4)
C              MISE EN TABLEAU DU TITRE
      DO 12 I=1,10
   12 LIB(I)=LTT(I)
      IDJ=ITAB(2)/4096
      IDF=ITAB(2)-IDJ*4096
      IUJ=IDF/256
      IDF=IDF-IUJ*256
      IDATE(1)=IDJ*10+IUJ
      IDM=IDF/16
      IUM=IDF-IDM*16
```

```
      IDATE(2)=IDM*10+IUM
      IDATE(3)=79
      DO 20 I=1,6
   20 IDB1(INDEX,I)=ITAB(I)
      DO 22 I=1,4
   22 DB1(INDEX,I)=TAB(I)
      DO 24 I=1,ITAB(5)
   24  TETA(INDEX,I)=ANG(I)
C              REMISE EN ORDRE DES SPECTRESB SI BANDE EN SENS INVERSE
      DO 250 LA=1,ITAB(5)
      IF(ITAB(6).GT.1) IA=ITAB(5)+1-LA;GO TO 170
      IA=LA
C              LECTURE DES SPECTRES
  170 CONTINUE
      READ(ND,105,END=630)(TAB2(I),I=1,50)
C              RANGEMENT DES ANGLES ET DES SPECTRES
      OMEGA(INDEX,IA)=ANGLE
      DO 250 IDB=1,45
  250 SDB(INDEX,IA,IDB)=SPE(IDB)
      NUMER=NUMER+1
      IF(NUMER.LE.NBPIST) GO TO 50
      GO TO 700
  500 DO 25 J=1,ITAB(5)
      READ(ND,105,END=620)(TAB2(I),I=1,50)
   25 CONTINUE
      GO TO 600
  610 KODR=1
      GO TO 650
  620 KODR=2
      GO TO 650
  630 KODR=3
  650 WRITE(6,104)KODR;STOP
  104 FORMAT(' ERREUR EN LECTURE BANDE KODR=',I5)
  700 CONTINUE
C     MISE EN TABLEAU DES FREQ   DES ANGLES ET SPECTRES DE 0A14 METRES
C     RANG-1 DE LA PREMIERE FREQ TRAITEE
      NFDEC=14
      NFREQ=25
      DO 5 IDB=1,NFREQ
    5 FREQ(IDB)= JFR(IDB+NFDEC)
C     CHOIX DU TRAITEMENT
C     KMIC=0  MICROS A+ B MOYENNES
C     KMIC=1  MICRO A
C     KMIC=2  MICRO B
C
C
      IA=IB=0
C     LIGNE 1 OU 2
      IF(KMIC.NE.0.AND.KMIC.NE.1)GO TO 1000
C     MICRO A
      IF(KLIG.EQ.1) M1=IPI(1);M2=IPI(5)
      IF(KLIG.EQ.2) M1=IPI(3);M2=IPI(7)
      NT1=IDB1(M1,5)
      I=1
      LEGAL=0
      DO 10 K=1,IDB1(M1,5)
      K1=INT(OMEGA(M1,K)+0.5)
      K2=INT(OMEGA(M2,I)+0.5)
      IF(K1.EQ.K2) I=I+1;LEGAL=LEGAL+1
   10 CONTINUE
```

```
C      SECTEUR Ø-7M
       DØ 30 I=1,IDB1(M1,5)
       IA=IA+1
       ANGLES(IA)=ØMEGA(M1,I)
       DØ 30 IDB=1,NFREQ
    30 DECB (IA,IDB)=SDB(M1,I  ,IDB+NFDEC)
C      SECTEUR 7-14M
       DØ 40 J=LEGAL    +1,IDB1(M2,5)
       IA=IA+1
       ANGLES(IA)=ØMEGA(M2,J)
       DØ 40 IDB=1,NFREQ
    40 DECB (IA,IDB)=SDB(M2,J,IDB+NFDEC)
       IF(KMIC.NE.0)GØ TØ 2000
C      MICRØ B
  1000 IF(KLIG.EQ.1) M1=IPI(2);M2=IPI(6)
       IF(KLIG.EQ.2) M1=IPI(4);M2=IPI(8)
       NT1=IDB1(M1,5)
       I=1
       LEGAL=0
       DØ 11 K=1,IDB1(M1,5)
       K1=INT(ØMEGA(M1,K)+0.5)
       K2=INT(ØMEGA(M2,I)+0.5)
       IF(K1.EQ.K2) I=I+1;LEGAL=LEGAL+1
    11 CØNTINUE
C      SECTEUR 0-7M
       DØ 31 I=1,IDB1(M1,5)
       IB=IB+1
       ANGLES(IB)=ØMEGA(M1,I)
       DØ 31 IDB=1,NFREQ
    31 AUX(IB,IDB)=SDB(M1,I,IDB+NFDEC)
C      SECTEUR 7-14M
       DØ 41 J=LEGAL+1,IDB1(M2,5)
       IB=IB+1
       ANGLES(IB)=ØMEGA(M2,J)
       DØ 41 IDB=1,NFREQ
    41 AUX(IB,IDB)=SDB(M2,J,IDB+NFDEC)
       IF(KMIC.NE.0)GØ TØ 3000
       MIKEA=IA
C      MØYENNE MICRØ A + MICRØ B
       DØ 70 I=1,MIKEA
       DØ 70 IDB=1,NFREQ
    70 DECB(I,IDB)=(DECB(I,IDB)+AUX(I  ,IDB))/2.
       GØ TØ 5000
  2000 MIKEA=IA
       GØ TØ 5000
  3000 MIKEA=IB
       DØ 72 I=1,MIKEA
       DØ 72 IDB=1,NFREQ
    72 DECB(I,IDB)=AUX(I,IDB)
  5000 IF(MIKEA.GT.70)WRITE(6,106)MIKEA;STØP
   106 FØRMAT(' TRØP D  ANGLES LIGNE 1 ØU 2  =',I5)
       IF(KF.EQ.0)RETURN
C      SAUVEGARDE BRUIT DE FØND
       IF(KPT.NE.1)GØ TØ 900
       DØ 80 I=1,MIKEA
       DØ 80 IDB=1,NFREQ
    80 DECBF(I,IDB)=DECB(I,IDB)
       RETURN
   900 CØNTINUE
       DØ 81 I=1,MIKEA
```

```
      DO 81 IDB=1,NFREQ
   81 ITEST(I,IDB)=0
C     RETRAIT BRUIT DE FOND
      DO 82 I=1,MIKEA
      DO 82 IDB=1,NFREQ
      DELT=DECB(I,IDB)-DECBF(I,IDB)
      IF(DELT.LE.0.)DECB(I,IDB)=0.;GO TO 82
      IF(DELT.LT.5.)ITEST(I,IDB)=1000
      TM=DECB(I,IDB)
      TF=DECBF(I,IDB)
      DECB(I,IDB)=10.*DLOG10(10.**(TM/10.)-10.**(TF/10.))
   82 CONTINUE
      RETURN
      END
*DECK STEST
      SUBROUTINE STEST(MIKES,NFREQ,ANGLES,FREQ)
C
      REAL*8 ANGLES(70),FREQ(33)
      COMMON/TST/ITEST(70,30)
C     TEST BRUIT DE FOND
      WRITE(6,605)
  605 FORMAT(1H1//' TEST BRUIT DE FOND'//)
      LC = MIKES / 15
      IF(MOD(MIKES,15).NE.0) LC = LC + 1
      IST = 1
      DO 375 J = 1,LC
      ISTP = IST + 14
      IF (ISTP.GT.MIKES) ISTP=MIKES
C
      WRITE (6,610) ((K),K=IST,ISTP)
      WRITE (6,620) (ANGLES(K),K=IST,ISTP)
      WRITE (6,650)
      DO 350 L=1,NFREQ
  350 WRITE(6,670) FREQ(L), (ITEST(K,L),K=IST,ISTP)
C
      WRITE (6,730)
      IST = ISTP + 1
  375 CONTINUE
C
  610 FORMAT (12H MICROPHONE:,14X,15(2X,I2,2X))
  620 FORMAT (12H ANGLE(DEG):,14X,15F6.1)
  650 FORMAT (12H FREQ(HERTZ))
  670 FORMAT (2X,F9.0,15X,15(2X,I2,2X))
  730 FORMAT (1H1)
      RETURN
      END
*DECK SPCTRA
      SUBROUTINE SPCTRA
C
      REAL*8 PRESS,FTOM,CONST,RTOK,DEGK,DV,SLD,ABDBM,DELDB,TERM,SPL,
     *PHI2,DIST,DISTN,ABSCOR
      REAL*8 VJ,FREQ,THETAS,XOVERD,XDMAX,THETSM,RNZDIA
      REAL*8 PSIS,XDN,PSI1,FFSPL,ST,STP,PSI2,VAMB,VJET,SDHUM,SDTEMP,
     *TTEMP,THUM,PSILO,PSIHI,ANGLES,DECB2,HTSRCE,HTMIKE,PSIVAL,XDVAL,
     *COFNR,AN,YY,R2D,D2R,XDIS
      COMMON /SUB1/ VJ,        FREQ(33),THETAS(50,33),XOVERD(50,33),
     *                 NTAB(33),NTEST,XDMAX(33),THETSM(33),RNZDIA,
     *                 NZTYPE(10),NFREQ
C
      COMMON /SUB2/  PSIS(50,35),XDN(50,35),PSI1(50,35),PSI2(50,35),
```

```
     1                FFSPL(50,35),ST(35),STP(35),
     3                IWT1,IWT2,VAMB,VJET,KFIT(2),SDHUM,
     4                SDTEMP,TTEMP,THUM,PSILO,PSIHI,MIKEA,IBIDON,
     5                ANGLES(70),DECB2(70,35),HTSRCE,HTMIKE(70),
     6                PSIVAL(50),XDVAL(50,35),COFNR(11,35),AN,YY,
     7                R2D,D2R,       XDIS(70,2),IMRC,IBNC,IRC,IAAC,
     8                IPFRQC,IPANGL,ICALL,NTYPE
C
C
      PRESS = 1.0
      FTOM = 0.3048
      CONST = 20.0*DLOG10(YY/AN)
      RTOK = 0.55555556
      DEGK = TTEMP*RTOK
      DV = VJET - VAMB
      SLD = AN / RNZDIA
C
C
C     PASS THROUGH EACH FREQUENCY AND DEFINE THE FAR FIELD SPECTRA
C
      IFCNT = 50
      DO 200 J=1,NFREQ
C
      IF (NTAB(J).EQ.0) GOTO 250
      WRITE(6,600) FREQ(J),ST(J)
  600 FORMAT(1H1,12H FREQUENCY =,F9.0,18X,14HSTROUHAL NO. =,F9.3,17X,
     *          26HRADIAL DISTANCE CORRECTION )
      WRITE(6,650) STP(J),CONST
  650 FORMAT(40X,14HST-PRIME NO. =,F9.3,17X,15H20*LOG(YY/AN) =,F9.4/)
      WRITE(6,675)
  675 FORMAT(109X, 9HCORRECTED )
      WRITE(6,700)
  700 FORMAT(58X,14HNEAR FIELD SPL,5X,10HABSORBTION,5X,10HNEAR FIELD,
     *          5X,13HFAR FIELD SPL )
      WRITE(6,725)
  725 FORMAT(5X,3HNO.,6X,5HPSI-S,8X,2HX2,8X,4HPSI1,8X,4HPSI2,8X,
     *          8HAT PSI-S,8X,2(10HCORRECTION,5X),3X,8HAT PSI-S )
C
C
C     FIND PSI1 (PSI-I1) FOR EACH PSIVAL, XDVAL
C     PAIR KNOWN FOR THIS FREQUENCY
C
      DO 100 IROW = 1,IFCNT
C
      ABDBM = 0.0
      DELDB = 0.0
C
      IF ( PSIVAL(IROW) .NE. 90. ) GO TO 140
      PSI1(IROW,J) = 90.
      PSI2(IROW,J) = 90.
      GO TO 175
C
  140 CONTINUE
      IF ( PSIVAL(IROW) .EQ. 180. ) GO TO 145
      TERM = DTAN((180.-PSIVAL(IROW))*D2R)
      TERM = (AN/TERM)+XDVAL(IROW,J)
      IF (TERM.NE.0.) GOTO 150
  145 CONTINUE
      PSI1(IROW,J) = 0.0
      GOTO 161
```

```
  150 PSI1(IROW,J) = -1.0*(DATAN(AN/TERM))*R2D
      IF ( PSI1(IROW,J) .LT. 0. ) PSI1(IROW,J) = PSI1(IROW,J) + 180.
C
C
C     DETERMINE PSI-I2 FOR EACH KNOWN PSI-I1
C     PSI-I2 WILL BE USED TO COMPUTE ARBITRARY FAR FIELD SPL
C
      IF ( PSIVAL(IROW) .EQ. 180. ) GO TO 161
      TERM = DTAN((180.-PSIVAL(IROW))*D2R)
      TERM = (YY/TERM)+XDVAL(IROW,J)
      IF (TERM.EQ.0.) GOTO 161
      PSI2(IROW,J) = -1.0*(DATAN(YY/TERM))*R2D
      IF ( PSI2(IROW,J) .LT. 0.) PSI2(IROW,J) = PSI2(IROW,J) + 180.
      GOTO 175
  161 PSI2(IROW,J) = 0.0
      GOTO 171
C
C
C     EVALUATE NEAR FIELD SPL AND ADJUST
C     FOR DISTANCE FOR PSI2 JUST COMPUTED
C
  175 SPL = POLYX(COFNR(1,J),KFIT(2),PSIVAL(IROW))
      FFSPL(IROW,J) = SPL-CONST
C
C     ADJUST FOR ATMOSPHERIC ATTENUATION
C
      PHI2 = 180. - PSIVAL(IROW)
C
C
      DIST = YY/DSIN(PHI2*D2R)
      CALL AIFAB(PRESS,DEGK,SDHUM,FREQ(J),ABDBM)
      FFSPL(IROW,J) = FFSPL(IROW,J)-ABDBM*DIST*FTOM
      DISTN = AN/DSIN(PHI2*D2R)
      CALL NFCORR(NTYPE,SLD,DISTN,FREQ(J),DV,DELDB )
      FFSPL(IROW,J) = FFSPL(IROW,J) - DELDB
C
      GOTO 170
  171 FFSPL(IROW,J) = 0.0
C
  170 CONTINUE
      ABSCOR = ABDBM*FTOM*DIST
C
      WRITE(6,802)IROW,PSIVAL(IROW),XDVAL(IROW,J),PSI1(IROW,J),
     *           PSI2(IROW,J),SPL,ABSCOR,DELDB,FFSPL(IROW,J)
  802 FORMAT(5X,I2,5X,F7.2,5X,F6.2,2(5X,F7.2) ,8X,2(F7.2, 9X),
     *        F6.2,10X,F7.2 )
C
  100 CONTINUE
      CALL WRTEQN (KFIT(2),COFNR(1,J))
      GO TO 200
  250 DO 110 IROW=1,IFCNT
  110 FFSPL(IROW,J)=0.
  200 CONTINUE
C
      RETURN
      END
*DECK SUBPDB
      SUBROUTINE SUBPDB (MIKES,DECIBL,NFREQ)
      REAL*8 DECIBL
      REAL*8 DL,ALO,ANN,ANO,PDB
```

```
      REAL*8  LP
      DIMENSION DECIBL(70,35),LP(27)
      DIMENSION DL(24,2),ALO(24,2),ANN(24,2),ANO(24,2)
      DATA DL/15*10.,9*110.,30.,25.,2*26.
     1        ,28.,2*27.,30.,51.,6*10.,7*110.,6.,9./
      DATA ALO/52.,51.,49.,47.,46.,45.,43.,42.,41.,5*40.,38.,34.
     1        ,32.,30.,2*29.,30.,31.,34.,37.,64.,60.,56.,53.,51.,48.
     2        ,46.,44.,42.,5*40.,38.,34.,32.,30.,2*29.,30.,31.,37.,41./
      DATA ANN/15*2.,9*1975.,13.5,10.3,2*9.07,9.76,2*7.94,9.15,
     1        136.7,6*2.,7*1975.,1.79,2.4/
      DATA ANO/48*1.0/
C
      L24 = 24
      IF ( NFREQ .LT. 24 ) L24 = NFREQ
      DO 280 II = 1,MIKES
      KSW=0
      DO 260 L=1,L24
      LP(L) = DECIBL(II,L+6)
      IF (LP(L).GT.0.0) KSW = 1
      IF (LP(L).LT.0.0) LP(L) = 0.0
  260 CONTINUE
      IF (KSW.GT.0) GO TO 270
      PDB=0.
      GO TO 280
  270 CONTINUE
      NF = L24
      CALL PNDB(LP,NF,PDB,DL,ALO,ANN,ANO)
  280 DECIBL(II,35) = PDB
      RETURN
      END
*DECK TAINT
      SUBROUTINE TAINT (XTAB, FTAB, X, FX, N, K, NER, MON)
      REAL*8 FTAB,FX,X,XTAB
      REAL*8 T,C
      DIMENSION XTAB(1), FTAB(1), T(10), C(10)
      REAL*8  MON
      IF (N-K) 1, 1, 2
    1 NER = 2
      RETURN
    2 IF (K-9) 3, 3, 1
    3 IF (MON) 4, 4, 5
    5 IF (MON-2.)6, 7, 4
    4 J = 0
      NM1 = N-1
      DO 8  I = 1, NM1
      IF (XTAB(I) - XTAB(I+1)) 9, 11, 10
   11 NER = 3
      RETURN
    9 J = J - 1
      GO TO 8
   10 J = J + 1
    8 CONTINUE
      MON = 1.
      IF (J) 12, 6, 6
   12 MON = 2.
    7 DO 13  I = 1, N
      IF (X-XTAB(I))  14, 14, 13
   14 J = I
      GO TO 18
   13 CONTINUE
```

```
      GO TO 15
    6 DO 16  I = 1, N
      IF (X-XTAB(I))  17, 17, 16
   17 J = I
      GO TO 18
   16 CONTINUE
   15 J = N
   18 J = J-(K+1)/2
      IF (J)  19, 19, 20
   19 J = 1
   20 M = J+K
      IF (M-N) 21, 21, 22
   22 J = J - 1
      GO TO 20
   21 KP1 = K + 1
      JSAVE = J
      DO 23  L = 1, KP1
      C(L) = X-XTAB(J)
      T(L) = FTAB(J)
   23 J = J + 1
      DO 24  J = 1, K
      I = J + 1
   25 T(I) = (C(J) * T(I) - C(I) * T(J)) / (C(J) - C(I))
      I = I + 1
      IF (I - KP1) 25, 25, 24
   24 CONTINUE
      FX = T(KP1)
      NER = 1
      RETURN
      END
*DECK THMERG
      SUBROUTINE THMERG
C
C     INSERT THETSM INTO THETAS AND INSERT XDMAX INTO XOVERD
C
C
      REAL*8 VJ,FREQ,THETAS,XOVERD,XDMAX,THETSM,RNZDIA
      REAL*8 PSIS,XDN,PSI1,FFSPL,ST,STP,PSI2,VAMB,VJET,SDHUM,SDTEMP,
     *TTEMP,THUM,PSILO,PSIHI,ANGLES,DECB2,HTSRCE,HTMIKE,PSIVAL,XDVAL,
     *COFNR,AN,YY,R2D,D2R,XDIS
      COMMON /SUB1/ VJ,        FREQ(33),THETAS(50,33),XOVERD(50,33),
     *                NTAB(33),NTEST,XDMAX(33),THETSM(33),RNZDIA,
     *                NZTYPE(10),NFREQ
C
      COMMON /SUB2/   PSIS(50,35),XDN(50,35),PSI1(50,35),PSI2(50,35),
     1                FFSPL(50,35),ST(35),STP(35),
     3                IWT1,IWT2,VAMB,VJET,KFIT(2),SDHUM,
     4                SDTEMP,TTEMP,THUM,PSILO,PSIHI,MIKEA,IBIDON,
     5                ANGLES(70),DECB2(70,35),HTSRCE,HTMIKE(70),
     6                PSIVAL(50),XDVAL(50,35),COFNR(11,35),AN,YY,
     7                R2D,D2R,       XDIS(70,2),IMRC,IBNC,IRC,IAAC,
     8                IPFRQC,IPANGL,ICALL,NTYPE
C
      DO 500 J = 1 , NFREQ
C
      NTB = NTAB(J)
        IF ( NTB .GT. 50 ) NTB = 50
      NTBAD1 = NTB + 1
C
      DO 400 I = 1 , NTB
```

```
C
      IF ( THETSM(J) .EQ. THETAS(I,J) ) GO TO 500
      IF ( THETSM(J) .GT. THETAS(I,J) ) GO TO 400
      IL = NTBAD1 - I
C
C
C     MOVE THE REST OF THE ELEMENTS FORWARD SO THAT THE APPROPRIATE PLACE IS
C     FREED FOR THE NEW VALUE.
C     IF THE ARRAY HAS 50 ELEMENTS ALREADY , THE LAST ELEMENT WILL BE LOST TO
C     MAKE ROOM FOR THE NEW VALUE.
C
C
C
      DO 300 L = 1 , IL
      LTB = NTBAD1 - L
      IF ( LTB .EQ. 50 ) GO TO 300
      THETAS(LTB+1,J) = THETAS(LTB,J)
      XOVERD(LTB+1,J) = XOVERD(LTB,J)
  300 CONTINUE
C
C     INSERT THE SINGLE VALUE INTO THE EMPTIED SLOT
C
      THETAS(I,J) = THETSM(J)
      XOVERD(I,J) = XDMAX(J)
      NTAB(J) = NTAB(J) + 1
      GO TO 500
C
  400 CONTINUE
C
C
C     CHECK IF THE SINGLE VALUE IS GREATER THAN THE LAST ELEMENT OF THE ARRAY.
C
      IF ( THETSM(J) .LE. THETAS(NTB,J) ) GO TO 500
      LST = NTB+1
      IF(NTB .EQ. 50 ) LST = 50
      THETAS(LST,J) = THETSM(J)
      XOVERD(LST,J) = XDMAX(J)
      NTAB(J) = NTAB(J) + 1
C
  500 CONTINUE
      RETURN
      END
*DECK WRTEQN
      SUBROUTINE WRTEQN (N,COEF)
C
      REAL*8 COEF
      REAL*8 ALPH,ARRAY1,ARRAY2
      DIMENSION  COEF(12),ALPH(12),ARRAY1(13),ARRAY2(12)
C
      DATA ALPH/5H A    ,5H+ B  ,5H+ C  ,5H+ D  ,5H+ E  ,5H+ F  ,5H+ G
     *,5H+ H  ,5H+ I  ,5H+ J  ,5H+ K  ,5H+ L  /
      DATA ARRAY1/5H      ,5HX     ,5HX**2 ,5HX**3 ,5HX**4 ,5HX**5 ,5HX**6
     * ,5HX**7 ,5HX**8 ,5HX**9 ,5HX**10,5HX**11,5HX**12/
      DATA ARRAY2/5HFIRST,6HSECOND,5HTHIRD,6HFOURTH,5HFIFTH,5HSIXTH,
     17HSEVENTH,6HEIGHTH,5HNINTH,5HTENTH,8HELEVENTH,7HTWELFTH/
      NN = N + 1
C
      WRITE (6,101)
  101 FORMAT(// 1X,32HEQUATION DEFINING NEAR FIELD SPL  /
     *   1X,27H(WHERE Y=SPL, X=ANGLE PSIS)  /)
```

```
      WRITE (6,310)
      DO 180 J=1,NN
      I2=J-1
  180 WRITE (6,320) I2,ALPH(J),COEF(J)
      N1 = NN-1
      WRITE(6,330) ARRAY2(N1)
      N1 = NN
      IF (N1.GT.9) N1=9
C
      WRITE(6,340) ALPH(1),ALPH(2),ARRAY1(2),(ALPH(I),ARRAY1(I),I=3,N1)
      IF (NN.LE.9) GOTO 191
      WRITE(6,350) (ALPH(I),ARRAY1(I),I=10,NN)
C
  191 RETURN
  310 FORMAT (7X,4HTERM,4X,6HLETTER,10X,11HCOEFFICIENT/)
  320 FORMAT (8X,I2,6X,A3,7X,E23.16)
  330 FORMAT (1H0,6X,12HEQUATION IS ,A8,18H DEGREE POLYNOMIAL /)
  340 FORMAT (7X,3HY =,2A3,A1,1X,7(A3,A4,1X))
  350 FORMAT (//1X,3(3H + ,A2,A5//))
      END
*DECK TDECB1
      SUBROUTINE TDECB1(KPLANC,DECB,ANGLES,FREQ,NFREQ,MIKEA,
     1ITIT,NCAR,XMOD)
C*****
C***** SOUS-PROGRAMME DE TRACE DES COURBES DECB=F(ANGLES)
C*****
      REAL*8 DECB(70,35),ANGLES(70),FREQ(33)
      COMMON /IDENT/NPOI,KMIC,NPOIF,KLIG
      COMMON /TITRE/LIB(10),IDATE(3),DB1(8,4),IPI(8)
      DIMENSION ITIT(1),XMOD(1)
C*****
      DIMENSION SANG(130)
      DIMENSION NAM(7),NASA(5),IPOINT(2),IX(2),IY(2),NMIC(2),IDEG(1),ITH
     *ETAS(2)
      DIMENSION MICRO(4),MOINS(1)
      DIMENSION IANG(4),XIANG(8),I5DB(1),IFREQ(2),IA(1),IHZ(1)
      DIMENSION X12(2),Y12(2)
      DIMENSION DIFF(70)
      DIMENSION NTR(15),NEP(15),NPL(15)
C*****
      DATA CX/300./,CY/210./
      DATA NAM/'P9-J.COURATIN   PROG.NOISE4 '/
      DATA NASA/'N.A.S.A./O.N.E.R.A. '/
      DATA IPOINT/'POINT    '/,IX/'X=      M'/,IY/'Y=      M'/,NMIC/' MICRO
     *= '/
      DATA IANG/50,90,130,170/
      DATA XIANG/13.,43.,73.,103.,153.,183.,213.,243./
      DATA IDEG/'DEG '/,I5DB/'5DB '/,IFREQ/'FREQ.    '/,ITHETAS/'THETAS
     *'/
      DATA MOINS/'-    '/,IHZ/'HZ  '/,IA/'A    '/
      DATA NTR/1,2,3,4,5,1,2,3,4,5,1,2,3,4,5/
      DATA NEP/1,2,1,1,1,1,2,1,1,1,1,2,1,1,1/
      DATA NPL/1,1,1,1,1,2,2,2,2,2,3,3,3,3,3/
C***** TRAITEMENT  LIGNE 1
      ILIGN=1
C***** INITIALISATION DES VALEURS X , Y , SANG ET MICRO
C***** INITIALISATION DES VALEURS POUR LA LIGNE 1
  140 CONTINUE
      IF(KLIG.EQ.1)X=DB1(IPI(1),1);Y=DB1(IPI(1),2)
      IF(KLIG.EQ.2)X=DB1(IPI(3),1);Y=DB1(IPI(3),2)
```

```
      DO 150 I=1,MIKEA
      SANG(I)=SNGL(ANGLES(I))
      DIFF(I)=SNGL(DECB(I,34))
  150 CONTINUE
      NBPT=MIKEA
      IF(KLIG.EQ.2) GO TO 260
      IF(KMIC.EQ.1) MICRO(1)=IPI(1) ; MICRO(2)=IPI(5) ; GO TO 160
      IF(KMIC.EQ.2) MICRO(1)=IPI(2) ; MICRO(2)=IPI(6) ; GO TO 160
      MICRO(1)=IPI(1)
      MICRO(2)=IPI(5)
      MICRO(3)=IPI(2)
      MICRO(4)=IPI(6)
      GO TO 160
  260 IF(KMIC.EQ.1) MICRO(1)=IPI(3) ; MICRO(2)=IPI(7) ; GO TO 160
      IF(KMIC.EQ.2) MICRO(1)=IPI(4) ; MICRO(2)=IPI(8) ; GO TO 160
      MICRO(1)=IPI(3)
      MICRO(2)=IPI(7)
      MICRO(3)=IPI(4)
      MICRO(4)=IPI(8)
C***** NOMBRE DE FREQUENCES PAR LIGNE
  160 CONTINUE
      NU=1
      CALL MINMAX(DIFF,NBPT,NU,DMIN,DMAX,XMOD)
      IDMAX=(DMAX/10.)+1
      IDMAX=IDMAX*10
      IDMIN=IDMAX-70
      DMAX=IDMAX
      DMIN=IDMIN
      IF(NFREQ.GT.25) GO TO 170
      IFD=1
      IFF=NFREQ
      GO TO 180
  170 CONTINUE
      IFD=1
      IFF=25
C***** TRACE DU CADRE ET DU CARTOUCHE
  180 CONTINUE
      XT=10.
      YT=200.
      ANG=0.
      NC=28
      CALL TPL(CX,CY,XT,YT,ANG,NAM,NC,XMOD)
      KODE=1
      NCL=40
      NC=1
      CALL TCART(KODE,CX,CY,LIB,NCL,IDATE,NC,XMOD)
      KPLANC=KPLANC+1
C***** ECRITURE NASA ET TITRE LU SUR CARTE
      XT=CX-10.
      YT=CY-55.
      HL=3.
      HH=5.
      ANG=270.
      NC=19
      CALL KSTEP(1,1,4,1,XMOD)
      CALL KTEXTE(XT,YT,HL,HH,NASA,ANG,NC,XMOD)
      CALL KSTEP(1,1,1,1,XMOD)
C*****
      XT=10.
      YT=180.
```

```
      HH=3.
      ANG=0.
      CALL KTEXTE(XT,YT,HL,HH,ITIT,ANG,NCAR,XMOD)
C***** ECRITURE DE NPOI, X, Y ET KMIC
      XT=10.
      YT=170.
      NC=6
      CALL KTEXTE(XT,YT,HL,HH,IPOINT,ANG,NC,XMOD)
      XT=XT+18.
      NC=4
      CALL KFIXE(XT,YT,HL,HH,NPOI,ANG,NC,XMOD)
      XT=XT+20.
      NC=8
      CALL KTEXTE(XT,YT,HL,HH,IX,ANG,NC,XMOD)
      XT=XT+6.
      NC=5
      CALL KDECIM(XT,YT,HL,HH,X,ANG,NC,XMOD)
      XT=XT+23.
      NC=8
      CALL KTEXTE(XT,YT,HL,HH,IY,ANG,NC,XMOD)
      XT=XT+6.
      NC=5
      CALL KDECIM(XT,YT,HL,HH,Y,ANG,NC,XMOD)
      XT=XT+23.
      NC=8
      CALL KTEXTE(XT,YT,HL,HH,NMIC,ANG,NC,XMOD)
      XT=XT+27.
      NC=1
      CALL KFIXE(XT,YT,HL,HH,MICRO(1),ANG,NC,XMOD)
      XT=XT+6.
      CALL KTEXTE(XT,YT,HL,HH,MOINS,ANG,NC,XMOD)
      XT=XT+6.
      CALL KFIXE(XT,YT,HL,HH,MICRO(2),ANG,NC,XMOD)
      IF(KMIC.NE.0) GO TO 190
      XT=XT+6.
      CALL KTEXTE(XT,YT,HL,HH,MOINS,ANG,NC,XMOD)
      XT=XT+6.
      CALL KFIXE(XT,YT,HL,HH,MICRO(3),ANG,NC,XMOD)
      XT=XT+6.
      CALL KTEXTE(XT,YT,HL,HH,MOINS,ANG,NC,XMOD)
      XT=XT+6.
      CALL KFIXE(XT,YT,HL,HH,MICRO(4),ANG,NC,XMOD)
  190 CONTINUE
C***** ECRITURE 'FREQ.         A '
      XT=20.
      YT=155.
      NC=5
      CALL KTEXTE(XT,YT,HL,HH,IFREQ,ANG,NC,XMOD)
      XT=XT+42.
      NC=1
      CALL KTEXTE(XT,YT,HL,HH,IA,ANG,NC,XMOD)
      XT=XT+30.
      NC=2
      CALL KTEXTE(XT,YT,HL,HH,IHZ,ANG,NC,XMOD)
C*****
      XT=160.
      NC=5
      CALL KTEXTE(XT,YT,HL,HH,IFREQ,ANG,NC,XMOD)
      XT=XT+42.
      NC=1
```

```
      CALL KTEXTE(XT,YT,HL,HH,IA,ANG,NC,XMOD)
      XT=XT+30.
      NC=2
      CALL KTEXTE(XT,YT,HL,HH,IHZ,ANG,NC,XMOD)
C***** TRACE DU PREMIER AXE VERTICAL
      XT=10.
      YT=10.
      NC=0
      PASMM=10.
      ANG=90.
      XMIN=1.
      PAS=1.
      NGRAD=15
      NF=0
      CALL KAXE(XT,YT,NORD,NC,PASMM,ANG,XMIN,PAS,NGRAD,NF,XMOD)
C***** TRACE DU SECOND AXE VERTICAL
      XT=150.
      YT=10.
      NGRAD=15
      CALL KAXE(XT,YT,NORD,NC,PASMM,ANG,XMIN,PAS,NGRAD,NF,XMOD)
C***** TRACE PREMIER AXE HORIZONTAL(PARTIE GAUCHE DE LA PLANCHE)
      XT=10.
      YT=10.
      PASMM=7.5
      ANG=0.
      NGRAD=14
      CALL KAXE(XT,YT,NORD,NC,PASMM,ANG,XMIN,PAS,NGRAD,NF,XMOD)
C***** TRACE PREMIER AXE HORIZONTAL(PARTIE DROITE DE LA PLANCHE)
      XT=150.
      YT=10.
      CALL KAXE(XT,YT,NORD,NC,PASMM,ANG,XMIN,PAS,NGRAD,NF,XMOD)
C***** ECRITURE DES COTATIONS SUR LES AXES HORIZONTAUX
      YT=5.
      HL=2.
      HH=3.
      NC=3
      DO 200 I=1,4
      XT=XIANG(I)
      CALL KFIXE(XT,YT,HL,HH,IANG(I),ANG,NC,XMOD)
  200 CONTINUE
      XT=XT+10.
      NC=3
      CALL KTEXTE(XT,YT,HL,HH,IDEG,ANG,NC,XMOD)
      YT=15.
      NC=6
      CALL KTEXTE(XT,YT,HL,HH,ITHETAS,ANG,NC,XMOD)
      NC=3
C*****
      YT=5.
      DO 210 I=1,4
      XT=XIANG(I+4)
      CALL KFIXE(XT,YT,HL,HH,IANG(I),ANG,NC,XMOD)
  210 CONTINUE
      XT=XT+10.
      NC=3
      CALL KTEXTE(XT,YT,HL,HH,IDEG,ANG,NC,XMOD)
      YT=15.
      NC=6
      CALL KTEXTE(XT,YT,HL,HH,ITHETAS,ANG,NC,XMOD)
      NC=3
```

```
C***** ECRITURE 2DB
      XT=8.
      YT=142.
      HH=2.
      ANG=90.
      NC=3
      CALL KTEXTE(XT,YT,HL,HH,I5DB,ANG,NC,XMOD)
      XT=148.
      YT=142.
      CALL KTEXTE(XT,YT,HL,HH,I5DB,ANG,NC,XMOD)
C***** ECRITURE DES VALEURS MAX
      XT=12.
      YT=150.
      HH=2.
      HL=2.
      ANG=0.
      NC=5
      CALL KDECIM(XT,YT,HL,HH,DMAX,ANG,NC,XMOD)
      XT=152.
      CALL KDECIM(XT,YT,HL,HH,DMAX,ANG,NC,XMOD)
C***** ECRITURE DES FREQUENCES
      XT=38.
      YT=155.
      NC=7
      HL=3.
      HH=3.
      ANG=0.
      SFREQ=SNGL(FREQ(IFD))
      CALL KDECIM(XT,YT,HL,HH,SFREQ,ANG,NC,XMOD)
      IF((IFD+9).GE.IFF) GO TO 240
      SFREQ=SNGL(FREQ(IFD+9))
      XT=XT+30.
      CALL KDECIM(XT,YT,HL,HH,SFREQ,ANG,NC,XMOD)
C*****
      XT=178.
      SFREQ=SNGL(FREQ(IFD+10))
      CALL KDECIM(XT,YT,HL,HH,SFREQ,ANG,NC,XMOD)
  240 CONTINUE
      XT=XT+30.
      SFREQ=SNGL(FREQ(IFF))
      CALL KDECIM(XT,YT,HL,HH,SFREQ,ANG,NC,XMOD)
C***** TRACE DES COURBES
      CXSUJ1=40.
      CXSUJ2=170.
      CYSUJ1=DMIN
      CYSUJ2=DMAX
      CXOBJ1=10.
      CXOBJ2=107.5
      CYOBJ1=10.
      CYOBJ2=150.
      IDEB=IFD
      IF(IFF.GT.(IFD+9)) GO TO 280
      IFIN=IFF
      GO TO 290
  280 CONTINUE
      IFIN=IFD+9
  290 CONTINUE
C*****
      CALL DEPLAC(0.,XMOD)
      CALL DIMSUJ(CXSUJ1,CXSUJ2,CYSUJ1,CYSUJ2,XMOD)
```

```
      CALL DIMOBJ(CXOBJ1,CXOBJ2,CYOBJ1,CYOBJ2,XMOD)
      K=0
      DO 340 I=IDEB,IFIN
      DO 320 J=1,MIKEA
      DIFF(J)=SNGL(DECB(J,I))
  320 CONTINUE
C*****
  330 CONTINUE
      K=K+1
      IF(K.GT.15) WRITE(108,500) ; RETURN
      CALL KSTEP(1,NTR(K),NEP(K),NPL(K),XMOD)
      CALL KTRACE(SANG,DIFF,NBPT,XMOD)
  340 CONTINUE
C*****
      CALL KSTEP(1,1,1,1,XMOD)
      IF(IFIN.EQ.IFF) GO TO 350
      IDEB=IFIN+1
      IFIN=IFF
      CXOBJ1=150.
      CXOBJ2=247.5
      GO TO 290
C*****
  350 CONTINUE
      IF(IFF.EQ.NFREQ) GO TO 360
      IFD=IFF+1
      IFF=NFREQ
      CCX=CX+20.
      CALL DEPLAC(CCX,XMOD)
      GO TO 180
  360 CONTINUE
      CCX=CX+20.
      CALL DEPLAC(CCX,XMOD)
C*****
      RETURN
  500 FORMAT(1X,'TROP DE COURBES 1/3 OCTAVES '//)
      END
*DECK TDECB2
      SUBROUTINE TDECB2(KPLANC,DECB,ANGLES,PSIVAL,FREQ,NFREQ,MIKEA,YY,
     1ITIT,NCAR,XMOD)
C*****
C***** SOUS-PROGRAMME DE TRACE DES COURBES DECB=F(ANGLES)
C*****
      REAL*8 DECB(50,35),ANGLES(50,35),FREQ(33),YY,PSIVAL(50)
      COMMON /IDENT/NPOI,KMIC,NPOIF,KLIG,IGLDEB,IGLFIN
      COMMON /TITRE/LIB(10),IDATE(3),DB1(8,4),IPI(8),LIB1(20),LIB2(20)
      DIMENSION ITIT(1),XMOD(1)
C*****
      DIMENSION SANG(50)
      DIMENSION NAM(7),NASA(5),IPOINT(2),IX(1),IY(3),NMIC(2),IDEG(1)
      DIMENSION MICRO(4),MOINS(1),IPSI2(1)
      DIMENSION IANG(4),XIANG(8),I5DB(1),IFREQ(2),IA(1),IHZ(1),IGLOBAL
     *(3),IHHZ(5)
      DIMENSION X12(2),Y12(2)
      DIMENSION DIFF(50)
      DIMENSION NTR(15),NEP(15),NPL(15)
C*****
      DATA CX/300./,CY/210./
      DATA NAM/'P9-COURATIN   PROG.NOISE4 '/
      DATA NASA/'N.A.S.A./O.N.E.R.A. '/
      DATA IPOINT/'POINT    '/,IX/'X=   '/,IY/'Y=       M    '/,NMIC/' MICRO
```

```
     *= '/,IPSI2/'PSI2'/
      DATA IANG/50,90,130,170/
      DATA XIANG/13.,43.,73.,103.,153.,183.,213.,243./
      DATA IDEG/'DEG '/,I5DB/'5DB '/,IFREQ/'FREQ.    '/,IGLOBAL/'GLOBAL(P
     *SIS)'/
      DATA MOINS/'-    '/,IHZ/'HZ  '/,IA/'A   '/
      DATA IHHZ/'(         ,          HZ) '/
      DATA NTR/1,2,3,4,5,1,2,3,4,5,1,2,3,4,5/
      DATA NEP/1,2,1,1,1,1,2,1,1,1,1,2,1,1,1/
      DATA NPL/1,1,1,1,1,2,2,2,2,2,3,3,3,3,3/
      GLDEB=SNGL(FREQ(IGLDEB))
      GLFIN=SNGL(FREQ(IGLFIN))
C***** TRAITEMENT  LIGNE 1
C***** INITIALISATION DES VALEURS POUR LA LIGNE 1
      Y=SNGL(YY)/3.2808
      DO 150 I=1,MIKEA
      SANG(I)=SNGL(PSIVAL(I))
      DIFF(I)=SNGL(DECB(I,34))
  150 CONTINUE
      NBPT=MIKEA
C***** NOMBRE DE FREQUENCES PAR LIGNE
      NU=1
      CALL MINMAX(DIFF,NBPT,NU,DMIN,DMAX,XMOD)
      IDMAX=(DMAX/10.)+1
      IDMAX=IDMAX*10
      IDMIN=IDMAX-70
      DMAX=IDMAX
      DMIN=IDMIN
      DO 190 III=1,NFREQ
      IF(DECB(1,III).LT.1.) GO TO 190
      IFI=III
      GO TO 195
  190 CONTINUE
  195 IF(NFREQ.GT.25) GO TO 170
      IFD=1
      IFF=NFREQ
      GO TO 180
  170 CONTINUE
      IFD=1
      IFF=25
C***** TRACE DU CADRE , DU CARTOUCHE ET DU LIBELLE
  180 CONTINUE
      XT=10.
      YT=200.
      ANG=0.
      NC=28
      CALL TPL(CX,CY,XT,YT,ANG,NAM,NC,XMOD)
      XT=95.
      YT=202.
      NC=80
      HL=2.5
      HH=2.5
      CALL KTEXTE(XT,YT,HL,HH,LIB1,ANG,NC,XMOD)
      YT=195.
      CALL KTEXTE(XT,YT,HL,HH,LIB2,ANG,NC,XMOD)
      KODE=1
      NCL=40
      NC=1
      CALL TCART(KODE,CX,CY,LIB,NCL,IDATE,NC,XMOD)
      KPLANC=KPLANC+1
```

```
C***** ECRITURE NASA ET TITRE LU SUR CARTE
      XT=CX-10.
      YT=CY-55.
      HL=3.
      HH=5.
      ANG=270.
      NC=19
      CALL KSTEP(1,1,4,1,XMOD)
      CALL KTEXTE(XT,YT,HL,HH,NASA,ANG,NC,XMOD)
      CALL KSTEP(1,1,1,1,XMOD)
C*****
      XT=10.
      YT=180.
      HH=3.
      ANG=0.
      CALL KTEXTE(XT,YT,HL,HH,ITIT,ANG,NCAR,XMOD)
      YT=170.
      XT=50.
      NC=9
      CALL KTEXTE(XT,YT,HL,HH,IY,ANG,NC,XMOD)
      XT=XT+6.
      NC=6
      CALL KDECIM(XT,YT,HL,HH,Y,ANG,NC,XMOD)
C*****ECRITURE DU NUMERO DE POINT ET DE B DE F
      XT=100.
      YT=180.
      HH=3.
      HL=3.
      ANG=0.
      NC=6
      CALL KTEXTE(XT,YT,HL,HH,'POINT ',ANG,NC,XMOD)
      XT=130.
      NC=4
      CALL KFIXE(XT,YT,HL,HH,NPOI,ANG,NC,XMOD)
      XT=155.
      NC=7
      CALL KTEXTE(XT,YT,HL,HH,'B DE F ',ANG,NC,XMOD)
      XT=180.
      NC=4
      CALL KFIXE(XT,YT,HL,HH,NPOIF,ANG,NC,XMOD)
C***** ECRITURE 'FREQ.          A '
      XT=20.
      YT=155.
      NC=5
      CALL KTEXTE(XT,YT,HL,HH,IFREQ,ANG,NC,XMOD)
      XT=XT+42.
      NC=1
      CALL KTEXTE(XT,YT,HL,HH,IA,ANG,NC,XMOD)
      XT=XT+30.
      NC=2
      CALL KTEXTE(XT,YT,HL,HH,IHZ,ANG,NC,XMOD)
C*****
      XT=160.
      NC=5
      CALL KTEXTE(XT,YT,HL,HH,IFREQ,ANG,NC,XMOD)
      XT=XT+42.
      NC=1
      CALL KTEXTE(XT,YT,HL,HH,IA,ANG,NC,XMOD)
      XT=XT+30.
      NC=2
```

```
      CALL KTEXTE(XT,YT,HL,HH,IHZ,ANG,NC,XMOD)
C***** TRACE DU PREMIER AXE VERTICAL
      XT=10.
      YT=10.
      NC=0
      PASMM=10.
      ANG=90.
      XMIN=1.
      PAS=1.
      NGRAD=15
      NF=0
      CALL KAXE(XT,YT,NORD,NC,PASMM,ANG,XMIN,PAS,NGRAD,NF,XMOD)
C***** TRACE DU SECOND AXE VERTICAL
      XT=150.
      YT=10.
      NGRAD=15
      CALL KAXE(XT,YT,NORD,NC,PASMM,ANG,XMIN,PAS,NGRAD,NF,XMOD)
C***** TRACE PREMIER AXE HORIZONTAL(PARTIE GAUCHE DE LA PLANCHE)
      XT=10.
      YT=10.
      PASMM=7.5
      ANG=0.
      NGRAD=14
      CALL KAXE(XT,YT,NORD,NC,PASMM,ANG,XMIN,PAS,NGRAD,NF,XMOD)
C***** TRACE PREMIER AXE HORIZONTAL(PARTIE DROITE DE LA PLANCHE)
      XT=150.
      YT=10.
      CALL KAXE(XT,YT,NORD,NC,PASMM,ANG,XMIN,PAS,NGRAD,NF,XMOD)
C***** ECRITURE DES COTATIONS SUR LES AXES HORIZONTAUX
      YT=5.
      HL=2.
      HH=3.
      NC=3
      DO 200 I=1,4
      XT=XIANG(I)
      CALL KFIXE(XT,YT,HL,HH,IANG(I),ANG,NC,XMOD)
  200 CONTINUE
      XT=XT+10.
      NC=3
      CALL KTEXTE(XT,YT,HL,HH,IDEG,ANG,NC,XMOD)
      YT=15.
      NC=4
      CALL KTEXTE(XT,YT,HL,HH,IPSI2,ANG,NC,XMOD)
      NC=3
C*****
      YT=5.
      DO 210 I=1,4
      XT=XIANG(I+4)
      CALL KFIXE(XT,YT,HL,HH,IANG(I),ANG,NC,XMOD)
  210 CONTINUE
      XT=XT+10.
      NC=3
      CALL KTEXTE(XT,YT,HL,HH,IDEG,ANG,NC,XMOD)
      YT=15.
      NC=4
      CALL KTEXTE(XT,YT,HL,HH,IPSI2,ANG,NC,XMOD)
C***** ECRITURE 2DB
      XT=8.
      YT=142.
      HH=2.
```

```
      ANG=90.
      NC=3
      CALL KTEXTE(XT,YT,HL,HH,I5DB,ANG,NC,XMOD)
      XT=148.
      YT=142.
      CALL KTEXTE(XT,YT,HL,HH,I5DB,ANG,NC,XMOD)
C***** ECRITURE DES VALEURS MAX
      XT=12.
      YT=150.
      HH=2.
      HL=2.
      ANG=0.
      NC=5
      CALL KDECIM(XT,YT,HL,HH,DMAX,ANG,NC,XMOD)
      XT=152.
      CALL KDECIM(XT,YT,HL,HH,DMAX,ANG,NC,XMOD)
C***** ECRITURE DES FREQUENCES
      XT=38.
      YT=155.
      NC=7
      HL=3.
      HH=3.
      ANG=0.
      SFREQ=SNGL(FREQ(IFI))
      CALL KDECIM(XT,YT,HL,HH,SFREQ,ANG,NC,XMOD)
      IF((IFD+9).GE.IFF) GO TO 240
      SFREQ=SNGL(FREQ(IFD+9))
      XT=XT+30.
      CALL KDECIM(XT,YT,HL,HH,SFREQ,ANG,NC,XMOD)
C***** ECRITURE GLOBAL
      XT=102.
      YT=140.
      NC=12
      CALL KTEXTE(XT,YT.HL,HH,IGLOBAL,ANG,NC,XMOD)
      NC=20
      YT=134.
      HL=2.
      HH=2.
      CALL KTEXTE(XT,YT,HL,HH,IHHZ,ANG,NC,XMOD)
      XT=104.
      NC=7
      CALL KDECIM(XT,YT,HL,HH,GLDEB,ANG,NC,XMOD)
      XT=120.
      CALL KDECIM(XT,YT,HL,HH,GLFIN,ANG,NC,XMOD)
      HL=3.
      HH=3.
C*****
      XT=178.
      YT=155.
      SFREQ=SNGL(FREQ(IFD+10))
      CALL KDECIM(XT,YT,HL,HH,SFREQ,ANG,NC,XMOD)
  240 CONTINUE
      XT=XT+30.
      SFREQ=SNGL(FREQ(IFF))
      CALL KDECIM(XT,YT,HL,HH,SFREQ,ANG,NC,XMOD)
C***** TRACE DES COURBES
      CXSUJ1=40.
      CXSUJ2=170.
      CYSUJ1=DMIN
      CYSUJ2=DMAX
```

```
      CXOBJ1=10.
      CXOBJ2=107.5
      CYOBJ1=10.
      CYOBJ2=150.
      IDEB=IFD
      IF(IFF.GT.(IFD+9)) GO TO 280
      IFIN=IFF
      GO TO 290
  280 CONTINUE
      IFIN=IFD+9
  290 CONTINUE
C***** TRACE DU GLOBAL (PSIVAL)
      CALL DEPLAC(0.,XMOD)
      CALL DIMSUJ(CXSUJ1,CXSUJ2,CYSUJ1,CYSUJ2,XMOD)
      CALL DIMOBJ(CXOBJ1,CXOBJ2,CYOBJ1,CYOBJ2,XMOD)
      CALL KSTEP(1,1,1,1,XMOD)
      CALL KTRACE(SANG,DIFF,NBPT,XMOD)
C***** TRACE DES 1/3 D'OCTAVE (PSI2)
  390 CALL DEPLAC(0.,XMOD)
      CALL DIMSUJ(CXSUJ1,CXSUJ2,CYSUJ1,CYSUJ2,XMOD)
      CALL DIMOBJ(CXOBJ1,CXOBJ2,CYOBJ1,CYOBJ2,XMOD)
      K=0
      DO 340 I=IDEB,IFIN
      DO 320 J=1,MIKEA
      SANG(J)=SNGL(ANGLES(J,I))
      DIFF(J)=SNGL(DECB(J,I))
  320 CONTINUE
C*****
  330 CONTINUE
      K=K+1
      IF(K.GT.15) WRITE(108,500) ; RETURN
      CALL KSTEP(1,NTR(K),NEP(K),NPL(K),XMOD)
      CALL KTRACE(SANG,DIFF,NBPT,XMOD)
  340 CONTINUE
C*****
      CALL KSTEP(1,1,1,1,XMOD)
      IF(IFIN.EQ.IFF) GO TO 350
      IDEB=IFIN+1
      IFIN=IFF
      CXOBJ1=150.
      CXOBJ2=247.5
      GO TO 390
C*****
  350 CONTINUE
      IF(IFF.EQ.NFREQ) GO TO 360
      IFD=IFF+1
      IFF=NFREQ
      CCX=CX+20.
      CALL DEPLAC(CCX,XMOD)
      GO TO 180
  360 CONTINUE
      CCX=CX+20.
      CALL DEPLAC(CCX,XMOD)
C*****
      RETURN
  500 FORMAT(1X,'TROP DE COURBES 1/3 OCTAVES '//)
      END
```

```
*
CPROGRAMMMES DES MISES EN BIBLIOTHEQUE BIBLOM
!JOB,T TPL,P003,P9COURA,40,(REST)  MISE EN BIBLOM DE TPL
!COMMENT ETUDE=2895PN141P
!COMMENT MISE EN BIBLOM DU SOUS-PROGRAMME TPL
!LIMIT (CORE,50),(TIME,1),(SPDISC,50),(PAGES,30)
!FORTRAN SI,LS,GO
      SUBROUTINE TPL(CX,CY,X,Y,ANG,NAM,NC,XMOD)
C***** SOUS-PROGRAMME DE TRACE DU CADRE ET DU NOM
C***** CX=DIMENSION EN MM,SUIVANT L AXE DES ABSCISSES DE LA PLANCHE
C***** CY=DIMENSION EN MM,SUIVANT L AXE DES ORDONNEES DE LA PLANCHE
C***** X,Y=COORDONNEES UTILISATEUR(EN MM) OU DOIT DEBUTER LE TRACE
C*****      DU NOM
C***** ANG=VARIABLE REPRESENTANT L ANGLE EN DEGRES ENTRE L AXE
C*****      OX DU TRACEUR ET LE SENS D ECRITURE DU NOM
C***** NC=NOMBRE DE CARACTERES DU NOM A ECRIRE
      DIMENSION XMOD(44)
      DIMENSION X12(5),Y12(5),NAM(1)
C*****
      DATA ZERO/0./
C*****
      X12(1)=ZERO
      X12(2)=ZERO
      X12(3)=CX
      X12(4)=CX
      X12(5)=ZERO
C*****
      Y12(1)=ZERO
      Y12(2)=CY
      Y12(3)=CY
      Y12(4)=ZERO
      Y12(5)=ZERO
C***** TRACE DU CADRE
      CALL DIMSUJ(ZERO,CX,ZERO,CY,XMOD)
      CALL DIMOBJ(ZERO,CX,ZERO,CY,XMOD)
      CALL KTRACE(X12,Y12,5,XMOD)
C***** TRACE DU NOM
      CALL KTEXTE(X,Y,3.,3.,NAM,ANG,NC,XMOD)
      RETURN
      END
!EXEC INOMB,%KEY=TPL
!JOB,T TCART,P003,P9COURA,40,(REST)  MISE EN BIBLOM DE TCART
!COMMENT ETUDE=2895PN141P
!COMMENT MISE EN BIBLOM DU SOUS-PROGRAMME TCART
!LIMIT (CORE,50),(TIME,1),(SPDISC,50),(PAGES,30)
!FORTRAN SI,LS,GO
      SUBROUTINE TCART(KODE,CX,CY,LIB,NCL,IDATE,NCD,XMOD)
C***** SOUS-PROGRAMME DE TRACE DE L EN-TETE ONERA
C***** KODE =1 SI EN-TETE TRACE PERPENDICULAIREMENT A L AXE OX
C*****           DU TRACEUR
C*****       =0 SI EN-TETE TRACE PARALLELEMENT A L AXE OX
C*****        DU TRACEUR
C***** CX   = DIMENSION EN MM SUIVANT L AXE DES ABSCISSES DE LA
C*****         PLANCHE
C***** CY   = DIMENSION EN MM SUIVANT L AXE DES ORDONNEES DE LA
C*****         PLANCHE
C***** LIB  =TABLEAU HOLLERITH CONTENANT LE TITRE A ECRIRE
C***** NCL  = NOMBRE DE CARACTERES DU TITRE A ECRIRE
C*****         SI NCL=0 PAS D ECRITURE
C***** IDATE= TABLEAU CONTENANT LES VALEURS NUMERIQUES DE LA DATE
```

```
C*****          IDATE(1)=NUMERO DU JOUR
C*****          IDATE(2)=NUMERO DU MOIS
C*****          IDATE(3)=NUMERO DE L ANNEE
C***** NCD  =0 SI PAS D ECRITURE DE DATE
C*****
      DIMENSION LIB(1),IDATE(1)
      DIMENSION XMOD(44)
      DIMENSION X(2),Y(2),ION(3),IPA(1),S(1)
      DATA ION/'O.N.E.R.A.   '/,IPA/'PAGE'/,S/'/    '/
C***** MODIFICATION DE L EPAISSEUR DU TRAIT
      CALL KSTEP(1,1,4,1,XMOD)
C*****
      IF(KODE.EQ.1) GO TO 130
C***** TRACE DE L EN-TETE PARALLELEMENT A L AXE OX DU TRACEUR
      X(1)=20.
      X(2)=X(1)
      Y(1)=0.
      Y(2)=CY
      CALL KTRACE(X,Y,2,XMOD)
      X(2)=CX
      Y(1)=(CY-20.)
      Y(2)=Y(1)
      CALL KTRACE(X,Y,2,XMOD)
      X(1)=53.
      X(2)=X(1)
      Y(1)=(CY-20.)
      Y(2)=CY
      CALL KTRACE(X,Y,2,XMOD)
      X(1)=(CX-30.)
      X(2)=X(1)
      CALL KTRACE(X,Y,2,XMOD)
      X(1)=53.
      X(2)=CX
      Y(1)=(CY-13.)
      Y(2)=Y(1)
      CALL KTRACE(X,Y,2,XMOD)
C***** ECRITURE ONERA ET PAGE
      XA=21.
      YA=(CY-15.)
      CALL KTEXTE(XA,YA,3.,10.,ION,0.,10,XMOD)
      XA=(CX-28.)
      YA=(CY-10.)
      CALL KTEXTE(XA,YA,3.,3.,IPA,0.,4,XMOD)
C***** ECRITURE EVENTUELLE DU TITRE
      IF(NCL.EQ.0) GO TO 120
      HX=3.
  100 CONTINUE
      XLON=HX*NCL
      XA=CX-83.
      IF(XLON.LT.XA) GO TO 110
      HX=HX-0.5
      IF(HX.LE.0.) GO TO 120
      GO TO 100
  110 CONTINUE
      XA=(XA-XLON)/2.
      XA=(53.+XA)
      YA=(CY-19.)
      CALL KTEXTE(XA,YA,HX,3.,LIB,0.,NCL,XMOD)
  120 CONTINUE
C***** ECRITURE EVENTUELLE DE LA DATE
```

```
      IF(NCD.EQ.0) CALL KSTEP(1,1,1,1,XMOD) ; RETURN
      XA=(CX-29.)
      YA=(CY-18.)
      CALL KFIXE(XA,YA,3.,3.,IDATE(1),0.,+2,XMOD)
      XA=XA+7.
      CALL KTEXTE(XA,YA,3.,3.,S,0.,1,XMOD)
      XA=XA+4.
      CALL KFIXE(XA,YA,3.,3.,IDATE(2),0.,+2,XMOD)
      XA=XA+7.
      CALL KTEXTE(XA,YA,3.,3.,S,0.,1,XMOD)
      XA=XA+4.
      CALL KFIXE(XA,YA,3.,3.,IDATE(3),0.,+2,XMOD)
      CALL KSTEP(1,1,1,1,XMOD)
      RETURN
C***** TRACE DE L EN-TETE PERPENDICULAIREMENT A L AXE OX DU TRACEUR
  130 CONTINUE
      X(1)=0.
      X(2)=CX
      Y(1)=(CY-20.)
      Y(2)=Y(1)
      CALL KTRACE(X,Y,2,XMOD)
      X(1)=(CX-20.)
      X(2)=X(1)
      Y(1)=0.
      CALL KTRACE(X,Y,2,XMOD)
      X(2)=CX
      Y(1)=(CY-53.)
      Y(2)=Y(1)
      CALL KTRACE(X,Y,2,XMOD)
      Y(1)=30.
      Y(2)=Y(1)
      CALL KTRACE(X,Y,2,XMOD)
      X(1)=(CX-13.)
      X(2)=X(1)
      Y(1)=0.
      Y(2)=(CY-53.)
      CALL KTRACE(X,Y,2,XMOD)
C***** ECRITURE ONERA ET PAGE
      XA=(CX-15.)
      YA=(CY-21.)
      CALL KTEXTE(XA,YA,3.,10.,ION,270.,10,XMOD)
      XA=(CX-10.)
      YA=28.
      CALL KTEXTE(XA,YA,3.,3.,IPA,270.,4,XMOD)
C***** ECRITURE EVENTUELLE DU TITRE
      IF(NCL.EQ.0) GO TO 220
      HY=3.
  200 CONTINUE
      YLON=HY*NCL
      YA=CY-83.
      IF(YLON.LT.YA) GO TO 210
      HY=HY-0.5
      IF(HY.LE.0.) GO TO 220
      GO TO 200
  210 CONTINUE
      XA=(CX-19.)
      YA=(YA-YLON)/2.
      YA=(CY-53.-YA)
      CALL KTEXTE(XA,YA,HY,3.,LIB,270.,NCL,XMOD)
  220 CONTINUE
```

```
C***** ECRITURE EVENTUELLE DE LA DATE
      IF(NCD.EQ.0) CALL KSTEP(1,1,1,1,XMOD) ; RETURN
      XA=(CX-18.)
      YA=29.
      CALL KFIXE(XA,YA,3.,3.,IDATE(1),270.,+2,XMOD)
      YA=YA-7.
      CALL KTEXTE(XA,YA,3.,3.,S,270.,1,XMOD)
      YA=YA-4.
      CALL KFIXE(XA,YA,3.,3.,IDATE(2),270.,+2,XMOD)
      YA=YA-7.
      CALL KTEXTE(XA,YA,3.,3.,S,270.,1,XMOD)
      YA=YA-4.
      CALL KFIXE(XA,YA,3.,3.,IDATE(3),270.,+2,XMOD)
      CALL KSTEP(1,1,1,1,XMOD)
      RETURN
      END
!EXEC INOMB,%KEY=TCART
!JOB,T TDEC,P003,P9COURA,40,(REST)  MISE EN BIBLOM DE TDECB
!COMMENT ETUDE=2895PN141P
!COMMENT MISE EN BIBLOM DE TDECB:TRACE DES COURBES AVANT LISSAGE
!LIMIT (CORE,50),(TIME,1),(SPDISC,50),(PAGES,49)
!EXEC DLOM,%KEY=TDECB
!FORTRAN SI,LS,GO
      SUBROUTINE TDECB(KPLANC,DECB,ANGLES,FREQ,NFREQ,MIKEA,MIKEB,
     1ITIT,NCAR,XMOD)
C*****
C***** SOUS-PROGRAMME DE TRACE DES COURBES DECB=F(ANGLES)
C*****
      REAL*8 DECB(130,35),ANGLES(130),FREQ(33)
      COMMON /IDENT/NPOI,KMIC
      COMMON /TITRE/LIB(10),IDATE(3),DB1(8,4),IPI(8)
      DIMENSION ITIT(1),XMOD(1)
C*****
      DIMENSION SANG(130)
      DIMENSION NAM(7),NASA(5),IPOINT(2),IX(1),IY(1),NMIC(2),IDEG(1)
      DIMENSION MICRO(4),MOINS(1)
      DIMENSION IANG(4),XIANG(8),I5DB(1),IFREQ(2),IA(1),IHZ(1)
      DIMENSION X12(2),Y12(2)
      DIMENSION DIFF(130)
      DIMENSION NTR(15),NEP(15),NPL(15)
C*****
      DATA CX/300./,CY/210./
      DATA NAM/'PA-J.BRASSEUR   PROG.NOISE3 '/
      DATA NASA/'N.A.S.A./O.N.E.R.A. '/
      DATA IPOINT/'POINT   '/,IX/'X=  '/,IY/'Y=  '/,NMIC/' MICRO= '/
      DATA IANG/50,90,130,170/
      DATA XIANG/13.,43.,73.,103.,153.,183.,213.,243./
      DATA IDEG/'DEG '/,I5DB/'5DB '/,IFREQ/'FREQ.   '/
      DATA MOINS/'-   '/,IHZ/'HZ  '/,IA/'A   '/
      DATA NTR/1,2,3,4,5,1,2,3,4,5,1,2,3,4,5/
      DATA NEP/1,2,1,1,1,1,2,1,1,1,1,2,1,1,1/
      DATA NPL/1,1,1,1,1,2,2,2,2,2,3,3,3,3,3/
C***** TRAITEMENT D UNE LIGNE
      ILIGN=1
C***** INITIALISATION DES VALEURS X , Y , SANG ET MICRO
  120 CONTINUE
      IF(ILIGN.EQ.1) GO TO 140
C***** INITIALISATION DES VALEURS POUR LA LIGNE 2
      X=DB1(IPI(3),1)
      Y=DB1(IPI(3),2)
```

```
      DO 130 I=1,MIKEB
      SANG(I)=SNGL(ANGLES(I+MIKEA))
      DIFF(I)=SNGL(DECB(I+MIKEA,34))
  130 CONTINUE
      NBPT=MIKEB
      IF(KMIC.EQ.1) MICRO(1)=IPI(3) ; MICRO(2)=IPI(7) ; GO TO 160
      IF(KMIC.EQ.2) MICRO(1)=IPI(4) ; MICRO(2)=IPI(8) ; GO TO 160
      MICRO(1)=IPI(3)
      MICRO(2)=IPI(7)
      MICRO(3)=IPI(4)
      MICRO(4)=IPI(8)
      GO TO 160
C***** INITIALISATION DES VALEURS POUR LA LIGNE 1
  140 CONTINUE
      X=DB1(IPI(1),1)
      Y=DB1(IPI(1),2)
      DO 150 I=1,MIKEA
      SANG(I)=SNGL(ANGLES(I))
      DIFF(I)=SNGL(DECB(I,34))
  150 CONTINUE
      NBPT=MIKEA
      IF(KMIC.EQ.1) MICRO(1)=IPI(1) ; MICRO(2)=IPI(5) ; GO TO 160
      IF(KMIC.EQ.2) MICRO(1)=IPI(2) ; MICRO(2)=IPI(6) ; GO TO 160
      MICRO(1)=IPI(1)
      MICRO(2)=IPI(5)
      MICRO(3)=IPI(2)
      MICRO(4)=IPI(6)
C***** NOMBRE DE FREQUENCES PAR LIGNE
  160 CONTINUE
      CALL MINMAX(DIFF,NBPT,1,DMIN,DMAX,XMOD)
      IDMAX=(DMAX/10.)+1
      IDMAX=IDMAX*10
      IDMIN=IDMAX-70
      DMAX=IDMAX
      DMIN=IDMIN
      IF(NFREQ.GT.25) GO TO 170
      IFD=1
      IFF=NFREQ
      GO TO 180
  170 CONTINUE
      IFD=1
      IFF=25
C***** TRACE DU CADRE ET DU CARTOUCHE
  180 CONTINUE
      XT=10.
      YT=200.
      ANG=0.
      NC=28
      CALL TPL(CX,CY,XT,YT,ANG,NAM,NC,XMOD)
      KODE=1
      NCL=40
      NC=1
      CALL TCART(KODE,CX,CY,LIB,NCL,IDATE,NC,XMOD)
      KPLANC=KPLANC+1
C***** ECRITURE NASA ET TITRE LU SUR CARTE
      XT=CX-10.
      YT=CY-55.
      HL=3.
      HH=5.
      ANG=270.
```

```
      NC=19
      CALL KSTEP(1,1,4,1,XMOD)
      CALL KTEXTE(XT,YT,HL,HH,NASA,ANG,NC,XMOD)
      CALL KSTEP(1,1,1,1,XMOD)
C*****
      XT=10.
      YT=180.
      HH=3.
      ANG=0.
      CALL KTEXTE(XT,YT,HL,HH,ITIT,ANG,NCAR,XMOD)
C***** ECRITURE DE NPOI, X, Y ET KMIC
      XT=10.
      YT=170.
      NC=6
      CALL KTEXTE(XT,YT,HL,HH,IPOINT,ANG,NC,XMOD)
      XT=XT+18.
      NC=4
      CALL KFIXE(XT,YT,HL,HH,NPOI,ANG,NC,XMOD)
      XT=XT+20.
      NC=2
      CALL KTEXTE(XT,YT,HL,HH,IX,ANG,NC,XMOD)
      XT=XT+6.
      NC=5
      CALL KDECIM(XT,YT,HL,HH,X,ANG,NC,XMOD)
      XT=XT+23.
      NC=2
      CALL KTEXTE(XT,YT,HL,HH,IY,ANG,NC,XMOD)
      XT=XT+6.
      NC=5
      CALL KDECIM(XT,YT,HL,HH,Y,ANG,NC,XMOD)
      XT=XT+23.
      NC=8
      CALL KTEXTE(XT,YT,HL,HH,NMIC,ANG,NC,XMOD)
      XT=XT+27.
      NC=1
      CALL KFIXE(XT,YT,HL,HH,MICRO(1),ANG,NC,XMOD)
      XT=XT+6.
      CALL KTEXTE(XT,YT,HL,HH,MOINS,ANG,NC,XMOD)
      XT=XT+6.
      CALL KFIXE(XT,YT,HL,HH,MICRO(2),ANG,NC,XMOD)
      IF(KMIC.NE.0) GO TO 190
      XT=XT+6.
      CALL KTEXTE(XT,YT,HL,HH,MOINS,ANG,NC,XMOD)
      XT=XT+6.
      CALL KFIXE(XT,YT,HL,HH,MICRO(3),ANG,NC,XMOD)
      XT=XT+6.
      CALL KTEXTE(XT,YT,HL,HH,MOINS,ANG,NC,XMOD)
      XT=XT+6.
      CALL KFIXE(XT,YT,HL,HH,MICRO(4),ANG,NC,XMOD)
  190 CONTINUE
C***** ECRITURE 'FREQ.          A '
      XT=20.
      YT=155.
      NC=5
      CALL KTEXTE(XT,YT,HL,HH,IFREQ,ANG,NC,XMOD)
      XT=XT+42.
      NC=1
      CALL KTEXTE(XT,YT,HL,HH,IA,ANG,NC,XMOD)
      XT=XT+30.
      NC=2
```

```
      CALL KTEXTE(XT,YT,HL,HH,IHZ,ANG,NC,XMOD)
C*****
      XT=160.
      NC=5
      CALL KTEXTE(XT,YT,HL,HH,IFREQ,ANG,NC,XMOD)
      XT=XT+42.
      NC=1
      CALL KTEXTE(XT,YT,HL,HH,IA,ANG,NC,XMOD)
      XT=XT+30.
      NC=2
      CALL KTEXTE(XT,YT,HL,HH,IHZ,ANG,NC,XMOD)
C***** TRACE DU PREMIER AXE VERTICAL
      XT=10.
      YT=10.
      NC=0
      PASMM=10.
      ANG=90.
      XMIN=1.
      PAS=1.
      NGRAD=15
      NF=0
      CALL KAXE(XT,YT,NORD,NC,PASMM,ANG,XMIN,PAS,NGRAD,NF,XMOD)
C***** TRACE DU SECOND AXE VERTICAL
      XT=150.
      YT=10.
      NGRAD=15
      CALL KAXE(XT,YT,NORD,NC,PASMM,ANG,XMIN,PAS,NGRAD,NF,XMOD)
C***** TRACE PREMIER AXE HORIZONTAL(PARTIE GAUCHE DE LA PLANCHE)
      XT=10.
      YT=10.
      PASMM=7.5
      ANG=0.
      NGRAD=14
      CALL KAXE(XT,YT,NORD,NC,PASMM,ANG,XMIN,PAS,NGRAD,NF,XMOD)
C***** TRACE PREMIER AXE HORIZONTAL(PARTIE DROITE DE LA PLANCHE)
      XT=150.
      YT=10.
      CALL KAXE(XT,YT,NORD,NC,PASMM,ANG,XMIN,PAS,NGRAD,NF,XMOD)
C***** ECRITURE DES COTATIONS SUR LES AXES HORIZONTAUX
      YT=5.
      HL=2.
      HH=3.
      NC=3
      DO 200 I=1,4
      XT=XIANG(I)
      CALL KFIXE(XT,YT,HL,HH,IANG(I),ANG,NC,XMOD)
  200 CONTINUE
      XT=XT+10.
      NC=3
      CALL KTEXTE(XT,YT,HL,HH,IDEG,ANG,NC,XMOD)
C*****
      YT=5.
      DO 210 I=1,4
      XT=XIANG(I+4)
      CALL KFIXE(XT,YT,HL,HH,IANG(I),ANG,NC,XMOD)
  210 CONTINUE
      XT=XT+10.
      NC=3
      CALL KTEXTE(XT,YT,HL,HH,IDEG,ANG,NC,XMOD)
C***** ECRITURE 2DB
```

```
      XT=8.
      YT=142.
      HH=2.
      ANG=90.
      NC=3
      CALL KTEXTE(XT,YT,HL,HH,I5DB,ANG,NC,XMOD)
      XT=148.
      YT=142.
      CALL KTEXTE(XT,YT,HL,HH,I5DB,ANG,NC,XMOD)
C***** ECRITURE DES VALEURS MAX
      XT=12.
      YT=150.
      HH=2.
      HL=2.
      ANG=0.
      NC=5
      CALL KDECIM(XT,YT,HL,HH,DMAX,ANG,NC,XMOD)
      XT=152.
      CALL KDECIM(XT,YT,HL,HH,DMAX,ANG,NC,XMOD)
C***** ECRITURE DES FREQUENCES
      XT=38.
      YT=155.
      NC=7
      HL=3.
      HH=3.
      ANG=0.
      SFREQ=SNGL(FREQ(IFD))
      CALL KDECIM(XT,YT,HL,HH,SFREQ,ANG,NC,XMOD)
      IF((IFD+9).GE.IFF) GO TO 240
      SFREQ=SNGL(FREQ(IFD+9))
      XT=XT+30.
      CALL KDECIM(XT,YT,HL,HH,SFREQ,ANG,NC,XMOD)
C*****
      XT=178.
      SFREQ=SNGL(FREQ(IFD+10))
      CALL KDECIM(XT,YT,HL,HH,SFREQ,ANG,NC,XMOD)
  240 CONTINUE
      XT=XT+30.
      SFREQ=SNGL(FREQ(IFF))
      CALL KDECIM(XT,YT,HL,HH,SFREQ,ANG,NC,XMOD)
C***** TRACE DES COURBES
      CXSUJ1=40.
      CXSUJ2=170.
      CYSUJ1=DMIN
      CYSUJ2=DMAX
      CXOBJ1=10.
      CXOBJ2=107.5
      CYOBJ1=10.
      CYOBJ2=150.
      IDEB=IFD
      IF(IFF.GT.(IFD+9)) GO TO 280
      IFIN=IFF
      GO TO 290
  280 CONTINUE
      IFIN=IFD+9
  290 CONTINUE
C*****
      CALL DEPLAC(0.,XMOD)
      CALL DIMSUJ(CXSUJ1,CXSUJ2,CYSUJ1,CYSUJ2,XMOD)
      CALL DIMOBJ(CXOBJ1,CXOBJ2,CYOBJ1,CYOBJ2,XMOD)
```

```
      K=0
      DO 340 I=IDEB,IFIN
      IF(ILIGN.EQ.1) GO TO 310
C*****
      DO 300 J=1,MIKEB
      DIFF(J)=SNGL(DECB(J+MIKEA,I))
  300 CONTINUE
      GO TO 330
C*****
  310 CONTINUE
      DO 320 J=1,MIKEA
      DIFF(J)=SNGL(DECB(J,I))
  320 CONTINUE
C*****
  330 CONTINUE
      K=K+1
      IF(K.GT.15) WRITE(108,500) ; RETURN
      CALL KSTEP(1,NTR(K),NEP(K),NPL(K),XMOD)
      CALL KTRACE(SANG,DIFF,NBPT,XMOD)
  340 CONTINUE
C*****
      CALL KSTEP(1,1,1,1,XMOD)
      IF(IFIN.EQ.IFF) GO TO 350
      IDEB=IFIN+1
      IFIN=IFF
      CXOBJ1=150.
      CXOBJ2=247.5
      GO TO 290
C*****
  350 CONTINUE
      IF(IFF.EQ.NFREQ) GO TO 360
      IFD=IFF+1
      IFF=NFREQ
      CCX=CX+20.
      CALL DEPLAC(CCX,XMOD)
      GO TO 180
  360 CONTINUE
      ILIGN=ILIGN+1
      CCX=CX+20.
      CALL DEPLAC(CCX,XMOD)
      IF(ILIGN.LE.2) GO TO 120
C*****
      RETURN
  500 FORMAT(1X,'TROP DE COURBES 1/3 OCTAVES '//)
      END
!EXEC INOMB,%KEY=TDECB
!JOB,T TDIF,P003,P9COURA,40,(REST)  MISE EN BIBLOM DE TDIFF
!COMMENT ETUDE=2895PN141P
!COMMENT MISE EN BIBLOM DE TDIFF:TRACE DES COURBES DE DIFFERENCE
!LIMIT (CORE,50),(TIME,1),(SPDISC,50),(PAGES,49)
!EXEC DLOM,%KEY=TDIFF
!FORTRAN SI,LS,GO
      SUBROUTINE TDIFF(KPLANC,DECB,ANGLES,FREQ,NFREQ,MIKEA,MIKEB,
     1ITIT,NCAR,XMOD)
C*****
C***** SOUS-PROGRAMME DE TRACE DES DIFFERENCES
C*****
      REAL*8 DECB(130,35),ANGLES(130),FREQ(33)
      REAL*8 DECBS
      COMMON /DONTD/DECBS(130,35)
```

```
      COMMON /IDENT/NPOI,KMIC
      COMMON /TITRE/LIB(10),IDATE(3),DB1(8,4),IPI(8)
      DIMENSION ITIT(1),XMOD(1)
C*****
      DIMENSION SFREQ(33),SANG(130)
      DIMENSION NAM(7),NASA(5),IPOINT(2),IX(1),IY(1),NMIC(2),IDEG(1)
      DIMENSION MICRO(4),MOINS(1)
      DIMENSION IANG(4),XIANG(8),I2DB(1),IFREQ(1)
      DIMENSION X12(2),Y12(2)
      DIMENSION DIFF(130)
C*****
      DATA CX/300./,CY/210./
      DATA NAM/'PA-J.BRASSEUR   PROG.NOISE3 '/
      DATA NASA/'N.A.S.A./O.N.E.R.A.  '/
      DATA IPOINT/'POINT    '/,IX/'X=   '/,IY/'Y=   '/,NMIC/' MICRO= '/
      DATA IANG/50,90,130,170/
      DATA XIANG/13.,43.,73.,103.,153.,183.,213.,243./
      DATA IDEG/'DEG '/,I2DB/'2DB '/,IFREQ/'FREQ'/
      DATA MOINS/'-    '/
C***** CALCUL DES DIFFERENCES EN DOUBLE PRECISION
      DO 100 J=1,130
      DO 100 I=1,35
      DECBS(J,I)=DECBS(J,I)-DECB(J,I)
  100 CONTINUE
C***** CONVERSION DES FREQUENCES EN SIMPLE PRECISION
      DO 110 I=1,33
      SFREQ(I)=SNGL(FREQ(I))
  110 CONTINUE
C***** TRAITEMENT D UNE LIGNE
      ILIGN=1
C***** INITIALISATION DES VALEURS X , Y , SANG ET MICRO
  120 CONTINUE
      IF(ILIGN.EQ.1) GO TO 140
C***** INITIALISATION DES VALEURS POUR LA LIGNE 2
      X=DB1(IPI(3),1)
      Y=DB1(IPI(3),2)
      DO 130 I=1,MIKEB
      SANG(I)=SNGL(ANGLES(I+MIKEA))
  130 CONTINUE
      NBPT=MIKEB
      IF(KMIC.EQ.1) MICRO(1)=IPI(3) ; MICRO(2)=IPI(7) ; GO TO 160
      IF(KMIC.EQ.2) MICRO(1)=IPI(4) ; MICRO(2)=IPI(8) ; GO TO 160
      MICRO(1)=IPI(3)
      MICRO(2)=IPI(7)
      MICRO(3)=IPI(4)
      MICRO(4)=IPI(8)
      GO TO 160
C***** INITIALISATION DES VALEURS POUR LA LIGNE 1
  140 CONTINUE
      X=DB1(IPI(1),1)
      Y=DB1(IPI(1),2)
      DO 150 I=1,MIKEA
      SANG(I)=SNGL(ANGLES(I))
  150 CONTINUE
      NBPT=MIKEA
      IF(KMIC.EQ.1) MICRO(1)=IPI(1) ; MICRO(2)=IPI(5) ; GO TO 160
      IF(KMIC.EQ.2) MICRO(1)=IPI(2) ; MICRO(2)=IPI(6) ; GO TO 160
      MICRO(1)=IPI(1)
      MICRO(2)=IPI(5)
      MICRO(3)=IPI(2)
```

```
      MICRO(4)=IPI(6)
C***** NOMBRE DE FREQUENCES PAR LIGNE
  160 CONTINUE
      IF(NFREQ.GT.25) GO TO 170
      IFD=1
      IFF=NFREQ
      GO TO 180
  170 CONTINUE
      IFD=1
      IFF=25
C***** TRACE DU CADRE ET DU CARTOUCHE
  180 CONTINUE
      XT=10.
      YT=200.
      ANG=0.
      NC=28
      CALL TPL(CX,CY,XT,YT,ANG,NAM,NC,XMOD)
      KODE=1
      NCL=40
      NC=1
      CALL TCART(KODE,CX,CY,LIB,NCL,IDATE,NC,XMOD)
      KPLANC=KPLANC+1
C***** ECRITURE NASA ET TITRE LU SUR CARTE
      XT=CX-10.
      YT=CY-55.
      HL=3.
      HH=5.
      ANG=270.
      NC=19
      CALL KSTEP(1,1,4,1,XMOD)
      CALL KTEXTE(XT,YT,HL,HH,NASA,ANG,NC,XMOD)
      CALL KSTEP(1,1,1,1,XMOD)
C*****
      XT=10.
      YT=180.
      HH=3.
      ANG=0.
      CALL KTEXTE(XT,YT,HL,HH,ITIT,ANG,NCAR,XMOD)
C***** ECRITURE DE NPOI, X, Y ET KMIC
      XT=10.
      YT=170.
      NC=6
      CALL KTEXTE(XT,YT,HL,HH,IPOINT,ANG,NC,XMOD)
      XT=XT+18.
      NC=4
      CALL KFIXE(XT,YT,HL,HH,NPOI,ANG,NC,XMOD)
      XT=XT+20.
      NC=2
      CALL KTEXTE(XT,YT,HL,HH,IX,ANG,NC,XMOD)
      XT=XT+6.
      NC=5
      CALL KDECIM(XT,YT,HL,HH,X,ANG,NC,XMOD)
      XT=XT+23.
      NC=2
      CALL KTEXTE(XT,YT,HL,HH,IY,ANG,NC,XMOD)
      XT=XT+6.
      NC=5
      CALL KDECIM(XT,YT,HL,HH,Y,ANG,NC,XMOD)
      XT=XT+23.
      NC=8
```

```
      CALL KTEXTE(XT,YT,HL,HH,NMIC,ANG,NC,XMOD)
      XT=XT+27.
      NC=1
      CALL KFIXE(XT,YT,HL,HH,MICRO(1),ANG,NC,XMOD)
      XT=XT+6.
      CALL KTEXTE(XT,YT,HL,HH,MOINS,ANG,NC,XMOD)
      XT=XT+6.
      CALL KFIXE(XT,YT,HL,HH,MICRO(2),ANG,NC,XMOD)
      IF(KMIC.NE.0) GO TO 190
      XT=XT+6.
      CALL KTEXTE(XT,YT,HL,HH,MOINS,ANG,NC,XMOD)
      XT=XT+6.
      CALL KFIXE(XT,YT,HL,HH,MICRO(3),ANG,NC,XMOD)
      XT=XT+6.
      CALL KTEXTE(XT,YT,HL,HH,MOINS,ANG,NC,XMOD)
      XT=XT+6.
      CALL KFIXE(XT,YT,HL,HH,MICRO(4),ANG,NC,XMOD)
  190 CONTINUE
C***** TRACE DU PREMIER AXE VERTICAL
      XT=10.
      YT=40.
      NC=0
      PASMM=10.
      ANG=90.
      XMIN=1.
      PAS=1.
      NGRAD=11
      NF=0
      CALL KAXE(XT,YT,NORD,NC,PASMM,ANG,XMIN,PAS,NGRAD,NF,XMOD)
C***** TRACE DU SECOND AXE VERTICAL
      XT=150.
      YT=10.
      NGRAD=16
      CALL KAXE(XT,YT,NORD,NC,PASMM,ANG,XMIN,PAS,NGRAD,NF,XMOD)
C***** TRACE PREMIER AXE HORIZONTAL(PARTIE GAUCHE DE LA PLANCHE)
      XT=10.
      YT=45.
      PASMM=7.5
      ANG=0.
      NGRAD=14
      CALL KAXE(XT,YT,NORD,NC,PASMM,ANG,XMIN,PAS,NGRAD,NF,XMOD)
C***** TRACE PREMIER AXE HORIZONTAL(PARTIE DROITE DE LA PLANCHE)
      XT=150.
      YT=15.
      CALL KAXE(XT,YT,NORD,NC,PASMM,ANG,XMIN,PAS,NGRAD,NF,XMOD)
C***** ECRITURE DES COTATIONS SUR LES AXES HORIZONTAUX
      YT=35.
      HL=2.
      HH=3.
      NC=3
      DO 200 I=1,4
      XT=XIANG(I)
      CALL KFIXE(XT,YT,HL,HH,IANG(I),ANG,NC,XMOD)
  200 CONTINUE
      XT=XT+10.
      NC=3
      CALL KTEXTE(XT,YT,HL,HH,IDEG,ANG,NC,XMOD)
C*****
      YT=5.
      DO 210 I=1,4
```

```
      XT=XIANG(I+4)
      CALL KFIXE(XT,YT,HL,HH,IANG(I),ANG,NC,XMOD)
  210 CONTINUE
      XT=XT+10.
      NC=3
      CALL KTEXTE(XT,YT,HL,HH,IDEG,ANG,NC,XMOD)
C***** ECRITURE 2DB
      XT=8.
      YT=132.
      HH=2.
      ANG=90.
      NC=3
      CALL KTEXTE(XT,YT,HL,HH,I2DB,ANG,NC,XMOD)
      XT=148.
      YT=152.
      CALL KTEXTE(XT,YT,HL,HH,I2DB,ANG,NC,XMOD)
C***** TRACE DES AUTRES AXES
      X12(1)=10.
      X12(2)=107.5
      Y12(1)=45.
      DO 220 I=1,9
      Y12(1)=Y12(1)+10.
      Y12(2)=Y12(1)
      CALL KTRACE(X12,Y12,2,XMOD)
  220 CONTINUE
C*****
      X12(1)=150.
      X12(2)=247.5
      Y12(1)=15.
      DO 230 I=1,14
      Y12(1)=Y12(1)+10.
      Y12(2)=Y12(1)
      CALL KTRACE(X12,Y12,2,XMOD)
  230 CONTINUE
C***** ECRITURE DES FREQUENCES EN BOUT D AXE
      YT=45.
      XT=111.
      HL=2.
      HH=2.
      ANG=0.
      NC=7
      DO 240 I=IFD,IFD+9
      IF(I.GT.IFF) GO TO 260
      CALL KDECIM(XT,YT,HL,HH,SFREQ(I),ANG,NC,XMOD)
      YT=YT+10.
  240 CONTINUE
      YT=YT-5.
      NC=4
      CALL KTEXTE(XT,YT,HL,HH,IFREQ,ANG,NC,XMOD)
C*****
      XT=251.
      YT=15.
      NC=7
      DO 250 I=IFD+10,IFF
      CALL KDECIM(XT,YT,HL,HH,SFREQ(I),ANG,NC,XMOD)
      YT=YT+10.
  250 CONTINUE
      YT=YT-5.
      NC=4
      CALL KTEXTE(XT,YT,HL,HH,IFREQ,ANG,NC,XMOD)
```

```
      GO TO 270
  260 CONTINUE
      YT=YT-5.
      NC=4
      CALL KTEXTE(XT,YT,HL,HH,IFREQ,ANG,NC,XMOD)
  270 CONTINUE
C***** TRACE DES COURBES DE DIFFERENCES
      CXSUJ1=40.
      CXSUJ2=170.
      CYSUJ1=-1.
      CYSUJ2=+1.
      CXOBJ1=10.
      CXOBJ2=107.5
      CYOBJ1=30.
      CYOBJ2=40.
      IDEB=IFD
      IF(IFF.GT.(IFD+9)) GO TO 280
      IFIN=IFF
      GO TO 290
  280 CONTINUE
      IFIN=IFD+9
  290 CONTINUE
C*****
      DO 340 I=IDEB,IFIN
      IF(ILIGN.EQ.1) GO TO 310
C*****
      DO 300 J=1,MIKEB
      DIFF(J)=SNGL(DECBS(J+MIKEA,I))
  300 CONTINUE
      GO TO 330
C*****
  310 CONTINUE
      DO 320 J=1,MIKEA
      DIFF(J)=SNGL(DECBS(J,I))
  320 CONTINUE
C*****
  330 CONTINUE
      CYOBJ1=CYOBJ1+10.
      CYOBJ2=CYOBJ2+10.
      CALL DEPLAC(0.,XMOD)
      CALL DIMSUJ(CXSUJ1,CXSUJ2,CYSUJ1,CYSUJ2,XMOD)
      CALL DIMOBJ(CXOBJ1,CXOBJ2,CYOBJ1,CYOBJ2,XMOD)
      CALL KTRACE(SANG,DIFF,NBPT,XMOD)
  340 CONTINUE
C*****
      IF(IFIN.EQ.IFF) GO TO 350
      IDEB=IFIN+1
      IFIN=IFF
      CXOBJ1=150.
      CXOBJ2=247.5
      CYOBJ1=0.
      CYOBJ2=10.
      GO TO 290
C*****
  350 CONTINUE
      IF(IFF.EQ.NFREQ) GO TO 360
      IFD=IFF+1
      IFF=NFREQ
      CCX=CX+20.
      CALL DEPLAC(CCX,XMOD)
```

```
      GO TO 180
  360 CONTINUE
      ILIGN=ILIGN+1
      CCX=CX+20.
      CALL DEPLAC(CCX,XMOD)
      IF(ILIGN.LE.2) GO TO 120
C*****
      RETURN
      END
!EXEC INOMB,%KEY=TDIFF
!JOB,T TXSD,P003,P9COURA,40,(REST)  MISE EN BIBLOM DE TXSD
!COMMENT ETUDE=2895PN141P
!COMMENT MISE EN BIBLOM DE TXSD:TRACE DES COURBES X/D=F(THETA-S)
!LIMIT (CORE,50),(TIME,1),(SPDISC,50),(PAGES,49)
!EXEC DLOM,%KEY=TXSD
!FORTRAN SI,LS,GO
      SUBROUTINE TXSD(KPLANC,XOVERD,THETAS,NTAB,NFREQ,XDMAX,
     1THETSM,RNZDIA,VJET,FREQ,LIB1,LIB2,XMOD)
C***** SOUS-PROGRAMME DE TRACE DES COURBES X/D=F(THETAS)
      REAL*8 XOVERD(50,33),THETAS(50,33),XDMAX(33),THETSM(33)
      REAL*8 RNZDIA,VJET,FREQ(33)
      COMMON /IDENT/NPOI
      COMMON /TITRE/LIB(10),IDATE(3)
      COMMON /TABD/STR(33),DFMAX(33),XPEAKN(33),XPEAKF(33)
      REAL*8 STR,DFMAX,XPEAKN,XPEAKF
      DIMENSION XMOD(1),NTAB(1),LIB1(1),LIB2(1)
C*****
      DIMENSION NAM(7),NASA(5),IPOINT(2),IDEG(1)
      DIMENSION IV(4),IDIA(3),IST(1),IDIF(2),IPEAK(3),INEAR(1),IFAR(1)
      DIMENSION ITHE(2),IXSD(1),IFREQ(1)
      DIMENSION IANG(7),XIANG(7),IVALX(6)
      DIMENSION SXSD(50),STHETA(50)
      DIMENSION IFIG(1)
      DIMENSION X12(2),Y12(2)
C*****
      DATA NAM/'PA-J.BRASSEUR   PROG.NOISE3 '/
      DATA NASA/'N.A.S.A./O.N.E.R.A.  '/
      DATA IPOINT/'POINT    '/
      DATA IDEG/'DEG '/
      DATA IV/'VJET(FT/SEC)=    '/
      DATA IDIA/'DIA.(FT)=    '/,IST/'ST= '/,IDIF/'DIF. MAX'/
      DATA IPEAK/'PEAK(DEG.)   '/,INEAR/'NEAR'/,IFAR/'FAR '/
      DATA ITHE/'THETA-S '/,IXSD/'X/D '/,IFREQ/'FREQ'/
C*****
      DATA CX/210./,CY/300./
      DATA IANG/40,60,80,100,120,140,160/
      DATA XIANG/47.,67.,87.,107.,127.,147.,167./
      DATA IVALX/0,2,4,6,8,10/
      DATA IFIG/'FIG.'/
C*****
C***** TRACE DE 2 COURBES PAR PLANCHE
      NBCT=0
      DO 210 IF=1,NFREQ
      IF(NTAB(IF).EQ.0) GO TO 210
      IF(NBCT.EQ.1) GO TO 160
C***** TRACE DU CADRE ET DU CARTOUCHE
      IF(NBCT.EQ.2) NBCT=0
      XT=10.
      YT=10.
      ANG=90.
```

```
      NC=28
      CALL TPL(CX,CY,XT,YT,ANG,NAM,NC,XMOD)
      KODE=0
      NCL=40
      NC=1
      CALL TCART(KODE,CX,CY,LIB,NCL,IDATE,NC,XMOD)
      KPLANC=KPLANC+1
C***** ECRITURE NASA
      XT=55.
      YT=CY-10.
      HL=3.
      HH=5.
      ANG=0.
      NC=19
      CALL KSTEP(1,1,4,1,XMOD)
      CALL KTEXTE(XT,YT,HL,HH,NASA,ANG,NC,XMOD)
      CALL KSTEP(1,1,1,1,XMOD)
C***** ECRITURE DANS LA MARGE DE LIB1 ET LIB2
      HL=2.5
      HH=2.5
      NC=80
      ANG=90.
      XT=6.5
      YT=100.
      CALL KTEXTE(XT,YT,HL,HH,LIB1,ANG,NC,XMOD)
      XT=16.5
      CALL KTEXTE(XT,YT,HL,HH,LIB2,ANG,NC,XMOD)
C***** ECRITURE NPOI
      XT=25.
      YT=CY-28.
      NC=5
      HL=3.
      ANG=0.
      HH=3.
      CALL KTEXTE(XT,YT,HL,HH,IPOINT,ANG,NC,XMOD)
C*****
      XT=XT+18.
      NC=4
      CALL KFIXE(XT,YT,HL,HH,NPOI,ANG,NC,XMOD)
C***** ECRITURE VJET
      XT=XT+18.
      NC=13
      CALL KTEXTE(XT,YT,HL,HH,IV,ANG,NC,XMOD)
C*****
      S=SNGL(VJET)
      XT=XT+42.
      NC=6
      CALL KDECIM(XT,YT,HL,HH,S,ANG,NC,XMOD)
C***** ECRITURE DE DIA.(FT)
      XT=XT+24.
      NC=9
      CALL KTEXTE(XT,YT,HL.,HH,IDIA,ANG,NC,XMOD)
C*****
      XT=XT+30.
      NC=5
      S=SNGL(RNZDIA)
      CALL KDECIM(XT,YT,HL,HH,S,ANG,NC,XMOD)
C***** ECRITURE DE FIG.
      XT=XT+30.
      NC=4
```

```
      CALL KTEXTE(XT,YT,HL,HH,IFIG,ANG,NC,XMOD)
C***** TRACE DU TABLEAU
      X12(1)=20.
      X12(2)=CX-10.
      Y12(1)=CY-45.
      Y12(2)=Y12(1)
      CALL KTRACE(X12,Y12,2,XMOD)
      X12(1)=18.
      Y12(1)=CY-60.
      Y12(2)=CY-35.
      DO 110 I=1,7
      X12(1)=X12(1)+26.
      X12(2)=X12(1)
      IF(I.EQ.4) GO TO 100
      CALL KTRACE(X12,Y12,2,XMOD)
      GO TO 110
  100 CONTINUE
      Y12(2)=Y12(2)-5.
      CALL KTRACE(X12,Y12,2,XMOD)
      Y12(2)=CY-35.
  110 CONTINUE
C***** DIFFERENTES INSCRIPTIONS DU TABLEAU
      YT=CY-40.
      XT=26.
      ANG=0.
      HL=3.
      HH=3.
      NC=4
      CALL KTEXTE(XT,YT,HL,HH,IFREQ,ANG,NC,XMOD)
C*****
      XT=54.
      NC=2
      CALL KTEXTE(XT,YT,HL,HH,IST,ANG,NC,XMOD)
C*****
      XT=72.
      NC=8
      CALL KTEXTE(XT,YT,HL,HH,IDIF,ANG,NC,XMOD)
C*****
      YT=YT+2.
      XT=107.
      NC=10
      CALL KTEXTE(XT,YT,HL,HH,IPEAK,ANG,NC,XMOD)
      YT=YT-5.
      XT=103.
      NC=4
      CALL KTEXTE(XT,YT,HL,HH,INEAR,ANG,NC,XMOD)
      XT=130.
      NC=3
      CALL KTEXTE(XT,YT,HL,HH,IFAR,ANG,NC,XMOD)
C*****
      YT=CY-40.
      XT=150.
      NC=7
      CALL KTEXTE(XT,YT,HL,HH,ITHE,ANG,NC,XMOD)
C*****
      XT=CX-28.
      NC=3
      CALL KTEXTE(XT,YT,HL,HH,IXSD,ANG,NC,XMOD)
C***** TRACE DU PREMIER AXE VERTICAL(PARTIE HAUTE DE LA PLANCHE)
      XT=40.
```

```
      YT=130.
      NC=0
      PASMM=20.
      ANG=90.
      XMIN=1.
      PAS=1.
      NGRAD=6
      NF=0
      CALL KAXE(XT,YT,NORD,NC,PASMM,ANG,XMIN,PAS,NGRAD,NF,XMOD)
C***** TRACE DU SECOND AXE VERTICAL(PARTIE BASSE DE LA PLANCHE)
      YT=10.
      CALL KAXE(XT,YT,NORD,NC,PASMM,ANG,XMIN,PAS,NGRAD,NF,XMOD)
C***** TRACE DU PREMIER AXE HORIZONTAL
      XT=40.
      YT=130.
      ANG=0.
      PASMM=10.
      NGRAD=15
      CALL KAXE(XT,YT,NORD,NC,PASMM,ANG,XMIN,PAS,NGRAD,NF,XMOD)
C***** TRACE DU SECOND AXE HORIZONTAL
      YT=10.
      CALL KAXE(XT,YT,NORD,NC,PASMM,ANG,XMIN,PAS,NGRAD,NF,XMOD)
C***** ECRITURE DES COTATIONS SUR LES AXES HORIZONTAUX
      YT=5.
      ANG=0.
      HL=2.
      HH=2.
      NC=3
      DO 120 I=1,7
      XT=XIANG(I)
      CALL KFIXE(XT,YT,HL,HH,IANG(I),ANG,NC,XMOD)
  120 CONTINUE
      XT=XT+10.
      NC=3
      CALL KTEXTE(XT,YT,HL,HH,IDEG,ANG,NC,XMOD)
      YT=10.
      XT=183.
      NC=7
      CALL KTEXTE(XT,YT,HL,HH,ITHE,ANG,NC,XMOD)
      YT=100.
      XT=60.
      NC=3
      CALL KTEXTE(XT,YT,HL,HH,IST,ANG,NC,XMOD)
C*****
      YT=125.
      NC=3
      DO 130 I=1,7
      XT=XIANG(I)
      CALL KFIXE(XT,YT,HL,HH,IANG(I),ANG,NC,XMOD)
  130 CONTINUE
      XT=XT+10.
      NC=3
      CALL KTEXTE(XT,YT,HL,HH,IDEG,ANG,NC,XMOD)
      YT=YT+5.
      XT=183.
      NC=7
      CALL KTEXTE(XT,YT,HL,HH,ITHE,ANG,NC,XMOD)
      YT=220.
      XT=60.
      NC=3
```

```
      CALL KTEXTE(XT,YT,HL,HH,IST,ANG,NC,XMOD)
C***** ECRITURE DES COTATIONS SUR LES AXES VERTICAUX
      XT=32.
      NC=2
      YT=-10.
      DO 140 I=1,6
      YT=YT+20.
      CALL KFIXE(XT,YT,HL,HH,IVALX(I),ANG,NC,XMOD)
  140 CONTINUE
      XT=21.
      NC=3
      CALL KTEXTE(XT,YT,HL,HH,IXSD,ANG,NC,XMOD)
C*****
      XT=32.
      NC=2
      DO 150 I=1,6
      YT=YT+20.
      CALL KFIXE(XT,YT,HL,HH,IVALX(I),ANG,NC,XMOD)
  150 CONTINUE
      XT=21.
      NC=3
      CALL KTEXTE(XT,YT,HL,HH,IXSD,ANG,NC,XMOD)
C***** CONVERSION EN SIMPLE PRECISION DE X/D ET THETA
  160 CONTINUE
      DO 170 I=1,NTAB(IF)
      SXSD(I)=SNGL(XOVERD(I,IF))
      STHETA(I)=SNGL(THETAS(I,IF))
  170 CONTINUE
      NBCT=NBCT+1
      IF(NBCT.EQ.1) YT=250. ; GO TO 180
C***** REMPLISSAGE DU TABLEAU
      YT=243.
  180 CONTINUE
      XT=25.
      HL=2.
      HH=2.
      NC=7
      ANG=0.
      S=SNGL(FREQ(IF))
      CALL KDECIM(XT,YT,HL,HH,S,ANG,NC,XMOD)
      XT=50.
      S=SNGL(STR(IF))
      CALL KDECIM(XT,YT,HL,HH,S,ANG,NC,XMOD)
      XT=XT+26.
      S=SNGL(DFMAX(IF))
      CALL KDECIM(XT,YT,HL,HH,S,ANG,NC,XMOD)
      XT=XT+26.
      S=SNGL(XPEAKN(IF))
      CALL KDECIM(XT,YT,HL,HH,S,ANG,NC,XMOD)
      XT=XT+26.
      S=SNGL(XPEAKF(IF))
      CALL KDECIM(XT,YT,HL,HH,S,ANG,NC,XMOD)
      XT=XT+26.
      S=SNGL(THETSM(IF))
      CALL KDECIM(XT,YT,HL,HH,S,ANG,NC,XMOD)
      XT=XT+26.
      S=SNGL(XDMAX(IF))
      CALL KDECIM(XT,YT,HL,HH,S,ANG,NC,XMOD)
C*****
      IF(NBCT.EQ.1) YT=220. ; GO TO 190
```

```
      YT=100.
  190 CONTINUE
      XT=70.
      NC=7
      S=SNGL(STR(IF))
      CALL KDECIM(XT,YT,HL,HH,S,ANG,NC,XMOD)
C*****
C***** TRACE EN POINTE DES COURBES
      CXSUJ1=30.
      CXSUJ2=170.
      CYSUJ1=-0.5
      CYSUJ2=10.
      CXOBJ1=40.
      CXOBJ2=CX-30.
      IF(NBCT.EQ.1) CYOBJ1=125. ; CYOBJ2=230. ; GO TO 200
      CYOBJ1=5.
      CYOBJ2=110.
  200 CONTINUE
      CALL DEPLAC(0.,XMOD)
      CALL DIMSUJ(CXSUJ1,CXSUJ2,CYSUJ1,CYSUJ2,XMOD)
      CALL DIMOBJ(CXOBJ1,CXOBJ2,CYOBJ1,CYOBJ2,XMOD)
      NBPT=NTAB(IF)
      CALL KSTEP(-16,1,1,1,XMOD)
      CALL KPOINT(STHETA,SXSD,NBPT,XMOD)
      CALL KSTEP(1,1,1,1,XMOD)
      IF(NBCT.NE.2) GO TO 220
      CCX=CX+20.
      CALL DEPLAC(CCX,XMOD)
      GO TO 210
  220 CONTINUE
      CALL DEPLAC(0.,XMOD)
      CALL DIMSUJ(0.,CX,0.,CY,XMOD)
      CALL DIMOBJ(0.,CX,0.,CY,XMOD)
  210 CONTINUE
      IF(NBCT.EQ.2) RETURN
      CCX=CX+20.
      CALL DEPLAC(CCX,XMOD)
      RETURN
      END
!EXEC INOMB,%KEY=TXSD
!JOB,T TPEA,P003,P9COURA,40,(REST)  MISE EN BIBLOM DE TPEAK
!COMMENT ETUDE=2895PN141P
!COMMENT MISE EN BIBLOM DE TPEAK:TRACE DES COURBES THETA-S DU PIC=F(STROUHAL)
!LIMIT (CORE,50),(TIME,1),(SPDISC,50),(PAGES,49)
!EXEC DLOM,%KEY=TPEAK
!FORTRAN SI,LS,GO
      SUBROUTINE TPEAK(KPLANC,THETSM,STR,NFREQ,RNZDIA,VJET,LIB1,LIB2
     1,XMOD)
C***** SOUS-PROGRAMME DE TRACE DES COURBES THETSM=F(STR)
      REAL*8 THETSM(1),STR(1)
      REAL*8 RNZDIA,VJET
      DIMENSION XMOD(1),LIB1(1),LIB2(1)
C*****
      COMMON /IDENT/NPOI
      COMMON /TITRE/LIB(10),IDATE(3)
C*****
      DIMENSION NAM(7),IPOINT(2),IDIA(3),IV(4),IFIG(1)
      DIMENSION NASA(5)
      DIMENSION IVALY(6)
      DIMENSION ITHE(4),IST(2)
```

```
      DIMENSION X(2),Y(2)
      DIMENSION VALX(5),XX(5)
      DIMENSION STHETA(33),SSTR(33)
C*****
      DATA NAM/'PA-J.BRASSEUR   PROG.NOISE3 '/
      DATA CX/300./,CY/210./
      DATA IPOINT/'POINT    '/,IV/'VJET(FT/SEC)=    '/
      DATA IDIA/'DIA.(FT)=    '/,IFIG/'FIG.'/
      DATA NASA/'N.A.S.A./O.N.E.R.A. '/
      DATA IVALY/60,80,100,120,140,160/
      DATA ITHE/'THETA-S DU PIC  '/
      DATA IST/'STROUHAL'/
      DATA VALX/+0.01,+0.10,+1.00,+10.0,+20.0/
      DATA XX/16.,86.,156.,226.,247./
C***** TRACE DU CADRE ET DU CARTOUCHE
      XT=10.
      YT=200.
      ANG=0.
      NC=28
      CALL TPL(CX,CY,XT,YT,ANG,NAM,NC,XMOD)
      KODE=1
      NCL=40
      NC=1
      CALL TCART(KODE,CX,CY,LIB,NCL,IDATE,NC,XMOD)
      KPLANC=KPLANC+1
C***** ECRITURE NASA
      XT=CX-10.
      YT=CY-55.
      HL=3.
      HH=5.
      ANG=270.
      NC=19
      CALL KSTEP(1,1,4,1,XMOD)
      CALL KTEXTE(XT,YT,HL,HH,NASA,ANG,NC,XMOD)
      CALL KSTEP(1,1,1,1,XMOD)
C***** ECRITURE DANS LA MARGE DE LIB1 ET LIB2
      HL=2.5
      HH=2.5
      NC=80
      ANG=0.
      XT=100.
      YT=CY-6.5
      CALL KTEXTE(XT,YT,HL,HH,LIB1,ANG,NC,XMOD)
      YT=CY-16.5
      CALL KTEXTE(XT,YT,HL,HH,LIB2,ANG,NC,XMOD)
C***** ECRITURE DE POINT
      XT=10.
      YT=CY-30.
      NC=5
      HL=3.
      HH=3.
      ANG=0.
      CALL KTEXTE(XT,YT,HL,HH,IPOINT,ANG,NC,XMOD)
C*****
      XT=XT+18.
      NC=4
      CALL KFIXE(XT,YT,HL,HH,NPOI,ANG,NC,XMOD)
C***** ECRITURE DE VJET
      XT=50.
      NC=13
```

```
      CALL KTEXTE(XT,YT,HL,HH,IV,ANG,NC,XMOD)
C*****
      XT=XT+42.
      NC=6
      S=SNGL(VJET)
      CALL KDECIM(XT,YT,HL,HH,S,ANG,NC,XMOD)
C***** ECRITURE DE DIA.(FT)=
      XT=120.
      NC=9
      CALL KTEXTE(XT,YT,HL,HH,IDIA,ANG,NC,XMOD)
C*****
      S=SNGL(RNZDIA)
      XT=XT+30.
      NC=5
      CALL KDECIM(XT,YT,HL,HH,S,ANG,NC,XMOD)
C***** ECRITURE DE FIG.
      XT=200.
      NC=4
      CALL KTEXTE(XT,YT,HL,HH,IFIG,ANG,NC,XMOD)
C***** TRACE DE L AXE VERTICAL
      XT=20.
      YT=20.
      ANG=90.
      XMIN=1.
      NC=0
      PAS=1.
      NGRAD=12
      NF=0
      PASMM=10.
      CALL KAXE(XT,YT,NORD,NC,PASMM,ANG,XMIN,PAS,NGRAD,NF,XMOD)
C***** ECRITURE DES COTATIONS SUR L AXE VERTICAL
      XT=10.
      HL=2.
      HH=2.
      YT=0.
      ANG=0.
      NC=3
      DO 100 I=1,6
      YT=YT+20.
      CALL KFIXE(XT,YT,HL,HH,IVALY(I),ANG,NC,XMOD)
  100 CONTINUE
C***** ECRITURE DE THETA-S DU PIC
      YT=YT+13.
      XT=10.
      NC=14
      CALL KTEXTE(XT,YT,HL,HH,ITHE,ANG,NC,XMOD)
C***** TRACE DE L AXE HORIZONTAL
      X(1)=20.
      X(2)=251.
      Y(1)=20.
      Y(2)=Y(1)
      CALL KTRACE(X,Y,2,XMOD)
C***** ECRITURE DE STROUHAL
      XT=255.
      YT=20.
      HL=2.
      HH=2.
      ANG=0.
      NC=8
      CALL KTEXTE(XT,YT,HL,HH,IST,ANG,NC,XMOD)
```

```
C***** ECRITURE DES COTATIONS SUR L AXE HORIZONTAL
      YT=14.
      NC=5
      DO 110 I=1,5
      CALL KDECIM(XX(I),YT,HL,HH,VALX(I),ANG,NC,XMOD)
  110 CONTINUE
C***** GRADUATIONS DE L AXE HORIZONTAL
      CXOBJ1=20.
      CXOBJ2=251.
      CYOBJ1=17.5
      CYOBJ2=22.5
      CXSUJ1=ALOG10(0.01)
      CXSUJ2=ALOG10(20.)
      CYSUJ1=-2.5
      CYSUJ2=+2.5
      CALL DEPLAC(0.,XMOD)
      CALL DIMSUJ(CXSUJ1,CXSUJ2,CYSUJ1,CYSUJ2,XMOD)
      CALL DIMOBJ(CXOBJ1,CXOBJ2,CYOBJ1,CYOBJ2,XMOD)
C*****
      Y(1)=-2.5
      Y(2)=+2.5
      PASX=0.001
      DO 120 J=1,3
      PASX=PASX*10.
      DO 120 I=1,9
      X(1)=ALOG10(I*PASX)
      X(2)=X(1)
      CALL KTRACE(X,Y,2,XMOD)
  120 CONTINUE
      X(1)=ALOG10(10.)
      X(2)=X(1)
      CALL KTRACE(X,Y,2,XMOD)
      X(1)=ALOG10(20.)
      X(2)=X(1)
      CALL KTRACE(X,Y,2,XMOD)
C***** TRACE DES COURBES EN POINTE
      CXOBJ1=20.
      CXOBJ2=251.
      CYOBJ1=20.
      CYOBJ2=130.
      CXSUJ1=ALOG10(+0.01)
      CXSUJ2=ALOG10(+20.)
      CYSUJ1=60.
      CYSUJ2=170.
      CALL DEPLAC(0.,XMOD)
      CALL DIMSUJ(CXSUJ1,CXSUJ2,CYSUJ1,CYSUJ2,XMOD)
      CALL DIMOBJ(CXOBJ1,CXOBJ2,CYOBJ1,CYOBJ2,XMOD)
C***** CONVERSION EN SIMPLE PRECISION DE THETSM ET STR
      NBPT=0
      DO 130 I=1,NFREQ
      IF(STR(I).LT.(0.01).OR.STR(I).GT.(+20.)) GO TO 130
      NBPT=NBPT+1
      STHETA(NBPT)=SNGL(THETSM(I))
      SSTR(NBPT)=SNGL(STR(I))
      SSTR(NBPT)=ALOG10(SSTR(NBPT))
  130 CONTINUE
C*****
      CALL KSTEP(-16,1,1,1,XMOD)
      CALL KPOINT(SSTR,STHETA,NBPT,XMOD)
      CALL KSTEP(1,1,1,1,XMOD)
```

```
C*****
      CCX=CX+20.
      CALL DEPLAC(CCX,XMOD)
      RETURN
      END
!EXEC INOMB,%KEY=TPEAK
!JOB,T DECB,P003,P9COURA,40,(REST)  MISE EN BIBLOM DE SAVDECB
!COMMENT ETUDE=2895PN141P
!COMMENT MISE EN BIBLOM DU SOUS-PROGRAMME SAVDECB
!LIMIT (CORE,50),(TIME,1),(SPDISC,50),(PAGES,49)
!EXEC DLOM,%KEY=SAVDECB
!FORTRAN SI,LS,LO,GO
      SUBROUTINE SAVDECB(DECB)
      REAL*8 DECB(130,35),DECBS
      COMMON /DONTD/DECBS(130,35)
      DO 100 J=1,130
      DO 100 I=1,35
      DECBS(J,I)=DECB(J,I)
  100 CONTINUE
      RETURN
      END
!EXEC INOMB,%KEY=SAVDECB
!JOB,T XSDN,P003,P9COURA,40,(REST)  MISE EN BIBLOM DE TXSDN
!COMMENT ETUDE=2895PN141P
!COMMENT MISE EN BIBLOM DE TXSDN:TRACE DES COURBES X/D=F(THETA-S)
!COMMENT AUX ECHELLES NASA
!LIMIT (CORE,50),(TIME,1),(SPDISC,50),(PAGES,49)
!EXEC DLOM,%KEY=TXSDN
!FORTRAN SI,LS,GO
      SUBROUTINE TXSDN(KPLANC,XOVERD,THETAS,NTAB,NFREQ,XDMAX,
     1THETSM,RNZDIA,VJET,FREQ,LIB1,LIB2,XMOD)
C***** SOUS-PROGRAMME DE TRACE DES COURBES X/D=F(THETAS)
      REAL*8 XOVERD(50,33),THETAS(50,33),XDMAX(33),THETSM(33)
      REAL*8 RNZDIA,VJET,FREQ(33)
      COMMON /IDENT/NPOI
      COMMON /TITRE/LIB(10),IDATE(3)
      COMMON /TABD/STR(33),DFMAX(33),XPEAKN(33),XPEAKF(33)
      REAL*8 STR,DFMAX,XPEAKN,XPEAKF
      DIMENSION XMOD(1),NTAB(1),LIB1(1),LIB2(1)
C*****
      DIMENSION NAM(7),NASA(5),IPOINT(2),IDEG(1)
      DIMENSION IV(4),IDIA(3),IST(1),IDIF(2),IPEAK(3),INEAR(1),IFAR(1)
      DIMENSION ITHE(2),IXSD(1),IFREQ(1)
      DIMENSION IANG(7),XIANG(7),IVALX(6)
      DIMENSION SXSD(50),STHETA(50)
      DIMENSION IFIG(1)
      DIMENSION X12(2),Y12(2)
C*****
      DATA NAM/'PA-J.BRASSEUR   ECH.N.A.S.A.'/
      DATA NASA/'N.A.S.A./O.N.E.R.A. '/
      DATA IPOINT/'POINT    '/
      DATA IDEG/'DEG '/
      DATA IV/'VJET(FT/SEC)=    '/
      DATA IDIA/'DIA.(FT)=    '/,IST/'ST= '/,IDIF/'DIF. MAX'/
      DATA IPEAK/'PEAK(DEG.)  '/,INEAR/'NEAR'/,IFAR/'FAR '/
      DATA ITHE/'THETA-S '/,IXSD/'X/D '/,IFREQ/'FREQ'/
C*****
      DATA CX/210./,CY/300./
      DATA IANG/40,60,80,100,120,140,160/
      DATA XIANG/47.25,67.75,88.25,108.75,129.25,149.75,170.25/
```

```
      DATA IVALX/0,2,4,6,8,10/
      DATA IFIG/'FIG.'/
C*****
C***** TRACE DE 2 COURBES PAR PLANCHE
      NBCT=0
      DO 210 IF=1,NFREQ
      IF(NTAB(IF).EQ.0) GO TO 210
      IF(NBCT.EQ.1) GO TO 160
C***** TRACE DU CADRE ET DU CARTOUCHE
      IF(NBCT.EQ.2) NBCT=0
      XT=10.
      YT=10.
      ANG=90.
      NC=28
      CALL TPL(CX,CY,XT,YT,ANG,NAM,NC,XMOD)
      KODE=0
      NCL=40
      NC=1
      CALL TCART(KODE,CX,CY,LIB,NCL,IDATE,NC,XMOD)
      KPLANC=KPLANC+1
C***** ECRITURE NASA
      XT=55.
      YT=CY-10.
      HL=3.
      HH=5.
      ANG=0.
      NC=19
      CALL KSTEP(1,1,4,1,XMOD)
      CALL KTEXTE(XT,YT,HL,HH,NASA,ANG,NC,XMOD)
      CALL KSTEP(1,1,1,1,XMOD)
C***** ECRITURE DANS LA MARGE DE LIB1,LIB2
      HL=2.5
      HH=2.5
      NC=80
      ANG=90.
      XT=6.5
      YT=100.
      CALL KTEXTE(XT,YT,HL,HH,LIB1,ANG,NC,XMOD)
      XT=16.5
      CALL KTEXTE(XT,YT,HL,HH,LIB2,ANG,NC,XMOD)
C***** ECRITURE NPOI
      XT=25.
      YT=CY-28.
      NC=5
      HL=3.
      ANG=0.
      HH=3.
      CALL KTEXTE(XT,YT,HL,HH,IPOINT,ANG,NC,XMOD)
C*****
      XT=XT+18.
      NC=4
      CALL KFIXE(XT,YT,HL,HH,NPOI,ANG,NC,XMOD)
C***** ECRITURE VJET
      XT=XT+18.
      NC=13
      CALL KTEXTE(XT,YT,HL,HH,IV,ANG,NC,XMOD)
C*****
      S=SNGL(VJET)
      XT=XT+42.
      NC=6
```

```
      CALL KDECIM(XT,YT,HL,HH,S,ANG,NC,XMOD)
C***** ECRITURE DE DIA.(FT)
      XT=XT+24.
      NC=9
      CALL KTEXTE(XT,YT,HL,HH,IDIA,ANG,NC,XMOD)
C*****
      XT=XT+30.
      NC=5
      S=SNGL(RNZDIA)
      CALL KDECIM(XT,YT,HL,HH,S,ANG,NC,XMOD)
C***** ECRITURE DE FIG.
      XT=XT+30.
      NC=4
      CALL KTEXTE(XT,YT,HL,HH,IFIG,ANG,NC,XMOD)
C***** TRACE DU TABLEAU
      X12(1)=20.
      X12(2)=CX-10.
      Y12(1)=CY-45.
      Y12(2)=Y12(1)
      CALL KTRACE(X12,Y12,2,XMOD)
      X12(1)=18.
      Y12(1)=CY-60.
      Y12(2)=CY-35.
      DO 110 I=1,7
      X12(1)=X12(1)+26.
      X12(2)=X12(1)
      IF(I.EQ.4) GO TO 100
      CALL KTRACE(X12,Y12,2,XMOD)
      GO TO 110
  100 CONTINUE
      Y12(2)=Y12(2)-5.
      CALL KTRACE(X12,Y12,2,XMOD)
      Y12(2)=CY-35.
  110 CONTINUE
C***** DIFFERENTES INSCRIPTIONS DU TABLEAU
      YT=CY-40.
      XT=26.
      ANG=0.
      HL=3.
      HH=3.
      NC=4
      CALL KTEXTE(XT,YT,HL,HH,IFREQ,ANG,NC,XMOD)
C*****
      XT=54.
      NC=2
      CALL KTEXTE(XT,YT,HL,HH,IST,ANG,NC,XMOD)
C*****
      XT=72.
      NC=8
      CALL KTEXTE(XT,YT,HL,HH,IDIF,ANG,NC,XMOD)
C*****
      YT=YT+2.
      XT=107.
      NC=10
      CALL KTEXTE(XT,YT,HL,HH,IPEAK,ANG,NC,XMOD)
      YT=YT-5.
      XT=103.
      NC=4
      CALL KTEXTE(XT,YT,HL,HH,INEAR,ANG,NC,XMOD)
      XT=130.
```

```
      NC=3
      CALL KTEXTE(XT,YT,HL,HH,IFAR,ANG,NC,XMOD)
C*****
      YT=CY-40.
      XT=150.
      NC=7
      CALL KTEXTE(XT,YT,HL,HH,ITHE,ANG,NC,XMOD)
C*****
      XT=CX-28.
      NC=3
      CALL KTEXTE(XT,YT,HL,HH,IXSD,ANG,NC,XMOD)
C***** TRACE DU PREMIER AXE VERTICAL(PARTIE HAUTE DE LA PLANCHE)
      XT=40.
      YT=130.
      NC=0
      PASMM=20.5
      ANG=90.
      XMIN=1.
      PAS=1.
      NGRAD=6
      NF=0
      CALL KAXE(XT,YT,NORD,NC,PASMM,ANG,XMIN,PAS,NGRAD,NF,XMOD)
C***** TRACE DU SECOND AXE VERTICAL(PARTIE BASSE DE LA PLANCHE)
      YT=10.
      CALL KAXE(XT,YT,NORD,NC,PASMM,ANG,XMIN,PAS,NGRAD,NF,XMOD)
C***** TRACE DU PREMIER AXE HORIZONTAL
      XT=40.
      YT=130.
      ANG=0.
      PASMM=10.25
      NGRAD=15
      CALL KAXE(XT,YT,NORD,NC,PASMM,ANG,XMIN,PAS,NGRAD,NF,XMOD)
C***** TRACE DU SECOND AXE HORIZONTAL
      YT=10.
      CALL KAXE(XT,YT,NORD,NC,PASMM,ANG,XMIN,PAS,NGRAD,NF,XMOD)
C***** ECRITURE DES COTATIONS SUR LES AXES HORIZONTAUX
      YT=5.
      ANG=0.
      HL=2.
      HH=2.
      NC=3
      DO 120 I=1,7
      XT=XIANG(I)
      CALL KFIXE(XT,YT,HL,HH,IANG(I),ANG,NC,XMOD)
  120 CONTINUE
      XT=XT+10.25
      NC=3
      CALL KTEXTE(XT,YT,HL,HH,IDEG,ANG,NC,XMOD)
      YT=10.
      XT=186.5
      NC=7
      CALL KTEXTE(XT,YT,HL,HH,ITHE,ANG,NC,XMOD)
      YT=100.
      XT=60.
      NC=3
      CALL KTEXTE(XT,YT,HL,HH,IST,ANG,NC,XMOD)
C*****
      YT=125.
      NC=3
      DO 130 I=1,7
```

```
      XT=XIANG(I)
      CALL KFIXE(XT,YT,HL,HH,IANG(I),ANG,NC,XMOD)
  130 CONTINUE
      XT=XT+10.25
      NC=3
      CALL KTEXTE(XT,YT,HL,HH,IDEG,ANG,NC,XMOD)
      YT=YT+5.
      XT=186.5
      NC=7
      CALL KTEXTE(XT,YT,HL,HH,ITHE,ANG,NC,XMOD)
      YT=220.
      XT=60.
      NC=3
      CALL KTEXTE(XT,YT,HL,HH,IST,ANG,NC,XMOD)
C***** ECRITURE DES COTATIONS SUR LES AXES VERTICAUX
      XT=32.
      NC=2
      YT=-10.5
      DO 140 I=1,6
      YT=YT+20.5
      CALL KFIXE(XT,YT,HL,HH,IVALX(I),ANG,NC,XMOD)
  140 CONTINUE
      XT=21.
      NC=3
      CALL KTEXTE(XT,YT,HL,HH,IXSD,ANG,NC,XMOD)
C*****
      XT=32.
      YT=109.5
      NC=2
      DO 150 I=1,6
      YT=YT+20.5
      CALL KFIXE(XT,YT,HL,HH,IVALX(I),ANG,NC,XMOD)
  150 CONTINUE
      XT=21.
      NC=3
      CALL KTEXTE(XT,YT,HL,HH,IXSD,ANG,NC,XMOD)
C***** CONVERSION EN SIMPLE PRECISION DE X/D ET THETA
  160 CONTINUE
      DO 170 I=1,NTAB(IF)
      SXSD(I)=SNGL(XOVERD(I,IF))
      STHETA(I)=SNGL(THETAS(I,IF))
  170 CONTINUE
      NBCT=NBCT+1
      IF(NBCT.EQ.1) YT=250. ; GO TO 180
C***** REMPLISSAGE DU TABLEAU
      YT=243.
  180 CONTINUE
      XT=25.
      HL=2.
      HH=2.
      NC=7
      ANG=0.
      S=SNGL(FREQ(IF))
      CALL KDECIM(XT,YT,HL,HH,S,ANG,NC,XMOD)
      XT=50.
      S=SNGL(STR(IF))
      CALL KDECIM(XT,YT,HL,HH,S,ANG,NC,XMOD)
      XT=XT+26.
      S=SNGL(DFMAX(IF))
      CALL KDECIM(XT,YT,HL,HH,S,ANG,NC,XMOD)
```

```
      XT=XT+26.
      S=SNGL(XPEAKN(IF))
      CALL KDECIM(XT,YT,HL,HH,S,ANG,NC,XMOD)
      XT=XT+26.
      S=SNGL(XPEAKF(IF))
      CALL KDECIM(XT,YT,HL,HH,S,ANG,NC,XMOD)
      XT=XT+26.
      S=SNGL(THETSM(IF))
      CALL KDECIM(XT,YT,HL,HH,S,ANG,NC,XMOD)
      XT=XT+26.
      S=SNGL(XDMAX(IF))
      CALL KDECIM(XT,YT,HL,HH,S,ANG,NC,XMOD)
C*****
      IF(NBCT.EQ.1) YT=220. ; GO TO 190
      YT=100.
  190 CONTINUE
      XT=70.
      NC=7
      S=SNGL(STR(IF))
      CALL KDECIM(XT,YT,HL,HH,S,ANG,NC,XMOD)
C*****
C***** TRACE EN POINTE DES COURBES
      CXSUJ1=30.
      CXSUJ2=170.
      CYSUJ1=-0.5
      CYSUJ2=10.
      CXOBJ1=40.
      CXOBJ2=183.5
      IF(NBCT.EQ.1) CYOBJ1=124.875 ; CYOBJ2=232.5 ; GO TO 200
      CYOBJ1=4.875
      CYOBJ2=112.5
  200 CONTINUE
      CALL DEPLAC(O.,XMOD)
      CALL DIMSUJ(CXSUJ1,CXSUJ2,CYSUJ1,CYSUJ2,XMOD)
      CALL DIMOBJ(CXOBJ1,CXOBJ2,CYOBJ1,CYOBJ2,XMOD)
      NBPT=NTAB(IF)
      CALL KSTEP(-16,1,1,1,XMOD)
      CALL KPOINT(STHETA,SXSD,NBPT,XMOD)
      CALL KSTEP(1,1,1,1,XMOD)
      IF(NBCT.NE.2) GO TO 220
      CCX=CX+20.
      CALL DEPLAC(CCX,XMOD)
      GO TO 210
  220 CONTINUE
      CALL DEPLAC(O.,XMOD)
      CALL DIMSUJ(O.,CX,O.,CY,XMOD)
      CALL DIMOBJ(O.,CX,O.,CY,XMOD)
  210 CONTINUE
      IF(NBCT.EQ.2) RETURN
      CCX=CX+20.
      CALL DEPLAC(CCX,XMOD)
      RETURN
      END
!EXEC INOMB,%KEY=TXSDN
!JOB,T PEAN,P003,P9COURA,40,(REST)  MISE EN BIBLOM DE TPEAKN
!COMMENT ETUDE=2895PN141P
!COMMENT MISE EN BIBLOM DE TPEAKN:TRACE DES COURBES THETA-S DU PIC=F(STROUHAL)
!COMMENT AUX ECHELLES NASA
!LIMIT (CORE,50),(TIME,1),(SPDISC,50),(PAGES,49)
!EXEC DLOM,%KEY=TPEAKN
```

```
 IFORTRAN SI,LS,GO
       SUBROUTINE TPEAKN(KPLANC,THETSM,STR,NFREQ,RNZDIA,VJET,LIB1,LIB2
      1,XMOD)
C***** SOUS-PROGRAMME DE TRACE DES COURBES THETSM=F(STR)
C***** AUX ECHELLES NASA
       REAL*8 THETSM(1),STR(1)
       REAL*8 RNZDIA,VJET
       DIMENSION XMOD(1),LIB1(1),LIB2(1)
C*****
       COMMON /IDENT/NPOI
       COMMON /TITRE/LIB(10),IDATE(3)
C*****
       DIMENSION NAM(7),IPOINT(2),IDIA(3),IV(4),IFIG(1)
       DIMENSION NASA(5)
       DIMENSION IVALY(6)
       DIMENSION ITHE(4),IST(2)
       DIMENSION X(2),Y(2)
       DIMENSION VALX(5),XX(5)
       DIMENSION STHETA(33),SSTR(33)
C*****
       DATA NAM/'PA-J.BRASSEUR   ECH.N.A.S.A.'/
       DATA CX/300./,CY/210./
       DATA IPOINT/'POINT   '/,IV/'VJET(FT/SEC)=    '/
       DATA IDIA/'DIA.(FT)=   '/,IFIG/'FIG.'/
       DATA NASA/'N.A.S.A./O.N.E.R.A. '/
       DATA IVALY/60,80,100,120,140,160/
       DATA ITHE/'THETA-S DU PIC  '/
       DATA IST/'STROUHAL'/
       DATA VALX/+0.01,+0.10,+1.00,+10.0,+20.0/
       DATA XX/16.,81.5,147.,212.5,232.5/
C***** TRACE DU CADRE ET DU CARTOUCHE
       XT=10.
       YT=200.
       ANG=0.
       NC=28
       CALL TPL(CX,CY,XT,YT,ANG,NAM,NC,XMOD)
       KODE=1
       NCL=40
       NC=1
       CALL TCART(KODE,CX,CY,LIB,NCL,IDATE,NC,XMOD)
       KPLANC=KPLANC+1
C***** ECRITURE NASA
       XT=CX-10.
       YT=CY-55.
       HL=3.
       HH=5.
       ANG=270.
       NC=19
       CALL KSTEP(1,1,4,1,XMOD)
       CALL KTEXTE(XT,YT,HL,HH,NASA,ANG,NC,XMOD)
       CALL KSTEP(1,1,1,1,XMOD)
C***** ECRITURE DANS LA MARGE DE LIB1 ET LIB2
       HL=2.5
       HH=2.5
       NC=80
       ANG=0.
       XT=100.
       YT=CY-6.5
       CALL KTEXTE(XT,YT,HL,HH,LIB1,ANG,NC,XMOD)
       YT=CY-16.5
```

```
      CALL KTEXTE(XT,YT,HL,HH,LIB2,ANG,NC,XMOD)
C***** ECRITURE DE POINT
      XT=10.
      YT=CY-30.
      NC=5
      HL=3.
      HH=3.
      ANG=0.
      CALL KTEXTE(XT,YT,HL,HH,IPOINT,ANG,NC,XMOD)
C*****
      XT=XT+18.
      NC=4
      CALL KFIXE(XT,YT,HL,HH,NPOI,ANG,NC,XMOD)
C***** ECRITURE DE VJET
      XT=50.
      NC=13
      CALL KTEXTE(XT,YT,HL,HH,IV,ANG,NC,XMOD)
C*****
      XT=XT+42.
      NC=6
      S=SNGL(VJET)
      CALL KDECIM(XT,YT,HL,HH,S,ANG,NC,XMOD)
C***** ECRITURE DE DIA.(FT)=
      XT=120.
      NC=9
      CALL KTEXTE(XT,YT,HL,HH,IDIA,ANG,NC,XMOD)
C*****
      S=SNGL(RNZDIA)
      XT=XT+30.
      NC=5
      CALL KDECIM(XT,YT,HL,HH,S,ANG,NC,XMOD)
C***** ECRITURE DE FIG.
      XT=200.
      NC=4
      CALL KTEXTE(XT,YT,HL,HH,IFIG,ANG,NC,XMOD)
C***** TRACE DE L AXE VERTICAL
      XT=20.
      YT=20.
      ANG=90.
      XMIN=1.
      NC=0
      PAS=1.
      NGRAD=12
      NF=0
      PASMM=13.
      CALL KAXE(XT,YT,NORD,NC,PASMM,ANG,XMIN,PAS,NGRAD,NF,XMOD)
C***** ECRITURE DES COTATIONS SUR L AXE VERTICAL
      XT=10.
      HL=2.
      HH=2.
      YT=-6.
      ANG=0.
      NC=3
      DO 100 I=1,6
      YT=YT+26.
      CALL KFIXE(XT,YT,HL,HH,IVALY(I),ANG,NC,XMOD)
  100 CONTINUE
C***** ECRITURE DE THETA-S DU PIC
      YT=YT+16.
      XT=10.
```

```
      NC=14
      CALL KTEXTE(XT,YT,HL,HH,ITHE,ANG,NC,XMOD)
C***** TRACE DE L AXE HORIZONTAL
      X(1)=20.
      X(2)=236.5
      Y(1)=20.
      Y(2)=Y(1)
      CALL KTRACE(X,Y,2,XMOD)
C***** ECRITURE DE STROUHAL
      XT=240.5
      YT=20.
      HL=2.
      HH=2.
      ANG=0.
      NC=8
      CALL KTEXTE(XT,YT,HL,HH,IST,ANG,NC,XMOD)
C***** ECRITURE DES COTATIONS SUR L AXE HORIZONTAL
      YT=14.
      NC=5
      DO 110 I=1,5
      CALL KDECIM(XX(I),YT,HL,HH,VALX(I),ANG,NC,XMOD)
  110 CONTINUE
C***** GRADUATIONS DE L AXE HORIZONTAL
      CXOBJ1=20.
      CXOBJ2=236.5
      CYOBJ1=17.5
      CYOBJ2=22.5
      CXSUJ1=ALOG10(0.01)
      CXSUJ2=ALOG10(20.)
      CYSUJ1=-2.5
      CYSUJ2=+2.5
      CALL DEPLAC(0.,XMOD)
      CALL DIMSUJ(CXSUJ1,CXSUJ2,CYSUJ1,CYSUJ2,XMOD)
      CALL DIMOBJ(CXOBJ1,CXOBJ2,CYOBJ1,CYOBJ2,XMOD)
C*****
      Y(1)=-2.5
      Y(2)=+2.5
      PASX=0.001
      DO 120 J=1,3
      PASX=PASX*10.
      DO 120 I=1,9
      X(1)=ALOG10(I*PASX)
      X(2)=X(1)
      CALL KTRACE(X,Y,2,XMOD)
  120 CONTINUE
      X(1)=ALOG10(10.)
      X(2)=X(1)
      CALL KTRACE(X,Y,2,XMOD)
      X(1)=ALOG10(20.)
      X(2)=X(1)
      CALL KTRACE(X,Y,2,XMOD)
C***** TRACE DES COURBES EN POINTE
      CXOBJ1=20.
      CXOBJ2=236.5
      CYOBJ1=20.
      CYOBJ2=163.
      CXSUJ1=ALOG10(+0.01)
      CXSUJ2=ALOG10(+20.)
      CYSUJ1=60.
      CYSUJ2=170.
```

```
      CALL DEPLAC(0.,XMOD)
      CALL DIMSUJ(CXSUJ1,CXSUJ2,CYSUJ1,CYSUJ2,XMOD)
      CALL DIMOBJ(CXOBJ1,CXOBJ2,CYOBJ1,CYOBJ2,XMOD)
C***** CONVERSION EN SIMPLE PRECISION DE THETSM ET STR
      NBPT=0
      DO 130 I=1,NFREQ
      IF(STR(I).LT.(0.01).OR.STR(I).GT.(+20.)) GO TO 130
      NBPT=NBPT+1
      STHETA(NBPT)=SNGL(THETSM(I))
      SSTR(NBPT)=SNGL(STR(I))
      SSTR(NBPT)=ALOG10(SSTR(NBPT))
  130 CONTINUE
C*****
      CALL KSTEP(-16,1,1,1,XMOD)
      CALL KPOINT(SSTR,STHETA,NBPT,XMOD)
      CALL KSTEP(1,1,1,1,XMOD)
C*****
      CCX=CX+20.
      CALL DEPLAC(CCX,XMOD)
      RETURN
      END
!EXEC INOMB,%KEY=TPEAKN
```

```
*PROGRAMMME SOURCE P242
C      TRANSFERT DE LA BANDE NUMERIQUE SUR LE DISQUE
       DIMENSION MAT(50)
       NR=1
       ND=2
    10 CALL BUFFER IN (NR,1,MAT,50,IBU)
       CALL BUFFER CHECK (NR,1,IBU,MOT)
       IF (IBU.EQ.3) GO TO 500
C                ECRITURE SUR DISQUE
       WRITE(ND,101)(MAT(I),I=1,50)
   101 FORMAT(50A4)
       GO TO 10
   500 STOP
       END
*PROGRAMME SOURCE P244
C      LECTURE DE BANDE BLOCS EN BCD FORMATTES FORMAT VARIABLE
C      TRAITEMENT DE PLUSIEURS FICHIERS
C      ECRITURE SUR DISQUE BLOCS EN EBCDIC FORMAT FIXE
       DIMENSION NZTYPE(3),FREQ(30),ANGLES(50),RDIST(50),DECB(50,31)
       DIMENSION MAT(100),NOMFICH(5)
       NR=1
       ND=2
       NFICH=0
C      SAUT DE FICHIERS
       READ(105,102)NFS
   102 FORMAT(I5)
       IF(NFS.EQ.0)GO TO 20
C
    10 CALL BUFFER IN (NR,1,MAT,01,IBU)
       CALL BUFFER CHECK (NR,1,IBU,MOT)
       IF (IBU.EQ.3) NFICH=NFICH+1
       IF(NFICH.EQ.NFS)GO TO 20
       GO TO 10
    20 NFICH=0
   300 READ(105,103,END=600)(NOMFICH(I),I=1,5)
       NFICH=NFICH+1
   103 FORMAT(5A4)
C      ASSIGNATION DYNAMIQUE DU FICHIER DISQUE
       CALL AWSM('DISK',ND,NOMFICH,'F',1024,124)
C      LECTURE D UN FICHIER
C
    30 CALL BUFFER IN (NR,1,MAT,34,IBU)
       CALL BUFFER CHECK (NR,1,IBU,MOT)
       IF(IBU.EQ.3)GO TO 30
       DECODE(128,250,MAT(3))IPT,N,VTUN,VJET,TEMPR,RHUM,SIDE,PRESS,XMACH,
      *DIANZL,NZTYPE
       WRITE(ND,150)IPT,N,VTUN,VJET,TEMPR,RHUM,SIDE,PRESS,XMACH,DIANZL,NZ
      *TYPE
C
       CALL BUFFER IN (NR,1,MAT,92,IBU)
       CALL BUFFER CHECK (NR,1,IBU,MOT)
       DECODE(360,252,MAT(3))(FREQ(I),I=1,30)
       WRITE(ND,152)(FREQ(I),I=1,30)
C
       CALL BUFFER IN (NR,1,MAT,68,IBU)
       CALL BUFFER CHECK (NR,1,IBU,MOT)
       DECODE(264,254,MAT(3))(ANGLES(I),I=1,N)
       WRITE(ND,154)(ANGLES(I),I=1,N)
C
       CALL BUFFER IN (NR,1,MAT,68,IBU)
       CALL BUFFER CHECK (NR,1,IBU,MOT)
```

```
      DECODE(264,254,MAT(3))(RDIST(I),I=1,N)
      WRITE(ND,154)(RDIST(I),I=1,N)
      DO 180 J=1,N
C
      CALL BUFFER IN (NR,1,MAT,95,IBU)
      CALL BUFFER CHECK (NR,1,IBU,MOT)
      DECODE(372,254,MAT(3))(DECB(J,I),I=1,31)
  180 WRITE(ND,154)(DECB(J,I),I=1,31)
      REWIND ND
      WRITE(108,104)NFICH
  104 FORMAT(' FICHIER ',I2)
      GO TO 300
  600 WRITE(108,101)
  101 FORMAT(' TRAVAIL TERMINE')
  150 FORMAT(13A4)
  250 FORMAT(2I10,8F12.2,3A4)
  152 FORMAT(30A4)
  252 FORMAT(30F12.0)
  154 FORMAT(31A4)
  254 FORMAT(31F12.2)
      STOP
      END
```

```
*
CPROGRAMME SOURCE RNOISE1
C      ELIMINATION D UNE LIGNE DE MESURE MODANE
C      A PARTIR DE FICHIERS 2 LIGNES
C      FICHIER UTILISE DANS LE CALCUL DE CHAMP LOINTAIN
       DIMENSION TAB1(50),TAB2(50),ITAB(6),NPOI(15)
       EQUIVALENCE (TAB1(2),ITAB(1))
       DATA NBPIST/8/
       KF=0
       ND1=1
       ND3=3
    10 READ(105,101,END=900)NBPT,(NPOI(I),I=1,NBPT)
   101 FORMAT(16I5)
C      BOUCLE SUR LES POINTS
       DO 5 L=1,NBPT
       NUMER=1
       ND=ND1+KF*3
       REWIND ND
       KODR=0
C      LECTURE BLOC DE TETE
   600 READ(ND,105,END=610)(TAB1(I),I=1,50)
   105 FORMAT(50A4)
       IF(ITAB(1).NE.NPOI(L))GO TO 500
       INDEX=ITAB(4)
       IF(INDEX.EQ.3.OR.INDEX.EQ.4.OR.INDEX.EQ.7.OR.INDEX.EQ.8)NUMER=NUME
      *R+1;GO TO 500
       WRITE(ND3,105)(TAB1(I),I=1,50)
C      LECTURE BLOCS SPECTRE
       DO 20 IA=1,ITAB(5)
       READ(ND,105,END=630)(TAB2(I),I=1,50)
    20 WRITE(ND3,105)(TAB2(I),I=1,50)
       NUMER=NUMER+1
       GO TO 600
   500 DO 30 J=1,ITAB(5)
    30 READ(ND,105,END=620)(TAB2(I),I=1,50)
       IF(NUMER.LE.NBPIST)GO TO 600
       GO TO 5
   610 KODR=1
       WRITE(108,102)KODR
       STOP
   620 KODR=2
       WRITE(108,102)KODR
       STOP
   630 KODR=3
       WRITE(108,102)KODR
   102 FORMAT(' KODR',I5)
       STOP
     5 CONTINUE
       KF=KF+1
       GO TO 10
   900 REWIND ND3
       WRITE(108,103)
   103 FORMAT(' TRAVAIL TERMINE')
       STOP
       END
```

```
*
CPROGRAMME SOURCE RNOISE12
C      REGROUPEMENT DE 2 LIGNES DE MESURE MODANE
C      A PARTIR DE FICHIERS 1 LIGNE
C      FICHIER UTILISE DANS LE CALCUL DE LOCALISATON DE SOURCE
       DIMENSION TAB1(50),TAB2(50),ITAB(6),NPOI(15)
       EQUIVALENCE (TAB1(2),ITAB(1))
       DATA NBPIST/4/
       KF=0
       ND1=1
       ND2=2
       ND3=3
   10  READ(105,101,END=900)NBPT,(NPOI(I),I=1,NBPT)
  101  FORMAT(16I5)
C      BOUCLE SUR LES POINTS
       DO 5 L=1,NBPT
C      BOUCLE SUR LES LIGNES
       DO 5 IL=1,2
       NUMER=1
       IF(IL.EQ.1)ND=ND1+KF*3
       IF(IL.EQ.2)ND=ND2+KF*3
       REWIND ND
   50  KODR=0
C      LECTURE BLOC DE TETE
  600  READ(ND,105,END=610)(TAB1(I),I=1,50)
  105  FORMAT(50A4)
       IF(ITAB(1).NE.NPOI(L))GO TO 500
       WRITE(ND3,105)(TAB1(I),I=1,50)
C      LECTURE BLOCS SPECTRE
       DO 20 IA=1,ITAB(5)
       READ(ND,105,END=630)(TAB2(I),I=1,50)
   20  WRITE(ND3,105)(TAB2(I),I=1,50)
       NUMER=NUMER+1
       IF(NUMER.LE.NBPIST)GO TO 50
       GO TO 5
  500  DO 30 J=1,ITAB(5)
   30  READ(ND,105,END=620)(TAB2(I),I=1,50)
       GO TO 600
  610  KODR=1
       WRITE(108,102)KODR
       STOP
  620  KODR=2
       WRITE(108,102)KODR
       STOP
  630  KODR=3
       WRITE(108,102)KODR
  102  FORMAT(' KODR',I5)
       STOP
    5  CONTINUE
       KF=KF+1
       GO TO 10
  900  REWIND ND3
       WRITE(108,103)
  103  FORMAT(' TRAVAIL TERMINE')
       STOP
       END
```

```
*
CPROGRAMME SOURCE ECHN4LM
      REAL*8 DUMP(3446),DUMP1(132),DUMP2(74),DUMP3(1800),DUMP4(3500)
      REAL*8 XOVERD,THETAS,XDMAX,THETSM
      REAL*8 RNZDIA,VJET,FREQ
      REAL*8 STR,DFMAX,XPEAKN,XPEAKF
      REAL*8 PSIVAL,XDVAL,ST,STP,VJ3,VJ4,VAMB
      REAL*8 PSIS,XDN
      COMMON /IDENT/NPOI
      COMMON /TITRE/LIB(10),IDATE(3)
      COMMON /TABD/STR(33),DFMAX(33),XPEAKN(33),XPEAKF(33)
      COMMON /SUB/VJ3,FREQ(33),THETAS(50,33),XOVERD(50,33),NTAB(33),
     1         NTEST,XDMAX(33),THETSM(33),RNZDIA,NZTYPE(10),NFREQ
      COMMON/SUB2/ST(35),STP(35),IWT1,IWT2,VAMB,VJ4
      COMMON/SUB3/PSIVAL(50),XDVAL(50,35)
      COMMON/SUB4/PSIS(50,35),XDN(50,35)
      DIMENSION LIB1(20),LIB2(20),LIBE(10),IDAT(3)
      DIMENSION XMOD(44)
C*****
      EQUIVALENCE (DUMP(1),VJ3)
      EQUIVALENCE (DUMP1(1),STR(1))
      EQUIVALENCE (DUMP2(1),ST(1))
      EQUIVALENCE (DUMP3(1),PSIVAL(1))
      EQUIVALENCE (DUMP4(1),PSIS(1,1))
C***** PREPARATION DU TRACE
      DO 100 I=1,44
      XMOD(I)=0.
  100 CONTINUE
      NDT=69
      CALL OPENTR(NDT,XMOD)
      KPLANC=0
C***** LECTURE DES DONNEES NOISE4
      READ(7) DUMP2
      READ(7) DUMP3
      READ(7) NPOI
      READ(7) LIB
      READ(7) IDATE
      REWIND 7
C***** LECTURE DES DONNEES NOISE3
      READ(8) DUMP
      READ(8) DUMP1
      READ(8) NOP
      READ(8) LIBE
      READ(8) IDAT
      READ(8) LIB1
      READ(8) LIB2
      REWIND 8
C***** TRACE
      DO 10 J=1,33
      DO 10 I=1,50
      THETAS(I,J)=PSIVAL(I)
   10 XOVERD(I,J)=XDVAL(I,J)
      DO 20 J=1,33
   20 NTAB(J)=50
      VJET=VJ3
      CALL TXSDN4(KPLANC,XOVERD,THETAS,NTAB,NFREQ,XDMAX,THETSM,RNZDIA,
     1VJET,FREQ,LIB1,LIB2,XMOD)
C***** FIN DE TRACE
      CALL CLOSTR(XMOD)
      WRITE(108,2010) KPLANC
```

```
 2010 FORMAT(///3X,'NB.PLANCHES=',I3//)
      STOP
      END
      SUBROUTINE TXSDN4(KPLANC,XOVERD,THETAS,NTAB,NFREQ,XDMAX,
     1THETSM,RNZDIA,VJET,FREQ,LIB1,LIB2,XMOD)
C***** SOUS-PROGRAMME DE TRACE DES COURBES X/D=F(PSIS)
      REAL*8 XOVERD(50,33),THETAS(50,33),XDMAX(33),THETSM(33)
      REAL*8 RNZDIA,VJET,FREQ(33),ST,STP
      COMMON /IDENT/NPOI
      COMMON /TITRE/LIB(10),IDATE(3)
      COMMON /TABD/STR(33),DFMAX(33),XPEAKN(33),XPEAKF(33)
      COMMON/SUB2/ST(35),STP(35)
      REAL*8 STR,DFMAX,XPEAKN,XPEAKF
      DIMENSION XMOD(1),NTAB(1),LIB1(1),LIB2(1)
C*****
      DIMENSION NAM(7),NASA(5),IPOINT(2),IDEG(1)
      DIMENSION IV(4)
      DIMENSION ITHE(2),IXSD(1),IFREQ(1)
      DIMENSION IANG(7),XIANG(7),IVALX(6)
      DIMENSION SXSD(50),STHETA(50)
      DIMENSION IFIG(1)
      DIMENSION X12(2),Y12(2)
C*****
      DATA NAM/'PA-J.BRASSEUR   ECH.N.A.S.A.'/
      DATA NASA/'N.A.S.A./O.N.E.R.A.  '/
      DATA IPOINT/'POINT   '/
      DATA IDEG/'DEG '/
      DATA IV/' VO (FT/SEC)=    '/
      DATA IST1/'STO='/,IST2/'ST ='/,IST3/'STP='/
      DATA ITHE/'  PSI-S '/,IXSD/'X/D '/,IFREQ/'FREQ'/
C*****
      DATA CX/210./,CY/300./
      DATA IANG/40,60,80,100,120,140,160/
      DATA XIANG/47.25,67.75,88.25,108.75,129.25,149.75,170.25/
      DATA IVALX/0,2,4,6,8,10/
      DATA IFIG/'FIG.'/
C*****
C***** TRACE DE 2 COURBES PAR PLANCHE
      NBCT=0
      DO 210 IF=1,NFREQ
      IF(NTAB(IF).EQ.0) GO TO 210
      IF(NBCT.EQ.1) GO TO 160
C***** TRACE DU CADRE ET DU CARTOUCHE
      IF(NBCT.EQ.2) NBCT=0
      XT=10.
      YT=10.
      ANG=90.
      NC=28
      CALL TPL(CX,CY,XT,YT,ANG,NAM,NC,XMOD)
      KODE=0
      NCL=40
      NC=1
      CALL TCART(KODE,CX,CY,LIB,NCL,IDATE,NC,XMOD)
      KPLANC=KPLANC+1
C***** ECRITURE NASA
      XT=55.
      YT=CY-10.
      HL=3.
      HH=5.
      ANG=0.
```

```
      NC=19
      CALL KSTEP(1,1,4,1,XMOD)
      CALL KTEXTE(XT,YT,HL,HH,NASA,ANG,NC,XMOD)
      CALL KSTEP(1,1,1,1,XMOD)
C***** ECRITURE DANS LA MARGE DE LIB1,LIB2
      HL=2.5
      HH=2.5
      NC=80
      ANG=90.
      XT=6.5
      YT=100.
      CALL KTEXTE(XT,YT,HL,HH,LIB1,ANG,NC,XMOD)
      XT=16.5
      CALL KTEXTE(XT,YT,HL,HH,LIB2,ANG,NC,XMOD)
C***** ECRITURE NPOI
      XT=25.
      YT=CY-28.
      NC=5
      HL=3.
      ANG=0.
      HH=3.
      CALL KTEXTE(XT,YT,HL,HH,IPOINT,ANG,NC,XMOD)
C*****
      XT=XT+18.
      NC=4
      CALL KFIXE(XT,YT,HL,HH,NPOI,ANG,NC,XMOD)
C***** ECRITURE DE FIG.
      XT=180.
      NC=4
      CALL KTEXTE(XT,YT,HL,HH,IFIG,ANG,NC,XMOD)
C***** TRACE DU PREMIER AXE VERTICAL(PARTIE HAUTE DE LA PLANCHE)
      XT=40.
      YT=130.
      NC=0
      PASMM=20.5
      ANG=90.
      XMIN=1.
      PAS=1.
      NGRAD=6
      NF=0
      CALL KAXE(XT,YT,NORD,NC,PASMM,ANG,XMIN,PAS,NGRAD,NF,XMOD)
C***** TRACE DU SECOND AXE VERTICAL(PARTIE BASSE DE LA PLANCHE)
      YT=10.
      CALL KAXE(XT,YT,NORD,NC,PASMM,ANG,XMIN,PAS,NGRAD,NF,XMOD)
C***** TRACE DU PREMIER AXE HORIZONTAL
      XT=40.
      YT=130.
      ANG=0.
      PASMM=10.25
      NGRAD=15
      CALL KAXE(XT,YT,NORD,NC,PASMM,ANG,XMIN,PAS,NGRAD,NF,XMOD)
C***** TRACE DU SECOND AXE HORIZONTAL
      YT=10.
      CALL KAXE(XT,YT,NORD,NC,PASMM,ANG,XMIN,PAS,NGRAD,NF,XMOD)
C***** ECRITURE DES COTATIONS SUR LES AXES HORIZONTAUX
      YT=5.
      ANG=0.
      HL=2.
      HH=2.
      NC=3
```

```
      DO 120 I=1,7
      XT=XIANG(I)
      CALL KFIXE(XT,YT,HL,HH,IANG(I),ANG,NC,XMOD)
  120 CONTINUE
      XT=XT+10.25
      NC=3
      CALL KTEXTE(XT,YT,HL,HH,IDEG,ANG,NC,XMOD)
      YT=10.
      XT=186.5
      NC=7
      CALL KTEXTE(XT,YT,HL,HH,ITHE,ANG,NC,XMOD)
      YT=112.
      XT=100.
      NC=13
      CALL KTEXTE(XT,YT,HL,HH,IV,ANG,NC,XMOD)
      XT=60.
      NC=3
      CALL KTEXTE(XT,YT,HL,HH,IST1,ANG,NC,XMOD)
      YT=YT-7.
      CALL KTEXTE(XT,YT,HL,HH,IST2,ANG,NC,XMOD)
      YT=YT-7.
      CALL KTEXTE(XT,YT,HL,HH,IST3,ANG,NC,XMOD)
C*****
      YT=125.
      NC=3
      DO 130 I=1,7
      XT=XIANG(I)
      CALL KFIXE(XT,YT,HL,HH,IANG(I),ANG,NC,XMOD)
  130 CONTINUE
      XT=XT+10.25
      NC=3
      CALL KTEXTE(XT,YT,HL,HH,IDEG,ANG,NC,XMOD)
      YT=YT+5.
      XT=186.5
      NC=7
      CALL KTEXTE(XT,YT,HL,HH,ITHE,ANG,NC,XMOD)
      YT=240.
      XT=100
      NC=13
      CALL KTEXTE(XT,YT,HL,HH,IV,ANG,NC,XMOD)
      XT=60.
      NC=3
      CALL KTEXTE(XT,YT,HL,HH,IST1,ANG,NC,XMOD)
      YT=YT-7.
      CALL KTEXTE(XT,YT,HL,HH,IST2,ANG,NC,XMOD)
      YT=YT-7.
      CALL KTEXTE(XT,YT,HL,HH,IST3,ANG,NC,XMOD)
C***** ECRITURE DES COTATIONS SUR LES AXES VERTICAUX
      XT=32.
      NC=2
      YT=-10.5
      DO 140 I=1,6
      YT=YT+20.5
      CALL KFIXE(XT,YT,HL,HH,IVALX(I),ANG,NC,XMOD)
  140 CONTINUE
      XT=21.
      NC=3
      CALL KTEXTE(XT,YT,HL,HH,IXSD,ANG,NC,XMOD)
C*****
      XT=32.
```

```
      YT=109.5
      NC=2
      DO 150 I=1,6
      YT=YT+20.5
      CALL KFIXE(XT,YT,HL,HH,IVALX(I),ANG,NC,XMOD)
  150 CONTINUE
      XT=21.
      NC=3
      CALL KTEXTE(XT,YT,HL,HH,IXSD,ANG,NC,XMOD)
C***** CONVERSION EN SIMPLE PRECISION DE X/D ET THETA
  160 CONTINUE
      DO 170 I=1,NTAB(IF)
      SXSD(I)=SNGL(XOVERD(I,IF))
      STHETA(I)=SNGL(THETAS(I,IF))
  170 CONTINUE
      NBCT=NBCT+1
C*****
      IF(NBCT.EQ.1) YT=240. ; GO TO 190
      YT=112.
  190 CONTINUE
C***** ECRITURE VJET
      XT=140.
      NC=6
      HL=2.
      HH=2.
      S=SNGL(VJET)
      CALL KDECIM(XT,YT,HL,HH,S,ANG,NC,XMOD)
C*****STROUHAL STATIQ. ET DYNAMIQ.
      XT=70.
      NC=7
      S=SNGL(STR(IF))
      CALL KDECIM(XT,YT,HL,HH,S,ANG,NC,XMOD)
      YT=YT-7.
      S=SNGL(ST(IF))
      CALL KDECIM(XT,YT,HL,HH,S,ANG,NC,XMOD)
      YT=YT-7.
      S=SNGL(STP(IF))
      CALL KDECIM(XT,YT,HL,HH,S,ANG,NC,XMOD)
C*****
C***** TRACE EN POINTE DES COURBES
      CXSUJ1=30.
      CXSUJ2=170.
      CYSUJ1=-0.5
      CYSUJ2=10.
      CXOBJ1=40.
      CXOBJ2=183.5
      IF(NBCT.EQ.1) CYOBJ1=124.875 ; CYOBJ2=232.5 ; GO TO 200
      CYOBJ1=4.875
      CYOBJ2=112.5
  200 CONTINUE
      CALL DEPLAC(0.,XMOD)
      CALL DIMSUJ(CXSUJ1,CXSUJ2,CYSUJ1,CYSUJ2,XMOD)
      CALL DIMOBJ(CXOBJ1,CXOBJ2,CYOBJ1,CYOBJ2,XMOD)
      NBPT=NTAB(IF)
      CALL KSTEP(-16,1,1,1,XMOD)
      CALL KPOINT(STHETA,SXSD,NBPT,XMOD)
      CALL KSTEP(1,1,1,1,XMOD)
      IF(NBCT.NE.2) GO TO 220
      CCX=CX÷20.
      CALL DEPLAC(CCX,XMOD)
```

```
      GO TO 210
  220 CONTINUE
      CALL DEPLAC(O.,XMOD)
      CALL DIMSUJ(O.,CX,O.,CY,XMOD)
      CALL DIMOBJ(O.,CX,O.,CY,XMOD)
  210 CONTINUE
      IF(NBCT.EQ.2) RETURN
      CCX=CX+20.
      CALL DEPLAC(CCX,XMOD)
      RETURN
      END
```

NASA
National Aeronautics and Space Administration

Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
NASA TP-3053		

4. Title and Subtitle	5. Report Date
J-85 Jet Engine Noise Measured in the ONERA S1 Wind Tunnel and Extrapolated to Far Field	January 1991
	6. Performing Organization Code
7. Author(s)	8. Performing Organization Report No.
Paul T. Soderman, Alain Julienne,* and Adolph Atencio, Jr.	A-89265
	10. Work Unit No.
	307-50-81
9. Performing Organization Name and Address	11. Contract or Grant No.
Ames Research Center Moffett Field, CA 94035-1000	
	13. Type of Report and Period Covered
12. Sponsoring Agency Name and Address	Technical Publication
National Aeronautics and Space Administration Washington, DC 20546-0001	14. Sponsoring Agency Code

15. Supplementary Notes

Point of Contact: Paul T. Soderman, Ames Research Center, MS 247-2
Moffett Field, CA 94035-1000, (415) 604-6675 or FTS 464-6675

*Office National d'Études et de Recherches Aérospatiales, Châtillon (Hauts-de-Seine), France

16. Abstract

Noise from a J-85 turbojet with a conical, convergent nozzle was measured in simulated flight in the ONERA S1 Wind Tunnel. Data are presented for several flight speeds up to 130 m/sec and for radiation angles of 40° to 160° relative to the upstream direction. The jet was operated with subsonic and sonic exhaust speeds. A moving microphone on a 2-m sideline was used to survey the radiated sound field in the acoustically treated, closed test section. The data were extrapolated to a 122-m sideline by means of a multiple-sideline source-location method, which was used to identify the acoustic source regions, directivity patterns, and near field effects. The source-location method is described along with its advantages and disadvantages.

Results indicate that the effects of simulated flight on J-85 noise are significant. At the maximum forward speed of 130 m/sec, the peak overall sound levels in the aft quadrant were attenuated approximately 10 dB relative to sound levels of the engine operated statically. As expected, the simulated flight and static data tended to merge in the forward quadrant as the radiation angle approached 40°. There is evidence that internal engine or shock noise was important in the forward quadrant. The data are compared with published predictions for flight effects on pure jet noise and internal engine noise. A new empirical prediction is presented that relates the variation of internally generated engine noise or broadband shock noise to forward speed. Measured near field noise extrapolated to far field agrees reasonably well with data from similar engines tested statically outdoors, in flyover, in a wind tunnel, and on the Bertin Aerotrain. Anomalies in the results for the forward quadrant and for angles above 140° are discussed.

The multiple-sideline method proved to be cumbersome in this application, and it did not resolve all of the uncertainties associated with measurements of jet noise close to the jet. The simulation was complicated by wind-tunnel background noise and the propagation of low-frequency sound around the circuit.

17. Key Words (Suggested by Author(s))	18. Distribution Statement
Aeroacoustics Jet noise Wind tunnel noise Jet engine noise	Unclassified-Unlimited Subject Category - 71

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	180	A04

NASA FORM 1626 OCT 86

For sale by the National Technical Information Service, Springfield, Virginia 22161

National Aeronautics and
Space Administration
Code NTT-4

Washington, D.C.
20546-0001