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COBRA GLINT MODEL AH-1G

by

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	Low Altitude Flight	Brightness Plots

20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)*

This report details the development of a computer simulation model of the Attack Helicopter to predict the visual detectivity of the aircraft by a ground observer due to sun reflections from its windows. In addition, the model was exercised to determine probabilities of detection versus angles of incident sunlight and also used to determine sunshade configuration for reducing reflections. The helicopter canopy was described by 1464 separate segments that were defined with respect to an earth-referenced coordinate

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BLOCK 20 CONT

system. This permitted the model to be used with various aircraft altitudes, attitudes and sun angle and zenith relationships.

The results showed that large glints occur at all angles of incidence and suggest that a combination of improved window design, improved anti-reflection window coatings, and a sunshade system may be required to reduce reflections to an acceptable level.

The model as developed to this point may also be used in evaluation of other canopy configurations by inputting the appropriate window information into the model.

FOREWORD

This effort was sponsored by the US Army Land Warfare Laboratory, Aberdeen Proving Ground, MD. It was initiated by, and performed under the technical supervision of, Mr. Harold C. Forst, Physicist, of the Advanced Development Division, Applied Physics Branch. The work was conducted to develop the capabilities required by LWL Task 06-P-72, entitled Glare Reduction, which involved various approaches to reduce the visible signature of the attack helicopter. The period of performance extended from August through December 1972 with the latter two months being under the technical supervision of Mr. Gerald E. Cook of the Applied Physics Branch due to reassignment of Mr. Forst.

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1. INTRODUCTION AND SUMMARY

Work Assignment #2 to Contract Number DAAD05-72-C-0284 is concerned with development of a Glint Model for the Cobra AH-1G to analyze glint off the windows. Sun glints off the rotor hub, fuselage and windows in level flight and while banking allow the visual observer to detect low flying aircraft at much longer ranges than is possible in nonglint conditions. Reflections and glints from the rotor blades, rotor hub and fuselage have been adequately taken care of by use of a non-reflecting light-dispersing paint. This task is then concerned with window areas.

The objectives of the task are to develop a simulation model of the Cobra AH-1G for use in predicting the visual detectivity of the aircraft by a ground observer due to sun glints from the windows; to exercise this model to determine probabilities of detection vs. angles of incidence of sunlight; and to use the model to determine the best sunshade configuration. These objectives were met by the model described in Section 3 which used the window configuration described in Section 2. The model included the parameters of sun angle, sun intensity, atmospheric transmission, sun-aircraft relationship, detection sensitivity of the human eye, background intensity and contrast between background and aircraft (to determine detection ranges for observer position relative to the aircraft). A 50% probability of detection criterion was used to determine the ranges. The required reflectivities for the windows were computed as a function of angle of incidence for reducing detection range to the nonglint detection range of the helicopter and for reducing detection range to 1500 meters.

The results showed that to reduce detection range to the nonglint detection range of the helicopter, the required reflectivity varied from less than

.1% to more than 30% over all angles of incidence. To reduce detection range to 1500 meters, the required reflectivity varied from less than .001% to more than .5% over all angles. The most stringent requirements were due to large glints off the relatively flat overhead window. If this window was removed from the model, the low end requirements were relaxed by an order of magnitude to less than 2% and less than .01% respectively. These data indicate that large glints occur at all angles of incidence and that a combination of improved window design, improved window coatings and a sunshade system may be required to reduce glints to an acceptable level.

It is recommended that additional work in this area be performed on shutter designs and then use the model developed under this task as a basic tool in evaluating the shutter redesigns. The model should be modified for future use to consider cluttered and uncluttered backgrounds with high and low background reflectance. This modification is a minor one. In addition, the criteria for use in evaluating shutter designs must be determined and agreed upon.

The model as developed to this point may also be used in evaluation of other helicopter windows by inputting the appropriate window information into the model.

2. THE HELICOPTER WINDOWS

The Cobra AH-1G has five windows, two on each side and an overhead. The location of the windows is described by five outline drawings (listed below) and their contour is described by Bell Helicopter drawing 209-B3 Revision A.

Window	Outline Drawing	Contour Drawing
Pilot's Door (Pilot's left side)	209-030-516	
Pilot's Window (Right side)	209-030-507	209-B3
Gunner's Door (Left side)	209-030-515	
Gunner's Window (Right side)	209-030-508	209-B3
Overhead Window	209-030-509	209-B3

The contour drawing describes the mold used in making the windows. Although it describes only the right hand side and overhead windows, the left side windows are the mirror image of the right hand side windows. The format of the drawing is a series of twenty-seven full scale curves taken at various flight stations from 53.5 to 169.5 along the longitudinal axis of the Cobra at intervals of at least .5" and no more than 6".

In order to describe the windows for use in the model, xyz information was generated for 726 points on the right side windows and for 12 points on the overhead window using the curves on the Bell drawing. Points were generated only for those portions of each curve which fell within the outline of the windows as determined by the five outline drawings noted above.

The center of the coordinate system for the x, y, z values was taken as the 0, 0, 0 point for Flight Station 0, Bulkhead Line 0 and Water Line 0.

This point is shown in figure 2-1 which was taken from figure 12-2 of the Cobra Manual[1]. This system assigns negative x values to Flight Station numbers, positive y values to left Bulkhead Line numbers and positive z values to Water Line numbers. The x y z points for the side windows were determined by plotting points at approximately 1" intervals along each of the twenty-seven curves of the contour drawing and noting their x, y, z values. Although this process could be done by a digitizing plotter with a printout in thousandths of an inch; it was done by hand for this task due to lead time requirements for the digitizer. x,y,z values were measured to the nearest hundredth of an inch, with an estimated accuracy of $\pm$.01 inches. The errors in blueprint distortion were estimated to be 1/16" in 36" or less than .5%. The right hand window was assigned negative x values, negative y values and positive z values. Corresponding points on the left hand window had identical x and z values and identical y values with a positive rather than negative sign.

The overhead window was flat along y and curved in x and z with flats at the front and top. It was described by twelve points, with the first and second describing the front flat, the eleventh and twelth describing the top flat and the second through eleventh describing the curved portion.

[1] Operator's Manual, Army Model AH-1G Helicopter, TM 55-1520-221-10, Headquarters, Department of the Army, 19 June 1971.

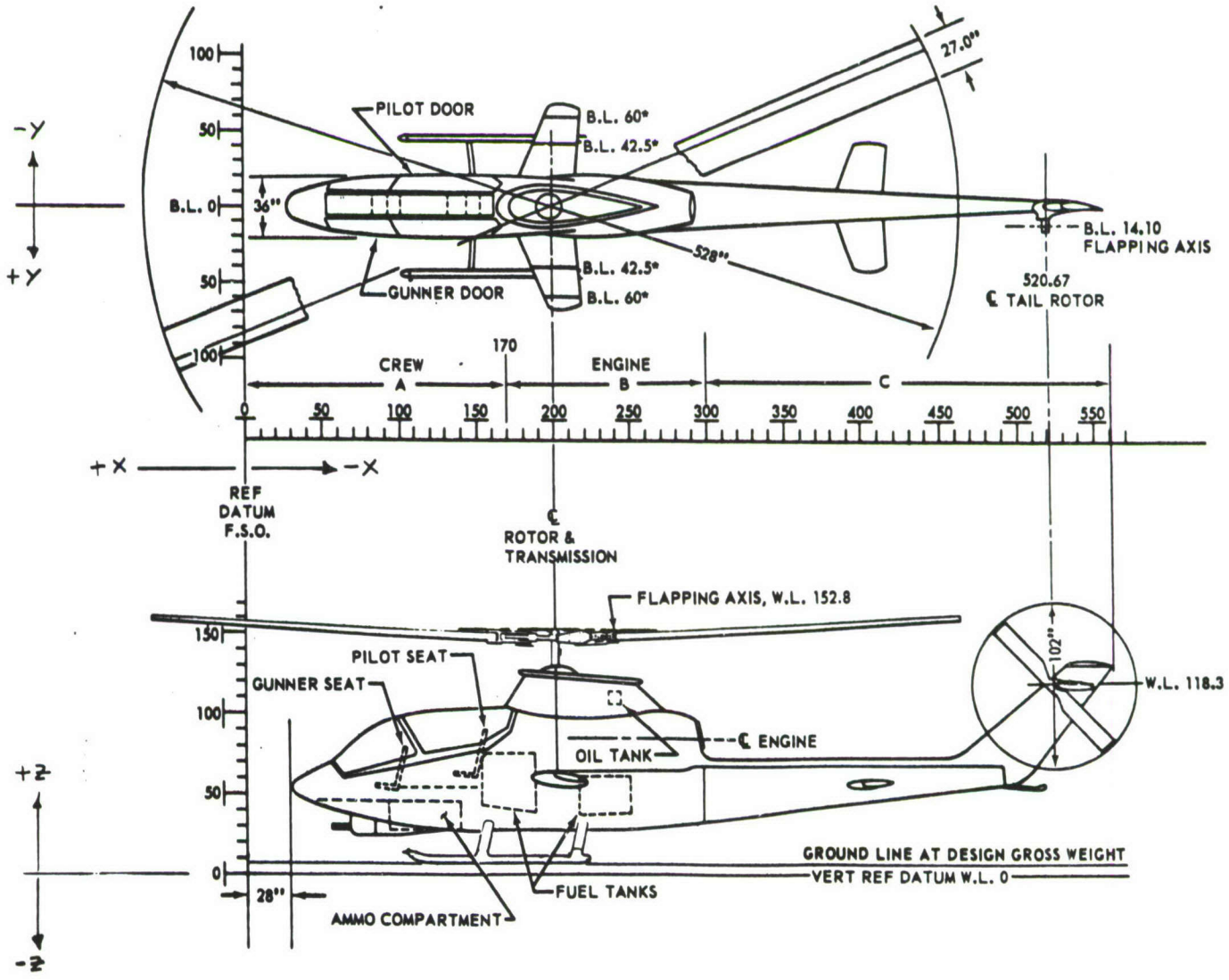


Figure 2-1. Helicopter Reference Points

3. THE COMPUTER MODEL

3.1 General

The computer model was programmed in Fortran IV and run on the Univac 1108 digital computer at the Westinghouse and Defense Center. The model output includes the following:

a) A listing of 726 side window surfaces and 12 center window surfaces with their x,y,z coordinates, x,y,z components of their normals and effective area.

b) A listing of the 1464 surfaces of both side windows and the center window by surface number with x,y,z coordinates for each surface.

c) An Area Contour Plot showing the projection of all normals in zenith and azimuth coordinates.

d) A listing of the azimuth and zenith coordinates of each normal.

e) A Brightness Plot showing the relative brightness of reflected rays in zenith and azimuth coordinates.

f) A Helicopter Detection Range contour plot showing the detection range of the helicopter along each reflected ray in zenith and azimuth coordinates.

g) A Window Detection Range contour plot showing the detection range of the glint along each reflected ray in zenith and azimuth coordinates.

h) A listing of the azimuth and zenith coordinates, the angle of incidence and the glint detection range for each reflected ray.

i) A listing of the required reflectivity for each angle of incidence.

j) A plot of required reflectivity vs. angle of incidence.

A flow chart of the model is shown in figure 3-1. Paragraph numbers are inserted in the flow chart to show where discussion on the various parts of the model can be found. In order to keep machine time and thus computer costs down, the model was divided into three segments. The first segment computed normals and effective areas. Its output is a) above. This output

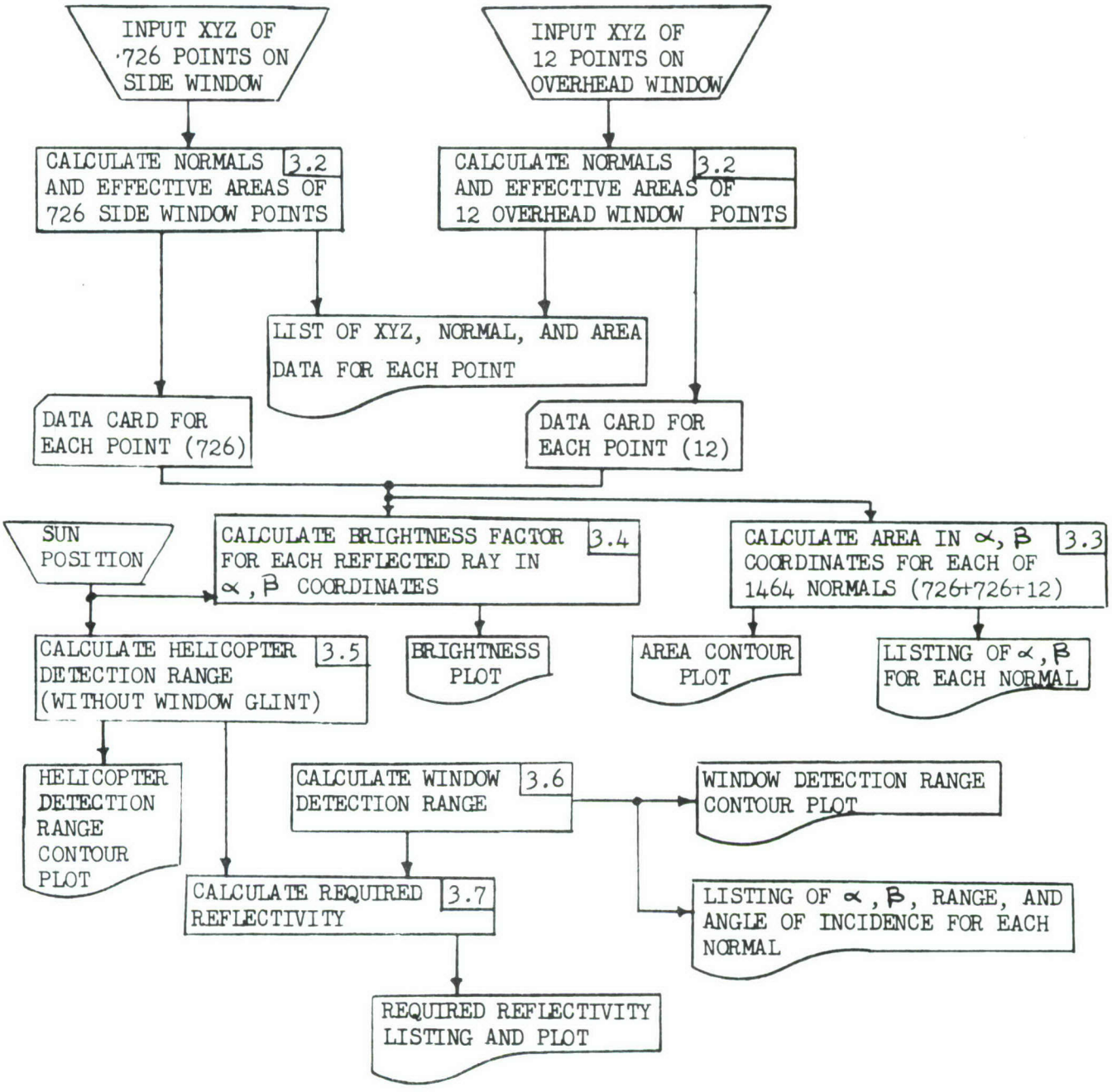


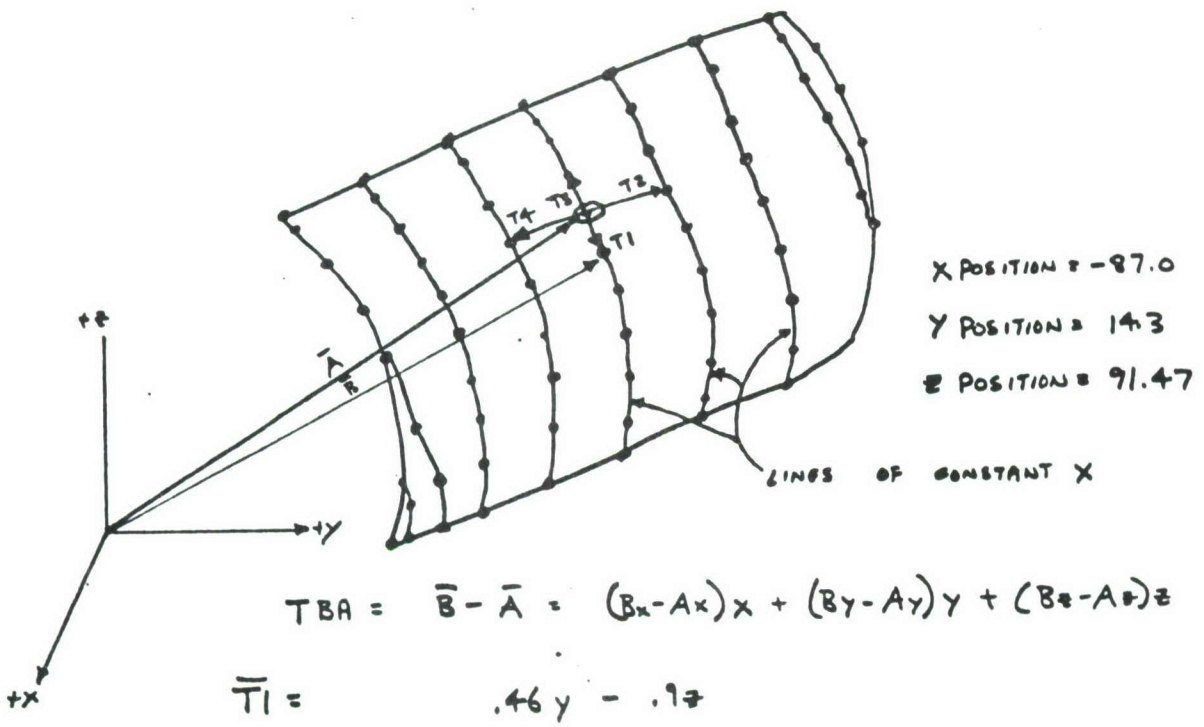
Figure 3-1. Flow Chart for Cobra Model

is fed into the second segment which computes an Area Contour Plot and an associated α,β (zenith, azimuth) plot. Its output is b), c) and d) above. This output is required only once for a given window configuration. The output of the first segment is also fed into the third segment which computes brightness factors, detection ranges and required reflectivities for various sun positions, visibility conditions and reflectivity requirement criteria. Its output is e) through g) above. A listing of the three segments is provided in Appendix A.

3.2 Normal Computation

The normal computation segment of the model was performed in two different programs, one for the right side window and one for the overhead window. Both programs computed tangents on the window and used these tangents to compute x,y,z components of the normals and effective areas. Since this data doesn't change for the same window, it was computed only once, and output on IBM cards which were then used as an integral part of the next program segments. The data generated for the right side window applied to the left side window when the signs of the y position and the y component of the normal were changed from - to +.

The 726 points on the side window were grouped in 27 sets of from 1 to 40 points which described contour curves of equal x values. Figure 3-2 shows a representation of several of these lines. Data for each of these points was read into the program. The data was then ordered in first x and then z. Then tangents along the x curve were computed by computing the vectors between adjacent points along the x curve. The tangents were described in x, y and z values. Each point, $P_{x,\ y,\ z}$, had tangents T1 and T3 computed where T1 was the vector from $P_{x,y,z}$ to $P_{x,y,z-1}$, the point with the next lowest z value on



$$TBA = \bar{B} - \bar{A} = (B_x - A_x)x + (B_y - A_y)y + (B_z - A_z)z$$

$$\bar{T1} = .46y - .9z$$

$$\bar{T2} = -.6x + .9y + .29z$$

$$\bar{T3} = -.5y + .86z$$

$$\bar{T4} = .6x - .95y - 1.21z$$

Figure 3-2. Tangents on Side Windows

that x curve, and T3 was the vector from $P_{x,y,z}$ to $P_{x,y,z+1}$, the point with the next highest z value on that x curve. At the end points, artificial vectors of length .001 were introduced to provide continuity. Tangents T2 and T4 across x curves were computed by finding the closest points on either side of the x curves and computing the vectors to them from $P_{x,y,z}$. On the extreme points, artificial vectors of length .001 were introduced to provide continuity. An example of the four tangent vectors for one point is given in figure 3-2.

To obtain the normals, cross products between T1 and T2, T2 and T3, T3 and T4 and T4 and T1 were computed. The result of each cross product computation was an x value, y value, z value and an area. The x value of the normal was obtained by dividing the sum of the four x values by the sum of the four area values. The y and z values were obtained in a similar manner. The result was a unit normal which was unaffected by the artificial tangents since they had a small length and thus a near zero area. A representation of the four subnormals, $\overline{N12}$, $\overline{N23}$, $\overline{N34}$ and $\overline{N41}$ and the resultant normal $\overline{N}$ is shown in figure 3-3.

The angle between each normal and its four subnormals was obtained by taking the dot product of the subnormal and the normal. The result was the cosine of the angle. This angle was then divided into $1/8^{\circ}$ and the result multiplied by the area obtained from the cross product computation to obtain the effective area for the subnormal. The four subnormal effective areas for each area were then added to provide a total effective area for each normal. This area was a function of the area of the sector defined by the normal, the radius of curvature of the sector and the $\pm 1/4^{\circ}$ angular subtense of the sun.

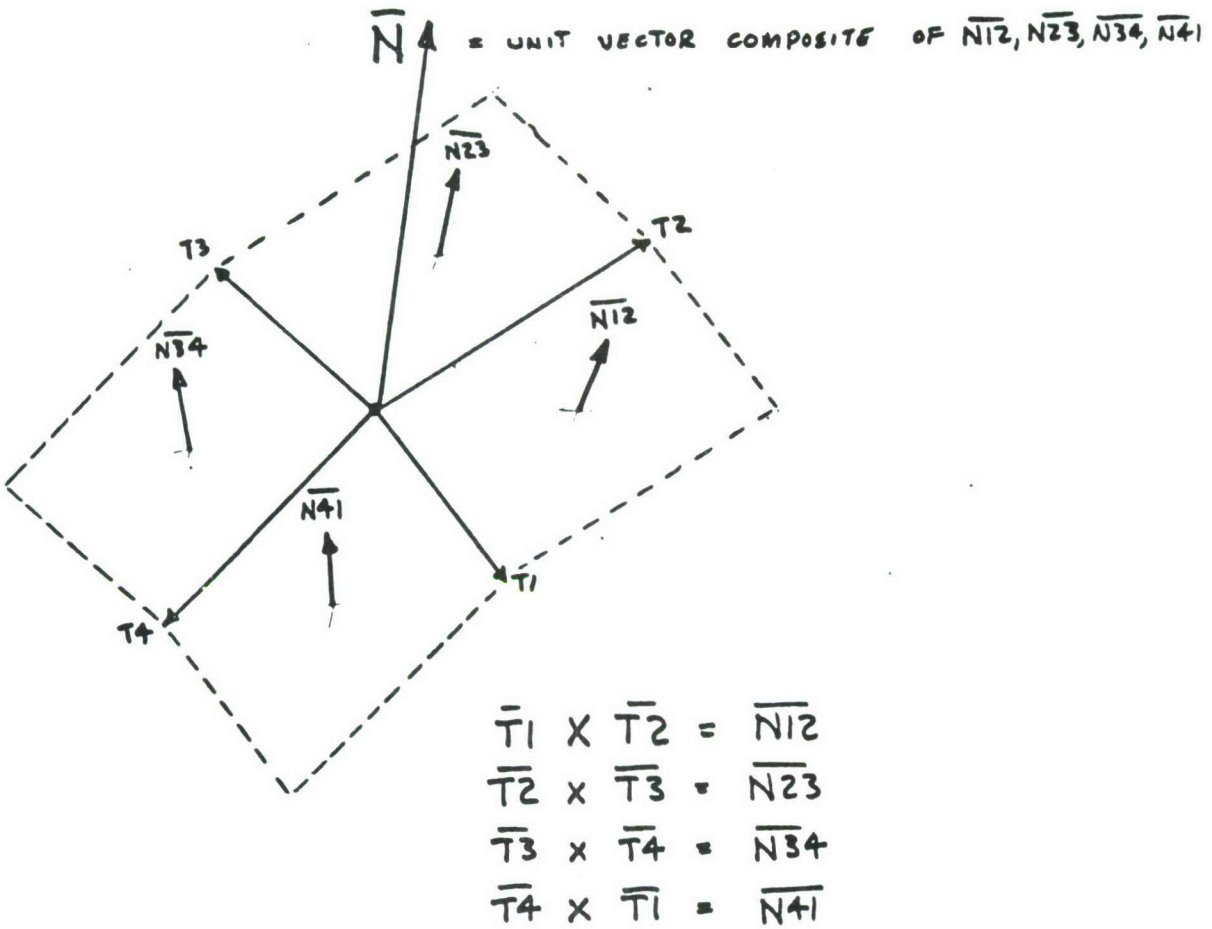


Figure 3-3. Normals on Side Window

A similar but simplified method was used for the twelve points on the overhead window. Two tangents, T1 and T3, were computed for each point using the adjacent points. A third tangent, T2 of x=0, y=16, z=0 was used to represent the window width. The normals and effective areas were then generated using two cross products, T1 x T2 and T2 x T3.

The output of the two programs was a listing of 738 points by their x,y,z position with x,y,z components of their unit vectors and their effective areas. This output is presented in Appendix B. An IBM data card was generated for each point for use in the next segments of the model.

3.3 Area Contour Plot

This segment of the model converts the data of 738 window sectors into 1464 window sectors covering both side windows (726 sectors each) and the overhead window (12 sectors).

The Area Contour Plot shows the projections of the normals in azimuth and zenith coordinates for a trimmed helicopter. The zenith angle of the normal is called α and the azimuth angle is called β on the plot. Figure 3-4 shows the α , β angular relationships. The zenith and azimuth angles are quantized in 3° increments and the sum of all areas within $\pm 1\frac{1}{2}^{\circ}$ of each quantized zenith and azimuth point are plotted on the Area Contour Plot. Numbers on the plot are two place integers representing 10 $\log_{10}$ (Area x 1000). This representation was chosen to guarantee that all areas could be represented by a positive two place number.

The output of this segment of the model is a listing by surface number of the x,y,z, coordinates of each of the 1464 normals, a listing by surface number of the α , β coordinates of each normal, and the Area Contour Plot. By assigning surface numbers and listing the α , β of each normal, it is

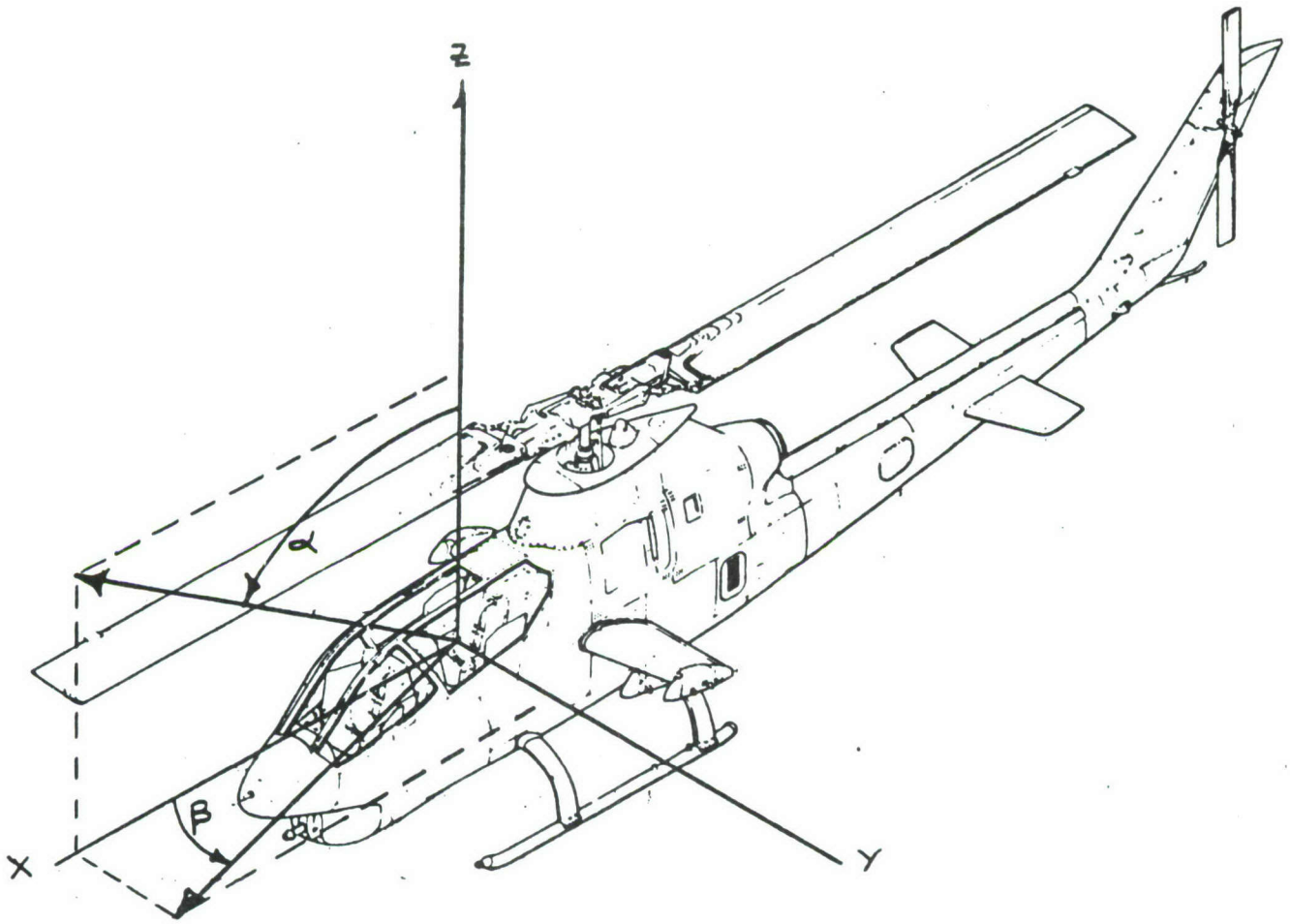


Figure 3-4. Alpha, Beta Coordinate System

possible to find the point or points on the windows which a given α , β or area corresponds to.

The surface x,y,z listing, the α , β listing and the Area Contour Plot are presented in Appendix B.

The data from this segment of the model is generated only once because it does not change for a given window configuration. This information is then used in the third segment of the model.

3.4 Brightness Plot

This segment of the program computes the reflected sun rays off the helicopter window and computes a brightness factor which is used later to compute detection range. A Brightness Plot showing relative brightness as a function of the azimuth and zenith position of the reflected rays is generated.

Each sun position relative to the helicopter's trim position is considered as one case. For each case a new brightness plot is generated showing all of the reflected rays. The x,y,z components of the reflected ray are computed by equations (1), (2) and (3).

(1) RX = SX - 2 x SDN x XN

(2) RY = SY - 2 x SDN x YN

(3) RZ = SZ - 2 x SDN x ZN

where :

SX = sun rays x component = -cos (sun azimuth) x sin (sun zenith)

SY = sun rays y component = -sin (sun azimuth) x sin (sun zenith)

SZ = sun rays z component = -cos (sun zenith)

XN = x component of normal

YN = y component of normal

ZN = Z component of normal

SDN = dot product of normal and sun ray = cosine of angle of incidence between sun ray and surface normal

When SDN is negative, the angle of incidence is greater than 90° and the normal under consideration is in the shadow of the window. For these normals there is no reflected ray and no brightness factor.

The sun ray vector is defined as a unit vector and the normal vector is a unit vector, thus the reflected ray vector is a unit vector. This vector is used to calculate the α , β position of the reflected ray in a manner similar to that of the α , β position of the normal vector in section 3.3, with the α , β position quantized in 3° sectors.

The brightness factor is computed by equation (4).

(4) BF = area x SDN x RO

where:

area = the area associated with the normal as computed in the normal computation

RO = coefficient of reflectivity of the window material (acrylic plastic) and the angle of incidence. This coefficient is computed in a continuous fraction subroutine which uses data supplied by LWL.

The highest brightness factor for each quantized α , β is printed on the Brightness Plot. Numbers on the plot are two place integers representing 10 $\log_{10}$ (Brightness Factor x 10^7). This representation was chosen to guarantee that all brightness factors could be represented by a positive two place number.

A typical Brightness Plot (sun zenith = 45°) is presented in Appendix B.

3.5 Helicopter Detection Range

Helicopter detection range is the 50% probability of detecting the

helicopter with the photopic eye and is calculated along each reflected ray. It is used in the determination of required reflectivity.

Two contrast equations are used in the calculations of detection range. The first equation (5) describes the contrast of the helicopter against an east horizon sky. The second equation (6) describes the contrast required in order to see the helicopter.

$$(5)\quad CT_1 = \frac{BH \times ROE - BH}{BH} \times 100 \times e^{(-3.9075 \times RT/RVIS)}$$

where:

BH = horizon brightness = .0009 w/cm^2/steradian

ROE = reflectivity of helicopter paint = .15

RT = detection range (50% probability) of helicopter in nautical miles

RVIS = visibility range in nautical miles

$e^{-(3.9075)}$ = two percent minimum contrast requirement

$$(6)\quad CT_2 = 1.57 + 36.5\ RT^2/A$$

where:

A = area in square feet

The area of the helicopter is calculated as the visible area of the helicopter along a reflected ray as calculated by equation (7).

$$(7)\quad AP = RX \times 35 + RY \times 450 + RZ \times 157.5$$

where:

35 = frontal area in square feet

450 = side area in square feet

157.5 = top area in square feet

Equations (5) and (6) are transcendental when solving for R. Thus, equation (8) and its derivative, equation (9) were used to solve for R. The equations approach a solution as F approaches 0. The pair of equations were iterated with initial R = 0 and $-F/F'$ being used as the correction factor. For each following iteration, R was incremented by $-F/F'$ until F/F' was less than .1 miles.

(8) $F = -CT_1 + 1.57 + 36 \times RT^2/AP$

(9) $F' = 3,9075\ CT_1/RVIS + 2 \times 36.5 \times RT/AP$

The Helicopter Detection Range Contour is obtained by using an α , β plot similar to that for the Brightness Plot except that the maximum Helicopter Range in nautical miles is plotted for each quantized α , β position. A typical Helicopter Detection Range Contour Plot (sun zenith = 45°, sun azimuth = 45°) is presented in Appendix B.

3.6 Window Detection Range

The window detection range is the range at which there is a 50% probability of detecting the window glint with the photopic eye.

As with helicopter detection range, two contrast equations, (10) and (11) respectively, describe the contrast of the sun glint against an eastern horizon sky and the contrast required to detect the glint, and difference equation (12) and its derivative, equation (13), are used to solve equations (10) and (11).

(10) $CG_1 = \dfrac{BS \times EYE \times RO - BH}{BH} \times 100 \times e^{(-3.9075\ RG/RVIS)}$

where:

BS = sun brightness = 2000 w/cm^2/steradian

EYE = photopic response of eye to the sun = .15

RG = detection range (50% probability) of window glint in nautical miles

(11) $CG_2 = 1.57 + 36.5 \times RG^2/ABF$

where: ABF = BF/(RO x 144.) = effective area of window sector in square feet

(12) $F = -CG_1 + 1.57 + 36.5\ RG^2/ABF$

(13) $F' = 3.9075\ CG_1/RVIS + 2 \times 36.5\ RG^2/ABF$

The Window Detection Range Contour is obtained by using an α , β plot similar to that for the Brightness Plot except that the maximum Window Detection Range in nautical miles is plotted for each quantized α , β position. A typical Window Detection Range Contour Plot (sun azimuth = 45°, sun zenith = 45°) is presented in Appendix B.

The relationship between brightness factor and window detection range can be shown by letting CG_1 of equation (10) equal CG_2 of equation (11). After some algebraic manipulation, we obtain equation (14).

(14) $$BF = \frac{36.5 \times RG^2 \times BH}{(BS \times EYE - BH) \times 100\ e^{(-3.9075\ RG/RVIS)}}$$

Figure 3-5 shows the relationship for visibility ranges of 5, 10 and 20 nautical miles.

3.7 Required Reflectivity

Required reflectivity is defined as that reflectivity which the windows would need in order that the detection range (50% probability) of the glint would not exceed a specified range, possibly the detection range of the helicopter itself, or a constant range such as 1500 meters. It is generated as a function of the angle of incidence of the sun's rays on the window surfaces.

The required reflectivity is computed by equating CG_1 of equation (10)

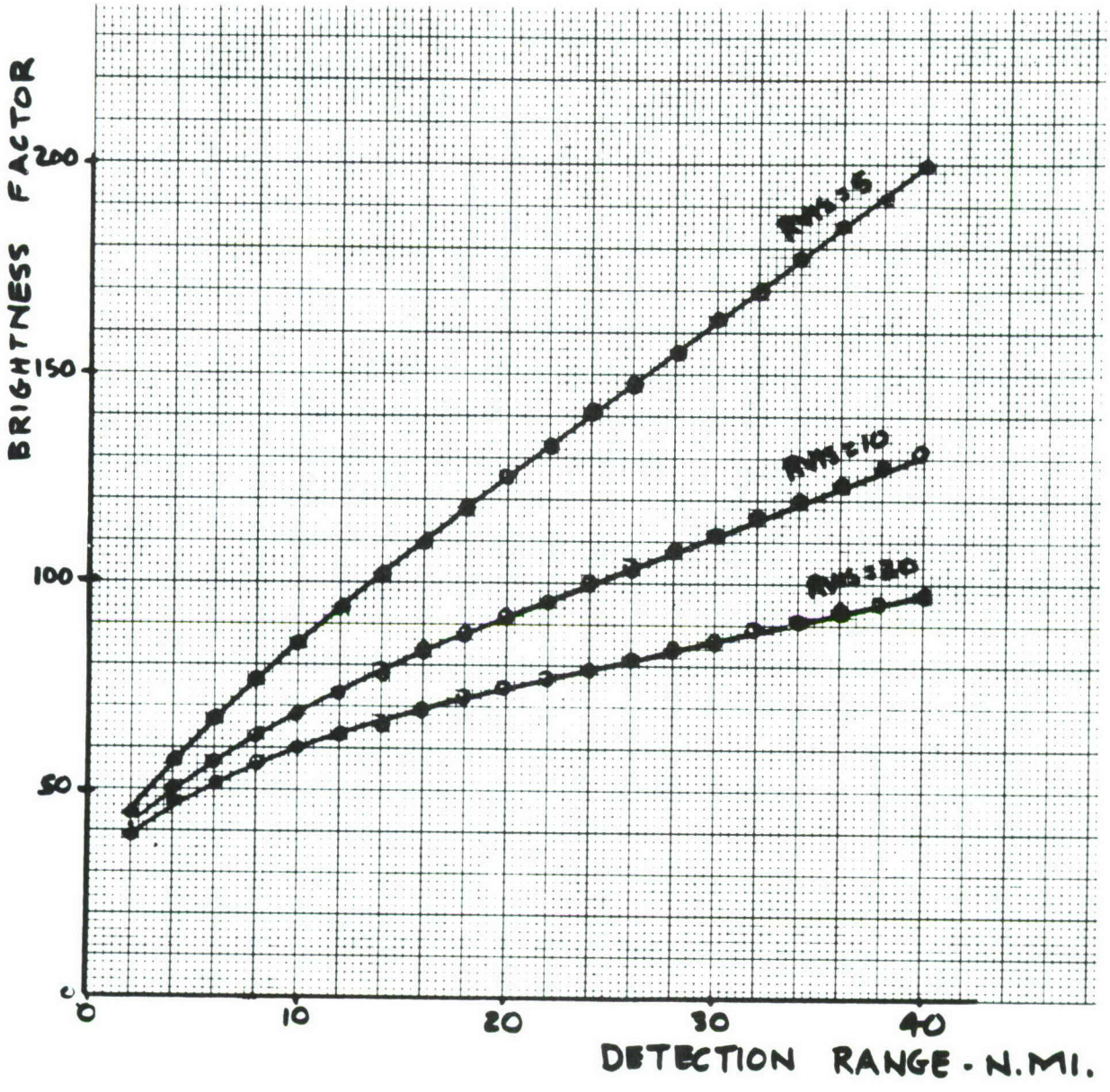


Figure 3-5. Brightness Factor vs. Detection Range

and CG_2 of equation (11) and solving for RO with RT, the desired range, substituted for RG. When helicopter detection range is the desired criteria, its value as computed earlier is used. When a constant range is specified, that range is used for RT. The resulting equation for required reflectivity (ROG) is given as equation (14).

$$(14) \quad ROG = \frac{1.57 + 36.5 \times RT^2}{ABF} \times \frac{BH}{BS \times EYE \times 100 \times e^{(-3.9075\ RT/RVIS)}}$$

The above calculation is made for each reflected ray. The angle of incidence of each ray is computed as arccosine (SDN) and rounded to the nearest degree. Then a lowest value of ROG is found for each angle of incidence from 0° to 90°. Where there are no reflected rays for an angle of incidence, ROG is assumed to be an arbitrary number, 10, which is higher than the actual maximum reflectivity of which any passive surface can have.

A listing and a plot of required reflectivity as a function of angle of incidence is generated for each case. The plot includes a count of the number of rays at each incident angle. At the end of a run of multiple cases, a summary listing and plot is printed out. An example of the listing and plot of required reflectivities is presented in Appendix B.

4. EXERCISING THE MODEL

The first two segments of the model were used one time to compute the window normals and the effective area associated with each normal and to generate an Area Contour Plot. These results are presented in Appendix B.

In the third segment of the program, several sets of runs were made for various visibility ranges and required reflectivity criteria. Each set of runs included 17 sun position cases as shown in Table 4-1. These sun positions relative to the helicopter covered the range of possible sun position-helicopter relationships. For example, a helicopter banking at 45° against a horizon sun might have a zenith = 135°, azimuth = 90° sun position relationship. Six sets of data were run as tabulated in Table 4-2. Different

Table 4-1. Sun Positions Relative to Helicopter

Zenith \ Azimuth	0	45	90	135	180
0	X				
45	X	X	X	X	X
90	X	X	X	X	X
135	X	X	X	X	X
180	X				

runs at 20 and 5 nautical miles were made to show the effect of visibility range on required reflectivity. Different runs using Helicopter Detection Range and a constant 1500 meters showed the effect of choosing the different criteria for judging window design. The runs without the overhead windows were run because the largest glints were found to occur on the overhead windows and these large glints overpowered the effect of glints off the curved

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Table 4-2. Parameter Variation in Runs Made

Run #	Reflectivity Requirement Criteria: Reduce Glint Range to:	Visibility Range N. Miles	Overhead Windows	Sun Position	Summary of Reflectivity Requirements
1	Helicopter Detection Range	5	Included	Per Table 4-1	Figure 4-1
2	Helicopter Detection Range	20	Included	Per Table 4-1	Figure 4-2
3	Helicopter Detection Range	5	Excluded	Per Table 4-1	Figure 4-3
4	1500 meters	5	Included	Per Table 4-1	Figure 4-4
5	1500 meters	20	Included	Per Table 4-1	Figure 4-5
6	1500 meters	5	Excluded	Per Table 4-1	Figure 4-6

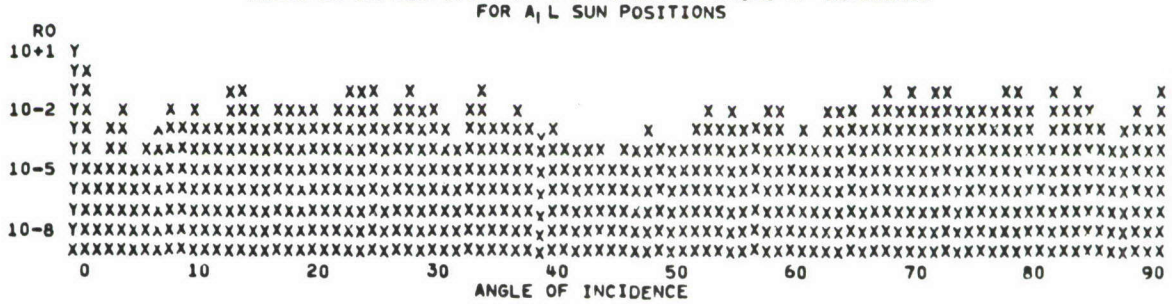
side windows.

The output for each case in the 6 runs included the brightness plot, a listing of normal numbers, α , β , angle of incidence and glint detection range, and a listing and plot of the required reflectivity vs. angle of incidence. The summary reflectivity listings and plots for cases 1 through 6 are shown in figures 4-1 through 4-6. The reflectivity listings and plots for the seventeen cases in run #1 are included in Appendix C.

REQUIRED REFLECTIVITY AS A FUNCTION OF ANGLE OF INCIDENCE

ANGLE	0	1	2	3	4	5	6	7	8	9
0	********	.000076	.001598	.031047	.000098	.000507	.002612	.057016	.002886	.088270
10	.005551	.003631	.109365	.147049	.054292	.004900	.033839	.011043	.036657	.099216
20	.006522	.040333	.213959	.247855	.314083	.007321	.029442	.313381	.026464	.084756
30	.005657	.000171	.021894	.189602	.004293	.004217	.011198	.003476	.008480	.003198
40	.000626	.000122	.000244	.000767	.000036	.000286	.000120	.002533	.000262	.000123
50	.000633	.003240	.034166	.00352	.062352	.009595	.004308	.052130	.029269	.000294
60	.005409	.000351	.030231	.044161	.054260	.005413	.028087	.117311	.039441	.110781
70	.016656	.142733	.158858	.02773	.021630	.014414	.055543	.384746	.162881	.012413
80	.000856	.202772	.011540	.223609	.012672	.002878	.000612	.003623	.055433	.002967
90	.071355									

SUMMARY OF
REQUIRED REFLECTIVITY AS A FUNCTION OF ANGLE OF INCIDENCE
FOR ALL SUN POSITIONS



RVIS = 5 n. mi.

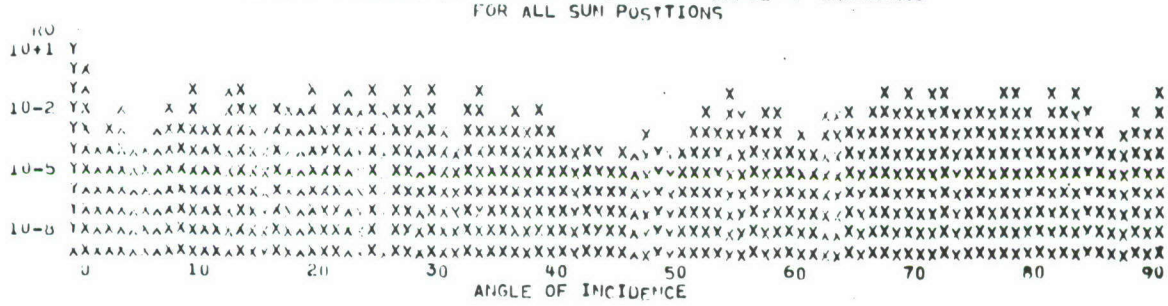
RT = Helicopter Detection Range

Figure 4-1. Case #1 Reflectivity Requirements

REQUIRED REFLECTIVITY AS A FUNCTION OF ANGLE OF INCIDENCE

ANGLE	0	1	2	3	4	5	6	7	8	9
0	********	.000104	.002206	.053244	.000139	.000723	.003734	.097520	.004124	.150899
10	.007876	.005173	.198241	.251100	.080283	.006922	.050631	.015712	.006496	.163654
20	.009035	.067640	.324477	.339573	.501592	.010435	.045475	.430538	.042993	.124861
30	.008083	.000271	.032279	.325846	.006111	.005171	.018213	.004918	.013801	.004493
40	.000874	.000169	.010394	.000977	.000045	.000483	.000170	.003609	.000419	.000164
50	.000842	.004475	.056708	.004567	.104539	.013603	.005309	.086356	.047903	.000471
60	.006663	.000593	.048165	.069759	.085978	.007161	.047627	.194789	.066328	.189140
70	.022446	.244043	.248756	.048324	.026248	.018764	.092915	.602964	.260581	.015278
80	.001353	.326693	.014052	.309556	.015262	.003438	.000727	.005871	.075260	.004032
90	.042491									

SUMMARY OF
REQUIRED REFLECTIVITY AS A FUNCTION OF ANGLE OF INCIDENCE
FOR ALL SUN POSITIONS



RVIS = 20 n. miles

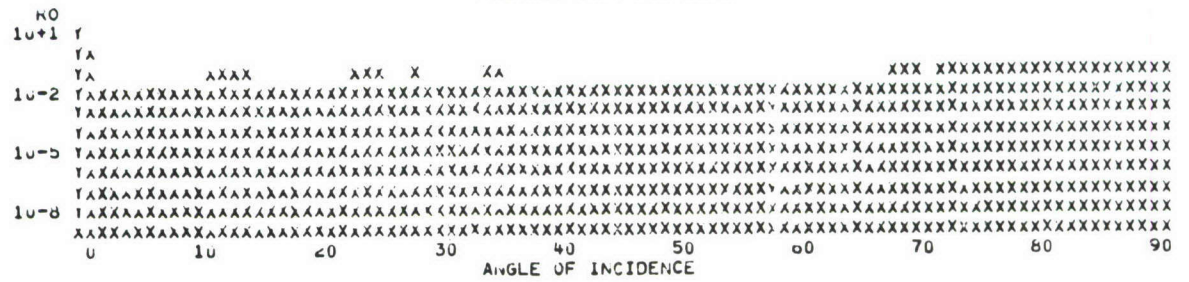
RT = Helicopter Detection Range

Figure 4-2. Case #2 Reflectivity Requirements

REQUIRED REFLECTIVITY AS A FUNCTION OF ANGLE OF INCIDENCE

ANGLE	0	1	2	3	4	5	6	7	8	9
0	********	.019297	.017359	.031047	.025236	.035949	.031275	.057016	.070168	.088270
10	.104196	.114317	.109366	.147049	.054297	.042046	.033539	.031225	.036657	.099216
20	.029076	.040333	.213959	.247891	.314085	.022846	.029442	.313381	.026464	.084756
30	.026304	.021100	.021894	.109603	.123630	.036108	.024597	.028021	.023104	.024357
40	.043635	.037743	.030162	.020785	.023118	.025932	.023043	.020674	.036708	.029796
50	.037326	.032453	.043208	.072250	.062352	.078226	.060344	.052130	.029269	.032241
60	.029736	.032729	.030233	.044161	.054265	.075137	.096976	.117321	.146261	.110781
70	.097857	.142733	.158658	.111342	.140114	.129950	.131300	.384746	.162881	.213600
80	.345074	.202772	.231393	.223609	.123129	.154087	.129183	.125708	.128318	.184402
90	.671355									

SUMMARY OF
REQUIRED REFLECTIVITY AS A FUNCTION OF ANGLE OF INCIDENCE
FOR ALL SUN POSITIONS



RVIS = 5 n. mi.

RT = Helicopter Detection Range

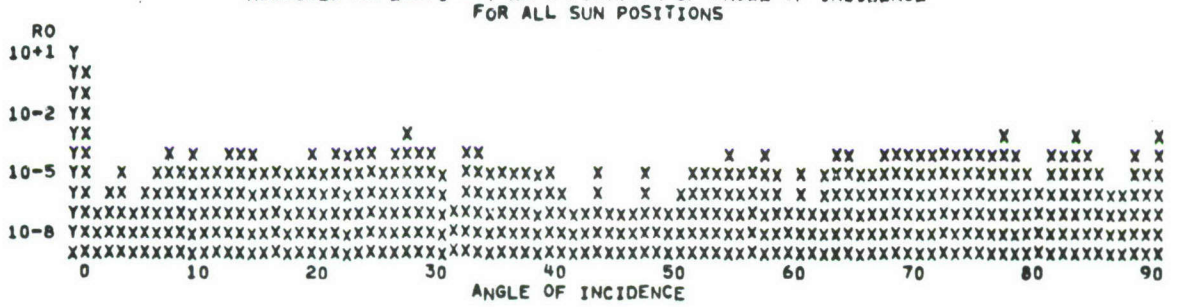
No Overhead Window

Figure 4-3. Case #3 Reflectivity Requirements

REQUIRED REFLECTIVITY AS A FUNCTION OF ANGLE OF INCIDENCE

ANGLE	0	1	2	3	4	5	6	7	8	9
0	********	.000001	.000009	.000076	.000001	.000003	.000014	.000141	.000015	.000218
10	.000029	.000019	.000261	.000365	.000175	.000026	.000094	.000058	.000099	.000268
20	.000037	.000104	.000721	.000791	.000852	.000038	.000130	.001007	.000107	.000308
30	.000030	.000001	.000106	.000482	.000023	.000036	.000031	.000019	.000024	.000017
40	.000004	.000001	.000001	.000013	.000001	.000001	.000001	.000013	.000001	.000001
50	.000004	.000021	.000091	.000025	.000154	.000050	.000033	.000139	.000081	.000001
60	.000050	.000001	.000089	.000134	.000172	.000081	.000071	.000311	.000151	.000275
70	.000102	.000351	.000666	.000101	.000208	.000101	.000145	.001190	.000476	.000099
80	.000003	.000582	.000104	.001266	.000130	.000032	.000007	.000010	.000333	.000018
90	.008913									

SUMMARY OF
REQUIRED REFLECTIVITY AS A FUNCTION OF ANGLE OF INCIDENCE
FOR ALL SUN POSITIONS



RVIS = 5 n. mi.

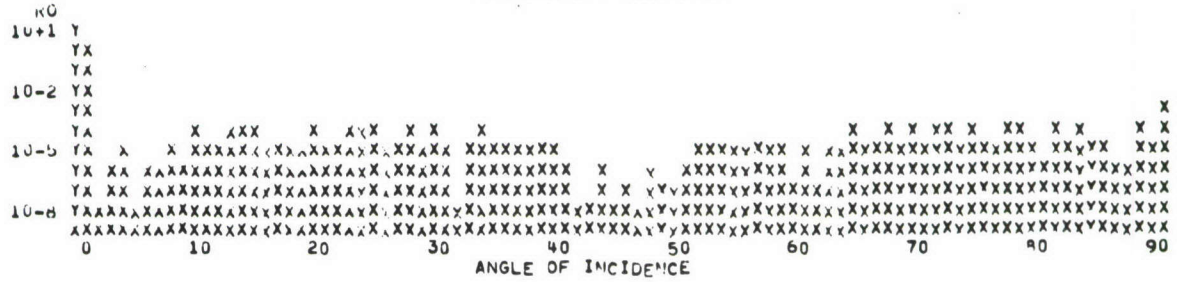
RT = 1500 meters

Figure 4-4. Case #4 Reflectivity Requirements

REQUIRED REFLECTIVITY AS A FUNCTION OF ANGLE OF INCIDENCE

ANGLE	0	1	2	3	4	5	6	7	8	9
0	********	.000000	.000006	.000047	.000000	.000002	.000008	.000088	.000000	.000136
10	.000018	.000012	.001o2	.000227	.000109	.000016	.000058	.000036	.000061	.000167
20	.000023	.000065	.000448	.000492	.000530	.000024	.000081	.000627	.000066	.000191
30	.000018	.000000	.000006	.000300	.000014	.000002	.000020	.000012	.000015	.000011
40	.000002	.000000	.000000	.000008	.000000	.000001	.000000	.000008	.000001	.000001
50	.000003	.000013	.000057	.000015	.000096	.000001	.000021	.000087	.000050	.000001
60	.000031	.000001	.000056	.000083	.000107	.000061	.000044	.000194	.000094	.000171
70	.000064	.000218	.000414	.000063	.000129	.000063	.000090	.000740	.000296	.000061
80	.000002	.000062	.000005	.000787	.000081	.000020	.000005	.000006	.000207	.000011
90	.005544									

SUMMARY OF
REQUIRED REFLECTIVITY AS A FUNCTION OF ANGLE OF INCIDENCE
FOR ALL SUN POSITIONS



RVIS = 20 n. mi

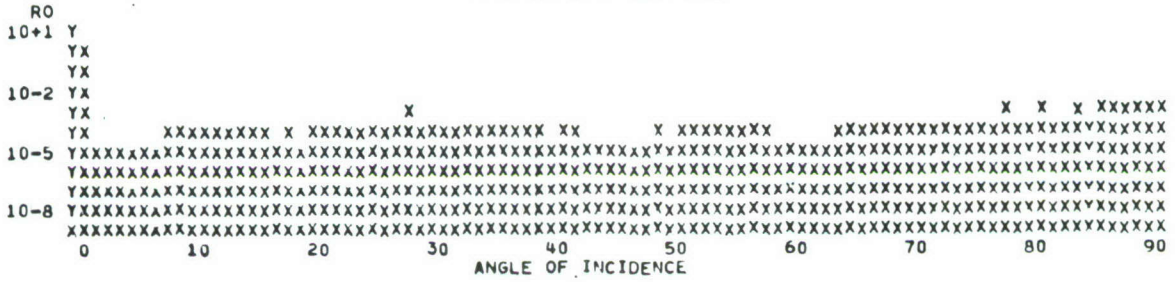
RT = 1500 meters

Figure 4-5. Case #5 Reflectivity Requirements

REQUIRED REFLECTIVITY AS A FUNCTION OF ANGLE OF INCIDENCE

ANGLE	0	1	2	3	4	5	6	7	8	9
0	********	.000047	.000042	.000076	.000062	.000088	.000077	.000141	.000173	.000218
10	.000253	.000282	.000261	.000365	.000175	.000219	.000094	.000120	.000099	.000268
20	.000124	.000104	.000721	.000791	.000852	.000107	.000130	.001007	.000107	.000308
30	.000104	.000110	.000106	.000482	.000306	.000148	.000120	.000146	.000119	.000099
40	.000117	.000102	.000082	.000058	.000059	.000065	.000061	.000062	.000114	.000093
50	.000135	.000121	.000158	.000287	.000154	.000205	.000161	.000139	.000081	.000090
60	.000084	.000095	.000069	.000134	.000172	.000271	.000236	.000311	.000574	.000275
70	.000348	.000351	.000666	.000319	.000337	.000369	.000372	.001190	.000476	.000620
80	.001592	.000582	.000663	.001266	.000776	.001045	.001046	.001010	.001319	.001926
90	.008913									

SUMMARY OF
REQUIRED REFLECTIVITY AS A FUNCTION OF ANGLE OF INCIDENCE
FOR ALL SUN POSITIONS



RVIS = 5 n. mi.

RT = 1500 meters

No Overhead Windows

Figure 4-6. Case #6 Reflectivity Requirements

5. CONCLUSIONS

From the data obtained in exercising the model, we can obtain several conclusions about the nature of the window glint. These conclusions point the way to future work required in designing the window.

5.1 Effect of Visibility Range on Required Reflectivity

Figures 4-1 and 4-2 show the results of runs #1 and #2 with visibilities of 5 and 20 n. miles respectively and reflectivity requirements based on reducing detection range to that of the non-glint helicopter. This criteria produces more stringent reflectivity requirements for lower visibility ranges because the non-glint detection range is affected more by the reduced visibility than the glint detection range.

However, if the reflectivity requirement is based on reducing detection range to a fixed value, as done in runs #4 and #5 (figures 4-4 and 4-5), the more stringent reflectivity requirements occur at higher visibility ranges.

5.2 Effect of Detection Criteria on Required Reflectivity

A comparison of the results of runs #1 and #4 (figures 4-1 and 4-4) and of the results of runs #2 and #5 (figures 4-2 and 4-5), shows a marked difference in requirements based on the selection of either reducing detection range to the non-glint detection range of the helicopter or reducing detection range to a fixed range (1500 meters in runs #4 and #5) as the detection criteria. This result points out the importance of selecting the criteria to be used in evaluating window modifications or redesign early in any future work effort to guarantee the proper evaluation of proposed solutions.

5.3 Effect of Flat vs. Curved Windows

Early evaluation of the results of exercising the model showed the largest glints came from the large flat sections of the overhead and that as sun

position relative to the helicopter changed, these glints caused very stringent reflectivity requirements over all angles of incidence. When the overhead and thus the flats were removed from the models, as in cases #3 and #6 (see results in figures 4-3 and 4-6), the more stringent reflectivity requirements were reduced by an order of magnitude.

This implies that any window redesign should attempt to eliminate flats and should probably attempt to achieve a minimum value for radius of curvature.

5.4 Use of Sunshades

The goal of using sunshades would be to block off certain sections of the windows which caused the largest glints or to limit the angles of incidence over certain portions of the window to ease the reflectivity requirements. It appears that sunshades would be sucessful in achieving this goal, but that they alone would not solve the complete problem of reducing sun glints because of the large glints remaining over low angles of incidence. A more detailed investigation of the effects of sunshades on both reduction of glint and reduction of pilot visibility should be made before a final recommendation is made.

APPENDIX A

LISTING OF

DIGITAL COMPUTER PROGRAM

FOR

COBRA WINDOW MODEL

Segment 1 - Normals and Effective Areas

COBWIN (side window) A-2

COBNOR (overhead window)..... A-8

Segment 2 - Area Contours

COBWIN A-11

NORMAL (data block for results of segment 1)..... A-15

PLOTT (subroutine for α , β plots) A-34

Segment 3 - Brightness Factors, Detection Ranges and Required Reflectivities

COBWIN (also uses NORMAL and PLOTT from segment 2)..... A-37

CONFRA (subroutine for continued fraction expansion calculation of reflectivity)..... A-46

```
M1 FOR COBWIN
COMPILATION BY UNIVAC 1107 FORTRAN-IV DATED      JUNE 22,1965 F.008
THIS COMPILATION WAS DONE ON 05 DEC 72 AT 14:21:24

 MAIN PROGRAM              ENTRY POINT 000000

 STORAGE USED (BLOCK, NAME, LENGTH)

        0001    *CODE    001327
        0000    *DATA    054531
        0002    *BLANK   000003


 EXTERNAL REFERENCES (BLOCK, NAME)

        0003    COS
        0004    SIN
        0005    SQRT
        0006    ATAN2
        0007    NRDU%
        0010    NLO1%
        0011    NL02%
        0012    NWDU%
        0013    NSTOP%

 STORAGE ASSIGNMENT FOR VARIABLES (BLOCK, TYPE, RELATIVE LOCATION, NAME)

 0000    054453 102F      0000    054470 103F      0000    054472 105F
 0001    000070 143G      0001    000074 147G      0000    054451 2F
 0001    000232 224G      0001    000174 23L       0001    000362 250G
 0001    000136 3L        0001    000523 330G      0001    000531 337G
 0001    000475 42L       0001    000506 45L       0001    000602 46L
 0000 R  054354 ANGLE     0000 R  054450 ANOR      0000 R  054413 AR12
 0000 R  054427 AR41      0000 R  054436 AR12      0000 R  054441 AR23
 0000 R  000000 ATAN2     0000 R  054435 A12       0000 R  054440 A23
 0000 R  000000 COS       0000 R  054373 DEL       0000 R  054402 DELTEM
 0000 R  054401 DELZ      0000 R  054434 D12       0000 R  054437 D23
 0000 I  054355 I         0000 I  054345 ICRD      0000 I  054370 II
 0000 I  054375 IIX       0000 I  054405 INUM      0000 I  054344 IOUT
```

```
0000 I 054371 IXI          0000 I 054406 IXMIN        0000 I 054376 IXPL
0000 I 054356 M            0000 I 054365 MM           0000 I 054407 MXY
0000 I 054374 NOIXP        0000 I 054362 NUMX         0000 I 054305 NUMXY
0005 R 000000 SQRT         0000 R 054351 SX           0000 R 054352 SY
0000 R 004216 X            0000 R 054364 XA           0000 R 010420 XL
0000 R 017055 XT1          0000 R 026763 XT2          0000 R 036071 XT3
0000 R 054410 X12          0000 R 054414 X23          0000 R 054420 X34
0000 R 012757 YL           0000 R 054432 YNORM        0000 R 002157 YT1
0000 R 047501 YT4          0000 R 001332 YY           0000 R 054411 Y12
0000 R 054425 Y41          0000 R 007072 Z            0000 R 015316 ZL
0000 R 054346 ZPOS         0000 R 024461 ZT1          0000 R 033567 ZT2
0000 R 002064 ZZ           0000 R 054412 Z12          0000 R 054416 Z23
```

```
1.      C       COBRA WINDOW
2.              DIMENSION XX(730),YY(730),ZZ(730),X(726),Y(726),Z(726)
3.              DIMENSION XL(29,43),YL(29,43), ZL(29,43)
4.              DIMENSION XT1(29,42),YT1(29,42),ZT1(29,42)
5.              DIMENSION XT2(29,42),YT2(29,42),ZT2(29,42)
6.              DIMENSION XT3(29,42),YT3(29,42),ZT3(29,42)
7.              DIMENSION XT4(29,42),YT4(29,42),ZT4(29,42)
8.              DIMENSION NUMXY(30)
9.              IIN=5
10.             IOUT=6
11.             ICRD=7
12.             ZPOS=12.*200.
13.             SZEN=.017453*45.
14.             SAZ=.017453*135.
15.             SX=-COS(SAZ)*SIN(SZEN)
16.             SY=-SIN(SAZ)*SIN(SZEN)
17.             SZ=-COS(SZEN)
18.             ANGLE=.125*.017453
19.             READ(IIN,2)(XX(I),YY(I),ZZ(I),I=1,726)
20.         2   FORMAT(9F8.3)
21.             DO 1 I=1,726
22.             X(I)=-XA(I)
23.         1   CONTINUE
24.             DO 10 M=2,727
25.             X0=900.
26.             DO 3 I=1,726
27.             IF(XA(I)-X0)4,5,3
```

```
      4 X(M)=XX(I)
        Z(M)=ZZ(I)
        Y(M)=YY(I)
        XO=XX(I)
        ZO=ZZ(I)
        K=I
        GO TO 3
      5 IF(ZZ(I)-ZO)6,3,3
      6 X(M)=XX(I)
        Z(M)=ZZ(I)
        Y(M)=YY(I)
        ZO=ZZ(I)
        K=I
      3 CONTINUE
        XX(K)=10000.
     10 CONTINUE
        NUMX=28
        M=2
        DO 30 IX=2,NUMX
     20 XA=X(M)
        MM=M
        N=1
        L=1
     23 M=M+1
        IF(X(M)-XA)21,22,21
     22 N=N+1
        GO TO 23
     21 XL(IX,1)=X(L)
        YL(IX,1)=Y(L)
        ZL(IX,1)=Z(L)-.001
        N=N+1
        DO 24 I=2,N
        XL(IX,I)=X(L)
        YL(IX,I)=Y(L)
        ZL(IX,I)=Z(L)
        II=I-1
        XT1(IX,I)=XL(IX,II)-XL(IX,I)
        YT1(IX,I)=YL(IX,II)-YL(IX,I)
        ZT1(IX,I)=ZL(IX,II)-ZL(IX,I)
        XT3(IX,IX)=-XT1(IX,I)
        YT3(IX,II)=-YT1(IX,I)
        ZT3(IX,II)=-ZT1(IX,I)
        L=L+1
```

```
      24 CONTINUE
         NUMX(IX)=N
         XT3(IX,N)=0.
         YT3(IX,N)=-.001
         ZT3(IX,N)=0.
      30 CONTINUE
         NUMX(1)=2
         NUMX(NUMX+1)=2
         XL(1,2)=-169.501
         XL(29,2)=-53.499
         YL(1,2)=YL(2,2)
         YL(29,2)=YL(28,2)
         ZL(1,2)=ZL(2,2)
         ZL(29,2)=ZL(28,2)
         DO 40 IX=2,NUMX
         IXI=NUMX(IX)
         DO 41 I=2,IXI
         III=I-1
         DEL=.5*(XL(IX,2)-XL(III,2))
         NOIXP=0
         IIX=NUMX(IX-1)
         DO 42 IXPL=2,IIX
         DELX=XL(III,IXPL)-XL(IX,I)
         DELY=YL(III,IXPL)-YL(IX,I)
         DELZ=ZL(III,IXPL)-ZL(IX,I)
         DELTEM=SQRT(DELX*DELX+DELY*DELY+DELZ*DELZ)
         IF(DEL - DELTEM)42,42,43
      43 DEL=DELTEM
         XT2(IX,I)=DELX
         YT2(IX,I)=DELY
         ZT2(IX,I)=DELZ
         NOIXP=IXPL
      42 CONTINUE
         IF(NOIXP)44,44,45
      44 ZT2(IX,I)=0.
         YT2(IX,I)=0.
         XT2(IX,I)=.001
      45 NOIXP=0
         IPLUS=IX+1
         DEL=.5*(XL(IPLUS,2)-XL(IX,2))
         INUM=NUMX(IX+1)
         DO 46 IXMIN=2,INUM
         DELX=XL(IPLUS,IXMIN)-XL(IX,I)
```

```
114.           DELY=YL(IPLUS,IXMIN)-YL(IX,I)
115.           DELZ=ZL(IPLUS,IXMIN)-ZL(IX,I)
116.           DELTEM=SQRT(DELX*DELX+DELY*DELY+DELZ*DELZ)
117.           IF(DEL-DELTEM)46,46,47
118.        47 DEL=DELTEM
119.           XT4(IX,I)=DELX
120.           YT4(IX,I)=DELY
121.           ZT4(IX,I)=DELZ
122.           NOIXM=IXMIN
123.        46 CONTINUE
124.           IF(NOIXM)45,48,41
125.        48 XT4(IX,I)=-.001
126.           YT4(IX,I)=0.
127.           ZT4(IX,I)=0.
128.        41 CONTINUE
129.        45 CONTINUE
130.           WRITE(IOUT,102)
131.       102 FORMAT(5X,1HX,9X,1HY,9X,1HZ,5X,8HX NORMAL,2X,8HY NORMAL,
132.          2 2X,8HZ NORMAL,6X,4HAREA)
133.           L=2
134.           DO 50 IX=2,NUMX
135.           IXY=NUMXY(IX)
136.           DO 60 I=2,MXY
137            X12=YT1(IX,I)*ZT2(IX,I)-YT2(IX,I)*ZT1(IX,I)
138.           Y12=XT1(IX,I)*ZT2(IX,I)-XT2(IX,I)*ZT1(IX,I)
139.           Y12=-Y12
140.           Z12=XT1(IX,I)*YT2(IX,I)-XT2(IX,I)*YT1(IX,I)
141.           A12=SQRT(X12*X12+Y12*Y12+Z12*Z12)
142.           X23=YT2(IX,I)*ZT3(IX,I)-YT3(IX,I)*ZT2(IX,I)
143.           Y23=XT2(IX,I)*ZT3(IX,I)-XT3(IX,I)*ZT2(IX,I)
144.           Y23=-Y23
145.           Z23=XT3(IX,I)*YT3(IX,I)-XT3(IX,I)*YT2(IX,I)
146.           A23=SQRT(X23*X23+Y23*Y23+Z23*Z23)
147.           X34=YT3(IX,I)*ZT4(IX,I)-YT4(IX,I)*ZT3(IX,I)
148.           Y34=XT3(IX,I)*ZT4(IX,I)-XT4(IX,I)*ZT3(IX,I)
149.           Y34=-Y34
150.           Z34=XT3(IX,I)*YT4(IX,I)-XT4(IX,I)*YT3(IX,I)
151.           A34=SQRT(X34*X34+Y34*Y34+Z34*Z34)
152.           X41=YT4(IX,I)*ZT1(IX,I)-YT1(IX,I)*ZT4(IX,I)
153.           Y41=XT4(IX,I)*ZT1(IX,I)-XT1(IX,I)*ZT4(IX,I)
154.           Y41=-Y41
155.           Z41=XT4(IX,I)*YT1(IX,I)-XT1(IX,I)*YT4(IX,I)
156.           A41=SQRT(X41*X41+Y41*Y41+Z41*Z41)
```

```
157.           AN=(AN12+AN23+AN34+AN41)/4.
158.           XNORM=(X12+X23+X34+X41)/(4.*AN)
159.           YNORM=(Y12+Y23+Y34+Y41)/(4.*AN)
160.           ZNORM=(Z12+Z23+Z34+Z41)/(4.*AN)
161.           D12=(X12*XNORM+Y12*YNORM+Z12*ZNORM)/(AN12)
162.           A12=ATAN2(SQRT(1.00-D12*D12),D12)
163.           AR12=AN12*ANGLE/A12
164.           D23=(X23*XNORM+Y23*YNORM+Z23*ZNORM)/(AN23)
165.           A23=ATAN2(SQRT(1.00-D23*D23),D23)
166.           AR23=AN23*ANGLE/A23
167.           D34=(X34*XNORM+Y34*YNORM+Z34*ZNORM)/(AN34)
168.           A34=ATAN2(SQRT(1.00-D34*D34),D34)
169.           AR34=AN34*ANGLE/A34
170.           D41=(X41*XNORM+Y41*YNORM+Z41*ZNORM)/(AN41)
171.           A41=ATAN2(SQRT(1.00-D41*D41),D41)
172.           AR41=AN41*ANGLE/A41
173.           ANOR=AR12+AR23+AR34+AR41
174.           WRITE(IOUT,103)X(L),Y(L),Z(L),XNORM,YNORM,ZNORM,ANOR
175.       103 FORMAT(2X,7F10.5)
176.           WRITE(ICRO,105)X(L),Y(L),Z(L),XNORM,YNORM,ZNORM,ANOR
177.       105 FORMAT(5X,1H1,3(F8.3,1H,),3(F7.5,1H,),F10.5,1H,)
178.           L=L+1
179.        60 CONTINUE
180.        50 CONTINUE
181.           STOP
182.           END

END OF LISTING.      0 *DIAGNOSTIC* MESSAGE(S).
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```
MI FOR COBNOR
COMPILATION BY UNIVAC 1107 FORTRAN-IV DATED      JUNE 20,1965 F4008
THIS COMPILATION WAS DONE ON 06 DEC 72 AT 10:26:37

   MAIN PROGRAM              ENTRY POINT 000000

   STORAGE USED (BLOCK, NAME, LENGTH)

        0001    *CODE    000447
        0002    *DATA    000375
        0002    *BLANK   000000

   EXTERNAL REFERENCES (BLOCK, NAME)

        0003    SQRT
        0004    ATAN2
        0005    NRDUB
        0006    NIO1B
        0007    NIO2B
        0010    NWDUB
        0011    NSTOPB

   STORAGE ASSIGNMENT FOR VARIABLES (BLOCK, TYPE, RELATIVE LOCATION, NAME)

   0000    000523 112F      0000    000325 112F      0000    000336 113F
   0001    000056 125G      0001    000056 141G      0001    000073 155G
   0001    000356 400L      0001    000360 420L      0001    000363 421L
   0000 R  000322 AN0R      0000 R  000304 AN12      0000 R  000310 AN23
   0004 R  000000 ATAN2     0000 R  000315 A12       0000 R  000320 A23
   0000 I  000265 I         0000 I  000261 ICRD      0000 I  000257 II
   0000 R  000255 SAZ       0003 R  000000 SQRT      0000 R  000264 SZEN
   0000 R  000275 XT1       0000 R  000267 XT2       0000 R  000276 XT3
   0000 R  000305 X23       0000 R  000144 YN        0000 R  000312 YNORM
   0000 R  000272 YT3       0000 R  000031 YY        0000 R  000302 Y12
   0000 R  000313 Z1OR      0000 R  000263 ZPOS      0000 R  000277 Z11
   0000 R  000002 ZZ        0000 R  000303 Z12       0000 R  000307 Z23
```

```
      C       COBRA WINDOW-CENTER
            DIMENSION XX(25),YY(25),ZZ(25),XN(25),YN(25),ZN(25),AN(25)
            IIN=5
            IOUT=6
            ICRD=7
            ANGLE=.125*.017453
            ZPOS=12.*200.
            SZEN=.017453*45.
            SZEN=0.
            SAZ=.017453*135.
            READ(IIN,102)(XX(I),YY(I),ZZ(I),I=2,13)
        102 FORMAT(9F8.3)
            DO 101 I=2,13
            XX(I)=-XX(I)
        101 CONTINUE
            XX(1)=-50.5
            XX(14)=-142.05
            YY(1)=YY(2)
            YY(14)=YY(13)
            ZZ(1)=70.
            ZZ(14)=103.9135
            DO 103 I=1,14
        103 CONTINUE
            WRITE(IOUT,112)
        112 FORMAT(1X,1HX,9X,1HY,9X,1HZ,8X,2HXN,8X,2HYN,8X,2HYN,8X,2HZN,9X,1HA)
            XT2=0.
            YT1=0.
            YT2=10.
            YT3=0.
            ZT2=0.
            DO 1 IX=2,13
            XT1=XX(IX-1)-XX(IX)
            XT3=XX(IX+1)-XX(IX)
            ZT1=ZZ(IX-1)-ZZ(IX)
            ZT3=ZZ(IX+1)-ZZ(IX)
            X12=YT1*ZT2-YT2*ZT1
            Y12=XT1*ZT2-XT2*ZT1
            Y12=-Y12
            Z12=XT1*YT2-XT2*YT1
            A12=SQRT(X12*X12+Y12*Y12+Z12*Z12)
        131 X23=YT2*ZT3-YT3*ZT2
```

```
      Y23=A12*ZT3-XT3*ZT2
      Y23=-Y23
      Z23=AT2*YT3-XT3*YT2
      AN23=SQRT(X23*X23+Y23*Y23+Z23*Z23)
      AN(IX)=(AN12+AN23)/2.
      XN(IX)=(X12+X23)/(2.*AN(IX))
      YN(IX)=(Y12+Y23)/(2.*AN(IX))
      ZN(IX)=(Z12+Z23)/(2.*AN(IX))
      XNORM=XN(IX)
      YNORM=YN(IX)
      ZNORM=ZN(IX)
      IF(IX.EQ.2) GO TO 421
      IF(IX.EQ.13)GO TO 421
      D12=(X12*XNORM+Y12*YNORM+Z12*ZNORM)/AN12
      IF(D12)300,300,310
  310 A12=ATAN2(SQRT(1-D12*D12),D12)
      AR12=AN12*ANGLE/A12
      GO TO 320
  300 AR12=AN12
  320 D23=(X23*XNORM+Y23*YNORM+Z23*ZNORM)/AN23
      IF(D23)400,400,410
  410 A23=ATAN2(SQRT(1-D23*D23),D23)
      AR23=AN23*ANGLE/A23
      GO TO 420
  400 AR23=AN23
  420 CONTINUE
      ANOR=AR12+AR23
  421 IF(IX.EQ.2) ANOR=AN12+AN23
      IF(IX.EQ.13)ANOR=AN12+AN23
      WRITE(IOUT,113)XX(IX),YY(IX),ZZ(IX),XNORM,YNORM,ZNORM,ANOR
  113 FORMAT(2X,7F10.5)
      WRITE(ICRO,115)XX(IX),YY(IX),ZZ(IX),XNORM,YNORM,ZNORM,ANOR
  115 FORMAT(5X,1H1,3(F10.5,1H,),3(F6.5,1H,),F10.5,1H,)
    1 CONTINUE
      STOP
      END

END OF LISTING.      0 *DIAGNOSTIC* MESSAGE(S).
```

```
.1 FOR COBWIN
COMPILATION BY UNIVAC 1108 FORTRAN-IV DATED     JUNE 22,1965 F4008
THIS COMPILATION WAS DONE ON 04 DEC 72 AT 21:24:26


MAIN PROGRAM            ENTRY POINT 000000


STORAGE USED (BLOCK, NAME, LENGTH)

      0001    *CODE    000552
      0000    *DATA    011046
      0002    *BLANK   000000
      0003    BLK1     012056
      0004    BLK2     016230


EXTERNAL REFERENCES (BLOCK, NAME)

      0005    ATAN2
      0006    SQRT
      0007    PLOTT
      0010    NAOO$
      0011    NA01$
      0012    NA02$
      0013    NA03$
      0014    NSTOP$


STORAGE ASSIGNMENT FOR VARIABLES (BLOCK, TYPE, RELATIVE LOCATION, NAME)

0000   010723 1F        0000   010710 105F      0000   010755 11F
0001   000074 147G      0001   000146 171G      0001   000340 2L
0000   010732 241F      0000   010745 243F      0000   010736 250F
0000   010710 3F        0001   000457 305G      0000   010752 341F
0000   011001 39F       0000   010737 4F        0001   000327 46L
0000   010702 9F        0000 R 010706 ALPHA     0003 R 010514 AN
0000 R 010707 BETA      0000 R 010662 BH        0000 R 010660 BS
0004 I 002670 IBETA     0000 I 010650 IIN       0000 I 010657 IOUT
0000 I 010702 JJ        0000 I 010674 JJD       0000 I 010703 JJJ
0000 I 010705 N         0000 I 010676 NN        0000 I 010654 NNOR
0000 I 010677 NUM       0000 R 010664 RA        0000 R 010653 RADIAN
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0000 R 010667 RD          0000 R 010670 RE          0000 R 010671 RF
0000 R 010661 ROL         0000 R 010520 ROGL        0004   005560 RT
0000 R 010450 SZE         0003 R 000000 X           0003 R 004246 XN
0000 R 005610 YN          0000 R 002670 YR          0003 R 002704 Z
```

```
      C       COBRA WINDOW
            DIMENSION XR(1464),YR(1464),ZR(1464)
            DIMENSION SZE(20),SAZI(20),ROGL(91)
            COMMON/BLK1/X(738),Y(738),Z(738),XN(738),YN(738),ZN(738),AN(738)
            COMMON/BLK2/IALPH(1464),IBETA(1464),RT(1464),RG(1464),B(1464)
            RADIAN=57.29578
            NOR=738
            NNORT=1464
            ROGL(1)=0.
            IIN=5
            IOUT=6
            BS=2000.
            ROL=.15
            BH=.0009
            EYE=.15
            READ(IIN,105)RA,RB,RC,RD,RE,RF,RGG
        105 FORMAT(F6.3,6E12.7)
            READ(IIN,49)JD
         49 FORMAT(I3)
            READ(IIN,46)(SZE(JJD),SAZI(JJD),JJD=1,JD)
         46 FORMAT(2F6.2)
            DO 250 NOR=1,NNORT
            NN=NOR
            IF(NOR.GT.738)NN=NOR-738
            XR(NOR)=X(NN)
            YR(NOR)=Y(NN)
            ZR(NOR)=Z(NN)
            IF(NOR.GT.738)YR(NOR)=-YR(NOR)
        250 CONTINUE
            NUM=INT(NNORT/4)
            WRITE(IOUT,3)
          3 FORMAT(54X,21HSURFACE X,Y,Z LISTING)
            L=0
            DO 240 L=1,NUM
            L=L+1
```

```
      IF(J.EQ.1)WRITE(IOUT,1)
    1 FORMAT(2X,4(31H NUM       X         Y         Z     ))
      JJ=L*4-3
      JJJ=JJ+3
      WRITE(IOUT,241)(LL,XR(LL),YR(LL),ZR(LL),LL=JJ,JJJ)
  241 FORMAT(2X,4(I4,F9.3,2F8.3,2X))
      IF(J.EQ.40)WRITE(IOUT,250)
      IF(J.EQ.40)J=0
  250 FORMAT(1H1)
  240 CONTINUE
      WRITE(IOUT,250)
      DO 2 N=1,NNOR
      AN(N)=AN(N)*1000.
      ALPHA=ATAN2(SQRT(1-ZN(N)*ZN(N)),ZN(N))
      ALPHA=ALPHA*RADIAN
      IALPH(N)=3*INT(ALPHA/3.+.5)
      BETA=ATAN2(YN(N),XN(N))
      BETA=BETA*RADIAN
      IF(BETA)47,46,46
   47 IBETA(N)=3*INT(BETA/3-.5)
      GO TO 2
   46 IBETA(N)=3*INT(BETA/3.+.5)
    2 CONTINUE
      DO 242 N=1,NNORT
      NN=N
      IF(N.GT.738)NN=N-738
      IALPH(N)=IALPH(NN)
      IBETA(N)=IBETA(NN)
      IF(N.GT.738)IBETA(N)=-IBETA(N)
      B(N)=AN(NN)
  242 CONTINUE
      NUM=INT(NNORT/6)
      WRITE(IOUT,4)
    4 FORMAT(52X,25HNORMAL ALPHA,BETA LISTING)
      J=0
      DO 350 L=1,NUM
      J=J+1
      IF(J.EQ.1)WRITE(IOUT,243)
  243 FORMAT(6(19H  NUM ALPHA  BETA  ))
      JJ=L*6-5
      JJJ=JJ+5
      WRITE(IOUT,341)(LL,IALPH(LL),IBETA(LL),LL=JJ,JJJ)
  341 FORMAT(6(I5,2I6,2X))
```

```
      IF(J.EQ.40)WRITE(IOUT,250)
      IF(J.EQ.40)J=0
  550 CONTINUE
      WRITE(IOUT,250)
      WRITE(IOUT,11)
   11 FORMAT(55X,17HAREA CONTOUR PLOT)
      WRITE(IOUT,9)
    9 FORMAT(39X,50HSCALE FACTOR: VALUE=10X LOG BASE 10 OF 1000X AREA )
      WRITE(IOUT,12)
   12 FORMAT(5H BETA)
      J=1
      CALL PLOTT(NNORT,J)
      WRITE(IOUT,38)
   38 FORMAT(5X,41(3HXXX))
      WRITE(IOUT,39)
   39 FORMAT(7X,1H0,8X,2H15,8X,2H30,8X,2H45,8X,2H60,8X,2H75,8X,2H90,
     27X,3H105,7X,3H120,7X,3H135,7X,3H150,7X,3H165,7X,3H180)
      WRITE(IOUT,37)
   37 FORMAT(65X,5HALPHA)
      STOP
      END

END OF LISTING.      0 *DIAGNOSTIC* MESSAGE(S).
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```
*I FOR NORMAL
COMPILATION BY UNIVAC 1108 FORTRAN-IV DATED      JUNE 22,1965 F4008
THIS COMPILATION WAS DONE ON 04 DEC 72 AT 21:24:28

    BLOCK DATA

    STORAGE USED (BLOCK, NAME, LENGTH)

          0003   BLK1     012056


    STORAGE ASSIGNMENT FOR VARIABLES (BLOCK, TYPE, RELATIVE LOCATION, NAME)

     0003 R 010514 AN          0000 I 000000 N           0003 R 000000 X
     0003 R 005610 YN          0003 R 002704 Z           0003 R 007152 ZN


      1.          BLOCK DATA
      2.          COMMON/BLK1/X(738),Y(738),Z(738),XN(738),YN(738),ZN(738),AN(738)
      3.          DATA(X(N),Y(N),Z(N),XN(N),YN(N),ZN(N),AN(N),N=1,18)/
      4.         1-109.300,  14.350,  98.300,-.03122, .92731, .37267,    .25151,
      5.         1-109.300,  14.040,  99.070,-.01722, .91356, .40315,    .14960,
      6.         1-109.300,  13.600, 100.000,-.01154, .90216, .42780,    .08933,
      7.         1-107.330,  16.430,  90.080,-.06907, .98876, .12973,    .42359,
      8.         1-107.330,  16.300,  91.070,-.07164, .98642, .14449,    .67862,
      9.         1-107.330,  16.140,  92.060,-.06732, .98186, .17446,    .66528,
     10.         1-107.330,  15.950,  93.040,-.06792, .97713, .19943,    .76526,
     11.         1-107.330,  15.740,  94.020,-.06170, .97232, .22326,    .68875,
     12.         1-107.330,  15.500,  95.000,-.05352, .96559, .25256,    .67155,
     13.         1-107.330,  15.230,  95.970,-.04041, .95879, .27967,    .72331,
     14.         1-107.330,  14.940,  96.920,-.03823, .95584, .26886,    .24134,
     15.         1-107.330,  14.600,  97.860,-.02630, .94080, .31240,    .21450,
     16.         1-107.330,  14.200,  98.800,-.01370, .92415, .35439,    .19572,
     17.         1-107.330,  13.770,  99.700, .00097, .90361, .39730,    .17042,
     18.         1-107.330,  13.280, 100.570, .00510, .87661, .45325,    .14879,
     19.         1-107.330,  12.900, 101.170, .00323, .87015, .45960,    .10491,
     20.         1-107.330,  12.580, 101.720, .01873, .86289, .50310,    .23592,
     21.         1-102.00000,  17.04000,  85.61000,-.10684, .99425, .00000,2.27102/
     22.          DATA(X(N),Y(N),Z(N),XN(N),YN(N),ZN(N),AN(N),N=19,36)/
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1-162.000,  17.040,  86.620,-.09867, .99502, .00479,   2.54481,
1-162.000,  17.020,  87.620,-.08650, .99570, .02417,   1.50846,
1-162.000,  16.960,  88.640,-.07538, .99509, .05340,   1.00382,
1-162.000,  16.860,  89.640,-.06973, .99364, .07613,    .77616,
1-162.000,  16.750,  90.640,-.06475, .99143, .09532,    .57549,
1-162.000,  16.560,  91.640,-.06074, .98729, .12630,    .47128,
1-162.000,  16.400,  92.650,-.05560, .98398, .14478,    .40025,
1-162.000,  16.170,  93.620,-.04925, .97640, .18060,    .32252,
1-162.000,  15.900,  94.600,-.04089, .97046, .20528,    .29047,
1-162.000,  15.610,  95.560,-.03472, .96532, .22357,    .26375,
1-162.000,  15.300,  96.500,-.03061, .95723, .24788,    .23368,
1-162.000,  14.940,  97.430,-.02311, .94471, .28271,    .20837,
1-162.000,  14.540,  98.350,-.01485, .92880, .32023,    .18528,
1-162.000,  14.070,  99.250,-.00799, .90251, .37469,    .16180,
1-162.000,  13.540, 100.100, .00034, .88090, .41250,    .14631,
1-162.000,  13.000, 100.940, .01016, .86876, .43207,    .14030,
1-162.000,  12.410, 101.760, .02406, .83593, .48117,    .12891,
1-162.00000,  11.75000, 102.52000, .02131, .79374, .53567,.11704/
 DATA(X(N),Y(N),Z(N),XN(N),YN(N),ZN(N),AN(N),N=37,54)/
1-162.000,  11.050, 103.240, .01205, .75030, .58646,    .10856,
1-162.000,  10.300, 103.880,-.00821, .69370, .64113,    .09859,
1-162.000,   9.520, 104.460,-.03712, .62681, .69943,    .08918,
1-162.000,   8.780, 104.900,-.07254, .55806, .73371,    .07367,
1-162.000,   8.000, 105.310,-.07087, .45988, .87545,    .10990,
1-157.000,  17.400,  81.490,-.12088, .99100,-.03850,    .35414,
1-157.000,  17.480,  82.490,-.11165, .99153,-.05412,    .82110,
1-157.000,  17.540,  83.490,-.10039, .99386,-.03465,    .97902,
1-157.000,  17.560,  84.490,-.09005, .99569,-.00509,   1.44547,
1-157.000,  17.540,  85.500,-.08576, .99583, .02195,   1.42026,
1-157.000,  17.490,  86.500,-.07943, .99573, .03961,   1.26952,
1-157.000,  17.430,  87.490,-.07107, .99550, .05243,    .94292,
1-157.000,  17.340,  88.470,-.06451, .99403, .07485,    .70092,
1-157.000,  17.220,  89.460,-.05694, .99164, .09856,    .54041,
1-157.000,  17.060,  90.460,-.04908, .98862, .12234,    .45751,
1-157.000,  16.880,  91.460,-.04309, .98500, .14347,    .38476,
1-157.000,  16.660,  92.430,-.03468, .97975, .17003,    .32530,
1-157.00000,  16.42000,  93.40000,-.02926, .97356, .19463,.28177/
 DATA(X(N),Y(N),Z(N),XN(N),YN(N),ZN(N),AN(N),N=55,72)/
1-157.000,  16.120,  94.360,-.02341, .96449, .22759,    .24703,
1-157.000,  15.810,  95.310,-.01707, .95926, .24370,    .22890,
1-157.000,  15.460,  96.250,-.00926, .94997, .27062,    .20773,
1-157.000,  15.090,  97.170,-.00435, .93916, .29716,    .18719,
1-157.000,  14.660,  98.080, .00136, .92201, .33667,    .16866,
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      1-157.000,  14.200,  98.960, .00750, .90577, .36851,    .15282,
      1-157.000,  13.690,  99.820, .00911, .88360, .40886,    .13947,
      1-157.000,  13.140, 100.640, .01558, .85433, .45461,    .12524,
      1-157.000,  12.520, 101.420, .02177, .82333, .49781,    .11613,
      1-157.000,  11.880, 102.180, .02801, .79453, .53762,    .10893,
      1-157.000,  11.220, 102.840, .03494, .75026, .58236,    .09650,
      1-157.000,  10.470, 103.500, .04207, .69789, .63856,    .09685,
      1-157.000,   9.660, 104.090, .05265, .62137, .71050,    .09173,
      1-157.000,   8.880, 104.540, .06040, .54584, .75777,    .08104,
      1-157.000,   8.000, 104.960, .06391, .42962, .90065,   1.60435,
      1-152.270,  17.670,  77.520,-.08827, .99391,-.03523,    .23796,
      1-152.270,  17.750,  78.520,-.08707, .99388,-.05052,    .58721,
      1-152.27000,  17.80000,  79.53000,-.08936, .99479,-.03811,.88286/
       DATA(X(N),Y(N),Z(N),XN(N),YN(N),ZN(N),AN(N),N=73,90)/
      1-152.270,  17.860,  80.520,-.08949, .99471,-.03886,    .83140,
      1-152.270,  17.900,  81.520,-.08909, .99542,-.02420,   1.08343,
      1-152.270,  17.920,  82.530,-.09015, .99655,-.01424,   1.62808,
      1-152.270,  17.940,  83.540,-.07273, .99713,-.00549,   1.33112,
      1-152.270,  17.920,  84.550,-.06566, .99750, .01873,   1.48568,
      1-152.270,  17.880,  85.550,-.06282, .99717, .03321,   1.13895,
      1-152.270,  17.820,  86.550,-.06033, .99612, .05197,    .75761,
      1-152.270,  17.720,  87.550,-.05207, .99455, .07582,    .57655,
      1-152.270,  17.600,  88.560,-.04658, .99219, .09645,    .45067,
      1-152.270,  17.430,  89.560,-.03975, .98838, .12471,    .36586,
      1-152.270,  17.250,  90.540,-.03564, .98564, .13959,    .31975,
      1-152.270,  17.030,  91.520,-.02994, .98038, .16550,    .27505,
      1-152.270,  16.780,  92.500,-.02556, .97537, .18686,    .24554,
      1-152.270,  16.510,  93.450,-.02001, .96944, .20792,    .21595,
      1-152.270,  16.200,  94.400,-.01612, .96134, .23436,    .19428,
      1-152.270,  15.860,  95.340,-.01772, .95300, .25779,    .17702,
      1-152.270,  15.480,  96.280,-.00971, .94411, .28226,    .16419,
      1-152.27000,  15.09000,  97.19000,-.00234, .93585, .30089,.15092/
       DATA(X(N),Y(N),Z(N),AN(N),YN(N),ZN(N),AN(N),N=91,108)/
      1-152.270,  14.650,  98.100, .00372, .91718, .34136,    .13607,
      1-152.270,  14.140,  98.980, .00819, .89431, .38510,    .12211,
      1-152.270,  13.610,  99.830, .01451, .87810, .41134,    .11341,
      1-152.270,  13.020, 100.670, .01968, .85252, .45195,    .10645,
      1-152.270,  12.390, 101.470, .02249, .81794, .50041,    .09673,
      1-152.270,  11.700, 102.200, .02915, .77439, .55140,    .08780,
      1-152.270,  10.960, 102.900, .03578, .72305, .61712,    .08248,
      1-152.270,  10.300, 103.410, .04726, .66779, .65051,    .06578,
      1-152.270,   9.460, 103.960, .05917, .59215, .73420,    .07412,
      1-152.270,   8.810, 104.320, .06903, .50899, .77833,    .05624,
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109.        1-152.270,   6.060, 104.620, .05609, .34636, .93569,   1.29560,
110.        1-148.500,  17.780,  76.800,-.04355, .99186,-.09039,    .17533,
111.        1-148.500,  17.860,  77.800,-.04204, .99105,-.11091,    .49216,
112.        1-148.500,  17.970,  78.790,-.04654, .99444,-.08346,    .68863,
113.        1-148.500,  18.070,  79.790,-.05205, .99560,-.06648,    .72351,
114.        1-148.500,  18.130,  80.800,-.05301, .99740,-.04109,   1.10966,
115.        1-148.500,  18.170,  81.800,-.05397, .99805,-.01980,   1.12040,
116.        1-148.500000,  18.170000,  82.810000,-.05253, .99853, .00283,2.10544/
117.         DATA(X(N),Y(N),Z(N),XN(N),YN(N),ZN(N),AN(N),N=109,126)/
118.        1-148.500,  18.160,  83.810,-.04674, .99838, .01922,   1.27816,
119.        1-148.500,  18.110,  84.810,-.04586, .99795, .03917,   1.38651,
120.        1-148.500,  18.060,  85.810,-.04280, .99752, .04769,   1.02917,
121.        1-148.500,  17.980,  86.810,-.03804, .99487, .07950,    .60800,
122.        1-148.500,  17.840,  87.810,-.03542, .99136, .11179,    .52241,
123.        1-148.500,  17.690,  88.810,-.03109, .98894, .12773,    .44836,
124.        1-148.500,  17.500,  89.810,-.03025, .98491, .15123,    .39124,
125.        1-148.500,  17.300,  90.790,-.02710, .98157, .16754,    .34399,
126.        1-148.500,  17.070,  91.750,-.02294, .97568, .19321,    .29627,
127.        1-148.500,  16.810,  92.700,-.02061, .96938, .21650,    .26610,
128.        1-148.500,  16.510,  93.680,-.01531, .96063, .24680,    .24011,
129.        1-148.500,  16.180,  94.600,-.01462, .95667, .25770,    .22035,
130.        1-148.500,  15.880,  95.540,-.01086, .94944, .27536,    .19914,
131.        1-148.500,  15.460,  96.460,-.00558, .92475, .33900,    .17616,
132.        1-148.500,  15.020,  97.370,-.00064, .91249, .36467,    .16415,
133.        1-148.500,  14.530,  98.260, .00701, .89569, .39734,    .15247,
134.        1-148.500,  14.020,  99.130, .01027, .87730, .43007,    .14012,
135.        1-148.500000,  13.470000,  99.940000, .01704, .85010, .47111,.12631/
136.         DATA(X(N),Y(N),Z(N),XN(N),YN(N),ZN(N),AN(N),N=127,144)/
137.        1-148.500,  12.860, 100.750, .02514, .82129, .51267,    .12120,
138.        1-148.500,  12.200, 101.520, .02927, .78530, .55895,    .11269,
139.        1-148.500,  11.510, 102.230, .03647, .73973, .60824,    .10389,
140.        1-148.500,  10.730, 102.900, .04537, .67057, .68231,    .09925,
141.        1-148.500,  10.010, 103.400, .05167, .59363, .73915,    .08275,
142.        1-148.500,   9.220, 103.840, .05444, .52043, .79742,    .08179,
143.        1-148.500,   8.590, 104.150, .07901, .45076, .83769,    .06603,
144.        1-148.500,   8.000, 104.360, .08544, .33429, .94009,    .86312,
145.        1-143.500,  17.800,  75.800,-.04276, .99433,-.06811,    .21855,
146.        1-143.500,  17.940,  76.800,-.04671, .99170,-.10342,    .55161,
147.        1-143.500,  18.080,  77.800,-.04406, .99272,-.09625,    .57869,
148.        1-143.500,  18.190,  78.800,-.04326, .99508,-.07666,    .72905,
149.        1-143.500,  18.280,  79.800,-.04139, .99569,-.05956,    .89249,
150.        1-143.500,  18.340,  80.800,-.04155, .99805,-.03952,   1.33812,
151.        1-143.500,  18.380,  81.810,-.03967, .99882,-.01986,   1.52826,
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1-143.500,  18.380,  82.810,-.03876, .99919, .00489,   3.54437,
1-143.500,  18.360,  83.810,-.03673, .99891, .02222,   1.84879,
1-143.50000,  18.31000,  84.81000,-.03685, .99808, .04227,1.26507/
 DATA(X(N),Y(N),Z(N),XN(N),YN(N),ZN(N),AN(N),N=145,162)/
1-143.500,  18.240,  85.800,-.03282, .99668, .06267,    .82232,
1-143.500,  18.130,  86.780,-.02878, .99442, .08722,    .63477,
1-143.500,  18.000,  87.780,-.02850, .99226, .10390,    .53846,
1-143.500,  17.840,  88.770,-.02524, .98929, .12399,    .45446,
1-143.500,  17.660,  89.760,-.02495, .98598, .14229,    .39460,
1-143.500,  17.450,  90.730,-.02176, .97993, .17040,    .32476,
1-143.500,  17.190,  91.700,-.01860, .97336, .19782,    .28720,
1-143.500,  16.920,  92.660,-.01542, .96769, .21734,    .25747,
1-143.500,  16.600,  93.600,-.01176, .96008, .24225,    .23217,
1-143.500,  16.290,  94.530,-.00755, .95572, .25356,    .21792,
1-143.500,  15.910,  95.470, .00150, .93892, .29964,    .19195,
1-143.500,  15.500,  96.350, .00329, .92736, .32406,    .17166,
1-143.500,  15.060,  97.260, .00570, .91501, .35153,    .16429,
1-143.500,  14.570,  98.120, .00872, .89364, .39147,    .14581,
1-143.500,  14.050,  98.960, .01573, .87438, .42354,    .13548,
1-143.500,  13.470,  99.780, .02031, .84484, .46919,    .12549,
1-143.500,  12.840, 100.560, .02709, .82012, .50244,    .11735,
1-143.50000,  12.20000, 101.32000, .03380, .78860, .54253,.11002/
 DATA(X(N),Y(N),Z(N),XN(N),YN(N),ZN(N),AN(N),N=163,180)/
1-143.500,  11.470, 102.010, .04314, .72728, .61001,    .10142,
1-143.500,  10.700, 102.640, .05150, .67139, .66384,    .09538,
1-143.500,   9.890, 103.190, .06041, .58502, .73462,    .09098,
1-143.500,   8.980, 103.640, .06984, .47620, .80721,    .09319,
1-143.500,   8.000, 104.010, .06481, .35230, .93358,   2.01327,
1-138.700,  17.800,  74.880,-.04498, .98898,-.10398,    .16892,
1-138.700,  17.990,  75.860,-.04388, .98559,-.14322,    .46026,
1-138.700,  18.170,  76.860,-.04390, .98868,-.12512,    .51224,
1-138.700,  18.300,  77.840,-.04312, .99336,-.09292,    .67975,
1-138.700,  18.400,  78.830,-.04129, .99576,-.07177,    .89420,
1-138.700,  18.480,  79.830,-.04022, .99713,-.05584,   1.13955,
1-138.700,  18.540,  80.840,-.03628, .99839,-.03520,   1.30624,
1-138.700,  18.560,  81.840,-.03429, .99929,-.00732,   2.43718,
1-138.700,  18.550,  82.830,-.03321, .99930, .01327,   3.09284,
1-138.700,  18.520,  83.820,-.03121, .99895, .02840,   2.06363,
1-138.700,  18.470,  84.840,-.02723, .99792, .04884,   1.13707,
1-138.700,  18.380,  85.840,-.02615, .99570, .07724,    .82611,
1-138.69999,  18.26000,  86.84000,-.02530, .99337, .09833,.66760/
 DATA(X(N),Y(N),Z(N),XN(N),YN(N),ZN(N),AN(N),N=181,196)/
1-138.700,  18.120,  87.820,-.02218, .99032, .11956,    .53551,
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     1-138.700,  17.940,  88.810,-.02015, .98682, .14112,    .47283,
     1-138.700,  17.750,  89.800,-.01533, .98363, .15721,    .41802,
     1-138.700,  17.520,  90.780,-.01372, .97704, .18692,    .35494,
     1-138.700,  17.260,  91.740,-.01056, .97044, .21152,    .31205,
     1-138.700,  16.960,  92.720,-.00766, .96283, .23780,    .28601,
     1-138.700,  16.630,  93.680,-.00601, .95223, .26877,    .25041,
     1-138.700,  16.250,  94.620,-.00179, .94135, .29787,    .22805,
     1-138.700,  15.860,  95.550, .00475, .93301, .31785,    .21229,
     1-138.700,  15.430,  96.450, .00700, .91926, .34823,    .19293,
     1-138.700,  14.980,  97.330, .01185, .90500, .37589,    .17791,
     1-138.700,  14.470,  98.200, .01384, .88009, .42141,    .16295,
     1-138.700,  13.910,  99.030, .01973, .85456, .46152,    .14931,
     1-138.700,  13.310,  99.840, .02329, .82682, .50181,    .13961,
     1-138.700,  12.660, 100.600, .02907, .79120, .54615,    .12935,
     1-138.700,  11.950, 101.340, .03804, .74665, .59869,    .12345,
     1-138.700,  11.190, 102.000, .04565, .68852, .65557,    .11406,
     1-138.69999,  10.38000, 102.60000, .05517, .61574, .72331,.10866/
      DATA(X(N),Y(N),Z(N),XN(N),YN(N),ZN(N),AN(N),N=199,216)/
     1-138.700,   9.600, 103.050, .06410, .51929, .79105,    .09576,
     1-138.700,   8.820, 103.390, .07165, .43144, .83901,    .09139,
     1-138.700,   8.000, 103.680, .06633, .33247, .94070,   1.67109,
     1-133.000,  17.840,  73.810,-.05307, .98340,-.12465,    .14753,
     1-133.000,  18.080,  74.780,-.04777, .97993,-.16699,    .40282,
     1-133.000,  18.260,  75.760,-.04508, .98829,-.12566,    .53727,
     1-133.000,  18.400,  76.760,-.04126, .99211,-.10303,    .68511,
     1-133.000,  18.530,  77.750,-.03889, .99392,-.08843,    .74363,
     1-133.000,  18.620,  78.740,-.03751, .99645,-.06528,   1.05738,
     1-133.000,  18.700,  79.750,-.03338, .99781,-.04458,   1.04079,
     1-133.000,  18.720,  80.760,-.03029, .99939,-.01504,   4.60218,
     1-133.000,  18.740,  81.760,-.02913, .99946,-.00745,   2.78829,
     1-133.000,  18.730,  82.760,-.02603, .99942, .01525,   2.44909,
     1-133.000,  18.690,  83.760,-.02273, .99829, .04300,   1.22904,
     1-133.000,  18.600,  84.760,-.02042, .99696, .06531,   1.06939,
     1-133.000,  18.520,  85.760,-.01848, .99639, .07051,    .92546,
     1-133.000,  18.400,  86.760,-.01592, .99299, .10082,    .67041,
     1-132.99999,  18.24000,  87.75000,-.01372, .98932, .12607,.55348/
      DATA(X(N),Y(N),Z(N),XN(N),YN(N),ZN(N),AN(N),N=217,234)/
     1-133.000,  18.060,  88.740,-.01132, .98511, .14824,    .46440,
     1-133.000,  17.830,  89.730,-.00848, .98021, .17225,    .41412,
     1-133.000,  17.600,  90.720,-.00489, .97578, .18951,    .36692,
     1-133.000,  17.310,  91.680,-.00217, .96660, .22345,    .31589,
     1-133.000,  17.010,  92.640,-.00024, .96170, .23884,    .29543,
     1-133.000,  16.670,  93.590, .00193, .95302, .26453,    .26907,
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     1-133.000,  16.310,  94.530, .00445, .93988, .29753,    .23621,
     1-133.000,  15.870,  95.440, .00996, .92159, .33966,    .21153,
     1-133.000,  15.420,  96.350, .01221, .91383, .35677,    .20231,
     1-133.000,  14.950,  97.210, .01715, .89919, .38289,    .18363,
     1-133.000,  14.430,  98.060, .02133, .87630, .42386,    .17204,
     1-133.000,  13.850,  98.900, .02538, .84775, .46702,    .15652,
     1-133.000,  13.230,  99.710, .03155, .81466, .52192,    .14388,
     1-133.000,  12.690, 100.300, .03695, .78429, .54128,    .11235,
     1-133.000,  11.980, 101.020, .04372, .73983, .60104,    .12849,
     1-133.000,  11.210, 101.660, .05278, .67299, .66500,    .11922,
     1-133.000,  10.380, 102.230, .06004, .60276, .73129,    .11339,
     1-132.99999,   9.68000, 102.64000, .06855, .53118, .76844,.09417/
      DATA(X(N),Y(N),Z(N),XN(N),YN(N),ZN(N),AN(N),N=235,252)/
     1-133.000,   8.760, 103.040, .07355, .41237, .85731,    .11688,
     1-133.000,   8.000, 103.270, .06697, .28881, .95497,   1.69831,
     1-127.000,  17.880,  72.640,-.05273, .98408,-.12038,    .15408,
     1-127.000,  18.120,  73.620,-.04837, .97978,-.16746,    .41350,
     1-127.000,  18.310,  74.600,-.04262, .98633,-.13769,    .50739,
     1-127.000,  18.480,  75.590,-.03875, .98962,-.11935,    .58168,
     1-127.000,  18.620,  76.590,-.03558, .99302,-.09682,    .71251,
     1-127.000,  18.730,  77.590,-.03161, .99548,-.07715,    .89584,
     1-127.000,  18.820,  78.590,-.02821, .99738,-.05456,   1.01711,
     1-127.000,  18.860,  79.600,-.02338, .99922,-.02721,   2.41705,
     1-127.000,  18.890,  80.610,-.02300, .99949,-.01725,   2.70650,
     1-127.000,  18.900,  81.630,-.01962, .99956, .00497,   1.85469,
     1-127.000,  18.860,  82.620,-.01622, .99899, .03532,   1.80169,
     1-127.000,  18.800,  83.610,-.01334, .99837, .04790,   1.42811,
     1-127.000,  18.730,  84.600,-.01271, .99718, .06232,   1.02433,
     1-127.000,  18.620,  85.610,-.00841, .99458, .08907,    .77795,
     1-127.000,  18.480,  86.610,-.00593, .99191, .10960,    .64123,
     1-127.00000,  18.32000,  87.60000,-.00412, .98857, .12981,.53525/
      DATA(X(N),Y(N),Z(N),XN(N),YN(N),ZN(N),AN(N),N=253,270)/
     1-127.000,  18.120,  88.590,-.00068, .98419, .15332,    .46281,
     1-127.000,  17.900,  89.590,-.00035, .97939, .17489,    .40524,
     1-127.000,  17.640,  90.550, .00442, .97210, .20356,    .34396,
     1-127.000,  17.360,  91.500, .00518, .96716, .22027,    .31728,
     1-127.000,  17.050,  92.460, .00745, .96024, .24259,    .29306,
     1-127.000,  16.710,  93.400, .01078, .94973, .27172,    .25968,
     1-127.000,  16.320,  94.330, .01657, .93488, .30907,    .23135,
     1-127.000,  15.890,  95.230, .01656, .92268, .33575,    .21190,
     1-127.000,  15.440,  96.130, .02007, .91155, .35848,    .20063,
     1-127.000,  14.940,  97.010, .02298, .89213, .39479,    .18442,
     1-127.000,  14.400,  97.870, .02845, .86985, .43234,    .17009,
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      1-127.000,  13.810,  98.690, .03228, .83829, .48016,    .15397,
      1-127.000,  13.180,  99.450, .03899, .80598, .52120,    .14042,
      1-127.000,  12.500, 100.190, .04281, .76943, .56625,    .13380,
      1-127.000,  11.770, 100.870, .05038, .71191, .62637,    .12400,
      1-127.000,  10.960, 101.480, .05703, .64377, .68855,    .11841,
      1-127.000,  10.120, 102.020, .06122, .57151, .75875,    .11295,
      1-127.00000,  9.49000, 102.35000, .07049, .48826, .80395,.08125/
       DATA(X(N),Y(N),Z(N),XN(N),YN(N),ZN(N),AN(N),N=271,288)/
      1-127.000,   8.640, 102.600, .08135, .40103, .84136,    .08224,
      1-127.000,   8.000, 102.860, .06597, .29486, .95320,   2.06973,
      1-121.000,  17.910,  71.520,-.05036, .98269,-.12650,    .14540,
      1-121.000,  18.160,  72.490,-.04405, .97819,-.17466,    .39252,
      1-121.000,  18.360,  73.480,-.03838, .98515,-.14502,    .48637,
      1-121.000,  18.540,  74.460,-.03479, .98859,-.12610,    .53755,
      1-121.000,  18.680,  75.440,-.02900, .99305,-.09780,    .68527,
      1-121.000,  18.790,  76.440,-.02506, .99566,-.07716,    .89141,
      1-121.000,  18.880,  77.440,-.02111, .99730,-.05984,   1.08347,
      1-121.000,  18.940,  78.440,-.01618, .99885,-.03746,   1.54143,
      1-121.000,  18.970,  79.440,-.01399, .99962,-.01989,   2.98152,
      1-121.000,  18.990,  80.450,-.01096, .99981,-.00742,   2.69908,
      1-121.000,  18.980,  81.460,-.00677, .99974, .01492,   2.49201,
      1-121.000,  18.940,  82.460,-.00427, .99895, .03746,   1.55833,
      1-121.000,  18.870,  83.460,-.00203, .99774, .05737,   1.15946,
      1-121.000,  18.780,  84.460, .00189, .99613, .07509,    .89004,
      1-121.000,  18.660,  85.450, .00442, .99385, .09537,    .72009,
      1-121.00000,  18.52000,  86.44000, .00607, .99131, .11322,.60527/
       DATA(X(N),Y(N),Z(N),XN(N),YN(N),ZN(N),AN(N),N=289,306)/
      1-121.000,  18.350,  87.420, .00855, .98696, .13848,    .49515,
      1-121.000,  18.140,  88.400, .01020, .98266, .16043,    .43838,
      1-121.000,  17.920,  89.380, .01410, .97837, .17811,    .38992,
      1-121.000,  17.650,  90.350, .01492, .97055, .20869,    .33924,
      1-121.000,  17.360,  91.310, .01614, .96555, .22513,    .31425,
      1-121.000,  17.040,  92.280, .02009, .95705, .25199,    .28397,
      1-121.000,  16.690,  93.190, .02366, .94419, .28535,    .24196,
      1-121.000,  16.290,  94.100, .02575, .93250, .31338,    .22596,
      1-121.000,  15.860,  95.020, .02680, .92159, .33741,    .21463,
      1-121.000,  15.380,  95.930, .03095, .90593, .36946,    .19926,
      1-121.000,  14.880,  96.810, .03312, .88847, .40058,    .18185,
      1-121.000,  14.320,  97.660, .03762, .86087, .44599,    .16575,
      1-121.000,  13.720,  98.470, .04118, .83082, .48903,    .15152,
      1-121.000,  13.060,  99.240, .04498, .79354, .53696,    .14079,
      1-121.000,  12.350,  99.970, .04921, .74919, .59311,    .13041,
      1-121.000,  11.680, 100.560, .05857, .69936, .63234,    .11127,
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     1-121.000,  10.850, 101.170, .06179, .63198, .69851,    .11962,
     1-121.00000,   9.99000, 101.70000, .06669, .54864, .77669,.11475/
      DATA(X(N),Y(N),Z(N),XN(N),YN(N),ZN(N),AN(N),N=307,324)/
     1-121.000,   9.360, 102.000, .07595, .45108, .82996,    .08014,
     1-121.000,   8.780, 102.200, .08182, .38368, .84585,    .07234,
     1-121.000,   8.000, 102.440, .06838, .29321, .95353,   1.81874,
     1-115.000,  17.900,  70.320,-.04397, .98329,-.12529,    .14811,
     1-115.000,  18.150,  71.300,-.03793, .97915,-.17147,    .39850,
     1-115.000,  18.340,  72.290,-.03037, .98637,-.14020,    .50365,
     1-115.000,  18.520,  73.270,-.02469, .98840,-.12914,    .53521,
     1-115.000,  18.680,  74.280,-.01961, .99202,-.10664,    .63148,
     1-115.000,  18.790,  75.270,-.01450, .99558,-.08005,    .85910,
     1-115.000,  18.890,  76.270,-.00995, .99681,-.06728,    .96269,
     1-115.000,  18.960,  77.270,-.00576, .99852,-.04495,   1.30336,
     1-115.000,  19.000,  78.270,-.00087, .99950,-.02486,   1.97750,
     1-115.000,19.020,79.280,.00222,.99984,-.00990,2.55072,
     1-115.000,  19.020,  80.290, .00626, .99981, .00750,   2.26124,
     1-115.000,  18.990,  81.280, .01048, .99921, .03013,   1.65029,
     1-115.000,  18.930,  82.280, .01362, .99818, .04966,   1.28398,
     1-115.000,  18.850,  83.290, .01604, .99676, .06695,    .97852,
     1-115.00000,  18.74000,  84.29000, .02008, .99461, .08747,.77873/
      DATA(X(N),Y(N),Z(N),XN(N),YN(N),ZN(N),AN(N),N=325,342)/
     1-115.000,  18.610,  85.280, .02229, .99261, .10277,    .66609,
     1-115.000,  18.460,  86.270, .02445, .99003, .11940,    .57707,
     1-115.000,  18.280,  87.270, .02769, .98601, .14193,    .49228,
     1-115.000,  18.070,  88.250, .02923, .98035, .16842,    .41086,
     1-115.000,  17.820,  89.220, .03326, .97487, .19095,    .36811,
     1-115.000,  17.560,  90.190, .03271, .97139, .20384,    .34472,
     1-115.000,  17.270,  91.150, .03631, .96246, .23302,    .29993,
     1-115.000,  16.930,  92.090, .03928, .95133, .26596,    .26530,
     1-115.000,  16.570,  93.010, .04011, .94302, .28701,    .24396,
     1-115.000,  16.170,  93.930, .04275, .93163, .31392,    .22711,
     1-115.000,  15.730,  94.850, .04575, .91659, .34756,    .20849,
     1-115.000,  15.260,  95.710, .04686, .90118, .37549,    .18754,
     1-115.000,  14.750,  96.590, .05101, .88356, .40820,    .17930,
     1-115.000,  14.190,  97.420, .05322, .85609, .45168,    .16127,
     1-115.000,  13.590,  98.220, .05692, .82697, .49249,    .14958,
     1-115.000,  12.920,  98.990, .05951, .78629, .55332,    .13762,
     1-115.000,  12.360,  99.570, .06528, .74826, .57959,    .10799,
     1-115.00000,  11.59000, 100.21000, .06930, .68518, .64926,.12069/
      DATA(X(N),Y(N),Z(N),XN(N),YN(N),ZN(N),AN(N),N=343,360)/
     1-115.000,  10.780, 100.810, .07414, .62770, .70056,    .11779,
     1-115.000,   9.900, 101.330, .08299, .53025, .77521,    .11692,
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     1-115.000,   8.970, 101.730, .08814, .40394, .85309,    .12084,
     1-115.000,   8.000, 102.000, .07529, .26725, .96062,   2.16446,
     1-109.000,  17.880,  69.160,-.03064, .98770,-.10854,    .17302,
     1-109.000,  18.100,  70.160,-.02871, .98314,-.15641,    .45317,
     1-109.000,  18.290,  71.140,-.02076, .98689,-.13847,    .50160,
     1-109.000,  18.460,  72.120,-.01427, .99016,-.11942,    .56701,
     1-109.000,  18.600,  73.130,-.01010, .99297,-.10229,    .69324,
     1-109.000,  18.730,  74.110,-.00138, .99462,-.08791,    .72657,
     1-109.000,  18.820,  75.110, .00297, .99745,-.06045,   1.04298,
     1-109.000,  18.880,  76.090, .00772, .99870,-.04287,   1.49389,
     1-109.000,  18.930,  77.090, .01338, .99923,-.02748,   1.51654,
     1-109.000,  18.940,  78.090, .01737, .99980,-.00497,   4.12069,
     1-109.000,  18.940,  79.100, .02191, .99968, .00495,   3.22820,
     1-109.000,  18.920,  80.110, .02582, .99922, .02237,   2.04045,
     1-109.000,  18.870,  81.110, .02894, .99833, .04222,   1.51829,
     1-109.00000,  18.80000,  82.12000, .03115, .99726, .05734,1.16702/
      DATA(X(N),Y(N),Z(N),XN(N),YN(N),ZN(N),AN(N),N=361,378)/
     1-109.000,  18.710,  83.110, .03528, .99519, .07752,    .84065,
     1-109.000,  18.580,  84.110, .03833, .99258, .09976,    .70059,
     1-109.000,  18.440,  85.100, .04102, .99105, .10956,    .63236,
     1-109.000,  18.280,  86.100, .04414, .98760, .12966,    .53263,
     1-109.000,  18.080,  87.080, .04624, .98281, .15465,    .45383,
     1-109.000,  17.860,  88.070, .05019, .97811, .17466,    .40301,
     1-109.000,  17.600,  89.040, .05114, .97312, .19462,    .36347,
     1-109.000,  17.340,  90.020, .05424, .96831, .21072,    .33259,
     1-109.000,  17.020,  90.970, .05755, .95704, .24682,    .28736,
     1-109.000,  16.680,  91.920, .05948, .95132, .26313,    .27102,
     1-109.000,  16.320,  92.850, .06182, .93962, .29204,    .24090,
     1-109.000,  15.890,  93.770, .06452, .92254, .33201,    .21806,
     1-109.000,  15.440,  94.670, .06859, .91295, .35133,    .20472,
     1-109.000,  14.970,  95.550, .06946, .89754, .38093,    .18776,
     1-109.000,  14.450,  96.390, .07405, .87461, .41909,    .17086,
     1-109.000,  13.880,  97.230, .07769, .84964, .45849,    .16161,
     1-109.000,  13.250,  98.030, .08131, .81319, .50956,    .14781,
     1-109.00000,  12.58000,  98.77000, .08671, .77306, .55802,.13459/
      DATA(X(N),Y(N),Z(N),XN(N),YN(N),ZN(N),AN(N),N=379,396)/
     1-109.000,  11.870,  99.450, .09290, .71693, .63051,    .12173,
     1-109.000,  11.320,  99.890, .09690, .67214, .65347,    .08559,
     1-109.000,  10.670, 100.350, .10144, .61894, .70843,    .09140,
     1-109.000,  10.070, 100.720, .10732, .55593, .75214,    .08060,
     1-109.000,   9.430, 101.030, .11374, .47171, .80191,    .08215,
     1-109.000,   8.670, 101.320, .11926, .37269, .86830,    .09721,
     1-109.000,   8.000, 101.500, .10015, .25790, .96068,    .59255,
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      1-103.000,  17.600,  68.020,-.01659, .99215,-.08360,    .18192,
      1-103.000,  17.980,  68.990,-.01447, .98695,-.13641,    .43042,
      1-103.000,  18.180,  69.980,-.01028, .98693,-.13663,    .43130,
      1-103.000,  18.340,  70.960,-.00257, .99175,-.10801,    .52444,
      1-103.000,  18.460,  71.950, .00405, .99417,-.09128,    .64209,
      1-103.000,  18.600,  72.960, .00940, .99465,-.08319,    .58517,
      1-103.000,  18.660,  73.950, .01519, .99840,-.04607,   1.24749,
      1-103.000,  18.730,  74.950, .02066, .99826,-.04605,   1.19321,
      1-103.000,  18.780,  75.960, .02356, .99906,-.02711,   1.42014,
      1-103.000,  18.790,  76.960, .02907, .99953,-.00497,   4.20375,
      1-103.00000,  18.79000,  77.97000, .03273, .99933, .00675,2.44574/
       DATA(X(N),Y(N),Z(N),XN(N),YN(N),ZN(N),AN(N),N=397,414)/
      1-103.000,  18.760,  78.980, .03732, .99888, .02371,   2.17418,
      1-103.000,  18.720,  80.000, .04188, .99828, .03358,   1.54858,
      1-103.000,  18.660,  80.980, .04462, .99729, .04878,   1.11633,
      1-103.000,  18.580,  81.970, .04752, .99558, .06731,    .81748,
      1-103.000,  18.460,  82.970, .05203, .99285, .09116,    .64819,
      1-103.000,  18.320,  83.970, .05369, .99083, .10539,    .56597,
      1-103.000,  18.160,  84.970, .05722, .98835, .12010,    .49926,
      1-103.000,  17.980,  85.960, .06088, .98563, .13463,    .44417,
      1-103.000,  17.790,  86.920, .06326, .98131, .15359,    .37399,
      1-103.000,  17.540,  87.900, .06740, .97443, .18304,    .33075,
      1-103.000,  17.280,  88.880, .06908, .97107, .19512,    .31005,
      1-103.000,  16.990,  89.850, .07377, .96397, .21863,    .27722,
      1-103.000,  16.670,  90.800, .07466, .95536, .24447,    .24619,
      1-103.000,  16.310,  91.740, .07974, .94550, .27080,    .22387,
      1-103.000,  15.930,  92.660, .08410, .93597, .29272,    .20556,
      1-103.000,  15.500,  93.580, .08615, .92006, .32899,    .18692,
      1-103.000,  15.030,  94.460, .09070, .90584, .35622,    .17028,
      1-103.00000,  14.55000,  95.33000, .09801, .89261, .37884,.16028/
       DATA(X(N),Y(N),Z(N),XN(N),YN(N),ZN(N),AN(N),N=415,432)/
      1-103.000,  14.000,  96.180, .10020, .86465, .42597,    .14658,
      1-103.000,  13.400,  97.000, .10587, .83723, .46675,    .13539,
      1-103.000,  12.770,  97.770, .12597, .79990, .51147,    .12275,
      1-103.000,  12.060,  98.490, .12058, .74499, .57816,    .11337,
      1-103.000,  11.300,  99.130, .13035, .68244, .63902,    .10402,
      1-103.000,  10.500,  99.690, .13662, .61710, .69984,    .09653,
      1-103.000,   9.790, 100.120, .14527, .54226, .76594,    .08189,
      1-103.000,   9.270, 100.360, .16053, .45103, .80329,    .05662,
      1-103.000,   8.690, 100.560, .17126, .36705, .84106,    .06160,
      1-103.000,   8.000, 100.750, .13810, .26269, .95462,    .54222,
      1 -98.000,  17.680,  67.060,-.00621, .99201,-.08919,    .17473,
      1 -98.000,  17.860,  68.060,-.00345, .98879,-.12919,    .45541,
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     1 -98.000,  18.020,  69.050, .00199, .98985,-.12251,    .47687,
     1 -98.000,  18.200,  70.080, .01104, .99077,-.11470,    .47770,
     1 -98.000,  18.310,  71.080, .01697, .99558,-.07965,    .72088,
     1 -98.000,  18.410,  72.080, .02201, .99641,-.07010,    .79386,
     1 -98.000,  18.490,  73.070, .02868, .99735,-.05764,    .98679,
     1 -98.00000,  18.56000,  74.07000, .03049, .99816,-.04242,1.03829/
      DATA(X(N),Y(N),Z(N),XN(N),YN(N),ZN(N),AN(N),N=433,450)/
     1 -98.000,  18.590,  75.070, .03632, .99897,-.02248,   2.16333,
     1 -98.000,  18.620,  76.070, .04206, .99883,-.01249,   1.52730,
     1 -98.000,  18.610,  77.070, .04475, .99882, .01249,   2.24111,
     1 -98.000,  18.580,  78.070, .05055, .99814, .02745,   1.63405,
     1 -98.000,  18.530,  79.070, .05338, .99732, .04218,   1.24529,
     1 -98.000,  18.460,  80.080, .05819, .99628, .05452,   1.04107,
     1 -98.000,  18.380,  81.080, .06180, .99520, .06501,    .86239,
     1 -98.000,  18.280,  82.070, .06595, .99279, .08524,    .64465,
     1 -98.000,  18.140,  83.060, .06941, .98994, .10642,    .54572,
     1 -98.000,  17.990,  84.070, .07148, .98792, .11855,    .49237,
     1 -98.000,  17.810,  85.060, .07506, .98410, .13917,    .42028,
     1 -98.000,  17.610,  86.050, .07848, .98044, .15598,    .37643,
     1 -98.000,  17.380,  87.040, .08329, .97447, .18083,    .32642,
     1 -98.000,  17.120,  87.990, .08666, .96858, .20179,    .28728,
     1 -98.000,  16.840,  88.960, .09076, .96386, .21724,    .27276,
     1 -98.000,  16.530,  89.920, .09439, .95675, .23919,    .24832,
     1 -98.000,  16.200,  90.860, .09976, .94610, .26672,    .21915,
     1 -98.00000,  15.80000,  91.80000, .10264, .93203, .30241,.20070/
      DATA(X(N),Y(N),Z(N),XN(N),YN(N),ZN(N),AN(N),N=451,468)/
     1 -98.000,  15.380,  92.740, .10921, .92181, .32490,    .18804,
     1 -98.000,  14.930,  93.630, .11361, .90444, .35822,    .16685,
     1 -98.000,  14.420,  94.520, .11906, .88272, .39824,    .15503,
     1 -98.000,  13.870,  95.370, .12861, .85983, .44138,    .13872,
     1 -98.000,  13.430,  96.020, .13801, .84545, .45222,    .10621,
     1 -98.000,  12.930,  96.660, .14871, .76260, .56462,    .08774,
     1 -98.000,  12.390,  97.060, .14959, .75519, .52681,    .07542,
     1 -98.000,  11.740,  97.900, .15727, .77424, .54796,    .11896,
     1 -98.000,  11.030,  98.480, .17110, .66413, .65780,    .09215,
     1 -98.000,  10.370,  98.950, .18346, .59644, .71282,    .07906,
     1 -98.000,   9.730,  99.300, .19893, .51574, .76171,    .06933,
     1 -98.000,   9.090,  99.600, .20953, .43314, .81767,    .06847,
     1 -98.000,   8.520,  99.790, .22040, .32374, .86678,    .06055,
     1 -98.000,   8.000,  99.910, .18492, .22068, .95721,    .31621,
     1 -93.000,  17.520,  66.080, .00653, .99188,-.09376,    .19638,
     1 -93.000,  17.690,  67.060, .01040, .98944,-.12648,    .53451,
     1 -93.000,  17.840,  68.050, .01523, .99191,-.11011,    .61483,
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     1 -93.00000,  17.97000,  69.05000, .02198, .99393,-.09395,.71595/
      DATA(X(N),Y(N),Z(N),XN(N),YN(N),ZN(N),AN(N),N=469,486)/
     1 -93.000,  18.080,  70.060, .03106, .99519,-.08147,    .85209,
     1 -93.000,  18.180,  71.060, .03492, .99623,-.06849,    .92868,
     1 -93.000,  18.250,  72.070, .04153, .99722,-.05394,   1.23151,
     1 -93.000,  18.320,  73.060, .04544, .99745,-.04602,   1.19432,
     1 -93.000,  18.360,  74.060, .05136, .99821,-.02257,   1.68323,
     1 -93.000,  18.370,  75.070, .05536, .99837,-.00226,   2.56224,
     1 -93.000,  18.360,  76.070, .06099, .99802, .01049,   3.16284,
     1 -93.000,  18.340,  77.060, .06491, .99725, .02642,   1.49081,
     1 -93.000,  18.280,  78.060, .06964, .99615, .04619,   1.40224,
     1 -93.000,  18.220,  79.060, .07339, .99530, .05375,   1.13237,
     1 -93.000,  18.130,  80.080, .07634, .99375, .07111,    .95738,
     1 -93.000,  18.030,  81.080, .08110, .99199, .08393,    .79069,
     1 -93.000,  17.900,  82.100, .08567, .98884, .10636,    .64722,
     1 -93.000,  17.740,  83.100, .08913, .98602, .12376,    .56299,
     1 -93.000,  17.580,  84.070, .09431, .98342, .13502,    .49453,
     1 -93.000,  17.380,  85.060, .09721, .97880, .15819,    .44191,
     1 -93.000,  17.160,  86.050, .10275, .97403, .17710,    .39400,
     1 -93.00000,  16.91000,  87.02000, .10758, .96678, .20341,.34133/
      DATA(X(N),Y(N),Z(N),XN(N),YN(N),ZN(N),AN(N),N=487,504)/
     1 -93.000,  16.620,  87.990, .11234, .95976, .22676,    .31193,
     1 -93.000,  16.320,  88.940, .11825, .95439, .24111,    .28935,
     1 -93.000,  15.990,  89.890, .12542, .94347, .26950,    .26060,
     1 -93.000,  15.600,  90.840, .13214, .93027, .30255,    .23984,
     1 -93.000,  15.200,  91.760, .13816, .91833, .32748,    .21611,
     1 -93.000,  14.750,  92.650, .14781, .90061, .36088,    .19771,
     1 -93.000,  14.260,  93.550, .15782, .88071, .39662,    .18432,
     1 -93.000,  13.730,  94.380, .16883, .85186, .43977,    .16279,
     1 -93.000,  13.140,  95.200, .17981, .81851, .49346,    .14928,
     1 -93.000,  12.630,  95.820, .18821, .79132, .51316,    .11951,
     1 -93.000,  11.960,  96.550, .18949, .74545, .58079,    .12838,
     1 -93.000,  11.360,  97.100, .22028, .68964, .62336,    .10243,
     1 -93.000,  10.720,  97.600, .23669, .62747, .67480,    .09780,
     1 -93.000,  10.040,  98.040, .25449, .54650, .73281,    .09480,
     1 -93.000,   9.320,  98.400, .26780, .44751, .79739,    .09283,
     1 -93.000,   8.680,  98.640, .28832, .34716, .83559,    .08177,
     1 -93.000,   8.000,  98.820, .24454, .24774, .93664,    .33090,
     1 -87.00000,  17.26000,  64.93000, .02181, .99407,-.07523,.24443/
      DATA(X(N),Y(N),Z(N),XN(N),YN(N),ZN(N),AN(N),N=505,522)/
     1 -87.000,  17.410,  65.920, .02448, .99186,-.10770,    .63703,
     1 -87.000,  17.540,  66.910, .03245, .99307,-.09731,    .70518,
     1 -87.000,  17.670,  67.910, .03804, .99401,-.08698,    .74274,
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      1 -87.000,  17.760,  68.910, .04535, .99611,-.06442,   1.01785,
      1 -87.000,  17.840,  69.920, .05051, .99646,-.05736,   1.13369,
      1 -87.000,  17.910,  70.910, .05699, .99693,-.04258,   1.16660,
      1 -87.000,  17.940,  71.910, .06154, .99762,-.02494,   2.09112,
      1 -87.000,  17.980,  72.910, .06760, .99723,-.02244,   1.75419,
      1 -87.000,  17.990,  73.910, .07396, .99715,-.00248,   2.51721,
      1 -87.000,  17.980,  74.920, .07852, .99669, .01240,   2.22156,
      1 -87.000,  17.950,  75.920, .08303, .99592, .02739,   1.71013,
      1 -87.000,  17.900,  76.920, .08919, .99449, .04475,   1.23563,
      1 -87.000,  17.820,  77.920, .09278, .99299, .06206,   1.02868,
      1 -87.000,  17.730,  78.920, .09776, .99186, .06943,    .93999,
      1 -87.000,  17.630,  79.920, .10403, .98981, .08207,    .77026,
      1 -87.000,  17.500,  80.910, .10829, .98699, .10167,    .65644,
      1 -87.000,  17.350,  81.910, .11460, .98378, .11805,    .57163,
      1 -87.00000,  17.17000,  82.91000, .11917, .97962, .13924,.49573/
     DATA(X(N),Y(N),Z(N),XN(N),YN(N),ZN(N),AN(N),N=523,540)/
      1 -87.000,  16.970,  83.880, .12632, .97601, .15266,    .44605,
      1 -87.000,  16.760,  84.860, .13289, .97143, .16851,    .40157,
      1 -87.000,  16.500,  85.840, .14124, .96315, .19757,    .35405,
      1 -87.000,  16.220,  86.810, .14883, .95603, .21796,    .31961,
      1 -87.000,  15.900,  87.770, .15638, .94658, .24412,    .28834,
      1 -87.000,  15.560,  88.710, .16631, .93657, .26652,    .26197,
      1 -87.000,  15.170,  89.650, .17854, .92319, .29532,    .24236,
      1 -87.000,  14.760,  90.570, .19154, .90946, .31981,    .22109,
      1 -87.000,  14.300,  91.470, .19816, .88837, .36090,    .20003,
      1 -87.000,  13.790,  92.330, .21175, .86267, .40089,    .18070,
      1 -87.000,  13.230,  93.170, .23620, .83119, .44109,    .16714,
      1 -87.000,  12.620,  93.960, .25343, .79467, .48449,    .15345,
      1 -87.000,  11.950,  94.720, .27269, .74600, .54537,    .14072,
      1 -87.000,  11.360,  95.280, .28560, .69218, .59096,    .10827,
      1 -87.000,  10.730,  95.780, .31450, .62781, .63409,    .10454,
      1 -87.000,   9.970,  96.280, .33783, .54389, .70639,    .11079,
      1 -87.000,   9.360,  96.600, .36547, .45611, .73651,    .08604,
      1 -87.00000,   8.61000,  96.89000, .37581, .33718, .80847,.09858/
     DATA(X(N),Y(N),Z(N),XN(N),YN(N),ZN(N),AN(N),N=541,558)/
      1 -87.000,   8.000,  97.040, .32880, .22491, .91537,    .21622,
      1 -81.000,  16.940,  63.780, .04050, .99542,-.06205,    .32136,
      1 -81.000,  17.060,  64.780, .04357, .99351,-.09106,    .80460,
      1 -81.000,  17.180,  65.770, .04993, .99421,-.08074,    .82422,
      1 -81.000,  17.260,  66.770, .05769, .99562,-.06312,   1.10924,
      1 -81.000,  17.350,  67.770, .06535, .99544,-.05774,   1.05579,
      1 -81.000,  17.400,  68.770, .07249, .99633,-.03786,   1.63190,
      1 -81.000,  17.450,  69.770, .07832, .99610,-.03251,   1.64502,
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582.          1 -81.000,  17.480,  70.780, .08523, .99600,-.01992,  2.18858,
583.          1 -81.000,  17.500,  71.790, .09205, .99549,-.00980,  1.87414,
584.          1 -81.000,  17.500,  72.800, .09918, .99478, .00772,  1.74132,
585.          1 -81.000,  17.470,  73.800, .10611, .99375, .02524,  1.67129,
586.          1 -81.000,  17.430,  74.800, .11287, .99256, .03516,  1.37911,
587.          1 -81.000,  17.370,  75.810, .12067, .99053, .05263,  1.05146,
588.          1 -81.000,  17.280,  76.810, .12906, .98807, .07015,   .89356,
589.          1 -81.000,  17.180,  77.810, .13649, .98600, .07960,   .78038,
590.          1 -81.000,  17.060,  78.820, .14590, .98202, .09977,   .63083,
591.          1 -81.00000,  16.90000,  79.81000, .15542, .97825, .11641,.57829/
592.           DATA(X(N),Y(N),Z(N),XN(N),YN(N),ZN(N),AN(N),N=559,576)/
593.          1 -81.000,  16.750,  80.820, .16619, .97486, .12381,   .51537,
594.          1 -81.000,  16.550,  81.810, .17657, .96793, .15192,   .44741,
595.          1 -81.000,  16.340,  82.790, .18844, .96205, .16689,   .39919,
596.          1 -81.000,  16.090,  83.770, .20271, .95265, .19270,   .35154,
597.          1 -81.000,  15.820,  84.720, .21683, .94300, .21434,   .31610,
598.          1 -81.000,  15.500,  85.690, .23015, .93150, .24103,   .29453,
599.          1 -81.000,  15.160,  86.640, .24855, .91894, .26139,   .26804,
600.          1 -81.000,  14.780,  87.580, .26749, .90179, .29012,   .24363,
601.          1 -81.000,  14.360,  88.500, .29117, .87873, .32330,   .21977,
602.          1 -81.000,  13.880,  89.400, .30125, .85412, .36669,   .20423,
603.          1 -81.000,  13.350,  90.260, .32742, .82417, .40064,   .18943,
604.          1 -81.000,  12.780,  91.100, .35345, .77544, .46732,   .16146,
605.          1 -81.000,  12.300,  91.620, .38114, .74185, .47282,   .12120,
606.          1 -81.000,  11.740,  92.310, .40877, .71780, .49775,   .14161,
607.          1 -81.000,  11.150,  92.870, .43065, .64225, .56445,   .12346,
608.          1 -81.000,  10.510,  93.360, .47032, .56301, .60315,   .12527,
609.          1 -81.000,   9.660,  93.880, .49261, .47286, .66595,   .14454,
610.          1 -81.00000,   8.83000,  94.27000, .52691, .35064, .71348,.13393/
611.           DATA(X(N),Y(N),Z(N),XN(N),YN(N),ZN(N),AN(N),N=577,594)/
612.          1 -81.000,   8.000,  94.500, .47584, .23322, .84215,   .19210,
613.          1 -74.500,  16.480,  62.500, .06041, .99608,-.04071,   .34383,
614.          1 -74.500,  16.580,  63.500, .06315, .99477,-.06602,   .78466,
615.          1 -74.500,  16.660,  64.500, .07143, .99507,-.05609,   .89302,
616.          1 -74.500,  16.740,  65.500, .07984, .99488,-.04818,   .89272,
617.          1 -74.500,  16.780,  66.490, .08645, .99553,-.02820,  1.35693,
618.          1 -74.500,  16.820,  67.490, .09649, .99473,-.02182,  1.28143,
619.          1 -74.500,  16.830,  68.500, .10384, .99435,-.00701,  1.65163,
620.          1 -74.500,  16.840,  69.490, .11287, .99330,-.00295,  1.39345,
621.          1 -74.500,  16.830,  70.490, .12385, .99163, .01510,  1.05875,
622.          1 -74.500,  16.780,  71.490, .13547, .98960, .03284,   .96967,
623.          1 -74.500,  16.740,  72.490, .14622, .98780, .03390,   .84068,
624.          1 -74.500,  16.670,  73.490, .15614, .98503, .05261,   .68999,
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     1 -74.500,  16.580,  74.490, .16862, .98135, .06859,    .56854,
     1 -74.500,  16.460,  75.480, .18355, .97604, .08940,    .46822,
     1 -74.500,  16.310,  76.470, .19668, .97072, .10763,    .41125,
     1 -74.500,  16.140,  77.460, .21292, .96431, .12326,    .36399,
     1 -74.50000,  15.94000,  78.44000, .22727, .95752, .14095,.33318/
      DATA(X(N),Y(N),Z(N),XN(N),YN(N),ZN(N),AN(N),N=595,612)/
     1 -74.500,  15.720,  79.430, .24732, .94783, .15863,    .29073,
     1 -74.500,  15.460,  80.390, .26969, .93584, .17975,    .26261,
     1 -74.500,  15.180,  81.380, .27861, .92874, .19774,    .25493,
     1 -74.500,  14.860,  82.320, .30435, .90880, .23107,    .21700,
     1 -74.500,  14.480,  83.250, .32928, .88612, .27164,    .18771,
     1 -74.500,  14.150,  84.000, .35938, .86739, .28112,    .14994,
     1 -74.500,  13.800,  84.710, .37741, .85040, .29474,    .15181,
     1 -74.500,  13.300,  85.600, .40895, .81631, .33821,    .16704,
     1 -74.500,  12.760,  86.450, .44351, .77541, .37560,    .15317,
     1 -74.500,  12.150,  87.230, .47968, .72203, .41915,    .14198,
     1 -74.500,  11.470,  87.980, .51181, .66309, .47360,    .13232,
     1 -74.500,  10.880,  88.520, .55845, .59281, .49744,    .10601,
     1 -74.500,  10.230,  89.000, .58346, .52137, .54265,    .10372,
     1 -74.500,   9.580,  89.400, .61764, .44488, .56513,    .09963,
     1 -74.500,   8.840,  89.750, .64553, .33580, .60647,    .10660,
     1 -74.500,   8.000,  90.000, .58828, .22883, .76926,    .18895,
     1 -70.000,  16.090,  61.630, .09420, .99516,-.03591,    .42222,
     1 -70.00000,  16.16000,  62.65000, .08913, .99409,-.05258,.97074/
      DATA(X(N),Y(N),Z(N),XN(N),YN(N),ZN(N),AN(N),N=613,630)/
     1 -70.000,  16.230,  63.650, .09920, .99355,-.04262,    .87224,
     1 -70.000,  16.260,  64.650, .10929, .99349,-.02275,   1.31893,
     1 -70.000,  16.290,  65.650, .12052, .99229,-.01750,   1.27709,
     1 -70.000,  16.300,  66.650, .13132, .99097, .00026,   1.08832,
     1 -70.000,  16.280,  67.650, .14314, .98920, .01779,   1.13601,
     1 -70.000,  16.250,  68.640, .15606, .98680, .02779,    .90488,
     1 -70.000,  16.200,  69.650, .17058, .98322, .04763,    .70191,
     1 -70.000,  16.110,  70.650, .18574, .97864, .07201,    .62063,
     1 -70.000,  16.000,  71.660, .20116, .97421, .08435,    .54873,
     1 -70.000,  15.880,  72.650, .22173, .96825, .09520,    .48001,
     1 -70.000,  15.740,  73.630, .24161, .96030, .11501,    .40050,
     1 -70.000,  15.560,  74.610, .26295, .94908, .14504,    .33985,
     1 -70.000,  15.330,  75.600, .27249, .94140, .17114,    .32778,
     1 -70.000,  15.090,  76.570, .29849, .92891, .18704,    .29113,
     1 -70.000,  14.800,  77.550, .32586, .91153, .21935,    .25078,
     1 -70.000,  14.560,  78.300, .35796, .89057, .23464,    .19312,
     1 -70.000,  14.170,  79.240, .39125, .86146, .27907,    .21096,
     1 -70.00000,  13.76000,  80.17000, .42369, .83722, .29834,.19972/
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      DATA(X(N),Y(N),Z(N),XN(N),YN(N),ZN(N),AN(N),N=631,648)/
     1 -70.000,  13.300,  81.070, .46009, .80028, .33361,    .18475,
     1 -70.000,  12.780,  81.930, .48159, .76209, .37913,    .17197,
     1 -70.000,  12.180,  82.750, .53356, .69999, .41972,    .16769,
     1 -70.000,  11.520,  83.510, .56465, .64085, .47114,    .15249,
     1 -70.000,  11.000,  84.020, .60675, .57791, .48729,    .11284,
     1 -70.000,  10.450,  84.470, .63369, .51519, .51336,    .10937,
     1 -70.000,   9.810,  84.910, .67360, .43407, .52872,    .12406,
     1 -70.000,   8.920,  85.380, .68947, .33380, .58064,    .14605,
     1 -70.000,   8.000,  85.700, .66044, .24647, .70900,   1.15109,
     1 -65.000,  15.570,  80.680, .10770, .99353,-.02127,    .46917,
     1 -65.000,  15.620,  81.680, .11486, .99242,-.02921,    .83421,
     1 -65.000,  15.640,  82.670, .12617, .99156,-.00997,    .96634,
     1 -65.000,  15.640,  83.670, .13988, .98977, .00424,    .99648,
     1 -65.000,  15.620,  84.670, .15256, .98765, .01607,    .87266,
     1 -65.000,  15.590,  85.690, .16578, .98492, .02911,    .70796,
     1 -65.000,  15.520,  86.700, .17988, .98135, .05092,    .62734,
     1 -65.000,  15.440,  87.700, .19569, .97689, .06452,    .49757,
     1 -65.00000,  15.32000,  88.69000, .21112, .97110, .08918,.42355/
      DATA(X(N),Y(N),Z(N),XN(N),YN(N),ZN(N),AN(N),N=649,666)/
     1 -65.000,  15.180,  89.660, .22126, .96690, .10447,    .39992,
     1 -65.000,  15.010,  90.660, .23913, .95904, .12530,    .34536,
     1 -65.000,  14.800,  91.650, .25944, .94766, .15492,    .28506,
     1 -65.000,  14.550,  92.600, .28587, .93320, .18173,    .24286,
     1 -65.000,  14.270,  93.550, .31258, .91821, .20374,    .22129,
     1 -65.000,  13.950,  94.480, .34174, .89607, .23627,    .19308,
     1 -65.000,  13.540,  95.430, .37418, .86529, .28197,    .17374,
     1 -65.000,  13.090,  96.330, .42546, .82608, .31028,    .15434,
     1 -65.000,  12.580,  97.210, .44978, .79190, .35130,    .14496,
     1 -65.000,  12.000,  98.040, .50812, .72746, .40217,    .13282,
     1 -65.000,  11.470,  98.670, .55698, .66638, .42759,    .10612,
     1 -65.000,  10.910,  99.240, .56455, .62112, .47052,    .09573,
     1 -65.000,  10.290,  99.760, .60823, .53907, .50939,    .09455,
     1 -65.000,   9.620, 100.200, .64499, .45716, .53663,    .09299,
     1 -65.000,   8.910, 100.590, .69772, .35653, .53723,    .09778,
     1 -65.000,   8.000, 100.930, .65080, .26551, .71096,    .92923,
     1 -61.250,  15.120,  60.000, .12089, .99214,-.00000,    .25402,
     1 -61.25000,  15.11000,  61.00000, .14780, .98831, .00869,.52609/
      DATA(X(N),Y(N),Z(N),XN(N),YN(N),ZN(N),AN(N),N=667,684)/
     1 -61.250,  15.090,  61.990, .15546, .98731, .01736,    .70014,
     1 -61.250,  15.050,  62.990, .16282, .98581, .03081,    .73083,
     1 -61.250,  14.990,  63.990, .17431, .98298, .04606,    .56561,
     1 -61.250,  14.900,  64.990, .18853, .97914, .06211,    .45846,
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     1 -61.250,   14.800,   66.000, .20591, .97457, .07212,    .39589,
     1 -61.250,   14.670,   67.000, .22108, .96825, .09467,    .30017,
     1 -61.250,   14.490,   68.020, .24051, .95969, .12056,    .25015,
     1 -61.250,   14.300,   69.000, .26124, .95062, .13720,    .20792,
     1 -61.250,   14.060,   69.960, .28501, .93636, .16825,    .17049,
     1 -61.250,   13.780,   70.920, .33411, .91094, .19897,    .14830,
     1 -61.250,   13.420,   71.860, .36888, .88016, .25344,    .12004,
     1 -61.250,   13.090,   72.600, .39191, .85775, .27352,    .08786,
     1 -61.250,   12.720,   73.330, .41871, .82680, .31374,    .08096,
     1 -61.250,   12.290,   74.000, .46845, .77104, .36124,    .07110,
     1 -61.250,   11.800,   74.640, .51737, .71973, .38914,    .06902,
     1 -61.250,   11.290,   75.260, .55816, .67037, .40776,    .06921,
     1 -61.250,   10.590,   75.910, .60833, .57538, .46576,    .07559,
     1 -61.25000,   9.78000,  76.50000, .65146, .46078, .50582,.07677/
      DATA(X(N),Y(N),Z(N),XN(N),YN(N),ZN(N),AN(N),N=685,702)/
     1 -61.250,    8.910,   76.990, .69843, .37954, .52240,    .07654,
     1 -61.250,    8.000,   77.380, .65617, .29707, .69345,    .91966,
     1 -59.000,   14.640,   62.850, .18379, .98208,-.00003,    .10803,
     1 -59.000,   14.570,   63.750, .22164, .97165, .06327,    .24512,
     1 -59.000,   14.460,   64.720, .21944, .97013, .08706,    .25421,
     1 -59.000,   14.320,   65.710, .22987, .96509, .10723,    .22397,
     1 -59.000,   14.150,   66.700, .25559, .95464, .13027,    .18441,
     1 -59.000,   13.940,   67.680, .28459, .93996, .16021,    .14872,
     1 -59.000,   13.680,   68.650, .32575, .91760, .19398,    .12412,
     1 -59.000,   13.370,   69.600, .36816, .88792, .23434,    .10264,
     1 -59.000,   12.980,   70.520, .41914, .84603, .28192,    .08973,
     1 -59.000,   12.520,   71.420, .44757, .80616, .33470,    .07933,
     1 -59.000,   11.980,   72.240, .50271, .73785, .39008,    .06961,
     1 -59.000,   11.330,   73.020, .57522, .64531, .43914,    .06751,
     1 -59.000,   10.600,   73.700, .62017, .55645, .48510,    .06364,
     1 -59.000,    9.780,   74.300, .65916, .46640, .52127,    .06336,
     1 -59.000,    8.910,   74.800, .70186, .37603, .53063,    .06208,
     1 -59.00000,   8.00000,  75.22000, .65809, .31531, .68352,.67377/
      DATA(X(N),Y(N),Z(N),XN(N),YN(N),ZN(N),AN(N),N=703,720)/
     1 -57.000,   13.880,   65.450, .23613, .97073,-.00009,    .02869,
     1 -57.000,   13.830,   65.730, .23493, .96759, .03861,    .05504,
     1 -57.000,   13.590,   66.700, .35589, .90542, .18296,    .09570,
     1 -57.000,   13.290,   67.660, .35883, .89285, .23026,    .09708,
     1 -57.000,   12.910,   68.600, .37852, .86647, .28255,    .08951,
     1 -57.000,   12.470,   69.500, .42944, .81913, .33144,    .07772,
     1 -57.000,   11.950,   70.330, .49107, .74666, .39200,    .06747,
     1 -57.000,   11.310,   71.100, .55237, .65839, .45179,    .06402,
     1 -57.000,   10.600,   71.780, .62622, .55528, .48154,    .06153,
```

```
754.          1 -57.000,   9.800,  72.360, .66526, .46324, .51799,     .06086,
755.          1 -57.000,   8.940,  72.880, .69480, .38098, .53904,     .06047,
756.          1 -57.000,   8.000,  73.320, .65291, .32090, .68592,     .76876,
757.          1 -55.000,  12.200,  68.050, .48229, .87493,-.00031,     .04805,
758.          1 -55.000,  11.900,  68.470, .45663, .82179, .20525,     .01685,
759.          1 -55.000,  11.270,  69.250, .55443, .67717, .40599,     .03992,
760.          1 -55.000,  10.570,  69.910, .62202, .57685, .44103,     .03679,
761.          1 -55.000,   9.780,  70.510, .66554, .48581, .47414,     .03650,
762.          1 -55.00000,   8.90000,  71.02000, .70182, .38932, .50483,.03683/
763.           DATA(X(N),Y(N),Z(N),XN(N),YN(N),ZN(N),AN(N),N=721,736)/
764.          1 -55.000,   8.000,  71.420, .65144, .30796, .69317,     .49396,
765.          1 -54.000,  10.180,  69.320, .77950, .62347,-.00091,     .01499,
766.          1 -54.000,   9.800,  69.580, .71243, .53616, .27469,     .00595,
767.          1 -54.000,   8.930,  70.060, .75063, .39676, .38313,     .00961,
768.          1 -54.000,   8.000,  70.480, .65341, .31138, .68973,     .21933,
769.          1 -53.00000,   8.00000,  70.00000, .48893, .51005, .00102,.01000,
770.          1 -73.00000,    .00000,  88.58000,.68977,.00000,.72403, 453.02071,
771.          1 -74.00000,    .00000,  89.53000,.68747,.00000,.72620,  21.37511,
772.          1 -74.00000,    .00000,  90.00000,.57845,.00000,.81472,   6.72945,
773.          1 -81.00000,    .00000,  94.50000,.48817,.00000,.86678,   3.50271,
774.          1 -87.00000,    .00000,  97.04000,.33819,.00000,.93941,   5.63053,
775.          1 -93.00000,    .00000,  98.82000,.25229,.00000,.96696,   7.66244,
776.          1 -98.00000,    .00000,  99.91000,.18945,.00000,.98160,  10.43519,
777.          1-103.00000,    .00000, 100.75000,.14303,.00000,.98950,  13.12666,
778.          1-109.00000,    .00000, 101.50000,.10358,.00000,.99441,  14.45457,
779.          1-115.00000,    .00000, 102.00000,.08085,.00000,.99672,  74.41462,
780.          1-118.00000,    .00000, 102.23000,.07479,.00000,.99720,  37.76113,
781.          1-119.00000,    .00000, 102.30000,.06983,.00000,.99756, 385.74158/
782.           END

END OF LISTING.      0 *DIAGNOSTIC* MESSAGE(S).
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«I FOR PLOIT
COMPILATION BY UNIVAC 1108 FORTRAN-IV DATED      JUNE 22,1965 F4008
THIS COMPILATION WAS DONE ON 04 DEC 72 AT 21:24:33


   SUBROUTINE PLOIT      ENTRY POINT 000265

   STORAGE USED (BLOCK, NAME, LENGTH)

         0001    *CODE    000302
         0000    *DATA    000306
         0002    *BLANK   000000
         0003    BLK1     012056
         0004    BLK2     016230


   EXTERNAL REFERENCES (BLOCK, NAME)

         0005    ALOG10
         0006    NWDU$
         0007    NIO1$
         0010    NIO2$


   STORAGE ASSIGNMENT FOR VARIABLES (BLOCK, TYPE, RELATIVE LOCATION, NAME)

    0001    000013 123G        0001    000021 127G        0001    000034 134G
    0000    000262 19F         0001    000130 22L         0001    000226 230G
    0001    000236 30L         0001    000247 40L         0001    000110 65L
    0001    000171 92L         0001    000201 93L         0000 R  000254 A
    0004 R  013540 B           0000 I  000144 IA          0004 I  000000 IALPH
    0000 I  000247 IC          0000 I  000255 ICON        0000 I  000000 ICONV
    0000 I  000245 IOUT        0000 I  000252 IX          0000 I  000253 IXX
    0000 I  000243 IZERO       0000 I  000246 K           0000 I  000241 N
    0003    000000 X           0003    004246 XN          0003    001342 Y
    0003    007152 ZN


1.          SUBROUTINE PLOIT(NNOR,J)
```

```
      DIMENSION ICONV(100)
      DIMENSION IA(61)
      COMMON/BLK1/X(738),Y(738),Z(738),XN(738),YN(738),ZN(738),AN(738)
      COMMON/BLK2/IALPH(1464),IBETA(1464),RT(1464),RG(1464),B(1464)
      DATA (ICONV(N),N=1,100)/2H01,2H02,2H03,2H04,2H05,2H06,2H07,2H08,
     12H09,2H10,2H11,2H12,2H13,2H14,2H15,2H16,2H17,2H18,2H19,2H20,
     22H21,2H22,2H23,2H24,2H25,2H26,2H27,2H28,2H29,2H30,
     32H31,2H32,2H33,2H34,2H35,2H36,2H37,2H38,2H39,2H40,
     42H41,2H42,2H43,2H44,2H45,2H46,2H47,2H48,2H49,2H50,
     52H51,2H52,2H53,2H54,2H55,2H56,2H57,2H58,2H59,2H60,
     62H61,2H62,2H63,2H64,2H65,2H66,2H67,2H68,2H69,2H70,
     72H71,2H72,2H73,2H74,2H75,2H76,2H77,2H78,2H79,2H80,
     82H81,2H82,2H83,2H84,2H85,2H86,2H87,2H88,2H89,2H90,
     92H91,2H92,2H93,2H94,2H95,2H96,2H97,2H98,2H99,2H00,
      DATA IBLNK/2H ./
      DATA IZERO/2H Z/
      DATA IHIGH/2H H/
      IOUT=6
      K=1
      IC=1
      DO 10 IY=3,360,3
      IYY=183-IY
      DO 15 IX=3,183,3
      IXX=IX/3
      A=0.
      DO 25 N=1,NNOR
      IF(IALPH(N).NE.(IX-3))GO TO 25
      IF(IBETA(N).NE.IYY)GO TO 25
      IF(J.EQ.1)A=A+B(N)
      IF(J.EQ.2)GO TO 70
      IF(J.EQ.3)GO TO 75
      IF(J.EQ.4)GO TO 65
       GO TO 25
   70 IF(A-B(N))71,25,25
   71 A=B(N)
      GO TO 25
   75 IF(A-RT(N))76,25,25
   76 A=RT(N)
      GO TO 25
   65 IF(A-RG(N))66,25,25
   66 A=RG(N)
   25 CONTINUE
      IF(A)21,21,22
```

```
      21 IA(IXX)=IBLNK
         GO TO 15
      22 IF(J.LE.2)ICON=INT(10.*ALOG10(A))
         IF(J.GE.3)ICON=INT(A+.5)
         IF(ICON)91,91,92
      91 IA(IXX)=IZERO
         GO TO 15
      92 IF(ICON-99)93,93,94
      94 IA(IXX)=IHIGH
         GO TO 15
      93 IA(IXX)=ICONV(ICON)
      15 CONTINUE
         IF(IC-K)30,35,30
      35 IO=180-(K-1)*3
         WRITE(IOUT,18)IO,(IA(IXX),IXX=1,61)
      18 FORMAT(1X,I4,1HY,61A2)
         IC=IC+5
         GO TO 40
      30 WRITE(IOUT,19)(IA(IXX),IXX=1,61)
      19 FORMAT(5X,1HY,61A2)
      40 K=K+1
      10 CONTINUE
         RETURN
         END

END OF LISTING.      0 *DIAGNOSTIC* MESSAGE(S).
```

```
.I FOR COBWIN
COMPILATION BY UNIVAC 1108 FORTRAN-IV DATED      JUNE 22,1965 F4008
THIS COMPILATION WAS DONE ON 17 NOV 72 AT 13:42:49


   MAIN PROGRAM              ENTRY POINT 000000

   STORAGE USED (BLOCK, NAME, LENGTH)

         0001    *CODE     002106
         0000    *DATA     015000
         0002    *BLANK    000000
         0003    BLK1      012056
         0004    BLK2      016230


   EXTERNAL REFERENCES (BLOCK, NAME)

         0005    COS
         0006    SIN
         0007    ATAN2
         0010    SQRT
         0011    CONFRA
         0012    EXP
         0013    PLOTT
         0014    ALOG10
         0015    NRDU$
         0016    N1O1$
         0017    N1O2$
         0020    NWDU$
         0021    NSTOP$


   STORAGE ASSIGNMENT FOR VARIABLES (BLOCK, TYPE, RELATIVE LOCATION, NAME)

    0001    000655 100L       0001    000335 101L       0001    001747 1012G
    0001    002011 1034G      0001    00203C 1045G      0000    014423 105F
    0000    014430 12F        0001    000031 130G       0001    000044 136G
    0001    000104 175G       0000    014525 201F       0000    014514 202F
    0001    000172 220G       0000    014567 243F       0000    014513 250F
    0000    014473 302F       0000    014634 311F       0000    014640 312F
```

```
0000    014432 38F          0000    014435 39F          0000    014504 401F
0000    014650 431F         0000    014653 432F         0000    014656 433F
0000    014646 436F         0000    014667 437F         0000    014707 438F
0001    001500 445L         0000    014644 449F         0001    001115 460G
0001    000573 471L         0001    000524 472L         0000    014426 48F
0000    014714 492F         0000    014551 500F         0000    014602 505F
0000    014720 508F         0000    014616 510F         0001    001164 511G
0001    001206 552G         0001    001277 560G         0001    001311 571G
0001    001415 623G         0001    001436 634G         0001    001457 645G
0001    001520 703G         0001    001541 711G         0001    001573 733G
0000 R  014370 AREA         0014 R  000000 ALOG10       0000 R  014377 ALPHA
0000 R  014344 BH           0007 R  000000 ATAN2        0004 R  013340 B
0000 R  014404 E            0000 R  014342 BS           0000 R  014362 CG
0004 I  000000 IALPH        0012 R  000000 EXP          0000 R  014345 EYE
0000 I  000302 IC10         0004 I  002670 IBETA        0000 I  014333 IBL
0000 I  014421 IROG         0000 I  000014 IDATA        0000 I  014340 IIN
0000 I  014413 JJ           0000 I  011240 ISD          0000 I  014410 J
0000 I  014422 JK           0000 I  014350 JJD          0000 I  014414 JJJ
0000 I  014363 N            0000 I  014346 K            0000 I  014412 L
0000 R  014403 R            0000 I  014364 NN           0000 I  014337 NNORT
0000 R  014407 ROG          0000 R  014336 RADIAN       0004 R  010450 RG
0000 R  014372 RX           0000 R  014200 ROGL         0004 R  005560 RT
0000 R  014375 SD           0000 R  014373 RY           0000 R  014374 RZ
0000 R  014356 SY           0000 R  014371 SDN          0006 R  000000 SIN
0000 R  000000 XC           0000 R  014357 SZ           0000 R  014130 SZE
0000 R  000006 YC           0003 R  004246 XN           0000 R  014365 XNORM
0003 R  007152 ZN           0000 R  005610 YN           0000 R  014366 YNORM
                            0000 R  014367 ZNORM        0000 R  006350 ZR
```

```
1.      C       COBRA WINDOW
2.              DIMENSION XC(6),YC(6)
3.              DIMENSION IDATA(91),IC(91),IC10(91),RTOT(91)
4.              DIMENSION XR(1464),YR(1464),ZR(1464)
5.              DIMENSION ISD(1464)
6.              DIMENSION SZE(20),SAZI(20),ROGL(91)
7.              COMMON/BLK1/X(738),Y(738),Z(738),XN(738),YN(738),ZN(738),AN(738)
8.              COMMON/BLK2/IALPH(1464),IBETA(1464),RT(1464),RG(1464),B(1464)
9.              DATA 1H1/1H /
10.             DATA 1HX/1HX/
11.             NXY=6
```

```
      RADIAN=57.29578
      NNORT=1464
      IIN=5
      IOUT=6
      BS=2000.
      ROE=.15
      BH=.0009
      EYE=.15
      READ(IIN,105)(XC(K),K=1,NXY)
      READ(IIN,105)(YC(K),K=1,NXY)
  105 FORMAT(6F6.3)
      READ(IIN,49)JD
   49 FORMAT(I3)
      READ(IIN,48)(SZE(JJD),SAZI(JJD),JJD=1,JD)
   48 FORMAT(2F8.2)
   12 FORMAT(5H BETA)
   38 FORMAT(5X,41(3HXXX))
   39 FORMAT(7X,1H0,8X,2H15,8X,2H30,8X,2H45,8X,2H60,8X,2H75,8X,2H90,
     27X,3H105,7X,3H120,7X,3H135,7X,3H150,7X,3H165,7X,3H180)
   37 FORMAT(65X,5HALPHA)
  301 FORMAT(47X,34HHELICOPTER DETECTION RANGE CONTOUR)
  302 FORMAT(43X,42HSCALE FACTOR:VALUE=RANGE IN NAUTICAL MILES)
  401 FORMAT(49X,30HWINDOW DETECTION RANGE CONTOUR)
      DO 600 IOA=1,91
      RTOT(IOA)=10.
  600 CONTINUE
      DO 80 M=1,JD
      SZEN=.017453*SZE(M)
      SAZ=.017453*SAZI(M)
      SX=-COS(SAZ)*SIN(SZEN)
      SY=-SIN(SAZ)*SIN(SZEN)
      SZ=-COS(SZEN)
      DO 260 IOA=1,91
      ROGL(IOA)=10.
      ICLO(IOA)=0
      IC(IOA)=0
  260 CONTINUE
      RVIS=5.
      CT=ABS(ROE*BH-BH)*100./BH
      CG=(BS*EYE*100.)/BH
      DO 100 N=1,NNORT
      NN=N
      IF(N.GT.738)NN=N-738
```

```
      XNORM=XN(NN)
      YNORM=YN(NN)
      ZNORM=ZN(NN)
      IF(N.GT.738)YNORM=-YNORM
      AREA=AN(NN)
      SDN=SX*XNORM+SY*YNORM+SZ*ZNORM
      RX=SX-2.*SDN*XNORM
      RY=SY-2.*SDN*YNORM
      RZ=SZ-2.*SDN*ZNORM
      XR(N)=RX
      YR(N)=RY
      ZR(N)=RZ
      SDN=-SDN
      IF(SDN)101,101,102
  102 SD=ATAN2(SQRT(1-SDN*SDN),SDN)
      SD=SD*RADIAN
      ISD(N)=INT(SD+.5)
      CALL CONFRA(NXY,XC,YC,SD,RO)
      B(N)=AREA*SDN*RO
      B(N)=B(N)*1.0E+07
      GO TO 103
  101 B(N)=0.
      RT(N)=0.
      RG(N)=0.
      ISD(N)=0
      IALPH(N)=0
      IBETA(N)=0
      GO TO 100
  103 CONTINUE
      ALPHA=ATAN2(SQRT(1-ZR(N)*ZR(N)),ZR(N))
      ALPHA=ALPHA*RADIAN
      IALPH(N)=3*INT(ALPHA/3.+.5)
      BETA=ATAN2(YR(N),XR(N))
      BETA=BETA*RADIAN
      IF(BETA)44,43,43
   44 IBETA(N)=3*INT(BETA/3-.5)
      GO TO 42
   43 IBETA(N)=3*INT(BETA/3.+.5)
   42 CONTINUE
      BF=B(N)/(144.*1.0E+07)
      AP=ABS(RX*35.)+ABS(RY*450.)+ABS(RZ*157.5)
      R=0.
  462 E=EXP(-3.9075*R/RVIS)*CT
```

```
      F=-E+1.57+R*R*36.5/AP
      F1=3.9075*E/RVIS+2.*R*36.5/AP
      IF(F/F1+.1)460,461,461
  460 R=R-F/F1
      GO TO 462
  461 RT(N)=R
      R=0.
  462 E=EXP(-3.9075*R/RVIS)*CG*RO
      F=-E+1.57+R*R*36.5*RO/BF
      F1=3.9075*E/RVIS+2.*R*36.5*RO/BF
      IF(F/F1+.1)470,471,471
  470 R=R-F/F1
      GO TO 472
  471 RG(N)=R
      IOA=INT(SD+1.5)
      IC(IOA)=IC(IOA)+1
      ROG=((1.57+36.5*RT(N)*RT(N)*RO/BF)*BH/(100.*EXP(-3.9075*RT(N)/
     2RVIS)))/(BS*EYE)
      IF(ROG-ROGL(IOA))261,262,262
  261 ROGL(IOA)=ROG
      IF(ROG-RTOT(IOA))601,262,262
  601 RTOT(IOA)=ROG
  262 CONTINUE
  100 CONTINUE
      WRITE(IOUT,250)
  250 FORMAT(1H1)
      WRITE(IOUT,202)SZE(M),SAZI(M)
  202 FORMAT(44X,11HSUN ZENITH=,F6.0,4X,12HSUN AZIMUTH=,F6.0)
      WRITE(IOUT,201)
  201 FORMAT(56X,15HBRIGHTNESS PLOT)
      WRITE(IOUT,203)
  203 FORMAT(24X,38HSCALE FACTOR: VALUE=10X LOG BASE 10 OF,
     242H AREA X REFLECTIVITY X 10 TO THE 7TH POWER)
      WRITE(IOUT,12)
      J=2
      CALL PLOTT(NNORT,J)
      WRITE(IOUT,38)
      WRITE(IOUT,39)
      WRITE(IOUT,37)
      WRITE(IOUT,250)
      WRITE(IOUT,301)
      WRITE(IOUT,302)
      WRITE(IOUT,12)
```

```
      J=3
      CALL PLOTT(NNORT,J)
      WRITE(IOUT,38)
      WRITE(IOUT,39)
      WRITE(IOUT,37)
      WRITE(IOUT,250)
      WRITE(IOUT,401)
      WRITE(IOUT,302)
      WRITE(IOUT,12)
      J=4
      CALL PLOTT(NNORT,J)
      WRITE(IOUT,38)
      WRITE(IOUT,39)
      WRITE(IOUT,37)
      WRITE(IOUT,250)
      WRITE(IOUT,500)
  500 FORMAT(29X,40HREFLECTED RAY ALPHA, BETA, ANGLE OF INCI,
     230HDENCE, DETECTION RANGE LISTING)
      NUM=INT(NNORT/4)
      J=0
      DO 340 L=1,NUM
      J=J+1
      IF(J.EQ.1)WRITE(IOUT,243)
  243 FORMAT(1X,4(29H  NUM ALPHA  BETA ANGLE RANGE))
      JJ=L*4-3
      JJJ=JJ+3
      WRITE(IOUT,341)(LL,IALPH(LL),IBETA(LL),ISD(LL),RG(LL),LL=JJ,JJJ)
  341 FORMAT(1X,4(I4,3I6,F6.0,1X))
      IF(J.EQ.40)WRITE(IOUT,250)
      IF(J.EQ.40)J=0
  340 CONTINUE
      WRITE(IOUT,250)
      WRITE(IOUT,505)
  505 FORMAT(21X,40HREQUIRED REFLECTIVITY AS A FUNCTION OF A,
     217HNGLE OF INCIDENCE)
      WRITE(IOUT,510)
  510 FORMAT(1X,5HANGLE,8X,1H0,8X,1H1,8X,1H2,8X,1H3,8X,1H4,8X,1H5,8X,
     21H6,8X,1H7,8X,1H8,8X,1H9)
      DO 310 JJ=1,9
      JJJ=JJ*10-9
      JJJJ=JJJ+9
      JJJJJ=JJ*10-10
      WRITE(IOUT,311)JJJJJ,(ROGL(LL),LL=JJJ,JJJJ)
```

```
184.      511 FORMAT(2X,I4,5X,10(F8.6,1X))
185.      510 CONTINUE
186.          WRITE(IOUT,512)ROGL(91)
187.      512 FORMAT(4X,2H90,5X,F8.6)
188.          WRITE(IOUT,506)
189.      506 FORMAT(//)
190.          WRITE(IOUT,505)
191.          DO 450 J=1,91
192.          IC10(J)=IC(J)/10
193.          IC(J)=INT(IC(J)-10*IC10(J)+.1)
194.      450 CONTINUE
195.          WRITE(IOUT,449)(IC10(J),J=1,91)
196.          WRITE(IOUT,449)(IC(J),J=1,91)
197.      449 FORMAT(7X,9I1)
198.          WRITE(IOUT,436)
199.      436 FORMAT(3X,2HR0)
200.          DO 440 JJ=1,10
201.          DO 430 J=1,91
202.          JA=11-JJ
203.          ROG=ROGL(J)*1.0E+09
204.          IROG=INT(100*ALOG10(ROG))
205.          IF(IROG.GE.JA*100)IDATA(J)=IBX
206.          IF(IROG.LT.JA*100)IDATA(J)=IBL
207.      430 CONTINUE
208.          IF(JJ.EQ.1)WRITE(IOUT,431)(IDATA(JJJ),JJJ=1,91)
209.          IF(JJ.EQ.1)GO TO 445
210.          IF(JJ.EQ.4)WRITE(IOUT,432)(IDATA(JJJ),JJJ=1,91)
211.          IF(JJ.EQ.4)GO TO 445
212.          IF(JJ.EQ.7)WRITE(IOUT,433)(IDATA(JJJ),JJJ=1,91)
213.          IF(JJ.EQ.7)GO TO 445
214.          IF(JJ.EQ.10)WRITE(IOUT,434)(IDATA(JJJ),JJJ=1,91)
215.          IF(JJ.EQ.10)GO TO 445
216.          WRITE(IOUT,435)(IDATA(JJJ),JJJ=1,91)
217.      431 FORMAT(1X,6H10+1 Y,91A1)
218.      432 FORMAT(1X,6H10-2 Y,91A1)
219.      433 FORMAT(1X,6H10-5 Y,91A1)
220.      434 FORMAT(1X,6H10-8 Y,91A1)
221.      435 FORMAT(1X,6H     Y,91A1)
222.      445 CONTINUE
223.      440 CONTINUE
224.          WRITE(IOUT,437)
225.      437 FORMAT(6X,92(1HX))
226.          WRITE(IOUT,439)
```

```
      439 FORMAT(7X,1H0,8X,2H10,8X,2H20,8X,2H30,8X,2H40,8X,2H50,8X,2H60,
     28X,2H70,8X,2H80,8X,2H90)
          WRITE(IOUT,438)
      438 FORMAT(40X,18HANGLE OF INCIDENCE)
          DO 491 JJ=1,13
          J=7*JJ-6
          JJJ=7*JJ
          WRITE(7,492)(ROGL(JK),JK=J,JJJ),M,JJ
      492 FORMAT(2X,7F9.6,3X,I2,2X,I2)
      491 CONTINUE
       80 CONTINUE
          WRITE(IOUT,250)
          WRITE(IOUT,505)
          WRITE(IOUT,510)
          DO 610 JJ=1,9
          JJJ=JJ*10-9
          JJJJ=JJJ+9
          JJJJJ=JJ*10-10
          WRITE(IOUT,311)JJJJJ,(RTOT(LL),LL=JJJ,JJJJ)
      610 CONTINUE
          WRITE(IOUT,312)RTOT(91)
          WRITE(IOUT,506)
          WRITE(IOUT,508)
      508 FORMAT(45X,10HSUMMARY OF)
          WRITE(IOUT,505)
          WRITE(IOUT,507)
      507 FORMAT(40X,21HFOR ALL SUN POSITIONS)
          WRITE(IOUT,436)
          DO 640 JJ=1,10
          DO 630 J=1,91
          JA=11-JJ
          ROG=RTOT(J)*1.0E+09
          IROG=INT(100*ALOG10(ROG))
          IF(IROG.GE.JA*100)IDATA(J)=IBX
          IF(IROG.LT.JA*100)IDATA(J)=IBL
      630 CONTINUE
          IF(JJ.EQ.1)WRITE(IOUT,431)(IDATA(JJJ),JJJ=1,91)
          IF(JJ.EQ.1)GO TO 645
          IF(JJ.EQ.4)WRITE(IOUT,432)(IDATA(JJJ),JJJ=1,91)
          IF(JJ.EQ.4)GO TO 645
          IF(JJ.EQ.7)WRITE(IOUT,433)(IDATA(JJJ),JJJ=1,91)
          IF(JJ.EQ.7)GO TO 645
          IF(JJ.EQ.10)WRITE(IOUT,434)(IDATA(JJJ),JJJ=1,91)
```

```
270.           IF(JJ.EQ.10)GO TO 645
271.           WRITE(IOUT,435)(IDATA(JJJ),JJJ=1,91)
272.       645 CONTINUE
273.       640 CONTINUE
274.           WRITE(IOUT,437)
275.           WRITE(IOUT,439)
276.           WRITE(IOUT,438)
277.           WRITE(7,490)(RTOT(J),J=1,91)
278.       490 FORMAT(2X,7F9.6)
279.           STOP
280.           END

END OF LISTING.      0 *DIAGNOSTIC* MESSAGE(S).
```

```
*I FOR CONFRA
COMPILATION BY UNIVAC 1108 FORTRAN-IV DATED      JUNE 22,1965 F4008
THIS COMPILATION WAS DONE ON 17 NOV 72 AT 13:42:59


   SUBROUTINE CONFRA     ENTRY POINT 000117

   STORAGE USED (BLOCK, NAME, LENGTH)

        0001    *CODE    000161
        0000    *DATA    000016
        0002    *BLANK   000300


   STORAGE ASSIGNMENT FOR VARIABLES (BLOCK, TYPE, RELATIVE LOCATION, NAME)

    0001    000004 I056        0001    000015 300L        0001    000025 310L
    0001    000075 600L        0001    000114 700L        0001    000104 800L
    0000 R  000004 C           0000 R  000003 C1          0000 I  000000 J



  1.          SUBROUTINE CONFRA(NXY,X,Y,XIN,YOUT)
  2.          DIMENSION X(10),Y(10)
  3.          DO 35 J=1,NXY
  4.          IF(XIN-X(J))300,35,35
  5.       35 CONTINUE
  6.      300 IF(J-3)370,310,310
  7.      370 J=J+1
  8.          IF(J-3)370,310,310
  9.      310 YOUT=Y(J-2)
 10.          IF(Y(J-1)-Y(J-2))710,700,710
 11.      710 A=(X(J-1)-X(J-2))/(Y(J-1)-Y(J-2))
 12.          IF(Y(J)-Y(J-2))720,700,720
 13.      720 A1=(X(J)-X(J-2))/(Y(J)-Y(J-2))
 14.          IF(A1-A)400,500,400
 15.      500 C1=0.0
 16.          GO TO 600
 17.      400 CONTINUE
 18.          C=(X(J)-X(J-1))/(A1-A)
 19.          C1=(XIN-X(J-1))/C
```

```
      800 IF(A+C1)800,900,800
      900 YOUT=1.
          GO TO 700
      800 CONTINUE
          YOUT=Y(J-2)+(XIN-X(J-2))/(A+C1)
      700 RETURN
          END

END OF LISTING.       0 *DIAGNOSTIC* MESSAGE(S).
```

APPENDIX B

TYPICAL RESULTS

FROM

COBRA WINDOW MODEL

Segment 1 - Normals and Effective Areas

Listing of Window Surfaces, Normals, and Effective Areas B-2

Segment 2 - Area Contours

Listing of Window Surfaces by Number and XYZ Coordinates B-20

Listing of α,β Coordinates for Each Window Surface B-30

Area Contour Plot B-37

Segment 3 - Brightness Factors, Detection Ranges and Required Reflectivities for Sun Azimuth = 45°, Sun Zenith = 45°, and Visibility = 5 Nautical Miles

Brightness Plot B-38

Helicopter Detection Range Plot B-39

Window Detection Range Plot B-40

Listing of α,β Coordinates, Angle of Incidence, and Window Detection Range for Reflected Rays B-41

Listing and Plot of Required Reflectivity as a Function of Angle of Incidence B-51

X	Y	Z	X NORMAL	Y NORMAL	Z NORMAL	AREA
-169.49999	14.35000	98.30000	-.03126	.92731	.37267	.25151
-169.49999	14.04000	99.07000	-.01726	.91356	.40315	.14960
-169.49999	13.60000	100.00000	-.01154	.90216	.42780	.08933
-167.53000	16.43000	90.08000	-.06907	.98876	.12973	.42359
-167.53000	16.30000	91.07000	-.07164	.98642	.14449	.67862
-167.53000	16.14000	92.06000	-.06732	.98186	.17446	.66528
-167.53000	15.95000	93.04000	-.06792	.97713	.19943	.76526
-167.53000	15.74000	94.02000	-.06170	.97232	.22326	.68875
-167.53000	15.50000	95.00000	-.05352	.96559	.25256	.67155
-167.53000	15.23000	95.97000	-.04041	.95879	.27967	.72301
-167.53000	14.94000	96.92000	-.03823	.95584	.28886	.24134
-167.53000	14.60000	97.86000	-.02630	.94080	.31240	.21450
-167.53000	14.20000	98.80000	-.01370	.92415	.35439	.19572
-167.53000	13.77000	99.70000	.00097	.90361	.39730	.17042
-167.53000	13.28000	100.57000	.00510	.87661	.45325	.14879
-167.53000	12.90000	101.17000	.00323	.87015	.45960	.10491
-167.53000	12.58000	101.72000	.01873	.86289	.50316	.23552
-162.00000	17.04000	85.61000	-.10684	.99425	.00000	2.27102
-162.00000	17.04000	86.62000	-.09867	.99502	.00479	2.54461
-162.00000	17.02000	87.62000	-.08650	.99570	.02417	1.50846
-162.00000	16.96000	88.64000	-.07538	.99509	.05340	1.00382
-162.00000	16.86000	89.64000	-.06973	.99364	.07613	.77616
-162.00000	16.75000	90.64000	-.06475	.99143	.09532	.57549
-162.00000	16.56000	91.64000	-.06074	.98729	.12630	.47128
-162.00000	16.40000	92.65000	-.05560	.98398	.14478	.40025
-162.00000	16.17000	93.62000	-.04925	.97640	.18060	.32252
-162.00000	15.90000	94.60000	-.04089	.97046	.20528	.29047
-162.00000	15.61000	95.56000	-.03472	.96532	.22357	.26375
-162.00000	15.30000	96.50000	-.03061	.95723	.24788	.23368
-162.00000	14.94000	97.43000	-.02311	.94471	.28271	.20837
-162.00000	14.54000	98.35000	-.01485	.92880	.32023	.18528
-162.00000	14.07000	99.25000	-.00799	.90251	.37469	.16180
-162.00000	13.54000	100.10000	.00034	.88090	.41250	.14631
-162.00000	13.00000	100.94000	.01016	.86876	.43207	.14030
-162.00000	12.41000	101.76000	.02406	.83593	.48117	.12891
-162.00000	11.75000	102.52000	.02131	.79374	.53567	.11704
-162.00000	11.05000	103.24000	.01205	.75030	.58646	.10856
-162.00000	10.30000	103.88000	-.00821	.69370	.64113	.09659
-162.00000	9.52000	104.46000	-.03712	.62681	.69943	.08918
-162.00000	8.70000	104.90000	-.07254	.55806	.73371	.07307
-162.00000	8.00000	105.31000	-.07087	.45988	.87545	.10990
-157.00000	17.40000	81.49000	-.12086	.99100	-.03850	.35414

-157.00000	17.48000	82.49000	-.11165	.99153	-.05412	.82110
-157.00000	17.54000	83.49000	-.10039	.99386	-.03465	.97902
-157.00000	17.56000	84.49000	-.09005	.99569	-.00509	1.44547
-157.00000	17.54000	85.50000	-.08576	.99583	.02195	1.42026
-157.00000	17.49000	86.50000	-.07943	.99573	.03961	1.26952
-157.00000	17.43000	87.49000	-.07107	.99550	.05243	.94292
-157.00000	17.34000	88.47000	-.06451	.99403	.07485	.70092
-157.00000	17.22000	89.46000	-.05694	.99164	.09856	.54041
-157.00000	17.06000	90.46000	-.04906	.98862	.12234	.45751
-157.00000	16.88000	91.46000	-.04309	.98500	.14347	.38476
-157.00000	16.66000	92.43000	-.03468	.97975	.17003	.32530
-157.00000	16.42000	93.40000	-.02926	.97356	.19463	.28177
-157.00000	16.12000	94.36000	-.02341	.96449	.22759	.24703
-157.00000	15.81000	95.31000	-.01707	.95926	.24370	.22890
-157.00000	15.46000	96.25000	-.00926	.94997	.27062	.20773
-157.00000	15.09000	97.17000	-.00435	.93916	.29716	.18719
-157.00000	14.66000	98.08000	.00136	.92201	.33667	.16866
-157.00000	14.20000	98.96000	.00750	.90577	.36851	.15282
-157.00000	13.69000	99.82000	.00911	.88360	.40886	.13947
-157.00000	13.14000	100.64000	.01558	.85433	.45461	.12524
-157.00000	12.52000	101.42000	.02177	.82333	.49781	.11613
-157.00000	11.88000	102.18000	.02801	.79453	.53762	.10893
-157.00000	11.22000	102.84000	.03494	.75026	.58236	.09650
-157.00000	10.47000	103.50000	.04207	.69789	.63858	.09685
-157.00000	9.66000	104.09000	.05265	.62137	.71050	.09173
-157.00000	8.86000	104.54000	.06040	.54584	.75777	.08104
-157.00000	8.00000	104.96000	.06391	.42962	.90065	1.60435
-152.27000	17.67000	77.52000	-.08827	.99391	-.03523	.23798
-152.27000	17.75000	78.52000	-.08707	.99388	-.05052	.58721
-152.27000	17.80000	79.53000	-.08936	.99479	-.03811	.88286
-152.27000	17.86000	80.52000	-.08949	.99471	-.03886	.83140
-152.27000	17.90000	81.52000	-.08909	.99542	-.02420	1.08343
-152.27000	17.92000	82.53000	-.08015	.99655	-.01424	1.62808
-152.27000	17.94000	83.54000	-.07273	.99713	-.00549	1.33112
-152.27000	17.92000	84.55000	-.06566	.99750	.01873	1.48568
-152.27000	17.86000	85.55000	-.06282	.99717	.03321	1.13895
-152.27000	17.82000	86.55000	-.06033	.99612	.05197	.75761
-152.27000	17.72000	87.55000	-.05207	.99455	.07582	.57655
-152.27000	17.60000	88.56000	-.04656	.99219	.09645	.45067
-152.27000	17.43000	89.56000	-.03975	.98838	.12471	.36588
-152.27000	17.25000	90.54000	-.03564	.98564	.13959	.31975
-152.27000	17.03000	91.52000	-.02994	.98038	.16550	.27505
-152.27000	16.78000	92.50000	-.02556	.97537	.18686	.24554

-152.27000	16.51000	93.45000	-.02001	.96944	.20792	.21595
-152.27000	16.20000	94.40000	-.01612	.96134	.23438	.19428
-152.27000	15.88000	95.34000	-.01772	.95300	.25779	.17702
-152.27000	15.48000	96.28000	-.00971	.94411	.28220	.16419
-152.27000	15.09000	97.19000	-.00234	.93585	.30089	.15092
-152.27000	14.65000	98.10000	.00372	.91718	.34136	.13607
-152.27000	14.14000	98.98000	.00819	.89431	.38516	.12211
-152.27000	13.61000	99.83000	.01451	.87810	.41134	.11341
-152.27000	13.02000	100.67000	.01986	.85252	.45195	.10645
-152.27000	12.39000	101.47000	.02249	.81794	.50041	.09673
-152.27000	11.70000	102.20000	.02915	.77439	.55140	.08780
-152.27000	10.96000	102.90000	.03578	.72305	.61712	.08248
-152.27000	10.30000	103.41000	.04726	.66779	.65051	.06578
-152.27000	9.46000	103.96000	.05917	.59215	.73420	.07412
-152.27000	8.61000	104.32000	.06903	.50899	.77833	.05624
-152.27000	8.00000	104.62000	.06609	.34636	.93569	1.29560
-148.50000	17.70000	76.80000	-.04355	.99186	-.09039	.17533
-148.50000	17.86000	77.80000	-.04204	.99105	-.11091	.49218
-148.50000	17.97000	78.79000	-.04654	.99444	-.08346	.68863
-148.50000	18.07000	79.79000	-.05205	.99560	-.06648	.72351
-148.50000	18.13000	80.80000	-.05301	.99740	-.04109	1.10968
-148.50000	18.17000	81.80000	-.05397	.99805	-.01986	1.12040
-148.50000	18.17000	82.81000	-.05253	.99853	.00283	2.10544
-148.50000	18.16000	83.81000	-.04874	.99838	.01922	1.27816
-148.50000	18.11000	84.81000	-.04586	.99795	.03917	1.38651
-148.50000	18.06000	85.81000	-.04280	.99752	.04769	1.02917
-148.50000	17.98000	86.81000	-.03804	.99487	.07950	.60800
-148.50000	17.84000	87.81000	-.03542	.99136	.11179	.52241
-148.50000	17.69000	88.81000	-.03109	.98894	.12773	.44838
-148.50000	17.50000	89.81000	-.03025	.98491	.15123	.39124
-148.50000	17.30000	90.79000	-.02710	.98157	.16754	.34399
-148.50000	17.07000	91.75000	-.02294	.97568	.19321	.29627
-148.50000	16.81000	92.70000	-.02061	.96938	.21650	.26610
-148.50000	16.51000	93.68000	-.01531	.96063	.24680	.24011
-148.50000	16.18000	94.60000	-.01462	.95667	.25770	.22035
-148.50000	15.88000	95.54000	-.01086	.94944	.27536	.19914
-148.50000	15.46000	96.46000	-.00558	.92475	.33900	.17616
-148.50000	15.02000	97.37000	-.00064	.91249	.36467	.16415
-148.50000	14.53000	98.26000	.00701	.89569	.39734	.15247
-148.50000	14.02000	99.13000	.01027	.87730	.43007	.14012
-148.50000	13.47000	99.94000	.01704	.85010	.47111	.12631
-148.50000	12.88000	100.75000	.02514	.82129	.51267	.12120
-148.50000	12.20000	101.52000	.02927	.78530	.55893	.11269

-148.50000	11.51000	102.23000	.03647	.73973	.60824	.10389
-148.50000	10.73000	102.90000	.04537	.67057	.66231	.09923
-148.50000	10.01000	103.40000	.05167	.59363	.73913	.08273
-148.50000	9.22000	103.84000	.06444	.52043	.79742	.08179
-148.50000	8.59000	104.15000	.07901	.45076	.83769	.06603
-148.50000	8.00000	104.36000	.06544	.33429	.94009	.86312
-143.50000	17.00000	75.00000	-.04276	.99433	-.06811	.21855
-143.50000	17.94000	76.00000	-.04671	.99170	-.10342	.55161
-143.50000	18.08000	77.00000	-.04406	.99272	-.09623	.57869
-143.50000	18.19000	78.00000	-.04326	.99508	-.07666	.72905
-143.50000	18.26000	79.00000	-.04139	.99669	-.05950	.89249
-143.50000	18.34000	80.00000	-.04155	.99805	-.03952	1.33812
-143.50000	18.38000	81.01000	-.03967	.99882	-.01988	1.52826
-143.50000	18.38000	82.01000	-.03876	.99919	.00489	3.54457
-143.50000	18.36000	83.01000	-.03673	.99891	.02222	1.84879
-143.50000	18.31000	84.01000	-.03685	.99808	.04227	1.26507
-143.50000	18.24000	85.00000	-.03282	.99668	.06267	.82232
-143.50000	18.13000	86.78000	-.02878	.99442	.08722	.63477
-143.50000	18.00000	87.78000	-.02850	.99226	.10390	.53848
-143.50000	17.84000	88.77000	-.02524	.98929	.12399	.45448
-143.50000	17.66000	89.76000	-.02495	.98598	.14229	.39460
-143.50000	17.45000	90.73000	-.02176	.97993	.17040	.32476
-143.50000	17.19000	91.70000	-.01860	.97336	.19782	.28720
-143.50000	16.92000	92.66000	-.01542	.96769	.21734	.25747
-143.50000	16.60000	93.60000	-.01176	.96008	.24225	.23217
-143.50000	16.29000	94.53000	-.00755	.95572	.25356	.21792
-143.50000	15.91000	95.47000	.00150	.93892	.29964	.19195
-143.50000	15.50000	96.35000	.00329	.92736	.32406	.17166
-143.50000	15.06000	97.26000	.00570	.91501	.35153	.16429
-143.50000	14.57000	98.12000	.00872	.89364	.39147	.14581
-143.50000	14.05000	98.96000	.01575	.87436	.42354	.13548
-143.50000	13.47000	99.78000	.02031	.84484	.46919	.12549
-143.50000	12.84000	100.56000	.02709	.82012	.50244	.11735
-143.50000	12.20000	101.32000	.03380	.78860	.54253	.11002
-143.50000	11.47000	102.01000	.04314	.72728	.61001	.10142
-143.50000	10.70000	102.64000	.05150	.67139	.66384	.09538
-143.50000	9.89000	103.19000	.06041	.58502	.73462	.09098
-143.50000	8.98000	103.64000	.06984	.47620	.80721	.09319
-143.50000	8.00000	104.01000	.06481	.35230	.93358	2.01327
-138.09999	17.00000	74.28000	-.04498	.98898	-.10398	.16892
-138.09999	17.99000	75.00000	-.04388	.98559	-.14322	.46026
-138.09999	18.17000	76.00000	-.04390	.98868	-.12512	.51224
-138.09999	18.30000	77.34000	-.04312	.99336	-.09292	.67973

-138.69999	18.40000	78.83000	-.04129	.99576	-.07177	.89420
-138.69999	18.48000	79.83000	-.04022	.99713	-.05584	1.13955
-138.69999	18.54000	80.84000	-.03628	.99639	-.03520	1.30624
-138.69999	18.56000	81.84000	-.03429	.99929	-.00732	2.43718
-138.69999	18.55000	82.83000	-.03321	.99930	.01327	3.09284
-138.69999	18.52000	83.82000	-.03121	.99895	.02840	2.06363
-138.69999	18.47000	84.84000	-.02723	.99792	.04884	1.13707
-138.69999	18.38000	85.84000	-.02615	.99570	.07724	.82611
-138.69999	18.26000	86.84000	-.02530	.99337	.09833	.66700
-138.69999	18.12000	87.82000	-.02216	.99032	.11950	.53551
-138.69999	17.94000	88.81000	-.02015	.98682	.14112	.47263
-138.69999	17.75000	89.80000	-.01533	.98363	.15721	.41802
-138.69999	17.52000	90.78000	-.01372	.97704	.18692	.35494
-138.69999	17.26000	91.74000	-.01056	.97044	.21152	.31205
-138.69999	16.96000	92.72000	-.00766	.96283	.23780	.28601
-138.69999	16.63000	93.68000	-.00601	.95223	.26877	.25041
-138.69999	16.25000	94.62000	-.00179	.94135	.29787	.22803
-138.69999	15.86000	95.55000	.00475	.93301	.31785	.21229
-138.69999	15.45000	96.45000	.00700	.91926	.34823	.19293
-138.69999	14.98000	97.33000	.01185	.90500	.37589	.17791
-138.69999	14.47000	98.20000	.01384	.88009	.42141	.16295
-138.69999	13.91000	99.03000	.01973	.85456	.46152	.14951
-138.69999	13.31000	99.84000	.02329	.82682	.50181	.13961
-138.69999	12.66000	100.60000	.02907	.79120	.54615	.12935
-138.69999	11.95000	101.34000	.03604	.74665	.59869	.12345
-138.69999	11.19000	102.00000	.04565	.68852	.65557	.11406
-138.69999	10.38000	102.60000	.05517	.61574	.72331	.10866
-138.69999	9.60000	103.05000	.06410	.51929	.79105	.09576
-138.69999	8.82000	103.39000	.07165	.43144	.83901	.09139
-138.69999	8.00000	103.68000	.06633	.33247	.94070	1.67109
-132.99999	17.84000	73.81000	-.05307	.98340	-.12465	.14753
-132.99999	18.08000	74.78000	-.04777	.97993	-.16699	.40282
-132.99999	18.26000	75.76000	-.04508	.98829	-.12568	.53727
-132.99999	18.40000	76.76000	-.04126	.99211	-.10303	.68511
-132.99999	18.53000	77.75000	-.03689	.99392	-.08843	.74363
-132.99999	18.62000	78.74000	-.03751	.99645	-.06528	1.05738
-132.99999	18.70000	79.75000	-.03338	.99781	-.04458	1.04079
-132.99999	18.72000	80.76000	-.03029	.99939	-.01504	4.60218
-132.99999	18.74000	81.76000	-.02913	.99946	-.00743	2.78829
-132.99999	18.73000	82.76000	-.02605	.99942	.01525	2.44909
-132.99999	18.69000	83.76000	-.02273	.99829	.04300	1.22964
-132.99999	18.60000	84.76000	-.02042	.99696	.06531	1.06959
-132.99999	18.52000	85.76000	-.01846	.99639	.07051	.92546

-132.99999	18.40000	86.76000	-.01592	.99299	.10082	.67041
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-132.99999	18.08000	88.74000	-.01132	.98511	.14824	.46440
-132.99999	17.93000	89.73000	-.00846	.98021	.17225	.41412
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-132.99999	17.71000	91.68000	-.00217	.96660	.22345	.31589
-132.99999	17.61000	92.64000	-.00024	.96170	.23884	.29543
-132.99999	17.67000	93.59000	.00193	.95302	.26453	.26907
-132.99999	16.51000	94.53000	.00445	.93988	.29753	.23621
-132.99999	15.87000	95.44000	.00996	.92159	.33966	.21153
-132.99999	15.42000	96.35000	.01221	.91383	.35677	.20231
-132.99999	14.95000	97.21000	.01715	.89919	.38289	.18363
-132.99999	14.43000	98.08000	.02133	.87630	.42386	.17204
-132.99999	13.85000	98.90000	.02536	.84775	.46702	.15652
-132.99999	13.23000	99.71000	.03155	.81466	.52192	.14368
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-132.99999	11.21000	101.66000	.05278	.67299	.66500	.11942
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-127.00000	18.31000	74.60000	-.04262	.98633	-.13769	.50739
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-127.00000	18.73000	77.59000	-.03161	.99548	-.07715	.89584
-127.00000	18.82000	78.59000	-.02821	.99738	-.05458	1.01711
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-127.00000	18.32000	87.60000	-.00412	.98857	.12981	.53325
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-127.00000	17.64000	90.55000	.00442	.97210	.20358	.34396
-127.00000	17.36000	91.50000	.00518	.96716	.22027	.31728
-127.00000	17.05000	92.46000	.00745	.96024	.24259	.29306

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-127.00000	14.94000	97.01000	.02296	.89213	.39479	.18442
-127.00000	14.40000	97.87000	.02845	.86985	.43234	.17009
-127.00000	13.81000	98.69000	.03228	.83829	.48016	.15397
-127.00000	13.18000	99.45000	.03899	.80598	.52120	.14042
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-127.00000	11.77000	100.87000	.05038	.71191	.62637	.12400
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-127.00000	10.12000	102.02000	.06122	.57151	.75873	.11295
-127.00000	9.49000	102.35000	.07049	.48826	.80395	.08125
-127.00000	8.84000	102.60000	.08135	.40103	.84138	.08224
-127.00000	8.00000	102.86000	.06597	.29486	.95320	2.06973
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-121.00000	18.16000	72.49000	-.04405	.97819	-.17468	.39252
-121.00000	18.36000	73.48000	-.03838	.98515	-.14502	.48637
-121.00000	18.54000	74.46000	-.03479	.98859	-.12610	.53755
-121.00000	18.68000	75.44000	-.02900	.99305	-.09780	.68527
-121.00000	18.79000	76.44000	-.02506	.99566	-.07716	.89141
-121.00000	18.88000	77.44000	-.02111	.99730	-.05984	1.08347
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-121.00000	18.98000	81.46000	-.00677	.99974	.01492	2.49201
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-121.00000	18.87000	83.46000	-.00203	.99774	.05737	1.15946
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-121.00000	15.38000	95.93000	.03095	.90593	.36946	.19926
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-121.00000	13.72000	98.47000	.04118	.83082	.48903	.15152
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-121.00000	12.35000	99.97000	.04921	.74919	.59311	.13041
-121.00000	11.68000	100.56000	.05857	.69936	.63234	.11127
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-121.00000	8.00000	102.44000	.06838	.29321	.95353	1.81874
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-115.00000	18.52000	73.27000	-.02469	.98840	-.12914	.53521
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-109.00000	11.87000	99.45000	.09290	.71693	.63051	.12173
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-109.00000	10.87000	100.72000	.10732	.55593	.75214	.08060
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-103.00000	12.77000	97.77000	.12597	.79990	.51147	.12275
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-98.00000	18.38000	81.08000	.06180	.99520	.06501	.86239
-98.00000	18.28000	82.07000	.06595	.99279	.08524	.64465
-98.00000	18.14000	83.06000	.06941	.98994	.10642	.54572
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-98.00000	17.38000	87.04000	.08329	.97447	.18083	.32642
-98.00000	17.12000	87.99000	.08666	.96858	.20179	.28728
-98.00000	16.84000	88.96000	.09076	.96386	.21724	.27276
-98.00000	16.53000	89.92000	.09439	.95675	.23919	.24832
-98.00000	16.20000	90.86000	.09976	.94610	.26672	.21915
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-98.00000	14.42000	94.52000	.11906	.88272	.39824	.15503
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-98.00000	13.45000	96.02000	.13801	.84545	.45222	.10621
-98.00000	12.93000	96.66000	.14871	.76260	.56462	.08774
-98.00000	12.59000	97.06000	.14959	.75519	.52681	.07542
-98.00000	11.74000	97.90000	.15727	.77424	.54796	.11896
-98.00000	11.03000	98.48000	.17110	.66413	.65780	.09215
-98.00000	10.37000	98.95000	.18346	.59644	.71282	.07906
-98.00000	9.73000	99.30000	.19893	.51574	.76171	.06933
-98.00000	9.09000	99.60000	.20953	.43314	.81767	.06847
-98.00000	8.52000	99.79000	.22040	.32374	.86678	.06055
-98.00000	8.00000	99.91000	.18492	.22068	.95721	.31621
-93.00000	17.52000	66.08000	.00653	.99188	-.09376	.19638
-93.00000	17.69000	67.06000	.01040	.98944	-.12648	.53451
-93.00000	17.84000	68.05000	.01523	.99191	-.11011	.61483
-93.00000	17.97000	69.05000	.02196	.99393	-.09395	.71595
-93.00000	18.08000	70.06000	.03106	.99519	-.08147	.85209
-93.00000	18.18000	71.06000	.03492	.99623	-.06849	.92868
-93.00000	18.25000	72.07000	.04153	.99722	-.05394	1.23151
-93.00000	18.32000	73.06000	.04544	.99745	-.04602	1.19432

-93.00000	18.36000	74.06000	.05136	.99821	-.02257	1.68323
-93.00000	18.37000	75.07000	.05536	.99837	-.00226	2.56224
-93.00000	18.36000	76.07000	.06099	.99802	.01049	3.16284
-93.00000	18.34000	77.06000	.06491	.99725	.02642	1.49081
-93.00000	18.28000	78.06000	.06964	.99615	.04619	1.40224
-93.00000	18.22000	79.06000	.07339	.99530	.05375	1.13237
-93.00000	18.13000	80.08000	.07634	.99375	.07111	.95738
-93.00000	18.03000	81.08000	.08110	.99199	.08393	.79069
-93.00000	17.90000	82.10000	.08567	.98884	.10636	.64722
-93.00000	17.74000	83.10000	.08913	.98602	.12376	.56299
-93.00000	17.58000	84.07000	.09431	.98342	.13502	.49453
-93.00000	17.38000	85.06000	.09721	.97880	.15819	.44191
-93.00000	17.16000	86.05000	.10275	.97403	.17710	.39400
-93.00000	16.91000	87.02000	.10758	.96678	.20341	.34133
-93.00000	16.62000	87.99000	.11234	.95976	.22676	.31193
-93.00000	16.32000	88.94000	.11825	.95439	.24111	.28953
-93.00000	15.99000	89.89000	.12542	.94347	.26950	.26060
-93.00000	15.60000	90.84000	.13214	.93027	.30255	.23984
-93.00000	15.20000	91.76000	.13816	.91833	.32748	.21611
-93.00000	14.75000	92.65000	.14781	.90061	.36088	.19771
-93.00000	14.26000	93.55000	.15782	.88071	.39662	.18432
-93.00000	13.73000	94.38000	.16883	.85186	.43977	.16279
-93.00000	13.14000	95.20000	.17981	.81851	.49348	.14928
-93.00000	12.53000	95.82000	.18821	.79132	.51316	.11951
-93.00000	11.96000	96.55000	.18949	.74545	.58079	.12838
-93.00000	11.36000	97.10000	.22026	.68964	.62336	.10243
-93.00000	10.72000	97.60000	.23669	.62747	.67480	.09780
-93.00000	10.04000	98.04000	.25449	.54650	.73281	.09480
-93.00000	9.32000	98.40000	.26780	.44751	.79739	.09263
-93.00000	8.68000	98.64000	.28832	.34716	.83559	.08177
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-87.00000	17.76000	68.91000	.04535	.99611	-.06442	1.01785
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-87.00000	17.50000	80.91000	.10829	.98699	.10167	.65644
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-87.00000	17.17000	82.91000	.11917	.97962	.13924	.49373
-87.00000	16.97000	83.88000	.12632	.97601	.15266	.44605
-87.00000	16.76000	84.86000	.13289	.97143	.16851	.40157
-87.00000	16.50000	85.84000	.14124	.96315	.19757	.35405
-87.00000	16.22000	86.81000	.14883	.95603	.21796	.31961
-87.00000	15.90000	87.77000	.15638	.94658	.24412	.28834
-87.00000	15.56000	88.71000	.16631	.93657	.26652	.26197
-87.00000	15.17000	89.65000	.17854	.92319	.29532	.24256
-87.00000	14.76000	90.57000	.19154	.90946	.31981	.22109
-87.00000	14.30000	91.47000	.19816	.88837	.36090	.20003
-87.00000	13.79000	92.33000	.21175	.86267	.40089	.18070
-87.00000	13.23000	93.17000	.23620	.83119	.44109	.16714
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-87.00000	11.95000	94.72000	.27269	.74600	.54537	.14072
-87.00000	11.36000	95.28000	.28560	.69218	.59096	.10827
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-87.00000	9.97000	96.28000	.33783	.54389	.70639	.11079
-87.00000	9.36000	96.60000	.36547	.45611	.73651	.08604
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-81.00000	16.09000	83.77000	.20271	.95265	.19270	.35154
-81.00000	15.82000	84.72000	.21683	.94300	.21434	.31610
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-81.00000	13.35000	90.26000	.32742	.82417	.40064	.18943
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-70.00000	15.56000	74.61000	.26295	.94908	.14504	.33985
-70.00000	15.33000	75.60000	.27249	.94140	.17114	.32778
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-70.00000	13.76000	80.17000	.42369	.83722	.29834	.19972
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-70.00000	10.45000	84.47000	.63369	.51519	.51336	.10957
-70.00000	9.81000	84.91000	.67360	.43407	.52872	.12408
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-65.00000	15.64000	62.67000	.12617	.99156	-.00997	.96654
-65.00000	15.64000	63.67000	.13986	.98977	.00424	.99648
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-65.00000	15.32000	68.69000	.21112	.97110	.08918	.42355
-65.00000	15.18000	69.66000	.22126	.96690	.10447	.39992
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-65.00000	14.80000	71.65000	.25944	.94766	.15492	.28506
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-57.00000	13.68000	65.45000	.23613	.97073	-.00009	.02869
-57.00000	13.63000	65.73000	.23495	.96759	.03861	.05504
-57.00000	13.59000	66.70000	.35589	.90542	.18296	.09570
-57.00000	13.29000	67.66000	.35883	.89285	.23026	.09708
-57.00000	12.91000	68.60000	.37852	.86647	.28255	.08951
-57.00000	12.47000	69.50000	.42944	.81913	.33144	.07772
-57.00000	11.95000	70.33000	.49107	.74666	.39200	.06747
-57.00000	11.31000	71.10000	.55237	.65839	.45179	.06402
-57.00000	10.60000	71.78000	.62622	.55528	.48154	.06153
-57.00000	9.80000	72.38000	.66526	.46324	.51799	.06086
-57.00000	8.94000	72.88000	.69480	.38098	.53904	.06047
-57.00000	8.00000	73.32000	.65291	.32090	.68592	.76876
-55.00000	12.20000	68.05000	.48229	.87493	-.00031	.04803
-55.00000	11.90000	68.47000	.45663	.82179	.20523	.01685
-55.00000	11.47000	69.25000	.55443	.67717	.40599	.03992
-55.00000	10.57000	69.91000	.62202	.57685	.44103	.03679
-55.00000	9.78000	70.51000	.66554	.48581	.47414	.03650
-55.00000	8.90000	71.02000	.70182	.38932	.50483	.03683
-55.00000	8.00000	71.42000	.65144	.30796	.69317	.49396
-54.00000	10.18000	69.32000	.77950	.62347	-.00091	.01499
-54.00000	9.80000	69.58000	.71245	.53616	.27469	.00595
-54.00000	8.93000	70.06000	.75063	.39676	.38313	.00961
-54.00000	8.00000	70.48000	.65341	.31138	.68973	.21933
-55.00000	8.00000	70.00000	.46895	.51005	.00102	.00000

X	Y	Z	XN	YN	ZN	A
-73.00000	.00000	88.58000	.68977	.00000	.72403	453.02071
-74.00000	.00000	89.53000	.68747	.00000	.72620	21.37511
-74.50000	.00000	90.00000	.57845	.00000	.81472	6.72945
-81.00000	.00000	94.50000	.48817	.00000	.86678	3.50271
-87.00000	.00000	97.04000	.33819	.00000	.93941	5.63053
-93.00000	.00000	98.82000	.25229	.00000	.96696	7.68244
-96.00000	.00000	99.91000	.18945	.00000	.98160	10.43519
-103.00000	.00000	100.75000	.14303	.00000	.98950	13.12666
-109.00000	.00000	101.50000	.10356	.00000	.99441	14.45457
-115.00000	.00000	102.00000	.08085	.00000	.99672	74.41462
-118.00000	.00000	102.23000	.07479	.00000	.99720	37.76113
-119.00000	.00000	102.30000	.06983	.00000	.99756	385.74158

SURFACE X,Y,Z LISTING

NUM	X	Y	Z	NUM	X	Y	Z	NUM	X	Y	Z	NUM	X	Y	Z
1	-169.500	14.350	98.300	2	-169.500	14.040	99.070	3	-169.500	13.600	100.000	4	-167.330	16.430	90.080
5	-167.330	16.300	91.070	6	-167.330	16.140	92.060	7	-167.330	15.950	93.040	8	-167.330	15.740	94.020
9	-167.330	15.500	95.000	10	-167.330	15.230	95.970	11	-167.330	14.940	96.920	12	-167.330	14.600	97.860
13	-167.330	14.200	98.800	14	-167.330	13.770	99.700	15	-167.330	13.280	100.570	16	-167.330	12.900	101.170
17	-167.330	12.580	101.720	18	-162.000	17.040	85.610	19	-162.000	17.040	86.620	20	-162.000	17.020	87.620
21	-162.000	16.960	88.640	22	-162.000	16.860	89.640	23	-162.000	16.750	90.640	24	-162.000	16.580	91.640
25	-162.000	16.400	92.630	26	-162.000	16.170	93.620	27	-162.000	15.900	94.600	28	-162.000	15.610	95.560
29	-162.000	15.300	96.500	30	-162.000	14.940	97.430	31	-162.000	14.540	98.350	32	-162.000	14.070	99.250
33	-162.000	13.540	100.100	34	-162.000	13.000	100.940	35	-162.000	12.410	101.760	36	-162.000	11.750	102.520
37	-162.000	11.050	103.240	38	-162.000	10.300	103.880	39	-162.000	9.520	104.460	40	-162.000	8.780	104.900
41	-162.000	8.000	105.310	42	-157.000	17.400	81.490	43	-157.000	17.480	82.490	44	-157.000	17.540	83.490
45	-157.000	17.560	84.490	46	-157.000	17.540	85.500	47	-157.000	17.490	86.500	48	-157.000	17.430	87.490
49	-157.000	17.340	88.470	50	-157.000	17.220	89.450	51	-157.000	17.060	90.460	52	-157.000	16.880	91.460
53	-157.000	16.660	92.430	54	-157.000	16.420	93.400	55	-157.000	16.120	94.360	56	-157.000	15.810	95.310
57	-157.000	15.460	96.250	58	-157.000	15.050	97.170	59	-157.000	14.660	98.060	60	-157.000	14.200	98.960
61	-157.000	13.690	99.820	62	-157.000	13.140	100.640	63	-157.000	12.520	101.420	64	-157.000	11.880	102.180
65	-157.000	11.220	102.840	66	-157.000	10.470	103.500	67	-157.000	9.660	104.090	68	-157.000	8.880	104.540
69	-157.000	8.000	104.960	70	-152.270	17.670	77.520	71	-152.270	17.750	78.520	72	-152.270	17.800	79.530
73	-152.270	17.860	80.520	74	-152.270	17.900	81.520	75	-152.270	17.920	82.530	76	-152.270	17.940	83.540
77	-152.270	17.920	84.550	78	-152.270	17.880	85.550	79	-152.270	17.820	86.550	80	-152.270	17.720	87.550
81	-152.270	17.600	88.560	82	-152.270	17.430	89.560	83	-152.270	17.250	90.540	84	-152.270	17.030	91.520
85	-152.270	16.780	92.500	86	-152.270	16.510	93.450	87	-152.270	16.200	94.400	88	-152.270	15.860	95.340
89	-152.270	15.480	96.280	90	-152.270	15.090	97.190	91	-152.270	14.650	98.100	92	-152.270	14.140	98.980
93	-152.270	13.610	99.830	94	-152.270	13.020	100.670	95	-152.270	12.390	101.470	96	-152.270	11.700	102.200
97	-152.270	10.960	102.900	98	-152.270	10.300	103.410	99	-152.270	9.460	103.960	100	-152.270	8.810	104.320
101	-152.270	8.000	104.620	102	-148.500	17.700	76.800	103	-148.500	17.860	77.800	104	-148.500	17.970	78.790
105	-148.500	18.070	79.790	106	-148.500	18.130	80.800	107	-148.500	18.170	81.800	108	-148.500	18.170	82.810
109	-148.500	18.160	83.810	110	-148.500	18.110	84.810	111	-148.500	18.060	85.810	112	-148.500	17.980	86.810
113	-148.500	17.840	87.810	114	-148.500	17.690	88.810	115	-148.500	17.500	89.810	116	-148.500	17.300	90.790
117	-148.500	17.070	91.750	118	-148.500	16.810	92.700	119	-148.500	16.510	93.640	120	-148.500	16.180	94.600
121	-148.500	15.880	95.540	122	-148.500	15.460	96.460	123	-148.500	15.020	97.370	124	-148.500	14.530	98.260
125	-148.500	14.020	99.130	126	-148.500	13.470	99.940	127	-148.500	12.860	100.750	128	-148.500	12.200	101.520
129	-148.500	11.510	102.230	130	-148.500	10.730	102.900	131	-148.500	10.010	103.400	132	-148.500	9.220	103.840
133	-148.500	8.590	104.150	134	-148.500	8.000	104.360	135	-143.500	17.800	75.800	136	-143.500	17.940	76.800
137	-143.500	18.080	77.800	138	-143.500	18.190	78.800	139	-143.500	18.280	79.800	140	-143.500	18.340	80.800
141	-143.500	18.380	81.810	142	-143.500	18.380	82.810	143	-143.500	18.360	83.810	144	-143.500	18.310	84.810
145	-143.500	18.240	85.800	146	-143.500	18.130	86.780	147	-143.500	18.000	87.790	148	-143.500	17.840	88.770
149	-143.500	17.660	89.760	150	-143.500	17.450	90.730	151	-143.500	17.190	91.700	152	-143.500	16.920	92.660
153	-143.500	16.600	93.600	154	-143.500	16.290	94.530	155	-143.500	15.910	95.470	156	-143.500	15.500	96.350
157	-143.500	15.060	97.260	158	-143.500	14.570	98.120	159	-143.500	14.050	98.960	160	-143.500	13.470	99.780

NUM	X	Y	Z	NUM	X	Y	Z	NUM	X	Y	Z	NUM	X	Y	Z
161	-143.500	12.840	100.500	162	-143.500	12.200	101.320	163	-143.500	11.470	102.010	164	-143.500	10.700	102.640
165	-143.500	9.890	103.190	166	-143.500	8.980	103.640	167	-143.500	8.000	104.010	168	-138.700	17.800	74.880
169	-138.700	17.990	75.800	170	-138.700	18.170	76.860	171	-138.700	18.300	77.840	172	-138.700	18.400	78.830
173	-138.700	18.480	79.830	174	-138.700	18.540	80.840	175	-138.700	18.560	81.840	176	-138.700	18.550	82.830
177	-138.700	18.520	83.820	178	-138.700	18.470	84.840	179	-138.700	18.380	85.840	180	-138.700	18.260	86.840
181	-138.700	18.120	87.820	182	-138.700	17.940	88.810	183	-138.700	17.750	89.800	184	-138.700	17.520	90.780
185	-138.700	17.260	91.740	186	-138.700	16.960	92.720	187	-138.700	16.630	93.690	188	-138.700	16.250	94.620
189	-138.700	15.860	95.550	190	-138.700	15.430	96.450	191	-138.700	14.980	97.330	192	-138.700	14.470	98.200
193	-138.700	13.910	99.050	194	-138.700	13.310	99.840	195	-138.700	12.660	100.600	196	-138.700	11.950	101.340
197	-138.700	11.190	102.000	198	-138.700	10.380	102.600	199	-138.700	9.600	103.050	200	-138.700	8.820	103.390
201	-138.700	8.000	103.680	202	-133.000	17.840	73.810	203	-133.000	18.080	74.780	204	-133.000	18.260	75.760
205	-133.000	18.400	76.760	206	-133.000	18.530	77.750	207	-133.000	18.620	78.740	208	-133.000	18.700	79.750
209	-133.000	18.720	80.760	210	-133.000	18.740	81.760	211	-133.000	18.730	82.760	212	-133.000	18.690	83.760
213	-133.000	18.600	84.760	214	-133.000	18.520	85.760	215	-133.000	18.400	86.760	216	-133.000	18.240	87.750
217	-133.000	18.060	88.740	218	-133.000	17.830	89.730	219	-133.000	17.600	90.720	220	-133.000	17.310	91.680
221	-133.000	17.010	92.640	222	-133.000	16.670	93.590	223	-133.000	16.310	94.530	224	-133.000	15.870	95.440
225	-133.000	15.420	96.350	226	-133.000	14.950	97.210	227	-133.000	14.430	98.020	228	-133.000	13.850	98.900
229	-133.000	13.230	99.710	230	-133.000	12.690	100.300	231	-133.000	11.980	101.020	232	-133.000	11.210	101.660
233	-133.000	10.380	102.230	234	-133.000	9.680	102.640	235	-133.000	8.760	103.040	236	-133.000	8.000	103.270
237	-127.000	17.880	72.640	238	-127.000	18.120	73.620	239	-127.000	18.310	74.600	240	-127.000	18.480	75.590
241	-127.000	18.620	76.590	242	-127.000	18.730	77.590	243	-127.000	18.820	78.590	244	-127.000	18.860	79.600
245	-127.000	18.890	80.610	246	-127.000	18.900	81.630	247	-127.000	18.860	82.620	248	-127.000	18.800	83.610
249	-127.000	18.730	84.600	250	-127.000	18.620	85.610	251	-127.000	18.480	86.610	252	-127.000	18.320	87.600
253	-127.000	18.120	88.590	254	-127.000	17.900	89.590	255	-127.000	17.640	90.550	256	-127.000	17.360	91.500
257	-127.000	17.050	92.480	258	-127.000	16.710	93.400	259	-127.000	16.320	94.330	260	-127.000	15.890	95.230
261	-127.000	15.440	96.130	262	-127.000	14.940	97.010	263	-127.000	14.400	97.870	264	-127.000	13.810	98.690
265	-127.000	13.180	99.450	266	-127.000	12.500	100.190	267	-127.000	11.770	100.870	268	-127.000	10.960	101.480
269	-127.000	10.120	102.020	270	-127.000	9.490	102.350	271	-127.000	8.840	102.600	272	-127.000	8.000	102.860
273	-121.000	17.910	71.520	274	-121.000	18.160	72.490	275	-121.000	18.360	73.480	276	-121.000	18.540	74.460
277	-121.000	18.680	75.440	278	-121.000	18.790	76.440	279	-121.000	18.880	77.440	280	-121.000	18.940	78.440
281	-121.000	18.970	79.440	282	-121.000	18.990	80.450	283	-121.000	18.980	81.460	284	-121.000	18.940	82.460
285	-121.000	18.870	83.460	286	-121.000	18.780	84.460	287	-121.000	18.660	85.450	288	-121.000	18.520	86.440
289	-121.000	18.350	87.420	290	-121.000	18.140	88.400	291	-121.000	17.920	89.380	292	-121.000	17.650	90.350
293	-121.000	17.360	91.310	294	-121.000	17.040	92.280	295	-121.000	16.690	93.190	296	-121.000	16.290	94.100
297	-121.000	15.860	95.020	298	-121.000	15.380	95.930	299	-121.000	14.880	96.810	300	-121.000	14.320	97.660
301	-121.000	13.720	98.470	302	-121.000	13.060	99.240	303	-121.000	12.350	99.970	304	-121.000	11.680	100.560
305	-121.000	10.850	101.170	306	-121.000	9.990	101.700	307	-121.000	9.360	102.000	308	-121.000	8.780	102.200
309	-121.000	8.000	102.440	310	-115.000	17.900	70.320	311	-115.000	18.150	71.300	312	-115.000	18.340	72.290
313	-115.000	18.520	73.270	314	-115.000	18.680	74.280	315	-115.000	18.790	75.270	316	-115.000	18.890	76.270
317	-115.000	18.960	77.270	318	-115.000	19.000	78.270	319	-115.000	19.020	79.260	320	-115.000	19.020	80.290

NUM	X	Y	Z	NUM	X	Y	Z	NUM	X	Y	Z	NUM	X	Y	Z
321	-115.000	16.990	81.280	322	-115.000	18.930	82.280	323	-115.000	18.850	83.290	324	-115.000	18.740	84.290
325	-115.000	18.610	85.230	326	-115.000	18.460	86.270	327	-115.000	18.280	87.270	328	-115.000	18.070	88.250
329	-115.000	17.820	89.220	330	-115.000	17.560	90.190	331	-115.000	17.270	91.150	332	-115.000	16.930	92.090
333	-115.000	16.570	93.010	334	-115.000	16.170	93.930	335	-115.000	15.730	94.850	336	-115.000	15.260	95.710
337	-115.000	14.750	96.590	338	-115.000	14.190	97.420	339	-115.000	13.590	98.220	340	-115.000	12.920	98.990
341	-115.000	12.360	99.570	342	-115.000	11.590	100.210	343	-115.000	10.780	100.810	344	-115.000	9.900	101.330
345	-115.000	8.970	101.730	346	-115.000	8.000	102.000	347	-109.000	17.880	69.160	348	-109.000	18.100	70.160
349	-109.000	18.290	71.140	350	-109.000	18.460	72.120	351	-109.000	18.600	73.190	352	-109.000	18.730	74.110
353	-109.000	18.820	75.110	354	-109.000	18.880	76.090	355	-109.000	18.930	77.090	356	-109.000	18.940	78.090
357	-109.000	18.940	79.100	358	-109.000	18.920	80.110	359	-109.000	18.870	81.110	360	-109.000	18.800	82.120
361	-109.000	18.710	83.110	362	-109.000	18.590	84.110	363	-109.000	18.440	85.100	364	-109.000	18.280	86.100
365	-109.000	18.080	87.090	366	-109.000	17.860	88.070	367	-109.000	17.600	89.040	368	-109.000	17.340	90.020
369	-109.000	17.020	90.970	370	-109.000	16.680	91.920	371	-109.000	16.320	92.850	372	-109.000	15.890	93.770
373	-109.000	15.440	94.670	374	-109.000	14.970	95.550	375	-109.000	14.450	96.370	376	-109.000	13.880	97.230
377	-109.000	13.250	98.030	378	-109.000	12.550	[illegible]	379	-109.000	11.870	99.450	380	-109.000	11.320	99.890
381	-109.000	10.670	100.350	382	-109.000	10.070	100.720	383	-109.000	9.430	101.070	384	-109.000	8.670	101.320
385	-109.000	8.000	101.500	386	-103.000	17.800	68.020	387	-103.000	17.980	68.990	388	-103.000	18.180	69.980
389	-103.000	18.340	70.900	390	-103.000	18.460	71.950	391	-103.000	18.600	72.960	392	-103.000	18.660	73.950
393	-103.000	18.730	74.950	394	-103.000	18.780	75.960	395	-103.000	18.790	76.960	396	-103.000	18.790	77.970
397	-103.000	18.760	78.980	398	-103.000	18.720	80.000	399	-103.000	18.660	80.990	400	-103.000	18.580	81.970
401	-103.000	18.460	82.970	402	-103.000	18.320	83.970	403	-103.000	18.160	84.970	404	-103.000	17.980	85.960
405	-103.000	17.790	86.920	406	-103.000	17.540	87.900	407	-103.000	17.280	88.880	408	-103.000	16.990	89.850
409	-103.000	16.670	90.800	410	-103.000	16.310	91.740	411	-103.000	15.930	92.660	412	-103.000	15.500	93.580
413	-103.000	15.030	94.490	414	-103.000	14.550	[illegible]	415	-103.000	14.000	96.190	416	-103.000	13.400	97.000
417	-103.000	12.770	97.770	418	-103.000	12.060	98.490	419	-103.000	11.300	99.190	420	-103.000	10.500	99.690
421	-103.000	9.790	100.120	422	-103.000	9.270	100.350	423	-103.000	8.690	100.560	424	-103.000	8.000	100.750
425	-98.000	17.680	67.000	426	-98.000	17.860	68.060	427	-98.000	18.020	69.050	428	-98.000	18.200	70.080
429	-98.000	18.310	71.080	430	-98.000	18.410	72.080	431	-98.000	18.490	73.070	432	-98.000	18.560	74.070
433	-98.000	18.590	75.070	434	-98.000	18.620	76.070	435	-98.000	18.610	77.070	436	-98.000	18.580	78.070
437	-98.000	18.530	79.070	438	-98.000	18.460	80.080	439	-98.000	18.380	81.080	440	-98.000	18.280	82.070
441	-98.000	18.140	83.000	442	-98.000	17.990	84.070	443	-98.000	17.810	85.060	444	-98.000	17.610	86.050
445	-98.000	17.380	87.040	446	-98.000	17.120	87.990	447	-98.000	16.840	88.960	448	-98.000	16.530	89.920
449	-98.000	16.200	90.800	450	-98.000	15.800	91.800	451	-98.000	15.380	92.740	452	-98.000	14.930	93.630
453	-98.000	14.420	94.520	454	-98.000	13.870	95.370	455	-98.000	13.430	96.070	456	-98.000	12.930	96.660
457	-98.000	12.390	97.060	458	-98.000	11.740	97.900	459	-98.000	11.030	98.480	460	-98.000	10.370	98.950
461	-98.000	9.730	99.300	462	-98.000	9.090	99.600	463	-98.000	8.520	99.790	464	-98.000	8.000	99.910
465	-93.000	17.520	66.060	466	-93.000	17.690	67.060	467	-93.000	17.840	68.050	468	-93.000	17.970	69.050
469	-93.000	18.080	70.060	470	-93.000	18.180	71.060	471	-93.000	18.250	72.070	472	-93.000	18.320	73.060
473	-93.000	18.360	74.060	474	-93.000	18.370	75.070	475	-93.000	18.360	76.070	476	-93.000	18.340	77.060
477	-93.000	18.280	78.060	478	-93.000	18.220	79.060	479	-93.000	18.130	80.090	480	-93.000	18.030	81.080

NUM	X	Y	Z	NUM	X	Y	Z	NUM	X	Y	Z	NUM	X	Y	Z
481	-93.000	17.900	82.100	482	-93.000	17.740	83.100	483	-93.000	17.580	84.070	484	-93.000	17.380	85.060
485	-93.000	17.160	86.050	486	-93.000	16.910	87.020	487	-93.000	16.620	87.990	488	-93.000	16.320	88.940
489	-93.000	15.990	89.890	490	-93.000	15.600	90.840	491	-93.000	15.200	91.760	492	-93.000	14.750	92.650
493	-93.000	14.260	93.550	494	-93.000	13.730	94.380	495	-93.000	13.140	95.200	496	-93.000	12.630	95.820
497	-93.000	11.960	96.550	498	-93.000	11.360	97.100	499	-93.000	10.720	97.600	500	-93.000	10.040	98.040
501	-93.000	9.320	98.400	502	-93.000	8.680	98.640	503	-93.000	8.000	98.820	504	-87.000	17.260	64.930
505	-87.000	17.410	85.920	506	-87.000	17.540	66.910	507	-87.000	17.670	67.910	508	-87.000	17.760	68.910
509	-87.000	17.840	89.920	510	-87.000	17.910	70.910	511	-87.000	17.940	71.910	512	-87.000	17.980	72.910
513	-87.000	17.990	73.910	514	-87.000	17.980	74.920	515	-87.000	17.950	75.920	516	-87.000	17.900	76.920
517	-87.000	17.820	77.920	518	-87.000	17.730	78.920	519	-87.000	17.630	79.920	520	-87.000	17.500	80.910
521	-87.000	17.350	81.910	522	-87.000	17.170	82.910	523	-87.000	16.970	83.880	524	-87.000	16.760	84.860
525	-87.000	16.500	85.840	526	-87.000	16.220	86.810	527	-87.000	15.900	87.770	528	-87.000	15.560	88.710
529	-87.000	15.170	89.650	530	-87.000	14.760	90.570	531	-87.000	14.300	91.470	532	-87.000	13.790	92.330
533	-87.000	13.230	93.170	534	-87.000	12.620	93.960	535	-87.000	11.950	94.720	536	-87.000	11.360	95.280
537	-87.000	10.730	95.780	538	-87.000	9.970	96.280	539	-87.000	9.360	96.600	540	-87.000	8.610	96.890
541	-87.000	8.000	97.040	542	-81.000	16.940	63.780	543	-81.000	17.060	64.780	544	-81.000	17.180	65.770
545	-81.000	17.260	66.770	546	-81.000	17.350	67.770	547	-81.000	17.400	68.770	548	-81.000	17.450	69.770
549	-81.000	17.480	70.760	550	-81.000	17.500	71.790	551	-81.000	17.500	72.800	552	-81.000	17.470	73.800
553	-81.000	17.430	74.800	554	-81.000	17.370	75.810	555	-81.000	17.280	76.810	556	-81.000	17.140	77.810
557	-81.000	17.060	78.820	558	-81.000	16.900	79.810	559	-81.000	16.750	80.820	560	-81.000	16.550	81.810
561	-81.000	16.340	82.790	562	-81.000	16.090	83.770	563	-81.000	15.820	84.770	564	-81.000	15.500	85.690
565	-81.000	15.160	86.640	566	-81.000	14.780	87.580	567	-81.000	14.360	88.500	568	-81.000	13.880	89.490
569	-81.000	13.350	90.200	570	-81.000	12.780	91.100	571	-81.000	12.300	91.620	572	-81.000	11.740	92.310
573	-81.000	11.150	92.870	574	-81.000	10.510	93.360	575	-81.000	9.660	93.840	576	-81.000	8.830	94.270
577	-81.000	8.000	94.500	578	-74.500	16.480	62.500	579	-74.500	16.580	63.500	580	-74.500	16.660	64.500
581	-74.500	16.740	65.500	582	-74.500	16.780	66.490	583	-74.500	16.820	67.490	584	-74.500	16.830	68.500
585	-74.500	16.840	69.490	586	-74.500	16.830	70.490	587	-74.500	16.780	71.490	588	-74.500	16.740	72.490
589	-74.500	16.670	73.490	590	-74.500	16.580	74.490	591	-74.500	16.460	75.480	592	-74.500	16.310	76.470
593	-74.500	16.140	77.480	594	-74.500	15.940	78.440	595	-74.500	15.720	79.430	596	-74.500	15.460	80.390
597	-74.500	15.180	81.380	598	-74.500	14.860	82.320	599	-74.500	14.480	83.250	600	-74.500	14.150	84.000
601	-74.500	13.800	84.710	602	-74.500	13.300	85.600	603	-74.500	12.760	86.450	604	-74.500	12.150	87.230
605	-74.500	11.470	87.980	606	-74.500	10.880	88.520	607	-74.500	10.230	89.000	608	-74.500	9.580	89.400
609	-74.500	8.840	89.750	610	-74.500	8.000	90.000	611	-70.000	16.090	61.630	612	-70.000	16.160	62.650
613	-70.000	16.230	63.650	614	-70.000	16.260	64.650	615	-70.000	16.290	65.650	616	-70.000	16.300	66.650
617	-70.000	16.280	67.630	618	-70.000	16.250	68.640	619	-70.000	16.200	69.650	620	-70.000	16.110	70.650
621	-70.000	16.000	71.660	622	-70.000	15.880	72.650	623	-70.000	15.740	73.630	624	-70.000	15.560	74.610
625	-70.000	15.330	75.600	626	-70.000	15.090	76.570	627	-70.000	14.800	77.550	628	-70.000	14.560	78.300
629	-70.000	14.170	79.240	630	-70.000	13.760	80.170	631	-70.000	13.300	81.070	632	-70.000	12.780	81.930
633	-70.000	12.180	82.750	634	-70.000	11.520	83.510	635	-70.000	11.000	84.020	636	-70.000	10.450	84.470
637	-70.000	9.810	84.910	638	-70.000	8.920	85.380	639	-70.000	8.000	85.700	640	-65.000	15.570	60.680

NUM	X	Y	Z	NUM	X	Y	Z	NUM	X	Y	Z	NUM	X	Y	Z
641	-65.000	15.620	61.680	642	-65.000	15.640	62.670	643	-65.000	15.640	63.670	644	-65.000	15.620	64.670
645	-65.000	15.590	65.690	646	-65.000	15.320	66.700	647	-65.000	15.440	67.700	648	-65.000	15.320	68.690
649	-65.000	15.180	69.660	650	-65.000	15.010	70.660	651	-65.000	14.800	71.650	652	-65.000	14.550	72.600
653	-65.000	14.270	73.550	654	-65.000	13.950	74.480	655	-65.000	13.540	75.430	656	-65.000	13.090	76.330
657	-65.000	12.580	77.210	658	-65.000	12.000	78.040	659	-65.000	11.470	78.670	660	-65.000	10.910	79.240
661	-65.000	10.290	79.700	662	-65.000	9.620	80.200	663	-65.000	8.910	80.500	664	-65.000	8.000	80.930
665	-61.250	15.120	60.000	666	-61.250	15.110	61.000	667	-61.250	15.090	61.900	668	-61.250	15.050	62.990
669	-61.250	14.990	63.990	670	-61.250	14.900	64.990	671	-61.250	14.800	66.000	672	-61.250	14.670	67.000
673	-61.250	14.490	68.020	674	-61.250	14.300	69.000	675	-61.250	14.060	69.960	676	-61.250	13.730	70.920
677	-61.250	13.420	71.800	678	-61.250	13.090	72.600	679	-61.250	12.720	73.330	680	-61.250	12.290	74.000
681	-61.250	11.800	74.640	682	-61.250	11.290	75.260	683	-61.250	10.590	75.910	684	-61.250	9.780	76.500
685	-61.250	8.910	76.990	686	-61.250	8.000	77.380	687	-59.000	14.640	62.850	688	-59.000	14.570	63.750
689	-59.000	14.460	64.720	690	-59.000	14.320	65.710	691	-59.000	14.150	66.700	692	-59.000	13.940	67.680
693	-59.000	13.680	68.650	694	-59.000	13.370	69.600	695	-59.000	12.980	70.520	696	-59.000	12.520	71.420
697	-59.000	11.980	72.240	698	-59.000	11.330	73.020	699	-59.000	10.600	73.700	700	-59.000	9.780	74.300
701	-59.000	8.910	74.800	702	-59.000	8.000	75.220	703	-57.000	13.880	65.450	704	-57.000	13.830	65.730
705	-57.000	13.590	66.700	706	-57.000	13.290	67.660	707	-57.000	12.910	68.600	708	-57.000	12.470	69.500
709	-57.000	11.950	70.330	710	-57.000	11.310	71.100	711	-57.000	10.600	71.780	712	-57.000	9.800	72.380
713	-57.000	8.940	72.880	714	-57.000	8.000	73.320	715	-55.000	12.200	68.050	716	-55.000	11.900	68.470
717	-55.000	11.270	69.230	718	-55.000	10.570	69.910	719	-55.000	9.780	70.510	720	-55.000	8.900	71.020
721	-55.000	8.000	71.420	722	-54.000	10.180	69.320	723	-54.000	9.800	69.580	724	-54.000	8.930	70.060
725	-54.000	8.000	70.480	726	-53.500	8.000	70.000	727	-73.000	.000	88.580	728	-74.000	.000	89.530
729	-74.500	.000	90.000	730	-81.000	.000	94.500	731	-87.000	.000	97.040	732	-93.000	.000	98.820
733	-98.000	.000	99.910	734	-103.000	.000	100.750	735	-109.000	.000	101.500	736	-115.000	.000	102.000
737	-118.000	.000	102.230	738	-119.000	.000	102.300	739	-169.500	-14.350	98.300	740	-169.500	-14.040	99.070
741	-169.500	-13.600	100.000	742	-167.330	-16.430	90.080	743	-167.330	-16.300	91.070	744	-167.330	-16.140	92.060
745	-167.330	-15.950	93.040	746	-167.330	-15.740	94.020	747	-167.330	-15.500	95.000	748	-167.330	-15.230	95.970
749	-167.330	-14.940	96.920	750	-167.330	-14.600	97.860	751	-167.330	-14.200	98.800	752	-167.330	-13.770	99.700
753	-167.330	-13.280	100.570	754	-167.330	-12.900	101.170	755	-167.330	-12.580	101.720	756	-162.000	-17.040	85.610
757	-162.000	-17.040	86.620	758	-162.000	-17.020	87.620	759	-162.000	-16.960	88.640	760	-162.000	-16.860	89.640
761	-162.000	-16.750	90.640	762	-162.000	-16.580	91.640	763	-162.000	-16.400	92.650	764	-162.000	-16.170	93.620
765	-162.000	-15.900	94.600	766	-162.000	-15.610	95.560	767	-162.000	-15.300	96.500	768	-162.000	-14.940	97.430
769	-162.000	-14.540	98.330	770	-162.000	-14.070	99.250	771	-162.000	-13.540	100.100	772	-162.000	-13.000	100.940
773	-162.000	-12.410	101.700	774	-162.000	-11.750	102.520	775	-162.000	-11.050	103.240	776	-162.000	-10.300	103.880
777	-162.000	-9.520	104.400	778	-162.000	-8.780	104.900	779	-162.000	-8.000	105.310	780	-157.000	-17.400	81.490
781	-157.000	-17.480	82.490	782	-157.000	-17.540	83.490	783	-157.000	-17.560	84.490	784	-157.000	-17.540	85.500
785	-157.000	-17.490	86.500	786	-157.000	-17.430	87.490	787	-157.000	-17.340	88.470	788	-157.000	-17.220	89.460
789	-157.000	-17.060	90.400	790	-157.000	-16.880	91.460	791	-157.000	-16.660	92.430	792	-157.000	-16.420	93.400
793	-157.000	-16.120	94.360	794	-157.000	-15.810	95.310	795	-157.000	-15.460	96.250	796	-157.000	-15.090	97.170
797	-157.000	-14.660	98.080	798	-157.000	-14.200	98.960	799	-157.000	-13.690	99.820	800	-157.000	-13.140	100.640

NUM	X	Y	Z
801	-157.000	-12.520	101.420
805	-157.000	-9.660	104.090
809	-152.270	-17.750	78.520
813	-152.270	-17.920	82.530
817	-152.270	-17.820	86.550
821	-152.270	-17.250	90.540
825	-152.270	-16.200	94.400
829	-152.270	-14.650	98.100
833	-152.270	-12.390	101.470
837	-152.270	-9.460	103.960
841	-148.500	-17.860	77.800
845	-148.500	-18.170	81.800
849	-148.500	-18.060	85.810
853	-148.500	-17.500	89.810
857	-148.500	-16.510	93.680
861	-148.500	-15.020	97.370
865	-148.500	-12.960	100.750
869	-148.500	-10.010	103.400
873	-143.500	-17.800	75.800
877	-143.500	-18.280	79.800
881	-143.500	-18.360	83.810
885	-143.500	-18.000	87.780
889	-143.500	-17.190	91.700
893	-143.500	-15.910	95.470
897	-143.500	-14.050	98.960
901	-143.500	-11.470	102.010
905	-143.500	-8.000	104.010
909	-138.700	-18.300	77.840
913	-138.700	-18.560	81.840
917	-138.700	-18.380	85.840
921	-138.700	-17.750	89.800
925	-138.700	-16.630	93.660
929	-138.700	-14.980	97.330
933	-138.700	-12.660	100.600
937	-138.700	-9.600	103.050
941	-133.000	-18.080	74.780
945	-133.000	-18.620	78.740
949	-133.000	-18.730	82.760
953	-133.000	-18.400	86.760
957	-133.000	-17.600	90.720

NUM	X	Y	Z
802	-157.000	-11.880	102.180
806	-157.000	-8.880	104.540
810	-152.270	-17.800	79.530
814	-152.270	-17.940	83.540
818	-152.270	-17.720	87.550
822	-152.270	-17.030	91.520
826	-152.270	-15.860	95.340
830	-152.270	-14.140	98.980
834	-152.270	-11.700	102.200
838	-152.270	-8.810	104.320
842	-148.500	-17.970	78.700
846	-148.500	-18.170	82.810
850	-148.500	-17.980	86.810
854	-148.500	-17.300	90.790
858	-148.500	-16.180	94.600
862	-148.500	-14.530	98.260
866	-148.500	-12.200	101.520
870	-148.500	-9.220	103.840
874	-143.500	-17.940	76.800
878	-143.500	-18.340	80.800
882	-143.500	-18.310	84.810
886	-143.500	-17.840	88.770
890	-143.500	-16.920	92.660
894	-143.500	-15.500	96.350
898	-143.500	-13.470	99.780
902	-143.500	-10.700	102.640
906	-138.700	-17.800	74.880
910	-138.700	-18.400	78.830
914	-138.700	-18.550	82.830
918	-138.700	-18.260	86.840
922	-138.700	-17.520	90.780
926	-138.700	-16.250	94.620
930	-138.700	-14.470	98.200
934	-138.700	-11.950	101.340
938	-138.700	-8.820	103.390
942	-133.000	-18.260	75.760
946	-133.000	-18.700	79.750
950	-133.000	-18.690	83.760
954	-133.000	-18.240	87.750
958	-133.000	-17.310	91.680

NUM	X	Y	Z
803	-157.000	-11.220	102.840
807	-157.000	-8.000	104.940
811	-152.270	-17.860	80.520
815	-152.270	-17.920	84.550
819	-152.270	-17.600	88.560
823	-152.270	-16.780	92.500
827	-152.270	-15.480	96.290
831	-152.270	-13.610	99.830
835	-152.270	-10.960	102.990
839	-152.270	-8.000	104.620
843	-148.500	-18.070	79.790
847	-148.500	-18.160	83.810
851	-148.500	-17.840	87.810
855	-148.500	-17.070	91.750
859	-148.500	-15.880	95.540
863	-148.500	-14.020	99.130
867	-148.500	-11.510	102.230
871	-148.500	-8.590	104.150
875	-143.500	-18.080	77.800
879	-143.500	-18.380	81.810
883	-143.500	-18.240	85.800
887	-143.500	-17.660	89.760
891	-143.500	-16.600	93.600
895	-143.500	-15.060	97.260
899	-143.500	-12.840	100.560
903	-143.500	-9.890	103.190
907	-138.700	-17.990	75.860
911	-138.700	-18.480	79.830
915	-138.700	-18.520	83.820
919	-138.700	-18.120	87.820
923	-138.700	-17.260	91.740
927	-138.700	-15.860	95.550
931	-138.700	-13.910	99.030
935	-138.700	-11.190	102.000
939	-138.700	-8.000	103.680
943	-133.000	-18.400	76.760
947	-133.000	-18.720	80.760
951	-133.000	-18.600	84.760
955	-133.000	-18.060	88.740
959	-133.000	-17.010	92.640

NUM	X	Y	Z
804	-157.000	-10.470	103.500
808	-152.270	-17.670	77.520
812	-152.270	-17.900	81.520
816	-152.270	-17.880	85.550
820	-152.270	-17.430	89.560
824	-152.270	-16.510	93.450
828	-152.270	-15.090	97.190
832	-152.270	-13.020	100.670
836	-152.270	-10.300	103.410
840	-148.500	-17.700	76.800
844	-148.500	-18.130	80.800
848	-148.500	-18.110	84.810
852	-148.500	-17.690	88.810
856	-148.500	-16.810	92.700
860	-148.500	-15.460	96.460
864	-148.500	-13.470	99.940
868	-148.500	-10.730	102.900
872	-148.500	-8.000	104.360
876	-143.500	-18.190	79.800
880	-143.500	-18.380	82.810
884	-143.500	-18.130	86.780
888	-143.500	-17.450	90.730
892	-143.500	-16.290	94.530
896	-143.500	-14.570	98.120
900	-143.500	-12.200	101.320
904	-143.500	-8.980	103.640
908	-138.700	-18.170	76.860
912	-138.700	-18.540	80.840
916	-138.700	-18.470	84.840
920	-138.700	-17.940	88.810
924	-138.700	-16.960	92.720
928	-138.700	-15.430	96.450
932	-138.700	-13.310	99.840
936	-138.700	-10.380	102.600
940	-133.000	-17.840	73.810
944	-133.000	-18.530	77.750
948	-133.000	-18.740	81.760
952	-133.000	-18.520	85.760
956	-133.000	-17.830	89.730
960	-133.000	-16.670	93.590

NUM	X	Y	Z	NUM	X	Y	Z	NUM	X	Y	Z	NUM	X	Y	Z
961	-133.000	-16.310	94.550	962	-133.000	-15.870	95.440	963	-133.000	-15.420	96.350	964	-133.000	-14.950	97.210
965	-133.000	-14.430	98.080	966	-133.000	-13.850	98.900	967	-133.000	-13.230	99.710	968	-133.000	-12.690	100.300
969	-133.000	-11.980	101.020	970	-133.000	-11.210	101.660	971	-133.000	-10.380	102.230	972	-133.000	-9.690	102.640
973	-133.000	-8.760	103.040	974	-133.000	-8.000	103.270	975	-127.000	-17.880	72.640	976	-127.000	-18.120	73.620
977	-127.000	-18.310	74.600	978	-127.000	-18.480	75.590	979	-127.000	-18.620	76.590	980	-127.000	-18.730	77.590
981	-127.000	-18.820	78.590	982	-127.000	-18.860	79.600	983	-127.000	-18.890	80.610	984	-127.000	-18.900	81.630
985	-127.000	-18.860	82.620	986	-127.000	-18.800	83.610	987	-127.000	-18.730	84.600	988	-127.000	-18.620	85.610
989	-127.000	-18.480	86.610	990	-127.000	-18.320	87.600	991	-127.000	-18.120	88.590	992	-127.000	-17.900	89.590
993	-127.000	-17.640	90.550	994	-127.000	-17.360	91.500	995	-127.000	-17.050	92.450	996	-127.000	-16.710	93.400
997	-127.000	-16.320	94.330	998	-127.000	-15.890	95.230	999	-127.000	-15.440	96.130	1000	-127.000	-14.940	97.010
1001	-127.000	-14.400	97.870	1002	-127.000	-13.810	98.690	1003	-127.000	-13.180	99.450	1004	-127.000	-12.500	100.190
1005	-127.000	-11.770	100.870	1006	-127.000	-10.960	101.490	1007	-127.000	-10.120	102.020	1008	-127.000	-9.490	102.350
1009	-127.000	-8.840	102.600	1010	-127.000	-8.000	102.860	1011	-121.000	-17.910	71.520	1012	-121.000	-18.160	72.490
1013	-121.000	-18.360	73.480	1014	-121.000	-18.540	74.460	1015	-121.000	-18.680	75.440	1016	-121.000	-18.790	76.440
1017	-121.000	-18.880	77.440	1018	-121.000	-18.940	78.440	1019	-121.000	-18.970	79.440	1020	-121.000	-18.990	80.450
1021	-121.000	-18.980	81.460	1022	-121.000	-18.940	82.460	1023	-121.000	-18.870	83.460	1024	-121.000	-18.780	84.460
1025	-121.000	-18.660	85.450	1026	-121.000	-18.520	86.440	1027	-121.000	-18.350	87.420	1028	-121.000	-18.140	88.400
1029	-121.000	-17.920	89.380	1030	-121.000	-17.650	90.350	1031	-121.000	-17.360	91.310	1032	-121.000	-17.040	92.280
1033	-121.000	-16.690	93.190	1034	-121.000	-16.290	94.100	1035	-121.000	-15.860	95.020	1036	-121.000	-15.380	95.930
1037	-121.000	-14.880	96.810	1038	-121.000	-14.320	97.660	1039	-121.000	-13.720	98.470	1040	-121.000	-13.060	99.240
1041	-121.000	-12.350	99.970	1042	-121.000	-11.690	100.560	1043	-121.000	-10.850	101.170	1044	-121.000	-9.990	101.700
1045	-121.000	-9.360	102.000	1046	-121.000	-8.780	102.200	1047	-121.000	-8.000	102.440	1048	-115.000	-17.900	70.320
1049	-115.000	-18.150	71.300	1050	-115.000	-18.340	72.290	1051	-115.000	-18.520	73.270	1052	-115.000	-18.680	74.280
1053	-115.000	-18.790	75.270	1054	-115.000	-18.890	76.270	1055	-115.000	-18.960	77.270	1056	-115.000	-19.000	78.270
1057	-115.000	-19.020	79.280	1058	-115.000	-19.020	80.290	1059	-115.000	-18.990	81.280	1060	-115.000	-18.930	82.280
1061	-115.000	-18.850	83.290	1062	-115.000	-18.740	84.290	1063	-115.000	-18.610	85.280	1064	-115.000	-18.460	86.270
1065	-115.000	-18.280	87.270	1066	-115.000	-18.070	88.250	1067	-115.000	-17.820	89.220	1068	-115.000	-17.560	90.190
1069	-115.000	-17.270	91.150	1070	-115.000	-16.930	92.090	1071	-115.000	-16.570	93.010	1072	-115.000	-16.170	93.930
1073	-115.000	-15.730	94.850	1074	-115.000	-15.260	95.710	1075	-115.000	-14.750	96.500	1076	-115.000	-14.190	97.420
1077	-115.000	-13.590	98.220	1078	-115.000	-12.920	98.990	1079	-115.000	-12.360	99.570	1080	-115.000	-11.590	100.210
1081	-115.000	-10.780	100.810	1082	-115.000	-9.900	101.330	1083	-115.000	-8.970	101.740	1084	-115.000	-8.000	102.000
1085	-109.000	-17.980	69.160	1086	-109.000	-18.100	70.160	1087	-109.000	-18.290	71.140	1088	-109.000	-18.460	72.120
1089	-109.000	-18.600	73.130	1090	-109.000	-18.730	74.110	1091	-109.000	-18.820	75.110	1092	-109.000	-18.880	76.090
1093	-109.000	-18.930	77.090	1094	-109.000	-18.940	78.090	1095	-109.000	-18.940	79.100	1096	-109.000	-18.920	80.110
1097	-109.000	-18.870	81.110	1098	-109.000	-18.800	82.120	1099	-109.000	-18.710	83.110	1100	-109.000	-18.580	84.110
1101	-109.000	-18.440	85.100	1102	-109.000	-18.280	86.100	1103	-109.000	-18.080	87.040	1104	-109.000	-17.860	88.070
1105	-109.000	-17.600	89.040	1106	-109.000	-17.340	90.020	1107	-109.000	-17.020	90.970	1108	-109.000	-16.680	91.920
1109	-109.000	-16.320	92.850	1110	-109.000	-15.890	93.770	1111	-109.000	-15.440	94.670	1112	-109.000	-14.970	95.550
1113	-109.000	-14.450	96.390	1114	-109.000	-13.880	97.230	1115	-109.000	-13.250	98.030	1116	-109.000	-12.580	98.770
1117	-109.000	-11.870	99.450	1118	-109.000	-11.320	99.890	1119	-109.000	-10.670	100.350	1120	-109.000	-10.070	100.720

NUM	X	Y	Z	NUM	X	Y	Z	NUM	X	Y	Z	NUM	X	Y	Z
1121	-109.000	-9.430	101.030	1122	-109.000	-8.670	101.320	1123	-109.000	-8.000	101.500	1124	-103.000	-17.800	68.020
1125	-103.000	-17.980	68.990	1126	-103.000	-18.180	69.990	1127	-103.000	-18.340	70.960	1128	-103.000	-18.460	71.950
1129	-103.000	-18.600	72.960	1130	-103.000	-18.660	73.950	1131	-103.000	-18.730	74.950	1132	-103.000	-18.780	75.960
1133	-103.000	-18.790	76.960	1134	-103.000	-18.790	77.970	1135	-103.000	-18.760	78.980	1136	-103.000	-18.720	80.000
1137	-103.000	-18.660	80.980	1138	-103.000	-18.580	81.970	1139	-103.000	-18.460	82.970	1140	-103.000	-18.320	83.970
1141	-103.000	-18.160	84.970	1142	-103.000	-17.980	85.960	1143	-103.000	-17.790	86.920	1144	-103.000	-17.540	87.900
1145	-103.000	-17.280	88.880	1146	-103.000	-16.990	89.850	1147	-103.000	-16.670	90.800	1148	-103.000	-16.310	91.740
1149	-103.000	-15.930	92.600	1150	-103.000	-15.500	93.580	1151	-103.000	-15.030	94.460	1152	-103.000	-14.550	95.330
1153	-103.000	-14.000	96.180	1154	-103.000	-13.400	97.000	1155	-103.000	-12.770	97.770	1156	-103.000	-12.060	98.490
1157	-103.000	-11.300	99.130	1158	-103.000	-10.500	99.690	1159	-103.000	-9.730	100.120	1160	-103.000	-9.270	100.360
1161	-103.000	-8.090	100.500	1162	-103.000	-8.000	100.750	1163	-98.000	-17.680	67.060	1164	-93.000	-17.860	68.060
1165	-98.000	-18.020	69.050	1166	-98.000	-18.200	70.030	1167	-98.000	-18.310	71.080	1168	-98.000	-18.410	72.080
1169	-98.000	-18.490	73.070	1170	-98.000	-18.560	74.070	1171	-98.000	-18.590	75.070	1172	-98.000	-18.620	76.070
1173	-98.000	-18.610	77.070	1174	-98.000	-18.580	78.070	1175	-98.000	-18.530	79.070	1176	-98.000	-18.460	80.080
1177	-98.000	-18.380	81.080	1178	-98.000	-18.280	82.070	1179	-98.000	-18.140	83.060	1180	-98.000	-17.990	84.070
1181	-98.000	-17.810	85.060	1182	-98.000	-17.610	86.050	1183	-98.000	-17.380	87.040	1184	-98.000	-17.120	87.990
1185	-98.000	-16.840	88.980	1186	-98.000	-16.530	89.920	1187	-98.000	-16.200	90.860	1188	-98.000	-15.800	91.800
1189	-98.000	-15.380	92.740	1190	-98.000	-14.930	93.630	1191	-98.000	-14.420	94.520	1192	-98.000	-13.870	95.370
1193	-98.000	-13.430	96.020	1194	-98.000	-12.930	96.660	1195	-98.000	-12.390	97.060	1196	-98.000	-11.740	97.900
1197	-98.000	-11.030	98.480	1198	-98.000	-10.370	98.950	1199	-98.000	-9.730	99.300	1200	-98.000	-9.090	99.600
1201	-98.000	-8.520	99.790	1202	-98.000	-8.000	99.910	1203	-93.000	-17.520	66.090	1204	-93.000	-17.690	67.060
1205	-93.000	-17.840	68.050	1206	-93.000	-17.970	69.050	1207	-93.000	-18.080	70.060	1208	-93.000	-18.180	71.060
1209	-93.000	-18.250	72.070	1210	-93.000	-18.320	73.060	1211	-93.000	-18.360	74.060	1212	-93.000	-18.370	75.070
1213	-93.000	-18.360	76.070	1214	-93.000	-18.340	77.060	1215	-93.000	-18.280	78.060	1216	-93.000	-18.220	79.060
1217	-93.000	-18.130	80.080	1218	-93.000	-18.030	81.080	1219	-93.000	-17.900	82.100	1220	-93.000	-17.740	83.100
1221	-93.000	-17.580	84.070	1222	-93.000	-17.380	85.060	1223	-93.000	-17.160	86.050	1224	-93.000	-16.910	87.020
1225	-93.000	-16.620	87.940	1226	-93.000	-16.320	88.940	1227	-93.000	-15.990	89.890	1228	-93.000	-15.600	90.840
1229	-93.000	-15.200	91.760	1230	-93.000	-14.750	92.650	1231	-93.000	-14.260	93.550	1232	-93.000	-13.730	94.380
1233	-93.000	-13.140	95.200	1234	-93.000	-12.630	95.820	1235	-93.000	-11.960	96.550	1236	-93.000	-11.360	97.100
1237	-93.000	-10.720	97.600	1238	-93.000	-10.040	98.040	1239	-93.000	-9.320	98.400	1240	-93.000	-8.680	98.640
1241	-93.000	-8.000	98.820	1242	-87.000	-17.260	64.930	1243	-87.000	-17.410	65.920	1244	-87.000	-17.540	66.910
1245	-87.000	-17.670	67.910	1246	-87.000	-17.760	68.910	1247	-87.000	-17.840	69.920	1248	-87.000	-17.910	70.910
1249	-87.000	-17.940	71.910	1250	-87.000	-17.980	72.910	1251	-87.000	-17.990	73.910	1252	-87.000	-17.980	74.920
1253	-87.000	-17.950	75.920	1254	-87.000	-17.900	76.920	1255	-87.000	-17.820	77.920	1256	-87.000	-17.730	78.920
1257	-87.000	-17.630	79.920	1258	-87.000	-17.500	80.910	1259	-87.000	-17.350	81.910	1260	-87.000	-17.170	82.910
1261	-87.000	-16.970	83.880	1262	-87.000	-16.760	84.860	1263	-87.000	-16.500	85.840	1264	-87.000	-16.220	86.810
1265	-87.000	-15.900	87.770	1266	-87.000	-15.560	88.710	1267	-87.000	-15.170	89.650	1268	-87.000	-14.760	90.570
1269	-87.000	-14.300	91.470	1270	-87.000	-13.790	92.330	1271	-87.000	-13.230	93.170	1272	-87.000	-12.620	93.960
1273	-87.000	-11.950	94.720	1274	-87.000	-11.360	95.280	1275	-87.000	-10.730	95.780	1276	-87.000	-9.970	96.280
1277	-87.000	-9.360	96.600	1278	-87.000	-8.610	96.890	1279	-87.000	-8.000	97.040	1280	-81.000	-16.940	63.780

NUM	X	Y	Z	NUM	X	Y	Z	NUM	X	Y	Z	NUM	X	Y	Z
1281	-81.000	-17.060	64.780	1282	-81.000	-17.180	65.770	1283	-81.000	-17.260	66.770	1284	-81.000	-17.350	67.770
1285	-81.000	-17.400	68.770	1286	-81.000	-17.450	69.770	1287	-81.000	-17.480	70.780	1288	-81.000	-17.500	71.790
1289	-81.000	-17.500	72.800	1290	-81.000	-17.470	73.800	1291	-81.000	-17.430	74.800	1292	-81.000	-17.370	75.810
1293	-81.000	-17.280	76.810	1294	-81.000	-17.180	77.810	1295	-81.000	-17.060	78.820	1296	-81.000	-16.900	79.810
1297	-81.000	-16.750	80.820	1298	-81.000	-16.550	81.810	1299	-81.000	-16.340	82.790	1300	-81.000	-16.090	83.770
1301	-81.000	-15.820	84.720	1302	-81.000	-15.500	85.690	1303	-81.000	-15.160	86.640	1304	-81.000	-14.780	87.580
1305	-81.000	-14.360	88.500	1306	-81.000	-13.880	89.400	1307	-81.000	-13.350	90.250	1308	-81.000	-12.780	91.100
1309	-81.000	-12.300	91.620	1310	-81.000	-11.740	92.310	1311	-81.000	-11.150	92.870	1312	-81.000	-10.510	93.360
1313	-81.000	-9.660	93.880	1314	-81.000	-8.830	94.270	1315	-81.000	-8.000	94.500	1316	-74.500	-16.480	62.500
1317	-74.500	-16.580	63.500	1318	-74.500	-16.660	64.500	1319	-74.500	-16.740	65.500	1320	-74.500	-16.780	66.490
1321	-74.500	-16.820	67.490	1322	-74.500	-16.830	68.500	1323	-74.500	-16.840	69.490	1324	-74.500	-16.830	70.490
1325	-74.500	-16.780	71.490	1326	-74.500	-16.740	72.490	1327	-74.500	-16.670	73.490	1328	-74.500	-16.580	74.490
1329	-74.500	-16.460	75.480	1330	-74.500	-16.310	76.470	1331	-74.500	-16.140	77.460	1332	-74.500	-15.940	78.440
1333	-74.500	-15.720	79.430	1334	-74.500	-15.460	80.390	1335	-74.500	-15.180	81.390	1336	-74.500	-14.860	82.320
1337	-74.500	-14.480	83.250	1338	-74.500	-14.150	84.000	1339	-74.500	-13.800	84.710	1340	-74.500	-13.300	85.600
1341	-74.500	-12.760	86.450	1342	-74.500	-12.150	87.230	1343	-74.500	-11.470	87.980	1344	-74.500	-10.880	88.520
1345	-74.500	-10.230	89.000	1346	-74.500	-9.580	89.400	1347	-74.500	-8.840	89.750	1348	-74.500	-8.000	90.000
1349	-70.000	-16.090	61.630	1350	-70.000	-16.150	62.650	1351	-70.000	-16.230	63.650	1352	-70.000	-16.260	64.650
1353	-70.000	-16.290	65.630	1354	-70.000	-16.300	66.650	1355	-70.000	-16.280	67.650	1356	-70.000	-16.250	68.640
1357	-70.000	-16.200	69.630	1358	-70.000	-16.110	70.650	1359	-70.000	-16.000	71.660	1360	-70.000	-15.880	72.650
1361	-70.000	-15.740	73.630	1362	-70.000	-15.560	74.610	1363	-70.000	-15.330	75.600	1364	-70.000	-15.090	76.570
1365	-70.000	-14.800	77.530	1366	-70.000	-14.560	78.300	1367	-70.000	-14.170	79.240	1368	-70.000	-13.760	80.170
1369	-70.000	-13.300	81.070	1370	-70.000	-12.780	81.930	1371	-70.000	-12.180	82.750	1372	-70.000	-11.520	83.510
1373	-70.000	-11.000	84.020	1374	-70.000	-10.450	84.470	1375	-70.000	-9.810	84.910	1376	-70.000	-8.920	85.380
1377	-70.000	-8.000	85.700	1378	-65.000	-15.570	60.690	1379	-65.000	-15.620	61.690	1380	-65.000	-15.640	62.670
1381	-65.000	-15.640	63.670	1382	-65.000	-15.620	64.670	1383	-65.000	-15.590	65.690	1384	-65.000	-15.520	66.700
1385	-65.000	-15.440	67.700	1386	-65.000	-15.320	68.690	1387	-65.000	-15.180	69.660	1388	-65.000	-15.010	70.660
1389	-65.000	-14.800	71.650	1390	-65.000	-14.550	72.600	1391	-65.000	-14.270	73.550	1392	-65.000	-13.950	74.480
1393	-65.000	-13.540	75.430	1394	-65.000	-13.090	76.330	1395	-65.000	-12.580	77.210	1396	-65.000	-12.000	78.040
1397	-65.000	-11.470	78.870	1398	-65.000	-10.910	79.240	1399	-65.000	-10.290	79.760	1400	-65.000	-9.620	80.200
1401	-65.000	-8.910	80.590	1402	-65.000	-8.000	80.930	1403	-61.250	-15.120	60.000	1404	-61.250	-15.110	61.000
1405	-61.250	-15.090	61.990	1406	-61.250	-15.050	62.990	1407	-61.250	-14.990	63.990	1408	-61.250	-14.900	64.990
1409	-61.250	-14.800	66.000	1410	-61.250	-14.670	67.000	1411	-61.250	-14.490	68.020	1412	-61.250	-14.300	69.000
1413	-61.250	-14.060	69.960	1414	-61.250	-13.780	70.920	1415	-61.250	-13.420	71.860	1416	-61.250	-13.090	72.600
1417	-61.250	-12.720	73.330	1418	-61.250	-12.290	74.000	1419	-61.250	-11.800	74.640	1420	-61.250	-11.290	75.260
1421	-61.250	-10.590	75.910	1422	-61.250	-9.780	76.500	1423	-61.250	-8.910	76.900	1424	-61.250	-8.000	77.380
1425	-59.000	-14.640	62.850	1426	-59.000	-14.570	63.750	1427	-59.000	-14.460	64.720	1428	-59.000	-14.320	65.710
1429	-59.000	-14.150	66.700	1430	-59.000	-13.940	67.680	1431	-59.000	-13.680	68.650	1432	-59.000	-13.370	69.600
1433	-59.000	-12.980	70.520	1434	-59.000	-12.520	71.420	1435	-59.000	-11.980	72.240	1436	-59.000	-11.330	73.020
1437	-59.000	-10.600	73.700	1438	-59.000	-9.780	74.300	1439	-59.000	-8.910	74.800	1440	-59.000	-8.000	75.220

NUM	X	Y	Z	NUM	X	Y	Z	NUM	X	Y	Z	NUM	X	Y	Z
1441	-57.000	-13.080	65.450	1442	-57.000	-13.830	65.730	1443	-57.000	-13.590	66.700	1444	-57.000	-13.290	67.660
1445	-57.000	-12.910	68.600	1446	-57.000	-12.470	69.500	1447	-57.000	-11.950	70.330	1448	-57.000	-11.310	71.100
1449	-57.000	-10.600	71.780	1450	-57.000	-9.800	72.380	1451	-57.000	-8.940	72.880	1452	-57.000	-8.000	73.320
1453	-55.000	-12.200	68.050	1454	-55.000	-11.900	68.470	1455	-55.000	-11.270	69.250	1456	-55.000	-10.570	69.910
1457	-55.000	-9.780	70.510	1458	-55.000	-8.900	71.020	1459	-55.000	-8.000	71.420	1460	-54.000	-10.180	69.320
1461	-54.000	-9.800	69.580	1462	-54.000	-8.930	70.060	1463	-54.000	-8.000	70.480	1464	-53.500	-8.000	70.000

NORMAL ALPHA•BETA LISTING

NUM	ALPHA	BETA	NUM	ALPHA	BETA	NUM	ALPHA	BETA	NUM	ALPHA	BETA	NUM	ALPHA	BETA	NUM	ALPHA	BETA
1	69	93	2	66	90	3	66	90	4	84	93	5	81	93	6	81	93
7	78	93	8	78	93	9	75	93	10	75	93	11	75	93	12	72	93
13	69	90	14	66	90	15	63	90	16	63	90	17	60	90	18	90	96
19	90	96	20	90	96	21	87	93	22	87	93	23	84	93	24	84	93
25	81	93	26	81	93	27	78	93	28	78	93	29	75	93	30	75	90
31	72	90	32	69	90	33	66	90	34	63	90	35	60	87	36	57	87
37	54	90	38	51	90	39	45	93	40	42	96	41	30	96	42	93	96
43	93	96	44	93	96	45	90	96	46	90	96	47	87	96	48	87	93
49	87	93	50	84	93	51	84	93	52	81	93	53	81	93	54	78	93
55	78	90	56	75	90	57	75	90	58	72	90	59	69	90	60	69	90
61	66	90	62	63	90	63	60	87	64	57	87	65	54	87	66	51	87
67	45	84	68	42	84	69	27	81	70	93	96	71	93	96	72	93	96
73	93	96	74	90	96	75	90	96	76	90	93	77	90	93	78	87	93
79	87	93	80	87	93	81	84	93	82	84	93	83	81	93	84	81	93
85	78	93	86	78	90	87	75	90	88	75	90	89	75	90	90	72	90
91	69	90	92	66	90	93	66	90	94	63	90	95	60	87	96	57	87
97	51	87	98	48	87	99	42	84	100	39	81	101	21	78	102	96	93
103	96	93	104	96	93	105	93	93	106	93	93	107	90	93	108	90	93
109	90	93	110	87	93	111	87	93	112	84	93	113	84	93	114	84	93
115	81	93	116	81	93	117	78	90	118	78	90	119	75	90	120	75	90
121	75	90	122	69	90	123	69	90	124	66	90	125	66	90	126	63	90
127	60	87	128	57	87	129	54	87	130	48	87	131	42	84	132	36	84
133	33	81	134	21	78	135	93	93	136	96	93	137	96	93	138	93	93
139	93	93	140	93	93	141	90	93	142	90	93	143	90	93	144	87	93
145	87	93	146	84	93	147	84	93	148	84	90	149	81	90	150	81	90
151	78	90	152	78	90	153	75	90	154	75	90	155	72	90	156	72	90
157	69	90	158	66	90	159	66	90	160	63	90	161	60	87	162	57	87
163	51	87	164	48	87	165	42	84	166	36	81	167	21	81	168	96	93
169	99	93	170	96	93	171	96	93	172	93	93	173	93	93	174	93	93
175	90	93	176	90	93	177	87	93	178	87	93	179	87	93	180	84	90
181	84	90	182	81	90	183	81	90	184	78	90	185	78	90	186	75	90
187	75	90	188	72	90	189	72	90	190	69	90	191	69	90	192	66	90
193	63	90	194	60	87	195	57	87	196	54	87	197	48	87	198	45	84
199	39	84	200	33	81	201	21	78	202	96	93	203	99	93	204	96	93
205	96	93	206	96	93	207	93	93	208	93	93	209	90	93	210	90	93
211	90	90	212	87	90	213	87	90	214	87	90	215	84	90	216	84	90
217	81	90	218	81	90	219	78	90	220	78	90	221	75	90	222	75	90
223	72	90	224	69	90	225	69	90	226	66	90	227	66	90	228	63	87
229	60	87	230	57	87	231	54	87	232	48	87	233	42	84	234	39	84
235	30	81	236	18	78	237	96	93	238	99	93	239	99	93	240	96	93

NUM	ALPHA	BETA	NUM	ALPHA	BETA	NUM	ALPHA	BETA	NUM	ALPHA	BETA	NUM	ALPHA	BETA
241	96	93	242	93	93	243	93	93	244	93	90	245	90	90
247	87	90	248	87	90	249	87	90	250	84	90	251	84	90
253	81	90	254	81	90	255	78	90	256	78	90	257	75	90
259	72	90	260	69	90	261	69	90	262	66	90	263	63	87
265	60	87	266	57	87	267	51	87	268	45	84	269	42	84
271	33	78	272	18	78	273	96	93	274	99	93	275	99	93
277	96	93	278	93	90	279	93	90	280	93	90	281	90	90
283	90	90	284	87	90	285	87	90	286	87	90	287	84	90
289	81	90	290	81	90	291	81	90	292	78	90	293	78	90
295	72	90	296	72	87	297	69	87	298	69	87	299	66	87
301	60	87	302	57	87	303	54	87	304	51	84	305	45	84
307	33	81	308	33	78	309	18	78	310	96	93	311	99	93
313	96	90	314	96	90	315	96	90	316	93	90	317	93	90
319	90	90	320	90	90	321	87	90	322	87	90	323	87	90
325	84	90	326	84	90	327	81	87	328	81	87	329	78	87
331	78	87	332	75	87	333	72	87	334	72	87	335	69	87
337	66	87	338	63	87	339	60	87	340	57	87	341	54	84
343	45	84	344	39	81	345	30	78	346	15	75	347	96	93
349	99	90	350	96	90	351	96	90	352	96	90	353	93	90
355	93	90	356	90	90	357	90	90	358	90	90	359	87	87
361	87	87	362	84	87	363	84	87	364	84	87	365	81	87
367	78	87	368	78	87	369	75	87	370	75	87	371	72	87
373	69	87	374	69	87	375	66	84	376	63	84	377	60	84
379	51	84	380	48	81	381	45	81	382	42	78	383	36	75
385	15	69	386	96	90	387	99	90	388	99	90	389	96	90
391	96	90	392	93	90	393	93	90	394	93	90	395	90	87
397	90	87	398	87	87	399	87	87	400	87	87	401	84	87
403	84	87	404	81	87	405	81	87	406	78	87	407	78	87
409	75	87	410	75	84	411	72	84	412	72	84	413	69	84
415	66	84	416	63	84	417	60	81	418	54	81	419	51	78
421	39	75	422	30	69	423	33	66	424	18	63	425	96	90
427	96	90	428	96	90	429	96	90	430	93	90	431	93	87
433	90	87	434	90	87	435	90	87	436	87	87	437	87	87
439	87	87	440	84	87	441	84	87	442	84	87	443	81	87
445	81	84	446	78	84	447	78	84	448	75	84	449	75	84
451	72	84	452	69	84	453	66	81	454	63	81	455	63	81
457	57	78	458	57	78	459	48	75	460	45	72	461	39	69
463	30	57	464	18	51	465	96	90	466	96	90	467	96	90
469	96	87	470	93	87	471	93	87	472	93	87	473	90	87
475	90	87	476	87	87	477	87	87	478	87	87	479	87	87

NUM	ALPHA	BETA
246	90	90
252	84	90
258	75	90
264	60	87
270	36	81
276	96	93
282	90	90
288	84	90
294	75	90
300	63	87
306	39	84
312	99	93
318	90	90
324	84	90
330	78	87
336	69	87
342	51	84
348	99	93
354	93	90
360	87	87
366	81	87
372	72	87
378	57	84
384	30	72
390	96	90
396	90	87
402	84	87
408	78	87
414	69	84
420	45	76
426	96	90
432	93	87
438	87	87
444	81	84
450	72	84
456	57	78
462	36	63
468	96	90
474	90	87
480	84	84

NUM	ALPHA	BETA	NUM	ALPHA	BETA	NUM	ALPHA	BETA	NUM	ALPHA	BETA	NUM	ALPHA	BETA
481	84	84	482	84	84	483	81	84	484	81	84	485	81	84	486	78	84
487	78	84	488	75	84	489	75	81	490	72	81	491	72	81	492	69	81
493	66	81	494	63	78	495	60	78	496	60	78	497	54	75	498	51	72
499	48	69	500	42	66	501	36	60	502	33	51	503	21	45	504	93	90
505	96	90	506	90	87	507	96	87	508	93	87	509	93	87	510	93	87
511	90	87	512	90	87	513	90	87	514	90	84	515	87	84	516	87	84
517	87	84	518	87	84	519	84	84	520	84	84	521	84	84	522	81	84
523	81	84	524	81	81	525	78	81	526	78	81	527	75	81	528	75	81
529	72	78	530	72	78	531	69	78	532	66	75	533	63	75	534	60	72
535	57	69	536	54	69	537	51	63	538	45	57	539	42	51	540	36	42
541	24	33	542	93	87	543	96	87	544	96	87	545	93	87	546	93	87
547	93	87	548	93	87	549	90	84	550	90	84	551	90	84	552	90	84
553	87	84	554	87	84	555	87	84	556	84	81	557	84	81	558	84	81
559	84	81	560	81	81	561	81	78	562	78	78	563	78	78	564	75	75
565	75	75	566	72	72	567	72	72	568	69	72	569	66	69	570	63	66
571	63	63	572	60	60	573	57	57	574	54	51	575	48	45	576	45	33
577	33	27	578	93	87	579	93	87	580	93	87	581	93	84	582	93	84
583	90	84	584	90	84	585	90	84	586	90	84	587	87	81	588	87	81
589	87	81	590	87	81	591	84	78	592	84	78	593	84	78	594	81	78
595	81	75	596	81	75	597	78	72	598	78	72	599	75	69	600	75	66
601	72	66	602	69	63	603	69	60	604	66	57	605	63	51	606	60	48
607	57	42	608	57	36	609	54	27	610	39	21	611	93	84	612	93	84
613	93	84	614	90	84	615	90	84	616	90	81	617	90	81	618	87	81
619	87	81	620	87	78	621	84	78	622	84	78	623	84	75	624	81	75
625	81	75	626	78	72	627	78	69	628	75	69	629	75	66	630	72	63
631	72	60	632	69	57	633	66	54	634	63	48	635	60	45	636	60	39
637	57	33	638	54	27	639	45	21	640	90	84	641	93	84	642	90	84
643	90	81	644	90	81	645	87	81	646	87	81	647	87	78	648	84	78
649	84	78	650	84	75	651	81	75	652	81	72	653	78	72	654	75	69
655	75	66	656	72	63	657	69	60	658	66	54	659	66	51	660	63	48
661	60	42	662	57	36	663	57	27	664	45	21	665	90	84	666	90	81
667	90	81	668	87	81	669	87	81	670	87	78	671	87	78	672	84	78
673	84	75	674	81	75	675	81	72	676	78	69	677	75	66	678	75	66
679	72	63	680	69	60	681	66	54	682	66	51	683	63	42	684	60	36
685	60	30	686	45	24	687	90	78	688	87	78	689	84	78	690	84	78
691	84	75	692	81	72	693	78	69	694	75	66	695	75	63	696	69	60
697	66	57	698	63	48	699	60	42	700	60	36	701	57	27	702	48	27
703	90	75	704	87	75	705	78	69	706	78	69	707	75	66	708	72	63
709	66	57	710	63	51	711	60	42	712	60	36	713	57	30	714	48	27
715	90	60	716	78	60	717	66	51	718	63	42	719	63	36	720	60	30

NUM	ALPHA	BETA
721	45	24
727	45	0
733	12	0
739	69	-93
745	78	-93
751	69	-90
757	90	-96
763	81	-93
769	72	-90
775	54	-90
781	93	-96
787	87	-93
793	78	-90
799	66	-90
805	45	-84
811	93	-96
817	87	-93
823	78	-93
829	69	-90
835	51	-87
841	96	-93
847	90	-93
853	81	-93
859	75	-90
865	60	-87
871	33	-81
877	93	-93
883	87	-93
889	78	-90
895	69	-90
901	51	-87
907	99	-93
913	90	-93
919	84	-90
925	75	-90
931	63	-90
937	39	-84
943	96	-93
949	90	-90
955	81	-90

NUM	ALPHA	BETA
722	90	39
728	42	0
734	9	0
740	66	-90
746	78	-93
752	60	-90
758	90	-96
764	81	-93
770	69	-90
776	51	-90
782	93	-96
788	84	-93
794	75	-90
800	63	-90
806	42	-84
812	90	-96
818	87	-93
824	78	-90
830	66	-90
836	48	-87
842	96	-93
848	87	-93
854	81	-93
860	69	-90
866	57	-87
872	21	-78
878	93	-93
884	84	-93
890	78	-90
896	66	-90
902	48	-87
908	96	-93
914	90	-93
920	81	-90
926	72	-90
932	60	-87
938	33	-81
944	96	-93
950	87	-90
956	81	-90

NUM	ALPHA	BETA
723	75	36
729	36	0
735	6	0
741	66	-90
747	75	-93
753	63	-90
759	87	-93
765	78	-93
771	66	-90
777	45	-93
783	90	-96
789	84	-93
795	75	-90
801	60	-87
807	27	-81
813	90	-96
819	84	-93
825	75	-90
831	66	-90
837	42	-84
843	93	-93
849	87	-93
855	78	-90
861	69	-90
867	54	-87
873	93	-93
879	90	-93
885	84	-93
891	75	-90
897	66	-90
903	42	-84
909	96	-93
915	87	-93
921	81	-90
927	72	-90
933	57	-87
939	21	-78
945	93	-93
951	87	-90
957	78	-90

NUM	ALPHA	BETA
724	66	27
730	30	0
736	6	0
742	84	-93
748	75	-93
754	63	-90
760	87	-93
766	78	-93
772	63	-90
778	42	-96
784	90	-96
790	81	-93
796	72	-90
802	57	-87
808	93	-96
814	90	-93
820	84	-93
826	75	-90
832	63	-90
838	39	-81
844	93	-93
850	84	-93
856	78	-90
862	66	-90
868	48	-87
874	96	-93
880	90	-93
886	84	-90
892	75	-90
898	63	-90
904	36	-81
910	93	-93
916	87	-93
922	78	-90
928	69	-90
934	54	-87
940	96	-93
946	93	-93
952	87	-90
958	78	-90

NUM	ALPHA	BETA
725	45	24
731	21	0
737	3	0
743	81	-93
749	75	-93
755	60	-90
761	84	-93
767	75	-93
773	60	-87
779	30	-99
785	87	-96
791	81	-93
797	69	-90
803	54	-87
809	93	-96
815	90	-93
821	81	-93
827	75	-90
833	60	-87
839	21	-78
845	90	-93
851	84	-93
857	75	-90
863	66	-90
869	42	-84
875	96	-93
881	90	-93
887	81	-90
893	72	-90
899	60	-87
905	21	-81
911	93	-93
917	87	-93
923	78	-90
929	69	-90
935	48	-87
941	99	-93
947	90	-93
953	84	-90
959	75	-90

NUM	ALPHA	BETA
726	90	45
732	15	0
738	3	0
744	81	-93
750	72	-93
756	90	-96
762	84	-93
768	75	-90
774	57	-87
780	93	-96
786	87	-93
792	78	-93
798	69	-90
804	51	-87
810	93	-96
816	87	-93
822	81	-93
828	72	-90
834	57	-87
840	96	-93
846	90	-93
852	84	-93
858	75	-90
864	63	-90
870	36	-84
876	93	-93
882	87	-93
888	81	-90
894	72	-90
900	57	-87
906	96	-93
912	93	-93
918	84	-90
924	75	-90
930	66	-90
936	45	-84
942	96	-93
948	90	-93
954	84	-90
960	75	-90

NUM	ALPHA	BETA	NUM	ALPHA	BETA	NUM	ALPHA	BETA	NUM	ALPHA	BETA	NUM	ALPHA	BETA	NUM	ALPHA	BETA
961	72	-90	962	69	-90	963	69	-90	964	66	-90	965	66	-90	966	63	-87
967	60	-87	968	57	-87	969	54	-87	970	48	-87	971	42	-84	972	39	-84
973	30	-81	974	18	-78	975	96	-93	976	99	-93	977	99	-93	978	96	-93
979	96	-93	980	93	-93	981	93	-93	982	93	-90	983	90	-90	984	90	-90
985	87	-90	986	87	-90	987	87	-90	988	84	-90	989	84	-90	990	84	-90
991	81	-90	992	81	-90	993	78	-90	994	78	-90	995	75	-90	996	75	-90
997	72	-90	998	69	-90	999	69	-90	1000	66	-90	1001	63	-87	1002	60	-87
1003	60	-87	1004	57	-87	1005	51	-87	1006	45	-84	1007	42	-84	1008	36	-81
1009	33	-78	1010	18	-78	1011	96	-93	1012	99	-93	1013	99	-93	1014	96	-93
1015	96	-93	1016	93	-90	1017	93	-90	1018	93	-90	1019	90	-90	1020	90	-90
1021	90	-90	1022	87	-90	1023	87	-90	1024	87	-90	1025	84	-90	1026	84	-90
1027	81	-90	1028	81	-90	1029	81	-90	1030	78	-90	1031	78	-90	1032	75	-90
1033	72	-90	1034	72	-87	1035	69	-87	1036	69	-87	1037	66	-87	1038	63	-87
1039	60	-87	1040	57	-87	1041	54	-87	1042	51	-84	1043	45	-84	1044	39	-84
1045	33	-81	1046	33	-78	1047	18	-78	1048	96	-93	1049	99	-93	1050	99	-93
1051	96	-90	1052	96	-90	1053	96	-90	1054	93	-90	1055	93	-90	1056	90	-90
1057	90	-90	1058	90	-90	1059	87	-90	1060	87	-90	1061	87	-90	1062	84	-90
1063	84	-90	1064	84	-90	1065	81	-87	1066	81	-87	1067	78	-87	1068	78	-87
1069	78	-87	1070	75	-87	1071	72	-87	1072	72	-87	1073	69	-87	1074	69	-87
1075	66	-87	1076	63	-87	1077	60	-87	1078	57	-87	1079	54	-84	1080	51	-84
1081	45	-84	1082	39	-81	1083	30	-78	1084	15	-75	1085	96	-93	1086	99	-93
1087	99	-90	1088	96	-90	1089	96	-90	1090	96	-90	1091	93	-90	1092	93	-90
1093	93	-90	1094	90	-90	1095	90	-90	1096	90	-90	1097	87	-87	1098	87	-87
1099	87	-87	1100	84	-87	1101	84	-87	1102	84	-87	1103	81	-87	1104	81	-87
1105	78	-87	1106	78	-87	1107	75	-87	1108	75	-87	1109	72	-87	1110	72	-87
1111	69	-87	1112	69	-87	1113	66	-84	1114	63	-84	1115	60	-84	1116	57	-84
1117	51	-84	1118	48	-81	1119	45	-81	1120	42	-78	1121	36	-75	1122	30	-72
1123	15	-69	1124	96	-90	1125	99	-90	1126	99	-90	1127	96	-90	1128	96	-90
1129	96	-90	1130	93	-90	1131	93	-90	1132	93	-90	1133	90	-87	1134	90	-87
1135	90	-87	1136	87	-87	1137	87	-87	1138	87	-87	1139	84	-87	1140	84	-87
1141	84	-87	1142	81	-87	1143	81	-87	1144	78	-87	1145	78	-87	1146	78	-87
1147	75	-87	1148	75	-84	1149	72	-84	1150	72	-84	1151	69	-84	1152	69	-84
1153	66	-84	1154	63	-84	1155	60	-81	1156	54	-81	1157	51	-78	1158	45	-78
1159	39	-75	1160	36	-69	1161	33	-66	1162	18	-63	1163	96	-90	1164	96	-90
1165	96	-90	1166	96	-90	1167	96	-90	1168	93	-90	1169	93	-87	1170	93	-87
1171	90	-87	1172	90	-87	1173	90	-87	1174	87	-87	1175	87	-87	1176	87	-87
1177	87	-87	1178	84	-87	1179	84	-87	1180	84	-87	1181	81	-87	1182	81	-84
1183	81	-84	1184	78	-84	1185	78	-84	1186	75	-84	1187	75	-84	1188	72	-84
1189	72	-84	1190	69	-84	1191	66	-81	1192	63	-81	1193	63	-81	1194	57	-78
1195	57	-78	1196	57	-78	1197	48	-75	1198	45	-72	1199	39	-69	1200	36	-63

NUM	ALPHA	BETA	NUM	ALPHA	BETA	NUM	ALPHA	BETA	NUM	ALPHA	BETA	NUM	ALPHA	BETA
1201	30	-57	1202	18	-51	1203	96	-90	1204	96	-90	1205	96	-90
1207	96	-87	1208	93	-87	1209	93	-87	1210	93	-87	1211	90	-87
1213	90	-87	1214	87	-87	1215	87	-87	1216	87	-87	1217	87	-87
1219	84	-84	1220	84	-84	1221	81	-84	1222	81	-84	1223	81	-84
1225	78	-84	1226	75	-84	1227	75	-81	1228	72	-81	1229	72	-81
1231	66	-81	1232	63	-78	1233	60	-78	1234	60	-78	1235	54	-75
1237	48	-69	1238	42	-66	1239	36	-60	1240	33	-51	1241	21	-45
1243	96	-90	1244	96	-87	1245	96	-87	1246	93	-87	1247	93	-87
1249	90	-87	1250	90	-87	1251	90	-87	1252	90	-84	1253	87	-84
1255	87	-84	1256	87	-84	1257	84	-84	1258	84	-84	1259	84	-84
1261	81	-84	1262	81	-81	1263	78	-81	1264	78	-81	1265	75	-81
1267	72	-78	1268	72	-78	1269	69	-78	1270	66	-75	1271	63	-75
1273	57	-69	1274	54	-69	1275	51	-63	1276	45	-57	1277	42	-51
1279	24	-33	1280	93	-87	1281	96	-87	1282	96	-87	1283	93	-87
1285	93	-87	1286	93	-87	1287	90	-84	1288	90	-84	1289	90	-84
1291	87	-84	1292	87	-84	1293	87	-84	1294	84	-81	1295	84	-81
1297	84	-81	1298	81	-81	1299	81	-78	1300	78	-78	1301	78	-78
1303	75	-75	1304	72	-72	1305	72	-72	1306	69	-72	1307	66	-69
1309	63	-63	1310	60	-60	1311	57	-57	1312	54	-51	1313	48	-45
1315	33	-27	1316	93	-87	1317	93	-87	1318	93	-87	1319	93	-84
1321	90	-84	1322	90	-84	1323	90	-84	1324	90	-84	1325	87	-81
1327	87	-81	1328	87	-81	1329	84	-78	1330	84	-78	1331	84	-78
1333	81	-75	1334	81	-75	1335	78	-72	1336	78	-72	1337	75	-69
1339	72	-66	1340	69	-63	1341	69	-60	1342	66	-57	1343	63	-51
1345	57	-42	1346	57	-36	1347	54	-27	1348	39	-21	1349	93	-84
1351	93	-84	1352	90	-84	1353	90	-84	1354	90	-81	1355	90	-81
1357	87	-81	1358	87	-78	1359	84	-78	1360	84	-78	1361	84	-75
1363	81	-75	1364	78	-72	1365	78	-69	1366	75	-69	1367	75	-66
1369	72	-60	1370	69	-57	1371	66	-54	1372	63	-48	1373	60	-45
1375	57	-33	1376	54	-27	1377	45	-21	1378	90	-84	1379	93	-84
1381	90	-81	1382	90	-81	1383	87	-81	1384	87	-81	1385	87	-78
1387	84	-78	1388	84	-75	1389	81	-75	1390	81	-72	1391	78	-72
1393	75	-66	1394	72	-63	1395	69	-60	1396	66	-54	1397	66	-51
1399	60	-42	1400	57	-36	1401	57	-27	1402	45	-21	1403	90	-84
1405	90	-81	1406	87	-81	1407	87	-81	1408	87	-78	1409	87	-78
1411	84	-75	1412	81	-75	1413	81	-72	1414	78	-69	1415	75	-66
1417	72	-63	1418	69	-60	1419	66	-54	1420	66	-51	1421	63	-42
1423	60	-30	1424	45	-24	1425	90	-78	1426	87	-78	1427	84	-78
1429	84	-75	1430	81	-72	1431	78	-69	1432	75	-66	1433	75	-63
1435	66	-57	1436	63	-48	1437	60	-42	1438	60	-36	1439	57	-27
1440	48	-27												

NUM	ALPHA	BETA
1441	90	-75
1447	66	-57
1453	90	-60
1459	45	-24

NUM	ALPHA	BETA
1442	87	-75
1448	63	-51
1454	78	-60
1460	90	-39

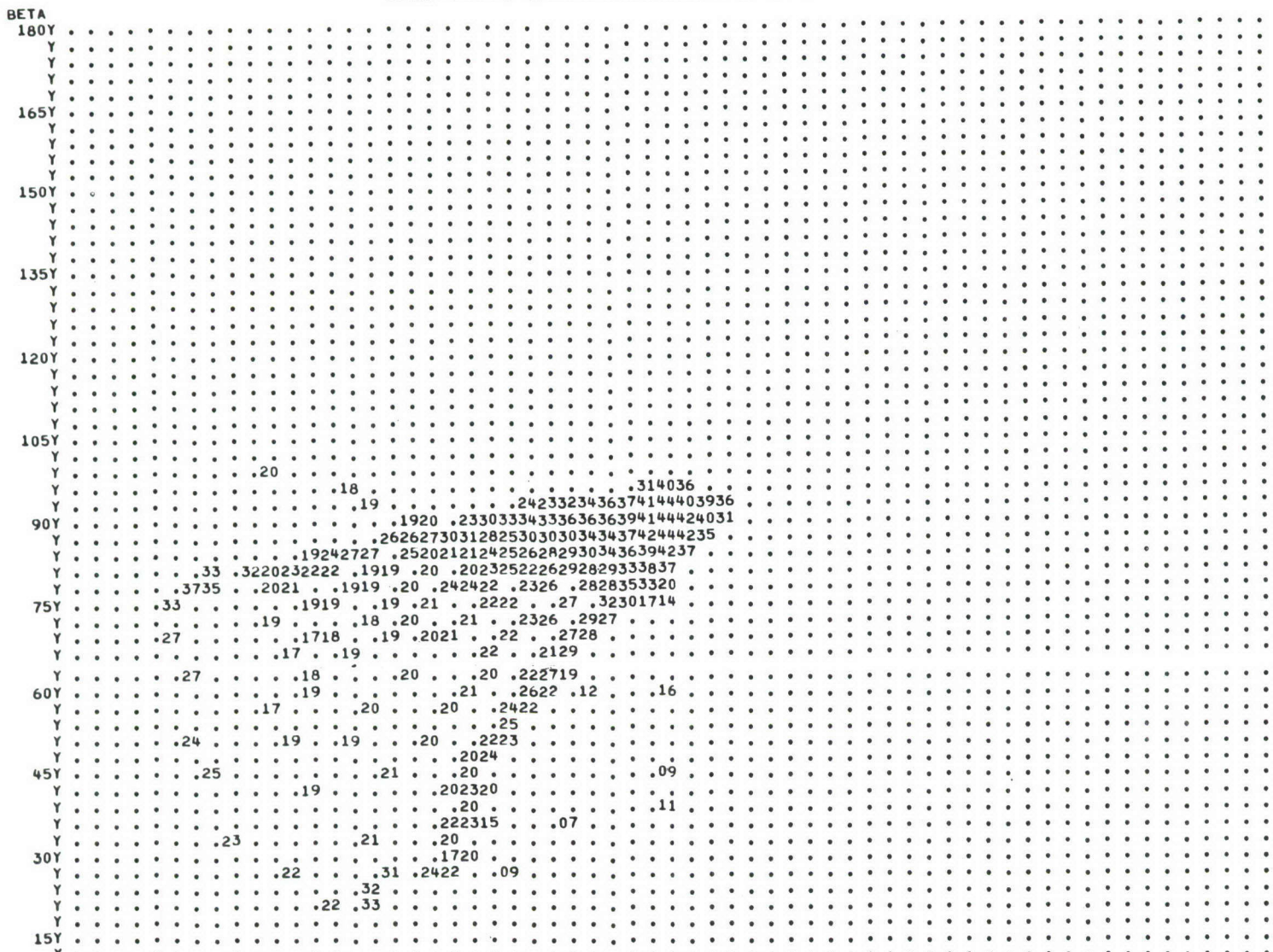
NUM	ALPHA	BETA
1443	75	-69
1449	60	-42
1455	66	-51
1461	75	-36

NUM	ALPHA	BETA
1444	78	-69
1450	60	-36
1456	63	-42
1462	66	-27

NUM	ALPHA	BETA
1445	75	-66
1451	57	-30
1457	63	-36
1463	45	-24

NUM	ALPHA	BETA
1446	72	-63
1452	48	-27
1458	60	-30
1464	90	-45

AREA CONTOUR PLOT
SCALE FACTOR: VALUE=10X LOG BASE 10 OF 1000X AREA

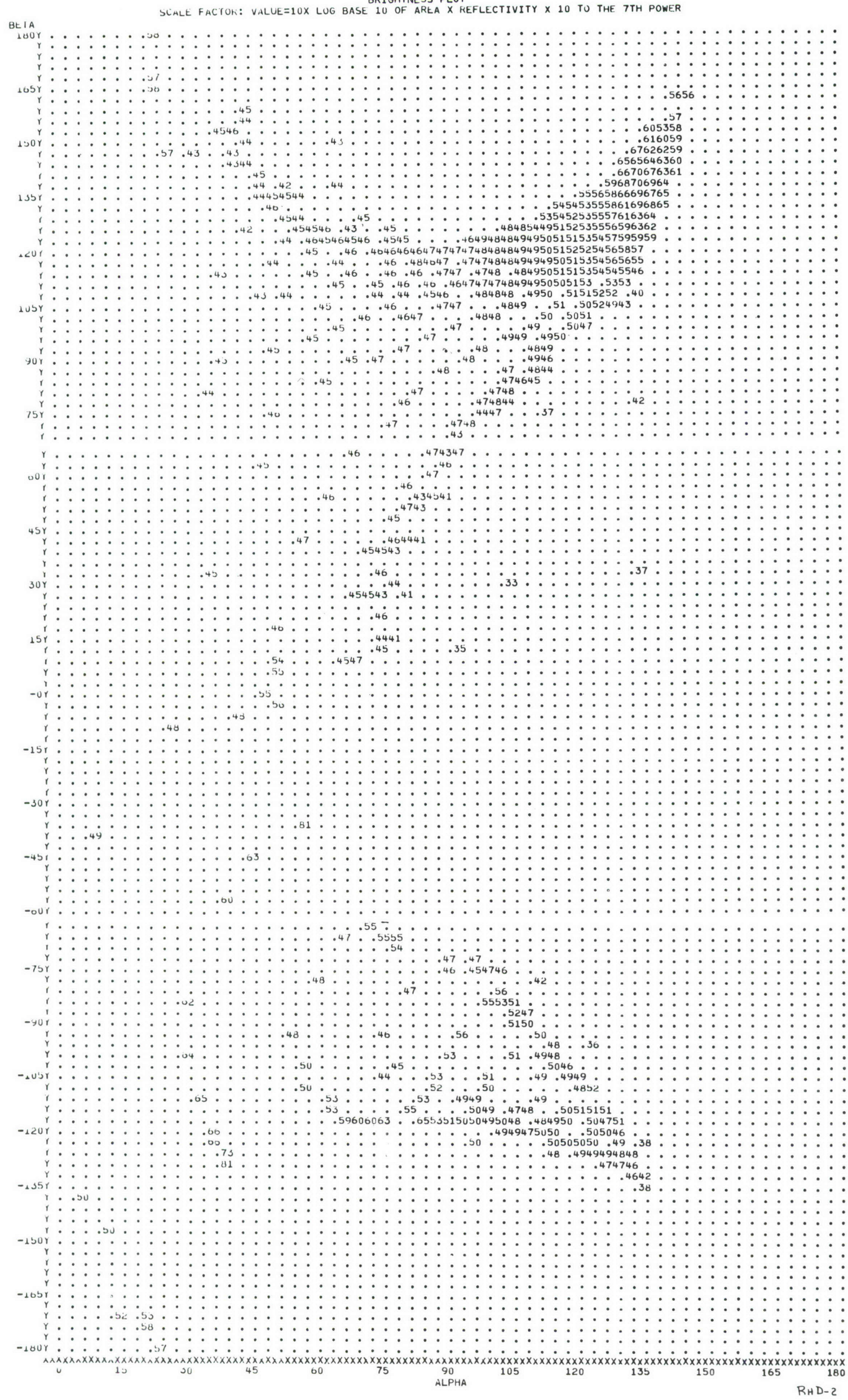


RHD-1

UNCLASSIFIED

UNCLASSIFIED

SUN ZENITH= 45. SUN AZIMUTH= 45.
BRIGHTNESS PLOT
SCALE FACTOR: VALUE=10X LOG BASE 10 OF AREA X REFLECTIVITY X 10 TO THE 7TH POWER

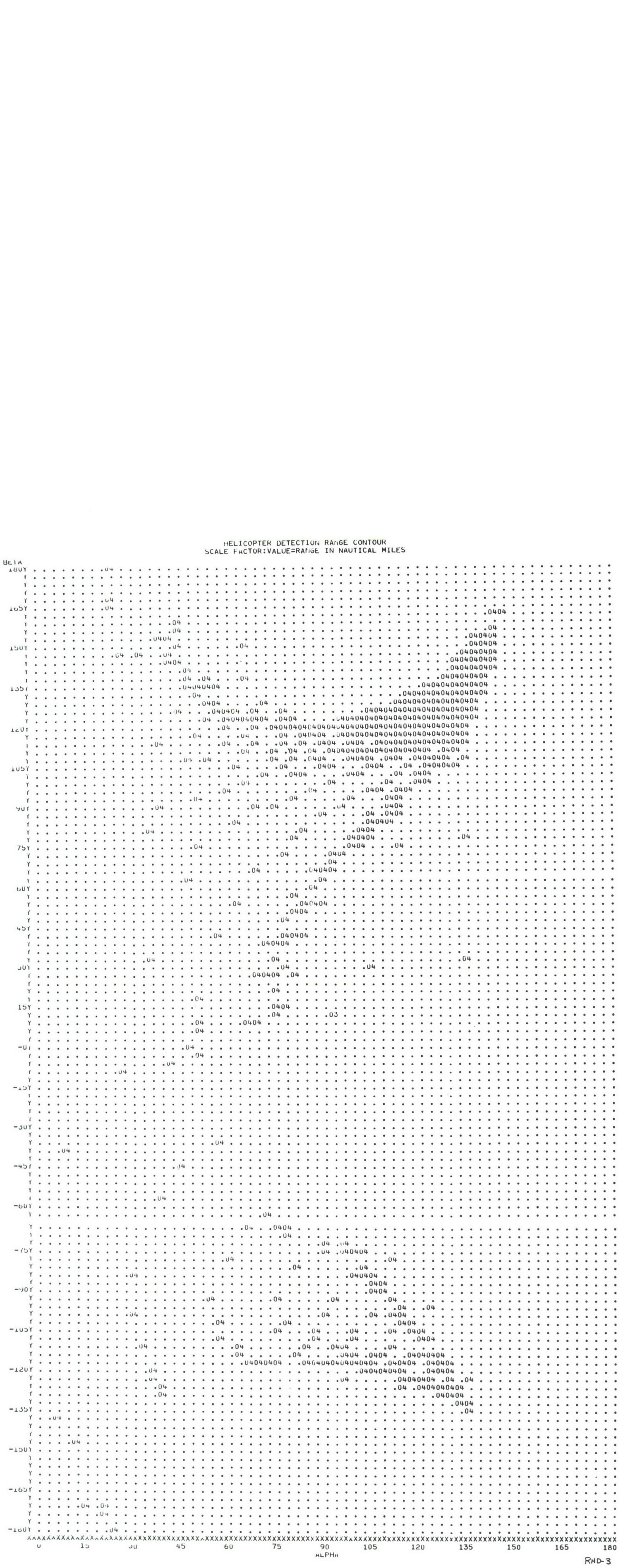


RHD-2

UNCLASSIFIED

UNCLASSIFIED

HELICOPTER DETECTION RANGE CONTOUR
SCALE FACTOR:VALUE=RANGE IN NAUTICAL MILES



RHD-3

REFLECTED RAY ALPHA, BETA, ANGLE OF INCIDENCE, DETECTION RANGE LISTING

NUM	ALPHA	BETA	ANGLE	RANGE	NUM	ALPHA	BETA	ANGLE	RANGE	NUM	ALPHA	BETA	ANGLE	RANGE	NUM	ALPHA	BETA	ANGLE	RANGE
1	99	123	45	3.	2	96	123	43	2.	3	93	120	42	2.	4	123	135	57	3.
5	123	135	56	4.	6	120	132	55	3.	7	117	132	53	4.	8	117	129	52	3.
9	114	129	51	3.	10	111	126	49	3.	11	111	126	50	3.	12	105	126	47	3.
13	102	123	45	2.	14	96	120	43	2.	15	90	120	40	2.	16	90	120	40	2.
17	84	117	37	3.	18	135	147	64	6.	19	135	147	63	6.	20	132	144	62	6.
21	132	141	60	6.	22	129	138	59	4.	23	126	135	58	4.	24	126	135	56	3.
25	123	132	55	3.	26	120	129	54	3.	27	117	129	52	3.	28	114	129	51	3.
29	114	126	50	3.	30	108	126	49	3.	31	105	123	47	2.	32	99	123	45	2.
33	90	123	43	2.	34	93	120	42	2.	35	87	120	40	2.	36	81	123	38	2.
37	78	120	37	2.	38	72	129	37	2.	39	66	138	38	2.	40	66	150	40	2.
41	45	159	36	2.	42	138	153	66	4.	43	138	153	66	5.	44	138	150	65	5.
45	135	147	63	5.	46	132	144	62	6.	47	132	141	61	6.	48	132	138	60	6.
49	129	138	59	4.	50	126	135	58	4.	51	126	132	56	3.	52	123	132	55	3.
53	120	129	54	3.	54	117	129	52	3.	55	114	126	51	3.	56	114	126	50	3.
57	111	123	49	3.	58	108	123	47	2.	59	105	123	46	2.	60	99	120	44	2.
61	90	120	43	2.	62	90	120	41	2.	63	87	120	39	2.	64	81	120	38	2.
65	78	123	36	2.	66	69	123	35	2.	67	60	126	33	2.	68	57	135	33	2.
69	27	147	28	4.	70	138	150	65	4.	71	138	150	65	4.	72	138	150	65	5.
73	138	150	65	5.	74	138	147	64	5.	75	135	144	63	5.	76	135	144	63	5.
77	135	141	61	6.	78	132	141	61	6.	79	132	138	60	5.	80	129	135	58	4.
81	126	135	57	3.	82	126	132	56	3.	83	123	132	55	3.	84	120	129	54	3.
85	120	129	55	3.	86	117	126	52	3.	87	114	126	50	2.	88	111	126	49	2.
89	108	123	48	2.	90	108	123	47	2.	91	102	123	45	2.	92	99	123	44	2.
93	96	120	43	2.	94	90	120	41	2.	95	87	120	39	2.	96	81	123	38	2.
97	72	123	36	2.	98	69	126	35	2.	99	57	129	32	2.	100	54	138	33	2.
101	24	105	30	4.	102	141	150	66	3.	103	144	153	67	4.	104	141	150	65	4.
105	141	147	65	5.	106	138	144	64	5.	107	135	144	63	5.	108	135	141	62	6.
109	132	138	61	6.	110	132	136	60	5.	111	132	135	59	5.	112	129	135	58	4.
113	120	132	56	3.	114	123	132	55	3.	115	123	129	54	3.	116	120	129	53	3.
117	117	126	52	3.	118	117	126	51	3.	119	114	126	50	3.	120	111	126	49	3.
121	111	123	48	2.	122	102	123	46	2.	123	102	123	44	2.	124	96	120	43	2.
125	93	120	42	2.	126	90	120	40	2.	127	84	120	38	2.	128	78	120	37	2.
129	72	123	35	2.	130	63	123	33	2.	131	57	129	32	2.	132	48	135	31	2.
133	42	144	31	2.	134	24	168	30	4.	135	141	147	65	4.	136	141	150	66	4.
137	141	150	66	4.	138	141	147	65	5.	139	138	147	64	5.	140	138	144	63	5.
141	138	141	62	6.	142	135	138	61	6.	143	132	138	60	6.	144	132	135	59	5.
145	129	135	58	4.	146	129	132	57	4.	147	126	132	56	3.	148	123	129	55	3.
149	123	129	54	3.	150	120	129	53	3.	151	117	126	52	3.	152	117	126	51	3.
153	114	126	50	3.	154	111	123	49	3.	155	108	123	47	2.	156	105	123	46	2.
157	102	123	45	2.	158	99	120	43	2.	159	93	120	42	2.	160	90	120	40	2.

NUM	ALPHA	BETA	ANGLE	RANGE	NUM	ALPHA	BETA	ANGLE	RANGE	NUM	ALPHA	BETA	ANGLE	RANGE	NUM	ALPHA	BETA	ANGLE	RANGE
161	87	120	39	2.	162	81	120	37	2.	163	72	123	35	2.	164	66	123	34	2.
165	57	129	33	2.	166	48	141	32	2.	167	24	165	30	4.	168	141	153	67	3.
169	144	156	68	4.	170	144	153	67	4.	171	141	150	66	4.	172	141	147	65	5.
173	138	144	64	5.	174	138	141	63	5.	175	135	141	61	6.	176	135	138	61	6.
177	132	135	60	6.	178	132	135	59	4.	179	129	132	57	4.	180	126	132	56	4.
181	126	129	55	3.	182	123	129	54	3.	183	120	129	53	3.	184	120	126	52	3.
185	117	126	51	3.	186	114	123	50	3.	187	111	123	48	3.	188	108	123	47	3.
189	105	123	46	3.	190	102	120	45	2.	191	99	120	44	2.	192	96	120	42	2.
193	96	120	40	2.	194	87	120	39	2.	195	81	120	37	2.	196	75	120	35	2.
197	69	123	34	2.	198	60	126	32	2.	199	51	135	32	2.	200	45	150	32	2.
201	24	168	30	4.	202	144	156	68	3.	203	144	162	70	4.	204	144	153	67	4.
205	141	150	66	4.	206	141	150	65	5.	207	141	147	64	5.	208	138	144	63	5.
209	135	141	62	7.	210	135	138	61	6.	211	135	138	60	6.	212	132	135	59	5.
213	129	132	58	4.	214	129	132	57	4.	215	126	129	56	4.	216	123	129	55	3.
217	123	129	54	3.	218	120	126	53	3.	219	117	126	52	3.	220	114	123	50	3.
221	114	123	49	3.	222	111	123	48	3.	223	108	123	47	3.	224	102	120	45	3.
225	102	120	44	2.	226	99	120	43	2.	227	93	120	42	2.	228	90	120	40	2.
229	84	120	38	2.	230	81	120	37	2.	231	75	120	35	2.	232	66	123	34	2.
233	57	126	32	2.	234	54	135	33	2.	235	42	153	32	2.	236	24	-180	31	4.
237	144	156	68	3.	238	144	162	70	4.	239	144	156	68	4.	240	144	153	67	4.
241	141	150	66	4.	242	141	147	65	5.	243	138	144	64	5.	244	138	141	62	6.
245	135	138	62	6.	246	135	138	60	6.	247	132	135	59	5.	248	132	132	58	5.
249	129	132	58	4.	250	126	129	56	4.	251	126	129	55	3.	252	123	129	54	3.
253	123	126	53	3.	254	120	126	52	3.	255	117	123	51	3.	256	114	123	50	3.
257	114	123	49	3.	258	111	123	48	3.	259	105	120	46	3.	260	102	120	45	3.
261	102	120	44	2.	262	96	120	43	2.	263	93	120	41	2.	264	87	120	39	2.
265	84	120	38	2.	266	78	120	36	2.	267	72	123	35	2.	268	63	126	33	2.
269	54	129	31	2.	270	48	138	32	2.	271	45	156	33	2.	272	24	180	31	4.
273	144	156	68	3.	274	147	162	70	4.	275	144	156	68	4.	276	144	153	67	4.
277	141	150	66	4.	278	141	147	64	5.	279	141	144	64	5.	280	138	141	62	6.
281	138	138	61	6.	282	135	138	61	6.	283	135	135	60	6.	284	132	132	58	5.
285	129	132	57	4.	286	129	129	56	4.	287	126	129	55	4.	288	126	126	55	3.
289	123	126	53	3.	290	120	126	52	3.	291	120	123	52	3.	292	117	123	50	3.
293	114	123	49	3.	294	111	120	48	3.	295	108	120	47	3.	296	105	120	46	3.
297	102	120	45	3.	298	99	120	43	2.	299	96	120	42	2.	300	90	117	40	2.
301	87	120	39	2.	302	81	120	37	2.	303	75	120	35	2.	304	69	123	34	2.
305	63	126	33	2.	306	51	132	31	2.	307	45	144	32	2.	308	45	159	34	2.
309	24	180	31	4.	310	144	156	68	3.	311	147	162	70	4.	312	144	156	68	4.
313	144	153	67	4.	314	144	150	66	4.	315	141	144	64	5.	316	141	144	64	5.
317	138	141	62	5.	318	138	138	61	6.	319	135	135	60	6.	320	135	135	59	6.

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NUM	ALPHA	BETA	ANGLE	RANGE	NUM	ALPHA	BETA	ANGLE	RANGE	NUM	ALPHA	BETA	ANGLE	RANGE
321	132	132	58	5.	322	132	129	57	4.	323	129	129	56	4.	324	126	126	55	4.
325	126	126	55	3.	326	123	126	54	3.	327	123	123	53	3.	328	120	123	51	3.
329	117	123	50	3.	330	117	120	50	3.	331	114	120	48	3.	332	111	120	47	3.
333	108	120	46	3.	334	105	117	45	3.	335	102	117	43	2.	336	99	117	42	2.
337	90	117	41	2.	338	90	117	39	2.	339	87	117	38	2.	340	78	117	35	2.
341	75	120	39	2.	342	69	120	33	2.	343	60	123	32	2.	344	51	132	31	2.
345	42	153	32	2.	346	21	-174	32	4.	347	144	150	66	3.	348	144	156	68	4.
349	144	153	67	4.	350	144	150	66	4.	351	141	147	65	4.	352	141	144	64	5.
353	141	141	63	5.	354	138	138	62	6.	355	138	135	61	6.	356	135	132	60	6.
357	135	132	59	6.	358	132	129	58	5.	359	132	129	57	4.	360	129	129	56	4.
361	129	126	55	4.	362	126	123	54	3.	363	126	123	54	3.	364	123	123	53	3.
365	120	120	51	3.	366	120	120	50	3.	367	117	120	49	3.	368	114	120	49	3.
369	111	117	47	3.	370	111	117	46	3.	371	108	117	45	3.	372	102	117	43	3.
373	102	114	42	2.	374	99	114	41	2.	375	93	114	40	2.	376	90	114	38	2.
377	84	114	36	2.	378	78	114	34	2.	379	69	114	32	2.	380	66	117	32	2.
381	60	120	31	2.	382	54	123	30	2.	383	48	135	31	2.	384	39	153	31	2.
385	21	-171	31	3.	386	141	147	65	3.	387	144	153	67	4.	388	144	153	67	4.
389	144	147	65	4.	390	141	144	64	5.	391	141	141	64	5.	392	138	138	62	5.
393	138	138	62	5.	394	138	135	61	6.	395	135	132	59	6.	396	135	132	59	5.
397	132	129	58	5.	398	132	129	57	4.	399	132	126	56	4.	400	129	126	55	4.
401	126	123	54	3.	402	126	123	53	3.	403	123	123	53	3.	404	123	120	52	3.
405	120	120	51	3.	406	117	117	49	3.	407	117	117	49	3.	408	114	117	48	3.
409	111	117	47	3.	410	108	114	45	3.	411	108	114	44	2.	412	102	114	43	2.
413	99	114	41	2.	414	96	111	40	2.	415	93	111	38	2.	416	87	111	37	2.
417	81	111	34	2.	418	75	111	33	2.	419	66	111	31	2.	420	60	114	29	2.
421	51	117	28	2.	422	45	126	29	2.	423	42	147	30	2.	424	15	-171	29	3.
425	141	144	65	3.	426	144	150	66	4.	427	144	147	66	4.	428	144	147	65	4.
429	141	141	63	5.	430	141	136	63	5.	431	141	138	62	5.	432	138	135	61	5.
433	138	132	60	6.	434	135	132	59	5.	435	135	129	58	5.	436	132	126	57	4.
437	132	126	56	4.	438	129	126	56	4.	439	129	123	55	4.	440	126	123	54	3.
441	126	120	53	3.	442	123	120*	52	3.	443	123	120	51	3.	444	120	117	50	3.
445	117	117	49	3.	446	117	117	48	3.	447	114	114	47	3.	448	111	114	46	3.
449	108	114	45	3.	450	105	111	43	2.	451	102	111	42	2.	452	99	111	40	2.
453	90	111	39	2.	454	90	108	36	2.	455	87	108	36	2.	456	75	108	31	2.
457	81	108	34	2.	458	78	105	31	2.	459	63	105	28	2.	460	54	108	27	2.
461	48	108	26	2.	462	39	114	26	2.	463	33	147	28	2.	464	12	-147	28	3.
465	141	144	64	4.	466	144	147	66	4.	467	144	144	65	4.	468	141	141	64	5.
469	141	138	63	5.	470	141	138	62	5.	471	138	135	61	6.	472	138	135	61	6.
473	138	132	59	5.	474	135	129	58	5.	475	135	126	58	5.	476	132	126	57	4.
477	132	123	56	4.	478	129	123	55	4.	479	129	123	54	4.	480	126	120	53	4.

NUM	ALPHA	BETA	ANGLE	RANGE	NUM	ALPHA	BETA	ANGLE	RANGE	NUM	ALPHA	BETA	ANGLE	RANGE	NUM	ALPHA	BETA	ANGLE	RANGE
481	120	120	52	3.	482	123	117	51	3.	483	123	117	51	3.	484	120	117	49	3.
485	117	114	48	3.	486	114	114	47	3.	487	114	111	46	3.	488	111	111	45	3.
489	108	111	44	3.	490	105	108	42	3.	491	102	108	41	3.	492	99	108	39	2.
493	99	105	37	2.	494	90	105	35	2.	495	84	102	32	2.	496	81	102	32	2.
497	72	102	29	2.	498	60	99	26	2.	499	60	96	25	2.	500	51	93	23	2.
501	39	90	23	2.	502	36	81	25	2.	503	6	-138	25	3.	504	141	141	63	4.
505	144	144	64	4.	506	144	141	64	5.	507	141	138	63	5.	508	141	135	62	5.
509	141	135	61	3.	510	138	132	60	6.	511	138	129	59	5.	512	138	129	59	5.
513	135	132	58	3.	514	135	126	57	5.	515	132	123	56	4.	516	132	123	55	4.
517	129	120	54	4.	518	129	120	54	4.	519	126	117	53	3.	520	126	117	52	3.
521	123	114	51	3.	522	123	114	50	3.	523	120	114	49	3.	524	120	111	48	3.
525	117	111	48	3.	526	114	108	45	3.	527	111	108	44	3.	528	108	105	42	3.
529	105	105	41	3.	530	102	102	39	3.	531	99	102	37	2.	532	93	99	35	2.
533	87	96	36	2.	534	81	93	30	2.	535	75	90	26	2.	536	69	90	25	2.
537	60	84	23	2.	538	51	75	20	2.	539	48	83	21	2.	540	36	33	22	2.
541	9	-39	22	3.	542	141	135	62	4.	543	141	138	63	5.	544	141	138	62	5.
545	141	135	61	5.	546	138	132	61	6.	547	138	129	59	5.	548	138	129	59	5.
549	138	126	58	5.	550	135	126	58	5.	551	135	123	56	4.	552	132	120	55	4.
553	132	120	55	4.	554	129	117	54	4.	555	129	117	53	4.	556	126	114	52	3.
557	126	114	51	3.	558	123	111	50	3.	559	123	111	49	3.	560	120	108	47	3.
561	117	105	48	3.	562	117	105	44	3.	563	114	102	43	3.	564	111	99	41	3.
565	108	96	40	3.	566	105	96	38	3.	567	99	93	36	3.	568	96	90	33	2.
569	90	87	31	2.	570	84	81	27	2.	571	81	78	26	2.	572	78	72	24	2.
573	69	66	21	2.	574	63	54	19	2.	575	57	42	18	2.	576	51	18	19	2.
577	27	-9	18	3.	578	138	132	60	5.	579	141	135	61	5.	580	141	132	60	5.
581	138	129	60	5.	582	138	126	59	5.	583	138	126	58	4.	584	135	123	57	4.
585	135	123	57	4.	586	135	120	55	4.	587	132	117	54	4.	588	132	117	54	4.
589	129	114	53	3.	590	129	111	51	3.	591	126	108	50	3.	592	123	108	49	3.
593	123	105	47	3.	594	120	102	46	3.	595	120	99	45	3.	596	117	96	43	3.
597	114	96	42	3.	598	111	93	40	3.	599	105	87	37	2.	600	105	84	36	2.
601	102	81	35	2.	602	99	78	32	2.	603	93	72	29	2.	604	87	66	26	2.
605	81	57	23	2.	606	78	48	22	2.	607	72	39	21	2.	608	69	27	21	2.
609	60	9	23	2.	610	42	-6	18	3.	611	138	129	59	4.	612	138	129	60	5.
613	135	126	59	4.	614	138	123	58	4.	615	138	123	57	4.	616	135	120	56	4.
617	132	117	55	4.	618	132	114	54	4.	619	129	114	52	3.	620	129	111	51	3.
621	126	108	50	3.	622	126	105	49	3.	623	123	102	47	3.	624	120	99	45	3.
625	117	96	43	3.	626	114	93	42	3.	627	111	90	39	3.	628	111	87	38	2.
629	105	81	35	3.	630	102	78	33	2.	631	96	72	30	2.	632	93	66	27	2.
633	87	60	24	2.	634	81	51	21	2.	635	78	42	20	2.	636	75	33	20	2.
637	75	41	22	2.	638	69	9	23	2.	639	51	-3	17	4.	640	138	123	58	4.

NUM	ALPHA	BETA	ANGLE	RANGE	NUM	ALPHA	BETA	ANGLE	RANGE	NUM	ALPHA	BETA	ANGLE	RANGE	NUM	ALPHA	BETA	ANGLE	RANGE
641	130	123	58	4.	642	135	120	57	4.	643	135	120	55	4.	644	135	117	54	4.
645	132	114	53	3.	646	129	111	52	3.	647	129	108	51	3.	648	126	105	49	3.
649	126	105	48	3.	650	123	102	47	3.	651	120	99	45	3.	652	117	96	42	3.
653	114	93	41	3.	654	111	87	38	2.	655	105	84	35	2.	656	102	75	32	2.
657	90	72	30	2.	658	90	63	26	2.	659	87	54	24	2.	660	81	51	22	2.
661	75	59	21	2.	662	72	27	21	2.	663	75	12	25	2.	664	48	0	16	4.
665	135	120	50	3.	666	135	117	55	3.	667	132	117	54	3.	668	132	114	53	3.
669	132	111	52	3.	670	129	111	51	3.	671	129	108	50	3.	672	126	105	49	3.
673	123	102	47	3.	674	120	99	45	3.	675	117	96	43	2.	676	114	90	40	2.
677	108	84	37	2.	678	105	81	35	2.	679	99	78	32	2.	680	93	69	29	2.
681	90	63	27	2.	682	87	54	25	2.	683	81	42	23	2.	684	78	30	23	2.
685	75	15	25	2.	686	51	6	15	4.	687	135	114	54	2.	688	129	105	50	3.
689	120	105	49	3.	690	123	102	48	3.	691	123	99	46	2.	692	117	96	43	2.
693	114	90	41	2.	694	111	84	37	2.	695	105	78	34	2.	696	96	72	30	2.
697	90	63	26	2.	698	84	51	23	2.	699	78	39	21	2.	700	75	27	21	2.
701	75	12	24	2.	702	51	9	14	3.	703	135	108	53	1.	704	132	105	51	2.
705	114	87	41	2.	706	111	87	38	2.	707	105	81	35	2.	708	99	75	31	2.
709	90	66	26	2.	710	84	54	22	2.	711	78	39	21	2.	712	75	27	21	2.
713	75	15	23	2.	714	51	9	14	3.	715	135	78	47	2.	716	114	75	38	1.
717	90	54	25	2.	718	84	42	24	2.	719	81	27	24	2.	720	78	15	26	2.
721	51	6	14	3.	722	135	33	46	1.	723	105	30	35	1.	724	93	12	32	1.
725	51	9	14	3.	726	135	138	60	2.	727	57	-36	31	9.	728	57	-36	31	6.
729	45	-45	30	5.	730	39	-57	31	5.	731	30	-84	34	5.	732	30	-99	36	5.
733	33	-111	38	5.	734	36	-120	40	6.	735	36	-123	41	6.	736	39	-126	42	7.
737	39	-129	42	7.	738	39	-129	42	9.	739	0	0	0	0.	740	0	0	0	0.
741	0	0	0	0.	742	0	0	0	0.	743	0	0	0	0.	744	0	0	0	0.
745	0	0	0	0.	746	0	0	0	0.	747	0	0	0	0.	748	0	0	0	0.
749	0	0	0	0.	750	0	0	0	0.	751	0	0	0	0.	752	0	0	0	0.
753	0	0	0	0.	754	0	0	0	0.	755	0	0	0	0.	756	0	0	0	0.
757	0	0	0	0.	758	0	0	0	0.	759	0	0	0	0.	760	0	0	0	0.
761	0	0	0	0.	762	0	0	0	0.	763	0	0	0	0.	764	0	0	0	0.
765	0	0	0	0.	766	0	0	0	0.	767	0	0	0	0.	768	0	0	0	0.
769	0	0	0	0.	770	0	0	0	0.	771	0	0	0	0.	772	0	0	0	0.
773	0	0	0	0.	774	0	0	0	0.	775	132	-132	87	2.	776	126	-129	84	2.
777	120	-126	81	3.	778	114	-126	78	3.	779	96	-123	69	3.	780	0	0	0	0.
781	0	0	0	0.	782	0	0	0	0.	783	0	0	0	0.	784	0	0	0	0.
785	0	0	0	0.	786	0	0	0	0.	787	0	0	0	0.	788	0	0	0	0.
789	0	0	0	0.	790	0	0	0	0.	791	0	0	0	0.	792	0	0	0	0.
793	0	0	0	0.	794	0	0	0	0.	795	0	0	0	0.	796	0	0	0	0.
797	0	0	0	0.	798	0	0	0	0.	799	0	0	0	0.	800	0	0	0	0.

NUM	ALPHA	BETA	ANGLE	RANGE	NUM	ALPHA	BETA	ANGLE	RANGE	NUM	ALPHA	BETA	ANGLE	RANGE	NUM	ALPHA	BETA	ANGLE	RANGE
801	0	0	0	0.	802	0	0	0	0.	803	129	-129	87	2.	804	123	-126	83	3.
805	114	-123	77	3.	806	105	-120	73	2.	807	84	-117	63	5.	808	0	0	0	0.
809	0	0	0	0.	810	0	0	0	0.	811	0	0	0	0.	812	0	0	0	0.
813	0	0	0	0.	814	0	0	0	0.	815	0	0	0	0.	816	0	0	0	0.
817	0	0	0	0.	818	0	0	0	0.	819	0	0	0	0.	820	0	0	0	0.
821	0	0	0	0.	822	0	0	0	0.	823	0	0	0	0.	824	0	0	0	0.
825	0	0	0	0.	826	0	0	0	0.	827	0	0	0	0.	828	0	0	0	0.
829	0	0	0	0.	830	0	0	0	0.	831	0	0	0	0.	832	0	0	0	0.
833	0	0	0	0.	834	132	-132	89	1.	835	126	-129	85	2.	836	120	-126	81	2.
837	111	-120	75	2.	838	102	-120	71	2.	839	75	-117	59	5.	840	0	0	0	0.
841	0	0	0	0.	842	0	0	0	0.	843	0	0	0	0.	844	0	0	0	0.
845	0	0	0	0.	846	0	0	0	0.	847	0	0	0	0.	848	0	0	0	0.
849	0	0	0	0.	850	0	0	0	0.	851	0	0	0	0.	852	0	0	0	0.
853	0	0	0	0.	854	0	0	0	0.	855	0	0	0	0.	856	0	0	0	0.
857	0	0	0	0.	858	0	0	0	0.	859	0	0	0	0.	860	0	0	0	0.
861	0	0	0	0.	862	0	0	0	0.	863	0	0	0	0.	864	0	0	0	0.
865	0	0	0	0.	866	132	-132	89	2.	867	129	-129	85	2.	868	117	-123	80	3.
869	111	-120	75	2.	870	99	-117	70	3.	871	90	-117	66	3.	872	72	-117	58	4.
873	0	0	0	0.	874	0	0	0	0.	875	0	0	0	0.	876	0	0	0	0.
877	0	0	0	0.	878	0	0	0	0.	879	0	0	0	0.	880	0	0	0	0.
881	0	0	0	0.	882	0	0	0	0.	883	0	0	0	0.	884	0	0	0	0.
885	0	0	0	0.	886	0	0	0	0.	887	0	0	0	0.	888	0	0	0	0.
889	0	0	0	0.	890	0	0	0	0.	891	0	0	0	0.	892	0	0	0	0.
893	0	0	0	0.	894	0	0	0	0.	895	0	0	0	0.	896	0	0	0	0.
897	0	0	0	0.	898	0	0	0	0.	899	0	0	0	0.	900	135	-135	90	1.
901	126	-129	85	2.	902	120	-123	81	3.	903	108	-120	75	2.	904	96	-117	68	3.
905	75	-117	59	5.	906	0	0	0	0.	907	0	0	0	0.	908	0	0	0	0.
909	0	0	0	0.	910	0	0	0	0.	911	0	0	0	0.	912	0	0	0	0.
913	0	0	0	0.	914	0	0	0	0.	915	0	0	0	0.	916	0	0	0	0.
917	0	0	0	0.	918	0	0	0	0.	919	0	0	0	0.	920	0	0	0	0.
921	0	0	0	0.	922	0	0	0	0.	923	0	0	0	0.	924	0	0	0	0.
925	0	0	0	0.	926	0	0	0	0.	927	0	0	0	0.	928	0	0	0	0.
929	0	0	0	0.	930	0	0	0	0.	931	0	0	0	0.	932	0	0	0	0.
933	135	-135	90	1.	934	129	-129	86	2.	935	120	-126	82	3.	936	111	-120	77	3.
937	99	-117	71	3.	938	90	-117	66	3.	939	72	-117	58	5.	940	0	0	0	0.
941	0	0	0	0.	942	0	0	0	0.	943	0	0	0	0.	944	0	0	0	0.
945	0	0	0	0.	946	0	0	0	0.	947	0	0	0	0.	948	0	0	0	0.
949	0	0	0	0.	950	0	0	0	0.	951	0	0	0	0.	952	0	0	0	0.
953	0	0	0	0.	954	0	0	0	0.	955	0	0	0	0.	956	0	0	0	0.
957	0	0	0	0.	958	0	0	0	0.	959	0	0	0	0.	960	0	0	0	0.

NUM	ALPHA	BETA	ANGLE	RANGE	NUM	ALPHA	BETA	ANGLE	RANGE	NUM	ALPHA	BETA	ANGLE	RANGE	NUM	ALPHA	BETA	ANGLE	RANGE
961	0	0	0	0.	962	0	0	0	0.	963	0	0	0	0.	964	0	0	0	0.
965	0	0	0	0.	966	0	0	0	0.	967	0	0	0	0.	968	135	-135	89	1.
969	129	-129	86	2.	970	129	-123	81	3.	971	111	-120	76	3.	972	102	-120	72	3.
973	87	-117	64	3.	974	69	-117	56	4.	975	0	0	0	0.	976	0	0	0	0.
977	0	0	0	0.	978	0	0	0	0.	979	0	0	0	0.	980	0	0	0	0.
981	0	0	0	0.	982	0	0	0	0.	983	0	0	0	0.	984	0	0	0	0.
985	0	0	0	0.	986	0	0	0	0.	987	0	0	0	0.	988	0	0	0	0.
989	0	0	0	0.	990	0	0	0	0.	991	0	0	0	0.	992	0	0	0	0.
993	0	0	0	0.	994	0	0	0	0.	995	0	0	0	0.	996	0	0	0	0.
997	0	0	0	0.	998	0	0	0	0.	999	0	0	0	0.	1000	0	0	0	0.
1001	0	0	0	0.	1002	0	0	0	0.	1003	0	0	0	0.	1004	132	-132	88	2.
1005	126	-126	84	3.	1006	117	-123	79	3.	1007	105	-120	74	3.	1008	96	-117	69	3.
1009	90	-117	64	3.	1010	69	-117	56	4.	1011	0	0	0	0.	1012	0	0	0	0.
1013	0	0	0	0.	1014	0	0	0	0.	1015	0	0	0	0.	1016	0	0	0	0.
1017	0	0	0	0.	1018	0	0	0	0.	1019	0	0	0	0.	1020	0	0	0	0.
1021	0	0	0	0.	1022	0	0	0	0.	1023	0	0	0	0.	1024	0	0	0	0.
1025	0	0	0	0.	1026	0	0	0	0.	1027	0	0	0	0.	1028	0	0	0	0.
1029	0	0	0	0.	1030	0	0	0	0.	1031	0	0	0	0.	1032	0	0	0	0.
1033	0	0	0	0.	1034	0	0	0	0.	1035	0	0	0	0.	1036	0	0	0	0.
1037	0	0	0	0.	1038	0	0	0	0.	1039	0	0	0	0.	1040	135	-135	90	1.
1041	129	-129	86	2.	1042	123	-126	83	3.	1043	114	-123	78	3.	1044	102	-120	72	3.
1045	93	-117	66	3.	1046	87	-117	63	3.	1047	69	-117	56	4.	1048	0	0	0	0.
1049	0	0	0	0.	1050	0	0	0	0.	1051	0	0	0	0.	1052	0	0	0	0.
1053	0	0	0	0.	1054	0	0	0	0.	1055	0	0	0	0.	1056	0	0	0	0.
1057	0	0	0	0.	1058	0	0	0	0.	1059	0	0	0	0.	1060	0	0	0	0.
1061	0	0	0	0.	1062	0	0	0	0.	1063	0	0	0	0.	1064	0	0	0	0.
1065	0	0	0	0.	1066	0	0	0	0.	1067	0	0	0	0.	1068	0	0	0	0.
1069	0	0	0	0.	1070	0	0	0	0.	1071	0	0	0	0.	1072	0	0	0	0.
1073	0	0	0	0.	1074	0	0	0	0.	1075	0	0	0	0.	1076	0	0	0	0.
1077	0	0	0	0.	1078	132	-132	88	2.	1079	129	-129	86	2.	1080	120	-123	81	3.
1081	114	-120	77	3.	1082	102	-117	71	3.	1083	87	-117	64	3.	1084	66	-117	54	4.
1085	0	0	0	0.	1086	0	0	0	0.	1087	0	0	0	0.	1088	0	0	0	0.
1089	0	0	0	0.	1090	0	0	0	0.	1091	0	0	0	0.	1092	0	0	0	0.
1093	0	0	0	0.	1094	0	0	0	0.	1095	0	0	0	0.	1096	0	0	0	0.
1097	0	0	0	0.	1098	0	0	0	0.	1099	0	0	0	0.	1100	0	0	0	0.
1101	0	0	0	0.	1102	0	0	0	0.	1103	0	0	0	0.	1104	0	0	0	0.
1105	0	0	0	0.	1106	0	0	0	0.	1107	0	0	0	0.	1108	0	0	0	0.
1109	0	0	0	0.	1110	0	0	0	0.	1111	0	0	0	0.	1112	0	0	0	0.
1113	0	0	0	0.	1114	0	0	0	0.	1115	0	0	0	0.	1116	132	-129	87	2.
1117	123	-123	82	3.	1118	120	-123	80	3.	1119	111	-120	76	3.	1120	105	-117	72	2.

NUM	ALPHA	BETA	ANGLE	RANGE	NUM	ALPHA	BETA	ANGLE	RANGE	NUM	ALPHA	BETA	ANGLE	RANGE	NUM	ALPHA	BETA	ANGLE	RANGE
1121	96	-114	67	3.	1122	81	-114	61	4.	1123	63	-114	53	3.	1124	0	0	0	0.
1125	0	0	0	0.	1126	0	0	0	0.	1127	0	0	0	0.	1128	0	0	0	0.
1129	0	0	0	0.	1130	0	0	0	0.	1131	0	0	0	0.	1132	0	0	0	0.
1133	0	0	0	0.	1134	0	0	0	0.	1135	0	0	0	0.	1136	0	0	0	0.
1137	0	0	0	0.	1138	0	0	0	0.	1139	0	0	0	0.	1140	0	0	0	0.
1141	0	0	0	0.	1142	0	0	0	0.	1143	0	0	0	0.	1144	0	0	0	0.
1145	0	0	0	0.	1146	0	0	0	0.	1147	0	0	0	0.	1148	0	0	0	0.
1149	0	0	0	0.	1150	0	0	0	0.	1151	0	0	0	0.	1152	0	0	0	0.
1153	0	0	0	0.	1154	0	0	0	0.	1155	132	-132	89	2.	1156	126	-126	84	2.
1157	120	-123	80	3.	1158	111	-117	75	2.	1159	99	-114	70	3.	1160	93	-111	65	3.
1161	84	-111	60	3.	1162	63	-111	52	3.	1163	0	0	0	0.	1164	0	0	0	0.
1165	0	0	0	0.	1166	0	0	0	0.	1167	0	0	0	0.	1168	0	0	0	0.
1169	0	0	0	0.	1170	0	0	0	0.	1171	0	0	0	0.	1172	0	0	0	0.
1173	0	0	0	0.	1174	0	0	0	0.	1175	0	0	0	0.	1176	0	0	0	0.
1177	0	0	0	0.	1178	0	0	0	0.	1179	0	0	0	0.	1180	0	0	0	0.
1181	0	0	0	0.	1182	0	0	0	0.	1183	0	0	0	0.	1184	0	0	0	0.
1185	0	0	0	0.	1186	0	0	0	0.	1187	0	0	0	0.	1188	0	0	0	0.
1189	0	0	0	0.	1190	0	0	0	0.	1191	0	0	0	0.	1192	0	0	0	0.
1193	0	0	0	0.	1194	126	-126	85	2.	1195	129	-129	86	2.	1196	129	-126	85	2.
1197	114	-117	77	3.	1198	105	-114	73	2.	1199	96	-111	68	3.	1200	87	-108	62	3.
1201	75	-105	56	2.	1202	57	-108	49	3.	1203	0	0	0	0.	1204	0	0	0	0.
1205	0	0	0	0.	1206	0	0	0	0.	1207	0	0	0	0.	1208	0	0	0	0.
1209	0	0	0	0.	1210	0	0	0	0.	1211	0	0	0	0.	1212	0	0	0	0.
1213	0	0	0	0.	1214	0	0	0	0.	1215	0	0	0	0.	1216	0	0	0	0.
1217	0	0	0	0.	1218	0	0	0	0.	1219	0	0	0	0.	1220	0	0	0	0.
1221	0	0	0	0.	1222	0	0	0	0.	1223	0	0	0	0.	1224	0	0	0	0.
1225	0	0	0	0.	1226	0	0	0	0.	1227	0	0	0	0.	1228	0	0	0	0.
1229	0	0	0	0.	1230	0	0	0	0.	1231	0	0	0	0.	1232	0	0	0	0.
1233	132	-132	88	2.	1234	129	-129	86	2.	1235	123	-123	82	3.	1236	117	-117	78	3.
1237	108	-114	74	3.	1238	99	-108	68	3.	1239	87	-105	62	3.	1240	78	-102	56	2.
1241	57	-102	49	3.	1242	0	0	0	0.	1243	0	0	0	0.	1244	0	0	0	0.
1245	0	0	0	0.	1246	0	0	0	0.	1247	0	0	0	0.	1248	0	0	0	0.
1249	0	0	0	0.	1250	0	0	0	0.	1251	0	0	0	0.	1252	0	0	0	0.
1253	0	0	0	0.	1254	0	0	0	0.	1255	0	0	0	0.	1256	0	0	0	0.
1257	0	0	0	0.	1258	0	0	0	0.	1259	0	0	0	0.	1260	0	0	0	0.
1261	0	0	0	0.	1262	0	0	0	0.	1263	0	0	0	0.	1264	0	0	0	0.
1265	0	0	0	0.	1266	0	0	0	0.	1267	0	0	0	0.	1268	0	0	0	0.
1269	0	0	0	0.	1270	0	0	0	0.	1271	135	-132	89	2.	1272	129	-126	86	2.
1273	123	-120	81	3.	1274	117	-114	78	3.	1275	111	-111	73	3.	1276	99	-105	67	3.
1277	90	-99	62	3.	1278	75	-93	54	2.	1279	54	-93	46	3.	1280	0	0	0	0.

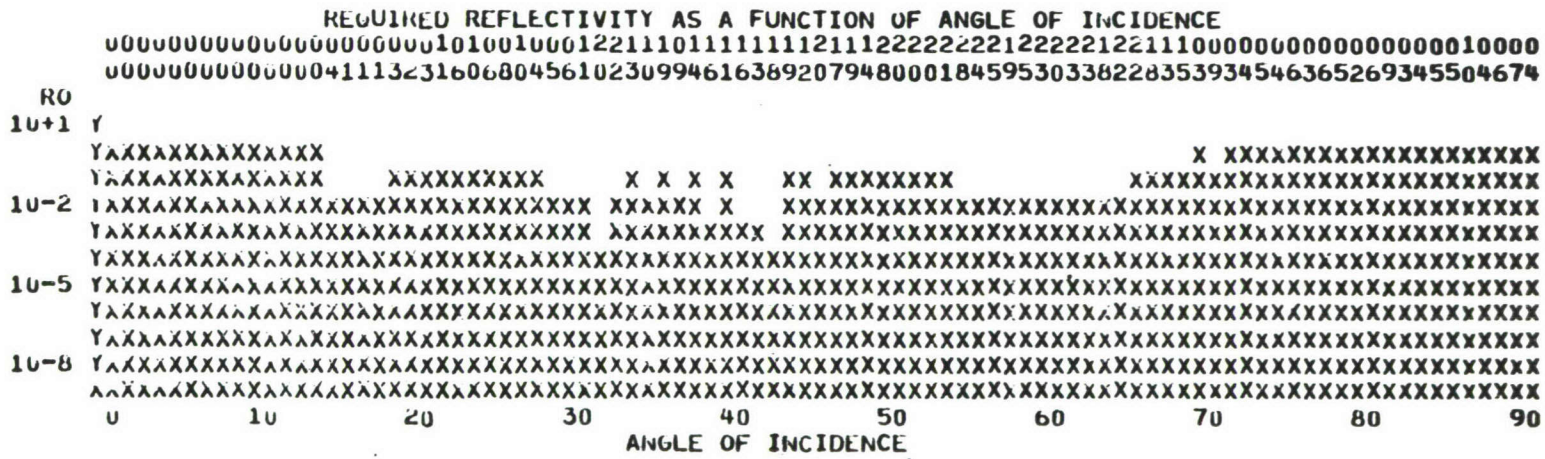
NUM	ALPHA	BETA	ANGLE	RANGE	NUM	ALPHA	BETA	ANGLE	RANGE	NUM	ALPHA	BETA	ANGLE	RANGE	NUM	ALPHA	BETA	ANGLE	RANGE
1261	0	0	0	0.	1262	0	0	0	0.	1283	0	0	0	0.	1284	0	0	0	0.
1265	0	0	0	0.	1286	0	0	0	0.	1287	0	0	0	0.	1288	0	0	0	0.
1269	0	0	0	0.	1290	0	0	0	0.	1291	0	0	0	0.	1292	0	0	0	0.
1273	0	0	0	0.	1294	0	0	0	0.	1295	0	0	0	0.	1296	0	0	0	0.
1277	0	0	0	0.	1298	0	0	0	0.	1299	0	0	0	0.	1300	0	0	0	0.
1281	0	0	0	0.	1302	0	0	0	0.	1303	0	0	0	0.	1304	0	0	0	0.
1285	0	0	0	0.	1306	0	0	0	0.	1307	132	-132	88	2.	1308	126	-120	83	3.
1289	120	-117	81	3.	1310	120	-114	79	3.	1311	111	-105	73	3.	1312	105	-99	68	3.
1293	93	-93	61	4.	1314	81	-81	54	2.	1315	60	-78	44	2.	1316	0	0	0	0.
1297	0	0	0	0.	1318	0	0	0	0.	1319	0	0	0	0.	1320	0	0	0	0.
1301	0	0	0	0.	1322	0	0	0	0.	1323	0	0	0	0.	1324	0	0	0	0.
1305	0	0	0	0.	1326	0	0	0	0.	1327	0	0	0	0.	1328	0	0	0	0.
1309	0	0	0	0.	1330	0	0	0	0.	1331	0	0	0	0.	1332	0	0	0	0.
1313	0	0	0	0.	1334	0	0	0	0.	1335	0	0	0	0.	1336	0	0	0	0.
1317	0	0	0	0.	1338	0	0	0	0.	1339	0	0	0	0.	1340	132	-129	88	2.
1321	0	0	0	0.	1342	123	-114	80	3.	1343	117	-105	75	3.	1344	111	-99	70	3.
1325	0	-123	84	3.	1346	99	-84	61	4.	1347	90	-75	54	2.	1348	66	-66	44	2.
1329	0	-90	65	3.	1350	0	0	0	0.	1351	0	0	0	0.	1352	0	0	0	0.
1333	0	0	0	0.	1354	0	0	0	0.	1355	0	0	0	0.	1356	0	0	0	0.
1337	0	0	0	0.	1358	0	0	0	0.	1359	0	0	0	0.	1360	0	0	0	0.
1341	129	-123	84	3.	1342	123	-114	80	3.	1343	117	-105	75	3.	1344	111	-99	70	3.
1345	105	-90	65	3.	1346	99	-84	61	4.	1347	90	-75	54	2.	1348	66	-66	44	2.
1349	0	0	0	0.	1350	0	0	0	0.	1351	0	0	0	0.	1352	0	0	0	0.
1353	0	0	0	0.	1354	0	0	0	0.	1355	0	0	0	0.	1356	0	0	0	0.
1357	0	0	0	0.	1358	0	0	0	0.	1359	0	0	0	0.	1360	0	0	0	0.
1361	0	0	0	0.	1362	0	0	0	0.	1363	0	0	0	0.	1364	0	0	0	0.
1365	0	0	0	0.	1366	0	0	0	0.	1367	0	0	0	0.	1368	135	-135	90	1.
1369	132	-126	86	3.	1370	129	-117	83	3.	1371	123	-108	78	3.	1372	114	-102	73	3.
1373	111	-93	69	3.	1374	105	-87	65	3.	1375	102	-81	60	4.	1376	90	-72	54	2.
1377	72	-63	45	4.	1378	0	0	0	0.	1379	0	0	0	0.	1380	0	0	0	0.
1381	0	0	0	0.	1382	0	0	0	0.	1383	0	0	0	0.	1384	0	0	0	0.
1385	0	0	0	0.	1386	0	0	0	0.	1387	0	0	0	0.	1388	0	0	0	0.
1389	0	0	0	0.	1390	0	0	0	0.	1391	0	0	0	0.	1392	0	0	0	0.
1393	0	0	0	0.	1394	135	-132	89	2.	1395	132	-126	86	2.	1396	126	-114	80	3.
1397	120	-105	76	3.	1398	114	-99	72	3.	1399	108	-90	67	3.	1400	102	-84	62	3.
1401	90	-72	57	2.	1402	75	-66	46	4.	1403	0	0	0	0.	1404	0	0	0	0.
1405	0	0	0	0.	1406	0	0	0	0.	1407	0	0	0	0.	1408	0	0	0	0.
1409	0	0	0	0.	1410	0	0	0	0.	1411	0	0	0	0.	1412	0	0	0	0.
1413	0	0	0	0.	1414	0	0	0	0.	1415	0	0	0	0.	1416	0	0	0	0.
1417	135	-132	89	1.	1418	129	-120	84	2.	1419	126	-114	80	2.	1420	120	-108	77	2.
1421	114	-96	70	3.	1422	105	-84	64	3.	1423	99	-75	58	2.	1424	78	-66	48	4.
1425	0	0	0	0.	1426	0	0	0	0.	1427	0	0	0	0.	1428	0	0	0	0.
1429	0	0	0	0.	1430	0	0	0	0.	1431	0	0	0	0.	1432	0	0	0	0.
1433	0	0	0	0.	1434	132	-126	87	2.	1435	126	-114	81	2.	1436	117	-102	74	2.
1437	111	-93	68	3.	1438	102	-84	62	3.	1439	99	-75	57	2.	1440	78	-69	49	3.

NUM	ALPHA	BETA	ANGLE	RANGE	NUM	ALPHA	BETA	ANGLE	RANGE	NUM	ALPHA	BETA	ANGLE	RANGE	NUM	ALPHA	BETA	ANGLE	RANGE
1441	0	0	0	0.	1442	0	0	0	0.	1443	0	0	0	0.	1444	0	0	0	0.
1445	0	0	0	0.	1446	132	-129	88	2.	1447	126	-117	81	2.	1448	117	-105	75	2.
1449	111	-93	66	3.	1450	102	-84	62	3.	1451	96	-75	57	2.	1452	78	-69	49	3.
1453	0	0	0	0.	1454	0	0	0	0.	1455	123	-108	77	2.	1456	114	-96	70	2.
1457	100	-87	65	2.	1458	102	-75	59	2.	1459	78	-69	49	3.	1460	135	-123	86	1.
1461	129	-96	74	1.	1462	111	-78	63	2.	1463	78	-69	49	3.	1464	0	0	0	0.

REQUIRED REFLECTIVITY AS A FUNCTION OF ANGLE OF INCIDENCE

ANGLE	0	1	2	3	4	5	6	7	8	9
0	********	********	********	********	********	********	********	********	********	********
10	********	********	********	********	.054297	.042046	.037069	.031225	.216112	.331653
20	.505109	.486715	.213959	.247891	.464866	.134858	.560137	.485047	.036218	.084756
30	.011751	.000171	.021894	.453444	.014821	.460485	.011198	.407770	.008480	.417643
40	.006866	.006570	.000244	.359509	.320802	.096464	.122596	.262292	.129019	.158949
50	.209615	.175298	.160232	.141172	.062352	.078226	.067988	.059843	.042315	.032424
60	.033165	.038908	.030233	.054803	.054268	.128891	.156531	.224997	.261403	1.914056
70	.326812	2.026948	2.179306	1.862839	2.428542	2.341416	2.767450	2.988529	2.216915	2.815054
80	3.136613	3.657446	4.446417	3.470840	4.903486	7.796664	6.005301	********	********	********
90	********									

REQUIRED REFLECTIVITY AS A FUNCTION OF ANGLE OF INCIDENCE



APPENDIX C

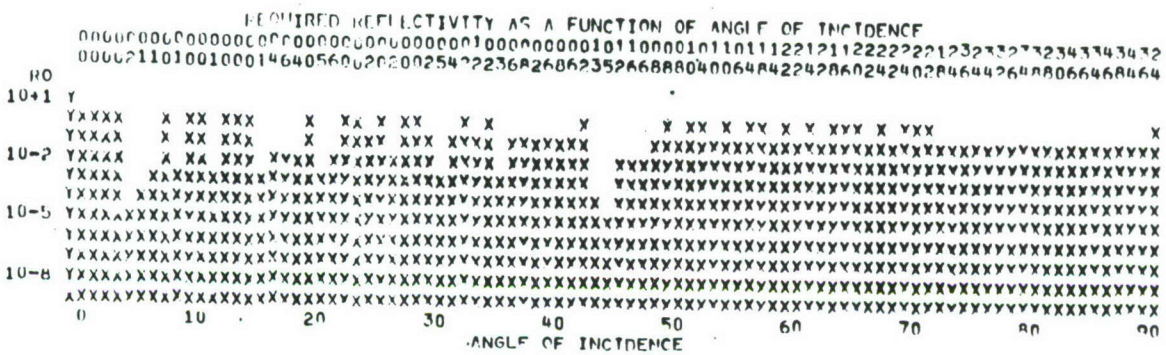
REQUIRED REFLECTIVITY

FOR COBRA WINDOW

SUN AZIMUTH	SUN ZENITH	
0	0	C-2
0	45	C-3
0	90	C-4
0	135	C-5
45	45	C-6
45	90	C-7
45	135	C-8
90	45	C-9
90	90	C-10
90	135	C-11
135	45	C-12
135	90	C-13
135	135	C-14
180	45	C-15
180	90	C-16
180	135	C-17
0	180	C-18
Summary Chart		C-19

REQUIRED REFLECTIVITY AS A FUNCTION OF ANGLE OF INCIDENCE

ANGLE	0	1	2	3	4	5	6	7	8	9
0	********	********	********	********	.000098	.000507	.002612	********	.002806	********
10	********	.003631	********	********	********	.004900	.033830	.044335	.036657	********
20	.006522	.010333	********	********	.310506	********	.054866	********	********	.824323
30	.009295	.702715	1.141053	.318117	1.112852	.004217	.797339	.965742	.994353	.823004
40	.314001	.004622	1.230533	.000767	.000036	.051390	.072302	.091031	.672689	1.032641
50	.982402	1.003619	1.266639	.766031	1.022784	.585821	1.046435	1.010704	.828834	1.054266
60	.683817	1.050209	.993465	1.061723	1.051681	1.020980	.993104	1.050777	.818283	1.030075
70	1.023730	1.019074	.994547	.990099	.351126	.406705	.949691	.432718	.421819	.901543
80	.470092	.746505	.534266	.726146	.694954	.686099	.646018	.631027	.654677	.779754
90	2.171874									

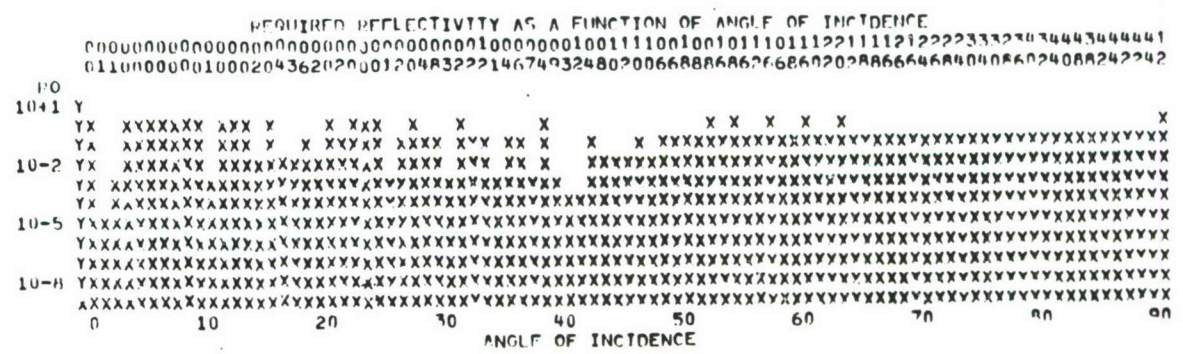


Sun Zenith = 0°

Sun Azimuth = 0°

REQUIRED REFLECTIVITY AS A FUNCTION OF ANGLE OF INCIDENCE

ANGLE	0	1	2	3	4	5	6	7	8	9
0	********	.000076	.001598	********	********	********	********	********	********	********
10	.005551	********	********	********	.050875	********	.076502	.011043	.112234	.009216
20	********	.371406	********	********	********	.007321	.510319	********	.340877	.500794
30	.005657	2.126677	.676334	.237811	.004293	.635890	.244572	.003476	1.000530	.003198
40	.000626	.000122	.932411	.039438	.042842	.047126	.829408	.064108	.696680	.050811
50	.851715	.871234	1.105339	.767180	1.190694	.836211	.777242	1.028746	.991284	.784848
60	1.179338	.950567	.791402	1.149794	.804383	.954248	.971840	.783700	.800485	.762710
70	.734557	.735433	.605366	.711214	.699165	.661998	.756521	.598338	.694169	.471879
80	.418006	.427803	.397467	.368548	.323473	.293023	.295870	.253668	.403898	.501939
90	2.364390									



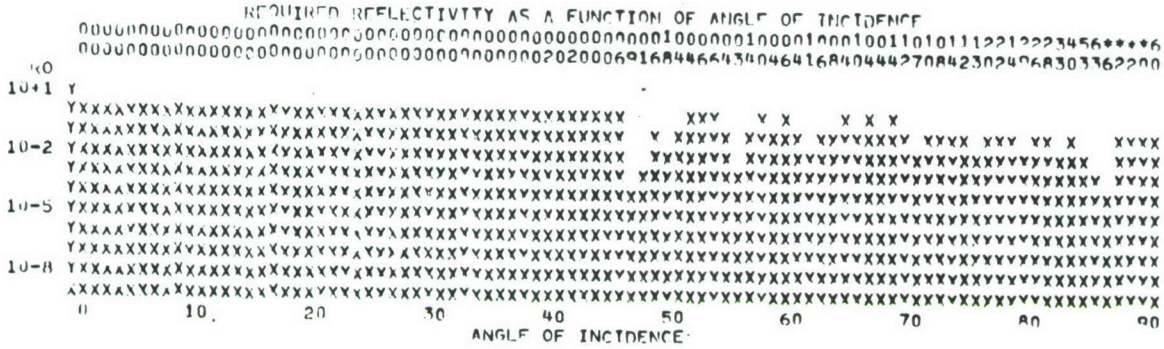
Sun Zenith = 45°

Sun Azimuth = 0°

REQUIRED REFLECTIVITY AS A FUNCTION OF ANGLE OF INCIDENCE

ANGLE OF	0	1	2	3	4	5	6	7	8	9
0	********	********	********	********	********	********	********	********	********	********
10	********	********	********	********	********	********	********	********	********	********
20	********	********	********	********	********	********	********	********	********	********
30	********	********	********	********	********	********	********	********	********	********
40	********	9.650987	********	********	********	1.576195	.000130	.002533	.858842	.071235
50	.941068	1.071376	1.136059	1.108212	.466404	.009505	.886472	********	.769733	1.080618
60	.921728	.031040	.533197	.369252	1.059686	.848369	1.026463	.941772	1.045967	.954821
70	.016656	.585760	.821557	.620440	.581441	.014414	.456408	.442967	.407641	.012413
80	.345074	.278926	.011540	.223609	.012672	.002878	.000612	.125708	.144186	.184402
90	.799229									

REQUIRED REFLECTIVITY AS A FUNCTION OF ANGLE OF INCIDENCE

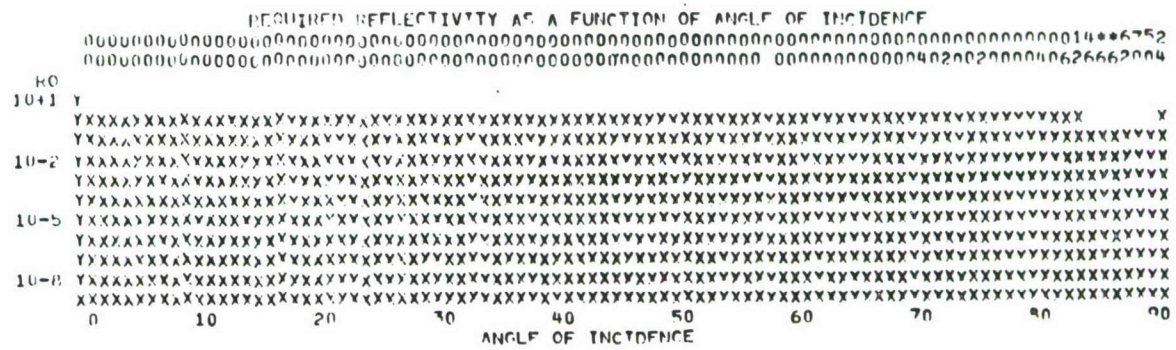


Sun Zenith = 90°

Sun Azimuth = 0°

REQUIRED REFLECTIVITY AS A FUNCTION OF ANGLE OF INCIDENCE

ANGLE	0	1	2	3	4	5	6	7	8	9
0	********	********	********	********	********	********	********	********	********	********
10	********	********	********	********	********	********	********	********	********	********
20	********	********	********	********	********	********	********	********	********	********
30	********	********	********	********	********	********	********	********	********	********
40	********	********	********	********	********	********	********	********	********	********
50	********	********	********	********	********	********	********	9.279870	********	********
60	********	********	********	********	********	********	********	********	********	********
70	4.462324	********	********	********	********	********	********	********	********	********
80	********	********	6.539168	3.503263	.369055	.369816	.266903	.301390	.301883	.365381
90	1.586299									



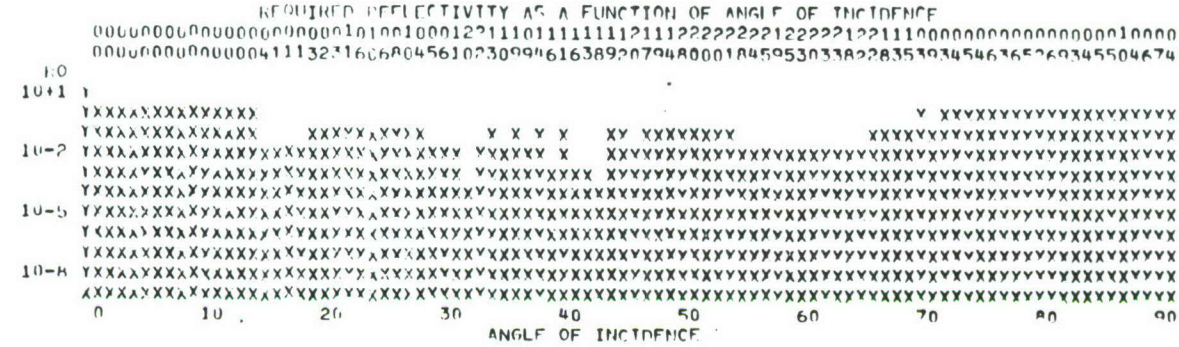
Sun Zenith = 135°

Sun Azimuth = 0°

REQUIRED REFLECTIVITY AS A FUNCTION OF ANGLE OF INCIDENCE

ANGLE	0	1	2	3	4	5	6	7	8	9
0	********	********	********	********	********	********	********	********	********	********
10	********	********	********	********	.054207	.002046	.037069	.031225	.216112	.331653
20	.505169	.406713	.213959	.247891	.464866	.134858	.560137	.485047	.036218	.084756
30	.011751	.000171	.021894	.453444	.014921	.460485	.011108	.407770	.000480	.417643
40	.006866	.006370	.000244	.339509	.320802	.096464	.122506	.262202	.130019	.158949
50	.209613	.175298	.160232	.141172	.062352	.078226	.067988	.050843	.002315	.032424
60	.033185	.038908	.030233	.054803	.054268	.128891	.156531	.224997	.261403	1.914056
70	.326812	2.026948	2.179306	1.802839	2.428542	2.341416	2.767450	2.988529	2.218915	2.915054
80	3.138613	3.657446	4.446417	3.470840	4.903486	7.796664	6.005301	********	********	********
90	********									

REQUIRED REFLECTIVITY AS A FUNCTION OF ANGLE OF INCIDENCE



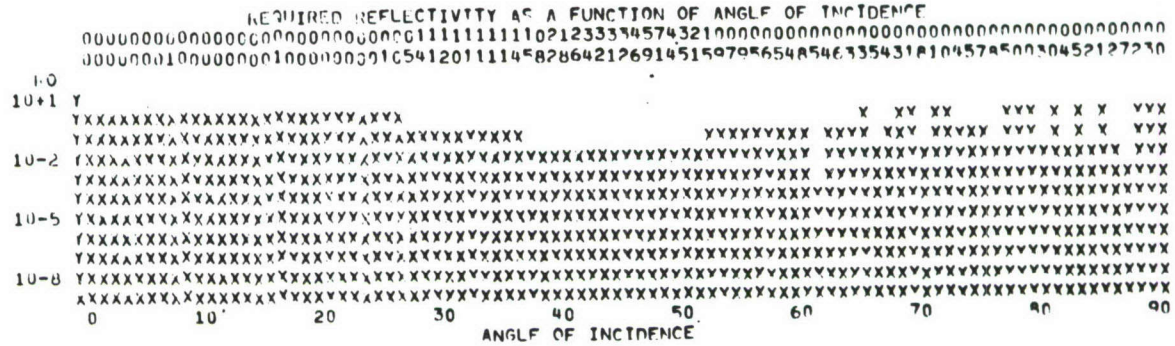
Sun Zenith = 45°

Sun Azimuth = 45°

REQUIRED REFLECTIVITY AS A FUNCTION OF ANGLE OF INCIDENCE

ANGLE	0	1	2	3	4	5	6	7	8	9
0	********	********	********	********	********	********	********	3.442951	********	********
10	********	********	********	********	********	********	1.709606	********	********	********
20	********	********	********	********	********	4.945838	********	.438725	.422363	.367088
30	.319677	.276244	.235059	.196707	.172789	.134938	.104435	.083169	.070312	.054497
40	.043635	.037743	.030162	.022668	.023118	.037381	.032052	.020674	.044721	.055931
50	.050965	.032457	.102026	.562292	.560510	.570599	.564570	.540986	.533038	.509521
60	.639951	.000351	.799013	.000186	.946919	1.163669	.028007	.828598	1.777367	1.661601
70	.963413	2.669130	********	.111342	.141906	.128950	.055543	3.354671	********	********
80	.053431	********	.051436	4.463946	.053353	7.958373	.065900	.003623	********	********
90	********									

REQUIRED REFLECTIVITY AS A FUNCTION OF ANGLE OF INCIDENCE



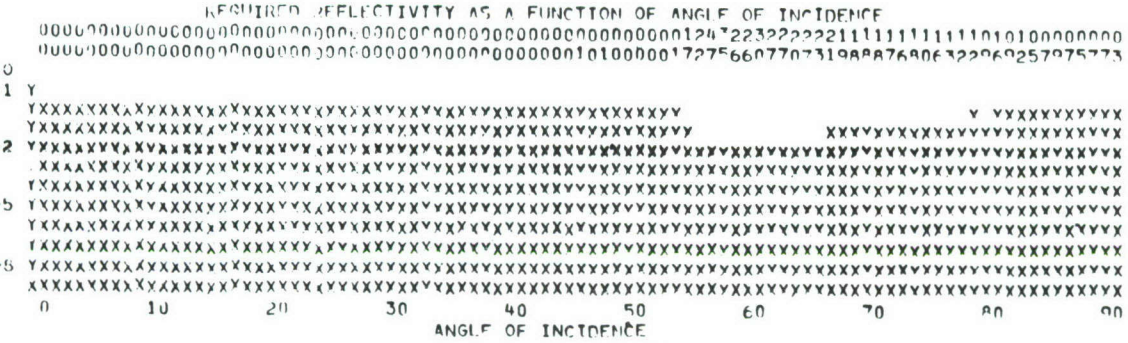
Sun Zenith = 90°

Sun Azimuth = 45°

REQUIRED REFLECTIVITY AS A FUNCTION OF ANGLE OF INCIDENCE

ANGLE	0	1	2	3	4	5	6	7	8	9
0	********	********	********	********	********	********	********	********	********	********
10	********	********	********	********	********	********	********	********	********	********
20	********	********	********	********	********	********	********	********	********	********
30	********	********	********	********	********	********	********	********	********	********
40	********	********	********	********	********	5.167035	********	2.754520	********	********
50	********	********	********	4.401995	.159123	.099161	.060344	.053195	.052569	.052241
60	.029738	.049277	.034114	.094490	.054265	.098939	.165502	.225909	.281172	.108366
70	.205365	.429687	.180415	.201600	.207191	.191701	.759859	.836279	1.024102	.901037
80	1.436759	1.945629	2.066856	2.903176	3.193451	2.711518	6.446977	8.302135	********	********
90	********									

REQUIRED REFLECTIVITY AS A FUNCTION OF ANGLE OF INCIDENCE

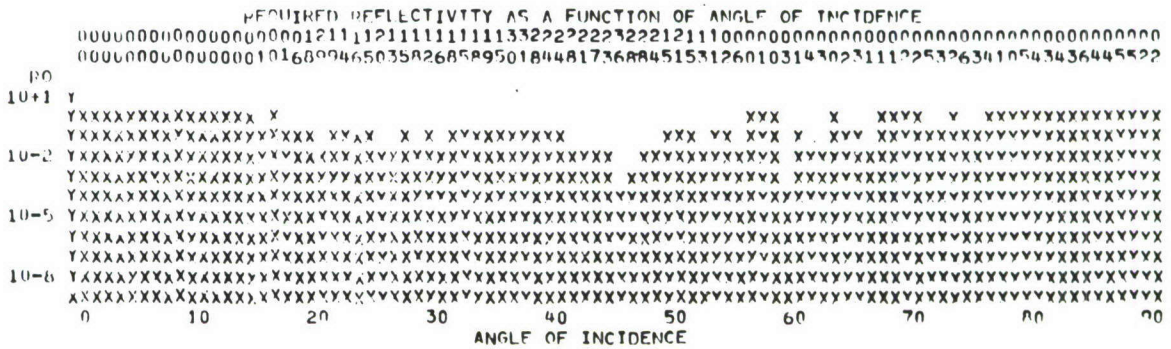


Sun Zenith = 135°

Sun Azimuth = 45°

REQUIRED REFLECTIVITY AS A FUNCTION OF ANGLE OF INCIDENCE

ANGLE	0	1	2	3	4	5	6	7	8	9
0	********	********	********	********	********	********	********	********	********	********
10	********	********	********	********	********	.358695	********	.724808	.588824	.448445
20	.029076	.527816	.495081	.344733	.450679	.022846	.029443	.313381	.026464	.120020
30	.027088	.110213	.140757	.189603	.128630	.150213	.217437	.149864	.178179	.148501
40	.132857	.099010	.074762	.052272	.035124	.000286	.008425	.014634	.020321	.101005
50	.125518	.158722	.034166	.212719	.234832	.018413	********	8.022140	********	.000204
60	.277949	.077095	.084567	********	.927463	.112361	.006976	3.375254	1.070710	2.330638
70	2.818750	.151194	.279253	2.520895	.309845	.404529	3.505074	4.491861	********	3.930949
80	3.142184	4.393442	4.085316	6.326991	8.351261	7.770634	9.511791	********	********	********
90	********									



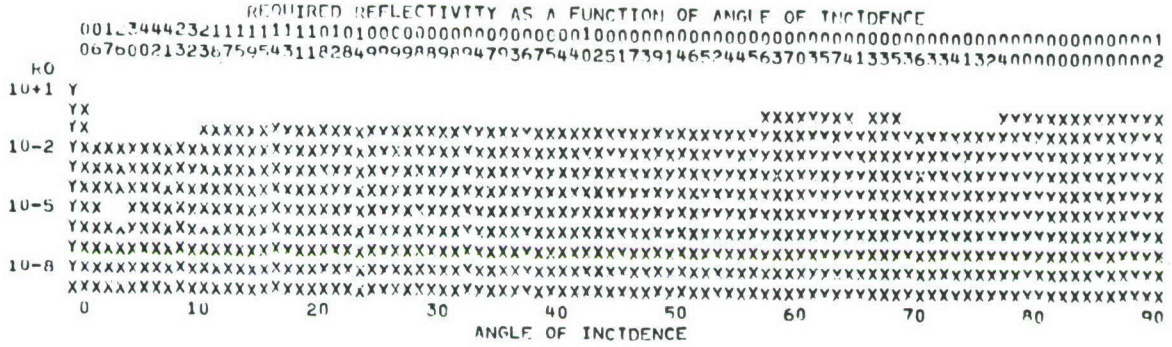
Sun Zenith = 45°

Sun Azimuth = 90°

REQUIRED REFLECTIVITY AS A FUNCTION OF ANGLE OF INCIDENCE

ANGLE	0	1	2	3	4	5	6	7	8	9
0	********	.019297	.017359	.031047	.025236	.035949	.031275	.057016	.070168	.088270
10	.104196	.114317	.109366	.147049	.121840	.125243	.200915	.116385	.232976	.258275
20	.245320	.276049	.273560	.300772	.314085	.362454	.326508	.396898	.411110	.353719
30	.338953	.351256	.422193	.315891	.338249	.369294	.436151	.322726	.406063	.369040
40	.318430	.438847	.402643	.359798	.329813	.402952	.271151	.472037	.455163	.956681
50	.442992	.625027	.736703	.743392	.783528	.776351	.756851	1.011179	1.055480	1.133055
60	********	1.749858	1.020522	1.436898	1.314726	.108449	1.545966	2.749042	2.120916	.110781
70	.175608	.142733	.369563	.131773	.140114	.324497	.283479	1.172090	********	********
80	********	********	********	********	********	********	********	********	********	********
90	4.699064									

REQUIRED REFLECTIVITY AS A FUNCTION OF ANGLE OF INCIDENCE

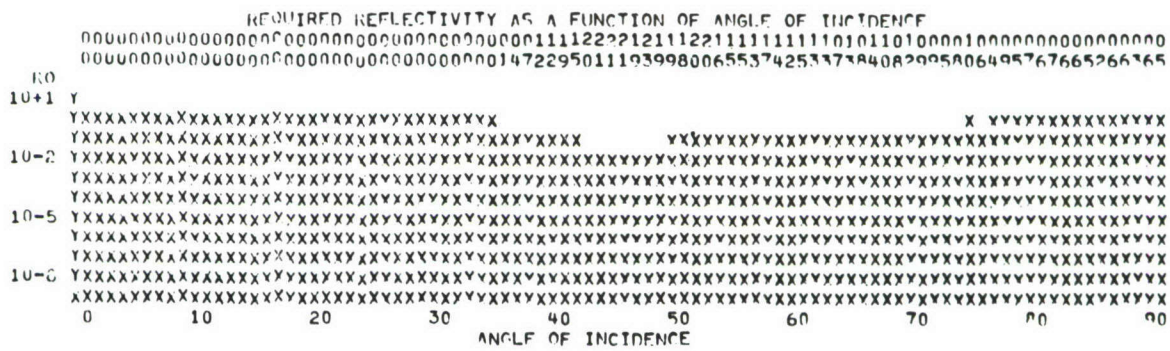


Sun Zenith = 90°

Sun Azimuth = 90°

REQUIRED REFLECTIVITY AS A FUNCTION OF ANGLE OF INCIDENCE

ANGLE	0	1	2	3	4	5	6	7	8	9
0	********	********	********	********	********	********	********	********	********	********
10	********	********	********	********	********	********	********	********	********	********
20	********	********	********	********	********	********	********	********	********	********
30	********	********	********	********	********	.253471	.221994	.200654	.176885	.149654
40	.122254	.100211	.081990	.044636	.023583	.025932	.034732	.053565	.077899	.104698
50	.125575	.156721	.187282	.168903	.231036	.173041	.284281	.150667	.147872	.316140
60	.152773	.142222	.371215	.419864	.399231	.441315	.429660	.390260	.504836	.588923
70	.635182	.779912	.892899	.872335	1.105762	.860737	1.448529	1.579241	1.973130	2.002440
80	2.570051	2.957856	3.475804	3.930561	4.942731	7.479308	9.526771	9.890507	********	********
90	********									

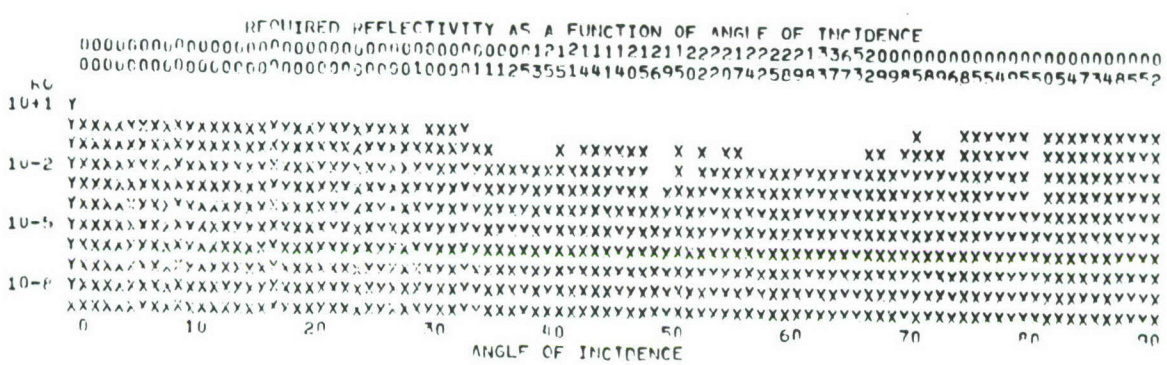


Sun Zenith = 135°

Sun Azimuth = 90°

REQUIRED REFLECTIVITY AS A FUNCTION OF ANGLE OF INCIDENCE

ANGLE	0	1	2	3	4	5	6	7	8	9
0	********	********	********	********	********	********	********	********	********	********
10	********	********	********	********	********	********	********	********	********	********
20	********	********	********	********	********	********	********	********	.585744	********
30	********	********	********	.066232	.884028	.036108	.024507	.028021	.023104	.024357
40	.418011	.093044	.103059	.573706	.541368	.510486	.155524	.170278	.000262	.007092
50	.180912	.007995	.263953	.010358	.165192	.120326	.014706	.052130	.043562	.038135
60	.019119	.032910	.063670	.055308	.056675	.095155	.159700	.117321	.030441	.678248
70	1.257008	.190057	.158059	.027732	1.612830	1.467915	1.465533	1.457647	2.467889	3.575870
80	.000856	********	2.606187	6.005806	5.746583	7.342781	7.894595	1.246926	********	5.432113
90	********									



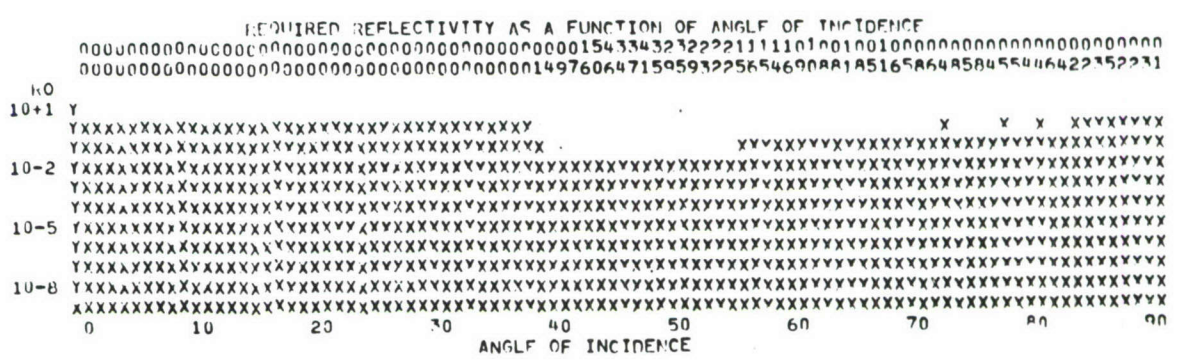
Sun Zenith = 45°

Sun Azimuth = 135°

REQUIRED REFLECTIVITY AS A FUNCTION OF ANGLE OF INCIDENCE

ANGLE	0	1	2	3	4	5	6	7	8	9
0	********	********	********	********	********	********	********	********	********	********
10	********	********	********	********	********	********	********	********	********	********
20	********	********	********	********	********	********	********	********	********	********
30	********	********	********	********	********	********	********	********	.260655	.037260
40	.058572	.064372	.045196	.020785	.032127	.037365	.023083	.022544	.036708	.029796
50	.037326	.047464	.060381	.072250	.090532	.115143	.131649	.147514	.165339	.193167
60	.201959	.218695	.221475	.272723	.226559	.256447	.222150	.246460	.208486	.407466
70	.479572	.442594	1.310850	.635909	.884059	.153940	.979641	1.563936	.162881	.213600
80	2.068616	.202772	.232343	2.696936	1.031766	1.421999	7.655040	7.839233	********	8.431180
90	********									

REQUIRED REFLECTIVITY AS A FUNCTION OF ANGLE OF INCIDENCE

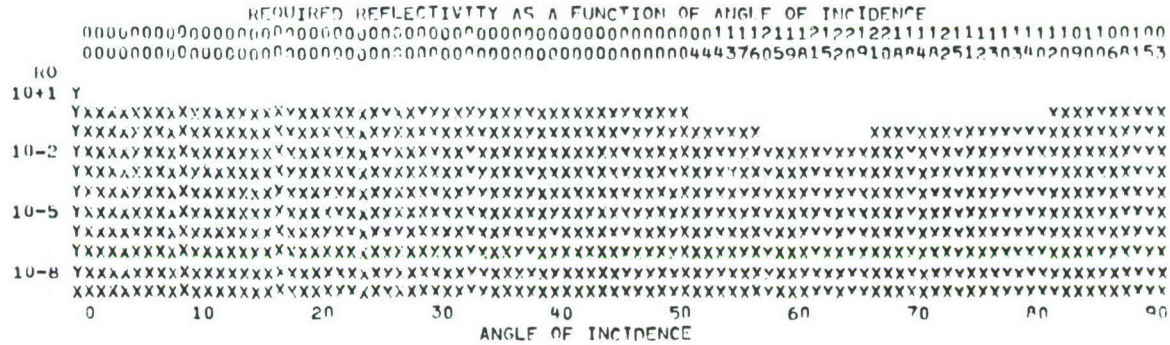


Sun Zenith = 90°

Sun Azimuth = 135°

REQUIRED REFLECTIVITY AS A FUNCTION OF ANGLE OF INCIDENCE

ANGLE	0	1	2	3	4	5	6	7	8	9
0	********	********	********	********	********	********	********	********	********	********
10	********	********	********	********	********	********	********	********	********	********
20	********	********	********	********	********	********	********	********	********	********
30	********	********	********	********	********	********	********	********	********	********
40	********	********	********	********	********	********	********	********	********	********
50	********	.223455	.244643	.216324	.156123	.133023	.115006	.052417	.020269	.038345
60	.053296	.032729	.054093	.044161	.070966	.075137	.111444	.122482	.146261	.105476
70	.211799	.203966	.191554	.304316	.333805	.401262	.458068	.638128	.594731	.848447
80	.860290	1.200797	1.437098	2.146164	1.902144	2.983633	4.043001	7.701043	8.192090	********
90	********									



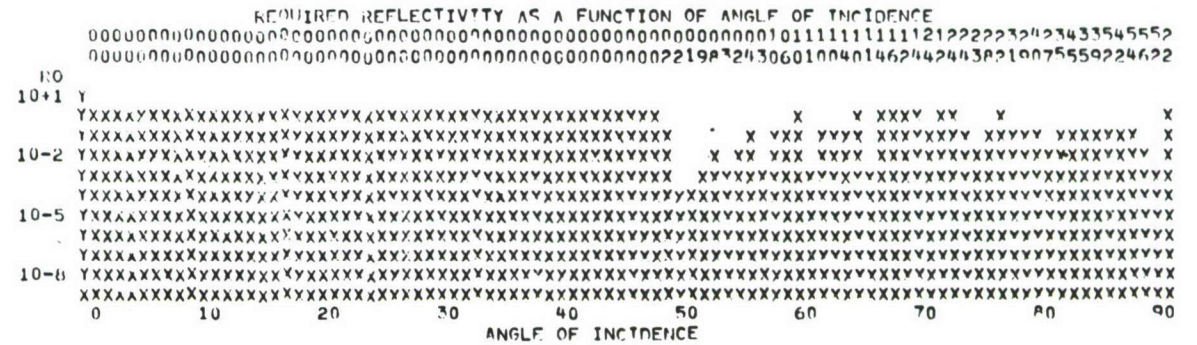
Sun Zenith = 35°

Sun Azimuth = 135°

REQUIRED REFLECTIVITY AS A FUNCTION OF ANGLE OF INCIDENCE

ANGLE	0	1	2	3	4	5	6	7	8	9
0	********	********	********	********	********	********	********	********	********	********
10	********	********	********	********	********	********	********	********	********	********
20	********	********	********	********	********	********	********	********	********	********
30	********	********	********	********	********	********	********	********	********	********
40	********	********	********	********	********	********	********	********	.960304	.000123
50	.000633	.003240	.043268	.003520	.066616	.149701	.004308	.245004	.935747	1.061721
60	.005469	.245067	.904776	.939642	1.024326	.005413	1.262591	1.194812	1.241765	1.306555
70	.839015	1.406036	1.233296	.930074	.021630	.640498	1.145766	.384746	.389451	.360528
80	.023513	.409503	.786355	.726803	.570713	.416310	.232591	.469914	.055433	.002967
90	3.050709									

REQUIRED REFLECTIVITY AS A FUNCTION OF ANGLE OF INCIDENCE

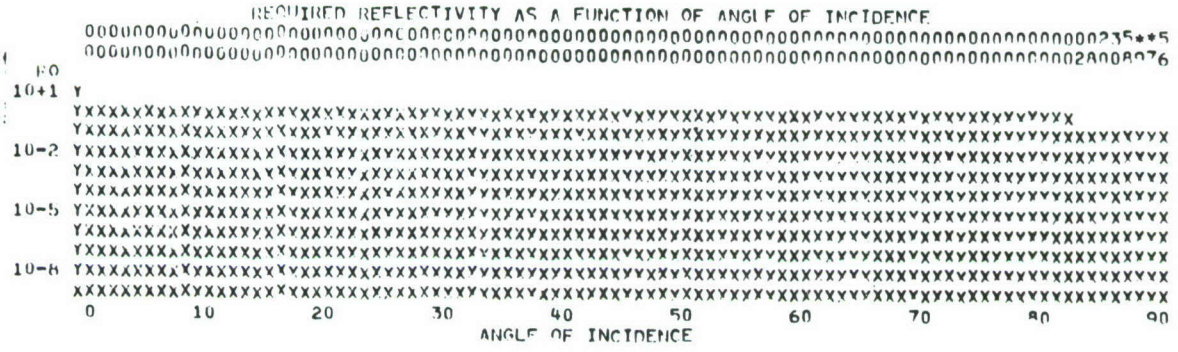


Sun Zenith = 45°

Sun Azimuth = 180°

REQUIRED REFLECTIVITY AS A FUNCTION OF ANGLE OF INCIDENCE

ANGLE	0	1	2	3	4	5	6	7	8	9
0	********	********	********	********	********	********	********	********	********	********
10	********	********	********	********	********	********	********	********	********	********
20	********	********	********	********	********	********	********	********	********	********
30	********	********	********	********	********	********	********	********	********	********
40	********	********	********	********	********	********	********	********	********	********
50	********	********	********	********	********	********	********	********	********	********
60	********	********	********	********	********	********	********	********	********	********
70	********	********	********	********	********	********	********	********	********	********
80	********	********	********	.807620	.123129	.213097	.257932	.203781	.128318	.261005
90	.671355									

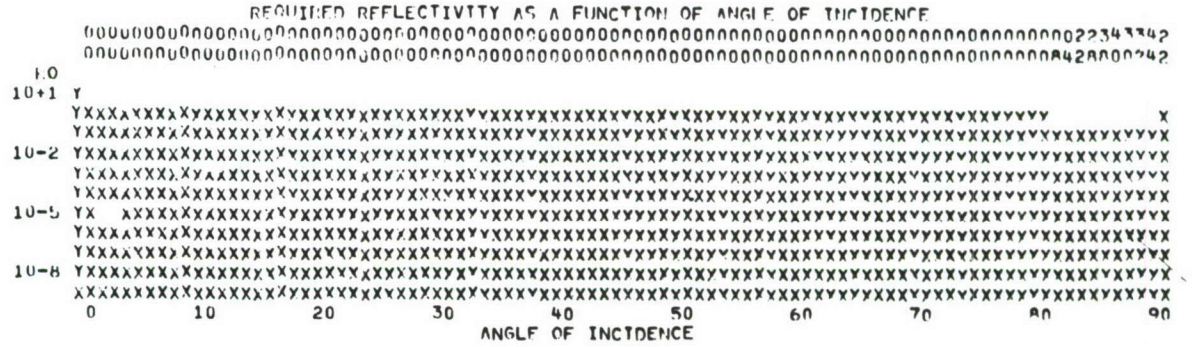


Sun Zenith = 90°

Sun Azimuth = 180°

REQUIRED REFLECTIVITY AS A FUNCTION OF ANGLE OF INCIDENCE

ANGLE	0	1	2	3	4	5	6	7	8	9
0	********	********	********	********	********	********	********	********	********	********
10	********	********	********	********	********	********	********	********	********	********
20	********	********	********	********	********	********	********	********	********	********
30	********	********	********	********	********	********	********	********	********	********
40	********	********	********	********	********	********	********	********	********	********
50	********	********	********	********	********	********	********	********	********	********
60	********	********	********	********	********	********	********	********	********	********
70	********	********	********	********	********	********	********	********	********	********
80	********	.801245	.803625	.497451	.660835	.489105	.251649	.538785	.257892	.434770
90	1.840982									

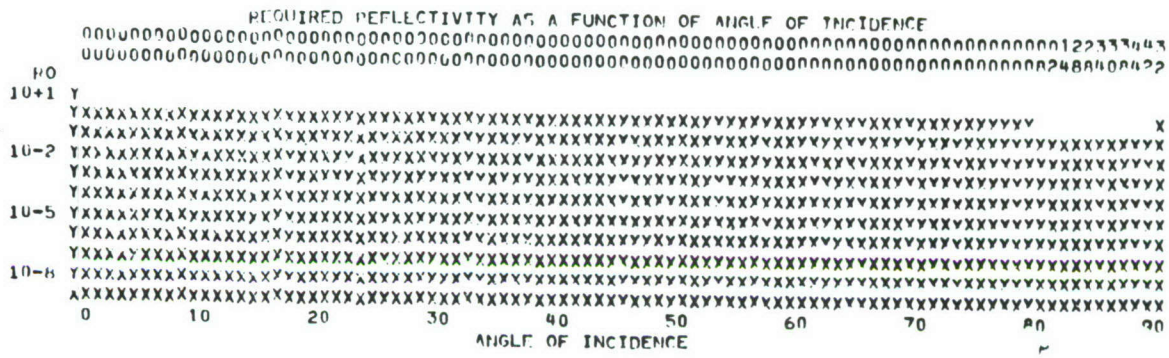


Sun Zenith = 135°

Sun Azimuth = 180°

REQUIRED REFLECTIVITY AS A FUNCTION OF ANGLE OF INCIDENCE

ANGLE	0	1	2	3	4	5	6	7	8	9
0	********	********	********	********	********	********	********	********	********	********
10	********	********	********	********	********	********	********	********	********	********
20	********	********	********	********	********	********	********	********	********	********
30	********	********	********	********	********	********	********	********	********	********
40	********	********	********	********	********	********	********	********	********	********
50	********	********	********	********	********	********	********	********	********	********
60	********	********	********	********	********	********	********	********	********	********
70	********	********	********	********	********	********	********	********	********	********
80	.760003	.750847	.736485	.724701	.688032	.651730	.641145	.660377	.618038	.564181
90	1.801698									



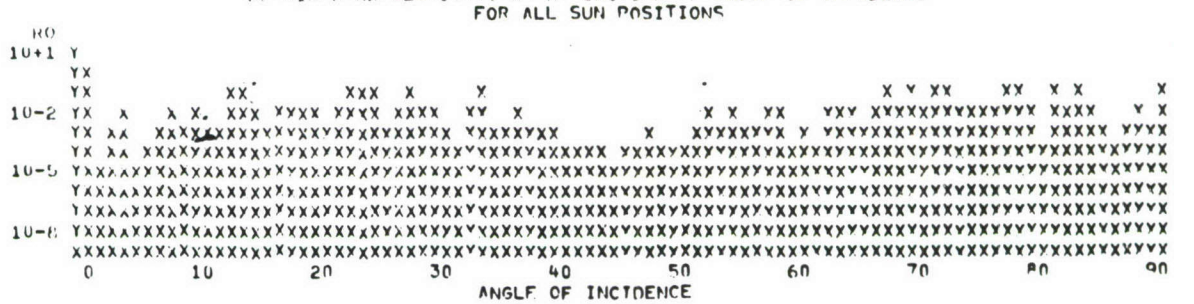
Sun Zenith = 180°

Sun Azimuth = 0°

REQUIRED REFLECTIVITY AS A FUNCTION OF ANGLE OF INCIDENCE

ANGLE	0	1	2	3	4	5	6	7	8	9
0	********	.000076	.001598	.031047	.000098	.000507	.002612	.057016	.002886	.088270
10	.005551	.003631	.109366	.147049	.054297	.004900	.033839	.011043	.036657	.000214
20	.006522	.040333	.213959	.247891	.314085	.007321	.029442	.313381	.026464	.084756
30	.005657	.000171	.021894	.189603	.004293	.004217	.011108	.003476	.009480	.003194
40	.000626	.000122	.002244	.000767	.000036	.000286	.000120	.002533	.000262	.000123
50	.000633	.003240	.034166	.003520	.062352	.009595	.004308	.052130	.020269	.000294
60	.005469	.000351	.030233	.044161	.054265	.005413	.028087	.117321	.039441	.110781
70	.016656	.142733	.158858	.027732	.021630	.014414	.055543	.384746	.162881	.012413
80	.000856	.292772	.011540	.223609	.012672	.002878	.000612	.003623	.055433	.002967
90	.671355									

SUMMARY OF
REQUIRED REFLECTIVITY AS A FUNCTION OF ANGLE OF INCIDENCE
FOR ALL SUN POSITIONS



Summary Chart

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