SOUND PROPAGATION FROM A MOVING SOURCE

by

C. Eugene Buell
Duane Stevenson

Final Report, Contract No. NAS8-11348

KN-70-698-(FR)

November 24, 1970

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COLORADO SPRINGS, COLORADO
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I. SUMMARY

The following pages are the final report on contract number NAS8-11348 and contain the program for estimation of sound intensity from a rising space vehicle.

The second chapter contains a summary of the ray tracing methods used and the modifications that are required to apply the technique to the case of a moving sound source. Chapter III is devoted to a discussion of the inputs to the program. The description of the various program subroutines is contained in Chapter IV. The program flow charts constitute Chapter V. Chapter VI contains the input and output data for several sample runs. The listing of the program and subroutines is contained in Chapter VII.

II. RAY TRACING METHOD

The basic ray equations in the form

$$\begin{aligned} dx/dt &= c \cos \varphi + u \\ dz/dt &= c \sin \varphi \end{aligned} \qquad (1)$$

and Snell's law in the form

$$c/\cos \varphi + u = c_o/\cos \varphi_o + u_o = K = \text{constant} \qquad (2)$$

lead to the integral for the ray displacement in the horizontal when penetrating a layer in the vertical

$$x_2 - x_1 = \int_{z_1}^{z_2} [(c \cos \varphi + u)/c \sin \varphi] dz. \qquad (3)$$

If the layer z_1, z_2 is completely penetrated, the phase normal inclination, φ, does not become zero within the layer and the integral is perfectly proper. If the ray is refracted earthward within a layer, z_2 is the level at which the ray becomes horizontal. In this case $\varphi(z_2) = 0$, and the integral is improper. Under most circumstances the way in which $\varphi(z_2)$ approaches zero is such that the improper integral is convergent and may be evaluated by elementary methods. (The exceptional cases are of no importance as far as the problem being discussed is concerned.)

It is obvious that one may obtain $\partial r/\partial\varphi$ from $\partial x_2/\partial\varphi_o - \partial x_1/\partial\varphi_o$ by addition of values through the layers penetrated. Using (3) for this purpose, the result is

$$\partial x_2/\partial\varphi_o - \partial x_1/\partial\varphi_o = -(c_o \sin\varphi_o/\cos^2\varphi_o) \int_{z_1}^{z_2} [(c+u\cos\varphi)\cos^2\varphi/c^2\sin^3\varphi]dz \tag{4}$$

where use has been made of

$$\partial\varphi/\partial\varphi_o = c_o \sin\varphi_o \cos^2\varphi/c \sin\varphi \cos^2\varphi_o \tag{5}$$

from (2). The integrand may also be expressed as

$$(c+u\cos\varphi)\cos^2\varphi/c^2\sin^3\varphi = Kc/[(K-u)^2-c^2]^{3/2} \tag{6}$$

As long as the ray penetrates the layer (z_1, z_2) the integral (4) is proper and is evaluated with no difficulty. When z_2 is the level at which the ray becomes horizontal, then $\varphi = 0$ at that level and the integral is improper at the upper limit. It is readily seen from (6), if $(dc/dz)+(du/dz)$ is not zero at the level z_2, that $\sin\varphi$ approaches zero proportionally to $(z_2-z)^{1/2}$ and consequently the integrand behaves like $(z_2-z)^{3/2}$. This means that the integral is divergent.

Another item that needs consideration is the fact that at the crest of the ray, the value of z_2 is dependent on φ_o. In other words, the process of differentiating under the integral sign to obtain (4) is no longer valid. To avoid the difficulties, the process is started anew for a ray that becomes horizontal at z_2. Let $z^* = z_2 - \epsilon$ and consider the limit for $\epsilon \to 0$. Then

$$\partial x_2/\partial\varphi_o - \partial x_1/\partial\varphi_o = \lim_{\epsilon \to 0} [(c\cos\varphi + u)/c\sin\varphi]_{z^*}(\partial z^*/\partial\varphi_o)$$

$$- \lim_{\epsilon\to 0} \{c_o \sin\varphi_o/\cos^2\varphi_o \int_{z_1}^{z_*} [\cos^2\varphi(c+u\cos\varphi)/c^2\sin^{-3}\varphi]dz. \qquad (7)$$

Since $z_2 = z_2(\varphi_o)$ is given by Snell's Law in the form

$$c(z_2) + u(z_2) = c_o/\cos\varphi_o + u_o$$

then

$$\partial z_2/\partial\varphi_o = [c_o/(c' + u')]\sin\varphi_o/\cos^2\varphi_o$$

and replace $\partial z_*/\partial\varphi_o$ by its limit, $\partial z_2/\partial\varphi_o$ so that the expression becomes

$$\partial x_2/\partial\varphi_o - \partial x_1/\partial\varphi_o = [c_o\sin\varphi_o/\cos^2\varphi_o]_{z^*}$$

$$- \lim_{\epsilon\to 0} \left\{ \int_{z_1}^{z^*} [\cos^2\varphi(c+u\cos\varphi)/c^2\sin^{-3}\varphi]dz + \left\{(u+c\cos\varphi)/c'+u')c\sin\varphi\right\}_{z_*}\right.$$

The last expression contains two terms that become large in the limit for ϵ. Let the integral expression in the above be indicated by I. If the variable of integration is changed from z to φ, then

$$I = -\int_{\varphi_1}^{\varphi_*} [(c+u\cos\varphi)/(c'+u'\cos\varphi)][\cos\varphi/\sin^2\varphi]d\varphi$$

and

$$I = -[(c_o+u_o\cos\varphi_o)/\cos\varphi_o]\int_{\varphi_1}^{\varphi_2}[\cos\varphi/c(c(c'+u')\cos\varphi]d(1/\sin\varphi).$$

The last expression may be integrated by parts to give

$$I = [(c_o+u_o\cos\varphi_o)/\cos\varphi_o]\left\{\left[\cos\varphi/c(c'+u'\cos\varphi)\sin\varphi\right]_{\varphi_1}^{\varphi_*} - \int_{z_1}^{z_*}\left[\frac{d}{dz}\left(\frac{\cos\varphi}{c(c'+u'\cos\varphi)}\right)\right]\frac{dz}{\sin\varphi}\right\}$$

where, in the second term on the right, z has been restored as the parameter of integration. Then carrying out the differentiation with respect to z in the integrand on the right

$$I = [(c_o+u_o\cos\varphi_o)/\cos\varphi_o]\left\{\left[\cos^2\varphi/c\sin\varphi(c'+u'\cos\varphi)\right]_{z_1}^{z_2} + \int_{z_1}^{z_2}[\cos\varphi(c''+u''\cos\varphi)/c\sin\varphi(c'+u'\cos\varphi)^2]dz\right\}.$$

The final limit to be evaluated then becomes $\partial x_2/\partial\varphi_o - \partial x_1/\partial\varphi_o = [c\sin\varphi/\cos^2\varphi]\lim_{\epsilon\to 0}(A-B+C-D)$

where

$$A = [(u+c\cos\varphi)/c(c'+u')\sin\varphi]_{z^*},$$

$$B = [(c_o+u_o\cos\varphi_o/\cos\varphi_o][\cos\varphi/c(c'+u'\cos\varphi)\sin\varphi]_{z_*},$$

$$C = [(c_o+u_o\cos\varphi_o/\cos\varphi_o][\cos\varphi/c(c'+u'\cos\varphi)\sin\varphi]_{z_1},$$

$$D = \int_{z_1}^{z_*}\cos\varphi(c''+u''\cos\varphi)/c\sin^2\varphi(c'+u'\cos\varphi)dz.$$

It may be readily verified that $\lim_{\epsilon \to o} (A-B) = 0$ so that the final result is

$$\partial x_3/\partial \varphi_o - \partial x_1/\partial \varphi_o = (c_o \sin\varphi_o/\cos^2\varphi_o)[(c_o+u_o\cos\varphi_o)/\cos\varphi_o]$$

$$x \left\{[\cos\varphi/c(c'+u'\cos\varphi)\sin\varphi]_{z_1} \right. \tag{8}$$

$$\left. - \int_{z_1}^{z_2} [\cos\varphi(c''+u''\cos\varphi)/c(c'+u'\cos\varphi)^2\sin\varphi]dz \right\}.$$

In the above the integral is convergent provided that the denominator factor $c'+u'\cos\varphi$ is not zero.

Another formulation for (8) is

$$\partial x_2/\partial \varphi_o - \partial x_1/\partial \varphi_o = (c_o \sin\varphi_o/\cos^2\varphi)\left\{K(K-u)/[(K-u)c'+cu'][(K-u)^2-c^2]^{\frac{1}{2}}\right]_{z_1}$$

$$- \int_{z_1}^{z_2} \left\{K(K-u)[(K-u)c''+cu'']/[(K-u)c'+cu'']^2[(K-u)^2-c^2]\right\}dz$$

where K is the Snell's Law constant from (2) and the explicit dependence on $u=u(z)$ and $c=c(z)$ as functions of altitude is shown.

In order to reduce redundant efforts in computations it is of primary importance to consider conditions, such as particular initial ray inclination angles and/or speed of sound profiles, for which rays will not be returned to the ground. The ray (ray tangent or phase normal) for which C + U is equal to $C_o/\cos \varphi_o + U_c$ is parallel to the layers of the sound profile. This relation determines conditions under which rays can or cannot be returned to earth.

If one lets V_1 be the maximum value of the C + U profile at or below the source level and lets V_2 be the maximum above the source, then φ_1 and φ_2 will be the values from Snell's laws giving the phase normals for V_1 and V_2 respectively. These values are a function of the source altitude in that the values of C_o and U_o are C and U at the source. The rays may now be listed in the following categories:

(1)	$-\frac{\pi}{2} < \varphi_o < -\varphi_1$	descending rays that reach the ground
(2)	$-\varphi_1 < \varphi_o < 0$	descending rays that are refracted upwards
(3)	$0 < \varphi_o < \varphi_1,\ \varphi_1 < \varphi_2$	ascending rays that are trapped.
(4)	$\varphi_1 < \varphi_o < \varphi_2,\ \varphi_1 < \varphi_2$	ascending rays that are refracted to earth
(5)	$0 < \varphi_o < \varphi_2,\ \varphi_2 < \varphi_1$	ascending rays that are trapped
(6)	$\varphi_2 < \varphi_o,\ \varphi_2 < \varphi_1$	ascending rays that continue upward

Descending rays that are refracted upward may be returned towards earth, but will again be refracted upwards so they ultimately will be attenuated in the atmosphere without ever returning to earth. Ascending rays that are trapped likewise are unable to reach the ground because of a maximum in the sounding profile below the source which is larger than the maximum above the source. Ultimately, then, there are only two cases to consider for which rays reach the ground, Cases 1 and 4. Thus one need only find the two maximum, calculate the phase normal for those points and initiate rays from the source with inclination angles which satisfy Cases 1 and 4 above.

Classification of Sounding Profiles

Consideration of multiple reflections implies a necessity to organize sounding profiles into types for calculation of distance, time and the partial derivatives for ascending or descending leg of the ray path. These are needed for evaluating the focusing factor and ultimately the sound intensity at the field points.

TYPE 1: A sounding profile for which the maximum C(z) occurs below the source level Z_s with no effective maximum (one which is larger than the maximum below the source) above the source will return a ray to the ground only for $\varphi_o < -\varphi_1$. The φ_1 is calculated from Snell's Law at the maximum C(z) below the source. All rays which are reflected at the ground will escape and one need only calculate the down leg.

TYPE 2: A sounding of Type 2 is one where an effective maximum of C(z) occurs above the source level Z_s while $C(z) < C(Z_s)$ for $z < Z_s$, i.e., there are no maximums in the sounding profile below the source level. If a ray is initiated at an angle less than $-\varphi_2$, it will not be returned after the first reflection from the ground. Thus one needs to compute the down leg only. For $-\varphi_2 < \varphi_o < 0$, i.e., ground level

dust, the rays will reach the ground at DL, 3DL and 2 UL, 5DL + 4UL, etc. Under the condition $0 < \varphi_o < \varphi_2$, ground based dust, rays reach the ground at DL + 2UL, 3DL + 4UL, 5DL + 6UL, etc.

TYPE 3: There is a sounding profile in which there is an effective maximum in C(z) both above and below Z_s. The value of the maximum above Z_s is the larger, and φ_2 corresponds to this larger maximum.

The ranges for φ_o are

i) $-\frac{\pi}{2} < \varphi_o < -\varphi_2$ for which rays escape after the first reflection,

ii) $-\varphi_2 < \varphi_o < -\varphi_1$, ground based duct for which rays reach the ground at DL, 3DL + 2UL, 5DL + 4 UL, etc.

iii) $-\varphi_1 < \varphi_o < +\varphi_1$ an elevated duct which is trapped

iv) $\varphi_1 < \varphi_o < \varphi_2$ ground based duct whose rays reach the ground at DL + 2UL, 3DL + 4UL, 5DL + 6UL, etc.

v) $\varphi_2 < \varphi_o < \frac{\pi}{2}$, all rays escape.

CASE	TYPE OF SOUNDING PROFILE
1	Effective Max C(z), $Z < Z_s$; no effective Max C(z), $Z > Z_s$
2.	Effective max C(z), $Z > Z_s$; No effective Max Max C(z), $Z < Z_s$
3.	Effective Max C(z), $Z > Z_s$: Effective Max C(z), $Z < Z_s$ such that Max above Z_s > Max below Z_s

TABLE 1

SUMMARY OF SOUNDING PROFILES

One could conceivably run a set of rays with initial inclination angles running the gamut from $-\frac{\pi}{2}$ to $+\frac{\pi}{2}$ to get values of sound intensity at their respective field points from r = 0 to $r = r_{max}$. If an area of field points is of particular interest, a method to select the ray azimuth which will "deposit" rays in that area is described in the section on fix area.

Table 2 summarizes the necessary calculations for multiple reflections. DL is the horizontal distance traveled on the down leg, UL is that for the up leg. Travel times and necessary partial derivatives are calculated simultaneously.

CASE	INITIAL INCLINATION ANGLE	NECESSARY CALCULATIONS	LANDING DISTANCES FOR MULTIPLE REFLECTIONS
1	$-\frac{\pi}{2} < \phi_o < -\varphi_1$	DL	DL only
2	$-\frac{\pi}{2} < \varphi_o < -\varphi_2$	DL	DL only
	$-\varphi_2 < \varphi_o \leq 0$	DL and UL	DL, 3DL+2UL, 5DL +4UL, ...
	$0 \leq \varphi_o < \varphi_2$	DL and UL	DL+2UL, 3DL+4UL, ...
3	$-\frac{\pi}{2} < \varphi_o < -\varphi_2$	DL	DL only
	$-\varphi_2 < \varphi_o < -\varphi_1$	DL and UL	DL, 3DL+2UL, 5DL +4UL, ...
	$\varphi_1 < \varphi_o < \varphi_2$		

TABLE 2

III. INPUTS TO THE PROGRAM

Due to the numerous types of data which must be input to calculate sound intensities from a moving source, the formats will all be either twelve column field for non-integer or ten column fields for integer data. Thus, one need not refer to format statements to check data inputs. The majority of data can be categorized as

i) trajectory information
ii) sounding profile data or
iii) source and field point information.

These sets will be considered as separate units in preparation of data to execute the program. These sets of data are read in subroutines called RDTRAJ, and RDMET, except for the information about the source and field points.

1. Trajectory Data

The trajectory information is read as three groups of cards all in twelve column fields. A card preceding these sets contains the number of trajectory points. The groups are as follows:

(1)	Time	Altitude	Mach No.	Pitch	Yaw
(2)	Time	Latitude	Longitude		
(3)	Time	Relative Velocity	Angle from Horizontal		

2. Sounding Profile Data

The first card is again a control card containing (a) number of radiosonde data levels, (b) number of wind data levels and (c) control parameter IMET where IMET is:

(1) for wind data interpolated to radiosonde levels
(2) for radiosonde
(3) radio and radiosonde combined into one table
(4) combined table input (for which number of radiosonde and wind levels are input the same)

Card two contains the measured dew point.

Options (IMET) one through four have the following two sets of data:

(a) Card three - number of radiosonde levels + 2
altitude - pressure - temperature - relative humidity

(b) Card NMET + 3 through NMET + 3 + MWND + 2
altitude - direction - speed.

The variables are defined as follows:

i) meteorological data
altitude in meters
pressure in mb
temperature in degrees centigrade
dew point temperature

ii) wind data
altitude in meters
direction degrees clockwise from north
speed in meters per second

End of sounding profile data.

3. Source and Field Point Information

CARD 1: minimum and maximum source altitude. Source altitude will be selected from the meteorological data levels from the minimum and maximum altitude in kilometers indicated above. CARD 2: Location of points, in form X, Y, X_2, Y_2, X_i positive north from source, Y_i positive east from source in kilometers, of interest. From these locations, sound intensities will be calculated through the gamut of azimuths and approximately a kilometer on either side of the line.

If there is only one datum card for the field point, calculations are made every 30 degrees around the source.

IV. SUBROUTINE DESCRIPTIONS

The various subroutines of the program are described in the following sections.

1. Subroutine RAY TRAC

The necessary quantities for calculating the focusing factor, r, τ, $\frac{\partial r}{\partial \varphi_o}$, $\frac{\partial \tau}{\partial \varphi_o}$, $\frac{\partial r}{\partial z}$ $\frac{\partial \tau}{\partial z}$, where

$$\left.\begin{aligned} r &= \sum_z \int_{z_i}^{z_{i+1}} \frac{c^2 + u(K-u)}{c\sqrt{K-u+c}} \frac{dz}{\sqrt{K-(u+c)}} \\ \tau &= \sum_z \int_{z_i}^{z_{i+1}} \frac{K-u}{c\sqrt{K-u+c}} \frac{dz}{\sqrt{K-(u+c)}} \end{aligned}\right\}$$

$$\frac{\partial r}{\partial \varphi_o} = c_o \frac{\sin\varphi_o}{\cos^2\varphi_o} \frac{\partial r}{\partial K}$$

$$\frac{\partial r}{\partial z} = \left(\frac{c_o'}{\cos\varphi_o} + u_o'\right) \frac{\partial r}{\partial K}$$

$$\frac{\partial \tau}{\partial \varphi_o} = c_o \frac{\sin\varphi_o}{\cos^2\varphi_o} \frac{1}{K} \frac{\partial r}{\partial K}$$

$$\frac{\partial \tau}{\partial z} = \left(\frac{c_o'}{\cos\varphi_o} + u_o'\right)\frac{1}{K} \frac{\partial r}{\partial K} \quad ,$$

are evaluated from the results of RAY TRAC.

Inputs to the subroutine are as follows: LCMAX is the total number of layers in the atmosphere after subdivision in subroutine PARAB; AAA, GGG and ZZZ are the parameters of the parabolic fit to the speed of sound plus wind component for each of the LCMAX layers of the form

$$v = A + G\,(z - z_o)$$

where $G_i \equiv GGG(I)$, $A_i = AAA(I)$ and $z_o = ZZZ(I)$, CCC and UUU are the tabulated values of the speed of sound and wind components in azimuthal direction from which a numerical differentiation with respect to altitude. JS is the altitude level at which the source is located , ICASE indicates calculations are to be made for down legs of the ray and/or up legs, UTEST is the Snell's law constant.

The computations for each ray for the layers passed through are

$$\Delta r = r_2 - r_1 = \int_{z_1}^{z_2} \frac{c^2 + u(K-u)}{c\sqrt{K-u+c}} \frac{dz}{\sqrt{K-v}}$$

$$\Delta\tau = \tau_2 - \tau_1 = \int_{z_1}^{z_2} \frac{K-u}{c\sqrt{K-u+c}} \frac{dz}{\sqrt{K-v}}$$

and $$\frac{\Delta r}{\Delta K} = \frac{\partial r_2}{\partial K} - \frac{\partial r_1}{\partial K} = -\int \frac{cu}{(\sqrt{K-u+c})^3} \frac{dz}{(\sqrt{K-v})^3} .$$

These are evaluated as

$$\Delta r = F_1(\xi) \int_{z_1}^{z_2} \frac{dz}{\sqrt{K-v}}$$

$$\Delta\tau = F_2(\xi) \int_{z_1}^{z_2} \frac{dz}{\sqrt{K-v}}$$

$$\frac{\Delta r}{\Delta K} = F_3(\xi) \int_{z_1}^{z_2} \frac{dz}{(K-v)^{3/2}}$$

where

$$F_1(\xi) = \left.\frac{c^2 + u(K-u)}{c\sqrt{K-u+c}}\right|_{\xi}$$

$$F_2(\xi) = \left.\frac{K-u}{c\sqrt{K-u+c}}\right|_{\xi}$$

$$F_3(\xi) = \left.\frac{cK}{(\sqrt{K-u}+c)^3}\right|_{\xi} \quad .$$

These values are averaged between the top and bottom of each layer.

In those lavers for which the ray becomes horizontal z_2 is evaluated at the turning point

$$z_2 = z_o \pm \sqrt{\frac{K-A}{G}}$$

where

$$K = A + G\,(z - z_o)^2 \quad .$$

The integrals are evaluated the same for Δr and $\Delta\tau$ and the $\frac{\Delta r}{\Delta K}$ integral becomes

$$\frac{\Delta r}{\Delta K} = F_4(z_1) + F_5(\xi) \int_{z_1}^{z_2} \frac{dz}{\sqrt{K-v}} \quad ,$$

where

$$F_4 = \left.\frac{K(K-u)}{[(K-u)c' + cu']\sqrt{(K-u)^2-c^2}}\right|_{z_1}$$

$$F_5(\xi) = \left.\frac{K(K-u)[(K-u)c'' + cu'']}{[(K-u)c' + cu']^2\sqrt{K-u+c}}\right|_{\xi}$$

where $z_1 < \xi < z_2$.

The integrals $\int_{z_1}^{z_2} \frac{dz}{\sqrt{K-v}}$ and $\int_{z_1}^{z_2} \frac{dz}{(K-v)^{3/2}}$ are evaluated in three regions depending upon the sign of (K-A) and G where $v(z) = A + G(z - z_o)^2$.

Case 1: $G > o$, $(K - A) > o$

$$\int_{z_1}^{z_2} \frac{dz}{\sqrt{K-v}} = \frac{1}{\sqrt{G}} \arcsin \frac{z_2 - z_o}{\sqrt{\frac{K-A}{G}}} - \arcsin \frac{z_1 - z_o}{\sqrt{\frac{K-A}{G}}}$$

$$\int_{z_1}^{z_2} \frac{dz}{(K-v)^{3/2}} = \frac{-1}{\sqrt{G}(K-A)} \frac{z_2 - z_o}{\sqrt{\frac{K-A}{G} - (z_2 - z_o)^2}} - \frac{z_1 - z_o}{\sqrt{\frac{K-A}{G} - (z_1 - z_o)^2}}$$

Case 2: $G < o$, $(K - A) > o$

$$\int_{z_1}^{z_2} \frac{dz}{\sqrt{K-v}} = \frac{1}{\sqrt{-G}} \log \frac{z_2 - z_o + \sqrt{\frac{K-A}{-G} + z_2 - z_o}}{z_1 - z_o + \sqrt{\frac{K-A}{-G} + z_1 - z_o}}$$

$$\int_{z_1}^{z_2} \frac{dz}{(\sqrt{K-v})^3} = \frac{-1}{\sqrt{-G}(K-A)} \left[\frac{z_2 - z_o}{\sqrt{\frac{(K-A)}{-G} + (z_2 - z_o)^2}} - \frac{z_1 - z_o}{\sqrt{\frac{(K-A)}{-G} + (z - z_o)^2}} \right]$$

Case 3: $G < o, (K-A) < o$

$$\int_{z_1}^{z_2} \frac{dz}{(\sqrt{K-v})} = \frac{1}{\sqrt{-G}} \log \frac{z_2 - z_o + \sqrt{z_2 - z_o + \frac{K-A}{G}}}{z_1 - z_o + \sqrt{z_1 - z_o + \frac{K-A}{G}}}$$

$$\int_{z_1}^{z_2} \frac{dz}{(K-v)^3} = \frac{1}{\sqrt{-G}(K-A)} \frac{z_2 - z_o}{\sqrt{\frac{K-A}{-G} + (z_2 - z_o)^2}} - \frac{z_1 - z_o}{\sqrt{\frac{K-A}{-G} + (z_1 - z_o)^2}}$$

These integrals were accomplished by using the substitution $x = z - z_o$, and it is readily seen that the solution

$$\int \frac{dx}{a^2 + x^2} = \log (x + \sqrt{x^2 + a^2})$$

is not symmetric in the variable x. This is seen by supposing that a is small compared to x, then if $x < o$ we have $\log (-|x| + \sqrt{x^2}) = \log (-|x| + |x|)$ which is $\log (0)$.

In this case, the substitution $x = (z - z_o)$ is used; the limits are interchanged and the solution for Case 2 is

$$\int_{z_1}^{z_2} \frac{dz}{\sqrt{K-v}} = \frac{1}{\sqrt{-G}} \log \left\{ \frac{-(z_1 - z_o) + \sqrt{\frac{K-A}{-G} + (z_1 - z_o)^2}}{-(z_2 - z_o) + \sqrt{\frac{K-A}{-G} + (z_2 - z_o)^2}} \right\} .$$

There is the analogous expression for Case 3.

The integrals $\int dx/(a^2 + x^2)^3$ are symmetric in x thus the substitution $x = (z - z_o)$ gives the same solution as $x = (z - z_o)$.

The output of this routine is

DL	the horizontal travel during descent of ray
DU	the horizontal travel during ascent of ray
TAUD	the time of travel during descent of ray
TAUU	the time of travel during ascent of ray
DRDDK	$\Delta r/\Delta K$ during descent of ray
DRUDK	$\Delta r/\Delta K$ during ascent of ray

The partial derivatives used in calculating the focus factor are used in the main program in order that multiple reflections may be taken into account. The values for reflections are integer multiples of the output variables from RAY TRAC.

2. Subroutine INTERP

Subroutine INTERP does a linear interpolation after searching the independent variable table for the pair which bound the point of interest; i.e. $x_i \leq x \leq x_{i+1}$. The result is given as

$$y = y_i + \frac{(y_{i+1} - y_i)}{(x_{i+1} - x_i)} (x - x_i) .$$

In case the value of x is outside the range of tabular points, the subroutine does an extrapolation.

3. Subroutine DIVDIF

The subroutine DIVDIF makes use of the standard divided difference formulas for interpolating function values and values of the first and second derivatives of a function that is tabulated at unequal intervals. These relations are as follows.

$$f(x) = f(a_o) + \alpha_o f(a_o,a_1) + \alpha_o\alpha_1 f(a_o,a_1,a_2) + \alpha_o\alpha_1\alpha_2 f(a_o,a_1,a_2,a_3)$$

$$f'(x) = f(a_o,a_1) + (\alpha_o + \alpha_1) f(a_o,a_1,a_2) + (\alpha_o\alpha_1 + \alpha_o\alpha_2 + \alpha_1\alpha_2) f(a_o,a_1,a_2,a_3)$$

$$f''(x) = 2[f(a_o,a_1,a_2) + (\alpha_o+\alpha_1+\alpha_2) f(a_o,a_1,a_2,a_3)]$$

where

$$\alpha_o = x - a_o$$

$$\alpha_1 = x - a_1$$

$$\alpha_2 = x - a_3$$

$$f(a_o,a_1) = \frac{f(a_o) - f(a_1)}{a_o - a_1}$$

$$f(a_1,a_2) = \frac{f(a_1) - f(a_2)}{a_1 - a_2}$$

$$f(a_2,a_3) = \frac{f(a_2) - f(a_3)}{a_2 - a_3}$$

$$f(a_o,a_1,a_2) = \frac{f(a_o,a_1) - f(a_1,a_2)}{a_o - a_2}$$

$$f(a_1,a_2,a_3) = \frac{f(a_1,a_2) - f(a_2,a_3)}{a_1 - a_3}$$

$$f(a_o,a_1,a_2,a_3) = \frac{f(a_o,a_1,a_2) - f(a_1,a_2,a_3)}{a_o - a_3}$$

4. Subroutine PARAB

Subroutine PARAB is used to obtain the parameters of a parabolic layer model of the speed of sound plus wind component profile v(z) that exactly fit the observed data. The formula for these parabolic layers is in the form

$$v(z) = A + G(z - z_o)^2$$

where the parameters A, G, z_c are given by the following relations. The layer between data values is divided in half and the two "half-layers" are represented by different parabolic formulas. Let z_2 and z_1, $z_2 > z_1$, be the height values at the data points. Then in the bottom "half-layer," $z_1 < z < (z_1+z_2)/2$, the relations are

$$A = A_1 - B_1^2/4C_1$$

$$z_o = z_1 - B_1(z_2 - z_1)/4C_1$$

$$G = 4C_1/(z_2 - z_1)^2$$

where

$$A_1 = v_1$$

$$B_1 = v_1'(z_2 - z_1)/2$$

$$C_1 = [(v_2 - v_1) - v_2' + 3v_1')(z_2 - z_1)/4]/2$$

In the top "half-layer," $(z_1 + z_2)/2 < z < z_2$, the relations are

$$A = A_2 - B_2^2/4C_2$$

$$Z_o = (z_2 + z_1)/2 - B_2(z_2 - z_1)/4C_2$$

$$G = 4C_2/(z_2 - z_1)^2$$

where

$$A_2 = [v_1 + v_2 - (v_2' - v_1')(z_2 - z_1)/4]/2$$

$$B_2 = v_2 - v_1 - (v_1' + v_2')(z_2 - z_1)/4$$

$$C_2 = - [(z_2 - z_1) - (3v_2' + v_1')(z_2 - z_1)/4]/2.$$

The values v_1, v_2 are for speed of sound plus wind component at the levels z_1 and z_2 respectively. The values of v_1' and v_2' are the slopes of the speed of sound plus wind component at z_1 and z_2 respectively. These slopes were computed using the secant

approximation

$$v_i' = (v_{i+1} - v_{i-1})/(z_{i+1} - z_{i-1})$$

where i is the data level index.

In the case of a "linear layer" (for which the parabolic approximation is not appropriate), the value of z_o was entered as zero and the parameter G was used for the slope of the speed of sound plus wind over the layer.

In the case that there is a minimum or maximum of v within a "half-layer," i.e. $z_1 < z_o < (z_1 + z_2)/2$ or $(z_1 + z_2)/2 < z_o < z_2$, the layer is further subdivided so that the maximum or minimum occurs at a layer division point.

5. Subroutines RDTRAJ and RDMET

The RDTRAJ and RDMET subroutines are described in the section on program inputs.

6. Subroutine FIX AREA

Nominal inputs to the program include, in the form of field point information data, locations of particular areas for which calculations are to be made. This subroutine utilizes the input information to calculate the ranges to the border of the area for a set of azimuthal ray angles in constant increments.

The method used is calculation of the points of intersection of all of the boundary lines for the ray azimuth of interest. In general a point on the boundary can be written (see accompanying figure)

$$\frac{y - y_1}{x - x_1} = \frac{y_2 - y_1}{x_2 - x_1}$$

and a point on the azimuthal line from the source is given by

$$x_s = r_v \sin \theta_v + r_s \sin \theta_s$$

$$y_s = r_v \cos \theta_v + r_s \cos \theta_s \ .$$

The intersection of these lines is the point on the boundary given by

$$\theta_s = \tan^{-1} \left(\frac{x_i - r_v \sin \theta_v}{y_i - r_v \cos \theta_v} \right)$$

and

$$r_s = \frac{r_v \left[(y_2 - y_1) \sin\theta_v - (x_2 - x_1) \cos\theta_v \right] + (x_2 y_1 - x_1 y_2)}{(x_2 - x_1) \cos\theta_s - (y_2 - y_1) \sin \theta_s}$$

This equation is valid at both points where the ray azimuth crosses the boundary. The program uses the output ($[r_i, \theta_i]$, $i = 1$, NRAY)where NRAY is the number of rays) to calculate initial inclination angles which will deposit rays in the area, and ultimately the associated intensities.

In case there is only one datum point for areas, the program calculates intensities every thirty degrees from zero to 360. Due to the very nominal computer time required for the computations, this is the easiest way to run the program.

V. FLOW CHARTS

The following flow charts, Figs. 1, 2, and 3, present a graphical picture of the organization of the program.

VI. SAMPLE RUN

The trajectory data for the ascending vehicle was extracted S&E-AERO-GT-5-70 dated Feb. 4, 1970, for shuttle trajectory with 3.0-g limit for longitudinal acceleration. The relevant portion of this trajectory data is given in Tables I, II, and III. The meteorological data used is tabulated in Table IV.

Sound propagation was calculated in the northward, eastward, southward, and westward directions. For these directions, the speed of sound plus wind component was represented by parabolic arcs through the data points. The form used was

$$v = A + G\,(z - z_o)^2 \ .$$

The parameters A, G, and ZO are tabulated in the first three columns of Tables V, VI, VII, and VIII. The values of speed of sound (C), wind component (U), and speed of sound plus wind component (V) are shown as a function of altitude (Z) in the remaining columns. The four tables correspond to the northward, eastward, southward, and westward propagation directions.

The speed of sound plus wind component profiles for the northward, eastward, southward, and westward propagation of sound are illustrated in Figs. 4, 5, 6, and 7 respectively.

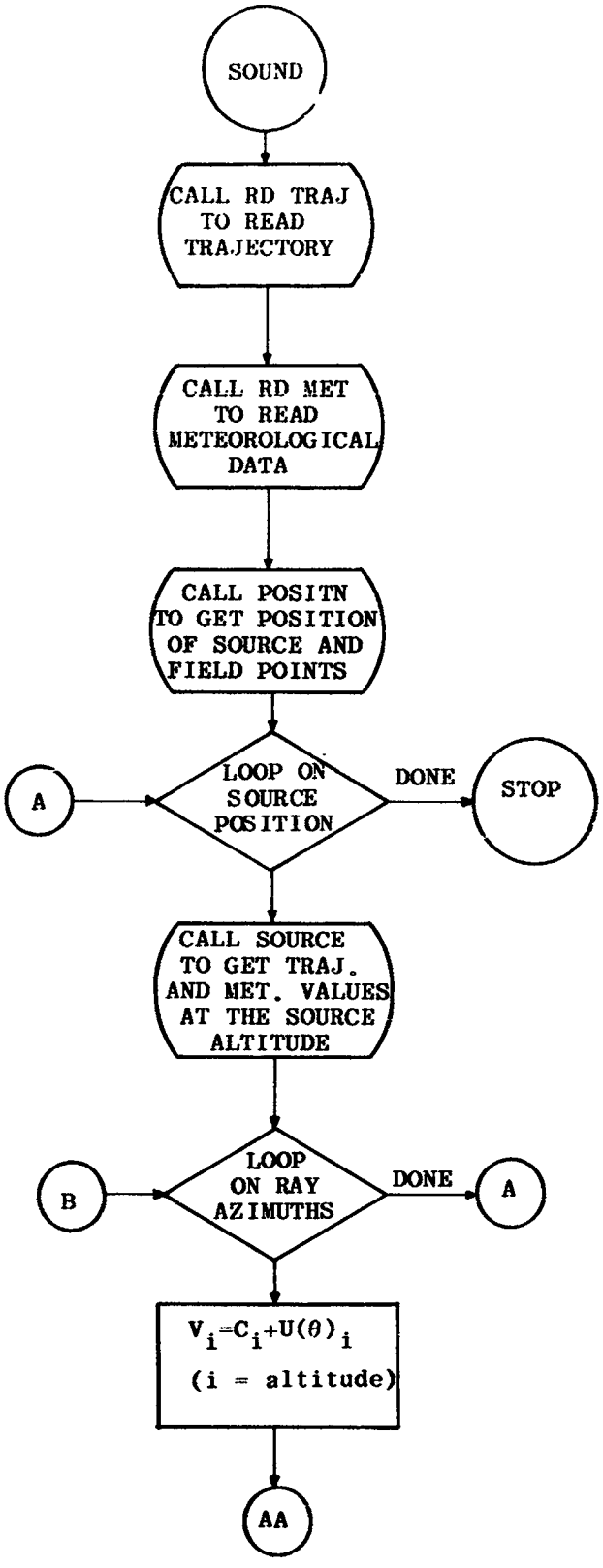

Figure 1. Flow diagram of computer program.

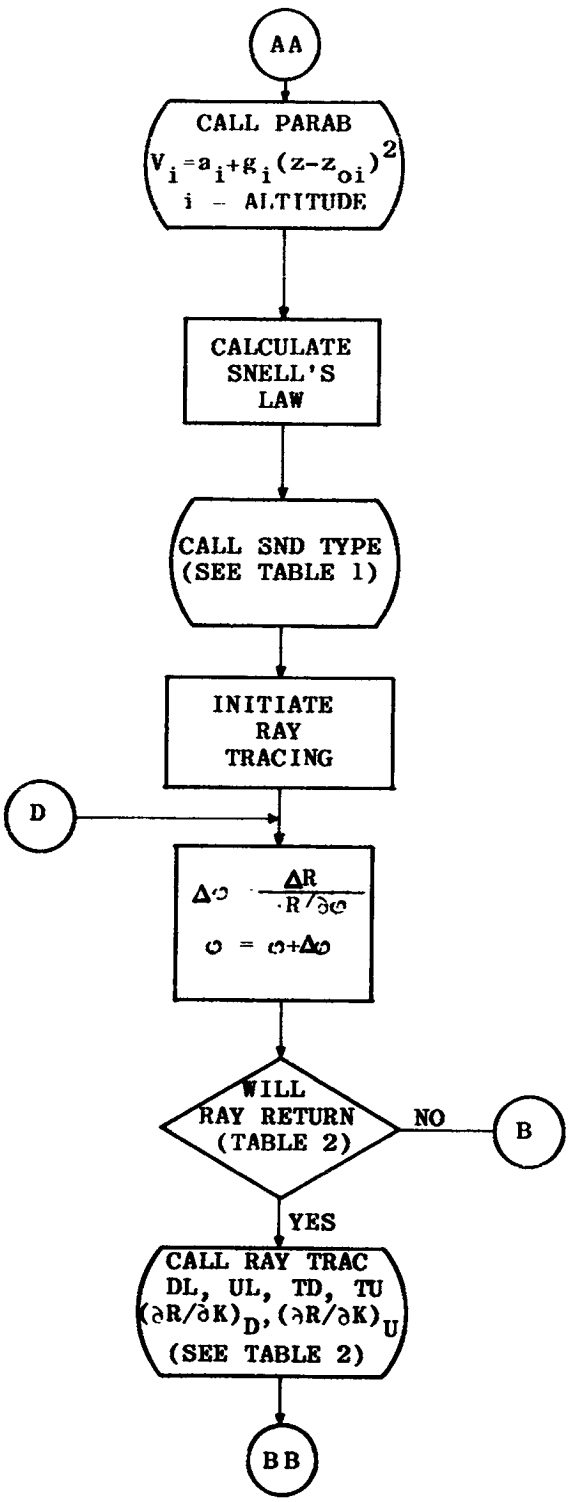

Figure 2. Flow diagram of computer program. (Contd.)

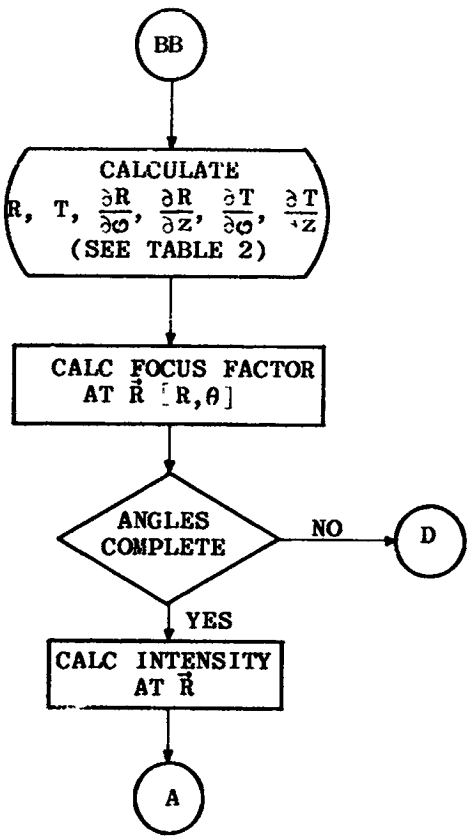

Figure 3. Flow diagram of computer program. (Contd.)

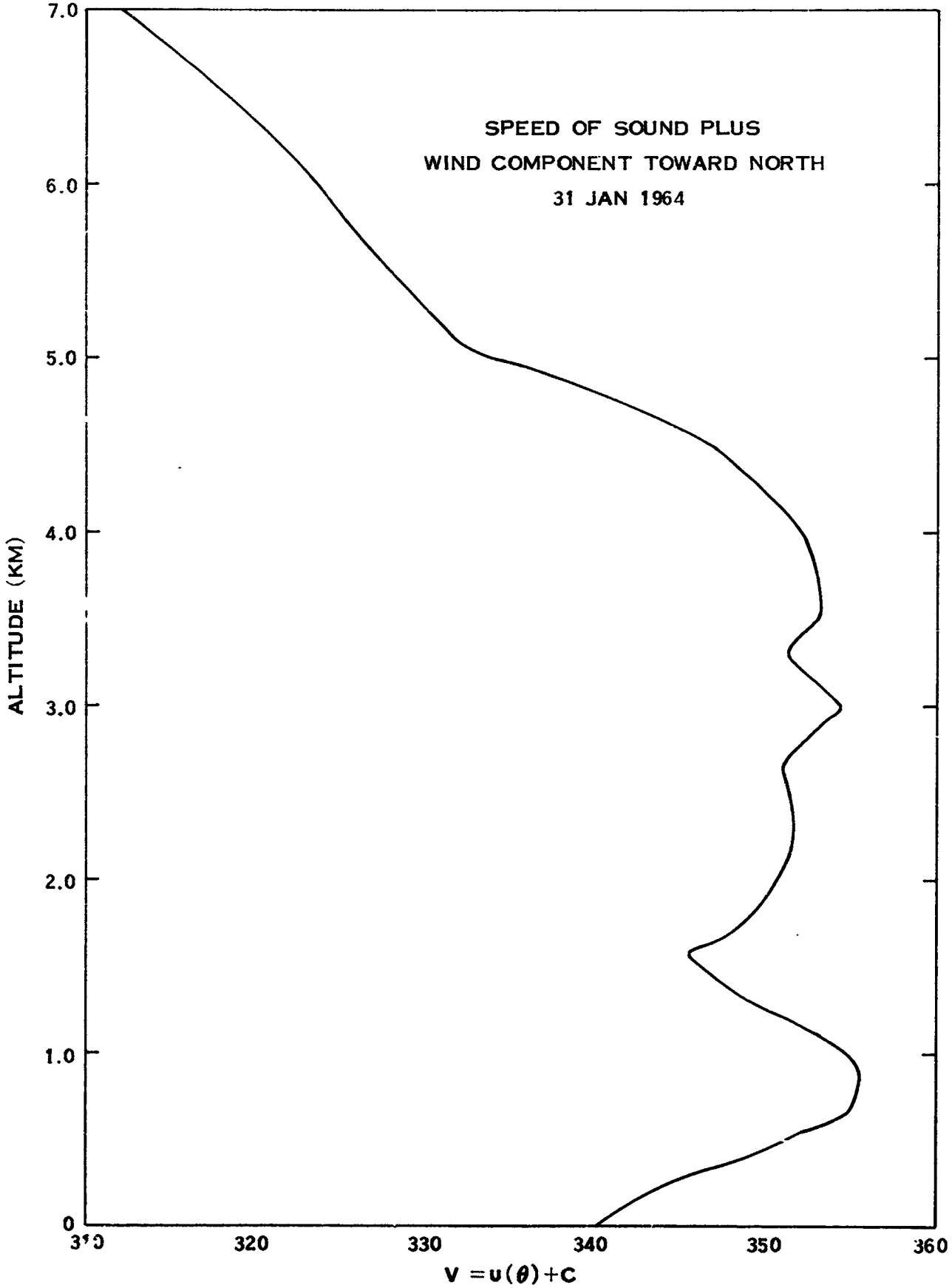

Figure 4: SOUND PROFILE

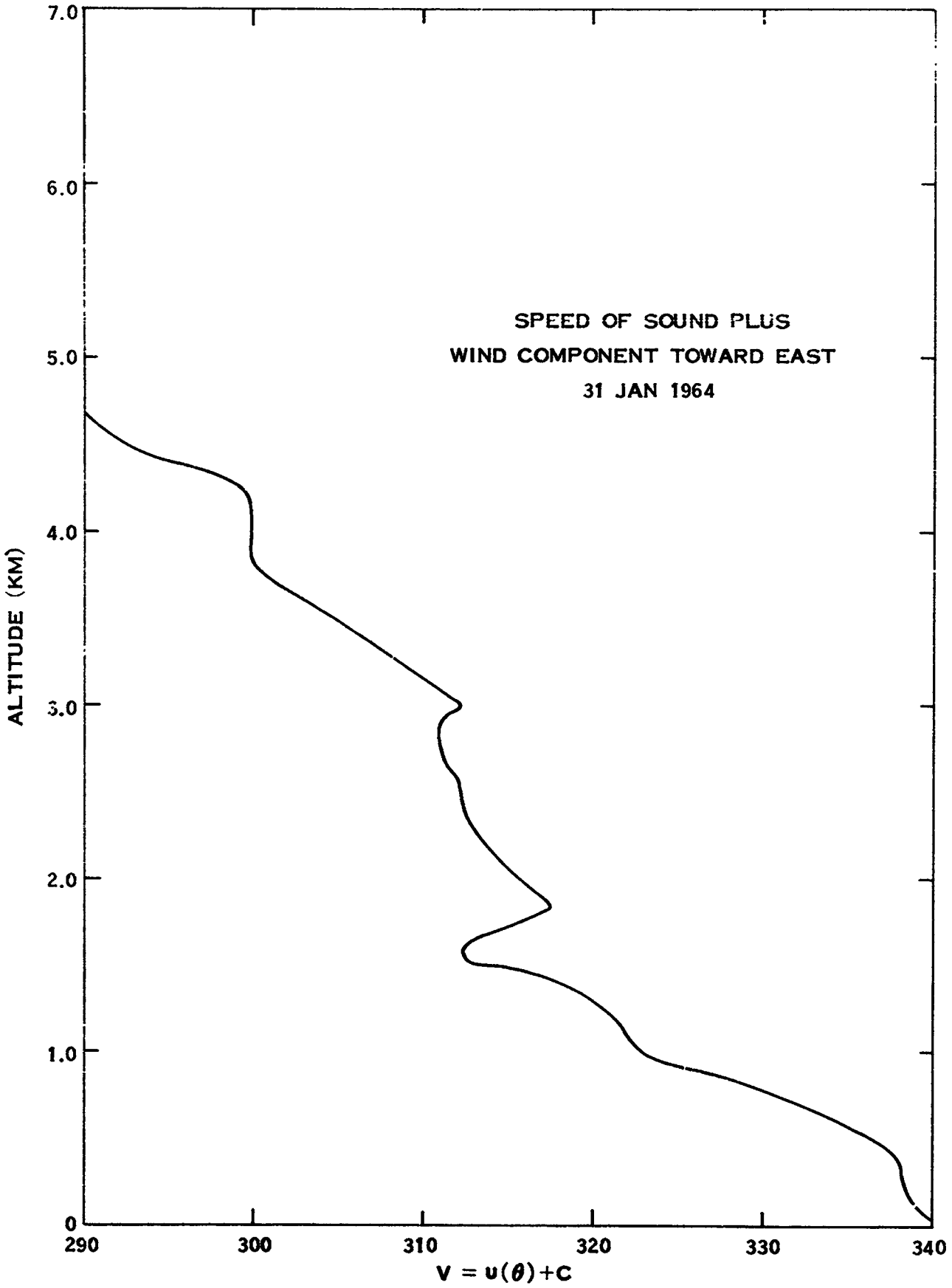

Figure 5: SOUND PROFILE

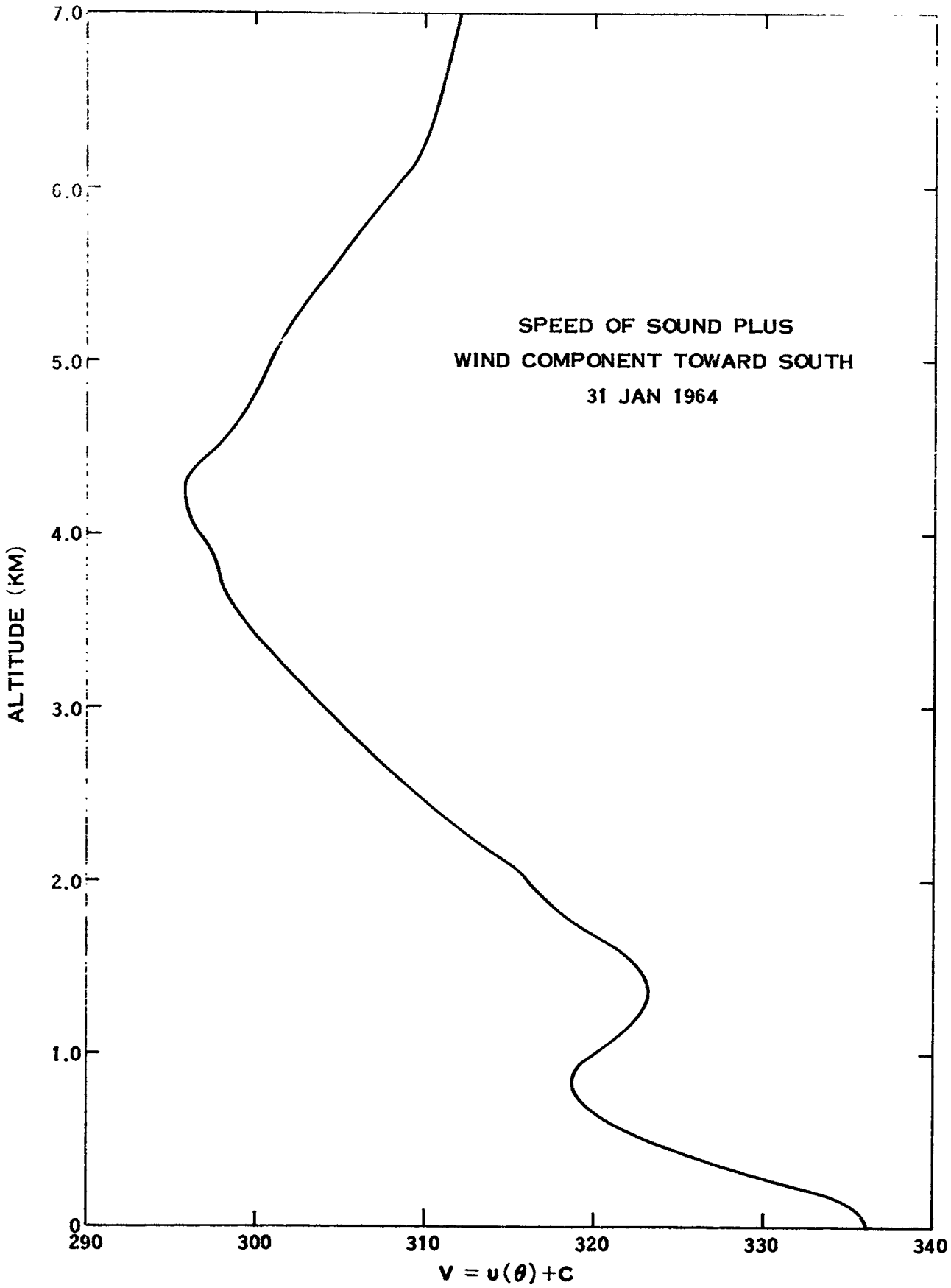

Figure 6: SOUND PROFILE

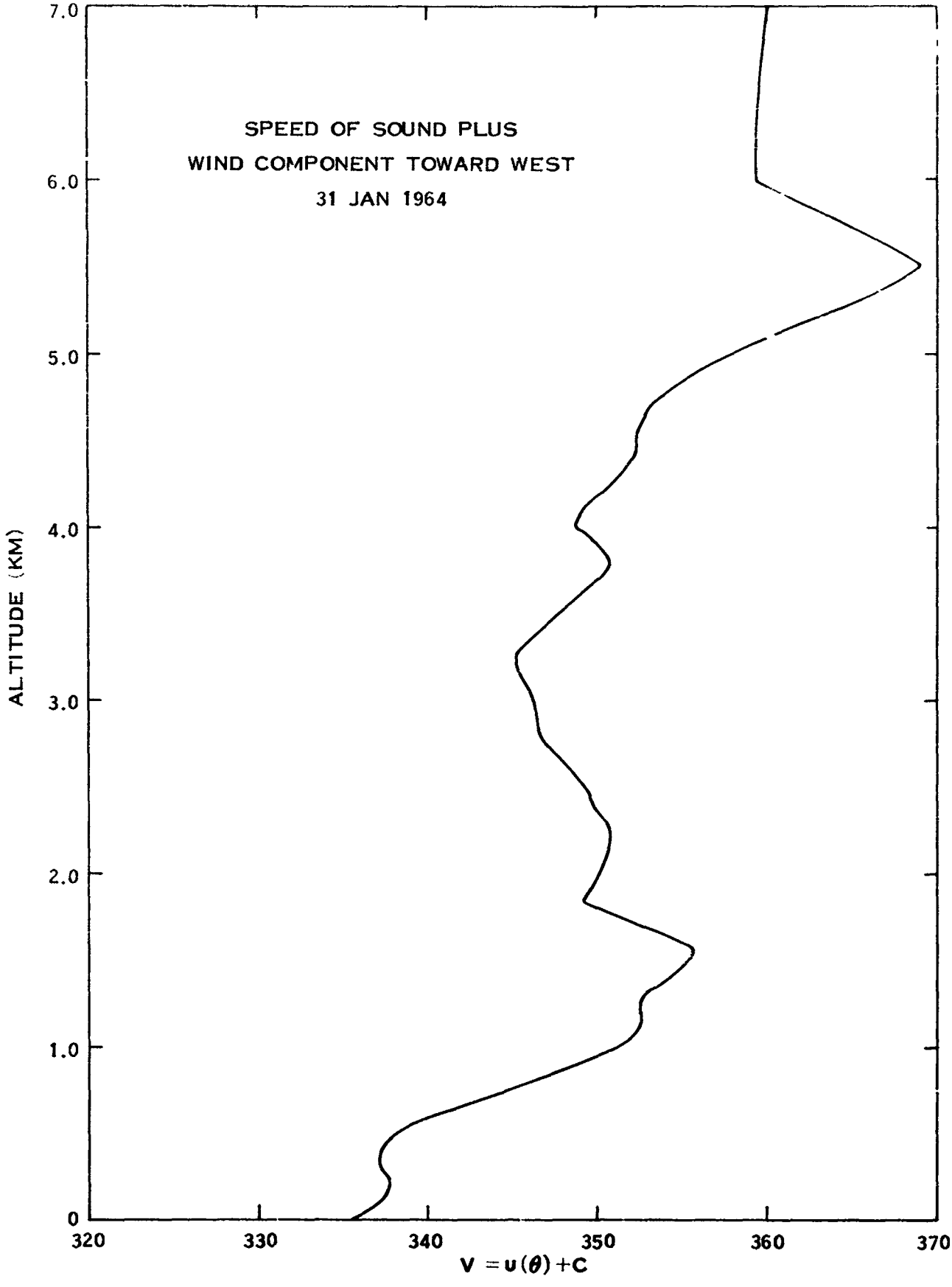

Figure 7: SOUND PROFILE

TRAJECTORY DATA

TIME	ALTITUDE	MACH NO	PITCH	YAW
0.	2.5000E-01	0.	0.	-0.
0.	2.5000E-01	0.	0.	-0.
4.0000E+00	3.8440E+01	5.6400E-02	-9.0000E-03	-0.
8.0000E+00	1.5770E+02	1.1570E-01	-1.6000E-02	-0.
1.2000E+01	3.6070E+02	1.7810E-01	-2.7000E-02	-0.
1.6000E+01	6.5090E+02	2.4380E-01	-3.0000E+00	-0.
2.0000E+01	1.0320E+03	3.1340E-01	-6.0010E+00	-0.
2.4000E+01	1.5090E+03	3.8810E-01	-9.0010E+00	-0.
2.8000E+01	2.0830E+03	4.6910E-01	-1.2000E+01	-0.
3.2000E+01	2.7580E+03	5.5720E-01	-1.5000E+01	-0.
3.5000E+01	3.3330E+03	6.2870E-01	-1.7250E+01	-0.
3.6000E+01	3.5380E+03	6.5360E-01	-1.7860E+01	-0.
4.0000E+01	4.4230E+03	7.5950E-01	-2.1020E+01	-0.
4.4000E+01	5.4170E+03	8.7480E-01	-2.4200E+01	-0.
4.8000E+01	6.5110E+03	9.9340E-01	-2.7380E+01	-0.
5.2000E+01	7.6930E+03	1.1180E+00	-3.0570E+01	-0.
5.6000E+01	8.9550E+03	1.2530E+00	-3.3750E+01	-0.
5.9150E+01	1.0000E+04	1.3680E+00	-3.6230E+01	-0.
6.0000E+01	1.0290E+04	1.4010E+00	-3.6900E+01	-0.
6.3000E+01	1.1330E+04	1.5220E+00	-3.9230E+01	-0.
6.3920E+01	1.1660E+04	1.5620E+00	-3.9930E+01	-0.
6.6000E+01	1.2410E+04	1.6530E+00	-4.1520E+01	-0.
6.9000E+01	1.3530E+04	1.7930E+00	-4.3750E+01	-0.
7.0240E+01	1.4000E+04	1.8520E+00	-4.4660E+01	-0.
7.2000E+01	1.4680E+04	1.9380E+00	-4.5930E+01	-0.
7.5000E+01	1.5870E+04	2.0880E+00	-4.8040E+01	-0.
7.8000E+01	1.7090E+04	2.2370E+00	-5.0070E+01	-0.
8.1000E+01	1.8340E+04	2.3760E+00	-5.2030E+01	-0.
8.4000E+01	1.9630E+04	2.5240E+00	-5.3900E+01	-0.
8.7000E+01	2.0950E+04	2.6790E+00	-5.5690E+01	-0.
9.0000E+01	2.2300E+04	2.8430E+00	-5.7400E+01	-0.
9.3000E+01	2.3680E+04	3.0150E+00	-5.9030E+01	-0.
9.6000E+01	2.5090E+04	3.1980E+00	-6.0570E+01	-0.
9.9000E+01	2.6530E+04	3.3900E+00	-6.2050E+01	-0.
1.0200E+02	2.8000E+04	3.5910E+00	-6.3450E+01	-0.
1.0500E+02	2.9490E+04	3.7900E+00	-6.4780E+01	-0.
1.0800E+02	3.1000E+04	3.9950E+00	-6.6040E+01	-0.
1.1100E+02	3.2530E+04	4.2040E+00	-6.7250E+01	-0.
1.1300E+02	3.3560E+04	4.3460E+00	-6.8010E+01	-0.
1.1300E+02	3.3560E+04	4.3460E+00	-6.8010E+01	-0.
1.1400E+02	3.4080E+04	4.4180E+00	-6.8390E+01	-0.
1.1700E+02	3.5640E+04	4.6300E+00	-6.9480E+01	-0.
1.2000E+02	3.7220E+04	4.8390E+00	-7.0520E+01	-0.
1.2300E+02	3.8810E+04	5.0470E+00	-7.1510E+01	-0.
1.2600E+02	4.0400E+04	5.2520E+00	-7.2460E+01	-0.
1.2900E+02	4.1990E+04	5.4580E+00	-7.3370E+01	-0.
1.3200E+02	4.3580E+04	5.6640E+00	-7.4240E+01	-0.
1.3500E+02	4.5170E+04	5.8750E+00	-7.5080E+01	-0.
1.3800E+02	4.6740E+04	6.0910E+00	-7.5890E+01	-0.

TABLE I. Trajectory Data (Altitude, Mach No., Pitch, and Yaw as a function of time).

TRAJECTORY POSITION DATA

TIME	LATITUDE	LONGITUDE
0.	2.8371E+01	-8.0565E+01
0.	2.8371E+01	-8.0565E+01
4.0000E+00	2.8371E+01	-8.0565E+01
8.0000E+00	2.8371E+01	-8.0565E+01
1.2000E+01	2.8371E+01	-8.0565E+01
1.6000E+01	2.8371E+01	-8.0565E+01
2.0000E+01	2.8371E+01	-8.0565E+01
2.4000E+01	2.8371E+01	-8.0565E+01
2.8000E+01	2.8372E+01	-8.0564E+01
3.2000E+01	2.8373E+01	-8.0563E+01
3.5000E+01	2.8374E+01	-8.0562E+01
3.6000E+01	2.8375E+01	-8.0562E+01
4.0000E+01	2.8377E+01	-8.0560E+01
4.4000E+01	2.8380E+01	-8.0557E+01
4.8000E+01	2.8384E+01	-8.0554E+01
5.2000E+01	2.8388E+01	-8.0550E+01
5.6000E+01	2.8394E+01	-8.0545E+01
5.9150E+01	2.8399E+01	-8.0540E+01
6.0000E+01	2.8401E+01	-8.0539E+01
6.3000E+01	2.8406E+01	-8.0534E+01
6.3923E+01	2.8408E+01	-8.0532E+01
6.6000E+01	2.8413E+01	-8.0528E+01
6.9000E+01	2.8420E+01	-8.0522E+01
7.0236E+01	2.8423E+01	-8.0519E+01
7.2000E+01	2.8428E+01	-8.0515E+01
7.5000E+01	2.8437E+01	-8.0507E+01
7.8000E+01	2.8447E+01	-8.0498E+01
8.1000E+01	2.8458E+01	-8.0488E+01
8.4000E+01	2.8470E+01	-8.0478E+01
8.7000E+01	2.8483E+01	-8.0466E+01
9.0000E+01	2.8497E+01	-8.0453E+01
9.3000E+01	2.8513E+01	-8.0440E+01
9.6000E+01	2.8530E+01	-8.0425E+01
9.9000E+01	2.8548E+01	-8.0408E+01
1.0200E+02	2.8568E+01	-8.0391E+01
1.0500E+02	2.8589E+01	-8.0372E+01
1.0800E+02	2.8612E+01	-8.0352E+01
1.1100E+02	2.8636E+01	-8.0330E+01
1.1300E+02	2.8653E+01	-8.0315E+01
1.1300E+02	2.8653E+01	-8.0315E+01
1.1400E+02	2.8662E+01	-8.0307E+01
1.1700E+02	2.8690E+01	-8.0282E+01
1.2000E+02	2.8719E+01	-8.0256E+01
1.2300E+02	2.8750E+01	-8.0228E+01
1.2600E+02	2.8783E+01	-8.0198E+01
1.2900E+02	2.8818E+01	-8.0167E+01
1.3200E+02	2.8854E+01	-8.0135E+01
1.3500E+02	2.8892E+01	-8.0100E+01
1.3800E+02	2.8932E+01	-8.0064E+01

TABLE II. Trajectory Data (Latitude and Longitude as a function of time).

TRAJECTORY VELOCITY DATA

TIME	VELOCITY	ALGLE FROM HORIZ.
0.	0.	-6.7100E-01
0.	0.	-6.7100E-01
4.0000E+00	1.9568E+01	8.9839E+01
8.0000E+00	4.0065E+01	8.9837E+01
1.2000E+01	6.1505E+01	8.9835E+01
1.6000E+01	8.3895E+01	8.8706E+01
2.0000E+01	1.0739E+02	8.5819E+01
2.4000E+01	1.3233E+02	8.2357E+01
2.8000E+01	1.5905E+02	7.8804E+01
3.2000E+01	1.8768E+02	7.5355E+01
3.5000E+01	2.1056E+02	7.2869E+01
3.6000E+01	2.1846E+02	7.2094E+01
4.0000E+01	2.5149E+02	6.8954E+01
4.4000E+01	2.8634E+02	6.5787E+01
4.8000E+01	3.2064E+02	6.2614E+01
5.2000E+01	3.5476E+02	5.9439E+01
5.6000E+01	3.8994E+02	5.6276E+01
5.9150E+01	4.1878E+02	5.3808E+01
6.0000E+01	4.2677E+02	5.3146E+01
6.3000E+01	4.5606E+02	5.0833E+01
6.3923E+01	4.6545E+02	5.0129E+01
6.6000E+01	4.8736E+02	4.8560E+01
6.9000E+01	5.2110E+02	4.6339E+01
7.0236E+01	5.3577E+02	4.5441E+01
7.2000E+01	5.5747E+02	4.4179E+01
7.5000E+01	5.9661E+02	4.2089E+01
7.8000E+01	6.3878E+02	4.0074E+01
8.1000E+01	6.8393E+02	3.8140E+01
8.4000E+01	7.3212E+02	3.6289E+01
8.7000E+01	7.8343E+02	3.4522E+01
9.0000E+01	8.3772E+02	3.2839E+01
9.3000E+01	8.9485E+02	3.1238E+01
9.6000E+01	9.5487E+02	2.9718E+01
9.9000E+01	1.0177E+03	2.8275E+01
1.0200E+02	1.0833E+03	2.6907E+01
1.0500E+02	1.1515E+03	2.5609E+01
1.0800E+02	1.2226E+03	2.4380E+01
1.1100E+02	1.2963E+03	2.3214E+01
1.1300E+02	1.3471E+03	2.2471E+01
1.1300E+02	1.3471E+03	2.2471E+01
1.1400E+02	1.3728E+03	2.2110E+01
1.1700E+02	1.4503E+03	2.1062E+01
1.2000E+02	1.5283E+03	2.0058E+01
1.2300E+02	1.6068E+03	1.9122E+01
1.2600E+02	1.6857E+03	1.8221E+01
1.2900E+02	1.7650E+03	1.7363E+01
1.3200E+02	1.8448E+03	1.6543E+01
1.3500E+02	1.9249E+03	1.5759E+01
1.3800E+02	2.0054E+03	1.5010E+01

TABLE III. Trajectory Data (velocity and angle from horizontal as a function of time).

Z	P(MB)	T(C)	DEW PT	DIR	SPD	C
0.	1.013E+03	9.890E+00	9.890E+00	1.300E+02	3.100E+00	3.382E+02
1.330E+02	1.001E+03	9.790E+00	9.790E+00	1.663E+02	2.700E+00	3.381E+02
2.860E+02	9.770E+02	9.090E+00	9.090E+00	1.747E+02	8.000E+00	3.377E+02
4.330E+02	9.660E+02	8.790E+00	8.790E+00	1.800E+02	1.240E+01	3.375E+02
5.740E+02	9.430E+02	8.690E+00	8.690E+00	1.876E+02	1.610E+01	3.374E+02
7.540E+02	9.200E+02	8.890E+00	8.890E+00	2.005E+02	1.940E+01	3.376E+02
9.000E+02	9.090E+02	8.390E+00	8.390E+00	2.118E+02	2.160E+01	3.373E+02
1.011E+03	8.980E+02	8.390E+00	8.390E+00	2.197E+02	2.240E+01	3.373E+02
1.181E+03	8.770E+02	7.990E+00	7.990E+00	2.256E+02	2.170E+01	3.370E+02
1.314E+03	8.660E+02	6.490E+00	5.490E+00	2.316E+02	2.090E+01	3.361E+02
1.450E+03	8.550E+02	5.490E+00	5.490E+00	2.363E+02	2.170E+01	3.354E+02
1.567E+03	8.350E+02	3.390E+00	3.390E+00	2.421E+02	2.430E+01	3.341E+02
1.705E+03	8.250E+02	3.090E+00	3.090E+00	2.328E+02	2.370E+01	3.339E+02
1.856E+03	8.040E+02	2.490E+00	2.490E+00	2.241E+02	2.270E+01	3.335E+02
1.989E+03	7.950E+02	1.790E+00	1.790E+00	2.278E+02	2.350E+01	3.331E+02
2.123E+03	7.850E+02	7.900E-01	7.900E-01	2.247E+02	2.510E+01	3.324E+02
2.249E+03	7.750E+02	3.900E-01	3.900E-01	2.237E+02	2.690E+01	3.322E+02
2.408E+03	7.560E+02	-1.210E+00	-1.210E+00	2.225E+02	2.780E+01	3.312E+02
2.559E+03	7.370E+02	-1.710E+00	-1.710E+00	2.217E+02	2.800E+01	3.309E+02
2.690E+03	7.280E+02	-3.910E+00	-3.910E+00	2.198E+02	2.860E+01	3.295E+02
2.835E+03	7.190E+02	-4.510E+00	-4.510E+00	2.162E+02	2.980E+01	3.291E+02
3.004E+03	7.010E+02	-4.010E+00	-4.010E+00	2.143E+02	3.030E+01	3.294E+02
3.130E+03	6.920E+02	-6.110E+00	-6.110E+00	2.143E+02	3.050E+01	3.291E+02
3.292E+03	6.740E+02	-8.410E+00	-8.410E+00	2.170E+02	3.100E+01	3.266E+02
3.422E+03	6.660E+02	-8.610E+00	-8.610E+00	2.175E+02	3.250E+01	3.265E+02
3.565E+03	6.490E+02	-8.810E+00	-8.810E+00	2.184E+02	3.500E+01	3.263E+02
3.711E+03	6.410E+02	-1.011E+01	-1.011E+01	2.224E+02	3.700E+01	3.255E+02
3.872E+03	6.240E+02	-1.061E+01	-1.061E+01	2.227E+02	3.730E+01	3.252E+02
4.023E+03	6.160E+02	-1.181E+01	-1.181E+01	2.214E+02	3.690E+01	3.244E+02
4.163E+03	6.000E+02	-1.271E+01	-1.271E+01	2.225E+02	3.800E+01	3.239E+02
4.326E+03	5.920E+02	-1.351E+01	-1.351E+01	2.266E+02	3.910E+01	3.233E+02
4.477E+03	5.770E+02	-1.481E+01	-1.481E+01	2.305E+02	3.840E+01	3.225E+02
4.624E+03	5.690E+02	-1.561E+01	-1.561E+01	2.328E+02	3.810E+01	3.220E+02
4.774E+03	5.550E+02	-1.661E+01	-1.661E+01	2.357E+02	3.960E+01	3.214E+02
5.000E+03	5.400E+02	-1.900E+01	-2.500E+01	2.500E+02	4.000E+01	3.198E+02
5.500E+03	5.050E+00	-2.200E+01	-3.000E+01	2.550E+02	4.200E+01	3.205E+02
6.000E+03	4.720E+02	-2.500E+01	-3.300E+01	2.600E+02	4.400E+01	3.160E+02
6.500E+03	4.410E+02	-2.800E+01	-3.500E+01	2.650E+02	4.600E+01	3.141E+02
7.000E+03	4.110E+02	-3.100E+01	-4.000E+01	2.700E+02	4.800E+01	3.121E+02
7.500E+03	3.830E+03	-3.400E+01	-4.500E+01	2.750E+02	5.000E+01	3.101E+02
8.000E+03	3.560E+02	-3.700E+01	-5.000E+01	2.800E+02	5.200E+01	3.082E+02
8.500E+03	3.310E+02	-4.000E+01	-5.000E+01	2.750E+02	5.400E+01	3.062E+02
9.000E+03	3.070E+02	-4.300E+01	-5.500E+01	2.700E+02	5.600E+01	3.042E+02
9.500E+03	2.820E+02	-4.600E+01	-6.000E+01	2.600E+02	5.800E+01	3.023E+02
1.000E+04	2.640E+02	-4.900E+01	-6.500E+01	2.500E+02	6.000E+01	3.003E+02

TABLE IV. Meteorological Data as a function of altitude.

PARABOLIC DATA

	A	G	ZO	C	U	V	Z
1	3.3991E+02	1.1162E-04	4.7137E+01	3.3816E+02	1.9926E+00	3.4016E+02	0.
2	3.4003E+02	1.3161E-04	6.0173E+01	3.3811E+02	2.6232E+00	3.4073E+02	1.3300E+02
3	3.4969E+02	-5.7423E-05	5.5174E+02	3.3790E+02	5.0706E+00	3.4297E+02	2.0950E+02
4	3.5923E+02	-9.8695E-06	1.8321E+03	3.3767E+02	7.9658E+00	3.4564E+02	2.8600E+02
5	3.6244E+02	-1.4441E-05	1.3660E+03	3.3756E+02	1.0272E+01	3.4743E+02	3.5950E+02
6	2.4639E+02	1.7539E-06	-7.2487E+03	3.3749E+02	1.2400E+01	3.4989E+02	4.3300E+02
7	3.5473E+02	-6.3076E-05	7.1905E+02	3.3744E+02	1.4352E+01	3.5180E+02	5.0350E+02
8	3.5666E+02	-2.5710E-05	9.2988E+02	3.3744E+02	1.5959E+01	3.5340E+02	5.7400E+02
9	3.5607E+02	-3.7907E-05	8.4432E+02	3.3753E+02	1.7304E+01	3.5484E+02	6.6400E+02
10	3.5594E+02	-6.5948E-05	8.0592E+02	3.3759E+02	1.8171E+01	3.5576E+02	7.5400E+02
11	3.5594E+02	-6.5948E-05	8.0592E+02	3.3749E+02	1.8453E+01	3.5594E+02	8.0592E+02
12	3.5605E+02	-1.4090E-05	7.2833E+02	3.3745E+02	1.8465E+01	3.5591E+02	8.2700E+02
13	3.5573E+02	-6.0782E-05	8.6021E+02	3.3727E+02	1.8359E+01	3.5563E+02	9.0000E+02
14	3.6206E+02	-4.8774E-06	-2.3207E+02	3.3727E+02	1.7902E+01	3.5518E+02	9.5550E+02
15	3.2548E+02	1.2661E-06	5.7997E+03	3.3728E+02	1.7234E+01	3.5452E+02	1.0110E+03
16	3.5440E+02	-3.5950E-05	9.3034E+02	3.3723E+02	1.6267E+01	3.5350E+02	1.0960E+03
17	3.5314E+02	-8.8409E-05	1.0791E+03	3.3704E+02	1.5183E+01	3.5222E+02	1.1810E+03
18	3.4820E+02	9.1094E-05	1.4110E+03	3.3659E+02	1.4043E+01	3.5064E+02	1.2475E+03
19	3.4803E+02	7.5767E-05	1.4306E+03	3.3608E+02	1.2982E+01	3.4906E+02	1.3140E+03
20	3.4848E+02	-5.0496E-05	1.3091E+03	3.3579E+02	1.2421E+01	3.4821E+02	1.3820E+03
21	3.4788E+02	-1.2464E-04	1.3929E+03	3.3543E+02	1.2040E+01	3.4747E+02	1.4500E+03
22	3.4545E+02	2.7162E-04	1.5615E+03	3.3473E+02	1.1481E+01	3.4621E+02	1.5085E+03
23	3.4545E+02	2.9401E-04	1.5597E+03	3.3409E+02	1.1370E+01	3.4546E+02	1.5670E+03
24	3.4872E+02	-1.1591E-04	1.7702E+03	3.3392E+02	1.2710E+01	3.4663E+02	1.6360E+03
25	3.5152E+02	-1.7371E-05	2.1404E+03	3.3390E+02	1.4329E+01	3.4823E+02	1.7050E+03
26	3.4985E+02	-6.7920E-05	1.8725E+03	3.3373E+02	1.5540E+01	3.4927E+02	1.7805E+03
27	3.4984E+02	-1.4049E-04	1.8640E+03	3.3353E+02	1.6301E+01	3.4983E+02	1.8560E+03
28	3.4984E+02	-1.4049E-04	1.8640E+03	3.3350E+02	1.6335E+01	3.4984E+02	1.8640E+03
29	3.4886E+02	1.3645E-04	1.9827E+03	3.3332E+02	1.6033E+01	3.4936E+02	1.9225E+03
30	3.4886E+02	9.8996E-05	1.9804E+03	3.3308E+02	1.5785E+01	3.4887E+02	1.9890E+03
31	3.5117E+02	-3.2135E-05	2.2890E+03	3.3275E+02	1.6674E+01	3.4943E+02	2.0560E+03
32	3.4912E+02	2.4476E-05	1.9051E+03	3.3244E+02	1.7841E+01	3.5029E+02	2.1230E+03
33	3.5173E+02	-7.0498E-05	2.2835E+03	3.3234E+02	1.8719E+01	3.5105E+02	2.1860E+03
34	3.5177E+02	-4.4750E-05	2.3034E+03	3.3219E+02	1.9448E+01	3.5164E+02	2.2490E+03
35	3.5177E+02	-4.4750E-05	2.3034E+03	3.3184E+02	1.9930E+01	3.5177E+02	2.3034E+03
36	3.5167E+02	1.6806E-05	2.3953E+03	3.3168E+02	2.0064E+01	3.5175E+02	2.3285E+03
37	3.5167E+02	7.4127E-06	2.3792E+03	3.3118E+02	2.0496E+01	3.5167E+02	2.4080E+03
38	3.5179E+02	-1.5954E-05	2.5319E+03	3.3106E+02	2.0691E+01	3.5175E+02	2.4835E+03
39	3.5179E+02	-1.5954E-05	2.5319E+03	3.3094E+02	2.0850E+01	3.5179E+02	2.5319E+03
40	3.5178E+02	-4.8805E-05	2.5502E+03	3.3087E+02	2.0906E+01	3.5177E+02	2.5590E+03
41	3.5137E+02	9.2670E-05	2.6637E+03	3.3017E+02	2.1339E+01	3.5151E+02	2.6245E+03
42	3.5135E+02	7.7344E-05	2.6584E+03	3.2946E+02	2.1973E+01	3.5143E+02	2.6900E+03
43	3.5363E+02	-4.4951E-05	2.9416E+03	3.2915E+02	2.3040E+01	3.5219E+02	2.7625E+03
44	3.4922E+02	5.8740E-06	2.0196E+03	3.2907E+02	2.4047E+01	3.5312E+02	2.8350E+03
45	3.5444E+02	-5.9957E-05	3.0077E+03	3.2931E+02	2.4662E+01	3.5397E+02	2.9195E+03
46	3.5444E+02	-1.1210E-04	3.0060E+03	3.2941E+02	2.5031E+01	3.5444E+02	3.0040E+03
47	3.5444E+02	-1.1210E-04	3.0060E+03	3.2939E+02	2.5049E+01	3.5444E+02	3.0060E+03
48	3.5201E+02	2.3290E-05	3.3608E+03	3.2883E+02	2.5190E+01	3.5402E+02	3.0670E+03
49	3.5407E+02	-3.5300E-05	2.9777E+03	3.2806E+02	2.5196E+01	3.5325E+02	3.1300E+03
50	3.5130E+02	8.0353E-05	3.3135E+03	3.2723E+02	2.4917E+01	3.5215E+02	3.2110E+03
51	3.5132E+02	1.1232E-04	3.3074E+03	3.2658E+02	2.4758E+01	3.5134E+02	3.2920E+03
52	3.5338E+02	-1.7427E-05	3.6769E+03	3.2645E+02	2.5144E+01	3.5159E+02	3.3570E+03
53	3.5184E+02	4.8773E-05	3.3309E+03	3.2646E+02	2.5784E+01	3.5224E+02	3.4220E+03
54	3.5378E+02	-9.6703E-05	3.5755E+03	3.2644E+02	2.6686E+01	3.5313E+02	3.4935E+03
55	3.5378E+02	-9.5847E-05	3.5756E+03	3.2634E+02	2.7429E+01	3.5377E+02	3.5650E+03
56	3.5378E+02	-9.5847E-05	3.5756E+03	3.2628E+02	2.7499E+01	3.5378E+02	3.5756E+03
57	3.5277E+02	5.6021E-05	3.7448E+03	3.2593E+02	2.7474E+01	3.5340E+02	3.6360E+03
58	3.5269E+02	2.5145E-05	3.7863E+03	3.2551E+02	2.7323E+01	3.5283E+02	3.7110E+03
59	3.5269E+02	-1.6047E-05	3.7997E+03	3.2534E+02	2.7343E+01	3.5265E+02	3.7915E+03
60	3.5269E+02	-1.6047E-05	3.7997E+03	3.2533E+02	2.7360E+01	3.5269E+02	3.7997E+03

TABLE V. Parabolic fit to wind component (U) plus speed of sound (C). The values of A, G, ZO are the parabolic parameters. Direction of propagation is toward the north.

61	3.5271E+02	-1.2415E-05	3.7786E+03	3.2519E+02	2.7412E+01	3.5260E+02	3.8720E+03
62	3.5196E+02	1.1103E-05	4.1364E+03	3.2483E+02	2.7528E+01	3.5236E+02	3.9475E+03
63	3.5205E+02	2.7072E-05	4.0695E+03	3.2443E+02	2.7679E+01	3.5211E+02	4.0230E+03
64	3.5207E+02	-5.6911E-05	4.1042E+03	3.2413E+02	2.7934E+01	3.5206E+02	4.0930E+03
65	3.5207E+02	-5.6911E-05	4.1042E+03	3.2408E+02	2.7985E+01	3.5207E+02	4.1042E+03
66	3.5217E+02	-3.7365E-05	4.0734E+03	3.2386E+02	2.8016E+01	3.5187E+02	4.1630E+03
67	3.5262E+02	-2.5601E-05	3.9994E+03	3.2361E+02	2.7594E+01	3.5120E+02	4.2345E+03
68	3.5182E+02	-3.8299E-05	4.1010E+03	3.2335E+02	2.6865E+01	3.5021E+02	4.3060E+03
69	3.4506E+02	3.5057E-05	4.7088E+03	3.2293E+02	2.5658E+01	3.4859E+02	4.3915E+03
70	3.4452E+02	2.7260E-05	4.7751E+03	3.2252E+02	2.4425E+01	3.4694E+02	4.4770E+03
71	3.4159E+02	8.7103E-06	5.2535E+03	3.2226E+02	2.3639E+01	3.4589E+02	4.5505E+03
72	3.4471E+02	9.1209E-05	4.6841E+03	3.2201E+02	2.3035E+01	3.4504E+02	4.6240E+03
73	3.4474E+02	-2.2235E-04	4.7051E+03	3.2172E+02	2.3008E+01	3.4473E+02	4.6990E+03
74	3.4474E+02	-2.2235E-04	4.7051E+03	3.2170E+02	2.3045E+01	3.4474E+02	4.7051E+03
75	3.4498E+02	-1.8139E-04	4.6895E+03	3.2137E+02	2.2315E+01	3.4369E+02	4.7740E+03
76	3.3349E+02	2.9049E-04	5.0103E+03	3.2017E+02	1.7740E+01	3.3791E+02	4.8870E+03
77	3.3340E+02	7.4395E-05	5.0402E+03	3.1984E+02	1.3680E+01	3.3352E+02	5.0000E+03
78	3.3964E+02	-8.2201E-05	5.4399E+03	3.2501E+02	1.1667E+01	3.3668E+02	5.2500E+03
79	3.3964E+02	-8.2201E-05	5.4399E+03	3.2764E+02	1.2000E+01	3.3964E+02	5.4399E+03
80	3.3967E+02	-7.4718E-05	5.4339E+03	3.2847E+02	1.0870E+01	3.3934E+02	5.5000E+03
81	3.2146E+02	5.1946E-05	6.2047E+03	3.2290E+02	9.3060E+00	3.3220E+02	5.7500E+03
82	3.1997E+02	3.0806E-05	6.3452E+03	3.1600E+02	7.6397E+00	3.2364E+02	6.0000E+03
83	3.2101E+02	-1.1297E-05	5.9903E+03	3.1437E+02	5.8727E+00	3.2025E+02	6.2500E+03
84	3.6161E+02	-7.6131E-07	-1.0624E+03	3.1407E+02	4.0082E+00	3.1807E+02	6.5000E+03
85	3.5937E+02	-7.9985E-07	-6.6604E+02	3.1310E+02	2.0490E+00	3.1515E+02	6.7500E+03
86	3.5378E+02	-9.0721E-07	2.2355E+02	3.1212E+02	-1.0258E-03	3.1212E+02	7.0000E+03
87	4.0151E+02	-4.3922E-07	-7.2630E+03	3.1113E+02	-2.1385E+00	3.0899E+02	7.2500E+03
88	3.1006E+02	-9.8172E-06	6.8395E+03	3.1014E+02	-4.3589E+00	3.0578E+02	7.5000E+03
89	2.9839E+02	2.7227E-05	8.0783E+03	3.0916E+02	-7.2375E+00	3.0192E+02	7.7500E+03
90	2.9898E+02	2.6578E-05	8.0802E+03	3.0819E+02	-9.0309E+00	2.9915E+02	8.0000E+03
91	3.0234E+02	-7.8715E-06	8.8233E+03	3.0721E+02	-7.4554E+00	2.9975E+02	8.2500E+03
92	3.0304E+02	-4.2410E-06	9.1000E+03	3.0622E+02	-4.7076E+00	3.0151E+02	8.5000E+03
93	3.0238E+02	1.5687E-05	8.6554E+03	3.0524E+02	-2.7137E+00	3.0252E+02	8.7500E+03
94	3.0238E+02	1.5692E-05	8.6555E+03	3.0425E+02	-1.1968E-03	3.0424E+02	9.0000E+03

TABLE V. (Contd.)

PARABOLIC DATA

	A	G	ZO	C	U	V	Z
1	3.3844E+02	4.5333E-05	2.1502E+02	3.3816E+02	2.3747E+00	3.4054E+02	0.
2	3.3851E+02	5.7945E-05	1.9717E+02	3.3811E+02	6.3942E-01	3.3875E+02	1.3300E+02
3	3.3853E+02	-3.6810E-05	2.2891E+02	3.3790E+02	6.2049E-01	3.3852E+02	2.0950E+02
4	3.3853E+02	-3.5810E-05	2.2891E+02	3.3784E+02	6.9131E-01	3.3853E+02	2.2891E+02
5	3.3914E+02	-6.0993E-06	-5.8520E+01	3.3767E+02	7.3880E-01	3.3841E+02	2.8600E+02
6	3.3824E+02	-3.8558E-05	2.9338E+02	3.3756E+02	5.1311E-01	3.3807E+02	3.5950E+02
7	3.3844E+02	-3.0438E-05	2.5613E+02	3.3749E+02	-2.6500E-04	3.3749E+02	4.3300E+02
8	3.3796E+02	-4.1044E-05	3.2005E+02	3.3744E+02	-8.6748E-01	3.3658E+02	5.0350E+02
9	3.3970E+02	-2.4760E-05	1.5302E+02	3.3744E+02	-2.1297E+00	3.3531E+02	5.7400E+02
10	3.4126E+02	-1.9954E-05	2.9960E+01	3.3753E+02	-4.2997E+10	3.3323E+02	6.6400E+02
11	3.3433E+02	-5.9051E-05	5.0934E+02	3.3759E+02	-6.7945E+00	3.3080E+02	7.5400E+02
12	3.2112E+02	4.8530E-05	1.2135E+03	3.3745E+02	-9.0730E+00	3.2837E+02	8.2700E+02
13	2.9535E+02	7.5801E-06	2.9073E+03	3.3727E+02	-1.1383E+01	3.2589E+02	9.0000E+02
14	3.2250E+02	1.2698E-04	1.0720E+03	3.3727E+02	-1.3048E+01	3.2423E+02	9.5550E+02
15	3.2211E+02	6.9071E-05	1.1232E+03	3.3728E+02	-1.4309E+01	3.2298E+02	1.0110E+03
16	3.2224E+02	-4.1578E-05	1.0809E+03	3.3723E+02	-1.5073E+01	3.2216E+02	1.0960E+03
17	3.2258E+02	-2.8033E-05	9.6799E+02	3.3704E+02	-1.5505E+01	3.2154E+02	1.1810E+03
18	3.2843E+02	-6.8416E-06	1.8419E+02	3.3659E+02	-1.5898E+01	3.2069E+02	1.2475E+03
19	3.1709E+02	2.2895E-05	1.6516E+03	3.3608E+02	-1.6380E+01	3.1970E+02	1.3140E+03
20	3.1908E+02	-1.1512E-04	1.3284E+03	3.3579E+02	-1.7035E+01	3.1875E+02	1.3820E+03
21	3.1804E+02	-2.3804E-04	1.4030E+03	3.3543E+02	-1.8054E+01	3.1738E+02	1.4500E+03
22	3.1257E+02	4.5839E-04	1.5771E+03	3.3473E+02	-2.0012E+01	3.1472E+02	1.5085E+03
23	3.1254E+02	2.8947E-04	1.5830E+03	3.3409E+02	-2.1476E+01	3.1261E+02	1.5670E+03
24	3.1586E+02	-9.4157E-05	1.7991E+03	3.3392E+02	-2.0572E+01	3.1335E+02	1.6360E+03
25	3.1357E+02	5.3985E-05	1.5410E+03	3.3390E+02	-1.8878E+01	3.1502E+02	1.7050E+03
26	3.1774E+02	-1.5611E-04	1.8633E+03	3.3373E+02	-1.7065E+01	3.1667E+02	1.7805E+03
27	3.1774E+02	-2.1702E-04	1.8613E+03	3.3353E+02	-1.5798E+01	3.1773E+02	1.8560E+03
28	3.1774E+02	-2.1702E-04	1.8613E+03	3.3351E+02	-1.5776E+01	3.1774E+02	1.8613E+03
29	3.1541E+02	1.1697E-04	2.0361E+03	3.3332E+02	-1.6402E+01	3.1692E+02	1.9225E+03
30	3.1512E+02	5.4474E-05	2.0901E+03	3.3308E+02	-1.7409E+01	3.1567E+02	1.9890E+03
31	3.1529E+02	-3.1522E-05	1.9970E+03	3.3275E+02	-1.7573E+01	3.1518E+02	2.0560E+03
32	3.1555E+02	-2.0853E-05	1.9326E+03	3.3244E+02	-1.7656E+01	3.1479E+02	2.1230E+03
33	3.1258E+02	1.7215E-05	2.4929E+03	3.3234E+02	-1.8130E+01	3.1421E+02	2.1860E+03
34	3.1975E+02	-2.8698E-06	7.8564E+02	3.3219E+02	-1.8585E+01	3.1361E+02	2.2490E+03
35	3.1222E+02	2.7947E-05	2.4869E+03	3.3168E+02	-1.8760E+01	3.1292E+02	2.3285E+03
36	3.1229E+02	4.4910E-05	2.4571E+03	3.3118E+02	-1.8782E+01	3.1240E+02	2.4080E+03
37	3.1235E+02	-4.4951E-05	2.5099E+03	3.3106E+02	-1.8739E+01	3.1232E+02	2.4835E+03
38	3.1235E+02	-4.4951E-05	2.5099E+03	3.3099E+02	-1.8642E+01	3.1235E+02	2.5099E+03
39	3.1231E+02	-6.5999E-05	2.5255E+03	3.3087E+02	-1.8627E+01	3.1224E+02	2.5590E+03
40	3.1112E+02	7.8495E-05	2.7077E+03	3.3017E+02	-1.8501E+01	3.1167E+02	2.6245E+03
41	3.1111E+02	4.6593E-05	2.7198E+03	3.2946E+02	-1.8308E+01	3.1115E+02	2.6900E+03
42	3.1393E+02	-1.4436E-06	4.1392E+03	3.2915E+02	-1.7958E+01	3.1119E+02	2.7625E+03
43	3.1137E+02	3.2778E-05	2.7776E+03	3.2907E+02	-1.7601E+01	3.1147E+02	2.8350E+03
44	3.1235E+02	-6.7222E-05	2.9887E+03	3.2931E+02	-1.7285E+01	3.1203E+02	2.9195E+03
45	3.1235E+02	-6.7222E-05	2.9887E+03	3.2939E+02	-1.7042E+01	3.1235E+02	2.9887E+03
46	3.1234E+02	-9.9383E-05	2.9937E+03	3.2941E+02	-1.7076E+01	3.1233E+02	3.0040E+03
47	3.2116E+02	-5.6804E-06	1.7838E+03	3.2883E+02	-1.7023E+01	3.1181E+02	3.0670E+03
48	3.1240E+02	-3.8095E-05	2.9293E+03	3.2806E+02	-1.7188E+01	3.1087E+02	3.1300E+03
49	3.0675E+02	4.3855E-05	3.4557E+03	3.2723E+02	-1.7854E+01	3.0938E+02	3.2110E+03
50	3.0713E+02	6.4262E-05	3.4037E+03	3.2658E+02	-1.8657E+01	3.0793E+02	3.2920E+03
51	3.0745E+02	-4.7637E-05	3.2940E+03	3.2645E+02	-1.9182E+01	3.0727E+02	3.3570E+03
52	3.3905E+02	-1.1490E-06	-1.8866E+03	3.2646E+02	-1.9786E+01	3.0667E+02	3.4220E+03
53	3.0642E+02	-6.1552E-05	3.3931E+03	3.2644E+02	-2.0646E+01	3.0580E+02	3.4935E+03
54	3.0562E+02	-1.0918E-04	3.4681E+03	3.2634E+02	-2.1741E+01	3.0460E+02	3.5650E+03
55	3.0016E+02	1.4928E-04	3.7623E+03	3.2593E+02	-2.3460E+01	3.0247E+02	3.6380E+03
56	2.9995E+02	9.7612E-05	3.7899E+03	3.2551E+02	-2.4950E+01	3.0056E+02	3.7110E+03
57	2.9996E+02	-1.2538E-05	3.8038E+03	3.2534E+02	-2.5391E+01	2.9995E+02	3.7915E+03
58	2.9996E+02	-1.2538E-05	3.8038E+03	3.2532E+02	-2.5366E+01	2.9996E+02	3.8038E+03
59	2.9988E+02	4.7608E-05	3.8900E+03	3.2519E+02	-2.5296E+01	2.9990E+02	3.8720E+03
60	3.0014E+02	-7.5297E-05	3.9839E+03	3.2483E+02	-2.4792E+01	3.0004E+02	3.9475E+03

TABLE VI. Parabolic fit to speed of sound plus wind component
Direction of propagation is toward the east.

61	3.0014E+02	-7.5297E-05	3.9839E+03	3.2464E+02	-2.4498E+01	3.0014E+02	3.9839E+03
62	3.0017E+02	-6.8533E-05	3.9743E+03	3.2443E+02	-2.4403E+01	3.0002E+02	4.0230E+03
63	3.0131E+02	-2.5799E-05	3.8146E+03	3.2413E+02	-2.4813E+01	2.9931E+02	4.0930E+03
64	2.9934E+02	-6.9981E-05	4.0346E+03	3.2386E+02	-2.5673E+01	2.9818E+02	4.1630E+03
65	2.9402E+02	7.7740E-05	4.4145E+03	3.2361E+02	-2.7069E+01	2.9654E+02	4.2345E+03
66	2.9306E+02	3.7895E-05	4.5286E+03	3.2335E+02	-2.8410E+01	2.9494E+02	4.3060E+03
67	2.3673E+02	4.7289E-07	1.5375E+04	3.2293E+02	-2.9160E+01	2.9377E+02	4.3915E+03
68	2.9222E+02	3.9990E-05	4.6059E+03	3.2252E+02	-2.9631E+01	2.9289E+02	4.4770E+03
69	2.9242E+02	-6.6770E-05	4.5173E+03	3.2226E+02	-2.9911E+01	2.9234E+02	4.5505E+03
70	2.9289E+02	-4.1088E-05	4.4507E+03	3.2201E+02	-3.0349E+01	2.9166E+02	4.6240E+03
71	2.9375E+02	-3.0707E-05	4.3667E+03	3.2172E+02	-3.1365E+01	2.9036E+02	4.6990E+03
72	2.9055E+02	-8.2388E-05	4.6222E+03	3.2137E+02	-3.2714E+01	2.8866E+02	4.7740E+03
73	2.8225E+02	1.8848E-04	5.0027E+03	3.2017E+02	-3.5390E+01	2.8478E+02	4.8870E+03
74	2.8225E+02	5.7897E-05	5.0089E+03	3.1984E+02	-3.7588E+01	2.8225E+02	5.0000E+03
75	2.8821E+02	-7.5000E-05	5.4361E+03	3.2501E+02	-3.9396E+01	2.8561E+02	5.2500E+03
76	2.8821E+02	-7.5000E-05	5.4361E+03	3.2759E+02	-3.9377E+01	2.8821E+02	5.4361E+03
77	2.8822E+02	-7.3475E-05	5.4348E+03	3.2847E+02	-4.0569E+01	2.8790E+02	5.5000E+03
78	2.7085E+02	5.3321E-05	6.1844E+03	3.2290E+02	-4.1981E+01	2.8092E+02	5.7500E+03
79	2.6966E+02	3.2122E-05	6.3061E+03	3.1600E+02	-4.3332E+01	2.7267E+02	6.0000E+03
80	2.7009E+02	-9.8788E-06	6.0677E+03	3.1437E+02	-4.4615E+01	2.6976E+02	6.2500E+03
81	2.3850E+02	6.1335E-07	1.3464E+04	3.1407E+02	-4.5825E+01	2.6824E+02	6.5000E+03
82	2.3989E+02	6.4581E-07	1.3126E+04	3.1310E+02	-4.6955E+01	2.6614E+02	6.7500E+03
83	2.3350E+02	5.1104E-07	1.4742E+04	3.1212E+02	-4.8000E+01	2.6412E+02	7.0000E+03
84	2.4778E+02	1.0177E-06	1.1012E+04	3.1113E+02	-4.8953E+01	2.6218E+02	7.2500E+03
85	2.5529E+02	2.5336E-06	8.9107E+03	3.1014E+02	-4.9810E+01	2.6033E+02	7.5000E+03
86	2.6084E+02	-4.0368E-06	7.0215E+03	3.0916E+02	-5.0461E+01	2.5870E+02	7.7500E+03
87	2.6092E+02	-3.9576E-06	7.0020E+03	3.0819E+02	-5.1210E+01	2.5698E+02	8.0000E+03
88	2.4413E+02	2.2961E-06	1.0401E+04	3.0721E+02	-5.2452E+01	2.5475E+02	8.2500E+03
89	2.5243E+02	-8.7306E-03	0.	3.0622E+02	-5.3794E+01	2.5243E+02	8.5000E+03
90	2.4359E+02	2.8542E-06	1.0277E+04	3.0524E+02	-5.4989E+01	2.5025E+02	8.7500E+03
91	2.3860E+02	1.3775E-06	1.1646E+04	3.0425E+02	-5.6000E+01	2.4825E+02	9.0000E+03

TABLE VI. Continued

PARABOLIC DATA

	A	S	ZO	C	U	V	Z
1	3.3646E+02	-1.3115E-04	4.6832E+01	3.3816E+02	-1.9927E+00	3.3617E+02	0.
2	3.3646E+02	-1.3115E-04	4.6832E+01	3.3815E+02	-1.6855E+00	3.3646E+02	4.6832E+01
3	3.3529E+02	-1.5880E-04	6.1835E+01	3.3811E+02	-2.6232E+00	3.3549E+02	1.3300E+02
4	3.2595E+02	7.9983E-05	5.0267E+02	3.3790E+02	-5.0707E+00	3.3283E+02	2.0950E+02
5	3.1477E+02	2.3208E-05	1.0327E+03	3.3767E+02	-7.9658E+00	3.2971E+02	2.8600E+02
6	3.1334E+02	1.8290E-05	1.2137E+03	3.3756E+02	-1.0272E+01	3.2729E+02	3.5950E+02
7	2.7112E+02	3.7783E-06	4.2124E+03	3.3749E+02	-1.2400E+01	3.2509E+02	4.3300E+02
8	3.2042E+02	7.3530E-05	6.9408E+02	3.3744E+02	-1.4351E+01	3.2309E+02	5.0350E+02
9	3.1961E+02	4.1642E-05	7.8603E+02	3.3744E+02	-1.5958E+01	3.2148E+02	5.7400E+02
10	3.1821E+02	1.2748E-05	1.0626E+03	3.3753E+02	-1.7304E+01	3.2023E+02	6.6400E+02
11	3.1881E+02	2.5355E-05	9.0917E+02	3.3759E+02	-1.8171E+01	3.1942E+02	7.5400E+02
12	3.1889E+02	4.5358E-05	8.7293E+02	3.3745E+02	-1.8465E+01	3.1898E+02	8.2700E+02
13	3.1890E+02	1.0353E-04	8.8814E+02	3.3727E+02	-1.8357E+01	3.1892E+02	9.0000E+02
14	3.2093E+02	-3.1294E-05	1.1783E+03	3.3727E+02	-1.7902E+01	3.1937E+02	9.5550E+02
15	3.1175E+02	3.3051E-06	-5.7338E+02	3.3728E+02	-1.7234E+01	3.2005E+02	1.0110E+03
16	3.2621E+02	-5.8040E-06	2.0466E+03	3.3723E+02	-1.6266E+01	3.2096E+02	1.0960E+03
17	3.1662E+02	4.8209E-06	1.3884E+02	3.3704E+02	-1.5182E+01	3.2186E+02	1.1810E+03
18	3.2331E+02	-3.7510E-05	1.3900E+03	3.3659E+02	-1.4042E+01	3.2255E+02	1.2475E+03
19	3.2342E+02	-2.5072E-05	1.4277E+03	3.3608E+02	-1.2981E+01	3.2310E+02	1.3140E+03
20	3.2341E+02	-2.7793E-05	1.4232E+03	3.3579E+02	-1.2420E+01	3.2337E+02	1.3820E+03
21	3.2341E+02	-2.7793E-05	1.4232E+03	3.3557E+02	-1.2158E+01	3.2341E+02	1.4232E+03
22	3.2343E+02	-1.5595E-05	1.4023E+03	3.3543E+02	-1.2039E+01	3.2339E+02	1.4500E+03
23	3.2328E+02	-9.9749E-05	1.4919E+03	3.3473E+02	-1.1480E+01	3.2325E+02	1.5085E+03
24	3.2329E+02	-9.8609E-05	1.4910E+03	3.3409E+02	-1.1369E+01	3.2272E+02	1.5670E+03
25	3.1827E+02	6.9516E-05	1.8417E+03	3.3392E+02	-1.2709E+01	3.2121E+02	1.6360E+03
26	3.1010E+02	9.5255E-06	2.7023E+03	3.3390E+02	-1.4328E+01	3.1957E+02	1.7050E+03
27	3.1697E+02	6.3249E-05	1.9193E+03	3.3373E+02	-1.5540E+01	3.1819E+02	1.7805E+03
28	3.1711E+02	1.3525E-04	1.8856E+03	3.3353E+02	-1.6301E+01	3.1723E+02	1.8560E+03
29	3.1746E+02	-1.4888E-04	1.9560E+03	3.3332E+02	-1.6032E+01	3.1729E+02	1.9225E+03
30	3.1746E+02	-1.4888E-04	1.9560E+03	3.3320E+02	-1.5743E+01	3.1746E+02	1.9560E+03
31	3.1749E+02	-1.2472E-04	1.9496E+03	3.3308E+02	-1.5784E+01	3.1730E+02	1.9890E+03
32	3.1347E+02	6.7404E-05	2.2528E+03	3.3275E+02	-1.6673E+01	3.1608E+02	2.0560E+03
33	3.1196E+02	2.8980E-05	2.4250E+03	3.3244E+02	-1.7840E+01	3.1460E+02	2.1230E+03
34	2.4548E+02	7.0405E-07	1.2024E+04	3.3234E+02	-1.8719E+01	3.1362E+02	2.1860E+03
35	3.2172E+02	-5.2788E-06	9.4533E+02	3.3219E+02	-1.9447E+01	3.1275E+02	2.2490E+03
36	3.1011E+02	3.5362E-05	2.5350E+03	3.3168E+02	-2.0063E+01	3.1162E+02	2.3285E+03
37	3.1037E+02	6.3685E-05	2.4785E+03	3.3118E+02	-2.0495E+01	3.1068E+02	2.4080E+03
38	3.1037E+02	-7.9284E-05	2.4875E+03	3.3106E+02	-2.0690E+01	3.1037E+02	2.4855E+03
39	3.1037E+02	-7.9284E-05	2.4875E+03	3.3105E+02	-2.0679E+01	3.1037E+02	2.4875E+03
40	3.1032E+02	-9.0717E-05	2.4965E+03	3.3087E+02	-2.0905E+01	3.0996E+02	2.5590E+03
41	3.0552E+02	4.0745E-05	2.9094E+03	3.3017E+02	-2.1338E+01	3.0883E+02	2.6245E+03
42	3.1293E+02	-1.4672E-05	2.0806E+03	3.2946E+02	-2.1972E+01	3.0749E+02	2.6900E+03
43	3.0468E+02	6.9741E-05	2.9060E+03	3.2915E+02	-2.3039E+01	3.0611E+02	2.7625E+03
44	3.0465E+02	6.4064E-05	2.9122E+03	3.2907E+02	-2.4047E+01	3.0503E+02	2.8350E+03
45	3.0465E+02	-4.8974E-05	2.9290E+03	3.2931E+02	-2.4662E+01	3.0465E+02	2.9195E+03
46	3.0465E+02	-4.8974E-05	2.9290E+03	3.2932E+02	-2.4668E+01	3.0465E+02	2.9290E+03
47	3.0457E+02	-6.8553E-05	2.9504E+03	3.2941E+02	-2.5030E+01	3.0438E+02	3.0040E+03
48	3.0251E+02	5.6596E-05	3.2082E+03	3.2883E+02	-2.5189E+01	3.0364E+02	3.0670E+03
49	3.0212E+02	2.6377E-05	3.2978E+03	3.2806E+02	-2.5195E+01	3.0286E+02	3.1300E+03
50	3.0261E+02	-1.7889E-05	3.0830E+03	3.2723E+02	-2.4916E+01	3.0232E+02	3.2110E+03
51	3.0341E+02	-8.8473E-06	2.8693E+03	3.2658E+02	-2.4757E+01	3.0183E+02	3.2920E+03
52	3.0248E+02	-1.5837E-05	3.0846E+03	3.2645E+02	-2.5144E+01	3.0130E+02	3.3570E+03
53	3.0161E+02	-3.0522E-05	3.2469E+03	3.2646E+02	-2.5783E+01	3.0068E+02	3.4220E+03
54	2.9850E+02	4.4991E-05	3.6608E+03	3.2644E+02	-2.6685E+01	2.9976E+02	3.4935E+03
55	2.9835E+02	3.3165E-05	3.6949E+03	3.2634E+02	-2.7428E+01	2.9891E+02	3.5650E+03
56	2.9340E+02	7.0495E-07	6.3167E+03	3.2593E+02	-2.7473E+01	2.9846E+02	3.6380E+03
57	2.9799E+02	1.7396E-05	3.8166E+03	3.2551E+02	-2.7322E+01	2.9819E+02	3.7110E+03
58	2.9801E+02	-2.3175E-05	3.7727E+03	3.2534E+02	-2.7342E+01	2.9800E+02	3.7915E+03
59	2.9801E+02	-2.2786E-05	3.7710E+03	3.2519E+02	-2.7411E+01	2.9778E+02	3.8720E+03
60	2.9553E+02	9.0975E-06	4.3897E+03	3.2483E+02	-2.7527E+01	2.9730E+02	3.9475E+03

TABLE VII. Parabolic fit to speed of sound plus wind component. Direction of propagation is toward the south.

61	2.9737E+02	-1.7839E-05	3.8360E+03	3.2443E+02	-2.7678E+01	2.9675E+02	4.0230E+03
62	2.9584E+02	5.8760E-05	4.1710E+03	3.2413E+02	-2.7933E+01	2.9619E+02	4.0930E+03
63	2.9584E+02	4.7551E-05	4.1729E+03	3.2386E+02	-2.8015E+01	2.9534E+02	4.1630E+03
64	[illegible]	9.2106E-06	3.9165E+03	3.2361E+02	-2.7592E+01	2.9602E+02	4.2345E+03
65	2.9535E+02	2.4362E-05	4.1587E+03	3.2335E+02	-2.6864E+01	2.9648E+02	4.3060E+03
66	2.9884E+02	-2.0507E-05	4.6680E+03	3.2293E+02	-2.5657E+01	2.9727E+02	4.3915E+03
67	2.9970E+02	-9.5229E-06	4.8883E+03	3.2252E+02	-2.4424E+01	2.9809E+02	4.4770E+03
68	2.9909E+02	-2.1717E-05	4.6986E+03	3.2226E+02	-2.3638E+01	2.9862E+02	4.5505E+03
69	2.9900E+02	-8.8792E-05	4.6423E+03	3.2201E+02	-2.3034E+01	2.9897E+02	4.6240E+03
70	2.9900E+02	-8.8792E-05	4.6423E+03	3.2194E+02	-2.2935E+01	2.9900E+02	4.6423E+03
71	2.9859E+02	1.9466E-04	4.7249E+03	3.2172E+02	-2.3007E+01	2.9872E+02	4.6990E+03
72	2.9809E+02	9.4850E-05	4.6732E+03	3.2137E+02	-2.2314E+01	2.9906E+02	4.7740E+03
73	3.0862E+02	-6.6407E-05	5.1924E+03	3.2017E+02	-1.7739E+01	3.0243E+02	4.8870E+03
74	2.9330E+02	1.2691E-05	3.9934E+03	3.1984E+02	-1.3679E+01	3.0616E+02	5.0000E+03
75	3.1763E+02	-5.9395E-05	5.5185E+03	3.2501E+02	-1.1655E+01	3.1334E+02	5.2500E+03
76	3.1762E+02	-7.3004E-05	5.5151E+03	3.2847E+02	-1.0808E+01	3.1761E+02	5.5000E+03
77	3.1762E+02	-7.3004E-05	5.5151E+03	3.2814E+02	-1.0516E+01	3.1762E+02	5.5151E+03
78	3.0809E+02	5.3516E-05	6.0705E+03	3.2290E+02	-9.7042E+00	3.1359E+02	5.7500E+03
79	3.0792E+02	3.2459E-05	6.1162E+03	3.1600E+02	-7.6378E+00	3.0836E+02	6.0000E+03
80	3.1042E+02	-9.8328E-06	6.6915E+03	3.1437E+02	-6.[illegible]08E+00	3.0850E+02	6.2500E+03
81	3.0567E+02	8.0827E-07	4.1698E+03	3.1407E+02	-4.[illegible]063E+00	3.1006E+02	6.5000E+03
82	3.0294E+02	5.3622E-07	2.8607E+03	3.1310E+02	-2.9470E+00	3.1105E+02	6.7500E+03
83	3.0327E+02	5.5623E-07	3.0096E+03	3.1212E+02	3.0774E-03	[illegible]3E+02	7.0000E+03
84	3.0584E+02	7.4825E-07	4.0978E+03	3.1113E+02	2.1406E+00	3.1327E+02	7.2500E+03
85	3.1385E+02	1.0058E-05	7.2469E+03	3.1014E+02	4.3610E+00	3.1450E+02	7.5000E+03
86	3.1734E+02	-2.7373E-05	7.9349E+03	3.0916E+02	7.2396E+00	3.1640E+02	7.7500E+03
87	3.1734E+02	-2.7373E-05	7.9349E+03	3.0844E+02	8.8954E+00	3.1734E+02	7.9349E+03
88	3.1734E+02	-2.6627E-05	7.9330E+03	3.0819E+02	9.0331E+00	3.1722E+02	8.0000E+03
89	3.0555E+02	7.8202E-06	9.3292E+03	3.0721E+02	7.4577E+00	3.1466E+02	8.2500E+03
90	3.0090E+02	4.1908E-06	1.0047E+04	3.0622E+02	4.7099E+00	3.1093E+02	8.5000E+03
91	3.0983E+02	-1.5739E-05	8.4045E+03	3.0524E+02	2.7160E+00	3.0795E+02	8.7500E+03
92	3.0983E+02	-1.5743E-05	8.4047E+03	3.0425E+02	3.5903E-03	3.0425E+02	9.0000E+03

TABLE VII. Continued

PARAPOLIC DATA

	A	G	ZO	C	U	V	Z
1	3.3753E+02	-6.4848E-05	1.6388E+02	3.3816E+02	-2.3746E+00	3.3579E+02	0.
2	3.3752E+02	-8.5125E-05	1.5652E+02	3.3811E+02	-6.3930E-01	3.3747E+02	1.3300E+02
3	3.3752E+02	-8.5125E-05	1.5652E+02	3.3804E+02	-5.2738E-01	3.3752E+02	1.5652E+02
4	3.3694E+02	5.9365E-05	2.8547E+02	3.3790E+02	-6.2028E-01	3.3728E+02	2.0950E+02
5	3.3694E+02	1.9436E-05	2.8437E+02	3.3767E+02	-7.3846E-01	3.3694E+02	2.8600E+02
6	3.3699E+02	4.2405E-05	3.2507E+02	3.3756E+02	-5.1267E-01	3.3704E+02	3.5950E+02
7	3.3691E+02	3.5969E-05	3.0575E+02	3.3749E+02	-7.9500E-04	3.3749E+02	4.3300E+02
8	3.3733E+02	5.1493E-05	3.6537E+02	3.3744E+02	8.6809E-01	3.3831E+02	5.0350E+02
9	3.3674E+02	4.0689E-05	3.0997E+02	3.3744E+02	2.1304E+00	3.3957E+02	5.7400E+02
10	3.8169E+02	-5.2072E-06	3.4304E+03	3.3753E+02	4.3004E+00	3.4184E+02	6.6400E+02
11	3.3386E+02	1.8455E-05	-1.1628E+00	3.3759E+02	6.7953E+00	3.4439E+02	7.5400E+02
12	3.6005E+02	-1.7262E-05	1.7124E+03	3.3745E+02	9.0738E+00	3.4652E+02	8.2700E+02
13	3.4306E+02	3.5159E-05	5.0114E+02	3.3727E+02	1.1384E+01	3.4866E+02	9.0000E+02
14	3.5189E+02	-1.6314E-04	1.0534E+03	3.3727E+02	1.3049E+01	3.5032E+02	9.5550E+02
15	3.5234E+02	-6.4497E-05	1.1183E+03	3.3728E+02	1.4310E+01	3.5159E+02	1.0110E+03
16	3.6393E+02	-1.7788E-07	9.1817E+03	3.3723E+02	1.5074E+01	3.5230E+02	1.0960E+03
17	3.5258E+02	-5.5557E-05	1.2066E+03	3.3704E+02	1.5505E+01	3.5255E+02	1.1810E+03
18	3.5258E+02	-5.5557E-05	1.2066E+03	3.3687E+02	1.5715E+01	3.5258E+02	1.2066E+03
19	3.5241E+02	6.0426E-05	1.2851E+03	3.3659E+02	1.5893E+01	3.5249E+02	1.2475E+03
20	3.5235E+02	2.7802E-05	1.2512E+03	3.3608E+02	1.6380E+01	3.5246E+02	1.3140E+03
21	3.5246E+02	3.6832E-05	1.2832E+03	3.3579E+02	1.7036E+01	3.5282E+02	1.3820E+03
22	3.5325E+02	1.5779E-04	1.4111E+03	3.3543E+02	1.8054E+01	3.5349E+02	1.4500E+03
23	3.5557E+02	-2.8650E-04	1.5622E+03	3.3473E+02	2.0013E+01	3.5475E+02	1.5085E+03
24	3.5557E+02	-2.8650E-04	1.5622E+03	3.3414E+02	2.1430E+01	3.5557E+02	1.5622E+03
25	3.5557E+02	-1.8405E-04	1.5595E+03	3.3409E+02	2.1476E+01	3.5556E+02	1.5670E+03
26	3.5034E+02	4.7758E-05	1.9310E+03	3.3392E+02	2.0572E+01	3.5450E+02	1.6360E+03
27	3.5466E+02	-6.1829E-05	1.5305E+03	3.3390E+02	1.8879E+01	3.5278E+02	1.7050E+03
28	3.4922E+02	1.5143E-04	1.8826E+03	3.3373E+02	1.7065E+01	3.5080E+02	1.7805E+03
29	3.4925E+02	2.1176E-04	1.8750E+03	3.3353E+02	1.5798E+01	3.4933E+02	1.8560E+03
30	3.5051E+02	-1.2939E-04	2.0002E+03	3.3332E+02	1.6403E+01	3.4973E+02	1.9225E+03
31	3.5052E+02	-8.0191E-05	2.0071E+03	3.3308E+02	1.7410E+01	3.5049E+02	1.9890E+03
32	3.5052E+02	-8.0191E-05	2.0071E+03	3.3299E+02	1.7525E+01	3.5052E+02	2.0071E+03
33	3.5010E+02	6.6786E-05	2.1147E+03	3.3275E+02	1.7574E+01	3.5033E+02	2.0560E+03
34	3.5010E+02	7.4306E-05	2.1156E+03	3.3244E+02	1.7657E+01	3.5010E+02	2.1230E+03
35	3.5078E+02	-8.7009E-05	2.2462E+03	3.3234E+02	1.8130E+01	3.5047E+02	2.1860E+03
36	3.5078E+02	-8.7009E-05	2.2462E+03	3.3220E+02	1.8580E+01	3.5078E+02	2.2462E+03
37	3.5078E+02	-4.7159E-05	2.2438E+03	3.3219E+02	1.8586E+01	3.5078E+02	2.2490E+03
38	3.4978E+02	2.4220E-05	2.4935E+03	3.3168E+02	1.8760E+01	3.5044E+02	2.3285E+03
39	3.4980E+02	2.6187E-05	2.4871E+03	3.3118E+02	1.8783E+01	3.4996E+02	2.4080E+03
40	3.4980E+02	-5.0286E-05	2.4816E+03	3.3106E+02	1.8740E+01	3.4980E+02	2.4835E+03
41	3.4970E+02	-7.3522E-05	2.5061E+03	3.3087E+02	1.8628E+01	3.4950E+02	2.5590E+03
42	3.4729E+02	5.4922E-05	2.7830E+03	3.3017E+02	1.8502E+01	3.4867E+02	2.6245E+03
43	3.4614E+02	1.6081E-05	3.0077E+03	3.2946E+02	1.8309E+01	3.4777E+02	2.6900E+03
44	3.4652E+02	2.6231E-05	2.9128E+03	3.2915E+02	1.7959E+01	3.4711E+02	2.7625E+03
45	3.4656E+02	3.7159E-05	2.8899E+03	3.2907E+02	1.7602E+01	3.4668E+02	2.8350E+03
46	3.4663E+02	-4.1710E-05	2.9458E+03	3.2931E+02	1.7286E+01	3.4660E+02	2.9195E+03
47	3.4663E+02	-4.1710E-05	2.9458E+03	3.2934E+02	1.7285E+01	3.4663E+02	2.9458E+03
48	3.4656E+02	-8.1275E-05	2.9742E+03	3.2941E+02	1.7077E+01	3.4648E+02	3.0040E+03
49	3.4519E+02	8.5564E-05	3.1552E+03	3.2883E+02	1.7025E+01	3.4586E+02	3.0670E+03
50	3.4509E+02	2.9169E-05	3.2039E+03	3.2806E+02	1.7189E+01	3.4524E+02	3.1300E+03
51	3.4508E+02	1.8612E-05	3.1999E+03	3.2723E+02	1.7855E+01	3.4509E+02	3.2110E+03
52	3.4517E+02	3.9210E-05	3.2483E+03	3.2658E+02	1.8658E+01	3.4524E+02	3.2920E+03
53	3.4437E+02	1.4372E-05	3.0604E+03	3.2645E+02	1.9183E+01	3.4563E+02	3.3570E+03
54	3.4485E+02	1.9401E-05	3.1541E+03	3.2646E+02	1.9787E+01	3.4625E+02	3.4220E+03
55	3.4268E+02	9.8352E-06	2.8240E+03	3.2644E+02	2.0647E+01	3.4709E+02	3.4935E+03
56	3.4694E+02	4.6488E-05	3.4082E+03	3.2634E+02	2.1742E+01	3.4808E+02	3.5650E+03
57	3.5062E+02	-9.2548E-05	3.7534E+03	3.2593E+02	2.3461E+01	3.4939E+02	3.6380E+03
58	3.5074E+02	-5.4468E-05	3.7831E+03	3.2551E+02	2.4951E+01	3.5046E+02	3.7110E+03
59	3.5074E+02	-5.4468E-05	3.7831E+03	3.2536E+02	2.5379E+01	3.5074E+02	3.7831E+03
60	3.5075E+02	-2.6684E-05	3.7743E+03	3.2534E+02	2.5393E+01	3.5074E+02	3.7915E+03

TABLE VIII. Parabolic fit to speed of sound plus wind component. Direction of propagation is toward the west.

61	3.5057E+02	-8.2807E-05	3.8405E+03	3.2519E+02	2.5297E+01	3.5049E+02	3.8720E+03
62	3.4880E+02	9.5493E-05	4.0403E+03	3.2483E+02	2.4793E+01	3.4962E+02	3.9475E+03
63	3.4879E+02	6.9764E-05	4.0466E+03	3.2443E+02	2.4404E+01	3.4883E+02	4.0230E+03
64	3.4856E+02	2.7645E-05	3.9760E+03	3.2413E+02	2.4814E+01	3.4894E+02	4.0930E+03
65	3.4920E+02	8.0163E-05	4.0985E+03	3.2386E+02	2.5675E+01	3.4953E+02	4.1630E+03
66	3.5194E+02	-9.4128E-05	4.3503E+03	3.2361E+02	2.7071E+01	3.5068E+02	4.2345E+03
67	3.5209E+02	-5.1832E-05	4.3865E+03	3.2335E+02	2.8411E+01	3.5176E+02	4.3060E+03
68	3.5209E+02	-5.1832E-05	4.3865E+03	3.2295E+02	2.9138E+01	3.5209E+02	4.3865E+03
69	3.5209E+02	1.4078E-05	4.4100E+03	3.2293E+02	2.9161E+01	3.5209E+02	4.3915E+03
70	3.5219E+02	-2.2250E-05	4.5194E+03	3.2252E+02	2.9632E+01	3.5215E+02	4.4770E+03
71	3.5219E+02	-2.2250E-05	4.5194E+03	3.2237E+02	2.9823E+01	3.5219E+02	4.5194E+03
72	3.5216E+02	5.3762E-05	4.5634E+03	3.2226E+02	2.9912E+01	3.5217E+02	4.5505E+03
73	3.5211E+02	4.3507E-05	4.5491E+03	3.2201E+02	3.0350E+01	3.5236E+02	4.6240E+03
74	3.3895E+02	3.0089E-06	2.5315E+03	3.2172E+02	3.1366E+01	3.5309E+02	4.6990E+03
75	3.6504E+02	-4.1551E-06	6.3979E+03	3.2137E+02	3.2715E+01	3.5409E+02	4.7740E+03
76	3.5445E+02	3.5607E-05	4.7107E+03	3.2017E+02	3.5390E+01	3.5556E+02	4.8870E+03
77	3.5380E+02	2.9191E-05	4.6471E+03	3.1984E+02	3.7589E+01	3.5743E+02	5.0000E+03
78	3.6906E+02	-6.6597E-05	5.5143E+03	3.2501E+02	3.9397E+01	3.6441E+02	5.2500E+03
79	3.6906E+02	-7.4247E-05	5.5128E+03	3.2847E+02	4.0570E+01	3.6904E+02	5.5000E+03
80	3.6906E+02	-7.4247E-05	5.5128E+03	3.2819E+02	4.0867E+01	3.6906E+02	5.5128E+03
81	3.5893E+02	5.2142E-05	6.0878E+03	3.2290E+02	4.1981E+01	3.6488E+02	5.7500E+03
82	3.5866E+02	3.1143E-05	6.1469E+03	3.1600E+02	4.3332E+01	3.5933E+02	6.0000E+03
83	3.5990E+02	-1.1251E-05	6.5353E+03	3.1437E+02	4.4615E+01	3.5899E+02	6.2500E+03
84	3.6017E+02	-5.6639E-07	7.2008E+03	3.1407E+02	4.5825E+01	3.5989E+02	6.5000E+03
85	3.6013E+02	-9.0943E-07	7.0307E+03	3.1310E+02	4.6955E+01	3.6005E+02	6.7500E+03
86	3.6013E+02	-8.6202E-07	7.0324E+03	3.1212E+02	4.8000E+01	3.6012E+02	7.0000E+03
87	3.6013E+02	-8.6202E-07	7.0324E+03	3.1200E+02	4.8130E+01	3.6013E+02	7.0324E+03
88	3.6013E+02	-7.0863E-07	6.9853E+03	3.1113E+02	4.8953E+01	3.6008E+02	7.2500E+03
89	3.6000E+02	-2.2931E-06	7.3410E+03	3.1014E+02	4.9809E+01	3.5995E+02	7.5000E+03
90	3.5939E+02	3.8913E-06	7.9910E+03	3.0916E+02	5.0461E+01	3.5962E+02	7.7500E+03
91	3.5939E+02	3.9095E-06	7.9911E+03	3.0819E+02	5.1209E+01	3.5940E+02	8.0000E+03
92	3.6009E+02	-2.3476E-06	8.6812E+03	3.0721E+02	5.2451E+01	3.5966E+02	8.2500E+03
93	3.6240E+02	-7.5898E-08	1.4104E+04	3.0622E+02	5.3794E+01	3.6002E+02	8.5000E+03
94	3.6028E+02	-2.9057E-06	8.8898E+03	3.0524E+02	5.4989E+01	3.6022E+02	8.7500E+03
95	3.6028E+02	-2.9057E-06	8.8898E+03	3.0468E+02	5.5599E+01	3.6028E+02	8.8898E+03
96	3.6032E+02	-1.4281E-06	8.7759E+03	3.0425E+02	5.6000E+01	3.6025E+02	9.0000E+03

TABLE VIII. Continued.

Tables IXa through XXc contain the tabulation of the computed sound intensity on the ground and summarize the initial condition. Each Roman numeral table is divided into three parts; a, b, and c. Part (a) contains the pertinent information applicable to the sound source. Part (b) contains the sound intensity on the ground as a function of the ray elevation at the sound source. Part (c) contains the sound intensity on the ground as a function of distance from the ground point beneath the vehicle.

The tables are grouped into three sets of four tables each. Tables IX, X, XI, XII are for the sound source at 955.5 m altitude Tables XIII, XIV, XV, XVI are for the source at 1450 m altitude. Tables XVII, XVIII, XIX and XX are for the sound source at 1989 m altitude. In each set of tables, the direction of sound propagation is toward the north, east, south, and west respectively.

The sound pressure level as a function of distance from the point below the source is shown in Figs. 8, 9 and 10 for the 955.5 m, 1450 m, and 1989 m source elevations respectively. The four directions of propagation are shown in each figure.

SOURCE PARAMETERS

SOURCE ALTITUDE	=	9.5550E+02
X-COORD	=	0.
Y-COORD	=	0.
HORIZ RANGE	=	0.
VEHICLE AZIMUTH	=	7.2159E-01
VEHICLE PITCH	=	-5.4809E+00
VEHICLE YAW	=	0.
VEHICLE MACH NO	=	3.0095E-01
VEHICLE Z-VELOCITY	=	1.0302E+02
VEHICLE XY-VELOCITY	=	6.2512E+00
T (ZS)	=	8.3490E+00
DEW-POINT	=	8.3490E+00
C (ZS)	=	3.3725E+02
P (ZS)	=	9.0378E+02
SOUND RAY AZIMUTH PLANE	=	0.

TABLE IXa. Parameter for sound source at 955.5 meters altitude, northward propagation.

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PHIZ	RADIUS	TIME	FOCUS FAC	SND PRESS(DB)
-8.5871E+01	1.0342E+02	2.8373E+00	6.7122E-01	1.4366E+02
-2.6284E+01	1.8896E+03	6.0716E+00	9.4039E-01	1.1989E+02
-1.2823E+01	3.5569E+03	1.0508E+01	4.7733E-01	1.1145E+02
-8.0844E+00	4.9619E+03	1.4377E+01	4.0054E-01	1.0779E+02
-5.9064E+00	6.3955E+03	1.8378E+01	1.4958E+00	1.1131E+02
-4.8816E+00	7.8963E+03	2.2020E+01	2.5259E+00	1.1198E+02
-4.3156E+00	9.1729E+03	2.6162E+01	3.6434E+00	1.1205E+02
-4.0666E+00	1.0303E+04	2.9333E+01	4.3411E+00	1.1180E+02

TABLE IXb. Sound conditions at the ground as a function of ray inclination. Source at 955.5 meters, northward propagation.

SUMMARY FOR AZIMUTH OF 0.

R	FOCUS FACT	SND PRESS (DB)
1.0000E+02	0.	0.
1.0000E+03	8.8633E-01	1.2477E+02
2.0000E+03	9.0973E-01	1.1927E+02
3.0000E+03	6.3200E-01	1.1416E+02
4.0000E+03	4.5311E-01	1.1022E+02
5.0000E+03	4.2966E-01	1.0805E+02
6.0000E+03	1.1936E+00	1.1091E+02
7.0000E+03	1.9745E+00	1.1175E+02
8.0000E+03	2.7557E+00	1.1204E+02
9.0000E+03	3.5125E+00	1.1207E+02
1.0000E+04	4.1542E+00	1.1185E+02
1.1000E+04	0.	0.
1.2000E+04	0.	0.
1.3000E+04	0.	0.
1.4000E+04	0.	0.
1.5000E+04	0.	0.

TABLE IXc. Sound conditions on the ground as a function of distance. Source at 955.5 meters, northward propagation.

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SOURCE PARAMETERS

SOURCE ALTITUDE	=	9.5550E+02
X-COORD	=	0.
Y-COORD	=	0.
HORIZ RANGE	=	0.
VEHICLE AZIMUTH	=	7.2159E-01
VEHICLE PITCH	=	-5.4809E+00
VEHICLE YAW	=	0.
VEHICLE MACH NO.	=	3.0095E-01
VEHICLE Z-VELOCITY	=	1.0302E+02
VEHICLE XY-VELOCITY	=	6.2512E+00
T (ZS)	=	8.3490E+00
DEW-POINT	=	8.3490E+00
C (ZS)	=	3.3725E+02
P (ZS)	=	9.0378E+02
SOUND RAY AZIMUTH PLANE	=	9.0000E+01

TABLE Xa. Parameter for sound source at 955.5 meters, eastward propagation.

PHIZ	RADIUS	TIME	FOCUS FAC	SND PRESS(DB)
-3.5732E+01	6.3284E+01	2.8380E+00	1.1212E+00	1.5015E+02
-2.6399E+01	2.2766E+03	7.3725E+00	5.8464E-01	1.1620E+02
-1.9269E+01	4.3525E+03	1.3298E+01	1.1538E+00	1.1353E+02
-1.7823E+01	5.9988E+03	1.8112E+01	5.7897E+00	1.1775E+02

TABLE Xb. Sound conditions on the ground as a function of ray inclination. Source at 955.5 meters, eastward propagation.

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SUMMARY FOR AZIMUTH OF		9.0000E+01
R	FOCUS FACT	SND PRESS (DB)
1.0000E+02	1.1123E+00	1.4616E+02
1.0000E+03	8.9412E-01	1.2521E+02
2.0000E+03	6.5169E-01	1.1782E+02
3.0000E+03	7.8297E-01	1.1510E+02
4.0000E+03	1.0571E+00	1.1390E+02
5.0000E+03	2.9771E+00	1.1646E+02
6.0000E+03	0.	0.
7.0000E+03	0.	0.
8.0000E+03	0.	0.
9.0000E+03	0.	0.
1.0000E+04	0.	0.
1.1000E+04	0.	0.
1.2000E+04	0.	0.
1.3000E+04	0.	0.
1.4000E+04	0.	0.
1.5000E+04	0.	0.

TABLE Xc. Sound conditions on the ground as a function of distance. Source at 955.5 meters, eastward propagation.

SOURCE PARAMETERS

SOURCE ALTITUDE	=	9.5550E+02
X-COORD	=	0.
Y-COORD	=	0.
HORIZ RANGE	=	0.
VEHICLE AZIMUTH	=	7.2159E-01
VEHICLE PITCH	=	-5.4809E+00
VEHICLE YAW	=	0.
VEHICLE MACH NO.	=	3.0095E-01
VEHICLE Z-VELOCITY	=	1.0302E+02
VEHICLE XY-VELOCITY	=	6.2512E+00
T (ZS)	=	8.3490E+00
DEW-POINT	=	8.3490E+00
C (ZS)	=	3.3725E+02
P (ZS)	=	9.0373E+02
SOUND RAY AZIMUTH PLANE	=	1.8000E+02

TABLE XIa. Parameters for sound source at 955.5 meters, southward propagation.

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PHIZ	RADIUS	TIME	FOCUS FAC	SND PRESS(DB)
-8.5710E+01	3.7468E+01	2.8381E+00	1.9059E+00	1.5701E+02
-2.6145E+01	2.0978E+03	7.0576E+00	1.1078E+00	1.1969E+02

TABLE XIb. Sound conditions on the ground as a function of ray inclination. Source at 955.5 meters, southward propagation.

SUMMARY FOR R	AZIMUTH OF FOCUS FACT	1.8000E+02 SND PRESS (DB)
1.0000E+02	1.8816E+00	1.4845E+02
1.0000E+03	1.5330E+00	1.2756E+02
2.0000E+03	1.1456E+00	1.2027E+02
3.0000E+03	0.	0.
4.0000E+03	0.	0.
5.0000E+03	0.	0.
6.0000E+03	0.	0.
7.0000E+03	0.	0.
8.0000E+03	0.	0.
9.0000E+03	0.	0.
1.0000E+04	0.	0.
1.1000E+04	0.	0.
1.2000E+04	0.	0.
1.3000E+04	0.	0.
1.4000E+04	0.	0.
1.5000E+04	0.	0.
1.6000E+04	0.	0.
1.7000E+04	0.	0.
1.8000E+04	0.	0.
1.9000E+04	0.	0.
2.0000E+04	0.	0.

TABLE XIc. Sound conditions on the ground as a function of distance. Source at 955.5 meters, southward propagation.

SOURCE PARAMETERS

SOURCE ALTITUDE	=	9.5550E+02
X-COORD	=	0.
Y-COORD	=	0.
HORIZ RANGE	=	0.
VEHICLE AZIMUTH	=	7.2159E-01
VEHICLE PITCH	=	-5.4809E+00
VEHICLE YAW	=	0.
VEHICLE MACH NO.	=	3.0095E-01
VEHICLE Z-VELOCITY	=	1.0302E+02
VEHICLE XY-VELOCITY	=	6.2512E+00
T (ZS)	=	8.3490E+00
DEW-POINT	=	8.3490E+00
C (ZS)	=	3.3725E+02
P (ZS)	=	9.0378E+02
SOUND RAY AZIMUTH PLANE	=	2.7000E+02

TABLE XIIa. Parameters for sound source at 955.5 meters, westward propagation.

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PHIZ	RADIUS	TIME	FOCUS FAC	SND PRESS(DB)
-8.5886E+01	7.6880E+01	2.8373E+00	8.9837E-01	1.4750E+02
-2.6069E+01	1.7516E+03	5.8612E+00	1.3110E+00	1.2199E+02
-1.0151E+01	3.0079E+03	9.2042E+00	3.1213E+00	1.2106E+02
-1.0151E+01	6.1684E+04	1.7952E+02	1.8281E+01	1.0250E+02
-1.0151E+01	1.2036E+05	3.4983E+02	2.8868E+01	9.8675E+01
-1.0151E+01	1.7903E+05	5.2015E+02	3.4486E+01	9.5999E+01
2.4409E-01	4.3129E+03	1.2892E+01	2.5398E+02	1.3703E+02
2.4409E-01	1.2937E+04	3.8673E+01	1.2349E+03	1.3436E+02
2.4409E-01	2.1562E+04	6.4454E+01	2.3670E+03	1.3275E+02
2.4409E-01	3.0186E+04	9.0235E+01	3.3406E+03	1.3132E+02

TABLE XIIb Sound conditions on the ground as a function of ray inclination. Source at 955.5 meters, southward propagation.

SUMMARY FOR AZIMUTH OF		2.7000E+02
R	FOCUS FACT	SND PRESS (DB)
1.0000E+02	9.0407E-01	1.4526E+02
1.0000E+03	1.1258E+00	1.2621E+02
2.0000E+03	1.6590E+00	1.2190E+02
3.0000E+03	3.1099E+00	1.2109E+02
4.0000E+03	3.3776E+00	1.1894E+02
5.0000E+03	3.3576E+02	1.3698E+02
6.0000E+03	4.4976E+02	1.3667E+02
7.0000E+03	5.6375E+02	1.3631E+02
8.0000E+03	6.7775E+02	1.3595E+02
9.0000E+03	7.9175E+02	1.3560E+02
1.0000E+04	9.0574E+02	1.3527E+02
1.1000E+04	1.0197E+03	1.3496E+02
1.2000E+04	1.1337E+03	1.3466E+02
1.3000E+04	1.2486E+03	1.3439E+02
1.4000E+04	1.3804E+03	1.3418E+02
1.5000E+04	1.5119E+03	1.3397E+02
1.6000E+04	1.6434E+03	1.3378E+02
1.7000E+04	1.7749E+03	1.3358E+02
1.8000E+04	1.9065E+03	1.3340E+02
1.9000E+04	2.0380E+03	1.3322E+02
2.0000E+04	2.1695E+03	1.3304E+02
2.1000E+04	2.3010E+03	1.3287E+02
2.2000E+04	2.4245E+03	1.3270E+02
2.3000E+04	2.5376E+03	1.3251E+02
2.4000E+04	2.6508E+03	1.3233E+02
2.5000E+04	2.7639E+03	1.3216E+02
2.6000E+04	2.8771E+03	1.3199E+02
2.7000E+04	2.9902E+03	1.3183E+02
2.8000E+04	3.1034E+03	1.3168E+02
2.9000E+04	3.2165E+03	1.3153E+02
3.0000E+04	3.3296E+03	1.3138E+02
3.1000E+04	1.0353E+01	1.0602E+02
3.2000E+04	1.0612E+01	1.0585E+02
3.3000E+04	1.0870E+01	1.0569E+02
3.4000E+04	1.1128E+01	1.0553E+02
3.5000E+04	1.1387E+01	1.0538E+02
3.6000E+04	1.1645E+01	1.0524E+02
3.7000E+04	1.1903E+01	1.0509E+02
3.8000E+04	1.2162E+01	1.0495E+02
3.9000E+04	1.2420E+01	1.0482E+02
4.0000E+04	1.2678E+01	1.0469E+02
4.1000E+04	1.2937E+01	1.0456E+02
4.2000E+04	1.3195E+01	1.0444E+02
4.3000E+04	1.3453E+01	1.0432E+02
4.4000E+04	1.3712E+01	1.0420E+02
4.5000E+04	1.3970E+01	1.0409E+02
4.6000E+04	1.4229E+01	1.0398E+02
4.7000E+04	1.4487E+01	1.0387E+02
4.8000E+04	1.4745E+01	1.0376E+02
4.9000E+04	1.5004E+01	1.0366E+02
5.0000E+04	1.5262E+01	1.0356E+02

TABLE XIIc. Sound condition on the ground as a function of distance. Source at 955.5 meters, westward propagation.

SOURCE PARAMETERS

SOURCE ALTITUDE	=	1.4500E+03
X-COORD	=	0.
Y-COORD	=	0.
HORIZ RANGE	=	0.
VEHICLE AZIMUTH	=	7.2159E-01
VEHICLE PITCH	=	-8.6755E+00
VEHICLE YAW	=	0.
VEHICLE MACH NO.	=	3.7961E-01
VEHICLE Z-VELOCITY	=	1.2849E+02
VEHICLE XY-VELOCITY	=	1.6284E+01
T (ZS)	=	5.4900E+00
DEW-POINT	=	5.4900E+00
C (ZS)	=	3.3543E+02
P (ZS)	=	8.5600E+02

SOUND RAY AZIMUTH PLANE = 0.

TABLE XIIIa. Parameters for sound source at 1450 meters, northward propagation.

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PHIZ	RADIUS	TIME	FOCUS FAC	SND PRESS(DB)
-8.5848E+01	1.6185E+02	4.3105E+00	6.5138E-01	1.3964E+02
-4.6884E+01	1.4543E+03	5.9282E+00	9.3068E-01	1.2212E+02
-2.6994E+01	3.1087E+03	9.8234E+00	6.0622E-01	1.1366E+02
-2.0121E+01	4.5396E+03	1.3517E+01	3.0063E-02	9.7321E+01
-1.6843E+01	5.8161E+03	1.7093E+01	6.4202E-01	1.0846E+02
-1.4994E+01	6.9711E+03	2.0267E+01	1.3241E+00	1.1003E+02
-1.3847E+01	8.0863E+03	2.4205E+01	2.1597E+00	1.1055E+02
-1.3293E+01	9.7713E+03	2.8079E+01	2.8567E+00	1.1044E+02
-1.3015E+01	1.1041E+04	3.1636E+01	3.4204E+00	1.1016E+02
-1.2865E+01	1.2499E+04	3.5726E+01	3.9976E+00	1.0976E+02
-1.2798E+01	1.3516E+04	3.8582E+01	4.3548E+00	1.0945E+02

TABLE XIIIb. Sound conditions on the ground as a function of ray inclination. Source at 1450 meters, northward propagation.

SUMMARY FOR AZIMUTH OF		0.
R	FOCUS FACT	SND PRESS (DB)
1.0000E+02	0.	0.
1.0000E+03	8.3250E-01	1.2490E+02
2.0000E+03	8.2366E-01	1.1884E+02
3.0000E+03	6.2754E-01	1.1413E+02
4.0000E+03	2.4732E-01	1.0759E+02
5.0000E+03	2.5079E-01	1.0571E+02
6.0000E+03	7.5061E-01	1.0889E+02
7.0000E+03	1.3411E+00	1.1007E+02
8.0000E+03	1.9316E+00	1.1050E+02
9.0000E+03	2.4686E+00	1.1054E+02
1.0000E+04	2.9582E+00	1.1041E+02
1.1000E+04	3.4021E+00	1.1019E+02
1.2000E+04	3.8002E+00	1.0991E+02
1.3000E+04	4.1736E+00	1.0963E+02
1.4000E+04	0.	0.
1.5000E+04	0.	0.
1.6000E+04	0.	0.
1.7000E+04	0.	0.
1.8000E+04	0.	0.
1.9000E+04	0.	0.
2.0000E+04	0.	0.

TABLE XIIIc. Sound conditions on the ground as a function of distance. Source at 1450 meters, northward propagation.

SOURCE PARAMETERS

SOURCE ALTITUDE	=	1.4500E+03
X-COORD	=	0.
Y-COORD	=	0.
HORIZ RANGE	=	0.
VEHICLE AZIMUTH	=	7.2159E-01
VEHICLE PITCH	=	-8.6755E+00
VEHICLE YAW	=	0.
VEHICLE MACH NO.	=	3.7961E-01
VEHICLE Z-VELOCITY	=	1.2849E+02
VEHICLE XY-VELOCITY	=	1.6284E+01
T (ZS)	=	5.4900E+00
DEW-POINT	=	5.4900E+00
C (ZS)	=	3.3543E+02
P (ZS)	=	8.5600E+02
SOUND RAY AZIMUTH PLANE	=	9.0000E+01

TABLE XIVa. Parameters for sound source at 1450 meters, eastward propagation.

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PHIZ	RADIUS	TIME	FOCUS FAC	SND PRESS(DB)
-8.5758E+01	7.6850E+01	4.3112E+00	1.3880E+00	1.4939E+02
-4.6806E+01	1.3952E+03	6.0593E+00	8.9472E-01	1.2230E+02
-2.8188E+01	3.2354E+03	1.0718E+01	1.4776E-01	1.0718E+02
-2.3280E+01	4.8398E+03	1.5267E+01	1.6965E+00	1.1428E+02
-2.1505E+01	6.3742E+03	1.9727E+01	5.8197E+00	1.1724E+02
-2.0802E+01	7.9512E+03	2.4350E+01	2.3586E+01	1.2140E+02

TABLE XIVb. Sound conditions at the ground as a function of ray inclination. Source at 1450 meters, eastward propagation.

SUMMARY FOR AZIMUTH OF		9.0000E+01
R	FOCUS FACT	SND PRESS (DB)
1.0000E+02	1.3793E+00	1.4710E+02
1.0000E+03	1.0426E+00	1.2588E+02
2.0000E+03	6.4923E-01	1.1780E+02
3.0000E+03	2.4332E-01	1.1002E+02
4.0000E+03	8.8581E-01	1.1313E+02
5.0000E+03	2.1269E+00	1.1500E+02
6.0000E+03	4.8141E+00	1.1696E+02
7.0000E+03	1.2870E+01	1.1989E+02
8.0000E+03	0.	0.
9.0000E+03	0.	0.
1.0000E+04	0.	0.
1.1000E+04	0.	0.
1.2000E+04	0.	0.
1.3000E+04	0.	0.
1.4000E+04	0.	0.
1.5000E+04	0.	0.
1.6000E+04	0.	0.
1.7000E+04	0.	0.
1.8000E+04	0.	0.
1.9000E+04	0.	0.
2.0000E+04	0.	0.

TABLE XIVc. Sound conditions on the ground as a function of distance. Source of 1450 meters, eastward propagation.

SOURCE PARAMETERS

SOURCE ALTITUDE	=	1.4500E+03
X-COORD	=	0.
Y-COORD	=	0.
HORIZ RANGE	=	0.
VEHICLE AZIMUTH	=	7.2159E-01
VEHICLE PITCH	=	-8.6755E+00
VEHICLE YAW	=	0.
VEHICLE MACH NO.	=	3.7961E-01
VEHICLE Z-VELOCITY	=	1.2849E+02
VEHICLE XY-VELOCITY	=	1.6284E+01
T (ZS)	=	5.4900E+00
DEW-POINT	=	5.4900E+00
C (ZS)	=	3.3543E+02
P (ZS)	=	8.5600E+02
SOUND RAY AZIMUTH PLANE	=	1.8000E+02

TABLE XVa. Parameters for sound source at 1450 meters, southward propagation.

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PHIZ	RADIUS	TIME	FOCUS FAC	SND PRESS(DB)
-8.5808E+01	5.0906E+01	4.3108E+00	2.0808E+00	1.5473E+02
-4.6600E+01	1.3053E+03	5.9405E+00	1.0731E+00	1.2367E+02
-2.5509E+01	3.0016E+03	1.0238E+01	1.1390E+00	1.1670E+02
-1.8701E+01	4.5391E+03	1.4650E+01	1.1200E+00	1.1303E+02
-1.6084E+01	6.6647E+03	2.0936E+01	1.7793E-01	1.0171E+02

TABLE XVb. Sound conditions on the ground as a function of ray inclination. Source at 1450 meters, southward propagation.

SUMMARY FOR	AZIMUTH OF	1.8000E+02
R	FOCUS FACT	SND PRESS (DB)
1.0000E+02	2.0413E+00	1.4880E+02
1.0000E+03	1.3183E+00	1.2690E+02
2.0000E+03	1.1001E+00	1.2009E+02
3.0000E+03	1.1390E+00	1.1672E+02
4.0000E+03	1.1267E+00	1.1418E+02
5.0000E+03	9.1569E-01	1.1134E+02
6.0000E+03	4.7252E-01	1.0688E+02
7.0000E+03	0.	0.
8.0000E+03	0.	0.
9.0000E+03	0.	0.
1.0000E+04	0.	0.
1.1000E+04	0.	0.
1.2000E+04	0.	0.
1.3000E+04	0.	0.
1.4000E+04	0.	0.
1.5000E+04	0.	0.
1.6000E+04	0.	0.
1.7000E+04	0.	0.
1.8000E+04	0.	0.
1.9000E+04	0.	0.
2.0000E+04	0.	0.

TABLE XVc. Sound conditions on the ground as a function of distance. Source at 1450 meters, southward propagation.

SOURCE PARAMETERS

SOURCE ALTITUDE	=	1.4500E+03
X-COORD	=	0.
Y-COORD	=	0.
HORIZ RANGE	=	0.
VEHICLE AZIMUTH	=	7.2159E-01
VEHICLE PITCH	=	-8.6755E+00
VEHICLE YAW	=	0.
VEHICLE MACH NO.	=	3.7961E-01
VEHICL. Z-VELOCITY	=	1.2849E+02
VEHICLE XY-VELOCITY	=	1.6284E+01
T (ZS)	=	5.4900E+00
DEW-POINT	=	5.4900E+00
C (ZS)	=	3.3543E+02
P (ZS)	=	8.5600E+02
SOUND RAY AZIMUTH PLANE	=	2.7000E+02

TABLE XVIa. Parameters for sound source at 1450 meters, westward propagation.

PHIZ	RADIUS	TIME	FOCUS FAC	SND PRESS(DB)
-8.5908E+01	1.3558E+02	4.3101E+00	7.6847E-01	1.4189E+02
-4.6692E+01	1.3694E+03	5.8254E+00	1.0901E+00	1.2332E+02
-2.4410E+01	2.9221E+03	9.4791E+00	1.3555E+00	1.1769E+02
-1.5432E+01	4.1743E+03	1.2785E+01	1.9277E+00	1.1612E+02
-1.5432E+01	4.0803E+04	1.2191E+02	1.7724E-01	8.5953E+01
-1.5432E+01	7.7433E+04	2.3104E+02	1.7323E+00	9.0299E+01
-1.5432E+01	1.1406E+05	3.4017E+02	2.6712E+00	8.8805E+01
-1.0115E+01	5.2517E+03	1.5721E+01	3.1005E+00	1.1619E+02
-1.0115E+01	5.2614E+04	1.5437E+02	5.6643E+00	9.8790E+01
-1.0115E+01	9.9975E+04	2.9303E+02	1.0652E+01	9.5957E+01
-1.0115E+01	1.4734E+05	4.3168E+02	1.3412E+01	9.3590E+01
-5.8895E+00	6.5951E+03	1.9460E+01	5.3660E+00	1.1659E+02
-5.8895E+00	2.1918E+04	6.4407E+01	4.8444E+01	1.1572E+02
-5.8895E+00	3.7241E+04	1.0935E+02	1.0056E+02	1.1428E+02
-5.8895E+00	5.2565E+04	1.5430E+02	1.4380E+02	1.1284E+02
-3.4951E+00	7.7751E+03	2.2779E+01	9.9007E+00	1.1782E+02
-3.4951E+00	2.5538E+04	7.4593E+01	1.0400E+01	1.0771E+02
-3.4951E+00	4.3302E+04	1.2641E+02	1.1367E+01	1.0351E+02
-3.4951E+00	6.1065E+04	1.7822E+02	1.1606E+01	1.0061E+02
-1.7381E+00	8.8439E+03	2.5796E+01	2.1836E+01	1.2014E+02
-1.7381E+00	2.8003E+04	8.1549E+01	7.4272E+01	1.1544E+02
-1.7381E+00	4.7163E+04	1.3730E+02	1.0676E+02	1.1249E+02
-1.7381E+00	6.6322E+04	1.9306E+02	1.2357E+02	1.1017E+02
-1.4418E-01	9.7828E+03	2.8451E+01	2.7984E+02	1.3034E+02
-1.4418E-01	2.9493E+04	8.5763E+01	3.2882E+03	1.3146E+02
-1.4418E-01	4.9203E+04	1.4307E+02	7.8483E+03	1.3079E+02
-1.4418E-01	6.8914E+04	2.0039E+02	1.2636E+04	1.2993E+02
1.7672E+00	1.0315E+04	2.9956E+01	7.1677E+01	1.2397E+02
1.7672E+00	2.9455E+04	8.5657E+01	1.0683E+02	1.1658E+02
1.7672E+00	4.8596E+04	1.4136E+02	1.3047E+02	1.1310E+02
1.7672E+00	6.7736E+04	1.9706E+02	1.4081E+02	1.1055E+02
3.2666E+00	1.0052E+04	2.9217E+01	8.7241E-01	1.0504E+02
3.2666E+00	2.8012E+04	8.1583E+01	6.6326E+00	1.0495E+02
3.2666E+00	4.5971E+04	1.3395E+02	1.0230E+01	1.0253E+02
3.2666E+00	6.3930E+04	1.8632E+02	1.2151E+01	1.0041E+02
4.1495E+00	9.7908E+03	2.8479E+01	2.8014E+00	1.1034E+02
4.1495E+00	2.6998E+04	7.8726E+01	2.6277E+00	1.0125E+02
4.1495E+00	4.4204E+04	1.2897E+02	2.2095E+00	9.6214E+01
4.1495E+00	6.1411E+04	1.7922E+02	1.8185E+00	9.2513E+01
4.7794E+00	9.5939E+03	2.7925E+01	3.5415E+00	1.1153E+02
4.7794E+00	2.6284E+04	7.6718E+01	5.0697E+00	1.0434E+02
4.7794E+00	4.2975E+04	1.2551E+02	5.6749E+00	1.0056E+02
4.7794E+00	5.9665E+04	1.7430E+02	5.8042E+00	9.7804E+01
5.3107E+00	8.8395E+03	2.5798E+01	2.6256E+01	1.2094E+02
5.3107E+00	2.4526E+04	7.1763E+01	3.2741E+01	1.1304E+02
5.3107E+00	4.0212E+04	1.1773E+02	3.8689E+01	1.0947E+02
5.3107E+00	5.5899E+04	1.6369E+02	4.1173E+01	1.0688E+02
1.0408E+01	4.1540E+04	1.2135E+02	9.4292E+00	1.0306E+02
1.0408E+01	8.8264E+04	2.5823E+02	1.4851E+01	9.8483E+01
1.0408E+01	1.3499E+05	3.9511E+02	1.7725E+01	9.5561E+01

TABLE XVIb. Sound conditions on the ground as a function of ray inclination. Source at 1450 meters, westward propagation.

PHIZ	RADIUS	TIME	FOCUS FAC SNO	PRESS(DB)
1.0408E+01	1.8171E+05	5.3200E+02	1.8856E+01	9.3248E+01
1.0880E+01	4.0660E+04	1.1891E+02	8.6611E+00	1.0287E+02
1.0880E+01	8.6399E+04	2.5306E+02	1.3751E+01	9.8334E+01
1.0880E+01	1.3214E+05	3.8722E+02	1.6457E+01	9.5424E+01
1.0880E+01	1.7788E+05	5.2137E+02	1.7530E+01	9.3116E+01
1.1371E+01	3.9788E+04	1.1649E+02	7.6875E+00	1.0254E+02
1.1371E+01	8.4550E+04	2.4795E+02	1.2118E+01	9.7973E+01
1.1371E+01	1.2931E+05	3.7940E+02	1.4469E+01	9.5052E+01
1.1371E+01	1.7407E+05	5.1085E+02	1.5394E+01	9.2740E+01
1.1874E+01	3.8931E+04	1.1412E+02	7.0337E+00	1.0235E+02
1.1874E+01	8.2725E+04	2.4290E+02	1.1180E+01	9.7813E+01
1.1874E+01	1.2652E+05	3.7168E+02	1.3387E+01	9.4905E+01
1.1874E+01	1.7031E+05	5.0046E+02	1.4264E+01	9.2598E+01
1.2395E+01	3.8090E+04	1.1180E+02	6.4261E+00	1.0214E+02
1.2395E+01	8.0932E+04	2.3796E+02	1.0309E+01	9.7651E+01
1.2395E+01	1.2377E+05	3.6411E+02	1.2382E+01	9.4756E+01
1.2395E+01	1.6662E+05	4.9027E+02	1.3213E+01	9.2457E+01
1.2936E+01	3.7264E+04	1.0953E+02	5.8591E+00	1.0193E+02
1.2936E+01	7.9175E+04	2.3312E+02	9.4952E+00	9.7484E+01
1.2936E+01	1.2109E+05	3.5672E+02	1.1443E+01	9.4604E+01
1.2936E+01	1.6300E+05	4.8031E+02	1.2232E+01	9.2312E+01
1.3497E+01	3.6456E+04	1.0731E+02	5.3255E+00	1.0171E+02
1.3497E+01	7.7454E+04	2.2840E+02	8.7284E+00	9.7309E+01
1.3497E+01	1.1845E+05	3.4950E+02	1.0558E+01	9.4446E+01
1.3497E+01	1.5945E+05	4.7059E+02	1.1306E+01	9.2162E+01

TABLE XVIb. Continued

SUMMARY FOR AZIMUTH OF 2.7000E+02

R	FOCUS FACT	SND PRESS (DB)
1.0000E+02	0.	0.
1.0000E+03	9.9380E-01	1.2567E+02
2.0000E+03	1.1979E+00	1.2046E+02
3.0000E+03	1.3911E+00	1.1759E+02
4.0000E+03	1.8481E+00	1.1633E+02
5.0000E+03	2.8265E+00	1.1623E+02
6.0000E+03	4.3624E+00	1.1653E+02
7.0000E+03	6.9220E+00	1.1720E+02
8.0000E+03	1.2412E+01	1.1858E+02
9.0000E+03	8.6154E+01	1.2597E+02
1.0000E+04	2.7695E+02	1.3012E+02
1.1000E+04	3.2643E+02	1.3001E+02
1.2000E+04	3.0462E+02	1.2895E+02
1.3000E+04	2.8281E+02	1.2794E+02
1.4000E+04	2.6101E+02	1.2694E+02
1.5000E+04	2.3920E+02	1.2597E+02
1.6000E+04	2.1739E+02	1.2499E+02
1.7000E+04	1.9558E+02	1.2400E+02
1.8000E+04	1.7378E+02	1.2299E+02
1.9000E+04	1.5197E+02	1.2194E+02
2.0000E+04	1.3016E+02	1.2082E+02
2.1000E+04	1.0835E+02	1.1960E+02
2.2000E+04	8.7247E+01	1.1826E+02
2.3000E+04	7.3998E+01	1.1716E+02
2.4000E+04	6.0749E+01	1.1593E+02
2.5000E+04	4.1333E+01	1.1390E+02
2.6000E+04	3.1907E+01	1.1244E+02
2.7000E+04	5.0913E+01	1.1414E+02
2.8000E+04	8.0775E+01	1.1583E+02
2.9000E+04	2.2997E+03	1.3007E+02
3.0000E+04	3.1786E+03	1.3118E+02
3.1000E+04	2.7527E+03	1.3027E+02
3.2000E+04	2.3268E+03	1.2926E+02
3.3000E+04	1.9009E+03	1.2812E+02
3.4000E+04	1.4750E+03	1.2576E+02
3.5000E+04	1.0491E+03	1.2503E+02
3.6000E+04	6.2322E+02	1.2252E+02
3.7000E+04	2.0558E+02	1.1747E+02
3.8000E+04	8.5551E+01	1.1343E+02
3.9000E+04	5.8090E+01	1.1152E+02
4.0000E+04	4.5982E+01	1.1028E+02
4.1000E+04	1.0015E+01	1.0345E+02
4.2000E+04	1.3763E+01	1.0462E+02
4.3000E+04	1.5620E+01	1.0497E+02
4.4000E+04	3.1408E+01	1.0780E+02
4.5000E+04	5.9152E+01	1.1036E+02
4.6000E+04	8.9606E+01	1.1197E+02
4.7000E+04	1.6012E+02	1.1430E+02
4.8000E+04	3.3867E+03	1.2737E+02
4.9000E+04	7.2024E+03	1.3047E+02
5.0000E+04	6.1356E+03	1.2960E+02

TABLE XVIc. Sound conditions on the ground as a function of distance. Source at 1450 meters, westward propagation.

SOURCE PARAMETERS

SOURCE ALTITUDE	=	1.9890E+03
X-COORD	=	7.4523E+01
Y-COORD	=	9.4697E+01
HORIZ RANGE	=	1.1291E+02
VEHICLE AZIMUTH	=	7.2159E-01
VEHICLE PITCH	=	-1.1555E+01
VEHICLE YAW	=	0.
VEHICLE MACH NO.	=	4.5650E-01
VEHICLE Z-VELOCITY	=	1.5224E+02
VEHICLE XY-VELOCITY	=	2.8654E+01
T (ZS)	=	1.7900E+00
DEW-POINT	=	1.7900E+00
C (ZS)	=	3.3708E+02
P (ZS)	=	7.9500E+02
SOUND RAY AZIMUTH PLANE	=	0.

TABLE XVIIa. Parameters for sound source at 1989 meters, northward propagation.

PHIZ	RADIUS	TIME	FOCUS FAC	SND PRESS(DB)
-8.5878E+01	2.2356E+02	5.9291E+00	6.4216E-01	1.3677E+02
-5.7554E+01	1.3683E+03	7.0233E+00	9.8126E-01	1.2287E+02
-3.7659E+01	2.7374E+03	9.7482E+00	1.0112E+00	1.1698E+02
-2.7457E+01	4.0756E+03	1.3017E+01	9.9091E-01	1.1344E+02
-2.1842E+01	5.3449E+03	1.6341E+01	9.5940E-01	1.1094E+02
-1.8387E+01	6.5506E+03	1.9588E+01	9.5999E-01	1.0918E+02
-1.6011E+01	7.7800E+03	2.2951E+01	9.4465E-01	1.0761E+02
-1.4371E+01	8.9273E+03	2.6106E+01	9.1401E-01	1.0628E+02
-1.3244E+01	1.0204E+04	2.9653E+01	8.4225E-01	1.0476E+02
-1.2567E+01	1.1490E+04	3.3246E+01	7.9889E-01	1.0350E+02
-1.2169E+01	1.2759E+04	3.6800E+01	7.9770E-01	1.0258E+02
-1.1922E+01	1.4195E+04	4.0825E+01	7.8988E-01	1.0161E+02
-1.1807E+01	1.5596E+04	4.4757E+01	8.3102E-01	1.0102E+02
-1.1739E+01	1.6710E+04	4.7881E+01	8.5639E-01	1.0055E+02

TABLE XVIIb. Sound conditions on the ground as a function of ray inclination. Source at 1989 meters, northward propagation.

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SUMMARY FOR AZIMUTH OF 0.

R	FOCUS FACT	SND PRESS (DB)
1.0000E+02	0.	0.
1.0000E+03	8.7215E-01	1.2511E+02
2.0000E+03	9.9505E-01	1.1966E+02
3.0000E+03	1.0072E+00	1.1619E+02
4.0000E+03	9.9205E-01	1.1362E+02
5.0000E+03	9.6796E-01	1.1158E+02
6.0000E+03	9.5972E-01	1.0996E+02
7.0000E+03	9.5438E-01	1.0860E+02
8.0000E+03	9.3877E-01	1.0736E+02
9.0000E+03	9.0992E-01	1.0621E+02
1.0000E+04	8.5371E-01	1.0501E+02
1.1000E+04	8.1542E-01	1.0399E+02
1.2000E+04	7.9842E-01	1.0314E+02
1.3000E+04	7.9639E-01	1.0243E+02
1.4000E+04	7.9095E-01	1.0176E+02
1.5000E+04	8.1352E-01	1.0128E+02
1.6000E+04	8.4022E-01	1.0086E+02
1.7000E+04	0.	0.
1.8000E+04	0.	0.
1.9000E+04	0.	0.
2.0000E+04	0.	0.

TABLE XVIIc. Sound conditions on the ground as a function of distance. Source at 1989 meters, northward propagation.

SOURCE PARAMETERS

SOURCE ALTITUDE	=	1.9890E+03
X-COORD	=	7.4523E+01
Y-COORD	=	8.4697E+01
HORIZ RANGE	=	1.1291E+02
VEHICLE AZIMUTH	=	7.2159E-01
VEHICLE PITCH	=	-1.1555E+01
VEHICLE YAW	=	0.
VEHICLE MACH NO.	=	4.5650E-01
VEHICLE Z-VELOCITY	=	1.5224E+02
VEHICLE XY-VELOCITY	=	2.8654E+01
T (ZS)	=	1.7900E+00
DEW-POINT	=	1.7900E+00
C (ZS)	=	3.3308E+02
P (ZS)	=	7.9500E+02
SOUND RAY AZIMUTH PLANE	=	9.0000E+01

TABLE XVIIIa. Parameters for sound source at 1989 meters, eastward propagation.

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PHIZ	RADIUS	TIME	FOCUS FAC	SND PRESS(DB)
-8.5795E+01	8.6583E+01	5.9300E+00	1.6750E+00	1.4917E+02
-5.7455E+01	1.2366E+03	7.0816E+00	1.0227E+00	1.2393E+02
-3.7916E+01	2.6679E+03	1.0144E+01	9.2219E-01	1.1691E+02
-2.8958E+01	4.1056E+03	1.3935E+01	6.6855E-01	1.1166E+02
-2.4800E+01	5.5127E+03	1.7900E+01	1.2090E-01	1.0168E+02
-2.2791E+01	6.9314E+03	2.2001E+01	9.7294E-01	1.0875E+02
-2.1845E+01	8.3896E+03	2.6264E+01	3.6205E+00	1.1279E+02

TABLE XVIIIb. Sound conditions on the ground as a function of ray inclination. Source at 1989 meters, eastward propagation.

SUMMARY FOR R	AZIMUTH OF FOCUS FACT	9.0000E+01 SND PRESS (DB)
1.0000E+02	1.6673E+00	1.4792E+02
1.0000E+03	1.1569E+00	1.2633E+02
2.0000E+03	9.6911E-01	1.1954E+02
3.0000E+03	8.6360E-01	1.1552E+02
4.0000E+03	6.8717E-01	1.1203E+02
5.0000E+03	3.2044E-01	1.0678E+02
6.0000E+03	4.1356E-01	1.0630E+02
7.0000E+03	1.0976E+00	1.0920E+02
8.0000E+03	2.9131E+00	1.1228E+02
9.0000E+03	0.	0.
1.0000E+04	0.	0.
1.1000E+04	0.	0.
1.2000E+04	0.	0.
1.3000E+04	0.	0.
1.4000E+04	0.	0.
1.5000E+04	0.	0.
1.6000E+04	0.	0.
1.7000E+04	0.	0.
1.8000E+04	0.	0.
1.9000E+04	0.	0.
2.0000E+04	0.	0.

TABLE XVIIIc. Sound conditions on the ground as a function of distance. Source at 1989 meters, eastward propagation.

SOURCE PARAMETERS

SOURCE ALTITUDE	=	1.9890E+03
X-COORD	=	7.4523E+01
Y-COORD	=	8.4697E+01
HORIZ RANGE	=	1.1281E+02
VEHICLE AZIMUTH	=	7.2159E-11
VEHICLE PITCH	=	-1.1555E+01
VEHICLE YAW	=	0.
VEHICLE MACH NO.	=	4.5650E-01
VEHICLE Z-VELOCITY	=	1.5224E+02
VEHICLE XY-VELOCITY	=	2.8654E+01
T (ZS)	=	1.7900E+00
DEW-POINT	=	1.7900E+10
C (ZS)	=	3.3308E+02
P (ZS)	=	7.9500E+02
SOUND RAY AZIMUTH PLANE	=	1.8000E+02

TABLE XIXa. Parameters for sound source at 1989 meters, southward propagation.

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PHIZ	RADIUS	TIME	FOCUS FAC SND PRESS(DB)	
-8.5819E+01	6.8089E+01	5.9298E+00	2.1223E+00	1.5229E+02
-5.7399E+01	1.2040E+03	7.0621E+00	1.0657E+00	1.2434E+02
-3.7259E+01	2.6079E+03	1.0072E+01	9.9650E-01	1.1734E+02
-2.7584E+01	4.0011E+03	1.3772E+01	8.1358E-01	1.1274E+02
-2.2736E+01	5.3514E+03	1.7617E+01	3.3549E-01	1.0637E+02
-2.0181E+01	6.7959E+03	2.1851E+01	1.0823E+00	1.0938E+02
-1.9092E+01	9.2300E+03	2.9077E+01	7.0002E+00	1.1493E+02

TABLE XIXb. Sound conditions on the ground as a function of ray inclination. Source at 1989 meters, southward propagation.

SUMMARY FOR R	AZIMUTH OF FOCUS FACT	1.8000E+02 SND PRESS (DB)
1.0000E+02	2.0927E+00	1.4991E+02
1.0000E+03	1.2554E+00	1.2569E+02
2.0000E+03	1.0265E+00	1.1079E+02
3.0000E+03	9.4502E-01	1.1591E+02
4.0000E+03	9.1372E-01	1.1276E+02
5.0000E+03	4.5990E-01	1.0835E+02
6.0000E+03	6.7081E-01	1.0840E+02
7.0000E+03	1.5785E+00	1.1078E+02
8.0000E+03	4.0098E+00	1.1367E+02
9.0000E+03	6.4411E+00	1.1470E+02
1.0000E+04	0.	0.
1.1000E+04	0.	0.
1.2000E+04	0.	0.
1.3000E+04	0.	0.
1.4000E+04	0.	0.
1.5000E+04	0.	0.
1.6000E+04	0.	0.
1.7000E+04	0.	0.
1.8000E+04	0.	0.
1.9000E+04	0.	0.
2.0000E+04	0.	0.

TABLE XIXc. Sound conditions on the ground as a function of distance. Source at 1989 meters, southward propagation.

- - - - - - - - - - -

SOURCE PARAMETERS

SOURCE ALTITUDE	=	1.9890E+03
X-COORD	=	7.4523E+01
Y-COORD	=	8.4697E+01
HORIZ RANGE	=	1.1281E+02
VEHICLE AZIMUTH	=	7.2159E-01
VEHICLE PITCH	=	-1.1555E+01
VEHICLE YAW	=	0.
VEHICLE MACH NO.	=	4.5650E-01
VEHICLE Z-VELOCITY	=	1.5224E+02
VEHICLE XY-VELOCITY	=	2.8654E+01
T (ZS)	=	1.7900E+00
DEW-POINT	=	1.7900E+00
C (ZS)	=	3.3308E+02
P (ZS)	=	7.9500E+02

SOUND RAY AZIMUTH PLANE = 2.7000E+02

TABLE XXa. Parameters for sound source at 1989 meters, westward propagation.

PHIZ	RADIUS	TIME	FOCUS FAC	SND PRESS(DB)
-8.5884E+01	2.0559E+02	5.9290E+00	6.9786E-01	1.7786E+02
-5.7484E+01	1.3377E+03	7.0078E+00	1.0153E+00	1.2372E+02
-3.7049E+01	2.5912E+03	9.7074E+00	1.0634E+00	1.1736E+02
-2.6320E+01	4.0171E+03	1.2962E+01	1.0568E+00	1.13[illegible]E+02
-2.0291E+01	5.2310E+03	1.6134E+01	1.1025E+00	1.1173E+02
-1.6332E+01	6.4813E+03	1.9515E+01	1.0757E+00	1.0976E+02
-1.6332E+01	4.5507E+04	1.3520E+02	1.1702E+00	9.3202E+01
-1.6332E+01	8.4533E+04	2.5089E+02	9.9536E-01	8.7120E+01
-1.6332E+01	1.2356E+05	3.6659E+02	8.2890E-01	8.3029E+01
-1.3814E+01	7.5931E+03	2.2561E+01	1.1222E+00	1.0857E+02
-1.3814E+01	5.2014E+04	1.5307E+02	7.2451E-01	8.9960E+01
-1.3814E+01	9.5436E+04	2.8358E+02	3.7174E-01	8.1699E+01
-1.3814E+01	1.4086E+05	4.1410E+02	1.2558E-01	7.3695E+01
-1.1987E+01	8.8082E+03	2.5926E+01	1.1060E+00	1.0722E+02
-1.1987E+01	5.8164E+04	1.7012E+02	1.1478E+00	9.0971E+01
-1.1987E+01	1.0752E+05	3.1432E+02	9.5754E-01	8.4863E+01
-1.1987E+01	1.5688E+05	4.5851E+02	7.8823E-01	8.0737E+01
-1.0826E+01	1.0133E+04	2.9627E+01	1.0576E+00	1.0585E+02
-1.0826E+01	6.3856E+04	1.8603E+02	1.1163E+00	9.0056E+01
-1.0826E+01	1.1758E+05	3.4244E+02	9.6412E-01	8.4116E+01
-1.0826E+01	1.7130E+05	4.9884E+02	8.1574E-01	8.0135E+01
-1.0197E+01	1.1642E+04	3.3863E+01	1.0384E+00	1.0449E+02
-1.0197E+01	6.8844E+04	2.0003E+02	4.2401E+00	9.5197E+01
-1.0197E+01	1.2605E+05	3.6620E+02	6.0605E+00	9.1495E+01
-1.0197E+01	1.8325E+05	5.3237E+02	6.9748E+00	8.8856E+01
-9.9577E+00	1.4220E+04	4.1122E+01	1.1012E+00	1.0334E+02
-9.9577E+00	7.5918E+04	2.1995E+02	5.3570E+00	9.5367E+01
-9.9577E+00	1.3761E+05	3.9877E+02	8.0020E+00	9.1[illegible]E+01
-9.9577E+00	1.9931E+05	5.7760E+02	9.3915E+00	8.9414E+01
-9.9392E+00	4.8553E+04	1.[illegible]3E+02	3.0703E+00	9.5329E+01
-9.9392E+00	1.1264E+05	3.2629E+02	5.0363E+00	9.2455E+01
-9.9392E+00	1.7673E+05	5.1183E+02	7.6648E+00	8.9[illegible]E+01
-9.9392E+00	2.4082E+05	6.9741E+02	8.3972E+00	8.[illegible]E+01
9.9609E+00	4.7349E+04	1.3734E+02	5.1694E+00	1.[illegible]E+02
9.9609E+00	1.0876E+05	3.1537E+02	9.3343E+00	9.[illegible]E+01
9.9609E+00	1.7017E+05	4.9339E+02	1.1247E+01	9.[illegible]E+01
9.9609E+00	2.3159E+05	6.7141E+02	1.2946E+01	8.9195E+01
9.9910E+00	4.5726E+04	1.3559E+02	8.0083E+00	1.0133E+02
9.9910E+00	1.0668E+05	3.0952E+02	1.0808E+01	9.5456E+01
9.9910E+00	1.5664E+05	4.8345E+02	1.2740E+01	9.2297E+01
9.9910E+00	2.2660E+05	6.5737E+02	1.3520E+01	8.9885E+01
1.0079E+01	4.6059E+04	1.3371E+02	7.0149E+00	1.0087E+02
1.0079E+01	1.0439E+05	3.0306E+02	9.6637E+00	9.5159E+01
1.0079E+01	1.6272E+05	4.7241E+02	1.1407E+01	9.2024E+01
1.0079E+01	2.2106E+05	6.4175E+02	1.2109E+01	8.9622E+01
1.0284E+01	4.5256E+04	1.3145E+02	2.5014E+00	9.6549E+01
1.0284E+01	1.0183E+05	2.9587E+02	4.4782E+00	9.2034E+01
1.0284E+01	1.5841E+05	4.6029E+02	5.5670E+00	8.9141E+01
1.0284E+01	2.1499E+05	6.2470E+02	6.0415E+00	8.6844E+01
1.0524E+01	4.4487E+04	1.2929E+02	5.5423E-01	9.0153E+01

TABLE XXb. Sound conditions on the ground as a function of ray inclination. Source at 1989 meters, westward propagation.

PHIZ	RADIUS	TIME	FOCUS FAC	SND PRESS(DB)
1.0524E+01	9.9664E+04	2.8978E+02	1.4830E+00	8.7422E+01
1.0524E+01	1.5484E+05	4.5026E+02	1.0956E+00	8.4894E+01
1.0524E+01	2.1002E+05	6.1074E+02	2.2406E+00	8.2740E+01
1.0753E+01	4.3801E+04	1.2737E+02	2.2906E-01	8.6472E+01
1.0753E+01	9.7855E+04	2.8470E+02	7.5378E-02	7.4642E+01
1.0753E+01	1.5191E+05	4.4204E+02	2.5367E-01	7.6092E+01
1.0753E+01	2.0596E+05	5.9937E+02	3.5564E-01	7.4915E+01
1.0972E+01	4.3173E+04	1.2561E+02	6.238[illegible]-01	9.0927E+01
1.0972E+01	9.6259E+04	2.8023E+02	7.024[illegible]-01	8.4478E+01
1.0972E+01	1.4935E+05	4.3486E+02	7.309[illegible]-01	8.0876E+01
1.0972E+01	2.0243E+05	5.8948E+02	7.208oE-01	7.8134E+01
1.1183E+01	4.2528E+04	1.2397E+02	8.5140E-01	9.2396E+01
1.1183E+01	9.4811E+04	2.7618E+02	1.1801E+00	8.6863E+01
1.1183E+01	1.4703E+05	4.2838E+02	1.3458E+00	8.3627E+01
1.1183E+01	1.9926E+05	5.8059E+02	1.3984E+00	8.1149E+01
1.1387E+01	4.2041E+04	1.2244E+02	9.9145E-01	9.3170E+01
1.1387E+01	9.3475E+04	2.7244E+02	1.4921E+00	8.8005E+01
1.1387E+01	1.4491E+05	4.2245E+02	1.7533E+00	8.4898E+01
1.1387E+01	1.9634E+05	5.7245E+02	1.8505E+00	8.2494E+01
1.1585E+01	4.1525E+04	1.2100E+02	1.0805E+00	9.3651E+01
1.1585E+01	9.2233E+04	2.6897E+02	1.7032E+00	8.8696E+01
1.1585E+01	1.4294E+05	4.1695E+02	2.0332E+00	8.5660E+01
1.1585E+01	1.9365E+05	5.6492E+02	2.1529E+00	8.3291E+01
1.1779E+01	4.1044E+04	1.1965E+02	1.6496E-01	8.5590E+01
1.1779E+01	9.1082E+04	2.6575E+02	2.5465E-01	8.0552E+01
1.1779E+01	1.4112E+05	4.1185E+02	3.0300E-01	7.7504E+01
1.1779E+01	1.9116E+05	5.5795E+02	3.2199E-01	7.5132E+01
1.2162E+01	4.0142E+04	1.1714E+02	7.5171E-02	8.2369E+01
1.2162E+01	8.8947E+04	2.5980E+02	1.1843E-02	6.7473E+01
1.2162E+01	1.3775E+05	4.0246E+02	2.6453E-02	6.7124E+01
1.2162E+01	1.8655E+05	5.4512E+02	4.9479E-02	6.7209E+01
1.2563E+01	3.9260E+04	1.1469E+02	4.3753E-02	8.0212E+01
1.2563E+01	8.6877E+04	2.5405E+02	1.2562E-01	7.7894E+01
1.2563E+01	1.3449E+05	3.9341E+02	2.2531E-01	7.6635E+01
1.2563E+01	1.8211E+05	5.3277E+02	2.7952E-01	7.4979E+01
1.2985E+01	3.8391E+04	1.1228E+02	4.1366E-02	8.0163E+01
1.2985E+01	8.4855E+04	2.4844E+02	2.0608E-01	8.0248E+01
1.2985E+01	1.3132E+05	3.8460E+02	3.5205E-01	7.8781E+01
1.2985E+01	1.7778E+05	5.2077E+02	4.3074E-01	7.7025E+01
1.3429E+01	3.7535E+04	1.0990E+02	5.5521E-02	8.1637E+01
1.3429E+01	8.2879E+04	2.4297E+02	2.5989E-01	8.1397E+01
1.3429E+01	1.2822E+05	3.7603E+02	4.3280E-01	7.9885E+01
1.3429E+01	1.7357E+05	5.0909E+02	5.3124E-01	7.8145E+01
1.3895E+01	3.6683E+04	1.0755E+02	1.0536E-01	8.4619E+01
1.3895E+01	8.0916E+04	2.3754E+02	2.0301E-01	8.0595E+01
1.3895E+01	1.2515E+05	3.6753E+02	3.8764E-01	7.9617E+01
1.3895E+01	1.5938E+05	4.9752E+02	4.8957E-01	7.8002E+01
1.4378E+01	3.5857E+04	1.0527E+02	1.3622E-01	8.5932E+01
1.4378E+01	7.9016E+04	2.3230E+02	2.0324E-01	8.0807E+01
1.4378E+01	1.2217E+05	3.5932E+02	4.0803E-01	8.0048E+01

TABLE XXb. Continued

PHIZ	RADIUS	TIME	FOCUS FAC SND	PRESS(DR)
1.4378E+01	1.6533E+05	4.8635E+02	5.2209E-01	7.8491E+11
1.4884E+01	3.5049E+04	1.0305E+02	1.7340E-01	8.7178E+11
1.4884E+01	7.7164E+04	2.2720E+02	1.8815E-01	8.0678E+11
1.4894E+01	1.1928E+05	3.5136E+02	4.0810E-01	8.0257E+11
1.4894E+01	1.5139E+05	4.7551E+02	5.3194E-01	7.8782E+11

TABLE XXb. Continued.

SUMMARY FOR AZIMUTH OF		2.7000E+02
R	FOCUS FACT	SND PRESS (DB)
1.0000E+02	0.	0.
1.0000E+03	9.2059E-01	1.2534E+02
2.0000E+03	1.0388E+00	1.1984E+02
3.0000E+03	1.0642E+00	1.1643E+02
4.0000E+03	1.0667E+00	1.1394E+02
5.0000E+03	1.0957E+00	1.1212E+02
6.0000E+03	1.0860E+00	1.1050E+02
7.0000E+03	1.0974E+00	1.0920E+02
8.0000E+03	1.1167E+00	1.0812E+02
9.0000E+03	1.1005E+00	1.0703E+02
1.0000E+04	1.0715E+00	1.0600E+02
1.1000E+04	1.0462E+00	1.0507E+02
1.2000E+04	1.0402E+00	1.0429E+02
1.3000E+04	1.0677E+00	1.0371E+02
1.4000E+04	1.0951E+00	1.0317E+02
1.5000E+04	1.1029E+00	1.0269E+02
1.6000E+04	1.1051E+00	1.0205E+02
1.7000E+04	1.1073E+00	1.0153E+02
1.8000E+04	1.1095E+00	1.0105E+02
1.9000E+04	1.1117E+00	1.0058E+02
2.0000E+04	1.1139E+00	1.0015E+02
2.1000E+04	1.1161E+00	9.9733E+01
2.2000E+04	1.1183E+00	9.9337E+01
2.3000E+04	1.1205E+00	9.8960E+01
2.4000E+04	1.1227E+00	9.8599E+01
2.5000E+04	1.1249E+00	9.8252E+01
2.6000E+04	1.1271E+00	9.7920E+01
2.7000E+04	1.1294E+00	9.7601E+01
2.8000E+04	1.1316E+00	9.7294E+01
2.9000E+04	1.1338E+00	9.6997E+01
3.0000E+04	1.1360E+00	9.6711E+01
3.1000E+04	1.1382E+00	9.6435E+01
3.2000E+04	1.1404E+00	9.6167E+01
3.3000E+04	1.1426E+00	9.5909E+01
3.4000E+04	1.1448E+00	9.5658E+01
3.5000E+04	1.1470E+00	9.5414E+01
3.6000E+04	1.2801E+00	9.5646E+01
3.7000E+04	1.2382E+00	9.5264E+01
3.8000E+04	1.2014E+00	9.4901E+01
3.9000E+04	1.1989E+00	9.4666E+01
4.0000E+04	1.2281E+00	9.4551E+01
4.1000E+04	1.3208E+00	9.4653E+01
4.2000E+04	2.1609E+00	9.6581E+01
4.3000E+04	1.8557E+00	9.5716E+01
4.4000E+04	1.4895E+00	9.4561E+01
4.5000E+04	3.0231E+00	9.7440E+01
4.6000E+04	7.8190E+00	1.0138E+02
4.7000E+04	8.2684E+00	1.0143E+02
4.8000E+04	5.4930E+00	9.9473E+01
4.9000E+04	3.9562E+00	9.7869E+01
5.0000E+04	3.7870E+00	9.7504E+01

TABLE XXc. Sound conditions on the ground as a function of distance. Source at 1989 meters, westward propagation.

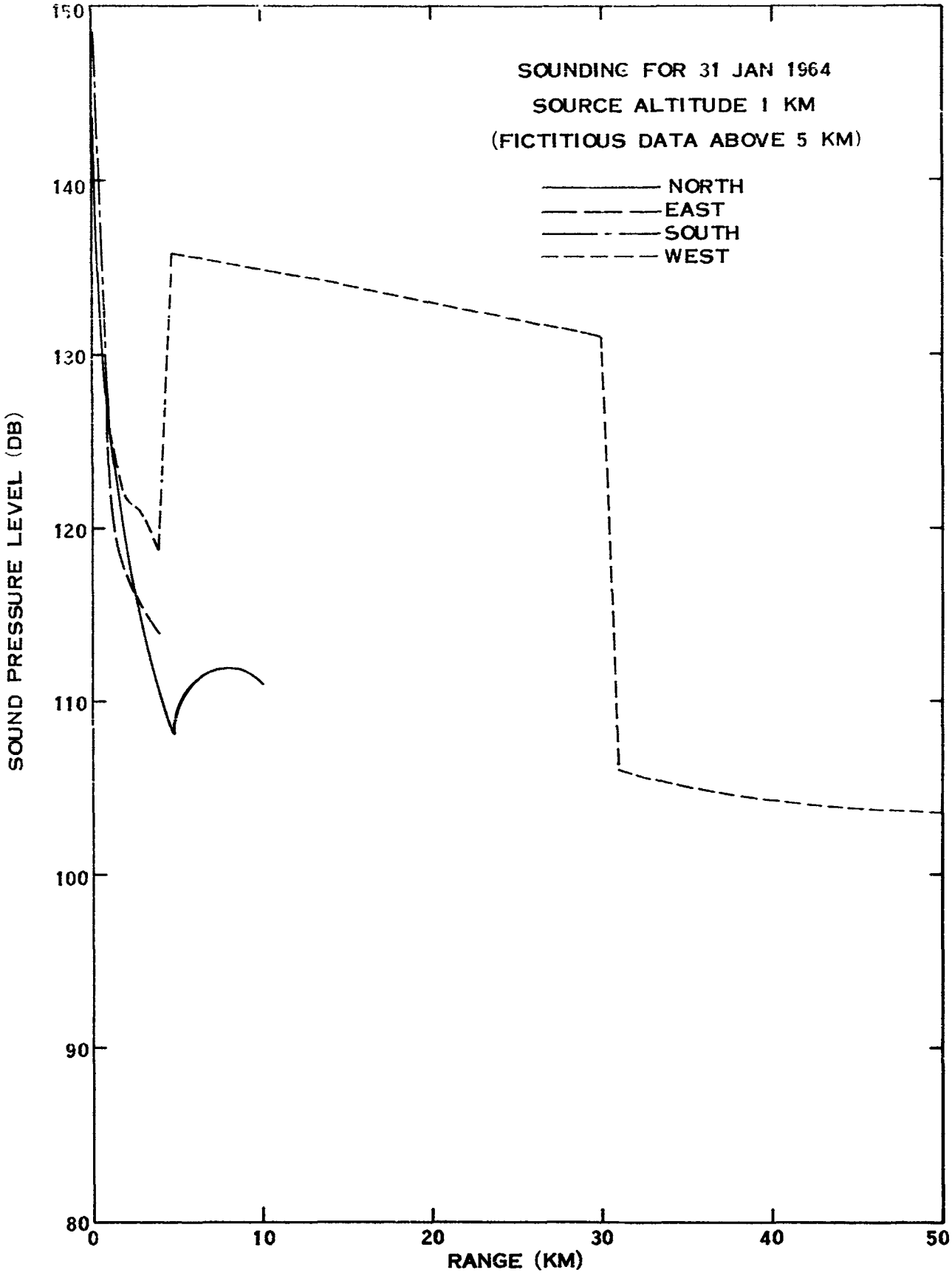

Figure 8: SOUND PRESSURE LEVEL

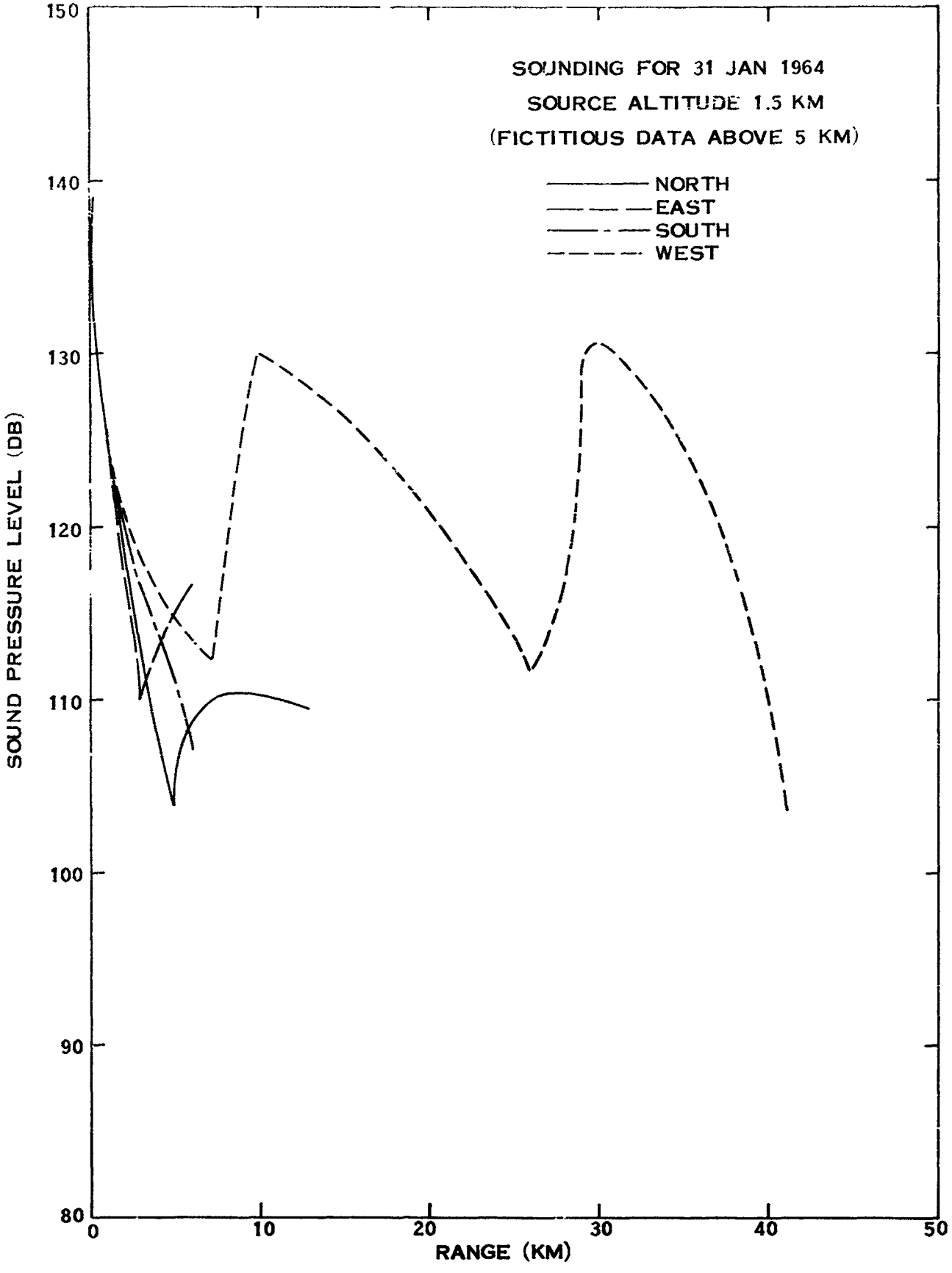

Figure 9: SOUND PRESSURE LEVEL

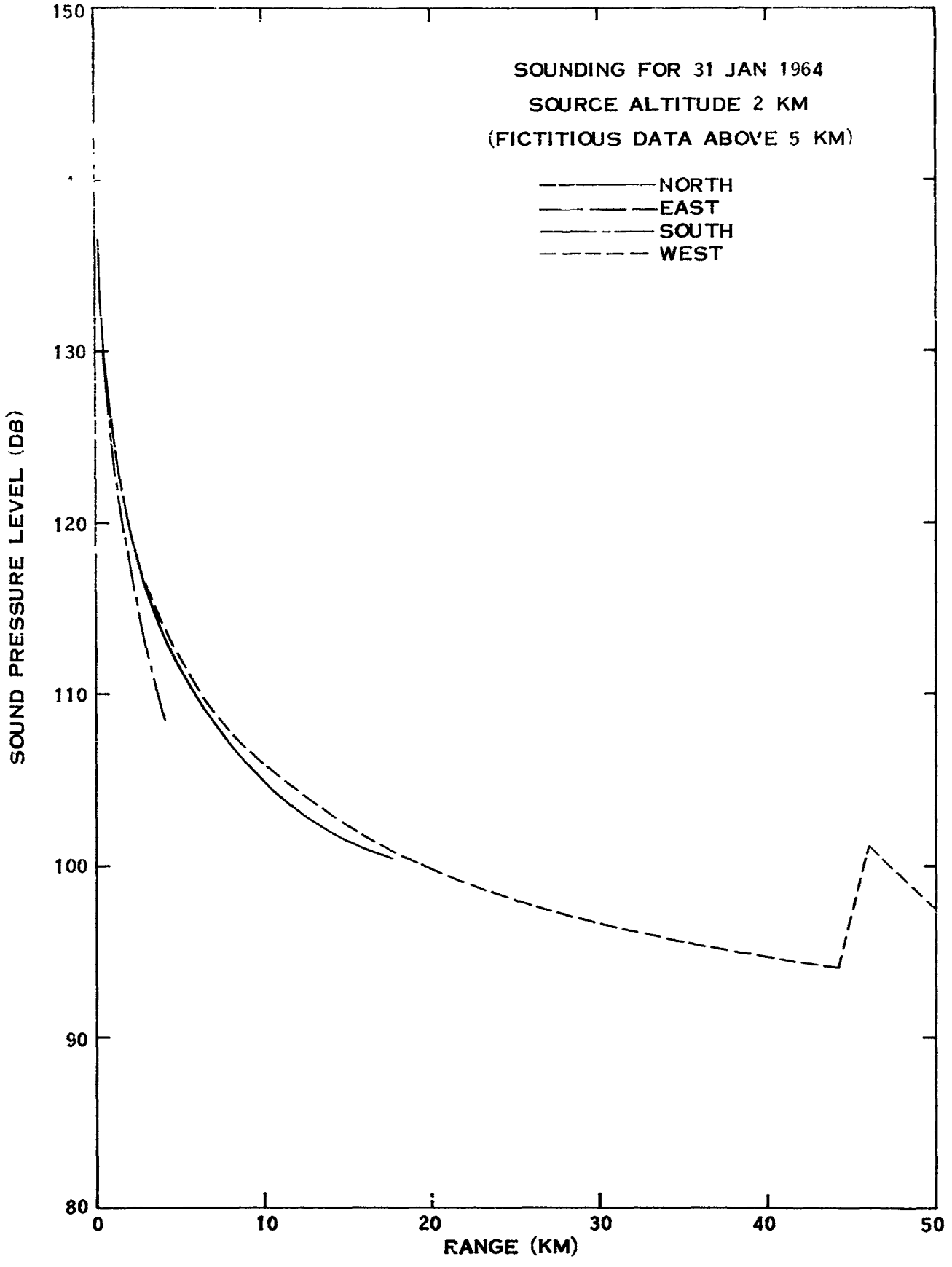

Figure 10: SOUND PRESSURE LEVEL

VII. PROGRAM LISTING

The following pages, numbered independently, contain a complete listing of the program and the subroutines used. An index to these is as follows:

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      PROGRAM SOUND (INPUT,OUTPUT,PUNCH)                                SOUN   0
      DIMENSION R(250),TM(250)                                          SOUN   5
      DIMENSION FFACT(250),FINTS(250)                                   SOUN  10
      COMMON/TRAJ/NVEH,TIM(100),ZVEH(100),AMACH(100),PCH(100),YAW(100)  SOUN  15
     X   ,  ALONG(100),ALAT(100),VEL(100),GAMMAR(100)                   SOUN  20
      COMMON NMET,LCMAX,C(100),U(100),V(100),Z(100),YYY(100),VVV(100),  SOUN  25
     1UUU(100),TTT(100),T(100),P(100),RH(100),SPD(100),DIR(100),ZWND(10)SOUN  30
     2),ZMET(100),AAA(100),ZZZ(100),GGG(100),CCC(100)                   SOUN  35
      COMMON/PARAM/ZS,YPOS,ZPOS,RNGV,AZV,PPCH,YYAW,AMCH,VVZ,VVXY,       SOUN  40
     1 TZRO,RHZRO,CZRO,PZRO                                             SOUN  45
      DIMENSION AZS(50),RNGS(50),XA(5),YA(5),ZRAY(25)                   SOUN  50
      DIMENSION PHI2(10),V2(10)                                         SOUN  55
      COMMON/TRACE/RD,RU,DRDDK,DRUDK,TD,TU                              SOUN  60
   10 FORMAT (3I10)                                                     SOUN  65
   12 FORMAT(11E12.4)                                                   SOUN  70
   14 FORMAT (11X,10E12.4)                                              SOUN  75
      CALL RD TRAJ                                                      SOUN  80
      CALL RD MET                                                       SOUN  85
CCCCCCCCCCCCCCCC                                                        SOUN  90
      READ 10,NRAY                                                      SOUN  95
      READ 12, (ZRAY(I),I=1,NRAY)                                       SOUN 100
      READ 10, NAREA                                                    SOUN 105
      READ 12, XA                                                       SOUN 110
      READ 12, YA                                                       SOUN 115
      READ 12,RSTEP                                                     SOUN 120
      READ 10,NREFL                                                     SOUN 125
      READ 12, DZRO,RFACT                                               SOUN 130
CCCCCCCCCCCCCCCC                                                        SOUN 135
C     LOOP ON VEHICLE LEVELS USED FOR RAYS                              SOUN 140
      DO 190 IRAY=1,NRAY                                                SOUN 145
C     SET  UP SOURCE PARAMETERS OF VEHICLE                              SOUN 150
      ZS=ZRAY(IRAY)                                                     SOUN 155
      CALL POSITN                                                       SOUN 160
      CALL FIXAREA (AZV,NAREA,XA,YA,NAZS,AZS,RNGS,RNGV)                 SOUN 165
      PRINT 5                                                           SOUN 170
    5 FORMAT (*0            FIELD POINT DATA*/                          SOUN 175
     1*0              X-Y COORD OF FIELD POINTS*)                       SOUN 180
      PRINT 14,(XA(I),YA(I),I=1,NAREA)                                  SOUN 185
   24 FORMAT(*0   RANGE AND AZIMUTH TO REACH LINE BETWEEN FIELD POINTS*)SOUN 190
      PRINT24                                                           SOUN 195
      DO 25 I = 1,NAZS                                                  SOUN 200
      AZSD = AZS(I)                                                     SOUN 205
   25 PRINT 12 ,AZSD,RNGS(I)                                            SOUN 210
      DO 180 J=1,NAZS                                                   SOUN 215
      FIRSTP = 0.                                                       SOUN 220
C     LOOP OVER AZIMUTH ANGLES                                          SOUN 225
C     GETS V(I)=U(I)+C(I) FOR THIS AZIMUTH                              SOUN 230
      AZSD=AZS(J)   $   RRNGS=RNGS(J)                                   SOUN 235
      AZSS=AZSD/57.295                                                  SOUN 240
      DO 52 I=1,NMET                                                    SOUN 245
C     CONSTRUCTS PARABOLIC MODEL FOR V(I)                               SOUN 250
   52 V(I) = C(I) + SPD(I) * COSF(AZSS-(180.- DIR(I))/57.295)           SOUN 255
      CALL PARAB                                                        SOUN 260
      DO 54 I=1, LCMAX                                                  SOUN 265
      IF(ZS- YYY(I))58,56,54                                            SOUN 270
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   54 CONTINUE                                                          SOUN 275
   56 JS=I                                                              SOUN 280
      GO TO 60                                                          SOUN 285
   58 JS=I-1                                                            SOUN 290
   60 CONTINUE                                                          SOUN 295
      ZS= YYY(JS)                                                       SOUN 300
      CALL POSITN                                                       SOUN 305
      PRINT 61, AZSD                                                    SOUN 310
   61 FORMAT(*0      SOUND RAY AZIMUTH PLANE =*,E12.4)                 SOUN 315
      VZRO = AAA(JS) + GGG(JS) * (ZS-ZZZ(JS))**2                        SOUN 320
      IND=3                                                             SOUN 325
      CALL DIVDIF(ZS,YYY(JS-1),CCC(JS-1),4,ANS1,CP,CPP,IND)             SOUN 330
      IND=3                                                             SOUN 335
      CALL DIVDIF(ZS,YYY(JS-1),UUU(JS-1),4,ANS1,UP,UPP,IND)             SOUN 340
      UZRO = ANS1                                                       SOUN 345
      VP = 2.*GGG(JS)*(ZS-ZZZ(JS))                                      SOUN 350
      CZRO = VZRO - UZRO                                                SOUN 355
C     PICKS UP LARGEST V(I) .GT. V(JS), J .LT. JS, AND ASCENDING MAXIMUMSOUN 360
C     V(I) .GT. V(JS)                                                   SOUN 365
C     INPUT DATA JS=LEVEL NO. OF SOURCE (AMET DATA LEVEL)               SOUN 370
C                V.I), U(I), C(I) = FROM MET SOUNDING                   SOUN 375
C                LCMAX = NO. FOR TOP OF MET DATA                        SOUN 380
C     OUTPUT DATA V1 = MAX V(I) .GT. V(JS), I .LT. JS                   SOUN 385
C                PHI1 = CORRESP PHIZ VALUE                              SOUN 390
C                IV1 = LEVEL NO. FOR V1, PHI1                           SOUN 395
C                V2(K) = V(I) VALUES AT MAXS I .GT. J                   SOUN 400
C                PHI2(K) = PHIZ VALUES AT V2(K)                         SOUN 405
C                KMAX = TOTAL NO. OF SUCH MAXS                          SOUN 410
C                PHI2MAX = PHI2(KMAX)                                   SOUN 415
C                V22 = V2(KMAX)                                         SOUN 420
C                VZRO = V(JS)                                           SOUN 425
      JM = JS-1                                                         SOUN 430
      JP = JS+1                                                         SOUN 435
      VZRO = VVV(JS)                                                    SOUN 440
      BIG = 0.0                                                         SOUN 445
      IV1 = 0                                                           SOUN 450
      DO 64 I=1,JM                                                      SOUN 455
      VV = VVV(I)                                                       SOUN 460
      IF(VV .GT. BIG)62,64                                              SOUN 465
   62 BIG = VV                                                          SOUN 470
      IV1 = I                                                           SOUN 475
   64 CONTINUE                                                          SOUN 480
      IF(BIG .GT. VZRO) GO TO 66                                        SOUN 485
      V1 = 0.                                                           SOUN 490
      IV1 = 0                                                           SOUN 495
      PHI1 = 0.                                                         SOUN 500
      GO TO 68                                                          SOUN 505
   66 V1 = BIG                                                          SOUN 510
      PHI1 = ACOSF(CCC(JS)/(V1-UUU(JS)))                                SOUN 515
   68 V22 = 0.                                                          SOUN 520
      K = 0                                                             SOUN 525
      PHI2MX = 0.                                                       SOUN 530
      IMAXM = LCMAX-1                                                   SOUN 535
      DO 70 I=JP,IMAXM                                                  SOUN 540
      VV = VVV(I)                                                       SOUN 545
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      IF((VV .GT. VZRO) .AND. (VV .GT. V1) .AND. (VV .GT. V22)          SOUN 550
     1.AND. (VV .GT.VVV(I-1)) .AND. (VV .GT.VVV(I+1))) 69,70            SOUN 555
   69 K = K+1                                                           SOUN 560
      V22 = V2(K) = VV                                                  SOUN 565
      PHI2(K) = ACOSF(CCC(JS)/(VV-UUU(JS)))                             SOUN 570
   70 CONTINUE                                                          SOUN 575
      KMAX = K                                                          SOUN 580
      IF(K .GT. 3) 72,74                                                SOUN 585
   72 PHI2MX = PHI2(KMAX)                                               SOUN 590
      V22 = V2(KMAX)                                                    SOUN 595
   74 CONTINUE                                                          SOUN 600
C     SORTS OUT THE THREE CASES                                         SOUN 605
      IF((V22 .EQ. 0.) .AND. (V1 .GT. VZRO)) 76,78                      SOUN 610
   76 ICASE = 1                                                         SOUN 615
      GO TO 88                                                          SOUN 620
   78 IF((V1 .EQ. 0.) .AND. (V22 .GT. VZRO)) 80,82                      SOUN 625
   80 ICASE = 2                                                         SOUN 630
      GO TO 88                                                          SOUN 635
   82 IF((V1 .GT. VZRO) .AND. (V22 .GT. V1)) 84,86                      SOUN 640
   84 ICASE = 3                                                         SOUN 645
      GO TO 88                                                          SOUN 650
   86 PRINT 1000, AZ                                                    SOUN 655
 1000 FORMAT(* SOMETHING WRONG ON AZIMUTH*,F6.2)                        SOUN 660
      GO TO 180                                                         SOUN 665
   88 CONTINUE                                                          SOUN 670
C     CONTROL SECTION FOR RAY TRACING                                   SOUN 675
C     STARTER                                                           SOUN 680
      L = 0                                                             SOUN 685
      ILEG=1                                                            SOUN 690
      PHIZ =-PHI1-0.5                                                   SOUN 695
      AK0 = CZRO/COS(PHIZ)+UZRO                                         SOUN 700
      RO=0.                                                             SOUN 705
      RU=0.                                                             SOUN 710
      DRODK=0.                                                          SOUN 715
      DRUDK=0.                                                          SOUN 720
      TO=0.                                                             SOUN 725
      TU=0.                                                             SOUN 730
      CALL RAYTRAC (JS,ILEG,AK0)                                        SOUN 735
      PHIZ = - 1.5                                                      SOUN 740
C     RETURN POINT FOR RAYTRC                                           SOUN 745
      DRDP  =ABS(DRODK*CZRO*SIN(PHIZ)/COS(PHIZ)**2 )                    SOUN 750
   89 DPHIZ =ABS( RSTEP/DRDP)                                           SOUN 755
      PHIZ = PHIZ + DPHIZ                                               SOUN 760
      PHDG = PHIZ *57.295                                               SOUN 765
      SPHZRO=SIN(PHIZ)                                                  SOUN 770
      CPHZRO=COS(PHIZ)                                                  SOUN 775
      DKDPHD = CZRO    * SIN(2.*3.1416 - PHIZ) / CPHZRO**2              SOUN 780
      DKDPHU = CZRO    * SIN(             PHIZ) / CPHZRO**2              SOUN 785
      AK0 = CZRO / CPHZRO + UZRO                                        SOUN 790
      CPHP = CCC(1)*CPHZRO/(CZRO +(UZRO - UUU(1))*CPHZRO  )             SOUN 795
      IF(CPHP .GE. 1.) GO TO 89                                         SOUN 800
      SPHP=SQRT(1.-CPHP**2)                                             SOUN 805
      GO TO (90,94,94),ICASE                                            SOUN 810
   90 IF(PHIZ .LT. (-PHI1*1.001))92,170                                 SOUN 815
   92 ILEG=1                                                            SOUN 820
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      GO TO 99                                                          SOUN 825
   94 IF(PHIZ .LT. (-PHI2MX)) 96,97                                     SOUN 830
   96 ILEG = 1                                                          SOUN 835
      GO TO 99                                                          SOUN 840
   97 IF(PHIZ .LT. (-PHI1-1.E-4))100,102                                SOUN 845
  100 ILEG = 2                                                          SOUN 850
      GO TO 99                                                          SOUN 855
  102 IF(FIRSTP  .EQ.  0.) PHIZ =-PHIZ + DPHIZ                          SOUN 860
      FIRSTP = 1.                                                       SOUN 865
      IF(PHIZ .GT. PHI2MX*0.80)170,98                                   SOUN 870
   98 ILEG = 3                                                          SOUN 875
   99 RO=0.                                                             SOUN 880
      RU=0.                                                             SOUN 885
      DRODK=0.                                                          SOUN 890
      DRUDK=0.                                                          SOUN 895
      TO=0.                                                             SOUN 900
      TU=0.                                                             SOUN 905
C     RAY TRACING ENDED THIS AZIMUTH, NOW TIME TO                       SOUN 910
C     ADJUST INTENSITIES AND FIND FOCI.                                 SOUN 915
C     TEST FOR INFINITERAY BETWEEN OR ON INCREMENTED                    SOUN 920
      CALL RAYTRAC (JS,ILEG,AK0)                                        SOUN 925
      DKDZ=CP/CPHZRO+UP                                                 SOUN 930
      NREFL = 3                                                         SOUN 935
      NREFL1=NREFL+1                                                    SOUN 940
      IF(L .GT. 240) GO TO 170                                          SOUN 945
      GO TO (12),12),140),ILEG                                          SOUN 950
                                                                        SOUN 955
                                                                        SOUN 960
  120 L = L + 1                                                         SOUN 965
      IF(( L  -  L/50*50)  .EQ.  1) PRINT 15                            SOUN 970
   15 FORMAT(*1                PHIZ       RADIUS       TIME    FOCUS FAC SOUN 975
     1SND PRESS(DB) *)                                                  SOUN 980
      R(L)=RO                                                           SOUN 985
      TM(L)=TO                                                          SOUN 990
      DRDPHI=DKDPHO*DRDDK                                               SOUN 995
      DRDP=DPDPHI                                                       SOUN1000
      DRDZ=DPDDK*DKDZ                                                   SOUN1005
      DTDPHI=DRDPHI/AK0                                                 SOUN1010
      DTDZ=DRDZ/AK0                                                     SOUN1015
      FFACT(L)=1.                                                       SOUN1020
      FINTS(L)=1.                                                       SOUN1025
      R2=ZS**2+R(L)**2                                                  SOUN1030
      RDRDPT=R(L)*(DRDPHI-DTDPHI*(VVZ*DRDZ+VVXY)/                       SOUN1035
     1(1.+VVZ*DTDZ))                                                    SOUN1040
      IF(ABS(RDRDPT).LT.1.E-50)GO TO 124                                SOUN1045
      FFACT(L)=ABS(R2*CPHZRO/RDRDPT/SPHP )                              SOUN1050
      FINTS(L) = DZRO-10.32+4.3429*ALOG(FFACT(L)/R(L)**2)               SOUN1055
  124 PRINT 14, PHDG,R(L),TM(L),FFACT(L),FINTS(L)                       SOUN1060
      KL1=KL2=L                                                         SOUN1065
      IF(ILEG.EQ.1)89,130                                               SOUN1070
                                                                        SOUN1075
                                                                        SOUN1080
  130 DO 135 I=2,NREFL1                                                 SOUN1085
      L = L + 1                                                         SOUN1090
      IF(( L  -  L/50*50)  .EQ.  1) PRINT 15                            SOUN1095
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      R(L)= (2.*I-1.)*RD+2.*(I-1.)*RU                                   SOUN1100
      TM(L)= (2.*I-1.)*TD+2.*(I-1.)*TU                                  SOUN1105
      DRDPHI= (2.*I-1.)*DRDDK*DKDPHD+2.*(I-1.)*DRUDK*DKDPHU             SOUN1110
      DRDZ= (2.*I-1.)*DRDDK*DKDZ+2.*(I-1.)*DRUDK*DKDZ                   SOUN1115
      DTDPHI=DRDPHI/AKD                                                 SOUN1120
      FINTS(L)=1.                                                       SOUN1125
      FFACT(L)=1.                                                       SOUN1130
      DTDZ=DRDZ/AKD                                                     SOUN1135
      R2=ZS**2+R(L)**2                                                  SOUN1140
      RDRDPT=R(L)*(DRDPHI-DTDPHI*(VVZ*DRDZ+VVXY)/                       SOUN1145
     1(1.+VVZ*DTDZ))                                                    SOUN1150
      IF(ABS(RDRDPT).LT.1.E-50) GO TO 134                               SOUN1155
      FFACT(L)=ABS(R2*CPHZRO/RDRDPT/SPHP )*RFACT**(I-1.)                SOUN1160
      FINTS(L) = DZRO-18.32+4.3429*ALOG(FFACT(L)/R(L)**2)               SOUN1165
  134 PRINT 14, PHDG,R(L),TM(L),FFACT(L),FINTS(L)                       SOUN1170
  135 CONTINUE                                                          SOUN1175
      KL1=L                                                             SOUN1180
      KL1=KL2=L                                                         SOUN1185
      GO TO 89                                                          SOUN1190
                                                                        SOUN1195
                                                                        SOUN1200
                                                                        SOUN1205
                                                                        SOUN1210
  140 DO 145 I=1,NREFL1                                                 SOUN1215
      L = L + 1                                                         SOUN1220
      IF(( L  -  L/50*50)  .EQ.  1) PRINT 15                            SOUN1225
      TM(L)= (2.*I-1.)*TD+2.*I*TU                                       SOUN1230
      R(L)= (2.*I-1.)*RD+2.*I*RU                                        SOUN1235
      DRDPHI   = (2.*I-1.)*DRDDK*DKDPHD+2.*I* DRUDK*DKDPHU              SOUN1240
      DRDZ   = (2.*I-1.)*DRDDK*DKDZ+2.*I*DRUDK*DKDZ                     SOUN1245
      DTDPHI=DRDPHI/AKD                                                 SOUN1250
      DTDZ=DRDZ/AKD                                                     SOUN1255
      FFACT(L)=1.                                                       SOUN1260
      FINTS(L)=1.                                                       SOUN1265
      R2=ZS**2+R(L)**2                                                  SOUN1270
      RDRDPT=R(L)*(DRDPHI-DTDPHI*(VVZ*DRDZ+VVXY)/                       SOUN1275
     1(1.+VVZ*DTDZ))                                                    SOUN1280
      IF(ABS(RDRDPT).LT.1.E-50) GO TO 144                               SOUN1285
      FFACT(L)=ABS(R2*CPHZRO/RDRDPT/SPHP )*RFACT**(I-1.)                SOUN1290
      FINTS(L) = DZRO-18.32+4.3429*ALOG(FFACT(L)/R(L)**2)               SOUN1295
  144 PRINT 14, PHDG,R(L),TM(L),FFACT(L),FINTS(L)                       SOUN1300
  145 CONTINUE                                                          SOUN1305
      DRDP=DRDDK*DKDPHD+2.*DRUDK*DKDPHU                                 SOUN1310
      KL2=L                                                             SOUN1315
      GO TO 89                                                          SOUN1320
  170 CONTINUE                                                          SOUN1325
  181 FORMAT(*1           SUMMARY FOR AZIMUTH OF *,E12.4 /              SOUN1330
     115X*  R      FOCUS FACT    SND PRESS (DB)   *  )                  SOUN1335
      PRINT 181,AZSD                                                    SOUN1340
      CALL SORT(KL1,R(1),FFACT(1))                                      SOUN1345
      KL=KL2-KL1                                                        SOUN1350
      IF(KL.EQ.0) GO TO 175                                             SOUN1355
      CALL SORT((KL2-KL1),R(KL1+1),FFACT(KL1+1))                        SOUN1360
  175 DO 200 I=1,51                                                     SOUN1365
      RR=(I-1)*1000.                                                    SOUN1370
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      IF(I.EQ.1)RR=100.                                                 SOUN1375
      FF1=0                                                             SOUN1380
      FF2=0                                                             SOUN1385
      IF(RR.GT.R(1).AND.RR.LT.R(KL1))CALL INTRP(KL1,R(1),FFACT(1),RR,FF SOUN1390
     11,0)                                                              SOUN1395
      IF(KL.EQ.0) GO TO 185                                             SOUN1400
      IF(RR.GT.R(KL1+1).AND.RR.LT.R(KL2))CALL INTRP(KL,R(KL1+1),FFACT(K SOUN1405
     1L1+1),RR,FF2,0)                                                   SOUN1410
  185 FF=FF1+FF2                                                        SOUN1415
      FTNS=0                                                            SOUN1420
      IF(FF.GT.0)FTNS=DZRO-10.3+10.*ALOG10(FF/RR**2)                    SOUN1425
      PRINT 14,RR,FF,FTNS                                               SOUN1430
  200 CONTINUE                                                          SOUN1435
  180 CONTINUE                                                          SOUN1440
  190 CONTINUE                                                          SOUN1445
      END                                                               SOUN1450
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      SUBROUTINE RD TRAJ                                                RD T   1
      COMMON/TRAJ/NVEH,TIM(100),ZVEH(100),AMACH(100),PCH(100),YAW(100)  RD T   5
     X   ,  ALONG(100),ALAT(100),VEL(100),GAMMAR(100)                   RD T  10
CCCCCCCCCCCCCCCCC                                                       RD T  15
      READ 10, IVEH,NVEH                                                RD T  20
      PRINT 2                                                           RD T  25
    2 FORMAT(*1  TRAJECTORY DATA */*0                TIME      ALTITUDE RD T  30
     1  MACH NO      PITCH        YAW    *  )                           RD T  35
      DO 20 I = 1,NVEH                                                  RD T  40
      IF(I.EQ.50) PRINT 2                                               RD T  45
      READ 12, TIM(I),ZVEH(I),AMACH(I),PCH(I),YAW(I)                    RD T  50
      PRINT 14, TIM(I),ZVEH(I),AMACH(I),PCH(I),YAW(I)                   RD T  55
   20 CONTINUE                                                          RD T  60
      PRINT 3                                                           RD T  65
    3 FORMAT(*1 TRAJECTORY POSITION DATA * /*0            TIME          RD T  70
     ALATITUDE    LONGITUDE  *)                                        RD T  75
   22 DO 24 I = 1,NVEH                                                  RD T  80
      IF(I.EQ.50) PRINT 3                                               RD T  85
      READ 12,TIM(I),ALAT(I),ALONG(I)                                   RD T  90
      PRINT14,TIM(I),ALAT(I),ALONG(I)                                   RD T  95
   24 CONTINUE                                                          RD T 100
      PRINT 4                                                           RD T 105
    4 FORMAT(*1          TRAJECTOPY VELOCITY DATA*                    RD T 110
     1 / 10X*   TIME       VELOCITY    ALGLE FROM HORIZ.  *)          RD T 115
      DO 25 I = 1,NVEH                                                  RD T 120
      IF(I.EQ.50) PRINT 4                                               RD T 125
      READ  12,TIM(I),VEL(I),GAMMAR(I)                                  RD T 130
      PRINT 14,TIM(I),VEL(I),GAMMAR(I)                                  RD T 135
   25 CONTINUE                                                          RD T 140
CCCCCCCCCCCCCCCCC                                                       RD T 145
   10 FORMAT( 2I10)                                                     RD T 150
   14 FORMAT(10X5E12.4)                                                 RD T 155
      RETURN                                                            RD T 160
      END                                                               RD T 165
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      SUBROUTINE FIXAREA (AZV,NAREA,XA,YA,NAZS,AZS,RNGS,RNGV)          FIXA    3
      DIMENSION AZV(1),XA(1),YA(1),AZS(1),RNGS(1),AA(50)               FIXA    5
      DIMENSION DAZ(5)                                                 FIXA   10
C     GETS AZIMUTH AND RANGE FOR AREA COVERED                          FIXA   15
C     CONSTRUCTS TABLE OF AZIMUTH ANGLES TO CORNERS                    FIXA   20
      IF(NAREA.EQ.1)40,50                                              FIXA   25
   40 DO 45 I=1,12                                                     FIXA   30
      RNGS(I)=3.                                                       FIXA   35
   45 AZS(I) = 30.0*(I-1.)                                             FIXA   40
      NAZS=12                                                          FIXA   45
      RETURN                                                           FIXA   50
   50 CAZV=COSF(AZV)                                                   FIXA   55
      SAZV=SINF(AZV)                                                   FIXA   60
      DO 4 I=1,NAREA                                                   FIXA   65
      F1=XA(I)-RNGV*SAZV                                               FIXA   70
      F2=YA(I)-RNGV*CAZV                                               FIXA   75
      AA(I)=ATAN2(F1,F2)                                               FIXA   80
      IF(AA(I) .LT. 0.) 2,3                                            FIXA   85
    2 AA(I)=AA(I)+6.2831853                                            FIXA   90
    3 IF(I-1)4,4,33                                                    FIXA   95
   33 DAZ(I-1) = (AA(I) - AA(I-1)) /  8.                               FIXA  100
    4 CONTINUE                                                         FIXA  105
C     COMPUTES RANGE TO FARTHER BOUNDARY                               FIXA  110
      K = 1                                                            FIXA  115
      NAREA1 = NAREA - 1                                               FIXA  120
      DO 25 I = 1,NAREA1                                               FIXA  125
      AZSS = AZS(K) = AA(I)                                            FIXA  130
      DO 22 II = 1,9                                                   FIXA  135
    8 SAZS=SINF(AZSS)                                                  FIXA  140
      CAZS=COSF(AZSS)                                                  FIXA  145
      J1=1                                                             FIXA  150
   10 DO 12 J=J1,NAREA                                                 FIXA  155
      JP=J+1                                                           FIXA  160
      IF((AA(J).LE.AZSS).AND.(AZSS.LT.AA(JP)))14,12                    FIXA  165
   12 CONTINUE                                                         FIXA  170
   14 J1=J+1                                                           FIXA  175
      I1=J                                                             FIXA  180
      I2=J1                                                            FIXA  185
      X1=XA(I1)                                                        FIXA  190
      X2=XA(I2)                                                        FIXA  195
      Y1=YA(I1)                                                        FIXA  200
      Y2=YA(I2)                                                        FIXA  205
      F1=X2*Y1-X1*Y2                                                   FIXA  210
      F2=RNGV*(SAZV*(Y2-Y1)-CAZV*(X2-X1))                              FIXA  215
      DEN=CAZS*(X2-X1)-SAZS*(Y2-Y1)                                    FIXA  220
      RNGS(K) = (F2 + F1) / DEN                                        FIXA  225
      K = K + 1                                                        FIXA  230
      AZSS = AZS(K) = AZS(K-1) + DAZ(I)                                FIXA  235
   22 CONTINUE                                                         FIXA  240
   25 CONTINUE                                                         FIXA  245
      NAZS = K-1                                                       FIXA  250
      DO 35 I=1,NAZS                                                   FIXA  255
   35 AZS(I) = AZS(I)/57.295                                           FIXA  260
C     AT THIS POINT THERE IS A TABLE AZS(I) AND RNGS(I)                FIXA  265
C     I=1,NAZS OF AZIMUTH AND RANGE FROM VEHICLE                       FIXA  270
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C       GROUND PROJECTION THAT COVERS AREA.                    FIXA 275
        RETURN                                                 FIXA 281
        END                                                    FIXA 285
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      SUBROUTINE RAYTRAC (JS,ICASE,VTEST)                                RAYT   3
      COMMON LMAX,LCMAX,Z(100),U(100),V(100),ZK(100),YYY(100),VVV(100), RAYT   5
     1UU(100),TTT(100),T(100),P(100),RH(100),SPD(100),DIR(100),ZWND(100RAYT  10
     2),ZMET(100),AAA(100),ZZZ(100),GGG(100),CCC(100)                    RAYT  15
      COMMON/TRACE/RD,RL,DRDDK,DRUDK,TD,TU                               RAYT  20
C     TEST FOR RAY EXACTLY ON LAYER TOP (K = 2) OR NOT (K = 1).          RAYT  25
COMMENT   ARITHMETIC STATEMENT FUNCTIONS --- SOLN TO INTEGRALS           RAYT  30
C                                                                        RAYT  35
C                                                                        RAYT  40
      AI1(Z) = ASIN((Z-ZZ)/P1)/GGGQRT                                    RAYT  45
      AI2(Z) = (ABS(Z-ZZ)+SQRT((Z-ZZ)**2+P1**2))                         RAYT  50
      AI3(Z) = (Z-ZZ)/SQRT(P1**2+(Z-ZZ)**2)/(SQRT(-GI)*(VTEST-AI))       RAYT  55
      AI4(Z) = (Z-ZZ)/SQRT(P1**2-(Z-ZZ)**2)/(SQRT(GI)*(VTEST-AI))        RAYT  60
C                                                                        RAYT  65
      JSP = JS + 1                                                       RAYT  70
      DO 820 K1=JSP,LCMAX                                                RAYT  75
      IF (VTEST.GT.(VVV(K1)+1.E-5)) 820, 830                             RAYT  80
  830 IF (VTEST.GT.(VVV(K1)-1.E-5)) 810, 840                             RAYT  85
  820 CONTINUE                                                           RAYT  90
  810 K = 2                                                              RAYT  95
      GO TO 845                                                          RAYT 100
  840 K = 1                                                              RAYT 105
  845 K2= K1 - 1                                                         RAYT 110
      IF(ICASE .EQ. 1) K2 = JS + 1                                       RAYT 115
      XM = 0.                                                            RAYT 120
      K3 = 1                                                             RAYT 125
      GO TO 851                                                          RAYT 130
C     INDEX DELIMITING THE 1000-LOOP TO JUST FINDING THE HEIGHT CORRESPORAYT 135
C      THE VTEST-VALUE OF THAT INFINITELY TRAVELING RAY (VIZ., THE PHIRORAYT 140
C      OF THE NEXT MORE ELEVATED FAN AND REFRACTING LAYER NOW TO BE CONSRAYT 145
C      WHICH TOPS OUT AT A LOCAL MAX IN THE SOUND-PROPAGATION SOUNDING. RAYT 150
  850 K3 = K2                                                            RAYT 155
C     LOOP TO COMPUTE CURVATURE AND DISTANCE FOR EACH RAY                RAYT 160
  851 DO 1000 K1 =K3, K2                                                 RAYT 165
C     K2 REFERENCES THE LEVEL AT WHICH THE PHIBOT-RAY (I1=1) OF A FAN-FARAYT 170
C      OUT (K=1), OR THE BOTTOM OF THE LAYER IN WHICH THE FANS INTERNAL-RAYT 175
C      .GT.1 TO I1.LT.IM-1) TOP OUT (K=1), OR AT THE TOP OF WHICH THE PHRAYT 180
C      (I1=IM-1) TOPS OUT (K=2), EXCEPT IF NOT ONLY I1=1 (AND HENCE K=1)RAYT 185
C      ALSO ITS TOP IS THE ONE AS RECOGNIZED BY THE 820-LOOP AS BEING ABRAYT 190
C      LOCAL MAX (IN WHICH EXCEPTION THE RAY TOPS OUT AT THE LEVEL OF THRAYT 195
C      INCIDENTALLY, BOTH BOUNDING LEVELS OF THIS LAYER ARE ADJACENT LC-RAYT 200
C      (VIZ., EITHER PARABOLIC JOIN-POINTS AT ONE OF THE DATA LEVELS ANDRAYT 205
C      LEVEL BETWEEN THEM OR ONE SUCH JOIN-POINT AND AN LC-SUBDIVISION ORAYT 210
C      LOCAL MAX, OVER WHICH ONE PARABOLIC ARC IS CONTINUOUS).  WHEREAS RAYT 215
C      NITELY RANGING PHITOP-RAY ASYMPTOTES OUT ALWAYS AT THE TOP OF THERAYT 220
C      SUCH LAYER SUPERJACENT TO K2, AT EXTENDED RANGE THE I1-RAY ASYMPTRAYT 225
C      APPROACHES AS ITS ZENITH A LOCAL-MAX LEVEL WHICH IS (OFTEN WELL) RAYT 230
C      THE ASSOCIATED K2-LEVEL.  BUT, FOR SUCH AN I1-RAY, THE LEVEL TO BRAYT 235
C      FIED AND SOUGHT SHALL NEVERTHELESS BE THAT CORRESPONDING TO ITS VRAYT 240
C      VALUE, CONTAINED IN THE LAYER MENTIONED, SINCE ITS ZENITH IS OTHERAYT 245
C      SPECIFIED BY THE HEIGHT-COORDINATE OF THE LOCAL MAX.               RAYT 250
      I = K1                                                             RAYT 255
      GGGI = GGG(I)                                                      RAYT 260
      GGGQRT =SQRT (ABS (GGGI))                                          RAYT 265
      IF (GGGQRT .EQ. 0.) GGGQRT = 1.E-200                               RAYT 270
```

```
      AAAI = AAA(I)                                                      RAYT 275
      P1= SQRT (ABS ((VTEST-AAAI)/GGGI))                                 RAYT 280
      ZZZI = ZZZ(I)                                                      RAYT 285
C     SHUNT FOR INFINITELY RANGING PHIBOT-RAY, TO FIND HEIGHT CORRESPONDRAYT 290
C      ITS ASSOCIATED VTEST VALUE.                                       RAYT 295
C     ROUND-OFF OF REAL-VARIABLE P-FUNCTION TO FIXED ZERO FOR INFINITELYRAYT 300
C      PHITOP-RAY.                                                       RAYT 305
C     ROUND-OFF NOW AUTHORIZED SINCE LARGEST ROUND P1 AT LOCAL MAX .LE. RAYT 310
      J = I + 1                                                          RAYT 315
      YYYJ = YYY(J)                                                      RAYT 320
      YYYI = YYY(I)                                                      RAYT 325
      A1 =     ((YYYI-ZZZI)/P1)                                          RAYT 330
      C2 = CCC(J)                                                        RAYT 335
      C1 = CCC(I)                                                        RAYT 340
      V1 = VVV(I)                                                        RAYT 345
C     D1,E1,F1 ARE VALUES OF F1,F2,F3                                    RAYT 350
C     I.E. SLOWLY VARYING PARTS OF INTEGRALS                             RAYT 355
   10 FORMAT (1HX3E12.4,2I10)                                            RAYT 360
      IF((VTEST+2.*C1-V1).LE.0) PRINT 10, VTEST,C1,V1,I,J                RAYT 365
      D1 = (C1**2 + (V1-C1)*(VTEST-V1+C1))/(C1*SQRT (VTEST+2.*C1-V1))    RAYT 370
      E1 = (VTEST -(V1-C1))/(C1*SQRT(VTEST+2.*C1-V1))                    RAYT 375
      F1 = C1*VTEST/SQRT(VTEST+2.*C1-V1)**3                              RAYT 380
      IF(K1.NE.K2) 855, 960                                              RAYT 385
C     K1  NOT UP TO THE REFERENCE SURFACE FOR WHICH THE RAY TOPS OUT IN  RAYT 390
C      THE NEXT SUPERJACENT LAYER OR AT ITS BOUNDARIES, SO RAY PENETRATE RAYT 395
C      LAYER WHOSE LOWER BOUNDARY IS K1.                                 RAYT 400
  855 V2 = VVV(J)                                                        RAYT 405
      D2 = (C2**2 + (V2-C2)*(VTEST-V2+C2))/(C2*SQRT (VTEST+2.*C2-V2))    RAYT 410
      E2 = (VTEST-(V2-C2))/(C2*SQRT(VTEST+2.*C2-V2))                     RAYT 415
      F2 = C2*VTEST/SQRT(VTEST + 2.*C2-V2)**3                            RAYT 420
  857 DMEAN  =  (2.*D2+D1) / 3.                                          RAYT 425
      EMEAN  =  (2.*E2+E1) / 3.                                          RAYT 430
      FMEAN = -(2.*F2+F1)/3.                                             RAYT 435
  858 A2 =     ((YYYJ-ZZZI)/P1)                                          RAYT 440
      IF (ZZZI         )       860, 910                                  RAYT 445
C     REMAINS PARABOLIC                                                  RAYT 450
COMMENTS                                                                 RAYT 455
C                                                                        RAYT 460
C                                                                        RAYT 465
C      CASES TO BE CONSIDERED FOR RAY  TRACING                           RAYT 470
C                                                                        RAYT 475
C   I)   G.GT.0    K.LT.A   NO REAL SOLUTION                            RAYT 480
C  II)   G.GT.0    K.GT.A                                               RAYT 485
C  III)  G.LT.0    K.LT.A                                               RAYT 490
C  IV)   G.LT.0    K.GT.A                                               RAYT 495
C                                                                        RAYT 500
  860 ZI = YYYI                                                          RAYT 505
      ZJ = YYYJ                                                          RAYT 510
      ZZ = ZZZI                                                          RAYT 515
      GI = GGGI                                                          RAYT 520
      AI = AAAI                                                          RAYT 525
      IF(GI .LE.0.) GO TO 880                                            RAYT 530
      IF(VTEST .LT. AI) GO TO 1005                                       RAYT 535
      ADD1 = AI1(ZJ) - AI1(ZI)                                           RAYT 540
      ADD2 = ADD1                                                        RAYT 545
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      IF(K1 .EQ. K2) GO TO 950                                          RAYT 550
      ADD2 = AI4(ZJ) - AI4(ZI)                                          RAYT 555
      GO TO 950                                                         RAYT 560
  880 IF(VTEST .LE. AI) GO TO 900                                       RAYT 565
      IF(ZJ .LT. 1.0001*ZZ) 882,884                                     RAYT 570
  882 ADD1 = ALOG(AI2(ZI)/AI2(ZJ))/GGGQRT                               RAYT 575
      GO TO 890                                                         RAYT 580
  884 ADD1 = ALOG(AI2(ZJ) / AI2(ZI))/GGGQRT                             RAYT 585
  890 ADD2=ADD1                                                         RAYT 590
      IF(K1.EQ.K2)GO TO 950                                             RAYT 595
      ADD2 = AI3(ZJ) - AI3(ZI)                                          RAYT 600
      GO TO 950                                                         RAYT 605
  900 IF(ZJ .LE. 1.0001*ZZ) GO TO 906                                   RAYT 610
      ADD1 = ALOG(AI2(ZJ) / AI2(ZI))/GGGQRT                             RAYT 615
      GO TO 908                                                         RAYT 620
  906 ADD1 = ALOG(AI2(ZI) / AI2(ZJ))/GGGQRT                             RAYT 625
  908 ADD2 = ADD1                                                       RAYT 630
      IF(K2.EQ.K1)GO TO 950                                             RAYT 635
      ADD2 = AI3(ZJ) - AI3(ZI)                                          RAYT 640
      GO TO 950                                                         RAYT 645
                                                                        RAYT 650
C                                                                       RAYT 655
C                                                                       RAYT 660
C     ERROR INSERTIONS FROM IMPOSSIBLE TESTS                            RAYT 665
C     INITIAL PHIBOT-RAY OF A REFRACTING LAYER HAS ITS ZENITH ON A SOUNDRAYT 670
C     LINEAR LAYER CASE                                                 RAYT 675
  910 IF (VTEST .LT. AAAI) GO TO 1005                                   RAYT 680
      IF (VTEST .EQ. AAAI) VTEST = AAAI + 1.E-200                       RAYT 685
      ADD2=4./GGGI*(1./SQRT(VTEST-C1-GGGI*(YYYJ-YYYI))-1./SQRT(VTEST-C1)RAYT 690
     1)                                                                 RAYT 695
C     CONSIDER SLOPE OF LINEAR SOUNDING                                 RAYT 700
      QQ = (YYYJ - YYYI)/(ABS((VTEST - AAAI)/GGGI))                     RAYT 705
      IF (GGGI .LT. -1.E-8) GO TO 920                                   RAYT 710
      IF (GGGI .GT. 1.E-8) GO TO 930                                    RAYT 715
      GO TO 940                                                         RAYT 720
C     COMPUTE TRAVEL DISTANCE OF RAY PENETRATING LINEAR LAYER           RAYT 725
  920 IF (QQ .LT. 0.) QQ = 0.                                           RAYT 730
      ADD1= 2.*(SQRT(ABS((VTEST-AAAI)))/(-GGGI))*FMEAN*(SQRT(1.+QQ) -1.)RAYT 735
      GO TO 950                                                         RAYT 740
  930 IF (QQ .GT. 1.) QQ = 1.                                           RAYT 745
      ADD1= 2.*(SQRT (ABS ((VTEST-AAAI)))/GGGI)*FMEAN*(1.-SQRT (1. -QQ))RAYT 750
      GO TO 950                                                         RAYT 755
  940 ADD1= FMEAN*(YYYJ-YYYI)/(SQRT (ABS (VTEST-AAAI)))                 RAYT 760
COMMENT  WE KNOW HAVE THE INTEGRALS AND THE SLOWLY VARYING PART OF THE  RAYT 765
C     INTEGRAL AND CAN USE THEM TO CALCULATE THE PARTIAL DERIVATIONS    RAYT 770
C     NECESSARY FOR THE FOCUSING FACTOR.                                RAYT 775
  950 R=OMEAN*ADD1                                                      RAYT 780
      TAU=EMEAN*ADD1                                                    RAYT 785
      IF(K1.LT.K2)951,952                                               RAYT 790
  951 DRDK=FMEAN*ADD2                                                   RAYT 795
      GO TO 995                                                         RAYT 800
COMMENT  G AND H CALCULATED FOR HORIZONTAL RAY ONLY                     RAYT 805
  952 IND = 3                                                           RAYT 810
      CALL DIVDIF(YYYI,YYY(I),CCC(I),4,ANS1,CP,CPP,IND)                 RAYT 815
      CALL DIVDIF(YYYI,YYY(I),UUU(I),4,ANS1,UP,UPP,IND)                 RAYT 820
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      G1 = VTEST*(VTEST-(V1-C1))/(((VTEST-(V1-C1))*CP+C1*UP)*          RAYT 825
     X SQRT((VTEST-(V1-C1))**2-C1**2))                                 RAYT 830
      H1 = VTEST*(VTEST-(V1-C1))*((VTEST-(V1-C1))*CPP+C1*UPP)/         RAYT 835
     X (((VTEST-(V1-C1))*CP+C1*UP)**2*SQRT(VTEST-(V1-C1)+C1))         RAYT 840
      IND = 3                                                          RAYT 845
      CALL DIVDIF(YTOP,YYY(I),UUU(I),6,ANS1,UP,UPP,IND)                RAYT 850
      IND = 3                                                          RAYT 855
      CALL DIVDIF(YTOP,YYY(I),CCC(I),6,ANS1,CP,CPP,IND)                RAYT 860
      H2 = VTEST*(VTEST-(V2-C2))*((VTEST-(V2-C2))*CPP+ C2*UPP) /       RAYT 865
     X (((VTEST-(V2-C2))*CP+C2*UP)**2*SQRT(VTEST-(V2-C2)+C2))         RAYT 870
      DPDK = G1-(H1+H2)/2.*ADD1                                        RAYT 875
      GO TO 995                                                        RAYT 880
C     COMPUTE PARAMETERS OF RAY AND LAYER IN WHICH RAY TOPS OUT        RAYT 885
  960 IF (ZZZI.EQ.0.) GO TO 990                                        RAYT 890
C     SOUNDING IN LAYER IS PARABOLIC                                   RAYT 895
      IF (VTEST .GE. AAAI .AND. GGGI .GT. 0.) GO TO 963                RAYT 900
C    HAVE ALREADY REACHED THE MAXIMUM---RETURN                         RAYT 905
                                                                       RAYT 910
      IF (VTEST .LT. AAAI .AND. GGGI .LT. 0.) GO TO 964                RAYT 915
      DIFF = ABS (VTEST - AAAI)                                        RAYT 920
C     961-BYPASS AUTHORIZED.                                           RAYT 925
      GO TO 962                                                        RAYT 930
  962 IF (DIFF .LT. 1.E-6) GO TO 963                                   RAYT 935
      GO TO 1005                                                       RAYT 940
C     FIND RAY ZENITH                                                  RAYT 945
  963 YTOP = ZZZI + P1                                                 RAYT 950
      GO TO 980                                                        RAYT 955
  964 YTOP = ZZZI - P1                                                 RAYT 960
C     EVALUATE SOUNDING AT RAY TOP                                     RAYT 965
  980 V2 = VTEST                                                       RAYT 970
      A2 = 1.                                                          RAYT 975
      GO TO 992                                                        RAYT 980
C     SOUNDING IN LAYER IS LINEAR                                      RAYT 985
  990 YTOP = YYYI + (VTEST-AAAI)/GGGI                                  RAYT 990
      Q= 1.                                                            RAYT 995
  992 C2 = C1 + (C2-C1)*(YTOP-YYYI)/(YYYJ-YYYI)                        RAYT1000
C     FIND F-FUNCTION OF RAY FOR ITS TOPPING LAYER, LINEAR OR PARABOLIC RAYT1005
      E2 = 1. / SQRT(2.*C2)                                            RAYT1010
      D2 = V2 * E2                                                     RAYT1015
      DMEAN = (2.*D2 + D1) / 3.                                        RAYT1020
      EMEAN = (2.*E2 + E1) / 3.                                        RAYT1025
      FMEAN = -(2.*F2+F1)/3.                                           RAYT1030
      YYYJ = YTOP                                                      RAYT1035
      IF(ZZZI) 860, 910                                                RAYT1040
  995 IF(J.LE.JS)996,997                                               RAYT1045
  996 RD=RD+R                                                          RAYT1050
      TD=TD+TAU                                                        RAYT1055
      URDDK=DRDDK-DRDK                                                 RAYT1060
      IF(ICASE .EQ. 1   .AND.   J .EQ. JS) RETURN                      RAYT1065
      GO TO 1000                                                       RAYT1070
  997 IF(ICASE.EQ.1)RETURN                                             RAYT1075
      RU=RU+R                                                          RAYT1080
      TU=TU+TAU                                                        RAYT1085
      DRUDK = DRUDK + DPDK                                             RAYT1090
 1000 CONTINUE                                                         RAYT1095
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      RETURN                                                    PAYT1103
1005  PP=1.E10                                                  PAYT1105
      RETURN                                                    PAYT1111
      END                                                       PAYT1113
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      SUBROUTINE POSITN                                                  POSI    1
      COMMON/TRAJ/NVEH,TIM(100),ZVEH(100),AMACH(100),PCH(100),YAW(100)   POSI    5
     X   ,  ALONG(100),ALAT(100),VEL(100),GAMMAR(100)                    POSI   10
      COMMON NMET,LCMAX,C(100),U(100),V(100),Z(100),YYY(100),VVV(100),   POSI   15
     1DDU(100),TTT(100),T(100),P(100),PH(100),SPD(100),DIR(100),ZWND(100)POSI   20
     2),ZMET(100),AAA(100),ZZZ(100),GGG(100),CCC(100)                    POSI   25
      COMMON/PARAM/ZS,YPOS,ZPOS,RNGV,AZV,PPCH,YYAW,AMCH,VVZ,VVXY,        POSI   30
     1 TZRO,RHZRO,CZRO,PZRO                                             POSI   35
C     SETS UP SOURCE PARAMETERS OF VEHICLE                               POSI   40
C     LOCATES SOURCE LEVEL IN DATA SYSTEM                                POSI   45
C     JS=LEVEL AT OR FIRST BELOW ZS.                                     POSI   50
C     SETS STARTING PARAMETERS FROM DATA (DIRECTIONAL)                   POSI   55
      IND=2                                                             POSI   60
      CALL DIVDIF (ZS,ZVEH,ALONG,NVEH,ANS1,ANS2,ANS3,IND)               POSI   65
      XPOS = (ANS1-ALONG(1))*6.373E6/57.295                             POSI   70
      IND=2                                                             POSI   75
      CALL DIVDIF (ZS,ZVEH,ALAT,NVEH,ANS1,ANS2,ANS3,IND)                POSI   80
      YPOS = (ANS1-ALAT(1))*6.373E6/57.295                              POSI   85
      XPOS = XPOS * COS(ANS1/57.295)                                    POSI   90
      RNGV= SQRT(XPOS**2 + YPOS**2)                                     POSI   95
      DO 40 I = 1,NVEH                                                  POSI  100
      IF(ABS((ALAT(1)-ALAT(I))/ALAT(1)) .LE. 0.00 ) 40,50               POSI  105
   40 CONTINUE                                                          POSI  110
   50 AZV = ATAN((ALONG(I) - ALONG(1))/(ALAT(I) - ALAT(1))              POSI  115
     X   * COS(ANS1/57.295) )                                           POSI  120
      IND=2                                                             POSI  125
      CALL DIVDIF (ZS,ZVEH,PCH,NVEH,ANS1,ANS2,ANS3,IND)                 POSI  130
      PPCH=ANS1                                                         POSI  135
      IND=2                                                             POSI  140
      CALL DIVDIF (ZS,ZVEH,YAW,NVEH,ANS1,ANS2,ANS3,IND)                 POSI  145
      YYAW=ANS1                                                         POSI  150
      IND=2                                                             POSI  155
      CALL DIVDIF (ZS,ZVEH,AMACH,NVEH,ANS1,ANS2,ANS3,IND)               POSI  160
      AMCH=ANS1                                                         POSI  165
      IND=2                                                             POSI  170
      CALL DIVDIF (ZS,ZVEH,VEL,NVEH,ANS1,ANS2,ANS3,IND)                 POSI  175
      VVX=ANS1                                                          POSI  180
      IND=2                                                             POSI  185
      CALL DIVDIF (ZS,ZVEH,GAMMAR,NVEH,ANS1,ANS2,ANS3,IND)              POSI  190
      VVXY = VVX * COS(ANS1/57.295)                                     POSI  195
      VVZ  = VVX * SIN(ANS1/57.295)                                     POSI  200
C     SETS UP SOURCE PARAMETERS OF ATMOSPHERE (NON DIRETIONAL)           POSI  205
      IND=2                                                             POSI  210
      CALL DIVDIF (ZS,ZMET,T,NMET,ANS1,ANS2,ANS3,IND)                   POSI  215
      TZRO=ANS1                                                         POSI  220
      IND=2                                                             POSI  225
      CALL DIVDIF (ZS,ZMET,PH,NMET,ANS1,ANS2,ANS3,IND)                  POSI  230
      RHZRO=ANS1                                                        POSI  235
      IND=2                                                             POSI  240
      CALL DIVDIF (ZS,ZMET,C,NMET,ANS1,ANS2,ANS3,IND)                   POSI  245
      CZRO=ANS1                                                         POSI  250
      IND=2                                                             POSI  255
      CALL DIVDIF (ZS,ZMET,P,NMET,ANS1,ANS2,ANS3,IND)                   POSI  260
      PZRO=EXP(ANS1)                                                    POSI  265
      PRINT 11                                                          POSI  270
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11 FORMAT(*1           SOURCE PARAMETERS *)                                    POSI 275
   AZVV=AZV*57.295                                                             POSI 281
   PRINT 13, ZS,XPOS,YPOS,PNGV,AZV,PPCH,YYAW,AMCH,VVZ,VVXY,TZRO,               POSI 285
  1RHZRO,CZRO,PZRO                                                             POSI 291
13 FORMAT(*0           SOURCE ALTITUDE    = *,E12.4,/                        POSI 295
  2        *           X-COORD            = *,E12.4,/                        POSI 300
  1        *           Y-COORD            = *,E12.4,/                        POSI 305
  3        *)          HORIZ RANGE        = *,E12.4,/                        POSI 310
  4        *0          VEHICLE AZIMUTH    = *,E12.4,/                        POSI 315
  5        *0          VEHICLE PITCH      = *,E12.4,/                        POSI 320
  6        *           VEHICLE YAW        = *,F12.4,/                        POSI 325
  7        *0          VEHICLE MACH NO.   = *,E12.4,/                        POSI 330
  1        *           VEHICLE Z-VELOCITY = *,E12.4,/                        POSI 335
  8        *0         VEHICLE XY-VELOCITY = *,E12.4,/                        POSI 340
  2        *0          T (ZS)             = *,F12.4,/                        POSI 345
  3        *0          DEW-POINT          = *,F12.4,/                        POSI 350
  4        *0          C (ZS)             = *,E12.4,/                        POSI 355
  5        *0          P (ZS)             = *,E12.4 )                        POSI 360
   RETURN                                                                     POSI 365
   END                                                                        POSI 370
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```
      SUBROUTINE RD MET                                                 RD M   1
      COMMON NMET,LCMAX,C(100),U(100),V(100),Z(100),YYY(100),VVV(100),  RD M   5
     1UUU(100),TTT(100),T(100),P(100),RH(100),SPD(100),DIR(100),ZWND(10RD M  11
     2),ZMET(100),AAA(100),ZZZ(100),GGG(100),CCC(100)                   RD M  15
   10 FORMAT (3I10)                                                     RD M  21
   12 FORMAT(11E12.3)                                                   RD M  25
C     READ DATA AND INTERPOLATE AND PRINT THE RESULTS.                  RD M  31
      READ 10, NMET,NWND,IMET                                           RD M  35
      PRINT 18, IMET,NMET                                               RD M  41
      IF(IMET.EQ.4)28,32                                                RD M  45
   28 DO 30 I=1,NMET                                                    RD M  51
      READ 12, ZMET(I),P(I),T(I),RH(I),DIR(I),SPD(I)                    RD M  55
      P(I)=ALOG(P(I))                                                   RD M  61
   30 CONTINUE                                                          RD M  65
      GO TO 40                                                          RD M  71
   32 DO 34 I=1,NMET                                                    RD M  75
      READ 12, ZMET(I),P(I),T(I),RH(I)                                  RD M  81
      P(I) = ALOG(P(I))                                                 RD M  85
   34 CONTINUE                                                          RD M  91
      DO 36 I = 1,NMET                                                  RD M  95
      READ 12, ZWND(I),DIR(I),SPD(I)                                    RD M 101
   36 CONTINUE                                                          RD M 105
   40 CALL FIXMET (IMET,NMET,NWND,ZWND,ZMET,P,T,RH,DIR,SPD,C,DPT)       RD M 111
    8 FORMAT(*1        Z        P(MB)        T(C)       DEW PT         DIR  RD M 115
     1      SPD            C        * // )                             RD M 121
      LMAX=NMET                                                         RD M 125
      PRINT 8                                                           RD M 130
      DO 50 I = 1,NMET                                                  RD M 135
      PP = EXP(P(I))                                                    RD M 141
      PRINT 12, ZMET(I),PP,T(I),RH(I),DIR(I),SPD(I),C(I)                RD M 145
   50 CONTINUE                                                          RD M 151
    1 FORMAT(A10)                                                       RD M 155
   18 FORMAT (*1          METEROLOGICAL OPTION * I10,*   NMET = *I4)    RD M 160
CCCCCCCCCCCCCCCC                                                        RD M 165
      RETURN                                                            RD M 171
      END                                                               RD M 175
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      SUBROUTINE FIXMET (IMET1,NMET,NWND,ZWND,ZMET,P,T,RH,DIR,SPD,C,OPT)FIXM    1
C     IMET=1 INTERPOLATES WIND INTO RADIOSONDE LEVELS                   FIXM    5
C     ENDS UP WITH NMET LEVELS                                          FIXM   11
C     IMET = 2 INTERPOLATES RADIOSONDE TO WIND LEVELS                   FIXM   15
C     IMET = 3 MERGES THE TWO                                           FIXM   21
C     ACCEPTS DATA AND MAKES UP ONE SOUNDING FOR ALL                    FIXM   25
C     ALSO COMPUTED SPEED OF SOUND                                      FIXM   31
      DIMENSION AA(80),BB(80),CC(80),DD(80),EE(80),AB(81),AC(80),AD(81),FIXM   35
     1AF(80),AG(80),AE(80),PL(80)                                       FIXM   41
      DIMENSION ZWND(1),ZMET(1),P(1),T(1),RH(1),DIR(1),SPD(1),C(1)      FIXM   45
      IF (IMET1 .EQ. 4) GO TO 65                                        FIXM   51
      GO TO (12,22,12),IMET1                                            FIXM   55
C     INTERPOLATES WIND AT RADIOSONDE LEVELS                            FIXM   61
   12 DO 18 I=1,NMET                                                    FIXM   65
      TT=ZMET(I)                                                        FIXM   71
      CALL INTRP(NWND,ZWND,DIR,TT,FT,IR)                                FIXM   75
      IF(IP)16,14                                                       FIXM   81
   14 DD(I)=SP(I)=99999.                                                FIXM   85
      GO TO 18                                                          FIXM   91
   16 DD(I)=FT                                                          FIXM   95
      CALL INTRP(NWND,ZWND,SPD,TT,FT,IR)                                FIXM  101
      EE(I)=FT                                                          FIXM  105
   18 CONTINUE                                                          FIXM  111
      GO TO (19,22,22),IMET1                                            FIXM  115
   19 DO 20 I=1,NMET                                                    FIXM  121
      SPD(I)=EE(I)                                                      FIXM  125
   20 DIR(I)=DD(I)                                                      FIXM  131
      GO TO 60                                                          FIXM  135
C     INTERPOLATES RADIOSOND TO WIND LEVELS                             FIXM  141
   22 DO 24 I=1,NMET                                                    FIXM  145
   24 PL(I)=LOGF(P(I))                                                  FIXM  151
      DO 30 I=1,NWND                                                    FIXM  155
      TT=ZWND(I)                                                        FIXM  161
      CALL INTRP(NMET,ZMET,PL,TT,FT,IR)                                 FIXM  165
      IF(IP)28,26                                                       FIXM  171
   26 AA(I)=BB(I)=CC(I)=99999.                                          FIXM  175
      GO TO 30                                                          FIXM  181
   28 AA(I)=EXP(FT)                                                     FIXM  185
      CALL INTRP(NMET,ZMET,T,TT,FT,IR)                                  FIXM  191
      BB(I)=FT                                                          FIXM  195
      CALL INTRP(NMET,ZMET,RH,TT,FT,IR)                                 FIXM  201
      CC(I)=FT                                                          FIXM  205
   30 CONTINUE                                                          FIXM  211
      GO TO (60,32,36),IMET1                                            FIXM  215
   32 DO 34 I=1,NWND                                                    FIXM  221
      P(I)=AA(I)                                                        FIXM  225
      T(I)=BB(I)                                                        FIXM  231
   34 RH(I)=CC(I)                                                       FIXM  235
      NMET=NWND                                                         FIXM  241
      GO TO 60                                                          FIXM  245
C     INTERPOLATES EACH INTO OTHER                                      FIXM  251
C     SOUNDINGS ALREADY INTERPOLATED. NOW MELD INTO ONE                 FIXM  255
   36 I=1                                                               FIXM  261
      J=1                                                               FIXM  265
      K=1                                                               FIXM  271
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   38 IF(ZMET(J)-ZWND(K))40,40,44                                    FIXM 275
   40 AB(I)=ZMET(J)                                                  FIXM 285
      AC(I)=P(J)                                                     FIXM 295
      AD(I)=T(J)                                                     FIXM 305
      AE(I)=RH(J)                                                    FIXM 315
      AF(I)=DD(J)                                                    FIXM 325
      AG(I)=EE(J)                                                    FIXM 335
      IF(J.LT.NMET)42,48                                             FIXM 345
   42 J=J+1                                                          FIXM 355
      I=I+1                                                          FIXM 365
      GO TO 38                                                       FIXM 375
   44 AB(I)=ZWND(K)                                                  FIXM 385
      AC(I)=AA(K)                                                    FIXM 395
      AD(I)=BB(K)                                                    FIXM 405
      AE(I)=CC(K)                                                    FIXM 415
      AF(I)=DIR(K)                                                   FIXM 425
      AG(I)=SPD(K)                                                   FIXM 435
      IF(K.LT.NWND)46,52                                             FIXM 445
   46 K=K+1                                                          FIXM 455
      I=I+1                                                          FIXM 465
      GO TO 38                                                       FIXM 475
   48 IF(K.LT.NWND)50,56                                             FIXM 485
   50 J=J+1                                                          FIXM 495
      I=I+1                                                          FIXM 505
      ZMET(J)=99999.                                                 FIXM 515
      GO TO 38                                                       FIXM 525
   52 IF(J.LT.NMET)54,56                                             FIXM 535
   54 K=K+1                                                          FIXM 545
      I=I+1                                                          FIXM 555
      ZWND(K)=99999.                                                 FIXM 565
      GO TO 38                                                       FIXM 575
   56 NMET=NWND=I                                                    FIXM 585
      DO 58 I=1,NMET                                                 FIXM 595
      ZMET(I)=AB(I)                                                  FIXM 605
      P(I)=AC(I)                                                     FIXM 615
      T(I)=AD(I)                                                     FIXM 625
      RH(I)=AE(I)                                                    FIXM 635
      DIR(I)=AF(I)                                                   FIXM 645
   58 SPD(I)=AG(I)                                                   FIXM 655
   60 CONTINUE                                                       FIXM 665
C     ON COMPLETION THERE IS ONE COMBINED WIND AND                   FIXM 675
C     RADIOSONDE OBSERVATION WITH NMET LEVELS OF                     FIXM 685
C     ZMET(I),ALTITUDE P(I),PRESSURE T(I),TEMPERATURE                FIXM 695
C     RH(I),RELATIVE HUMIDITY, DIRECT WIND DIRECTION AND             FIXM 705
C     SPD(I),WIND SPEED.                                             FIXM 715
C     CALCULATES SPEED OF SOUND.                                     FIXM 725
   65 DO 70 I=1,NMET                                                 FIXM 735
      TT=T(I)                                                        FIXM 745
      DPT = RH(I)                                                    FIXM 755
      CALL RELHUM(TT,DPT,VP,2)                                       FIXM 765
      TT=(TT+273.16)/(1.-3.*VP/(8.*EXP(P(I))))                       FIXM 775
   70 C(I)=331.45*SQRTF(TT/273.16)                                   FIXM 785
      RETURN                                                         FIXM 795
      END                                                            FIXM 805
```

```
      SUBROUTINE PARAB                                                    PARA    1
      COMMON LMAX,LCMAX,C(100),U(100),V(100),Z(100),YYY(100),VVV(100),    PARA    5
     1UUU(100),TTT(100),T(100),P(100),PH(100),SPD(100),DIR(100),ZWND(100PARA   10
     2),Y   (100),AAA(100),ZZZ(100),GGG(100),CCC(100)                     PARA   15
      DIMENSION YY(100),VV(100),CC(100),AA(100),ZZ(100),GG(100)           PARA   20
C     PARABOLIC LAYER MODEL.                                             PARA   25
C     ADJUSTS LAYERS AND GETS PARABOLA PARAMETERS.                       PARA   30
C     FIRST LAYER, TWO POINTS AND ONE TANGENT PARABOLA.                  PARA   35
      F1 = V(1)                                                          PARA   40
      F2 = V(2)                                                          PARA   45
      Z1 = Y(1)                                                          PARA   50
      Z2 = Y(2)                                                          PARA   55
      F2P = (V(3)-V(1))/(Y(3)-Y(1))                                      PARA   60
      DZ = Z2 - Z1                                                       PARA   65
      FS = (F2-F1)/DZ                                                    PARA   70
      C1 = (F2P-FS)/DZ                                                   PARA   75
      B1 = FS*2.*Z2/DZ - F2P*(Z1+Z2)/DZ                                  PARA   80
      A1 = F1 + (Z2*F2P-FS*(2*Z2-Z1))*Z1/DZ                              PARA   85
      AA (1) = A1 - (B1**2)/(4*C1)                                       PARA   90
      GG(1) = C1                                                         PARA   95
      ZZ(1) = -B1/(2.*C1)                                                PARA  100
      VV(1) = V(1) $ YY(1) = Y(1)                                        PARA  105
      CC (1) = C(1)                                                      PARA  110
      LM2 = LMAX - 2                                                     PARA  115
      LC = 1                                                             PARA  120
      DO 740 L = 2,LM2                                                   PARA  125
      LP = L + 1 $ LP2 = L + 2 $ LM = L - 1                              PARA  130
      F1 = V(L)                                                          PARA  135
      F2 = V(LP)                                                         PARA  140
      Z1 = Y(L)                                                          PARA  145
      Z2 = Y(LP)                                                         PARA  150
      FM = V(LM)                                                         PARA  155
      ZM = Y(LM)                                                         PARA  160
      FP2 = V(LP2)                                                       PARA  165
      ZP2 = Y(LP2)                                                       PARA  170
      DZ = Z2 - Z1                                                       PARA  175
      DF = F2 - F1                                                       PARA  180
      F1P = (F2 - FM)/(Z2-ZM)                                            PARA  185
      F2P = (FP2-F1)/(ZP2-Z1)                                            PARA  190
C     BOTTOM HALFLAYER.                                                  PARA  195
      A1 = F1                                                            PARA  200
      B1 = F1P*DZ/2.                                                     PARA  205
      C1 = (DF-(F2P+3.*F1P)*DZ/4.)/2. $ LC = LC + 1                      PARA  210
      IF(ABS (C1/B1).LT.1.E-3) GO TO 700                                 PARA  215
      AA(LC) = A1 - (B1**2)/(4.*C1)                                      PARA  220
      ZZ(LC) = Z1 - B1*DZ/(4.*C1)                                        PARA  225
      GG(LC) = 4.*C1/(DZ**2)                                             PARA  230
      GO TO 710                                                          PARA  235
  700 AA(LC) = A1                                                        PARA  240
      GG(LC) = 2.*B1/DZ                                                  PARA  245
      ZZ(LC) = 0.                                                        PARA  250
C     THIS ZZ(LC) VALUE FLAGS LINEAR FORM A + G(Z-Z0), Z0 = VALUE AT     PARA  255
C      BOTTOM.                                                           PARA  260
  710 CC(LC) = C(L)                                                      PARA  265
      YY(LC) = Y(L)                                                      PARA  270
```

```
      VV(LC) = V(L)                                                    PARA 275
C     TOP HALF LAYER.                                                  PARA 280
      A1 = (F1+F2-(F2P-F1P)*DZ/4.)/2.                                  PARA 285
      B1 = DF - (F2P + F1P)*DZ/4.                                      PARA 290
      C1 = -(DF-(3.*F2P+F1P)*DZ/4.)/2.                                 PARA 295
      LC = LC + 1                                                      PARA 300
      IF(ABS (C1/B1).LT.1.E-3) GO TO 720                               PARA 305
      AA(LC) = A1 - (B1**2)/(4.*C1)                                    PARA 310
      ZZ(LC) = (Z2+Z1)/2 - B1*DZ/(4.*C1)                               PARA 315
      GG(LC) = 4.*C1/(DZ**2)                                           PARA 320
      GO TO 730                                                        PARA 325
  720 AA(LC) = A1                                                      PARA 330
      GG(LC) = 2.*B1/DZ                                                PARA 335
      ZZ(LC) = 0.                                                      PARA 340
  730 CC(LC) = (C(L)+C(LP)-((C(LP2)-C(L))/(ZP2-Z1)-(C(LP)-C(LM))       PARA 345
     1 /(Z2-ZM))*DZ/4.)/2                                              PARA 350
      YY(LC) = (Z2+Z1)/2.                                              PARA 355
  740 VV(LC) = A1                                                      PARA 360
      LCMAX = LC                                                       PARA 365
C     CHECKS FOR MAX WITHIN HALF LAYERS AND RESUBDIVIDES.              PARA 370
      LC = 0                                                           PARA 375
      LM = LCMAX-1                                                     PARA 380
      DO 770 L = 1, LM                                                 PARA 385
      LC = LC + 1                                                      PARA 390
      AAA(LC) = AA(L)                                                  PARA 395
      ZZZ(LC) = ZZ(L)                                                  PARA 400
      GGG(LC) = GG(L)                                                  PARA 405
      CCC(LC) = CC(L)                                                  PARA 410
      YYY(LC) = YY(L)                                                  PARA 415
      VVV(LC) = VV(L)                                                  PARA 420
      LP = L + 1                                                       PARA 425
      Y1 = YY(L)                                                       PARA 430
      Y2 = YY(LP)                                                      PARA 435
      Y3 = ZZ(L)                                                       PARA 440
      IF (Y3.EQ.Y1) GO TO 770                                          PARA 445
C     MAX/MIN/LINEARITY DOES NOT FALL AT BOTTOM OF LAYERS.             PARA 450
      IF (Y3.GT.Y1.AND.Y3.LT.Y2) 750, 770                              PARA 455
C     MAX/MIN WITHIN LAYERS.                                           PARA 460
  750 IF (GG(L).GT.0.) 770, 760                                        PARA 465
C     SUBDIVIDES ON MAX WITHIN LAYERS.                                 PARA 470
  760 LC = LC + 1                                                      PARA 475
      AAA(LC) = AA(L)                                                  PARA 480
      ZZZ(LC) = ZZ(L)                                                  PARA 485
      GGG(LC) = GG(L)                                                  PARA 490
      CCC(LC) = CC(L) + (CC(LP)-CC(L))*(ZZ(L)-YY(L))/(YY(LP)-YY(L))    PARA 495
      YYY(LC) = ZZ(L)                                                  PARA 500
      VVV(LC) = AA(L)                                                  PARA 505
  770 CONTINUE                                                         PARA 510
      LCMAX = LC                                                       PARA 515
      VELS = 20.0468                                                   PARA 520
    6 FORMAT(*1          PARABOLIC DATA */8X*      A          G       PARA 525
     1    Z0          C          U          V          Z *)           PARA 530
      DO 775 I = 1, LCMAX                                              PARA 535
      IJ=I                                                             PARA 540
      IF((I-I/50*50).EQ.1) PRINT 6                                     PARA 545
```

```
      TTT(I) = ((CCC(I))/(VELS))**2                                          PARA 550
      UUU(I) = VVV(I) - CCC(I)                                               PARA 555
      TTT(1) = T(1) + 273.15                                                 PARA 560
      PRINT 791, IJ,AAA(IJ),GGG(IJ),ZZZ(IJ),CCC(IJ),UUU(IJ),VVV(IJ),YYY(PARA 565
     1IJ)                                                                    PARA 570
  791 FORMAT(I1J,7E12.4)                                                     PARA 575
  775 CONTINUE                                                               PARA 580
      RETURN                                                                 PARA 585
      END                                                                    PARA 590
```

```
      SUBROUTINE INTRP (NP,X,Y,T,FT,IR)                                 INTR   0
C     GENERAL LINEAR INTERPOLATION SUBROUTINE                           INTR   5
C     X IS ABSCISSA ARRAY                                               INTR  10
C     Y IS ORDINATE ARRAY                                               INTR  15
C     TT IS ABSCISSA FOR WHICH ORDINATE IS REQUIRED                     INTR  20
C     FT IS THE REQUIRED ORDINATE                                       INTR  25
C     IR IS RANGE INDICATOR, +1 IF IN RANGE, -1 IF OUT OF RANGE.        INTR  30
      DIMENSION X(25),Y(25)                                             INTR  35
      IR=1                                                              INTR  40
    1 DO 2 I=1,NP                                                       INTR  45
      IF(X(I)-T)2,3,4                                                   INTR  50
    2 CONTINUE                                                          INTR  55
      I=NP                                                              INTR  60
    3 FT=Y(I)                                                           INTR  65
      GO TO 5                                                           INTR  70
    4 K=I-1                                                             INTR  75
      FT=Y(K)+(Y(I)-Y(K))*(T-X(K))/(X(I)-X(K))                          INTR  80
    5 RETURN                                                            INTR  85
      END                                                               INTR  90
```

```
      SUBROUTINE RELHUM (TEMP,DPT,RH,IND)                                RELH    0
C     CONVERTS TEMPERATOR AND DEW POINT TO RELATIVE HUMIDITY WHEN IND=1  RELH    5
C     IND=2 RETURNS VAPOR PRESSURE                                       RELH   10
      DIMENSION T(11),E(11)                                              RELH   15
      DATA((E(I),I=1,11)=0.27,0.77,1.98,4.39,10.02,19.38,35.65,62.76,    RELH   20
     1106.11,173.11,273.3)                                               RELH   25
      DATA((T(I),I=1,11)=240.,250.,260.,270.,280.,290.,300.,310.,320.,   RELH   30
     1330.,350.)                                                         RELH   35
      I1=1                                                               RELH   40
      X=TEMP+273.16                                                      RELH   45
    1 IF(T(1)-X)2,2,8                                                    RELH   50
    2 DO 3 I=1,11                                                        RELH   55
      IF(T(I)-X)3,4,5                                                    RELH   60
    3 CONTINUE                                                           RELH   65
      GO TO 8                                                            RELH   70
    4 F1=E(I)                                                            RELH   75
      GO TO 9                                                            RELH   80
    5 K=I-1                                                              RELH   85
      AA=ALOG(E(I))                                                      RELH   90
      BB=ALOG(E(K))                                                      RELH   95
C     LINEAR INTERPOLATION ON E VS. T CURVE                              RELH  100
      F1=BB+(AA-BB)*(X-T(K))/(T(I)-T(K))                                 RELH  105
      IF(IND-1)9,9,10                                                    RELH  110
    9 GO TO (6,7),I1                                                     RELH  115
    6 F1=EXPF(F1)                                                        RELH  120
      I1=2                                                               RELH  125
      X=DPT+273.16                                                       RELH  130
      GO TO 1                                                            RELH  135
    7 F2=EXPF(F1)                                                        RELH  140
      RH=F2/F1                                                           RELH  145
      RETURN                                                             RELH  150
    8 RH=0.                                                              RELH  155
      RETURN                                                             RELH  160
C     IF IND=2, OUTPUTS VAPOR PRESSURE IN RH.                            RELH  165
   10 RH=EXPF(F1)                                                        RELH  170
      RETURN                                                             RELH  175
      END                                                                RELH  180
```

```
      SUBROUTINE DIVDIF (X,XX,YY,N,ANS1,ANS2,ANS3,IND)                  DIVD   0
C     INTERPOLATES AND GETS DERNATIVES ON BASIS OF DIVIDED DIFFS.       DIVD   5
C     X IS ABSCISSA FOR WHICH VALUES ARE REQUIRED                       DIVD  10
C     IND IS DEGREE OF INTEPP TO BE USED WHEN INPUT                     DIVD  15
C     XX IS TABLE OF ABSCISSA                                           DIVD  20
C     YY IS TABLE OF ORDINATES                                          DIVD  25
C     N IS NO. OF TABLE ENTRIES                                         DIVD  30
C     ANS1 IS INTERPOLATED VALUE                                        DIVD  35
C     ANS2 IS INTERPOLATED FIRST DERIVATIVE                             DIVD  40
C     ANS3 IS INTERPOLATED SECOND DERIVATIVE                            DIVD  45
C     IS CUBIC                                                          DIVD  50
      DIMENSION XX(1),YY(1)                                             DIVD  55
      IF(XX(1)-X)2,2,1                                                  DIVD  60
    1 IND = -1                                                          DIVD  65
      ANS1 = ANS2= ANS3=0.                                              DIVD  70
      RETURN                                                            DIVD  75
    2 DO 3 I=2,N                                                        DIVD  80
      IF(XX(I)-X)3,4,4                                                  DIVD  85
    3 CONTINUE                                                          DIVD  90
      GO TO 1                                                           DIVD  95
    4 K=I-1                                                             DIVD 100
      GO TO (5,6,9),IND                                                 DIVD 105
    5 A1=YY(K)                                                          DIVD 110
      A2=YY(K+1)                                                        DIVD 115
      B1=XX(K)                                                          DIVD 120
      B2=XX(K+1)                                                        DIVD 125
      F1=(A1-A2)/(B1-B2)                                                DIVD 130
      GO TO (51,52,52),IND                                              DIVD 135
   51 ANS1=A1+(X-B1)*F1                                                 DIVD 140
      ANS2=ANS3=0.                                                      DIVD 145
      GO TO 53                                                          DIVD 150
   52 ANS1=A1+(X-B1)*F1                                                 DIVD 155
      ANS2=F1                                                           DIVD 160
      ANS3=0.                                                           DIVD 165
   53 IND=1                                                             DIVD 170
      RETURN                                                            DIVD 175
    6 IF(K-1)1,7,8                                                      DIVD 180
    7 K=K+1                                                             DIVD 185
    8 A1=YY(K-1)                                                        DIVD 190
      A2=YY(K)                                                          DIVD 195
      A3=YY(K+1)                                                        DIVD 200
      B1=XX(K-1)                                                        DIVD 205
      B2=XX(K)                                                          DIVD 210
      B3=XX(K+1)                                                        DIVD 215
      F1=(A1-A2)/(B1-B2)                                                DIVD 220
      F2=(A2-A3)/(B2-B3)                                                DIVD 225
      G1=(F1-F2)/(B1-B3)                                                DIVD 230
      X1=X-B1                                                           DIVD 235
      X2=X-B2                                                           DIVD 240
      ANS1=A1+X1*(F1+X2*G1)                                             DIVD 245
      GO TO (81,82,83),IND                                              DIVD 250
   81 ANS2=ANS3=0.                                                      DIVD 255
      GO TO 84                                                          DIVD 260
   82 ANS2=F1+(X1+X2)*G1                                                DIVD 265
      ANS3=0                                                            DIVD 270
```

```
      IF(IND.EQ.3) 83,84                                          DIVD 275
   83 ANS3=2.*G1                                                  DIVD 280
   84 IND=2                                                       DIVD 285
      RETURN                                                      DIVD 290
    9 IF(K-1)1,10,11                                             DIVD 295
   10 K=K+1                                                       DIVD 300
      GO TO 13                                                    DIVD 305
   11 IF(N-1-K)12,13,13                                           DIVD 310
   12 K=K-1                                                       DIVD 315
   13 A1=YY(K-1)                                                  DIVD 320
      A2=YY(K)                                                    DIVD 325
      A3=YY(K+1)                                                  DIVD 330
      A4=YY(K+2)                                                  DIVD 335
      B1=XX(K-1)                                                  DIVD 340
      B2=XX(K)                                                    DIVD 345
      B3=XX(K+1)                                                  DIVD 350
      B4=XX(K+2)                                                  DIVD 355
      F1=(A1-A2)/(B1-B2)                                          DIVD 360
      F2=(A2-A3)/(B2-B3)                                          DIVD 365
      F3=(A3-A4)/(B3-B4)                                          DIVD 370
      G1=(F1-F2)/(B1-B3)                                          DIVD 375
      G2=(F2-F3)/(B2-B4)                                          DIVD 380
      H1=(G1-G2)/(B1-B4)                                          DIVD 385
      X1=X-B1                                                     DIVD 390
      X2=X-B2                                                     DIVD 395
      X3=X-B3                                                     DIVD 400
      ANS1=A1+X1*(F1+X2*(G1+X3*H1))                               DIVD 405
      GO TO (131,132,132),IND                                     DIVD 410
  131 ANS2=ANS3=0.                                                DIVD 415
      GO TO 134                                                   DIVD 420
  132 ANS2=F1+(X1+X2)*G1+(X1*X2+X1*X3+X2*X3)*H1                   DIVD 425
      ANS3=0.                                                     DIVD 430
      IF(IND.EQ.3) 133,134                                        DIVD 435
  133 ANS3=2.*(G1+(X1+X2+X3)*H1)                                  DIVD 440
  134 IND=3                                                       DIVD 445
      RETURN                                                      DIVD 450
      END                                                         DIVD 455
```

```
      SUBROUTINE SORT(N,X,Y)                                          SORT   0
      DIMENSION X(1),Y(1)                                             SORT   5
      N1=N-1                                                          SORT  10
      DO 50 I=1,N1                                                    SORT  15
      DO 50 K=I,N1                                                    SORT  20
      J=K+1                                                           SORT  25
      IF(X(J).GE.X(I)) GO TO 50                                       SORT  30
      S=X(J)                                                          SORT  35
      X(J)=X(I)                                                       SORT  40
      X(I)=S                                                          SORT  45
      S=Y(J)                                                          SORT  50
      Y(J)=Y(I)                                                       SORT  55
      Y(I)=S                                                          SORT  60
   50 CONTINUE                                                        SORT  65
      RETURN                                                          SORT  70
      END                                                             SORT  75
```

```
      SUBROUTINE FIXVEH (IVEH,NVEH,TIM,ZVEH,AZV,RNG, PCH,YAW,VX,VY,VZ)  FIXV    0
C     COMPUTES REQUIRED TRAJ DATA AS BEST IT CAN FROM INPUT             FIXV    5
C     IVEH=1, FOR VX,VY,VZ WITH RESPECT TO TRACECTORY                   FIXV   10
C     PLANE. ROTATES TO N-E-COORDINATES                                 FIXV   15
C     IVEH=2, VX,VY,VZ COMPUTED NO N-E-COORDS.                          FIXV   20
C     IVEH=1, PCH,YAW ALSO COMPUTED,YAW=0.                              FIXV   25
C     NVEH = NUMBER OF TRAJECTORY LEVELS                                FIXV   30
C     TIM(I) = TIME FROM START (SECONDS)                                FIXV   35
C     VEH(I) = ALTITUDE OF VEHICLE (KILOMETERS)                         FIXV   40
C     RNG(I) = RANGE FROM LAUNCH (KILOMETERS)                           FIXV   45
C     AZV(I) = AZIMUTH FROM NORTH (DEGREES CLOCKWISE)                   FIXV   50
C     PCH(I) = PITCH DEGREES                                            FIXV   55
C     YAW(I) = DEGREES FROM TRAJECTORY PLANE                            FIXV   60
C     VX(I) = VEHICLE SPEED (EAST COMPONENT)                            FIXV   65
C     VY(I) = VEHICLE SPEED (NORTH COMPONENT)                           FIXV   70
C     VZ(I) = VEHICLE SPEED (VERTICLE COMPONENT)                        FIXV   75
      DIMENSION TIM(1),ZVEH(1),AZV(1),RNG(1), PCH(1),YAW(1),VX(1),VY(1),FIXV   80
     1VZ(1)                                                             FIXV   85
      NVEHM=NVEH-1                                                      FIXV   90
      DO 2 I=1,NVEHM                                                    FIXV   95
      IF(I-1)2,2,4                                                      FIXV  100
    2 IS=2                                                              FIXV  105
      GO TO 6                                                           FIXV  110
    4 IS=I                                                              FIXV  115
    6 IP=IS+1                                                           FIXV  120
      IM=IS-1                                                           FIXV  125
      ANG=AZV(I)*0.01745329                                             FIXV  130
      SAZV=SINF(ANG)                                                    FIXV  135
      CAZV=COSF(ANG)                                                    FIXV  140
      GO TO (8,10,10),IVEH                                              FIXV  145
    8 AX=VX(I)*CAZV-VY(I)*SAZV                                          FIXV  150
      AY=VX(I)*SAZV+VY(I)*CAZV                                          FIXV  155
      VX(I)=AX                                                          FIXV  160
      VY(I)=AY                                                          FIXV  165
      GO TO 14                                                          FIXV  170
   10 DT=TIM(IP)-TIM(IM)                                                FIXV  175
      DRDT=(RNG(IP)-RNG(IM))/DT                                         FIXV  180
      DTHDT=(AZV(IP)-AZV(IM))/DT                                        FIXV  185
      DZDT=(ZVEH(IP)-ZVEH(IM))/DT                                       FIXV  190
      VX(I)=DRDT*SAZV+RNG(I)*CAZV*DTHDT                                 FIXV  195
      VY(I)=DRDT*CAZV-RNG(I)*SAZV*DTHDT                                 FIXV  200
      VZ(I)=DZDT                                                        FIXV  205
      GO TO (14,14,12),IVEH                                             FIXV  210
   12 PCH(I)=ATANF(DZDT/DRDT)                                           FIXV  215
      YAW(I)=0.                                                         FIXV  220
   14 CONTINUE                                                          FIXV  225
      RETURN                                                            FIXV  230
      END                                                               FIXV  235
```