UNIVERSITY OF CALIFORNIA, SAN DIEGO
SCRIPPS INSTITUTION OF OCEANOGRAPHY
VISIBILITY LABORATORY
SAN DIEGO, CALIFORNIA 92152

COMPUTERIZED VISIBILITY CALCULATIONS MAXIMUM SIGHTING RANGE PROGRAM

IVAN HARRY BARKDOLL III.

SIO Ref. 67-23
July 1967

Department of the Navy
Naval Ship Systems Command
Contract NObs-92058, Task III
NASA Interagency Fund Transfer R-139

Contents

		Page No.
I.	Introduction	1
II.	Summary and Illustrative Examples	2
	II.1 Brief Description of the Calculation	2
	II.2 Illustrative Examples	4
	II.3 Extension to Non-Circular Objects	6
III.	Calculations	6
	III.1 Object Definition	6
	III.2 Background Definition	7
	III.2.1 Directional Luminous Reflectance of the Object	7
	III.3 Reflectance Data	7
	III.3.1 Inherent Background Luminance	7
	III.4 Calculation of Inherent Contrast	8
	III.5 Calculation of Apparent Contrast	8
	III.6 Atmospheric Optical Data	10
	III.6.1 Transmission Media	10
	III.6.2 General	10
	III.6.3 Atmospheric Beam Transmittance	10
	III.6.4 Path Luminance	11
	III.6.5 Apparent Background Luminance B	12
	III.7 Vision Data	13
	III.7.1 General	13
	III.7.2 Change in Target Diameter	14
	III.7.3 Probability of Detection other than 50%	14
IV.	The Computer Program	15
	IV.1 General	15
	IV.2 Description of PODV1	15
	IV.2.1 Program ACI1	15
	IV.2.2 Program PODV1	17
	IV.2.3 Subroutine Data 1	17
	IV.2.4 Subroutine Data 2	17
	IV.2.5 Subroutine Data 3	18
	IV.2.6 Subroutine TCAL	18
	IV.2.7 Subroutine PLTSU	18
	IV.2.8 Subroutine PLOT 1	18
	IV.2.9 Function Routines	19
V.	Conclusions	19

Contents (contd)

		Page No.
APPENDIX A		21
Vision Data		21
APPENDIX B		27
B1	PROGRAM ACI1 and SUBROUTINE TIFIN	28
B2	PROGRAM PODV1	36
B3	SUBROUTINE DATA 1	39
B4	SUBROUTINE DATA 2	43
B5	SUBROUTINE DATA 3	47
B6	SUBROUTINE TCAL	49
B7	FUNCTION TRF	57
B8	FUNCTION BSTRF	62
B9	FUNCTION TROF	66
B10	FUNCTION BSTOF	68
B11	FUNCTION BBOF	70
B12	FUNCTION COF	73
B13	SUBROUTINE PLTSU	76
B14	SUBROUTINE PLOT 1	80
APPENDIX C		83
Input and Output Examples from PODV1		83

COMPUTERIZED VISIBILITY CALCULATIONS
MAXIMUM SIGHTING RANGE PROGRAM

Ivan Harry Barkdoll III

I. INTRODUCTION

The distance at which an object can be detected is a complex function of the properties of the object, the background, the lighting geometry, the transmission medium, and the human visual system. The science of predicting detection range is termed *visibility*, and a specific numerical treatment of the pertinent factors to obtain a quantitative prediction is termed *visibility calculation*. The history and present state of the art of visibility calculations are well summarized in existing literature.[1]

The data on objects, backgrounds, lighting geometries, transmission media, and the visual system are far from complete. However, sufficient data are in existence to allow calculations to be made for a large number of important cases of practical interest. The large number of important variables involved in a visibility calculation creates a situation in which a modest quantity of input data permutes into an extremely large number of individual prediction calculations. In the most prevalent application of visibility calculations the user is unable to state a specific set of conditions under which the observations will be made, but instead, is interested in exploring the sensitivity of the predictions to the variables. This means that an extremely large number of calculations are frequently required.

The numerical operations involved in visibility calculations are well established, and within the limitations of the existing environmental and vision data, such calculations can be performed in a straightforward manner. However, visibility calculations performed with tables, hand calculators, graphical overlays, etc., are so slow that it is impractical to make a sufficient number of calculations to allow a reasonable exploration of the variables.

The program of research which is described in this progress report has as a goal, the development of computer programs which allow the use of high-speed digital computers for performing visibility calculations. The research is funded by a NASA transfer of funds to Bureau of Ships Contract NObs-92058 between the Naval Ship Systems Command and the University of California.

This report deals specifically with the first step of this research which treats the case of maximum sighting range calculations for circular objects. The case is defined by stating that the observer knows where to look, i.e., no search is involved, and he has unlimited time for his observations. The output from the calculation is the numerical definition of the boundary of the volume within which the object can be detected. In many ways this represents the most simple type of visibility calculation and as such represents the logical starting point for the research in developing computer solutions for visibility calculations.

[1] S. Q. Duntley, et al. Appl. Opt., 3, 550 (1964).

Continuing research effort is being directed toward the more complex cases involving dynamic viewing geometries where visual search is required. The case of visual search is beyond the scope of this report, but will be the subject of future reports which will be issued upon the completion of logical units of the computer program development.

Sec. II. of the present report gives a brief non-mathematical description of the calculation and gives illustrative examples of calculations which have been made with the program, Sec. III. presents the mathematics of the calculation, Sec. IV. describes the details of the computer program (aided by several appendices), and Sec. V. offers conclusions and a brief description of the future work.

II. SUMMARY AND ILLUSTRATIVE EXAMPLES

II.1 Brief Description of the Calculation

A maximum sighting range calculation combines data on the object, background, lighting geometry, transmission medium, and the human visual system to predict the maximum range at which the particular object in its specific environment can be visually detected. As indicated in Sec. I.. the calculations reported here are limited to circular objects. The extension of the program to include complex non-circular objects is discussed in Sec. II.3.

The calculation begins by determining the inherent contrast of the object for a selected path of sight. Throughout this report contrast is defined as the luminance of the object minus the luminance of the background, divided by the luminance of the background. Inherent contrast means the contrast which would exist in the absence of any contrast reduction. The computer program allows the inherent contrast to be specified directly in the input data or calculated from a specification of the directional reflectance properties of the object and background and a numerical value for the illuminance associated with the scene.

The next step in the calculation is to compute the contrast reduction associated with the path of sight. This calculation, which uses appropriate input data, includes the contrast transmittance of the atmosphere, window, and optical system (if any). Where an atmosphere is present the contrast transmittance will change with the range to the object. When the inherent contrast is multiplied by the contrast transmittance, the *apparent contrast* is obtained. This is the contrast available to the eye of the observer. A typical plot of apparent contrast as a function of range is shown in Fig. 2-1.

The next step is to introduce the visual threshold data. The Tiffany data which is used in this program defines contrast threshold as a function of the angular subtense of circular, uniform luminance objects viewed against a uniform background. The conditions under which the data were acquired included the fact that the observer knew where to look, i.e., no visual search was required, and that the observer had as much time to make the observation as he required. It is in the sense of these conditions that the calculation produces a *maximum* sighting range.

Since the Tiffany data are given in terms of angular subtense, the first step in the computer calculation is to transform the contrast threshold values into functions of range for a specified object size. A plot of the vision data can then be superimposed on Fig. 2-1 to give the result shown in Fig. 2-2.

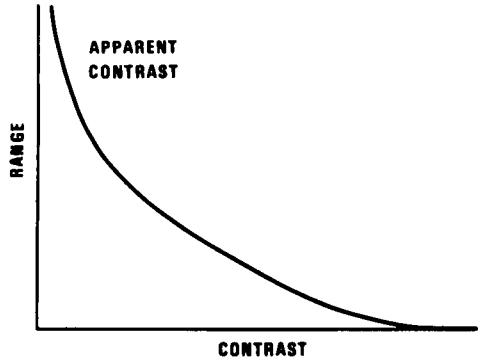


Figure 2-1

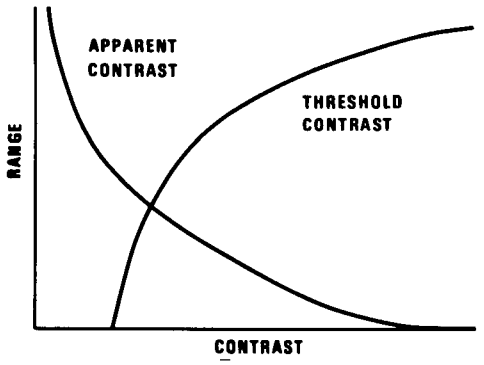


Figure 2-2

From this simultaneous plot of contrast *required* (contrast threshold) and contrast *available* (apparent contrast) it is clear that detection can occur at any range less than that associated with the intersection of these two curves, i.e., in the region where there is more contrast available than is required. The computer calculation determines this point of intersection and tabulates the detection range for this path of sight. Fig. 2-2 shows a single threshold contrast curve. Actually there is a family of such curves, one for each specific probability of detection associated with the threshold data. The computer program determines the detection range for whichever value or values of detection probability which are specified by the user.

The calculation described above defines the detection range for one particular path of sight. The program repeats the calculation for the necessary number of paths of sight required to adequately define the detection volume. The volume is defined by four vertical planes whose azimuths with respect to the sun are 0°, 45°, 90°, and 135°. The planes are sketched in Fig. 2-3. For each of these vertical planes fifteen paths of sight are calculated corresponding to zenith angles (measured from the vertical) of $\pm 95°$, $\pm 100°$, $\pm 105°$, $\pm 120°$, $\pm 135°$, $\pm 150°$, $\pm 165°$, and 180°.

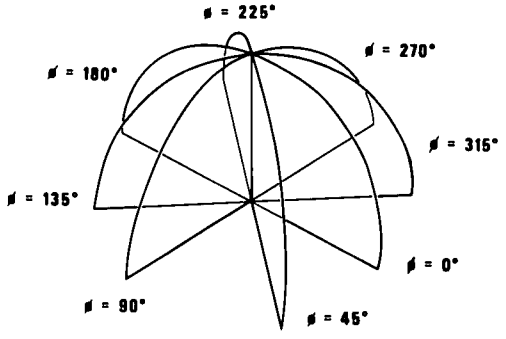


Figure 2-3

The computer output consists of tabular data and automatic plots of the fifteen detection ranges corresponding to the fifteen paths of sight for each of the four azimuth planes shown in Fig. 2-3. Examples of these plots are shown in Sec. II.2.

II.2 Illustrative Examples

Figs. 2-4 through 2-11 are direct photographic reproductions of the computer plots for a series of trial calculations. A detailed description of these calculations is given in Appendix C. The calculations utilized measured atmospheric, object reflectance, and background reflectance data specifically referenced in Appendix C.

A summary of the distinguishing features of the calculations is as follows:

Fig. 2-4 was calculated using specific atmospheric data for a solar zenith angle of 41.5°. The background was assumed to be pine trees and used measured directional reflectance data. The object was a 100-foot-diameter circular object always oriented perpendicular to the path of sight, i.e., always appearing to be circular. Its directional reflectance properties were assumed to be those of data for a specific haze gray paint. Detection probability was chosen to be 50%, i.e., the contrast thresholds were adjusted to a 50% level.

Fig. 2-5 is the same case as 2-4, but with a probability of 70%.

Fig. 2-6 is the same case as 2-4, but with a probability of 90%.

Fig. 2-7 is the same case as 2-4, but with an object diameter of 10 feet.

Fig. 2-8 is the same case as 2-4, but with an object diameter of 1 foot.

Fig. 2-9 is the same case as 2-4, but with an object diameter of 1 foot and with the directional reflectance properties of calm water.

Fig. 2-10 is the same case as 2-4, but includes the transmission properties of an optical system. The optical system data is purely artificial. The example was run for the purpose of testing the optical system subroutine.

Fig. 2-11 is the same case as 2-10, but with no atmosphere. The example was run for the purpose of testing the ability to bypass the atmospheric data subroutine for those cases where an atmosphere is not involved.

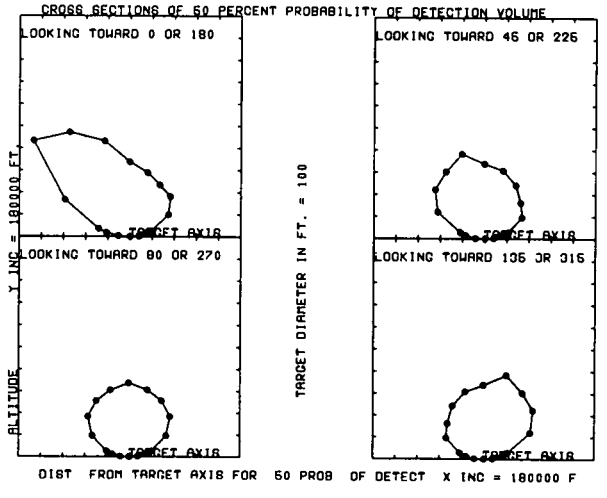


Figure 2-4

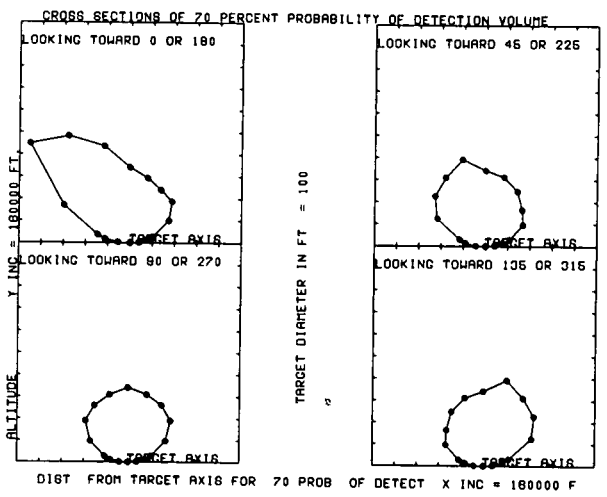


Figure 2-5

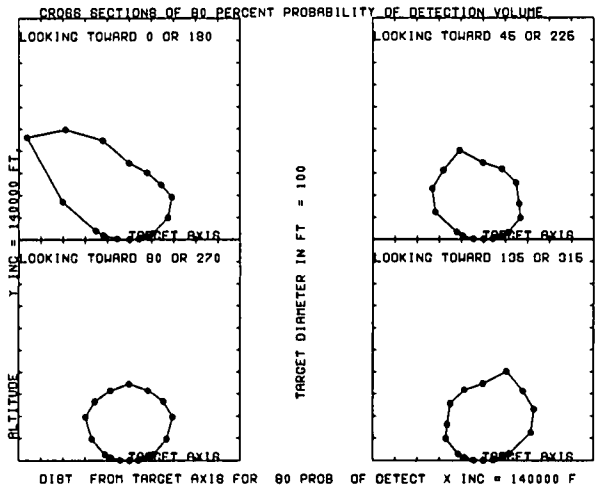


Figure 2-6

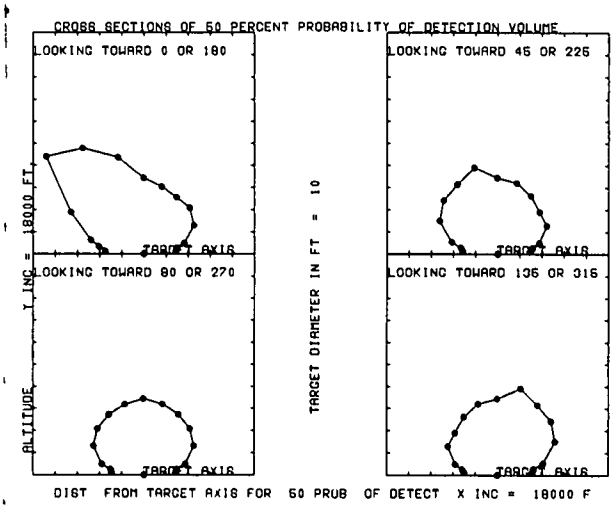


Figure 2-7

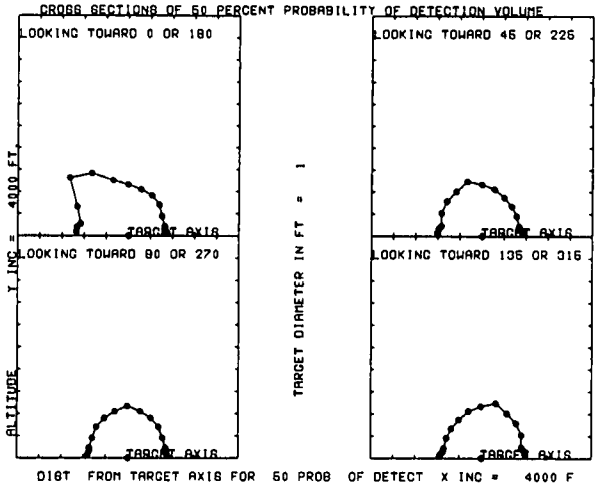


Figure 2-8

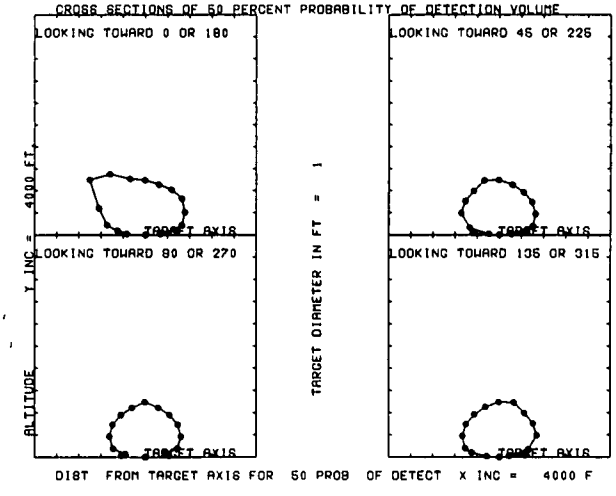


Figure 2-9

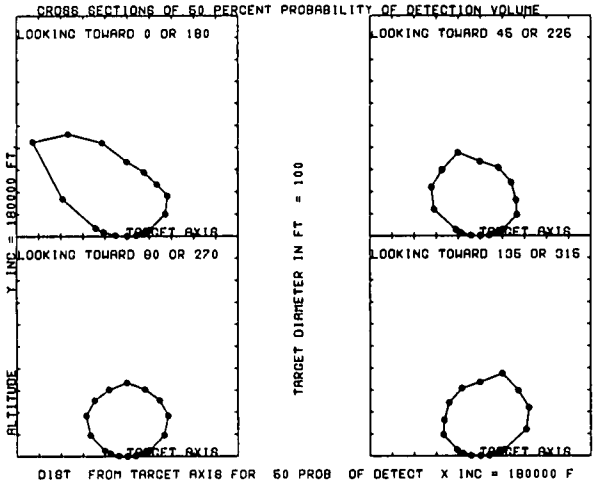


Figure 2-10

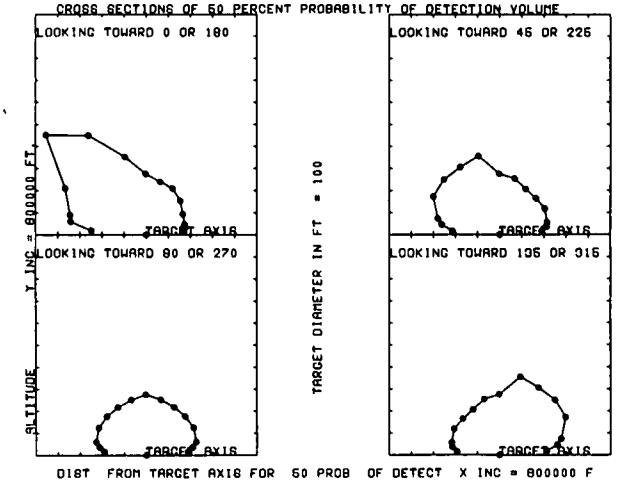


Figure 2-11

II.3 Extension to Non-Circular Objects

Although considerable insight can be gained as to the relative importance of the various factors involved in a visibility calculation by making such calculations for circular objects, the fact remains that most objects of interest are not circular nor of uniform luminance. The general case of calculations for non-circular, nonuniform objects has been studied extensively by this Laboratory.[2]

Previous studies have indicated that under threshold conditions, the human visual system may be approximated as a linear system. This means that the characteristics of the visual system may be described by a spatial weighting function, variously called a summative function, element contribution function, etc. This function, which can be determined from threshold data for circular objects, when convolved with the luminance map of a complex object allows prediction of the threshold for the complex object. During the program of research described in reference 2, computer programs were developed which (1) derive the summative function from appropriate circular object threshold data and (2) perform the convolution of the summative function with the luminance map of the object and (3) numerically specify the detectability of the complex object as a function of visual range.

These previously developed computer programs, when coupled with the newly developed computational tools described in this report, will allow ready extension of the maximum sighting range calculation to the case of complex objects. The two programs are not presently compatible, and considerable rewriting of the earlier program will be required before the combination can be used efficiently. This conversion will be accomplished in the near future.

III. CALCULATIONS

III.1 Object Definition

The maximum sighting range program as described in this report assumes that the object to be detected is projected into the path of sight as a uniform luminance circle. The photometric properties of the circle are specified by indicating *either* (a) the luminance, (b) the contrast with respect to the background, or (c) the directional reflectance for each path of sight.[1] The object must be defined in this way for paths of sight corresponding to azimuth angles with respect to the sun of 0°, ±45°, ±90°, ±135°, and 180° with zenith angles of the path of sight of 95°, 100°, 105°, 120°, 135°, 150°, 165°, and 180° for each azimuth. The program as presently written assumes symmetry about the azimuth of the sun.

[2] J. L. Harris, Appl. Opt. 3, 587

III.2 Background Definition

The background specification is similar to that required for the object. The photometric properties of the background are specified by indicating *either* (a) the luminance, or (b) the directional reflectance for each path of sight. The background must be defined for paths of sight corresponding to azimuth angles with respect to the sun of 0°, ±45°, ±90°, ±135°, and 180° with zenith angles of the path of sight of 95°, 100°, 105°, 120°, 135°, 150°, 165°, and 180° for each azimuth.

The computer program utilizes vision data derived from detection experiments of circular objects viewed against a uniform background. The present program is therefore restricted to the case in chich the object to be detected is located on a background which, at least immediately surrounding the object is "reasonably" uniform. "Reasonably" may be defined as meaning that in the luminance map which represents the object and background, any non-uniformities or structure in the background surrounding the object is of low contrast compared to the luminance structure of the object itself.

III.2.1 Directional Luminous Reflectance of the Object

The measured directional luminous reflectance values for the object are provided as a table with values for the same zeniths and azimuths of path of sight. The samples of program output in Appendix C use reflectance values for a background of pine trees, or reflectance values for a background of clear water of infinite optical depth. Both examples use target reflectance values for haze gray paint. The data for the paint was taken with a goniophotometer for similar lighting conditions to those during Flight 74. The reflectance data for the water were computed from equations by Duntley (1952) for lighting conditions similar to Flight 74.

III.3 Reflectance Data

III.3.1 Inherent Background Luminance

Flight 74 was flown over a background of small uniformly spaced pine trees. A table of Directional Luminous Reflectance values (${}_bR_o$) for pine trees was computed for thetas of 180°, 165°, 150°, 135°, 120°, 105°, 100°, and 95°, and phis of 0°, 45°, 90°, 135°, and 180°. The pre-subscript, b, denotes background and the post-subscript, o, indicates inherent, i.e., zero range. The computer program has used this table for one background, and a similar table of reflectance values for calm water with infinite optical depth for another background. The equation for inherent background luminance in foot lamberts is

$$ {}_bB_o(0,\theta,\phi) = (5940)\ {}_bR_o(0,\theta,\phi) $$

where 5940 lumens per square foot was the total illuminance on a fully exposed horizontal plane at sea level during Flight 74. The parenthetic attachments (z,θ,ϕ) define the path of sight. The altitude of the observer, zero in this case, is denoted by z. The zenith of path of sight is denoted by θ, and the azimuth of path of sight by ϕ.

III.4 Calculation of Inherent Contrast

The *inherent luminance of the object* is that object luminance which would be measured in the absence of any contrast reduction mechanism such as atmosphere or an optical system. The symbol for inherent object luminance is ${}_{T}B_{o}$, where the pre-subscript, T, indicates object (or target) and the post-subscript, o, indicates inherent, i.e., zero range. In a similar manner the *inherent background luminance* is ${}_{b}B_{o}$ where the pre-subscript b indicates background. The inherent contrast of the object is defined by the equation

$$C_{o} = \frac{{}_{T}B_{o} - {}_{b}B_{o}}{{}_{b}B_{o}} \tag{3-1}$$

The luminance of the object and background will in general be different for each path of sight.

Due to the fact that the inherent contrast between a target and a background may change sign, the program uses the absolute value of C_{o}. However, the correct sign of C_{o} is shown on the printed output.

III.5 Calculation of Apparent Contrast

As the optical signal generated by the object and background is propagated to the observer, two mechanisms act to reduce the contrast. The first of these mechanisms is the attenuation of flux from the scene due to scattering and absorption. The attenuation is quantitatively defined by the beam transmittance T_{r}, the subscript indicating transmission over a path length r. The second mechanism is the flux which is scattered into the path of sight from the lighting environment, i.e., sun, sky, earthshine, etc. This component of the contrast reduction is quantitatively defined by the path luminance B_{r}^{*}.

The *apparent contrast* is obtained directly by application of the two components of the contrast reduction, i.e., the *apparent luminance of the object* is

$${}_{T}B_{r} = {}_{T}B_{o}T_{r} + B_{r}^{*}, \tag{3-2}$$

and the apparent luminance of the background is

$${}_{b}B_{r} = {}_{b}B_{o}T_{r} + B_{r}^{*}, \tag{3-3}$$

The apparent contrast of the object is by definition

$$C_r = \frac{{}_TB_r - {}_bB_r}{{}_bB_r} \tag{3-4}$$

By substitution for the apparent luminance

$$C_r = \frac{({}_TB_oT_r + B_r^*) - ({}_bB_oT_r + B_r^*)}{{}_bB_oT_r + B_r^*} \tag{3-5}$$

The contrast transmittance is the ratio of the apparent and inherent contrast, so that

$$T_C = \frac{C_r}{C_o} = \frac{\dfrac{({}_TB_o - {}_bB_o)\,T_r}{{}_bB_oT_r + B_r^*}}{\dfrac{({}_TB_o - {}_bB_o)}{{}_bB_o}} \tag{3-6}$$

This reduces to

$$T_C = \frac{{}_bB_oT_r}{{}_bB_oT_r + B_r^*} \tag{3-7}$$

or

$$T_C = \frac{1}{1 + \dfrac{B_r^*}{{}_bB_oT_r}} \tag{3-8}$$

other formulations of contrast transmittance appear in the literature.[3] This basic equation for contrast transmittance applies to an atmosphere, an optical system, a window, or any combination of the three. The calculation must use the beam transmittance and path luminance associated with the total path of sight. The apparent contrast is calculated by the equation

$$C_r = C_oT_C.$$

Where atmospheric attenuation is involved, the apparent contrast will be a function of range.

---

[3] S. Q. Duntley, A. R. Boileau, and R. W. Preisendorfer (1957), J. Opt. Soc. Am. 47 499.

III.6 Atmospheric Optical Data

III.6.1 Transmission Media

The calculation includes the contrast reduction resulting from (1) atmospheric transmission properties and/or (2) optical instrument or windshield transmission properties. These two types of contrast reduction mechanisms are handled in separate subroutines so that either (1) or (2), (1) and (2), or neither can be included as appropriate to the particular problem being considered.

The specification of the transmission media is identical for (1) and (2) and consists of specifying the beam transmittance (transmission of image forming rays from object) and the path luminance (flux scattered into the path of sight). These two parameters must be numerically specified for each of the paths of sight corresponding to the 8 azimuths with respect to the sun and the 8 zenith angles as indicated in paragraphs III.1 and III.2.

III.6.2 General

The present package of atmospheric optical data used by the computer program was compiled from the output of the Visibility Laboratory's airborne instrument system used in a B-29 aircraft. The particular data used were taken on Flight 74 over an area south of Crestview, Florida about mid-day on 28 February 1956.[4] The day was cloudless, but with a pronounced haze in the first 4 000 feet of altitude. The airborne photometers started taking data at 20 000 feet and continued at descending increments to 1 000 feet. Data were recorded simultaneously at sea level by photometers in an instrument van beneath the flight pattern. The average solar zenith angle during the flight was 41.5°.

III.6.3 Atmospheric Beam Transmittance

Beam transmittance is calculated in three ways, depending on the altitude. From zero through 20 000 feet ${}^{a}T_{r}(z, \theta)$ is calculated by a summation of measured attenuation lengths $L_{(z)}$. The attenuation lengths are in nautical miles and were obtained every 100 feet from 1 000 feet to 20 000 feet. The $L_{(z)}$ values were extrapolated from 1 000 feet down to ground level. The equation is

$$ {}^{a}T_{r}(z, \theta) = \exp - \left[\left(\sum_{2}^{n-1} \frac{1}{L_{(z)}} \Delta z \right) + \left(\frac{1}{L_{(z)_1}} + \frac{1}{L_{(z)_n}} \right) \frac{\Delta z}{2} \right] f(z, \theta) $$

[4] A. R. Boileau, Visibility, Section VI Atmospheric Properties, Applied Optics 3, No. 5 (1964), pp. 570-581.

where Δz, in nautical miles is the distance between the altitudes for the consecutive attenuation lengths, and n is the number of 100-foot increments for the desired altitude. The term $f(z, \theta)$ is a geometric correction for path length for paths of sight other than the straight downward-looking case. This term $f(z, \theta)$ is equal to $\sec(180° - \theta)$ for all values of θ greater than 100°. For thetas of 100° and 95°, i.e., near horizontal paths of sight, $f(z, \theta)$ is poorly approximated by the secant function and is therefore estimated from optical air mass tables for the given altitude and theta.[5] These relative optical air mass values are incorporated in the program as a table of constants. From 20 000 feet through 60 000 feet ${}^{a}T_{r}(z, \theta)$ is found by interpolating a table of extrapolated values of atmospheric beam transmittance ${}^{a}T_{r_{ext}}(z, 180°)$ based on optical standard atmosphere. For paths of sight other than $\theta = 180°$,

$$ {}^{a}T_{r}(z, \theta) = \left[{}^{a}T_{r_{ext}}(z, 180°) \right]^{f(z, \theta)} $$

Above 60 000 feet beam transmittance is found by the equation

$$ {}^{a}T_{r}(z, \theta) = \left\{ {}^{a}T_{r}(60\,000, 180°) \left[\exp - \frac{4.94}{L_{z_{60\,000}}} \left(1 - \exp \left(\frac{z - 60\,000}{30\,000} \right) \right) \right] \right\}^{f(z, \theta)} $$

The values 4.94 N.Mi. and 30 000 feet are constants from the optical standard atmosphere. $L_{z_{60\,000}}$ is the extrapolated attenuation length for 60 000 feet.

III.6.4 Path Luminance

The atmospheric path luminance values of ${}^{a}B_{r}^{*}(z, \theta, \phi)$ derived from Flight 74 were compiled into tables. Altitude values range from 1 000 feet through 20 000 feet with extrapolations to 60 000 feet. The tables have path luminance values for thetas of 180°, 165°, 150°, 135°, 120°, 105°, 100°, and 95°. There is a table of ${}^{a}B_{r}^{*}(z, \theta)$ values for each of five different azimuths, ϕ.

Path luminance values used by the program from 0 to 60 000 feet for all values of θ, except $\theta = 95°$, are found by linear interpolation of ${}^{a}B_{r}^{*}(z, \theta, \phi)$ table values. When $\theta = 95°$, path luminance values are found by linear interpolation of ${}^{a}B_{r}^{*}(z, \theta, \phi)$ table values up to 20 000 feet. For a θ of 95° above 20 000 feet path luminance is calculated by the equation

$$ {}^{a}B_{r}^{*}(z, 95°, \phi) = \frac{{}^{a}B_{r}^{*}(20\,000, 95°, \phi) \left\{ 1 - {}^{a}T_{r}(z, 180°)^{\text{secant}\,(180° - 95°)} \right\}}{1 - {}^{a}T_{r}(20\,000, 180°)^{\text{secant}\,(180° - 95°)}} $$

[5] F. Kasten, "A New Table and Approximation Formula for the Relative Optical Air Mass." Cold Regions Research and Engineering Laboratory, U.S. Army Materiel Command, Hanover, New Hampshire (1964).

For altitudes above 60 000 feet, for thetas other than 95°, path luminance is calculated by the equation

$$ {}^{a}B_r^*(z, \theta, \phi) = \frac{{}^{a}B_r^*(60\,000, \theta, \phi)\left[1 - {}^{a}T_r(z, 180°)^{\text{secant}(180° - \theta)}\right]}{1 - {}^{a}T_r(60\,000, 180°)^{\text{secant}(180° - \theta)}} $$

III.6.5 Apparent Background Luminance B

The apparent background luminance for any path of sight and altitude is calculated from the equation

$$ {}_{b}B_r(z, \theta, \phi) = {}_{b}B_o(0, \theta, \phi)\, T_r(z, \theta) + B_r^*(z, \theta, \phi). $$

$T_r(z, \theta)$ and $B_r^*(z, \theta, \phi)$ are the values of beam transmittance for the path of sight from the eye of the observer to the target. Assuming the path of sight is viewed through an atmosphere only, then

$$ T_r(z, \theta) = {}^{a}T_r(z, \theta) \text{ and } B_r^*(z, \theta, \phi) = {}^{a}B_r^*(z, \theta, \phi). $$

For a path of sight through an optical system and an atmosphere, then

$$ T_r(z, \theta) = {}^{a}T_r(z, \theta, \phi) \circ T_r(\theta) \text{ and } B_r^*(z, \theta, \phi) = {}^{a}B_r^*(z, \theta, \phi) \circ T_r(\theta) + {}^{\circ}B_r^*(\theta, \phi). $$

For a path of sight through an optical system and no atmosphere, then

$$ T_r(z, \theta) = {}^{\circ}T_r(\theta) \text{ and } B_r^* = {}^{\circ}B_r^*(\theta, \phi). $$

The equation for apparent background luminance enables the computer program to interpolate for the correct value of contrast threshold from the nine levels of Tiffany inherent background luminance. This is important because as an observer's altitude increases, the value of apparent background luminance changes. This means that to obtain all twenty values of contrast threshold used to represent a C_T versus altitude curve, that the C_T values may come from more than one level of apparent background luminance.

III.7 Vision Data

III.7.1 General

The computer program uses Tiffany vision data for liminal contrast, i.e., a detection probability of fifty percent. These data show the contrast thresholds for specified visual angles alpha (α) subtended by circular targets when the exact location of each target is known and the time of search is essentially unlimited.[6] The Tiffany data covers values of α ranging from a maximum of 358.9 minutes of arc to a minimum of 0.129 minutes of arc. For each value of α there are nine values of contrast threshold, one value for each of the nine levels of apparent background luminance (see Appendix A). Alpha is related to the target diameter and the distance from the target to the observer by the formula

$$\alpha = \frac{D}{r} \quad (3437.760),$$

where the diameter (D) of the target is in feet, and r is the perpendicular distance from the target to the observer in feet. The factor of 3437.760 converts α from radians to minutes of arc. From this formula the minimum and maximum distances to the targets covered by the Tiffany data are 96 feet and 26 000 feet for a one-foot-diameter target.

The Tiffany data does not have contrast threshold values at the smaller angular subtense values for all nine levels of apparent background luminance. The missing threshold values are for small enough α's to allow Ricco's law to be used.[7] Ricco's law states that $C_r = \frac{K}{\alpha^2}$, where K is a constant for a given level of inherent background luminance.[8] This "law" amounts to a statement that the object is too small to be resolved and that detection is a function of the total energy from the object.

Hand calculations were made for an object projecting an area one foot in diameter. The intersections of the C_T and C_r curves indicated that twenty C_T values would cover the range of intersection points from minimum through maximum altitude. These contrast threshold values correspond to altitudes of 20, 40, 60, 80, 100, 200, 400, 600, 800, 1000, 2000, 4000, 6000, 8000, 10 000, 15 000, 20 000, and 25 000 feet. Computer program ACI1 (Apparent Contrast Interpolater number 1) was written to solve for twenty values of contrast threshold corresponding to the altitudes previously mentioned. Program ACI1 solves, by straight line interpolation of the Tiffany data in Appendix A, for twenty values of contrast threshold for each of the nine levels of background luminance. These are the C_T values used by the computer program.

---

[6] Visibility Studies and Some Applications in the Field of Camouflage, Summary Technical Report of Division 16, Vol. 2, National Defense Research Committee, Washington, D.C., (1946), p. 58.

[7] Ibid., p. 128.

[8] Internal Visibility Laboratory Memorandum to Dr. S. Q. Duntley, 24 July 1959, Table 1.

III.7.2 Change in Target Diameter

The computer program uses the contrast threshold for a one-foot target, for each of the twenty altitudes listed in the preceding paragraph. For targets other than one foot in diameter, the same twenty contrast threshold values correspond to twenty altitude values larger by an amount directly proportional to the target diameter in feet. If the target diameter is increased from one foot to 100 feet, then all twenty of the original altitude values are multiplied by 100.

III.7.3 Probability of Detection other than 50%

The Tiffany data is for liminal detection with a probability of target detection of fifty percent. Blackwell found that this type of threshold probability data conforms well to normal ogives.[9] He found that there appears to be a constant ratio of the standard deviation divided by the mean, for all foveal conditions varying over five log units. From experimental data this ratio was found to be .390.[10] The factor K in the equation

$$K = 1 + (f_a)(.390)$$

is the conversion factor by which contrast threshold should be modified in order to convert the Tiffany data to the desired probability of detection. The factor f_a is derived from standard tables of the normal probability functions and is numerically dependent on the probability which is desired. For example, if the desired probability of detection is 90%, f_a is equal to 1.29 and

$$K = 1 + (1.29)(.390) \approx 1.50.$$

Therefore, the Tiffany values for liminal contrast threshold should be multiplied by the constant 1.50 to obtain threshold values for a probability level of 90%.

---

[9] H. Richard Blackwell, J. Opt. Soc. Am. 53, 131 (1963).

[10] H. R. Blackwell and D. W. McCready, Jr., "Foveal Contrast Thresholds for Various Durations of Single Pulses," USN BuShips Contract NObs-72038, Index No. 2455-13-F, University of Michigan Engineering Research Institute, June 1958.

IV. THE COMPUTER PROGRAM

IV.1 General

The general computer program PODVI (Probability of Detection Volumes Phase 1) has evolved out of several earlier programs with more simplifying restrictions. The program is heuristic in that its output provides a tool for making future versions of the program more analytic in function and more general in scope. The program has purposely been split into subroutines and functions to facilitate continuing modification. The combined factors of low-cost, high-speed automatic computing and the uncertainty of the best form for input and output data have dictated the loose coding of the program.

The limited input data for atmospheres and reflectance properties has prevented the complete check-out of all the data ranges of the present program. Actual examples have been run using only background luminances greater than or equal to 100 foot lamberts, and the contrasts of objects and backgrounds used have been fairly low. As new data become available it is possible that some of the variables used in the program may overflow their bounds and cause error.

Program ACI1, and PODVI are written in Control Data Corporation's Fortran 63 language. The programs were developed and run on a Control Data 3600 computer controlled by the University of California's own PRESTO monitor.

IV.2 Description of PODVI

The computer program consists of a calling program with linked processing subroutines and functions. This linkage is represented by Fig. 4-1. Program ACI 1 is included, as it was developed to calculate contrast threshold values from Tiffany data.

IV.2.1 Program ACI 1

Program ACI 1 (Apparent Contrast Interpolater No. 1) was written to obtain twenty values of contrast threshold for each of the nine levels of background luminance from the Tiffany data. This program prints nine columns of contrast threshold values for twenty altitudes. These are the contrast thresholds used by the program PODVI. A description and listing of Program ACI 1 is given in Appendix B1.

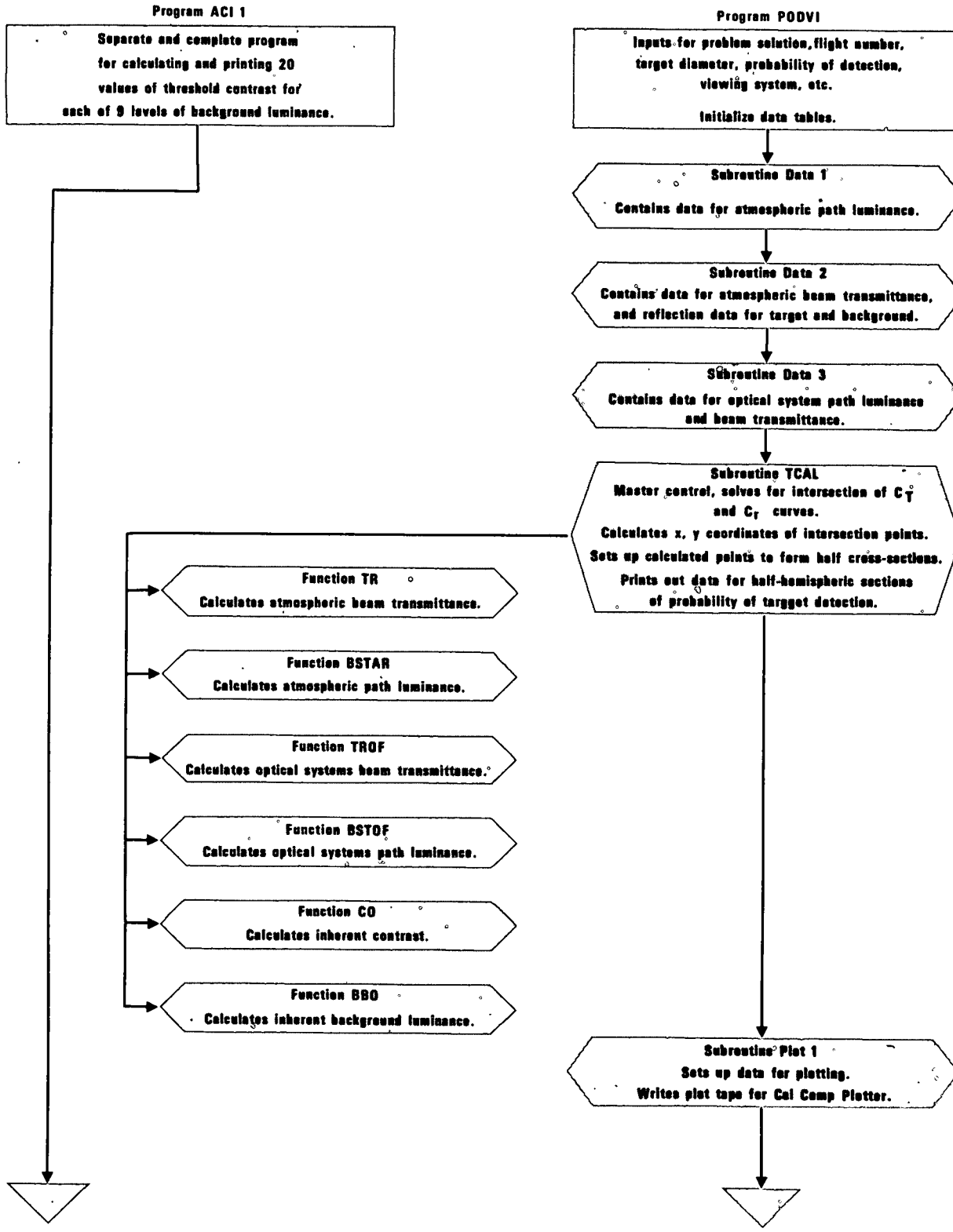


Figure 4-1. Computer program linkage for determining probability of target detection volumes.

IV.2.2 Program PODVI

Program PODVI is the program that provides input data and triggers the computer solution of the detection volume. These inputs are:

1. Option for viewing system, atmosphere only, atmosphere and optical system, or optical system and no atmosphere.
2. Flight number for the appropriate atmospheric data package.
3. Target diameter.
4. Index number for the object reflectance.
5. Index number for background reflectance.
6. Constant for converting 50% Tiffany data to the desired probability,
7. Desired probability as integers.
8. Switch for printing cross-section data.
9. Switch for plotting cross-sections.

The program initializes the atmospheric and reflectance data tables, then calls in the main calculating and control subroutine TCAL. A description and listing of program PODVI is given in Appendix B2.

IV.2.3 Subroutine Data 1

Subroutine Data 1 is a data package. This routine contains one large three-dimensional array BS(8, 18, 5) of all the atmospheric path luminance values for a given flight. Each of the five planes represents one azimuth of path of sight. The eight columns represent zeniths of path of sight, and the 18 rows represent altitudes from 1 000 feet to 60 000 feet. A description and listing of this routine is given in Appendix B3.

IV.2.4 Subroutine Data 2

This subroutine is also a data package. The routine contains five blocks of data. There is a one-dimensional array R(201) of atmospheric attenuation lengths. There is a two-dimensional array AMV(6, 2) of twelve optical air mass values. The array RB(5, 8, 2) is a three-dimensional array of background directional reflectance values. The two planes provide for two separate backgrounds. The five rows represent the azimuths of path of sight, and the eight columns represent the zeniths of path of sight. Array RO(5, 8, 1) is a similar array but it contains directional reflectance values for one target. Array CR(20, 9) is a two-dimensional array of 20 rows and 9 columns of threshold contrast values derived from program ACI1. A description and listing of Subroutine Data 2 is given in Appendix B4.

IV.2.5 Subroutine Data 3

This subroutine is a dummy data package. It is provided to hold data for path luminance and beam transmittance for an optical system when such data become available. A listing is given in Appendix B5.

IV.2.6 Subroutine TCAL

This subroutine is the main processing and calling routine in the program. This routine prints given information concerning the problem, then calculates internally or calls in function routines as it iterates the solutions of the various C_T and C_r curve intersections. If the switch indicating printed output is set, this routine prints the values of the variables used in calculating the approach and intersections of the C_T and C_r curves. This allows the user to determine at a glance the values of the variables that determine the shape of a half-hemispheric cross-section of target detection probability. The subroutine prints the x and y coordinate values for each of the eight calculated points for a half-hemispheric cross-section.

If the switch indicating plotting is set, subroutine TCAL calls on the two plot preparation subroutines PLTSU and PLOT 1. A description and listing of subroutine TCAL is given in Appendix B6.

IV.2.7 Subroutine PLTSU

This routine sets up the x and y coordinates used for plotting the four complete hemispheric cross-sections. The routine also sets up the boundary, scaling, and comment format for the cross-section plots. The description and listing for this subroutine is given in Appendix B13.

IV.2.8 Subroutine PLOT 1

This subroutine calls computer center library routines PREP 1 through PREP 9. The calls to these routines prepare the plot data for being written on magnetic tape. PREP 1 through PREP 9 compose the computer center's library routine Q9Q plot. The call to PREP 9 causes a magnetic tape to be written containing data to be plotted. This tape is then sent to another building where the tape is read into a Control Data 160-A computer which in turn drives a Cal Comp 165 incremental plotter. The call to PREP 9 is actually the next to the last instruction in program PODVI. A description and listing of subroutine PLOT 1 is given in Appendix B14.

IV. 2.9 Function Routines

Variables that require repeated calculations have been set up as separate function routines. Function BBOF calculates inherent background luminance. Function TRF calculates atmospheric beam transmittance. Function BSTRF calculates atmospheric path luminance, and function COF calculates inherent contrast. Function TROF is a dummy function to calculate beam transmittance for an optical system. Until an actual function is provided, function TROF returns a value of .9 for calls for optical system beam transmittance. Function BSTOF is a dummy function to calculate path luminance for an optical system. Until an actual function is provided, BSTOF returns a value of 11.111 for calls for optical system path luminance.

Descriptions and listings of functions TROF through BSTOF are given in Appendices B7 through B12.

V. CONCLUSIONS

Program PODVI, while somewhat limited in scope, does provide a real and valuable breakthrough with respect to the barrier imposed by hand calculation methods for computing maximum sighting range volumes. The computer program provides rapid analysis of data and output of results at a reasonable cost. The addition of optical system functions and data, as well as the addition of new atmospheric and reflectance data will increase the usefulness of the present program and at the same time probably point out areas where modifications may be needed. The heuristic nature of the problem and program indicate that as more data become available, more analytic methods of calculating results may become apparent.

Work is progressing on computer programs to handle maximum sighting range calculations for irregularly shaped, nonluminous targets and to solve problems where visual search is involved. These programs will use short stimulus duration vision data and off-axis vision data. It is hoped these new programs will greatly extend the computerized solution of actual visibility problems.

APPENDIX A

Vision Data

This appendix was taken directly from Appendix A of *Visibility Studies and Some Applications in the Field of Camouflage.*[6] This book is the second volume of a summary technical report produced by division 16 of the National Defense Research Council in 1946. The appendix shows Tiffany data for the liminal contrast values of circular targets. Liminal contrast is the value of contrast for which the probability of an observer making a correct response is 50 percent greater than chance. These liminal contrasts or interpolations of them are used as Apparent Contrasts by the computer program.

Angular subtense of target (minutes)	LIMINAL CONTRAST (FOOT-LAMBERTS)								
	1,000	100	10	1	10^{-1}	10^{-2}	10^{-3}	10^{-4}	10^{-5}
358.9	0.00272	0.00272	0.00277	0.00334	0.00534		0.0303	0.0624	0.136
340.4	0.00272	0.00272	0.00277	0.00334	0.00536	0.0112	0.0308	0.0637	0.140
340.0	0.00272	0.00272	0.00277	0.00334	0.00537	0.0112	0.0308	0.0638	0.140
323.0	0.00272	0.00272	0.00277	0.00335	0.00539	0.0114	0.0314	0.0652	0.144
302.6	0.00272	0.00272	0.00277	0.00335	0.00542	0.0116	0.0320	0.0664	0.147
293.6	0.00272	0.00272	0.00277	0.00335	0.00544	0.0117	0.0325	0.0678	0.151
291.8	0.00272	0.00272	0.00277	0.00335	0.00544	0.0117	0.0326	0.0679	0.152
280.9	0.00272	0.00272	0.00278	0.00335	0.00547	0.0119	0.0330	0.0690	0.155
269.2	0.00272	0.00272	0.00278	0.00335	0.00550	0.0120	0.0335	0.0703	0.159
258.4	0.00272	0.00272	0.00278	0.00335	0.00553	0.0121	0.0340	0.0716	0.164
255.3	0.00272	0.00272	0.00278	0.00335	0.00553	0.0122	0.0341	0.0720	0.164
234.9	0.00272	0.00272	0.00278	0.00336	0.00558	0.0124	0.0352	0.0748	0.172
226.9	0.00272	0.00272	0.00278	0.00336	0.00562	0.0126	0.0356	0.0760	0.176
215.3	0.00272	0.00272	0.00279	0.00336	0.00565	0.0128	0.0364	0.0780	0.182
204.3	0.00272	0.00272	0.00279	0.00336	0.00569	0.0129	0.0370	0.0800	0.188
198.8	0.00272	0.00272	0.00279	0.00337	0.00570	0.0130	0.0376	0.0811	0.191
185.7	0.00272	0.00272	0.00279	0.00338	0.00575	0.0133	0.0386	0.0840	0.200
184.6	0.00272	0.00272	0.00279	0.00338	0.00577	0.0133	0.0386	0.0842	0.201
172.3	0.00273	0.00273	0.00279	0.00339	0.00581	0.0136	0.0398	0.0875	0.210
170.2	0.00273	0.00273	0.00279	0.00339	0.00582	0.0136	0.0401	0.0880	0.212
161.5	0.00273	0.00273	0.00279	0.00340	0.00588	0.0138	0.0410	0.0907	0.220
157.1	0.00273	0.00273	0.00279	0.00340	0.00589	0.0140	0.0415	0.0922	0.224
152.0	0.00274	0.00274	0.00279	0.00340	0.00593	0.0141	0.0422	0.0940	0.230
145.9	0.00274	0.00274	0.00279	0.00341	0.00596	0.0143	0.0430	0.0963	0.237
143.6	0.00274	0.00274	0.00279	0.00341	0.00597	0.0144	0.0434	0.0973	0.240
136.2	0.00274	0.00274	0.00279	0.00342	0.00603	0.0146	0.0446	0.101	0.250
136.0	0.00274	0.00274	0.00280	0.00342	0.00603	0.0146	0.0446	0.101	0.250
129.2	0.00275	0.00275	0.00280	0.00343	0.00608	0.0149	0.0459	0.104	0.259
127.7	0.00275	0.00275	0.00280	0.00343	0.00608	0.0150	0.0461	0.104	0.263
120.1	0.00275	0.00275	0.00280	0.00344	0.00615	0.0153	0.0476	0.109	0.274
117.5	0.00276	0.00276	0.00280	0.00345	0.00617	0.0154	0.0482	0.110	0.280
113.5	0.00276	0.00276	0.00280	0.00345	0.00621	0.0156	0.0493	0.113	0.287
107.7	0.00276	0.00276	0.00281	0.00347	0.00627	0.0159	0 0508	0.118	0.301
107.5	0.00277	0.00277	0.00281	0.00347	0.00627	0.0160	0.0508	0.118	0.301
102.1	0.00277	0.00277	0.00281	0.00348	0.00634	0.0163	0.0523	0.122	0.315
99.38	0.00277	0.00277	0.00281	0.00349	0.00638	0.0165	0.0536	0.125	0.323
97.26	0.00277	0.00277	0.00281	0.00349	0.00639	0.0166	0.0540	0.127	0.328
92.84	0.00278	0.00278	0.00282	0.00351	0.00646	0.0169	0.0554	0.131	0.343
92.29	0.00278	0.00278	0.00282	0.00351	0.00646	0.0169	0.0562	0.132	0.344
88.80	0.00278	0.00278	0.00282	0.00352	0.00652	0.0172	0.0572	0.136	0.356
86.13	0.00278	0.00278	0.00283	0.00352	0.00656	0.0175	0.0581	0.139	0.366
85.10	0.00278	0.00278	0.00283	0.00352	0.00659	0.0176	0.0586	0.140	0.371

Angular subtense of target (minutes)	LIMINAL CONTRAST (FOOT-LAMBERTS)								
	1,000	100	10	1	10^{-1}	10^{-2}	10^{-3}	10^{-4}	10^{-5}
81 70	0 00279	0 00279	0 00283	0 00353	0 00664	0 0179	0 0605	0 145	0 386
80 75	0 00279	0 00279	0 00284	0 00355	0 00667	0 0180	0 0607	0 146	0 389
76 00	0 00279	0 00279	0 00284	0 00358	0 00675	0 0184	0 0632	0 154	0 413
74 28	0 00279	0 00279	0 00284	0 00358	0 00679	0 0187	0 0643	0 157	0 422
71 78	0 00280	0 00280	0 00285	0 00360	0 00685	0 0190	0 0658	0 162	0 436
68 08	0 00280	0 00280	0 00286	0 00361	0 00695	0 0194	0 0684	0 169	0 462
68 00	0 00280	0 00280	0 00286	0 00361	0 00696	0 0195	0 0686	0 170	0 462
64 60	0 00281	0 00281	0 00286	0 00365	0 00705	0 0200	0 0710	0 177	0 485
62 85	0 00281	0 00281	0 00287	0 00366	0 00710	0 0202	0 0725	0 182	0 501
58 73	0 00282	0 00282	0 00289	0 00369	0 00724	0 0209	0 0764	0 194	0 537
58 36	0 00282	0 00282	0 00289	0 00369	0 00725	0 0210	0 0767	0 194	0 541
54 47	0 00284	0 00284	0 00290	0 00374	0 00741	0 0218	0 0809	0 208	0 583
53 83	0 00284	0 00284	0 00290	0 00374	0 00743	0 0220	0 0818	0 210	0 591
51 06	0 00285	0 00285	0 00292	0 00378	0 00756	0 0225	0 0850	0 222	0 627
49 69	0 00286	0 00286	0 00293	0 00380	0 00763	0 0229	0 0874	0 228	0 649
48 06	0 00286	0 00286	0 00294	0 00382	0 00771	0 0233	0 0897	0 236	0 673
46 14	0 00287	0 00287	0 00295	0 00385	0 00782	0 0238	0 0926	0 246	0 708
45 39	0 00288	0 00288	0 00296	0 00386	0 00785	0 0240	0 0940	0 250	0 721
43 07	0 00290	0 00290	0 00298	0 00390	0 00802	0 0248	0 0982	0 265	0 767
43 00	0 00290	0 00290	0 00298	0 00390	0 00802	0 0249	0 0984	0 265	0 768
40 85	0 00292	0 00292	0 00301	0 00394	0 00815	0 0256	0 103	0 280	0 818
40 38	0 00292	0 00292	0 00301	0 00395	0 00820	0 0258	0 104	0 283	0 831
38 00	0 00294	0 00294	0 00304	0 00402	0 00840	0 0267	0 110	0 303	0 896
37 14	0 00295	0 00295	0 00305	0 00404	0 00845	0 0271	0 112	0 312	0 925
36 91	0 00295	0 00295	0 00306	0 00405	0 00848	0 0272	0 113	0 314	0 930
35 89	0 00296	0 00296	0 00307	0 00407	0 00857	0 0277	0 116	0 324	0 967
34 04	0 00299	0 00299	0 00310	0 00413	0 00876	0 0286	0 122	0 344	1 04
34 00	0 00299	0 00299	0 00310	0 00413	0 00881	0 0287	0 122	0 345	1 04
32 30	0 00302	0 00302	0 00313	0 00420	0 00895	0 0297	0 128	0 367	1 12
31 42	0 00304	0 00304	0 00314	0 00422	0 00904	0 0302	0 131	0 380	1 16
30 76	0 00305	0 00305	0 00316	0 00425	0 00913	0 0306	0 134	0 389	1 20
29 36	0 00307	0 00307	0 00320	0 00432	0 00933	0 0316	0 141	0 412	1 28
29 18	0 00308	0 00308	0 00321	0 00432	0 00934	0 0317	0 142	0 416	1 30
28 71	0 00309	0 00309	0 00321	0 00434	0 00942	0 0321	0 144	0 425	1 33
28 09	0 00310	0 00310	0 00323	0 00438	0 00954	0 0326	0 148	0 436	1 37
27 23	0 00312	0 00312	0 00327	0 00442	0 00966	0 0332	0 153	0 454	1 44
26 92	0 00313	0 00313	0 00327	0 00444	0 00970	0 0335	0 154	0 460	1 46
25 84	0 00316	0 00316	0 00330	0 00452	0 00991	0 0346	0 161	0 486	1 56
25 53	0 00316	0 00316	0 00331	0 00453	0 00994	0 0348	0 163	0 494	1 58
24 03	0 00321	0 00321	0 00337	0 00462	0 0103	0 0364	0 175	0 537	1 74
23 49	0 00323	0 00323	0 00340	0 00469	0 0104	0 0371	0 179	0 555	1 80
22 69	0 00326	0 00326	0 00344	0 00474	0 0106	0 0381	0 186	0 581	1 91
21 53	0 00330	0 00330	0 00350	0 00485	0 0110	0 0397	0 198	0 625	2 07
21 50	0 00330	0 00330	0 00350	0 00486	0 0110	0 0398	0 199	0 628	2 09
20 43	0 00335	0 00335	0 00357	0 00498	0 0113	0 0414	0 211	0 676	2 27
19 88	0 00337	0 00337	0 00361	0 00506	0 0115	0 0423	0 218	0 703	2 38
18 57	0 00344	0 00344	0 00371	0 00524	0 0120	0 0449	0 237	0 781	2 68
18 46	0 00345	0 00345	0 00371	0 00526	0 0120	0 0452	0 239	0 787	2 71
17 23	0 00352	0 00352	0 00383	0 00547	0 0126	0 0479	0 262	0 877	3 08
17 02	0 00354	0 00354	0 00386	0 00551	0 0127	0 0485	0 266	0 891	3 15
16 15	0 00360	0 00360	0 00395	0 00569	0 0132	0 0508	0 286	0 972	3 44
15 71	0 00364	0 00364	0 00401	0 00581	0 0135	0 0522	0 297	1 02	3 64
15 20	0 00368	0 00368	0 00409	0 00593	0 0138	0 0540	0 312	1 08	3 89
14 59	0 00374	0 00370	0 00417	0 00611	0 0143	0 0562	0 330	1 15	4 21
14 36	0 00376	0 00372	0 00420	0 00618	0 0144	0 0571	0 337	1 19	4 34
13 62	0 00384	0 00382	0 00434	0 00643	0 0151	0 0604	0 365	1 30	4 83
13 60	0 00384	0 00382	0 00436	0 00644	0 0152	0 0605	0 366	1 30	4 84
12 92	0 00392	0 00391	0 00449	0 00668	0 0158	0 0639	0 393	1 43	5 36
12 77	0 00394	0 00394	0 00453	0 00678	0 0160	0 0649	0 401	1 46	5 47
12 01	0 00406	0 00407	0 00473	0 00713	0 0170	0 0695	0 439	1 64	6 18
11 75	0 00410	0 00412	0 00481	0 00728	0 0172	0 0713	0 455	1 71	6 47
11 67	0 00411	0 00413	0 00484	0 00733	0 0174	0 0719	0 460	1 73	6 52
11 35	0 00417	0 00419	0 00493	0 00750	0 0179	0 0742	0 480	1 82	6 93

Angular subtense of target (minutes)	LIMINAL CONTRAST (FOOT-LAMBERTS)								
	1,000	100	10	1	10^{-1}	10^{-2}	10^{-3}	10^{-4}	10^{-5}
10 77	0 00430	0 00434	0 00518	0 00791	0 0189	0 0794	0 522	2 03	7 73
10 75	0 00430	0 00436	0 00520	0 00792	0 0189	0 0796	0 524	2 03	7 74
10 21	0 00443	0 00450	0 00542	0 00836	0 0200	0 0847	0 569	2 24	8 55
9 938	0 00451	0 00460	0 00558	0 00861	0 0206	0 0879	0 593	2 37	9 01
9 726	0 00456	0 00468	0 00572	0 00883	0 0212	0 0904	0 616	2 47	9 45
9 284	0 00470	0 00485	0 00598	0 00931	0 0224	0 0965	0 667	2 71	10 3
9 229	0 00472	0 00489	0 00603	0 00940	0 0226	0 0966	0 674	2 74	10 5
9 078	0 00478	0 00494	0 00612	0 00957	0 0231	0 0988	0 692	2 82	10 8
8 880	0 00485	0 00506	0 00629	0 00984	0 0237	0 102	0 720	2 95	11 4
8 613	0 00496	0 00519	0 00649	0 0103	0 0248	0 107	0 758	3 13	12 0
8 510	0 00500	0 00525	0 00659	0 0104	0 0251	0 108	0 774	3 21	12 3
8 170	0 00518	0 00544	0 00696	0 0110	0 0266	0 116	0 838	3 49	13 4
8 075	0 00522	0 00552	0 00703	0 0112	0 0272	0 117	0 852	3 55	13 6
7 600	0 00550	0 00589	0 00763	0 0122	0 0298	0 129	0 956	4 01	15 5
7 430	0 00562	0 00605	0 00787	0 0126	0 0309	0 133	0 995	4 20	16 1
7 178	0 00579	0 00627	0 00824	0 0133	0 0327	0 140	1 06	4 49	17 3
6 808	0 00611	0 00673	0 00891	0 0145	0 0358	0 153	1 19	5 00	19 2
6 800	0 00611	0 00675	0 00892	0 0146	0 0359	0 154	1 19	5 01	19 3
6 460	0 00646	0 00720	0 00962	0 0158	0 0393	0 167	1 31	5 55	21 4
6 290	0 00667	0 00745	0 0100	0 0166	0 0413	0 175	1 38	5 82	22 6
5 873	0 00721	0 00824	0 0113	0 0188	0 0468	0 197	1 57	6 68	25 9
5 836	0 00728	0 00828	0 0113	0 0190	0 0472	0 199	1 60	6 76	26 2
5 447	0 00794	0 00923	0 0127	0 0216	0 0534	0 226	1 83	7 78	30 0
5 383	0 00807	0 00943	0 0130	0 0220	0 0546	0 230	1 88	7 97	30 7
5 106	0 00869	0 0102	0 0143	0 0243	0 0603	0 254	2 07	8 83	34 2
4 969	0 00906	0 0107	0 0149	0 0256	0 0639	0 268	2 19	9 35	36 1
4 806	0 00955	0 0114	0 0159	0 0275	0 0681	0 286	2 34	9 98	38 6
4 614	0 0101	0 0123	0 0171	0 0297	0 0736	0 309	2 55	10 80	41 9
4 539	0 0104	0 0126	0 0175	0 0307	0 0759	0 319	2 63	11 2	43 2
4 307	0 0114	0 0137	0 0193	0 0339	0 0840	0 354	2 93	12 4	47 9
4 300	0 0115	0 0138	0 0194	0 0339	0 0845	0 355	2 94	12 4	48 2
4 085	0 0124	0 0151	0 0213	0 0375	0 0933	0 391	3 26	13 8	53 5
4 038	0 0127	0 0154	0 0217	0 0383	0 0948	0 402	3 33	14 1	54 4
3 800	0 0140	0 0172	0 0244	0 0430	0 107	0 451	3 74	16 0	61 7
3 714	0 0146	0 0179	0 0255	0 0450	0 112	0 470	3 93	16 8	64 4
3 691	0 0148	0 0182	0 0257	0 0455	0 113	0 479	4 00	17 0	65 1
3 589	0 0156	0 0191	0 0272	0 0480	0 119	0 502	4 21	18 0	69 1
3 404	0 0171	0 0211	0 0301	0 0531	0 132	0 560	4 67	20 0	77 0
3 400	0 0171	0 0211	0 0302	0 0533	0 133	0 560	4 70	20 0	77 4
3 230	0 0187	0 0232	0 0333	0 0589	0 147	0 617	5 19	22 2	85 4
3 142	0 0196	0 0243	0 0350	0 0622	0 154	0 653	5 47	23 3	89 6
3 076	0 0203	0 0253	0 0364	0 0645	0 161	0 678	5 72	24 4	94 1
2 936	0 0221	0 0276	0 0397	0 0706	0 177	0 746	6 27	26 9	103
2 918	0 0222	0 0277	0 0403	0 0716	0 178	0 752	6 35	27 2	104
2 871	0 0229	0 0287	0 0414	0 0736	0 184	0 776	6 55	28 0	108
2 809	0 0237	0 0298	0 0432	0 0770	0 192	0 814	6 84	29 2	113
2 723	0 0251	0 0316	0 0461	0 0818	0 204	0 863	7 26	31 3	120
2 692	0 0257	0 0322	0 0471	0 0838	0 207	0 883	7 46	31 9	122
2 584	0 0277	0 0348	0 0508	0 0910	0 226	0 964	8 13	34 8	133
2 553	0 0283	0 0355	0 0519	0 0929	0 231	0 977	8 30	35 4	136
2 403	0 0313	0 0398	0 0583	0 104	0 260	1 11	9 34	40 0	154
2 349	0 0328	0 0413	0 0607	0 109	0 272	1 18	9 75	42 0	161
2 269	0 0350	0 0442	0 0652	0 116	0 291	1 25	10 5	44 9	173
2 153	0 0384	0 0488	0 0718	0 129	0 321	1 38	11 7	49 9	192 0
2 150	0 0384	0 0489	0 0721	0 130	0 322	1 39	11 7	50 0	193 0
2 043	0 0423	0 0538	0 0794	0 143	0 355	1 53	12 9	55 5	213
1 988	0 0444	0 0566	0 0838	0 150	0 376	1 61	13 6	58 3	225
1 857	0 0502	0 0644	0 0954	0 171	0 430	1 85	15 6	66 7	258
1 846	0 0506	0 0653	0 0964	0 173	0 432	1 88	15 8	67 6	261 0
1 723	0 0574	0 0740	0 110	0 198	0 496	2 15	18 1	77 6	299
1 702	0 0588	0 0757	0 113	0 202	0 507	2 20	18 5	79 4	306
1 615	0 0643	0 0840	0 125	0 224	0 562	2 44	20 6	88 1	340 0
1 571	0 0680	0 0882	0 132	0 236	0 594	2 59	21 8	93 3	361

Angular subtense of target (minutes)	LIMINAL CONTRAST (FOOT-LAMBERTS)								
	1,000	100	10	1	10^{-1}	10^{-2}	10^{-3}	10^{-4}	10^{-5}
1.520	0.0720	0.0944	0.141	0.251	0.633	2.77	23.3	100.0	386.
1.459	0 0776	0 101	0.152	0.272	0.684	2.99	25.2	108.	417.
1 436	0.0796	0.105	0.157	0 281	0.703	3.09	26.1	112.	432.
1 362	0 0877	0 116	0.174	0.311	0.783	3.43	28.9	124	479.
1.360	0.0881	0.116	0.175	0.312	0.785	3.45	29 0	125.	480.
1.292	0.0966	0.128	0.193	0.345	0.868	3.82	32.2	138.	535.
1.277	0.0986	0.131	0.197	0.352	0.885	3.90	32.9		544.
1.201	0.110	0.148	0.222	0.395	0.995	4.45	37.1		617.
1.175	0.115	0.154	0.232	0.413	1.05	4.58	38.7		643.
1.167	0.117	0.155	0.234	0.419	1.06	4.63	39.3		652.
1.135	0.123	0.164	0.248	0.442	1.12	4.91	41.4		687.
1.077	0.135	0.182	0.274	0.491	1.24	5.48	46.0		766.
1.075	0.136	0.182	0.275	0.492	1.25	5.50	46 2		770.
1.021	0.149	0.200	0.304	0.542	1.38	6.09	51.3		851.
0.9938	0.157	0.210	0.319	0.572	1.45	6.41	53 6		893.
0.9726	0.168	0.219	0.333	0.596	1 52	6.67	56.1		941.
0.9234	0.177	0.239	0.364	0.652	1.66	7 33	61.6		1030.
0.9229	0.180	0 242	0.368	0.662	1 68	7.41	62.4		1042.
0.9078	0.185	0.250	0.381	0.682	1.74	7.66	69.5		1080.
0 8880	0.192	0.260	0.395	0.714	1.82	7.98	67.4		1130.
0.8613	0.203	0.277	0.420	0.758	1 93	8.49	71.2		
0 8510	0 209	0.284	0.432	0.776	1.98	8.70	73.3		
0.8170	0 225	0.306	0.463	0.841	2.14	9.44	79.4		1330
0 8075	0.232	0.313	0.476	0.859	2.20	9.66	81.3		
0 7600	0.258	0.352	0.538	0.967	2.48	11.0	92.0		
0.7428	0.271	0.367	0.562	1.01	2.61	11.5	96.2		
0 7178	0 290	0.392	0.598	1.08	2.79	12 4	104.		
0 6808	0.320	0.434	0.664	1 20	3 10	13 8	116.		
0 6800	0.322	0.436	0.667	1.22	3.12		116.		
0 6460	0.355	0.480	0.740	1.34	3.43		129.		
0 6285	0 374	0.512	0.783	1.41	3.64		136.		
0 5873	0 426	0.582	0.898	1.61	4.16				
0 5836	0.432	0.586	0.912	1.64	4.21				
0 5447	0 497	0.676	1.04	1.88	4.82				
0 5383	0 507	0.692	1.07	1.92	4.96				
0 5106	0.562	0.766	1.19	2.14	5.45				
0 4969	0.596	0.807	1.26	2.26	5.77				
0 4806	0.637	0.871	1.34	2.42	6.19				
0 4614	0.687	0.935	1.46	2.62	6.68				
0 4539	0 714	0.975	1.50	2.71	6.92				
0 4307	0 787	1.08	1.67	3.01	7.67				
0 4300	0.793	1.08	1.68	3.01	7.74				
0 4085	0.881	1.20	1.85	3.34	8.52				
0 4038	0 902	1 23	1.90	3.42	8.70				
0 3800	1 02	1.38	2.14	3.85	9.86				
0 3714	1 06	1.44	2.24	4.04	10.4				
0 3691	1.08	1.46	2.27	4.09	10.5				
0 3589	1.14	1.55	2.40	4.32	11.1				
0.3404	1.28	1.73	2.68	4.82	12.4				
0 3400	1.28	1.73	2.68	4.83	12.4				
0 3230	1.40	1.91	2.96	5.31	13.7				
0 3142	1 49	2.02	3.14	5.62					
0 3076	1 55	2.11	3.26	5.85					
0 2936	1 70	2.32	3.58	6.43					
0 2918	1 73	2.33	3.63	6.53					
0 2871	1 77	2.42	3.76	6.74					
0 2809	1 86	2.54	3.91	7.02					
0 2723	1 99	2.69	4.17	7.50	19.3				
0 2692	2.03	2.75	4.27	7.67					
0 2584	2 19	2 98	4.63	8.32					
0 2553	2 25	3 07	4.74	8.55					
0 2403	2 52	3 43	5.36	9.55					
0 2349	2 66	3.62	5 60	10.0					

Angular subtense of target (minutes)	LIMINAL CONTRAST (FOOT-LAMBERTS)								
	1,000	100	10	1	10^{-1}	10^{-2}	10^{-3}	10^{-4}	10^{-5}
0.2269	2.86	3.88	6.01	10.8					
0.2153	3.16	4.28	6.68	12.0					
0.2150	3.19	4.32	6.68	12.0					
0.2043	3.53	4.78	7.40	13 3					
0.1988	3.72	5.04	7.81	14.1					
0.1857	4.26	5.76	8.97						
0.1846	4.32	5.82	9.06						
0.1723	4.96	6.67	10.3						
0.1702	5.08	6.86	10.6						
0.1615	5.62	7.62	11.9						
0.1571	5.96	8.04	12.5						
0.1520	6.38	8.61	13.4						
0.1459	6.91	9.31	14.5						
0.1436	7.14	9.66							
0.1362	7.74	10.7							
0.1360	7.95	10.7							
0.1292	8.83	11.9							

APPENDIX B

This appendix contains fourteen programs and subroutines as follows:

	Title
B1	PROGRAM ACI1 and SUBROUTINE TIFIN
B2	PROGRAM PODV1
B3	SUBROUTINE DATA 1
B4	SUBROUTINE DATA 2
B5	SUBROUTINE DATA 3
B6	SUBROUTINE TCAL
B7	FUNCTION TRF
B8	FUNCTION BSTRF
B9	FUNCTION TROF
B10	FUNCTION BSTOF
B11	FUNCTION BBOF
B12	FUNCTION COF
B13	SUBROUTINE PLTSU
B14	SUBROUTINE PLOT 1

VISIBILITY LABORATORY U.C.S.D.
PROGRAM OR SUBROUTINE DESCRIPTION

A. IDENTIFICATION

Title	PROGRAM AC11 and SUBROUTINE TIFIN
Category	CVC
Programmer	Barkdoll
Date	1 November 1965
Type	Fortran 63

B. DESCRIPTION

This program calculates 20 values of contrast threshold from each of the nine levels of background luminance from the Tiffany data. The calculated contrast thresholds are found by using 20 given values of altitude. The values of contrast threshold calculated by this program are used as inputs to program PODVI.

C. USAGE

1. Calling Sequence

Program AC11
TIFIN (IBAC, Z, CCR, CALPH)

2. Arguments or Parameters

IBAC = 1 of 9 levels of background luminance from Tiffany data.
Z = The altitude value to be used in the interpolation procedure.
CCR = The interpolation result for contrast threshold.
CALPH = The calculated value of alpha.

3. Storage Requirements (Decimal)	338 words
4. Temporary Storage Requirements	Not Applicable
5. Alarms, Print-Outs	Prints out values of apparent contrast.
6. Error Returns	None
7. Error Stops	None
8. Input and Output Tape Mountings	Not Applicable
9. Input and Output Formats	Not Applicable
10. Selective Jump and Stop Settings	Not Applicable
11. Machine Time	
12. Accuracy	Not Applicable
13. Cautions to User	None
14. Equipment Configuration	CDC 3600
15. References	

D. METHOD

(1) Interpolation of table values

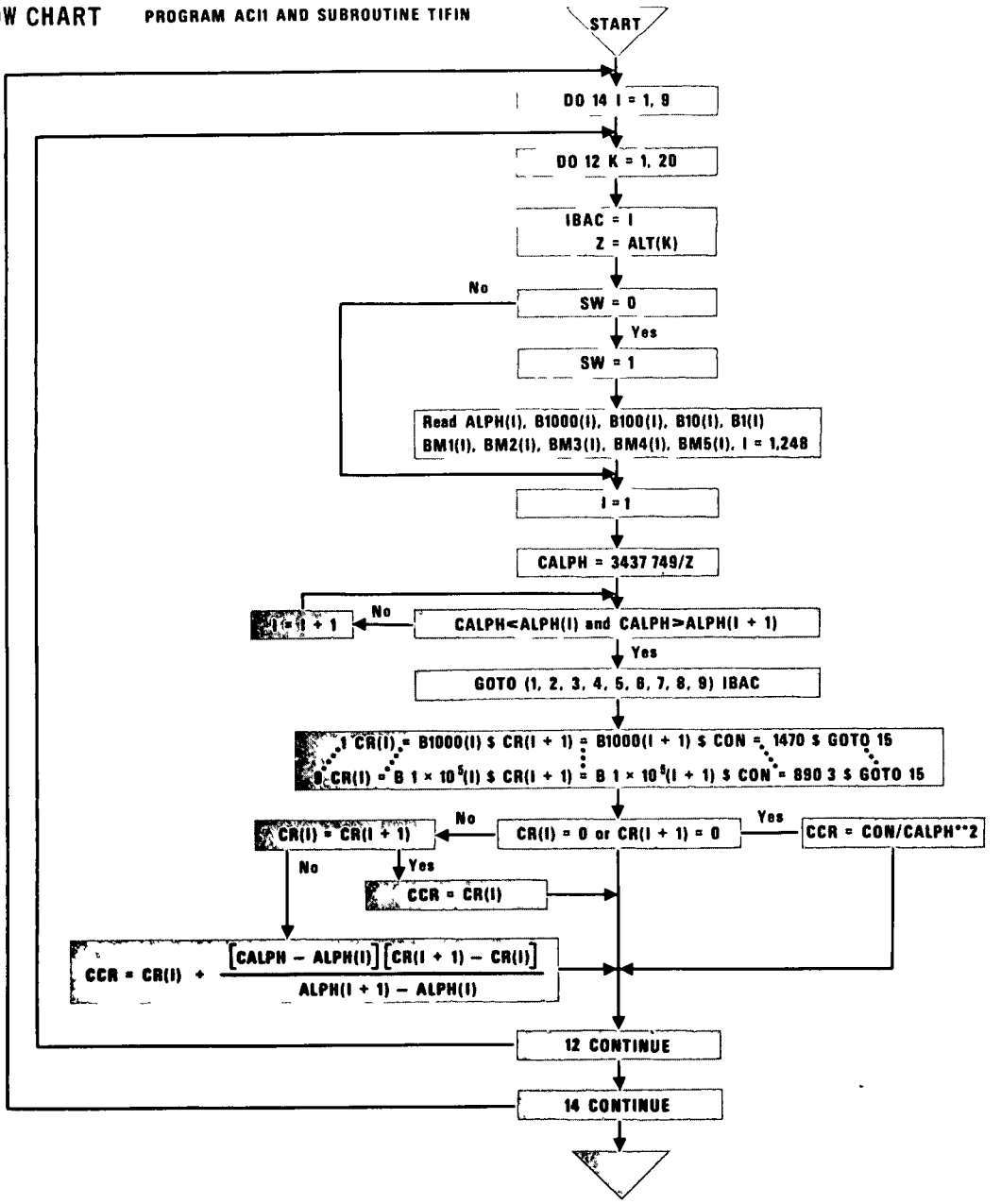
$$CCR = CR(I) + \frac{[CALPH - ALPH(I)]\,[CR(I+1) - CR(I)]}{[ALPH(I+1) - ALPH(I)]}$$

(2) Ricco's Law, where CR(I) = 0

$$CCR = \frac{CON}{(ALPHA)}\,2$$

CON is a constant for a given level of background luminance.
ALPHA must be less than a given maximum angular size for each level of inherent background luminance.

E. FLOW CHART PROGRAM ACII AND SUBROUTINE TIFIN



PROGRAM ACI1

```
      PROGRAM ACI1                                                      ACI 0000
C     PROGRAM ACI1...1NOV,65...BARKDOLL...VISLAB...UCSD                 ACI 0010
C     ***ACII=THRESHOLD CONTRAST INTERPOLATER NO 1.                     ACI 0020
C     ***THIS PROGRAM CONTAINS THE ALTITUDE VALUES USED BY SUBROUTINE   ACI 0030
C     ****TIFIN FOR INTERPOLATION OF TIFFANY DATA TO                    ACI 0040
C     ****GIVE THRESHOLD CONTRAST VALUES.                               ACI 0050
C     ***INPUT DATA ARRAY=ALT(20)  THIS ARRAY CONTAINS THE ALTITUDES    ACI 0060
C     ****FOR WHICH THRESHOLD CONTRASTS ARE DESIRED.                    ACI 0070
C                                                                       ACI 0080
C     ...OUTPUT=THIS PROGRAM PRINTS OUT ARRAY ALT=20 GIVEN              ACI 0090
C     ....VALUES OF ALTITUDE, ARRAY VALPH=20 CALCULATED                 ACI 0100
C     ....VALUES OF ALPHA, AND ARRAY VCR=20 VALUES OF THRESHOLD         ACI 0110
C     ....CONTRAST FOR EACH OF 9 VALUES OF BACKGROUND LUMINANCE.        ACI 0120
C                                                                       ACI 0130
C     ***NOTE CCR=THRESHOLD CONTRAST VALUE                              ACI 0140
C                                                                       ACI 0150
C     ...SUBROUTINES CALLED TIFIN                                       ACI 0160
C                                                                       ACI 0170
      DIMENSION ALT(20),VALPH(20),VCR(20,9)                             ACI 0180
      DATA(ALT=20.,40.,60.,80.,100.,200.,400.,600.,800.,1000.,          ACI 0190
     12000.,4000.,6000.,8000.,10000.,15000.,20000.,25000.,30000.,40000.)ACI 0200
      DO 14 I=1,9                                                       ACI 0210
      DO 12 K=1,20                                                      ACI 0220
      IBAC=I $ Z=ALT(K)                                                 ACI 0230
      CALL TIFIN(IBAC,Z,CCR,ALPH)                                       ACI 0240
      VCR(K,I)=CCR $ VALPH(K)=ALPH                                      ACI 0250
   12 CONTINUE                                                          ACI 0260
   14 CONTINUE                                                          ACI 0270
      PRINT 100                                                         ACI 0280
  100 FORMAT(1H1,40X,36HBACKGROUND LUMINANCE IN FT. LAMBERTS)           ACI 0290
      PRINT 120                                                         ACI 0300
  120 FORMAT(//1X,8HALTITUDE,3X,5HALPHA,5X,5H1000.,4X,4H100.,6X,3H10.,6XACI 0310
     1,2H1.,8X,2H.1,7X,3H.01,7X,4H.001,7X,5H.0001,7X,6H.00001)          ACI 0320
      PRINT 125                                                         ACI 0330
  125 FORMAT (//50X,19HTHRESHOLD CONTRASTS)                             ACI 0340
      PRINT 130,(ALT(L),VALPH(L),(VCR(L,M),M=1,9),L=1,20)               ACI 0350
  130 FORMAT(//3X,F7.1,F10.5,4F9.5,2F10.5,F11.5,F12.5,F13.5)            ACI 0360
      END                                                               ACI 0370
```

SUBROUTINE TIFIN(IBAC,Z,CCR,CALPH)

```
      SUBROUTINE TIFIN(IBAC,Z,CCR,CALPH)                                TIF 0000
C     SUBROUTINE TIFIN...1NOV,65...BARKDOLL...VISLAB...UCSD             TIF 0010
C     ***THIS SUBROUTINE WILL INTERPOLATE FOR THRESHOLD                 TIF 0020
C     ***CONTRAST VALUE FROM ONE OF 9 ADAPTION                          TIF 0030
C     ***LEVELS OF TIFFANY DATA.                                        TIF 0040
C     ***INPUT DATA IBAC = 1 OF 9 LEVELS OF BACKGROUND LUMINANCE        TIF 0050
C     ***Z = THE ALTITUDE VALUE TO BE USED IN INTERPOLATION             TIF 0060
C                                                                       TIF 0070
C     ***OUTPUT CCR=INTERPOLATED VALUE FOR THRESHOLD CONTRAST,          TIF 0080
C     ****CALPH = THE CALCULATED VALUE OF ALPHA.                        TIF 0090
C     ***PROGRAMS CALLED NONE.                                          TIF 0100
C                                                                       TIF 0110
      DIMENSION ALPH(253),B1000(253),B100(253),B10(253),                TIF 0120
     1B1(253),BM1(253),BM2(253),BM3(253),BM4(253),BM5(253),CR(253)      TIF 0130
      IF(SW.EQ.0)10,30                                                  TIF 0140
   10 SW=1                                                              TIF 0150
      READ 20,(ALPH(I),B1000(I),B100(I),B10(I),B1(I),BM1(I),            TIF 0160
     1BM2(I),BM3(I),BM4(I),BM5(I),I=1,248 )                             TIF 0170
   20 FORMAT(10F6)                                                      TIF 0180
   30 I=1                                                               TIF 0190
      CALPH=3437.749/Z                                                  TIF 0200
   40 IF(CALPH.LT.ALPH(I).AND.CALPH.GT.ALPH(I+1))50,60                  TIF 0210
```

```
   50 GO TO(70,80,90,100,110,120,130,140,150)IBAC                          TIF 0220
   60 I=I+1                                                                TIF 0230
      GO TO 40                                                             TIF 0240
   70 CR(I)=B1000(I) $ CR(I+1)=B1000(I+1) $ CON=.1470 $ GO TO 160          TIF 0250
   80 CR(I)=B100(I) $ CR(I+1)=B100(I+1) $ CON=.1995 $ GO TO 160            TIF 0260
   90 CR(I)=B10(I) $ CR(I+1)=B10(I+1) $ CON=.3092$ GO TO 160               TIF 0270
  100 CR(I)=B1(I) $ CR(I+1)=B1(I+1) $ CON=.5571 $ GO TO 160                TIF 0280
  110 CR(I)=BM1(I) $ CR(I+1)=BM1(I+1) $ CON=1.434 $ GO TO 160              TIF 0290
  120 CR(I)=BM2(I) $ CR(I+1)=BM2(I+1) $ CON=6.367 $ GO TO 160              TIF 0300
  130 CR(I)=BM3(I) $ CR(I+1)=BM3(I+1) $ CON=53.87 $ GO TO 160              TIF 0310
  140 CR(I)=BM4(I) $ CR(I+1)=BM4(I+1) $ CON=231.0 $ GO TO 160              TIF 0320
  150 CR(I)=BM5(I) $ CR(I+1)=BM5(I+1) $ CON=890.3 $ GO TO 160              TIF 0330
  160 IF(CR(I).EQ.0.OR.CR(I+1).EQ.0) 170,180                              TIF 0340
  170 CCR=CON/CALPH**2                                                    TIF 0350
      GO TO 210                                                           TIF 0360
  180 IF(CR(I).EQ.CR(I+1))190,200                                         TIF 0370
  190 CCR=CR(I)                                                           TIF 0380
      GO TO 210                                                           TIF 0390
  200 CCR=CR(I)+(((CALPH-ALPH(I))*(CR(I+1)-CR(I)))/(ALPH(I+1)-ALPH(I)))   TIF 0400
  210 CONTINUE                                                            TIF 0410
      END                                                                 TIF 0420
```

```
      **********TIFFANY THRESHOLD CONTRAST DATA**********
.358.90.00272.00272.00277.00334.00534.01120.03030.06240.13600.....001
 340.40.00272.00272.00277.00334.00536.01120.03080.06370.14000 002
.340.00.00272.00272.00277.00334.00537.01120.03080.06380.14000.....003
 323.00.00272.00272.00277.00335.00539.01140.03140.06520.14400 004
.302.60.00272.00272.00277.00335.00542.01160.03200.06640.14700.....005
 293.60.00272.00272.00277.00335.00544.01170.03250.06780.15100 006
.291.80.00272.00272.00277.00335.00544.01170.03260.06790.15200.....007
 280.90.00272.00272.00278.00335.00547.01190.03300.06900.15500 008
.269.20.00272.00272.00278.00335.00550.01200.03350.07030.15900.....009
 258.40.00272.00272.00278.00335.00553.01210.03400.07160.16400 010
.255.30.00272.00272.00278.00335.00553.01220.03410.07200.16400.....011
 234.90.00272.00272.00278.00336.00558.01240.03520.07480.17200 012
.226.90.00272.00272.00278.00336.00562.01260.03560.07600.17600.....013
 215.30.00272.00272.00279.00336.00565.01280.03640.07800.18200 014
.204.30.00272.00272.00279.00336.00569.01290.03700.08000.18800.....015
 198.80.00272.00272.00279.00337.00570.01300.03760.08110.19100 016
.185.70.00272.00272.00279.00338.00575.01330.03860.08400.20000.....017
 184.60.00272.00272.00279.00338.00577.01330.03860.08420.20100 018
.172.30.00273.00273.00279.00339.00581.01360.03980.08750.21000.....019
 170.20.00273.00273.00279.00339.00582.01360.04010.08800.21200 020
.161.50.00273.00273.00279.00340.00588.01380.04100.09070.22000.....021
 157.10.00273.00273.00279.00340.00589.01400.04150.09220.22400 022
.152.00.00274.00274.00279.00340.00593.01410.04220.09400.23000.....023
 145.90.00274.00274.00279.00341.00596.01430.04300.09630.23700 024
.143.60.00274.00274.00279.00341.00597.01440.04340.09730.24000.....025
 136.20.00274.00274.00279.00342.00603.01460.04460.10100.25000 026
.136.00.00274.00274.00280.00342.00603.01460.04460.10100.25000.....027
 129.20.00275.00275.00280.00343.00608.01490.04590.10400.25900 028
.127.70.00275.00275.00280.00343.00608.01500.04610.10400.26300.....029
 120.10.00275.00275.00280.00344.00615.01530.04760.10900.27400 030
.117.50.00276.00276.00280.00345.00617.01540.04820.11000.28000.....031
 113.50.00276.00276.00280.00345.00621.01560.04930.11300.28700 032
.107.70.00276.00276.00281.00347.00627.01590.05080.11800.30100.....033
 107.50.00277.00277.00281.00347.00627.01600.05080.11800.30100 034
.102.10.00277.00277.00281.00348.00634.01630.05230.12200.31500.....035
 099.38.00277.00277.00281.00349.00638.01650.05360.12500.32300 036
.097.26.00277.00277.00281.00349.00639.01660.05400.12700.32800.....037
 092.84.00278.00278.00282.00351.00646.01690.05540.13100.34300 038
.092.29.00278.00278.00282.00351.00646.01690.05620.13200.34400.....039
```

088.80.00278.00278.00282.00352.00652.01720.05720.13600.35600	040
086.13.00278.00278.00283.00352.00656.01750.05810.13900.36600	041
085.10.00278.00278.00283.00352.00659.01760.05860.14000.37100	042
081.70.00279.00279.00283.00353.00664.01790.06050.14500.38600	043
080.75.00279.00279.00284.00355.00667.01800.06070.14600.38900	044
076.00.00279.00279.00284.00358.00675.01840.06320.15400.41300	045
074.28.00279.00279.00284.00358.00679.01870.06430.15700.42200	046
071.78.00280.00280.00285.00360.00685.01900.06580.16200.43600	047
068.08.00280.00280.00286.00361.00695.01940.06840.16900.46200	048
068.00.00280.00280.00286.00361.00696.01950.06860.17000.46200	049
064.60.00281.00281.00286.00365.00705.02000.07100.17700.48500	050
062.85.00281.00281.00287.00366.00710.02020.07250.18200.50100	051
058.73.00282.00282.00289.00369.00724.02090.07640.19400.53700	052
058.36.00282.00282.00289.00369.00725.02100.07670.19400.54100	053
054.47.00284.00284.00290.00374.00741.02180.08090.20800.58300	054
053.83.00284.00284.00290.00374.00743.02200.08180.21000.59100	055
051.06.00285.00285.00292.00378.00756.02250.08500.22200.62700	056
049.69.00286.00286.00293.00380.00763.02290.08740.22800.64900	057
048.06.00286.00286.00294.00382.00771.02330.08970.23600.67300	058
046.14.00287.00287.00295.00385.00782.02380.09260.24600.70800	059
045.39.00288.00288.00296.00386.00785.02400.09400.25000.72100	060
043.07.00290.00290.00298.00390.00802.02480.09820.26500.76700	061
043.00.00290.00290.00298.00390.00802.02490.09840.26500.76800	062
040.85.00292.00292.00301.00394.00815.02560.10300.28000.81800	063
040.38.00292.00292.00301.00395.00820.02580.10400.28300.83100	064
038.00.00294.00294.00304.00402.00840.02670.11000.30300.89600	065
037.14.00295.00295.00305.00404.00845.02710.11200.31200.92500	066
036.91.00295.00295.00306.00405.00848.02720.11300.31400.93000	067
035.89.00296.00296.00307.00407.00857.02770.11600.32400.96700	068
034.04.00299.00299.00310.00413.00876.02860.12200.344001.0400	069
034.00.00299.00299.00310.00413.00881.02870.12200.345001.0400	070
032.30.00302.00302.00313.00420.00895.02970.12800.367001.1200	071
031.42.00304.00304.00314.00422.00904.03020.13100.380001.1600	072
030.76.00305.00305.00316.00425.00913.03060.13400.389001.2000	073
029.36.00307.00307.00320.00432.00933.03160.14100.412001.2800	074
029.18.00308.00308.00321.00432.00934.03170.14200.416001.3000	075
028.71.00309.00309.00321.00434.00942.03210.14400.425001.3300	076
028.09.00310.00310.00323.00438.00954.03260.14800.436001.3700	077
027.23.00312.00312.00327.00442.00966.03320.15300.454001.4400	078
026.92.00313.00313.00327.00444.00970.03350.15400.460001.4600	079
025.84.00316.00316.00330.00452.00991.03460.16100.486001.5600	080
025.53.00316.00316.00331.00453.00994.03480.16300.494001.5800	081
024.03.00321.00321.00337.00462.01030.03640.17500.537001.7400	082
023.49.00323.00323.00340.00469.01040.03710.17900.555001.8000	083
022.69.00326.00326.00344.00474.01060.03810.18600.581001.9100	084
021.53.00330.00330.00350.00485.01100.03970.19800.625002.0700	085
021.50.00330.00330.00350.00486.01100.03980.19900.628002.0900	086
020.43.00335.00335.00357.00498.01130.04140.21100.676002.2700	087
019.88.00337.00337.00361.00506.01150.04230.21800.703002.3800	088
018.57.00344.00344.00371.00524.01200.04490.23700.781002.6800	089
018.46.00345.00345.00371.00526.01200.04520.23900.787002.7100	090
017.23.00352.00352.00383.00547.01260.04790.26200.877003.0800	091
017.02.00354.00354.00386.00551.01270.04850.26600.891003.1500	092
016.15.00360.00360.00395.00569.01320.05080.28600.972003.4400	093
015.71.00364.00364.00401.00581.01350.05220.297001.02003.6400	094
015.20.00368.00368.00409.00593.01380.05400.312001.08003.8900	095
014.59.00374.00370.00417.00611.01430.05620.330001.15004.2100	096
014.36.00376.00372.00420.00618.01440.05710.337001.19004.3400	097
013.62.00384.00382.00434.00643.01510.06040.365001.30004.8300	098
013.60.00384.00382.00436.00644.01520.06050.366001.30004.8400	099
012.92.00392.00391.00449.00668.01580.06390.393001.43005.3600	100
012.77.00394.00394.00453.00678.01600.06490.401001.46005.4700	101
012.01.00406.00407.00473.00713.01700.06950.439001.64006.1800	102
011.75.00410.00412.00481.00728.01720.07130.455001.71006.4700	103
011.67.00411.00413.00484.00733.01740.07190.460001.73006.5200	104
011.35.00417.00419.00493.00750.01790.07420.480001.82006.9300	105

010.77.00430.00434.00518.00791.01890.07940.522002.03007.7300	106
010.75.00430.00436.00520.00792.01890.07960.524002.03007.7400	107
010.21.00443.00450.00542.00836.02000.08470.569002.24008.5500	108
09.938.00451.00460.00558.00861.02060.08790.593002.37009.0100	109
09.726.00456.00468.00572.00883.02120.09040.616002.47009.4500	110
09.284.00470.00485.00598.00931.02240.09650.667002.71010.300	111
09.229.00472.00489.00603.00940.02260.09660.674002.74010.500	112
09.078.00478.00494.00612.00957.02310.09880.692002.82010.800	113
08.880.00485.00506.00629.00984.02370.10200.720002.95011.400	114
08.613.00496.00519.00649.01030.02480.10700.758003.13012.000	115
08.510.00500.00525.00659.01040.02510.10800.774003.21012.300	116
08.170.00518.00544.00696.01100.02660.11600.838003.49013.400	117
08.075.00522.00552.00703.01120.02720.11700.852003.55013.600	118
07.600.00550.00589.00763.01220.02980.12900.956004.01015.500	119
07.430.00562.00605.00787.01260.03090.13300.995004.20016.100	120
07.178.00579.00627.00824.01330.03270.14001.06004.49017.300	121
06.808.00611.00673.00891.01450.03580.15301.19005.00019.200	122
06.800.00611.00675.00892.01460.03590.15401.19005.01019.300	123
06.460.00646.00720.00962.01580.03930.16701.31005.55021.400	124
06.290.00667.00745.01000.01660.04130.17501.38005.82022.600	125
05.873.00721.00824.01130.01880.04680.19701.57006.68025.900	126
05.836.00728.00828.01130.01900.04720.19901.60006.76026.200	127
05.447.00794.00923.01270.02160.05340.22601.83007.78030.000	128
05.383.00807.00943.01300.02200.05460.23001.88007.97030.700	129
05.106.00869.01020.01430.02430.06030.25402.07008.83034.200	130
04.969.00906.01070.01490.02560.06390.26802.19009.35036.100	131
04.806.00955.01140.01590.02750.06810.28602.34009.98038.600	132
04.614.01010.01230.01710.02970.07360.30902.55010.80041.900	133
04.539.01040.01260.01750.03070.07590.31902.63011.20043.200	134
04.307.01140.01370.01930.03390.08400.35402.93012.40047.900	135
04.300.01150.01380.01940.03390.08450.35502.94012.40048.200	136
04.085.01240.01510.02130.03750.09330.39103.26013.80053.500	137
04.038.01270.01540.02170.03830.09480.40203.33014.10054.400	138
03.800.01400.01720.02440.04300.10700.45103.74016.00061.700	139
03.714.01460.01790.02550.04500.11200.47003.93016.80064.400	140
03.691.01480.01820.02570.04550.11300.47904.00017.00065.100	141
03.589.01560.01910.02720.04800.11900.50204.21018.00069.100	142
03.404.01710.02110.03010.05310.13200.56004.67020.00077.000	143
03.400.01710.02110.03020.05330.13300.56004.70020.00077.400	144
03.230.01870.02320.03330.05890.14700.61705.19022.20085.400	145
03.142.01960.02430.03500.06220.15400.65305.47023.30089.600	146
03.076.02030.02530.03640.06450.16100.67805.72024.40094.100	147
02.936.02210.02760.03970.07060.17700.74606.27026.900103.00	148
02.918.02220.02770.04030.07160.17800.75206.35027.200104.00	149
02.871.02290.02870.04140.07360.18400.77606.55028.000108.00	150
02.809.02370.02980.04320.07700.19200.81406.84029.200113.00	151
02.723.02510.03160.04610.08180.20400.86307.26031.300120.00	152
02.692.02570.03220.04710.08380.20700.88307.46031.900122.00	153
02.584.02770.03480.05080.09100.22600.96408.13034.800133.00	154
02.553.02830.03550.05190.09290.23100.97708.30035.400136.00	155
02.403.03130.03980.05830.10400.26001.11009.34040.000154.00	156
02.349.03280.04130.06070.10900.27201.18009.75042.000161.00	157
02.269.03500.04420.06520.11600.29101.25010.50044.900173.00	158
02.153.03840.04880.07180.12900.32101.38011.70049.900192.00	159
02.150.03840.04890.07210.13000.32201.39011.70050.000193.00	160
02.043.04230.05380.07940.14300.35501.53012.90055.500213.00	161
01.988.04440.05660.08380.15000.37601.61013.60058.300225.00	162
01.857.05020.06440.09540.17100.43001.85015.60066.700258.00	163
01.846.05060.06530.09640.17300.43201.88015.80067.600261.00	164
01.723.05740.07400.11000.19800.49602.15018.10077.600299.00	165
01.702.05880.07570.11300.20200.50702.20018.50079.400306.00	166
01.615.06430.08400.12500.22400.56202.44020.60088.100340.00	167
01.571.06800.08820.13200.23600.59402.59021.80093.300361.00	168
01.520.07200.09440.14100.25100.63302.77023.30100.00386.00	169
01.459.07760.10100.15200.27200.68402.99025.20108.00417.00	170
01.436.07960.10500.15700.28100.70303.09026.10112.00432.00	171

01	362	08770	11600	17400	31100	783003	430028	900124	00479.00	172
1	3600	06810	11600	17500	31200	785003	450029	900125	00480.00	173
1	2920	09660	12800	19300	34500	868003	820032	200138	00535.00	174
1	2770	09860	13100	19700	35200	885003	900032	900	544.00	175
1	2010	11600	14800	22200	39500	995004	450037	100	617.00	176
1	1750	11500	15400	23200	41300	05004	580038	700	643.00	177
1	1670	11700	15500	23400	41900	06004	630039	300	652.00	178
1	1350	12300	16400	24800	44200	12004	910041	400	687.00	179
1	0770	13500	18200	27400	49100	24005	480046	000	766.00	180
1	0750	13600	18200	27500	49200	25005	500046	200	770.00	181
1	0210	14900	20000	30400	54200	38006	090051	300	851.00	182
	99380	15700	21000	31900	57200	45006	410053	600	893.00	183
	97260	16800	21900	33300	59600	52006	670056	100	941.00	184
	92840	17700	23900	36400	65200	66007	330061	600	1030.0	185
	92290	18000	24200	36800	66200	68007	410062	400	1042.0	186
	90780	18500	25000	38100	68200	74007	660069	500	1080.0	187
	88800	19200	26000	39500	71400	82007	980067	400	1130.0	188
	86130	20300	27700	42000	75800	93008	490071	200		189
	85100	20900	28400	43200	77600	98008	700073	300		190
	81700	22500	30600	46600	84100	14009	440079	400		191
	80750	23200	31300	47600	85900	20009	660081	300		192
	76000	25800	35200	53800	96700	48001	100092	000		193
	74280	27100	36700	56200	10100	61001	150096	200		194
	71780	29000	39200	59800	10800	79001	240010	400		195
	68080	32000	43400	66400	10020	03	100013	800	116.00	196
	68000	32200	43600	66700	12200	03	1200	116.00		197
	64600	35500	48000	74000	13400	03	4300	129.00		198
	62850	37400	51200	78300	14100	03	6400	136.00		199
	58730	42600	58200	89800	16100	04	1600			200
	58360	43200	58600	91200	16400	04	2100			201
	54470	49700	67600	10400	18800	04	8200			202
	53830	50700	69200	10700	19200	04	9600			203
	51060	56200	76600	11900	21400	05	4500			204
	49690	59600	80700	12600	22600	05	7700			205
	48060	63700	87100	13400	24200	06	1900			206
	46140	68700	93500	14600	26200	06	6800			207
	45390	71400	97500	15000	27100	06	9200			208
	43070	78700	10800	16700	30100	07	6700			209
	43000	79300	10800	16800	30100	07	7400			210
	40850	88100	12000	18500	34000	08	5200			211
	40380	90200	12300	19000	34200	08	7000			212
	38000	10200	13800	21400	38500	09	8600			213
	37140	10600	14400	22400	40400	10	0400			214
	36910	10800	14600	22700	40900	10	0500			215
	35890	11400	15500	24000	43200	11	1100			216
	34040	12800	17300	26800	48200	12	4000			217
	34000	12800	17300	26800	48300	12	4000			218
	32300	14000	19100	29600	53100	13	7000			219
	31420	14900	20300	31400	56200	14	0600			220
	30760	15500	21100	32600	58500	14	8500			221
	29360	17000	23200	35800	64300	16	4300			222
	29180	17300	23300	36300	65300	16	5300			223
	28710	17700	24200	37600	67400	17	0200			224
	28090	18600	25400	39100	70200	17	8200			225
	27230	19900	26900	41700	75000	19	2000			226
	26920	20300	27500	42700	76700	19	6700			227
	25840	21900	29800	46300	83200	21	3200			228
	25530	22500	30700	47500	85500	21	9500			229
	24030	25200	34300	53600	96000	24	8000			230
	23490	26600	36200	56200	10100	26	0000			231
	22690	28600	38800	60100	10800	27	6800			232
	21530	31600	42800	66800	12000	30	0000			233
	21500	31900	43200	67300	12100	30	0000			234
	20430	35300	47800	74600	13400	33	0000			235
	19880	37200	50400	78700	14100	34	4100			236
	18570	42600	57600	89900	16100	39	7000			237

```
.184604.32005.82009.0600                                                238
.172304.96006.670010.300                                                239
.170205.08006.860010.600                                                240
.161505.62007.620011.900                                                241
.157105.96008.040012.500                                                242
.152006.38008.610013.400                                                243
.145906.91009.310014.500                                                244
.143607.14009.6600                                                      245
.136207.740010.700                                                      246
.136007.950010.700                                                      247
.129208.830011.900                                                      248
```

330 CARDS

VISIBILITY LABORATORY U.C.S.D.
PROGRAM OR SUBROUTINE DESCRIPTION

A. IDENTIFICATION

Title	PROGRAM PODV1
Category	CVC
Programmer	Barkdoll
Date	1 September 1965
Type	F-63 Calling Program

B. DESCRIPTION

Provides input data and calls the sequence of programs that will solve for a probability of target detection volumn.

C. USAGE

1. Calling Sequence

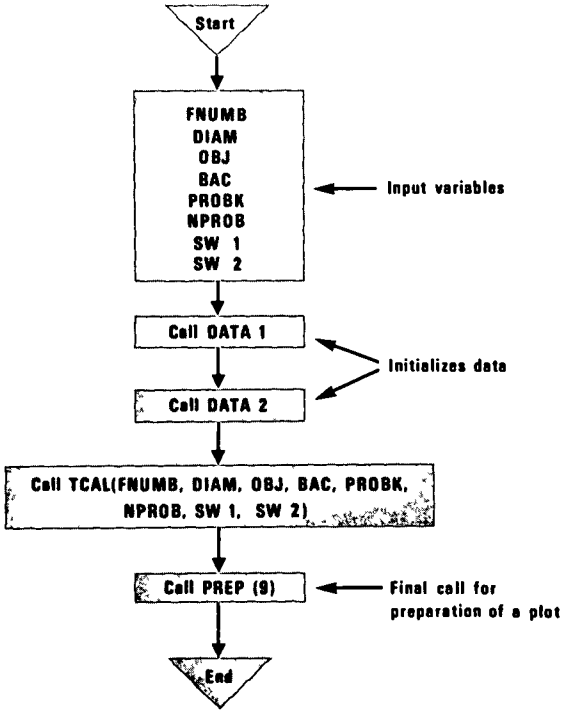
Calling Program

2. Arguments or Parameters

FNUMB = flight number used for atmospheric data.
DIAM = target diameter in feet – not to exceed 100 ft.
OBJ = index for directional reflectance properties of target object.
BAC = index for directional reflectance properties of the background.
PROBK = constant for deviation from 50% probability of detection.
NPROB = integer representing probability of detection.
SW2 = switch for plotting; 1 if plot is desired, 0 if no plot is desired.
SW1 = switch for output printing; 1 for calculations and coordinates, 0 for coordinates only.

3. Storage Requirements (Decimal)	37 words
4. Temporary Storage Requirements	(a) Not Applicable (b) Not Applicable
5. Alarms, or Print-Outs	None
6. Error Returns	None
7. Error Stops	None
8. Input and Output Tape Mountings	Not Applicable
9. Input and Output Formats	Not Applicable
10. Selective Jump and Stop Settings	Not Applicable
11. Machine Time	Approximately one minute
12. Accuracy	Not Applicable
13. Cautions to User	None
14. Equipment Configuration	CDC 3600 Fortran 63
15. References	

E. FLOW CHART


Start
FNUMB
DIAM
OBJ
BAC
PROBK
NPROB
SW 1
SW 2
Input variables
Call DATA 1
Call DATA 2
Initializes data
Call TCAL(FNUMB, DIAM, OBJ, BAC, PROBK, NPROB, SW 1, SW 2)
Call PREP (9)
Final call for preparation of a plot
End

PROGRAM PODV1

```
      PROGRAM PODV1                                                    POD 0000
C     ...PROGRAM PODV1...1NOV,65...BARKDOLL,...VISLAB...UCSD           POD 0010
C     ...PODV1= PROBABILITY OF DETECTION VOLUME PHASE 1                POD 0020
C     ...THIS PROGRAM PROVIDES INPUT DATA FOR THE                      POD 0030
C     ...SOLUTION OF A PROBABILITY OF TARGET DETECTION VOLUME.         POD 0040
C     ...THE CALLED SEQUENCE OF PROGRAMS WILL PRINT THE                POD 0050
C     ...ALTITUDE AND DISTANCE FROM THE TARGET AXIS FOR                POD 0060
C     ...8 DOWNWARD LOOKING ZENITHS OF PATH OF SIGHT,                  POD 0070
C     ...THETA=180,165,150,135,120,105,100,95 DEGREES AND              POD 0080
C     ...FOR 5 AZIMUTHS OF PATH OF SIGHT WITH RESPECT                  POD 0090
C     ...TO THE SUN, PHI=0,45,90,135,180 DEGREES.                      POD 0100
C     ...THE PROGRAM WILL ALSO PLOT THESE POINTS AS                    POD 0110
C     ...4 HEMISPHERIC CROSS SECTIONS.                                 POD 0120
C                                                                      POD 0130
C     ...VARIABLE INPUTS...                                            POD 0140
C     ...OPT=OPTION FOR ATMOSPHERIC AND OPTICAL SYSTEM                 POD 0150
C     .....OPT=0 FOR VIEWING THROUGH ATMOSPHERE ONLY                   POD 0160
C     .....OPT=-1 FOR OPTICS AND NO ATMOSPHERE                         POD 0170
C     .....OPT=+1 FOR OPTICS AND AN ATMOSPHERE                         POD 0180
C     ...FNUMB=FLIGHT NUMBER FOR ATMOSPHERIC DATA                      POD 0190
C     ...OPTNU=OPTICAL SYSTEM INDEX NUMBER                             POD 0200
C     ...DIAM=TARGET DIAMETER IN FT.,NOT TO EXCEED 100 FT.             POD 0210
C     ...OBJ=INDEX FOR DIRECTIONAL REFLECTANCE PROPERTIES              POD 0220
C     ...OF TARGET OBJECT                                              POD 0230
C     ...BAC=INDEX FOR DIRECTIONAL REFLECTANCE PROPERTIES              POD 0240
C     ...OF BACKGROUND                                                 POD 0250
C     ...PROBK=CONSTANT FOR DEVIATION FROM 50 PERCENT                  POD 0260
C     ...PROBABILITY,1. FOR 50,1.206 FOR 70, 1.50 FOR 90, AND          POD 0270
C     ...1.91 FOR 99 PERCENT PROBABILITY OF DETECTION                  POD 0280
C     ...NPROB=INTEGER REPRESENTING PROBABILITY                        POD 0290
C     ...SW1=SWITCH FOR OUTPUT PRINTING, 1 FOR CALCULATIONS            POD 0300
C     ...AND COORDINATES, 0 FOR COORDINATES ONLY                       POD 0310
C     ...SW2=SWITCH FOR PLOTTING, 1 IF PLOT IS DESIRED                 POD 0320
C     ...0 FOR NO PLOT                                                 POD 0330
C     ...                                                              POD 0340
C     ...CALLED PROGRAMS=TCAL                                          POD 0350
C                                                                      POD 0360
      OPT=0.                                                           POD 0370
      FNUMB=74.                                                        POD 0380
      DIAM=10.
      OBJ=1.                                                           POD 0400
      BAC=1.                                                           POD 0410
      PROBK=1.                                                         POD 0420
      NPROB=50                                                         POD 0430
      SW1=1.                                                           POD 0440
      SW2=1.                                                           POD 0450
C     ***INITIALIZE DATA TABLES.                                       POD 0455
      CALL DATA1                                                       POD 0460
      CALL DATA2                                                       POD 0470
      CALL DATA 3                                                      POD 0480
C     ***CALL MAIN PROCESSING ROUTINE                                  POD 0485
      CALL TCAL(OPT,FNUMB,OPTNU,DIAM,OBJ,BAC,PROBK,NPROB,              POD 0490
     1SW1,SW2)                                                         POD 0500
C     ***INITIATE PLOTTING OUT DATA                                    POD 0505
      CALL PREP(9)                                                     POD 0510
      END                                                              POD 0520

                                                                       56 CARDS
```

VISIBILITY LABORATORY U.C.S.D.
PROGRAM OR SUBROUTINE DESCRIPTION

A. IDENTIFICATION

Title	SUBROUTINE DATA 1
Category	CVC
Programmer	Barkdoll
Date	29 September 1965
Type	F-63 Subroutine

B. DESCRIPTION

Data package containing a three dimensional array (8, 18, 5) of Path Luminance values for a given flight. The eight columns represent zeniths of path of sight, the eighteen rows represent altitudes from 1,000 feet to 60,000 feet, and the five planes represent azimuths of path of sight.

C. USAGE

1. Calling Sequence	Called by PODV1, data used by BSTRF
2. Arguments or Parameters	ARRAY BS gives Path Luminance values COMMON /A/ BS(8.18,5) COMMON WITH BSTRF
3. Storage Requirements (Decimal)	720 words
4. Temporary Storage Requirements	Not Applicable
5. Alarms, or Print-Outs	None
6. Error Returns	None
7. Error Stops	None
8. Input and Output Tape Mountings	Not Applicable
9. Input and Output Formats	Not Applicable
10. Selective Jump and Stop Settings	Not Applicable
11. Machine Time	Not Applicable
12. Accuracy	Not Applicable
13. Cautions to User	None
14. Equipment Configuration	CDC 3600 FORTRAN 63
15. References	

D. METHOD

Data package only

E. FLOW CHART

Not applicable

SUBROUTINE DATA1

```
      SUBROUTINE DATA1                                                      DA1 0000
C     ...SUBROUTINE DATA1...1NOV,65...BARKDOLL...VISLAB...UCSD              DA1 0010
C     ...THIS SUBROUTINE IS A DATA PACKAGE FOR PATH                         DA1 0020
C     ...LUMINANCE VALUES,ARRAY BS(8,18,5)USED BY BSTRF                     DA1 0030
C     ...TABLE OF BSTAR PATH LUMINANCE VALUES FOR FLIGHT 74                 DA1 0040
C     ***NOTE DATA STORED IN THIS WAY FOR PILOT DEBUGGING ONLY.             DA1 0045
C                                                                           DA1 0050
      COMMON/A/BS(8,18,5)                                                   DA1 0060
C     ...PATH LUMINANCE VALUES.                                             DA1 0065
      BS(1,1,1)=0$ BS(1,2,1)=60.9$ BS(1,3,1)=134.$ BS(1,4,1)=192.           DA1 0070
      BS(1,5,1)=233.$ BS(1,6,1)=264.$ BS(1,7,1)=291.$ BS(1,8,1)=313.        DA1 0080
      BS(1,9,1)=341.$BS(1,10,1)=367.$BS(1,11,1)=388.$BS(1,12,1)=484.        DA1 0090
      BS(1,13,1)=603.$BS(1,14,1)=710.$BS(1,15,1)=798.$BS(1,16,1)=928.       DA1 0100
      BS(1,17,1)=1010.$BS(1,18,1)=1060.                                     DA1 0110
      BS(2,1,1)=0$ BS(2,2,1)=60.9$ BS(2,3,1)=132.$ BS(2,4,1)=204.           DA1 0120
      BS(2,5,1)=259.$ BS(2,6,1)=281.$ BS(2,7,1)=301.$ BS(2,8,1)=327.        DA1 0130
      BS(2,9,1)=366.$BS(2,10,1)=388.$BS(2,11,1)=399.$BS(2,12,1)=457.        DA1 0140
      BS(2,13,1)=510.$BS(2,14,1)=557.$BS(2,15,1)=596.$BS(2,16,1)=653.       DA1 0150
      BS(2,17,1)=689.$BS(2,18,1)=710.                                       DA1 0160
      BS(3,1,1)=0$ BS(3,2,1)=81.8$ BS(3,3,1)=158.$ BS(3,4,1)=229.           DA1 0170
      BS(3,5,1)=298.$ BS(3,6,1)=318.$ BS(3,7,1)=344.$ BS(3,8,1)=377.        DA1 0180
      BS(3,9,1)=419.$BS(3,10,1)=445.$BS(3,11,1)=459.$BS(3,12,1)=532.        DA1 0190
      BS(3,13,1)=604.$BS(3,14,1)=674.$BS(3,15,1)=731.$BS(3,16,1)=815.       DA1 0200
      BS(3,17,1)=867.$BS(3,18,1)=899.                                       DA1 0210
      BS(4,1,1)=0$ BS(4,2,1)=88.7$ BS(4,3,1)=163.$ BS(4,4,1)=236.           DA1 0220
      BS(4,5,1)=305.$ BS(4,6,1)=340.$ BS(4,7,1)=381.$ BS(4,8,1)=434.        DA1 0230
      BS(4,9,1)=496.$BS(4,10,1)=531.$BS(4,11,1)=545.$BS(4,12,1)=610.        DA1 0240
      BS(4,13,1)=672.$BS(4,14,1)=731.$BS(4,15,1)=779.$BS(4,16,1)=848.       DA1 0250
      BS(4,17,1)=891.$BS(4,18,1)=917.                                       DA1 0260
      BS(5,1,1)=0$ BS(5,2,1)=123.$ BS(5,3,1)=214.$ BS(5,4,1)=298.           DA1 0270
      BS(5,5,1)=371.$ BS(5,6,1)=414.$ BS(5,7,1)=469.$ BS(5,8,1)=545.        DA1 0280
      BS(5,9,1)=671.$BS(5,10,1)=732.$BS(5,11,1)=749.$BS(5,12,1)=823.        DA1 0290
      BS(5,13,1)=896.$BS(5,14,1)=967.$BS(5,15,1)=1020.$BS(5,16,1)=1110.     DA1 0300
      BS(5,17,1)=1150.$BS(5,18,1)=1180.                                     DA1 0310
      BS(6,1,1)=0$ BS(6,2,1)=223.$ BS(6,3,1)=461.$ BS(6,4,1)=676.           DA1 0320
      BS(6,5,1)=868.$ BS(6,6,1)=973.$ BS(6,7,1)=1070.$ BS(6,8,1)=1180.      DA1 0330
      BS(6,9,1)=1290.$BS(6,10,1)=1360.$BS(6,11,1)=1380.$BS(6,12,1)=1510.DA1 0340
      BS(6,13,1)=1660.$BS(6,14,1)=1790.$BS(6,15,1)=1890.$BS(6,16,1)=2040DA1 0350
     1.                                                                     DA1 0360
      BS(6,17,1)=2120.$BS(6,18,1)=2170.                                     DA1 0370
      BS(7,1,1)=0$ BS(7,2,1)=398.$ BS(7,3,1)=727.$ BS(7,4,1)=998.           DA1 0380
      BS(7,5,1)=1210.$ BS(7,6,1)=1300.$ BS(7,7,1)=1390.$ BS(7,8,1)=1470.DA1 0390
      BS(7,9,1)=1530.$BS(7,10,1)=1580.$BS(7,11,1)=1610.$BS(7,12,1)=1780.DA1 0400
      BS(7,13,1)=1980.$BS(7,14,1)=2150.$BS(7,15,1)=2270.$BS(7,16,1)=2440DA1 0410
     1.                                                                     DA1 0420
      BS(7,17,1)=2540.$BS(7,18,1)=2590.                                     DA1 0430
      BS(8,1,1)=0$ BS(8,2,1)=750.$ BS(8,3,1)=1140.$ BS(8,4,1)=1400.         DA1 0440
      BS(8,5,1)=1590.$ BS(8,6,1)=1690.$ BS(8,7,1)=1780.$ BS(8,8,1)=1890.DA1 0450
      BS(8,9,1)=2020.$BS(8,10,1)=2110.$BS(8,11,1)=2140.$BS(8,12,1)=2310.DA1 0460
      BS(8,13,1)=2500.                                                      DA1 0470
      BS(1,1,2)=0 $BS(1,2,2)=86.2 $BS(1,3,2)=159. $BS(1,4,2)=220.           DA1 0480
      BS(1,5,2)=267. $BS(1,6,2)=299. $BS(1,7,2)=324. $BS(1,8,2)=340.        DA1 0490
      BS(1,9,2)=375.$BS(1,10,2)=401.$BS(1,11,2)=417.$BS(1,12,2)=495.        DA1 0500
      BS(1,13,2)=587.$BS(1,14,2)=671.$BS(1,15,2)=740.$BS(1,16,2)=841.       DA1 0510
      BS(1,17,2)=903.$BS(1,18,2)=941.                                       DA1 0520
      BS(2,1,2)=0 $BS(2,2,2)=103. $BS(2,3,2)=183. $BS(2,4,2)=252.           DA1 0530
      BS(2,5,2)=308. $BS(2,6,2)=335. $BS(2,7,2)=356. $BS(2,8,2)=371.        DA1 0540
      BS(2,9,2)=417.$BS(2,10,2)=447.$BS(2,11,2)=463.$BS(2,12,2)=541.        DA1 0550
      BS(2,13,2)=628.$BS(2,14,2)=707.$BS(2,15,2)=772.$BS(2,16,2)=866.       DA1 0560
      BS(2,17,2)=925.$BS(2,18,2)=961.                                       DA1 0570
      BS(3,1,2)=0 $BS(3,2,2)=110. $BS(3,3,2)=192. $BS(3,4,2)=262.           DA1 0580
      BS(3,5,2)=318. $BS(3,6,2)=365. $BS(3,7,2)=406. $BS(3,8,2)=441.        DA1 0590
      BS(3,9,2)=487.$BS(3,10,2)=518.$BS(3,11,2)=534.$BS(3,12,2)=607.        DA1 0600
      BS(3,13,2)=689.$BS(3,14,2)=763.$BS(3,15,2)=824.$BS(3,16,2)=912.       DA1 0610
```

```
BS(3,17,2)=967.$BS(3,18,2)=1000.                                                DA1 0620
BS(4,1,2)=0 $BS(4,2,2)=128. $BS(4,3,2)=244. $BS(4,4,2)=331.                     DA1 0630
BS(4,5,2)=391. $BS(4,6,2)=444. $BS(4,7,2)=484. $BS(4,8,2)=525.                  DA1 0640
BS(4,9,2)=606.$BS(4,10,2)=645.$BS(4,11,2)=678.$BS(4,12,2)=755.                  DA1 0650
BS(4,13,2)=856.$BS(4,14,2)=947.$BS(4,15,2)=1020.$BS(4,16,2)=1130.               DA1 0660
BS(4,17,2)=1190.$BS(4,18,2)=1230.                                               DA1 0670
BS(5,1,2)=0 $BS(5,2,2)=259. $BS(5,3,2)=473. $BS(5,4,2)=639.                     DA1 0680
BS(5,5,2)=771. $BS(5,6,2)=854. $BS(5,7,2)=935. $BS(5,8,2)=956.                  DA1 0690
BS(5,9,2)=1020.$BS(5,10,2)=1070.$BS(5,11,2)=1100.$BS(5,12,2)=1280.              DA1 0700
BS(5,13,2)=1470.$BS(5,14,2)=1630.$BS(5,15,2)=1760.$BS(5,16,2)=1930              DA1 0710
BS(5,17,2)=2040.$BS(5,18,2)=2110.                                               DA1 0720
BS(6,1,2)=0 $BS(6,2,2)=359. $BS(6,3,2)=692. $BS(6,4,2)=837.                     DA1 0730
BS(6,5,2)=1100. $BS(6,6,2)=1180. $BS(6,7,2)=1270. $BS(6,8,2)=1320.              DA1 0740
BS(6,9,2)=1390.$BS(6,10,2)=1450.$BS(6,11,2)=1480.$BS(6,12,2)=1600.              DA1 0750
BS(6,13,2)=1760.$BS(6,14,2)=1910.$BS(6,15,2)=2010.$BS(6,16,2)=2160              DA1 0760
1.                                                                              DA1 0770
BS(6,17,2)=2240.$BS(6,18,2)=2280.                                               DA1 0780
BS(7,1,2)=0 $BS(7,2,2)=650. $BS(7,3,2)=964. $BS(7,4,2)=1190.                    DA1 0790
BS(7,5,2)=1310. $BS(7,6,2)=1450. $BS(7,7,2)=1570. $BS(7,8,2)=1640.              DA1 0800
BS(7,9,2)=1700.$BS(7,10,2)=1780.$BS(7,11,2)=1800.$BS(7,12,2)=1920.              DA1 0810
BS(7,13,2)=2100.                                                                DA1 0820
BS(1,1,3)=0 $BS(1,2,3)=69.7 $BS(1,3,3)=138. $BS(1,4,3)=195.                     DA1 0830
BS(1,5,3)=238. $BS(1,6,3)=268. $BS(1,7,3)=293. $BS(1,8,3)=321.                  DA1 0840
BS(1,9,3)=351.$BS(1,10,3)=376.$BS(1,11,3)=393.$BS(1,12,3)=479.                  DA1 0850
BS(1,13,3)=582.$BS(1,14,3)=675.$BS(1,15,3)=751.$BS(1,16,3)=864.                 DA1 0860
BS(1,17,3)=934.$BS(1,18,3)=976.                                                 DA1 0870
BS(2,1,3)=0 $BS(2,2,3)=77.8 $BS(2,3,3)=156. $BS(2,4,3)=226.                     DA1 0880
BS(2,5,3)=279. $BS(2,6,3)=306. $BS(2,7,3)=328. $BS(2,8,3)=344.                  DA1 0890
BS(2,9,3)=383.$BS(2,10,3)=409.$BS(2,11,3)=426.$BS(2,12,3)=516.                  DA1 0900
BS(2,13,3)=609.$BS(2,14,3)=694.$BS(2,15,3)=763.$BS(2,16,3)=864.                 DA1 0910
BS(2,17,3)=926.$BS(2,18,3)=964.                                                 DA1 0920
BS(3,1,3)=0 $BS(3,2,3)=82.8 $BS(3,3,3)=174. $BS(3,4,3)=245.                     DA1 0930
BS(3,5,3)=298. $BS(3,6,3)=339. $BS(3,7,3)=372. $BS(3,8,3)=403.                  DA1 0940
BS(3,9,3)=439.$BS(3,10,3)=463.$BS(3,11,3)=481.$BS(3,12,3)=571.                  DA1 0950
BS(3,13,3)=670.$BS(3,14,3)=759.$BS(3,15,3)=831.$BS(3,16,3)=936.                 DA1 0960
BS(3,17,3)=1000.$BS(3,18,3)=1040.                                               DA1 0970
BS(4,1,3)=0 $BS(4,2,3)=109. $BS(4,3,3)=226. $BS(4,4,3)=325.                     DA1 0980
BS(4,5,3)=404. $BS(4,6,3)=462. $BS(4,7,3)=508. $BS(4,8,3)=549.                  DA1 0990
BS(4,9,3)=580.$BS(4,10,3)=607.$BS(4,11,3)=628.$BS(4,12,3)=739.                  DA1 1000
BS(4,13,3)=873.$BS(4,14,3)=993.$BS(4,15,3)=1090.$BS(4,16,3)=1230.               DA1 1010
BS(4,17,3)=1314.$BS(4,18,3)=1370.                                               DA1 1020
BS(5,1,3)=0 $BS(5,2,3)=203. $BS(5,3,3)=389. $BS(5,4,3)=540.                     DA1 1030
BS(5,5,3)=665. $BS(5,6,3)=744. $BS(5,7,3)=810. $BS(5,8,3)=881.                  DA1 1040
BS(5,9,3)=932.$BS(5,10,3)=963.$BS(5,11,3)=1000.$BS(5,12,3)=1160.                DA1 1050
BS(5,13,3)=1310.$BS(5,14,3)=1450.$BS(5,15,3)=1560.$BS(5,16,3)=1710              DA1 1060
1.                                                                              DA1 1070
BS(5,17,3)=1800.$BS(5,18,3)=1860.                                               DA1 1080
BS(6,1,3)=0 $BS(6,2,3)=359. $BS(6,3,3)=562. $BS(6,4,3)=722.                     DA1 1090
BS(6,5,3)=867. $BS(6,6,3)=975. $BS(6,7,3)=1090. $BS(6,8,3)=1170.                DA1 1100
BS(6,9,3)=1190.$BS(6,10,3)=1240.$BS(6,11,3)=1270.$BS(6,12,3)=1420.              DA1 1110
BS(6,13,3)=1580.$BS(6,14,3)=1730.$BS(6,15,3)=1830.$BS(6,16,3)=1980              DA1 1120
1.                                                                              DA1 1130
BS(6,17,3)=2060.$BS(6,18,3)=2100.                                               DA1 1140
BS(7,1,3)=0 $BS(7,2,3)=595. $BS(7,3,3)=833. $BS(7,4,3)=990.                     DA1 1150
BS(7,5,3)=1110. $BS(7,6,3)=1190. $BS(7,7,3)=1260. $BS(7,8,3)=1310.              DA1 1160
BS(7,9,3)=1380.$BS(7,10,3)=1410.$BS(7,11,3)=1450.$BS(7,12,3)=1600.              DA1 1170
BS(7,13,3)=1800.                                                                DA1 1180
BS(1,1,4)=0 $BS(1,2,4)=93.4 $BS(1,3,4)=161. $BS(1,4,4)=218.                     DA1 1190
BS(1,5,4)=259. $BS(1,6,4)=292. $BS(1,7,4)=323. $BS(1,8,4)=344.                  DA1 1200
BS(1,9,4)=364.$BS(1,10,4)=395.$BS(1,11,4)=417.$BS(1,12,4)=531.                  DA1 1210
BS(1,13,4)=634.$BS(1,14,4)=725.$BS(1,15,4)=802.$BS(1,16,4)=915.                 DA1 1220
BS(1,17,4)=986.$BS(1,18,4)=1030.                                                DA1 1230
BS(2,1,4)=0 $BS(2,2,4)=120. $BS(2,3,4)=207. $BS(2,4,4)=278.                     DA1 1240
BS(2,5,4)=326. $BS(2,6,4)=358. $BS(2,7,4)=385. $BS(2,8,4)=401.                  DA1 1250
BS(2,9,4)=427.$BS(2,10,4)=458.$BS(2,11,4)=485.$BS(2,12,4)=620.                  DA1 1260
BS(2,13,4)=724.$BS(2,14,4)=818.$BS(2,15,4)=895.$BS(2,16,4)=1010.                DA1 1270
```

```
BS(2,17,4)=1080.$BS(2,18,4)=1120.                                        DA1 1280
BS(3,1,4)=0 $BS(3,2,4)=137. $BS(3,3,4)=241. $BS(3,4,4)=315.              DA1 1290
BS(3,5,4)=375. $BS(3,6,4)=414. $BS(3,7,4)=440. $BS(3,8,4)=466.           DA1 1300
BS(3,9,4)=497.$BS(3,10,4)=523.$BS(3,11,4)=560.$BS(3,12,4)=691.           DA1 1310
BS(3,13,4)=856.$BS(3,14,4)=1000.$BS(3,15,4)=1130.$BS(3,16,4)=1300.DA1 1320
BS(3,17,4)=1410.$BS(3,18,4)=1480.                                        DA1 1330
BS(4,1,4)=0 $BS(4,2,4)=137. $BS(4,3,4)=282. $BS(4,4,4)=385.              DA1 1340
BS(4,5,4)=462. $BS(4,6,4)=525. $BS(4,7,4)=573. $BS(4,8,4)=609.           DA1 1350
BS(4,9,4)=630.$BS(4,10,4)=652.$BS(4,11,4)=694.$BS(4,12,4)=861.           DA1 1360
BS(4,13,4)=995.$BS(4,14,4)=1120.$BS(4,15,4)=1220.$BS(4,16,4)=1360.DA1 1370
BS(4,17,4)=1440.$BS(4,18,4)=1490.                                        DA1 1380
BS(5,1,4)=0 $BS(5,2,4)=336. $BS(5,3,4)=494. $BS(5,4,4)=625.              DA1 1390
BS(5,5,4)=729. $BS(5,6,4)=804. $BS(5,7,4)=885. $BS(5,8,4)=936.           DA1 1400
BS(5,9,4)=1040.$BS(5,10,4)=1140.$BS(5,11,4)=1170.$BS(5,12,4)=1350.DA1 1410
BS(5,13,4)=1470.$BS(5,14,4)=1590.$BS(5,15,4)=1670.$BS(5,16,4)=1790DA1 1420
1.                                                                       DA1 1430
BS(5,17,4)=1860.$BS(5,18,4)=1900.                                        DA1 1440
BS(6,1,4)=0 $BS(6,2,4)=486. $BS(6,3,4)=677. $BS(6,4,4)=813.              DA1 1450
BS(6,5,4)=910. $BS(6,6,4)=1000. $BS(6,7,4)=1090. $BS(6,8,4)=1170. DA1 1460
BS(6,9,4)=1290.$BS(6,10,4)=1390.$BS(6,11,4)=1450.$BS(6,12,4)=1660.DA1 1470
BS(6,13,4)=1780.$BS(6,14,4)=1890.$BS(6,15,4)=1980.$BS(6,16,4)=2090DA1 1480
1.                                                                       DA1 1490
BS(6,17,4)=2150.$BS(6,18,4)=2180.                                        DA1 1500
BS(7,1,4)=0 $BS(7,2,4)=693. $BS(7,3,4)=951. $BS(7,4,4)=1100.             DA1 1510
BS(7,5,4)=1230. $BS(7,6,4)=1290. $BS(7,7,4)=1310. $BS(7,8,4)=1400.DA1 1520
BS(7,9,4)=1520.$BS(7,10,4)=1650.$BS(7,11,4)=1700.$BS(7,12,4)=1910.DA1 1530
BS(7,13,4)=2050.                                                         DA1 1540
BS(1,1,5)=0 $BS(1,2,5)=65.9 $BS(1,3,5)=138. $BS(1,4,5)=198.              DA1 1550
BS(1,5,5)=241. $BS(1,6,5)=264. $BS(1,7,5)=285. $BS(1,8,5)=316.           DA1 1560
BS(1,9,5)=387.$BS(1,10,5)=448.$BS(1,11,5)=472.$BS(1,12,5)=575.           DA1 1570
BS(1,13,5)=699.$BS(1,14,5)=816.$BS(1,15,5)=912.$BS(1,16,5)=1050.         DA1 1580
BS(1,17,5)=1140.$BS(1,18,5)=1190.                                        DA1 1590
BS(2,1,5)=0 $BS(2,2,5)=94.3 $BS(2,3,5)=193. $BS(2,4,5)=276.              DA1 1600
BS(2,5,5)=341. $BS(2,6,5)=364. $BS(2,7,5)=386. $BS(2,8,5)=417.           DA1 1610
BS(2,9,5)=453.$BS(2,10,5)=485.$BS(2,11,5)=509.$BS(2,12,5)=637.           DA1 1620
BS(2,13,5)=792.$BS(2,14,5)=943.$BS(2,15,5)=1070.$BS(2,16,5)=1250.        DA1 1630
BS(2,17,5)=1360.$BS(2,18,5)=1430.                                        DA1 1640
BS(3,1,5)=0 $BS(3,2,5)=106. $BS(3,3,5)=227. $BS(3,4,5)=327.              DA1 1650
BS(3,5,5)=407. $BS(3,6,5)=450. $BS(3,7,5)=484. $BS(3,8,5)=515.           DA1 1660
BS(3,9,5)=539.$BS(3,10,5)=558.$BS(3,11,5)=583.$BS(3,12,5)=721.           DA1 1670
BS(3,13,5)=867.$BS(3,14,5)=997.$BS(3,15,5)=1100.$BS(3,16,5)=1260.        DA1 1680
BS(3,17,5)=1350.$BS(3,18,5)=1410.                                        DA1 1690
BS(4,1,5)=0 $BS(4,2,5)=144. $BS(4,3,5)=274. $BS(4,4,5)=382.              DA1 1700
BS(4,5,5)=451. $BS(4,6,5)=512. $BS(4,7,5)=570. $BS(4,8,5)=617.           DA1 1710
BS(4,9,5)=659.$BS(4,10,5)=681.$BS(4,11,5)=705.$BS(4,12,5)=816.           DA1 1720
BS(4,13,5)=944.$BS(4,14,5)=1060.$BS(4,15,5)=1160.$BS(4,16,5)=1300.DA1 1730
BS(4,17,5)=1380.$BS(4,18,5)=1430.                                        DA1 1740
BS(5,1,5)=0 $BS(5,2,5)=228. $BS(5,3,5)=496. $BS(5,4,5)=682.              DA1 1750
BS(5,5,5)=815. $BS(5,6,5)=867. $BS(5,7,5)=920. $BS(5,8,5)=987.           DA1 1760
BS(5,9,5)=1110.$BS(5,10,5)=1220.$BS(5,11,5)=1250.$BS(5,12,5)=1420.DA1 1770
BS(5,13,5)=1620.$BS(5,14,5)=1810.$BS(5,15,5)=1960.$BS(5,16,5)=2160DA1 1780
1.                                                                       DA1 1790
BS(5,17,5)=2280.$BZ(5,18,5)=2350.                                        DA1 1800
BS(6,1,5)=0 $BS(6,2,5)=485. $BS(6,3,5)=763. $BS(6,4,5)=935.              DA1 1810
BS(6,5,5)=1040. $BS(6,6,5)=1130. $BS(6,7,5)=1230. $BS(6,8,5)=1360.DA1 1820
BS(6,9,5)=1450.$BS(6,10,5)=1500.$BS(6,11,5)=1540.$BS(6,12,5)=1750.DA1 1830
BS(6,13,5)=1970.$BS(6,14,5)=2170.$BS(6,15,5)=2330.$BS(6,16,5)=2530DA1 1840
1.                                                                       DA1 1850
BS(6,17,5)=2650.$BS(6,18,5)=2710.                                        DA1 1860
BS(7,1,5)=0 $BS(7,2,5)=860. $BS(7,3,5)=1140. $BS(7,4,5)=1270.            DA1 1870
BS(7,5,5)=1330. $BS(7,6,5)=1380. $BS(7,7,5)=1450. $BS(7,8,5)=1480.DA1 1880
BS(7,9,5)=1680.$BS(7,10,5)=1770.$BS(7,11,5)=1800.$BS(7,12,5)=2000.DA1 1890
BS(7,13,5)=2200.                                                         DA1 1900
END                                                                      DA1 1910
```

194 CARDS

VISIBILITY LABORATORY U.C.S.D.
PROGRAM OR SUBROUTINE DESCRIPTION

A. IDENTIFICATION

Title	SUBROUTINE DATA 2
Category	CVC
Programmer	Barkdoll
Date	29 September 1965
Type	

B. DESCRIPTION

Data package containing seven blocks of data.
(1) R(201) = attenuation lengths used by TRF
(2) AMV(6,2) = optical air mass values used by TRF.
(3) TILLH = total illuminance on horizontal ground or seaplane for reflectance data.
(4) RB(5,8,2) = background directional reflectance values used by BBOF and COF.
(5) RO(5,8,1) = target directional reflectance values used by COF.
(6) CR(20,9) = threshold contrast values used by TCAL.
(7) TRV(7) = beam transmittance values from 20,000 to 60,000 feet, used by TRF.

C. USAGE

1. Calling Sequence	Called by PODVI
2. Arguments or Parameters	
COMMON/B/RB(5,8,2), RO(5,8,1)	– common with COF and BBOF
COMMON/C/CR(20,9)	– common with TCAL
COMMON/D/R(201), AMV(6,2), TRV(7)	– common with TRF
3. Storage Requirements (Decimal)	520
4. Temporary Storage Requirements	Not Applicable
5. Alarms, Print-Outs	Not Applicable
6. Error Returns	None
7. Error Stops	None
8. Input and Output Tape Mountings	Not Applicable
9. Input and Output Formats	Not Applicable
10. Selective Jump and Stop Settings	Not Applicable
11. Machine Time	Not Applicable
12. Accuracy	Not Applicable
13. Cautions to User	None
14. Equipment Configuration	CDC 3600 FORTRAN 63
15. References	

D. METHOD

Data package only

E. FLOW CHART

Not Applicable

SUBROUTINE DATA2

```
      SUBROUTINE DATA2                                                    DA2 0000
C     ...SUBROUTINE DATA2...1NOV,65...BARKDOLL...VISLAB...UCSD            DA2 0010
C     ...THIS SUBROUTINE IS A DATA PACKAGE                                DA2 0020
C     ...ARRAY CR= THRESHOLD CONTRAST VALUES FROM TIFFANY DATA.           DA2 0030
C     ....USED BY TCAL                                                    DA2 0040
C     ...ARRAY AMV=AIR MASS VALUES                                        DA2 0050
C     ....USED BY TRF                                                     DA2 0060
C     ...ARRAY R=ATTENUATION LENGTHS                                      DA2 0070
C     ....USED BY TRF                                                     DA2 0080
C     ...DATA TRV=BEAM TRANSMITTANCE VALUES 20K TO 60K                    DA2 0090
C     ....USED BY TRF                                                     DA2 0100
C     ...ARRAY RB=DIRECTIONAL LUMINOUS REFLECTANCE OF BACKGROUNDS         DA2 0110
C     ....USED BY COF AND BBOF                                            DA2 0120
C     ...ARRAY RO=DIRECTIONAL LUMINOUS REFLECTANCE OF OBJECTS             DA2 0130
C     ....USED BY COF                                                     DA2 0140
C                                                                         DA2 0150
      COMMON /B/ RB(5,8,2),RO(5,8,1),TILLH                                DA2 0160
      COMMON/C/CR(20,9)                                                   DA2 0170
      COMMON/D/R(201),AMV(6,2),TRV(7)                                     DA2 0180
C     ...THIS DATA IS FOR FLIGHT 74                                       DA2 0190
C     ...EXTRAPOLATED BEAM TRANSMITTANCE VALUES                           DA2 0195
      DATA(TRV=.641,.628,.618,.610,.603,.593,.587)                        DA2 0200
C     ...ATTENUATION LENGTHS                                              DA2 0205
      R(  1)=4.6 $R(  2)=4.3 $R(  3)=4.0 $R(  4)=3.5 $R(  5)=3.3          DA2 0210
      R(  6)=3.0 $R(  7)=2.6 $R(  8)=2.3 $R(  9)=2.0 $R( 10)=1.8          DA2 0220
      R( 11)=1.5 $R( 12)=1.25$R( 13)=1.2 $R( 14)=1.2 $R( 15)=1.35         DA2 0230
      R( 16)=1.6 $R( 17)=2.5 $R( 18)=3.0 $R( 19)=1.8 $R( 20)=1.2          DA2 0240
      R( 21)=0.4 $R( 22)=0.75$R( 23)=1.5 $R( 24)=2.1 $R( 25)=2.4          DA2 0250
      R( 26)=2.6 $R( 27)=2.75$R( 28)=2.9 $R( 29)=3.0 $R( 30)=3.0          DA2 0260
      R( 31)=3.1 $R( 32)=3.1 $R( 33)=3.0 $R( 34)=2.9 $R( 35)=2.9          DA2 0270
      R( 36)=3.1 $R( 37)=3.3 $R( 38)=4.6 $R( 39)=5.3 $R( 40)=6.4          DA2 0280
      R( 41)=7.  $R( 42)=6.1 $R( 43)=6.1 $R( 44)=9.0 $R( 45)=7.4          DA2 0290
      R( 46)=7.8 $R( 47)=9.  $R( 48)=12. $R( 49)=18. $R( 50)=20.          DA2 0300
      R( 51)=22. $R( 52)=25. $R( 53)=26.5$R( 54)=27. $R( 55)=28.          DA2 0310
      R( 56)=28.5$R( 57)=29.5$R( 58)=28. $R( 59)=26. $R( 60)=26.          DA2 0320
      R( 61)=28.5$R( 62)=32. $R( 63)=33. $R( 64)=33.5$R( 65)=33.5         DA2 0330
      R( 66)=34. $R( 67)=35. $R( 68)=36. $R( 69)=33. $R( 70)=31.          DA2 0340
      R( 71)=31. $R( 72)=23. $R( 73)=23.5$R( 74)=24. $R( 75)=25.          DA2 0350
      R( 76)=26.5$R( 77)=30. $R( 78)=32.5$R( 79)=34. $R( 80)=34.          DA2 0360
      R( 81)=34. $R( 82)=35. $R( 83)=35. $R( 84)=36. $R( 85)=37.          DA2 0370
      R( 86)=34. $R( 87)=22. $R( 88)=20. $R( 89)=19. $R( 90)=18.          DA2 0380
      R( 91)=17.5$R( 92)=17.5$R( 93)=17.5$R( 94)=17.5$R( 95)=17.5         DA2 0390
      R( 96)=17.5$R( 97)=17.5$R( 98)=17.5$R( 99)=18. $R(100)=19.          DA2 0400
      R(101)=19.5$R(102)=21. $R(103)=22. $R(104)=22. $R(105)=21.5         DA2 0410
      R(106)=21.5$R(107)=22. $R(108)=22.5$R(109)=22.5$R(110)=21.5         DA2 0420
      R(111)=21.5$R(112)=21. $R(113)=20.5$R(114)=21. $R(115)=21.          DA2 0430
      R(116)=21. $R(117)=21.5$R(118)=22. $R(119)=22.5$R(120)=22.5         DA2 0440
      R(121)=22.5$R(122)=21.5$R(123)=22. $R(124)=23. $R(125)=23.5         DA2 0450
      R(126)=24. $R(127)=24. $R(128)=24.5$R(129)=25. $R(130)=26.          DA2 0460
      R(131)=26.5$R(132)=26.5$R(133)=26.5$R(134)=27.5$R(135)=28.5         DA2 0470
      R(136)=25. $R(137)=25.5$R(138)=26. $R(139)=28. $R(140)=31.          DA2 0480
      R(141)=31.5$R(142)=30. $R(143)=29.5$R(144)=28.5$R(145)=29.5         DA2 0490
      R(146)=32. $R(147)=33.5$R(148)=35. $R(149)=35.5$R(150)=33.5         DA2 0500
      R(151)=30. $R(152)=29. $R(153)=31. $R(154)=32. $R(155)=32.5         DA2 0510
      R(156)=32.5$R(157)=32.5$R(158)=33. $R(159)=33. $R(160)=34.          DA2 0520
      R(161)=34.5$R(162)=34. $R(163)=32.5$R(164)=31.5$R(165)=31.5         DA2 0530
      R(166)=32.5$R(167)=32.5$R(168)=33. $R(169)=33.5$R(170)=34.          DA2 0540
      R(171)=34. $R(172)=34. $R(173)=36. $R(174)=37.5$R(175)=37.5         DA2 0550
      R(176)=37.5$R(177)=38. $R(178)=38. $R(179)=38. $R(180)=38.          DA2 0560
      R(181)=38. $R(182)=38. $R(183)=38. $R(184)=37. $R(185)=38.          DA2 0570
      R(186)=38. $R(187)=38. $R(188)=37. $R(189)=37. $R(190)=37.          DA2 0580
      R(191)=39. $R(192)=40. $R(193)=40. $R(194)=40. $R(195)=39.          DA2 0590
      R(196)=40. $R(197)=40. $R(198)=38. $R(199)=36. $R(200)=37.          DA2 0600
      R(201)=35.                                                          DA2 0610
```

```
C     ...AIR MASS VALUES                                                    DA2 0615
      AMV(1,1)=5.7588 $ AMV(1,2)=11.4740                                    DA2 0620
      AMV(2,1)=5.7281 $ AMV(2,2)=11.0000                                    DA2 0630
      AMV(3,1)=5.6975 $ AMV(3,2)=10.8400                                    DA2 0640
      AMV(4,1)=5.6405 $ AMV(4,2)=10.6400                                    DA2 0650
      AMV(5,1)=5.6075 $ AMV(5,2)=10.3450                                    DA2 0660
      AMV(6,1)=5.5851 $ AMV(6,2)=10.3224                                    DA2 0670
C     ...TOTAL ILLUM. ON A HORIZONTAL GROUND PLANE FOR FLIGHT 74            DA2 0680
      TILLH=5940.                                                           DA2 0690
C     ...REFLECTANCE DATA FOR PINE TREES FLIGHT 74                          DA2 0700
      RB(1,1,1)=.0333$RB(1,2,1)=.0241$RB(1,3,1)=.0214$RB(1,4,1)=.0214       DA2 0710
      RB(1,5,1)=.0261$RB(1,6,1)=.0379$RB(1,7,1)=.0463$RB(1,8,1)=.0859       DA2 0720
      RB(2,1,1)=.0333$RB(2,2,1)=.0222$RB(2,3,1)=.0202$RB(2,4,1)=.0194       DA2 0730
      RB(2,5,1)=.0210$RB(2,6,1)=.0303$RB(2,7,1)=.0387$RB(2,8,1)=.0549       DA2 0740
      RB(3,1,1)=.0333$RB(3,2,1)=.0315$RB(3,3,1)=.0311$RB(3,4,1)=.0317       DA2 0750
      RB(3,5,1)=.0317$RB(3,6,1)=.0337$RB(3,7,1)=.0387$RB(3,8,1)=.0463       DA2 0760
      RB(4,1,1)=.0333$RB(4,2,1)=.0335$RB(4,3,1)=.0382$RB(4,4,1)=.0392       DA2 0770
      RB(4,5,1)=.0387$RB(4,6,1)=.0438$RB(4,7,1)=.0463$RB(4,8,1)=.0572       DA2 0780
      RB(5,1,1)=.0333$RB(5,2,1)=.0402$RB(5,3,1)=.0444$RB(5,4,1)=.0578       DA2 0790
      RB(5,5,1)=.0640$RB(5,6,1)=.0711$RB(5,7,1)=.0758$RB(5,8,1)=.0825       DA2 0800
C     ...REFLECTANCE DATA FOR HAZE GRAY PAINT FLIGHT 74                     DA2 0810
      RO(1,1,1)=.198$RO(1,2,1)=.235$RO(1,3,1)=.410$RO(1,4,1)=.61            DA2 0820
      RO(1,5,1)=.325$RO(1,6,1)=.334$RO(1,7,1)=.382$RO(1,8,1)=.382           DA2 0830
      RO(2,1,1)=.198$RO(2,2,1)=.224$RO(2,3,1)=.190$RO(2,4,1)=.184           DA2 0840
      RO(2,5,1)=.187$RO(2,6,1)=.193$RO(2,7,1)=.210$RO(2,8,1)=.210           DA2 0850
      RO(3,1,1)=.198$RO(3,2,1)=.170$RO(3,3,1)=.159$RO(3,4,1)=.157           DA2 0860
      RO(3,5,1)=.156$RO(3,6,1)=.153$RO(3,7,1)=.152$RO(3,8,1)=.151           DA2 0870
      RO(4,1,1)=.198$RO(4,2,1)=.182$RO(4,3,1)=.175$RO(4,4,1)=.173           DA2 0880
      RO(4,5,1)=.175$RO(4,6,1)=.180$RO(4,7,1)=.182$RO(4,8,1)=.187           DA2 0890
      RO(5,1,1)=.198$RO(5,2,1)=.195$RO(5,3,1)=.206$RO(5,4,1)=.228           DA2 0900
      RO(5,5,1)=.207$RO(5,6,1)=.211$RO(5,7,1)=.215$RO(5,8,1)=.222           DA2 0910
C     ...REFLECTANCE DATA FOR INF. OPT. DEPTH WATER FLIGHT 74               DA2 0920
      RB(1,1,2)=.0222$RB(1,2,2)=.0234$RB(1,3,2)=.0297$RB(1,4,2)=.0438       DA2 0930
      RB(1,5,2)=.0569$RB(1,6,2)=.139$RB(1,7,2)=.267$RB(1,8,2)=.461          DA2 0940
      RB(2,1,2)=.0222$RB(2,2,2)=.0230$RB(2,3,2)=.0240$RB(2,4,2)=.0272       DA2 0950
      RB(2,5,2)=.0357$RB(2,6,2)=.107$RB(2,7,2)=.199$RB(2,8,2)=.325          DA2 0960
      RB(3,1,2)=.0222$RB(3,2,2)=.0221$RB(3,3,2)=.0222$RB(3,4,2)=.0234       DA2 0970
      RB(3,5,2)=.0293$RB(3,6,2)=.0711$RB(3,7,2)=.121$RB(3,8,2)=.214         DA2 0980
      RB(4,1,2)=.0222$RB(4,2,2)=.0213$RB(4,3,2)=.0212$RB(4,4,2)=.0220       DA2 0990
      RB(4,5,2)=.0270$RB(4,6,2)=.0665$RB(4,7,2)=.113$RB(4,8,2)=.203         DA2 1000
      RB(5,1,2)=.0222$RB(5,2,2)=.0214$RB(5,3,2)=.0212$RB(5,4,2)=.0216       DA2 1010
      RB(5,5,2)=.0267$RB(5,6,2)=.0718$RB(5,7,2)=.125$RB(5,8,2)=.254         DA2 1020
C     ...THRESHOLD CONTRAST VALUES FROM THE TIFFANY DATA                    DA2 1025
      CR(1,1)=.00273$CR(1,2)=.00273$CR(1,3)=.00279$CR(1,4)=.00339           DA2 1030
      CR(1,5)=.00581$CR(1,6)=.01360$CR(1,7)=.03986$CR(1,8)=.0876            DA2 1040
      CR(1,9)=.21039                                                        DA2 1050
      CR(2,1)=.00278$CR(2,2)=.00278$CR(2,3)=.00283$CR(2,4)=.00352           DA2 1060
      CR(2,5)=.00657$CR(2,6)=.01752$CR(2,7)=.05819$CR(2,8)=.13918           DA2 1070
      CR(2,9)=.36690                                                        DA2 1080
      CR(3,1)=.00283$CR(3,2)=.00283$CR(3,3)=.00289$CR(3,4)=.00370           DA2 1090
      CR(3,5)=.00729$CR(3,6)=.02122$CR(3,7)=.07785$CR(3,8)=.19783           DA2 1100
      CR(3,9)=.55249                                                        DA2 1110
      CR(4,1)=.00290$CR(4,2)=.00290$CR(4,3)=.00298$CR(4,4)=.00390$          DA2 1120
      CR(4,5)=.00802$CR(4,6)=.02491$CR(4,7)=.09846$CR(4,8)=.26520           DA2 1130
      CR(4,9)=.76865                                                        DA2 1140
      CR(5,1)=.00298$CR(5,2)=.00298$CR(5,3)=.00309$CR(5,4)=.00412           DA2 1150
      CR(5,5)=.00873$CR(5,6)=.02844$CR(5,7)=.12091$CR(5,8)=.34035           DA2 1160
      CR(5,9)=1.02668                                                       DA2 1170
      CR(6,1)=.00352$CR(6,2)=.00352$CR(6,3)=.00384$CR(6,4)=.00548           DA2 1180
      CR(6,5)=.01262$CR(6,6)=.04802$CR(6,7)=.26279$CR(6,8)=.87975           DA2 1190
      CR(6,9)=3.09375                                                       DA2 1200
      CR(7,1)=.00497$CR(7,2)=.00520$CR(7,3)=.00651$CR(7,4)=.01032           DA2 1210
      CR(7,5)=.02485$CR(7,6)=.10718$CR(7,7)=.76089$CR(7,8)=3.14447          DA2 1220
      CR(7,9)=12.05425                                                      DA2 1230
      CR(8,1)=.00746$CR(8,2)=.00854$CR(8,3)=.01168$CR(8,4)=.01971           DA2 1240
      CR(8,5)=.04890$CR(8,6)=.20639$CR(8,7)=1.66292$CR(8,8)=7.03904         DA2 1250
```

```
CR(8,9)=27.23956                                                                DA2 1260
CR(9,1)=.01151$CR(9,2)=.01382$CR(9,3)=.01942$CR(9,4)=.03395                     DA2 1270
CR(9,5)=.08462$CR(9,6)=.35547$CR(9,7)=2.94419$CR(9,8)=12.41832                  DA2 1280
CR(9,9)=48.26936                                                                DA2 1290
CR(10,1)=.01683      $CR(10,2)=.02074      $CR(10,3)=.02957                     DA2 1300
CR(10,4)=.05217      $CR(10,5)=.12963      $CR(10,6)=.54942                     DA2 1310
CR(10,7)=4.58608     $CR(10,8)=19.63515    $CR(10,9)=75.55883                   DA2 1320
CR(11,1)=.05768      $CR(11,2)=.07433      $CR(11,3)=.11059                     DA2 1330
CR(11,4)=.19879      $CR(11,5)=.49816      $CR(11,6)=2.15982                    DA2 1340
CR(11,7)=18.17858  $CR(11,8)=77.95361   $CR(11,9)=300.37517                     DA2 1350
CR(12,1)=.20409     $CR(12,2)=.27827     $CR(12,3)=.42217                       DA2 1360
CR(12,4)=.76126      $CR(12,5)=1.93904     $CR(12,6)=8.52798                    DA2 1370
CR(12,7)=71.57978    $CR(12,8)=312.74015 $CR(12,9)=1205.3357                    DA2 1380
CR(13,1)=.44978      $CR(13,2)=.61062      $CR(13,3)=.94702                     DA2 1390
CR(13,4)=1.70566     $CR(13,5)=4.37688     $CR(13,6)=19.39497                   DA2 1400
CR(13,7)=164.09719   $CR(13,8)=703.66533 $CR(13,9)=2712.00537                   DA2 1410
CR(14,1)=.79415      $CR(14,2)=1.08157     $CR(14,3)=1.68222                    DA2 1420
CR(14,4)=3.01432     $CR(14,5)=7.75021     $CR(14,6)=34.47994                   DA2 1430
CR(14,7)=291.72834   $CR(14,8)=1250.9606 $CR(14,9)=4821.34288                   DA2 1440
CR(15,1)=1.25446     $CR(15,2)=1.69716     $CR(15,3)=2.62892                    DA2 1450
CR(15,4)=4.72879     $CR(15,5)=12.16284    $CR(15,6)=53.87491                   DA2 1460
CR(15,7)=455.82553   $CR(15,8)=1954.6259 $CR(15,9)=7533.34825                   DA2 1470
CR(16,1)=2.80292     $CR(16,2)=3.80579     $CR(16,3)=5.89298                    DA2 1480
CR(16,4)=10.57167    $CR(16,5)=27.30130    $CR(16,6)=121.21854                  DA2 1490
CR(16,7)=1025.60754   $CR(16,8)=4397.9083 $CR(16,9)=16950.03357                  DA2 1500
CR(17,1)=4.98357     $CR(17,2)=6.70733     $CR(17,3)=10.35894                   DA2 1510
CR(17,4)=18.85579    $CR(17,5)=48.53565    $CR(17,6)=215.49962                  DA2 1520
CR(17,7)=1823.30212   $CR(17,8)=7818.5036 $CR(17,9)=30133.39301                  DA2 1530
CR(18,1)=7.63379     $CR(18,2)=10.51590    $CR(18,3)=16.35201                   DA2 1540
CR(18,4)=29.46218    $CR(18,5)=75.83695    $CR(18,6)=336.71816                  DA2 1550
CR(18,7)=2848.90957   $CR(18,8)=12216.4119 $CR(18,9)=47083.42658                 DA2 1560
CR(19,1)=11.19468    $CR(19,2)=15.19277    $CR(19,3)=23.54690                   DA2 1570
CR(19,4)=42.42554    $CR(19,5)=109.20520   $CR(19,6)=484.87415                  DA2 1580
CR(19,7)=4102.42978   $CR(19,8)=17591.6332 $CR(19,9)=67800.13428                 DA2 1590
CR(20,1)=19.90165    $CR(20,2)=27.00938    $CR(20,3)=41.86115                   DA2 1600
CR(20,4)=75.42318    $CR(20,5)=194.14258   $CR(20,6)=861.99849                  DA2 1610
CR(20,7)=7293.20850   $CR(20,8)=31274.0145 $CR(20,9)=120533.57205               DA2 1620
END                                                                             DA2 1630
```

168 CARDS

VISIBILITY LABORATORY U.C.S.D.
PROGRAM OR SUBROUTINE DESCRIPTION

A. IDENTIFICATION

Title	SUBROUTINE DATA 3
Category	CVC
Programmer	Barkdoll
Date	28 January 1966
Type	F-63 SUBROUTINE

B. DESCRIPTION

Data package to contain data for optical system beam transmittance and path luminance when this information becomes available.

C. USAGE

1. Calling Sequence

Called by PODVI, data to be used by TROF and BSTOF.

2. Arguments or Parameters

None at present.
COMMON F TROV (1) COMMON WITH TROF
COMMON E BSOV (1) COMMON WITH BSTOF

3. Storage Requirements (Decimal)	Unknown at present
4. Temporary Storage Requirements	Not Applicable
5. Alarms, or Print-Outs	None
6. Error Returns	None
7. Error Stops	None
8. Input and Output Tape Mountings	Not Applicable
9. Input and Output Formats	Not Applicable
10. Selective Jump and Stop Settings	Not Applicable
11. Machine Time	
12. Accuracy	Not Applicable
13. Cautions to User	None
14. Equipment Configuration	CDC 3600 FORTRAN 63
15. References	

D. METHOD

Dummy data package.

E. FLOW CHART

Not Applicable

SUBROUTINE DATA 3

```
      SUBROUTINE DATA 3                                                  DA3 0000
C     ...DATA 3...14JAN,65...BARKDOLL...VISLAB...UCSD                        0010
C     ...THIS SUBROUTINE IS A DATA PACKAGE OF PATH                           0020
C     ...LUMINANCE VALUES AND BEAM TRANSMITTANCE VALUES                      0030
C     ...FOR OPTICAL SYSTEM NO. XXX                                          0040
      COMMON/E/BSTOV(1)                                                      0050
      COMMON/F/TROV(1)                                                       0060
      RETURN                                                                 0070
      END                                                                    0080
```

9 CARDS

VISIBILITY LABORATORY U.C.S.D.
PROGRAM OR SUBROUTINE DESCRIPTION

A. IDENTIFICATION

Title	SUBROUTINE TCAL
Category	CVC
Programmer	Barkdoll
Date	29 September 1965
Type	FORTRAN 63

B. DESCRIPTION

SUBROUTINE TCAL is the main processing and calling routine. It provides for the solution of a probability of target detection volume. It will give the altitude and distance to the target axis for eight downward looking zeniths of path of sight (THETA = 180°, 165°, 150°, 135°, 120°, 105°, 100°, and 95°) and for five azimuth of path of sight with respect to the sun (PHI = 0°, 45°, 90°, 135°, 180°). If desired, these points can be plotted as four hemispheric cross sections.

C. USAGE

1. Calling Sequence

TCAL(FNUMB, DIAM, OBJ, BAC, PROBK, NPROB, SW1, SW2)

2. Arguments or Parameters

FNUMB = flight number used for atmospheric data package.
DIAM = target diameter in feet – not to exceed 100 feet.
OBJ = index for table of directional reflectance properties of target object.
BAC = index for table of directional reflectance properties of background.
PROBK = constant for deviation from 50% probability of detection.
NPROB = integer representing probability of detection.
SW1 = switch for output printing, 1 for calculation and coordinates, 0 for coordinates only.
SW2 = switch for plotting, 1 if plot is desired, 0 for no plot.
Shares common Block C with Subroutine Data 2.

3. Storage Requirements (Decimal)
1050 words

4. Temporary Storage Requirements
Not Applicable

5. Alarms, or Print-Outs
(1) Target diameter exceeds limits.
(2) Warning is printed out when $T_C \cdot |C_O| > 30$.
(3) AY = 1. If cross-over of TC and CR curves does not occur within given ALTITUDE range covered by program.

6. Error Returns
None

7. Error Stops
None

8. Input and Output Tape Mountings
Not Applicable

9. Input and Output Formats
Not Applicable

10. Selective Jump and Stop Settings
Not Applicable

11. Machine Time
Not Applicable

12. Accuracy
Not Applicable

13. Cautions to User
(a) None (b) Target diameter not to exceed 100 ft.
Results of values of $T_C \cdot |C_O| > 30$ have not been checked.

14. Equipment Configuration
CDC 3600 FORTRAN 63

15. References

D. METHOD

(1) TABLES in COMMON BLOCK C are values of C_T (threshold contrast)

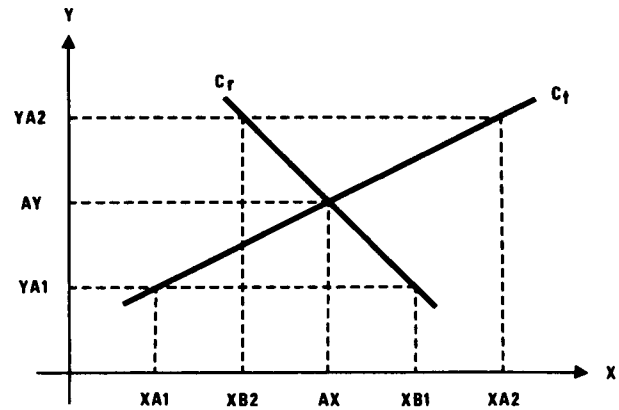
(2) $$T_C \cdot | C_o | = \left[\frac{1}{1 + \frac{BSTAR}{(T_r)(B_o)}} \right]$$

T_c = contrast transmittance
C_o = inherent contrast
BSTAR = path luminance
T_r = beam transmittance
B_o = inherent background luminance

(3) Point of Intersection: C_r and C_T curves are broken up into straight line segments.

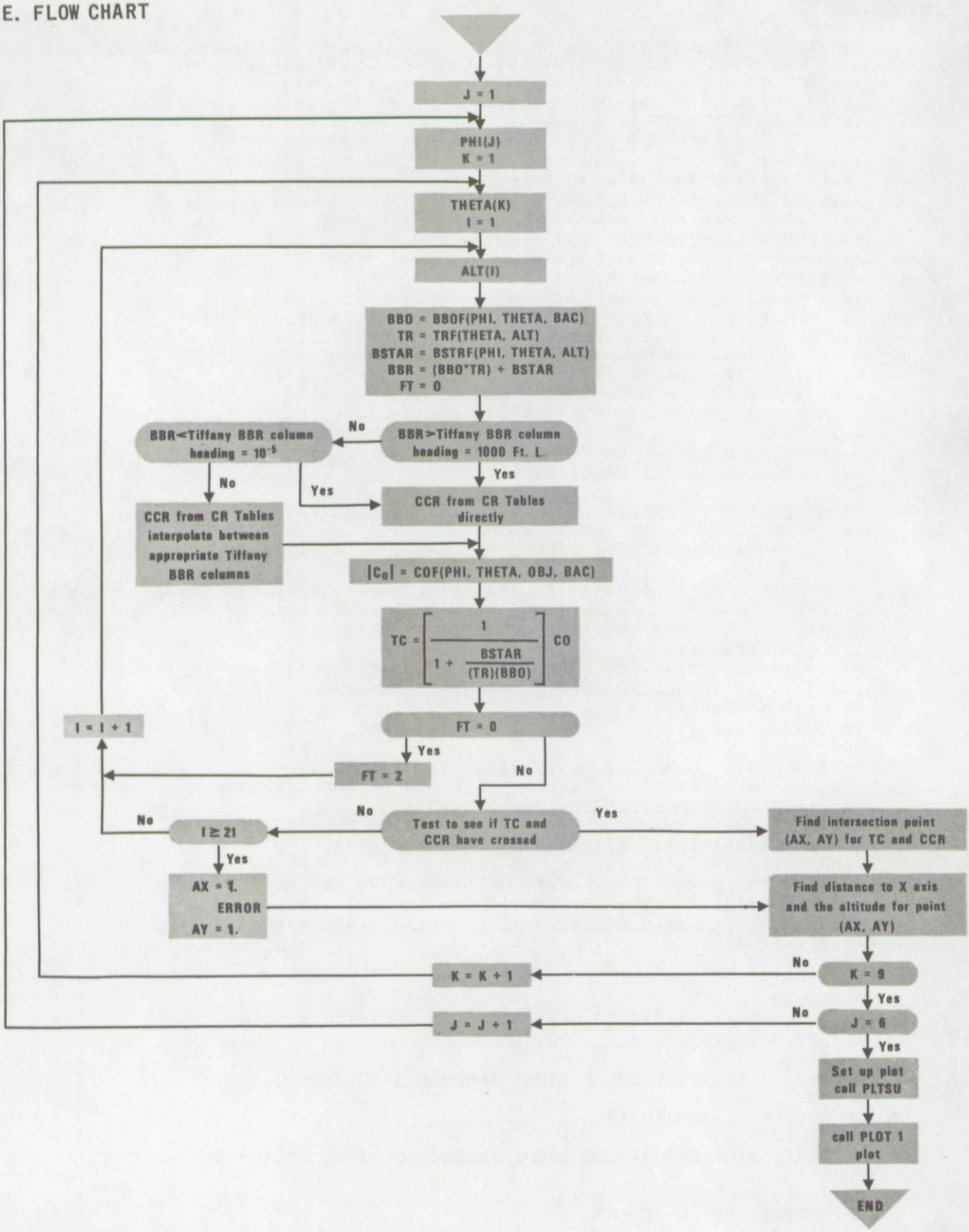
$$AX = \left[\frac{(XB1)(XA2) - (XA1)(XB2)}{(XA2 + XB1 - XA1 - XB2)} \right]$$

$$AY = \left[\frac{(YA2 - YA1)(XA1 - XB1)}{(XB2 + XA1 - XB1 - XA2)} \right] + YA1$$



C_r = Apparent contrast
C_T = Threshold contrast

E. FLOW CHART


J = 1
PHI(J)
K = 1
THETA(K)
I = 1
ALT(I)
BBO = BBOF(PHI, THETA, BAC)
TR = TRF(THETA, ALT)
BSTAR = BSTRF(PHI, THETA, ALT)
BBR = (BBO*TR) + BSTAR
FT = 0
BBR<Tiffany BBR column heading = 10^-5
No
BBR>Tiffany BBR column heading = 1000 Ft. L.
Yes
No
Yes
CCR from CR Tables directly
CCR from CR Tables interpolate between appropriate Tiffany BBR columns
|C0| = COF(PHI, THETA, OBJ, BAC)
TC = [1 / (1 + BSTAR/(TR)(BBO))] CO
FT = 0
Yes
FT = 2
No
I = I + 1
No
I ≥ 21
No
Test to see if TC and CCR have crossed
Yes
Find intersection point (AX, AY) for TC and CCR
Yes
AX = 1. ERROR AY = 1.
Find distance to X axis and the altitude for point (AX, AY)
No
K = 9
K = K + 1
Yes
No
J = 6
J = J + 1
Yes
Set up plot call PLTSU
call PLOT 1 plot
END

SUBROUTINE TCAL

```
      SUBROUTINE TCAL(OPT,FNUMB,OPTNU,DIAM,OBJ,BAC,PROBK,NPROB,SW1,SW2) TCA 0000
C     ...SUBROUTINE TCAL...1 NOV, 65...BARKDOLL...VISLAB...UCSD        TCA 0010
C     ...THIS IS THE MAIN PROCESSING AND CONTROL ROUTINE               TCA 0020
C     ...IT SOLVES FOR THE PROBABILITY OF DETECTION VOLUME             TCA 0030
C     ...AND PRINTS OUT THE RESULTS.                                   TCA 0040
C                                                                      TCA 0050
C     ...INPUTS                                                        TCA 0060
C     ...OPT=OPTION FOR VIEWING THROUGH ATMOSPHERE ONLY                TCA 0070
C     .....=0 FOR ATMOSPHERE ONLY,=-1 FOR OPTICS WITHOUT               TCA 0080
C     .....ATMOSPHERE,=+1 FOR OPTICS AND AN ATMOSPHERE                 TCA 0090
C     ...FNUMB=FLIGHT NUMBER FOR ATMOSPHERIC DATA                      TCA 0100
C     ...OPTNU=OPTICAL SYSTEM NUMBER                                   TCA 0110
C     ...DIAM=TARGET DIAMETER IN FEET                                  TCA 0120
C     ...OBJ=INDEX FOR TABLE OF TARGET OBJECT REFLECTANCE              TCA 0130
C     ...BAC=INDEX FOR TABLE OF BACKGROUND REFLECTANCE PROPERTIES      TCA 0140
C     ...PROBK=CONSTANT FOR DEVIATION FROM 50 PERCENT PROBABILITY OF   TCA 0150
C     ...DETECTION. NPROB=INTEGER REPRESENTING PROB. OF DETECTION      TCA 0160
C     ...SW1=SWITCH FOR PLOTTING, 1 FOR PLOT, 0 FOR NO PLOT            TCA 0170
C     ...SW2=SWITCH FOR OUTPUT PRINTING, 1 FOR CALCULATIONS            TCA 0180
C     ...AND COORDINATES, 0 FOR COORDINATES ONLY.                      TCA 0190
C     ...                                                              TCA 0200
C     ...FUNCTIONS CALLED=BBTF,TRF,BSTRF,COF                           TCA 0210
C     ...SUBROUTINES CALLED=PLTSU,PLOT1                                TCA 0220
C                                                                      TCA 0230
C     ***NOTE IN THIS PROGRAM TIFFANY THRESHOLD CONTRAST VALUES MAY BE TCA 0231
C     ...REFERED TO  AS CCR OR CT VALUES.                              TCA 0232
C     ...CR APPARENT CONTRAST VALUES ARE EQUAL TO TC*CO                TCA 0233
C                                                                      TCA 0234
      DIMENSION TPHE(5),TETA(8),ZALT(20),ALTW(20),SAX(48), SAY(48)     TCA 0240
C     ...ZALT AND ALTW = 20 ALTITUDE VALUES TO COVER PROBLEM           TCA 0250
C     ...SAX AND SAY = X AND Y COORDINATES OF DISTANCE                 TCA 0260
C     ...FROM TARGET.                                                  TCA 0270
      DIMENSION X1(15),X2(15),X3(15),X4(15),Z1(15),Z2(15),Z3(15),Z4(15) TCA 0280
C     ...X1 TO X4 AND Z1 TO Z4 = COORDINATES FOR 4 CROSS SECTIONS      TCA 0290
      DIMENSION TFBBR(9)                                               TCA 0300
      COMMON/C/CR(20,9)                                                TCA 0310
C                                                                      TCA 0315
      DATA(TFBBR=1000.,100.,10.,1.,.1,.01,.001,.0001,.00001)           TCA 0320
C     ...TFBBR = 9 LEVELS OF TIFFANY DATA BACKGROUND ILLUMINATION      TCA 0330
      DATA(TPHE=0.,.7854,1.5708,2.3562,3.14159)                        TCA 0340
C     ...TPHE=PHI,AZIMUTHS OF PATH OF SIGHT WITH RESPECT TO SUN        TCA 0350
      DATA(TETA=3.14159,2.8797,2.6180,2.3562,2.0944,                   TCA 0360
     11.8326,1.7453,1.6580)                                            TCA 0370
C     ...TETA=THETA,ZENITHS OF PATH OF SIGHT FROM OBSERVER             TCA 0380
      DATA(ZALT=20.,40.,60.,80.,100.,200.,400.,600.,800.,              TCA 0390
     11000.,2000.,4000.,6000.,8000.,10000.,15000.,20000.,25000.,      TCA 0400
     230000.,40000.)                                                   TCA 0410
C                                                                      TCA 0415
      INC=0                                                            TCA 0420
      PRINT 10                                                         TCA 0430
   10 FORMAT(1H1,8X,42HTARGET DETECTION FOR INFINITE VIEWING TIME)     TCA 0440
      IF(OPT.NE.0.)GO TO 30                                            TCA 0450
      PRINT 20                                                         TCA 0460
   20 FORMAT(///,12X,37HPATH OF SIGHT THROUGH ATMOSPHERE ONLY)         TCA 0470
      GO TO 70                                                         TCA 0480
   30 IF(OPT.NE.-1.)GO TO 50                                           TCA 0490
      PRINT 40                                                         TCA 0500
   40 FORMAT(///,12X,54HPATH OF SIGHT THROUGH OPTICAL SYSTEM AND NO ATMOSTCA 0510
     1PHERE)                                                           TCA 0520
      GO TO 70                                                         TCA 0530
   50 IF(OPT.NE.+1.)GO TO 840                                          TCA 0540
      PRINT 60                                                         TCA 0550
   60 FORMAT(///,12X,51HPATH OF SIGHT THROUGH OPTICAL SYSTEM AND ATMOSPHETCA 0560
     1RE)                                                              TCA 0570
```

```
     70 PRINT 80 ,FNUMB                                                    TCA 0580
     80 FORMAT(//,12X,31HPROGRAM DATA FROM FLIGHT NUMBERF4.0)              TCA 0590
        PRINT 90 ,NPROB                                                    TCA 0600
     90 FORMAT(//12X,28HPROBABILITY OF DETECTION IS ,I2,1X,7HPERCENT)      TCA 0610
        PRINT 100,DIAM                                                     TCA 0620
    100 FORMAT (//,12X,25HTARGET DIAMETER IN FT. = F3.0)                   TCA 0630
        IF(BAC.EQ.1.)110,130                                               TCA 0640
    110 PRINT 120                                                          TCA 0650
    120 FORMAT(// 12X, 35HBACKGROUND FOR TARGET IS PINE TREES)             TCA 0660
        GO TO 160                                                          TCA 0670
    130 IF(BAC.EQ.2.)140,840                                               TCA 0680
    140 PRINT 150                                                          TCA 0690
    150 FORMAT(//12X,35HBACKGROUND FOR TARGET IS CALM WATER)               TCA 0700
    160 IF(OBJ.EQ.1.)170,84)                                               TCA 0710
    170 PRINT 180                                                          TCA 0720
    180 FORMAT(//,12X,36HTARGET IS SPHERICAL AND PAINTED GRAY)             TCA 0730
        IF(DIAM.EQ.0.OR.DIAM.GT.100)190,21)                                TCA 0740
    190 PRINT 200                                                          TCA 0750
    200 FORMAT(//30HTARGET DIAMETER EXCEEDS LIMITS)                        TCA 0760
        GO TO 840                                                          TCA 0770
    210 DO 750J=1,5                                                        TCA 0780
        PHI=TPHE(J)*57.29578                                               TCA 0790
        PRINT 220,PHI                                                      TCA 0800
    220 FORMAT(1H1,8X,48HAZIMUTH OF PATH OF SIGHT WITH RESPECT TO SUN IS ,TCA 0810
       1F3.0,1X,7HDEGREES)                                                 TCA 0820
        DO 230N=1,20                                                       TCA 0830
  C     ...CONVERTS TO PROPER VALUES OF ALTITUDE FOR TARGET DIAMETER.      TCA 0840
        ALTW(N)=ZALT(N)*DIAM                                               TCA 0850
    230 CONTINUE                                                           TCA 0860
        KK=0 $ LL=0 $ K=1                                                  TCA 0870
    240 FT=0 $ I=1                                                         TCA 0880
        PHI=TPHE(J)                                                        TCA 0890
        THETA=TETA(K)                                                      TCA 0900
    250 ALT=ALTW(I)                                                        TCA 0910
  C     ...SOLVE FOR INHERENT BACKGROUND LUMINANCE                         TCA 0920
        BB0=BB0F(PHI,THETA,BAC)                                            TCA 0930
  C     ...SOLVE FOR BEAM TRANSMITTANCE                                    TCA 0940
  C     ...SOLVE FOR PATH LUMINANCE                                        TCA 0950
        IF(OPT.EQ.-1.)GO TO 270                                            TCA 0960
        IF(OPT.EQ.0.)GO TO 280                                             TCA 0970
        IF(OPT.EQ.+1.)GO TO 290                                            TCA 0980
        PRINT 260 ,OPT                                                     TCA 0990
    260 FORMAT(//,12X,6HOPT = ,F3.2)                                       TCA 1000
        GO TO 840                                                          TCA 1010
    270 TR=TROF(THETA)                                                     TCA 1020
        BSTAR=BSTOF(PHI,THETA)                                             TCA 1030
        GO TO 300                                                          TCA 1040
    280 TR=TRF(THETA,ALT)                                                  TCA 1050
        BSTAR=BSTRF(PHI,THETA,ALT)                                         TCA 1060
        GO TO 300                                                          TCA 1070
    290 TV1=TROF(THETA)                                                    TCA 1080
        TR=TRF(THETA,ALT)*TV1                                              TCA 1090
        BSTAR=BSTRF(PHI,THETA,ALT)*TV1+BSTOF(PHI,THETA)                    TCA 1100
  C     ...SOLVE FOR APPARENT BACKGROUND LUMINANCE                         TCA 1110
    300 BBR=(BB0*TR)+BSTAR                                                 TCA 1120
        IF(BBR.GT.TEBBR(1).OR.BBR.EQ.TEBBR(1))340,310                      TCA 1130
    310 DO 320 N=2,9                                                       TCA 1140
  C     ...INTERPOLATE FOR THRESHOLD CONTRAST ASSOCIATED                   TCA 1150
  C     ...WITH CALCULATED APPARENT BACKGROUND LUMINANCE                   TCA 1160
  C     ...AND CORRECT FOR DEVIATION FROM 50 PERCENT                       TCA 1170
  C     ...PROBABILITY OF DETECTION.                                       TCA 1180
        IF(BBR.GT.TEBBR(N))330,320                                         TCA 1190
    320 CONTINUE                                                           TCA 1200
        NN=9                                                               TCA 1210
        GO TO 350                                                          TCA 1220
    330 NN2=N-1$ NN1=N                                                     TCA 1230
```

```
C       ...SOLVE FOR THRESHOLD CONTRAST (CCR) OR (CT)                          TCA 1240
        CCR=((BBR-TFBBR(NN1))/(TFBBR(NN2)-TFBBR(NN1))*(CR(I,NN2)-CR(I,NN1)TCA 1250
       1)+CR(I,NN1))*PROBK                                                     TCA 1260
        GO TO 360                                                              TCA 1270
  340 NN=1                                                                     TCA 1280
  350 CCR=CR(I,NN)*PROBK                                                       TCA 1290
  360 C0=COF(PHI,THETA,OBJ,BAC)                                                TCA 1300
C       ...NOTE WHETHER THE INHERENT CONTRAST IS POSITIVE OR NEGATIVE.         TCA 1310
        IF(C0.LT. )380,370                                                     TCA 1320
  370 CON=+1.                                                                  TCA 1330
        GO TO 390                                                              TCA 1340
  380 CON=-1.                                                                  TCA 1350
        C0=ABSF(C0)                                                            TCA 1360
C       ...CALCULATE CONTRAST TRANSMITTANCE                                    TCA 1370
  390 TC=(1./(1.+(BSTAR/(TR*BB' ))))*C0                                        TCA 1380
        CAT=THETA*57.29578                                                     TCA 1390
        CT=CCR                                                                 TCA 1400
         C0=C0*CON                                                             TCA 1410
        IF(SW1.EQ.1)400,440                                                    TCA 1420
C       ...PRINT DATA FOR THE CONVERGENCE OF THE APPARENT CONTRAST             TCA 1430
C       ...AND THRESHOLD CONTRAST CURVES.                                      TCA 1440
C       ...CR APPARENT CONTRAST VALUES ARE EQUAL TO TC*C0                      TCA 1445
  400 PRINT 41',CAT,ALT,BSTAR,TR,BB ),C ),TC,CT,I,BBR                         TCA 1450
  410 FORMAT (1X,6HTHETA=,F5.1,1X,4HZ D=,F9.1,1X,6HBSTAR=,F8.2,1X,3HTR=,TCA 1460
     1F5.3,1X,4HBB =F8.2,1X,3HC =,F6.2,1X,5HTC*C =,F6.3,1X,5HCT*P=,F5.2,TCA 1470
     21X,2HI=,I2,1X,4HBBR=,F7.2)                                               TCA 1480
        IF (TC.GT.30.)420,440                                                  TCA 1490
  420 PRINT 430                                                                TCA 1500
  430 FORMAT(//8X,39HWATCH OUT TC*C0 IS NOW GREATER THAN 30.)                  TCA 1510
  440 IF(FT.EQ.0)450,470                                                       TCA 1520
  450 FT=2                                                                     TCA 1530
  460 XA1=CCR $ YA1=ALTW(I)                                                    TCA 1540
        XB1=TC                                                                 TCA 1550
        I=I+1                                                                  TCA 1560
        GO TO 250                                                              TCA 1570
  470 XA2=CCR $ YA2=ALTW(I)                                                    TCA 1580
        XB2=TC                                                                 TCA 1590
C       ...HAVE THE CURVES INTERSECTED.                                        TCA 1600
        IF(TC-CCR)480,520,490                                                  TCA 1610
C       ...CALCULATE X AND Y COORDINATES                                       TCA 1620
  480 AX=((XB1*XA2)-(XA1*XB2))/(XA2+XB1-XA1-XB2)                               TCA 1630
        AY=(((YA2-YA1)*(XA1-XB1))/(XB2+XA1-XB1-XA2))+YA1                       TCA 1640
        GO TO 550                                                              TCA 1650
  490 IF(I.EQ.21)500,460                                                       TCA 1660
  500 AX=1.$ AY=1.                                                             TCA 1670
        PRINT 510                                                              TCA 1680
  510 FORMAT (//8X,95HTHE CT AND TC*C0 CURVES HAVE NOT INTERSECTED WITH TCA 1690
     1IN THE ALTITUDE RANGE COVERED BY THIS PROGRAM)                           TCA 1700
        GO TO 550                                                              TCA 1710
  520 AX=CCR $ AY=ALTW(I)                                                      TCA 1720
        IF(SW1.EQ.1)530,580                                                    TCA 1730
  530 PRINT 540                                                                TCA 1740
  540 FORMAT (//8X,5HTC=CR)                                                    TCA 1750
  550 PRINT 560,AX,AY                                                          TCA 1760
  560 FORMAT(//8X,20HCURVES INTERSECT AT ,3HAX=F15.5,2X,3HAY=F15.5)            TCA 1770
        PRINT 570                                                              TCA 1780
  570 FORMAT(1H0)                                                              TCA 1790
  580 KK=KK+1                                                                  TCA 1800
        LL=LL+1                                                                TCA 1810
        IF(C0.LT.0.)590,600                                                    TCA 1820
  590 AY=-AY                                                                   TCA 1830
C       ...SAVE THE INTERSECTION POINT                                         TCA 1840
  600 SAX(KK)=AX                                                               TCA 1850
        SAY(LL)=AY                                                             TCA 1860
        K=K+1                                                                  TCA 1870
        IF(K.EQ.9)630,610                                                      TCA 1880
```

```
  610 DO 620,IZ=1,2                                                    TCA 1890
C     ...MODIFY ALTITUDES FOR NE  ZENITH OF PATH OF SIGHT.             TCA 1900
      ALTM(IZ)=ZALT(IZ)*COSF(3.14159-TETA(K))*DIAM                     TCA 1910
  620 CONTINUE                                                         TCA 1920
      GO TO 240                                                        TCA 1930
  630 DO 660JK=1,8                                                     TCA 1940
      IF (SAY(JK).EQ.)64 ,66                                           TCA 1950
  640 HZ=0.$CX=0.                                                      TCA 1960
      PRINT 650,HZ,CX,IZ                                               TCA 1970
  650 FORMAT(//10X,5HERROR,2X,3HHZ=F3.2,2X,3HCX=F3.2,2X,3HIZ=I12)      TCA 1980
      GO TO 750                                                        TCA 1990
  660 CONTINUE                                                         TCA 1995
      DO 670JK=2,8                                                     TCA 2000
C     ...CONVERT X COORDINATE TO DISTANCE FRO  TARGET AXIS.            TCA 2010
      SAX(JK)=SAY(JK)/TANF(TETA(JK)-1.570(77)                          TCA 2020
  670 CONTINUE                                                         TCA 2030
      AZM=TPHE(J)*57.29578                                             TCA 2040
      PRINT 680,AZM                                                    TCA 2050
  680 FORMAT(//8X,48HAZIMUTH OF PATH OF SIGHT WITH RESPECT TO SUN IS ,F3TCA 2060
     1.0,1X,7HDEGREES)                                                 TCA 2070
      DO 730LJ=1,8                                                     TCA 2080
      ANGLE=TETA(LJ)*57.29578                                          TCA 2090
C     ...TEST FOR PRINTING CONTRAST, POS. OR NEG.                      TCA 2100
      IF(SAY(LJ).LT.)690,71                                            TCA 2110
  690 SAY(LJ)=SAY(LJ)*(-1.)                                            TCA 2120
      SAX(LJ)=SAX(LJ)*(-1.)                                            TCA 2130
      PRINT 700,ANGLE,SAX(LJ),SAY(LJ)                                  TCA 2140
  700 FORMAT(//2X,25HZENITH OF PATH OF SIGHT =,F4.0,2X,25HDISTANCE TO TATCA 2150
     1RGET AXIS =,F8. ,2X,1 HALTITUDE =,F8.0,2X,24HCONTRAST IS NOW NEGATTCA 2160
     2IVE)                                                             TCA 2170
      GO TO 730                                                        TCA 2180
  710 PRINT 720,ANGLE,SAX(LJ),SAY(LJ)                                  TCA 2190
  720 FORMAT(//2X,25HZENITH OF PATH OF SIGHT =,F4. ,2X,25HDISTANCE TO TATCA 2200
     1RGET AXIS =,F8. ,2X,1 HALTITUDE =,F8. ,2X,24HCONTRAST IS POSITIVE)TCA 2210
  730 CONTINUE                                                         TCA 2220
      INC=INC+8                                                        TCA 2230
      DO 740JK=1,8                                                     TCA 2240
C     ...SAVE COORDINATES FOR PLOTTING                                 TCA 2250
      SAX(JK+INC)=SAX(JK)                                              TCA 2260
      SAY(JK+INC)=SAY(JK)                                              TCA 2270
  740 CONTINUE                                                         TCA 2280
  750 CONTINUE                                                         TCA 2290
      JK=40                                                            TCA 2300
      JJ=15                                                            TCA 2310
      NTGDM=DIAM                                                       TCA 2320
C     ...SET UP VALUES FOR PLOTTING                                    TCA 2330
      CALL PLTSU(SAX,SAY,JK,X1,X2,X3,X4,Z1,Z2,Z3,Z4,JJ,AXSL,CSLX,      TCA 2340
     1CSLY,AXLX,AXLY,NTGDM,NAINC,NPROB)                                TCA 2350
      IF(SW1.EQ.1)760,820                                              TCA 2360
  760 PRINT 770                                                        TCA 2370
C     ...PRINT OUT VALUES FOR PLOTTING CROSS SECTIONS                  TCA 2380
  770 FORMAT(//2X,70HCOORDINATES FOR PLOTTING 4 CROSS SECTIONS. X = HORITCA 2390
     1ZONTAL Z = VERTICAL)                                             TCA 2400
      PRINT 780                                                        TCA 2410
  780 FORMAT(//5X,2HX1,6X,2HZ1,6X,2HX2,6X,2HZ2,6X,2HX3,6X,2HZ3,6X,2HX4,6TCA 2420
     1X,2HZ4)                                                          TCA 2430
      PRINT 790,(X1(I),Z1(I),X2(I),Z2(I),X3(I),Z3(I),X4(I),Z4(I),I=1,15)TCA 2440
  790 FORMAT (//,2X,8F8.0)                                             TCA 2450
C     ...PRINT OUT VALUES FOR CHECKING OUTPUT OF Q9Q PLOT              TCA 2460
      PRINT 800, AXSL,CSLX,CSLY,AXLX,AXLY                              TCA 2470
  800 FORMAT (//,2X,5HAXSL=F10.1,2X,5HCSLX=F10.1,2X,5HCSLY=F10.1,2X,   TCA 2480
     15HAXLX=F10.1,2X,5HAXLY=F10.1)                                    TCA 2490
      PRINT 810, NTGDM,NAINC,NPROB                                     TCA 2500
  810 FORMAT (//,2X,6HNTGDM=I4,2X,6HNAINC=I8,2X,6HNPROB=I3)            TCA 2510
  820 IF(SW2.EQ.1)830,840                                              TCA 2520
C     ...SET UP INPUT FOR Q9Q PLOT ROUTINE.                            TCA 2530
```

```
830 CALL PLOT1(X1,X2,X3,X4,Z1,Z2,Z3,Z4,JJ,AXSL,CSLX,CSLY,                TCA 2540
   1AXLX,AXLY,NTGDM,NAINC,NPROB)                                          TCA 2550
840 END                                                                   TCA 2560
```

265 CARDS

VISIBILITY LABORATORY U.C.S.D.
PROGRAM OR SUBROUTINE DESCRIPTION

A. IDENTIFICATION

Title	FUNCTION TRF
Category	CVC
Programmer	Barkdoll
Date	1 September 1965
Type	FORTRAN 63

B. DESCRIPTION

This function calculates the value of Beam Transmittance (TR) for a given THETA and ALT by means of TABLES.

1. R — attenuation lengths for indicated flight.
2. AMV — air mass values.
3. TRV — extrapolated values of Beam Transmittance for $20\,000 < ALT < 60\,000$ and specified formulas for the desired altitude.

C. USAGE

1. Calling Sequence	TRF(THETA, ALT)
2. Arguments or Parameters	THETA = Zenith of path of sight from observer ALT = Altitude of observer Shares COMMON BLOCK D with SUBROUTINE DATA 2
3. Storage Requirements (Decimal)	270
4. Temporary Storage Requirements	Not Applicable
5. Alarms, or Print-Outs	If ALT < 1 ft or ALT > 4000000 ft, then ALT is out of the indicated range for FUNCTION TRF. Program also checks THETA to see if it is in the required range for FUNCTION TRF.
6. Error Returns	None
7. Error Stops	None
8. Input and Output Tape Mountings	Not Applicable
9. Input and Output Formats	Not Applicable
10. Selective Jump and Stop Settings	Not Applicable
11. Machine Time	Not Applicable
12. Accuracy	Not Applicable
13. Cautions to User	(a) None (b) The values used from TABLE R (attenuation length) must be those for the particular flight's atmospheric data.
14. Equipment Configuration	CDC 3600 FORTRAN 63
15. References	

D. METHOD

(1) 0 ft. ALT 20 000 ft.

$$TR = \exp - \left[\sum_{2}^{N-1} \left(\frac{1}{L_N} \Delta z \right) + \left(\frac{1}{L} + \frac{1}{L_N} \right) \frac{\Delta z}{2} \right] \left[\frac{1}{\cos (180^\circ - \theta)} \right]$$

If THETA $\leq 100^\circ$ interpolate Air Mass Value Table for indicated altitude and substitute this value for

$$\left[\frac{1}{\cos (180^\circ - \theta)} \right]$$

(2) 20 000 ft. < ALT $\leq$ 60 000 ft.

$$TR = TRV_{180^\circ}(ALT) \left(\frac{1}{\cos (180^\circ - \theta)} \right) \text{for } \theta > 100^\circ.$$

If THETA = 100° or 95°, interpolate Air Mass Value Table for desired altitude and substitute this value for

$$\left[\frac{1}{\cos (180^\circ - \theta)} \right]$$

(3) 60 000 ft. ALT → 00t

$$TR = \left[TR(60\,000 \text{ ft.}, 180^\circ) \left(\exp - \frac{4.94}{214} \left[1 - e \left(\frac{ALT - 60\,000}{30\,000} \right) \right] \right) \right] \left(\frac{1}{\cos (180^\circ - \theta)} \right)$$

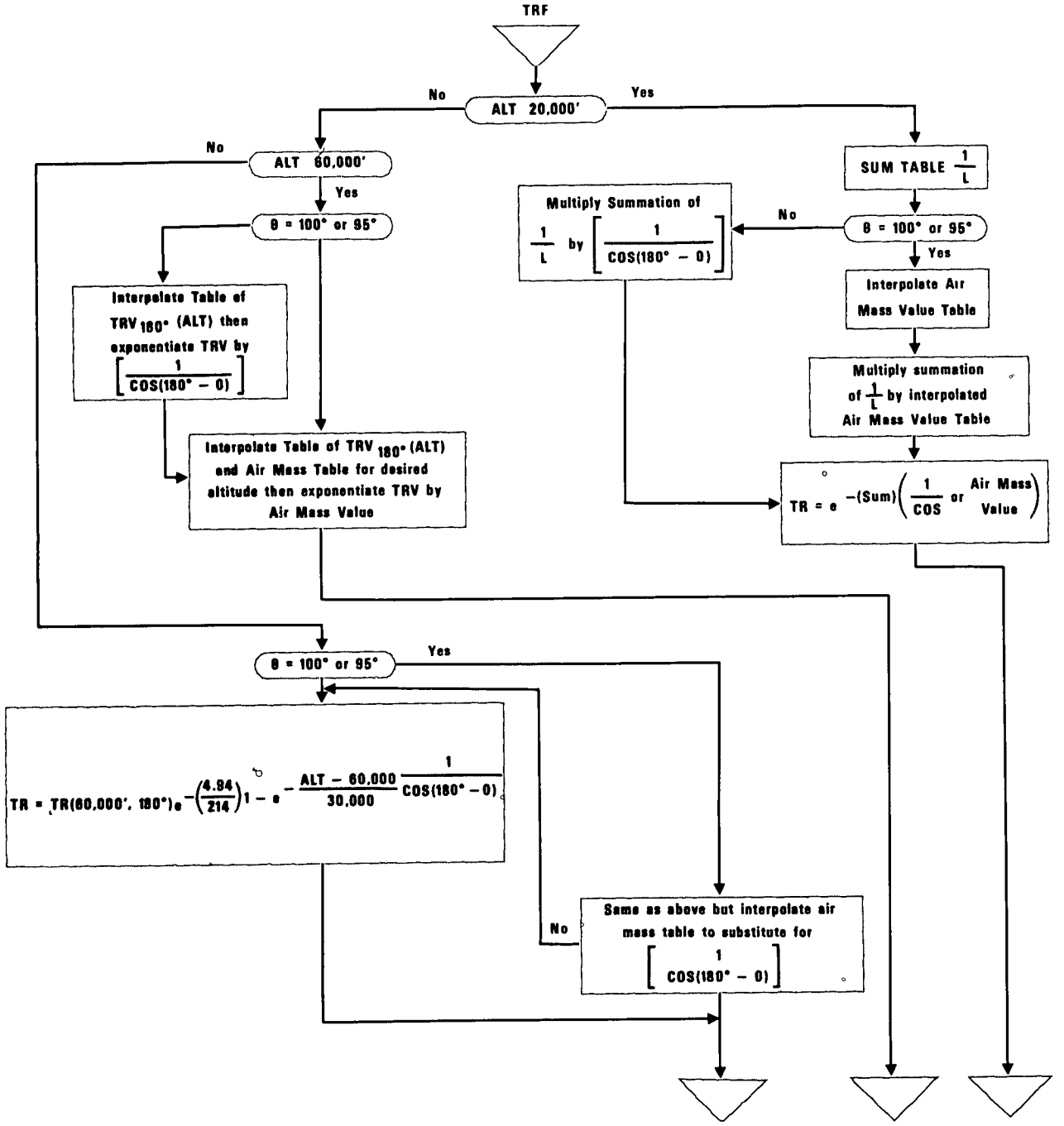
for $\theta > 100^\circ$.

If THETA = 100° or 95° interpolate Air Mass Table for desired altitude and substitute this value for

$$\frac{1}{\cos (180^\circ - \theta)}$$

TR = Beam Transmittance
N = Number of terms
L_N = Value of L (attenuation length) at altitude N
Δz = Altitude increment (100 ft.)
ALT = Altitude
TRV = Extrapolated values of beam transmittance for $20\,000^\circ < ALT < 60\,000$.

E. FLOW CHART


TRF
ALT 20,000'
No
Yes
ALT 60,000'
No
Yes
θ = 100° or 95°
Interpolate Table of TRV 180° (ALT) then exponentiate TRV by [1 / COS(180° − θ)]
Interpolate Table of TRV 180° (ALT) and Air Mass Table for desired altitude then exponentiate TRV by Air Mass Value
SUM TABLE 1/L
θ = 100° or 95°
No
Yes
Multiply Summation of 1/L by [1 / COS(180° − θ)]
Interpolate Air Mass Value Table
Multiply summation of 1/L by interpolated Air Mass Value Table
TR = e −(Sum)(1/COS or Air Mass Value)
θ = 100° or 95°
Yes
TR = TR(60,000', 180°)e −(4.84/214)[1 − e − (ALT − 60,000)/30,000 · 1/COS(180° − θ)]
No
Same as above but interpolate air mass table to substitute for [1 / COS(180° − θ)]

FUNCTION TRF (THETA,ALT)

```
      FUNCTION TRF(THETA,ALT)                                          TRF 0000
C     ...FUNCTION TRF...1 NOV, 65...BARKDOLL...VISLAB...UCSD           TRF 0010
C     ...THIS FUNCTION CALCULATES THE VALUE OF BEAM TRANSMITTANCE.     TRF 0020
C                                                                      TRF 0030
C     ...INPUTS...THETA=ZENITH OF PATH OF SIGHT                        TRF 0040
C     ...ALT=ALTITUDE OF OBSERVER                                      TRF 0050
C     ...                                                              TRF 0060
C     ...OUTPUT...THIS FUNCTION RETURNS THE CALCULATED                 TRF 0070
C     ...VALUE OF BEAM TRANSMITTANCE TR                                TRF 0080
C                                                                      TRF 0090
C     ...SHARES COMMON BLOCK D WITH SUBROUTINE DATA 2                  TRF 0100
C                                                                      TRF 0110
C     ...ROUTINES CALLED=NONE                                          TRF 0120
C                                                                      TRF 0130
      DIMENSION AMALT(6),ALTS(7)                                       TRF 0140
      COMMON/D/R(201),AMV(6,2),TRV(7)                                  TRF 0150
C                                                                      TRF 0155
      DATA(AMALT=0.,10000.,2 000.,400 .,1  .  .,2 0 0C.)               TRF 0160
      DATA(ALTS=2000 .,25 0.,3 00 .,35 0 .,40 0 .,5 0 0.,60000.)       TRF 0170
C                                                                      TRF 0175
      IF(THETA.GT.3.14165.OR.THETA.LT.1.6575) 10,30                    TRF 0180
   10 PRINT 20 ,THETA                                                  TRF 0190
   20 FORMAT(//,12X,32HTHETA OUT OF RANGE IN FUNCT. TRF,2X,F10.5)      TRF 0200
      GO TO 530                                                        TRF 0210
   30 IF(ALT.LT.1..OR.ALT.GT.4000000.)40,60                            TRF 0220
   40 PRINT 50 ,ALT                                                    TRF 0230
   50 FORMAT(//,2X,3 HALT OUT OF RANGE IN FUNCT. TRF,2X,F10.1)         TRF 0240
      GO TO 530                                                        TRF 0250
   60 Z=ALT $ THET=THETA $ S=0 $ DZ=1 0.760 0.                         TRF 0260
      TR=0                                                             TRF 0270
      IF(Z.LT.20000..OR.Z.EQ.20000.)70,250                             TRF 0280
   70 A=20000.                                                         TRF 0290
      IF(Z-A)90,100,80                                                 TRF 0300
   80 GO TO 40                                                         TRF 0310
   90 IF(Z-(A-100.))140,160,100                                        TRF 0320
  100 Y1=A-100. $ I=(A/100.) $ X1=1./R(I)                              TRF 0330
      Y2=A $ I=(I+1) $ X2=1./R(I)                                      TRF 0340
      IF(X2-X1.EQ.0)110,120                                            TRF 0350
  110 BN=X2                                                            TRF 0360
      GO TO 130                                                        TRF 0370
  120 M=(Y2-Y1)/(X2-X1)                                                TRF 0380
      BN=((Z-Y1)/M)+X1                                                 TRF 0390
  130 K=I-1                                                            TRF 0400
      GO TO 170                                                        TRF 0410
  140 A=A-200.                                                         TRF 0420
      IF(Z-A)90,100,150                                                TRF 0430
  150 A=A+100.                                                         TRF 0440
      GO TO 100                                                        TRF 0450
  160 A=A-100.                                                         TRF 0460
      I=(A/100.)+1                                                     TRF 0470
      BN=1./R(I)                                                       TRF 0480
      GO TO 130                                                        TRF 0490
  170 DO 180I=2,K                                                      TRF 0500
      S=S+(1./R(I))*DZ                                                 TRF 0510
  180 CONTINUE                                                         TRF 0520
      IF (THET.EQ.1.6580)190,200                                       TRF 0530
  190 ASSIGN 230 TO IRETN                                              TRF 0540
      INTP=2                                                           TRF 0550
      GO TO 450                                                        TRF 0560
  200 IF(THET.EQ.1.7453)210,220                                        TRF 0570
  210 ASSIGN 230 TO IRETN                                              TRF 0580
      INTP=1                                                           TRF 0590
```

```
      GO TO 450                                                          TRF 0600
  220 VALM=1./COSF(3.14159-THET)                                         TRF 0610
  230 V=(S+(((1./R(1))+(1./R(N)))*(DZ/2.)))*VALM                         TRF 0620
      TP=2.71828**(-V)                                                   TRF 0630
  240 TRF=TR                                                             TRF 0640
      GO TO 530                                                          TRF 0650
  250 IF(Z.LT.60000..OR.Z.EQ.60000.)260,390                              TRF 0660
  260 N=7                                                                TRF 0670
  270 IF(Z.EQ.ALTS(N))300,280                                            TRF 0680
  280 IF(Z-ALTS(N-1))290,310,320                                         TRF 0690
  290 N=N-1 $ GO TO 270                                                  TRF 0700
  300 TR=TRV(N) $ GO TO 330                                              TRF 0710
  310 TR=TRV(N-1) $ GO TO 330                                            TRF 0720
  320 X1=TRV(N-1) $ Y1=ALTS(N-1)                                         TRF 0730
      X2=TRV(N)$  Y2=ALTS(N)                                             TRF 0740
      SL=(Y2-Y1)/(X2-X1)                                                 TRF 0750
      TR=((Z-Y1)/SL)+X1                                                  TRF 0760
  330 IF(THET.EQ.1.6580)340,350                                          TRF 0770
  340 ASSIGN 380 TO IRETN                                                TRF 0780
      INTP=2                                                             TRF 0790
      GO TO 450                                                          TRF 0800
  350 IF(THET.EQ.1.7453)360,370                                          TRF 0810
  360 ASSIGN 380 TO IRETN                                                TRF 0820
      INTP=1                                                             TRF 0830
      GO TO 450                                                          TRF 0840
  370 VALM=1./COSF(3.14159 -THET)                                        TRF 0850
  380 TR=TR**VALM                                                        TRF 0860
      GO TO 240                                                          TRF 0870
  390 IF(THET.EQ.1.6580)400,410                                          TRF 0880
  400 ASSIGN 440 TO IRETN                                                TRF 0890
      INTP=2                                                             TRF 0900
      GO TO 450                                                          TRF 0910
  410 IF(THET.EQ.1.7453)420,430                                          TRF 0920
  420 ASSIGN 440 TO IRETN                                                TRF 0930
      INTP=1                                                             TRF 0940
      GO TO 450                                                          TRF 0950
  430 VALM=1./COSF(3.14159-THET)                                         TRF 0960
  440 E2=1.-(2.71828**(-(Z-60000.)/30000.))                              TRF 0970
      E1=2.71828**(-(4.94/214.)*E2)                                      TRF 0980
      TR=TRV(7)*E1                                                       TRF 0990
      TR=TR**VALM                                                        TRF 1000
      GO TO 240                                                          TRF 1010
  450 N=6                                                                TRF 1020
      IF(Z.GT.200000.)460,470                                            TRF 1030
  460 VALM=AMV(6,INTP)$ GO TO IRETN                                      TRF 1040
  470 IF(Z.EQ.AMALT(N))500,480                                           TRF 1050
  480 IF(Z-AMALT(N-1))490,510,520                                        TRF 1060
  490 N=N-1 $ GO TO 470                                                  TRF 1070
  500 VALM=AMV(N,INTP)$ GO TO IRETN                                      TRF 1080
  510 VALM=AMV(N-1,INTP)$ GO TO IRETN                                    TRF 1090
  520 X1=AMV(N-1,INTP) $ Y1=AMALT(N-1)                                   TRF 1100
      X2=AMV(N,INTP) $ Y2=AMALT(N)                                       TRF 1110
      SL=(Y2-Y1)/(X2-X1)                                                 TRF 1120
      VALM=((Z-Y1)/SL)+X1                                                TRF 1130
      GO TO IRETN                                                        TRF 1140
  530 END                                                                TRF 1150
```

VISIBILITY LABORATORY U.C.S.D
PROGRAM OR SUBROUTINE DESCRIPTION

A. IDENTIFICATION

Title	FUNCTION BSTRF
Category	CVC
Programmer	Barkdoll
Date	18 August 1965
Type	FORTRAN 63

B. DESCRIPTION

This subroutine calculates the Path Luminance (B*) for given, PHI, THETA, ALT by means of table values and specified formulas.

Uses TABLE BS in COMMON BLOCK A

C. USAGE

1. Calling Sequence	BSTRF (PHI, THETA, ALT)
2. Arguments or Parameters	PHI = Azimuth of path of sight of observer with respect to the sun. THETA = Zenith of path of sight from observer. ALT = Altitude of observer. Shares COMMON BLOCK A with SUBROUTINE DATA 1
3. Storage Requirements (Decimal)	276
4. Temporary Storage Requirements	Not Applicable
5. Alarms, or Print-Outs	(1) Indicates if ALT < 1 ft or ALT > 4 000 000 (i.e., out of given range). (2) Checks both THETA and PHI to make sure they are one of the values given in the DATA statements for those angles.
6. Error Returns	None
7. Error Stops	None
8. Input and Output Tape Mountings	Not Applicable
9. Input and Output Formats	Not Applicable
10. Selective Jump and Stop Settings	Not Applicable
11. Machine Time	Not Applicable
12. Accuracy	Not Applicable
13. Cautions to User	This routine calls FUNCTION TRF for Tr values. The table of BS (Path Luminance) values must be for the particular flight's atmospheric data.
14. Equipment Configuration	CDC 3600 FORTRAN 63
15. References	

D. METHOD

(1) $0 \text{ ft.} < \text{ALT} \leq 20\,000 \text{ ft.}$ for all THETAS

Interpolate TABLE BS (COMMON BLOCK A) for indicated ALT, THETA, PHI.

(2) $20\,000 \text{ ft.} < \text{ALT} \leq 60\,000 \text{ ft.}$ for all THETAS except THETA = 95°

Interpolate TABLE BS (COMMON BLOCK A) for indicated ALT, THETA, PHI.

(3) $60\,000 < \text{ALT} < \infty$ for all THETAS except THETA = 95°

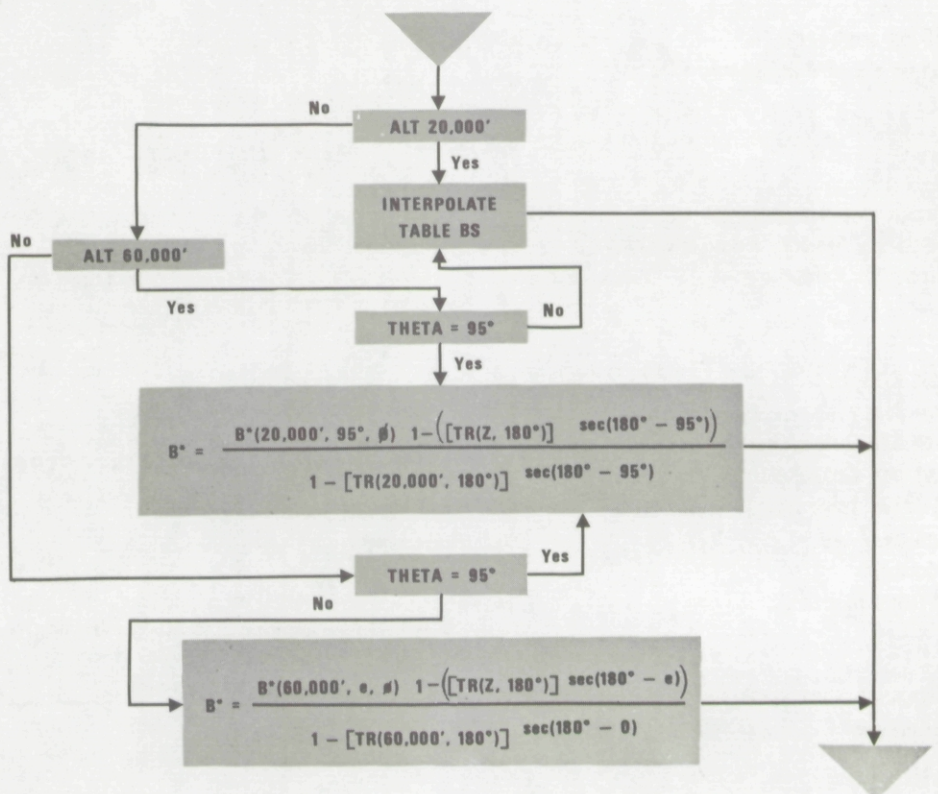
$$B^* = \frac{B^*(60\,000 \text{ ft.}, \theta, \phi)\left(1 - \left[TR(Z, 180°)\right]\left[\frac{1}{\cos(180° - \theta)}\right]\right)}{1 - \left[TR(6000 \text{ ft.}, 180°)\right]\left[\frac{1}{\cos(180° - \theta)}\right]}$$

(4) $20\,000 \text{ ft} < \text{ALT} < \infty$ THETA = 95°

$$B^* = \frac{B^*(20\,000 \text{ ft.}, 95°, \phi)\left(1 - \left[TR(Z, 180°)\right]\left[\frac{1}{\cos(180° - 95°)}\right]\right)}{1 - \left[TR(20\,000 \text{ ft.}, 180°)\right]\left[\frac{1}{\cos(180° - 95°)}\right]}$$

B^* = Path Luminance
TR = Beam Transmittance
θ = Zenith of path of sight from observer
ϕ = Azimuth of path of sight
z = Altitude of observer

E. FLOW CHART



FUNCTION BSTRF (PHI,THETA,ALT)

```
      FUNCTION BSTRF(PHI,THETA,ALT)                                          BST 0000
C     ...FUNCTION BSTRF...1 NOV, 65...BARKDOLL...VISLAB...UCSD               BST 0010
C     ...THIS FUNCTION CALCULATES PATH LUMINANCE BY                          BST 0020
C     ...LINEAR INTERPOLATION OF TABLE BS(THE VALUES OF                      BST 0030
C     ...PATH LUMINANCE FOR THE PARTICULAR FLIGHT).                          BST 0040
C                                                                            BST 0050
C     ...INPUTS...PHI=AZIMUTH OF PATH OF SIGHT WITH RESPECT TO SUN           BST 0060
C     ...THETA=ZENITH OF PATH OF SIGHT FROM OBSERVER                         BST 0070
C     ...ALT=ALTITUDE OF OBSERVER                                            BST 0080
C     ...                                                                    BST 0090
C     ...OUTPUT...THIS FUNCTION RETURNS THE CALCULATED VALUE OF              BST 0100
C     ...PATH LUMINANCE B*                                                   BST 0110
C                                                                            BST 0120
C     ...SHARES COMMON BLOCK A WITH SUBROUTINE DATA 1                        BST 0130
C                                                                            BST 0140
C     ...ROUTINES CALLED=TRF                                                 BST 0150
      DIMENSION Y(18)                                                        BST 0160
      DIMENSION PHE(5),THET (8)                                              BST 0170
      COMMON/A/BS(8,18,5)                                                    BST 0180
C                                                                            BST 0190
      DATA(PHE=0.,.7854,1.5708,2.3562,3.14159)                               BST 0195
      DATA(THET=2.8797,2.6180,2.3562,2.0944,1.8326,1.7453,1.6580)            BST 0200
      DATA(Y=0.,1000.,2000.,3000.,4000.,5000.,6000.,7000.,8000.,             BST 0210
     19000.,10000.,15000.,20000.,25000.,30000.,40000.,50000.,60000.)         BST 0220
C                                                                            BST 0230
      IF (ALT.LT.1..OR.ALT.GT.4000000.)10 ,30                                BST 0240
   10 PRINT 20 ,ALT                                                          BST 0250
   20 FORMAT (//,12X,32HALT OUT OF RANGE IN FUNCT. BSTRF,2X,F10.1)           BST 0260
      GO TO 310                                                              BST 0270
   30 Z=ALT                                                                  BST 0280
      STR=0                                                                  BST 0290
      DO 40 J=1,5                                                            BST 0300
      IF(PHI.EQ.PHE(J))60,40                                                 BST 0310
   40 CONTINUE                                                               BST 0320
      PRINT 50 ,PHI                                                          BST 0330
   50 FORMAT(//,12X,42HPHI IS NOT A CORRECT VALUE IN FUNCT. BSTRF,2X,F10BST 0340
     1.5)                                                                    BST 0350
      GO TO 310                                                              BST 0360
   60 L=J                                                                    BST 0370
      IF(THETA.EQ.3.14159)70,80                                              BST 0380
   70 M=1                                                                    BST 0390
      L=1                                                                    BST 0400
      GO TO 120                                                              BST 0410
   80 DO 90 I=1,7                                                            BST 0420
      IF(THETA.EQ.THET(I))110,90                                             BST 0430
   90 CONTINUE                                                               BST 0440
      PRINT 100,THETA                                                        BST 0450
  100 FORMAT(//,12X,44HTHETA IS NOT A CORRECT VALUE IN FUNCT. BSTRF,2X,FBST 0460
     110.5)                                                                  BST 0470
      GO TO 310                                                              BST 0480
  110 M=I+1                                                                  BST 0490
  120 IF(PHI.NE.0.AND.THETA.NE.3.14159)130,140                               BST 0500
  130 M=M-1                                                                  BST 0510
  140 N=18                                                                   BST 0520
      DC=3.14159                                                             BST 0530
      IF(Z.LT.20000..OR.Z.EQ.20000.)150,160                                  BST 0540
  150 ASSIGN 300 TO IRETN                                                    BST 0550
      GO TO 230                                                              BST 0560
  160 IF(Z.LT.60000..OR.Z.EQ.60000.)170,200                                  BST 0570
  170 IF(THETA.EQ.1.6580)180,150                                             BST 0580
  180 ASSIGN 190 TO IRETN                                                    BST 0590
                                                                             BST 0600
```

```
      ZZ=Z$Z=20000.                                                    BST 0610
      GO TO 230                                                        BST 0620
  190 STR=X*(1.-(TRF(DC,ZZ)**(1./COSF(3.14159-1.6580))))/              BST 0630
     1(1.-(TRF(DC,Z)**(1./COSF(3.14159-1.6580))))                      BST 0640
      X=STR                                                            BST 0650
      GO TO 300                                                        BST 0660
  200 IF(THETA.EQ.1.6580)180,210                                       BST 0670
  210 ASSIGN 220 TO IRETN                                              BST 0680
      ZZ=Z $ Z=60000.                                                  BST 0690
      GO TO 230                                                        BST 0700
  220 STR=X*(1.-(TRF(DC,ZZ)**(1./COSF(3.14159-THETA))))/               BST 0710
     1(1.-(TRF(DC,Z)**(1./COSF(3.14159-THETA))))                       BST 0720
      X=STR                                                            BST 0730
      GO TO 300                                                        BST 0740
  230 IF(Y(N)-Z)280,250,240                                            BST 0750
  240 IF(Z-Y(N-1))270,260,290                                          BST 0760
  250 X=BS(M,N,L)                                                      BST 0770
      GO TO IRETN                                                      BST 0780
  260 X=BS(M,N-1,L) $ GO TO IRETN                                      BST 0790
  270 N=N-1                                                            BST 0800
      IF(N.EQ.0)280,230                                                BST 0810
  280 ALT=7777.                                                        BST 0820
      GO TO 10                                                         BST 0830
  290 X1=BS(M,N-1,L) $ Y1=Y(N-1)                                       BST 0840
      X2=BS(M,N,L) $ Y2=Y(N)                                           BST 0850
      SL=(Y2-Y1)/(X2-X1)                                               BST 0860
      X=((Z-Y1)/SL)+X1                                                 BST 0870
      GO TO IRETN                                                      BST 0880
  300 BSTRF=X                                                          BST 0890
  310 END                                                              BST 0900
```

VISIBILITY LABORATORY U.C.S.D.
PROGRAM OR SUBROUTINE DESCRIPTION

A. IDENTIFICATION

Title	FUNCTION TROF
Category	CVC
Programmer	Barkdoll
Date	28 February 1966
Type	FORTRAN 63

B. DESCRIPTION

This function returns a value of .9 for calls for optical system beam transmittance.
Can use table TROV in common block F.
This function will be used to return values of optical system beam transmittance when data becomes available.

C. USAGE

1. Calling Sequence	TROF (THETA)
2. Arguments or Parameters	THETA = zenith of path of sight from observer.
3. Storage Requirements (Decimal)	Unknown
4. Temporary Storage Requirements	Not Applicable
5. Alarms, or Print-Outs	None
6. Error Returns	None
7. Error Stops	None
8. Input and Output Tape Mountings	Not Applicable
9. Input and Output Formats	Not Applicable
10. Selective Jump and Stop Settings	Not Applicable
11. Machine Time	
12. Accuracy	Not Applicable
13. Cautions to User	None
14. Equipment Configuration	CDC 3600
15. References	None

D. METHOD

Dummy function, always returns TROF = .9.

E. FLOW CHART

Not Applicable

FUNCTION TROF(THETA)

```
      FUNCTION TROF(THETA)                                              TRO 0000
C     ...THIS FUNCTION CALCULATES BEAM TRANSMITTANCE                    TRO 0010
C     ...THROUGH AN OPTICAL SYSTEM                                      TRO 0020
      COMMON/F/TROV(1)                                                  TRO 0030
      TROF=.9                                                           TRO 0040
      END                                                               TRO 0050
```

VISIBILITY LABORATORY U.C.S.D.
PROGRAM OR SUBROUTINE DESCRIPTION

A. IDENTIFICATION

Title	FUNCTION BSTOF
Category	CVC
Programmer	Barkdoll
Date	28 February 1966
Type	FORTRAN 63

B. DESCRIPTION

This function returns a value of 11.11111 for calls for optical system path luminance. Can use table BSOV in common block E. This function will be used to return values of optical system path luminance when data becomes available.

C. USAGE

1. **Calling Sequence** — BSTOF (PHI, THETA)
2. **Arguments or Parameters**

   PHI = azimuth of path of sight of observer with respect to sun.
   THETA = zenith of path of sight from observer.

3. **Storage Requirements (Decimal)** — Unknown at present
4. **Temporary Storage Requirements** — Not Applicable
5. **Alarms, or Print-Outs** — None
6. **Error Returns** — None
7. **Error Stops** — None
8. **Input and Output Tape Mountings** — Not Applicable
9. **Input and Output Formats** — Not Applicable
10. **Selective Jump and Stop Settings** — Not Applicable
11. **Machine Time**
12. **Accuracy** — Not Applicable
13. **Cautions to User** — None
14. **Equipment Configuration** — CDC 3600
15. **References** — None

D. METHOD

Dummy function, always returns BSTOF = 11.111111.

E. FLOW CHART

Not Applicable

FUNCTION BSTOF(PHI,THETA)

```
      FUNCTION BSTOF(PHI,THETA)                                    BSO 0000
C     ...THIS FUNCTION CALCULATES PATH LUMINANCE IN AN             BSO 0010
C     ...OPTICAL SYSTEM                                            BSO 0020
      COMMON/E/BSTOV(1)                                            BSO 0030
      BSTOF=11.11111                                               BSO 0040
      END                                                          BSO 0050
```

VISIBILITY LABORATORY U.C.S.D.
PROGRAM OR SUBROUTINE DESCRIPTION

A. IDENTIFICATION

Title	FUNCTION BBOF
Category	CVC Problem 1
Programmer	Barkdoll
Date	18 August 1965
Type	

B. DESCRIPTION

This function calculates the Inherent Background Luminance, ${}_bB_o$, for specified values of PHI, THETA, and BAC.

C. USAGE

1. **Calling Sequence** — BBOF (PHI, THETA, BAC)
2. **Arguments or Parameters**

   PHI — Azimuth angle of path of sight with respect to the sun.
   THETA — Zenith of path of sight from the observer.
   BAC — Index for particular table of background directional luminous reflectances.

   Shares COMMON BLOCK B with SUBROUTINE DATA 2.
3. **Storage Requirements (Decimal)** — 101
4. **Temporary Storage Requirements** — Not Applicable
5. **Alarms, or Print-Outs**
   (a) None
   (b) Checks THETA and PHI to ascertain if they are correct values in Function COF.
6. **Error Returns** — None
7. **Error Stops** — None
8. **Input and Output Tape Mountings** — Not Applicable
9. **Input and Output Formats** — Not Applicable
10. **Selective Jump and Stop Settings** — Not Applicable
11. **Machine Time** — Not Applicable
12. **Accuracy** — Not Applicable
13. **Cautions to User**

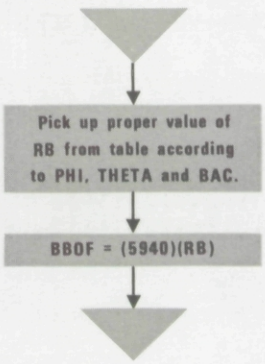
    (a) None
    (b) (1) Uses Table (RB) which contains the values for Directional Luminous Reflectance of Terrain Background for given PHI, THETA, and BAC.
    (2) Total Background Illuminance = 5940 lumens/ft.
14. **Equipment Configuration** — 3600, FORTRAN 63
15. **References** — None

D. METHOD

The proper value of Directional Luminous Reflectance corresponding to the given PHI, THETA, and BAC, is multiplied by the Total Background illuminance. This product is in Foot Lamberts.

$$_{b}B_{o} = (5940)\ _{b}R_{o}\ (0, \theta, \phi)$$

E. FLOW CHART



FUNCTION BBOF (PHI,THETA,BAC)

```
      FUNCTION BBOF(PHI,THETA,BAC)                                      BBO 0000
C     ...FUNCTION BBOF...1 NOV, 65...BARKDOLL...VISLAB...UCSD           BBO 0010
C     ...FUNCTION BBOF CALCULATES THEINHERENT BACKGROUND                BBO 0020
C     ...LUMINANCE BBO FOR A GIVEN VALUE OF PHI AND THETA               BBO 0030
C                                                                       BBO 0040
C     ...INPUTS...PHI=AZIMUTH OF PATH OF SIGHT WITH RESPECT             BBO 0050
C     ...TO SUN...THETA= ZENITH OF PATH OF SIGHT FROM OBSERVER          BBO 0060
C     ...BAC=INDEX FOR PARTICULAR TABLE OF BACKGROUND                   BBO 0070
C     ...DIRECTIONAL LUMINOUS REFLECTANCES                              BBO 0080
C                                                                       BBO 0090
C     ...SHARES COMMON BLOCK B WITH SUBROUTINE DATA 2                   BBO 0100
C     ...TABLES USED=TABLE(RB),VALUES OF DIRECTIONAL                    BBO 0110
C     ...LUMINOUS REFLECTANCE. BAC=1= PINE TREES                        BBO 0120
C                                                                       BBO 0130
C     ...ROUTINES CALLED=NONE                                           BBO 0140
C                                                                       BBO 0150
      DIMENSION PHE(5),THET(8)                                          BBO 0160
      COMMON /B/ RB(5,8,2),RO(5,8,1),TILLH                              BBO 0170
C                                                                       BBO 0175
      DATA(PHE=0.,.7854,1.5708,2.3562,3.14159)                          BBO 0180
      DATA(THET=3.14159,2.8797,2.6180,2.3562,2.0944,1.8326,             BBO 0190
     11.7453,1.6580)                                                    BBO 0200
C                                                                       BBO 0205
      JJ=BAC                                                            BBO 0210
      DO 20I=1,5                                                        BBO 0220
      IF(PHI.EQ.PHE(I))10,20                                            BBO 0230
   10 L=I                                                               BBO 0240
      GO TO 40                                                          BBO 0250
   20 CONTINUE                                                          BBO 0260
      PRINT 30 ,PHI                                                     BBO 0270
   30 FORMAT(8X,39HPHI IS NOT CORRECT VALUE IN FUNCT. BBOF,2X,F10.5)    BBO 0280
   40 DO 60I=1,8                                                        BBO 0290
      IF(THETA.EQ.THET(I))50,60                                         BBO 0300
   50 M=I                                                               BBO 0310
      GO TO 80                                                          BBO 0320
   60 CONTINUE                                                          BBO 0330
      PRINT 70 ,THETA                                                   BBO 0340
   70 FORMAT(8X,41HTHETA IS NOT CORRECT VALUE IN FUNCT. BBOF,2X,F10.5)  BBO 0350
C     ...TILLH = TOTAL ILLUMINANCE ON A HORIZONTAL PLANE AT GROUND OR   BBO 0360
C     ...SEA LEVEL FOR THE REFLECTANCE DATA                             BBO 0370
   80 BBOF=TILLH*RB(L,M,JJ)                                             BBO 0380
      END                                                               BBO 0390
```

VISIBILITY LABORATORY U.C.S.D.
PROGRAM OR SUBROUTINE DESCRIPTION

A. IDENTIFICATION

Title	FUNCTION COF
Category	CVC
Programmer	Barkdoll
Date	18 August 1965
Type	FORTRAN 63

B. DESCRIPTION

This function calculates the value of the Inherent Contrast (C_o) for given THETA, PHI, and BAC.

C. USAGE

1. **Calling Sequence** — COF (PHI, THETA, OBJ, BAC)
2. **Arguments or Parameters**

   PHI = Azimuth of path of sight of observer with respect to sun.
   THETA = Zenith of path of sight from observer.
   OBJ = Index of proper table of object reflectance.
   BAC = Index of proper table of background reflectance.

   Shares common Block B with Subroutine Data 2.
3. **Storage Requirements (Decimal)** — 121
4. **Temporary Storage Requirements** — Not Applicable
5. **Alarms, or Print-Outs** — Checks both THETA and PHI to ascertain if they are correct values in the FUNCTION COF.
6. **Error Returns** — None
7. **Error Stops** — None
8. **Input and Output Tape Mountings** — Not Applicable
9. **Input and Output Formats** — Not Applicable
10. **Selective Jump and Stop Settings** — Not Applicable
11. **Machine Time** — Not Applicable
12. **Accuracy** — Not Applicable
13. **Cautions to User** — None

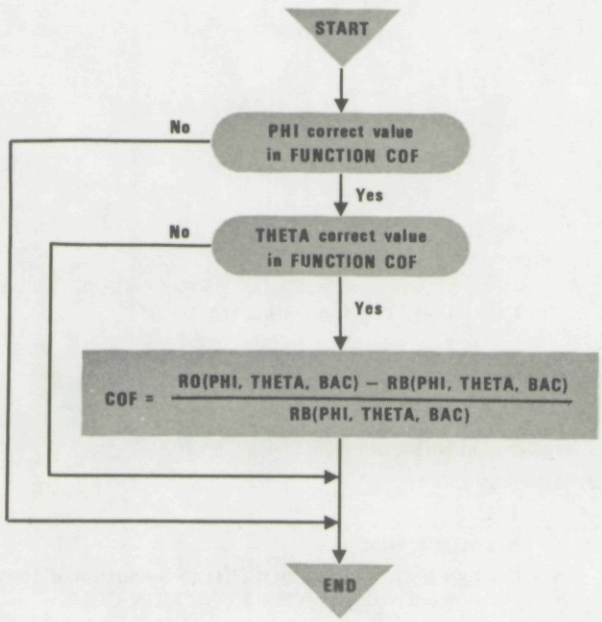
    Shares common block B with subroutine Data 2. This block contains the table of object and background reflectances.
14. **Equipment Configuration** — CDC 3600 FORTRAN 63
15. **References**

D. METHOD

$$CO = \frac{RO(PHI, THETA, BAC) - RB(PHI, THETA, BAC)}{RB(PHI, THETA, BAC)}$$

CO = Inherent contrast
RO = Reflectance of target
RB = Reflectance of background

E. FLOW CHART



FUNCTION COF(PHI,THETA,OBJ,BAC)

```
      FUNCTION COF(PHI,THETA,OBJ,BAC)                                   COF 0000
C     ...FUNCTION COF... 1 NOV, 65...BARKDOLL...VISLAB...UCSD           COF 0010
C     ...THIS FUNCTION CALCULATES THE VALUE OF INHERENT CONTRAST        COF 0020
C                                                                       COF 0030
C     ...INPUTS...PHI=AZIMUTH OF PATH OF SIGHT WITH RESPECT TO SUN      COF 0040
C     ...THETA=ZENITH OF PATH OF SIGHT FROM OBSERVER                    COF 0050
C     ...OBJ=INDEX OF PROPER TABLE OF OBJECT REFLECTANCE                COF 0060
C     ...BAC=INDEX OF PROPER TABLE OF BACKGROUND REFLECTANCE            COF 0070
C                                                                       COF 0080
C     ...OUTPUT...THIS FUNCTION RETURNS THE CALCULATED VALUE            COF 0090
C     ...OF INHERENT CONTRAST CO                                        COF 0100
C                                                                       COF 0110
C     ...SHARES COMMON BLOCK B WITH SUBROUTINE DATA 2                   COF 0120
C                                                                       COF 0130
C     ...ROUTINES CALLED=NONE                                           COF 0140
C                                                                       COF 0150
      DIMENSION PHE(5), THET(8)                                         COF 0160
      COMMON/B/RB(5,8,2),RO(5,8,1),TILLH                                COF 0170
C                                                                       COF 0175
      DATA(PHE=0.,.7854,1.5708,2.3562,3.14159)                          COF 0180
      DATA(THET=3.14159,2.8797,2.618),2.3562,2.0944,1.8326,1.7453,1.6580COF 0190
     1)                                                                 COF 0200
C                                                                       COF 0205
      KK=OBJ$JJ=BAC                                                     COF 0210
      DO 20 I=1,5                                                       COF 0220
      IF(PHI.EQ.PHE(I))10,20                                            COF 0230
   10 L=I                                                               COF 0240
      GO TO 40                                                          COF 0250
   20 CONTINUE                                                          COF 0260
      PRINT 30 ,PHI                                                     COF 0270
   30 FORMAT(8X,38HPHI IS NOT CORRECT VALUE IN FUNCT. COF,2X,F10.5)     COF 0280
      GO TO 90                                                          COF 0290
   40 DO 60 I=1,8                                                       COF 0300
      IF (THETA.EQ.THET(I))50,60                                        COF 0310
   50 M=I                                                               COF 0320
      GO TO 80                                                          COF 0330
   60 CONTINUE                                                          COF 0340
      PRINT 70 ,THETA                                                   COF 0350
   70 FORMAT(8X,40HTHETA IS NOT CORRECT VALUE IN FUNCT. COF,2X,F10.5)   COF 0360
      GO TO 90                                                          COF 0370
   80 COF=(RO(L,M,KK)-RB(L,M,JJ))/RB(L,M,JJ)                           COF 0380
   90 CONTINUE                                                          COF 0390
      END                                                               COF 0400
```

VISIBILITY LABORATORY U.C.S.D.
PROGRAM OR SUBROUTINE DESCRIPTION

A. IDENTIFICATION

Title	SUBROUTINE PLTSU
Category	CVC
Programmer	Barkdoll
Date	
Type	FORTRAN 63

B. DESCRIPTION

This routine takes data used in printing coordinates of cross sections of probability of detection hemispheres and formats this data to be used for plotting. The data processed by this routine is used by subroutine PLOT 1.

C. USAGE

1. Calling Sequence

SUBROUTINE PLTSU (SAX, SAY, JK, X1, X2, X3, X4, Z1, Z2, Z3, Z4, JJ, AXSL, CSLX, CSLY, AXLX, AXLY, NTGDM, NAINC, NPROB)

2. Arguments or Parameters

INPUTS:

SAX = Distance to axis array.
SAY = Altitude array.
JK = Length of dimension of array SAX.

OUTPUTS:

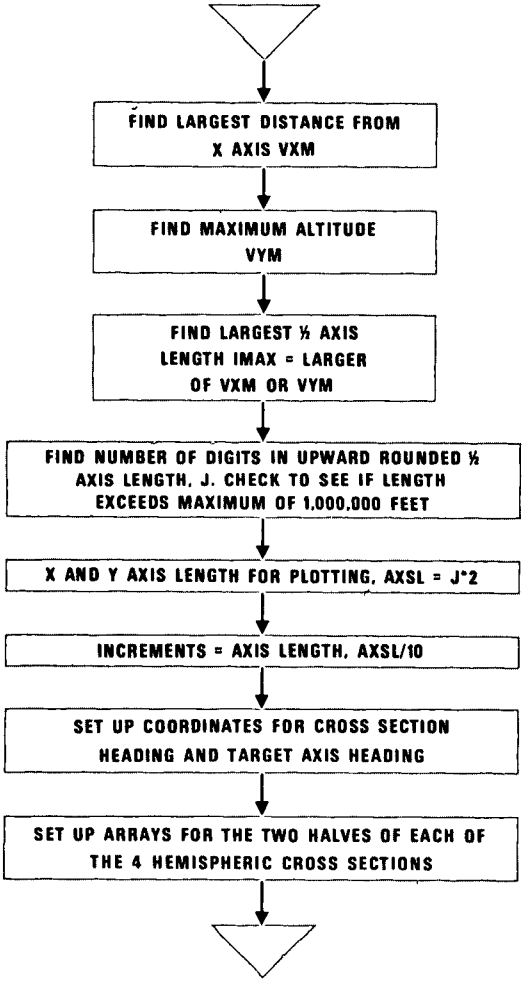
X1, X2, X3, X4 array names of X axis distances of 4 cross sections to be plotted.
Z1, Z2, Z3, Z4 array names of Y axis altitudes for 4 cross sections.
JJ = Length of dimension of X and Z arrays.
AXSL = X and Y axis lengths for each plot.
CSLX and CSLY are the X and Y cross section heading coordinates.
AXLX and AXLY are the X and Y coordinates of target axis heading.
NTGDM = Target diameter.
NAINC = Axis increment value.
NPROB = Probability of detection.

3. Storage Requirements (Decimal)	250
4. Temporary Storage Requirements	Not Applicable
5. Alarms, or Print-Outs	Print out value if X or Y axis length exceeds maximum of 10,000,000 ft.
6. Error Returns	None
7. Error Stops	None
8. Input and Output Tape Mountings	Not Applicable
9. Input and Output Formats	Not Applicable
10. Selective Jump and Stop Settings	Not Applicable
11. Machine Time	
12. Accuracy	Not Applicable
13. Cautions to User	None
14. Equipment Configuration	CDC 3600 FORTRAN 63
15. References	None

D. METHOD

Not Applicable

E. FLOW CHART


FIND LARGEST DISTANCE FROM X AXIS VXM
FIND MAXIMUM ALTITUDE VYM
FIND LARGEST ½ AXIS LENGTH IMAX = LARGER OF VXM OR VYM
FIND NUMBER OF DIGITS IN UPWARD ROUNDED ½ AXIS LENGTH, J. CHECK TO SEE IF LENGTH EXCEEDS MAXIMUM OF 1,000,000 FEET
X AND Y AXIS LENGTH FOR PLOTTING, AXSL = J**2
INCREMENTS = AXIS LENGTH, AXSL/10
SET UP COORDINATES FOR CROSS SECTION HEADING AND TARGET AXIS HEADING
SET UP ARRAYS FOR THE TWO HALVES OF EACH OF THE 4 HEMISPHERIC CROSS SECTIONS

SUBROUTINE PLTSU

```
      SUBROUTINE PLTSU(SAX,SAY,JK,X1,X2,X3,X4,Z1,Z2,Z3,Z4,JJ,          PSU 0000
     1AXSL,CSLX,CSLY,AXLX,AXLY,NTGDM,NAINC,NPROB)                      PSU 0010
C     ...SUBROUTINE PLTSU...1 NOV, 65...BARKDOLL...VISLAB...UCSD       PSU 0020
C     ...THIS SUBROUTINE TAKES THE DATA USED IN PRINTING THE 5          PSU 0030
C     ...1/2 HEMISPHERIC CROSS SECTIONS ALTITUDES AND                   PSU 0040
C     ...DISTANCES TO THE AXIS, AND TRANSFORMS THIS DATA                PSU 0050
C     ...INTO 4 HEMISPHERIC CROSS SECTIONS TO BE                        PSU 0060
C     ...PLOTTED BY SUBROUTINE PLOT1. PLTSU IS AN                       PSU 0070
C     ...AUTOMATIC FORMATTING ROUTINE.                                  PSU 0080
C     ...NOTE...TO SOLVE FOR SEVERAL DIFFERENT DETECTION                PSU 0090
C     ...VOLUMES ADDITIONAL CALLS TO SUBROUTINE TCAL                    PSU 0100
C     ...WITH THE APPROPRIATE DATA PRECEEDING EACH                      PSU 0110
C     ...CALL, CAN BE MADE.  THE CARD PRECEEDING THE                    PSU 0120
C     ...END CARD MUST BE THE ONLY CALL TO PREP(9)                      PSU 0130
C     ...USED IN THE ENTIRE SEQUENCE OF PROGRAMS.                       PSU 0140
C     ...THIS CALL ENABLES WRITING MAGNETIC TAPE WHICH WILL             PSU 0150
C     ...BE USED BY THE CDC 160A TO DRIVE THE PLOTTER.                  PSU 0160
C                                                                       PSU 0170
C     ...INPUTS...SAX=NAME OF DISTANCE TO AXIS ARRAY.                   PSU 0180
C     ...SAY=NAME OF ALTITUDE ARRAY.  JK=LENGTH DIMENSION               PSU 0190
C     ...OF ARRAY SAX OR SAY.                                           PSU 0200
C                                                                       PSU 0210
C     ...OUTPUTS...X1,X2,X3,X4=ARRAY NAMES OF                           PSU 0220
C     ...X AXIS DISTANCE VALUES FOR THE 4 CROSS SECTIONS                PSU 0230
C     ...TO BE PLOTTED.  Z1,Z2,Z3,Z4,ARRAY NAMES OF Y AXIS              PSU 0240
C     ...ALTITUDES FOR THE 4 CROSS SECTIONS TO BE PLOTTED.              PSU 0250
C     ...AXSL=X AND Y AXIS LENGTHS FOR EACH PLOT                        PSU 0260
C     ...CSLX,CSLY=X AND Y COORDINATES OF CROSS SECTION HEADING         PSU 0270
C     ...AXLX,AXLY=X AND Y COORDINATES OF TARGET AXIS HEADING           PSU 0280
C     ...NTGDM=TARGET DIAMETER                                          PSU 0290
C     ...NAINC=AXIS INCREMENT VALUE                                     PSU 0300
C     ...NPROB=PROBABILITY OF DETECTION                                 PSU 0310
C                                                                       PSU 0320
C                                                                       PSU 0330
C     ...OUTPUT = NONE                                                  PSU 0340
C                                                                       PSU 0350
C     ...SUBROUTINES CALLED=NONE                                        PSU 0360
C                                                                       PSU 0370
      DIMENSION X1(JJ),Z1(JJ),X2(JJ),Z2(JJ),X3(JJ),Z3(JJ),X4(JJ),Z4(JJ) PSU 0380
      DIMENSION SAX(JK),SAY(JK)                                         PSU 0390
C                                                                       PSU 0395
      VXM=0                                                             PSU 0400
      DO 20 I=1,32                                                      PSU 0410
      IF (SAX(I+8).GT.VXM)10,20                                         PSU 0420
   10 VXM=SAX(I+8)                                                      PSU 0430
   20 CONTINUE                                                          PSU 0440
      IMAX=VXM                                                          PSU 0450
      VYM=0                                                             PSU 0460
      DO 40 I=1,32                                                      PSU 0470
      IF(SAY(I+8).GT.VYM)30,40                                          PSU 0480
   30 VYM=SAY(I+8)                                                      PSU 0490
   40 CONTINUE                                                          PSU 0500
      IF(IMAX.GT.VYM)60,50                                              PSU 0510
   50 IMAX=VYM                                                          PSU 0520
   60 IF(IMAX.LT.100)70,80                                              PSU 0530
   70 ND=2 $ GO TO 200                                                  PSU 0540
   80 IF(IMAX.LT.1000)90,100                                            PSU 0550
   90 ND=3 $ GO TO 200                                                  PSU 0560
  100 IF(IMAX.LT.10000)110,120                                          PSU 0570
  110 ND=4 $ GO TO 200                                                  PSU 0580
  120 IF(IMAX.LT.100000)130,140                                         PSU 0590
  130 ND=5 $ GO TO 200                                                  PSU 0600
  140 IF(IMAX.LT.1000000)150,160                                        PSU 0610
  150 ND=6 $ GO TO 200                                                  PSU 0620
```

```
  160 IF(IMAX.LT.100000)17 ,180                                          PSU 0630
  170 ND=7 $ GO TO 200                                                   PSU 0640
  180 PRINT 190,IMAX                                                     PSU 0650
  190 FORMAT(//8X,5 HMAXIMUM X VALUE EXCEEDS 1000000 FT. IN SUB. PLTSU,PSU 0660
     12X,F15.1)                                                          PSU 0670
      GO TO 290                                                         PSU 0680
  200 NN=10**(ND-1)                                                     PSU 0690
      J=(IMAX/NN)*NN+NN                                                 PSU 0700
      AXSL=2*J                                                          PSU 0710
      NAINC=AXSL/10.                                                    PSU 0720
      CSLX=NAINC/10.                                                    PSU 0730
      CSLY=9.*NAINC                                                     PSU 0740
      AXLX=J                                                            PSU 0750
      AXLY=0                                                            PSU 0760
      DO 210I=1,8                                                       PSU 0770
      X1(I)=AXLX-SAX(17-I)                                              PSU 0780
      Z1(I)=SAY(17-I)                                                   PSU 0790
  210 CONTINUE                                                          PSU 0800
      DO 220I=1,8                                                       PSU 0810
      X2(I)=AXLX-SAX(25-I)                                              PSU 0820
      Z2(I)=SAY(25-I)                                                   PSU 0830
  220 CONTINUE                                                          PSU 0840
      DO 230I=1,8                                                       PSU 0850
      X3(I)=AXLX-SAX(33-I)                                              PSU 0860
      Z3(I)=SAY(33-I)                                                   PSU 0870
  230 CONTINUE                                                          PSU 0880
      DO 240I=1,8                                                       PSU 0890
      X4(I)=AXLX-SAX(41-I)                                              PSU 0900
      Z4(I)=SAY(41-I)                                                   PSU 0910
  240 CONTINUE                                                          PSU 0920
      DO 250I=9,15                                                      PSU 0930
      K=I-8                                                             PSU 0940
      X1(I)=SAX(K+1)+AXLX                                               PSU 0950
      Z1(I)=SAY(K+1)                                                    PSU 0960
  250 CONTINUE                                                          PSU 0970
      DO 260I=9,15                                                      PSU 0980
      K=I-8                                                             PSU 0990
      X2(I)=SAX(K+33)+AXLX                                              PSU 1000
      Z2(I)=SAY(K+33)                                                   PSU 1010
  260 CONTINUE                                                          PSU 1020
      DO 270I=9,15                                                      PSU 1030
      K=I-8                                                             PSU 1040
      X3(I)=SAX(K+25)+AXLX                                              PSU 1050
      Z3(I)=SAY(K+25)                                                   PSU 1060
  270 CONTINUE                                                          PSU 1070
      DO 280 I=9,15                                                     PSU 1080
      K=I-8                                                             PSU 1090
      X4(I)=SAX(K+17)+AXLX                                              PSU 1100
      Z4(I)=SAY(K+17)                                                   PSU 1110
  280 CONTINUE                                                          PSU 1120
  290 END                                                               PSU 1130
```

VISIBILITY LABORATORY U.C.S.D.
PROGRAM OR SUBROUTINE DESCRIPTION

A. IDENTIFICATION

Title	SUBROUTINE PLOT 1
Category	CVC
Programmer	Barkdoll
Date	1 November 1965
Type	FORTRAN 63

B. DESCRIPTION

This subroutine sets up probability of detection cross section data and format data for plotting. This is done by making calls to the UCSD Q9Q plot program PREP 1 through PREP 9. PLOT 1 enables Q9Q PLOT to write a magnetic tape for data to be plotted by a Cal Comp 165 incrementor plotter.

C. USAGE

1. Calling Sequence

PLOT 1 (X1, X2, X3, X4, Z1, Z2, Z3, Z4, JJ, AXSL, CSLX, CSLY, AXLX, AXCY, NTGDM, NAINC, NPROB)

2. Arguments or Parameters

INPUTS:

X1, X2, X3, X4	= Arrays of X coordinate points.
Z1, Z2, Z3, Z4	= Arrays of Y coordinate points.
JJ	= Length of each X and Y array.
AXSL	= Length of X and Y axis.
CSLX and CSLY	= Cross section heading coordinates.
AXCX and AXCY	= Target axis heading coordinates.
NTGDM	= Target diameter in feet.
NAINC	= X and Y axis increment values in feet.
NPROB	= Heading probability value (absolute).

3. Storage Requirements (Decimal)

4. Temporary Storage Requirements — Not Applicable

5. Alarms, or Print-Outs — None

6. Error Returns — None

7. Error Stops — None

8. Input and Output Tape Mountings — Not Applicable

9. Input and Output Formats — Not Applicable

10. Selective Jump and Stop Settings — Not Applicable

11. Machine Time

12. Accuracy — Not Applicable

13. Cautions to User — None .

This program makes calls to UCSD Q9Q PLOT program subroutine PREP 1 through PREP 9.

14. Equipment Configuration — CDC 3600 with Fortran 63

15. References — See write-up for Q9Q Plot

D. METHOD — Not Applicable

SUBROUTINE PLOT1

```
      SUBROUTINE PLOT1(X1,X2,X3,X4,Z1,Z2,Z3,Z4,JJ,AXSL,CSLX,CSLY,AXLX,AXPT1 0000
     1LY,NTGDM,NAINC,NPROB)                                              PT1 0010
C     ...SUBROUTINE PLOT1...1 NOV, 65...BARKDOLL...VISLAN...UCSD        PT1 0020
C     ...THIS SUBROUTINE SETS UP CROSS SECTION DATA AND                  PT1 0030
C     ...FORMAT DATA FOR WRITING ON PLOT MAGNETIC                        PT1 0040
C     ...TAPE.  THE PLOT TAPE IS PROCESSED BY A CDC 160A                 PT1 0050
C     ...COMPUTER THAT DRIVES A CAL COMP165A PLOTTER.                    PT1 0060
C     ...PLOT 1 USES UCSD Q90PLOT PROGRAM (CALLS                         PT1 0070
C     ...TO PREP 1 THROUGH 9).                                           PT1 0080
C                                                                        PT1 0090
C     ...INPUTS...                                                       PT1 0100
C     ...X1,X2,X3,X4 ARE ARRAYS OF X COORDINATE POINTS                   PT1 0110
C     ...Z1,Z2,Z3,Z4 ARE ARRAYS OF Y COORDINATE POINTS                   PT1 0120
C     ...JJ IS THE LENGTH OF EACH X AND Y ARRAY                          PT1 0130
C     ...AXSL=LENGTH OF THE X AND Y AXIS                                 PT1 0140
C     ...CSLX=X CROSS SECTION HEADING COORDINATE                         PT1 0150
C     ...CSLY=Y CROSS SECTION HEADING COORDINATE                         PT1 0160
C     ...AXLX=X TARGET AXIS HEADING COORDINATE                           PT1 0170
C     ...AXLY=Y TARGET AXIS HEADING COORDINATE                           PT1 0180
C     ...NTGDM=TARGET DIAMETER IN FT.                                    PT1 0190
C     ...NAINC=X AND Y AXIS INCREMENT VALUES IN FT.                      PT1 0200
C     ...NPROB=HEADING PROBABILITY VALUE (ABSOLUTE)                      PT1 0210
C                                                                        PT1 0220
C     ...OUTPUT = NONE                                                   PT1 0230
C     ...SUBROUTINES CALLED=PREP1 THROUGH 9 FROM UCSD Q90 PLOT PROGRAM.  PT1 0240
C                                                                        PT1 0250
      DIMENSION X1(JJ),X2(JJ),X3(JJ),X4(JJ),Z1(JJ),Z2(JJ),Z3(JJ),Z4(JJ)  PT1 0260
      DIMENSION II(4),KK(5),LL(8),MM(8)                                  PT1 0270
C                                                                        PT1 0275
      DATA(KK=8HALTITUDE,6,8H Y INC =,0,3HFT.)                           PT1 0280
      DATA(LL=8HCROSS SE,8HCTIONS O,0,8HCENT PRO,8HBABILITY,8H OF DETE,8PT1 0290
     1HCTION VO,4HLUME)                                                  PT1 0300
      DATA (MM=8HDIST. FR,8HOM TARGE,8HT AXIS F. ),8HROB. OF ,8HDETECT. ,PT1 0310
     18HX INC.= ,0,2HT.)                                                 PT1 0320
      DATA(II=8HTARGET D,8HIAMETER ,8HIN. FT. =,0)                       PT1 0330
C                                                                        PT1 0335
      X=0$ Y=0                                                           PT1 0340
      Z=0. $ W=0                                                         PT1 0350
      ENCODE(8,10,KK(4))NAINC                                            PT1 0360
   10 FORMAT(1X,I6,1X)                                                   PT1 0370
      ENCODE(8,20,LL(3))NPROB                                            PT1 0380
   20 FORMAT(2HF ,I2,4H PER)                                             PT1 0390
      ENCODE(8,30,MM(4))NPROB                                            PT1 0400
   30 FORMAT (4HOR ,,I2,2H P)                                            PT1 0410
      ENCODE (8,40,MM(8)) NAINC                                          PT1 0420
   40 FORMAT (I6,2H F)                                                   PT1 0430
      ENCODE(8,50,II(4))NTGDM                                            PT1 0440
   50 FORMAT(1X,I3,4X)                                                   PT1 0450
      CALL PREP(1,74,1.,.60,14.,10.)                                     PT1 0460
      CALL PREP(3,0,1,1,0,0,0,0)                                         PT1 0470
      CALL PREP(4,1,1,X,Y)                                               PT1 0480
      CALL PREP(5,0.,0.,1.,1.)                                           PT1 0490
      CALL PREP(8,4,5,KK)                                                PT1 0500
      CALL PREP(8,1,8,LL)                                                PT1 0510
      CALL PREP(8,3,9,MM)                                                PT1 0520
      CALL PREP (2,1,1.,5.6,5.,5.)                                       PT1 0530
      CALL PREP(3,0,2,6,0,0,0,0)                                         PT1 0540
      CALL PREP(4,15,15,X1,Z1)                                           PT1 0550
      CALL PREP(5,0.,0.,AXSL,AXSL)                                       PT1 0560
      CALL PREP(6,CSLX,CSLY,0,3,23HLOOKING TOWARD 0 OR 180)              PT1 0570
      CALL PREP(6,AXLX,AXLY,7,2,11HTARGET AXIS)                          PT1 0580
      CALL PREP(7,-0,-0,0)                                               PT1 0590
      CALL PREP(2,2,9.,5.6,5.,5.)                                        PT1 0600
      CALL PREP(3,0,2,6, , , , )                                         PT1 0610
```

```
      CALL PREP(4,15,15,X2,Z2)                                          PT1 0620
      CALL PREP(5,0.,0.,AXSL,AXSL)                                      PT1 0630
      CALL PREP(6,CSLX,CSLY,0,3,24HLOOKING TOWARD 45 OR 225)            PT1 0640
      CALL PREP(6,AXLX,AXLY,7,2,11HTARGET AXIS)                         PT1 0650
      CALL PREP(7,-0,-0,0)                                              PT1 0660
      CALL PREP(2,5,7.5,1.5,.5,8.)                                      PT1 0670
      CALL PREP(3,0,1,1,0,0,0)                                          PT1 0680
      CALL PREP(4,1,1,Z,W)                                              PT1 0690
      CALL PREP(5,0.,0.,.4,8.)                                          PT1 0700
      CALL PREP(8,4,4,II)                                               PT1 0710
      CALL PREP (2,3,1.,.6,5.,5.)                                       PT1 0720
      CALL PREP(3,0,2,6,0,0,0,0)                                        PT1 0730
      CALL PREP(4,15,15,X3,Z3)                                          PT1 0740
      CALL PREP(5,0.,0.,AXSL,AXSL)                                      PT1 0750
      CALL PREP(6,CSLX,CSLY,0,3,24HLOOKING TOWARD 90 OR 270)            PT1 0760
      CALL PREP(6,AXLX,AXLY,7,2,11HTARGET AXIS)                         PT1 0770
      CALL PREP(7,-0,-0,0)                                              PT1 0780
      CALL PREP (2,4, 9,.,6,5,.5.)                                      PT1 0790
      CALL PREP(3,0,2,6,0,0,0,0)                                        PT1 0800
      CALL PREP(4,15,15,X4,Z4)                                          PT1 0810
      CALL PREP(5,0.,0.,AXSL,AXSL)                                      PT1 0820
      CALL PREP(6,CSLX,CSLY, ,4,25HLOOKING TOWARD 135 OR 315)           PT1 0830
      CALL PREP(6,AXLX,AXLY,7,2,11HTARGET AXIS)                         PT1 0840
      CALL PREP(7,-0,-0,0)                                              PT1 0850
      END                                                               PT1 0860
```

APPENDIX C

Input and Output Examples from PODVI

This appendix contains a copy of the computer listing from a run of PODVI (Probability of Target Detection Volumes.) This program was run using data from Flight 74. The given data includes:

1. Atmospheric data from Flight 74. (No optical system used.)
2. Average solar zenith angle of 41.5°.
3. Pine tree background.
4. Target object is painted haze grey.
5. Target diameter is 100 feet.
6. Detection probability is 50%.

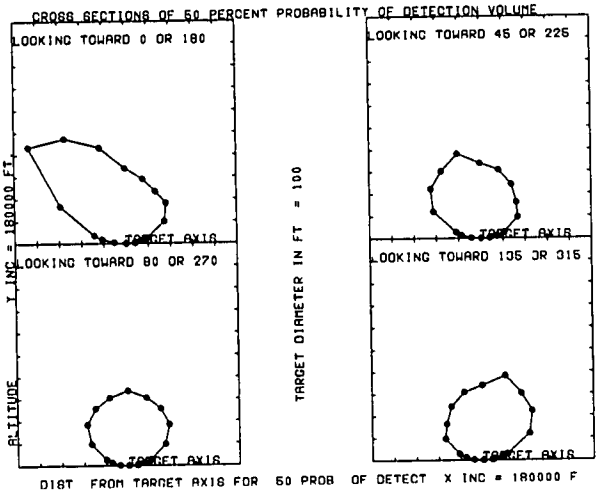


Figure C-1. Plot of data produced by this program.

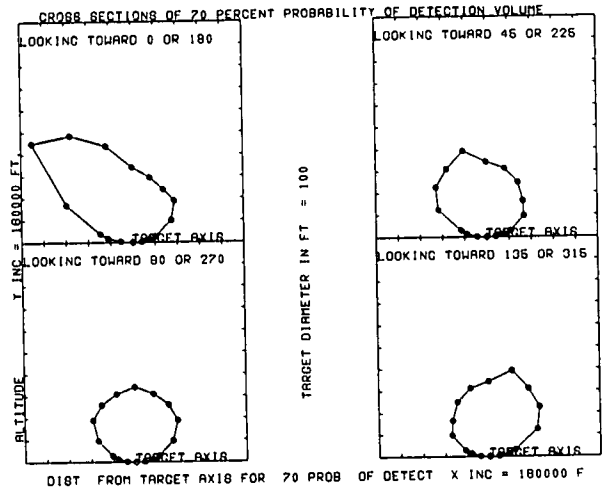


Figure C-2. Plot of data produced by this program, when probabilities of target = 70%.

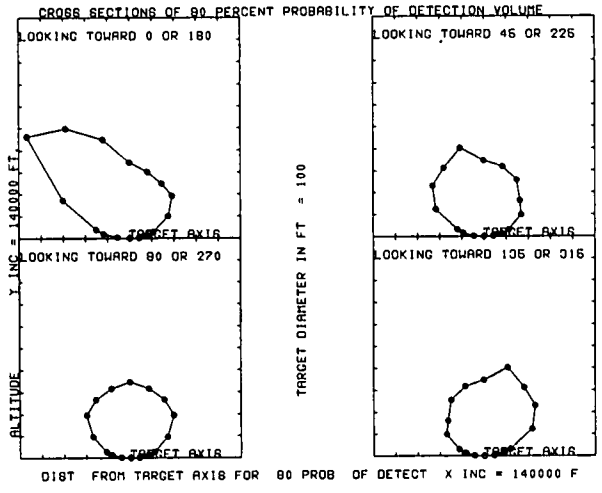


Figure C-3. Plot of data produced by this program, when probabilities of target = 90%.

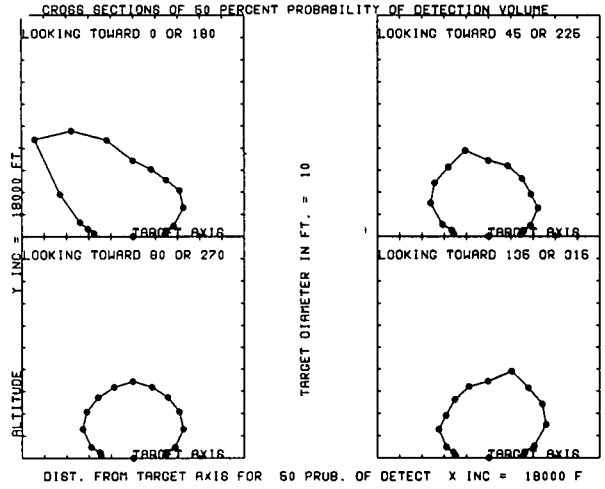


Figure C-4. Plot of data produced by this program, when target diameter = 10 feet and probabilities of target detection = 50%.

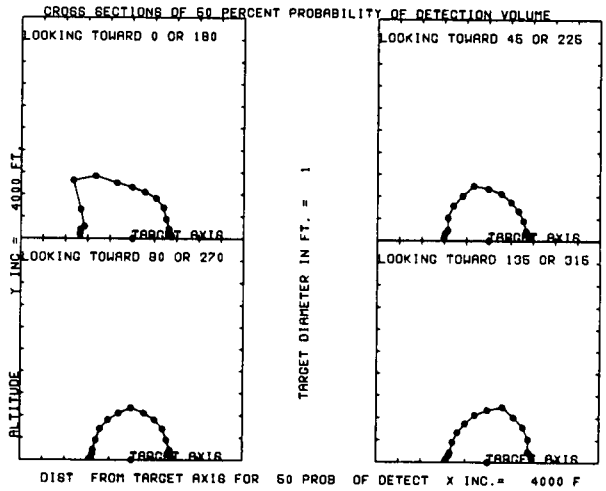


Figure C-5. Plot of data produced by this program, when target diameter = 1 foot and probabilities of target detection = 50%.

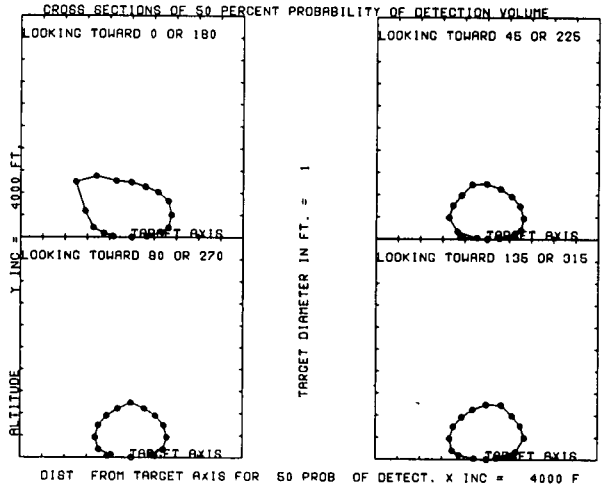


Figure C-6. Plot of data produced by this program, when background reflectance data is for clear water with infinite optical depth.

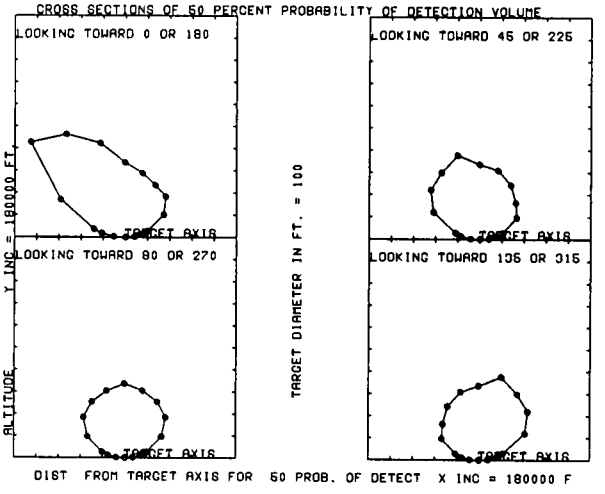


Figure C-7. Plot of data produced by this program, when simulated optical system was used in conjunction with an atmosphere.

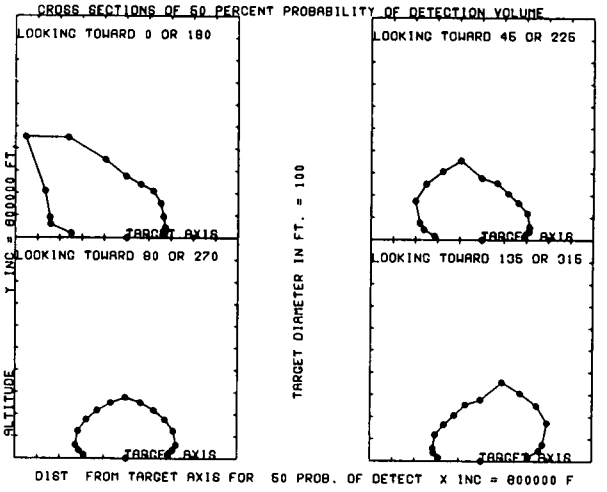


Figure C-8. Plot of data produced by this program, when no atmosphere and a simulated optical system was utilized.

PROGRAM PODV1

```
                                                                  JOB 1387  02/04/66     PAGE 1

      PROGRAM PODV1
C     ...PROGRAM PODV1...1NOV.65...BARKDOLL,...VISLAB...UCSD
C     ...PODV1= PROBABILITY OF DETECTION VOLUME PHASE 1
C     ...THIS PROGRAM PROVIDES INPUT DATA FOR THE
C     ...SOLUTION OF A PROBABILITY OF TARGET DETECTION VOLUME.
C     ...THE CALLED SEQUENCE OF PROGRAMS WILL PRINT THE
C     ...ALTITUDE AND DISTANCE FROM THE TARGET AXIS FOR
C     ...8 DOWNWARD LOOKING ZENITHS OF PATH OF SIGHT,
C     ...THETA=180,165,150,135,120,105,100,95 DEGREES AND
C     ...FOR 5 AZIMUTHS OF PATH OF SIGHT WITH RESPECT
C     ...TO THE SUN, PHI=0,45,90,135,180 DEGREES.
C     ...THE PROGRAM WILL ALSO PLOT THESE POINTS AS
C     ...4 HEMISPHERIC CROSS SECTIONS.
C
C     ...VARIABLE INPUTS,...
C     ...OPT=OPTION FOR ATMOSPHERIC AND OPTICAL SYSTEM
C     .....OPT=0 FOR VIEWING THROUGH ATMOSPHERE ONLY
C     .....OPT=-1 FOR OPTICS AND NO ATMOSPHERE
C     .....OPT=+1 FOR OPTICS AND AN ATMOSPHERE
C     ...FNUMB=FLIGHT NUMBER FOR ATMOSPHERIC DATA
C     ...OPTNU=OPTICAL SYSTEM INDEX NUMBER
C     ...DIAM=TARGET DIAMETER IN FT.,NOT TO EXCEED 100 FT.
C     ...OBJ=INDEX FOR DIRECTIONAL REFLECTANCE PROPERTIES
C     ...OF TARGET OBJECT
C     ...BAC=INDEX FOR DIRECTIONAL REFLECTANCE PROPERTIES
C     ...OF BACKGROUND
C     ...PROBK=CONSTANT FOR DEVIATION FROM 50 PERCENT
C     ...PROBABILITY,1. FOR 50,1.206 FOR 70, 1.50 FOR 90, AND
C     ...1.91 FOR 99 PERCENT PROBABILITY OF DETECTION
C     ...NPROB=INTEGER REPRESENTING PROBABILITY
C     ...SW1=SWITCH FOR OUTPUT PRINTING, 1 FOR CALCULATIONS
C     ...AND COORDINATES, 0 FOR COORDINATES ONLY
C     ...SW2=SWITCH FOR PLOTTING, 1 IF PLOT IS DESIRED
C     ...0 FOR NO PLOT
C     ...
C     ...CALLED PROGRAMS=TCA,
C
      OPT=0.
      FNUMB=74.
      DIAM=100.
      OBJ=1.
      BAC=1.
      PROBK=1.
      NPROB=50
      SW1=1.
      SW2=1.
      CALL DATA1
      CALL DATA2
      CALL DATA 3
      CALL TCAL(OPT,FNUMB,OPTNU,DIAM,OBJ,BAC,PROBK,NPROB,
     1SW1,SW2)
      CALL PREP(9)
      END
```

```
TARGET DETECTION FOR INFINITE VIEWING TIME

  PATH OF SIGHT THROUGH ATMOSPHERE ONLY

  PROGRAM DATA FROM FLIGHT NUMBER  74

  PROBABILITY OF DETECTION IS 50 PERCENT

  TARGET DIAMETER IN FT. = 100

  BACKGROUND FOR TARGET IS PINE TREES

  TARGET IS SPHERICAL AND PAINTED GRAY
```

AZIMUTH OF PATH OF SIGHT WITH RESPECT TO SUN IS 0 DEGREES

THETA=180.0	Z*D=	2000.0	3STAR=	134.00	TR=	.848	BBO=	197.80	CO=	4.95	TC*CO=	2.750	CT*P=	.00	I= 1	BBR=	301.78
THETA=180.0	Z*D=	4000.0	3STAR=	233.00	TR=	.719	BBO=	197.80	CO=	4.95	TC*CO=	1.875	CT*P=	.00	I= 2	BBR=	375.31
THETA=180.0	Z*D=	6000.0	3STAR=	291.00	TR=	.702	BBO=	197.80	CO=	4.95	TC*CO=	1.597	CT*P=	.00	I= 3	BBR=	429.79
THETA=180.0	Z*D=	8000.0	3STAR=	341.00	TR=	.694	BBO=	197.80	CO=	4.95	TC*CO=	1.420	CT*P=	.00	I= 4	BBR=	478.28
THETA=180.0	Z*D=	10000.0	3STAR=	388.00	TR=	.683	BBO=	197.80	CO=	4.95	TC*CO=	1.278	CT*P=	.00	I= 5	BBR=	523.18
THETA=180.0	Z*D=	20000.0	3STAR=	603.00	TR=	.646	BBO=	197.80	CO=	4.95	TC*CO=	.864	CT*P=	.00	I= 6	BBR=	730.71
THETA=180.0	Z*D=	40000.0	3STAR=	928.00	TR=	.603	BBO=	197.80	CO=	4.95	TC*CO=	.563	CT*P=	.00	I= 7	BBR=	1047.27
THETA=180.0	Z*D=	60000.0	3STAR=	1060.00	TR=	.587	BBO=	197.80	CO=	4.95	TC*CO=	.488	CT*P=	.01	I= 8	BBR=	1176.11
THETA=180.0	Z*D=	80000.0	3STAR=	1076.83	TR=	.580	BBO=	197.80	CO=	4.95	TC*CO=	.477	CT*P=	.01	I= 9	BBR=	1191.64
THETA=180.0	Z*D=	100000.0	3STAR=	1085.39	TR=	.577	BBO=	197.80	CO=	4.95	TC*CO=	.471	CT*P=	.02	I=10	BBR=	1199.55
THETA=180.0	Z*D=	200000.0	3STAR=	1094.06	TR=	.574	BBO=	197.80	CO=	4.95	TC*CO=	.465	CT*P=	.06	I=11	BBR=	1207.55
THETA=180.0	Z*D=	400000.0	3STAR=	1094.38	TR=	.574	BBO=	197.80	CO=	4.95	TC*CO=	.465	CT*P=	.20	I=12	BBR=	1207.84
THETA=180.0	Z*D=	600000.0	3STAR=	1094.38	TR=	.574	BBO=	197.80	CO=	4.95	TC*CO=	.465	CT*P=	.45	I=13	BBR=	1207.84
THETA=180.0	Z*D=	800000.0	3STAR=	1094.38	TR=	.574	BBO=	197.80	CO=	4.95	TC*CO=	.465	CT*P=	.79	I=14	BBR=	1207.84

CURVES INTERSECT AT AX= .46460 AY= 608609.64926

THETA=165.0	Z*D=	1931.8	3STAR=	127.15	TR=	.841	BBO=	143.15	CO=	8.75	TC*CO=	4.255	CT*P=	.00	I= 1	BBR=	267.48
THETA=165.0	Z*D=	3863.6	3STAR=	251.50	TR=	.711	BBO=	143.15	CO=	8.75	TC*CO=	2.521	CT*P=	.00	I= 2	BBR=	353.24
THETA=165.0	Z*D=	5795.4	3STAR=	296.91	TR=	.692	BBO=	143.15	CO=	8.75	TC*CO=	2.188	CT*P=	.00	I= 3	BBR=	395.91
THETA=165.0	Z*D=	7727.2	3STAR=	355.36	TR=	.684	BBO=	143.15	CO=	8.75	TC*CO=	1.890	CT*P=	.00	I= 4	BBR=	453.22
THETA=165.0	Z*D=	9659.0	3STAR=	395.25	TR=	.674	BBO=	143.15	CO=	8.75	TC*CO=	1.717	CT*P=	.00	I= 5	BBR=	491.73
THETA=165.0	Z*D=	19318.0	3STAR=	502.77	TR=	.635	BBO=	143.15	CO=	8.75	TC*CO=	1.341	CT*P=	.00	I= 6	BBR=	593.73
THETA=165.0	Z*D=	38636.1	3STAR=	645.23	TR=	.594	BBO=	143.15	CO=	8.75	TC*CO=	1.019	CT*P=	.01	I= 7	BBR=	730.30
THETA=165.0	Z*D=	57954.1	3STAR=	705.70	TR=	.577	BBO=	143.15	CO=	8.75	TC*CO=	.917	CT*P=	.01	I= 8	BBR=	788.35
THETA=165.0	Z*D=	77272.2	3STAR=	720.04	TR=	.570	BBO=	143.15	CO=	8.75	TC*CO=	.891	CT*P=	.01	I= 9	BBR=	801.65
THETA=165.0	Z*D=	96590.2	3STAR=	726.11	TR=	.566	BBO=	143.15	CO=	8.75	TC*CO=	.879	CT*P=	.02	I=10	BBR=	807.20
THETA=165.0	Z*D=	193180.5	3STAR=	732.52	TR=	.563	BBO=	143.15	CO=	8.75	TC*CO=	.867	CT*P=	.06	I=11	BBR=	813.06
THETA=165.0	Z*D=	386360.9	3STAR=	732.78	TR=	.562	BBO=	143.15	CO=	8.75	TC*CO=	.866	CT*P=	.22	I=12	BBR=	813.30
THETA=165.0	Z*D=	579541.4	3STAR=	732.78	TR=	.562	BBO=	143.15	CO=	8.75	TC*CO=	.866	CT*P=	.48	I=13	BBR=	813.30
THETA=165.0	Z*D=	772721.9	3STAR=	732.78	TR=	.562	BBO=	143.15	CO=	8.75	TC*CO=	.866	CT*P=	.85	I=14	BBR=	813.30
THETA=165.0	Z*D=	965902.4	3STAR=	732.78	TR=	.562	BBO=	143.15	CO=	8.75	TC*CO=	.866	CT*P=	1.35	I=15	BBR=	813.30

CURVES INTERSECT AT AX= .86637 AY= 777662.12134

THETA=150.0	Z*D=	1732.1	3STAR=	137.58	TR=	.846	BBO=	127.12	CO=	18.16	TC*CO=	7.966	CT*P=	.00	I= 1	BBR=	245.11
THETA=150.0	Z*D=	3464.1	3STAR=	261.02	TR=	.697	BBO=	127.12	CO=	18.16	TC*CO=	4.601	CT*P=	.00	I= 2	BBR=	349.60
THETA=150.0	Z*D=	5196.2	3STAR=	323.10	TR=	.666	BBO=	127.12	CO=	18.16	TC*CO=	3.768	CT*P=	.00	I= 3	BBR=	407.70
THETA=150.0	Z*D=	6928.2	3STAR=	374.63	TR=	.658	BBO=	127.12	CO=	18.16	TC*CO=	3.314	CT*P=	.00	I= 4	BBR=	458.28
THETA=150.0	Z*D=	8660.3	3STAR=	436.17	TR=	.651	BBO=	127.12	CO=	18.16	TC*CO=	2.895	CT*P=	.00	I= 5	BBR=	518.90
THETA=150.0	Z*D=	17320.6	3STAR=	565.42	TR=	.609	BBO=	127.12	CO=	18.16	TC*CO=	2.187	CT*P=	.00	I= 6	BBR=	642.83
THETA=150.0	Z*D=	34641.2	3STAR=	769.99	TR=	.566	BBO=	127.12	CO=	18.16	TC*CO=	1.551	CT*P=	.01	I= 7	BBR=	841.90
THETA=150.0	Z*D=	51961.8	3STAR=	873.28	TR=	.546	BBO=	127.12	CO=	18.16	TC*CO=	1.336	CT*P=	.01	I= 8	BBR=	942.64
THETA=150.0	Z*D=	69282.4	3STAR=	906.48	TR=	.537	BBO=	127.12	CO=	18.16	TC*CO=	1.271	CT*P=	.01	I= 9	BBR=	974.71
THETA=150.0	Z*D=	86603.0	3STAR=	915.45	TR=	.532	BBO=	127.12	CO=	18.16	TC*CO=	1.249	CT*P=	.02	I=10	BBR=	983.10
THETA=150.0	Z*D=	173206.0	3STAR=	926.19	TR=	.527	BBO=	127.12	CO=	18.16	TC*CO=	1.224	CT*P=	.06	I=11	BBR=	993.14
THETA=150.0	Z*D=	346411.9	3STAR=	926.82	TR=	.526	BBO=	127.12	CO=	18.16	TC*CO=	1.223	CT*P=	.20	I=12	BBR=	993.73
THETA=150.0	Z*D=	519617.9	3STAR=	926.82	TR=	.526	BBO=	127.12	CO=	18.16	TC*CO=	1.223	CT*P=	.45	I=13	BBR=	993.73
THETA=150.0	Z*D=	692823.8	3STAR=	926.82	TR=	.526	BBO=	127.12	CO=	18.16	TC*CO=	1.223	CT*P=	.80	I=14	BBR=	993.73
THETA=150.0	Z*D=	866029.8	3STAR=	926.82	TR=	.526	BBO=	127.12	CO=	18.16	TC*CO=	1.223	CT*P=	1.26	I=15	BBR=	993.73

CURVES INTERSECT AT AX= 1.22262 AY= 852920.47382

THETA=135.0	Z*D=	1414.2	3STAR=	119.48	TR=	.841	BBO=	127.12	CO=	27.50	TC*CO=	12.987	CT*P=	.00	I= 1	BBR=	226.36
THETA=135.0	Z*D=	2828.5	3STAR=	223.48	TR=	.673	BBO=	127.12	CO=	27.50	TC*CO=	7.615	CT*P=	.00	I= 2	BBR=	309.03
THETA=135.0	Z*D=	4242.7	3STAR=	313.49	TR=	.618	BBO=	127.12	CO=	27.50	TC*CO=	5.512	CT*P=	.00	I= 3	BBR=	382.07
THETA=135.0	Z*D=	5656.9	3STAR=	366.93	TR=	.605	BBO=	127.12	CO=	27.50	TC*CO=	4.764	CT*P=	.00	I= 4	BBR=	443.81
THETA=135.0	Z*D=	7071.1	3STAR=	438.41	TR=	.598	BBO=	127.12	CO=	27.50	TC*CO=	4.067	CT*P=	.00	I= 5	BBR=	514.49
THETA=135.0	Z*D=	14142.3	3STAR=	598.85	TR=	.557	BBO=	127.12	CO=	27.50	TC*CO=	2.910	CT*P=	.00	I= 6	BBR=	669.70
THETA=135.0	Z*D=	28284.5	3STAR=	762.53	TR=	.510	BBO=	127.12	CO=	27.50	TC*CO=	2.156	CT*P=	.01	I= 7	BBR=	827.40
THETA=135.0	Z*D=	42426.8	3STAR=	858.44	TR=	.486	BBO=	127.12	CO=	27.50	TC*CO=	1.847	CT*P=	.01	I= 8	BBR=	920.24
THETA=135.0	Z*D=	56569.0	3STAR=	908.08	TR=	.473	BBO=	127.12	CO=	27.50	TC*CO=	1.708	CT*P=	.01	I= 9	BBR=	968.22
THETA=135.0	Z*D=	70711.3	3STAR=	924.96	TR=	.466	BBO=	127.12	CO=	27.50	TC*CO=	1.656	CT*P=	.02	I=10	BBR=	984.22
THETA=135.0	Z*D=	141422.5	3STAR=	941.49	TR=	.457	BBO=	127.12	CO=	27.50	TC*CO=	1.597	CT*P=	.06	I=11	BBR=	999.53
THETA=135.0	Z*D=	282845.0	3STAR=	943.18	TR=	.456	BBO=	127.12	CO=	27.50	TC*CO=	1.591	CT*P=	.20	I=12	BBR=	1001.11
THETA=135.0	Z*D=	424267.5	3STAR=	943.20	TR=	.456	BBO=	127.12	CO=	27.50	TC*CO=	1.591	CT*P=	.45	I=13	BBR=	1001.12
THETA=135.0	Z*D=	565690.0	3STAR=	943.20	TR=	.456	BBO=	127.12	CO=	27.50	TC*CO=	1.591	CT*P=	.79	I=14	BBR=	1001.12
THETA=135.0	Z*D=	707112.6	3STAR=	943.20	TR=	.456	BBO=	127.12	CO=	27.50	TC*CO=	1.591	CT*P=	1.25	I=15	BBR=	1001.12
THETA=135.0	Z*D=	1060668.8	3STAR=	943.20	TR=	.456	BBO=	127.12	CO=	27.50	TC*CO=	1.591	CT*P=	2.80	I=16	BBR=	1001.12

CURVES INTERSECT AT AX= 1.59129 AY= 784021.24614

THETA=120.0	Z*D=	1000.0	3STAR=	123.00	TR=	.870	BBO=	155.03	CO=	11.45	TC*CO=	5.989	CT*P=	.00	I= 1	BBR=	287.82
THETA=120.0	Z*D=	2000.0	3STAR=	214.00	TR=	.658	BBO=	155.03	CO=	11.45	TC*CO=	3.699	CT*P=	.00	I= 2	BBR=	316.09
THETA=120.0	Z*D=	3000.0	3STAR=	298.00	TR=	.559	BBO=	155.03	CO=	11.45	TC*CO=	2.580	CT*P=	.00	I= 3	BBR=	384.68
THETA=120.0	Z*D=	4000.1	3STAR=	371.00	TR=	.512	BBO=	155.03	CO=	11.45	TC*CO=	2.018	CT*P=	.00	I= 4	BBR=	450.37
THETA=120.0	Z*D=	5000.1	3STAR=	414.00	TR=	.495	BBO=	155.03	CO=	11.45	TC*CO=	1.790	CT*P=	.00	I= 5	BBR=	490.69
THETA=120.0	Z*D=	10000.1	3STAR=	749.00	TR=	.463	BBO=	155.03	CO=	11.45	TC*CO=	1.002	CT*P=	.00	I= 6	BBR=	880.83
THETA=120.0	Z*D=	20000.3	3STAR=	896.00	TR=	.411	BBO=	155.03	CO=	11.45	TC*CO=	.760	CT*P=	.00	I= 7	BBR=	959.70
THETA=120.0	Z*D=	30000.4	3STAR=	1020.00	TR=	.382	BBO=	155.03	CO=	11.45	TC*CO=	.628	CT*P=	.01	I= 8	BBR=	1079.22
THETA=120.0	Z*D=	40000.5	3STAR=	1110.00	TR=	.364	BBO=	155.03	CO=	11.45	TC*CO=	.553	CT*P=	.01	I= 9	BBR=	1166.37
THETA=120.0	Z*D=	50000.7	3STAR=	1150.00	TR=	.352	BBO=	155.03	CO=	11.45	TC*CO=	.518	CT*P=	.02	I=10	BBR=	1204.58

```
THETA=120.0 Z*D= 100001.3 BSTAR= 1200.74 TR= .333 BBO= 155.03 CO= 11.45 TC*CO= .472 CT*P= .06 I=11 BBR=1282.37
THETA=120.0 Z*D= 200002.6 BSTAR= 1207.73 TR= .329 BBO= 155.03 CO= 11.45 TC*CO= .464 CT*P= .20 I=12 BBR=1288.76
THETA=120.0 Z*D= 300003.9 BSTAR= 1207.98 TR= .329 BBO= 155.03 CO= 11.45 TC*CO= .464 CT*P= .45 I=13 BBR=1288.99
THETA=120.0 Z*D= 400005.2 BSTAR= 1207.99 TR= .329 BBO= 155.03 CO= 11.45 TC*CO= .464 CT*P= .79 I=14 BBR=1289.00

        CURVES INTERSECT AT AX=          .46401  AY=   304136.33726

THETA=105.0 Z*D=    517.7 BSTAR=  115.44 TR= .897 BBO=  225.13 CO=  7.81 TC*CO= 4.972 CT*P= .00 I= 1 BBR= 317.44
THETA=105.0 Z*D=   1035.3 BSTAR=  231.40 TR= .763 BBO=  225.13 CO=  7.81 TC*CO= 3.330 CT*P= .00 I= 2 BBR= 403.28
THETA=105.0 Z*D=   1553.0 BSTAR=  354.60 TR= .598 BBO=  225.13 CO=  7.81 TC*CO= 2.151 CT*P= .00 I= 3 BBR= 489.33
THETA=105.0 Z*D=   2070.6 BSTAR=  476.18 TR= .446 BBO=  225.13 CO=  7.81 TC*CO= 1.361 CT*P= .00 I= 4 BBR= 576.61
THETA=105.0 Z*D=   2588.3 BSTAR=  587.48 TR= .362 BBO=  225.13 CO=  7.81 TC*CO=  .952 CT*P= .00 I= 5 BBR= 669.03
THETA=105.0 Z*D=   5176.5 BSTAR=  990.12 TR= .256 BBO=  225.13 CO=  7.81 TC*CO=  .430 CT*P= .00 I= 6 BBR=1047.76
THETA=105.0 Z*D=  10353.0 BSTAR= 1389.18 TR= .224 BBO=  225.13 CO=  7.81 TC*CO=  .274 CT*P= .00 I= 7 BBR=1439.66
THETA=105.0 Z*D=  15529.5 BSTAR= 1525.89 TR= .197 BBO=  225.13 CO=  7.81 TC*CO=  .221 CT*P= .01 I= 8 BBR=1570.21
THETA=105.0 Z*D=  20706.1 BSTAR= 1678.36 TR= .177 BBO=  225.13 CO=  7.81 TC*CO=  .182 CT*P= .01 I= 9 BBR=1718.30
THETA=105.0 Z*D=  25882.6 BSTAR= 1807.65 TR= .164 BBO=  225.13 CO=  7.81 TC*CO=  .156 CT*P= .02 I=10 BBR=1844.56
THETA=105.0 Z*D=  51765.1 BSTAR= 2128.83 TR= .132 BBO=  225.13 CO=  7.81 TC*CO=  .107 CT*P= .06 I=11 BBR=2158.58
THETA=105.0 Z*D= 103530.3 BSTAR= 2190.96 TR= .119 BBO=  225.13 CO=  7.81 TC*CO=  .095 CT*P= .20 I=12 BBR=2217.81

        CURVES INTERSECT AT AX=          .10343  AY=    67941.16234

THETA=100.0 Z*D=    347.2 BSTAR=  138.20 TR= .910 BBO=  275.02 CO=  7.25 TC*CO= 4.672 CT*P= .00 I= 1 BBR= 388.94
THETA=100.0 Z*D=    694.5 BSTAR=  276.41 TR= .826 BBO=  275.02 CO=  7.25 TC*CO= 3.272 CT*P= .00 I= 2 BBR= 503.68
THETA=100.0 Z*D=   1041.7 BSTAR=  411.73 TR= .674 BBO=  275.02 CO=  7.25 TC*CO= 2.250 CT*P= .00 I= 3 BBR= 597.03
THETA=100.0 Z*D=   1389.0 BSTAR=  525.97 TR= .534 BBO=  275.02 CO=  7.25 TC*CO= 1.581 CT*P= .00 I= 4 BBR= 672.70
THETA=100.0 Z*D=   1736.2 BSTAR=  640.22 TR= .437 BBO=  275.02 CO=  7.25 TC*CO= 1.147 CT*P= .00 I= 5 BBR= 760.53
THETA=100.0 Z*D=   3472.4 BSTAR= 1098.16 TR= .167 BBO=  275.02 CO=  7.25 TC*CO=  .291 CT*P= .00 I= 6 BBR=1144.02
THETA=100.0 Z*D=   6944.9 BSTAR= 1465.39 TR= .126 BBO=  275.02 CO=  7.25 TC*CO=  .167 CT*P= .00 I= 7 BBR=1500.21
THETA=100.0 Z*D=  10417.3 BSTAR= 1624.19 TR= .109 BBO=  275.02 CO=  7.25 TC*CO=  .132 CT*P= .01 I= 8 BBR=1654.23
THETA=100.0 Z*D=  13889.8 BSTAR= 1742.25 TR= .096 BBO=  275.02 CO=  7.25 TC*CO=  .108 CT*P= .01 I= 9 BBR=1768.56
THETA=100.0 Z*D=  17362.2 BSTAR= 1874.49 TR= .087 BBO=  275.02 CO=  7.25 TC*CO=  .091 CT*P= .02 I=10 BBR=1898.37
THETA=100.0 Z*D=  34724.4 BSTAR= 2350.31 TR= .061 BBO=  275.02 CO=  7.25 TC*CO=  .052 CT*P= .06 I=11 BBR=2367.18

        CURVES INTERSECT AT AX=          .05462  AY=    33425.39875

THETA= 95.0 Z*D=    174.2 BSTAR=  130.64 TR= .917 BBO=  510.25 CO=  3.45 TC*CO= 2.695 CT*P= .00 I= 1 BBR= 598.71
THETA= 95.0 Z*D=    348.4 BSTAR=  261.29 TR= .829 BBO=  510.25 CO=  3.45 TC*CO= 2.131 CT*P= .00 I= 2 BBR= 684.43
THETA= 95.0 Z*D=    522.6 BSTAR=  391.93 TR= .736 BBO=  510.25 CO=  3.45 TC*CO= 1.686 CT*P= .00 I= 3 BBR= 767.34
THETA= 95.0 Z*D=    696.8 BSTAR=  522.58 TR= .685 BBO=  510.25 CO=  3.45 TC*CO= 1.381 CT*P= .00 I= 4 BBR= 871.85
THETA= 95.0 Z*D=    871.0 BSTAR=  653.22 TR= .574 BBO=  510.25 CO=  3.45 TC*CO= 1.068 CT*P= .00 I= 5 BBR= 946.28
THETA= 95.0 Z*D=   1741.9 BSTAR= 1039.35 TR= .195 BBO=  510.25 CO=  3.45 TC*CO=  .301 CT*P= .00 I= 6 BBR=1138.63
THETA= 95.0 Z*D=   3483.8 BSTAR= 1491.93 TR= .029 BBO=  510.25 CO=  3.45 TC*CO=  .034 CT*P= .00 I= 7 BBR=1506.97
THETA= 95.0 Z*D=   5225.8 BSTAR= 1710.32 TR= .019 BBO=  510.25 CO=  3.45 TC*CO=  .020 CT*P= .01 I= 8 BBR=1720.12
THETA= 95.0 Z*D=   6967.7 BSTAR= 1886.44 TR= .018 BBO=  510.25 CO=  3.45 TC*CO=  .017 CT*P= .01 I= 9 BBR=1895.56
THETA= 95.0 Z*D=   8709.6 BSTAR= 2083.96 TR= .016 BBO=  510.25 CO=  3.45 TC*CO=  .014 CT*P= .02 I=10 BBR=2092.24

        CURVES INTERSECT AT AX=          .01484  AY=     8057.16557


        AZIMUTH OF PATH OF SIGHT WITH RESPECT TO SUN IS   0 DEGREES

 ZENITH OF PATH OF SIGHT = 180  DISTANCE TO TARGET AXIS =       0  ALTITUDE =  608610  CONTRAST IS POSITIVE

 ZENITH OF PATH OF SIGHT = 165  DISTANCE TO TARGET AXIS =  208430  ALTITUDE =  777662  CONTRAST IS POSITIVE

 ZENITH OF PATH OF SIGHT = 150  DISTANCE TO TARGET AXIS =  492397  ALTITUDE =  852920  CONTRAST IS POSITIVE

 ZENITH OF PATH OF SIGHT = 135  DISTANCE TO TARGET AXIS =  783971  ALTITUDE =  784021  CONTRAST IS POSITIVE

 ZENITH OF PATH OF SIGHT = 120  DISTANCE TO TARGET AXIS =  526742  ALTITUDE =  304136  CONTRAST IS POSITIVE

 ZENITH OF PATH OF SIGHT = 105  DISTANCE TO TARGET AXIS =  253529  ALTITUDE =   67941  CONTRAST IS POSITIVE

 ZENITH OF PATH OF SIGHT = 100  DISTANCE TO TARGET AXIS =  189568  ALTITUDE =   33425  CONTRAST IS POSITIVE

 ZENITH OF PATH OF SIGHT =  95  DISTANCE TO TARGET AXIS =   92133  ALTITUDE =    8057  CONTRAST IS POSITIVE
```

AZIMUTH OF PATH OF SIGHT WITH RESPECT TO SUN IS 45 DEGREES

THETA=180.0	Z*D=	2000.0	BSTAR=	134.00	TR=	.847	BBO=	197.80	CO=	4.95	TC*CO=	2.747	CT*P=	.00	I= 1 BBR= 301.46
THETA=180.0	Z*D=	4000.0	BSTAR=	233.00	TR=	.718	BBO=	197.80	CO=	4.95	TC*CO=	1.873	CT*P=	.00	I= 2 BBR= 375.04
THETA=180.0	Z*D=	6000.0	BSTAR=	291.00	TR=	.700	BBO=	197.80	CO=	4.95	TC*CO=	1.595	CT*P=	.00	I= 3 BBR= 429.53
THETA=180.0	Z*D=	8000.0	BSTAR=	341.00	TR=	.693	BBO=	197.80	CO=	4.95	TC*CO=	1.418	CT*P=	.00	I= 4 BBR= 478.02
THETA=180.0	Z*D=	10000.0	BSTAR=	388.00	TR=	.682	BBO=	197.80	CO=	4.95	TC*CO=	1.276	CT*P=	.00	I= 5 BBR= 522.92
THETA=180.0	Z*D=	20000.0	BSTAR=	603.00	TR=	.644	BBO=	197.80	CO=	4.95	TC*CO=	.863	CT*P=	.00	I= 6 BBR= 730.47
THETA=180.0	Z*D=	40000.0	BSTAR=	928.00	TR=	.603	BBO=	197.80	CO=	4.95	TC*CO=	.563	CT*P=	.00	I= 7 BBR=1047.27
THETA=180.0	Z*D=	60000.0	BSTAR=	1060.00	TR=	.587	BBO=	197.80	CO=	4.95	TC*CO=	.488	CT*P=	.01	I= 8 BBR=1176.11
THETA=180.0	Z*D=	80000.0	BSTAR=	1076.83	TR=	.580	BBO=	197.80	CO=	4.95	TC*CO=	.477	CT*P=	.01	I= 9 BBR=1191.64
THETA=180.0	Z*D=	100000.0	BSTAR=	1085.39	TR=	.577	BBO=	197.80	CO=	4.95	TC*CO=	.471	CT*P=	.02	I=10 BBR=1199.55
THETA=180.0	Z*D=	200000.0	BSTAR=	1094.06	TR=	.574	BBO=	197.80	CO=	4.95	TC*CO=	.465	CT*P=	.06	I=11 BBR=1207.55
THETA=180.0	Z*D=	400000.0	BSTAR=	1094.38	TR=	.574	BBO=	197.80	CO=	4.95	TC*CO=	.465	CT*P=	.20	I=12 BBR=1207.84
THETA=180.0	Z*D=	600000.0	BSTAR=	1094.38	TR=	.574	BBO=	197.80	CO=	4.95	TC*CO=	.465	CT*P=	.45	I=13 BBR=1207.84
THETA=180.0	Z*D=	800000.0	BSTAR=	1094.38	TR=	.574	BBO=	197.80	CO=	4.95	TC*CO=	.465	CT*P=	.79	I=14 BBR=1207.84

CURVES INTERSECT AT AX= .46460 AY= 608609.64926

THETA=165.0	Z*D=	1931.8	BSTAR=	154.04	TR=	.841	BBO=	131.87	CO=	9.09	TC*CO=	3.804	CT*P=	.00	I= 1 BBR= 264.87
THETA=165.0	Z*D=	3863.6	BSTAR=	260.59	TR=	.711	BBO=	131.87	CO=	9.09	TC*CO=	2.404	CT*P=	.00	I= 2 BBR= 384.31
THETA=165.0	Z*D=	5795.4	BSTAR=	318.89	TR=	.692	BBO=	131.87	CO=	9.09	TC*CO=	2.022	CT*P=	.00	I= 3 BBR= 470.08
THETA=165.0	Z*D=	7727.2	BSTAR=	365.45	TR=	.684	BBO=	131.87	CO=	9.09	TC*CO=	1.799	CT*P=	.00	I= 4 BBR= 485.60
THETA=165.0	Z*D=	9659.0	BSTAR=	411.54	TR=	.674	BBO=	131.87	CO=	9.09	TC*CO=	1.614	CT*P=	.00	I= 5 BBR= 500.42
THETA=165.0	Z*D=	19318.0	BSTAR=	574.45	TR=	.635	BBO=	131.87	CO=	9.09	TC*CO=	1.157	CT*P=	.00	I= 6 BBR= 658.24
THETA=165.0	Z*D=	38636.1	BSTAR=	827.22	TR=	.594	BBO=	131.87	CO=	9.09	TC*CO=	.787	CT*P=	.00	I= 7 BBR= 905.59
THETA=165.0	Z*D=	57954.1	BSTAR=	933.23	TR=	.577	BBO=	131.87	CO=	9.09	TC*CO=	.686	CT*P=	.01	I= 8 BBR=1009.35
THETA=165.0	Z*D=	77272.2	BSTAR=	954.31	TR=	.570	BBO=	131.87	CO=	9.09	TC*CO=	.664	CT*P=	.01	I= 9 BBR=1029.48
THETA=165.0	Z*D=	96590.2	BSTAR=	962.35	TR=	.566	BBO=	131.87	CO=	9.09	TC*CO=	.655	CT*P=	.02	I=10 BBR=1037.09
THETA=165.0	Z*D=	193180.5	BSTAR=	970.84	TR=	.563	BBO=	131.87	CO=	9.09	TC*CO=	.645	CT*P=	.06	I=11 BBR=1045.04
THETA=165.0	Z*D=	386360.9	BSTAR=	971.20	TR=	.562	BBO=	131.87	CO=	9.09	TC*CO=	.645	CT*P=	.20	I=12 BBR=1045.37
THETA=165.0	Z*D=	579541.4	BSTAR=	971.20	TR=	.562	BBO=	131.87	CO=	9.09	TC*CO=	.645	CT*P=	.45	I=13 BBR=1045.37
THETA=165.0	Z*D=	772721.9	BSTAR=	971.20	TR=	.562	BBO=	131.87	CO=	9.09	TC*CO=	.645	CT*P=	.79	I=14 BBR=1045.37

CURVES INTERSECT AT AX= .64496 AY= 689029.00374

THETA=150.0	Z*D=	1732.1	BSTAR=	161.56	TR=	.846	BBO=	119.99	CO=	8.41	TC*CO=	3.243	CT*P=	.00	I= 1 BBR= 263.06
THETA=150.0	Z*D=	3464.1	BSTAR=	277.99	TR=	.697	BBO=	119.99	CO=	8.41	TC*CO=	1.944	CT*P=	.00	I= 2 BBR= 361.60
THETA=150.0	Z*D=	5196.2	BSTAR=	339.12	TR=	.666	BBO=	119.99	CO=	8.41	TC*CO=	1.602	CT*P=	.00	I= 3 BBR= 418.97
THETA=150.0	Z*D=	6928.2	BSTAR=	389.99	TR=	.658	BBO=	119.99	CO=	8.41	TC*CO=	1.479	CT*P=	.00	I= 4 BBR= 448.88
THETA=150.0	Z*D=	8660.3	BSTAR=	436.81	TR=	.651	BBO=	119.99	CO=	8.41	TC*CO=	1.275	CT*P=	.00	I= 5 BBR= 514.90
THETA=150.0	Z*D=	17320.6	BSTAR=	581.38	TR=	.609	BBO=	119.99	CO=	8.41	TC*CO=	.939	CT*P=	.00	I= 6 BBR= 654.46
THETA=150.0	Z*D=	34641.2	BSTAR=	815.63	TR=	.566	BBO=	119.99	CO=	8.41	TC*CO=	.646	CT*P=	.00	I= 7 BBR= 883.51
THETA=150.0	Z*D=	51961.8	BSTAR=	932.06	TR=	.546	BBO=	119.99	CO=	8.41	TC*CO=	.552	CT*P=	.01	I= 8 BBR= 987.94
THETA=150.0	Z*D=	69282.4	BSTAR=	968.99	TR=	.537	BBO=	119.99	CO=	8.41	TC*CO=	.524	CT*P=	.01	I= 9 BBR=1033.40
THETA=150.0	Z*D=	86603.0	BSTAR=	978.58	TR=	.532	BBO=	119.99	CO=	8.41	TC*CO=	.515	CT*P=	.02	I=10 BBR=1042.44
THETA=150.0	Z*D=	173206.0	BSTAR=	990.07	TR=	.527	BBO=	119.99	CO=	8.41	TC*CO=	.504	CT*P=	.06	I=11 BBR=1053.26
THETA=150.0	Z*D=	346411.9	BSTAR=	990.74	TR=	.526	BBO=	119.99	CO=	8.41	TC*CO=	.504	CT*P=	.20	I=12 BBR=1053.89
THETA=150.0	Z*D=	519617.9	BSTAR=	990.74	TR=	.526	BBO=	119.99	CO=	8.41	TC*CO=	.504	CT*P=	.45	I=13 BBR=1053.90
THETA=150.0	Z*D=	692823.8	BSTAR=	990.74	TR=	.526	BBO=	119.99	CO=	8.41	TC*CO=	.504	CT*P=	.79	I=14 BBR=1053.90

CURVES INTERSECT AT AX= .50373 AY= 546752.86415

THETA=135.0	Z*D=	1414.2	BSTAR=	143.97	TR=	.841	BBO=	115.24	CO=	8.48	TC*CO=	3.413	CT*P=	.00	I= 1 BBR= 240.86
THETA=135.0	Z*D=	2828.5	BSTAR=	249.99	TR=	.673	BBO=	115.24	CO=	8.48	TC*CO=	2.009	CT*P=	.00	I= 2 BBR= 327.55
THETA=135.0	Z*D=	4242.7	BSTAR=	329.41	TR=	.618	BBO=	115.24	CO=	8.48	TC*CO=	1.509	CT*P=	.00	I= 3 BBR= 400.64
THETA=135.0	Z*D=	5656.9	BSTAR=	391.93	TR=	.605	BBO=	115.24	CO=	8.48	TC*CO=	1.281	CT*P=	.00	I= 4 BBR= 461.63
THETA=135.0	Z*D=	7071.1	BSTAR=	444.27	TR=	.598	BBO=	115.24	CO=	8.48	TC*CO=	1.140	CT*P=	.00	I= 5 BBR= 513.24
THETA=135.0	Z*D=	14142.3	BSTAR=	594.48	TR=	.557	BBO=	115.24	CO=	8.48	TC*CO=	.827	CT*P=	.00	I= 6 BBR= 658.71
THETA=135.0	Z*D=	28284.5	BSTAR=	803.07	TR=	.510	BBO=	115.24	CO=	8.48	TC*CO=	.599	CT*P=	.01	I= 7 BBR= 861.87
THETA=135.0	Z*D=	42426.8	BSTAR=	925.35	TR=	.486	BBO=	115.24	CO=	8.48	TC*CO=	.484	CT*P=	.01	I= 8 BBR= 981.38
THETA=135.0	Z*D=	56569.0	BSTAR=	988.68	TR=	.473	BBO=	115.24	CO=	8.48	TC*CO=	.443	CT*P=	.01	I= 9 BBR=1043.20
THETA=135.0	Z*D=	70711.3	BSTAR=	1008.68	TR=	.466	BBO=	115.24	CO=	8.48	TC*CO=	.429	CT*P=	.02	I=10 BBR=1062.40
THETA=135.0	Z*D=	141422.5	BSTAR=	1026.71	TR=	.457	BBO=	115.24	CO=	8.48	TC*CO=	.414	CT*P=	.06	I=11 BBR=1079.33
THETA=135.0	Z*D=	282845.0	BSTAR=	1028.55	TR=	.456	BBO=	115.24	CO=	8.48	TC*CO=	.412	CT*P=	.20	I=12 BBR=1081.06
THETA=135.0	Z*D=	424267.5	BSTAR=	1028.57	TR=	.456	BBO=	115.24	CO=	8.48	TC*CO=	.412	CT*P=	.45	I=13 BBR=1081.08

CURVES INTERSECT AT AX= .41209 AY= 402572.37090

THETA=120.0	Z*D=	1000.0	BSTAR=	128.00	TR=	.870	BBO=	124.74	CO=	7.90	TC*CO=	3.626	CT*P=	.00	I= 1 BBR= 236.48
THETA=120.0	Z*D=	2000.0	BSTAR=	244.00	TR=	.658	BBO=	124.74	CO=	7.90	TC*CO=	1.991	CT*P=	.00	I= 2 BBR= 326.14
THETA=120.0	Z*D=	3000.0	BSTAR=	331.00	TR=	.559	BBO=	124.74	CO=	7.90	TC*CO=	1.376	CT*P=	.00	I= 3 BBR= 400.74
THETA=120.0	Z*D=	4000.1	BSTAR=	391.00	TR=	.512	BBO=	124.74	CO=	7.90	TC*CO=	1.110	CT*P=	.00	I= 4 BBR= 454.86
THETA=120.0	Z*D=	5000.1	BSTAR=	444.00	TR=	.495	BBO=	124.74	CO=	7.90	TC*CO=	.964	CT*P=	.00	I= 5 BBR= 505.70
THETA=120.0	Z*D=	10000.1	BSTAR=	678.00	TR=	.463	BBO=	124.74	CO=	7.90	TC*CO=	.621	CT*P=	.00	I= 6 BBR= 735.79
THETA=120.0	Z*D=	20000.3	BSTAR=	856.00	TR=	.411	BBO=	124.74	CO=	7.90	TC*CO=	.447	CT*P=	.00	I= 7 BBR= 907.85
THETA=120.0	Z*D=	30000.4	BSTAR=	1020.00	TR=	.382	BBO=	124.74	CO=	7.90	TC*CO=	.353	CT*P=	.01	I= 8 BBR=1067.68
THETA=120.0	Z*D=	40000.5	BSTAR=	1130.00	TR=	.364	BBO=	124.74	CO=	7.90	TC*CO=	.305	CT*P=	.01	I= 9 BBR=1175.36
THETA=120.0	Z*D=	50000.7	BSTAR=	1190.00	TR=	.352	BBO=	124.74	CO=	7.90	TC*CO=	.281	CT*P=	.02	I=10 BBR=1233.87
THETA=120.0	Z*D=	100001.3	BSTAR=	1251.62	TR=	.333	BBO=	124.74	CO=	7.90	TC*CO=	.254	CT*P=	.06	I=11 BBR=1293.16
THETA=120.0	Z*D=	200002.6	BSTAR=	1258.91	TR=	.329	BBO=	124.74	CO=	7.90	TC*CO=	.250	CT*P=	.20	I=12 BBR=1299.97
THETA=120.0	Z*D=	300003.9	BSTAR=	1259.17	TR=	.329	BBO=	124.74	CO=	7.90	TC*CO=	.250	CT*P=	.45	I=13 BBR=1300.21

CURVES INTERSECT AT AX= .24965 AY= 218547.05849

THETA=105.0	Z*D=	517.7	BSTAR=	134.07	TR=	.897	BBO=	179.98	CO=	5.37	TC*CO=	2.934	CT*P=	.00 I= 1 BBR= 295.57
THETA=105.0	Z*D=	1035.3	BSTAR=	266.55	TR=	.763	BBO=	179.98	CO=	5.37	TC*CO=	1.826	CT*P=	.00 I= 2 BBR= 403.96
THETA=105.0	Z*D=	1553.0	BSTAR=	377.33	TR=	.598	BBO=	179.98	CO=	5.37	TC*CO=	1.192	CT*P=	.00 I= 3 BBR= 485.04
THETA=105.0	Z*D=	2070.6	BSTAR=	484.72	TR=	.446	BBO=	179.98	CO=	5.37	TC*CO=	.763	CT*P=	.00 I= 4 BBR= 565.02
THETA=105.0	Z*D=	2588.3	BSTAR=	570.65	TR=	.362	BBO=	179.98	CO=	5.37	TC*CO=	.551	CT*P=	.00 I= 5 BBR= 635.88
THETA=105.0	Z*D=	5176.5	BSTAR=	868.30	TR=	.256	BBO=	179.98	CO=	5.37	TC*CO=	.271	CT*P=	.00 I= 6 BBR= 914.30
THETA=105.0	Z*D=	10353.0	BSTAR=	1112.71	TR=	.224	BBO=	179.98	CO=	5.37	TC*CO=	.188	CT*P=	.00 I= 7 BBR=1153.06
THETA=105.0	Z*D=	15529.5	BSTAR=	1300.12	TR=	.197	BBO=	179.98	CO=	5.37	TC*CO=	.142	CT*P=	.01 I= 8 BBR=1335.56
THETA=105.0	Z*D=	20706.1	BSTAR=	1492.59	TR=	.177	BBO=	179.98	CO=	5.37	TC*CO=	.112	CT*P=	.01 I= 9 BBR=1524.92
THETA=105.0	Z*D=	25882.6	BSTAR=	1652.95	TR=	.164	BBO=	179.98	CO=	5.37	TC*CO=	.094	CT*P=	.02 I=10 BBR=1682.45
THETA=105.0	Z*D=	51765.1	BSTAR=	2052.36	TR=	.132	BBO=	179.98	CO=	5.37	TC*CO=	.061	CT*P=	.06 I=11 BBR=2076.09
THETA=105.0	Z*D=	103530.3	BSTAR=	2130.39	TR=	.119	BBO=	179.98	CO=	5.37	TC*CO=	.054	CT*P=	.20 I=12 BBR=2151.89

CURVES INTERSECT AT AX= .06120 AY= 53010.42546

THETA=100.0	Z*D=	347.2	BSTAR=	124.66	TR=	.910	BBO=	229.88	CO=	4.43	TC*CO=	2.774	CT*P=	.00 I= 1 BBR= 333.90
THETA=100.0	Z*D=	694.5	BSTAR=	249.32	TR=	.826	BBO=	229.88	CO=	4.43	TC*CO=	1.914	CT*P=	.00 I= 2 BBR= 439.29
THETA=100.0	Z*D=	1041.7	BSTAR=	372.90	TR=	.674	BBO=	229.88	CO=	4.43	TC*CO=	1.299	CT*P=	.00 I= 3 BBR= 527.78
THETA=100.0	Z*D=	1389.0	BSTAR=	488.53	TR=	.534	BBO=	229.88	CO=	4.43	TC*CO=	.888	CT*P=	.00 I= 4 BBR= 611.17
THETA=100.0	Z*D=	1736.2	BSTAR=	604.16	TR=	.437	BBO=	229.88	CO=	4.43	TC*CO=	.632	CT*P=	.00 I= 5 BBR= 704.72
THETA=100.0	Z*D=	3472.4	BSTAR=	961.25	TR=	.167	BBO=	229.88	CO=	4.43	TC*CO=	.170	CT*P=	.00 I= 6 BBR= 999.98
THETA=100.0	Z*D=	6944.9	BSTAR=	1317.24	TR=	.126	BBO=	229.88	CO=	4.43	TC*CO=	.095	CT*P=	.00 I= 7 BBR=1346.18
THETA=100.0	Z*D=	10417.3	BSTAR=	1490.02	TR=	.109	BBO=	229.88	CO=	4.43	TC*CO=	.073	CT*P=	.01 I= 8 BBR=1515.13
THETA=100.0	Z*D=	13889.8	BSTAR=	1573.35	TR=	.096	BBO=	229.88	CO=	4.43	TC*CO=	.061	CT*P=	.01 I= 9 BBR=1595.34
THETA=100.0	Z*D=	17362.2	BSTAR=	1675.59	TR=	.087	BBO=	229.88	CO=	4.43	TC*CO=	.052	CT*P=	.02 I=10 BBR=1695.59
THETA=100.0	Z*D=	34724.4	BSTAR=	2080.87	TR=	.061	BBO=	229.88	CO=	4.43	TC*CO=	.030	CT*P=	.06 I=11 BBR=2094.97

CURVES INTERSECT AT AX= .03964 AY= 27057.83110

THETA= 95.0	Z*D=	174.2	BSTAR=	113.22	TR=	.917	BBO=	326.11	CO=	2.83	TC*CO=	2.049	CT*P=	.00 I= 1 BBR= 412.37
THETA= 95.0	Z*D=	348.4	BSTAR=	226.45	TR=	.829	BBO=	326.11	CO=	2.83	TC*CO=	1.538	CT*P=	.00 I= 2 BBR= 496.89
THETA= 95.0	Z*D=	522.6	BSTAR=	339.67	TR=	.736	BBO=	326.11	CO=	2.83	TC*CO=	1.169	CT*P=	.00 I= 3 BBR= 579.60
THETA= 95.0	Z*D=	696.8	BSTAR=	452.90	TR=	.685	BBO=	326.11	CO=	2.83	TC*CO=	.933	CT*P=	.00 I= 4 BBR= 676.13
THETA= 95.0	Z*D=	871.0	BSTAR=	566.12	TR=	.574	BBO=	326.11	CO=	2.83	TC*CO=	.702	CT*P=	.00 I= 5 BBR= 793.42
THETA= 95.0	Z*D=	1741.9	BSTAR=	882.96	TR=	.195	BBO=	326.11	CO=	2.83	TC*CO=	.189	CT*P=	.00 I= 6 BBR= 946.41
THETA= 95.0	Z*D=	3483.8	BSTAR=	1248.06	TR=	.029	BBO=	326.11	CO=	2.83	TC*CO=	.022	CT*P=	.00 I= 7 BBR=1257.67
THETA= 95.0	Z*D=	5225.8	BSTAR=	1477.09	TR=	.019	BBO=	326.11	CO=	2.83	TC*CO=	.012	CT*P=	.01 I= 8 BBR=1483.36
THETA= 95.0	Z*D=	6967.7	BSTAR=	1637.74	TR=	.018	BBO=	326.11	CO=	2.83	TC*CO=	.010	CT*P=	.01 I= 9 BBR=1643.56

CURVES INTERSECT AT AX= .01049 AY= 6530.52735

AZIMUTH OF PATH OF SIGHT WITH RESPECT TO SUN IS 45 DEGREES

ZENITH OF PATH OF SIGHT = 180 DISTANCE TO TARGET AXIS = 0 ALTITUDE = 608610 CONTRAST IS POSITIVE

ZENITH OF PATH OF SIGHT = 165 DISTANCE TO TARGET AXIS = 184674 ALTITUDE = 689029 CONTRAST IS POSITIVE

ZENITH OF PATH OF SIGHT = 150 DISTANCE TO TARGET AXIS = 315644 ALTITUDE = 546753 CONTRAST IS POSITIVE

ZENITH OF PATH OF SIGHT = 135 DISTANCE TO TARGET AXIS = 402547 ALTITUDE = 402572 CONTRAST IS POSITIVE

ZENITH OF PATH OF SIGHT = 120 DISTANCE TO TARGET AXIS = 378507 ALTITUDE = 218547 CONTRAST IS POSITIVE

ZENITH OF PATH OF SIGHT = 105 DISTANCE TO TARGET AXIS = 197813 ALTITUDE = 53010 CONTRAST IS POSITIVE

ZENITH OF PATH OF SIGHT = 100 DISTANCE TO TARGET AXIS = 153455 ALTITUDE = 27058 CONTRAST IS POSITIVE

ZENITH OF PATH OF SIGHT = 95 DISTANCE TO TARGET AXIS = 74676 ALTITUDE = 6531 CONTRAST IS POSITIVE

AZIMUTH OF PATH OF SIGHT WITH RESPECT TO SUN IS 90 DEGREES

THETA=180.0	Z*D=	2000.0	3STAR=	134.00	TR=	.847	BBO=	197.80	CO=	4.95	TC*CO=	2.747	CT*P=	.00	I= 1 BBR= 301.46
THETA=180.0	Z*D=	4000.0	3STAR=	233.00	TR=	.718	BBO=	197.80	CO=	4.95	TC*CO=	1.873	CT*P=	.00	I= 2 BBR= 375.04
THETA=180.0	Z*D=	6000.0	3STAR=	291.00	TR=	.700	BBO=	197.80	CO=	4.95	TC*CO=	1.595	CT*P=	.00	I= 3 BBR= 429.53
THETA=180.0	Z*D=	8000.0	3STAR=	341.00	TR=	.693	BBO=	197.80	CO=	4.95	TC*CO=	1.418	CT*P=	.00	I= 4 BBR= 478.02
THETA=180.0	Z*D=	10000.0	3STAR=	388.00	TR=	.682	BBO=	197.80	CO=	4.95	TC*CO=	1.276	CT*P=	.00	I= 5 BBR= 522.92
THETA=180.0	Z*D=	20000.0	3STAR=	603.00	TR=	.644	BBO=	197.80	CO=	4.95	TC*CO=	.863	CT*P=	.00	I= 6 BBR= 730.47
THETA=180.0	Z*D=	40000.0	3STAR=	928.00	TR=	.603	BBO=	197.80	CO=	4.95	TC*CO=	.563	CT*P=	.00	I= 7 BBR=1047.27
THETA=180.0	Z*D=	60000.0	3STAR=	1060.00	TR=	.587	BBO=	197.80	CO=	4.95	TC*CO=	.488	CT*P=	.01	I= 8 BBR=1176.11
THETA=180.0	Z*D=	80000.0	3STAR=	1076.83	TR=	.580	BBO=	197.80	CO=	4.95	TC*CO=	.477	CT*P=	.01	I= 9 BBR=1191.64
THETA=180.0	Z*D=	100000.0	3STAR=	1085.39	TR=	.577	BBO=	197.80	CO=	4.95	TC*CO=	.471	CT*P=	.02	I=10 BBR=1199.55
THETA=180.0	Z*D=	200000.0	3STAR=	1094.06	TR=	.574	BBO=	197.80	CO=	4.95	TC*CO=	.465	CT*P=	.06	I=11 BBR=1207.55
THETA=180.0	Z*D=	400000.0	3STAR=	1094.38	TR=	.574	BBO=	197.80	CO=	4.95	TC*CO=	.465	CT*P=	.20	I=12 BBR=1207.84
THETA=180.0	Z*D=	600000.0	3STAR=	1094.38	TR=	.574	BBO=	197.80	CO=	4.95	TC*CO=	.465	CT*P=	.45	I=13 BBR=1207.84
THETA=180.0	Z*D=	800000.0	3STAR=	1094.38	TR=	.574	BBO=	197.80	CO=	4.95	TC*CO=	.465	CT*P=	.79	I=14 BBR=1207.84

CURVES INTERSECT AT AX= .46460 AY= 608609.64926

THETA=165.0	Z*D=	1931.8	3STAR=	133.34	TR=	.841	BBO=	187.11	CO=	4.40	TC*CO=	2.379	CT*P=	.00	I= 1 BBR= 290.61
THETA=165.0	Z*D=	3863.6	3STAR=	232.14	TR=	.711	BBO=	187.11	CO=	4.40	TC*CO=	1.601	CT*P=	.00	I= 2 BBR= 365.12
THETA=165.0	Z*D=	5795.4	3STAR=	287.89	TR=	.692	BBO=	187.11	CO=	4.40	TC*CO=	1.363	CT*P=	.00	I= 3 BBR= 417.29
THETA=165.0	Z*D=	7727.2	3STAR=	342.82	TR=	.684	BBO=	187.11	CO=	4.40	TC*CO=	1.195	CT*P=	.00	I= 4 BBR= 470.72
THETA=165.0	Z*D=	9659.0	3STAR=	387.20	TR=	.674	BBO=	187.11	CO=	4.40	TC*CO=	1.080	CT*P=	.00	I= 5 BBR= 513.31
THETA=165.0	Z*D=	19318.0	3STAR=	567.95	TR=	.635	BBO=	187.11	CO=	4.40	TC*CO=	.761	CT*P=	.00	I= 6 BBR= 686.84
THETA=165.0	Z*D=	38636.1	3STAR=	848.59	TR=	.594	BBO=	187.11	CO=	4.40	TC*CO=	.509	CT*P=	.00	I= 7 BBR= 959.78
THETA=165.0	Z*D=	57954.1	3STAR=	967.41	TR=	.577	BBO=	187.11	CO=	4.40	TC*CO=	.442	CT*P=	.01	I= 8 BBR=1075.43
THETA=165.0	Z*D=	77272.2	3STAR=	989.80	TR=	.570	BBO=	187.11	CO=	4.40	TC*CO=	.428	CT*P=	.01	I= 9 BBR=1096.47
THETA=165.0	Z*D=	96590.2	3STAR=	998.15	TR=	.566	BBO=	187.11	CO=	4.40	TC*CO=	.422	CT*P=	.02	I=10 BBR=1104.14
THETA=165.0	Z*D=	193180.5	3STAR=	1006.95	TR=	.563	BBO=	187.11	CO=	4.40	TC*CO=	.416	CT*P=	.06	I=11 BBR=1112.23
THETA=165.0	Z*D=	386360.9	3STAR=	1007.32	TR=	.562	BBO=	187.11	CO=	4.40	TC*CO=	.416	CT*P=	.20	I=12 BBR=1112.56
THETA=165.0	Z*D=	579541.4	3STAR=	1007.32	TR=	.562	BBO=	187.11	CO=	4.40	TC*CO=	.416	CT*P=	.45	I=13 BBR=1112.56

CURVES INTERSECT AT AX= .41591 AY= 552913.44362

THETA=150.0	Z*D=	1732.1	3STAR=	135.05	TR=	.846	BBO=	184.73	CO=	4.11	TC*CO=	2.206	CT*P=	.00	I= 1 BBR= 291.31
THETA=150.0	Z*D=	3464.1	3STAR=	250.60	TR=	.697	BBO=	184.73	CO=	4.11	TC*CO=	1.396	CT*P=	.00	I= 2 BBR= 379.32
THETA=150.0	Z*D=	5196.2	3STAR=	310.32	TR=	.666	BBO=	184.73	CO=	4.11	TC*CO=	1.167	CT*P=	.00	I= 3 BBR= 433.26
THETA=150.0	Z*D=	6928.2	3STAR=	342.85	TR=	.658	BBO=	184.73	CO=	4.11	TC*CO=	1.076	CT*P=	.00	I= 4 BBR= 464.41
THETA=150.0	Z*D=	8660.3	3STAR=	400.17	TR=	.651	BBO=	184.73	CO=	4.11	TC*CO=	.950	CT*P=	.00	I= 5 BBR= 520.40
THETA=150.0	Z*D=	17320.6	3STAR=	559.16	TR=	.609	BBO=	184.73	CO=	4.11	TC*CO=	.689	CT*P=	.00	I= 6 BBR= 671.67
THETA=150.0	Z*D=	34641.2	3STAR=	809.88	TR=	.566	BBO=	184.73	CO=	4.11	TC*CO=	.470	CT*P=	.00	I= 7 BBR= 914.38
THETA=150.0	Z*D=	51961.8	3STAR=	933.45	TR=	.546	BBO=	184.73	CO=	4.11	TC*CO=	.401	CT*P=	.01	I= 8 BBR=1034.26
THETA=150.0	Z*D=	69282.4	3STAR=	972.02	TR=	.537	BBO=	184.73	CO=	4.11	TC*CO=	.381	CT*P=	.01	I= 9 BBR=1071.17
THETA=150.0	Z*D=	86603.0	3STAR=	981.64	TR=	.532	BBO=	184.73	CO=	4.11	TC*CO=	.374	CT*P=	.02	I=10 BBR=1079.99
THETA=150.0	Z*D=	173206.0	3STAR=	993.16	TR=	.527	BBO=	184.73	CO=	4.11	TC*CO=	.367	CT*P=	.06	I=11 BBR=1090.45
THETA=150.0	Z*D=	346411.9	3STAR=	993.83	TR=	.526	BBO=	184.73	CO=	4.11	TC*CO=	.367	CT*P=	.20	I=12 BBR=1091.07
THETA=150.0	Z*D=	519617.9	3STAR=	993.83	TR=	.526	BBO=	184.73	CO=	4.11	TC*CO=	.367	CT*P=	.45	I=13 BBR=1091.07

CURVES INTERSECT AT AX= .36650 AY= 460909.34851

THETA=135.0	Z*D=	1414.2	3STAR=	120.58	TR=	.841	BBO=	188.30	CO=	3.95	TC*CO=	2.244	CT*P=	.00	I= 1 BBR= 278.90
THETA=135.0	Z*D=	2828.5	3STAR=	232.82	TR=	.673	BBO=	188.30	CO=	3.95	TC*CO=	1.393	CT*P=	.00	I= 2 BBR= 359.56
THETA=135.0	Z*D=	4242.7	3STAR=	307.95	TR=	.618	BBO=	188.30	CO=	3.95	TC*CO=	1.084	CT*P=	.00	I= 3 BBR= 424.34
THETA=135.0	Z*D=	5656.9	3STAR=	360.68	TR=	.605	BBO=	188.30	CO=	3.95	TC*CO=	.949	CT*P=	.00	I= 4 BBR= 474.56
THETA=135.0	Z*D=	7071.1	3STAR=	405.56	TR=	.598	BBO=	188.30	CO=	3.95	TC*CO=	.860	CT*P=	.00	I= 5 BBR= 518.29
THETA=135.0	Z*D=	14142.3	3STAR=	555.56	TR=	.557	BBO=	188.30	CO=	3.95	TC*CO=	.628	CT*P=	.00	I= 6 BBR= 660.51
THETA=135.0	Z*D=	28284.5	3STAR=	806.30	TR=	.510	BBO=	188.30	CO=	3.95	TC*CO=	.421	CT*P=	.00	I= 7 BBR= 902.38
THETA=135.0	Z*D=	42426.8	3STAR=	951.53	TR=	.486	BBO=	188.30	CO=	3.95	TC*CO=	.347	CT*P=	.01	I= 8 BBR=1043.09
THETA=135.0	Z*D=	56569.0	3STAR=	1026.28	TR=	.473	BBO=	188.30	CO=	3.95	TC*CO=	.316	CT*P=	.01	I= 9 BBR=1115.36
THETA=135.0	Z*D=	70711.3	3STAR=	1049.02	TR=	.466	BBO=	188.30	CO=	3.95	TC*CO=	.305	CT*P=	.02	I=10 BBR=1136.60
THETA=135.0	Z*D=	141422.5	3STAR=	1067.77	TR=	.457	BBO=	188.30	CO=	3.95	TC*CO=	.295	CT*P=	.06	I=11 BBR=1153.76
THETA=135.0	Z*D=	282845.0	3STAR=	1069.70	TR=	.456	BBO=	188.30	CO=	3.95	TC*CO=	.293	CT*P=	.20	I=12 BBR=1155.50
THETA=135.0	Z*D=	424267.5	3STAR=	1069.71	TR=	.456	BBO=	188.30	CO=	3.95	TC*CO=	.293	CT*P=	.45	I=13 BBR=1155.51

CURVES INTERSECT AT AX= .29350 AY= 334308.40501

THETA=120.0	Z*D=	1000.0	3STAR=	109.00	TR=	.870	BBO=	188.30	CO=	3.92	TC*CO=	2.354	CT*P=	.00	I= 1 BBR= 272.75
THETA=120.0	Z*D=	2000.0	3STAR=	226.00	TR=	.658	BBO=	188.30	CO=	3.92	TC*CO=	1.389	CT*P=	.00	I= 2 BBR= 349.99
THETA=120.0	Z*D=	3000.0	3STAR=	325.00	TR=	.559	BBO=	188.30	CO=	3.92	TC*CO=	.959	CT*P=	.00	I= 3 BBR= 430.28
THETA=120.0	Z*D=	4000.1	3STAR=	404.00	TR=	.512	BBO=	188.30	CO=	3.92	TC*CO=	.755	CT*P=	.00	I= 4 BBR= 500.40
THETA=120.0	Z*D=	5000.1	3STAR=	462.00	TR=	.495	BBO=	188.30	CO=	3.92	TC*CO=	.658	CT*P=	.00	I= 5 BBR= 555.14
THETA=120.0	Z*D=	10000.1	3STAR=	628.00	TR=	.463	BBO=	188.30	CO=	3.92	TC*CO=	.478	CT*P=	.00	I= 6 BBR= 715.24
THETA=120.0	Z*D=	20000.3	3STAR=	873.01	TR=	.421	BBO=	188.30	CO=	3.92	TC*CO=	.319	CT*P=	.00	I= 7 BBR= 950.38
THETA=120.0	Z*D=	30000.4	3STAR=	1090.01	TR=	.382	BBO=	188.30	CO=	3.92	TC*CO=	.243	CT*P=	.01	I= 8 BBR=1161.92
THETA=120.0	Z*D=	40000.5	3STAR=	1230.00	TR=	.364	BBO=	188.30	CO=	3.92	TC*CO=	.207	CT*P=	.01	I= 9 BBR=1298.47
THETA=120.0	Z*D=	50000.7	3STAR=	1314.00	TR=	.352	BBO=	188.30	CO=	3.92	TC*CO=	.188	CT*P=	.02	I=10 BBR=1380.22
THETA=120.0	Z*D=	100001.3	3STAR=	1394.08	TR=	.333	BBO=	188.30	CO=	3.92	TC*CO=	.169	CT*P=	.06	I=11 BBR=1456.79
THETA=120.0	Z*D=	200002.6	3STAR=	1402.20	TR=	.329	BBO=	188.30	CO=	3.92	TC*CO=	.166	CT*P=	.20	I=12 BBR=1464.18

CURVES INTERSECT AT AX= .15671 AY= 174470.20861

```
THETA=105.0 Z*D=     517.7 BSTAR=  105.08 TR= .897 BBO=  200.18 CO=  3.54 TC*CO= 2.233 CT*P=  .00 I= 1 BBR= 284.70
THETA=105.0 Z*D=    1035.3 BSTAR=  209.57 TR= .763 BBO=  200.18 CO=  3.54 TC*CO= 1.493 CT*P=  .00 I= 2 BBR= 382.39
THETA=105.0 Z*D=    1553.0 BSTAR=  305.85 TR= .598 BBO=  200.18 CO=  3.54 TC*CO=  .996 CT*P=  .00 I= 3 BBR= 485.64
THETA=105.0 Z*D=    2070.6 BSTAR=  399.66 TR= .448 BBO=  200.18 CO=  3.54 TC*CO=  .647 CT*P=  .00 I= 4 BBR= 488.97
THETA=105.0 Z*D=    2588.3 BSTAR=  477.83 TR= .362 BBO=  200.18 CO=  3.54 TC*CO=  .466 CT*P=  .00 I= 5 BBR= 550.34
THETA=105.0 Z*D=    5176.5 BSTAR=  755.65 TR= .256 BBO=  200.18 CO=  3.54 TC*CO=  .325 CT*P=  .00 I= 6 BBR= 806.90
THETA=105.0 Z*D=   10353.0 BSTAR= 1011.30 TR= .224 BBO=  200.18 CO=  3.54 TC*CO=  .150 CT*P=  .00 I= 7 BBR=1056.18
THETA=105.0 Z*D=   15529.5 BSTAR= 1175.89 TR= .197 BBO=  200.18 CO=  3.54 TC*CO=  .115 CT*P=  .01 I= 8 BBR=1215.30
THETA=105.0 Z*D=   20706.1 BSTAR= 1329.77 TR= .177 BBO=  200.18 CO=  3.54 TC*CO=  .092 CT*P=  .01 I= 9 BBR=1365.28
THETA=105.0 Z*D=   25882.6 BSTAR= 1469.42 TR= .164 BBO=  200.18 CO=  3.54 TC*CO=  .077 CT*P=  .02 I=10 BBR=1502.23
THETA=105.0 Z*D=   51765.1 BSTAR= 1810.99 TR= .132 BBO=  200.18 CO=  3.54 TC*CO=  .051 CT*P=  .06 I=11 BBR=1836.99

        CURVES INTERSECT AT AX=      .05355  AY=   49147.92366

THETA=100.0 Z*D=     347.2 BSTAR=  124.66 TR= .910 BBO=  229.88 CO=  2.93 TC*CO= 1.835 CT*P=  .00 I= 1 BBR= 333.90
THETA=100.0 Z*D=     694.5 BSTAR=  249.32 TR= .826 BBO=  229.88 CO=  2.93 TC*CO= 1.266 CT*P=  .00 I= 2 BBR= 439.29
THETA=100.0 Z*D=    1041.7 BSTAR=  367.47 TR= .674 BBO=  229.88 CO=  2.93 TC*CO=  .868 CT*P=  .00 I= 3 BBR= 522.36
THETA=100.0 Z*D=    1389.0 BSTAR=  437.96 TR= .534 BBO=  229.88 CO=  2.93 TC*CO=  .640 CT*P=  .00 I= 4 BBR= 580.61
THETA=100.0 Z*D=    1736.2 BSTAR=  508.48 TR= .437 BBO=  229.88 CO=  2.93 TC*CO=  .483 CT*P=  .00 I= 5 BBR= 609.01
THETA=100.0 Z*D=    3472.4 BSTAR=  790.50 TR= .167 BBO=  229.88 CO=  2.93 TC*CO=  .135 CT*P=  .00 I= 6 BBR= 828.84
THETA=100.0 Z*D=    6944.9 BSTAR= 1165.59 TR= .126 BBO=  229.88 CO=  2.93 TC*CO=  .071 CT*P=  .00 I= 7 BBR=1194.53
THETA=100.0 Z*D=   10417.3 BSTAR= 1282.52 TR= .109 BBO=  229.88 CO=  2.93 TC*CO=  .056 CT*P=  .01 I= 8 BBR=1307.63
THETA=100.0 Z*D=   13889.8 BSTAR= 1386.69 TR= .096 BBO=  229.88 CO=  2.93 TC*CO=  .046 CT*P=  .01 I= 9 BBR=1408.68
THETA=100.0 Z*D=   17362.2 BSTAR= 1495.59 TR= .087 BBO=  229.88 CO=  2.93 TC*CO=  .039 CT*P=  .02 I=10 BBR=1515.55
THETA=100.0 Z*D=   34724.4 BSTAR= 1900.87 TR= .061 BBO=  229.88 CO=  2.93 TC*CO=  .022 CT*P=  .06 I=11 BBR=1914.97

        CURVES INTERSECT AT AX=      .03217  AY=   23882.19111

THETA= 95.0 Z*D=     174.2 BSTAR=  103.64 TR= .917 BBO=  275.02 CO=  2.26 TC*CO= 1.603 CT*P=  .00 I= 1 BBR= 355.93
THETA= 95.0 Z*D=     348.4 BSTAR=  207.29 TR= .829 BBO=  275.02 CO=  2.26 TC*CO= 1.185 CT*P=  .00 I= 2 BBR= 435.36
THETA= 95.0 Z*D=     522.6 BSTAR=  310.93 TR= .736 BBO=  275.02 CO=  2.26 TC*CO=  .891 CT*P=  .00 I= 3 BBR= 513.28
THETA= 95.0 Z*D=     696.8 BSTAR=  414.58 TR= .685 BBO=  275.02 CO=  2.26 TC*CO=  .706 CT*P=  .00 I= 4 BBR= 602.84
THETA= 95.0 Z*D=     871.0 BSTAR=  518.22 TR= .574 BBO=  275.02 CO=  2.26 TC*CO=  .528 CT*P=  .00 I= 5 BBR= 676.18
THETA= 95.0 Z*D=    1741.9 BSTAR=  771.58 TR= .195 BBO=  275.02 CO=  2.26 TC*CO=  .147 CT*P=  .00 I= 6 BBR= 825.09
THETA= 95.0 Z*D=    3483.8 BSTAR= 1048.06 TR= .029 BBO=  275.02 CO=  2.26 TC*CO=  .017 CT*P=  .00 I= 7 BBR=1056.17
THETA= 95.0 Z*D=    5225.8 BSTAR= 1205.80 TR= .019 BBO=  275.02 CO=  2.26 TC*CO=  .010 CT*P=  .01 I= 8 BBR=1211.09
THETA= 95.0 Z*D=    6967.7 BSTAR= 1308.38 TR= .018 BBO=  275.02 CO=  2.26 TC*CO=  .008 CT*P=  .01 I= 9 BBR=1313.29

        CURVES INTERSECT AT AX=      .00925  AY=    5993.98175

        AZIMUTH OF PATH OF SIGHT WITH RESPECT TO SUN IS  90 DEGREES

ZENITH OF PATH OF SIGHT = 180  DISTANCE TO TARGET AXIS =      0  ALTITUDE =  608610  CONTRAST IS POSITIVE

ZENITH OF PATH OF SIGHT = 165  DISTANCE TO TARGET AXIS =  148192  ALTITUDE =  552913  CONTRAST IS POSITIVE

ZENITH OF PATH OF SIGHT = 150  DISTANCE TO TARGET AXIS =  266086  ALTITUDE =  460909  CONTRAST IS POSITIVE

ZENITH OF PATH OF SIGHT = 135  DISTANCE TO TARGET AXIS =  334287  ALTITUDE =  334308  CONTRAST IS POSITIVE

ZENITH OF PATH OF SIGHT = 120  DISTANCE TO TARGET AXIS =  302169  ALTITUDE =  174470  CONTRAST IS POSITIVE

ZENITH OF PATH OF SIGHT = 105  DISTANCE TO TARGET AXIS =  183400  ALTITUDE =   49148  CONTRAST IS POSITIVE

ZENITH OF PATH OF SIGHT = 100  DISTANCE TO TARGET AXIS =  135445  ALTITUDE =   23882  CONTRAST IS POSITIVE

ZENITH OF PATH OF SIGHT =  95  DISTANCE TO TARGET AXIS =   68540  ALTITUDE =    5994  CONTRAST IS POSITIVE
```

AZIMUTH OF PATH OF SIGHT WITH RESPECT TO SUN IS 135 DEGREES

THETA= 180.0	Z=	2000.0	BSTAR=	134.00	YR=	.047	BB=	197.80	C0=	4.95	YC0C0=	2.747	CY=	.00	I= 1 BBR= 381.46
THETA= 180.0	Z=	4000.0	BSTAR=	233.00	YR=	.710	BB=	197.80	C0=	4.95	YC0C0=	1.073	CY=	.00	I= 2 BBR= 379.04
THETA= 180.0	Z=	6000.0	BSTAR=	291.00	YR=	.700	BB=	197.80	C0=	4.95	YC0C0=	1.395	CY=	.00	I= 3 BBR= 439.93
THETA= 180.0	Z=	8000.0	BSTAR=	341.00	YR=	.693	BB=	197.80	C0=	4.95	YC0C0=	1.418	CY=	.00	I= 4 BBR= 478.02
THETA= 180.0	Z=	10000.0	BSTAR=	388.00	YR=	.682	BB=	197.80	C0=	4.95	YC0C0=	1.276	CY=	.00	I= 5 BBR= 522.92
THETA= 180.0	Z=	20000.0	BSTAR=	603.00	YR=	.644	BB=	197.80	C0=	4.95	YC0C0=	.863	CY=	.00	I= 6 BBR= 730.47
THETA= 180.0	Z=	40000.0	BSTAR=	928.00	YR=	.603	BB=	197.80	C0=	4.95	YC0C0=	.963	CY=	.00	I= 7 BBR=1047.27
THETA= 180.0	Z=	60000.0	BSTAR=	1060.00	YR=	.987	BB=	197.80	C0=	4.95	YC0C0=	.480	CY=	.01	I= 8 BBR=1170.11
THETA= 180.0	Z=	80000.0	BSTAR=	1076.93	YR=	.980	BB=	197.80	C0=	4.95	YC0C0=	.477	CY=	.01	I= 9 BBR=1181.04
THETA= 180.0	Z=	100000.0	BSTAR=	1089.39	YR=	.977	BB=	197.80	C0=	4.95	YC0C0=	.471	CY=	.02	I=10 BBR=1188.95
THETA= 180.0	Z=	200000.0	BSTAR=	1094.06	YR=	.974	BB=	197.80	C0=	4.95	YC0C0=	.465	CY=	.06	I=11 BBR=1207.90
THETA= 180.0	Z=	400000.0	BSTAR=	1094.30	YR=	.974	BB=	197.80	C0=	4.95	YC0C0=	.465	CY=	.20	I=12 BBR=1207.04
THETA= 180.0	Z=	600000.0	BSTAR=	1094.30	YR=	.974	BB=	197.80	C0=	4.95	YC0C0=	.465	CY=	.49	I=13 BBR=1207.04
THETA= 180.0	Z=	800000.0	BSTAR=	1094.30	YR=	.974	BB=	197.80	C0=	4.95	YC0C0=	.465	CY=	.79	I=14 BBR=1207.04

CURVES INTERSECT AT AX= .46460 AY= 608809.64926

THETA= 165.0	Z=	1931.6	BSTAR=	196.39	YR=	.041	BB=	190.99	C0=	4.43	YC0C0=	2.291	CY=	.00	I= 1 BBR= 383.05
THETA= 165.0	Z=	3863.2	BSTAR=	293.41	YR=	.711	BB=	190.99	C0=	4.43	YC0C0=	1.508	CY=	.00	I= 2 BBR= 304.03
THETA= 165.0	Z=	5795.4	BSTAR=	316.66	YR=	.692	BB=	190.99	C0=	4.43	YC0C0=	1.343	CY=	.00	I= 3 BBR= 000.20
THETA= 165.0	Z=	7727.2	BSTAR=	398.94	YR=	.684	BB=	190.99	C0=	4.43	YC0C0=	1.219	CY=	.00	I= 4 BBR= 404.97
THETA= 165.0	Z=	9659.0	BSTAR=	409.98	YR=	.670	BB=	190.99	C0=	4.43	YC0C0=	1.094	CY=	.00	I= 5 BBR= 903.01
THETA= 165.0	Z=	19318.0	BSTAR=	619.95	YR=	.635	BB=	190.99	C0=	4.43	YC0C0=	.791	CY=	.00	I= 6 BBR= 746.30
THETA= 165.0	Z=	38636.1	BSTAR=	899.98	YR=	.990	BB=	190.99	C0=	4.43	YC0C0=	.919	CY=	.00	I= 7 BBR=1087.00
THETA= 165.0	Z=	57954.1	BSTAR=	1021.00	YR=	.979	BB=	190.99	C0=	4.43	YC0C0=	.448	CY=	.01	I= 8 BBR=1159.00
THETA= 165.0	Z=	77272.2	BSTAR=	1044.96	YR=	.970	BB=	190.99	C0=	4.43	YC0C0=	.434	CY=	.01	I= 9 BBR=1100.00
THETA= 165.0	Z=	96590.2	BSTAR=	1053.37	YR=	.966	BB=	190.99	C0=	4.43	YC0C0=	.420	CY=	.02	I=10 BBR=1166.00
THETA= 165.0	Z=	193180.9	BSTAR=	1062.67	YR=	.963	BB=	190.99	C0=	4.43	YC0C0=	.423	CY=	.06	I=11 BBR=1174.02
THETA= 165.0	Z=	386360.9	BSTAR=	1063.05	YR=	.962	BB=	190.99	C0=	4.43	YC0C0=	.422	CY=	.20	I=12 BBR=1174.90
THETA= 165.0	Z=	579541.4	BSTAR=	1063.09	YR=	.962	BB=	190.99	C0=	4.43	YC0C0=	.422	CY=	.49	I=13 BBR=1174.90

CURVES INTERSECT AT AX= .48220 AY= 597099.46853

THETA= 150.0	Z=	1732.1	BSTAR=	193.69	YR=	.048	BB=	226.91	C0=	3.98	YC0C0=	1.930	CY=	.00	I= 1 BBR= 379.05
THETA= 150.0	Z=	3464.1	BSTAR=	300.20	YR=	.697	BB=	226.91	C0=	3.98	YC0C0=	1.239	CY=	.00	I= 2 BBR= 490.90
THETA= 150.0	Z=	5196.2	BSTAR=	363.30	YR=	.686	BB=	226.91	C0=	3.98	YC0C0=	1.091	CY=	.00	I= 3 BBR= 550.31
THETA= 150.0	Z=	6928.2	BSTAR=	399.89	YR=	.678	BB=	226.91	C0=	3.98	YC0C0=	.974	CY=	.00	I= 4 BBR= 940.10
THETA= 150.0	Z=	8660.3	BSTAR=	447.07	YR=	.671	BB=	226.91	C0=	3.98	YC0C0=	.889	CY=	.00	I= 5 BBR= 909.15
THETA= 150.0	Z=	17320.6	BSTAR=	660.27	YR=	.609	BB=	226.91	C0=	3.98	YC0C0=	.614	CY=	.00	I= 6 BBR= 006.40
THETA= 150.0	Z=	34641.2	BSTAR=	948.37	YR=	.966	BB=	226.91	C0=	3.98	YC0C0=	.427	CY=	.00	I= 7 BBR=1075.70
THETA= 150.0	Z=	51961.8	BSTAR=	1087.09	YR=	.946	BB=	226.91	C0=	3.98	YC0C0=	.366	CY=	.01	I= 8 BBR=1211.07
THETA= 150.0	Z=	69282.4	BSTAR=	1129.31	YR=	.937	BB=	226.91	C0=	3.98	YC0C0=	.349	CY=	.01	I= 9 BBR=1251.11
THETA= 150.0	Z=	86603.0	BSTAR=	1140.09	YR=	.932	BB=	226.91	C0=	3.98	YC0C0=	.343	CY=	.02	I=10 BBR=1201.24
THETA= 150.0	Z=	173206.0	BSTAR=	1153.00	YR=	.927	BB=	226.91	C0=	3.98	YC0C0=	.336	CY=	.06	I=11 BBR=1273.30
THETA= 150.0	Z=	346411.9	BSTAR=	1154.66	YR=	.926	BB=	226.91	C0=	3.98	YC0C0=	.336	CY=	.20	I=12 BBR=1274.00
THETA= 150.0	Z=	519617.9	BSTAR=	1154.66	YR=	.926	BB=	226.91	C0=	3.98	YC0C0=	.336	CY=	.49	I=13 BBR=1274.00

CURVES INTERSECT AT AX= .33969 AY= 439189.72300

THETA= 139.0	Z=	1414.2	BSTAR=	190.00	YR=	.041	BB=	232.09	C0=	3.41	YC0C0=	1.778	CY=	.00	I= 1 BBR= 379.06
THETA= 139.0	Z=	2828.5	BSTAR=	302.31	YR=	.673	BB=	232.09	C0=	3.41	YC0C0=	1.165	CY=	.00	I= 2 BBR= 490.80
THETA= 139.0	Z=	4242.7	BSTAR=	384.48	YR=	.618	BB=	232.09	C0=	3.41	YC0C0=	.930	CY=	.00	I= 3 BBR= 900.40
THETA= 135.0	Z=	5656.9	BSTAR=	431.00	YR=	.605	BB=	232.09	C0=	3.41	YC0C0=	.840	CY=	.00	I= 4 BBR= 971.90
THETA= 135.0	Z=	7071.1	BSTAR=	468.20	YR=	.590	BB=	232.09	C0=	3.41	YC0C0=	.783	CY=	.00	I= 5 BBR= 607.90
THETA= 139.0	Z=	14142.3	BSTAR=	668.53	YR=	.557	BB=	232.09	C0=	3.41	YC0C0=	.999	CY=	.00	I= 6 BBR= 700.34
THETA= 135.0	Z=	28284.5	BSTAR=	1005.40	YR=	.910	BB=	232.09	C0=	3.41	YC0C0=	.337	CY=	.00	I= 7 BBR=1204.20
THETA= 135.0	Z=	42426.8	BSTAR=	1326.69	YR=	.906	BB=	232.09	C0=	3.41	YC0C0=	.260	CY=	.01	I= 8 BBR=1400.91
THETA= 135.0	Z=	56569.0	BSTAR=	1455.90	YR=	.879	BB=	232.09	C0=	3.41	YC0C0=	.240	CY=	.01	I= 9 BBR=1906.16
THETA= 135.0	Z=	70711.3	BSTAR=	1492.04	YR=	.866	BB=	232.09	C0=	3.41	YC0C0=	.231	CY=	.02	I=10 BBR=1081.30
THETA= 139.0	Z=	141422.5	BSTAR=	1919.92	YR=	.859	BB=	232.09	C0=	3.41	YC0C0=	.223	CY=	.06	I=11 BBR=1609.09
THETA= 135.0	Z=	282845.0	BSTAR=	1922.26	YR=	.856	BB=	232.09	C0=	3.41	YC0C0=	.222	CY=	.20	I=12 BBR=1600.30
THETA= 135.0	Z=	424267.5	BSTAR=	1922.20	YR=	.856	BB=	232.09	C0=	3.41	YC0C0=	.222	CY=	.49	I=13 BBR=1600.30

CURVES INTERSECT AT AX= .22240 AY= 293382.99072

THETA= 120.0	Z=	1000.0	BSTAR=	137.00	YR=	.078	BB=	229.00	C0=	3.92	YC0C0=	2.090	CY=	.00	I= 1 BBR= 376.98
THETA= 120.0	Z=	2000.0	BSTAR=	282.00	YR=	.698	BB=	229.00	C0=	3.92	YC0C0=	1.230	CY=	.00	I= 2 BBR= 403.37
THETA= 120.0	Z=	3000.0	BSTAR=	305.00	YR=	.959	BB=	229.00	C0=	3.92	YC0C0=	.881	CY=	.00	I= 3 BBR= 983.90
THETA= 120.0	Z=	4000.1	BSTAR=	462.00	YR=	.918	BB=	229.00	C0=	3.92	YC0C0=	.715	CY=	.00	I= 4 BBR= 990.60
THETA= 120.0	Z=	5000.1	BSTAR=	525.00	YR=	.909	BB=	229.00	C0=	3.92	YC0C0=	.627	CY=	.00	I= 5 BBR= 000.70
THETA= 120.0	Z=	10000.1	BSTAR=	694.00	YR=	.863	BB=	229.00	C0=	3.92	YC0C0=	.469	CY=	.00	I= 6 BBR= 000.98
THETA= 120.0	Z=	20000.3	BSTAR=	995.01	YR=	.811	BB=	229.00	C0=	3.92	YC0C0=	.309	CY=	.00	I= 7 BBR=1000.40
THETA= 120.0	Z=	30000.4	BSTAR=	1220.01	YR=	.803	BB=	229.00	C0=	3.92	YC0C0=	.236	CY=	.01	I= 8 BBR=1309.00
THETA= 120.0	Z=	40000.5	BSTAR=	1360.06	YR=	.804	BB=	229.00	C0=	3.92	YC0C0=	.204	CY=	.01	I= 9 BBR=1400.90
THETA= 120.0	Z=	50000.7	BSTAR=	1440.00	YR=	.852	BB=	229.00	C0=	3.92	YC0C0=	.107	CY=	.02	I=10 BBR=1500.04
THETA= 120.0	Z=	100001.3	BSTAR=	1916.10	YR=	.833	BB=	229.00	C0=	3.92	YC0C0=	.169	CY=	.06	I=11 BBR=1902.75
THETA= 120.0	Z=	200002.6	BSTAR=	1925.02	YR=	.829	BB=	229.00	C0=	3.92	YC0C0=	.166	CY=	.20	I=12 BBR=1000.00

CURVES INTERSECT AT AX= .16720 AY= 174005.00060

```
THETA=105.0 Z*D=    517.7 BSTAR=  173.93 TR= .897 BBO=  260.17 CO=  3.11 TC*C0= 1.782 CT*P= .00 I= 1 BBR= 467.38
THETA=105.0 Z*D=   1035.3 BSTAR=  341.58 TR= .763 BBO=  260.17 CO=  3.11 TC*C0= 1.143 CT*P= .00 I= 2 BBR= 560.21
THETA=105.0 Z*D=   1553.0 BSTAR=  423.37 TR= .598 BBO=  260.17 CO=  3.11 TC*C0=  .836 CT*P= .00 I= 3 BBR= 599.06
THETA=105.0 Z*D=   2070.6 BSTAR=  503.25 TR= .446 BBO=  260.17 CO=  3.11 TC*C0=  .583 CT*P= .00 I= 4 BBR= 619.38
THETA=105.0 Z*D=   2588.3 BSTAR=  571.06 TR= .362 BBO=  260.17 CO=  3.11 TC*C0=  .441 CT*P= .00 I= 5 BBR= 665.31
THETA=105.0 Z*D=   5176.5 BSTAR=  818.30 TR= .254 BBO=  260.17 CO=  3.11 TC*C0=  .234 CT*P= .00 I= 6 BBR= 884.91
THETA=105.0 Z*D=  10353.0 BSTAR= 1182.71 TR= .224 BBO=  260.17 CO=  3.11 TC*C0=  .146 CT*P= .00 I= 7 BBR=1241.09
THETA=105.0 Z*D=  15529.5 BSTAR= 1362.71 TR= .197 BBO=  260.17 CO=  3.11 TC*C0=  .113 CT*P= .01 I= 8 BBR=1413.94
THETA=105.0 Z*D=  20706.1 BSTAR= 1486.95 TR= .177 BBO=  260.17 CO=  3.11 TC*C0=  .094 CT*P= .01 I= 9 BBR=1503.18
THETA=105.0 Z*D=  25882.6 BSTAR= 1604.12 TR= .164 BBO=  260.17 CO=  3.11 TC*C0=  .081 CT*P= .02 I=10 BBR=1646.77
THETA=105.0 Z*D=  51765.1 BSTAR= 1867.06 TR= .132 BBO=  260.17 CO=  3.11 TC*C0=  .056 CT*P= .06 I=11 BBR=1901.37

        CURVES INTERSECT AT AX=        .09670  AY=    51144.16126

THETA=100.0 Z*D=    347.2 BSTAR=  168.76 TR= .918 BBO=  279.02 CO=  2.93 TC*C0= 1.751 CT*P= .00 I= 1 BBR= 419.09
THETA=100.0 Z*D=    694.5 BSTAR=  337.52 TR= .826 BBO=  279.02 CO=  2.93 TC*C0= 1.179 CT*P= .00 I= 2 BBR= 564.79
THETA=100.0 Z*D=   1041.7 BSTAR=  493.97 TR= .674 BBO=  279.02 CO=  2.93 TC*C0=  .800 CT*P= .00 I= 3 BBR= 679.27
THETA=100.0 Z*D=   1389.0 BSTAR=  580.29 TR= .534 BBO=  279.02 CO=  2.93 TC*C0=  .608 CT*P= .00 I= 4 BBR= 707.08
THETA=100.0 Z*D=   1736.2 BSTAR=  626.62 TR= .437 BBO=  279.02 CO=  2.93 TC*C0=  .472 CT*P= .00 I= 5 BBR= 746.93
THETA=100.0 Z*D=   3472.4 BSTAR=  858.83 TR= .167 BBO=  279.02 CO=  2.93 TC*C0=  .149 CT*P= .00 I= 6 BBR= 914.69
THETA=100.0 Z*D=   6944.9 BSTAR= 1165.59 TR= .126 BBO=  279.02 CO=  2.93 TC*C0=  .085 CT*P= .00 I= 7 BBR=1200.21
THETA=100.0 Z*D=  10417.3 BSTAR= 1467.53 TR= .109 BBO=  279.02 CO=  2.93 TC*C0=  .059 CT*P= .01 I= 8 BBR=1497.97
THETA=100.0 Z*D=  13889.8 BSTAR= 1613.37 TR= .096 BBO=  279.02 CO=  2.93 TC*C0=  .047 CT*P= .01 I= 9 BBR=1689.68
THETA=100.0 Z*D=  17362.2 BSTAR= 1716.69 TR= .087 BBO=  279.02 CO=  2.93 TC*C0=  .040 CT*P= .02 I=10 BBR=1780.57
THETA=100.0 Z*D=  34724.4 BSTAR= 2031.97 TR= .061 BBO=  279.02 CO=  2.93 TC*C0=  .024 CT*P= .06 I=11 BBR=2048.84

        CURVES INTERSECT AT AX=        .03360  AY=    24491.84310

THETA= 95.0 Z*D=    174.2 BSTAR=  120.71 TR= .917 BBO=  339.77 CO=  2.27 TC*C0= 1.636 CT*P= .00 I= 1 BBR= 432.40
THETA= 95.0 Z*D=    348.4 BSTAR=  241.43 TR= .829 BBO=  339.77 CO=  2.27 TC*C0= 1.222 CT*P= .00 I= 2 BBR= 523.20
THETA= 95.0 Z*D=    522.6 BSTAR=  362.14 TR= .736 BBO=  339.77 CO=  2.27 TC*C0=  .927 CT*P= .00 I= 3 BBR= 612.13
THETA= 95.0 Z*D=    696.8 BSTAR=  482.86 TR= .685 BBO=  339.77 CO=  2.27 TC*C0=  .738 CT*P= .00 I= 4 BBR= 715.44
THETA= 95.0 Z*D=    871.0 BSTAR=  603.57 TR= .574 BBO=  339.77 CO=  2.27 TC*C0=  .554 CT*P= .00 I= 5 BBR= 798.72
THETA= 95.0 Z*D=   1741.9 BSTAR=  884.41 TR= .195 BBO=  339.77 CO=  2.27 TC*C0=  .158 CT*P= .00 I= 6 BBR= 990.52
THETA= 95.0 Z*D=   3483.8 BSTAR= 1162.90 TR= .029 BBO=  339.77 CO=  2.27 TC*C0=  .019 CT*P= .00 I= 7 BBR=1172.91
THETA= 95.0 Z*D=   5225.8 BSTAR= 1294.52 TR= .019 BBO=  339.77 CO=  2.27 TC*C0=  .011 CT*P= .01 I= 8 BBR=1301.04
THETA= 95.0 Z*D=   6967.7 BSTAR= 1397.09 TR= .018 BBO=  339.77 CO=  2.27 TC*C0=  .010 CT*P= .01 I= 9 BBR=1403.16

        CURVES INTERSECT AT AX=        .01029  AY=     6442.18191

        AZIMUTH OF PATH OF SIGHT WITH RESPECT TO SUN IS 135 DEGREES

  ZENITH OF PATH OF SIGHT = 180  DISTANCE TO TARGET AXIS =       0  ALTITUDE =  608610  CONTRAST IS POSITIVE

  ZENITH OF PATH OF SIGHT = 165  DISTANCE TO TARGET AXIS =  149529  ALTITUDE =  557899  CONTRAST IS POSITIVE

  ZENITH OF PATH OF SIGHT = 150  DISTANCE TO TARGET AXIS =  253547  ALTITUDE =  439190  CONTRAST IS POSITIVE

  ZENITH OF PATH OF SIGHT = 135  DISTANCE TO TARGET AXIS =  293364  ALTITUDE =  293383  CONTRAST IS POSITIVE

  ZENITH OF PATH OF SIGHT = 120  DISTANCE TO TARGET AXIS =  302751  ALTITUDE =  174806  CONTRAST IS POSITIVE

  ZENITH OF PATH OF SIGHT = 105  DISTANCE TO TARGET AXIS =  190849  ALTITUDE =   51144  CONTRAST IS POSITIVE

  ZENITH OF PATH OF SIGHT = 100  DISTANCE TO TARGET AXIS =  138003  ALTITUDE =   24492  CONTRAST IS POSITIVE

  ZENITH OF PATH OF SIGHT =  95  DISTANCE TO TARGET AXIS =   73665  ALTITUDE =    6442  CONTRAST IS POSITIVE
```

AZIMUTH OF PATH OF SIGHT WITH RESPECT TO SUN IS 180 DEGREES

THETA=180.0	Z*D=	2000.0	3STAR=	134.00	TR=	.847	BBO=	197.80	CO=	4.95	TC*CO=	2.747	CT*P=	.00 I= 1 BBR= 301.46
THETA=180.0	Z*D=	4000.0	3STAR=	233.00	TR=	.718	BBO=	197.80	CO=	4.95	TC*CO=	1.873	CT*P=	.00 I= 2 BBR= 375.04
THETA=180.0	Z*D=	6000.0	3STAR=	291.00	TR=	.700	BBO=	197.80	CO=	4.95	TC*CO=	1.595	CT*P=	.00 I= 3 BBR= 429.53
THETA=180.0	Z*D=	8000.0	3STAR=	341.00	TR=	.693	BBO=	197.80	CO=	4.95	TC*CO=	1.418	CT*P=	.00 I= 4 BBR= 478.02
THETA=180.0	Z*D=	10000.0	3STAR=	388.00	TR=	.682	BBO=	197.80	CO=	4.95	TC*CO=	1.276	CT*P=	.00 I= 5 BBR= 522.92
THETA=180.0	Z*D=	20000.0	3STAR=	603.00	TR=	.644	BBO=	197.80	CO=	4.95	TC*CO=	.863	CT*P=	.00 I= 6 BBR= 730.47
THETA=180.0	Z*D=	40000.0	3STAR=	928.00	TR=	.603	BBO=	197.80	CO=	4.95	TC*CO=	.563	CT*P=	.00 I= 7 BBR=1047.27
THETA=180.0	Z*D=	60000.0	3STAR=	1060.00	TR=	.587	BBO=	197.80	CO=	4.95	TC*CO=	.488	CT*P=	.01 I= 8 BBR=1176.11
THETA=180.0	Z*D=	80000.0	3STAR=	1076.83	TR=	.580	BBO=	197.80	CO=	4.95	TC*CO=	.477	CT*P=	.01 I= 9 BBR=1191.64
THETA=180.0	Z*D=	100000.0	3STAR=	1085.39	TR=	.577	BBO=	197.80	CO=	4.95	TC*CO=	.471	CT*P=	.02 I=10 BBR=1199.55
THETA=180.0	Z*D=	200000.0	3STAR=	1094.06	TR=	.574	BBO=	197.80	CO=	4.95	TC*CO=	.465	CT*P=	.06 I=11 BBR=1207.55
THETA=180.0	Z*D=	400000.0	3STAR=	1094.36	TR=	.574	BBO=	197.80	CO=	4.95	TC*CO=	.465	CT*P=	.20 I=12 BBR=1207.84
THETA=180.0	Z*D=	600000.0	3STAR=	1094.38	TR=	.574	BBO=	197.80	CO=	4.95	TC*CO=	.465	CT*P=	.45 I=13 BBR=1207.84
THETA=180.0	Z*D=	800000.0	3STAR=	1094.38	TR=	.574	BBO=	197.80	CO=	4.95	TC*CO=	.465	CT*P=	.79 I=14 BBR=1207.84

CURVES INTERSECT AT AX= .46460 AY= 608609.64926

THETA=165.0	Z*D=	1931.8	3STAR=	133.08	TR=	.841	BBO=	238.79	CO=	3.85	TC*CO=	2.315	CT*P=	.00 I= 1 BBR= 333.79
THETA=165.0	Z*D=	3863.6	3STAR=	235.14	TR=	.711	BBO=	238.79	CO=	3.85	TC*CO=	1.614	CT*P=	.00 I= 2 BBR= 404.85
THETA=165.0	Z*D=	5795.4	3STAR=	280.70	TR=	.692	BBO=	238.79	CO=	3.85	TC*CO=	1.426	CT*P=	.00 I= 3 BBR= 445.85
THETA=165.0	Z*D=	7727.2	3STAR=	367.63	TR=	.684	BBO=	238.79	CO=	3.85	TC*CO=	1.184	CT*P=	.00 I= 4 BBR= 530.86
THETA=165.0	Z*D=	9659.0	3STAR=	463.82	TR=	.674	BBO=	238.79	CO=	3.85	TC*CO=	.992	CT*P=	.00 I= 5 BBR= 624.75
THETA=165.0	Z*D=	19318.0	3STAR=	682.09	TR=	.635	BBO=	238.79	CO=	3.85	TC*CO=	.701	CT*P=	.00 I= 6 BBR= 833.81
THETA=165.0	Z*D=	38636.1	3STAR=	1031.18	TR=	.594	BBO=	238.79	CO=	3.85	TC*CO=	.466	CT*P=	.00 I= 7 BBR=1173.08
THETA=165.0	Z*D=	57954.1	3STAR=	1179.77	TR=	.577	BBO=	238.79	CO=	3.85	TC*CO=	.403	CT*P=	.01 I= 8 BBR=1317.63
THETA=165.0	Z*D=	77272.2	3STAR=	1206.83	TR=	.570	BBO=	238.79	CO=	3.85	TC*CO=	.390	CT*P=	.01 I= 9 BBR=1342.95
THETA=165.0	Z*D=	96590.2	3STAR=	1217.00	TR=	.566	BBO=	238.79	CO=	3.85	TC*CO=	.385	CT*P=	.02 I=10 BBR=1352.26
THETA=165.0	Z*D=	193180.5	3STAR=	1227.74	TR=	.563	BBO=	238.79	CO=	3.85	TC*CO=	.380	CT*P=	.06 I=11 BBR=1362.09
THETA=165.0	Z*D=	386360.9	3STAR=	1228.19	TR=	.562	BBO=	238.79	CO=	3.85	TC*CO=	.380	CT*P=	.20 I=12 BBR=1362.50
THETA=165.0	Z*D=	579541.4	3STAR=	1228.19	TR=	.562	BBO=	238.79	CO=	3.85	TC*CO=	.380	CT*P=	.45 I=13 BBR=1362.50

CURVES INTERSECT AT AX= .37959 AY= 524351.98720

THETA=150.0	Z*D=	1732.1	3STAR=	166.55	TR=	.846	BBO=	263.74	CO=	3.64	TC*CO=	2.084	CT*P=	.00 I= 1 BBR= 389.64
THETA=150.0	Z*D=	3464.1	3STAR=	306.17	TR=	.697	BBO=	263.74	CO=	3.64	TC*CO=	1.365	CT*P=	.00 I= 2 BBR= 489.94
THETA=150.0	Z*D=	5196.2	3STAR=	368.32	TR=	.666	BBO=	263.74	CO=	3.64	TC*CO=	1.175	CT*P=	.00 I= 3 BBR= 543.83
THETA=150.0	Z*D=	6928.2	3STAR=	414.78	TR=	.658	BBO=	263.74	CO=	3.64	TC*CO=	1.074	CT*P=	.00 I= 4 BBR= 588.32
THETA=150.0	Z*D=	8660.3	3STAR=	474.13	TR=	.651	BBO=	263.74	CO=	3.64	TC*CO=	.967	CT*P=	.00 I= 5 BBR= 645.78
THETA=150.0	Z*D=	17320.6	3STAR=	708.94	TR=	.609	BBO=	263.74	CO=	3.64	TC*CO=	.672	CT*P=	.00 I= 6 BBR= 869.56
THETA=150.0	Z*D=	34641.2	3STAR=	1153.54	TR=	.566	BBO=	263.74	CO=	3.64	TC*CO=	.417	CT*P=	.00 I= 7 BBR=1382.74
THETA=150.0	Z*D=	51961.8	3STAR=	1373.73	TR=	.546	BBO=	263.74	CO=	3.64	TC*CO=	.345	CT*P=	.01 I= 8 BBR=1517.65
THETA=150.0	Z*D=	69282.4	3STAR=	1441.89	TR=	.537	BBO=	263.74	CO=	3.64	TC*CO=	.325	CT*P=	.01 I= 9 BBR=1583.45
THETA=150.0	Z*D=	86603.0	3STAR=	1456.17	TR=	.532	BBO=	263.74	CO=	3.64	TC*CO=	.320	CT*P=	.02 I=10 BBR=1596.51
THETA=150.0	Z*D=	173206.0	3STAR=	1473.25	TR=	.527	BBO=	263.74	CO=	3.64	TC*CO=	.314	CT*P=	.06 I=11 BBR=1612.15
THETA=150.0	Z*D=	346411.9	3STAR=	1474.25	TR=	.526	BBO=	263.74	CO=	3.64	TC*CO=	.313	CT*P=	.20 I=12 BBR=1613.07
THETA=150.0	Z*D=	519617.9	3STAR=	1474.26	TR=	.526	BBO=	263.74	CO=	3.64	TC*CO=	.313	CT*P=	.45 I=13 BBR=1613.07

CURVES INTERSECT AT AX= .31322 AY= 423344.62403

THETA=135.0	Z*D=	1414.2	3STAR=	156.12	TR=	.841	BBO=	343.33	CO=	2.94	TC*CO=	1.911	CT*P=	.00 I= 1 BBR= 444.80
THETA=135.0	Z*D=	2828.5	3STAR=	309.85	TR=	.673	BBO=	343.33	CO=	2.94	TC*CO=	1.258	CT*P=	.00 I= 2 BBR= 540.93
THETA=135.0	Z*D=	4242.7	3STAR=	417.44	TR=	.618	BBO=	343.33	CO=	2.94	TC*CO=	.992	CT*P=	.00 I= 3 BBR= 629.66
THETA=135.0	Z*D=	5656.9	3STAR=	472.33	TR=	.605	BBO=	343.33	CO=	2.94	TC*CO=	.899	CT*P=	.00 I= 4 BBR= 679.97
THETA=135.0	Z*D=	7071.1	3STAR=	516.71	TR=	.598	BBO=	343.33	CO=	2.94	TC*CO=	.838	CT*P=	.00 I= 5 BBR= 722.19
THETA=135.0	Z*D=	14142.3	3STAR=	697.33	TR=	.557	BBO=	343.33	CO=	2.94	TC*CO=	.634	CT*P=	.00 I= 6 BBR= 888.69
THETA=135.0	Z*D=	28284.5	3STAR=	1064.66	TR=	.510	BBO=	343.33	CO=	2.94	TC*CO=	.416	CT*P=	.00 I= 7 BBR=1239.86
THETA=135.0	Z*D=	42426.8	3STAR=	1281.84	TR=	.486	BBO=	343.33	CO=	2.94	TC*CO=	.339	CT*P=	.01 I= 8 BBR=1448.78
THETA=135.0	Z*D=	56569.0	3STAR=	1389.41	TR=	.473	BBO=	343.33	CO=	2.94	TC*CO=	.308	CT*P=	.01 I= 9 BBR=1551.89
THETA=135.0	Z*D=	70711.3	3STAR=	1422.23	TR=	.466	BBO=	343.33	CO=	2.94	TC*CO=	.298	CT*P=	.02 I=10 BBR=1582.29
THETA=135.0	Z*D=	141422.5	3STAR=	1447.66	TR=	.457	BBO=	343.33	CO=	2.94	TC*CO=	.288	CT*P=	.06 I=11 BBR=1604.43
THETA=135.0	Z*D=	282845.0	3STAR=	1450.26	TR=	.456	BBO=	343.33	CO=	2.94	TC*CO=	.287	CT*P=	.20 I=12 BBR=1606.70
THETA=135.0	Z*D=	424267.5	3STAR=	1450.28	TR=	.456	BBO=	343.33	CO=	2.94	TC*CO=	.287	CT*P=	.45 I=13 BBR=1606.72

CURVES INTERSECT AT AX= .28671 AY= 330402.68397

THETA=120.0	Z*D=	1000.0	3STAR=	144.00	TR=	.870	BBO=	380.16	CO=	2.23	TC*CO=	1.556	CT*P=	.00 I= 1 BBR= 474.59
THETA=120.0	Z*D=	2000.0	3STAR=	274.00	TR=	.658	BBO=	380.16	CO=	2.23	TC*CO=	1.067	CT*P=	.00 I= 2 BBR= 524.33
THETA=120.0	Z*D=	3000.0	3STAR=	382.00	TR=	.559	BBO=	380.16	CO=	2.23	TC*CO=	.799	CT*P=	.00 I= 3 BBR= 594.54
THETA=120.0	Z*D=	4000.1	3STAR=	451.00	TR=	.512	BBO=	380.16	CO=	2.23	TC*CO=	.674	CT*P=	.00 I= 4 BBR= 645.63
THETA=120.0	Z*D=	5000.1	3STAR=	512.00	TR=	.495	BBO=	380.16	CO=	2.23	TC*CO=	.600	CT*P=	.00 I= 5 BBR= 700.04
THETA=120.0	Z*D=	10000.1	3STAR=	705.00	TR=	.463	BBO=	380.16	CO=	2.23	TC*CO=	.447	CT*P=	.00 I= 6 BBR= 881.13
THETA=120.0	Z*D=	20000.3	3STAR=	944.01	TR=	.411	BBO=	380.16	CO=	2.23	TC*CO=	.317	CT*P=	.00 I= 7 BBR=1180.21
THETA=120.0	Z*D=	30000.4	3STAR=	1160.01	TR=	.382	BBO=	380.16	CO=	2.23	TC*CO=	.249	CT*P=	.01 I= 8 BBR=1305.20
THETA=120.0	Z*D=	40000.5	3STAR=	1300.00	TR=	.364	BBO=	380.16	CO=	2.23	TC*CO=	.215	CT*P=	.01 I= 9 BBR=1438.24
THETA=120.0	Z*D=	50000.7	3STAR=	1380.00	TR=	.352	BBO=	380.16	CO=	2.23	TC*CO=	.197	CT*P=	.02 I=10 BBR=1513.69
THETA=120.0	Z*D=	100001.3	3STAR=	1455.13	TR=	.333	BBO=	380.16	CO=	2.23	TC*CO=	.179	CT*P=	.06 I=11 BBR=1581.74
THETA=120.0	Z*D=	200002.6	3STAR=	1463.61	TR=	.329	BBO=	380.16	CO=	2.23	TC*CO=	.176	CT*P=	.20 I=12 BBR=1588.74

CURVES INTERSECT AT AX= .17653 AY= 181178.33280

```
THETA=105.0 Z*D=    517.7 BSTAR=  118.02 TR= .897 BBO=  422.33 CO=  1.97 TC*C0= 1.500 CT*P= .00 I= 1 BBR= 496.98
THETA=105.0 Z*D=   1035.3 BSTAR=  237.46 TR= .763 BBO=  422.33 CO=  1.97 TC*C0= 1.133 CT*P= .00 I= 2 BBR= 559.90
THETA=105.0 Z*D=   1553.0 BSTAR=  376.19 TR= .598 BBO=  422.33 CO=  1.97 TC*C0=  .791 CT*P= .00 I= 3 BBR= 628.93
THETA=105.0 Z*D=   2070.6 BSTAR=  509.13 TR= .446 BBO=  422.33 CO=  1.97 TC*C0=  .531 CT*P= .00 I= 4 BBR= 697.95
THETA=105.0 Z*D=   2588.3 BSTAR=  605.42 TR= .362 BBO=  422.33 CO=  1.97 TC*C0=  .397 CT*P= .00 I= 5 BBR= 758.41
THETA=105.0 Z*D=   5176.5 BSTAR=  876.36 TR= .256 BBO=  422.33 CO=  1.97 TC*C0=  .216 CT*P= .00 I= 6 BBR= 984.48
THETA=105.0 Z*D=  10353.0 BSTAR= 1262.00 TR= .224 BBO=  422.33 CO=  1.97 TC*C0=  .137 CT*P= .00 I= 7 BBR=1356.70
THETA=105.0 Z*D=  15529.5 BSTAR= 1441.18 TR= .197 BBO=  422.33 CO=  1.97 TC*C0=  .107 CT*P= .01 I= 8 BBR=1524.34
THETA=105.0 Z*D=  20706.1 BSTAR= 1646.83 TR= .177 BBO=  422.33 CO=  1.97 TC*C0=  .086 CT*P= .01 I= 9 BBR=1721.75
THETA=105.0 Z*D=  25882.6 BSTAR= 1836.48 TR= .164 BBO=  422.33 CO=  1.97 TC*C0=  .071 CT*P= .02 I=10 BBR=1905.71
THETA=105.0 Z*D=  51765.1 BSTAR= 2292.36 TR= .132 BBO=  422.33 CO=  1.97 TC*C0=  .047 CT*P= .06 I=11 BBR=2348.05

        CURVES INTERSECT AT AX=         .05083  AY=    47426.63640

THETA=100.0 Z*D=    347.2 BSTAR=  168.41 TR= .910 BBO=  450.25 CO=  1.84 TC*C0= 1.302 CT*P= .00 I= 1 BBR= 578.25
THETA=100.0 Z*D=    694.5 BSTAR=  336.83 TR= .826 BBO=  450.25 CO=  1.84 TC*C0=  .964 CT*P= .00 I= 2 BBR= 708.90
THETA=100.0 Z*D=   1041.7 BSTAR=  496.60 TR= .674 BBO=  450.25 CO=  1.84 TC*C0=  .696 CT*P= .00 I= 3 BBR= 799.97
THETA=100.0 Z*D=   1389.0 BSTAR=  593.14 TR= .534 BBO=  450.25 CO=  1.84 TC*C0=  .529 CT*P= .00 I= 4 BBR= 833.35
THETA=100.0 Z*D=   1736.2 BSTAR=  689.67 TR= .437 BBO=  450.25 CO=  1.84 TC*C0=  .408 CT*P= .00 I= 5 BBR= 886.64
THETA=100.0 Z*D=   3472.4 BSTAR=  984.61 TR= .167 BBO=  450.25 CO=  1.84 TC*C0=  .130 CT*P= .00 I= 6 BBR=1059.69
THETA=100.0 Z*D=   6944.9 BSTAR= 1352.83 TR= .126 BBO=  450.25 CO=  1.84 TC*C0=  .074 CT*P= .00 I= 7 BBR=1409.51
THETA=100.0 Z*D=  10417.3 BSTAR= 1557.53 TR= .109 BBO=  450.25 CO=  1.84 TC*C0=  .056 CT*P= .01 I= 8 BBR=1606.71
THETA=100.0 Z*D=  13889.8 BSTAR= 1703.37 TR= .096 BBO=  450.25 CO=  1.84 TC*C0=  .045 CT*P= .01 I= 9 BBR=1746.44
THETA=100.0 Z*D=  17362.2 BSTAR= 1853.94 TR= .087 BBO=  450.25 CO=  1.84 TC*C0=  .038 CT*P= .02 I=10 BBR=1893.03
THETA=100.0 Z*D=  34724.4 BSTAR= 2424.49 TR= .061 BBO=  450.25 CO=  1.84 TC*C0=  .021 CT*P= .06 I=11 BBR=2452.10

        CURVES INTERSECT AT AX=         .03166  AY=    23666.18193

THETA= 95.0 Z*D=    174.2 BSTAR=  149.80 TR= .917 BBO=  490.05 CO=  1.69 TC*C0= 1.268 CT*P= .00 I= 1 BBR= 599.35
THETA= 95.0 Z*D=    348.4 BSTAR=  299.61 TR= .829 BBO=  490.05 CO=  1.69 TC*C0=  .973 CT*P= .00 I= 2 BBR= 706.01
THETA= 95.0 Z*D=    522.6 BSTAR=  449.41 TR= .736 BBO=  490.05 CO=  1.69 TC*C0=  .753 CT*P= .00 I= 3 BBR= 809.97
THETA= 95.0 Z*D=    696.8 BSTAR=  599.22 TR= .585 BBO=  490.05 CO=  1.69 TC*C0=  .607 CT*P= .00 I= 4 BBR= 934.67
THETA= 95.0 Z*D=    871.0 BSTAR=  749.02 TR= .574 BBO=  490.05 CO=  1.69 TC*C0=  .462 CT*P= .00 I= 5 BBR=1030.48
THETA= 95.0 Z*D=   1741.9 BSTAR= 1067.74 TR= .195 BBO=  490.05 CO=  1.69 TC*C0=  .139 CT*P= .00 I= 6 BBR=1163.09
THETA= 95.0 Z*D=   3483.8 BSTAR= 1299.03 TR= .029 BBO=  490.05 CO=  1.69 TC*C0=  .019 CT*P= .00 I= 7 BBR=1313.48
THETA= 95.0 Z*D=   5225.8 BSTAR= 1395.80 TR= .019 BBO=  490.05 CO=  1.69 TC*C0=  .011 CT*P= .01 I= 8 BBR=1409.22
THETA= 95.0 Z*D=   6967.7 BSTAR= 1479.03 TR= .018 BBO=  490.05 CO=  1.69 TC*C0=  .010 CT*P= .01 I= 9 BBR=1487.78

        CURVES INTERSECT AT AX=         .01035  AY=     6466.60132

        AZIMUTH OF PATH OF SIGHT WITH RESPECT TO SUN IS 180 DEGREES.

  ZENITH OF PATH OF SIGHT = 180  DISTANCE TO TARGET AXIS =       0  ALTITUDE =  608610  CONTRAST IS POSITIVE

  ZENITH OF PATH OF SIGHT = 165  DISTANCE TO TARGET AXIS =  140537  ALTITUDE =  924352  CONTRAST IS POSITIVE

  ZENITH OF PATH OF SIGHT = 150  DISTANCE TO TARGET AXIS =  244400  ALTITUDE =  423345  CONTRAST IS POSITIVE

  ZENITH OF PATH OF SIGHT = 135  DISTANCE TO TARGET AXIS =  330382  ALTITUDE =  330403  CONTRAST IS POSITIVE

  ZENITH OF PATH OF SIGHT = 120  DISTANCE TO TARGET AXIS =  313787  ALTITUDE =  181178  CONTRAST IS POSITIVE

  ZENITH OF PATH OF SIGHT = 105  DISTANCE TO TARGET AXIS =  176977  ALTITUDE =   47427  CONTRAST IS POSITIVE

  ZENITH OF PATH OF SIGHT = 100  DISTANCE TO TARGET AXIS =  134220  ALTITUDE =   23666  CONTRAST IS POSITIVE

  ZENITH OF PATH OF SIGHT =  95  DISTANCE TO TARGET AXIS =   73945  ALTITUDE =    6467  CONTRAST IS POSITIVE

  COORDINATES FOR PLOTTING 4 CROSS SECTIONS, X = HORIZONTAL Z = VERTICAL

     X1      Z1      X2      Z2      X3      Z3      X4      Z4

   807867    8057  825324    6531  831460    9994  826335    6442

   710432   33425  746545   27058  764555   23882  761097   24492

   646471   67941  702187   53010  716800   49148  709151   51144
```

```
   373258  304136  521493  218547  597831  174470  597249  174806

   116029  784021  497453  402572  565713  334308  606636  293383

   407603  852920  584356  546753  633914  460909  646453  439190

   691570  777662  715326  689029  751808  552913  750471  557899

   900000  608610  900000  608610  900000  608610  900000  608610

  1040537  524352 1049529  557899 1048192  552913 1084674  689029

  1144400  423345 1153547  439190 1166086  460909 1215644  546753

  1230382  330403 1193364  293383 1234287  334308 1302947  402572

  1213787  181178 1202751  174806 1202169  174470 1278507  218547

  1076977   47427 1090849   51144 1083400   49148 1097813   53010

  1034220   23666 1038903   24492 1035445   23882 1053455   27058

   973945    6467  973665    6442  968540    5994  974676    6531

 AXSL= 1800000.0  CSLX=   18000.0  CSLY= 1620000.0  AXLX=  900000.0  AXLY=         0

 NTGDM= 100  NAINC=  180000  NPROB= 50

 CURRENT ELAPSED TIME IS       0 MINUTES       55 SECONDS.
```

```
      PROGRAM PODV1
C     ...PROGRAM PODV1...1NOV.65...BARKDOLL,...VISLAB ..UCSD
C     ...PODV1= PROBABILITY OF DETECTION VOLUME PHASE 1
C     ...THIS PROGRAM PROVIDES INPUT DATA FOR THE
C     ...SOLUTION OF A PROBABILITY OF TARGET DETECTION VOLUME.
C     ...THE CALLED SEQUENCE OF PROGRAMS WILL PRINT THE
C     ...ALTITUDE AND DISTANCE FROM THE TARGET AXIS FOR
C     ...8 DOWNWARD LOOKING ZENITHS OF PATH OF SIGHT,
C     ..THETA=180,165,150,135,120,105,100,95 DEGREES AND
C     ...FOR 5 AZIMUTHS OF PATH OF SIGHT WITH RESPECT
C     ..TO THE SUN, PHI=0,45,90,135,180 DEGREES.
C     ...THE PROGRAM WILL ALSO PLOT THESE POINTS AS
C     ...4 HEMISPHERIC CROSS SECTIONS.
C
C     ...VARIABLE INPUTS...
C     ...OPT=OPTION FOR ATMOSPHERIC AND OPTICAL SYSTEM
C     .....OPT=0 FOR VIEWING THROUGH ATMOSPHERE ONLY
C     .....OPT=-1 FOR OPTICS AND NO ATMOSPHERE
C     .....OPT=+1 FOR OPTICS AND AN ATMOSPHERE
C     ...FNUMB=FLIGHT NUMBER FOR ATMOSPHERIC DATA
C     ...OPTNU=OPTICAL SYSTEM INDEX NUMBER
C     ...DIAM=TARGET DIAMETER IN FT..NOT TO EXCEED 100 FT.
C     ...OBJ=INDEX FOR DIRECTIONAL REFLECTANCE PROPERTIES
C     ...OF TARGET OBJECT
C     ...BAC=INDEX FOR DIRECTIONAL REFLECTANCE PROPERTIES
C     ...OF BACKGROUND
C     ...PROBK=CONSTANT FOR DEVIATION FROM 50 PERCENT
C     ...PROBABILITY,1. FOR 50,1.206 FOR 70, 1.50 FOR 90, AND
C     ...1.91 FOR 99 PERCENT PROBABILITY OF DETECTION
C     ...NPROB=INTEGER REPRESENTING PROBABILITY
C     ...SW1=SWITCH FOR OUTPUT PRINTING, 1 FOR CALCULATIONS
C     ...AND COORDINATES, 0 FOR COORDINATES ONLY
C     ...SW2=SWITCH FOR PLOTTING, 1 IF PLOT IS DESIRED
C     ...0 FOR NO PLOT
C     ...
C     ...CALLED PROGRAMS=TCA.
C
      OPT=+1.
      FNUMB=74.
      DIAM=100.
      OBJ=1.
      BAC=1.
      PROBK=1.
      NPROB=50
      SW1=1.
      SW2=1.
      CALL DATA1
      CALL DATA2
      CALL DATA 3
      CALL TCA(OPT,FNUMB,OPTNU,DIAM,OBJ,BAC,PROBK,NPROB,
     1SW1,SW2)
      CALL PREP(9)
      END
```

```
TARGET DETECTION FOR INFINITE VIEWING TIME

PATH OF SIGHT THROUGH OPTICAL SYSTEM AND ATMOSPHERE

PROGRAM DATA FROM FLIGHT NUMBER  74

PROBABILITY OF DETECTION IS 50 PERCENT

TARGET DIAMETER IN FT. = 100

BACKGROUND FOR TARGET IS PINE TREES

TARGET IS SPHERICAL AND PAINTED GRAY
```

AZIMUTH OF PATH OF SIGHT WITH RESPECT TO SUN IS 0 DEGREES

THETA=180.0	Z*D=	2000.0	BSTAR=	131.71	TR=	.763	BBO=	197.80	CO=	4.95	TC*CO=	2.642	CR*P=	.00	I= 1 BBR= 282.71
THETA=180.0	Z*D=	4000.0	BSTAR=	220.81	TR=	.648	BBO=	197.80	CO=	4.95	TC*CO=	1.816	CR*P=	.00	I= 2 BBR= 348.99
THETA=180.0	Z*D=	6000.0	BSTAR=	273.01	TR=	.632	BBO=	197.80	CO=	4.95	TC*CO=	1.553	CR*P=	.00	I= 3 BBR= 397.92
THETA=180.0	Z*D=	8000.0	BSTAR=	318.01	TR=	.625	BBO=	197.80	CO=	4.95	TC*CO=	1.384	CR*P=	.00	I= 4 BBR= 441.56
THETA=180.0	Z*D=	10000.0	BSTAR=	360.31	TR=	.615	BBO=	197.80	CO=	4.95	TC*CO=	1.248	CR*P=	.00	I= 5 BBR= 481.97
THETA=180.0	Z*D=	20000.0	BSTAR=	553.81	TR=	.581	BBO=	197.80	CO=	4.95	TC*CO=	.850	CR*P=	.00	I= 6 BBR= 668.75
THETA=180.0	Z*D=	40000.0	BSTAR=	846.31	TR=	.543	BBO=	197.80	CO=	4.95	TC*CO=	.557	CR*P=	.00	I= 7 BBR= 953.46
THETA=180.0	Z*D=	60000.0	BSTAR=	965.11	TR=	.528	BBO=	197.80	CO=	4.95	TC*CO=	.483	CR*P=	.01	I= 8 BBR=1069.61
THETA=180.0	Z*D=	80000.0	BSTAR=	980.26	TR=	.522	BBO=	197.80	CO=	4.95	TC*CO=	.472	CR*P=	.01	I= 9 BBR=1083.59
THETA=180.0	Z*D=	100000.0	BSTAR=	987.97	TR=	.519	BBO=	197.80	CO=	4.95	TC*CO=	.466	CR*P=	.02	I=10 BBR=1090.70
THETA=180.0	Z*D=	200000.0	BSTAR=	995.77	TR=	.516	BBO=	197.80	CO=	4.95	TC*CO=	.460	CR*P=	.06	I=11 BBR=1097.90
THETA=180.0	Z*D=	400000.0	BSTAR=	996.05	TR=	.516	BBO=	197.80	CO=	4.95	TC*CO=	.460	CR*P=	.20	I=12 BBR=1098.17
THETA=180.0	Z*D=	600000.0	BSTAR=	996.05	TR=	.516	BBO=	197.80	CO=	4.95	TC*CO=	.460	CR*P=	.45	I=13 BBR=1098.17
THETA=180.0	Z*D=	800000.0	BSTAR=	996.05	TR=	.516	BBO=	197.80	CO=	4.95	TC*CO=	.460	CR*P=	.79	I=14 BBR=1098.17

CURVES INTERSECT AT AX= .45990 AY= 609879.55823

THETA=165.0	Z*D=	1931.8	BSTAR=	125.55	TR=	.756	BBO=	143.15	CO=	8.75	TC*CO=	4.053	CR*P=	.00	I= 1 BBR= 233.94
THETA=165.0	Z*D=	3863.6	BSTAR=	237.46	TR=	.640	BBO=	143.15	CO=	8.75	TC*CO=	2.435	CR*P=	.00	I= 2 BBR= 329.03
THETA=165.0	Z*D=	5795.4	BSTAR=	278.33	TR=	.622	BBO=	143.15	CO=	8.75	TC*CO=	2.122	CR*P=	.00	I= 3 BBR= 367.43
THETA=165.0	Z*D=	7727.2	BSTAR=	330.94	TR=	.615	BBO=	143.15	CO=	8.75	TC*CO=	1.839	CR*P=	.00	I= 4 BBR= 419.01
THETA=165.0	Z*D=	9659.0	BSTAR=	366.84	TR=	.607	BBO=	143.15	CO=	8.75	TC*CO=	1.675	CR*P=	.00	I= 5 BBR= 453.67
THETA=165.0	Z*D=	19318.0	BSTAR=	453.61	TR=	.572	BBO=	143.15	CO=	8.75	TC*CO=	1.313	CR*P=	.00	I= 6 BBR= 545.47
THETA=165.0	Z*D=	38636.1	BSTAR=	591.81	TR=	.535	BBO=	143.15	CO=	8.75	TC*CO=	1.002	CR*P=	.01	I= 7 BBR= 668.38
THETA=165.0	Z*D=	57954.1	BSTAR=	646.24	TR=	.520	BBO=	143.15	CO=	8.75	TC*CO=	.903	CR*P=	.01	I= 8 BBR= 720.52
THETA=165.0	Z*D=	77272.2	BSTAR=	659.15	TR=	.513	BBO=	143.15	CO=	8.75	TC*CO=	.877	CR*P=	.01	I= 9 BBR= 732.59
THETA=165.0	Z*D=	96590.2	BSTAR=	664.61	TR=	.510	BBO=	143.15	CO=	8.75	TC*CO=	.866	CR*P=	.02	I=10 BBR= 737.59
THETA=165.0	Z*D=	193180.5	BSTAR=	670.38	TR=	.506	BBO=	143.15	CO=	8.75	TC*CO=	.854	CR*P=	.06	I=11 BBR= 742.96
THETA=165.0	Z*D=	386360.9	BSTAR=	670.62	TR=	.506	BBO=	143.15	CO=	8.75	TC*CO=	.853	CR*P=	.23	I=12 BBR= 743.08
THETA=165.0	Z*D=	579541.4	BSTAR=	670.62	TR=	.506	BBO=	143.15	CO=	8.75	TC*CO=	.853	CR*P=	.50	I=13 BBR= 743.08
THETA=165.0	Z*D=	772721.9	BSTAR=	670.62	TR=	.506	BBO=	143.15	CO=	8.75	TC*CO=	.853	CR*P=	.88	I=14 BBR= 743.08

CURVES INTERSECT AT AX= .85341 AY= 761154.48257

THETA=150.0	Z*D=	1732.1	BSTAR=	134.94	TR=	.761	BBO=	127.12	CO=	18.16	TC*CO=	7.584	CR*P=	.00	I= 1 BBR= 231.71
THETA=150.0	Z*D=	3464.1	BSTAR=	246.03	TR=	.627	BBO=	127.12	CO=	18.16	TC*CO=	4.444	CR*P=	.00	I= 2 BBR= 325.75
THETA=150.0	Z*D=	5196.2	BSTAR=	301.90	TR=	.599	BBO=	127.12	CO=	18.16	TC*CO=	3.657	CR*P=	.00	I= 3 BBR= 378.04
THETA=150.0	Z*D=	6928.2	BSTAR=	348.28	TR=	.592	BBO=	127.12	CO=	18.16	TC*CO=	3.227	CR*P=	.00	I= 4 BBR= 423.56
THETA=150.0	Z*D=	8660.3	BSTAR=	403.66	TR=	.586	BBO=	127.12	CO=	18.16	TC*CO=	2.828	CR*P=	.00	I= 5 BBR= 478.12
THETA=150.0	Z*D=	17320.6	BSTAR=	519.99	TR=	.548	BBO=	127.12	CO=	18.16	TC*CO=	2.146	CR*P=	.00	I= 6 BBR= 589.56
THETA=150.0	Z*D=	34641.2	BSTAR=	704.10	TR=	.509	BBO=	127.12	CO=	18.16	TC*CO=	1.529	CR*P=	.01	I= 7 BBR= 768.92
THETA=150.0	Z*D=	51961.8	BSTAR=	797.06	TR=	.491	BBO=	127.12	CO=	18.16	TC*CO=	1.319	CR*P=	.01	I= 8 BBR= 859.49
THETA=150.0	Z*D=	69282.4	BSTAR=	826.94	TR=	.483	BBO=	127.12	CO=	18.16	TC*CO=	1.255	CR*P=	.01	I= 9 BBR= 888.35
THETA=150.0	Z*D=	86603.0	BSTAR=	835.02	TR=	.479	BBO=	127.12	CO=	18.16	TC*CO=	1.234	CR*P=	.02	I=10 BBR= 895.90
THETA=150.0	Z*D=	173206.0	BSTAR=	844.68	TR=	.474	BBO=	127.12	CO=	18.16	TC*CO=	1.209	CR*P=	.06	I=11 BBR= 904.94
THETA=150.0	Z*D=	346411.9	BSTAR=	845.25	TR=	.474	BBO=	127.12	CO=	18.16	TC*CO=	1.208	CR*P=	.21	I=12 BBR= 905.47
THETA=150.0	Z*D=	519617.9	BSTAR=	845.25	TR=	.474	BBO=	127.12	CO=	18.16	TC*CO=	1.208	CR*P=	.47	I=13 BBR= 905.47
THETA=150.0	Z*D=	692823.8	BSTAR=	845.25	TR=	.474	BBO=	127.12	CO=	18.16	TC*CO=	1.208	CR*P=	.82	I=14 BBR= 905.47
THETA=150.0	Z*D=	866029.8	BSTAR=	845.25	TR=	.474	BBO=	127.12	CO=	18.16	TC*CO=	1.208	CR*P=	1.30	I=15 BBR= 905.47

CURVES INTERSECT AT AX= 1.20762 AY= 832109.95479

THETA=135.0	Z*D=	1414.2	BSTAR=	118.64	TR=	.757	BBO=	127.12	CO=	27.50	TC*CO=	12.315	CR*P=	.00	I= 1 BBR= 214.43
THETA=135.0	Z*D=	2828.5	BSTAR=	212.24	TR=	.606	BBO=	127.12	CO=	27.50	TC*CO=	7.322	CR*P=	.00	I= 2 BBR= 289.24
THETA=135.0	Z*D=	4242.7	BSTAR=	293.26	TR=	.556	BBO=	127.12	CO=	27.50	TC*CO=	5.344	CR*P=	.00	I= 3 BBR= 363.97
THETA=135.0	Z*D=	5656.9	BSTAR=	341.35	TR=	.544	BBO=	127.12	CO=	27.50	TC*CO=	4.635	CR*P=	.00	I= 4 BBR= 410.54
THETA=135.0	Z*D=	7071.1	BSTAR=	405.68	TR=	.539	BBO=	127.12	CO=	27.50	TC*CO=	3.972	CR*P=	.00	I= 5 BBR= 474.15
THETA=135.0	Z*D=	14142.3	BSTAR=	550.08	TR=	.502	BBO=	127.12	CO=	27.50	TC*CO=	2.857	CR*P=	.00	I= 6 BBR= 613.94
THETA=135.0	Z*D=	28284.5	BSTAR=	697.39	TR=	.459	BBO=	127.12	CO=	27.50	TC*CO=	2.125	CR*P=	.01	I= 7 BBR= 755.77
THETA=135.0	Z*D=	42426.8	BSTAR=	783.70	TR=	.438	BBO=	127.12	CO=	27.50	TC*CO=	1.823	CR*P=	.01	I= 8 BBR= 839.33
THETA=135.0	Z*D=	56569.0	BSTAR=	828.38	TR=	.426	BBO=	127.12	CO=	27.50	TC*CO=	1.687	CR*P=	.01	I= 9 BBR= 882.51
THETA=135.0	Z*D=	70711.3	BSTAR=	843.57	TR=	.420	BBO=	127.12	CO=	27.50	TC*CO=	1.636	CR*P=	.02	I=10 BBR= 896.90
THETA=135.0	Z*D=	141422.5	BSTAR=	858.45	TR=	.411	BBO=	127.12	CO=	27.50	TC*CO=	1.578	CR*P=	.06	I=11 BBR= 910.59
THETA=135.0	Z*D=	282845.0	BSTAR=	859.98	TR=	.410	BBO=	127.12	CO=	27.50	TC*CO=	1.572	CR*P=	.21	I=12 BBR= 912.11
THETA=135.0	Z*D=	424267.5	BSTAR=	859.99	TR=	.410	BBO=	127.12	CO=	27.50	TC*CO=	1.572	CR*P=	.47	I=13 BBR= 912.12
THETA=135.0	Z*D=	565690.0	BSTAR=	859.99	TR=	.410	BBO=	127.12	CO=	27.50	TC*CO=	1.572	CR*P=	.82	I=14 BBR= 912.12
THETA=135.0	Z*D=	707112.6	BSTAR=	859.99	TR=	.410	BBO=	127.12	CO=	27.50	TC*CO=	1.572	CR*P=	1.30	I=15 BBR= 912.12
THETA=135.0	Z*D=	1060668.8	BSTAR=	859.99	TR=	.410	BBO=	127.12	CO=	27.50	TC*CO=	1.572	CR*P=	2.90	I=16 BBR= 912.12

CURVES INTERSECT AT AX= 1.97191 AY= 767588.77872

THETA=120.0	Z*D=	1000.0	BSTAR=	121.81	TR=	.783	BBO=	155.03	CO=	11.45	TC*CO=	5.715	CR*P=	.00	I= 1 BBR= 243.15
THETA=120.0	Z*D=	2000.0	BSTAR=	203.71	TR=	.593	BBO=	155.03	CO=	11.45	TC*CO=	3.560	CR*P=	.00	I= 2 BBR= 295.59
THETA=120.0	Z*D=	3000.0	BSTAR=	279.31	TR=	.503	BBO=	155.03	CO=	11.45	TC*CO=	2.500	CR*P=	.00	I= 3 BBR= 357.12
THETA=120.0	Z*D=	4000.1	BSTAR=	345.01	TR=	.461	BBO=	155.03	CO=	11.45	TC*CO=	1.964	CR*P=	.00	I= 4 BBR= 416.45
THETA=120.0	Z*D=	5000.1	BSTAR=	383.71	TR=	.445	BBO=	155.03	CO=	11.45	TC*CO=	1.746	CR*P=	.00	I= 5 BBR= 452.73
THETA=120.0	Z*D=	10000.1	BSTAR=	685.21	TR=	.417	BBO=	155.03	CO=	11.45	TC*CO=	.987	CR*P=	.00	I= 6 BBR= 749.88
THETA=120.0	Z*D=	20000.3	BSTAR=	817.51	TR=	.370	BBO=	155.03	CO=	11.45	TC*CO=	.750	CR*P=	.01	I= 7 BBR= 874.95
THETA=120.0	Z*D=	30000.4	BSTAR=	929.11	TR=	.344	BBO=	155.03	CO=	11.45	TC*CO=	.621	CR*P=	.01	I= 8 BBR= 982.40
THETA=120.0	Z*D=	40000.5	BSTAR=	1010.11	TR=	.327	BBO=	155.03	CO=	11.45	TC*CO=	.548	CR*P=	.01	I= 9 BBR=1060.35
THETA=120.0	Z*D=	50000.7	BSTAR=	1046.11	TR=	.316	BBO=	155.03	CO=	11.45	TC*CO=	.513	CR*P=	.02	I=10 BBR=1095.18
THETA=120.0	Z*D=	100001.3	BSTAR=	1091.77	TR=	.300	BBO=	155.03	CO=	11.45	TC*CO=	.468	CR*P=	.06	I=11 BBR=1138.25

THETA=120.0 Z*D= 200002.6 BSTAR= 1098.07 TR= .296 BBO= 155.03 CO= 11.45 TC*CO= .460 CR*P= .20 I=12 BBR=1144.00
THETA=120.0 Z*D= 300003.9 BSTAR= 1098.29 TR= .296 BBO= 155.03 CO= 11.45 TC*CO= .460 CR*P= .45 I=13 BBR=1144.20
THETA=120.0 Z*D= 400005.2 BSTAR= 1098.30 TR= .296 BBO= 155.03 CO= 11.45 TC*CO= .459 CR*P= .79 I=14 BBR=1144.21

CURVES INTERSECT AT AX= .45950 AY= 302827.90846

THETA=105.0 Z*D= 517.7 BSTAR= 115.00 TR= .808 BBO= 225.13 CO= 7.81 TC*CO= 4.785 CR*P= .00 I= 1 BBR= 296.90
THETA=105.0 Z*D= 1035.3 BSTAR= 219.37 TR= .687 BBO= 225.13 CO= 7.81 TC*CO= 3.231 CR*P= .00 I= 2 BBR= 374.06
THETA=105.0 Z*D= 1553.0 BSTAR= 330.25 TR= .539 BBO= 225.13 CO= 7.81 TC*CO= 2.098 CR*P= .00 I= 3 BBR= 451.51
THETA=105.0 Z*D= 2070.6 BSTAR= 439.67 TR= .402 BBO= 225.13 CO= 7.81 TC*CO= 1.332 CR*P= .00 I= 4 BBR= 530.06
THETA=105.0 Z*D= 2588.3 BSTAR= 539.84 TR= .326 BBO= 225.13 CO= 7.81 TC*CO= .935 CR*P= .00 I= 5 BBR= 613.24
THETA=105.0 Z*D= 5176.5 BSTAR= 902.22 TR= .230 BBO= 225.13 CO= 7.81 TC*CO= .425 CR*P= .00 I= 6 BBR= 954.09
THETA=105.0 Z*D= 10353.0 BSTAR= 1261.37 TR= .202 BBO= 225.13 CO= 7.81 TC*CO= .272 CR*P= .00 I= 7 BBR=1306.90
THETA=105.0 Z*D= 15529.5 BSTAR= 1384.41 TR= .177 BBO= 225.13 CO= 7.81 TC*CO= .219 CR*P= .01 I= 8 BBR=1424.30
THETA=105.0 Z*D= 20706.1 BSTAR= 1521.63 TR= .160 BBO= 225.13 CO= 7.81 TC*CO= .180 CR*P= .01 I= 9 BBR=1557.38
THETA=105.0 Z*D= 25882.6 BSTAR= 1638.00 TR= .148 BBO= 225.13 CO= 7.81 TC*CO= .155 CR*P= .02 I=10 BBR=1671.21
THETA=105.0 Z*D= 51765.1 BSTAR= 1927.05 TR= .119 BBO= 225.13 CO= 7.81 TC*CO= .107 CR*P= .06 I=11 BBR=1953.77
THETA=105.0 Z*D= 103530.3 BSTAR= 1992.98 TR= .107 BBO= 225.13 CO= 7.81 TC*CO= .094 CR*P= .20 I=12 BBR=2007.14

CURVES INTERSECT AT AX= .10289 AY= 67751.36679

THETA=100.0 Z*D= 347.2 BSTAR= 135.49 TR= .819 BBO= 275.02 CO= 7.25 TC*CO= 4.528 CR*P= .00 I= 1 BBR= 360.79
THETA=100.0 Z*D= 694.5 BSTAR= 259.88 TR= .744 BBO= 275.02 CO= 7.25 TC*CO= 3.193 CR*P= .00 I= 2 BBR= 464.42
THETA=100.0 Z*D= 1041.7 BSTAR= 381.67 TR= .606 BBO= 275.02 CO= 7.25 TC*CO= 2.205 CR*P= .00 I= 3 BBR= 548.44
THETA=100.0 Z*D= 1389.0 BSTAR= 494.49 TR= .480 BBO= 275.02 CO= 7.25 TC*CO= 1.553 CR*P= .00 I= 4 BBR= 616.54
THETA=100.0 Z*D= 1736.2 BSTAR= 597.31 TR= .394 BBO= 275.02 CO= 7.25 TC*CO= 1.129 CR*P= .00 I= 5 BBR= 695.39
THETA=100.0 Z*D= 3472.4 BSTAR= 999.45 TR= .150 BBO= 275.02 CO= 7.25 TC*CO= .288 CR*P= .00 I= 6 BBR=1040.73
THETA=100.0 Z*D= 6944.9 BSTAR= 1330.14 TR= .113 BBO= 275.02 CO= 7.25 TC*CO= .166 CR*P= .00 I= 7 BBR=1361.30
THETA=100.0 Z*D= 10417.3 BSTAR= 1472.88 TR= .098 BBO= 275.02 CO= 7.25 TC*CO= .131 CR*P= .01 I= 8 BBR=1499.92
THETA=100.0 Z*D= 13889.8 BSTAR= 1579.14 TR= .086 BBO= 275.02 CO= 7.25 TC*CO= .107 CR*P= .01 I= 9 BBR=1602.31
THETA=100.0 Z*D= 17362.2 BSTAR= 1698.15 TR= .078 BBO= 275.02 CO= 7.25 TC*CO= .091 CR*P= .02 I=10 BBR=1719.44
THETA=100.0 Z*D= 34724.4 BSTAR= 2126.39 TR= .055 BBO= 275.02 CO= 7.25 TC*CO= .051 CR*P= .06 I=11 BBR=2141.38

CURVES INTERSECT AT AX= .05447 AY= 33362.05398

THETA= 95.0 Z*D= 174.2 BSTAR= 128.69 TR= .826 BBO= 510.25 CO= 3.45 TC*CO= 2.640 CR*P= .00 I= 1 BBR= 549.95
THETA= 95.0 Z*D= 348.4 BSTAR= 246.27 TR= .746 BBO= 510.25 CO= 3.45 TC*CO= 2.093 CR*P= .00 I= 2 BBR= 627.10
THETA= 95.0 Z*D= 522.6 BSTAR= 363.85 TR= .662 BBO= 510.25 CO= 3.45 TC*CO= 1.660 CR*P= .00 I= 3 BBR= 701.72
THETA= 95.0 Z*D= 696.8 BSTAR= 491.43 TR= .616 BBO= 510.25 CO= 3.45 TC*CO= 1.362 CR*P= .00 I= 4 BBR= 795.78
THETA= 95.0 Z*D= 871.0 BSTAR= 599.01 TR= .517 BBO= 510.25 CO= 3.45 TC*CO= 1.054 CR*P= .00 I= 5 BBR= 862.76
THETA= 95.0 Z*D= 1741.9 BSTAR= 946.52 TR= .175 BBO= 510.25 CO= 3.45 TC*CO= .297 CR*P= .00 I= 6 BBR=1035.98
THETA= 95.0 Z*D= 3483.8 BSTAR= 1333.85 TR= .027 BBO= 510.25 CO= 3.45 TC*CO= .034 CR*P= .00 I= 7 BBR=1367.38
THETA= 95.0 Z*D= 5225.8 BSTAR= 1550.40 TR= .017 BBO= 510.25 CO= 3.45 TC*CO= .020 CR*P= .01 I= 8 BBR=1559.22
THETA= 95.0 Z*D= 6967.7 BSTAR= 1708.91 TR= .016 BBO= 510.25 CO= 3.45 TC*CO= .016 CR*P= .01 I= 9 BBR=1717.11
THETA= 95.0 Z*D= 8709.6 BSTAR= 1886.59 TR= .015 BBO= 510.25 CO= 3.45 TC*CO= .014 CR*P= .02 I=10 BBR=1894.13

CURVES INTERSECT AT AX= .01478 AY= 8037.55352

AZIMUTH OF PATH OF SIGHT WITH RESPECT TO SUN IS 0 DEGREES

ZENITH OF PATH OF SIGHT = 180 DISTANCE TO TARGET AXIS = 0 ALTITUDE = 605880 CONTRAST IS POSITIVE

ZENITH OF PATH OF SIGHT = 165 DISTANCE TO TARGET AXIS = 234005 ALTITUDE = 761154 CONTRAST IS POSITIVE

ZENITH OF PATH OF SIGHT = 150 DISTANCE TO TARGET AXIS = 480383 ALTITUDE = 832110 CONTRAST IS POSITIVE

ZENITH OF PATH OF SIGHT = 135 DISTANCE TO TARGET AXIS = 767540 ALTITUDE = 767589 CONTRAST IS POSITIVE

ZENITH OF PATH OF SIGHT = 120 DISTANCE TO TARGET AXIS = 524476 ALTITUDE = 302828 CONTRAST IS POSITIVE

ZENITH OF PATH OF SIGHT = 105 DISTANCE TO TARGET AXIS = 252821 ALTITUDE = 67751 CONTRAST IS POSITIVE

ZENITH OF PATH OF SIGHT = 100 DISTANCE TO TARGET AXIS = 189209 ALTITUDE = 33362 CONTRAST IS POSITIVE

ZENITH OF PATH OF SIGHT = 95 DISTANCE TO TARGET AXIS = 91908 ALTITUDE = 8038 CONTRAST IS POSITIVE

AZIMUTH OF PATH OF SIGHT WITH RESPECT TO SUN IS 45 DEGREES

THETA=180.0	Z*D=	2000.0	BSTAR=	131.71	TR=	.762	BBO=	197.80	CO=	4.95	TC*CO=	2.639	CR*P=	.00	I= 1	BBR=	282.42
THETA=180.0	Z*D=	4000.0	BSTAR=	220.81	TR=	.646	BBO=	197.80	CO=	4.95	TC*CO=	1.813	CR*P=	.00	I= 2	BBR=	348.55
THETA=180.0	Z*D=	6000.0	BSTAR=	273.01	TR=	.630	BBO=	197.80	CO=	4.95	TC*CO=	1.551	CR*P=	.00	I= 3	BBR=	397.59
THETA=180.0	Z*D=	8000.0	BSTAR=	318.01	TR=	.623	BBO=	197.80	CO=	4.95	TC*CO=	1.382	CR*P=	.00	I= 4	BBR=	441.73
THETA=180.0	Z*D=	10000.0	BSTAR=	340.31	TR=	.614	BBO=	197.80	CO=	4.95	TC*CO=	1.247	CR*P=	.00	I= 5	BBR=	481.74
THETA=180.0	Z*D=	20000.0	BSTAR=	553.81	TR=	.580	BBO=	197.80	CO=	4.95	TC*CO=	.849	CR*P=	.00	I= 6	BBR=	668.53
THETA=180.0	Z*D=	40000.0	BSTAR=	846.31	TR=	.543	BBO=	197.80	CO=	4.95	TC*CO=	.557	CR*P=	.00	I= 7	BBR=	953.46
THETA=180.0	Z*D=	60000.0	BSTAR=	955.11	TR=	.528	BBO=	197.80	CO=	4.95	TC*CO=	.483	CR*P=	.01	I= 8	BBR=	1069.51
THETA=180.0	Z*D=	80000.0	BSTAR=	980.26	TR=	.522	BBO=	197.80	CO=	4.95	TC*CO=	.472	CR*P=	.01	I= 9	BBR=	1083.59
THETA=180.0	Z*D=	100000.0	BSTAR=	987.97	TR=	.519	BBO=	197.80	CO=	4.95	TC*CO=	.466	CR*P=	.02	I=10	BBR=	1090.70
THETA=180.0	Z*D=	200000.0	BSTAR=	995.77	TR=	.516	BBO=	197.80	CO=	4.95	TC*CO=	.460	CR*P=	.06	I=11	BBR=	1097.90
THETA=180.0	Z*D=	400000.0	BSTAR=	996.05	TR=	.516	BBO=	197.80	CO=	4.95	TC*CO=	.460	CR*P=	.20	I=12	BBR=	1098.17
THETA=180.0	Z*D=	600000.0	BSTAR=	996.05	TR=	.516	BBO=	197.80	CO=	4.95	TC*CO=	.460	CR*P=	.45	I=13	BBR=	1098.17
THETA=180.0	Z*D=	800000.0	BSTAR=	996.05	TR=	.516	BBO=	197.80	CO=	4.95	TC*CO=	.460	CR*P=	.79	I=14	BBR=	1098.17

CURVES INTERSECT AT AX= .45990 AY= 605879.55823

THETA=165.0	Z*D=	1931.8	BSTAR=	149.74	TR=	.756	BBO=	131.87	CO=	9.09	TC*CO=	3.634	CR*P=	.00	I= 1	BBR=	249.30
THETA=165.0	Z*D=	3863.6	BSTAR=	245.64	TR=	.640	BBO=	131.87	CO=	9.09	TC*CO=	2.324	CR*P=	.00	I= 2	BBR=	329.99
THETA=165.0	Z*D=	5795.4	BSTAR=	298.11	TR=	.622	BBO=	131.87	CO=	9.09	TC*CO=	1.962	CR*P=	.00	I= 3	BBR=	380.19
THETA=165.0	Z*D=	7727.2	BSTAR=	340.02	TR=	.615	BBO=	131.87	CO=	9.09	TC*CO=	1.751	CR*P=	.00	I= 4	BBR=	421.15
THETA=165.0	Z*D=	9659.0	BSTAR=	381.50	TR=	.607	BBO=	131.87	CO=	9.09	TC*CO=	1.576	CR*P=	.00	I= 5	BBR=	461.49
THETA=165.0	Z*D=	19318.0	BSTAR=	528.12	TR=	.572	BBO=	131.87	CO=	9.09	TC*CO=	1.136	CR*P=	.00	I= 6	BBR=	603.52
THETA=165.0	Z*D=	38636.1	BSTAR=	755.61	TR=	.535	BBO=	131.87	CO=	9.09	TC*CO=	.776	CR*P=	.01	I= 7	BBR=	826.14
THETA=165.0	Z*D=	57954.1	BSTAR=	851.01	TR=	.520	BBO=	131.87	CO=	9.09	TC*CO=	.677	CR*P=	.01	I= 8	BBR=	919.53
THETA=165.0	Z*D=	77272.2	BSTAR=	869.99	TR=	.513	BBO=	131.87	CO=	9.09	TC*CO=	.656	CR*P=	.01	I= 9	BBR=	937.54
THETA=165.0	Z*D=	96590.2	BSTAR=	877.25	TR=	.510	BBO=	131.87	CO=	9.09	TC*CO=	.647	CR*P=	.02	I=10	BBR=	944.46
THETA=165.0	Z*D=	193180.5	BSTAR=	894.87	TR=	.506	BBO=	131.87	CO=	9.09	TC*CO=	.638	CR*P=	.06	I=11	BBR=	951.64
THETA=165.0	Z*D=	386360.9	BSTAR=	895.19	TR=	.506	BBO=	131.87	CO=	9.09	TC*CO=	.637	CR*P=	.21	I=12	BBR=	951.94
THETA=165.0	Z*D=	579541.4	BSTAR=	895.19	TR=	.506	BBO=	131.87	CO=	9.09	TC*CO=	.637	CR*P=	.46	I=13	BBR=	951.94
THETA=165.0	Z*D=	772721.9	BSTAR=	895.19	TR=	.506	BBO=	131.87	CO=	9.09	TC*CO=	.637	CR*P=	.81	I=14	BBR=	951.94

CURVES INTERSECT AT AX= .63743 AY= 678054.57579

THETA=150.0	Z*D=	1732.1	BSTAR=	156.52	TR=	.761	BBO=	119.99	CO=	8.41	TC*CO=	3.098	CR*P=	.00	I= 1	BBR=	247.87
THETA=150.0	Z*D=	3464.1	BSTAR=	261.30	TR=	.627	BBO=	119.99	CO=	8.41	TC*CO=	1.879	CR*P=	.00	I= 2	BBR=	336.55
THETA=150.0	Z*D=	5196.2	BSTAR=	316.32	TR=	.599	BBO=	119.99	CO=	8.41	TC*CO=	1.556	CR*P=	.00	I= 3	BBR=	388.19
THETA=150.0	Z*D=	6928.2	BSTAR=	344.04	TR=	.592	BBO=	119.99	CO=	8.41	TC*CO=	1.439	CR*P=	.00	I= 4	BBR=	415.10
THETA=150.0	Z*D=	8660.3	BSTAR=	404.24	TR=	.586	BBO=	119.99	CO=	8.41	TC*CO=	1.245	CR*P=	.00	I= 5	BBR=	474.52
THETA=150.0	Z*D=	17320.6	BSTAR=	534.35	TR=	.548	BBO=	119.99	CO=	8.41	TC*CO=	.921	CR*P=	.00	I= 6	BBR=	600.12
THETA=150.0	Z*D=	34641.2	BSTAR=	745.18	TR=	.509	BBO=	119.99	CO=	8.41	TC*CO=	.637	CR*P=	.01	I= 7	BBR=	806.27
THETA=150.0	Z*D=	51961.8	BSTAR=	849.97	TR=	.491	BBO=	119.99	CO=	8.41	TC*CO=	.545	CR*P=	.01	I= 8	BBR=	908.90
THETA=150.0	Z*D=	69282.4	BSTAR=	893.20	TR=	.483	BBO=	119.99	CO=	8.41	TC*CO=	.518	CR*P=	.01	I= 9	BBR=	941.17
THETA=150.0	Z*D=	86603.0	BSTAR=	891.84	TR=	.479	BBO=	119.99	CO=	8.41	TC*CO=	.509	CR*P=	.02	I=10	BBR=	949.30
THETA=150.0	Z*D=	173206.0	BSTAR=	902.17	TR=	.474	BBO=	119.99	CO=	8.41	TC*CO=	.498	CR*P=	.06	I=11	BBR=	959.15
THETA=150.0	Z*D=	346411.9	BSTAR=	902.78	TR=	.474	BBO=	119.99	CO=	8.41	TC*CO=	.498	CR*P=	.21	I=12	BBR=	959.42
THETA=150.0	Z*D=	519617.9	BSTAR=	902.78	TR=	.474	BBO=	119.99	CO=	8.41	TC*CO=	.498	CR*P=	.46	I=13	BBR=	959.42
THETA=150.0	Z*D=	692823.8	BSTAR=	902.78	TR=	.474	BBO=	119.99	CO=	8.41	TC*CO=	.498	CR*P=	.81	I=14	BBR=	959.42

CURVES INTERSECT AT AX= .49790 AY= 539855.72945

THETA=135.0	Z*D=	1414.2	BSTAR=	140.68	TR=	.757	BBO=	115.24	CO=	8.48	TC*CO=	3.247	CR*P=	.00	I= 1	BBR=	227.38
THETA=135.0	Z*D=	2828.5	BSTAR=	236.10	TR=	.606	BBO=	115.24	CO=	8.48	TC*CO=	1.936	CR*P=	.00	I= 2	BBR=	305.91
THETA=135.0	Z*D=	4242.7	BSTAR=	307.58	TR=	.556	BBO=	115.24	CO=	8.48	TC*CO=	1.463	CR*P=	.00	I= 3	BBR=	371.68
THETA=135.0	Z*D=	5656.9	BSTAR=	353.85	TR=	.544	BBO=	115.24	CO=	8.48	TC*CO=	1.248	CR*P=	.00	I= 4	BBR=	426.57
THETA=135.0	Z*D=	7071.1	BSTAR=	410.96	TR=	.539	BBO=	115.24	CO=	8.48	TC*CO=	1.113	CR*P=	.00	I= 5	BBR=	473.03
THETA=135.0	Z*D=	14142.3	BSTAR=	546.14	TR=	.502	BBO=	115.24	CO=	8.48	TC*CO=	.812	CR*P=	.00	I= 6	BBR=	603.95
THETA=135.0	Z*D=	28284.5	BSTAR=	733.87	TR=	.459	BBO=	115.24	CO=	8.48	TC*CO=	.571	CR*P=	.01	I= 7	BBR=	786.90
THETA=135.0	Z*D=	42426.8	BSTAR=	843.92	TR=	.438	BBO=	115.24	CO=	8.48	TC*CO=	.478	CR*P=	.01	I= 8	BBR=	894.15
THETA=135.0	Z*D=	56569.0	BSTAR=	900.92	TR=	.426	BBO=	115.24	CO=	8.48	TC*CO=	.438	CR*P=	.01	I= 9	BBR=	949.39
THETA=135.0	Z*D=	70711.3	BSTAR=	918.92	TR=	.420	BBO=	115.24	CO=	8.48	TC*CO=	.424	CR*P=	.02	I=10	BBR=	967.27
THETA=135.0	Z*D=	141422.5	BSTAR=	935.15	TR=	.411	BBO=	115.24	CO=	8.48	TC*CO=	.409	CR*P=	.06	I=11	BBR=	982.51
THETA=135.0	Z*D=	282845.0	BSTAR=	936.81	TR=	.410	BBO=	115.24	CO=	8.48	TC*CO=	.407	CR*P=	.21	I=12	BBR=	984.07
THETA=135.0	Z*D=	424267.5	BSTAR=	936.82	TR=	.410	BBO=	115.24	CO=	8.48	TC*CO=	.407	CR*P=	.45	I=13	BBR=	984.08

CURVES INTERSECT AT AX= .40744 AY= 598417.91871

THETA=120.0	Z*D=	1000.0	BSTAR=	126.31	TR=	.783	BBO=	124.74	CO=	7.90	TC*CO=	3.446	CR*P=	.00	I= 1	BBR=	223.94
THETA=120.0	Z*D=	2000.0	BSTAR=	230.71	TR=	.593	BBO=	124.74	CO=	7.90	TC*CO=	1.918	CR*P=	.00	I= 2	BBR=	304.44
THETA=120.0	Z*D=	3000.0	BSTAR=	309.01	TR=	.503	BBO=	124.74	CO=	7.90	TC*CO=	1.335	CR*P=	.00	I= 3	BBR=	371.78
THETA=120.0	Z*D=	4000.1	BSTAR=	363.01	TR=	.461	BBO=	124.74	CO=	7.90	TC*CO=	1.080	CR*P=	.00	I= 4	BBR=	420.49
THETA=120.0	Z*D=	5000.1	BSTAR=	410.71	TR=	.445	BBO=	124.74	CO=	7.90	TC*CO=	.941	CR*P=	.00	I= 5	BBR=	466.24
THETA=120.0	Z*D=	10000.1	BSTAR=	621.31	TR=	.417	BBO=	124.74	CO=	7.90	TC*CO=	.611	CR*P=	.00	I= 6	BBR=	673.33
THETA=120.0	Z*D=	20000.3	BSTAR=	791.52	TR=	.370	BBO=	124.74	CO=	7.90	TC*CO=	.441	CR*P=	.01	I= 7	BBR=	827.64
THETA=120.0	Z*D=	30000.4	BSTAR=	929.11	TR=	.344	BBO=	124.74	CO=	7.90	TC*CO=	.349	CR*P=	.01	I= 8	BBR=	971.99
THETA=120.0	Z*D=	40000.5	BSTAR=	1028.11	TR=	.327	BBO=	124.74	CO=	7.90	TC*CO=	.302	CR*P=	.01	I= 9	BBR=	1068.94
THETA=120.0	Z*D=	50000.7	BSTAR=	1092.11	TR=	.316	BBO=	124.74	CO=	7.90	TC*CO=	.278	CR*P=	.02	I=10	BBR=	1121.59
THETA=120.0	Z*D=	100001.3	BSTAR=	1137.56	TR=	.300	BBO=	124.74	CO=	7.90	TC*CO=	.252	CR*P=	.06	I=11	BBR=	1174.96
THETA=120.0	Z*D=	200002.6	BSTAR=	1144.13	TR=	.296	BBO=	124.74	CO=	7.90	TC*CO=	.247	CR*P=	.20	I=12	BBR=	1181.08
THETA=120.0	Z*D=	300003.9	BSTAR=	1144.36	TR=	.296	BBO=	124.74	CO=	7.90	TC*CO=	.247	CR*P=	.45	I=13	BBR=	1181.30

CURVES INTERSECT AT AX= .24730 AY= 217591.73331

THETA=105.0 Z*D=	517.7	BSTAR=	131.78	TR=	.808	BBO=	179.98	CO=	5.37	TC*CO=	2.816	CR*P=	.00	I= 1 BBR= 277.12
THETA=105.0 Z*D=	1035.3	BSTAR=	251.01	TR=	.687	BBO=	179.98	CO=	5.37	TC*CO=	1.772	CR*P=	.00	I= 2 BBR= 374.68
THETA=105.0 Z*D=	1553.0	BSTAR=	350.71	TR=	.539	BBO=	179.98	CO=	5.37	TC*CO=	1.163	CR*P=	.00	I= 3 BBR= 447.45
THETA=105.0 Z*D=	2070.6	BSTAR=	447.36	TR=	.402	BBO=	179.98	CO=	5.37	TC*CO=	.747	CR*P=	.00	I= 4 BBR= 519.62
THETA=105.0 Z*D=	2588.3	BSTAR=	524.70	TR=	.326	BBO=	179.98	CO=	5.37	TC*CO=	.540	CR*P=	.00	I= 5 BBR= 583.38
THETA=105.0 Z*D=	5176.5	BSTAR=	792.58	TR=	.230	BBO=	179.98	CO=	5.37	TC*CO=	.267	CR*P=	.00	I= 6 BBR= 834.05
THETA=105.0 Z*D=	10353.0	BSTAR=	1012.55	TR=	.202	BBO=	179.98	CO=	5.37	TC*CO=	.186	CR*P=	.00	I= 7 BBR=1048.87
THETA=105.0 Z*D=	15529.5	BSTAR=	1181.22	TR=	.177	BBO=	179.98	CO=	5.37	TC*CO=	141	CR*P=	.01	I= 8 BBR=1213.12
THETA=105.0 Z*D=	20706.1	BSTAR=	1354.45	TR=	.160	BBO=	179.98	CO=	5.37	TC*CO=	.112	CR*P=	.01	I= 9 BBR=1383.18
THETA=105.0 Z*D=	25882.6	BSTAR=	1498.76	TR=	.148	BBO=	179.98	CO=	5.37	TC*CO=	093	CR*P=	.02	I=10 BBR=1525.52
THETA=105.0 Z*D=	51765.1	BSTAR=	1858.23	TR=	.119	BBO=	179.98	CO=	5.37	TC*CO=	.061	CR*P=	.06	I=11 BBR=1879.59
THETA=105.0 Z*D=	103530.3	BSTAR=	1928.46	TR=	.107	BBO=	179.98	CO=	5.37	TC*CO=	.053	CR*P=	.20	I=12 BBR=1947.77

CURVES INTERSECT AT AX= .06086 AY= 52889.04994

THETA=100.0 Z*D=	347.2	BSTAR=	123.31	TR=	.819	BBO=	229.88	CO=	4.43	TC*CO=	2.675	CR*P=	.00	I= 1 BBR= 311.52
THETA=100.0 Z*D=	694.5	BSTAR=	235.50	TR=	.744	BBO=	229.88	CO=	4.43	TC*CO=	1.862	CR*P=	.00	I= 2 BBR= 406.47
THETA=100.0 Z*D=	1041.7	BSTAR=	346.72	TR=	.606	BBO=	229.88	CO=	4.43	TC*CO=	1.269	CR*P=	.00	I= 3 BBR= 486.11
THETA=100.0 Z*D=	1389.0	BSTAR=	450.79	TR=	.480	BBO=	229.88	CO=	4.43	TC*CO=	.871	CR*P=	.00	I= 4 BBR= 561.17
THETA=100.0 Z*D=	1736.2	BSTAR=	554.86	TR=	.394	BBO=	229.88	CO=	4.43	TC*CO=	.621	CR*P=	.00	I= 5 BBR= 645.56
THETA=100.0 Z*D=	3472.4	BSTAR=	876.24	TR=	.150	BBO=	229.88	CO=	4.43	TC*CO=	.168	CR*P=	.00	I= 6 BBR= 910.74
THETA=100.0 Z*D=	6944.9	BSTAR=	1196.63	TR=	.113	BBO=	229.88	CO=	4.43	TC*CO=	.094	CR*P=	.00	I= 7 BBR=1222.47
THETA=100.0 Z*D=	10417.3	BSTAR=	1332.13	TR=	.098	BBO=	229.88	CO=	4.43	TC*CO=	.073	CR*P=	.01	I= 8 BBR=1374.73
THETA=100.0 Z*D=	13889.8	BSTAR=	1427.13	TR=	.086	BBO=	229.88	CO=	4.43	TC*CO=	.061	CR*P=	.01	I= 9 BBR=1446.92
THETA=100.0 Z*D=	17362.2	BSTAR=	1519.14	TR=	.078	BBO=	229.88	CO=	4.43	TC*CO=	.052	CR*P=	.02	I=10 BBR=1517.10
THETA=100.0 Z*D=	34724.4	BSTAR=	1893.89	TR=	.055	BBO=	229.88	CO=	4.43	TC*CO=	030	CR*P=	.06	I=11 BBR=1896.88

CURVES INTERSECT AT AX= .03947 AY= 26985.09406

THETA= 95.0 Z*D=	174.2	BSTAR=	113.01	TR=	.826	BBO=	326.11	CO=	2.83	TC*CO=	1.990	CR*P=	.00	I= 1 BBR= 382.95
THETA= 95.0 Z*D=	348.4	BSTAR=	214.92	TR=	.746	BBO=	326.11	CO=	2.83	TC*CO=	1.500	CR*P=	.00	I= 2 BBR= 458.31
THETA= 95.0 Z*D=	522.6	BSTAR=	316.82	TR=	.662	BBO=	326.11	CO=	2.83	TC*CO=	1.145	CR*P=	.00	I= 3 BBR= 532.76
THETA= 95.0 Z*D=	696.8	BSTAR=	418.72	TR=	.616	BBO=	326.11	CO=	2.83	TC*CO=	.916	CR*P=	.00	I= 4 BBR= 609.53
THETA= 95.0 Z*D=	871.0	BSTAR=	520.62	TR=	.517	BBO=	326.11	CO=	2.83	TC*CO=	.691	CR*P=	.00	I= 5 BBR= 689.19
THETA= 95.0 Z*D=	1741.9	BSTAR=	805.78	TR=	.175	BBO=	326.11	CO=	2.83	TC*CO=	.187	CR*P=	.00	I= 6 BBR= 862.98
THETA= 95.0 Z*D=	3483.8	BSTAR=	1134.37	TR=	.027	BBO=	326.11	CO=	2.83	TC*CO=	.021	CR*P=	.00	I= 7 BBR=1143.92
THETA= 95.0 Z*D=	5225.8	BSTAR=	1340.49	TR=	.017	BBO=	326.11	CO=	2.83	TC*CO=	.012	CR*P=	.01	I= 8 BBR=1346.13
THETA= 95.0 Z*D=	6967.7	BSTAR=	1485.07	TR=	.016	BBO=	326.11	CO=	2.83	TC*CO=	.010	CR*P=	.01	I= 9 BBR=1490.32

CURVES INTERSECT AT AX= .01044 AY= 6506.93054

AZIMUTH OF PATH OF SIGHT WITH RESPECT TO SUN IS 45 DEGREES

ZENITH OF PATH OF SIGHT = 180 DISTANCE TO TARGET AXIS = 0 ALTITUDE = 605880 CONTRAST IS POSITIVE

ZENITH OF PATH OF SIGHT = 165 DISTANCE TO TARGET AXIS = 181733 ALTITUDE = 678055 CONTRAST IS POSITIVE

ZENITH OF PATH OF SIGHT = 150 DISTANCE TO TARGET AXIS = 311662 ALTITUDE = 539856 CONTRAST IS POSITIVE

ZENITH OF PATH OF SIGHT = 135 DISTANCE TO TARGET AXIS = 398393 ALTITUDE = 398418 CONTRAST IS POSITIVE

ZENITH OF PATH OF SIGHT = 120 DISTANCE TO TARGET AXIS = 376853 ALTITUDE = 217592 CONTRAST IS POSITIVE

ZENITH OF PATH OF SIGHT = 105 DISTANCE TO TARGET AXIS = 197360 ALTITUDE = 52889 CONTRAST IS POSITIVE

ZENITH OF PATH OF SIGHT = 100 DISTANCE TO TARGET AXIS = 153043 ALTITUDE = 26985 CONTRAST IS POSITIVE

ZENITH OF PATH OF SIGHT = 95 DISTANCE TO TARGET AXIS = 74406 ALTITUDE = 6507 CONTRAST IS POSITIVE

AZIMUTH OF PATH OF SIGHT WITH RESPECT TO SUN IS 90 DEGREES

THETA=180.0	Z*D=	2000.0	BSTAR=	131.71	TR=	.762	BBO=	197.80	CO=	4.95	TC*CO=	2.639	CR*P=	.00	I= 1 BBR= 282.42
THETA=180.0	Z*D=	4000.0	BSTAR=	220.81	TR=	.646	BBO=	197.80	CO=	4.95	TC*CO=	1.813	CR*P=	.00	I= 2 BBR= 348.55
THETA=180.0	Z*D=	6000.0	BSTAR=	273.01	TR=	.630	BBO=	197.80	CO=	4.95	TC*CO=	1.551	CR*P=	.00	I= 3 BBR= 397.68
THETA=180.0	Z*D=	8000.0	BSTAR=	318.01	TR=	.623	BBO=	197.80	CO=	4.95	TC*CO=	1.382	CR*P=	.00	I= 4 BBR= 441.33
THETA=180.0	Z*D=	10000.0	BSTAR=	360.31	TR=	.614	BBO=	197.80	CO=	4.95	TC*CO=	1.247	CR*P=	.00	I= 5 BBR= 481.74
THETA=180.0	Z*D=	20000.0	BSTAR=	553.81	TR=	.580	BBO=	197.80	CO=	4.95	TC*CO=	.849	CR*P=	.00	I= 6 BBR= 668.53
THETA=180.0	Z*D=	40000.0	BSTAR=	846.31	TR=	.543	BBO=	197.80	CO=	4.95	TC*CO=	.557	CR*P=	.00	I= 7 BBR= 953.46
THETA=180.0	Z*D=	60000.0	BSTAR=	945.11	TR=	.528	BBO=	197.80	CO=	4.95	TC*CO=	.483	CR*P=	.01	I= 8 BBR=1069.41
THETA=180.0	Z*D=	80000.0	BSTAR=	990.26	TR=	.522	BBO=	197.80	CO=	4.95	TC*CO=	.472	CR*P=	.01	I= 9 BBR=1083.59
THETA=180.0	Z*D=	100000.0	BSTAR=	997.97	TR=	.519	BBO=	197.80	CO=	4.95	TC*CO=	.466	CR*P=	.02	I=10 BBR=1090.70
THETA=180.0	Z*D=	200000.0	BSTAR=	995.77	TR=	.516	BBO=	197.80	CO=	4.95	TC*CO=	.460	CR*P=	.06	I=11 BBR=1097.90
THETA=180.0	Z*D=	400000.0	BSTAR=	996.05	TR=	.516	BBO=	197.80	CO=	4.95	TC*CO=	.460	CR*P=	.20	I=12 BBR=1098.17
THETA=180.0	Z*D=	600000.0	BSTAR=	996.05	TR=	.516	BBO=	197.80	CO=	4.95	TC*CO=	.460	CR*P=	.45	I=13 BBR=1098.17
THETA=180.0	Z*D=	800000.0	BSTAR=	996.05	TR=	.516	BBO=	197.80	CO=	4.95	TC*CO=	.460	CR*P=	.79	I=14 BBR=1098.17

CURVES INTERSECT AT AX= .45990 AY= 605879.55823

THETA=165.0	Z*D=	1931.8	BSTAR=	131.12	TR=	.756	BBO=	187.11	CO=	4.40	TC*CO=	2.282	CR*P=	.00	I= 1 BBR= 272.46
THETA=165.0	Z*D=	3863.6	BSTAR=	220.03	TR=	.640	BBO=	187.11	CO=	4.40	TC*CO=	1.549	CR*P=	.00	I= 2 BBR= 339.72
THETA=165.0	Z*D=	5795.4	BSTAR=	270.21	TR=	.622	BBO=	187.11	CO=	4.40	TC*CO=	1.324	CR*P=	.00	I= 3 BBR= 386.47
THETA=165.0	Z*D=	7727.2	BSTAR=	319.65	TR=	.615	BBO=	187.11	CO=	4.40	TC*CO=	1.164	CR*P=	.00	I= 4 BBR= 434.76
THETA=165.0	Z*D=	9659.0	BSTAR=	359.59	TR=	.607	BBO=	187.11	CO=	4.40	TC*CO=	1.055	CR*P=	.00	I= 5 BBR= 473.09
THETA=165.0	Z*D=	19318.0	BSTAR=	522.27	TR=	.572	BBO=	187.11	CO=	4.40	TC*CO=	.748	CR*P=	.00	I= 6 BBR= 629.96
THETA=165.0	Z*D=	38636.1	BSTAR=	774.84	TR=	.535	BBO=	187.11	CO=	4.40	TC*CO=	.503	CR*P=	.01	I= 7 BBR= 874.91
THETA=165.0	Z*D=	57954.1	BSTAR=	881.78	TR=	.520	BBO=	187.11	CO=	4.40	TC*CO=	.437	CR*P=	.01	I= 8 BBR= 979.00
THETA=165.0	Z*D=	77272.2	BSTAR=	901.93	TR=	.513	BBO=	187.11	CO=	4.40	TC*CO=	.423	CR*P=	.01	I= 9 BBR= 997.33
THETA=165.0	Z*D=	96590.2	BSTAR=	909.44	TR=	.510	BBO=	187.11	CO=	4.40	TC*CO=	.417	CR*P=	.02	I=10 BBR=1004.83
THETA=165.0	Z*D=	193180.5	BSTAR=	917.37	TR=	.506	BBO=	187.11	CO=	4.40	TC*CO=	.412	CR*P=	.06	I=11 BBR=1012.11
THETA=165.0	Z*D=	386360.9	BSTAR=	917.70	TR=	.506	BBO=	187.11	CO=	4.40	TC*CO=	.411	CR*P=	.20	I=12 BBR=1012.42
THETA=165.0	Z*D=	579541.4	BSTAR=	917.70	TR=	.506	BBO=	187.11	CO=	4.40	TC*CO=	.411	CR*P=	.45	I=13 BBR=1012.42

CURVES INTERSECT AT AX= .41135 AY= 549324.41515

THETA=150.0	Z*D=	1732.1	BSTAR=	132.65	TR=	.761	BBO=	184.73	CO=	4.11	TC*CO=	2.116	CR*P=	.00	I= 1 BBR= 273.29
THETA=150.0	Z*D=	3464.1	BSTAR=	236.65	TR=	.627	BBO=	184.73	CO=	4.11	TC*CO=	1.352	CR*P=	.00	I= 2 BBR= 352.50
THETA=150.0	Z*D=	5196.2	BSTAR=	290.40	TR=	.599	BBO=	184.73	CO=	4.11	TC*CO=	1.135	CR*P=	.00	I= 3 BBR= 401.74
THETA=150.0	Z*D=	6928.2	BSTAR=	319.68	TR=	.592	BBO=	184.73	CO=	4.11	TC*CO=	1.049	CR*P=	.00	I= 4 BBR= 429.08
THETA=150.0	Z*D=	8660.3	BSTAR=	371.26	TR=	.586	BBO=	184.73	CO=	4.11	TC*CO=	.928	CR*P=	.00	I= 5 BBR= 479.47
THETA=150.0	Z*D=	17320.6	BSTAR=	514.36	TR=	.548	BBO=	184.73	CO=	4.11	TC*CO=	.676	CR*P=	.00	I= 6 BBR= 615.62
THETA=150.0	Z*D=	34641.2	BSTAR=	740.00	TR=	.509	BBO=	184.73	CO=	4.11	TC*CO=	.464	CR*P=	.01	I= 7 BBR= 834.05
THETA=150.0	Z*D=	51961.8	BSTAR=	851.22	TR=	.491	BBO=	184.73	CO=	4.11	TC*CO=	.396	CR*P=	.01	I= 8 BBR= 941.95
THETA=150.0	Z*D=	69282.4	BSTAR=	885.93	TR=	.483	BBO=	184.73	CO=	4.11	TC*CO=	.376	CR*P=	.01	I= 9 BBR= 975.17
THETA=150.0	Z*D=	86603.0	BSTAR=	894.59	TR=	.479	BBO=	184.73	CO=	4.11	TC*CO=	.370	CR*P=	.02	I=10 BBR= 983.16
THETA=150.0	Z*D=	173206.0	BSTAR=	904.95	TR=	.474	BBO=	184.73	CO=	4.11	TC*CO=	.363	CR*P=	.06	I=11 BBR= 992.52
THETA=150.0	Z*D=	346411.9	BSTAR=	905.56	TR=	.474	BBO=	184.73	CO=	4.11	TC*CO=	.362	CR*P=	.20	I=12 BBR= 993.17
THETA=150.0	Z*D=	519617.9	BSTAR=	905.56	TR=	.474	BBO=	184.73	CO=	4.11	TC*CO=	.362	CR*P=	.45	I=13 BBR= 993.07

CURVES INTERSECT AT AX= .36240 AY= 457314.77164

THETA=135.0	Z*D=	1414.2	BSTAR=	119.63	TR=	.757	BBO=	188.30	CO=	3.95	TC*CO=	2.149	CR*P=	.00	I= 1 BBR= 262.12
THETA=135.0	Z*D=	2828.5	BSTAR=	220.65	TR=	.606	BBO=	188.30	CO=	3.95	TC*CO=	1.347	CR*P=	.00	I= 2 BBR= 334.71
THETA=135.0	Z*D=	4242.7	BSTAR=	298.27	TR=	.556	BBO=	188.30	CO=	3.95	TC*CO=	1.054	CR*P=	.00	I= 3 BBR= 393.12
THETA=135.0	Z*D=	5656.9	BSTAR=	335.72	TR=	.544	BBO=	188.30	CO=	3.95	TC*CO=	.924	CR*P=	.00	I= 4 BBR= 438.21
THETA=135.0	Z*D=	7071.1	BSTAR=	376.12	TR=	.539	BBO=	188.30	CO=	3.95	TC*CO=	.840	CR*P=	.00	I= 5 BBR= 477.54
THETA=135.0	Z*D=	14142.3	BSTAR=	511.12	TR=	.502	BBO=	188.30	CO=	3.95	TC*CO=	.617	CR*P=	.00	I= 6 BBR= 605.57
THETA=135.0	Z*D=	28284.5	BSTAR=	736.78	TR=	.459	BBO=	188.30	CO=	3.95	TC*CO=	.415	CR*P=	.01	I= 7 BBR= 823.26
THETA=135.0	Z*D=	42426.8	BSTAR=	857.49	TR=	.438	BBO=	188.30	CO=	3.95	TC*CO=	.343	CR*P=	.01	I= 8 BBR= 949.99
THETA=135.0	Z*D=	56569.0	BSTAR=	934.76	TR=	.426	BBO=	188.30	CO=	3.95	TC*CO=	.312	CR*P=	.01	I= 9 BBR=1014.94
THETA=135.0	Z*D=	70711.3	BSTAR=	955.23	TR=	.420	BBO=	188.30	CO=	3.95	TC*CO=	.302	CR*P=	.02	I=10 BBR=1034.23
THETA=135.0	Z*D=	141422.5	BSTAR=	972.11	TR=	.411	BBO=	188.30	CO=	3.95	TC*CO=	.291	CR*P=	.06	I=11 BBR=1049.49
THETA=135.0	Z*D=	282845.0	BSTAR=	973.84	TR=	.410	BBO=	188.30	CO=	3.95	TC*CO=	.290	CR*P=	.20	I=12 BBR=1051.06
THETA=135.0	Z*D=	424267.5	BSTAR=	973.85	TR=	.410	BBO=	188.30	CO=	3.95	TC*CO=	.290	CR*P=	.45	I=13 BBR=1051.07

CURVES INTERSECT AT AX= .29039 AY= 332522.55129

THETA=120.0	Z*D=	1000.0	BSTAR=	109.21	TR=	.783	BBO=	188.30	CO=	3.92	TC*CO=	2.252	CR*P=	.00	I= 1 BBR= 256.58
THETA=120.0	Z*D=	2000.0	BSTAR=	214.51	TR=	.593	BBO=	188.30	CO=	3.92	TC*CO=	1.342	CR*P=	.00	I= 2 BBR= 326.11
THETA=120.0	Z*D=	3000.0	BSTAR=	303.61	TR=	.503	BBO=	188.30	CO=	3.92	TC*CO=	.933	CR*P=	.00	I= 3 BBR= 398.16
THETA=120.0	Z*D=	4000.1	BSTAR=	374.71	TR=	.461	BBO=	188.30	CO=	3.92	TC*CO=	.737	CR*P=	.00	I= 4 BBR= 441.47
THETA=120.0	Z*D=	5000.1	BSTAR=	426.91	TR=	.445	BBO=	188.30	CO=	3.92	TC*CO=	.644	CR*P=	.00	I= 5 BBR= 510.74
THETA=120.0	Z*D=	10000.1	BSTAR=	576.31	TR=	.417	BBO=	188.30	CO=	3.92	TC*CO=	.470	CR*P=	.00	I= 6 BBR= 654.43
THETA=120.0	Z*D=	20000.3	BSTAR=	796.82	TR=	.370	BBO=	188.30	CO=	3.92	TC*CO=	.315	CR*P=	.01	I= 7 BBR= 866.45
THETA=120.0	Z*D=	30000.4	BSTAR=	992.12	TR=	.344	BBO=	188.30	CO=	3.92	TC*CO=	.240	CR*P=	.01	I= 8 BBR=1056.84
THETA=120.0	Z*D=	40000.5	BSTAR=	1118.12	TR=	.327	BBO=	188.30	CO=	3.92	TC*CO=	.205	CR*P=	.01	I= 9 BBR=1179.74
THETA=120.0	Z*D=	50000.7	BSTAR=	1193.71	TR=	.316	BBO=	188.30	CO=	3.92	TC*CO=	.186	CR*P=	.02	I=10 BBR=1253.31
THETA=120.0	Z*D=	100001.3	BSTAR=	1255.78	TR=	.300	BBO=	188.30	CO=	3.92	TC*CO=	.167	CR*P=	.06	I=11 BBR=1322.22
THETA=120.0	Z*D=	200002.6	BSTAR=	1273.09	TR=	.296	BBO=	188.30	CO=	3.92	TC*CO=	.165	CR*P=	.20	I=12 BBR=1328.47

CURVES INTERSECT AT AX= .16534 AY= 173534.67178

THETA=105.0 Z*D= 517.7 BSTAR= 105.69 TR= .808 BB0= 200.18 C0= 3.54 TC*C0= 2.141 CR*P= .00 I= 1 BBR= 267.34
THETA=105.0 Z*D= 1035.3 BSTAR= 199.72 TR= .687 BB0= 200.18 C0= 3.54 TC*C0= 1.444 CR*P= .00 I= 2 BBR= 337.27
THETA=105.0 Z*D= 1553.0 BSTAR= 286.38 TR= .539 BB0= 200.18 C0= 3.54 TC*C0= .968 CR*P= .00 I= 3 BBR= 394.19
THETA=105.0 Z*D= 2070.6 BSTAR= 370.81 TR= .402 BB0= 200.18 C0= 3.54 TC*C0= .631 CR*P= .00 I= 4 BBR= 451.18
THETA=105.0 Z*D= 2588.3 BSTAR= 441.16 TR= .326 BB0= 200.18 C0= 3.54 TC*C0= .456 CR*P= .00 I= 5 BBR= 506.42
THETA=105.0 Z*D= 5176.5 BSTAR= 691.20 TR= .230 BB0= 200.18 C0= 3.54 TC*C0= .221 CR*P= .00 I= 6 BBR= 737.32
THETA=105.0 Z*D= 10353.0 BSTAR= 921.96 TR= .202 BB0= 200.18 C0= 3.54 TC*C0= .149 CR*P= .00 I= 7 BBR= 961.57
THETA=105.0 Z*D= 15529.5 BSTAR= 1069.41 TR= .177 BB0= 200.18 C0= 3.54 TC*C0= .114 CR*P= .01 I= 8 BBR=1104.98
THETA=105.0 Z*D= 20706.1 BSTAR= 1207.90 TR= .160 BB0= 200.18 C0= 3.54 TC*C0= .091 CR*P= .01 I= 9 BBR=1239.96
THETA=105.0 Z*D= 25882.6 BSTAR= 1333.59 TR= .148 BB0= 200.18 C0= 3.54 TC*C0= .077 CR*P= .02 I=10 BBR=1363.12
THETA=105.0 Z*D= 51765.1 BSTAR= 1640.64 TR= .119 BB0= 200.18 C0= 3.54 TC*C0= .051 CR*P= .06 I=11 BBR=1664.40

CURVES INTERSECT AT AX= .05332 AY= 49005.40761

THETA=100.0 Z*D= 347.2 BSTAR= 123.31 TR= .819 BB0= 229.88 C0= 2.93 TC*C0= 1.769 CR*P= .00 I= 1 BBR= 311.42
THETA=100.0 Z*D= 694.5 BSTAR= 235.50 TR= .744 BB0= 229.88 C0= 2.93 TC*C0= 1.231 CR*P= .00 I= 2 BBR= 406.47
THETA=100.0 Z*D= 1041.7 BSTAR= 341.84 TR= .606 BB0= 229.88 C0= 2.93 TC*C0= .848 CR*P= .00 I= 3 BBR= 481.23
THETA=100.0 Z*D= 1389.0 BSTAR= 405.28 TR= .480 BB0= 229.88 C0= 2.93 TC*C0= .627 CR*P= .00 I= 4 BBR= 515.56
THETA=100.0 Z*D= 1736.2 BSTAR= 468.72 TR= .394 BB0= 229.88 C0= 2.93 TC*C0= .474 CR*P= .00 I= 5 BBR= 559.22
THETA=100.0 Z*D= 3472.4 BSTAR= 722.56 TR= .150 BB0= 229.88 C0= 2.93 TC*C0= .133 CR*P= .00 I= 6 BBR= 757.06
THETA=100.0 Z*D= 6944.9 BSTAR= 1060.14 TR= .113 BB0= 229.88 C0= 2.93 TC*C0= .070 CR*P= .00 I= 7 BBR=1086.18
THETA=100.0 Z*D= 10417.3 BSTAR= 1165.38 TR= .098 BB0= 229.88 C0= 2.93 TC*C0= .056 CR*P= .01 I= 8 BBR=1187.98
THETA=100.0 Z*D= 13889.8 BSTAR= 1259.13 TR= .086 BB0= 229.88 C0= 2.93 TC*C0= .045 CR*P= .01 I= 9 BBR=1278.92
THETA=100.0 Z*D= 17362.2 BSTAR= 1357.14 TR= .078 BB0= 229.88 C0= 2.93 TC*C0= .038 CR*P= .02 I=10 BBR=1375.10
THETA=100.0 Z*D= 34724.4 BSTAR= 1721.89 TR= .055 BB0= 229.88 C0= 2.93 TC*C0= .021 CR*P= .06 I=11 BBR=1734.58

CURVES INTERSECT AT AX= .03200 AY= 23808.01959

THETA= 95.0 Z*D= 174.2 BSTAR= 104.39 TR= .826 BB0= 275.02 C0= 2.26 TC*C0= 1.549 CR*P= .00 I= 1 BBR= 331.45
THETA= 95.0 Z*D= 348.4 BSTAR= 197.67 TR= .746 BB0= 275.02 C0= 2.26 TC*C0= 1.152 CR*P= .00 I= 2 BBR= 402.94
THETA= 95.0 Z*D= 522.6 BSTAR= 290.95 TR= .662 BB0= 275.02 C0= 2.26 TC*C0= .871 CR*P= .00 I= 3 BBR= 473.06
THETA= 95.0 Z*D= 696.8 BSTAR= 384.23 TR= .616 BB0= 275.02 C0= 2.26 TC*C0= .692 CR*P= .00 I= 4 BBR= 553.66
THETA= 95.0 Z*D= 871.0 BSTAR= 477.51 TR= .517 BB0= 275.02 C0= 2.26 TC*C0= .519 CR*P= .00 I= 5 BBR= 619.47
THETA= 95.0 Z*D= 1741.9 BSTAR= 705.53 TR= .175 BB0= 275.02 C0= 2.26 TC*C0= .144 CR*P= .00 I= 6 BBR= 753.59
THETA= 95.0 Z*D= 3483.8 BSTAR= 954.37 TR= .027 BB0= 275.02 C0= 2.26 TC*C0= .017 CR*P= .00 I= 7 BBR= 961.56
THETA= 95.0 Z*D= 5225.8 BSTAR= 1096.33 TR= .017 BB0= 275.02 C0= 2.26 TC*C0= .010 CR*P= .01 I= 8 BBR=1101.09
THETA= 95.0 Z*D= 6967.7 BSTAR= 1198.66 TR= .016 BB0= 275.02 C0= 2.26 TC*C0= .008 CR*P= .01 I= 9 BBR=1193.18

CURVES INTERSECT AT AX= .00918 AY= 5965.04159

AZIMUTH OF PATH OF SIGHT WITH RESPECT TO SUN IS 90 DEGREES

ZENITH OF PATH OF SIGHT = 180 DISTANCE TO TARGET AXIS = 0 ALTITUDE = 605880 CONTRAST IS POSITIVE

ZENITH OF PATH OF SIGHT = 165 DISTANCE TO TARGET AXIS = 147230 ALTITUDE = 549324 CONTRAST IS POSITIVE

ZENITH OF PATH OF SIGHT = 150 DISTANCE TO TARGET AXIS = 264011 ALTITUDE = 457315 CONTRAST IS POSITIVE

ZENITH OF PATH OF SIGHT = 135 DISTANCE TO TARGET AXIS = 332501 ALTITUDE = 332923 CONTRAST IS POSITIVE

ZENITH OF PATH OF SIGHT = 120 DISTANCE TO TARGET AXIS = 300549 ALTITUDE = 173535 CONTRAST IS POSITIVE

ZENITH OF PATH OF SIGHT = 105 DISTANCE TO TARGET AXIS = 182868 ALTITUDE = 49005 CONTRAST IS POSITIVE

ZENITH OF PATH OF SIGHT = 100 DISTANCE TO TARGET AXIS = 135024 ALTITUDE = 23808 CONTRAST IS POSITIVE

ZENITH OF PATH OF SIGHT = 95 DISTANCE TO TARGET AXIS = 68209 ALTITUDE = 5965 CONTRAST IS POSITIVE

AZIMUTH OF PATH OF SIGHT WITH RESPECT TO SUN IS 135 DEGREES

THETA=180.0	Z*D=	2000.0	BSTAR=	131.71	TR=	.762	BBO=	197.80	CO=	4.95	TC*CO=	2.639	CR*P=	.00	I= 1 BBR= 282.42
THETA=180.0	Z*D=	4000.0	BSTAR=	220.81	TR=	.646	BBO=	197.80	CO=	4.95	TC*CO=	1.813	CR*P=	.00	I= 2 BBR= 348.65
THETA=180.0	Z*D=	6000.0	BSTAR=	273.01	TR=	.630	BBO=	197.80	CO=	4.95	TC*CO=	1.551	CR*P=	.00	I= 3 BBR= 397.48
THETA=180.0	Z*D=	8000.0	BSTAR=	318.01	TR=	.623	BBO=	197.80	CO=	4.95	TC*CO=	1.382	CR*P=	.00	I= 4 BBR= 441.53
THETA=180.0	Z*D=	10000.0	BSTAR=	360.31	TR=	.614	BBO=	197.80	CO=	4.95	TC*CO=	1.247	CR*P=	.00	I= 5 BBR= 481.74
THETA=180.0	Z*D=	20000.0	BSTAR=	553.81	TR=	.580	BBO=	197.80	CO=	4.95	TC*CO=	.849	CR*P=	.00	I= 6 BBR= 668.53
THETA=180.0	Z*D=	40000.0	BSTAR=	846.31	TR=	.543	BBO=	197.80	CO=	4.95	TC*CO=	.557	CR*P=	.00	I= 7 BBR= 953.56
THETA=180.0	Z*D=	60000.0	BSTAR=	955.11	TR=	.528	BBO=	197.80	CO=	4.95	TC*CO=	.483	CR*P=	.01	I= 8 BBR=1069.41
THETA=180.0	Z*D=	80000.0	BSTAR=	980.26	TR=	.522	BBO=	197.80	CO=	4.95	TC*CO=	.472	CR*P=	.01	I= 9 BBR=1083.59
THETA=180.0	Z*D=	100000.0	BSTAR=	987.97	TR=	.519	BBO=	197.80	CO=	4.95	TC*CO=	.466	CR*P=	.02	I=10 BBR=1090.70
THETA=180.0	Z*D=	200000.0	BSTAR=	995.77	TR=	.516	BBO=	197.80	CO=	4.95	TC*CO=	.460	CR*P=	.06	I=11 BBR=1097.90
THETA=180.0	Z*D=	400000.0	BSTAR=	996.05	TR=	.516	BBO=	197.80	CO=	4.95	TC*CO=	.460	CR*P=	.20	I=12 BBR=1098.17
THETA=180.0	Z*D=	600000.0	BSTAR=	996.05	TR=	.516	BBO=	197.80	CO=	4.95	TC*CO=	.460	CR*P=	.45	I=13 BBR=1098.17
THETA=180.0	Z*D=	800000.0	BSTAR=	996.05	TR=	.516	BBO=	197.80	CO=	4.95	TC*CO=	.460	CR*P=	.79	I=14 BBR=1098.17

CURVES INTERSECT AT AX= .45990 AY= 605879.55823

THETA=165.0	Z*D=	1931.8	BSTAR=	151.86	TR=	.756	BBO=	198.99	CO=	4.43	TC*CO=	2.207	CR*P=	.00	I= 1 BBR= 302.39
THETA=165.0	Z*D=	3863.6	BSTAR=	239.18	TR=	.640	BBO=	198.99	CO=	4.43	TC*CO=	1.540	CR*P=	.00	I= 2 BBR= 366.46
THETA=165.0	Z*D=	5795.4	BSTAR=	296.10	TR=	.622	BBO=	198.99	CO=	4.43	TC*CO=	1.307	CR*P=	.00	I= 3 BBR= 419.96
THETA=165.0	Z*D=	7727.2	BSTAR=	333.80	TR=	.615	BBO=	198.99	CO=	4.43	TC*CO=	1.190	CR*P=	.00	I= 4 BBR= 456.23
THETA=165.0	Z*D=	9659.0	BSTAR=	379.66	TR=	.607	BBO=	198.99	CO=	4.43	TC*CO=	1.069	CR*P=	.00	I= 5 BBR= 500.36
THETA=165.0	Z*D=	19318.0	BSTAR=	569.07	TR=	.572	BBO=	198.99	CO=	4.43	TC*CO=	.739	CR*P=	.00	I= 6 BBR= 682.96
THETA=165.0	Z*D=	38636.1	BSTAR=	820.74	TR=	.535	BBO=	198.99	CO=	4.43	TC*CO=	.509	CR*P=	.00	I= 7 BBR= 927.17
THETA=165.0	Z*D=	57954.1	BSTAR=	930.01	TR=	.520	BBO=	198.99	CO=	4.43	TC*CO=	.444	CR*P=	.01	I= 8 BBR=1033.40
THETA=165.0	Z*D=	77272.2	BSTAR=	951.22	TR=	.513	BBO=	198.99	CO=	4.43	TC*CO=	.430	CR*P=	.01	I= 9 BBR=1053.31
THETA=165.0	Z*D=	96590.2	BSTAR=	959.15	TR=	.510	BBO=	198.99	CO=	4.43	TC*CO=	.424	CR*P=	.02	I=10 BBR=1060.59
THETA=165.0	Z*D=	193180.5	BSTAR=	967.51	TR=	.506	BBO=	198.99	CO=	4.43	TC*CO=	.418	CR*P=	.06	I=11 BBR=1068.27
THETA=165.0	Z*D=	386360.9	BSTAR=	967.86	TR=	.506	BBO=	198.99	CO=	4.43	TC*CO=	.418	CR*P=	.20	I=12 BBR=1068.59
THETA=165.0	Z*D=	579541.4	BSTAR=	967.86	TR=	.506	BBO=	198.99	CO=	4.43	TC*CO=	.418	CR*P=	.45	I=13 BBR=1068.59

CURVES INTERSECT AT AX= .41786 AY= 554447.25531

THETA=150.0	Z*D=	1732.1	BSTAR=	176.43	TR=	.761	BBO=	226.91	CO=	3.58	TC*CO=	1.772	CR*P=	.00	I= 1 BBR= 349.18
THETA=150.0	Z*D=	3464.1	BSTAR=	281.36	TR=	.627	BBO=	226.91	CO=	3.58	TC*CO=	1.203	CR*P=	.00	I= 2 BBR= 423.66
THETA=150.0	Z*D=	5196.2	BSTAR=	338.08	TR=	.599	BBO=	226.91	CO=	3.58	TC*CO=	1.027	CR*P=	.00	I= 3 BBR= 473.99
THETA=150.0	Z*D=	6928.2	BSTAR=	370.98	TR=	.592	BBO=	226.91	CO=	3.58	TC*CO=	.952	CR*P=	.00	I= 4 BBR= 505.35
THETA=150.0	Z*D=	8660.3	BSTAR=	413.83	TR=	.586	BBO=	226.91	CO=	3.58	TC*CO=	.871	CR*P=	.00	I= 5 BBR= 546.75
THETA=150.0	Z*D=	17320.6	BSTAR=	612.55	TR=	.548	BBO=	226.91	CO=	3.58	TC*CO=	.604	CR*P=	.00	I= 6 BBR= 736.93
THETA=150.0	Z*D=	34641.2	BSTAR=	854.65	TR=	.509	BBO=	226.91	CO=	3.58	TC*CO=	.422	CR*P=	.00	I= 7 BBR= 980.17
THETA=150.0	Z*D=	51961.8	BSTAR=	990.17	TR=	.491	BBO=	226.91	CO=	3.58	TC*CO=	.362	CR*P=	.01	I= 8 BBR=1101.61
THETA=150.0	Z*D=	69282.4	BSTAR=	1027.49	TR=	.483	BBO=	226.91	CO=	3.58	TC*CO=	.345	CR*P=	.01	I= 9 BBR=1137.11
THETA=150.0	Z*D=	86603.0	BSTAR=	1037.55	TR=	.479	BBO=	226.91	CO=	3.58	TC*CO=	.340	CR*P=	.02	I=10 BBR=1146.23
THETA=150.0	Z*D=	173206.0	BSTAR=	1049.60	TR=	.474	BBO=	226.91	CO=	3.58	TC*CO=	.333	CR*P=	.06	I=11 BBR=1157.15
THETA=150.0	Z*D=	346411.9	BSTAR=	1050.30	TR=	.474	BBO=	226.91	CO=	3.58	TC*CO=	.332	CR*P=	.20	I=12 BBR=1157.79
THETA=150.0	Z*D=	519617.9	BSTAR=	1050.31	TR=	.474	BBO=	226.91	CO=	3.58	TC*CO=	.332	CR*P=	.45	I=13 BBR=1157.80

CURVES INTERSECT AT AX= .33247 AY= 436918.58942

THETA=135.0	Z*D=	1414.2	BSTAR=	173.18	TR=	.757	BBO=	232.85	CO=	3.41	TC*CO=	1.721	CR*P=	.00	I= 1 BBR= 349.38
THETA=135.0	Z*D=	2828.5	BSTAR=	283.19	TR=	.606	BBO=	232.85	CO=	3.41	TC*CO=	1.135	CR*P=	.00	I= 2 BBR= 424.24
THETA=135.0	Z*D=	4242.7	BSTAR=	357.13	TR=	.556	BBO=	232.85	CO=	3.41	TC*CO=	.909	CR*P=	.00	I= 3 BBR= 486.67
THETA=135.0	Z*D=	5656.9	BSTAR=	399.08	TR=	.544	BBO=	232.85	CO=	3.41	TC*CO=	.823	CR*P=	.00	I= 4 BBR= 525.92
THETA=135.0	Z*D=	7071.1	BSTAR=	432.50	TR=	.539	BBO=	232.85	CO=	3.41	TC*CO=	.767	CR*P=	.00	I= 5 BBR= 557.92
THETA=135.0	Z*D=	14142.3	BSTAR=	612.79	TR=	.502	BBO=	232.85	CO=	3.41	TC*CO=	.546	CR*P=	.00	I= 6 BBR= 729.59
THETA=135.0	Z*D=	28284.5	BSTAR=	987.97	TR=	.459	BBO=	232.85	CO=	3.41	TC*CO=	.333	CR*P=	.00	I= 7 BBR=1094.91
THETA=135.0	Z*D=	42426.8	BSTAR=	1205.14	TR=	.438	BBO=	232.85	CO=	3.41	TC*CO=	.266	CR*P=	.01	I= 8 BBR=1307.03
THETA=135.0	Z*D=	56569.0	BSTAR=	1321.50	TR=	.426	BBO=	232.85	CO=	3.41	TC*CO=	.238	CR*P=	.01	I= 9 BBR=1420.54
THETA=135.0	Z*D=	70711.3	BSTAR=	1354.67	TR=	.420	BBO=	232.85	CO=	3.41	TC*CO=	.230	CR*P=	.02	I=10 BBR=1452.36
THETA=135.0	Z*D=	141422.5	BSTAR=	1378.68	TR=	.411	BBO=	232.85	CO=	3.41	TC*CO=	.222	CR*P=	.06	I=11 BBR=1474.38
THETA=135.0	Z*D=	282845.0	BSTAR=	1381.14	TR=	.411	BBO=	232.85	CO=	3.41	TC*CO=	.221	CR*P=	.20	I=12 BBR=1476.63
THETA=135.0	Z*D=	424267.5	BSTAR=	1381.17	TR=	.410	BBO=	232.85	CO=	3.41	TC*CO=	.221	CR*P=	.45	I=13 BBR=1476.65

CURVES INTERSECT AT AX= .22072 AY= 292419.76497

THETA=120.0	Z*D=	1000.0	BSTAR=	134.41	TR=	.783	BBO=	229.88	CO=	3.52	TC*CO=	2.016	CR*P=	.00	I= 1 BBR= 314.33
THETA=120.0	Z*D=	2000.0	BSTAR=	264.91	TR=	.593	BBO=	229.88	CO=	3.52	TC*CO=	1.196	CR*P=	.00	I= 2 BBR= 401.15
THETA=120.0	Z*D=	3000.0	BSTAR=	357.61	TR=	.503	BBO=	229.88	CO=	3.52	TC*CO=	.861	CR*P=	.00	I= 3 BBR= 473.28
THETA=120.0	Z*D=	4000.1	BSTAR=	426.91	TR=	.461	BBO=	229.88	CO=	3.52	TC*CO=	.700	CR*P=	.00	I= 4 BBR= 532.93
THETA=120.0	Z*D=	5000.1	BSTAR=	483.61	TR=	.445	BBO=	229.88	CO=	3.52	TC*CO=	.615	CR*P=	.00	I= 5 BBR= 585.94
THETA=120.0	Z*D=	10000.1	BSTAR=	635.72	TR=	.417	BBO=	229.88	CO=	3.52	TC*CO=	.461	CR*P=	.00	I= 6 BBR= 731.57
THETA=120.0	Z*D=	20000.3	BSTAR=	906.62	TR=	.370	BBO=	229.88	CO=	3.52	TC*CO=	.302	CR*P=	.00	I= 7 BBR= 991.63
THETA=120.0	Z*D=	30000.4	BSTAR=	1109.12	TR=	.344	BBO=	229.88	CO=	3.52	TC*CO=	.234	CR*P=	.01	I= 8 BBR=1188.13
THETA=120.0	Z*D=	40000.5	BSTAR=	1235.11	TR=	.327	BBO=	229.88	CO=	3.52	TC*CO=	.202	CR*P=	.01	I= 9 BBR=1310.34
THETA=120.0	Z*D=	50000.7	BSTAR=	1307.11	TR=	.316	BBO=	229.88	CO=	3.52	TC*CO=	.186	CR*P=	.02	I=10 BBR=1379.97
THETA=120.0	Z*D=	100001.3	BSTAR=	1375.68	TR=	.300	BBO=	229.88	CO=	3.52	TC*CO=	.168	CR*P=	.06	I=11 BBR=1444.59
THETA=120.0	Z*D=	200002.6	BSTAR=	1383.63	TR=	.296	BBO=	229.88	CO=	3.52	TC*CO=	.165	CR*P=	.20	I=12 BBR=1451.73

CURVES INTERSECT AT AX= .16594 AY= 173947.02178

```
THETA=105.0 Z*D=    517.7 BSTAR=  167.65 TR= .808 BBO=  260.17 CO=  3.11 TC*CO= 1.730 CR*P= .00 I= 1 BBR= 377.75
THETA=105.0 Z*D=   1035.3 BSTAR=  318.53 TR= .687 BBO=  260.17 CO=  3.11 TC*CO= 1.118 CR*P= .00 I= 2 BBR= 497.30
THETA=105.0 Z*D=   1553.0 BSTAR=  392.14 TR= .539 BBO=  260.17 CO=  3.11 TC*CO=  .819 CR*P= .00 I= 3 BBR= 532.77
THETA=105.0 Z*D=   2070.6 BSTAR=  464.04 TR= .402 BBO=  260.17 CO=  3.11 TC*CO=  .571 CR*P= .00 I= 4 BBR= 568.50
THETA=105.0 Z*D=   2588.3 BSTAR=  525.07 TR= .326 BBO=  260.17 CO=  3.11 TC*CO=  .432 CR*P= .00 I= 5 BBR= 609.99
THETA=105.0 Z*D=   5176.5 BSTAR=  747.98 TR= .230 BBO=  260.17 CO=  3.11 TC*CO=  .231 CR*P= .00 I= 6 BBR= 807.53
THETA=105.0 Z*D=  10353.0 BSTAR= 1075.55 TR= .202 BBO=  260.17 CO=  3.11 TC*CO=  145 CR*P= .00 I= 7 BBR=1128.05
THETA=105.0 Z*D=  15529.5 BSTAR= 1237.55 TR= .177 BBO=  260.17 CO=  3.11 TC*CO=  .112 CR*P= .01 I= 8 BBR=1283.56
THETA=105.0 Z*D=  20706.1 BSTAR= 1349.36 TR= .160 BBO=  260.17 CO=  3.11 TC*CO=  .093 CR*P= .01 I= 9 BBR=1390.90
THETA=105.0 Z*D=  25882.6 BSTAR= 1454.82 TR= .148 BBO=  260.17 CO=  3.11 TC*CO=  .080 CR*P= .02 I=10 BBR=1493.21
THETA=105.0 Z*D=  51765.1 BSTAR= 1691.47 TR= .119 BBO=  260.17 CO=  3.11 TC*CO=  .056 CR*P= .06 I=11 BBR=1722.35

        CURVES INTERSECT AT AX=        .05647  AY=    50997.83236

THETA=100.0 Z*D=    347.2 BSTAR=  163.00 TR= .819 BBO=  275.02 CO=  2.93 TC*CO= 1.701 CR*P= .00 I= 1 BBR= 388.30
THETA=100.0 Z*D=    694.5 BSTAR=  314.88 TR= .744 BBO=  275.02 CO=  2.93 TC*CO= 1.154 CR*P= .00 I= 2 BBR= 519.42
THETA=100.0 Z*D=   1041.7 BSTAR=  455.68 TR= .606 BBO=  275.02 CO=  2.93 TC*CO=  .785 CR*P= .00 I= 3 BBR= 622.46
THETA=100.0 Z*D=   1389.0 BSTAR=  515.38 TR= .480 BBO=  275.02 CO=  2.93 TC*CO=  .598 CR*P= .00 I= 4 BBR= 647.43
THETA=100.0 Z*D=   1736.2 BSTAR=  575.07 TR= .394 BBO=  275.02 CO=  2.93 TC*CO=  .464 CR*P= .00 I= 5 BBR= 683.35
THETA=100.0 Z*D=   3472.4 BSTAR=  784.06 TR= .150 BBO=  275.02 CO=  2.93 TC*CO=  .147 CR*P= .00 I= 6 BBR= 825.33
THETA=100.0 Z*D=   6944.9 BSTAR= 1060.14 TR= .113 BBO=  275.02 CO=  2.93 TC*CO=  .084 CR*P= .00 I= 7 BBR=1091.30
THETA=100.0 Z*D=  10417.3 BSTAR= 1331.89 TR= .098 BBO=  275.02 CO=  2.93 TC*CO=  .058 CR*P= .01 I= 8 BBR=1358.93
THETA=100.0 Z*D=  13889.8 BSTAR= 1461.14 TR= .086 BBO=  275.02 CO=  2.93 TC*CO=  .047 CR*P= .01 I= 9 BBR=1486.92
THETA=100.0 Z*D=  17362.2 BSTAR= 1556.13 TR= .078 BBO=  275.02 CO=  2.93 TC*CO=  .040 CR*P= .02 I=10 BBR=1577.52
THETA=100.0 Z*D=  34724.4 BSTAR= 1839.88 TR= .055 BBO=  275.02 CO=  2.93 TC*CO=  .024 CR*P= .06 I=11 BBR=1855.06

        CURVES INTERSECT AT AX=        .03344  AY=    24422.67295

THETA= 95.0 Z*D=    174.2 BSTAR=  119.75 TR= .826 BBO=  339.77 CO=  2.27 TC*CO= 1.590 CR*P= .00 I= 1 BBR= 400.27
THETA= 95.0 Z*D=    348.4 BSTAR=  228.40 TR= .746 BBO=  339.77 CO=  2.27 TC*CO= 1.194 CR*P= .00 I= 2 BBR= 481.99
THETA= 95.0 Z*D=    522.6 BSTAR=  337.04 TR= .662 BBO=  339.77 CO=  2.27 TC*CO=  .908 CR*P= .00 I= 3 BBR= 562.03
THETA= 95.0 Z*D=    696.8 BSTAR=  445.68 TR= .616 BBO=  339.77 CO=  2.27 TC*CO=  .725 CR*P= .00 I= 4 BBR= 655.01
THETA= 95.0 Z*D=    871.0 BSTAR=  594.33 TR= .517 BBO=  339.77 CO=  2.27 TC*CO=  .546 CR*P= .00 I= 5 BBR= 729.96
THETA= 95.0 Z*D=   1741.9 BSTAR=  807.08 TR= .175 BBO=  339.77 CO=  2.27 TC*CO=  156 CR*P= .00 I= 6 BBR= 866.58
THETA= 95.0 Z*D=   3483.8 BSTAR= 1037.72 TR= .027 BBO=  339.77 CO=  2.27 TC*CO=  .019 CR*P= .00 I= 7 BBR=1066.73
THETA= 95.0 Z*D=   5225.8 BSTAR= 1176.17 TR= .017 BBO=  339.77 CO=  2.27 TC*CO=  011 CR*P= .01 I= 8 BBR=1182.05
THETA= 95.0 Z*D=   6967.7 BSTAR= 1258.49 TR= .016 BBO=  339.77 CO=  2.27 TC*CO=  .010 CR*P= .01 I= 9 BBR=1273.95

        CURVES INTERSECT AT AX=        .01022  AY=     6413.56954

        AZIMUTH OF PATH OF SIGHT WITH RESPECT TO SUN IS 135 DEGREES

 ZENITH OF PATH OF SIGHT = 180  DISTANCE TO TARGET AXIS =      0  ALTITUDE =  605880  CONTRAST IS POSITIVE

 ZENITH OF PATH OF SIGHT = 165  DISTANCE TO TARGET AXIS =  146603  ALTITUDE =  954447  CONTRAST IS POSITIVE

 ZENITH OF PATH OF SIGHT = 150  DISTANCE TO TARGET AXIS =  252236  ALTITUDE =  436919  CONTRAST IS POSITIVE

 ZENITH OF PATH OF SIGHT = 135  DISTANCE TO TARGET AXIS =  292401  ALTITUDE =  292420  CONTRAST IS POSITIVE

 ZENITH OF PATH OF SIGHT = 120  DISTANCE TO TARGET AXIS =  301263  ALTITUDE =  173947  CONTRAST IS POSITIVE

 ZENITH OF PATH OF SIGHT = 105  DISTANCE TO TARGET AXIS =  190303  ALTITUDE =   50998  CONTRAST IS POSITIVE

 ZENITH OF PATH OF SIGHT = 100  DISTANCE TO TARGET AXIS =  158510  ALTITUDE =   24423  CONTRAST IS POSITIVE

 ZENITH OF PATH OF SIGHT =  95  DISTANCE TO TARGET AXIS =   73338  ALTITUDE =    6414  CONTRAST IS POSITIVE
```

AZIMUTH OF PATH OF SIGHT WITH RESPECT TO SUN IS 180 DEGREES

THETA=180.0	Z*D=	2000.0	BSTAR=	131.71	TR=	.762	BB0=	197.80	C0=	4.95	TC*C0=	2.639	CR*P=	.00	I= 1	BBR= 282.42
THETA=180.0	Z*D=	4000.0	BSTAR=	220.81	TR=	.646	BB0=	197.80	C0=	4.95	TC*C0=	1.813	CR*P=	.00	I= 2	BBR= 348.45
THETA=180.0	Z*D=	6000.0	BSTAR=	273.01	TR=	.630	BB0=	197.80	C0=	4.95	TC*C0=	1.551	CR*P=	.00	I= 3	BBR= 397.48
THETA=180.0	Z*D=	8000.0	BSTAR=	318.01	TR=	.623	BB0=	197.80	C0=	4.95	TC*C0=	1.382	CR*P=	.00	I= 4	BBR= 441.33
THETA=180.0	Z*D=	10000.0	BSTAR=	360.31	TR=	.614	BB0=	197.80	C0=	4.95	TC*C0=	1.247	CR*P=	.00	I= 5	BBR= 481.74
THETA=180.0	Z*D=	20000.0	BSTAR=	553.81	TR=	.580	BB0=	197.80	C0=	4.95	TC*C0=	.849	CR*P=	.00	I= 6	BBR= 668.53
THETA=180.0	Z*D=	40000.0	BSTAR=	846.31	TR=	.543	BB0=	197.80	C0=	4.95	TC*C0=	.557	CR*P=	.00	I= 7	BBR= 953.46
THETA=180.0	Z*D=	60000.0	BSTAR=	955.11	TR=	.528	BB0=	197.80	C0=	4.95	TC*C0=	.483	CR*P=	.01	I= 8	BBR=1069.51
THETA=180.0	Z*D=	80000.0	BSTAR=	980.26	TR=	.522	BB0=	197.80	C0=	4.95	TC*C0=	.472	CR*P=	.01	I= 9	BBR=1083.59
THETA=180.0	Z*D=	100000.0	BSTAR=	987.97	TR=	.519	BB0=	197.80	C0=	4.95	TC*C0=	.466	CR*P=	.02	I=10	BBR=1090.70
THETA=180.0	Z*D=	200000.0	BSTAR=	995.77	TR=	.516	BB0=	197.80	C0=	4.95	TC*C0=	.460	CR*P=	.06	I=11	BBR=1097.90
THETA=180.0	Z*D=	400000.0	BSTAR=	996.05	TR=	.516	BB0=	197.80	C0=	4.95	TC*C0=	.460	CR*P=	.20	I=12	BBR=1098.17
THETA=180.0	Z*D=	600000.0	BSTAR=	996.05	TR=	.516	BB0=	197.80	C0=	4.95	TC*C0=	.460	CR*P=	.45	I=13	BBR=1098.17
THETA=180.0	Z*D=	800000.0	BSTAR=	996.05	TR=	.516	BB0=	197.80	C0=	4.95	TC*C0=	.460	CR*P=	.79	I=14	BBR=1098.17

CURVES INTERSECT AT AX= .45990 AY= 605879.55823

THETA=165.0	Z*D=	1931.8	BSTAR=	130.89	TR=	.756	BB0=	238.79	C0=	3.85	TC*C0=	2.233	CR*P=	.00	I= 1	BBR= 311.52
THETA=165.0	Z*D=	3863.6	BSTAR=	222.73	TR=	.640	BB0=	238.79	C0=	3.85	TC*C0=	1.566	CR*P=	.00	I= 2	BBR= 375.47
THETA=165.0	Z*D=	5795.4	BSTAR=	263.74	TR=	.622	BB0=	238.79	C0=	3.85	TC*C0=	1.388	CR*P=	.00	I= 3	BBR= 412.37
THETA=165.0	Z*D=	7727.2	BSTAR=	341.98	TR=	.615	BB0=	238.79	C0=	3.85	TC*C0=	1.157	CR*P=	.00	I= 4	BBR= 488.89
THETA=165.0	Z*D=	9659.0	BSTAR=	428.55	TR=	.607	BB0=	238.79	C0=	3.85	TC*C0=	.973	CR*P=	.00	I= 5	BBR= 573.39
THETA=165.0	Z*D=	19318.0	BSTAR=	624.99	TR=	.572	BB0=	238.79	C0=	3.85	TC*C0=	.690	CR*P=	.00	I= 6	BBR= 761.54
THETA=165.0	Z*D=	38636.1	BSTAR=	939.17	TR=	.535	BB0=	238.79	C0=	3.85	TC*C0=	.461	CR*P=	.00	I= 7	BBR=1066.89
THETA=165.0	Z*D=	57954.1	BSTAR=	1072.90	TR=	.520	BB0=	238.79	C0=	3.85	TC*C0=	.399	CR*P=	.01	I= 8	BBR=1196.97
THETA=165.0	Z*D=	77272.2	BSTAR=	1097.26	TR=	.513	BB0=	238.79	C0=	3.85	TC*C0=	.387	CR*P=	.01	I= 9	BBR=1219.77
THETA=165.0	Z*D=	96590.2	BSTAR=	1106.41	TR=	.510	BB0=	238.79	C0=	3.85	TC*C0=	.382	CR*P=	.02	I=10	BBR=1228.15
THETA=165.0	Z*D=	193180.5	BSTAR=	1116.08	TR=	.506	BB0=	238.79	C0=	3.85	TC*C0=	.376	CR*P=	.06	I=11	BBR=1236.99
THETA=165.0	Z*D=	386360.9	BSTAR=	1116.48	TR=	.506	BB0=	238.79	C0=	3.85	TC*C0=	.376	CR*P=	.20	I=12	BBR=1237.36
THETA=165.0	Z*D=	579541.4	BSTAR=	1116.48	TR=	.506	BB0=	238.79	C0=	3.85	TC*C0=	.376	CR*P=	.45	I=13	BBR=1237.36

CURVES INTERSECT AT AX= .37618 AY= 521671.88513

THETA=150.0	Z*D=	1732.1	BSTAR=	151.01	TR=	.761	BB0=	263.74	C0=	3.64	TC*C0=	2.020	CR*P=	.00	I= 1	BBR= 361.79
THETA=150.0	Z*D=	3464.1	BSTAR=	286.66	TR=	.627	BB0=	263.74	C0=	3.64	TC*C0=	1.332	CR*P=	.00	I= 2	BBR= 452.05
THETA=150.0	Z*D=	5196.2	BSTAR=	342.60	TR=	.599	BB0=	263.74	C0=	3.64	TC*C0=	1.149	CR*P=	.00	I= 3	BBR= 500.56
THETA=150.0	Z*D=	6928.2	BSTAR=	384.41	TR=	.592	BB0=	263.74	C0=	3.64	TC*C0=	1.052	CR*P=	.00	I= 4	BBR= 540.60
THETA=150.0	Z*D=	8660.3	BSTAR=	437.83	TR=	.586	BB0=	263.74	C0=	3.64	TC*C0=	.949	CR*P=	.00	I= 5	BBR= 592.31
THETA=150.0	Z*D=	17320.6	BSTAR=	649.16	TR=	.548	BB0=	263.74	C0=	3.64	TC*C0=	.663	CR*P=	.00	I= 6	BBR= 793.72
THETA=150.0	Z*D=	34641.2	BSTAR=	1049.30	TR=	.509	BB0=	263.74	C0=	3.64	TC*C0=	.413	CR*P=	.00	I= 7	BBR=1183.58
THETA=150.0	Z*D=	51961.8	BSTAR=	1247.47	TR=	.491	BB0=	263.74	C0=	3.64	TC*C0=	.342	CR*P=	.01	I= 8	BBR=1377.00
THETA=150.0	Z*D=	69282.4	BSTAR=	1308.81	TR=	.483	BB0=	263.74	C0=	3.64	TC*C0=	.323	CR*P=	.01	I= 9	BBR=1436.22
THETA=150.0	Z*D=	86603.0	BSTAR=	1321.66	TR=	.479	BB0=	263.74	C0=	3.64	TC*C0=	.318	CR*P=	.02	I=10	BBR=1447.97
THETA=150.0	Z*D=	173206.0	BSTAR=	1337.04	TR=	.474	BB0=	263.74	C0=	3.64	TC*C0=	.311	CR*P=	.06	I=11	BBR=1462.15
THETA=150.0	Z*D=	346411.9	BSTAR=	1337.94	TR=	.474	BB0=	263.74	C0=	3.64	TC*C0=	.311	CR*P=	.20	I=12	BBR=1462.97
THETA=150.0	Z*D=	519617.9	BSTAR=	1337.94	TR=	.474	BB0=	263.74	C0=	3.64	TC*C0=	.311	CR*P=	.45	I=13	BBR=1462.98

CURVES INTERSECT AT AX= .31084 AY= 421667.48001

THETA=135.0	Z*D=	1414.2	BSTAR=	151.62	TR=	.757	BB0=	343.33	C0=	2.94	TC*C0=	1.859	CR*P=	.00	I= 1	BBR= 411.43
THETA=135.0	Z*D=	2828.5	BSTAR=	289.97	TR=	.606	BB0=	343.33	C0=	2.94	TC*C0=	1.230	CR*P=	.00	I= 2	BBR= 497.95
THETA=135.0	Z*D=	4242.7	BSTAR=	386.80	TR=	.556	BB0=	343.33	C0=	2.94	TC*C0=	.973	CR*P=	.00	I= 3	BBR= 577.81
THETA=135.0	Z*D=	5656.9	BSTAR=	436.21	TR=	.544	BB0=	343.33	C0=	2.94	TC*C0=	883	CR*P=	.00	I= 4	BBR= 623.09
THETA=135.0	Z*D=	7071.1	BSTAR=	476.15	TR=	.539	BB0=	343.33	C0=	2.94	TC*C0=	824	CR*P=	.00	I= 5	BBR= 661.18
THETA=135.0	Z*D=	14142.3	BSTAR=	638.70	TR=	.502	BB0=	343.33	C0=	2.94	TC*C0=	.625	CR*P=	.00	I= 6	BBR= 810.94
THETA=135.0	Z*D=	28284.5	BSTAR=	959.31	TR=	.459	BB0=	343.33	C0=	2.94	TC*C0=	412	CR*P=	.00	I= 7	BBR=1126.98
THETA=135.0	Z*D=	42426.8	BSTAR=	1154.77	TR=	.438	BB0=	343.33	C0=	2.94	TC*C0=	.336	CR*P=	.01	I= 8	BBR=1315.01
THETA=135.0	Z*D=	56569.0	BSTAR=	1261.58	TR=	.426	BB0=	343.33	C0=	2.94	TC*C0=	306	CR*P=	.01	I= 9	BBR=1407.77
THETA=135.0	Z*D=	70711.3	BSTAR=	1291.12	TR=	.420	BB0=	343.33	C0=	2.94	TC*C0=	296	CR*P=	.02	I=10	BBR=1435.17
THETA=135.0	Z*D=	141422.5	BSTAR=	1314.00	TR=	.411	BB0=	343.33	C0=	2.94	TC*C0=	286	CR*P=	.06	I=11	BBR=1455.10
THETA=135.0	Z*D=	282845.0	BSTAR=	1316.35	TR=	.410	BB0=	343.33	C0=	2.94	TC*C0=	.285	CR*P=	.20	I=12	BBR=1457.14
THETA=135.0	Z*D=	424267.5	BSTAR=	1316.37	TR=	.410	BB0=	343.33	C0=	2.94	TC*C0=	.285	CR*P=	.45	I=13	BBR=1457.16

CURVES INTERSECT AT AX= .28452 AY= 329144.30197

THETA=120.0	Z*D=	1000.0	BSTAR=	140.71	TR=	.783	BB0=	380.16	C0=	2.23	TC*C0=	1.517	CR*P=	.00	I= 1	BBR= 438.24
THETA=120.0	Z*D=	2000.0	BSTAR=	257.71	TR=	.593	BB0=	380.16	C0=	2.23	TC*C0=	1.042	CR*P=	.00	I= 2	BBR= 483.11
THETA=120.0	Z*D=	3000.0	BSTAR=	354.91	TR=	.503	BB0=	380.16	C0=	2.23	TC*C0=	782	CR*P=	.00	I= 3	BBR= 546.20
THETA=120.0	Z*D=	4000.1	BSTAR=	417.01	TR=	.461	BB0=	380.16	C0=	2.23	TC*C0=	.661	CR*P=	.00	I= 4	BBR= 592.18
THETA=120.0	Z*D=	5000.1	BSTAR=	471.91	TR=	.445	BB0=	380.16	C0=	2.23	TC*C0=	.590	CR*P=	.00	I= 5	BBR= 641.14
THETA=120.0	Z*D=	10000.1	BSTAR=	645.61	TR=	.417	BB0=	380.16	C0=	2.23	TC*C0=	.440	CR*P=	.00	I= 6	BBR= 804.13
THETA=120.0	Z*D=	20000.3	BSTAR=	850.72	TR=	.370	BB0=	380.16	C0=	2.23	TC*C0=	.314	CR*P=	.00	I= 7	BBR=1001.30
THETA=120.0	Z*D=	30000.4	BSTAR=	1055.12	TR=	.344	BB0=	380.16	C0=	2.23	TC*C0=	.246	CR*P=	.01	I= 8	BBR=1185.79
THETA=120.0	Z*D=	40000.5	BSTAR=	1191.11	TR=	.327	BB0=	380.16	C0=	2.23	TC*C0=	.213	CR*P=	.01	I= 9	BBR=1305.52
THETA=120.0	Z*D=	50000.7	BSTAR=	1233.11	TR=	.316	BB0=	380.16	C0=	2.23	TC*C0=	.196	CR*P=	.02	I=10	BBR=1373.43
THETA=120.0	Z*D=	100001.3	BSTAR=	1320.73	TR=	.300	BB0=	380.16	C0=	2.23	TC*C0=	.177	CR*P=	.06	I=11	BBR=1434.58
THETA=120.0	Z*D=	200002.6	BSTAR=	1328.36	TR=	.296	BB0=	380.16	C0=	2.23	TC*C0=	175	CR*P=	.20	I=12	BBR=1440.98

CURVES INTERSECT AT AX= .17519 AY= 180265.52450

```
THETA=105.0 Z*D=    517.7 BSTAR=  117.13 TR= .808 BR0=  422.33 C0= 1.97 TC*C0= 1.464 CR*P= .00 I= 1 BBR= 458.39
THETA=105.0 Z*D=   1035.3 BSTAR=  224.83 TR= .687 BR0=  422.33 C0= 1.97 TC*C0= 1.109 CR*P= .00 I= 2 BBR= 515.12
THETA=105.0 Z*D=   1553.0 BSTAR=  349.68 TR= .539 BR0=  422.33 C0= 1.97 TC*C0=  .775 CR*P= .00 I= 3 BBR= 577.15
THETA=105.0 Z*D=   2070.6 BSTAR=  469.33 TR= .402 BR0=  422.33 C0= 1.97 TC*C0=  .522 CR*P= .00 I= 4 BBR= 638.90
THETA=105.0 Z*D=   2588.3 BSTAR=  555.99 TR= .326 BR0=  422.33 C0= 1.97 TC*C0=  .391 CR*P= .00 I= 5 BBR= 693.58
THETA=105.0 Z*D=   5176.5 BSTAR=  799.83 TR= .230 BR0=  422.33 C0= 1.97 TC*C0=  .213 CR*P= .00 I= 6 BBR= 897.14
THETA=105.0 Z*D=  10353.0 BSTAR= 1146.91 TR= .202 BR0=  422.33 C0= 1.97 TC*C0=  .136 CR*P= .00 I= 7 BBR=1232.14
THETA=105.0 Z*D=  15529.5 BSTAR= 1308.17 TR= .177 BR0=  422.33 C0= 1.97 TC*C0=  .106 CR*P= .01 I= 8 BBR=1383.12
THETA=105.0 Z*D=  20706.1 BSTAR= 1493.26 TR= .160 BR0=  422.33 C0= 1.97 TC*C0=  .085 CR*P= .01 I= 9 BBR=1560.59
THETA=105.0 Z*D=  25882.6 BSTAR= 1663.94 TR= .148 BR0=  422.33 C0= 1.97 TC*C0=  .071 CR*P= .02 I=10 BBR=1726.25
THETA=105.0 Z*D=  51765.1 BSTAR= 2074.23 TR= .119 BR0=  422.33 C0= 1.97 TC*C0=  .046 CR*P= .06 I=11 BBR=2124.36

        CURVES INTERSECT AT AX=      .05066  AY=    47315.77401

THETA=100.0 Z*D=    347.2 BSTAR=  162.68 TR= .819 BR0=  450.25 C0= 1.84 TC*C0= 1.274 CR*P= .00 I= 1 BBR= 531.53
THETA=100.0 Z*D=    694.5 BSTAR=  314.26 TR= .744 BR0=  450.25 C0= 1.84 TC*C0=  .947 CR*P= .00 I= 2 BBR= 649.12
THETA=100.0 Z*D=   1041.7 BSTAR=  458.05 TR= .606 BR0=  450.25 C0= 1.84 TC*C0=  .686 CR*P= .00 I= 3 BBR= 731.08
THETA=100.0 Z*D=   1389.0 BSTAR=  544.93 TR= .480 BR0=  450.25 C0= 1.84 TC*C0=  .522 CR*P= .00 I= 4 BBR= 761.13
THETA=100.0 Z*D=   1736.2 BSTAR=  631.81 TR= .394 BR0=  450.25 C0= 1.84 TC*C0=  .402 CR*P= .00 I= 5 BBR= 809.08
THETA=100.0 Z*D=   3472.4 BSTAR=  897.26 TR= .150 BR0=  450.25 C0= 1.84 TC*C0=  .179 CR*P= .00 I= 6 BBR= 964.93
THETA=100.0 Z*D=   6944.9 BSTAR= 1228.66 TR= .113 BR0=  450.25 C0= 1.84 TC*C0=  .073 CR*P= .00 I= 7 BBR=1279.57
THETA=100.0 Z*D=  10417.3 BSTAR= 1412.89 TR= .098 BR0=  450.25 C0= 1.84 TC*C0=  .056 CR*P= .01 I= 8 BBR=1457.15
THETA=100.0 Z*D=  13889.8 BSTAR= 1544.14 TR= .086 BR0=  450.25 C0= 1.84 TC*C0=  .045 CR*P= .01 I= 9 BBR=1582.90
THETA=100.0 Z*D=  17362.2 BSTAR= 1679.65 TR= .078 BR0=  450.25 C0= 1.84 TC*C0=  .038 CR*P= .02 I=10 BBR=1714.94
THETA=100.0 Z*D=  34724.4 BSTAR= 2193.15 TR= .055 BR0=  450.25 C0= 1.84 TC*C0=  .021 CR*P= .06 I=11 BBR=2218.10

        CURVES INTERSECT AT AX=      .03153  AY=    23608.92207

THETA= 95.0 Z*D=    174.2 BSTAR=  145.94 TR= .826 BR0=  490.95 C0= 1.69 TC*C0= 1.243 CR*P= .00 I= 1 BBR= 550.52
THETA= 95.0 Z*D=    348.4 BSTAR=  290.76 TR= .746 BR0=  490.95 C0= 1.69 TC*C0=  .957 CR*P= .00 I= 2 BBR= 646.52
THETA= 95.0 Z*D=    522.6 BSTAR=  415.58 TR= .662 BR0=  490.95 C0= 1.69 TC*C0=  .741 CR*P= .00 I= 3 BBR= 740.18
THETA= 95.0 Z*D=    696.8 BSTAR=  550.41 TR= .616 BR0=  490.95 C0= 1.69 TC*C0=  .599 CR*P= .00 I= 4 BBR= 852.32
THETA= 95.0 Z*D=    871.0 BSTAR=  685.23 TR= .517 BR0=  490.95 C0= 1.69 TC*C0=  .456 CR*P= .00 I= 5 BBR= 938.54
THETA= 95.0 Z*D=   1741.9 BSTAR=  972.07 TR= .175 BR0=  490.95 C0= 1.69 TC*C0=  .137 CR*P= .00 I= 6 BBR=1057.99
THETA= 95.0 Z*D=   3483.8 BSTAR= 1190.24 TR= .027 BR0=  490.95 C0= 1.69 TC*C0=  .018 CR*P= .00 I= 7 BBR=1193.24
THETA= 95.0 Z*D=   5225.8 BSTAR= 1257.33 TR= .017 BR0=  490.95 C0= 1.69 TC*C0=  .011 CR*P= .01 I= 8 BBR=1275.91
THETA= 95.0 Z*D=   6967.7 BSTAR= 1342.24 TR= .016 BR0=  490.95 C0= 1.69 TC*C0=  .010 CR*P= .01 I= 9 BBR=1350.11

        CURVES INTERSECT AT AX=      .01028  AY=     6438.73485

        AZIMUTH OF PATH OF SIGHT WITH RESPECT TO SUN IS 180 DEGREES

   ZENITH OF PATH OF SIGHT = 180  DISTANCE TO TARGET AXIS =      0  ALTITUDE =  605880  CONTRAST IS POSITIVE

   ZENITH OF PATH OF SIGHT = 165  DISTANCE TO TARGET AXIS =  139819  ALTITUDE =  521672  CONTRAST IS POSITIVE

   ZENITH OF PATH OF SIGHT = 150  DISTANCE TO TARGET AXIS =  243432  ALTITUDE =  421667  CONTRAST IS POSITIVE

   ZENITH OF PATH OF SIGHT = 135  DISTANCE TO TARGET AXIS =  329123  ALTITUDE =  329144  CONTRAST IS POSITIVE

   ZENITH OF PATH OF SIGHT = 120  DISTANCE TO TARGET AXIS =  312207  ALTITUDE =  180266  CONTRAST IS POSITIVE

   ZENITH OF PATH OF SIGHT = 105  DISTANCE TO TARGET AXIS =  176563  ALTITUDE =   47316  CONTRAST IS POSITIVE

   ZENITH OF PATH OF SIGHT = 100  DISTANCE TO TARGET AXIS =  133890  ALTITUDE =   23608  CONTRAST IS POSITIVE

   ZENITH OF PATH OF SIGHT =  95  DISTANCE TO TARGET AXIS =   73626  ALTITUDE =    6439  CONTRAST IS POSITIVE

   COORDINATES FOR PLOTTING 4 CROSS SECTIONS. X = HORIZONTAL Z = VERTICAL

      X1      Z1      X2      Z2      X3      Z3      X4      Z4

  808092    8038  825594    6507  831791    5965  826662    6414

  710791   33362  746957   26985  764976   23808  761490   24423

  647179   67751  702640   52889  717132   49005  709697   50998

  375524  302828  523147  217592  599451  173535  598737  173947
```

```
 132460  767589  501607  398418  567499  332523  607599  292420

 419617  832110  588338  539856  635989  457315  647764  436919

 695995  761154  718267  678055  752770  549324  751397  554447

 900000  605880  900000  605880  900000  605880  900000  605880

1039819  521672 1048603  554447 1047230  549324 1081733  678055

1143432  421667 1152236  436919 1164011  457315 1211662  539856

1229123  329144 1192401  292420 1232501  332523 1298393  398418

1212207  180766 1201263  173947 1300549  173535 1276853  217692

1076563   47316 1090303   50998 1082868   49005 1097360   52889

1033890   23608 1038510   24423 1035024   23808 1053043   26985

 973626    6439  973338    6414  968209    5965  974406    6507

AXSL= 1800000.0  CSLX=   18000.0  CSLY= 1620000.0  AXLX=  900000.0  AXLY=       0

NTGDM= 100  NAINC= 180000  NPROB= 50

CURRENT ELAPSED TIME IS     0 MINUTES       36 SECONDS.
```

```
                                                                    JOB 1353  02/04/65     PAGE 1
      PROGRAM PODV1
C     ...PROGRAM PODV1...1NOV,65...BARKDOLL,...VISLAB...UCSD
C     ...PODV1= PROBABILITY OF DETECTION VOLUME PHASE 1
C     ...THIS PROGRAM PROVIDES INPUT DATA FOR THE
C     ...SOLUTION OF A PROBABILITY OF TARGET DETECTION VOLUME.
C     ...THE CALLED SEQUENCE OF PROGRAMS WILL PRINT THE
C     ...ALTITUDE AND DISTANCE FROM THE TARGET AXIS FOR
C     ...8 DOWNWARD LOOKING ZENITHS OF PATH OF SIGHT,
C     ...THETA=180,165,150,135,120,105,100,95 DEGREES AND
C     ...FOR 5 AZIMUTHS OF PATH OF SIGHT WITH RESPECT
C     ...TO THE SUN, PHI=0,45,90,135,180 DEGREES.
C     ...THE PROGRAM WILL ALSO PLOT THESE POINTS AS
C     ...4 HEMISPHERIC CROSS SECTIONS,
C
C     ...VARIABLE INPUTS...
C     ...OPT=OPTION FOR ATMOSPHERIC AND OPTICAL SYSTEM
C     .....OPT=0 FOR VIEWING THROUGH ATMOSPHERE ONLY
C     .....OPT=-1 FOR OPTICS AND NO ATMOSPHERE
C     .....OPT=+1 FOR OPTICS AND AN ATMOSPHERE
C     ...FNUMB=FLIGHT NUMBER FOR ATMOSPHERIC DATA
C     ...OPTNU=OPTICAL SYSTEM INDEX NUMBER
C     ...DIAM=TARGET DIAMETER IN FT..NOT TO EXCEED 100 FT.
C     ...OBJ=INDEX FOR DIRECTIONAL REFLECTANCE PROPERTIES
C     ...OF TARGET OBJECT
C     ...BAC=INDEX FOR DIRECTIONAL REFLECTANCE PROPERTIES
C     ...OF BACKGROUND
C     ...PROBK=CONSTANT FOR DEVIATION FROM 50 PERCENT
C     ...PROBABILITY,1. FOR 50,1.206 FOR 70, 1.90 FOR 90, AND
C     ...1.91 FOR 99 PERCENT PROBABILITY OF DETECTION
C     ...NPROB=INTEGER REPRESENTING PROBABILITY
C     ...SW1=SWITCH FOR OUTPUT PRINTING, 1 FOR CALCULATIONS
C     ...AND COORDINATES, 0 FOR COORDINATES ONLY
C     ...SW2=SWITCH FOR PLOTTING, 1 IF PLOT IS DESIRED
C     ...0 FOR NO PLOT
C     ...
C     ...CALLED PROGRAMS=TCAL
C
      OPT=-1.
      FNUMB=74.
      DIAM=100.
      OBJ=1.
      BAC=1.
      PROBK=1.
      NPROB=50
      SW1=1.
      SW2=1.
      CALL DATA1
      CALL DATA2
      CALL DATA 3
      CALL TCAL(OPT,FNUMB,OPTNU,DIAM,OBJ,BAC,PROBK,NPROB,
     1SW1,SW2)
      CALL PREP(9)
      END
```

```
 TARGET DETECTION FOR INFINITE VIEWING TIME

  PATH OF SIGHT THROUGH OPTICAL SYSTEM AND NO ATMOSPHERE

  PROGRAM DATA FROM FLIGHT NUMBER  74

  PROBABILITY OF DETECTION IS 50 PERCENT

  TARGET DIAMETER IN FT. = 100

  BACKGROUND FOR TARGET IS PINE TREES

  TARGET IS SPHERICAL AND PAINTED GRAY
```

AZIMUTH OF PATH OF SIGHT WITH RESPECT TO SUN IS 0 DEGREES

THETA=180.0	Z*D=	2000.0	BSTAR=	11.11	TR= .900	BB0=	197.80	C0=	4.95	TC*C0= 4.655	CR*P=	.00	I= 1 BBR= 189.13
THETA=180.0	Z*D=	4000.0	BSTAR=	11.11	TR= .900	BB0=	197.80	C0=	4.95	TC*C0= 4.655	CR*P=	.00	I= 2 BBR= 189.13
THETA=180.0	Z*D=	6000.0	BSTAR=	11.11	TR= .900	BB0=	197.80	C0=	4.95	TC*C0= 4.655	CR*P=	.00	I= 3 BBR= 189.13
THETA=180.0	Z*D=	8000.0	BSTAR=	11.11	TR= .900	BB0=	197.80	C0=	4.95	TC*C0= 4.655	CR*P=	.00	I= 4 BBR= 189.13
THETA=180.0	Z*D=	10000.0	BSTAR=	11.11	TR= .900	BB0=	197.80	C0=	4.95	TC*C0= 4.655	CR*P=	.00	I= 5 BBR= 189.13
THETA=180.0	Z*D=	20000.0	BSTAR=	11.11	TR= .900	BB0=	197.80	C0=	4.95	TC*C0= 4.655	CR*P=	.00	I= 6 BBR= 189.13
THETA=180.0	Z*D=	40000.0	BSTAR=	11.11	TR= .900	BB0=	197.80	C0=	4.95	TC*C0= 4.655	CR*P=	.01	I= 7 BBR= 189.13
THETA=180.0	Z*D=	60000.0	BSTAR=	11.11	TR= .900	BB0=	197.80	C0=	4.95	TC*C0= 4.655	CR*P=	.01	I= 8 BBR= 189.13
THETA=180.0	Z*D=	80000.0	BSTAR=	11.11	TR= .900	BB0=	197.80	C0=	4.95	TC*C0= 4.655	CR*P=	.01	I= 9 BBR= 189.13
THETA=180.0	Z*D=	100000.0	BSTAR=	11.11	TR= .900	BB0=	197.80	C0=	4.95	TC*C0= 4.655	CR*P=	.02	I=10 BBR= 189.13
THETA=180.0	Z*D=	200000.0	BSTAR=	11.11	TR= .900	BB0=	197.80	C0=	4.95	TC*C0= 4.655	CR*P=	.07	I=11 BBR= 189.13
THETA=180.0	Z*D=	400000.0	BSTAR=	11.11	TR= .900	BB0=	197.80	C0=	4.95	TC*C0= 4.655	CR*P=	.27	I=12 BBR= 189.13
THETA=180.0	Z*D=	600000.0	BSTAR=	11.11	TR= .900	BB0=	197.80	C0=	4.95	TC*C0= 4.655	CR*P=	.59	I=13 BBR= 189.13
THETA=180.0	Z*D=	800000.0	BSTAR=	11.11	TR= .900	BB0=	197.80	C0=	4.95	TC*C0= 4.655	CR*P=	1.05	I=14 BBR= 189.13
THETA=180.0	Z*D=	1000000.0	BSTAR=	11.11	TR= .900	BB0=	197.80	C0=	4.95	TC*C0= 4.655	CR*P=	1.65	I=15 BBR= 189.13
THETA=180.0	Z*D=	1500000.0	BSTAR=	11.11	TR= .900	BB0=	197.80	C0=	4.95	TC*C0= 4.655	CR*P=	3.71	I=16 BBR= 189.13
THETA=180.0	Z*D=	2000000.0	BSTAR=	11.11	TR= .900	BB0=	197.80	C0=	4.95	TC*C0= 4.655	CR*P=	6.54	I=17 BBR= 189.13

CURVES INTERSECT AT Ax= 4.65538 AY= 1667644.05591

THETA=165.0	Z*D=	1931.8	BSTAR=	11.11	TR= .900	BB0=	143.15	C0=	8.75	TC*C0= 8.056	CR*P=	.00	I= 1 BBR= 139.95
THETA=165.0	Z*D=	3863.6	BSTAR=	11.11	TR= .900	BB0=	143.15	C0=	8.75	TC*C0= 8.056	CR*P=	.00	I= 2 BBR= 139.95
THETA=165.0	Z*D=	5795.4	BSTAR=	11.11	TR= .900	BB0=	143.15	C0=	8.75	TC*C0= 8.056	CR*P=	.00	I= 3 BBR= 139.95
THETA=165.0	Z*D=	7727.2	BSTAR=	11.11	TR= .900	BB0=	143.15	C0=	8.75	TC*C0= 8.056	CR*P=	.00	I= 4 BBR= 139.95
THETA=165.0	Z*D=	9659.0	BSTAR=	11.11	TR= .900	BB0=	143.15	C0=	8.75	TC*C0= 8.056	CR*P=	.00	I= 5 BBR= 139.95
THETA=165.0	Z*D=	19318.0	BSTAR=	11.11	TR= .900	BB0=	143.15	C0=	8.75	TC*C0= 8.056	CR*P=	.00	I= 6 BBR= 139.95
THETA=165.0	Z*D=	38636.1	BSTAR=	11.11	TR= .900	BB0=	143.15	C0=	8.75	TC*C0= 8.056	CR*P=	.01	I= 7 BBR= 139.95
THETA=165.0	Z*D=	57954.1	BSTAR=	11.11	TR= .900	BB0=	143.15	C0=	8.75	TC*C0= 8.056	CR*P=	.01	I= 8 BBR= 139.95
THETA=165.0	Z*D=	77272.2	BSTAR=	11.11	TR= .900	BB0=	143.15	C0=	8.75	TC*C0= 8.056	CR*P=	.01	I= 9 BBR= 139.95
THETA=165.0	Z*D=	96590.2	BSTAR=	11.11	TR= .900	BB0=	143.15	C0=	8.75	TC*C0= 8.056	CR*P=	.02	I=10 BBR= 139.95
THETA=165.0	Z*D=	193180.5	BSTAR=	11.11	TR= .900	BB0=	143.15	C0=	8.75	TC*C0= 8.056	CR*P=	.07	I=11 BBR= 139.95
THETA=165.0	Z*D=	386360.9	BSTAR=	11.11	TR= .900	BB0=	143.15	C0=	8.75	TC*C0= 8.056	CR*P=	.27	I=12 BBR= 139.95
THETA=165.0	Z*D=	579541.4	BSTAR=	11.11	TR= .900	BB0=	143.15	C0=	8.75	TC*C0= 8.056	CR*P=	.60	I=13 BBR= 139.95
THETA=165.0	Z*D=	772721.9	BSTAR=	11.11	TR= .900	BB0=	143.15	C0=	8.75	TC*C0= 8.056	CR*P=	1.07	I=14 BBR= 139.95
THETA=165.0	Z*D=	965902.4	BSTAR=	11.11	TR= .900	BB0=	143.15	C0=	8.75	TC*C0= 8.056	CR*P=	1.68	I=15 BBR= 139.95
THETA=165.0	Z*D=	1448853.6	BSTAR=	11.11	TR= .900	BB0=	143.15	C0=	8.75	TC*C0= 8.056	CR*P=	3.76	I=16 BBR= 139.95
THETA=165.0	Z*D=	1931804.7	BSTAR=	11.11	TR= .900	BB0=	143.15	C0=	8.75	TC*C0= 8.056	CR*P=	6.63	I=17 BBR= 139.95
THETA=165.0	Z*D=	2414755.9	BSTAR=	11.11	TR= .900	BB0=	143.15	C0=	8.75	TC*C0= 8.056	CR*P=	10.39	I=18 BBR= 139.95

CURVES INTERSECT AT Ax= 8.05626 AY= 2115034.18878

THETA=150.0	Z*D=	1732.1	BSTAR=	11.11	TR= .900	BB0=	127.12	C0=	18.16	TC*C0=16.551	CR*P=	.00	I= 1 BBR= 125.52
THETA=150.0	Z*D=	3464.1	BSTAR=	11.11	TR= .900	BB0=	127.12	C0=	18.16	TC*C0=16.551	CR*P=	.00	I= 2 BBR= 125.52
THETA=150.0	Z*D=	5196.2	BSTAR=	11.11	TR= .900	BB0=	127.12	C0=	18.16	TC*C0=16.551	CR*P=	.00	I= 3 BBR= 125.52
THETA=150.0	Z*D=	6928.2	BSTAR=	11.11	TR= .900	BB0=	127.12	C0=	18.16	TC*C0=16.551	CR*P=	.00	I= 4 BBR= 125.52
THETA=150.0	Z*D=	8660.3	BSTAR=	11.11	TR= .900	BB0=	127.12	C0=	18.16	TC*C0=16.551	CR*P=	.00	I= 5 BBR= 125.52
THETA=150.0	Z*D=	17320.6	BSTAR=	11.11	TR= .900	BB0=	127.12	C0=	18.16	TC*C0=16.551	CR*P=	.00	I= 6 BBR= 125.52
THETA=150.0	Z*D=	34641.2	BSTAR=	11.11	TR= .900	BB0=	127.12	C0=	18.16	TC*C0=16.551	CR*P=	.01	I= 7 BBR= 125.52
THETA=150.0	Z*D=	51961.8	BSTAR=	11.11	TR= .900	BB0=	127.12	C0=	18.16	TC*C0=16.551	CR*P=	.01	I= 8 BBR= 125.52
THETA=150.0	Z*D=	69282.4	BSTAR=	11.11	TR= .900	BB0=	127.12	C0=	18.16	TC*C0=16.551	CR*P=	.01	I= 9 BBR= 125.52
THETA=150.0	Z*D=	86603.0	BSTAR=	11.11	TR= .900	BB0=	127.12	C0=	18.16	TC*C0=16.551	CR*P=	.02	I=10 BBR= 125.52
THETA=150.0	Z*D=	173206.0	BSTAR=	11.11	TR= .900	BB0=	127.12	C0=	18.16	TC*C0=16.551	CR*P=	.07	I=11 BBR= 125.52
THETA=150.0	Z*D=	346411.9	BSTAR=	11.11	TR= .900	BB0=	127.12	C0=	18.16	TC*C0=16.551	CR*P=	.28	I=12 BBR= 125.52
THETA=150.0	Z*D=	519617.9	BSTAR=	11.11	TR= .900	BB0=	127.12	C0=	18.16	TC*C0=16.551	CR*P=	.61	I=13 BBR= 125.52
THETA=150.0	Z*D=	692823.8	BSTAR=	11.11	TR= .900	BB0=	127.12	C0=	18.16	TC*C0=16.551	CR*P=	1.07	I=14 BBR= 125.52
THETA=150.0	Z*D=	866029.8	BSTAR=	11.11	TR= .900	BB0=	127.12	C0=	18.16	TC*C0=16.551	CR*P=	1.68	I=15 BBR= 125.52
THETA=150.0	Z*D=	1299044.7	BSTAR=	11.11	TR= .900	BB0=	127.12	C0=	18.16	TC*C0=16.551	CR*P=	3.78	I=16 BBR= 125.52
THETA=150.0	Z*D=	1732059.6	BSTAR=	11.11	TR= .900	BB0=	127.12	C0=	18.16	TC*C0=16.551	CR*P=	6.66	I=17 BBR= 125.52
THETA=150.0	Z*D=	2165074.5	BSTAR=	11.11	TR= .900	BB0=	127.12	C0=	18.16	TC*C0=16.551	CR*P=	10.43	I=18 BBR= 125.52
THETA=150.0	Z*D=	2598089.4	BSTAR=	11.11	TR= .900	BB0=	127.12	C0=	18.16	TC*C0=16.551	CR*P=	15.08	I=19 BBR= 125.52
THETA=150.0	Z*D=	3464119.2	BSTAR=	11.11	TR= .900	BB0=	127.12	C0=	18.16	TC*C0=16.551	CR*P=	26.81	I=20 BBR= 125.52

CURVES INTERSECT AT Ax= 16.55139 AY= 2706779.30414

THETA=135.0	Z*D=	1414.2	BSTAR=	11.11	TR= .900	BB0=	127.12	C0=	27.50	TC*C0=25.070	CR*P=	.00	I= 1 BBR= 125.52
THETA=135.0	Z*D=	2828.5	BSTAR=	11.11	TR= .900	BB0=	127.12	C0=	27.50	TC*C0=25.070	CR*P=	.00	I= 2 BBR= 125.52
THETA=135.0	Z*D=	4242.7	BSTAR=	11.11	TR= .900	BB0=	127.12	C0=	27.50	TC*C0=25.070	CR*P=	.00	I= 3 BBR= 125.52
THETA=135.0	Z*D=	5656.9	BSTAR=	11.11	TR= .900	BB0=	127.12	C0=	27.50	TC*C0=25.070	CR*P=	.00	I= 4 BBR= 125.52
THETA=135.0	Z*D=	7071.1	BSTAR=	11.11	TR= .900	BB0=	127.12	C0=	27.50	TC*C0=25.070	CR*P=	.00	I= 5 BBR= 125.52
THETA=135.0	Z*D=	14142.3	BSTAR=	11.11	TR= .900	BB0=	127.12	C0=	27.50	TC*C0=25.070	CR*P=	.00	I= 6 BBR= 125.52
THETA=135.0	Z*D=	28284.5	BSTAR=	11.11	TR= .900	BB0=	127.12	C0=	27.50	TC*C0=25.070	CR*P=	.01	I= 7 BBR= 125.52
THETA=135.0	Z*D=	42426.8	BSTAR=	11.11	TR= .900	BB0=	127.12	C0=	27.50	TC*C0=25.070	CR*P=	.01	I= 8 BBR= 125.52
THETA=135.0	Z*D=	56569.0	BSTAR=	11.11	TR= .900	BB0=	127.12	C0=	27.50	TC*C0=25.070	CR*P=	.01	I= 9 BBR= 125.52
THETA=135.0	Z*D=	70711.3	BSTAR=	11.11	TR= .900	BB0=	127.12	C0=	27.50	TC*C0=25.070	CR*P=	.02	I=10 BBR= 125.52
THETA=135.0	Z*D=	141422.5	BSTAR=	11.11	TR= .900	BB0=	127.12	C0=	27.50	TC*C0=25.070	CR*P=	.07	I=11 BBR= 125.52
THETA=135.0	Z*D=	282845.0	BSTAR=	11.11	TR= .900	BB0=	127.12	C0=	27.50	TC*C0=25.070	CR*P=	.28	I=12 BBR= 125.52
THETA=135.0	Z*D=	424267.5	BSTAR=	11.11	TR= .900	BB0=	127.12	C0=	27.50	TC*C0=25.070	CR*P=	.61	I=13 BBR= 125.52
THETA=135.0	Z*D=	565690.0	BSTAR=	11.11	TR= .900	BB0=	127.12	C0=	27.50	TC*C0=25.070	CR*P=	1.07	I=14 BBR= 125.52
THETA=135.0	Z*D=	707112.6	BSTAR=	11.11	TR= .900	BB0=	127.12	C0=	27.50	TC*C0=25.070	CR*P=	1.68	I=15 BBR= 125.52
THETA=135.0	Z*D=	1060668.8	BSTAR=	11.11	TR= .900	BB0=	127.12	C0=	27.50	TC*C0=25.070	CR*P=	3.78	I=16 BBR= 125.52
THETA=135.0	Z*D=	1414225.1	BSTAR=	11.11	TR= .900	BB0=	127.12	C0=	27.50	TC*C0=25.070	CR*P=	6.66	I=17 BBR= 125.52
THETA=135.0	Z*D=	1767781.4	BSTAR=	11.11	TR= .900	BB0=	127.12	C0=	27.50	TC*C0=25.070	CR*P=	10.43	I=18 BBR= 125.52
THETA=135.0	Z*D=	2121337.7	BSTAR=	11.11	TR= .900	BB0=	127.12	C0=	27.50	TC*C0=25.070	CR*P=	15.08	I=19 BBR= 125.52
THETA=135.0	Z*D=	2828450.2	BSTAR=	11.11	TR= .900	BB0=	127.12	C0=	27.50	TC*C0=25.070	CR*P=	26.81	I=20 BBR= 125.52

CURVES INTERSECT AT AX= 25.06985 AY= 2723664.52417

THETA=120.0	Z*D=	1000.0	BSTAR=	11.11	TR=	.900	BB0=	155.03	C0=	11.45	TC*C0=10.607	CR*P=	.00	I= 1	BBR= 150.64
THETA=120.0	Z*D=	2000.0	BSTAR=	11.11	TR=	.900	BB0=	155.03	C0=	11.45	TC*C0=10.607	CR*P=	.00	I= 2	BBR= 150.64
THETA=120.0	Z*D=	3000.0	BSTAR=	11.11	TR=	.900	BB0=	155.03	C0=	11.45	TC*C0=10.607	CR*P=	.00	I= 3	BBR= 150.64
THETA=120.0	Z*D=	4000.1	BSTAR=	11.11	TR=	.900	BB0=	155.03	C0=	11.45	TC*C0=10.607	CR*P=	.00	I= 4	BBR= 150.64
THETA=120.0	Z*D=	5000.1	BSTAR=	11.11	TR=	.900	BB0=	155.03	C0=	11.45	TC*C0=10.607	CR*P=	.00	I= 5	BBR= 150.64
THETA=120.0	Z*D=	10000.1	BSTAR=	11.11	TR=	.900	BB0=	155.03	C0=	11.45	TC*C0=10.607	CR*P=	.00	I= 6	BBR= 150.64
THETA=120.0	Z*D=	20000.3	BSTAR=	11.11	TR=	.900	BB0=	155.03	C0=	11.45	TC*C0=10.607	CR*P=	.01	I= 7	BBR= 150.64
THETA=120.0	Z*D=	30000.4	BSTAR=	11.11	TR=	.900	BB0=	155.03	C0=	11.45	TC*C0=10.607	CR*P=	.01	I= 8	BBR= 150.64
THETA=120.0	Z*D=	40000.5	BSTAR=	11.11	TR=	.900	BB0=	155.03	C0=	11.45	TC*C0=10.607	CR*P=	.01	I= 9	BBR= 150.64
THETA=120.0	Z*D=	50000.7	BSTAR=	11.11	TR=	.900	BB0=	155.03	C0=	11.45	TC*C0=10.607	CR*P=	.02	I=10	BBR= 150.64
THETA=120.0	Z*D=	100001.3	BSTAR=	11.11	TR=	.900	BB0=	155.03	C0=	11.45	TC*C0=10.607	CR*P=	.07	I=11	BBR= 150.64
THETA=120.0	Z*D=	200002.6	BSTAR=	11.11	TR=	.900	BB0=	155.03	C0=	11.45	TC*C0=10.607	CR*P=	.27	I=12	BBR= 150.64
THETA=120.0	Z*D=	300003.9	BSTAR=	11.11	TR=	.900	BB0=	155.03	C0=	11.45	TC*C0=10.607	CR*P=	.60	I=13	BBR= 150.64
THETA=120.0	Z*D=	400005.2	BSTAR=	11.11	TR=	.900	BB0=	155.03	C0=	11.45	TC*C0=10.607	CR*P=	1.07	I=14	BBR= 150.64
THETA=120.0	Z*D=	500006.5	BSTAR=	11.11	TR=	.900	BB0=	155.03	C0=	11.45	TC*C0=10.607	CR*P=	1.67	I=15	BBR= 150.64
THETA=120.0	Z*D=	750009.8	BSTAR=	11.11	TR=	.900	BB0=	155.03	C0=	11.45	TC*C0=10.607	CR*P=	3.75	I=16	BBR= 150.64
THETA=120.0	Z*D=	1000013.1	BSTAR=	11.11	TR=	.900	BB0=	155.03	C0=	11.45	TC*C0=10.607	CR*P=	6.61	I=17	BBR= 150.64
THETA=120.0	Z*D=	1250016.3	BSTAR=	11.11	TR=	.900	BB0=	155.03	C0=	11.45	TC*C0=10.607	CR*P=	10.35	I=18	BBR= 150.64
THETA=120.0	Z*D=	1500019.6	BSTAR=	11.11	TR=	.900	BB0=	155.03	C0=	11.45	TC*C0=10.607	CR*P=	14.97	I=19	BBR= 150.64

CURVES INTERSECT AT AX= 10.60742 AY= 1263761.91306

THETA=105.0	Z*D=	517.7	BSTAR=	11.11	TR=	.900	BB0=	225.13	C0=	7.81	TC*C0= 7.407	CR*P=	.00	I= 1	BBR= 213.72
THETA=105.0	Z*D=	1035.3	BSTAR=	11.11	TR=	.900	BB0=	225.13	C0=	7.81	TC*C0= 7.407	CR*P=	.00	I= 2	BBR= 213.72
THETA=105.0	Z*D=	1553.0	BSTAR=	11.11	TR=	.900	BB0=	225.13	C0=	7.81	TC*C0= 7.407	CR*P=	.00	I= 3	BBR= 213.72
THETA=105.0	Z*D=	2070.6	BSTAR=	11.11	TR=	.900	BB0=	225.13	C0=	7.81	TC*C0= 7.407	CR*P=	.00	I= 4	BBR= 213.72
THETA=105.0	Z*D=	2588.3	BSTAR=	11.11	TR=	.900	BB0=	225.13	C0=	7.81	TC*C0= 7.407	CR*P=	.00	I= 5	BBR= 213.72
THETA=105.0	Z*D=	5176.5	BSTAR=	11.11	TR=	.900	BB0=	225.13	C0=	7.81	TC*C0= 7.407	CR*P=	.00	I= 6	BBR= 213.72
THETA=105.0	Z*D=	10353.0	BSTAR=	11.11	TR=	.900	BB0=	225.13	C0=	7.81	TC*C0= 7.407	CR*P=	.01	I= 7	BBR= 213.72
THETA=105.0	Z*D=	15529.5	BSTAR=	11.11	TR=	.900	BB0=	225.13	C0=	7.81	TC*C0= 7.407	CR*P=	.01	I= 8	BBR= 213.72
THETA=105.0	Z*D=	20706.1	BSTAR=	11.11	TR=	.900	BB0=	225.13	C0=	7.81	TC*C0= 7.407	CR*P=	.01	I= 9	BBR= 213.72
THETA=105.0	Z*D=	25882.6	BSTAR=	11.11	TR=	.900	BB0=	225.13	C0=	7.81	TC*C0= 7.407	CR*P=	.02	I=10	BBR= 213.72
THETA=105.0	Z*D=	51765.1	BSTAR=	11.11	TR=	.900	BB0=	225.13	C0=	7.81	TC*C0= 7.407	CR*P=	.07	I=11	BBR= 213.72
THETA=105.0	Z*D=	103530.3	BSTAR=	11.11	TR=	.900	BB0=	225.13	C0=	7.81	TC*C0= 7 407	CR*P=	.27	I=12	BBR= 213.72
THETA=105.0	Z*D=	155295.4	BSTAR=	11.11	TR=	.900	BB0=	225.13	C0=	7.81	TC*C0= 7.407	CR*P=	.59	I=13	BBR= 213.72
THETA=105.0	Z*D=	207060.6	BSTAR=	11.11	TR=	.900	BB0=	225.13	C0=	7.81	TC*C0= 7.407	CR*P=	1.05	I=14	BBR= 213.72
THETA=105.0	Z*D=	258825.7	BSTAR=	11.11	TR=	.900	BB0=	225.13	C0=	7.81	TC*C0= 7.407	CR*P=	1.64	I=15	BBR= 213.72
THETA=105.0	Z*D=	388238.6	BSTAR=	11.11	TR=	.900	BB0=	225.13	C0=	7.81	TC*C0= 7.407	CR*P=	3.68	I=16	BBR= 213.72
THETA=105.0	Z*D=	517651.5	BSTAR=	11.11	TR=	.900	BB0=	225.13	C0=	7.81	TC*C0= 7.407	CR*P=	6.49	I=17	BBR= 213.72
THETA=105.0	Z*D=	647064.4	BSTAR=	11.11	TR=	.900	BB0=	225.13	C0=	7.81	TC*C0= 7.407	CR*P=	10.15	I=18	BBR= 213.72

CURVES INTERSECT AT AX= 7.40650 AY= 550055.43394

THETA=100.0	Z*D=	347.2	BSTAR=	11.11	TR=	.900	BB0=	275.02	C0=	7.25	TC*C0= 6.939	CR*P=	.00	I= 1	BBR= 258.63
THETA=100.0	Z*D=	694.5	BSTAR=	11.11	TR=	.900	BB0=	275.02	C0=	7.25	TC*C0= 6.939	CR*P=	.00	I= 2	BBR= 258.63
THETA=100.0	Z*D=	1041.7	BSTAR=	11.11	TR=	.900	BB0=	275.02	C0=	7.25	TC*C0= 6.939	CR*P=	.00	I= 3	BBR= 258.63
THETA=100.0	Z*D=	1389.0	BSTAR=	11.11	TR=	.900	BB0=	275.02	C0=	7.25	TC*C0= 6.939	CR*P=	.00	I= 4	BBR= 258.63
THETA=100.0	Z*D=	1736.2	BSTAR=	11.11	TR=	.900	BB0=	275.02	C0=	7.25	TC*C0= 6.939	CR*P=	.00	I= 5	BBR= 258.63
THETA=100.0	Z*D=	3472.4	BSTAR=	11.11	TR=	.900	BB0=	275.02	C0=	7.25	TC*C0= 6.939	CR*P=	.00	I= 6	BBR= 258.63
THETA=100.0	Z*D=	6944.9	BSTAR=	11.11	TR=	.900	BB0=	275.02	C0=	7.25	TC*C0= 6.939	CR*P=	.01	I= 7	BBR= 258.63
THETA=100.0	Z*D=	10417.3	BSTAR=	11.11	TR=	.900	BB0=	275.02	C0=	7.25	TC*C0= 6.939	CR*P=	.01	I= 8	BBR= 258.63
THETA=100.0	Z*D=	13889.8	BSTAR=	11.11	TR=	.900	BB0=	275.02	C0=	7.25	TC*C0= 6.939	CR*P=	.01	I= 9	BBR= 258.63
THETA=100.0	Z*D=	17362.2	BSTAR=	11.11	TR=	.900	BB0=	275.02	C0=	7.25	TC*C0= 6.939	CR*P=	.02	I=10	BBR= 258.63
THETA=100.0	Z*D=	34724.4	BSTAR=	11.11	TR=	.900	BB0=	275.02	C0=	7.25	TC*C0= 6.939	CR*P=	.07	I=11	BBR= 258.63
THETA=100.0	Z*D=	69448.8	BSTAR=	11.11	TR=	.900	BB0=	275.02	C0=	7.25	TC*C0= 6.939	CR*P=	.27	I=12	BBR= 258.63
THETA=100.0	Z*D=	104173.2	BSTAR=	11.11	TR=	.900	BB0=	275.02	C0=	7.25	TC*C0= 6.939	CR*P=	.58	I=13	BBR= 258.63
THETA=100.0	Z*D=	138897.6	BSTAR=	11.11	TR=	.900	BB0=	275.02	C0=	7.25	TC*C0= 6.939	CR*P=	1.03	I=14	BBR= 258.63
THETA=100.0	Z*D=	173622.0	BSTAR=	11.11	TR=	.900	BB0=	275.02	C0=	7.25	TC*C0= 6.939	CR*P=	1.62	I=15	BBR= 258.63
THETA=100.0	Z*D=	260433.0	BSTAR=	11.11	TR=	.900	BB0=	275.02	C0=	7.25	TC*C0= 6.939	CR*P=	3.63	I=16	BBR= 258.63
THETA=100.0	Z*D=	347244.0	BSTAR=	11.11	TR=	.900	BB0=	275.02	C0=	7.25	TC*C0= 6.939	CR*P=	6.40	I=17	BBR= 258.63
THETA=100.0	Z*D=	434055.0	BSTAR=	11.11	TR=	.900	BB0=	275.02	C0=	7.25	TC*C0= 6.939	CR*P=	10.01	I=18	BBR= 258.63

CURVES INTERSECT AT AX= 6.93905 AY= 360142.32948

THETA= 95.0	Z*D=	174.2	BSTAR=	11.11	TR=	.900	BB0=	510.25	C0=	3.45	TC*C0= 3.366	CR*P=	.00	I= 1	BBR= 470.33
THETA= 95.0	Z*D=	348.4	BSTAR=	11.11	TR=	.900	BB0=	510.25	C0=	3.45	TC*C0= 3.366	CR*P=	.00	I= 2	BBR= 470.33
THETA= 95.0	Z*D=	522.6	BSTAR=	11.11	TR=	.900	BB0=	510.25	C0=	3.45	TC*C0= 3 366	CR*P=	.00	I= 3	BBR= 470.33
THETA= 95.0	Z*D=	696.8	BSTAR=	11.11	TR=	.900	BB0=	510.25	C0=	3.45	TC*C0= 3.366	CR*P=	.00	I= 4	BBR= 470.33
THETA= 95.0	Z*D=	871.0	BSTAR=	11.11	TR=	.900	BB0=	510.25	C0=	3.45	TC*C0= 3.366	CR*P=	.00	I= 5	BBR= 470.33
THETA= 95.0	Z*D=	1741.9	BSTAR=	11.11	TR=	.900	BB0=	510.25	C0=	3.45	TC*C0= 3.366	CR*P=	.00	I= 6	BBR= 470.33
THETA= 95.0	Z*D=	3483.8	BSTAR=	11.11	TR=	.900	BB0=	510.25	C0=	3.45	TC*C0= 3 366	CR*P=	.01	I= 7	BBR= 470.33
THETA= 95.0	Z*D=	5225.8	BSTAR=	11.11	TR=	.900	BB0=	510.25	C0=	3.45	TC*C0= 3.366	CR*P=	.01	I= 8	BBR= 470.33
THETA= 95.0	Z*D=	6967.7	BSTAR=	11.11	TR=	.900	BB0=	510.25	C0=	3.45	TC*C0= 3.366	CR*P=	.01	I= 9	BBR= 470.33
THETA= 95.0	Z*D=	8709.6	BSTAR=	11.11	TR=	.900	BB0=	510.25	C0=	3.45	TC*C0= 3.366	CR*P=	.02	I=10	BBR= 470.33
THETA= 95.0	Z*D=	17419.2	BSTAR=	11.11	TR=	.900	BB0=	510.25	C0=	3.45	TC*C0= 3.366	CR*P=	.07	I=11	BBR= 470.33
THETA= 95.0	Z*D=	34838.3	BSTAR=	11.11	TR=	.900	BB0=	510.25	C0=	3.45	TC*C0= 3.366	CR*P=	.25	I=12	BBR= 470.33
THETA= 95.0	Z*D=	52257.5	BSTAR=	11.11	TR=	.900	BB0=	510.25	C0=	3.45	TC*C0= 3.366	CR*P=	.54	I=13	BBR= 470.33
THETA= 95.0	Z*D=	69676.7	BSTAR=	11.11	TR=	.900	BB0=	510.25	C0=	3.45	TC*C0= 3.366	CR*P=	.96	I=14	BBR= 470.33
THETA= 95.0	Z*D=	87095.8	BSTAR=	11.11	TR=	.900	BB0=	510.25	C0=	3.45	TC*C0= 3.366	CR*P=	1.51	I=15	BBR= 470.33
THETA= 95.0	Z*D=	130643.8	BSTAR=	11.11	TR=	.900	BB0=	510.25	C0=	3.45	TC*C0= 3.366	CR*P=	3.39	I=16	BBR= 470.33

CURVES INTERSECT AT AX= 3.36560 AY= 130005.43046

AZIMUTH OF PATH OF SIGHT WITH RESPECT TO SUN IS 0 DEGREES

ZENITH OF PATH OF SIGHT = 180 DISTANCE TO TARGET AXIS = 5 ALTITUDE = 1667644 CONTRAST IS POSITIVE

ZENITH OF PATH OF SIGHT = 165 DISTANCE TO TARGET AXIS = 566873 ALTITUDE = 2115034 CONTRAST IS POSITIVE

ZENITH OF PATH OF SIGHT = 150 DISTANCE TO TARGET AXIS = 1562643 ALTITUDE = 2706779 CONTRAST IS POSITIVE

ZENITH OF PATH OF SIGHT = 135 DISTANCE TO TARGET AXIS = 2723491 ALTITUDE = 2723665 CONTRAST IS POSITIVE

ZENITH OF PATH OF SIGHT = 120 DISTANCE TO TARGET AXIS = 2188742 ALTITUDE = 1263762 CONTRAST IS POSITIVE

ZENITH OF PATH OF SIGHT = 105 DISTANCE TO TARGET AXIS = 2052583 ALTITUDE = 550055 CONTRAST IS POSITIVE

ZENITH OF PATH OF SIGHT = 100 DISTANCE TO TARGET AXIS = 2042504 ALTITUDE = 360142 CONTRAST IS POSITIVE

ZENITH OF PATH OF SIGHT = 95 DISTANCE TO TARGET AXIS = 1486593 ALTITUDE = 130005 CONTRAST IS POSITIVE

AZIMUTH OF PATH OF SIGHT WITH RESPECT TO SUN IS 45 DEGREES

THETA=180.0	Z*D= 2000.0	BSTAR=	11.11	TR= .900	BBO=	197.80	CO=	4.95	TC*CO= 4.655	CR*P= .00	I= 1 BBR= 189.13
THETA=180.0	Z*D= 4000.0	BSTAR=	11.11	TR= .900	BBO=	197.80	CO=	4.95	TC*CO= 4.655	CR*P= .00	I= 2 BBR= 189.13
THETA=180.0	Z*D= 6000.0	BSTAR=	11.11	TR= .900	BBO=	197.80	CO=	4.95	TC*CO= 4.655	CR*P= .00	I= 3 BBR= 189.13
THETA=180.0	Z*D= 8000.0	BSTAR=	11.11	TR= .900	BBO=	197.80	CO=	4.95	TC*CO= 4.655	CR*P= .00	I= 4 BBR= 189.13
THETA=180.0	Z*D= 10000.0	BSTAR=	11.11	TR= .900	BBO=	197.80	CO=	4.95	TC*CO= 4.655	CR*P= .00	I= 5 BBR= 189.13
THETA=180.0	Z*D= 20000.0	BSTAR=	11.11	TR= .900	BBO=	197.80	CO=	4.95	TC*CO= 4.655	CR*P= .00	I= 6 BBR= 189.13
THETA=180.0	Z*D= 40000.0	BSTAR=	11.11	TR= .900	BBO=	197.80	CO=	4.95	TC*CO= 4.655	CR*P= .01	I= 7 BBR= 189.13
THETA=180.0	Z*D= 60000.0	BSTAR=	11.11	TR= .900	BBO=	197.80	CO=	4.95	TC*CO= 4.655	CR*P= .01	I= 8 BBR= 189.13
THETA=180.0	Z*D= 80000.0	BSTAR=	11.11	TR= .900	BBO=	197.80	CO=	4.95	TC*CO= 4.655	CR*P= .01	I= 9 BBR= 189.13
THETA=180.0	Z*D= 100000.0	BSTAR=	11.11	TR= .900	BBO=	197.80	CO=	4.95	TC*CO= 4.655	CR*P= .02	I=10 BBR= 189.13
THETA=180.0	Z*D= 200000.0	BSTAR=	11.11	TR= .900	BBO=	197.80	CO=	4.95	TC*CO= 4.655	CR*P= .07	I=11 BBR= 189.13
THETA=180.0	Z*D= 400000.0	BSTAR=	11.11	TR= .900	BBO=	197.80	CO=	4.95	TC*CO= 4.655	CR*P= .27	I=12 BBR= 189.13
THETA=180.0	Z*D= 600000.0	BSTAR=	11.11	TR= .900	BBO=	197.80	CO=	4.95	TC*CO= 4.655	CR*P= .59	I=13 BBR= 189.13
THETA=180.0	Z*D= 800000.0	BSTAR=	11.11	TR= .900	BBO=	197.80	CO=	4.95	TC*CO= 4.655	CR*P= 1.05	I=14 BBR= 189.13
THETA=180.0	Z*D=1000000.0	BSTAR=	11.11	TR= .900	BBO=	197.80	CO=	4.95	TC*CO= 4.655	CR*P= 1.65	I=15 BBR= 189.13
THETA=180.0	Z*D=1500000.0	BSTAR=	11.11	TR= .900	BBO=	197.80	CO=	4.95	TC*CO= 4.655	CR*P= 3.71	I=16 BBR= 189.13
THETA=180.0	Z*D=2000000.0	BSTAR=	11.11	TR= .900	BBO=	197.80	CO=	4.95	TC*CO= 4.655	CR*P= 6.54	I=17 BBR= 189.13

CURVES INTERSECT AT AX= 4.65538 AY= 1667644.05591

THETA=165.0	Z*D= 1931.8	BSTAR=	11.11	TR= .900	BBO=	131.87	CO=	9.09	TC*CO= 8.312	CR*P= .00	I= 1 BBR= 129.79
THETA=165.0	Z*D= 3863.6	BSTAR=	11.11	TR= .900	BBO=	131.87	CO=	9.09	TC*CO= 8.312	CR*P= .00	I= 2 BBR= 129.79
THETA=165.0	Z*D= 5795.4	BSTAR=	11.11	TR= .900	BBO=	131.87	CO=	9.09	TC*CO= 8.312	CR*P= .00	I= 3 BBR= 129.79
THETA=165.0	Z*D= 7727.2	BSTAR=	11.11	TR= .900	BBO=	131.87	CO=	9.09	TC*CO= 8.312	CR*P= .00	I= 4 BBR= 129.79
THETA=165.0	Z*D= 9659.0	BSTAR=	11.11	TR= .900	BBO=	131.87	CO=	9.09	TC*CO= 8.312	CR*P= .00	I= 5 BBR= 129.79
THETA=165.0	Z*D= 19318.0	BSTAR=	11.11	TR= .900	BBO=	131.87	CO=	9.09	TC*CO= 8.312	CR*P= .00	I= 6 BBR= 129.79
THETA=165.0	Z*D= 38636.1	BSTAR=	11.11	TR= .900	BBO=	131.87	CO=	9.09	TC*CO= 8.312	CR*P= .01	I= 7 BBR= 129.79
THETA=165.0	Z*D= 57954.1	BSTAR=	11.11	TR= .900	BBO=	131.87	CO=	9.09	TC*CO= 8.312	CR*P= .01	I= 8 BBR= 129.79
THETA=165.0	Z*D= 77272.2	BSTAR=	11.11	TR= .900	BBO=	131.87	CO=	9.09	TC*CO= 8.312	CR*P= .01	I= 9 BBR= 129.79
THETA=165.0	Z*D= 96590.2	BSTAR=	11.11	TR= .900	BBO=	131.87	CO=	9.09	TC*CO= 8.312	CR*P= .02	I=10 BBR= 129.79
THETA=165.0	Z*D= 193180.5	BSTAR=	11.11	TR= .900	BBO=	131.87	CO=	9.09	TC*CO= 8.312	CR*P= .07	I=11 BBR= 129.79
THETA=165.0	Z*D= 386360.9	BSTAR=	11.11	TR= .900	BBO=	131.87	CO=	9.09	TC*CO= 8.312	CR*P= .28	I=12 BBR= 129.79
THETA=165.0	Z*D= 579541.4	BSTAR=	11.11	TR= .900	BBO=	131.87	CO=	9.09	TC*CO= 8.312	CR*P= .61	I=13 BBR= 129.79
THETA=165.0	Z*D= 772721.9	BSTAR=	11.11	TR= .900	BBO=	131.87	CO=	9.09	TC*CO= 8.312	CR*P= 1.07	I=14 BBR= 129.79
THETA=165.0	Z*D= 965902.4	BSTAR=	11.11	TR= .900	BBO=	131.87	CO=	9.09	TC*CO= 8.312	CR*P= 1.68	I=15 BBR= 129.79
THETA=165.0	Z*D=1448853.6	BSTAR=	11.11	TR= .900	BBO=	131.87	CO=	9.09	TC*CO= 8.312	CR*P= 3.77	I=16 BBR= 129.79
THETA=165.0	Z*D=1931804.7	BSTAR=	11.11	TR= .900	BBO=	131.87	CO=	9.09	TC*CO= 8.312	CR*P= 6.65	I=17 BBR= 129.79
THETA=165.0	Z*D=2414755.9	BSTAR=	11.11	TR= .900	BBO=	131.87	CO=	9.09	TC*CO= 8.312	CR*P=10.42	I=18 BBR= 129.79

CURVES INTERSECT AT AX= 8.31192 AY= 2144655.23987

THETA=150.0	Z*D= 1732.1	BSTAR=	11.11	TR= .900	BBO=	119.99	CO=	8.41	TC*CO= 7.622	CR*P= .00	I= 1 BBR= 119.10
THETA=150.0	Z*D= 3464.1	BSTAR=	11.11	TR= .900	BBO=	119.99	CO=	8.41	TC*CO= 7.622	CR*P= .00	I= 2 BBR= 119.10
THETA=150.0	Z*D= 5196.2	BSTAR=	11.11	TR= .900	BBO=	119.99	CO=	8.41	TC*CO= 7.622	CR*P= .00	I= 3 BBR= 119.10
THETA=150.0	Z*D= 6928.2	BSTAR=	11.11	TR= .900	BBO=	119.99	CO=	8.41	TC*CO= 7.622	CR*P= .00	I= 4 BBR= 119.10
THETA=150.0	Z*D= 8660.3	BSTAR=	11.11	TR= .900	BBO=	119.99	CO=	8.41	TC*CO= 7.622	CR*P= .00	I= 5 BBR= 119.10
THETA=150.0	Z*D= 17320.6	BSTAR=	11.11	TR= .900	BBO=	119.99	CO=	8.41	TC*CO= 7.622	CR*P= .00	I= 6 BBR= 119.10
THETA=150.0	Z*D= 34641.2	BSTAR=	11.11	TR= .900	BBO=	119.99	CO=	8.41	TC*CO= 7.622	CR*P= .01	I= 7 BBR= 119.10
THETA=150.0	Z*D= 51961.8	BSTAR=	11.11	TR= .900	BBO=	119.99	CO=	8.41	TC*CO= 7.622	CR*P= .01	I= 8 BBR= 119.10
THETA=150.0	Z*D= 69282.4	BSTAR=	11.11	TR= .900	BBO=	119.99	CO=	8.41	TC*CO= 7.622	CR*P= .01	I= 9 BBR= 119.10
THETA=150.0	Z*D= 86603.0	BSTAR=	11.11	TR= .900	BBO=	119.99	CO=	8.41	TC*CO= 7.622	CR*P= .02	I=10 BBR= 119.10
THETA=150.0	Z*D= 173206.0	BSTAR=	11.11	TR= .900	BBO=	119.99	CO=	8.41	TC*CO= 7.622	CR*P= .07	I=11 BBR= 119.10
THETA=150.0	Z*D= 346411.9	BSTAR=	11.11	TR= .900	BBO=	119.99	CO=	8.41	TC*CO= 7.622	CR*P= .28	I=12 BBR= 119.10
THETA=150.0	Z*D= 519617.9	BSTAR=	11.11	TR= .900	BBO=	119.99	CO=	8.41	TC*CO= 7.622	CR*P= .61	I=13 BBR= 119.10
THETA=150.0	Z*D= 692823.8	BSTAR=	11.11	TR= .900	BBO=	119.99	CO=	8.41	TC*CO= 7.622	CR*P= 1.08	I=14 BBR= 119.10
THETA=150.0	Z*D= 866029.8	BSTAR=	11.11	TR= .900	BBO=	119.99	CO=	8.41	TC*CO= 7.622	CR*P= 1.69	I=15 BBR= 119.10
THETA=150.0	Z*D=1299044.7	BSTAR=	11.11	TR= .900	BBO=	119.99	CO=	8.41	TC*CO= 7.622	CR*P= 3.78	I=16 BBR= 119.10
THETA=150.0	Z*D=1732059.6	BSTAR=	11.11	TR= .900	BBO=	119.99	CO=	8.41	TC*CO= 7.622	CR*P= 6.67	I=17 BBR= 119.10
THETA=150.0	Z*D=2165074.5	BSTAR=	11.11	TR= .900	BBO=	119.99	CO=	8.41	TC*CO= 7.622	CR*P=10.45	I=18 BBR= 119.10

CURVES INTERSECT AT AX= 7.62173 AY= 1840884.23999

THETA=135.0	Z*D=	1414.2	BSTAR=	11.11	TR=	.900	BB0=	115.24	C0=	8.48	TC*C0=	7.664	CR*P=	.00	I=	1	BBR=	114.92
THETA=135.0	Z*D=	2828.5	BSTAR=	11.11	TR=	.900	BB0=	115.24	C0=	8.48	TC*C0=	7.664	CR*P=	.00	I=	2	BBR=	114.92
THETA=135.0	Z*D=	4242.7	BSTAR=	11.11	TR=	.900	BB0=	115.24	C0=	8.48	TC*C0=	7.664	CR*P=	.00	I=	3	BBR=	114.92
THETA=135.0	Z*D=	5656.9	BSTAR=	11.11	TR=	.900	BB0=	115.24	C0=	8.48	TC*C0=	7.664	CR*P=	.00	I=	4	BBR=	114.92
THETA=135.0	Z*D=	7071.1	BSTAR=	11.11	TR=	.900	BB0=	115.24	C0=	8.48	TC*C0=	7.664	CR*P=	.00	I=	5	BBR=	114.92
THETA=135.0	Z*D=	14142.3	BSTAR=	11.11	TR=	.900	BB0=	115.24	C0=	8.48	TC*C0=	7.664	CR*P=	.00	I=	6	BBR=	114.92
THETA=135.0	Z*D=	28284.5	BSTAR=	11.11	TR=	.900	BB0=	115.24	C0=	8.48	TC*C0=	7.664	CR*P=	.01	I=	7	BBR=	114.92
THETA=135.0	Z*D=	42426.8	BSTAR=	11.11	TR=	.900	BB0=	115.24	C0=	8.48	TC*C0=	7.664	CR*P=	.01	I=	8	BBR=	114.92
THETA=135.0	Z*D=	56569.0	BSTAR=	11.11	TR=	.900	BB0=	115.24	C0=	8.48	TC*C0=	7.664	CR*P=	.01	I=	9	BBR=	114.92
THETA=135.0	Z*D=	70711.3	BSTAR=	11.11	TR=	.900	BB0=	115.24	C0=	8.48	TC*C0=	7.664	CR*P=	.02	I=	10	BBR=	114.92
THETA=135.0	Z*D=	141422.5	BSTAR=	11.11	TR=	.900	BB0=	115.24	C0=	8.48	TC*C0=	7.664	CR*P=	.07	I=	11	BBR=	114.92
THETA=135.0	Z*D=	282845.0	BSTAR=	11.11	TR=	.900	BB0=	115.24	C0=	8.48	TC*C0=	7.664	CR*P=	.28	I=	12	BBR=	114.92
THETA=135.0	Z*D=	424267.5	BSTAR=	11.11	TR=	.900	BB0=	115.24	C0=	8.48	TC*C0=	7.664	CR*P=	.61	I=	13	BBR=	114.92
THETA=135.0	Z*D=	565690.0	BSTAR=	11.11	TR=	.900	BB0=	115.24	C0=	8.48	TC*C0=	7.664	CR*P=	1.08	I=	14	BBR=	114.92
THETA=135.0	Z*D=	707112.6	BSTAR=	11.11	TR=	.900	BB0=	115.24	C0=	8.48	TC*C0=	7.664	CR*P=	1.69	I=	15	BBR=	114.92
THETA=135.0	Z*D=	1060668.8	BSTAR=	11.11	TR=	.900	BB0=	115.24	C0=	8.48	TC*C0=	7 664	CR*P=	3.79	I=	16	BBR=	114.92
THETA=135.0	Z*D=	1414225.1	BSTAR=	11.11	TR=	.900	BB0=	115.24	C0=	8.48	TC*C0=	7.664	CR*P=	6.66	I=	17	BBR=	114.92
THETA=135.0	Z*D=	1767781.4	BSTAR=	11.11	TR=	.900	BB0=	115.24	C0=	8.48	TC*C0=	7.664	CR*P=	10.47	I=	18	BBR=	114.92

CURVES INTERSECT AT AX= 7.68351 AY= 1506085.15417

THETA=120.0	Z*D=	1000.0	BSTAR=	11.11	TR=	.900	BB0=	124.74	C0=	7.90	TC*C0=	7.193	CR*P=	.00	I=	1	BBR=	123.38
THETA=120.0	Z*D=	2000.0	BSTAR=	11.11	TR=	.900	BB0=	124.74	C0=	7.90	TC*C0=	7.193	CR*P=	.00	I=	2	BBR=	123.38
THETA=120.0	Z*D=	3000.0	BSTAR=	11.11	TR=	.900	BB0=	124.74	C0=	7.90	TC*C0=	7.193	CR*P=	.00	I=	3	BBR=	123.38
THETA=120.0	Z*D=	4000.1	BSTAR=	11.11	TR=	.900	BB0=	124.74	C0=	7.90	TC*C0=	7.193	CR*P=	.00	I=	4	BBR=	123.38
THETA=120.0	Z*D=	5000.1	BSTAR=	11.11	TR=	.900	BB0=	124.74	C0=	7.90	TC*C0=	7.193	CR*P=	.00	I=	5	BBR=	123.38
THETA=120.0	Z*D=	10000.1	BSTAR=	11.11	TR=	.900	BB0=	124.74	C0=	7.90	TC*C0=	7.193	CR*P=	.00	I=	6	BBR=	123.38
THETA=120.0	Z*D=	20000.3	BSTAR=	11.11	TR=	.900	BB0=	124.74	C0=	7.90	TC*C0=	7.193	CR*P=	.01	I=	7	BBR=	123.38
THETA=120.0	Z*D=	30000.4	BSTAR=	11.11	TR=	.900	BB0=	124.74	C0=	7.90	TC*C0=	7.193	CR*P=	.01	I=	8	BBR=	123.38
THETA=120.0	Z*D=	40000.5	BSTAR=	11.11	TR=	.900	BB0=	124.74	C0=	7.90	TC*C0=	7.193	CR*P=	.01	I=	9	BBR=	123.38
THETA=120.0	Z*D=	50000.7	BSTAR=	11.11	TR=	.900	BB0=	124.74	C0=	7.90	TC*C0=	7.193	CR*P=	.02	I=	10	BBR=	123.38
THETA=120.0	Z*D=	100001.3	BSTAR=	11.11	TR=	.900	BB0=	124.74	C0=	7.90	TC*C0=	7.193	CR*P=	.07	I=	11	BBR=	123.38
THETA=120.0	Z*D=	200002.6	BSTAR=	11.11	TR=	.900	BB0=	124.74	C0=	7.90	TC*C0=	7.193	CR*P=	.28	I=	12	BBR=	123.38
THETA=120.0	Z*D=	300003.9	BSTAR=	11.11	TR=	.900	BB0=	124.74	C0=	7.90	TC*C0=	7.193	CR*P=	.61	I=	13	BBR=	123.38
THETA=120.0	Z*D=	400005.2	BSTAR=	11.11	TR=	.900	BB0=	124.74	C0=	7.90	TC*C0=	7.193	CR*P=	1.07	I=	14	BBR=	123.38
THETA=120.0	Z*D=	500006.5	BSTAR=	11.11	TR=	.900	BB0=	124.74	C0=	7.90	TC*C0=	7.193	CR*P=	1.69	I=	15	BBR=	123.38
THETA=120.0	Z*D=	750009.8	BSTAR=	11.11	TR=	.900	BB0=	124.74	C0=	7.90	TC*C0=	7.193	CR*P=	3.78	I=	16	BBR=	123.38
THETA=120.0	Z*D=	1000013.1	BSTAR=	11.11	TR=	.900	BB0=	124.74	C0=	7.90	TC*C0=	7.193	CR*P=	6.66	I=	17	BBR=	123.38
THETA=120.0	Z*D=	1250016.3	BSTAR=	11.11	TR=	.900	BB0=	124.74	C0=	7.90	TC*C0=	7.193	CR*P=	10.44	I=	18	BBR=	123.38

CURVES INTERSECT AT AX= 7.19287 AY= 1035101.55829

THETA=105.0	Z*D=	517.7	BSTAR=	11.11	TR=	.900	BB0=	179.98	C0=	5.37	TC*C0=	5.025	CR*P=	.00	I=	1	BBR=	173.09
THETA=105.0	Z*D=	1035.3	BSTAR=	11.11	TR=	.900	BB0=	179.98	C0=	5.37	TC*C0=	5.025	CR*P=	.00	I=	2	BBR=	173.09
THETA=105.0	Z*D=	1553.0	BSTAR=	11.11	TR=	.900	BB0=	179.98	C0=	5.37	TC*C0=	5.025	CR*P=	.00	I=	3	BBR=	173.09
THETA=105.0	Z*D=	2070.6	BSTAR=	11.11	TR=	.900	BB0=	179.98	C0=	5.37	TC*C0=	5.025	CR*P=	.00	I=	4	BBR=	173.09
THETA=105.0	Z*D=	2588.3	BSTAR=	11.11	TR=	.900	BB0=	179.98	C0=	5.37	TC*C0=	5.025	CR*P=	.00	I=	5	BBR=	173.09
THETA=105.0	Z*D=	5176.5	BSTAR=	11.11	TR=	.900	BB0=	179.98	C0=	5.37	TC*C0=	5.025	CR*P=	.00	I=	6	BBR=	173.09
THETA=105.0	Z*D=	10353.0	BSTAR=	11.11	TR=	.900	BB0=	179.98	C0=	5.37	TC*C0=	5.025	CR*P=	.01	I=	7	BBR=	173.09
THETA=105.0	Z*D=	15529.5	BSTAR=	11.11	TR=	.900	BB0=	179.98	C0=	5.37	TC*C0=	5.025	CR*P=	.01	I=	8	BBR=	173.09
THETA=105.0	Z*D=	20706.1	BSTAR=	11.11	TR=	.900	BB0=	179.98	C0=	5.37	TC*C0=	5.025	CR*P=	.01	I=	9	BBR=	173.09
THETA=105.0	Z*D=	25882.6	BSTAR=	11.11	TR=	.900	BB0=	179.98	C0=	5.37	TC*C0=	5.025	CR*P=	.02	I=	10	BBR=	173.09
THETA=105.0	Z*D=	51765.1	BSTAR=	11.11	TR=	.900	BB0=	179.98	C0=	5.37	TC*C0=	5.025	CR*P=	.07	I=	11	BBR=	173.09
THETA=105.0	Z*D=	103530.3	BSTAR=	11.11	TR=	.900	BB0=	179.98	C0=	5.37	TC*C0=	5.025	CR*P=	.27	I=	12	BBR=	173.09
THETA=105.0	Z*D=	155295.4	BSTAR=	11.11	TR=	.900	BB0=	179.98	C0=	5.37	TC*C0=	5.025	CR*P=	.60	I=	13	BBR=	173.09
THETA=105.0	Z*D=	207060.6	BSTAR=	11.11	TR=	.900	BB0=	179.98	C0=	5.37	TC*C0=	5.025	CR*P=	1.06	I=	14	BBR=	173.09
THETA=105.0	Z*D=	258825.7	BSTAR=	11.11	TR=	.900	BB0=	179.98	C0=	5.37	TC*C0=	5.025	CR*P=	1.66	I=	15	BBR=	173.09
THETA=105.0	Z*D=	388238.6	BSTAR=	11.11	TR=	.900	BB0=	179.98	C0=	5.37	TC*C0=	5.025	CR*P=	3.72	I=	16	BBR=	173.09
THETA=105.0	Z*D=	517651.5	BSTAR=	11.11	TR=	.900	BB0=	179.98	C0=	5.37	TC*C0=	5.025	CR*P=	6.57	I=	17	BBR=	173.09

CURVES INTERSECT AT AX= 5.82496 AY= 447442.56679

THETA=100.0	Z*D=	347.2	BSTAR=	11.11	TR=	.900	BB0=	229.88	C0=	4.43	TC*C0=	4.201	CR*P=	.00	I=	1	BBR=	218.00
THETA=100.0	Z*D=	694.5	BSTAR=	11.11	TR=	.900	BB0=	229.88	C0=	4.43	TC*C0=	4.201	CR*P=	.00	I=	2	BBR=	218.00
THETA=100.0	Z*D=	1041.7	BSTAR=	11.11	TR=	.900	BB0=	229.88	C0=	4.43	TC*C0=	4.201	CR*P=	.00	I=	3	BBR=	218.00
THETA=100.0	Z*D=	1389.0	BSTAR=	11.11	TR=	.900	BB0=	229.88	C0=	4.43	TC*C0=	4.201	CR*P=	.00	I=	4	BBR=	218.00
THETA=100.0	Z*D=	1736.2	BSTAR=	11.11	TR=	.900	BB0=	229.88	C0=	4.43	TC*C0=	4.201	CR*P=	.00	I=	5	BBR=	218.00
THETA=100.0	Z*D=	3472.4	BSTAR=	11.11	TR=	.900	BB0=	229.88	C0=	4.43	TC*C0=	4.201	CR*P=	.00	I=	6	BBR=	218.00
THETA=100.0	Z*D=	6944.9	BSTAR=	11.11	TR=	.900	BB0=	229.88	C0=	4.43	TC*C0=	4.201	CR*P=	.01	I=	7	BBR=	218.00
THETA=100.0	Z*D=	10417.3	BSTAR=	11.11	TR=	.900	BB0=	229.88	C0=	4.43	TC*C0=	4.201	CR*P=	.01	I=	8	BBR=	218.00
THETA=100.0	Z*D=	13889.8	BSTAR=	11.11	TR=	.900	BB0=	229.88	C0=	4.43	TC*C0=	4.201	CR*P=	.01	I=	9	BBR=	218.00
THETA=100.0	Z*D=	17362.2	BSTAR=	11.11	TR=	.900	BB0=	229.88	C0=	4.43	TC*C0=	4.201	CR*P=	.02	I=	10	BBR=	218.00
THETA=100.0	Z*D=	34724.4	BSTAR=	11.11	TR=	.900	BB0=	229.88	C0=	4.43	TC*C0=	4.201	CR*P=	.07	I=	11	BBR=	218.00
THETA=100.0	Z*D=	69448.8	BSTAR=	11.11	TR=	.900	BB0=	229.88	C0=	4.43	TC*C0=	4.201	CR*P=	.27	I=	12	BBR=	218.00
THETA=100.0	Z*D=	104173.2	BSTAR=	11.11	TR=	.900	BB0=	229.88	C0=	4.43	TC*C0=	4.201	CR*P=	.59	I=	13	BBR=	218.00
THETA=100.0	Z*D=	138897.6	BSTAR=	11.11	TR=	.900	BB0=	229.88	C0=	4.43	TC*C0=	4.201	CR*P=	1.04	I=	14	BBR=	218.00
THETA=100.0	Z*D=	173622.0	BSTAR=	11.11	TR=	.900	BB0=	229.88	C0=	4.43	TC*C0=	4.201	CR*P=	1.64	I=	15	BBR=	218.00
THETA=100.0	Z*D=	260433.0	BSTAR=	11.11	TR=	.900	BB0=	229.88	C0=	4.43	TC*C0=	4.201	CR*P=	3.67	I=	16	BBR=	218.00
THETA=100.0	Z*D=	347244.0	BSTAR=	11.11	TR=	.900	BB0=	229.88	C0=	4.43	TC*C0=	4.201	CR*P=	6.48	I=	17	BBR=	218.00

CURVES INTERSECT AT AX= 4.20075 AY= 276714.23695

```
THETA= 95.0 Z*D=     174.2 BSTAR=   11.11 TR= .900 BBO=  326.11 CO=  2.83 TC*CO= 2.722 CR*P=  .00 I= 1 BBR= 304.51
THETA= 95.0 Z*D=     348.4 BSTAR=   11.11 TR= .900 BBO=  326.11 CO=  2.83 TC*CO= 2.722 CR*P=  .00 I= 2 BBR= 304.51
THETA= 95.0 Z*D=     522.6 BSTAR=   11.11 TR= .900 BBO=  326.11 CO=  2.83 TC*CO= 2.722 CR*P=  .00 I= 3 BBR= 304.51
THETA= 95.0 Z*D=     696.8 BSTAR=   11.11 TR= .900 BBO=  326.11 CO=  2.83 TC*CO= 2.722 CR*P=  .00 I= 4 BBR= 304.51
THETA= 95.0 Z*D=     871.0 BSTAR=   11.11 TR= .900 BBO=  326.11 CO=  2.83 TC*CO= 2.722 CR*P=  .00 I= 5 BBR= 304.51
THETA= 95.0 Z*D=    1741.9 BSTAR=   11.11 TR= .900 BBO=  326.11 CO=  2.83 TC*CO= 2.722 CR*P=  .00 I= 6 BBR= 304.51
THETA= 95.0 Z*D=    3483.8 BSTAR=   11.11 TR= .900 BBO=  326.11 CO=  2.83 TC*CO= 2.722 CR*P=  .01 I= 7 BBR= 304.51
THETA= 95.0 Z*D=    5225.8 BSTAR=   11.11 TR= .900 BBO=  326.11 CO=  2.83 TC*CO= 2.722 CR*P=  .01 I= 8 BBR= 304.51
THETA= 95.0 Z*D=    6967.7 BSTAR=   11.11 TR= .900 BBO=  326.11 CO=  2.83 TC*CO= 2.722 CR*P=  .01 I= 9 BBR= 304.51
THETA= 95.0 Z*D=    8709.6 BSTAR=   11.11 TR= .900 BBO=  326.11 CO=  2.83 TC*CO= 2.722 CR*P=  .02 I=10 BBR= 304.51
THETA= 95.0 Z*D=   17419.2 BSTAR=   11.11 TR= .900 BBO=  326.11 CO=  2.83 TC*CO= 2.722 CR*P=  .07 I=11 BBR= 304.51
THETA= 95.0 Z*D=   34838.3 BSTAR=   11.11 TR= .900 BBO=  326.11 CO=  2.83 TC*CO= 2.722 CR*P=  .26 I=12 BBR= 304.51
THETA= 95.0 Z*D=   52257.5 BSTAR=   11.11 TR= .900 BBO=  326.11 CO=  2.83 TC*CO= 2.722 CR*P=  .57 I=13 BBR= 304.51
THETA= 95.0 Z*D=   69676.7 BSTAR=   11.11 TR= .900 BBO=  326.11 CO=  2.83 TC*CO= 2.722 CR*P= 1.02 I=14 BBR= 304.51
THETA= 95.0 Z*D=   87095.8 BSTAR=   11.11 TR= .900 BBO=  326.11 CO=  2.83 TC*CO= 2.722 CR*P= 1.60 I=15 BBR= 304.51
THETA= 95.0 Z*D=  130643.8 BSTAR=   11.11 TR= .900 BBO=  326.11 CO=  2.83 TC*CO= 2.722 CR*P= 3.58 I=16 BBR= 304.51

        CURVES INTERSECT AT AX=      2.72208  AY=  111835.46144

        AZIMUTH OF PATH OF SIGHT WITH RESPECT TO SUN IS  45 DEGREES

   ZENITH OF PATH OF SIGHT = 180  DISTANCE TO TARGET AXIS =       5  ALTITUDE = 1667644  CONTRAST IS POSITIVE

   ZENITH OF PATH OF SIGHT = 165  DISTANCE TO TARGET AXIS =  574813  ALTITUDE = 2144655  CONTRAST IS POSITIVE

   ZENITH OF PATH OF SIGHT = 150  DISTANCE TO TARGET AXIS = 1062755  ALTITUDE = 1840884  CONTRAST IS POSITIVE

   ZENITH OF PATH OF SIGHT = 135  DISTANCE TO TARGET AXIS = 1505989  ALTITUDE = 1506085  CONTRAST IS POSITIVE

   ZENITH OF PATH OF SIGHT = 120  DISTANCE TO TARGET AXIS = 1792719  ALTITUDE = 1035102  CONTRAST IS POSITIVE

   ZENITH OF PATH OF SIGHT = 105  DISTANCE TO TARGET AXIS = 1669674  ALTITUDE =  447443  CONTRAST IS POSITIVE

   ZENITH OF PATH OF SIGHT = 100  DISTANCE TO TARGET AXIS = 1569351  ALTITUDE =  276714  CONTRAST IS POSITIVE

   ZENITH OF PATH OF SIGHT =  95  DISTANCE TO TARGET AXIS = 1278822  ALTITUDE =  111835  CONTRAST IS POSITIVE

        AZIMUTH OF PATH OF SIGHT WITH RESPECT TO SUN IS  90 DEGREES
THETA=180.0 Z*D=    2000.0 BSTAR=   11.11 TR= .900 BBO=  197.80 CO=  4.95 TC*CO= 4.655 CR*P=  .00 I= 1 BBR= 189.13
THETA=180.0 Z*D=    4000.0 BSTAR=   11.11 TR= .900 BBO=  197.80 CO=  4.95 TC*CO= 4.655 CR*P=  .00 I= 2 BBR= 189.13
THETA=180.0 Z*D=    6000.0 BSTAR=   11.11 TR= .900 BBO=  197.80 CO=  4.95 TC*CO= 4.655 CR*P=  .00 I= 3 BBR= 189.13
THETA=180.0 Z*D=    8000.0 BSTAR=   11.11 TR= .900 BBO=  197.80 CO=  4.95 TC*CO= 4.655 CR*P=  .00 I= 4 BBR= 189.13
THETA=180.0 Z*D=   10000.0 BSTAR=   11.11 TR= .900 BBO=  197.80 CO=  4.95 TC*CO= 4.655 CR*P=  .00 I= 5 BBR= 189.13
THETA=180.0 Z*D=   20000.0 BSTAR=   11.11 TR= .900 BBO=  197.80 CO=  4.95 TC*CO= 4.655 CR*P=  .00 I= 6 BBR= 189.13
THETA=180.0 Z*D=   40000.0 BSTAR=   11.11 TR= .900 BBO=  197.80 CO=  4.95 TC*CO= 4.655 CR*P=  .01 I= 7 BBR= 189.13
THETA=180.0 Z*D=   60000.0 BSTAR=   11.11 TR= .900 BBO=  197.80 CO=  4.95 TC*CO= 4.655 CR*P=  .01 I= 8 BBR= 189.13
THETA=180.0 Z*D=   80000.0 BSTAR=   11.11 TR= .900 BBO=  197.80 CO=  4.95 TC*CO= 4.655 CR*P=  .01 I= 9 BBR= 189.13
THETA=180.0 Z*D=  100000.0 BSTAR=   11.11 TR= .900 BBO=  197.80 CO=  4.95 TC*CO= 4.655 CR*P=  .02 I=10 BBR= 189.13
THETA=180.0 Z*D=  200000.0 BSTAR=   11.11 TR= .900 BBO=  197.80 CO=  4.95 TC*CO= 4.655 CR*P=  .07 I=11 BBR= 189.13
THETA=180.0 Z*D=  400000.0 BSTAR=   11.11 TR= .900 BBO=  197.80 CO=  4.95 TC*CO= 4.655 CR*P=  .27 I=12 BBR= 189.13
THETA=180.0 Z*D=  600000.0 BSTAR=   11.11 TR= .900 BBO=  197.80 CO=  4.95 TC*CO= 4.655 CR*P=  .59 I=13 BBR= 189.13
THETA=180.0 Z*D=  800000.0 BSTAR=   11.11 TR= .900 BBO=  197.80 CO=  4.95 TC*CO= 4.655 CR*P= 1.05 I=14 BBR= 189.13
THETA=180.0 Z*D=1000000.0 BSTAR=   11.11 TR= .900 BBO=  197.80 CO=  4.95 TC*CO= 4.655 CR*P= 1.65 I=15 BBR= 189.13
THETA=180.0 Z*D=1500000.0 BSTAR=   11.11 TR= .900 BBO=  197.80 CO=  4.95 TC*CO= 4.655 CR*P= 3.71 I=16 BBR= 189.13
THETA=180.0 Z*D=2000000.0 BSTAR=   11.11 TR= .900 BBO=  197.80 CO=  4.95 TC*CO= 4.655 CR*P= 6.54 I=17 BBR= 189.13

        CURVES INTERSECT AT AX=      4.65538  AY=  1667644.05591

THETA=165.0 Z*D=    1931.8 BSTAR=   11.11 TR= .900 BBO=  187.11 CO=  4.40 TC*CO= 4.125 CR*P=  .00 I= 1 BBR= 179.51
THETA=165.0 Z*D=    3863.6 BSTAR=   11.11 TR= .900 BBO=  187.11 CO=  4.40 TC*CO= 4.125 CR*P=  .00 I= 2 BBR= 179.51
THETA=165.0 Z*D=    5795.4 BSTAR=   11.11 TR= .900 BBO=  187.11 CO=  4.40 TC*CO= 4.125 CR*P=  .00 I= 3 BBR= 179.51
THETA=165.0 Z*D=    7727.2 BSTAR=   11.11 TR= .900 BBO=  187.11 CO=  4.40 TC*CO= 4.125 CR*P=  .00 I= 4 BBR= 179.51
THETA=165.0 Z*D=    9659.0 BSTAR=   11.11 TR= .900 BBO=  187.11 CO=  4.40 TC*CO= 4.125 CR*P=  .00 I= 5 BBR= 179.51
THETA=165.0 Z*D=   19318.0 BSTAR=   11.11 TR= .900 BBO=  187.11 CO=  4.40 TC*CO= 4.125 CR*P=  .00 I= 6 BBR= 179.51
THETA=165.0 Z*D=   38636.1 BSTAR=   11.11 TR= .900 BBO=  187.11 CO=  4.40 TC*CO= 4.125 CR*P=  .01 I= 7 BBR= 179.51
THETA=165.0 Z*D=   57954.1 BSTAR=   11.11 TR= .900 BBO=  187.11 CO=  4.40 TC*CO= 4.125 CR*P=  .01 I= 8 BBR= 179.51
THETA=165.0 Z*D=   77272.2 BSTAR=   11.11 TR= .900 BBO=  187.11 CO=  4.40 TC*CO= 4.125 CR*P=  .01 I= 9 BBR= 179.51
THETA=165.0 Z*D=   96590.2 BSTAR=   11.11 TR= .900 BBO=  187.11 CO=  4.40 TC*CO= 4.125 CR*P=  .02 I=10 BBR= 179.51
THETA=165.0 Z*D=  193180.5 BSTAR=   11.11 TR= .900 BBO=  187.11 CO=  4.40 TC*CO= 4.125 CR*P=  .07 I=11 BBR= 179.51
THETA=165.0 Z*D=  386360.9 BSTAR=   11.11 TR= .900 BBO=  187.11 CO=  4.40 TC*CO= 4.125 CR*P=  .27 I=12 BBR= 179.51
THETA=165.0 Z*D=  579541.4 BSTAR=   11.11 TR= .900 BBO=  187.11 CO=  4.40 TC*CO= 4.125 CR*P=  .60 I=13 BBR= 179.51
THETA=165.0 Z*D=  772721.9 BSTAR=   11.11 TR= .900 BBO=  187.11 CO=  4.40 TC*CO= 4.125 CR*P= 1.06 I=14 BBR= 179.51
THETA=165.0 Z*D=  965902.4 BSTAR=   11.11 TR= .900 BBO=  187.11 CO=  4.40 TC*CO= 4.125 CR*P= 1.66 I=15 BBR= 179.51
THETA=165.0 Z*D=1448853.6 BSTAR=   11.11 TR= .900 BBO=  187.11 CO=  4.40 TC*CO= 4.125 CR*P= 3.72 I=16 BBR= 179.51
THETA=165.0 Z*D=1931804.7 BSTAR=   11.11 TR= .900 BBO=  187.11 CO=  4.40 TC*CO= 4.125 CR*P= 6.56 I=17 BBR= 179.51

        CURVES INTERSECT AT AX=      4.12468  AY=  1518199.92462
```

THETA=150.0	Z*D=	1732.1	BSTAR=	11.11	TR=	.900	BBO=	184.73	CO=	4.11	TC*CO=	3.855	CR*P=	.00	I=	1	BBR=	177.37
THETA=150.0	Z*D=	3464.1	BSTAR=	11.11	TR=	.900	BBO=	184.73	CO=	4.11	TC*CO=	3.855	CR*P=	.00	I=	2	BBR=	177.37
THETA=150.0	Z*D=	5196.2	BSTAR=	11.11	TR=	.900	BBO=	184.73	CO=	4.11	TC*CO=	3.855	CR*P=	.00	I=	3	BBR=	177.37
THETA=150.0	Z*D=	6928.2	BSTAR=	11.11	TR=	.900	BBO=	184.73	CO=	4.11	TC*CO=	3.855	CR*P=	.00	I=	4	BBR=	177.37
THETA=150.0	Z*D=	8660.3	BSTAR=	11.11	TR=	.900	BBO=	184.73	CO=	4.11	TC*CO=	3.855	CR*P=	.00	I=	5	BBR=	177.37
THETA=150.0	Z*D=	17320.6	BSTAR=	11.11	TR=	.900	BBO=	184.73	CO=	4.11	TC*CO=	3.855	CR*P=	.00	I=	6	BBR=	177.37
THETA=150.0	Z*D=	34641.2	BSTAR=	11.11	TR=	.900	BBO=	184.73	CO=	4.11	TC*CO=	3.855	CR*P=	.01	I=	7	BBR=	177.37
THETA=150.0	Z*D=	51961.8	BSTAR=	11.11	TR=	.900	BBO=	184.73	CO=	4.11	TC*CO=	3.855	CR*P=	.01	I=	8	BBR=	177.37
THETA=150.0	Z*D=	69282.4	BSTAR=	11.11	TR=	.900	BBO=	184.73	CO=	4.11	TC*CO=	3.855	CR*P=	.01	I=	9	BBR=	177.37
THETA=150.0	Z*D=	86603.0	BSTAR=	11.11	TR=	.900	BBO=	184.73	CO=	4.11	TC*CO=	3.855	CR*P=	.02	I=	10	BBR=	177.37
THETA=150.0	Z*D=	173206.0	BSTAR=	11.11	TR=	.900	BBO=	184.73	CO=	4.11	TC*CO=	3.855	CR*P=	.07	I=	11	BBR=	177.37
THETA=150.0	Z*D=	346411.9	BSTAR=	11.11	TR=	.900	BBO=	184.73	CO=	4.11	TC*CO=	3.855	CR*P=	.27	I=	12	BBR=	177.37
THETA=150.0	Z*D=	519617.9	BSTAR=	11.11	TR=	.900	BBO=	184.73	CO=	4.11	TC*CO=	3.855	CR*P=	.60	I=	13	BBR=	177.37
THETA=150.0	Z*D=	692823.8	BSTAR=	11.11	TR=	.900	BBO=	184.73	CO=	4.11	TC*CO=	3.855	CR*P=	1.06	I=	14	BBR=	177.37
THETA=150.0	Z*D=	866029.8	BSTAR=	11.11	TR=	.900	BBO=	184.73	CO=	4.11	TC*CO=	3.855	CR*P=	1.66	I=	15	BBR=	177.37
THETA=150.0	Z*D=	1299044.7	BSTAR=	11.11	TR=	.900	BBO=	184.73	CO=	4.11	TC*CO=	3.855	CR*P=	3.72	I=	16	BBR=	177.37
THETA=150.0	Z*D=	1732059.6	BSTAR=	11.11	TR=	.900	BBO=	184.73	CO=	4.11	TC*CO=	3.855	CR*P=	6.56	I=	17	BBR=	177.37

CURVES INTERSECT AT AX= 3.85492 AY= 1319683.63943

THETA=135.0	Z*D=	1414.2	BSTAR=	11.11	TR=	.900	BBO=	188.30	CO=	3.95	TC*CO=	3.709	CR*P=	.00	I=	1	BBR=	180.58
THETA=135.0	Z*D=	2828.5	BSTAR=	11.11	TR=	.900	BBO=	188.30	CO=	3.95	TC*CO=	3.709	CR*P=	.00	I=	2	BBR=	180.58
THETA=135.0	Z*D=	4242.7	BSTAR=	11.11	TR=	.900	BBO=	188.30	CO=	3.95	TC*CO=	3.709	CR*P=	.00	I=	3	BBR=	180.58
THETA=135.0	Z*D=	5656.9	BSTAR=	11.11	TR=	.900	BBO=	188.30	CO=	3.95	TC*CO=	3.709	CR*P=	.00	I=	4	BBR=	180.58
THETA=135.0	Z*D=	7071.1	BSTAR=	11.11	TR=	.900	BBO=	188.30	CO=	3.95	TC*CO=	3.709	CR*P=	.00	I=	5	BBR=	180.58
THETA=135.0	Z*D=	14142.3	BSTAR=	11.11	TR=	.900	BBO=	188.30	CO=	3.95	TC*CO=	3.709	CR*P=	.00	I=	6	BBR=	180.58
THETA=135.0	Z*D=	28284.5	BSTAR=	11.11	TR=	.900	BBO=	188.30	CO=	3.95	TC*CO=	3.709	CR*P=	.01	I=	7	BBR=	180.58
THETA=135.0	Z*D=	42426.8	BSTAR=	11.11	TR=	.900	BBO=	188.30	CO=	3.95	TC*CO=	3.709	CR*P=	.01	I=	8	BBR=	180.58
THETA=135.0	Z*D=	56569.0	BSTAR=	11.11	TR=	.900	BBO=	188.30	CO=	3.95	TC*CO=	3.709	CR*P=	.01	I=	9	BBR=	180.58
THETA=135.0	Z*D=	70711.3	BSTAR=	11.11	TR=	.900	BBO=	188.30	CO=	3.95	TC*CO=	3.709	CR*P=	.02	I=	10	BBR=	180.58
THETA=135.0	Z*D=	141422.5	BSTAR=	11.11	TR=	.900	BBO=	188.30	CO=	3.95	TC*CO=	3.709	CR*P=	.07	I=	11	BBR=	180.58
THETA=135.0	Z*D=	282845.0	BSTAR=	11.11	TR=	.900	BBO=	188.30	CO=	3.95	TC*CO=	3.709	CR*P=	.27	I=	12	BBR=	180.58
THETA=135.0	Z*D=	424267.5	BSTAR=	11.11	TR=	.900	BBO=	188.30	CO=	3.95	TC*CO=	3.709	CR*P=	.60	I=	13	BBR=	180.58
THETA=135.0	Z*D=	565690.0	BSTAR=	11.11	TR=	.900	BBO=	188.30	CO=	3.95	TC*CO=	3.709	CR*P=	1.06	I=	14	BBR=	180.58
THETA=135.0	Z*D=	707112.6	BSTAR=	11.11	TR=	.900	BBO=	188.30	CO=	3.95	TC*CO=	3.709	CR*P=	1.66	I=	15	BBR=	180.58
THETA=135.0	Z*D=	1060668.8	BSTAR=	11.11	TR=	.900	BBO=	188.30	CO=	3.95	TC*CO=	3.709	CR*P=	3.72	I=	16	BBR=	180.58

CURVES INTERSECT AT AX= 3.70947 AY= 1059547.43411

THETA=120.0	Z*D=	1000.0	BSTAR=	11.11	TR=	.900	BBO=	188.30	CO=	3.92	TC*CO=	3.680	CR*P=	.00	I=	1	BBR=	180.58
THETA=120.0	Z*D=	2000.0	BSTAR=	11.11	TR=	.900	BBO=	188.30	CO=	3.92	TC*CO=	3.680	CR*P=	.00	I=	2	BBR=	180.58
THETA=120.0	Z*D=	3000.0	BSTAR=	11.11	TR=	.900	BBO=	188.30	CO=	3.92	TC*CO=	3.680	CR*P=	.00	I=	3	BBR=	180.58
THETA=120.0	Z*D=	4000.1	BSTAR=	11.11	TR=	.900	BBO=	188.30	CO=	3.92	TC*CO=	3.680	CR*P=	.00	I=	4	BBR=	180.58
THETA=120.0	Z*D=	5000.1	BSTAR=	11.11	TR=	.900	BBO=	188.30	CO=	3.92	TC*CO=	3.680	CR*P=	.00	I=	5	BBR=	180.58
THETA=120.0	Z*D=	10000.1	BSTAR=	11.11	TR=	.900	BBO=	188.30	CO=	3.92	TC*CO=	3.680	CR*P=	.00	I=	6	BBR=	180.58
THETA=120.0	Z*D=	20000.3	BSTAR=	11.11	TR=	.900	BBO=	188.30	CO=	3.92	TC*CO=	3.680	CR*P=	.01	I=	7	BBR=	180.58
THETA=120.0	Z*D=	30000.4	BSTAR=	11.11	TR=	.900	BBO=	188.30	CO=	3.92	TC*CO=	3.680	CR*P=	.01	I=	8	BBR=	180.58
THETA=120.0	Z*D=	40000.5	BSTAR=	11.11	TR=	.900	BBO=	188.30	CO=	3.92	TC*CO=	3.680	CR*P=	.01	I=	9	BBR=	180.58
THETA=120.0	Z*D=	50000.7	BSTAR=	11.11	TR=	.900	BBO=	188.30	CO=	3.92	TC*CO=	3.680	CR*P=	.02	I=	10	BBR=	180.58
THETA=120.0	Z*D=	100001.3	BSTAR=	11.11	TR=	.900	BBO=	188.30	CO=	3.92	TC*CO=	3.680	CR*P=	.07	I=	11	BBR=	180.58
THETA=120.0	Z*D=	200002.6	BSTAR=	11.11	TR=	.900	BBO=	188.30	CO=	3.92	TC*CO=	3.680	CR*P=	.27	I=	12	BBR=	180.58
THETA=120.0	Z*D=	300003.9	BSTAR=	11.11	TR=	.900	BBO=	188.30	CO=	3.92	TC*CO=	3.680	CR*P=	.60	I=	13	BBR=	180.58
THETA=120.0	Z*D=	400005.2	BSTAR=	11.11	TR=	.900	BBO=	188.30	CO=	3.92	TC*CO=	3.680	CR*P=	1.06	I=	14	BBR=	180.58
THETA=120.0	Z*D=	500006.5	BSTAR=	11.11	TR=	.900	BBO=	188.30	CO=	3.92	TC*CO=	3.680	CR*P=	1.66	I=	15	BBR=	180.58
THETA=120.0	Z*D=	750009.8	BSTAR=	11.11	TR=	.900	BBO=	188.30	CO=	3.92	TC*CO=	3.680	CR*P=	3.72	I=	16	BBR=	180.58

CURVES INTERSECT AT AX= 3.67987 AY= 745621.34659

THETA=105.0	Z*D=	517.7	BSTAR=	11.11	TR=	.900	BBO=	200.18	CO=	3.54	TC*CO=	3.334	CR*P=	.00	I=	1	BBR=	191.27
THETA=105.0	Z*D=	1035.3	BSTAR=	11.11	TR=	.900	BBO=	200.18	CO=	3.54	TC*CO=	3.334	CR*P=	.00	I=	2	BBR=	191.27
THETA=105.0	Z*D=	1553.0	BSTAR=	11.11	TR=	.900	BBO=	200.18	CO=	3.54	TC*CO=	3.334	CR*P=	.00	I=	3	BBR=	191.27
THETA=105.0	Z*D=	2070.6	BSTAR=	11.11	TR=	.900	BBO=	200.18	CO=	3.54	TC*CO=	3.334	CR*P=	.00	I=	4	BBR=	191.27
THETA=105.0	Z*D=	2588.3	BSTAR=	11.11	TR=	.900	BBO=	200.18	CO=	3.54	TC*CO=	3.334	CR*P=	.00	I=	5	BBR=	191.27
THETA=105.0	Z*D=	5176.5	BSTAR=	11.11	TR=	.900	BBO=	200.18	CO=	3.54	TC*CO=	3.334	CR*P=	.00	I=	6	BBR=	191.27
THETA=105.0	Z*D=	10353.0	BSTAR=	11.11	TR=	.900	BBO=	200.18	CO=	3.54	TC*CO=	3.334	CR*P=	.01	I=	7	BBR=	191.27
THETA=105.0	Z*D=	15529.5	BSTAR=	11.11	TR=	.900	BBO=	200.18	CO=	3.54	TC*CO=	3.334	CR*P=	.01	I=	8	BBR=	191.27
THETA=105.0	Z*D=	20706.1	BSTAR=	11.11	TR=	.900	BBO=	200.18	CO=	3.54	TC*CO=	3.334	CR*P=	.01	I=	9	BBR=	191.27
THETA=105.0	Z*D=	25882.6	BSTAR=	11.11	TR=	.900	BBO=	200.18	CO=	3.54	TC*CO=	3.334	CR*P=	.02	I=	10	BBR=	191.27
THETA=105.0	Z*D=	51765.1	BSTAR=	11.11	TR=	.900	BBO=	200.18	CO=	3.54	TC*CO=	3.334	CR*P=	.07	I=	11	BBR=	191.27
THETA=105.0	Z*D=	103530.3	BSTAR=	11.11	TR=	.900	BBO=	200.18	CO=	3.54	TC*CO=	3.334	CR*P=	.27	I=	12	BBR=	191.27
THETA=105.0	Z*D=	155295.4	BSTAR=	11.11	TR=	.900	BBO=	200.18	CO=	3.54	TC*CO=	3.334	CR*P=	.59	I=	13	BBR=	191.27
THETA=105.0	Z*D=	207060.6	BSTAR=	11.11	TR=	.900	BBO=	200.18	CO=	3.54	TC*CO=	3.334	CR*P=	1.05	I=	14	BBR=	191.27
THETA=105.0	Z*D=	258825.7	BSTAR=	11.11	TR=	.900	BBO=	200.18	CO=	3.54	TC*CO=	3.334	CR*P=	1.65	I=	15	BBR=	191.27
THETA=105.0	Z*D=	388238.6	BSTAR=	11.11	TR=	.900	BBO=	200.18	CO=	3.54	TC*CO=	3.334	CR*P=	3.70	I=	16	BBR=	191.27

CURVES INTERSECT AT AX= 3.33441 AY= 364922.59957

THETA=100.0	Z*D=	347.2	BSTAR=	11.11	TR=	.900	BBO=	229.88	CO=	2.93	TC*CO=	2.778	CR*P=	.00	I=	1	BBR=	218.00
THETA=100.0	Z*D=	694.5	BSTAR=	11.11	TR=	.900	BBO=	229.88	CO=	2.93	TC*CO=	2.778	CR*P=	.00	I=	2	BBR=	218.00
THETA=100.0	Z*D=	1041.7	BSTAR=	11.11	TR=	.900	BBO=	229.88	CO=	2.93	TC*CO=	2.778	CR*P=	.00	I=	3	BBR=	218.00
THETA=100.0	Z*D=	1389.0	BSTAR=	11.11	TR=	.900	BBO=	229.88	CO=	2.93	TC*CO=	2.778	CR*P=	.00	I=	4	BBR=	218.00
THETA=100.0	Z*D=	1736.2	BSTAR=	11.11	TR=	.900	BBO=	229.88	CO=	2.93	TC*CO=	2.778	CR*P=	.00	I=	5	BBR=	218.00
THETA=100.0	Z*D=	3472.4	BSTAR=	11.11	TR=	.900	BBO=	229.88	CO=	2.93	TC*CO=	2.778	CR*P=	.00	I=	6	BBR=	218.00

```
THETA=100.0 Z*D=   6944.9 BSTAR=   11.11 TR= .900 BBO=  229.88 CO= 2.93 TC*CO= 2.778 CR*P=  .01 I= 7 BBR= 218.00
THETA=100.0 Z*D=  10417.3 BSTAR=   11.11 TR= .900 BBO=  229.88 CO= 2.93 TC*CO= 2.778 CR*P=  .01 I= 8 BBR= 218.00
THETA=100.0 Z*D=  13889.8 BSTAR=   11.11 TR= .900 BBO=  229.88 CO= 2.93 TC*CO= 2.778 CR*P=  .01 I= 9 BBR= 218.00
THETA=100.0 Z*D=  17362.2 BSTAR=   11.11 TR= .900 BBO=  229.88 CO= 2.93 TC*CO= 2.778 CR*P=  .02 I=10 BBR= 218.00
THETA=100.0 Z*D=  34724.4 BSTAR=   11.11 TR= .900 BBO=  229.88 CO= 2.93 TC*CO= 2.778 CR*P=  .07 I=11 BBR= 218.00
THETA=100.0 Z*D=  69448.8 BSTAR=   11.11 TR= .900 BBO=  229.88 CO= 2.93 TC*CO= 2.778 CR*P=  .27 I=12 BBR= 218.00
THETA=100.0 Z*D= 104173.2 BSTAR=   11.11 TR= .900 BBO=  229.88 CO= 2.93 TC*CO= 2.778 CR*P=  .59 I=13 BBR= 218.00
THETA=100.0 Z*D= 138897.6 BSTAR=   11.11 TR= .900 BBO=  229.88 CO= 2.93 TC*CO= 2.778 CR*P= 1.04 I=14 BBR= 218.00
THETA=100.0 Z*D= 173622.0 BSTAR=   11.11 TR= .900 BBO=  229.88 CO= 2.93 TC*CO= 2.778 CR*P= 1.64 I=15 BBR= 218.00
THETA=100.0 Z*D= 260433.0 BSTAR=   11.11 TR= .900 BBO=  229.88 CO= 2.93 TC*CO= 2.778 CR*P= 3.67 I=16 BBR= 218.00

        CURVES INTERSECT AT AX=      2.77843  AY=  222219.59030

THETA= 95.0 Z*D=    174.2 BSTAR=   11.11 TR= .900 BBO=  275.02 CO= 2.26 TC*CO= 2.164 CR*P=  .00 I= 1 BBR= 258.53
THETA= 95.0 Z*D=    348.4 BSTAR=   11.11 TR= .900 BBO=  275.02 CO= 2.26 TC*CO= 2.164 CR*P=  .00 I= 2 BBR= 258.53
THETA= 95.0 Z*D=    522.6 BSTAR=   11.11 TR= .900 BBO=  275.02 CO= 2.26 TC*CO= 2.164 CR*P=  .00 I= 3 BBR= 258.53
THETA= 95.0 Z*D=    696.8 BSTAR=   11.11 TR= .900 BBO=  275.02 CO= 2.26 TC*CO= 2.164 CR*P=  .00 I= 4 BBR= 258.53
THETA= 95.0 Z*D=    871.0 BSTAR=   11.11 TR= .900 BBO=  275.02 CO= 2.26 TC*CO= 2.164 CR*P=  .00 I= 5 BBR= 258.53
THETA= 95.0 Z*D=   1741.9 BSTAR=   11.11 TR= .900 BBO=  275.02 CO= 2.26 TC*CO= 2.164 CR*P=  .00 I= 6 BBR= 258.53
THETA= 95.0 Z*D=   3483.8 BSTAR=   11.11 TR= .900 BBO=  275.02 CO= 2.26 TC*CO= 2.164 CR*P=  .01 I= 7 BBR= 258.53
THETA= 95.0 Z*D=   5225.8 BSTAR=   11.11 TR= .900 BBO=  275.02 CO= 2.26 TC*CO= 2.164 CR*P=  .01 I= 8 BBR= 258.53
THETA= 95.0 Z*D=   6967.7 BSTAR=   11.11 TR= .900 BBO=  275.02 CO= 2.26 TC*CO= 2.164 CR*P=  .01 I= 9 BBR= 258.53
THETA= 95.0 Z*D=   8709.6 BSTAR=   11.11 TR= .900 BBO=  275.02 CO= 2.26 TC*CO= 2.164 CR*P=  .02 I=10 BBR= 258.53
THETA= 95.0 Z*D=  17419.2 BSTAR=   11.11 TR= .900 BBO=  275.02 CO= 2.26 TC*CO= 2.164 CR*P=  .07 I=11 BBR= 258.53
THETA= 95.0 Z*D=  34838.3 BSTAR=   11.11 TR= .900 BBO=  275.02 CO= 2.26 TC*CO= 2.164 CR*P=  .27 I=12 BBR= 258.53
THETA= 95.0 Z*D=  52257.5 BSTAR=   11.11 TR= .900 BBO=  275.02 CO= 2.26 TC*CO= 2.164 CR*P=  .58 I=13 BBR= 258.53
THETA= 95.0 Z*D=  69676.7 BSTAR=   11.11 TR= .900 BBO=  275.02 CO= 2.26 TC*CO= 2.164 CR*P= 1.03 I=14 BBR= 258.53
THETA= 95.0 Z*D=  87095.8 BSTAR=   11.11 TR= .900 BBO=  275.02 CO= 2.26 TC*CO= 2.164 CR*P= 1.62 I=15 BBR= 258.53
THETA= 95.0 Z*D= 130643.8 BSTAR=   11.11 TR= .900 BBO=  275.02 CO= 2.26 TC*CO= 2.164 CR*P= 3.63 I=16 BBR= 258.53

        CURVES INTERSECT AT AX=      2.16419  AY=   98905.46765

    AZIMUTH OF PATH OF SIGHT WITH RESPECT TO SUN IS  90 DEGREES

  ZENITH OF PATH OF SIGHT = 180  DISTANCE TO TARGET AXIS =       5  ALTITUDE = 1667644  CONTRAST IS POSITIVE

  ZENITH OF PATH OF SIGHT = 165  DISTANCE TO TARGET AXIS =  406909  ALTITUDE = 1518200  CONTRAST IS POSITIVE

  ZENITH OF PATH OF SIGHT = 150  DISTANCE TO TARGET AXIS =  761863  ALTITUDE = 1319684  CONTRAST IS POSITIVE

  ZENITH OF PATH OF SIGHT = 135  DISTANCE TO TARGET AXIS = 1059480  ALTITUDE = 1059547  CONTRAST IS POSITIVE

  ZENITH OF PATH OF SIGHT = 120  DISTANCE TO TARGET AXIS = 1291361  ALTITUDE =  745621  CONTRAST IS POSITIVE

  ZENITH OF PATH OF SIGHT = 105  DISTANCE TO TARGET AXIS = 1361743  ALTITUDE =  364923  CONTRAST IS POSITIVE

  ZENITH OF PATH OF SIGHT = 100  DISTANCE TO TARGET AXIS = 1260291  ALTITUDE =  222220  CONTRAST IS POSITIVE

  ZENITH OF PATH OF SIGHT =  95  DISTANCE TO TARGET AXIS = 1130970  ALTITUDE =   98905  CONTRAST IS POSITIVE

    AZIMUTH OF PATH OF SIGHT WITH RESPECT TO SUN IS 135 DEGREES
THETA=180.0 Z*D=    2000.0 BSTAR=   11.11 TR= .900 BBO=  197.80 CO= 4.95 TC*CO= 4.655 CR*P=  .00 I= 1 BBR= 189.13
THETA=180.0 Z*D=    4000.0 BSTAR=   11.11 TR= .900 BBO=  197.80 CO= 4.95 TC*CO= 4.655 CR*P=  .00 I= 2 BBR= 189.13
THETA=180.0 Z*D=    6000.0 BSTAR=   11.11 TR= .900 BBO=  197.80 CO= 4.95 TC*CO= 4.655 CR*P=  .00 I= 3 BBR= 189.13
THETA=180.0 Z*D=    8000.0 BSTAR=   11.11 TR= .900 BBO=  197.80 CO= 4.95 TC*CO= 4.655 CR*P=  .00 I= 4 BBR= 189.13
THETA=180.0 Z*D=   10000.0 BSTAR=   11.11 TR= .900 BBO=  197.80 CO= 4.95 TC*CO= 4.655 CR*P=  .00 I= 5 BBR= 189.13
THETA=180.0 Z*D=   20000.0 BSTAR=   11.11 TR= .900 BBO=  197.80 CO= 4.95 TC*CO= 4.655 CR*P=  .00 I= 6 BBR= 189.13
THETA=180.0 Z*D=   40000.0 BSTAR=   11.11 TR= .900 BBO=  197.80 CO= 4.95 TC*CO= 4.655 CR*P=  .01 I= 7 BBR= 189.13
THETA=180.0 Z*D=   60000.0 BSTAR=   11.11 TR= .900 BBO=  197.80 CO= 4.95 TC*CO= 4.655 CR*P=  .01 I= 8 BBR= 189.13
THETA=180.0 Z*D=   80000.0 BSTAR=   11.11 TR= .900 BBO=  197.80 CO= 4.95 TC*CO= 4.655 CR*P=  .01 I= 9 BBR= 189.13
THETA=180.0 Z*D=  100000.0 BSTAR=   11.11 TR= .900 BBO=  197.80 CO= 4.95 TC*CO= 4.655 CR*P=  .02 I=10 BBR= 189.13
THETA=180.0 Z*D=  200000.0 BSTAR=   11.11 TR= .900 BBO=  197.80 CO= 4.95 TC*CO= 4.655 CR*P=  .07 I=11 BBR= 189.13
THETA=180.0 Z*D=  400000.0 BSTAR=   11.11 TR= .900 BBO=  197.80 CO= 4.95 TC*CO= 4.655 CR*P=  .27 I=12 BBR= 189.13
THETA=180.0 Z*D=  600000.0 BSTAR=   11.11 TR= .900 BBO=  197.80 CO= 4.95 TC*CO= 4.655 CR*P=  .59 I=13 BBR= 189.13
THETA=180.0 Z*D=  800000.0 BSTAR=   11.11 TR= .900 BBO=  197.80 CO= 4.95 TC*CO= 4.655 CR*P= 1.05 I=14 BBR= 189.13
THETA=180.0 Z*D= 1000000.0 BSTAR=   11.11 TR= .900 BBO=  197.80 CO= 4.95 TC*CO= 4.655 CR*P= 1.65 I=15 BBR= 189.13
THETA=180.0 Z*D= 1500000.0 BSTAR=   11.11 TR= .900 BBO=  197.80 CO= 4.95 TC*CO= 4.655 CR*P= 3.71 I=16 BBR= 189.13
THETA=180.0 Z*D= 2000000.0 BSTAR=   11.11 TR= .900 BBO=  197.80 CO= 4.95 TC*CO= 4.655 CR*P= 6.54 I=17 BBR= 189.13

        CURVES INTERSECT AT AX=      4.65538  AY=  1667644.05591

THETA=165.0 Z*D=    1931.8 BSTAR=   11.11 TR= .900 BBO=  198.99 CO= 4.43 TC*CO= 4.174 CR*P=  .00 I= 1 BBR= 190.20
THETA=165.0 Z*D=    3863.6 BSTAR=   11.11 TR= .900 BBO=  198.99 CO= 4.43 TC*CO= 4.174 CR*P=  .00 I= 2 BBR= 190.20
```

```
THETA=165.0 Z*D=   5795.4 BSTAR=  11.11 TR= .900 BB0=  198.99 C0=  4.43 TC*C0= 4.174 CR*P=  .00 I= 3 BBR= 190.20
THETA=165.0 Z*D=   7727.2 BSTAR=  11.11 TR= .900 BB0=  198.99 C0=  4.43 TC*C0= 4.174 CR*P=  .00 I= 4 BBR= 190.20
THETA=165.0 Z*D=   9659.0 BSTAR=  11.11 TR= .900 BB0=  198.99 C0=  4.43 TC*C0= 4.174 CR*P=  .00 I= 5 BBR= 190.20
THETA=165.0 Z*D=  19318.0 BSTAR=  11.11 TR= .900 BB0=  198.99 C0=  4.43 TC*C0= 4.174 CR*P=  .00 I= 6 BBR= 190.20
THETA=165.0 Z*D=  38636.1 BSTAR=  11.11 TR= .900 BB0=  198.99 C0=  4.43 TC*C0= 4.174 CR*P=  .01 I= 7 BBR= 190.20
THETA=165.0 Z*D=  57954.1 BSTAR=  11.11 TR= .900 BB0=  198.99 C0=  4.43 TC*C0= 4.174 CR*P=  .01 I= 8 BBR= 190.20
THETA=165.0 Z*D=  77272.2 BSTAR=  11.11 TR= .900 BB0=  198.99 C0=  4.43 TC*C0= 4.174 CR*P=  .01 I= 9 BBR= 190.20
THETA=165.0 Z*D=  96590.2 BSTAR=  11.11 TR= .900 BB0=  198.99 C0=  4.43 TC*C0= 4.174 CR*P=  .02 I=10 BBR= 190.20
THETA=165.0 Z*D= 193180.5 BSTAR=  11.11 TR= .900 BB0=  198.99 C0=  4.43 TC*C0= 4.174 CR*P=  .07 I=11 BBR= 190.20
THETA=165.0 Z*D= 386360.9 BSTAR=  11.11 TR= .900 BB0=  198.99 C0=  4.43 TC*C0= 4.174 CR*P=  .27 I=12 BBR= 190.20
THETA=165.0 Z*D= 579541.4 BSTAR=  11.11 TR= .900 BB0=  198.99 C0=  4.43 TC*C0= 4.174 CR*P=  .59 I=13 BBR= 190.20
THETA=165.0 Z*D= 772721.9 BSTAR=  11.11 TR= .900 BB0=  198.99 C0=  4.43 TC*C0= 4.174 CR*P= 1.05 I=14 BBR= 190.20
THETA=165.0 Z*D= 965902.4 BSTAR=  11.11 TR= .900 BB0=  198.99 C0=  4.43 TC*C0= 4.174 CR*P= 1.65 I=15 BBR= 190.20
THETA=165.0 Z*D=1448853.6 BSTAR=  11.11 TR= .900 BB0=  198.99 C0=  4.43 TC*C0= 4.174 CR*P= 3.71 I=16 BBR= 190.20
THETA=165.0 Z*D=1931804.7 BSTAR=  11.11 TR= .900 BB0=  198.99 C0=  4.43 TC*C0= 4.174 CR*P= 6.53 I=17 BBR= 190.20

        CURVES INTERSECT AT AX=      4.17380  AY=  1520842.74527

THETA=150.0 Z*D=   1732.1 BSTAR=  11.11 TR= .900 BB0=  226.91 C0=  3.58 TC*C0= 3.396 CR*P=  .00 I= 1 BBR= 215.33
THETA=150.0 Z*D=   3464.1 BSTAR=  11.11 TR= .900 BB0=  226.91 C0=  3.58 TC*C0= 3.396 CR*P=  .00 I= 2 BBR= 215.33
THETA=150.0 Z*D=   5196.2 BSTAR=  11.11 TR= .900 BB0=  226.91 C0=  3.58 TC*C0= 3.396 CR*P=  .00 I= 3 BBR= 215.33
THETA=150.0 Z*D=   6928.2 BSTAR=  11.11 TR= .900 BB0=  226.91 C0=  3.58 TC*C0= 3.396 CR*P=  .00 I= 4 BBR= 215.33
THETA=150.0 Z*D=   8660.3 BSTAR=  11.11 TR= .900 BB0=  226.91 C0=  3.58 TC*C0= 3.396 CR*P=  .00 I= 5 BBR= 215.33
THETA=150.0 Z*D=  17320.6 BSTAR=  11.11 TR= .900 BB0=  226.91 C0=  3.58 TC*C0= 3.396 CR*P=  .00 I= 6 BBR= 215.33
THETA=150.0 Z*D=  34641.2 BSTAR=  11.11 TR= .900 BB0=  226.91 C0=  3.58 TC*C0= 3.396 CR*P=  .01 I= 7 BBR= 215.33
THETA=150.0 Z*D=  51961.8 BSTAR=  11.11 TR= .900 BB0=  226.91 C0=  3.58 TC*C0= 3.396 CR*P=  .01 I= 8 BBR= 215.33
THETA=150.0 Z*D=  69282.4 BSTAR=  11.11 TR= .900 BB0=  226.91 C0=  3.58 TC*C0= 3.396 CR*P=  .01 I= 9 BBR= 215.33
THETA=150.0 Z*D=  86603.0 BSTAR=  11.11 TR= .900 BB0=  226.91 C0=  3.58 TC*C0= 3.396 CR*P=  .02 I=10 BBR= 215.33
THETA=150.0 Z*D= 173206.0 BSTAR=  11.11 TR= .900 BB0=  226.91 C0=  3.58 TC*C0= 3.396 CR*P=  .07 I=11 BBR= 215.33
THETA=150.0 Z*D= 346411.9 BSTAR=  11.11 TR= .900 BB0=  226.91 C0=  3.58 TC*C0= 3.396 CR*P=  .27 I=12 BBR= 215.33
THETA=150.0 Z*D= 519617.9 BSTAR=  11.11 TR= .900 BB0=  226.91 C0=  3.58 TC*C0= 3.396 CR*P=  .59 I=13 BBR= 215.33
THETA=150.0 Z*D= 692823.8 BSTAR=  11.11 TR= .900 BB0=  226.91 C0=  3.58 TC*C0= 3.396 CR*P= 1.04 I=14 BBR= 215.33
THETA=150.0 Z*D= 866029.8 BSTAR=  11.11 TR= .900 BB0=  226.91 C0=  3.58 TC*C0= 3.396 CR*P= 1.64 I=15 BBR= 215.33
THETA=150.0 Z*D=1299044.7 BSTAR=  11.11 TR= .900 BB0=  226.91 C0=  3.58 TC*C0= 3.396 CR*P= 3.68 I=16 BBR= 215.33

        CURVES INTERSECT AT AX=      3.39636  AY=  1239324.13342

THETA=135.0 Z*D=   1414.2 BSTAR=  11.11 TR= .900 BB0=  232.85 C0=  3.41 TC*C0= 3.241 CR*P=  .00 I= 1 BBR= 220.67
THETA=135.0 Z*D=   2828.5 BSTAR=  11.11 TR= .900 BB0=  232.85 C0=  3.41 TC*C0= 3.241 CR*P=  .00 I= 2 BBR= 220.67
THETA=135.0 Z*D=   4242.7 BSTAR=  11.11 TR= .900 BB0=  232.85 C0=  3.41 TC*C0= 3.241 CR*P=  .00 I= 3 BBR= 220.67
THETA=135.0 Z*D=   5656.9 BSTAR=  11.11 TR= .900 BB0=  232.85 C0=  3.41 TC*C0= 3.241 CR*P=  .00 I= 4 BBR= 220.67
THETA=135.0 Z*D=   7071.1 BSTAR=  11.11 TR= .900 BB0=  232.85 C0=  3.41 TC*C0= 3.241 CR*P=  .00 I= 5 BBR= 220.67
THETA=135.0 Z*D=  14142.3 BSTAR=  11.11 TR= .900 BB0=  232.85 C0=  3.41 TC*C0= 3.241 CR*P=  .00 I= 6 BBR= 220.67
THETA=135.0 Z*D=  28284.5 BSTAR=  11.11 TR= .900 BB0=  232.85 C0=  3.41 TC*C0= 3.241 CR*P=  .01 I= 7 BBR= 220.67
THETA=135.0 Z*D=  42426.8 BSTAR=  11.11 TR= .900 BB0=  232.85 C0=  3.41 TC*C0= 3.241 CR*P=  .01 I= 8 BBR= 220.67
THETA=135.0 Z*D=  56569.0 BSTAR=  11.11 TR= .900 BB0=  232.85 C0=  3.41 TC*C0= 3.241 CR*P=  .01 I= 9 BBR= 220.67
THETA=135.0 Z*D=  70711.3 BSTAR=  11.11 TR= .900 BB0=  232.85 C0=  3.41 TC*C0= 3.241 CR*P=  .02 I=10 BBR= 220.67
THETA=135.0 Z*D= 141422.5 BSTAR=  11.11 TR= .900 BB0=  232.85 C0=  3.41 TC*C0= 3.241 CR*P=  .07 I=11 BBR= 220.67
THETA=135.0 Z*D= 282845.0 BSTAR=  11.11 TR= .900 BB0=  232.85 C0=  3.41 TC*C0= 3.241 CR*P=  .27 I=12 BBR= 220.67
THETA=135.0 Z*D= 424267.5 BSTAR=  11.11 TR= .900 BB0=  232.85 C0=  3.41 TC*C0= 3.241 CR*P=  .59 I=13 BBR= 220.67
THETA=135.0 Z*D= 565690.0 BSTAR=  11.11 TR= .900 BB0=  232.85 C0=  3.41 TC*C0= 3.241 CR*P= 1.04 I=14 BBR= 220.67
THETA=135.0 Z*D= 707112.6 BSTAR=  11.11 TR= .900 BB0=  232.85 C0=  3.41 TC*C0= 3.241 CR*P= 1.64 I=15 BBR= 220.67
THETA=135.0 Z*D=1060668.8 BSTAR=  11.11 TR= .900 BB0=  232.85 C0=  3.41 TC*C0= 3.241 CR*P= 3.67 I=16 BBR= 220.67

        CURVES INTERSECT AT AX=      3.24140  AY=  985921.58496

THETA=120.0 Z*D=   1000.0 BSTAR=  11.11 TR= .900 BB0=  229.88 C0=  3.52 TC*C0= 3.342 CR*P=  .00 I= 1 BBR= 218.00
THETA=120.0 Z*D=   2000.0 BSTAR=  11.11 TR= .900 BB0=  229.88 C0=  3.52 TC*C0= 3.342 CR*P=  .00 I= 2 BBR= 218.00
THETA=120.0 Z*D=   3000.0 BSTAR=  11.11 TR= .900 BB0=  229.88 C0=  3.52 TC*C0= 3.342 CR*P=  .00 I= 3 BBR= 218.00
THETA=120.0 Z*D=   4000.1 BSTAR=  11.11 TR= .900 BB0=  229.88 C0=  3.52 TC*C0= 3.342 CR*P=  .00 I= 4 BBR= 218.00
THETA=120.0 Z*D=   5000.1 BSTAR=  11.11 TR= .900 BB0=  229.88 C0=  3.52 TC*C0= 3.342 CR*P=  .00 I= 5 BBR= 218.00
THETA=120.0 Z*D=  10000.1 BSTAR=  11.11 TR= .900 BB0=  229.88 C0=  3.52 TC*C0= 3.342 CR*P=  .00 I= 6 BBR= 218.00
THETA=120.0 Z*D=  20000.3 BSTAR=  11.11 TR= .900 BB0=  229.88 C0=  3.52 TC*C0= 3.342 CR*P=  .01 I= 7 BBR= 218.00
THETA=120.0 Z*D=  30000.4 BSTAR=  11.11 TR= .900 BB0=  229.88 C0=  3.52 TC*C0= 3.342 CR*P=  .01 I= 8 BBR= 218.00
THETA=120.0 Z*D=  40000.5 BSTAR=  11.11 TR= .900 BB0=  229.88 C0=  3.52 TC*C0= 3.342 CR*P=  .01 I= 9 BBR= 218.00
THETA=120.0 Z*D=  50000.7 BSTAR=  11.11 TR= .900 BB0=  229.88 C0=  3.52 TC*C0= 3.342 CR*P=  .02 I=10 BBR= 218.00
THETA=120.0 Z*D= 100001.3 BSTAR=  11.11 TR= .900 BB0=  229.88 C0=  3.52 TC*C0= 3.342 CR*P=  .07 I=11 BBR= 218.00
THETA=120.0 Z*D= 200002.6 BSTAR=  11.11 TR= .900 BB0=  229.88 C0=  3.52 TC*C0= 3.342 CR*P=  .27 I=12 BBR= 218.00
THETA=120.0 Z*D= 300003.9 BSTAR=  11.11 TR= .900 BB0=  229.88 C0=  3.52 TC*C0= 3.342 CR*P=  .59 I=13 BBR= 218.00
THETA=120.0 Z*D= 400005.2 BSTAR=  11.11 TR= .900 BB0=  229.88 C0=  3.52 TC*C0= 3.342 CR*P= 1.04 I=14 BBR= 218.00
THETA=120.0 Z*D= 500006.5 BSTAR=  11.11 TR= .900 BB0=  229.88 C0=  3.52 TC*C0= 3.342 CR*P= 1.64 I=15 BBR= 218.00
THETA=120.0 Z*D= 750009.8 BSTAR=  11.11 TR= .900 BB0=  229.88 C0=  3.52 TC*C0= 3.342 CR*P= 3.67 I=16 BBR= 218.00

        CURVES INTERSECT AT AX=      3.34246  AY=  709245.76660

THETA=105.0 Z*D=    517.7 BSTAR=  11.11 TR= .900 BB0=  260.17 C0=  3.11 TC*C0= 2.969 CR*P=  .00 I= 1 BBR= 245.27
THETA=105.0 Z*D=   1035.3 BSTAR=  11.11 TR= .900 BB0=  260.17 C0=  3.11 TC*C0= 2.969 CR*P=  .00 I= 2 BBR= 245.27
THETA=105.0 Z*D=   1553.0 BSTAR=  11.11 TR= .900 BB0=  260.17 C0=  3.11 TC*C0= 2.969 CR*P=  .00 I= 3 BBR= 245.27
THETA=105.0 Z*D=   2070.6 BSTAR=  11.11 TR= .900 BB0=  260.17 C0=  3.11 TC*C0= 2.969 CR*P=  .00 I= 4 BBR= 245.27
THETA=105.0 Z*D=   2588.3 BSTAR=  11.11 TR= .900 BB0=  260.17 C0=  3.11 TC*C0= 2.969 CR*P=  .00 I= 5 BBR= 245.27
THETA=105.0 Z*D=   5176.5 BSTAR=  11.11 TR= .900 BB0=  260.17 C0=  3.11 TC*C0= 2.969 CR*P=  .00 I= 6 BBR= 245.27
THETA=105.0 Z*D=  10353.0 BSTAR=  11.11 TR= .900 BB0=  260.17 C0=  3.11 TC*C0= 2.969 CR*P=  .01 I= 7 BBR= 245.27
THETA=105.0 Z*D=  15529.5 BSTAR=  11.11 TR= .900 BB0=  260.17 C0=  3.11 TC*C0= 2.969 CR*P=  .01 I= 8 BBR= 245.27
```

```
THETA=105.0 Z*D=  20706.1 BSTAR=   11.11 TR= .900 BB0=  260.17 C0=  3.11 TC*C0= 2.969 CR*P=  .01 I= 9 BBR= 245.27
THETA=105.0 Z*D=  25882.6 BSTAR=   11.11 TR= .900 BB0=  260.17 C0=  3.11 TC*C0= 2.969 CR*P=  .02 I=10 BBR= 245.27
THETA=105.0 Z*D=  51765.1 BSTAR=   11.11 TR= .900 BB0=  260.17 C0=  3.11 TC*C0= 2.969 CR*P=  .07 I=11 BBR= 245.27
THETA=105.0 Z*D= 103530.3 BSTAR=   11.11 TR= .900 BB0=  260.17 C0=  3.11 TC*C0= 2.969 CR*P=  .27 I=12 BBR= 245.27
THETA=105.0 Z*D= 155295.4 BSTAR=   11.11 TR= .900 BB0=  260.17 C0=  3.11 TC*C0= 2.969 CR*P=  .58 I=13 BBR= 245.27
THETA=105.0 Z*D= 207060.6 BSTAR=   11.11 TR= .900 BB0=  260.17 C0=  3.11 TC*C0= 2.969 CR*P= 1.04 I=14 BBR= 245.27
THETA=105.0 Z*D= 258825.7 BSTAR=   11.11 TR= .900 BB0=  260.17 C0=  3.11 TC*C0= 2.969 CR*P= 1.63 I=15 BBR= 245.27
THETA=105.0 Z*D= 388238.6 BSTAR=   11.11 TR= .900 BB0=  260.17 C0=  3.11 TC*C0= 2.969 CR*P= 3.64 I=16 BBR= 245.27

          CURVES INTERSECT AT AX=      2.96872  AY=    344942.97360

THETA=100.0 Z*D=    347.2 BSTAR=   11.11 TR= .900 BB0=  275.02 C0=  2.93 TC*C0= 2.805 CR*P=  .00 I= 1 BBR= 258.53
THETA=100.0 Z*D=    694.5 BSTAR=   11.11 TR= .900 BB0=  275.02 C0=  2.93 TC*C0= 2.805 CR*P=  .00 I= 2 BBR= 258.53
THETA=100.0 Z*D=   1041.7 BSTAR=   11.11 TR= .900 BB0=  275.02 C0=  2.93 TC*C0= 2.805 CR*P=  .00 I= 3 BBR= 258.53
THETA=100.0 Z*D=   1389.0 BSTAR=   11.11 TR= .900 BB0=  275.02 C0=  2.93 TC*C0= 2.805 CR*P=  .00 I= 4 BBR= 258.53
THETA=100.0 Z*D=   1736.2 BSTAR=   11.11 TR= .900 BB0=  275.02 C0=  2.93 TC*C0= 2.805 CR*P=  .00 I= 5 BBR= 258.53
THETA=100.0 Z*D=   3472.4 BSTAR=   11.11 TR= .900 BB0=  275.02 C0=  2.93 TC*C0= 2.805 CR*P=  .00 I= 6 BBR= 258.53
THETA=100.0 Z*D=   6944.9 BSTAR=   11.11 TR= .900 BB0=  275.02 C0=  2.93 TC*C0= 2.805 CR*P=  .01 I= 7 BBR= 258.53
THETA=100.0 Z*D=  10417.3 BSTAR=   11.11 TR= .900 BB0=  275.02 C0=  2.93 TC*C0= 2.805 CR*P=  .01 I= 8 BBR= 258.53
THETA=100.0 Z*D=  13889.8 BSTAR=   11.11 TR= .900 BB0=  275.02 C0=  2.93 TC*C0= 2.805 CR*P=  .01 I= 9 BBR= 258.53
THETA=100.0 Z*D=  17362.2 BSTAR=   11.11 TR= .900 BB0=  275.02 C0=  2.93 TC*C0= 2.805 CR*P=  .02 I=10 BBR= 258.53
THETA=100.0 Z*D=  34724.4 BSTAR=   11.11 TR= .900 BB0=  275.02 C0=  2.93 TC*C0= 2.805 CR*P=  .07 I=11 BBR= 258.53
THETA=100.0 Z*D=  69448.8 BSTAR=   11.11 TR= .900 BB0=  275.02 C0=  2.93 TC*C0= 2.805 CR*P=  .27 I=12 BBR= 258.53
THETA=100.0 Z*D= 104173.2 BSTAR=   11.11 TR= .900 BB0=  275.02 C0=  2.93 TC*C0= 2.805 CR*P=  .58 I=13 BBR= 258.53
THETA=100.0 Z*D= 138897.6 BSTAR=   11.11 TR= .900 BB0=  275.02 C0=  2.93 TC*C0= 2.805 CR*P= 1.03 I=14 BBR= 258.53
THETA=100.0 Z*D= 173622.0 BSTAR=   11.11 TR= .900 BB0=  275.02 C0=  2.93 TC*C0= 2.805 CR*P= 1.62 I=15 BBR= 258.53
THETA=100.0 Z*D= 260433.0 BSTAR=   11.11 TR= .900 BB0=  275.02 C0=  2.93 TC*C0= 2.805 CR*P= 3.63 I=16 BBR= 258.53

          CURVES INTERSECT AT AX=      2.80497  AY=    224840.50816

THETA= 95.0 Z*D=    174.2 BSTAR=   11.11 TR= .900 BB0=  339.77 C0=  2.27 TC*C0= 2.190 CR*P=  .00 I= 1 BBR= 316.90
THETA= 95.0 Z*D=    348.4 BSTAR=   11.11 TR= .900 BB0=  339.77 C0=  2.27 TC*C0= 2.190 CR*P=  .00 I= 2 BBR= 316.90
THETA= 95.0 Z*D=    522.6 BSTAR=   11.11 TR= .900 BB0=  339.77 C0=  2.27 TC*C0= 2.190 CR*P=  .00 I= 3 BBR= 316.90
THETA= 95.0 Z*D=    696.8 BSTAR=   11.11 TR= .900 BB0=  339.77 C0=  2.27 TC*C0= 2.190 CR*P=  .00 I= 4 BBR= 316.90
THETA= 95.0 Z*D=    871.0 BSTAR=   11.11 TR= .900 BB0=  339.77 C0=  2.27 TC*C0= 2.190 CR*P=  .00 I= 5 BBR= 316.90
THETA= 95.0 Z*D=   1741.9 BSTAR=   11.11 TR= .900 BB0=  339.77 C0=  2.27 TC*C0= 2.190 CR*P=  .00 I= 6 BBR= 316.90
THETA= 95.0 Z*D=   3483.8 BSTAR=   11.11 TR= .900 BB0=  339.77 C0=  2.27 TC*C0= 2.190 CR*P=  .01 I= 7 BBR= 316.90
THETA= 95.0 Z*D=   5225.8 BSTAR=   11.11 TR= .900 BB0=  339.77 C0=  2.27 TC*C0= 2.190 CR*P=  .01 I= 8 BBR= 316.90
THETA= 95.0 Z*D=   6967.7 BSTAR=   11.11 TR= .900 BB0=  339.77 C0=  2.27 TC*C0= 2.190 CR*P=  .01 I= 9 BBR= 316.90
THETA= 95.0 Z*D=   8709.6 BSTAR=   11.11 TR= .900 BB0=  339.77 C0=  2.27 TC*C0= 2.190 CR*P=  .02 I=10 BBR= 316.90
THETA= 95.0 Z*D=  17419.2 BSTAR=   11.11 TR= .900 BB0=  339.77 C0=  2.27 TC*C0= 2.190 CR*P=  .07 I=11 BBR= 316.90
THETA= 95.0 Z*D=  34838.3 BSTAR=   11.11 TR= .900 BB0=  339.77 C0=  2.27 TC*C0= 2.190 CR*P=  .26 I=12 BBR= 316.90
THETA= 95.0 Z*D=  52257.5 BSTAR=   11.11 TR= .900 BB0=  339.77 C0=  2.27 TC*C0= 2.190 CR*P=  .57 I=13 BBR= 316.90
THETA= 95.0 Z*D=  69676.7 BSTAR=   11.11 TR= .900 BB0=  339.77 C0=  2.27 TC*C0= 2.190 CR*P= 1.01 I=14 BBR= 316.90
THETA= 95.0 Z*D=  87095.8 BSTAR=   11.11 TR= .900 BB0=  339.77 C0=  2.27 TC*C0= 2.190 CR*P= 1.59 I=15 BBR= 316.90
THETA= 95.0 Z*D= 130643.8 BSTAR=   11.11 TR= .900 BB0=  339.77 C0=  2.27 TC*C0= 2.190 CR*P= 3.56 I=16 BBR= 316.90

          CURVES INTERSECT AT AX=      2.18967  AY=    100317.12356

          AZIMUTH OF PATH OF SIGHT WITH RESPECT TO SUN IS 135 DEGREES

  ZENITH OF PATH OF SIGHT = 180  DISTANCE TO TARGET AXIS =      5  ALTITUDE = 1667644  CONTRAST IS POSITIVE

  ZENITH OF PATH OF SIGHT = 165  DISTANCE TO TARGET AXIS =  409762  ALTITUDE = 1528843  CONTRAST IS POSITIVE

  ZENITH OF PATH OF SIGHT = 150  DISTANCE TO TARGET AXIS =  715471  ALTITUDE = 1239324  CONTRAST IS POSITIVE

  ZENITH OF PATH OF SIGHT = 135  DISTANCE TO TARGET AXIS =  985859  ALTITUDE =  985922  CONTRAST IS POSITIVE

  ZENITH OF PATH OF SIGHT = 120  DISTANCE TO TARGET AXIS = 1228361  ALTITUDE =  709246  CONTRAST IS POSITIVE

  ZENITH OF PATH OF SIGHT = 105  DISTANCE TO TARGET AXIS = 1287187  ALTITUDE =  344943  CONTRAST IS POSITIVE

  ZENITH OF PATH OF SIGHT = 100  DISTANCE TO TARGET AXIS = 1275156  ALTITUDE =  224841  CONTRAST IS POSITIVE

  ZENITH OF PATH OF SIGHT =  95  DISTANCE TO TARGET AXIS = 1147112  ALTITUDE =  100317  CONTRAST IS POSITIVE
```

AZIMUTH OF PATH OF SIGHT WITH RESPECT TO SUN IS 180 DEGREES

THETA=180.0	Z*D=	2000.0	BSTAR=	11.11	TR=	.900	BBO=	197.80	CO=	4.95	TC*CO=	4.655	CR*P=	.00	I= 1	BBR= 189.13
THETA=180.0	Z*D=	4000.0	BSTAR=	11.11	TR=	.900	BBO=	197.80	CO=	4.95	TC*CO=	4.655	CR*P=	.00	I= 2	BBR= 189.13
THETA=180.0	Z*D=	6000.0	BSTAR=	11.11	TR=	.900	BBO=	197.80	CO=	4.95	TC*CO=	4.655	CR*P=	.00	I= 3	BBR= 189.13
THETA=180.0	Z*D=	8000.0	BSTAR=	11.11	TR=	.900	BBO=	197.80	CO=	4.95	TC*CO=	4.655	CR*P=	.00	I= 4	BBR= 189.13
THETA=180.0	Z*D=	10000.0	BSTAR=	11.11	TR=	.900	BBO=	197.80	CO=	4.95	TC*CO=	4.655	CR*P=	.00	I= 5	BBR= 189.13
THETA=180.0	Z*D=	20000.0	BSTAR=	11.11	TR=	.900	BBO=	197.80	CO=	4.95	TC*CO=	4.655	CR*P=	.00	I= 6	BBR= 189.13
THETA=180.0	Z*D=	40000.0	BSTAR=	11.11	TR=	.900	BBO=	197.80	CO=	4.95	TC*CO=	4.655	CR*P=	.01	I= 7	BBR= 189.13
THETA=180.0	Z*D=	60000.0	BSTAR=	11.11	TR=	.900	BBO=	197.80	CO=	4.95	TC*CO=	4.655	CR*P=	.01	I= 8	BBR= 189.13
THETA=180.0	Z*D=	80000.0	BSTAR=	11.11	TR=	.900	BBO=	197.80	CO=	4.95	TC*CO=	4.655	CR*P=	.01	I= 9	BBR= 189.13
THETA=180.0	Z*D=	100000.0	BSTAR=	11.11	TR=	.900	BBO=	197.80	CO=	4.95	TC*CO=	4.655	CR*P=	.02	I=10	BBR= 189.13
THETA=180.0	Z*D=	200000.0	BSTAR=	11.11	TR=	.900	BBO=	197.80	CO=	4.95	TC*CO=	4.655	CR*P=	.07	I=11	BBR= 189.13
THETA=180.0	Z*D=	400000.0	BSTAR=	11.11	TR=	.900	BBO=	197.80	CO=	4.95	TC*CO=	4.655	CR*P=	.27	I=12	BBR= 189.13
THETA=180.0	Z*D=	600000.0	BSTAR=	11.11	TR=	.900	BBO=	197.80	CO=	4.95	TC*CO=	4.655	CR*P=	.59	I=13	BBR= 189.13
THETA=180.0	Z*D=	800000.0	BSTAR=	11.11	TR=	.900	BBO=	197.80	CO=	4.95	TC*CO=	4.655	CR*P=	1.05	I=14	BBR= 189.13
THETA=180.0	Z*D=	1000000.0	BSTAR=	11.11	TR=	.900	BBO=	197.80	CO=	4.95	TC*CO=	4.655	CR*P=	1.65	I=15	BBR= 189.13
THETA=180.0	Z*D=	1500000.0	BSTAR=	11.11	TR=	.900	BBO=	197.80	CO=	4.95	TC*CO=	4.655	CR*P=	3.71	I=16	BBR= 189.13
THETA=180.0	Z*D=	2000000.0	BSTAR=	11.11	TR=	.900	BBO=	197.80	CO=	4.95	TC*CO=	4.655	CR*P=	6.54	I=17	BBR= 189.13

CURVES INTERSECT AT AX= 4.65538 AY= 1667644.05591

THETA=165.0	Z*D=	1931.8	BSTAR=	11.11	TR=	.900	BBO=	238.79	CO=	3.85	TC*CO=	3.661	CR*P=	.00	I= 1	BBR= 226.02
THETA=165.0	Z*D=	3863.6	BSTAR=	11.11	TR=	.900	BBO=	238.79	CO=	3.85	TC*CO=	3.661	CR*P=	.00	I= 2	BBR= 226.02
THETA=165.0	Z*D=	5795.4	BSTAR=	11.11	TR=	.900	BBO=	238.79	CO=	3.85	TC*CO=	3.661	CR*P=	.00	I= 3	BBR= 226.02
THETA=165.0	Z*D=	7727.2	BSTAR=	11.11	TR=	.900	BBO=	238.79	CO=	3.85	TC*CO=	3.661	CR*P=	.00	I= 4	BBR= 226.02
THETA=165.0	Z*D=	9659.0	BSTAR=	11.11	TR=	.900	BBO=	238.79	CO=	3.85	TC*CO=	3.661	CR*P=	.00	I= 5	BBR= 226.02
THETA=165.0	Z*D=	19318.0	BSTAR=	11.11	TR=	.900	BBO=	238.79	CO=	3.85	TC*CO=	3.661	CR*P=	.00	I= 6	BBR= 226.02
THETA=165.0	Z*D=	38636.1	BSTAR=	11.11	TR=	.900	BBO=	238.79	CO=	3.85	TC*CO=	3.661	CR*P=	.01	I= 7	BBR= 226.02
THETA=165.0	Z*D=	57954.1	BSTAR=	11.11	TR=	.900	BBO=	238.79	CO=	3.85	TC*CO=	3.661	CR*P=	.01	I= 8	BBR= 226.02
THETA=165.0	Z*D=	77272.2	BSTAR=	11.11	TR=	.900	BBO=	238.79	CO=	3.85	TC*CO=	3.661	CR*P=	.01	I= 9	BBR= 226.02
THETA=165.0	Z*D=	96590.2	BSTAR=	11.11	TR=	.900	BBO=	238.79	CO=	3.85	TC*CO=	3.661	CR*P=	.02	I=10	BBR= 226.02
THETA=165.0	Z*D=	193180.5	BSTAR=	11.11	TR=	.900	BBO=	238.79	CO=	3.85	TC*CO=	3.661	CR*P=	.07	I=11	BBR= 226.02
THETA=165.0	Z*D=	386360.9	BSTAR=	11.11	TR=	.900	BBO=	238.79	CO=	3.85	TC*CO=	3.661	CR*P=	.27	I=12	BBR= 226.02
THETA=165.0	Z*D=	579541.4	BSTAR=	11.11	TR=	.900	BBO=	238.79	CO=	3.85	TC*CO=	3.661	CR*P=	.59	I=13	BBR= 226.02
THETA=165.0	Z*D=	772721.9	BSTAR=	11.11	TR=	.900	BBO=	238.79	CO=	3.85	TC*CO=	3.661	CR*P=	1.04	I=14	BBR= 226.02
THETA=165.0	Z*D=	965902.4	BSTAR=	11.11	TR=	.900	BBO=	238.79	CO=	3.85	TC*CO=	3.661	CR*P=	1.64	I=15	BBR= 226.02
THETA=165.0	Z*D=	1448853.6	BSTAR=	11.11	TR=	.900	BBO=	238.79	CO=	3.85	TC*CO=	3.661	CR*P=	3.67	I=16	BBR= 226.02

CURVES INTERSECT AT AX= 3.66144 AY= 1447920.77249

THETA=150.0	Z*D=	1732.1	BSTAR=	11.11	TR=	.900	BBO=	263.74	CO=	3.64	TC*CO=	3.477	CR*P=	.00	I= 1	BBR= 248.47
THETA=150.0	Z*D=	3464.1	BSTAR=	11.11	TR=	.900	BBO=	263.74	CO=	3.64	TC*CO=	3.477	CR*P=	.00	I= 2	BBR= 248.47
THETA=150.0	Z*D=	5196.2	BSTAR=	11.11	TR=	.900	BBO=	263.74	CO=	3.64	TC*CO=	3.477	CR*P=	.00	I= 3	BBR= 248.47
THETA=150.0	Z*D=	6928.2	BSTAR=	11.11	TR=	.900	BBO=	263.74	CO=	3.64	TC*CO=	3.477	CR*P=	.00	I= 4	BBR= 248.47
THETA=150.0	Z*D=	8660.3	BSTAR=	11.11	TR=	.900	BBO=	263.74	CO=	3.64	TC*CO=	3.477	CR*P=	.00	I= 5	BBR= 248.47
THETA=150.0	Z*D=	17320.6	BSTAR=	11.11	TR=	.900	BBO=	263.74	CO=	3.64	TC*CO=	3.477	CR*P=	.00	I= 6	BBR= 248.47
THETA=150.0	Z*D=	34641.2	BSTAR=	11.11	TR=	.900	BBO=	263.74	CO=	3.64	TC*CO=	3.477	CR*P=	.01	I= 7	BBR= 248.47
THETA=150.0	Z*D=	51961.8	BSTAR=	11.11	TR=	.900	BBO=	263.74	CO=	3.64	TC*CO=	3.477	CR*P=	.01	I= 8	BBR= 248.47
THETA=150.0	Z*D=	69282.4	BSTAR=	11.11	TR=	.900	BBO=	263.74	CO=	3.64	TC*CO=	3.477	CR*P=	.01	I= 9	BBR= 248.47
THETA=150.0	Z*D=	86603.0	BSTAR=	11.11	TR=	.900	BBO=	263.74	CO=	3.64	TC*CO=	3.477	CR*P=	.02	I=10	BBR= 248.47
THETA=150.0	Z*D=	173206.0	BSTAR=	11.11	TR=	.900	BBO=	263.74	CO=	3.64	TC*CO=	3.477	CR*P=	.07	I=11	BBR= 248.47
THETA=150.0	Z*D=	346411.9	BSTAR=	11.11	TR=	.900	BBO=	263.74	CO=	3.64	TC*CO=	3.477	CR*P=	.27	I=12	BBR= 248.47
THETA=150.0	Z*D=	519617.9	BSTAR=	11.11	TR=	.900	BBO=	263.74	CO=	3.64	TC*CO=	3.477	CR*P=	.58	I=13	BBR= 248.47
THETA=150.0	Z*D=	692823.8	BSTAR=	11.11	TR=	.900	BBO=	263.74	CO=	3.64	TC*CO=	3.477	CR*P=	1.03	I=14	BBR= 248.47
THETA=150.0	Z*D=	866029.8	BSTAR=	11.11	TR=	.900	BBO=	263.74	CO=	3.64	TC*CO=	3.477	CR*P=	1.62	I=15	BBR= 248.47
THETA=150.0	Z*D=	1299044.7	BSTAR=	11.11	TR=	.900	BBO=	263.74	CO=	3.64	TC*CO=	3.477	CR*P=	3.64	I=16	BBR= 248.47

CURVES INTERSECT AT AX= 3.47688 AY= 1263938.66122

THETA=135.0	Z*D=	1414.2	BSTAR=	11.11	TR=	.900	BBO=	343.33	CO=	2.94	TC*CO=	2.842	CR*P=	.00	I= 1	BBR= 320.11
THETA=135.0	Z*D=	2828.5	BSTAR=	11.11	TR=	.900	BBO=	343.33	CO=	2.94	TC*CO=	2.842	CR*P=	.00	I= 2	BBR= 320.11
THETA=135.0	Z*D=	4242.7	BSTAR=	11.11	TR=	.900	BBO=	343.33	CO=	2.94	TC*CO=	2.842	CR*P=	.00	I= 3	BBR= 320.11
THETA=135.0	Z*D=	5656.9	BSTAR=	11.11	TR=	.900	BBO=	343.33	CO=	2.94	TC*CO=	2.842	CR*P=	.00	I= 4	BBR= 320.11
THETA=135.0	Z*D=	7071.1	BSTAR=	11.11	TR=	.900	BBO=	343.33	CO=	2.94	TC*CO=	2.842	CR*P=	.00	I= 5	BBR= 320.11
THETA=135.0	Z*D=	14142.3	BSTAR=	11.11	TR=	.900	BBO=	343.33	CO=	2.94	TC*CO=	2.842	CR*P=	.00	I= 6	BBR= 320.11
THETA=135.0	Z*D=	28284.5	BSTAR=	11.11	TR=	.900	BBO=	343.33	CO=	2.94	TC*CO=	2.842	CR*P=	.01	I= 7	BBR= 320.11
THETA=135.0	Z*D=	42426.8	BSTAR=	11.11	TR=	.900	BBO=	343.33	CO=	2.94	TC*CO=	2.842	CR*P=	.01	I= 8	BBR= 320.11
THETA=135.0	Z*D=	56569.0	BSTAR=	11.11	TR=	.900	BBO=	343.33	CO=	2.94	TC*CO=	2.842	CR*P=	.01	I= 9	BBR= 320.11
THETA=135.0	Z*D=	70711.3	BSTAR=	11.11	TR=	.900	BBO=	343.33	CO=	2.94	TC*CO=	2.842	CR*P=	.02	I=10	BBR= 320.11
THETA=135.0	Z*D=	141422.5	BSTAR=	11.11	TR=	.900	BBO=	343.33	CO=	2.94	TC*CO=	2.842	CR*P=	.07	I=11	BBR= 320.11
THETA=135.0	Z*D=	282845.0	BSTAR=	11.11	TR=	.900	BBO=	343.33	CO=	2.94	TC*CO=	2.842	CR*P=	.26	I=12	BBR= 320.11
THETA=135.0	Z*D=	424267.5	BSTAR=	11.11	TR=	.900	BBO=	343.33	CO=	2.94	TC*CO=	2.842	CR*P=	.57	I=13	BBR= 320.11
THETA=135.0	Z*D=	565690.0	BSTAR=	11.11	TR=	.900	BBO=	343.33	CO=	2.94	TC*CO=	2.842	CR*P=	1.01	I=14	BBR= 320.11
THETA=135.0	Z*D=	707112.6	BSTAR=	11.11	TR=	.900	BBO=	343.33	CO=	2.94	TC*CO=	2.842	CR*P=	1.59	I=15	BBR= 320.11
THETA=135.0	Z*D=	1060668.8	BSTAR=	11.11	TR=	.900	BBO=	343.33	CO=	2.94	TC*CO=	2.842	CR*P=	3.56	I=16	BBR= 320.11

CURVES INTERSECT AT AX= 2.84243 AY= 931898.97212

THETA=120.0	Z*D=	1000.0	BSTAR=	11.11	TR=	.900	BBO=	380.16	CO=	2.23	TC*CO=	2.164	CR*P=	.00	I= 1	BBR= 353.26
THETA=120.0	Z*D=	2000.0	BSTAR=	11.11	TR=	.900	BBO=	380.16	CO=	2.23	TC*CO=	2.164	CR*P=	.00	I= 2	BBR= 353.26
THETA=120.0	Z*D=	3000.0	BSTAR=	11.11	TR=	.900	BBO=	380.16	CO=	2.23	TC*CO=	2.164	CR*P=	.00	I= 3	BBR= 353.26
THETA=120.0	Z*D=	4000.1	BSTAR=	11.11	TR=	.900	BBO=	380.16	CO=	2.23	TC*CO=	2.164	CR*P=	.00	I= 4	BBR= 353.26
THETA=120.0	Z*D=	5000.1	BSTAR=	11.11	TR=	.900	BBO=	380.16	CO=	2.23	TC*CO=	2.164	CR*P=	.00	I= 5	BBR= 353.26

THETA=120.0 Z*D= 10000.1 BSTAR= 11.11 TR= .900 BB0= 380.16 C0= 2.23 TC*C0= 2.164 CR*P= .00 I= 6 BBR= 353.26
THETA=120.0 Z*D= 20000.3 BSTAR= 11.11 TR= .900 BB0= 380.16 C0= 2.23 TC*C0= 2.164 CR*P= .01 I= 7 BBR= 353.26
THETA=120.0 Z*D= 30000.4 BSTAR= 11.11 TR= .900 BB0= 380.16 C0= 2.23 TC*C0= 2.164 CR*P= .01 I= 8 BBR= 353.26
THETA=120.0 Z*D= 40000.5 BSTAR= 11.11 TR= .900 BB0= 380.16 C0= 2.23 TC*C0= 2.164 CR*P= .01 I= 9 BBR= 353.26
THETA=120.0 Z*D= 50000.7 BSTAR= 11.11 TR= .900 BB0= 380.16 C0= 2.23 TC*C0= 2.164 CR*P= .02 I=10 BBR= 353.26
THETA=120.0 Z*D= 100001.3 BSTAR= 11.11 TR= .900 BB0= 380.16 C0= 2.23 TC*C0= 2.164 CR*P= .07 I=11 BBR= 353.26
THETA=120.0 Z*D= 200002.6 BSTAR= 11.11 TR= .900 BB0= 380.16 C0= 2.23 TC*C0= 2.164 CR*P= .26 I=12 BBR= 353.26
THETA=120.0 Z*D= 300003.9 BSTAR= 11.11 TR= .900 BB0= 380.16 C0= 2.23 TC*C0= 2.164 CR*P= .57 I=13 BBR= 353.26
THETA=120.0 Z*D= 400005.2 BSTAR= 11.11 TR= .900 BB0= 380.16 C0= 2.23 TC*C0= 2.164 CR*P= 1.00 I=14 BBR= 353.26
THETA=120.0 Z*D= 500006.5 BSTAR= 11.11 TR= .900 BB0= 380.16 C0= 2.23 TC*C0= 2.164 CR*P= 1.57 I=15 BBR= 353.26
THETA=120.0 Z*D= 750009.8 BSTAR= 11.11 TR= .900 BB0= 380.16 C0= 2.23 TC*C0= 2.164 CR*P= 3.52 I=16 BBR= 353.26

CURVES INTERSECT AT AX= 2.16410 AY= 575803.16029

THETA=105.0 Z*D= 517.7 BSTAR= 11.11 TR= .900 BB0= 422.33 C0= 1.97 TC*C0= 1.912 CR*P= .00 I= 1 BBR= 391.21
THETA=105.0 Z*D= 1035.3 BSTAR= 11.11 TR= .900 BB0= 422.33 C0= 1.97 TC*C0= 1.912 CR*P= .00 I= 2 BBR= 391.21
THETA=105.0 Z*D= 1553.0 BSTAR= 11.11 TR= .900 BB0= 422.33 C0= 1.97 TC*C0= 1.912 CR*P= .00 I= 3 BBR= 391.21
THETA=105.0 Z*D= 2070.6 BSTAR= 11.11 TR= .900 BB0= 422.33 C0= 1.97 TC*C0= 1.912 CR*P= .00 I= 4 BBR= 391.21
THETA=105.0 Z*D= 2588.3 BSTAR= 11.11 TR= .900 BB0= 422.33 C0= 1.97 TC*C0= 1.912 CR*P= .00 I= 5 BBR= 391.21
THETA=105.0 Z*D= 5176.5 BSTAR= 11.11 TR= .900 BB0= 422.33 C0= 1.97 TC*C0= 1.912 CR*P= .00 I= 6 BBR= 391.21
THETA=105.0 Z*D= 10353.0 BSTAR= 11.11 TR= .900 BB0= 422.33 C0= 1.97 TC*C0= 1.912 CR*P= .01 I= 7 BBR= 391.21
THETA=105.0 Z*D= 15529.5 BSTAR= 11.11 TR= .900 BB0= 422.33 C0= 1.97 TC*C0= 1.912 CR*P= .01 I= 8 BBR= 391.21
THETA=105.0 Z*D= 20706.1 BSTAR= 11.11 TR= .900 BB0= 422.33 C0= 1.97 TC*C0= 1.912 CR*P= .01 I= 9 BBR= 391.21
THETA=105.0 Z*D= 25882.6 BSTAR= 11.11 TR= .900 BB0= 422.33 C0= 1.97 TC*C0= 1.912 CR*P= .02 I=10 BBR= 391.21
THETA=105.0 Z*D= 51765.1 BSTAR= 11.11 TR= .900 BB0= 422.33 C0= 1.97 TC*C0= 1.912 CR*P= .07 I=11 BBR= 391.21
THETA=105.0 Z*D= 103530.3 BSTAR= 11.11 TR= .900 BB0= 422.33 C0= 1.97 TC*C0= 1.912 CR*P= .25 I=12 BBR= 391.21
THETA=105.0 Z*D= 155295.4 BSTAR= 11.11 TR= .900 BB0= 422.33 C0= 1.97 TC*C0= 1.912 CR*P= .56 I=13 BBR= 391.21
THETA=105.0 Z*D= 207060.6 BSTAR= 11.11 TR= .900 BB0= 422.33 C0= 1.97 TC*C0= 1.912 CR*P= .99 I=14 BBR= 391.21
THETA=105.0 Z*D= 258825.7 BSTAR= 11.11 TR= .900 BB0= 422.33 C0= 1.97 TC*C0= 1.912 CR*P= 1.55 I=15 BBR= 391.21
THETA=105.0 Z*D= 388238.6 BSTAR= 11.11 TR= .900 BB0= 422.33 C0= 1.97 TC*C0= 1.912 CR*P= 3.48 I=16 BBR= 391.21

CURVES INTERSECT AT AX= 1.91177 AY= 282853.44553

THETA=100.0 Z*D= 347.2 BSTAR= 11.11 TR= .900 BB0= 450.25 C0= 1.84 TC*C0= 1.787 CR*P= .00 I= 1 BBR= 416.34
THETA=100.0 Z*D= 694.5 BSTAR= 11.11 TR= .900 BB0= 450.25 C0= 1.84 TC*C0= 1.787 CR*P= .00 I= 2 BBR= 416.34
THETA=100.0 Z*D= 1041.7 BSTAR= 11.11 TR= .900 BB0= 450.25 C0= 1.84 TC*C0= 1.787 CR*P= .00 I= 3 BBR= 416.34
THETA=100.0 Z*D= 1389.0 BSTAR= 11.11 TR= .900 BB0= 450.25 C0= 1.84 TC*C0= 1.787 CR*P= .00 I= 4 BBR= 416.34
THETA=100.0 Z*D= 1736.2 BSTAR= 11.11 TR= .900 BB0= 450.25 C0= 1.84 TC*C0= 1.787 CR*P= .00 I= 5 BBR= 416.34
THETA=100.0 Z*D= 3472.4 BSTAR= 11.11 TR= .900 BB0= 450.25 C0= 1.84 TC*C0= 1.787 CR*P= .00 I= 6 BBR= 416.34
THETA=100.0 Z*D= 6944.9 BSTAR= 11.11 TR= .900 BB0= 450.25 C0= 1.84 TC*C0= 1.787 CR*P= .01 I= 7 BBR= 416.34
THETA=100.0 Z*D= 10417.3 BSTAR= 11.11 TR= .900 BB0= 450.25 C0= 1.84 TC*C0= 1.787 CR*P= .01 I= 8 BBR= 416.34
THETA=100.0 Z*D= 13889.8 BSTAR= 11.11 TR= .900 BB0= 450.25 C0= 1.84 TC*C0= 1.787 CR*P= .01 I= 9 BBR= 416.34
THETA=100.0 Z*D= 17362.2 BSTAR= 11.11 TR= .900 BB0= 450.25 C0= 1.84 TC*C0= 1.787 CR*P= .02 I=10 BBR= 416.34
THETA=100.0 Z*D= 34724.4 BSTAR= 11.11 TR= .900 BB0= 450.25 C0= 1.84 TC*C0= 1.787 CR*P= .07 I=11 BBR= 416.34
THETA=100.0 Z*D= 69448.8 BSTAR= 11.11 TR= .900 BB0= 450.25 C0= 1.84 TC*C0= 1.787 CR*P= .25 I=12 BBR= 416.34
THETA=100.0 Z*D= 104173.2 BSTAR= 11.11 TR= .900 BB0= 450.25 C0= 1.84 TC*C0= 1.787 CR*P= .55 I=13 BBR= 416.34
THETA=100.0 Z*D= 138897.6 BSTAR= 11.11 TR= .900 BB0= 450.25 C0= 1.84 TC*C0= 1.787 CR*P= .98 I=14 BBR= 416.34
THETA=100.0 Z*D= 173622.0 BSTAR= 11.11 TR= .900 BB0= 450.25 C0= 1.84 TC*C0= 1.787 CR*P= 1.54 I=15 BBR= 416.34
THETA=100.0 Z*D= 260433.0 BSTAR= 11.11 TR= .900 BB0= 450.25 C0= 1.84 TC*C0= 1.787 CR*P= 3.45 I=16 BBR= 416.34

CURVES INTERSECT AT AX= 1.78740 AY= 184785.67677

THETA= 95.0 Z*D= 174.2 BSTAR= 11.11 TR= .900 BB0= 490.05 C0= 1.69 TC*C0= 1.649 CR*P= .00 I= 1 BBR= 452.16
THETA= 95.0 Z*D= 348.4 BSTAR= 11.11 TR= .900 BB0= 490.05 C0= 1.69 TC*C0= 1.649 CR*P= .00 I= 2 BBR= 452.16
THETA= 95.0 Z*D= 522.6 BSTAR= 11.11 TR= .900 BB0= 490.05 C0= 1.69 TC*C0= 1.649 CR*P= .00 I= 3 BBR= 452.16
THETA= 95.0 Z*D= 696.8 BSTAR= 11.11 TR= .900 BB0= 490.05 C0= 1.69 TC*C0= 1.649 CR*P= .00 I= 4 BBR= 452.16
THETA= 95.0 Z*D= 871.0 BSTAR= 11.11 TR= .900 BB0= 490.05 C0= 1.69 TC*C0= 1.649 CR*P= .00 I= 5 BBR= 452.16
THETA= 95.0 Z*D= 1741.9 BSTAR= 11.11 TR= .900 BB0= 490.05 C0= 1.69 TC*C0= 1.649 CR*P= .00 I= 6 BBR= 452.16
THETA= 95.0 Z*D= 3483.8 BSTAR= 11.11 TR= .900 BB0= 490.05 C0= 1.69 TC*C0= 1.649 CR*P= .01 I= 7 BBR= 452.16
THETA= 95.0 Z*D= 5225.8 BSTAR= 11.11 TR= .900 BB0= 490.05 C0= 1.69 TC*C0= 1.649 CR*P= .01 I= 8 BBR= 452.16
THETA= 95.0 Z*D= 6967.7 BSTAR= 11.11 TR= .900 BB0= 490.05 C0= 1.69 TC*C0= 1.649 CR*P= .01 I= 9 BBR= 452.16
THETA= 95.0 Z*D= 8709.6 BSTAR= 11.11 TR= .900 BB0= 490.05 C0= 1.69 TC*C0= 1.649 CR*P= .02 I=10 BBR= 452.16
THETA= 95.0 Z*D= 17419.2 BSTAR= 11.11 TR= .900 BB0= 490.05 C0= 1.69 TC*C0= 1.649 CR*P= .07 I=11 BBR= 452.16
THETA= 95.0 Z*D= 34838.3 BSTAR= 11.11 TR= .900 BB0= 490.05 C0= 1.69 TC*C0= 1.649 CR*P= .25 I=12 BBR= 452.16
THETA= 95.0 Z*D= 52257.5 BSTAR= 11.11 TR= .900 BB0= 490.05 C0= 1.69 TC*C0= 1.649 CR*P= .55 I=13 BBR= 452.16
THETA= 95.0 Z*D= 69676.7 BSTAR= 11.11 TR= .900 BB0= 490.05 C0= 1.69 TC*C0= 1.649 CR*P= .97 I=14 BBR= 452.16
THETA= 95.0 Z*D= 87095.8 BSTAR= 11.11 TR= .900 BB0= 490.05 C0= 1.69 TC*C0= 1.649 CR*P= 1.52 I=15 BBR= 452.16
THETA= 95.0 Z*D= 130643.8 BSTAR= 11.11 TR= .900 BB0= 490.05 C0= 1.69 TC*C0= 1.649 CR*P= 3.41 I=16 BBR= 452.16

CURVES INTERSECT AT AX= 1.64936 AY= 89986.49382

AZIMUTH OF PATH OF SIGHT WITH RESPECT TO SUN IS 180 DEGREES

ZENITH OF PATH OF SIGHT = 180 DISTANCE TO TARGET AXIS = 5 ALTITUDE = 1667644 CONTRAST IS POSITIVE

ZENITH OF PATH OF SIGHT = 165 DISTANCE TO TARGET AXIS = 388073 ALTITUDE = 1447921 CONTRAST IS POSITIVE

ZENITH OF PATH OF SIGHT = 150 DISTANCE TO TARGET AXIS = 729681 ALTITUDE = 1263939 CONTRAST IS POSITIVE

ZENITH OF PATH OF SIGHT = 135 DISTANCE TO TARGET AXIS = 931840 ALTITUDE = 931899 CONTRAST IS POSITIVE

ZENITH OF PATH OF SIGHT = 120 DISTANCE TO TARGET AXIS = 997248 ALTITUDE = 575803 CONTRAST IS POSITIVE

ZENITH OF PATH OF SIGHT = 105 DISTANCE TO TARGET AXIS = 1055494 ALTITUDE = 282853 CONTRAST IS POSITIVE

ZENITH OF PATH OF SIGHT = 100 DISTANCE TO TARGET AXIS = 1047990 ALTITUDE = 184786 CONTRAST IS POSITIVE

ZENITH OF PATH OF SIGHT = 95 DISTANCE TO TARGET AXIS = 1028982 ALTITUDE = 89986 CONTRAST IS POSITIVE

COORDINATES FOR PLOTTING 4 CROSS SECTIONS. X = HORIZONTAL Z = VERTICAL

X1	Z1	X2	Z2	X3	Z3	X4	Z4
1513467	130065	1721176	111835	1869030	98905	1852686	100317
957496	360142	1430649	276714	1739709	222220	1724844	224841
947417	550055	1330326	447443	1638257	364923	1712813	344943
811258	1263762	1207281	1035102	1708639	745621	1771639	709246
276509	2723665	1494011	1506085	1940520	1050547	2014141	985922
1437357	2706779	1937245	1840884	2238137	1319684	2284589	1239324
2433127	2115034	2425187	2144695	2593091	1518200	2590238	1528843
2999995	1667644	2999995	1667644	2999995	1667644	2999995	1667644
3386073	1447921	3409782	1528843	3406909	1518200	3374813	2144695
3729681	1263939	3715471	1239324	3761863	1319684	4062795	1840884
3931840	931899	3985859	985922	4059480	1050547	4505989	1506085
3997248	575803	4228361	709246	4291361	745621	4792719	1035102
4055494	282853	4287187	344943	4361743	364923	4669674	447443
4047990	184786	4275156	224841	4260291	222220	4569351	276714
4028982	89986	4147112	100317	4130970	98905	4278822	111835

AXSL= 6000000.0 CSLX= 60000.0 CSLY= 5400000.0 AXLX= 3000000.0 AXLY= 0

NTGDM= 100 NAINC= 600000 NPROB= 50

CURRENT ELAPSED TIME IS 0 MINUTES 37 SECONDS.

UNCLASSIFIED

Security Classification

DOCUMENT CONTROL DATA - R&D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1 ORIGINATING ACTIVITY (Corporate author) Visibility Laboratory University of California San Diego, Calif. 92152	2a REPORT SECURITY CLASSIFICATION UNCLASSIFIED 2b GROUP

3 REPORT TITLE

COMPUTERIZED VISIBILITY CALCULATIONS
MAXIMUM SIGHTING RANGE PROGRAM

4. DESCRIPTIVE NOTES (Type of report and inclusive dates)

Technical Report

5 AUTHOR(S) (Last name, first name, initial)

Barkdoll, Ivan Harry III

6 REPORT DATE	7a. TOTAL NO. OF PAGES	7b. NO. OF REFS
July 1967	121	10

8a. CONTRACT OR GRANT NO.	9a. ORIGINATOR'S REPORT NUMBER(S)
Naval Ship Systems Command NObs-92058 b. PROJECT NO. R-139 c Task 3 d	SIO Ref. 67-23 9b. OTHER REPORT NO(S) (Any other numbers that may be assigned this report)

10 AVAILABILITY/LIMITATION NOTICES

DISTRIBUTION OF THIS DOCUMENT IS UNLIMITED

11. SUPPLEMENTARY NOTES	12. SPONSORING MILITARY ACTIVITY
	Office of Grants and Research Contracts, Code SC, National Aeronautics and Space Administration Washington, D. C. 20546

13 ABSTRACT

This report describes the development of computer programs for the performance of visibility calculations. The computer programs use input data as to the directional reflectance properties of both object and background to determine the inherent contrast of the object for a particular path of sight. Atmospheric contrast transmittance for the path of sight is calculated from input atmospheric data in the form of path luminance and beam transmittance. The inherent contrast is then multiplied by the contrast transmittance to find the apparent contrast. These calculations are repeated for selected distances from the object to determine that range at which the apparent contrast of the object matches the contrast threshold for the human visual system for the angular subtense of the object as viewed at that distance, and for the adaptation level specified. The vision data used in the calculation is the Tiffany data and represents best visual performance, in that the stimulus duration was long, the observers knew where the object was located, and the observers were allowed to fixate in any manner of their choosing. Therefore, ranges calculated from this vision data are called maximum sighting ranges. The computer program described in this report calculates maximum sighting ranges for 57 paths of sight defining hemispherical volume within which the object can be detected.

DD FORM 1 JAN 64 1473

UNCLASSIFIED

Security Classification

14 KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
Visibility						
Vision						
Visual Detection						