NASA CONTRACTOR REPORT

NASA CR-726

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DERIVATION AND STATISTICAL COMPARISON OF VARIOUS ANALYTICAL TECHNIQUES WHICH DEFINE THE LOCATION OF REFERENCE HORIZONS IN THE EARTH'S HORIZON RADIANCE PROFILE

by John R. Thomas

Prepared by
HONEYWELL INC.
Minneapolis, Minn.
for Langley Research Center

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION • WASHINGTON, D. C. • APRIL 1967

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FOREWORD

This report documents the first phase of an Analytical and Conceptual Design Study for an Earth Coverage Infrared Horizon Definition Study performed under National Aeronautics and Space Administration Contract NAS 1-6010 for Langley Research Center.

This study provides for delineation of the experimental data required to define the infrared horizon on a global basis and for all time periods. Once defined, a number of flight techniques are evaluated to collect the experimental data required. The study includes assessment of the factors which affect the infrared horizon through statistical examination of a large body of meteorological information and the development of a state-of-the-art infrared horizon simulation.

The contractual effort was divided into numerous subtasks which are listed as follows:

Infrared Horizon Definition - A State-of-the-Art Report

Derivation of a Meteorological Body of Data Covering the Northern Hemisphere in the Longitude Region Between 60°W and 160°W from March 1964 through February 1965.

The Synthesis of 15μ Infrared Horizon Radiance Profiles from Meteorological Data Inputs

The Analysis of 15μ Infrared Horizon Radiance Profile Variations Over a Range of Meteorological, Geographical, and Seasonal Conditions

Derivation and Statistical Comparison of Various Analytical Techniques Which Define the Location of Reference Horizons in the Earth's Horizon Radiance Profile

The 15μ Infrared Horizon Radiance Profile Temporal, Spatial, and Statistical Sampling Requirements for a Global Measurement Program

Evaluation of Several Mission Approaches for Use in Defining Experimentally the Earth's 15μ Infrared Horizon

Evaluation of the Apollo Applications Program Missions in an Earth Coverage Horizon Measurement Program in the 15μ Infrared Spectral Region

Computer Program for Synthesis of 15μ Infrared Horizon Radiance Profiles

Compilation of Computer Programs for a Horizon Definition Study

Compilation of Atmospheric Profiles and Synthesized 15μ Infrared Horizon Radiance Profiles Covering the Northern Hemisphere in the Longitude Region Between 60°W and 160°W from March 1964 through February 1965 - Part I

Compilation of Atmospheric Profiles and Synthesized 15μ Infrared Horizon Radiance Profiles Covering the Northern Hemisphere in the Longitude Region Between 60°W and 160°W from March 1964 through February 1965 - Part II

Horizon Definition Study Summary - Part I

Honeywell Inc., Systems and Research Division, performed this study program under the technical direction of Mr. L. G. Larson. The program was conducted during the period 28 March 1966 through 10 October 1966.

The study results from the first five subtasks listed previously are of considerable interest and warrant wide distribution to the scientific community. It is anticipated that the results of the last eight subtasks are of limited interest to the general scientific community; therefore, distribution is provided to U. S. Government Agencies only.

Acknowledgment is extended to GCA Corporation and Barnes Engineering Company for their contributions on atmospheric physics/meteorology and locator identification respectively. The contributions on profile synthesis by Dr. J. C. Gille of Florida State University and on statistical analysis by Dr. J. H. Parks, Jr. of the University of Minnesota are also gratefully acknowledged.

Gratitude is extended to NASA/Langley Research Center for their technical guidance, under the program technical direction of Mr. L. Keafer and direct assistance from Messrs. J. Dodgen, R. Davis and H. Curfman, as well as the many people within their organization.

CONTENTS

ILLUSTRATIONS

TABLES

DERIVATION AND STATISTICAL COMPARISON OF VARIOUS ANALYTICAL TECHNIQUES WHICH DEFINE THE LOCATION OF REFERENCE HORIZONS IN THE EARTH'S HORIZON RADIANCE PROFILE.

By John R. Thomas

SUMMARY

The accuracy of horizon sensors which provide for a vertical reference in space control systems have been the subject of numerous investigations in the past few years; however, these errors due to the effects of horizon anomolies have not been completely defined or verified. This study focused attention on these errors, their frequency, and distribution for a large number of detection techniques.

To use a horizon scanner in determining an artificial Earth horizon, some function of the radiant energy received is used to define this horizon. This function is defined as a locator. Thirty locators were identified based on the radiance profile shape and amplitude and were mathematically defined for programming on a digital computer.

Using 1039 synthesized radiance profiles, each of these locators were processed and the resultant indicated altitudes statistically analyzed. This statistical comparison, using those locators which approximate the operation of horizon sensors, yields results applicable to horizon sensing accuracy. The most stable horizon calculated, over the sample of the 1039 radiance profiles, was obtained using fixed thresholds of the integral of normalized radiance.

For that locator and present component state-of-the-art, the mean located horizon altitude is 44.0 km with a standard deviation of only 1.1 km, producing an angular uncertainty in horizon location of ±0.034 degrees from a 280 km (150 nautical mile) viewing altitude.

INTRODUCTION

Horizon sensors in space vehicles have used various definitions of the measured radiance profile to determine vehicle attitude with respect to local vertical. However, variation of the measured radiance profile and, therefore, variation of the indicated horizon results in the inability of horizon sensors to define accurately the vehicle attitude under all spatial-temporal conditions. For example, a sharp horizon was defined to exist at the location of a fixed radiance level of 2.0 W/m^2-sr; then for any horizon gradient, the sharp horizon occurs, by definition, at the position indicated by that level of radiance. As the horizon radiance profile varies over the space-time environment, the indicated altitude varies.

Several investigators, Duncan (ref. 1) and (ref. 2), Earle (ref. 3), Schwarz (ref. 4) and others in publications of the various horizon sensor manufacturers have determined the ability of certain locators to define a stable horizon. Their studies were based primarily on eight horizon radiance profiles calculated by Wark, et al., (ref. 5) and, in total considered nine locators also included as part of the locators considered in this study.

A total of 81 locator and locator input constants were defined during the study to determine the variability of the radiance profile over the total altitude range considered. These locators were selected for the analysis based on their ability to describe variations in the profile shape and amplitude, on their applicability to the horizon sensing problem, and on their ability to define the effects of the many atmospheric phenomena and anomalies.

LOCATOR IDENTIFICATION AND MATHEMATICAL DESCRIPTION

Numerous locators must be identified and mathematically defined for use as a technique in statistical analysis of horizon profile variations. Three techniques were utilized in identifying locators: (1) a search of the literature was made to determine locators already identified at the beginning of the study; (2) new locators were identified by studying radiance profile characteristics; and (3) Barnes Engineering Company, a major horizon sensor supplier, was subcontracted to conduct an independent study to determine existing locators and to identify new locators.

Results of the literature search are listed in the references and bibliography. Primary sources of information are references 1 through 4; these four references contained all the existing locators. Although the 51 articles listed in the bibliography were examined, no information other than that already known from the above four references was found.

The philosophy used in identifying new locators is based on review of the locator concept: the tangent height at which a particular characteristic of the radiance profile exists is defined to be the located horizon; the characteristic is the locator. Thus, to find new locators, representative radiance profiles were examined to identify characteristics which could be used to locate a horizon.

Characteristics upon which locators are based are:

- Radiance
- Derivatives - including inflection points, minimum and maximum curvature
- Integral
- Average values over a certain region
- Moments and centroids
- Difference between profiles in closely separated spectral regions

The only constraint on identifying locators is that the particular characteristic used be determined from knowledge only of the radiance profile shape and amplitude and not of its position with respect to the mean sea level horizon.

Where applicable, these characteristics also apply to normalized radiance, that is, to each radiance profile normalized to its peak value of radiance.

This was done because results of analysis presented in references 1 through 3 show that less variability generally exists in normalized radiance profiles than in radiance profiles (see Figures 1 and 2). This is true because the major difference among profiles is in magnitude, with all profiles having similar shapes. Thus, by normalizing each radiance profile to its own value of peak radiance, amplitude differences between profiles are minimized, and only shape differences remain.

The following paragraphs discuss each locator identified during the study. Not all locators were used in determining horizon definition measurement data requirements; the selection procedure is discussed in the following section. However, all locators are discussed and defined in this report. Other characteristics which might be used as locators are not included; they were either overlooked or, if considered, were immediately rejected because of obvious instability or impracticality.

Thirty-eight locators were identified and defined in independent studies conducted at Honeywell and at Barnes Engineering Company; eight were identified in both studies. Locators L1 through L20 are the results of the Honeywell study; locators B1 through B10, which are different from L1 through L20, are the results of the Barnes study.

Locator L1, fixed radiance. -- The located horizon is defined to be at the altitude at which a particular value of radiance exists, as in Figure 3. The defining equation is

$$h_\ell = h(N = C_1). \tag{1}$$

The value of C_1 governs the region in which the located horizon is selected; i. e., the larger the value of C_1, the lower in altitude will be the located horizon.

Locator L2, normalized radiance. -- This locator is identical to L1 except it uses radiance normalized to peak radiance. The defining equation is

$$h_\ell = h\left(\frac{N}{N_m} = C_2\right). \tag{2}$$

The located horizon is at the altitude at which a particular percentage of peak radiance exists.

Locator L3, integrated radiance. -- The located horizon is defined to be at the altitude at which a particular value of the integral of radiance exists, as in Figure 4. Equation (3) is the defining equation

$$C_3 = \int_{h_\ell}^{\infty} N(h)\, dh. \tag{3}$$

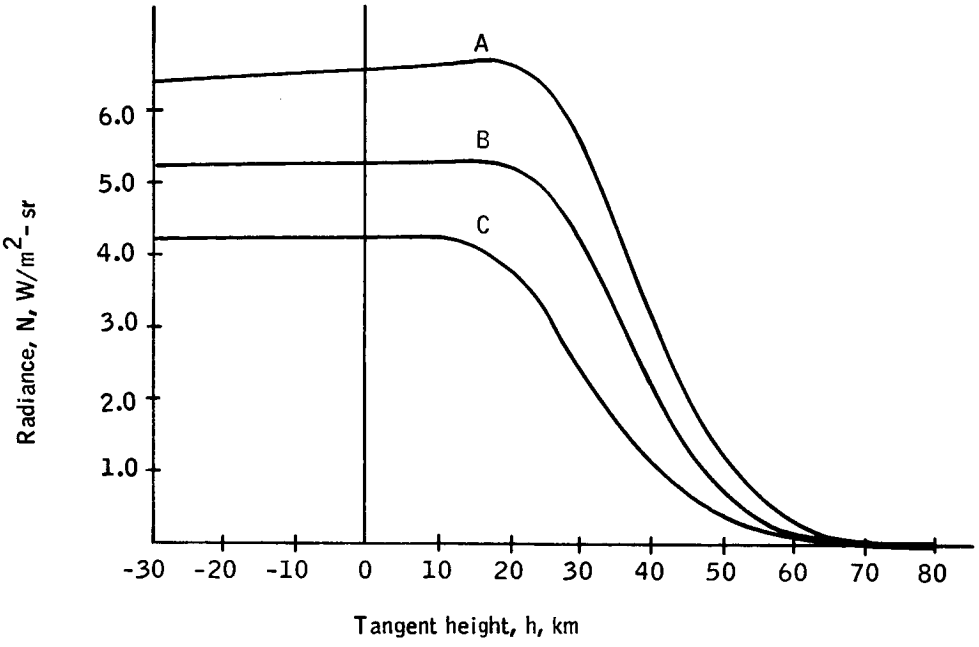


Figure 1. Radiance Profiles

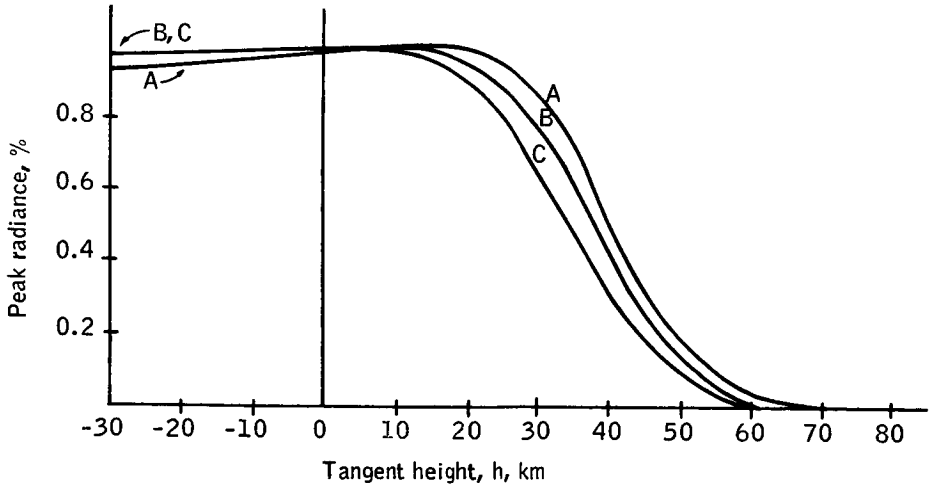


Figure 2. Normalized Radiance Profiles

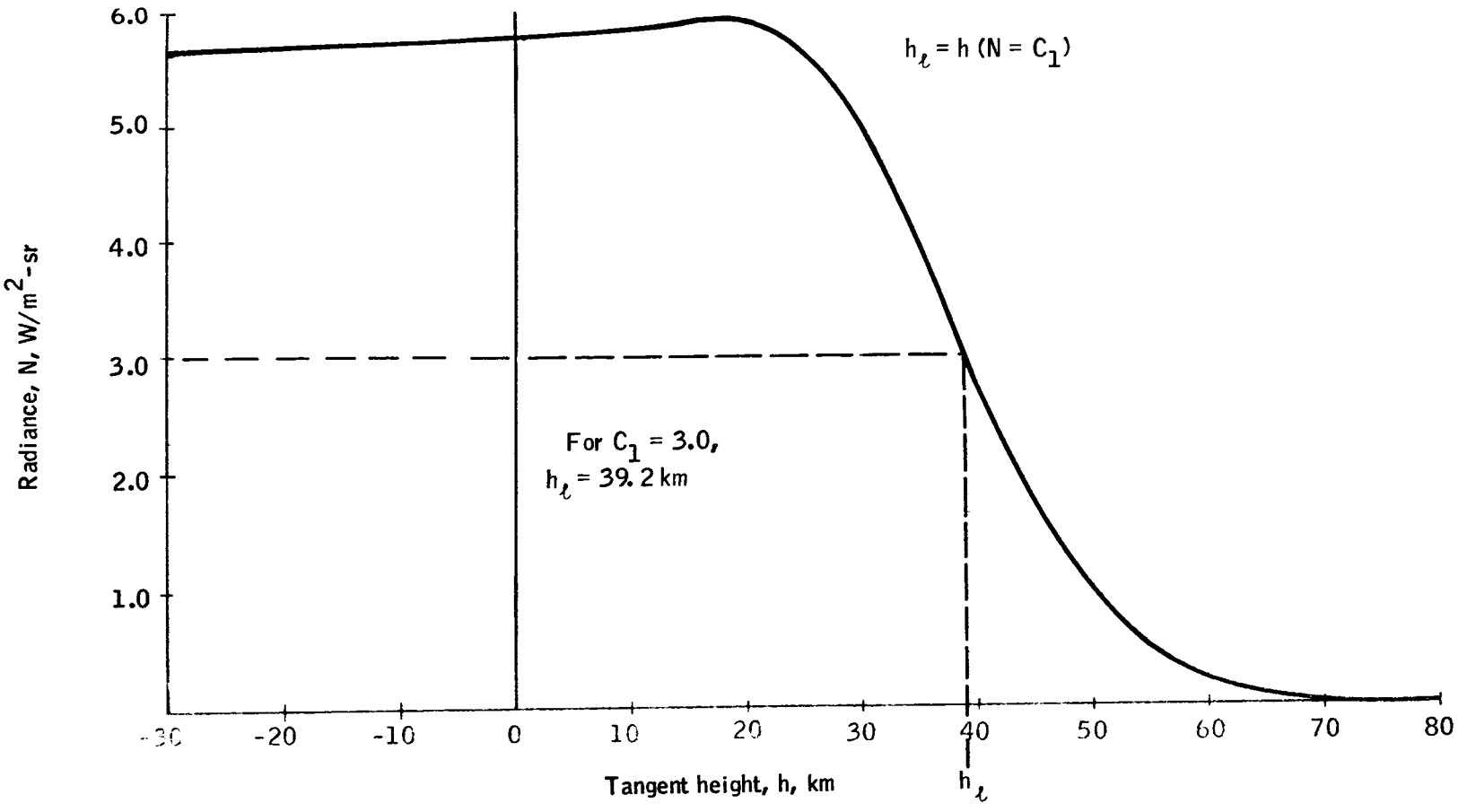


Figure 3. Locator L1 Fixed Radiance

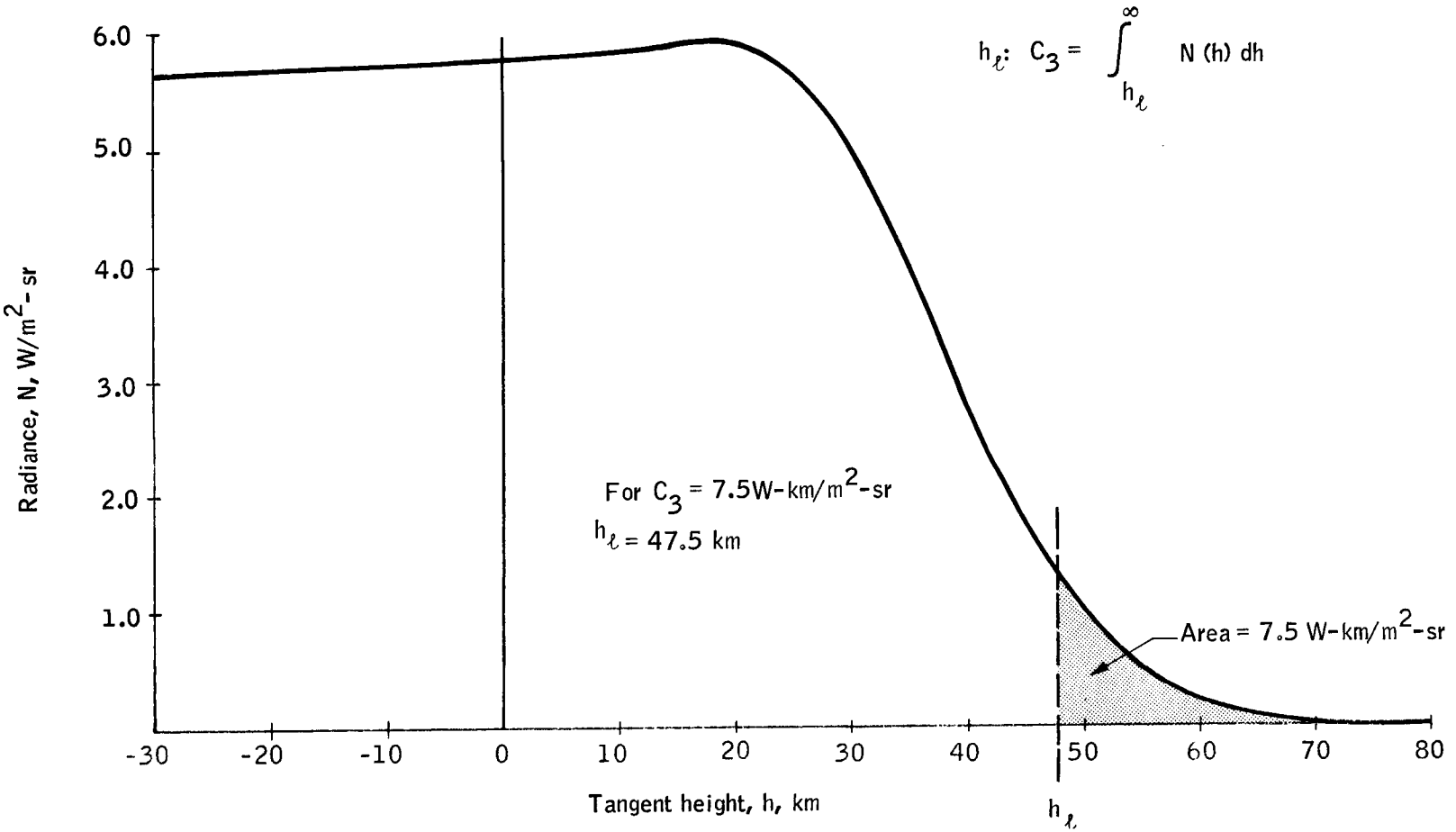


Figure 4. Locator L3 Integrated Radiance

Locator L4, integrated normalized radiance. -- This locator is identical to L3 except that the integration is on normalized radiance rather than radiance. The equation for located horizon is

$$C_4 = \int_{h_\ell} \frac{N}{N_m}(h)\, dh \quad . \tag{4}$$

Locator L5, slope. -- The located horizon is defined to be at the altitude at which a particular value of the slope of the radiance profile exists, as in Figure 5. The equation for located horizon is

$$h_\ell = \text{largest } h<h\ (N = 0) \text{ at which } C_5 = \frac{dN}{dh}. \tag{5}$$

Locator L6, slope of normalized radiance. -- This locator is identical to L5 except the slope of normalized radiance is used. The located horizon is given by

$$h_\ell = \text{largest } h<(N = 0) \text{ at which } C_6 = \frac{d\frac{N}{N_m}}{dh} \quad . \tag{6}$$

Locator L7, slope extrapolation. -- The located horizon is defined to be at the altitude at which a straight line, fitted through two values of radiance, intersects the altitude axis, as in Figure 6. The defining equation is

$$h_\ell = \frac{C_{7_a}\, h(C_7) - C_7 h(C_{7_a})}{C_{7_a} - C_7} \tag{7}$$

where C_7 and C_{7_a} are the two values of radiance through which the straight line is fitted.

Locator L8, slope extrapolation normalized radiance. - This locator is identical to L7 except that normalized radiance profiles rather than radiance profiles are used. Located horizon is defined by

$$h_\ell = \frac{C_{8_a}\, h(C_8) - C_8 h(C_{8_a})}{C_{8_a} - C_8} \tag{8}$$

where C_8 and C_{8_a} are the two values of normalized radiance through which the straight line is fitted.

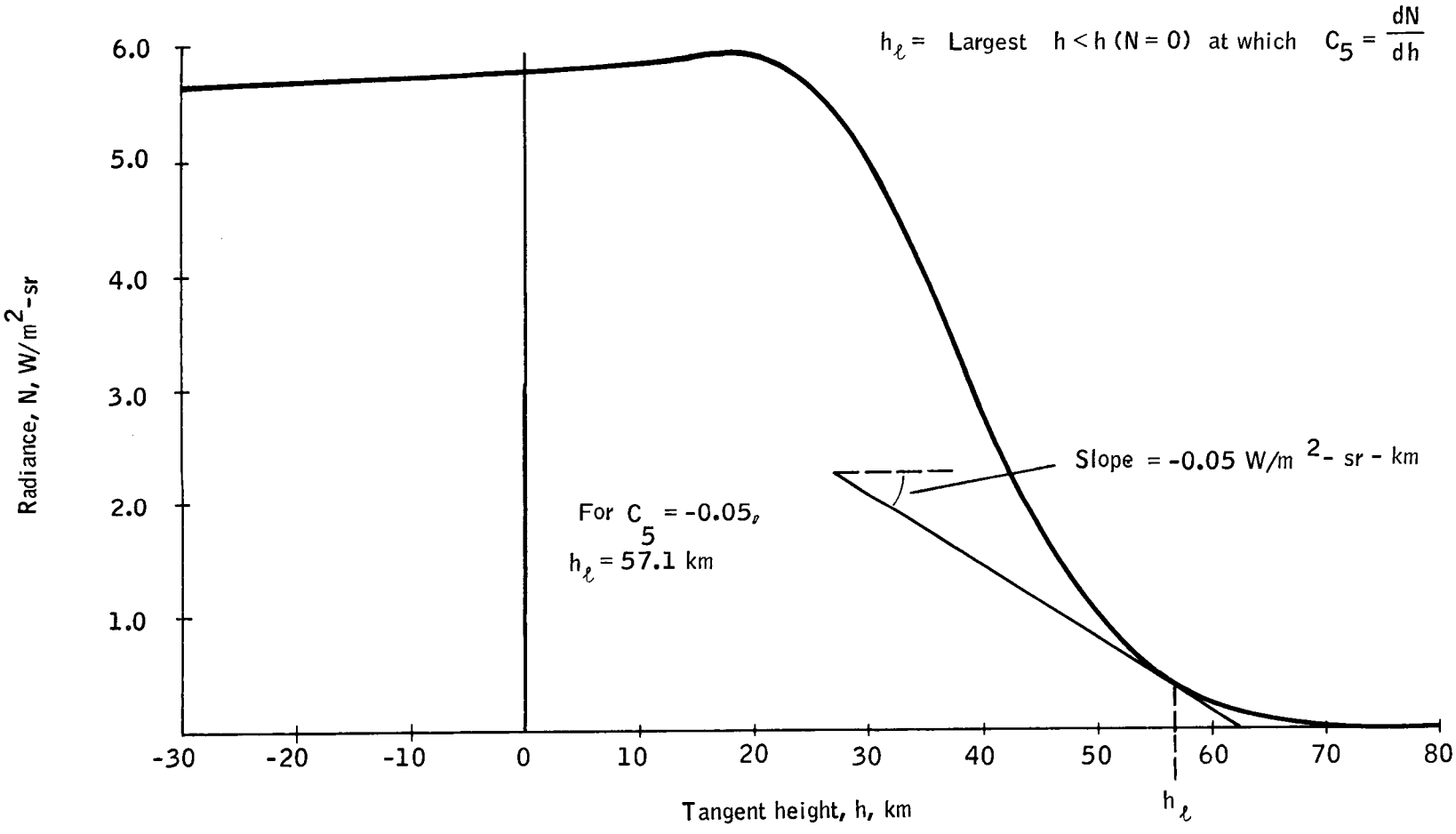


Figure 5. Locator L5 Slope

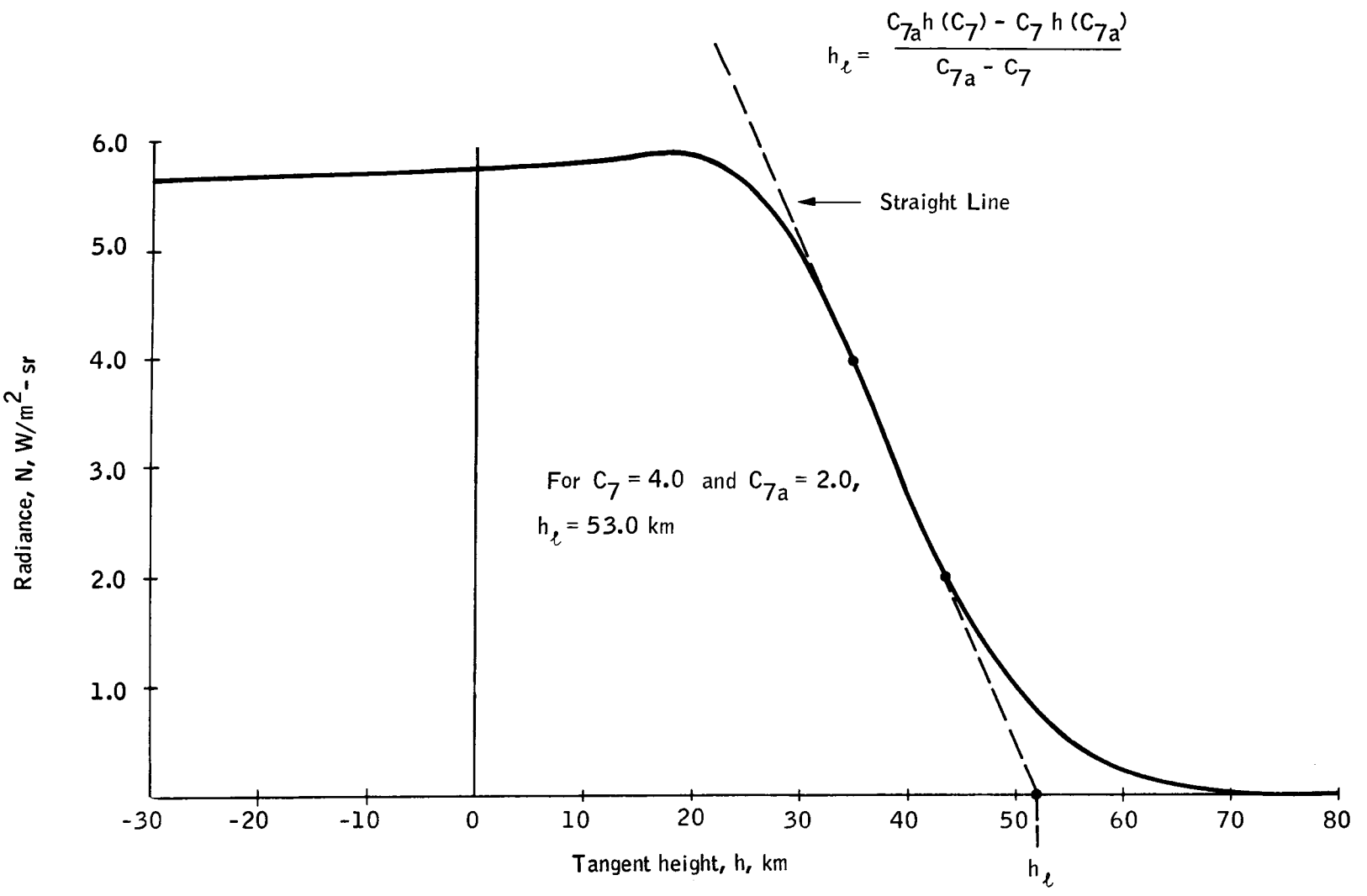


Figure 6. Locator L7 Slope Extrapolation

Locator L9, average radiance. -- The located horizon is defined to be at the altitude at which average radiance exists, as in Figure 7. Only that part of the radiance profile to the right of peak radiance is used in the determination of average radiance. This is necessary since calculation of average value requires a definite integral over an area of interest, and, by definition of the locator concept, some characteristics of radiance, rather than particular values of altitude, must be used to bound the area of interest.

The characteristic selected to bound the area of interest is peak radiance, since this allows averaging over a relatively large area, and radiance profiles used early in the study all exhibited limb brightening. The defining equations are

$$h_\ell = h(\bar{N}), \tag{9}$$

$$\bar{N} = \frac{1}{h(0) - h(N_m)} \int_{h(N_m)}^{\infty} N(h)\, dh; \; N_m = \text{Peak N}. \tag{10}$$

This locator's potential value is that the located horizon is a function of a large part of the total radiance profile rather than determined from a single value. However, as shown in Locator Processor Experimental Run section, it proved to result in an unstable horizon since the altitude at which peak radiance occurs exhibits a large variance, causing large variance in the integral from which the average value is calculated.

Locator L10, average normalized radiance. -- This locator is identical to L9 except that normalized radiance profiles are used. The defining equations are

$$h_\ell = h\left(\frac{\bar{N}}{N_m}\right), \tag{11}$$

$$\frac{\bar{N}}{N_m} = \frac{1}{h(0) - h(1.0)} \int_{h(1.0)}^{h(0)} \frac{N}{N_m}\, dh. \tag{12}$$

Subsequent to defining this locator, analysis (see Appendix A) showed that it was mathematically identical to L9; that is, both L9 and L10 produce the same located horizon for the same radiance profile. It is included here only for completeness.

Locator L11, radiance centroid. -- The located horizon is defined to be at the altitude at which the radiance centroid exists for the region shown in Figure 8.

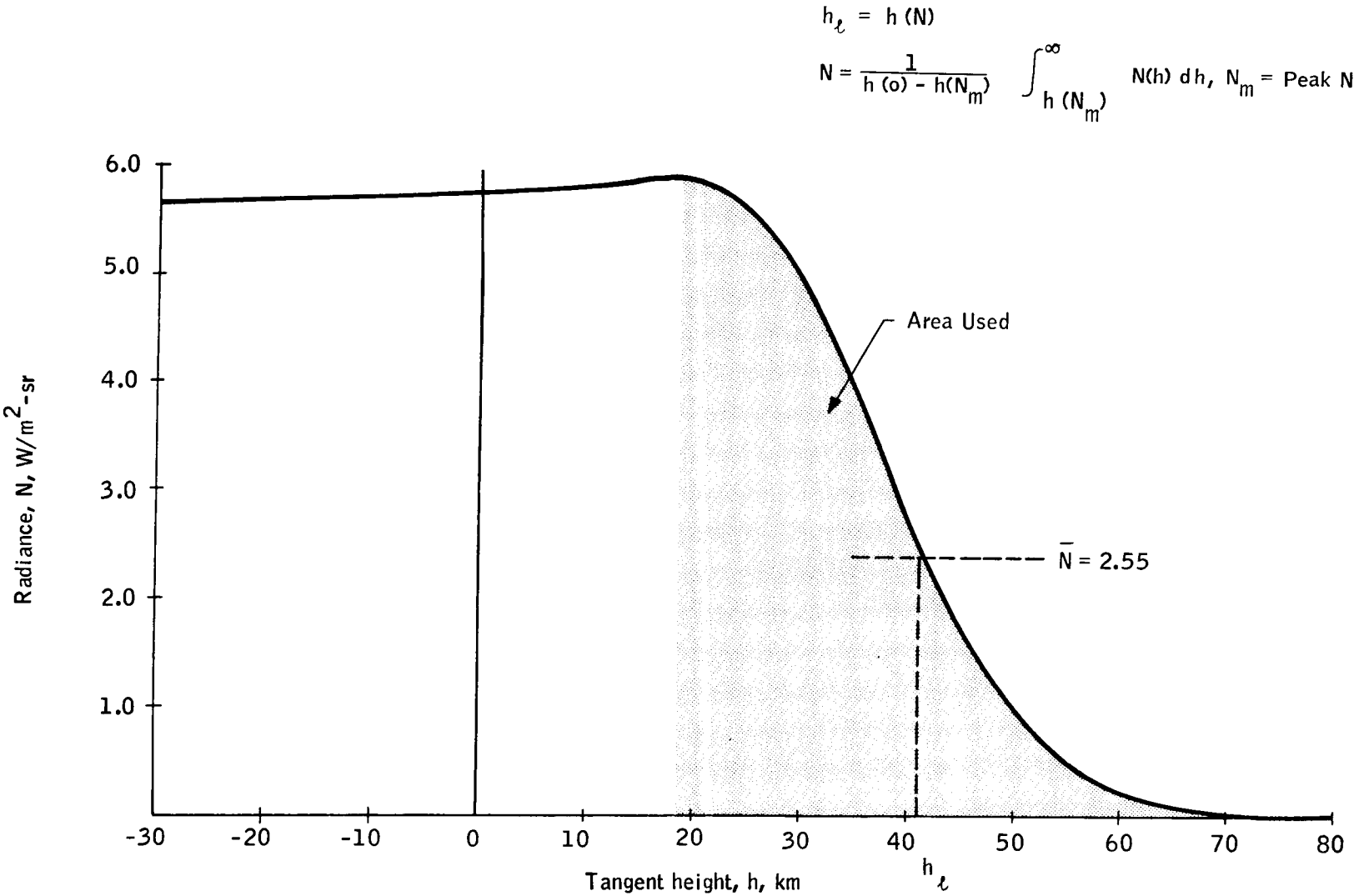


Figure 7. Locator L9 Average Radiance [Over Altitudes Greater than Altitude of Peak Radiance]

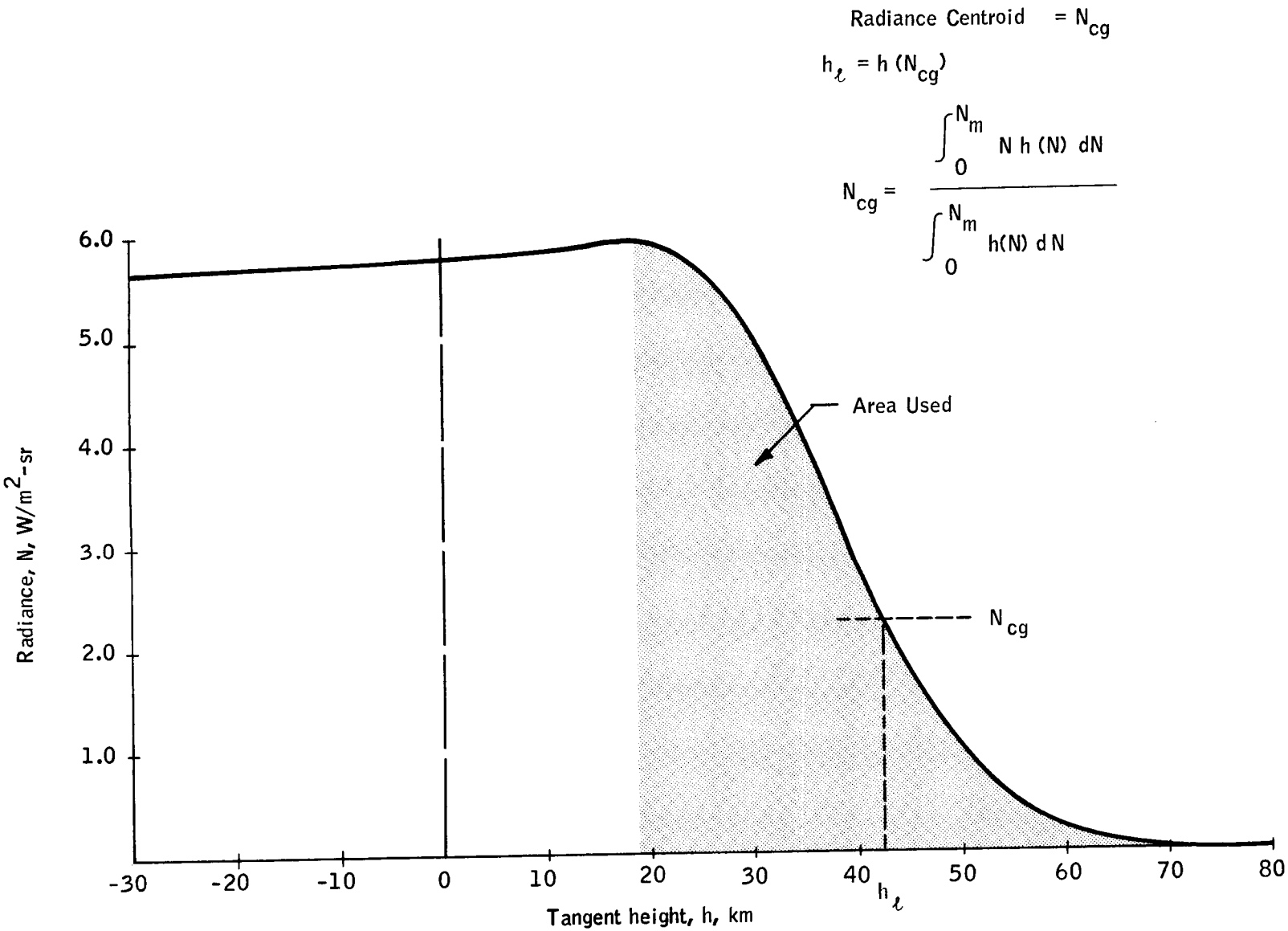


Figure 8. Locator L11 Radiance Centroid [Over Altitudes Greater than Altitude of Peak Radiance]

The defining equations are

$$\text{Radiance centroid} = N_{cg}\,, \tag{13}$$

$$h_\ell = h(N_{cg}), \tag{14}$$

$$N_{cg} = \frac{\int_0^{N_m} N\,h\,(N)\,dN}{\int_0^{N_m} h\,(N)\,dN} \tag{15}$$

The locator is interesting since it is based primarily on the shape of a large part of the radiance profile rather than on a single point. However, because of the large variation in the altitude at which peak radiance occurs, as mentioned under L9, this locator resulted in a relatively unstable horizon.

Locator L12, centroid of normalized radiance. -- This locator is identical to L11 except that normalized radiance profiles are used. Subsequent to defining this locator, analysis (see Appendix A) showed that it produced the same located horizon as L11 for the same radiance profile. It is included here only for completeness. The defining equations are:

$$h_\ell = h\left(\frac{N}{N_{m_{cg}}}\right), \tag{16}$$

$$\frac{N}{N_{m_{cg}}} = \frac{\int_0^1 \frac{N}{N_m}\; h\left(\frac{N}{N_m}\right)\, d\,\frac{N}{N_m}}{\int_0^1 h\left(\frac{N}{N_m}\right)\, d\,\frac{N}{N_m}}\,. \tag{17}$$

Locator L13, mean between two values of same slope. -- The located horizon is defined to be at the altitude midway between the two altitudes at which a particular value of slope exists, as in Figure 9. The defining equations are:

$$h_\ell = \frac{1}{2}\,(h_1 + h_2)\,, \tag{18}$$

$$h_1 = \text{largest } h<h(0) \text{ at which } \frac{dN}{dh} = C_{13}\,, \tag{19}$$

$$h_2 = \text{largest } h<h_1 \text{ at which } \frac{dN}{dn} = C_{13}, \tag{20}$$

where C_{13} is the value of slope used.

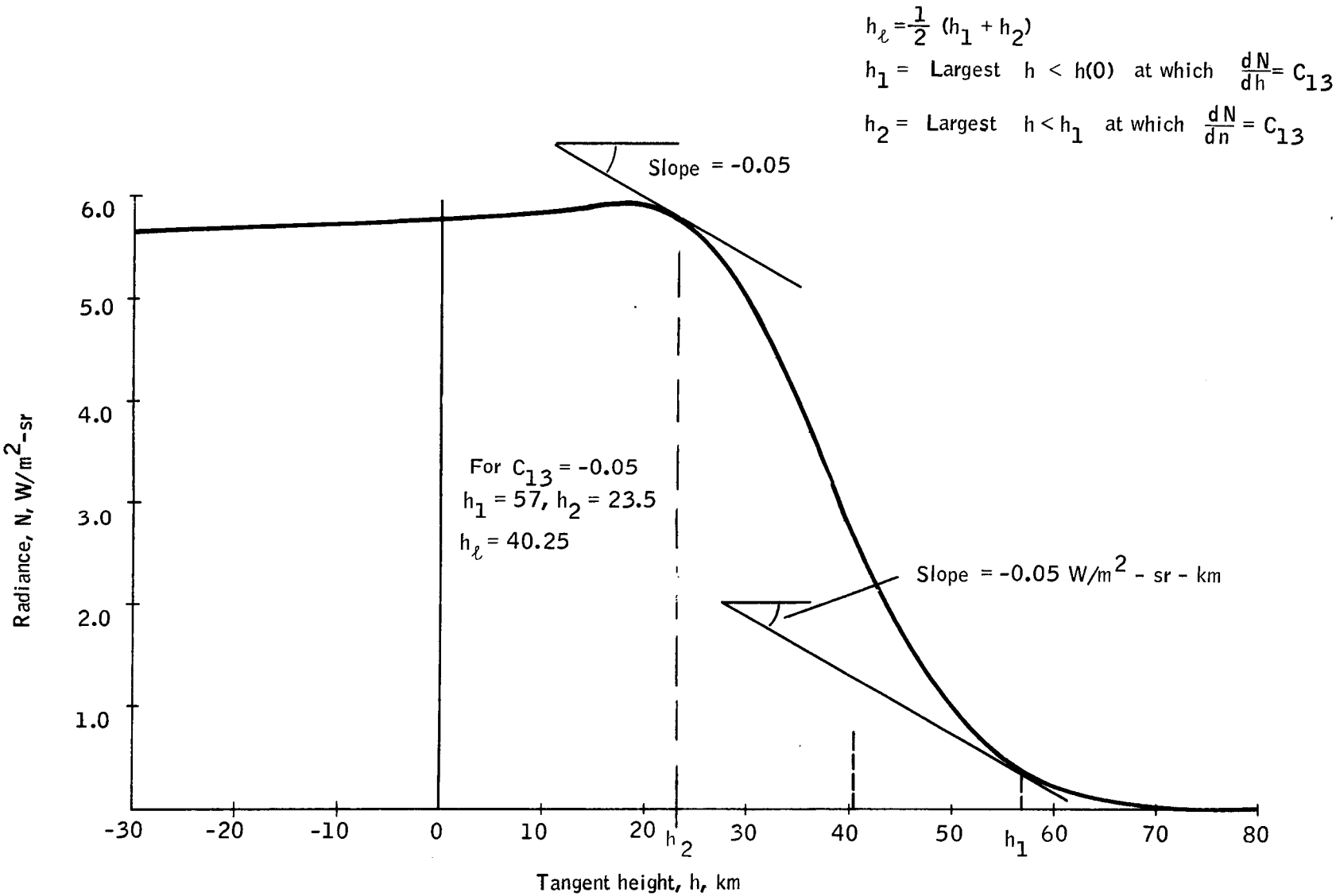


Figure 9. Locator L13 Mean Between Two Slopes

This locator is suggested because the radiance profile exhibits the characteristic that, near peak radiance and near zero radiance, equal values of slope exist. Thus, this locator defines a horizon based on features of the profile near both zero radiance and peak radiance; variations in location of slope in these two regions hopefully compensate, resulting in a more stable horizon than using slope at only one point. However, as shown later, this is not true.

Locator L14, mean between two slopes, normalized radiance. -- This locator is identical to L13 except that normalized radiance profiles are used. The defining equations are

$$h_\ell = \frac{1}{2}(h_1 + h_2) \quad , \tag{21}$$

$$h_1 = \text{largest } h<h(0) \text{ at which } \frac{d}{dh}\left(\frac{N}{N_m}\right) = C_{14}, \tag{22}$$

$$h_2 = \text{largest } h<h_1 \text{ at which } \frac{d}{dh}\left(\frac{N}{N_m}\right) = C_{14}. \tag{23}$$

The same comments for L13 also apply for L14.

Locator L15, average altitude. -- The located horizon is the average altitude, where averaging is done over those altitudes greater than the altitude of peak radiance, as in Figure 10. The equation for located horizon is

$$h_\ell = h(N_m) + \frac{1}{N_m} \int_{h(N_m)}^{h(0)} N(h)\, dh. \tag{24}$$

The locator is similar to L9 and the same comments apply for L15.

Locator L16, altitude centroid. -- The located horizon is the altitude centroid of that area under the radiance profile at altitudes greater than the altitude of peak radiance, as in Figure 11. The defining equation is

$$h_\ell = \frac{\displaystyle\int_{h(N_m)}^{h(0)} h\, N(h)\, dh}{\displaystyle\int_{h(N_m)}^{h(0)} N(h)\, dh}. \tag{25}$$

This locator is similar to L11 and the same comments apply for L16.

Locator L17, inflection point. -- The located horizon is defined to be at the largest altitude at which an inflection point exists in the radiance profile, as in Figure 12. The defining equation is

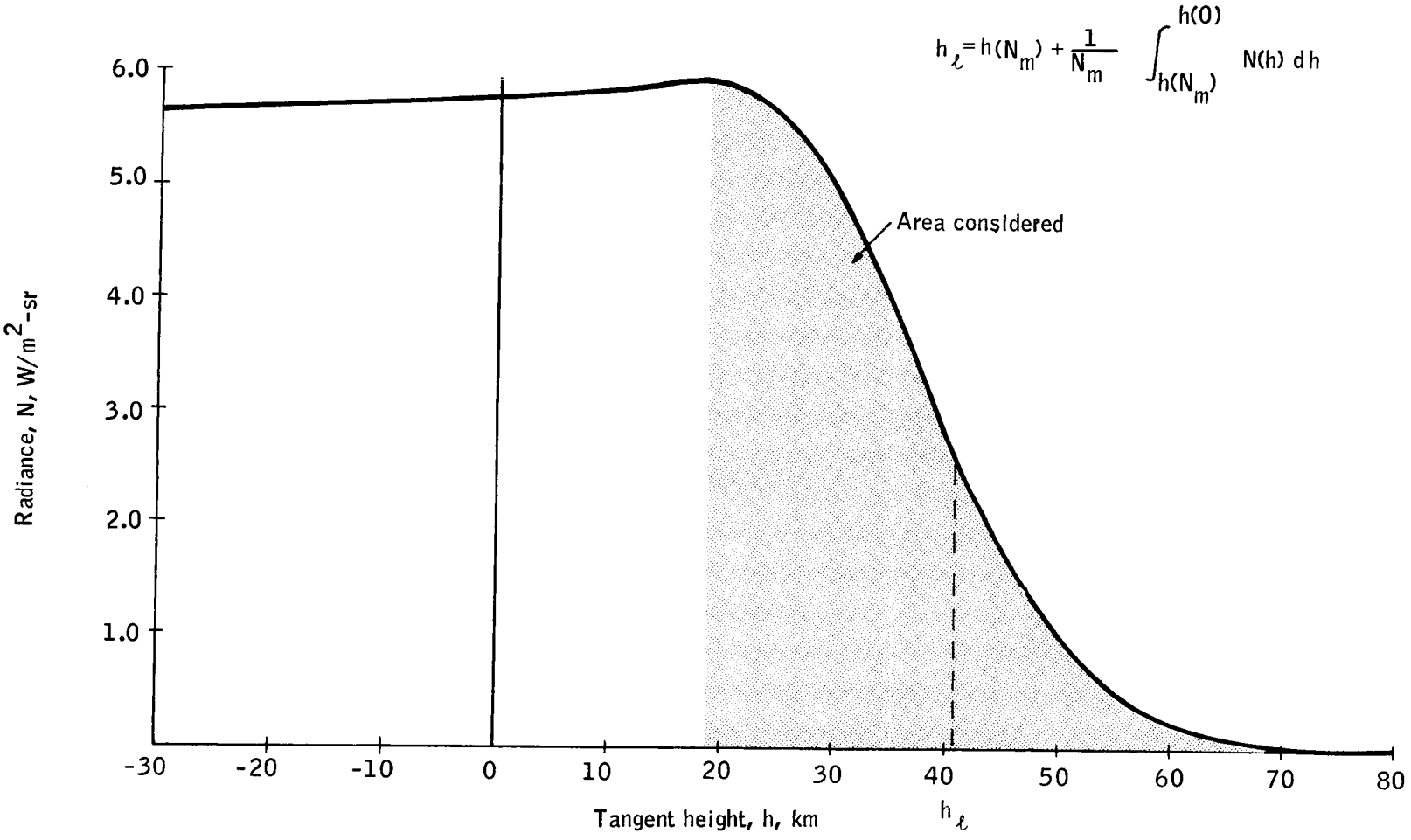


Figure 10. Locator L15 Average h [Over Altitudes Greater than Altitude of Peak Radiance]

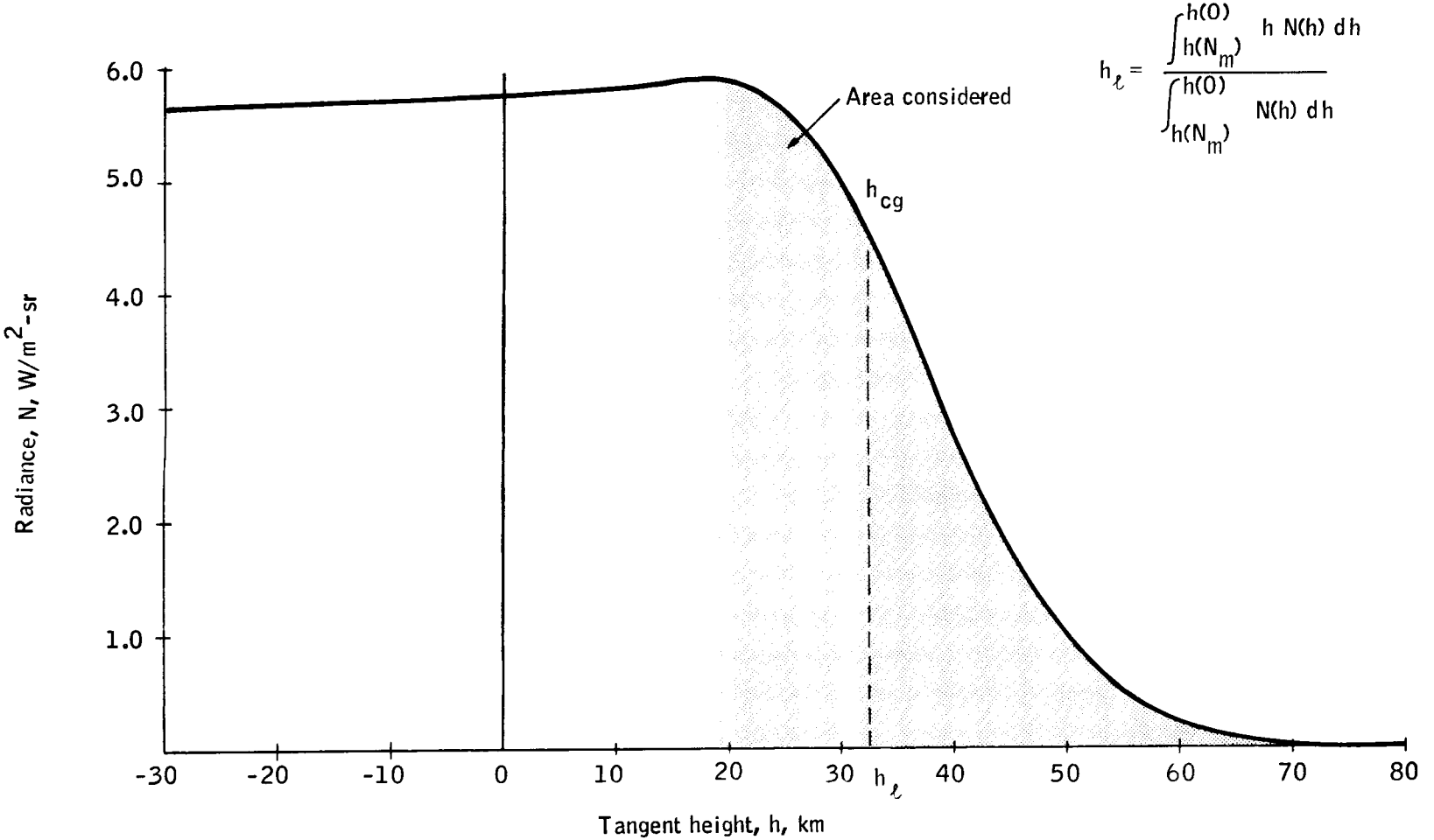


Figure 11. Locator L16 Altitude Centroid [Over Altitudes Greater than Altitude of Peak Radiance]

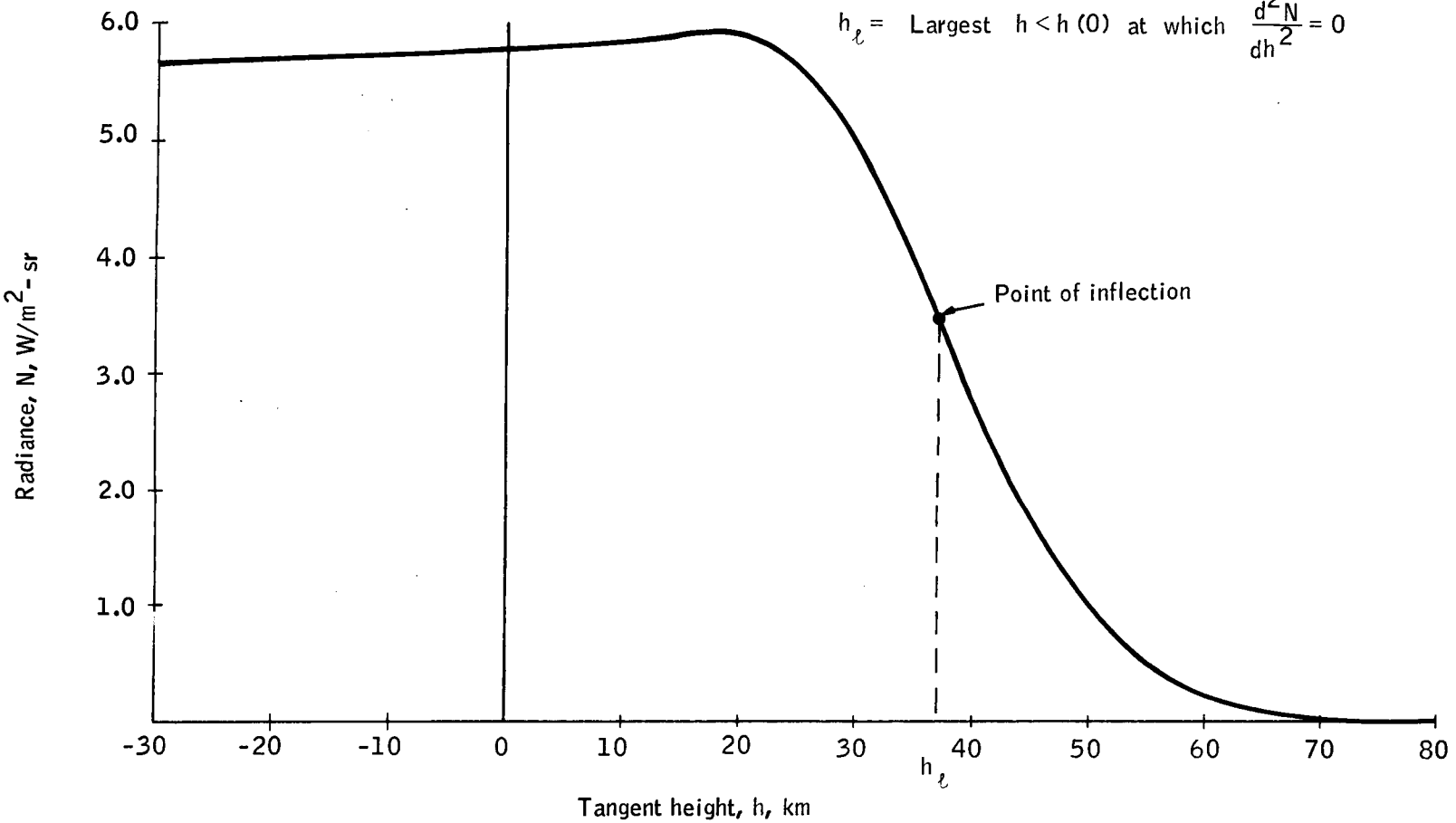


Figure 12. Locator L17 Inflection Point

$$h_\ell = \text{largest } h < h(N = 0) \text{ at which } \frac{d^2N}{dh^2} = 0. \qquad (26)$$

This locator is a special case of L3, Slope, in that the maximum value of slope is used rather than any particular value.

Locator L18, two-color difference. -- The located horizon is defined to be at the altitude at which the difference between two radiance profiles in different spectral regions is a maximum, as in Figure 13. The defining equation is

$$h_\ell = \text{altitude at which } \frac{d}{dh} \left[N(h, \Delta\lambda_1) - N(h, \Delta\lambda_2) \right] = 0, \qquad (27)$$

where $\Delta\lambda_1$, $\Delta\lambda_2$ refer to the two spectral intervals used. This locator was originally suggested and discussed in detail by Duncan(ref. 3). Earle(ref. 4) compares the stability of located horizon from this locator with that of L2, normalized radiance, and concludes that L18 is more stable, but with a small enough difference that the increased complexity implied by L18 in a horizon sensing application would not be warranted. This locator was not used during the study, since only one spectral interval was used, and this locator requires two.

Locator L19, normalized integral. -- Since normalized radiance and its characteristics generally exhibit more stability than radiance and its characteristics, certain characteristics normalized to peak value of the characteristic were examined, and this locator identified. The located horizon is defined to be at the altitude at which exists a given percent of the area under the radiance profile for altitudes greater than the altitude of peak radiance (i.e., percent of area to right of peak radiance in Figure 14).

The equation describing located horizon is:

$$C_{19} = \frac{\int_{h_\ell}^{\infty} N(h)\, dh}{\int_{h(N_m)}^{\infty} N(h)\, dh}. \qquad (28)$$

As in previous locators, peak radiance and its location were used to close the normalizing integral so that the locator could be independent of knowledge of altitude. However, as mentioned before, large variations in location of peak radiance cause relatively large instabilities.

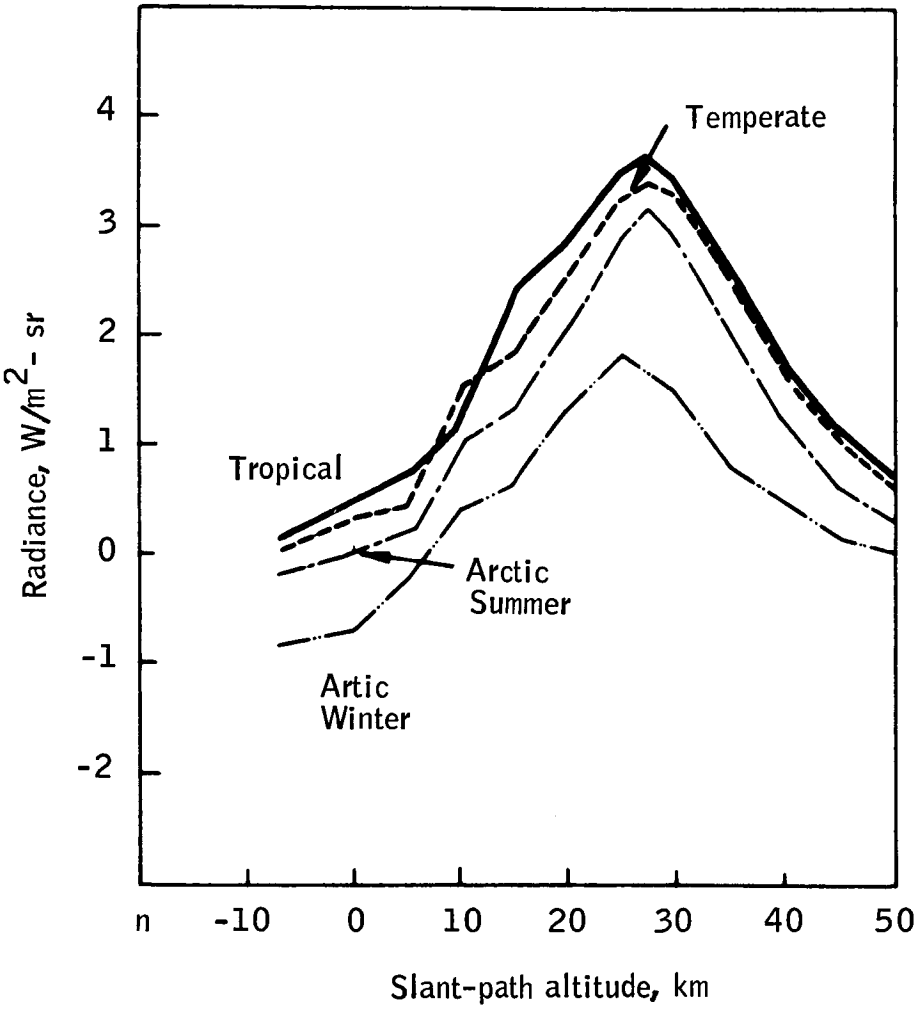


Figure 13. Difference of the Horizon Radiance Profiles Estimated for the 14 to 16 μ and 16 to 18 μ Spectral Intervals [ref. 2]

$$C_{19} = \frac{\int_{h_\ell}^{\infty} N(h)\, dh}{\int_{h(N_m)}^{\infty} N(h)\, dh}$$

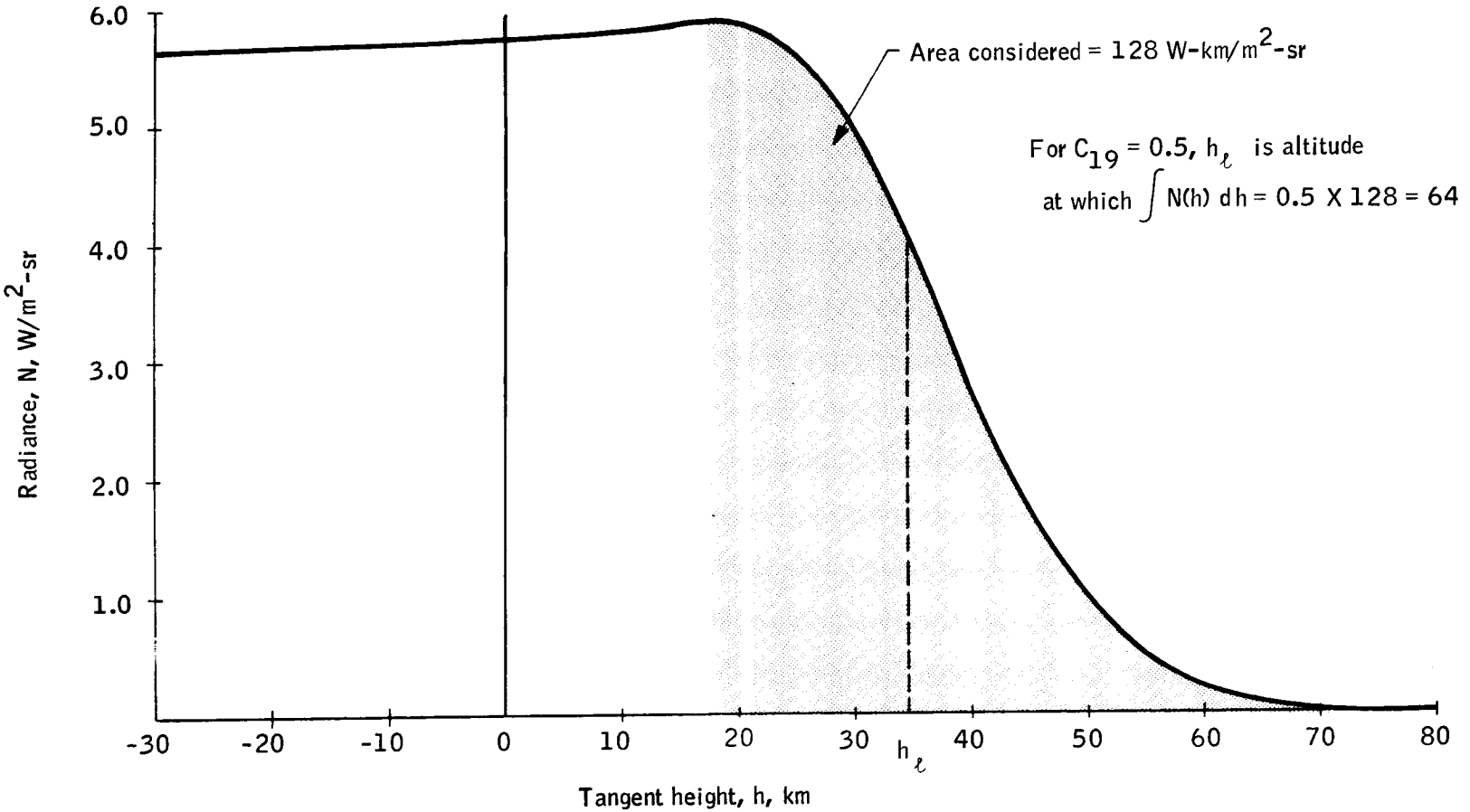


Figure 14. Locator L19 Integrated Radiance Normalized to Integrated Radiance up to Peak Radiance

Locator L20, radiance compensated integral. -- This locator is a combination of L1 and L6. The located horizon is defined to be the difference between the located horizon defined by L1 and by L6 for selected pairs of constants C_1 and C_6. It is the result of examining integrals of normalized radiance for the eight profiles calculated by Wark (ref. 5). A plot of integral of normalized radiance in Figure 15 shows that seven of the eight profiles result in a stable located horizon, but that one, Profile C, is separated from the others. Examination of the radiance profiles revealed that Profile C appeared to be shifted toward lower altitudes but had the same peak radiance as Profile A, see Figures 16 and 17. This suggested a compensation scheme; if located horizons at some value of integral of normalized radiance could be compensated by the value of radiance around 40 km altitude, then Profile C would be compensated by a greater amount than A or B, and the spread might be reduced. However, profile D might be compensated too heavily. The compensation technique selected was to subtract the located horizon at N = 2.0 from the located horizon at integral of normalized radiance equal 30.0. For the eight profiles shown, excellent results were obtained; the maximum spread in located horizon was only ±1.45 km, and the standard deviation was 0.78 km. However, subsequent analysis showed that the compensation technique utilized was not actually a compensation technique; the resulting located horizons were only the difference between two other located horizons and were not referenced to any earth reference.

Further work was done to identify a compensation technique that would result in a located horizon with a smaller standard deviation than L4.

For example, the located horizon at N = 2.0 was compensated by different values of integral of normalized radiance; also, the located horizon from L4 was compensated by different values of radiance. The effort was unsuccessful; a smaller standard deviation for Wark's eight profiles could not be obtained, compared to that obtained for L4.

This locator was discarded.

Locator B1, signal harmonics. -- This locator implies a particular scanning mechanization and was not used since it was desired to keep the locator concept free of particular scanning mechanizations. A complete description can be found in Reference 1.

Locator B2, three-point slope extrapolation. -- This locator is similar to L7, the difference being that three points are used instead of two. The average slope of the radiance profile in the nearly linear region is determined by using two of the three points. Then a line of that slope is fitted through the third point and extrapolated back to zero radiance to find the located horizon. The equation for located horizon is

$$h_\ell = h(N_1) + \frac{[h(N_3) - h(N_2)]}{N_2 - N_3} N_1 \qquad (29)$$

where N_1, N_2, and N_3 define the three points used.

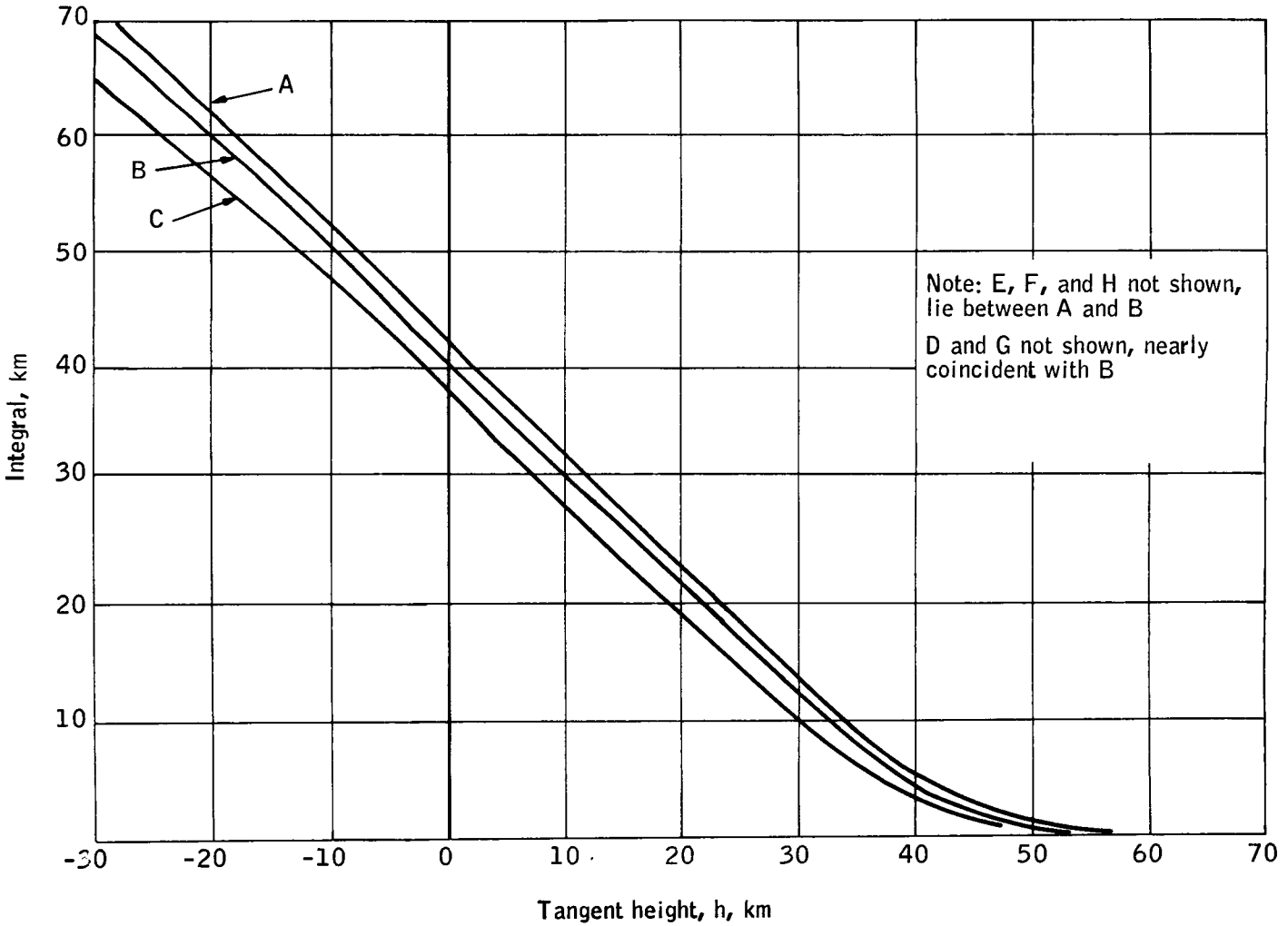
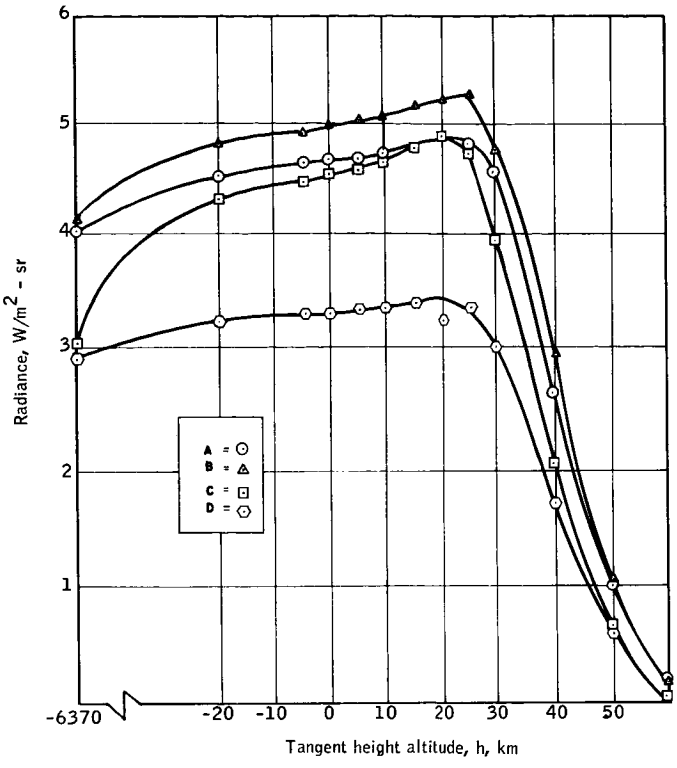
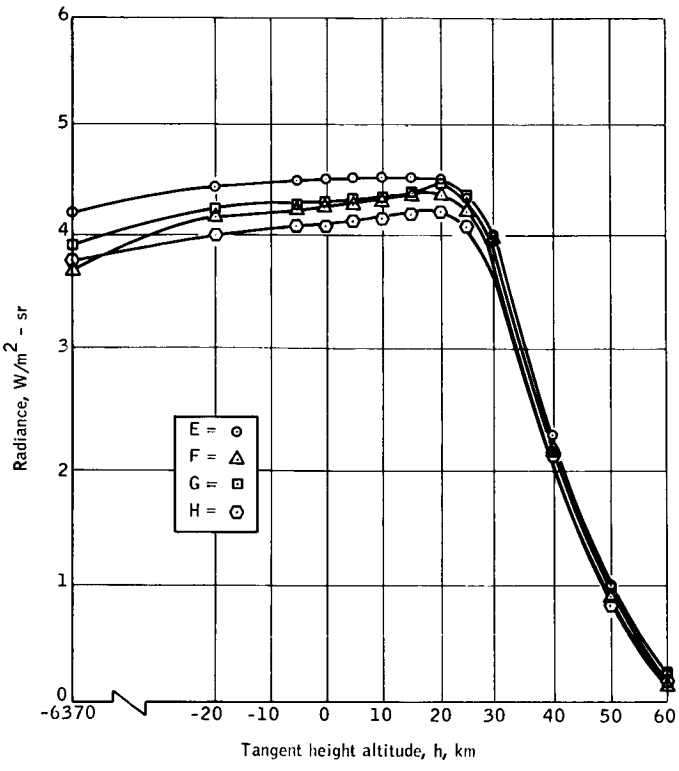


Figure 15. Integrated Normalized Radiance versus Tangent Weight for Wark's Profile



Designation	Location	Weather conditions	Total water vapor, g/cm^2	Total ozone content, cm-atmospheres	Date	Time of day, GMT hrs.
A	(ARDC. Standard)	Clear	1.334	0.435	1959	0000
B Summer Tropical	Albuquerque, New Mexico	Clear	1.363	0.289	7-11-58	1200
C Summer Tropical	Ponape, Caroline Islands	Undercast at 100 mb pressure	0.001	0.293	5-17-58	1200
D Arctic Winter	Resolute Northwest Territory	Undercast at 400 mb pressure	0.007	0.273	12-31-58	1200

Figure 16. Atmospheric Models A, B, C, and D, Radiance Versas Altitude, 14.29 to 16.0 Microns [ref. 5]



Designation	Location	Weather conditions	Total water vapor, g/cm^2	Total ozone content, cm-atmospheres	Date	Time of day, GMT hrs.
E Arctic Summer	Isachsen, Northwest Territory	Clear	0.265	0.255	9-29-58	1200
F Arctic Winter	Barter Island, Alaska	Clear	0.117	0.273	1-1-58	1200
G Tropical Summer	Kindley, Bermuda	Clear	5.078	0.255	8-1-58	1200
H	Thule, Greenland	Clear	0.159	0.254	10-20-58	0000

Figure 17. Atmospheric Models E, F, G, and H, Radiance Versus Altitude 14.29 to 16.0 Microns [ref. 5]

Locator B3, corrected slope extrapolation. -- This locator is the same as B2, with the addition of a correction term based on the magnitude of peak radiance. For simplicity, the equation for h_ℓ is given in terms of h_ℓ found by B2;

$$h_\ell = (h_\ell)_2 + \frac{f(N_m)}{N_2 - N_3} \tag{30}$$

where $f(N_m)$ is as yet undetermined. Suggested functions include:

a) $f(N_m) = KN_m$,

b) $f(N_m) = (N_m)^{1/n}$,

c) $f(N_m) = \ell n\, N_m$.

Time did not permit an in-depth study to find the best $f(N_m)$; consequently, this locator was not used. However, it appears to offer potential stability and further study is indicated.

Locator B4, modified normalized radiance. -- The located horizon is defined to be at the midpoint between the two altitudes at which exist two particular values of normalized radiance. The equations for located horizon are:

$$h_\ell = \frac{h_1 + h_2}{2}, \tag{31}$$

$$h_1 = h\left(\frac{N_1}{N_m}\right), \tag{32}$$

$$h_2 = h\left(\frac{N_2}{N_m}\right). \tag{33}$$

Preliminary analysis showed that the standard deviation of located horizon was never smaller for B4 than for L2, which uses only one rather than two points on the normalized radiance profile. Consequently, B4 was not used.

Locator B5, modified inflection point. -- To determine the located horizon, the derivative of radiance is first normalized to its peak magnitude. Then, as in Figure 18, the two altitudes at which the derivative is equal to 50 percent of the peak magnitude are selected. The located horizon is midway between these two altitudes. The governing equations are:

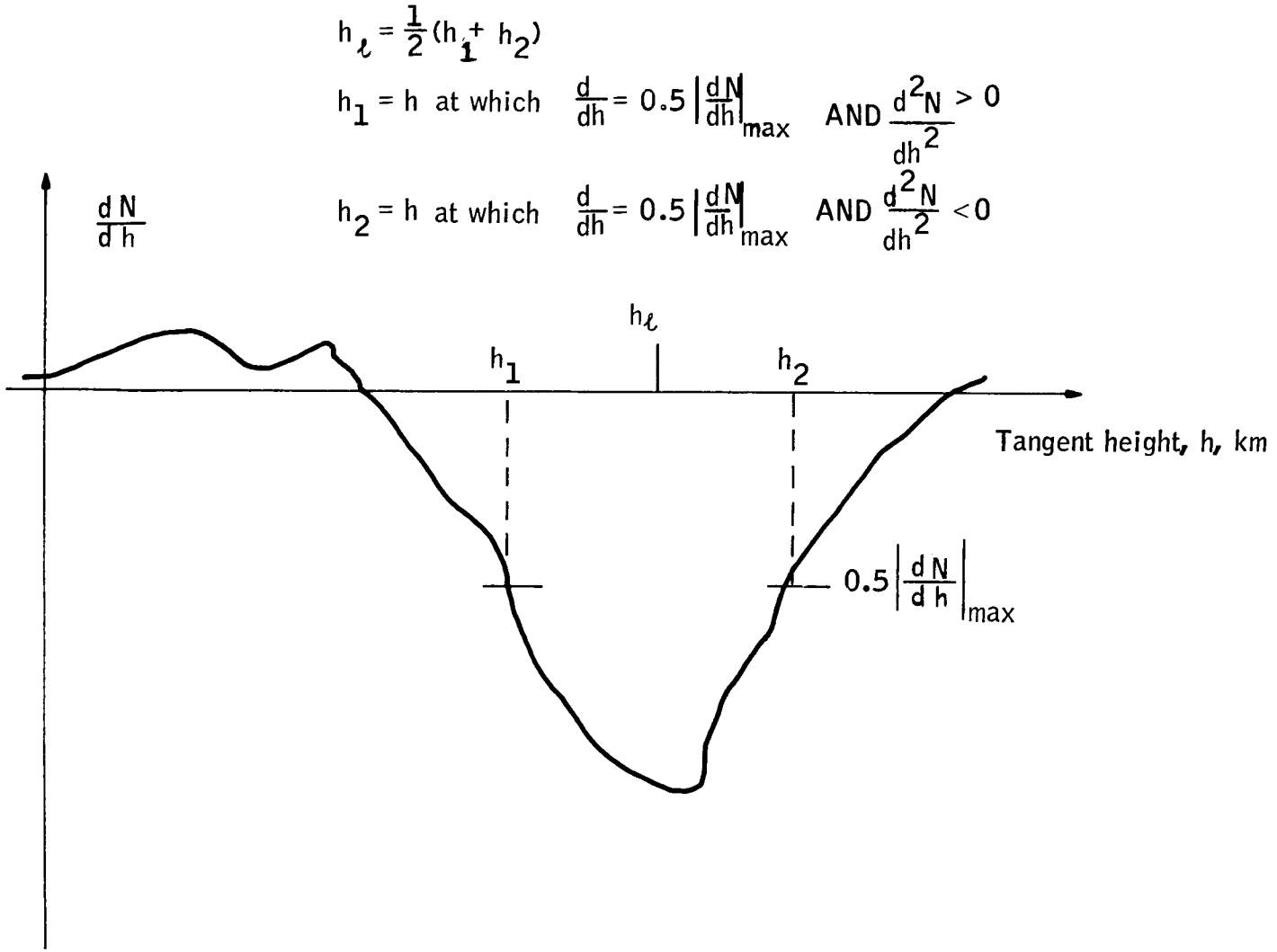


Figure 18. Locator B5 Modified Inflection Point

$$h_\ell = \frac{1}{2}(h_1 + h_2), \tag{34}$$

where h_1 and h_2 are defined as follows

$$h_1 : \frac{N'(h_1)}{|N'_m|} = -0.5 \text{ and } \frac{dN'}{dh} < 0, \tag{35}$$

$$h_2 : \frac{N'(h_2)}{|N'_m|} = -0.5 \text{ and } \frac{dN'}{dh} > 0, \tag{36}$$

where $N' = \frac{dN}{dh}$

and $|N'_m|$ = maximum magnitude of $\frac{dN}{dh}$.

Locator B6, minimum curvature. -- The located horizon is defined to be at the altitude at which the curvature of the radiance profile is algebraically least. For a smooth profile, as in Figure 19, the point of minimum curvature occurs near the upper knee of the profile, that is, approaching peak radiance. The equation is

$$h_\ell = h \text{ at which } \frac{d^2N}{dh^2} \text{ is minimum.} \tag{37}$$

Locator B7, maximum curvature. -- The located horizon is defined to be at the altitude where the curvature of the radiance profile is algebraically the largest. For a smooth profile, as in Figure 20, maximum curvature occurs near the lower knee of the curve. The governing equation is

$$h_\ell = h \text{ at which } \frac{d^2N}{dh^2} \text{ is maximum.} \tag{38}$$

Locator B8, midpoint between minimum and maximum curvature. -- The located horizon is defined to be midway between the altitude where minimum curvature and maximum curvature exist, as in Figure 21. The equation is

$$h_\ell = \frac{h_1 + h_2}{2}, \tag{39}$$

where h_1 is h_ℓ from B6,

and h_2 is h_ℓ from B7.

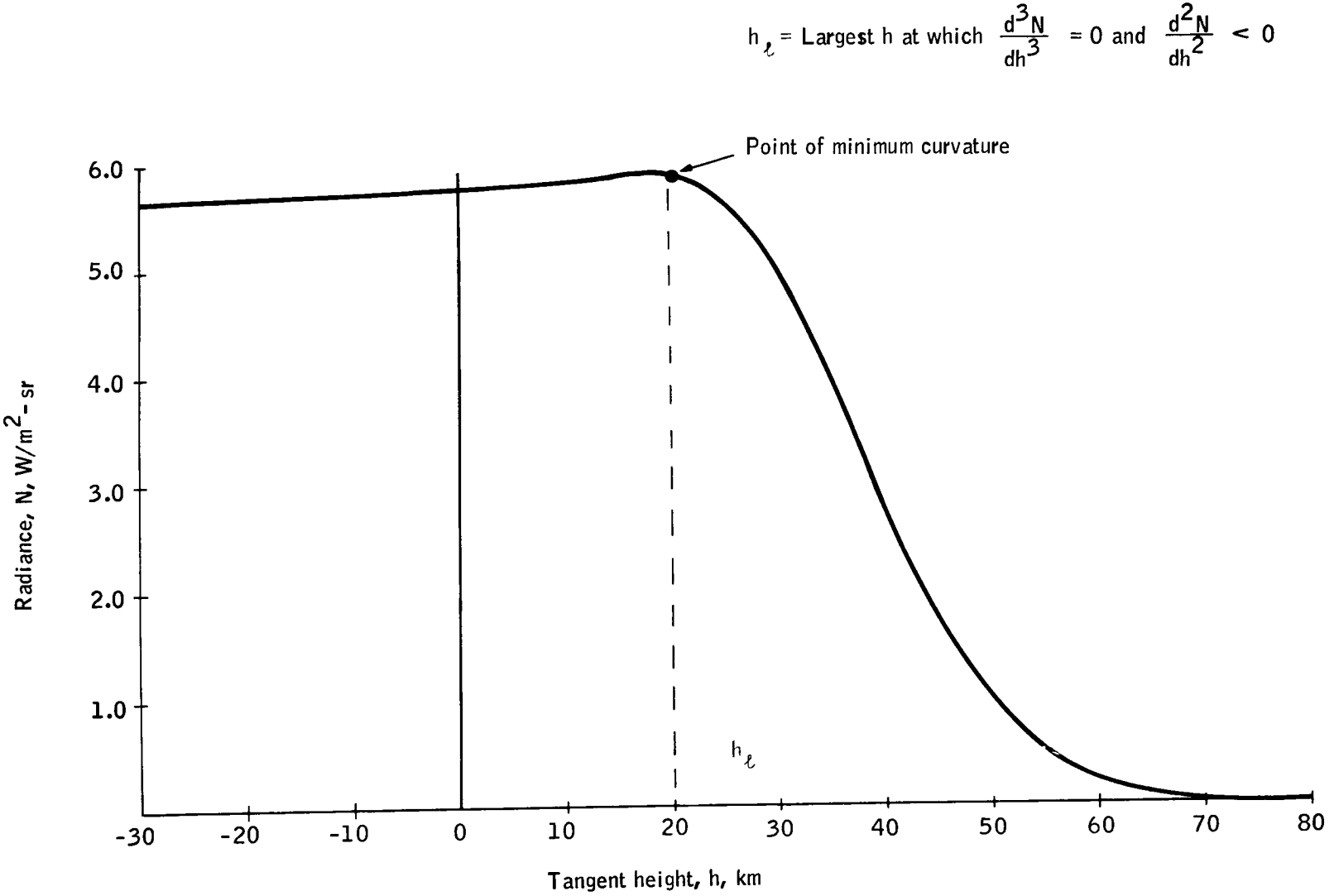


Figure 19. Locator B6 Minimum Curvature

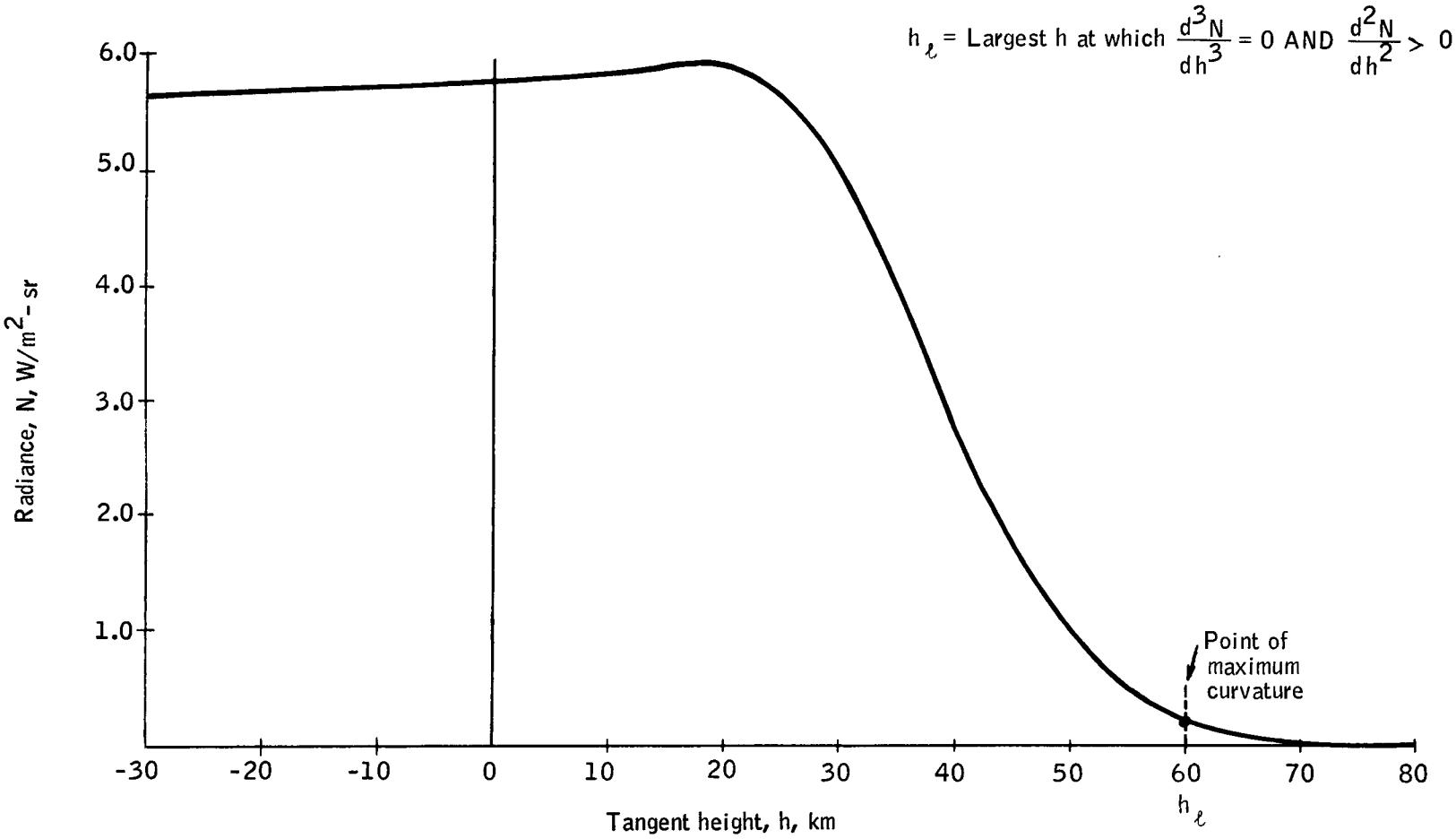


Figure 20. Locator B7 Maximum Curvature

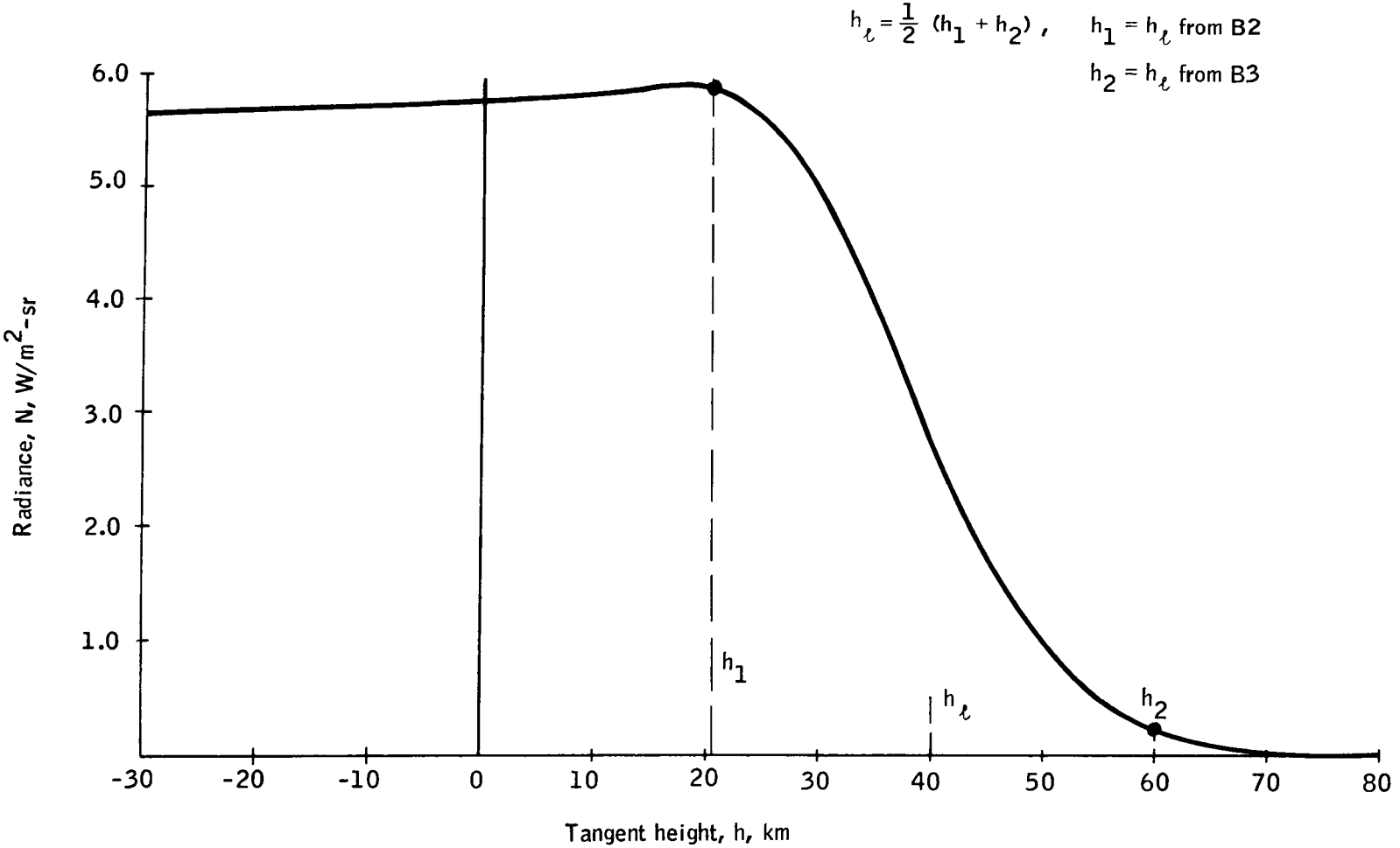


Figure 21. Locator B8 Mean Between Minimum and Maximum Curvature

Locator B9, two-color normalized difference. -- This locator is similar to L18, except that instead of using the absolute difference between radiance profiles in two spectral intervals, this locator normalizes one profile to the other so that both profiles have the same peak radiance magnitude. The located horizon is then at the altitude where the difference between these normalized profiles is a maximum. The equation for located horizon is

$$h_\ell = \text{altitude at which } \frac{d\Delta N}{dh} = 0 \qquad (40)$$

where $\Delta N(h) = N(h, \Delta\lambda_1) - N(h_1 \Delta\lambda_2)\left[\frac{N_m(h, \Delta\lambda_1)}{N_m(h, \Delta\lambda_2)}\right]$.

Locator B10, modified two-color normalized difference. -- This locator uses the same normalized difference between two radiance profiles in two different spectral regions as in B9. However, instead of using the maximum value of the normalized difference to define located horizon altitude, this locator uses the two altitudes at which the difference is 50 percent of the maximum difference. The located horizon is midway between these two altitudes. The equation is

$$h_\ell = \frac{h_1 + h_2}{2}, \qquad (41)$$

where h_1 = h at which $\Delta N = 0.5\Delta N_m$ and $\frac{d\Delta N}{dh} > 0$

and h_2 = h at which $\Delta N = 0.5\Delta N_m$ and $\frac{d\Delta N}{dh} < 0$

where $\Delta N(h)$ was defined under B9.

Master locator list. -- As locators were identified and defined during the study, they were added to a master locator list. At various times during the study, certain locators were eliminated from consideration for different reasons. They were not removed from the master list so that a history of all identified locators could be retained. The master list is shown in Table 1; the Barnes locators are referred to as B numbers.

TABLE 1.- MASTER LOCATOR LIST

Locator		Inputs	Function Defining h_ℓ (h_ℓ = located horizon)
L1	Fixed radiance	N(h), C_1	$C_1 = N(h_\ell)$
L2	Normalized radiance	N(h), C_2	$C_2 = \frac{N(h_\ell)}{N_m}$
L3	Integrated radiance	N(h), C_3	$C_3 = \int_{h_\ell}^{\infty} N(h)\, dh$
L4	Integrated normalized radiance	N(h), C_4	$C_4 = \frac{1}{N_m} \int_{h_\ell}^{\infty} N(h)\, dh$
L5	Slope	N(h), C_5	h_ℓ = largest $h<h$ ($N = 0$) at which $C_5 = \frac{dN}{dh}$
L6	Slope of normalized radiance	N(h), C_6	h_ℓ = largest $h<h$ ($N = 0$) at which $\frac{1}{N_m} \frac{dN}{dh} = C_6$
L7	Slope extrapolation	N(h), C_7, C_{7a}	$h_\ell = \frac{C_{7_a} h(C_7) - C_7 h(C_{7_a})}{C_{7_a} - C_7}$
L8	Slope extrapolation, normalized radiance	N(h), C_8, C_{8a}	$h_\ell = \frac{C_{8_a} H(C_8) - (C_8) h(C_{8_a})}{C_{8_a} - C_8}$

TABLE 1. - MASTER LOCATOR LIST- Continued

Locator		Inputs	Function Defining h_ℓ (h_ℓ = located horizon)
L9	Average radiance	N(h)	$h_\ell = h(\bar{N})$; $\bar{N} = \frac{1}{h(0) - h(N_m)} \int_{h(N_m)}^{\infty} N(h)\, dh$;
L10	Average normalized radiance	N(h)	$h_\ell = h\left(\frac{\bar{N}}{N_m}\right)$ $\frac{\bar{N}}{N_m} = \frac{1}{h(0) - h(1.0)} \int_{h(1.0)}^{h(0)} \frac{N}{N_m}\, dh$
L11	Radiance centroid	N(h)	Radiance centroid = N_{cg} $h_\ell = h(N_{cg})$ $N_{cg} = \frac{\int_0^{N_m} N\, h(N)\, dN}{\int_0^{N_m} h(N)\, dN}$
L12	Centroid of normalized radiance	N(h)	$h_\ell = h\left(\frac{N}{N_{m_{cg}}}\right)$ $\frac{N}{N_{m_{cg}}} = \frac{\int_0^1 \frac{N}{N_m}\, h\left(\frac{N}{N_m}\right) d\frac{N}{N_m}}{\int_0^1 h\left(\frac{N}{N_m}\right) d\frac{N}{N_m}}$

TABLE 1.- MASTER LOCATOR LIST - Continued

Locator		Inputs	Function Defining h_ℓ (h_ℓ = located horizon)
L13	Mean between two slopes	N(h), C_{13}	$h_\ell = \frac{1}{2}(h_1 + h_2)$ h_1 = largest $h<h(0)$ at which $\frac{dN}{dh} = C_{13}$ h_2 = largest $h< h_1$ at which $\frac{dN}{dh} = C_{13}$
L14	Mean between slopes, normalized radiance	N(h)	$h_\ell = \frac{1}{2}(h_1 + h_2)$ h_1 = largest $h<h(0)$ at which $\frac{d}{dh}\left(\frac{N}{N_m}\right) = C_{14}$ h_2 = largest $h<h_1$ at which $\frac{d}{dh}\left(\frac{N}{N_m}\right) = C_{14}$
L15	Average altitude	N(h)	$h_\ell = h(N_m) + \frac{1}{N_m}\int_{h(N_m)}^{h(0)} N(h)\, dh$
L16	Altitude centroid	N(h)	$h_\ell = \dfrac{\int_{h(N_m)}^{h(0)} h\, N(h)\, dh}{\int_{h(N_m)}^{h(0)} N(h)\, dh}$
L17	Inflection point	N(h)	h_ℓ = largest $h<h(0)$ at which $\frac{d^2N}{dh^2} = 0$
L18	Two-color difference	N(h, $\Delta\lambda_1$), N(h, $\Delta\lambda_2$)	h_ℓ = h at which $N_1 - N_2$ is maximum

TABLE 1. - MASTER LOCATOR LIST - Continued

Locator		Inputs	Function Defining h_ℓ (h_ℓ = located horizon)
L19	Normalized integral	N(h), C_{19}	$C_{19} = \dfrac{\int_{h_\ell}^{\infty} N(h)\, dh}{\int_{h(N_m)}^{\infty} N(h)\, dh}$
L20	Radiance compensated integral	N(h), C_{20a}, C_{20b}	$h_\ell = h_1 - h_2$ h_2: $C_{20_a} = \dfrac{1}{N_m} \int_{h_2}^{\infty} N(h)\, dh$ h_1: $C_{20_b} = N(h_1)$
B1	Signal harmonics		Defined in Reference 2
B2	Three-point slope extrapolation	N(h), N_1, N_2, N_3	$h_\ell = h(N_1) + \dfrac{[h(N_3) - h(N_2)]}{N_2 - N_3} N_i$
B3	Corrected slope extrapolation	N(h), N_1, N_2, N_3	$h_\ell = h(N_1) + \dfrac{h(N_3) - h(N_2)}{N_2 - N_3} \left[N_1 + f(N_p)\right]$

TABLE 1.- MASTER LOCATOR LIST - Concluded

Locator		Inputs	Function Defining h_ℓ (h_ℓ = located horizon)
B4	Modified normalized radiance	$N(h)$, $\frac{N}{N_{m_1}}$, $\frac{N}{N_{m_2}}$	$h_\ell = \frac{1}{2}(h_1 + h_2)$ $\quad h_1 = h\left(\frac{N}{N_{m_1}}\right)$ $\quad h_2 = h\left(\frac{N}{N_{m_2}}\right)$
B5	Modified inflection point	$N(h)$	$h_\ell = \frac{1}{2}(h_1 + h_2)$ h_1: $\frac{N'(h_1)}{N'_m} = -0.5$ and $\frac{dN'}{dh} < 0$ h_2: $\frac{N'(h_2)}{\lvert N'_m \rvert} = -0.5$ and $\frac{dN'}{dh} > 0$ where $N' \equiv \frac{dN}{dh}$ and $\lvert N'_m \rvert$ ≡ maximum magnitude of $\frac{dN}{dh}$
B6	Minimum curvature	$N(h)$	h_ℓ = largest h at which $\frac{d^3N}{dh^3} = 0$ and $\frac{d^2N}{dh^2} < 0$
B7	Maximum curvature	$N(h)$	h_ℓ = largest h at which $\frac{d^3N}{dh^3} = 0$ and $\frac{d^2N}{dh^2} > 0$
B8	Midpoint between maximum and minimum curvature	$N(h)$	$h_\ell = \frac{1}{2}(h_1 + h_2)$: $h_1 = h_\ell$ from B6 $h_2 = h_\ell$ from B7
B9	Two-color normalized difference	$N(h, \Delta\lambda_1)$ $N(h, \Delta\lambda_2)$	h_ℓ = altitude at which $\frac{d\Delta N}{dh} = 0$ $\Delta N(h) = N(h, \Delta\lambda_1) - N(h, \Delta\lambda_2)\left\lvert \frac{N_m(h, \Delta\lambda_1)}{N_m(h, \Delta\lambda_2)} \right\rvert$
B10	Modified two-color normalized difference	$N(h, \Delta\lambda_1)$ $N(h, \Delta\lambda_2)$	$h_\ell = \frac{h_1 + h_2}{2}$ h_1 = h at which $\Delta N = 0.5\,\Delta N_m$ and $\frac{d\Delta N}{dh} > 0$ h_2 = h at which $\Delta N = 0.5\,\Delta N_m$ and $\frac{d\Delta N}{dh} < 0$ where ΔN_m = peak value of ΔN $\Delta N(h)$ = defined under B9

LOCATOR SELECTION CRITERIA

Because of the potential data reduction and analysis problem resulting from operating on more than 800 horizon profiles with the multitude of identified and defined locators, it was necessary to determine criteria for selecting locators for statistical and times series analysis. This criteria definition was based on the following categories:

1. Locators which can be used to describe variation in the profile from a curve description point of view.
2. Locators that are promising candidates for mechanization in an actual horizon sensor.
3. Locators that allow study of atmospheric phenomena and anomalies.

The criteria for each of these three categories is discussed in the following paragraphs.

LOCATORS USEFUL FOR PROFILE DESCRIPTION

During the criteria definition for selecting locators, it became apparent that the locator concept was insufficient to provide an understanding of the complete profile curve since most locators operate at altitudes above the altitudes of peak radiance. Therefore, a combination of features of the profile itself and indicated altitude was considered. The locator concept was modified to include those profile features which warranted measurement in an actual experiment.

One of these features is peak radiance within the tangent height limits; any experiment must measure or produce, in the data reduction, variations in peak radiance. Thus, the variation of peak radiance with required factors must be determined for data requirements applications.

Peak radiance describes the amplitude of the radiance profile. Shape is given by normalized radiance; thus, selection of several input constants for locator L2, normalized radiance, allows study of profile shape through time series analysis.

The number of normalized radiance values analyzed was selected to give coverage to all parts of the profile which exhibit interesting features and nonlinearities. In general, points taken included the lower and upper knees as well as the nearly linear portion of the curve.

To include consideration of tangent heights below the altitude peak of radiance, the value of the slope at zero tangent height was also selected for time series analysis.

LOCATORS USEFUL FOR HORIZON SENSING

Operational Horizon Sensors

To ensure that the horizon definition experiment collected data which could be used to determine capabilities of currently operational horizon sensors, locators reflecting mechanizations of these sensors were selected for time series analysis.

Locators L1, L2, L3, L4 and L5 were used in operational horizon sensors. Locator L7 was proposed for use. None of the remaining locators have been used or proposed for mechanization.

How certain locators would be used in horizon sensors is not obvious, since certain locators require not only knowledge of radiance, the dependent variable but also require knowledge of some independent variable. For example, two values of radiance and two values of an independent variable must be known for slope extrapolation L7. During the study, the actual altitude of a particular located horizon was determined using tangent height as the independent variable. In a horizon sensing application, time replaces altitude for the independent variable. In L7, the time at which the extrapolated straight line would have intersected the time axis is computed by:

$$t = \frac{-N_1}{\Delta N/\Delta t} + t_1$$

where: N_1 = lower value radiance point,

t_1 = time at which N_1 occurred (generally zero),

ΔN = difference between two values of radiance used,

Δt = time differential between occurrence of the two radiance values.

Then, since t_1 and Δt are known, t may be calculated, and the located horizon is defined to have existed in the scan at that time.

Mechanizations utilizing locators based on integral of radiance or normalized radiance obtain the required values of that characteristic by using a large field-of-view detector. Its output is proportional to the integral of radiance in the field of view or, by time integrating the output of a small field-of-view detector.

Locator constants used, were based on an examination of existing sensors, the approach being to represent existing sensors as well as possible within the constraint of excluding actual hardware design considerations from the locator concept.

Future Sensors

Within the context of horizon sensors, new locators which show potential for extracting a highly stable indicated altitude, based on preliminary analysis of results of the profile synthesizer and profile analyzer, were selected for time series analysis. For these locators, a constant factor of state-of-the-art advancement was applied to the state-of-the-art inputs determined for operational sensors.

LOCATORS USEFUL FOR STUDY OF ATMOSPHERIC PHENOMENA AND ANOMALIES

To ensure that locators selected under the above two criteria do not suppress the effects of atmospheric phenomena and anomalies, those phenomena and anomalies which do have a significant effect must be considered, and locators must be selected which operate near that part of the profile which is affected. Atmospheric phenomena of interest are gross temperature effects caused by seasonal and latitudinal variations and effects attributable to the atmospheric identifiers and are:

- Tropopause temperature
- Stratopause temperature
- 10 millibar temperature
- Lapse rate from 500 millibars to tropopause
- Lapse rate from tropopause to 10 millibars
- Lapse rate from 10 millibars to stratopause

These identifiers affect the profile in different regions of tangent height. Thus, the temperature identifiers, which occur respectively at altitudes of approximately 15 km, 30 km, and 50 km, would be expected to affect radiance near and below those altitudes, as shown in Figure 22. Lapse rates are expected to affect radiance over the range of altitude in which the lapse rates apply. These are, approximately, from 5 km to 15 km, from 15 km to 30 km, and from 30 km to 50 km, respectively, as shown in Figure 22. To study effects caused by these identifiers, locators and input constants were selected which operate over these ranges of altitude.

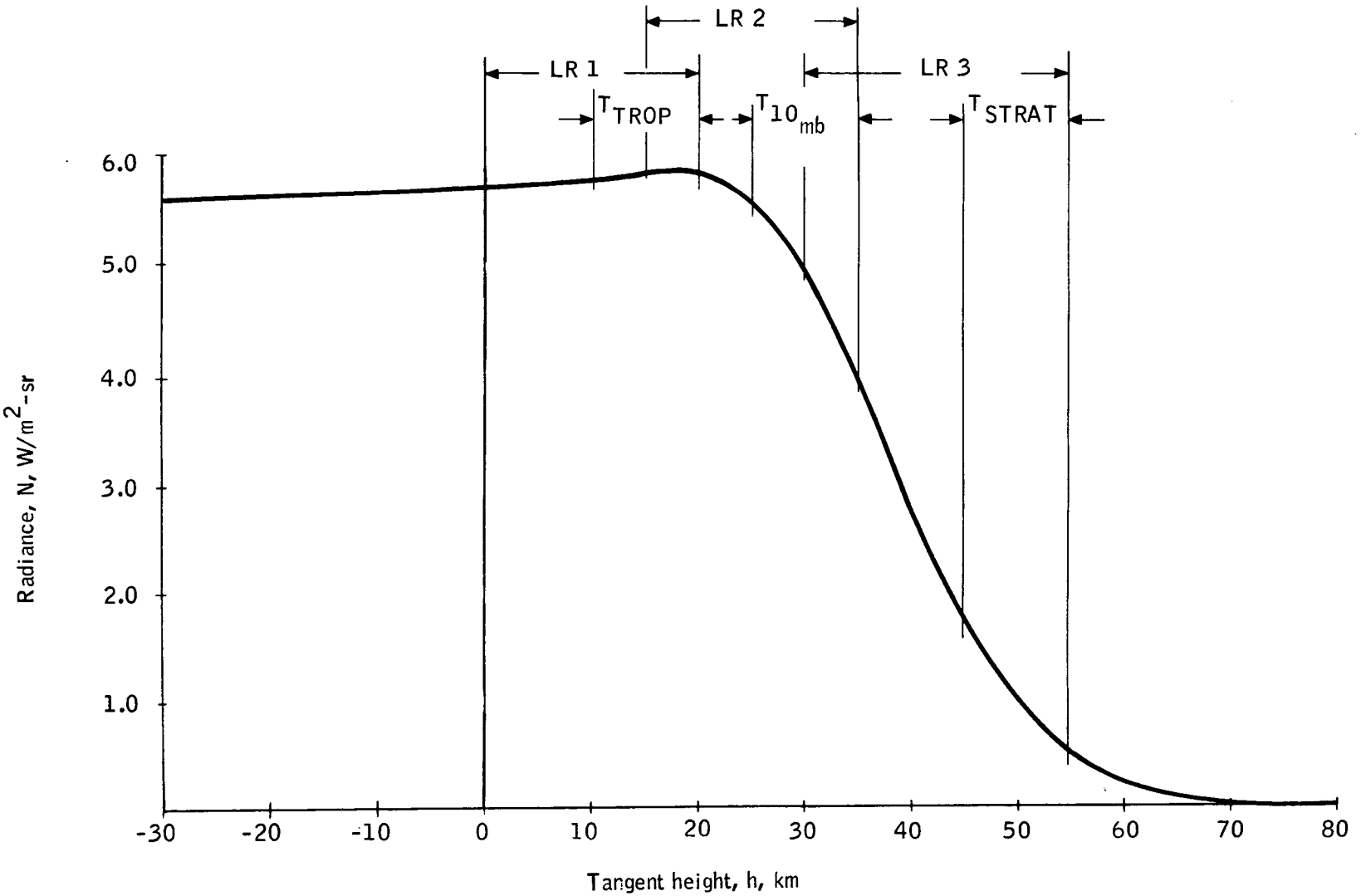


Figure 22. Regions of Atmospheric Identifier Effect

LOCATOR PROCESSOR EXPERIMENTAL RUNS

To determine the behavior of the located horizon with various input threshold constants in those locators which operate with input constants, and to obtain estimates of the located horizon stability for those locators not requiring input constants, all locators on the master locator list, which were not previously rejected, were exercised in the locator processor on a subset of horizon profiles selected to give coverage over one year for latitudes from the equator to the North Pole. Twenty-three locators were used. Within those locators requiring threshold constants, 53 extra constants (or sets) were used, so that for each radiance profile processed, 76 located horizons or the equivalent were calculated. In addition, means, variances, and maximum and minimum were calculated for each of the 76 different locators (or threshold constants).

INPUT THRESHOLD CONSTANTS

Input threshold constants were selected to give sufficient coverage of the range of tangent heights required to satisfy locator selection criteria (1) and (3) of the preceding section, i.e., curve description and atmospheric anomaly study. Also, horizon sensor state-of-the-art was examined to ensure inclusion of current and future state-of-the-art. The locator concept was developed to be independent of instrument consideration. However, selection of locators and locator constants which are representative of state-of-the-art mechanizations must of necessity be based on instrument considerations.

Astheimer (ref. 7) quotes the following typical instrument parameters upon which the minimum thresholds are based:

- Detector: Immersed thermistor
- Field of view: 1° x 1°
- Aperture: 2 in^2 (12.9 cm^2)
- Transmission: 20%
- Bandwidth: 250 cps

With these parameters, a signal-to-noise ratio of 10 is obtained with a source radiance of 1 W/m^2-sr, which is selected as the minimum fixed radiance threshold.

The noise equivalent source power must be determined to obtain an integral of radiance threshold. For the above parameters, the noise equivalent

source radiance is 0.1 W/m^2-sr (1 W/m^2-sr gives S/N = 10). Assuming constant radiance in the field of view, noise equivalent source power (NEP_s) is related to noise equivalent source radiance (NEN_s) by

$$NEP_s = (NEN_s)\, A_s\, \frac{A_{ap}}{L^2}$$

where:

A_s = area of source in field of view,

A_{ap} = aperture area,

L = distance from source to aperture.

In terms of field of view, $\omega_1 \times \omega_2$,

$$NEP_s = (NEN_s)\, \omega_1 \omega_2 A_{ap} = 0.1 \times \frac{1 \times 1}{(57.3)^2}\, A_{ap} = 3.06 \times 10^{-5} A_{ap}.$$

The integral threshold for a signal-to-noise ratio of 10 is set at that value where flux in the field of view is $3.06 \times 10^{-4} A_{ap}$. When viewing the horizon radiance profile, which varies across one dimension of the field of view and is constant across the other, the flux seen is

$$P = \omega_1 A_{ap} \int N\, d\omega_2 = \omega_1 A_{ap} \int N \frac{d\omega_2}{dh}\, dh.$$

A viewing altitude must be assumed to determine $d\omega_2/dh$. For 150 n. mi. (280 km) altitude,

$$\frac{d\omega_2}{dh} \cong 0.034 \text{ deg/km} = 0.034 \times 0.01745 \ \frac{\text{radians}}{\text{km}};$$

therefore,

$$P = \omega_1 A_{ap} \times 0.034 \times 0.01745 \int N\, dh.$$

Finally, the cross-axis field of view, ω_1, must be assigned a value. For a fixed source of power, P, the value of the integral increases as the cross-axis field increases. However, the noise equivalent source power is based on a particular detector area (1 mm^2) and will increase for larger detector areas. A field of view of four degrees in the cross-axis direction should reasonably permit detector areas of 1 to 2 mm^2 for which the present calculations are still valid, although the signal-to-noise ratio may be somewhat decreased. From these considerations,

$$P = 4 \times 0.01745 \times 0.034 \times 0.01745\, A_{ap} \int N\, dh.$$

The flux threshold is $3.06 \times 10^{-4}\, A_{ap}$, leading to an integral threshold of

$$\int N\,dh = \frac{3.06 \times 10^{-4} A_{ap}}{4 \times 0.034 \times 0.01745 \times 0.01745\, A_{ap}} \cong 7.5\ W/m^2\text{-sr-km}$$

The derivative threshold was established at -0.05 W/m^2-sr-km by Barnes Engineering Company based on typical instrument parameters.

State-of-the-art thresholds have thus far been determined for three of the primary characteristics on which locators are based. They are:

- Radiance: 1.0 W/m^2 - sr
- Integral of Radiance: 7.5 W-km/m^2 - sr
- Derivative of Radiance: W/m^2-sr-km

Input threshold constants for all locators, except those using normalized radiance, can be determined from the above three values. For locators using normalized radiance, minimum state-of-the-art (SOA) thresholds must be based on the radiance profile exhibiting the smallest value of peak radiance. For that profile, the normalized radiance threshold must yield a value of radiance of 1.0 W/m^2 - sr, the radiance SOA threshold. Then for all other profiles, the radiance will be greater than the SOA radiance value at the SOA value of normalized radiance. The minimum value of peak radiance observed in the 615 cm^{-1} to 715 cm^{-1} band was approximately 3.3 W/m^2 - sr thus the normalized radiance SOA threshold is 0.3.

Thresholds for integral and derivative of normalized radiance were determined in the same way:

- Integral of normalized radiance:

$$\text{SOA Threshold} = \frac{7.5\ \text{W-km/m}^2\text{-sr}}{3.3\ \text{W/m}^2\text{-sr}} \cong 2.5\ \text{km.}$$

- Derivative of normalized radiance:

$$\text{SOA Threshold} = \frac{-0.05\ \text{W/m}^2\text{ - sr km}}{3.3\ \text{W/m}^2\text{-sr}} \cong 0.015\ \text{km}^{-1}$$

State-of-the-art minimum threshold constants are shown in Table 2.

To obtain estimates of behavior of future SOA thresholds, present SOA thresholds were reduced by factors ranging from ≈ 2 to ≈ 10 for different locators.

Consideration of the other locator selection criteria, discussed in the preceding section, led to inclusion of peak radiance magnitude and slope at zero tangent height as psuedo-locators. Slope at zero tangent height was determined by calculating the slope of a straight line fit through five points around zero tangent height.

TABLE 2. - MINIMUM THRESHOLD CONSTANTS

Locator No.	Description	Minimum Threshold
L1	Fixed radiance	1.0 W/m^2-sr
L2	Normalized radiance	0.3
L3	Integrated radiance	7.5 W-km/m^2-sr
L4	Integrated normalized radiance	2.5 km
L5	Slope	-0.05 W-km/m^2-sr
L6	Slope of normalized radiance	-0.015 km^{-1}
L7	Slope extrapolation	1.0 W/m^2-sr
L8	Slope extrapolation, normalized radiance	0.3
L9	Average radiance (between N_m and zero)	Not Applicable (NA)
L10	Average normalized radiance	Not used
L11	Radiance centroid (between N_m and zero)	NA
L12	Centroid of normalized radiance	Not used
L13	Mean between two slopes	-0.05 W/m^2-sr-km
L14	Mean between slopes, normalized radiance	-0.015 km^{-1}
L15	Average altitude (between N_m and zero)	NA
L16	Altitude centroid	NA
L17	Inflection point	NA
L18	Two-color difference	Not used
L19	Normalized integral	0.06 (6%)
L20	Radiance compensated integral	Not used
B1	Signal harmonics	Not used
B2	Three-point slope extrapolation	1.0 W/m^2-sr
B3	Corrected slope extrapolation	Not used
B4	Modified normalized radiance	Not used
B5	Modified inflection point	NA
B6	Minimum curvature	NA
B7	Maximum curvature	NA
B8	Midpoint between minimum and maximum curvature	NA
B9	Two-color normalized difference	Not used
B10	Modified two-color normalized difference	Not used

All input constants selected for the experiment are shown in Table 3. They cover the complete range of tangent heights of interest, and bracket both existing and future state-of-the-art.

INPUT PROFILES

To obtain estimates of the behavior of the various locators over time and space, 120 radiance profiles taken from a set of 8 synoptic situations covering 56 locations over the Northern Hemisphere were selected to be run through the locator processor. To minimize computer time while retaining sufficient time and space coverage, half the synoptic locations and half the synoptic times were used. Every other latitude available on each longitude line, as shown in Figure 23, was used for each season. The times used were April 8, (Spring), August 12, (Summer), October 21, (Fall), and January 20, (Winter). A total of 120 profiles were used.

EXPERIMENT RESULTS

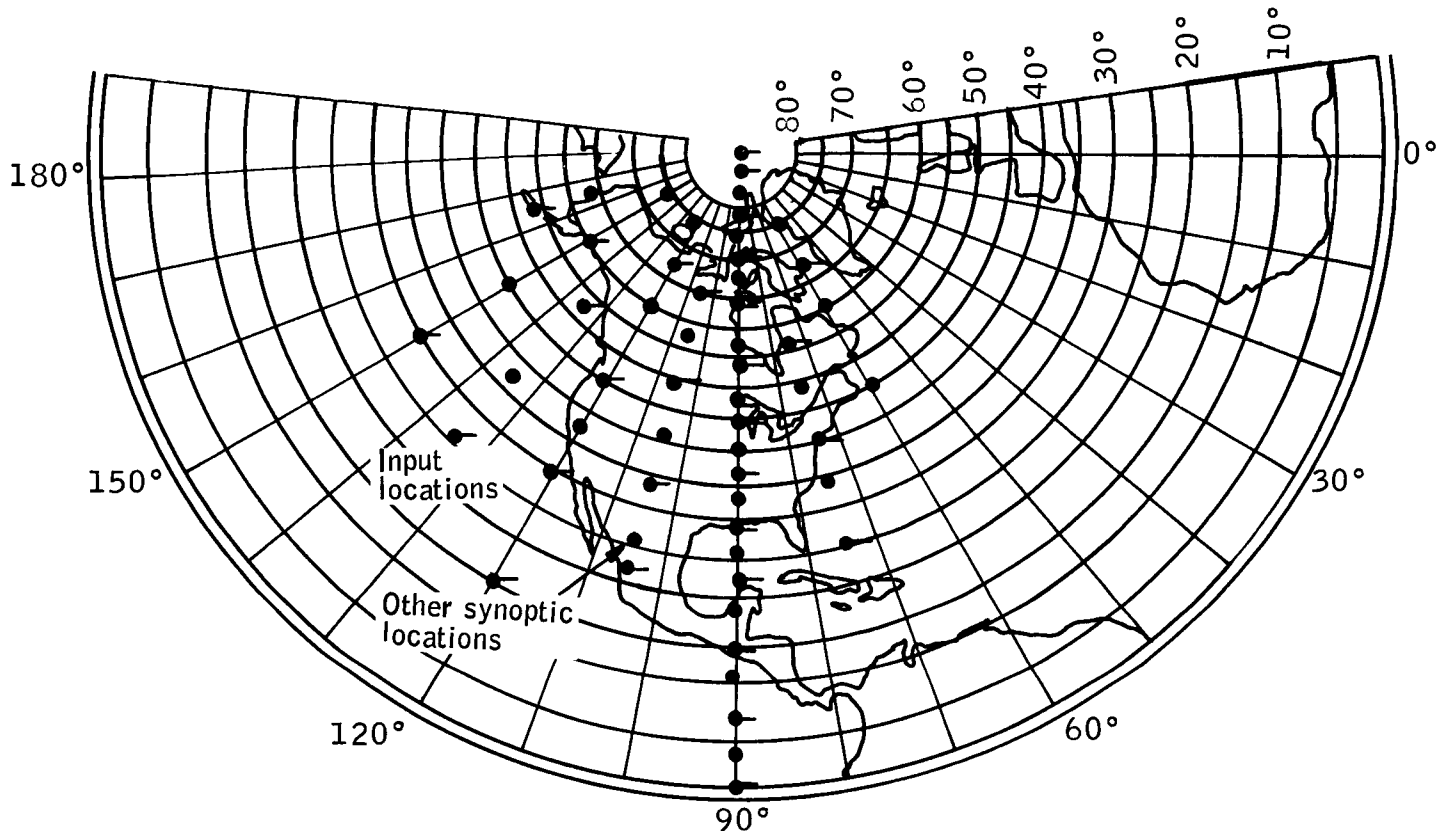
Eight thousand eight-hundred eighty located horizons were calculated and analyzed and 240 values of two different characteristics were analyzed. Table 4 presents a summary of the results showing the minimum, mean, maximum, and standard deviation of located horizon for each locator and threshold constant. The listing of all located horizons is contained in Appendix B. Figures 24 through 32 show plots of the mean, standard deviation, and spread (difference between maximum and minimum located horizon) vs threshold constants for various locators. Figures 33 and 34 show mean and standard deviation for several locators on one plot for ease of comparing locators. Both the standard deviation and spread always decrease as the threshold constant decreases, corresponding to selecting the located horizon at higher tangent heights. Thus, for those locators under study, horizon stability is a strong function of instrumentation state-of-the-art. Stability increases as instrument sensitivity increases.

In Table 4, two parameters which are not locators are characteristics of the radiance profile. These are peak radiance and slope at zero tangent height. The numbers shown for peak radiance are maximum, minimum, etc., of peak radiance rather than location of peak radiance, and similarly, the slope at zero tangent height is the slope of a least square straight line through the points around zero tangent height. Notice that the minimum slope is negative which indicates a limb darkening effect. With limb darkening, peak radiance is obtained at tangent heights below -30 km, the lowest tangent height for which radiance is calculated in this study. Locators which use radiance normalized to peak radiance (including slope, integral, etc. of normalized radiance) produce questionably located horizons for profiles which exhibit limb darkening. However, in an examination of those profiles which exhibited the most severe limb darkening (steepest negative slope at zero tangent height), radiance appeared to be asymptotically approaching a value of peak radiance negligibly different from the radiance at -30 km, as in Figure 35. Consequently, the error in normalizing is small. Furthermore, since this error

is present only in a small percentage of the total profiles, locators utilizing normalized radiance were used with no modifications to the program.

Results show that:

- Locators requiring input constants obtain the most stable horizon when input constants associated with higher tangent heights are used.
- Locators dependent on the altitude at which peak radiance occurs are not useful since the radiance profiles exhibit both limb brightening and limb darkening which causes a large variation in altitude of peak radiance; these locators are L9-L12, L14 and L15.
- Locators based on derivatives of radiance are less stable than locators based on radiance or integrated radiance (including normalized radiance).
- The smallest located horizon standard deviation, based on current state-of-the-art thresholds, is 1.20 km (0.025° from 300 nautical miles, 560 km, orbit) and is obtained using a fixed value of integrated normalized radiance of 2.5. Best stability obtainable with a factor of five improvement in state-of-the-art is a standard deviation of $\approx$ 0.9 km, for several locators. These statistics were slightly modified when the complete population of 1039 radiance profiles were used as discussed in the next section.



Dates used:
April 8, 1964 (Spring)
August 12, 1964 (Summer)
October 21, 1964 (Fall)
January 20, 1965 (Winter)

Figure 23. Experiment Input Profiles

TABLE 3.- EXPERIMENT INPUT CONSTANTS, LOCATOR INPUT CONSTANTS FOR LOCATOR PROCESSOR EXPERIMENTAL RUN

Locator	Input	Units
L1	0.5, 1.0, 1.5, 2.0, 3.0, 4.0, 5.0, 6.0	W/m^2-sr
L2	0.05, 0.1, 0.2, 0.3, 0.5, 0.7, 0.9	--
L3	1.0, 10.0, 20.0, 40.0, 60.0, 80.0, 120.0, 160.0	$W-km/m^2$-sr
L4	0.1, 1.0, 5.0, 10.0, 20.0, 30.0, 50.1	km
L5	-0.01, -0.05, -0.1, -0.16	W/m^2-sr-km
L6	-0.006, -0.03, -0.06, -0.09	km^{-1}
L7	Pair no. 1 2 3 4 5 0.75 0.5 0.5 0.5 1.0 1.5 1.5 2.0 2.5 2.0	W/m^2-sr
L8	Pair no. 1 2 3 4 5 0.75 0.5 0.1 0.1 0.4 0.7 0.2 0.5 0.8 0.8	--
L13	-0.01, -0.05, -0.1	W/m^2-sr-km
L14	-0.006, -0.03, -0.06	km^{-1}
L19	0.01, 0.06, 0.15, 0.25, 0.5, 0.75	--
B2	Set no. 1 2 3 4 5 0.5 0.5 1.0 1.0 1.0 1.0 1.5 1.5 2.0 3.0 1.5 2.5 2.0 3.0 5.0	W/m^2-sr

TABLE 4. - LOCATOR PROCESSOR EXPERIMENT RESULTS

Locator	Indicated altitude, km				
	Min	Mean	Max	σ	Spread
L1, fixed radiance					
0.5	47.897	54.248	56.470	1.994	8.573
1.0	40.726	48.681	51.540	2.662	10.814
1.5	35.151	44.559	48.072	3.138	12.921
2.0	31.304	41.225	45.091	3.559	13.787
3.0	19.247	35.692	40.473	4.362	21.226
4.0	--	--	--	--	--
5.0	--	--	--	--	--
6.0	--	--	--	--	--
L2, normalized radiance					
0.05	55.867	58.415	59.636	0.942	3.769
0.10	50.720	53.833	55.571	1.145	4.851
0.20	44.111	48.163	50.190	1.533	6.079
0.30	39.240	44.005	46.542	1.892	7.302
0.50	32.286	37.590	40.808	2.247	8.522
0.70	26.781	32.133	36.238	2.391	9.457
0.90	19.042	25.336	29.042	2.651	10.000
L3, integrated radiance					
1.0	58.244	61.005	62.238	0.979	3.994
10.0	39.938	46.212	48.406	2.039	8.468
20.0	32.849	40.345	43.120	2.529	10.271
40.0	23.960	33.246	36.695	3.094	12.735
60.0	17.056	28.187	32.150	3.525	15.094
80.0	10.912	23.895	28.353	3.933	17.441
120.0	- 1.123	16.088	21.759	4.861	22.882
160.0	-13.110	8.477	15.666	5.884	28.776
L4, integrated norm. radiance					
0.1	63.398	64.479	66.803	0.710	3.405
1.0	48.535	50.811	52.007	0.871	3.472
5.0	33.721	37.661	39.745	1.552	6.024
10.0	25.481	29.860	32.517	1.801	7.036
20.0	14.248	18.836	21.741	1.950	7.493
30.0	4.129	8.789	11.654	1.952	7.525
50.0	-15.971	-11.467	- 8.885	1.813	7.086

TABLE 4. -LOCATOR PROCESSOR EXPERIMENT RESULTS - Continued

Locator	Indicated altitude, km				
	Min	Mean	Max	σ	Spread
L5, slope					
-0.01	62.000	68.018	69.643	1.707	7.643
-0.05	48.750	57.152	59.286	2.335	10.456
-0.10	35.433	49.966	54.583	4.410	19.150
-0.15	--	--	--	--	--
L6, slope, norm. radiance					
-0.006	56.861	59.718	61.915	1.004	5.054
-0.030	32.999	42.099	49.308	3.927	16.309
-0.060	--	--	--	--	--
-0.090	--	--	--	--	--
L7, slope extrapolation					
0.75, 1.50	52.660	57.823	60.520	1.654	7.860
0.50, 1.50	54.270	59.092	61.394	1.525	7.124
0.50, 2.00	53.427	58.589	60.698	1.548	7.271
0.50, 2.50	53.497	58.222	60.320	1.563	6.823
1.00, 2.00	50.149	56.136	59.183	1.945	9.034
L8, slope ext., norm. radiance					
0.50, 0.70	44.482	51.232	55.403	2.655	10.921
0.10, 0.20	57.090	59.503	62.000	0.971	4.910
0.10, 0.50	55.291	57.894	60.001	0.966	4.710
0.10, 0.80	54.502	57.365	59.149	1.040	4.647
0.40, 0.80	45.638	52.107	55.207	2.172	9.569
L9, average radiance (between zero and N_m)	30.176	40.851	45.041	4.052	14.865
L10, not used					
L11, radiance centroid (between zero and N_m)	33.901	41.237	44.316	2.807	10.415
L12, not used					

TABLE 4. - LOCATOR PROCESSOR EXPERIMENT RESULTS - Continued

Locator	Indicated altitude, km				
	Min	Mean	Max	σ	Spread
L13, mean h between 2 slopes					
-0.010	36.750	42.444	45.979	2.052	9.229
-0.050	32.413	39.186	52.467	2.944	20.054
-0.100	30.646	40.042	51.492	5.359	20.846
L14, mean h between 2 slopes of norm. radiance					
-0.006	35.398	39.359	42.118	1.665	6.720
-0.030	29.072	38.204	48.018	4.265	18.946
-0.060	--	--	--	--	--
L15, mean alt. (between zero and N_m)	34.011	38.802	41.739	1.987	7.728
L16, alt. centroid (between zero and N_m)	3.256	26.692	34.145	9.124	30.889
L17, inflection point	28.000	35.033	43.000	3.027	5.000
L18, not used					
L19, % of peak integrated radiance (up to N_m)					
0.01	51.902	58.693	61.464	2.588	9.562
0.06	36.478	47.220	50.578	3.966	14.100
0.15	26.013	39.506	43.926	5.112	17.913
0.25	18.407	34.210	39.532	6.085	21.125
0.50	2.107	24.869	32.263	8.872	30.156
0.75	-13.974	17.160	26.900	12.206	39.874
L20, not used					

TABLE 4.- LOCATOR PROCESSOR EXPERIMENT RESULTS - Concluded

Locator	Min	Indicated altitude, km Mean	Max	σ	Spread
B2, three-point slope extrapolation					
0.50, 1.00, 1.50	53.472	58.370	61.098	1.655	7.626
0.50, 1.50, 2.00	52.725	57.351	59.318	1.634	6.593
1.00, 1.50, 2.00	48.420	55.348	58.532	1.974	10 112
1.00, 2.00, 3.00	48.309	54.214	56.840	2.113	8.531
1.00, 3.00, 5.00	--	--	--	--	--
B5, modified inflection point	30.481	38.340	50.833	4.461	20.352
B6, min curvature	16.000	30.142	47.000	5.393	31.000
B7, max curvature	28.000	39.200	49.000	5.478	21.000
B8, mean between max and min curvature	22.000	34.671	48.000	3.986	26.000
SL1, peak radiance(a)	3.352	(c)	6.624	(c)	3.272
SL2, slope at zero tangent height(b)	-0.002	0.002	0.005	0.002	0.007

[a] Statistics shown are values of peak radiance, W/m^2-sr, not tangent height location of peak radiance

[b] Statistics shown are values of slope at zero tangent height, radiance/km, not tangent height

[c] Not Calculated

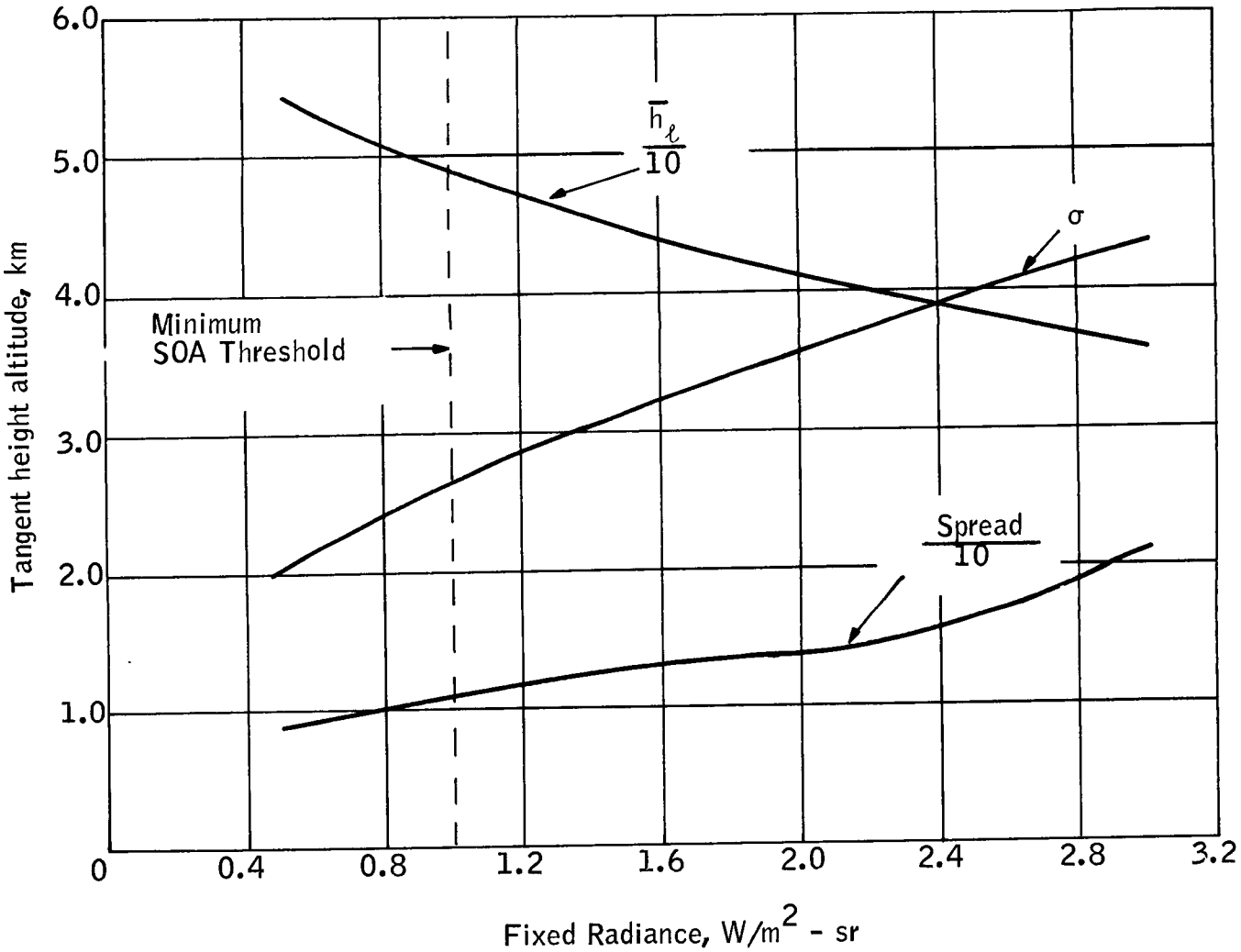


Figure 24. Results of Locator Processor Experiments - L1, Located Horizon Statistics versus Threshold Level, Radiance

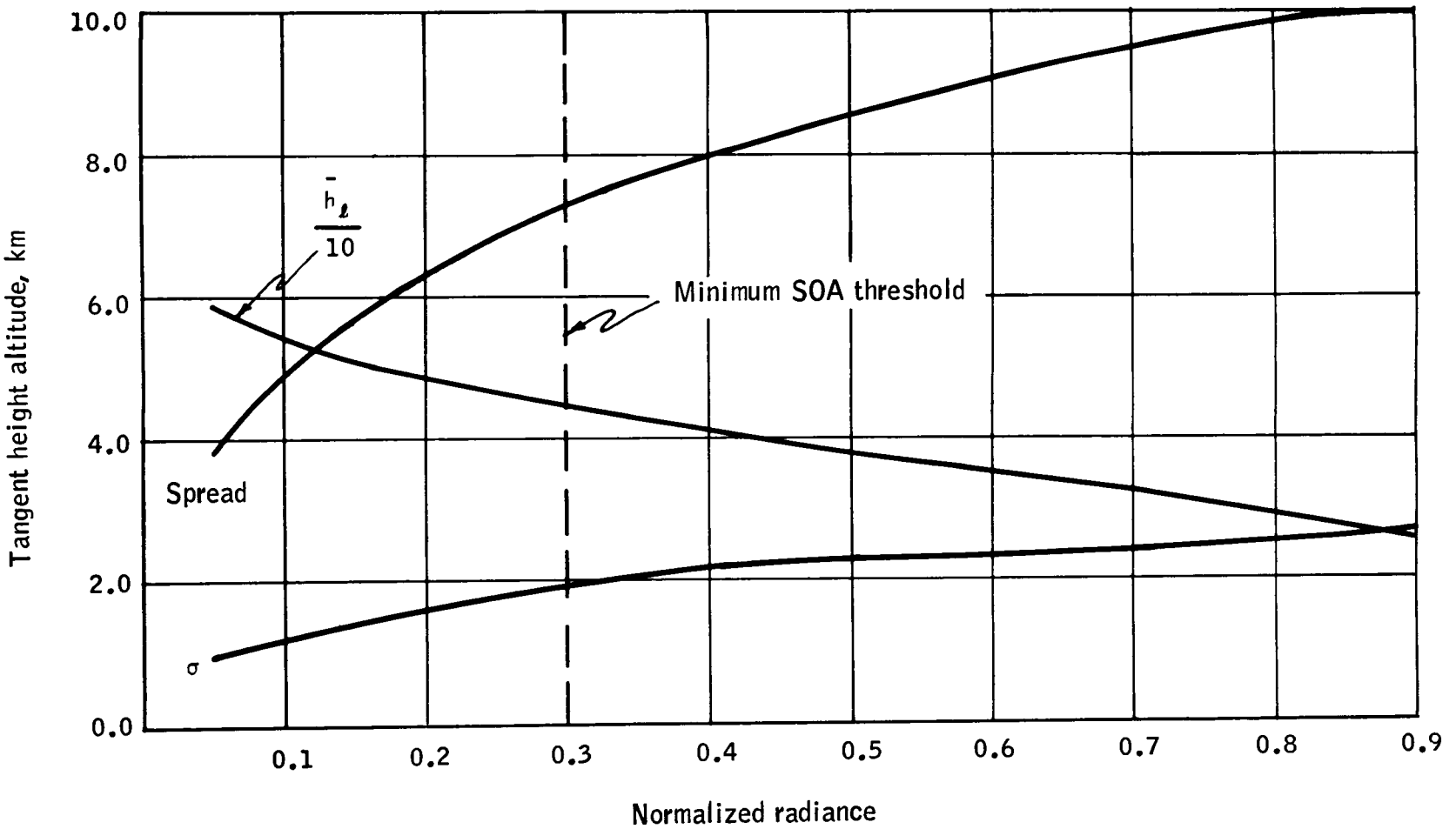


Figure 25. Results of Locator Processor Experiments - L2, Located Horizon Statistics versus Threshold Level, Normalized Radiance

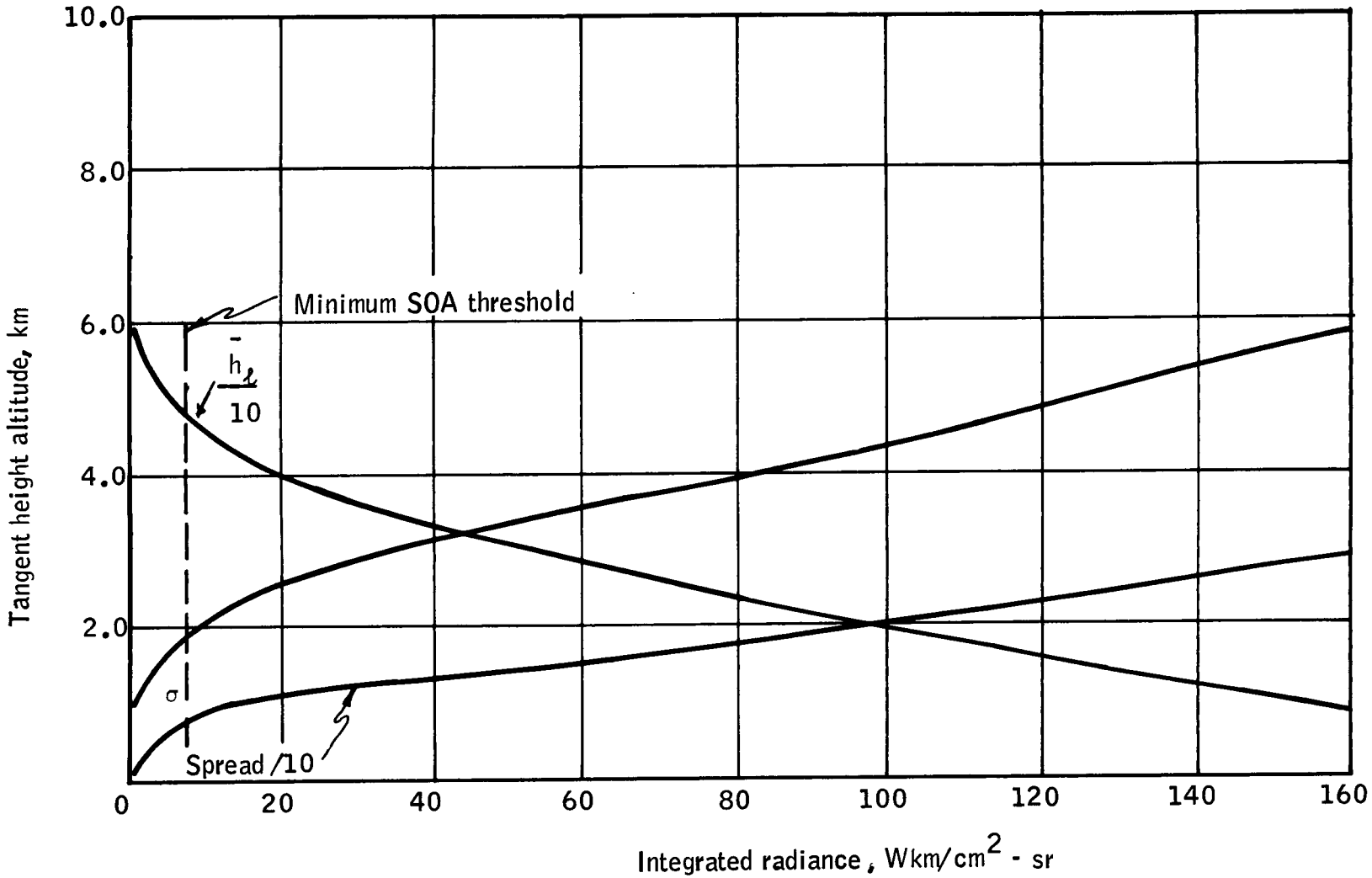


Figure 26. Results of Locator Processor Experiments - L3, Located Horizon Statistics versus Threshold Level, Integrated Radiance

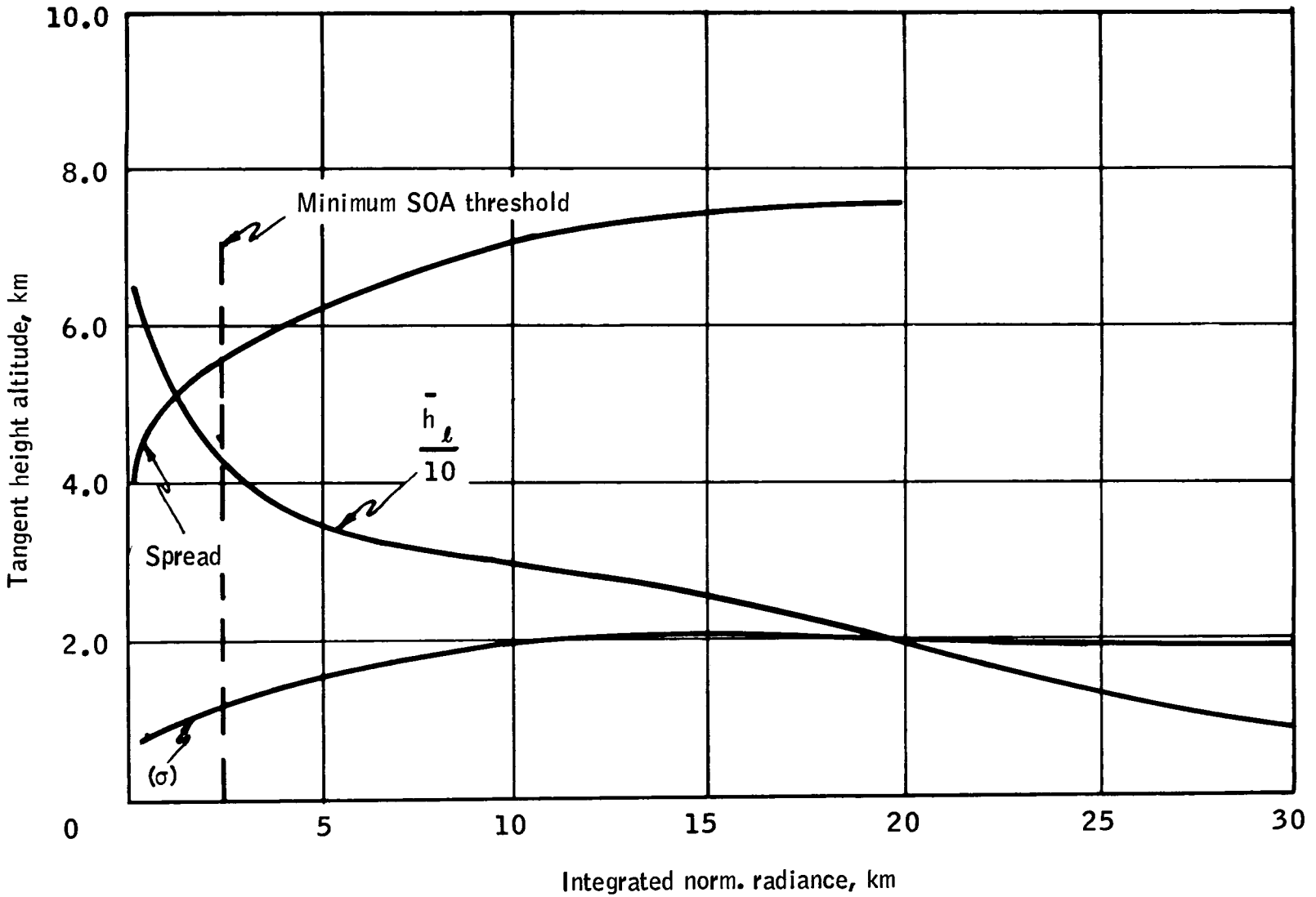


Figure 27. Results of Locator Processor Experiments - L4, Located Horizon Statistics versus Threshold Level, Integrated Normalized Radiance

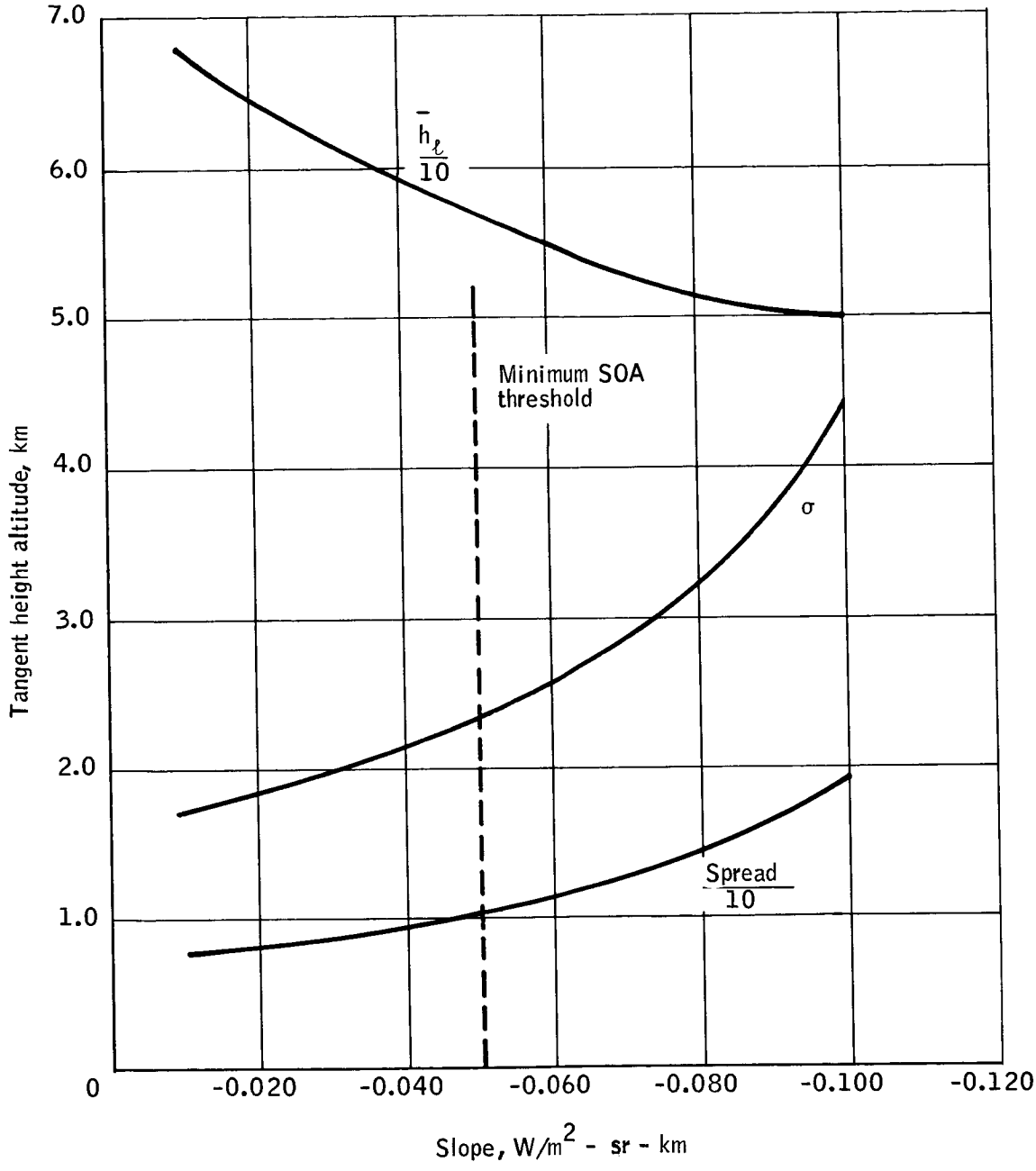


Figure 28. Results of Locator Processor Experiments - L5, Located Horizon Statistics versus Threshold Level, Slope

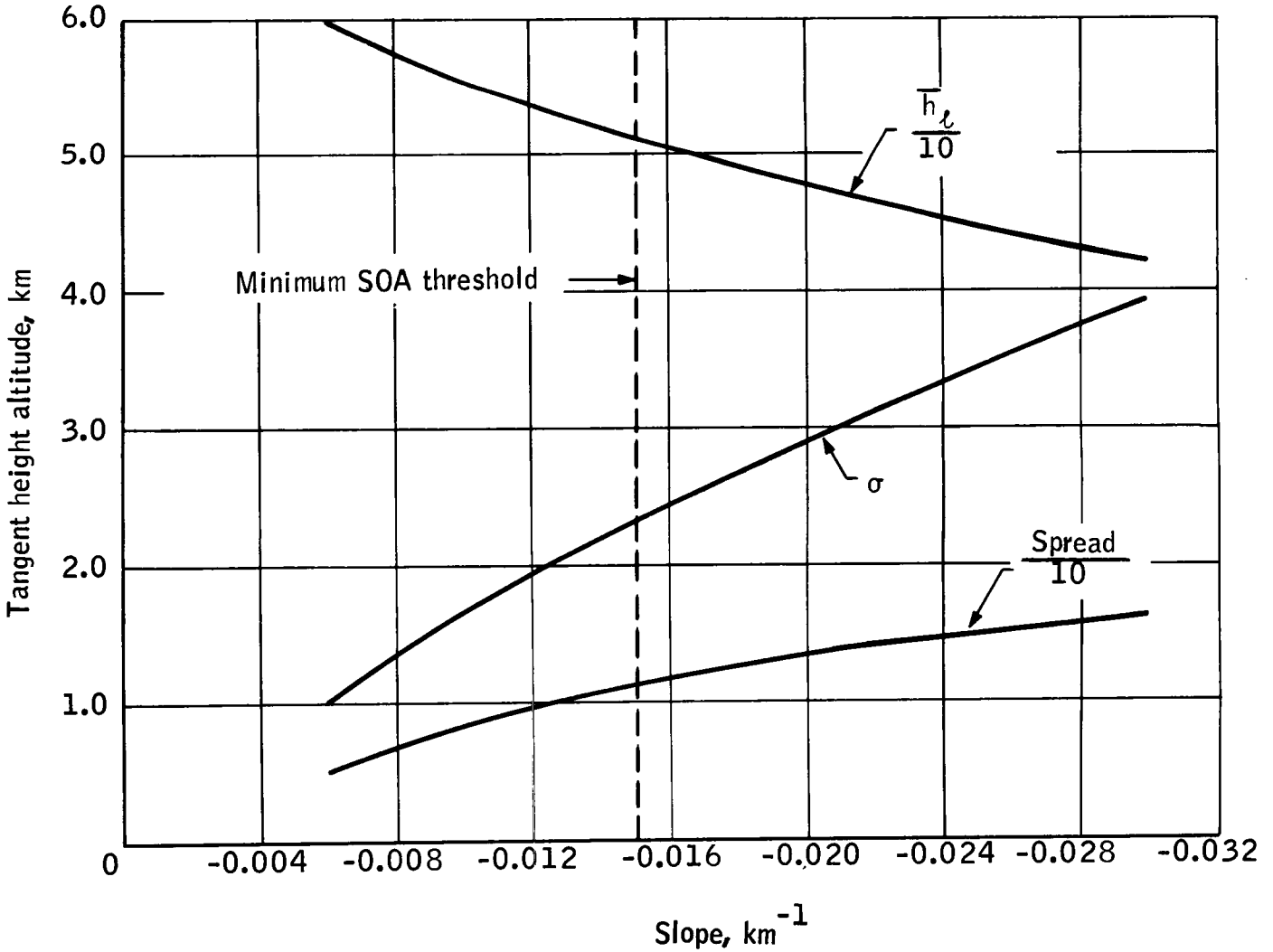


Figure 29. Results of Locator Processor Experiments - L6, Located Horizon Statistics versus Threshold Level, Slope Normalized Radiance

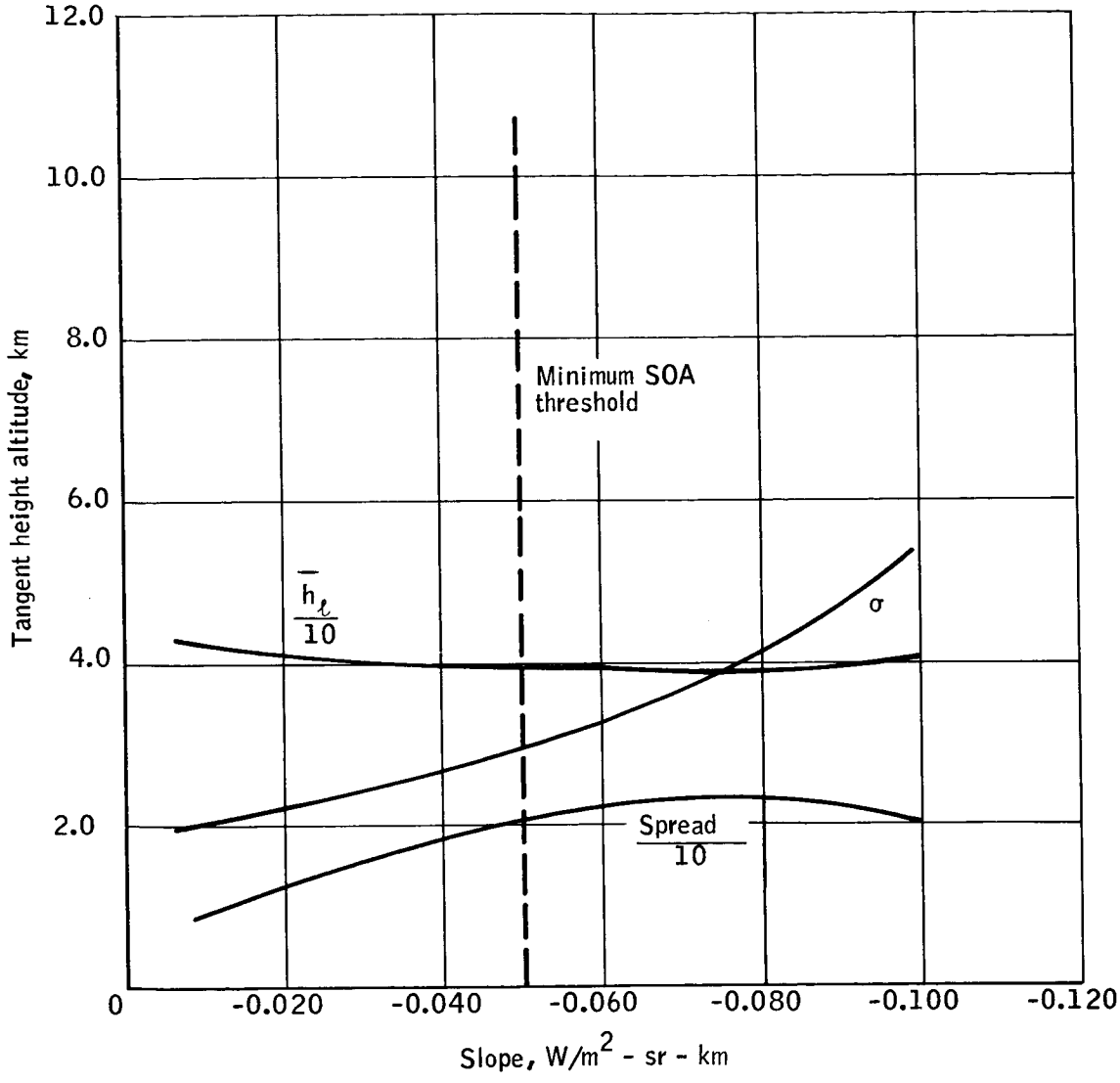


Figure 30. Results of Locator Processor Experiments - L13, Located Horizon Statistics versus Threshold Level, Slope

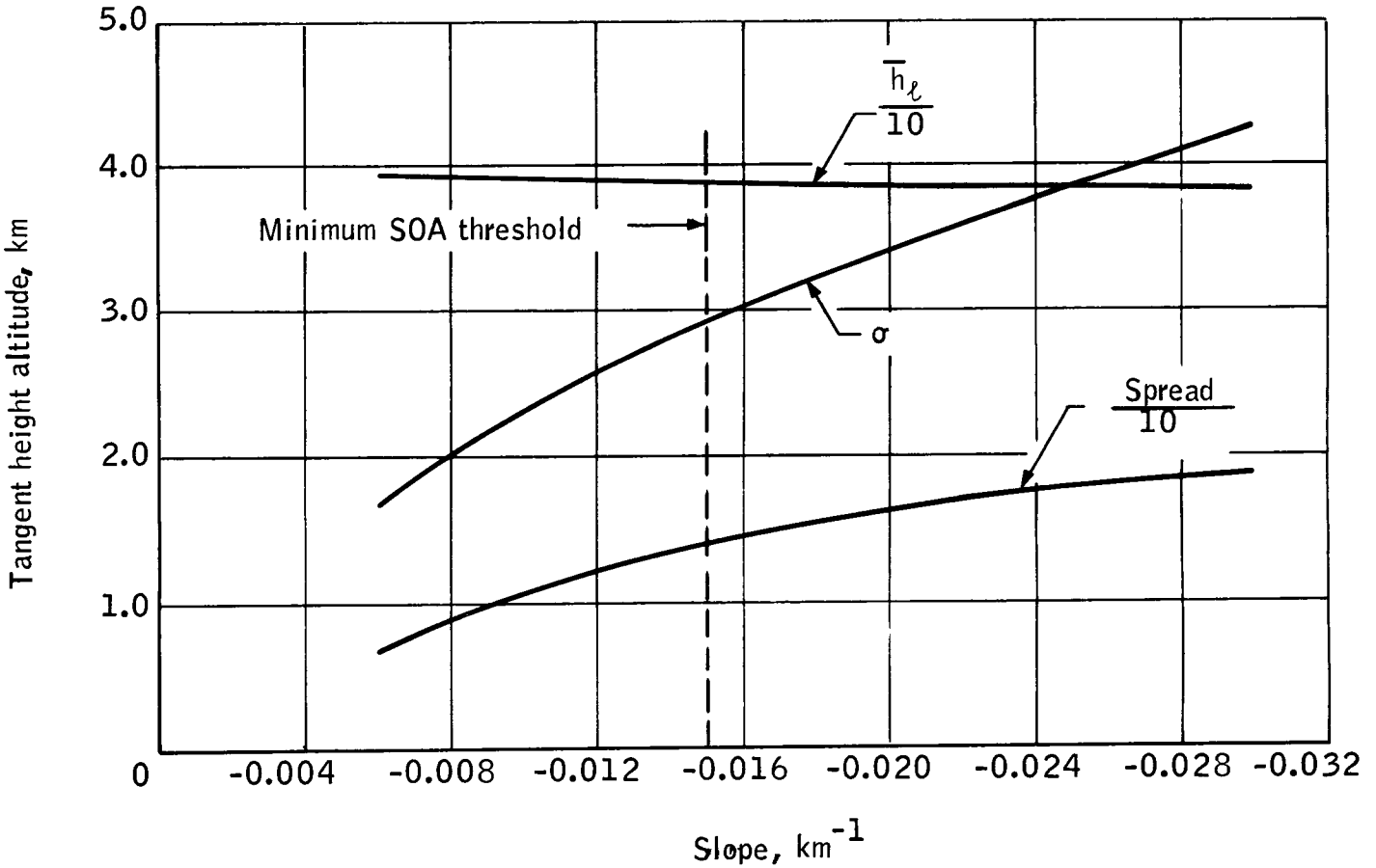


Figure 31. Results of Locator Processor Experiments - L14, Located Horizon Statistics versus Threshold Level, Slope Normalized Radiance

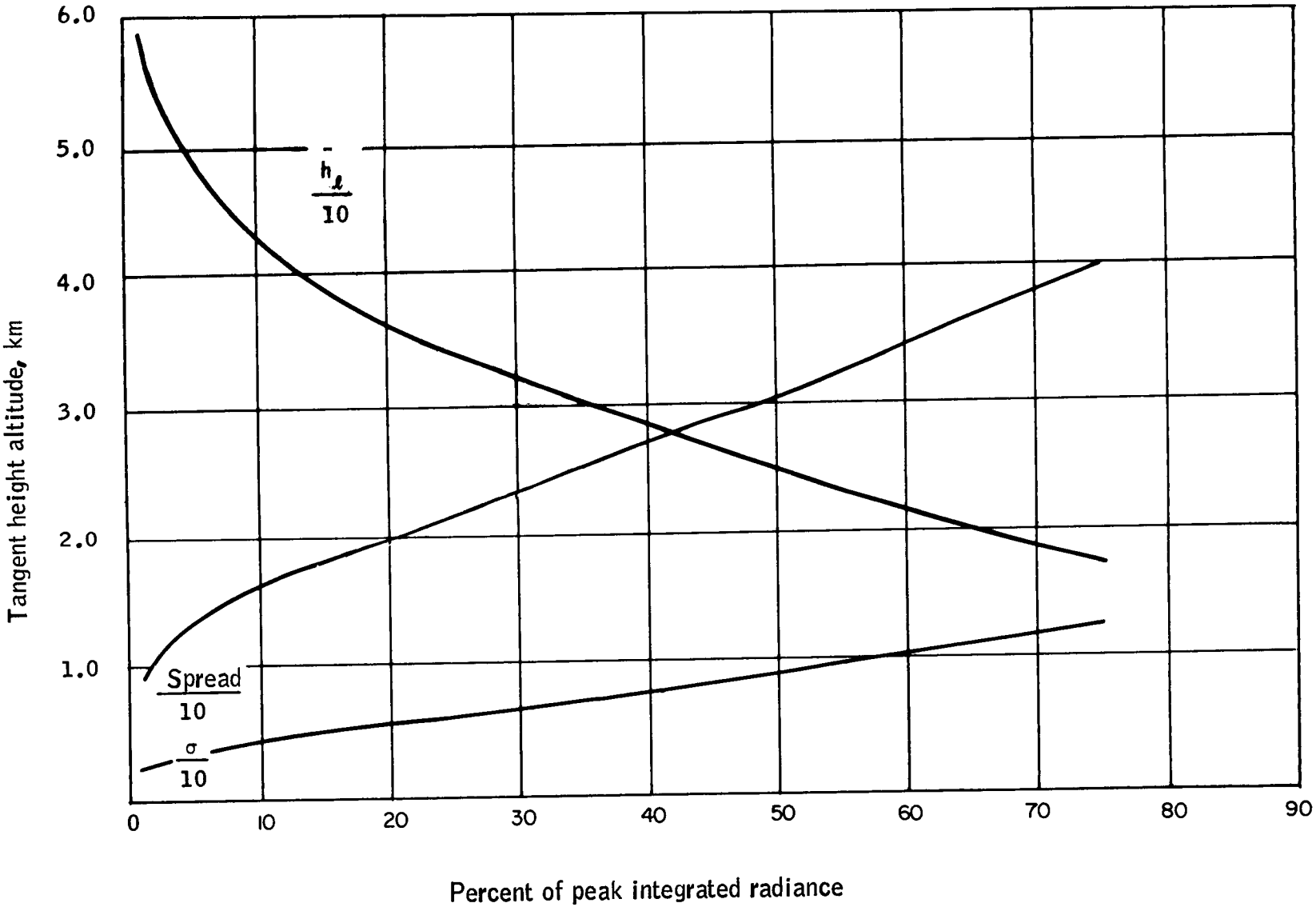


Figure 32. Results of Locator Processor Experiments - L19, Located Horizon Statistics versus Threshold Level, Percent of Peak Integrated Radiance

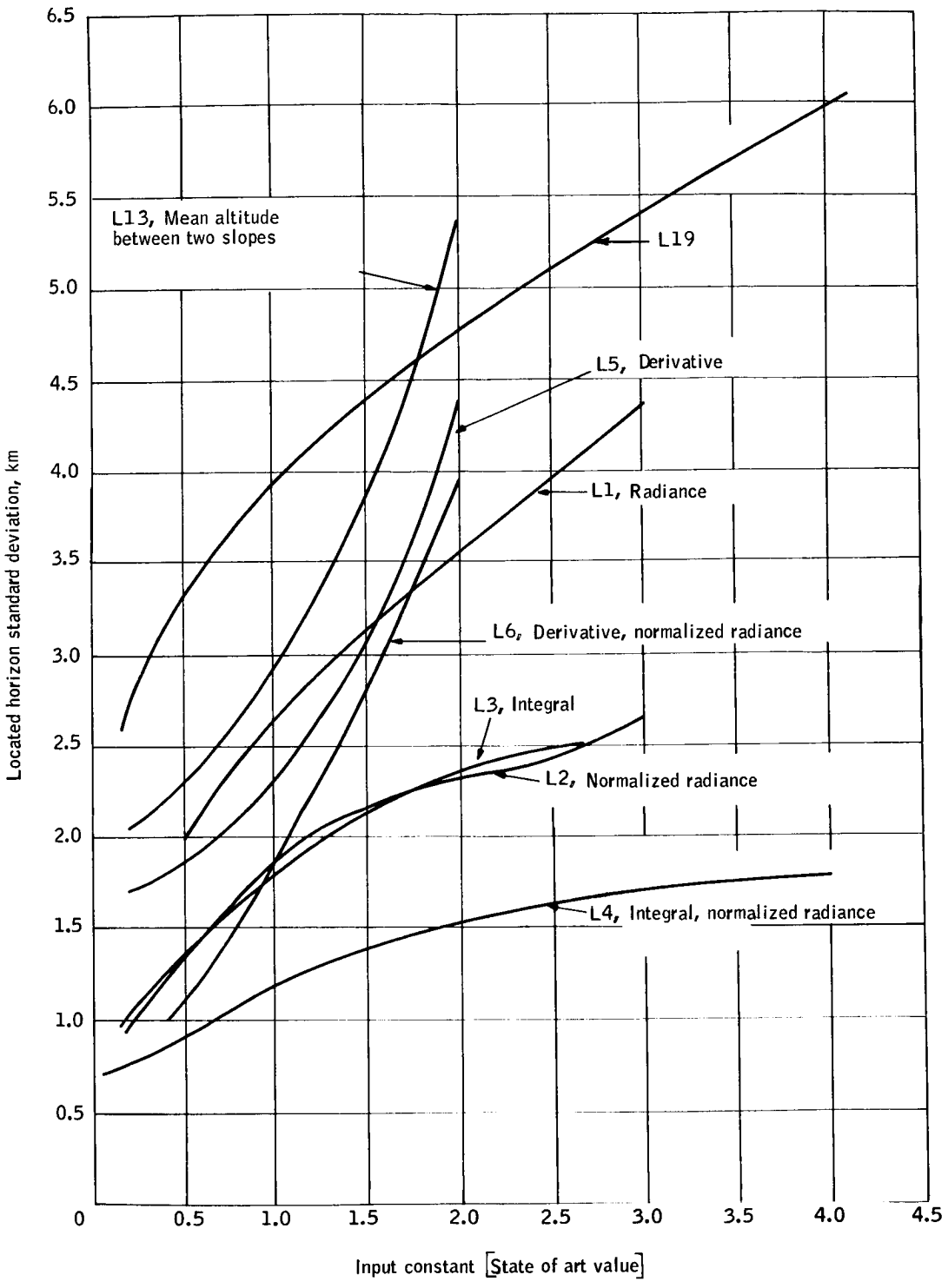


Figure 33. Located Horizon Standard Deviation versus Input Constant for Eight Locators

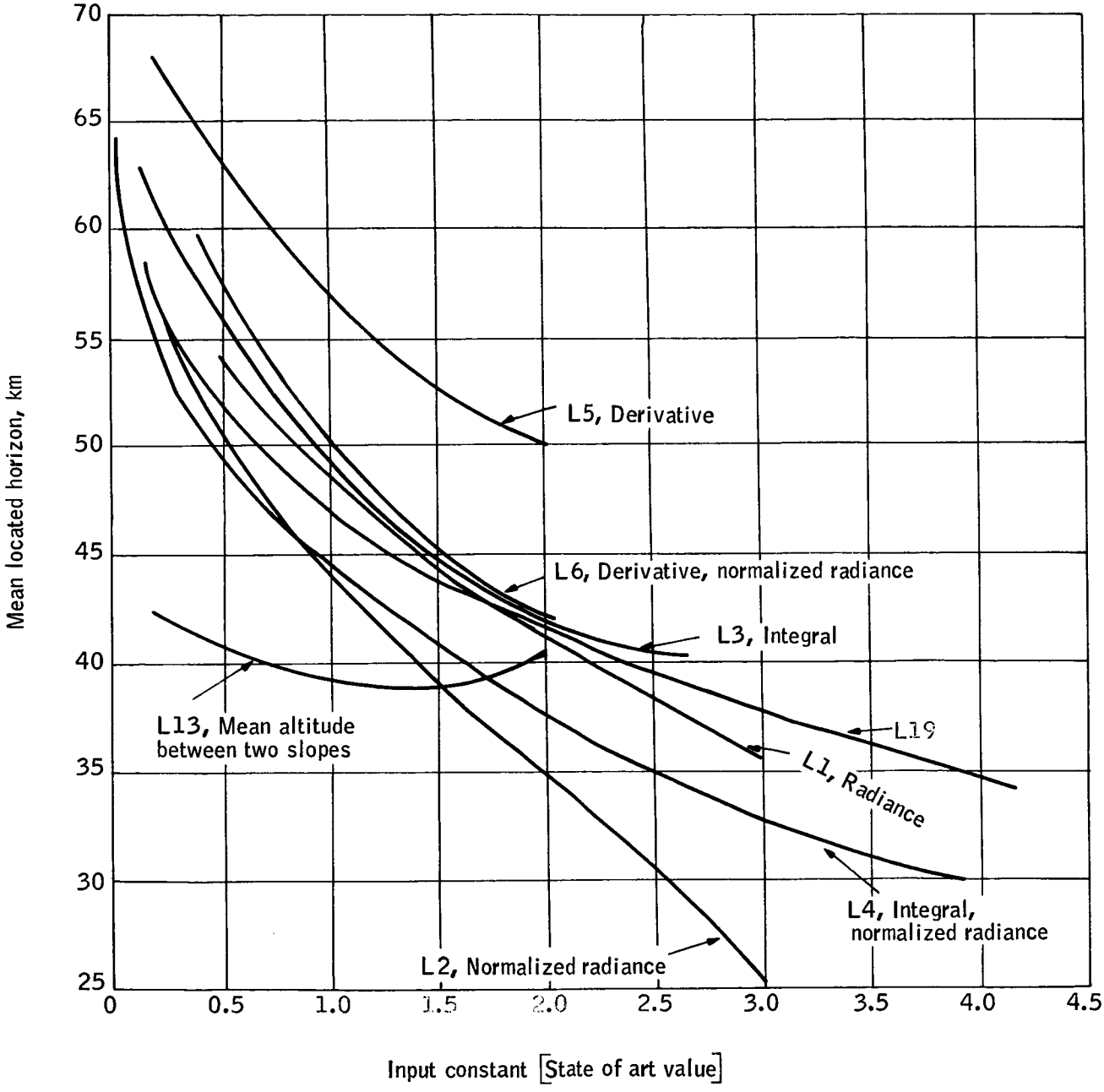


Figure 34. Mean Located Horizon versus Input Constants for Eight Locators

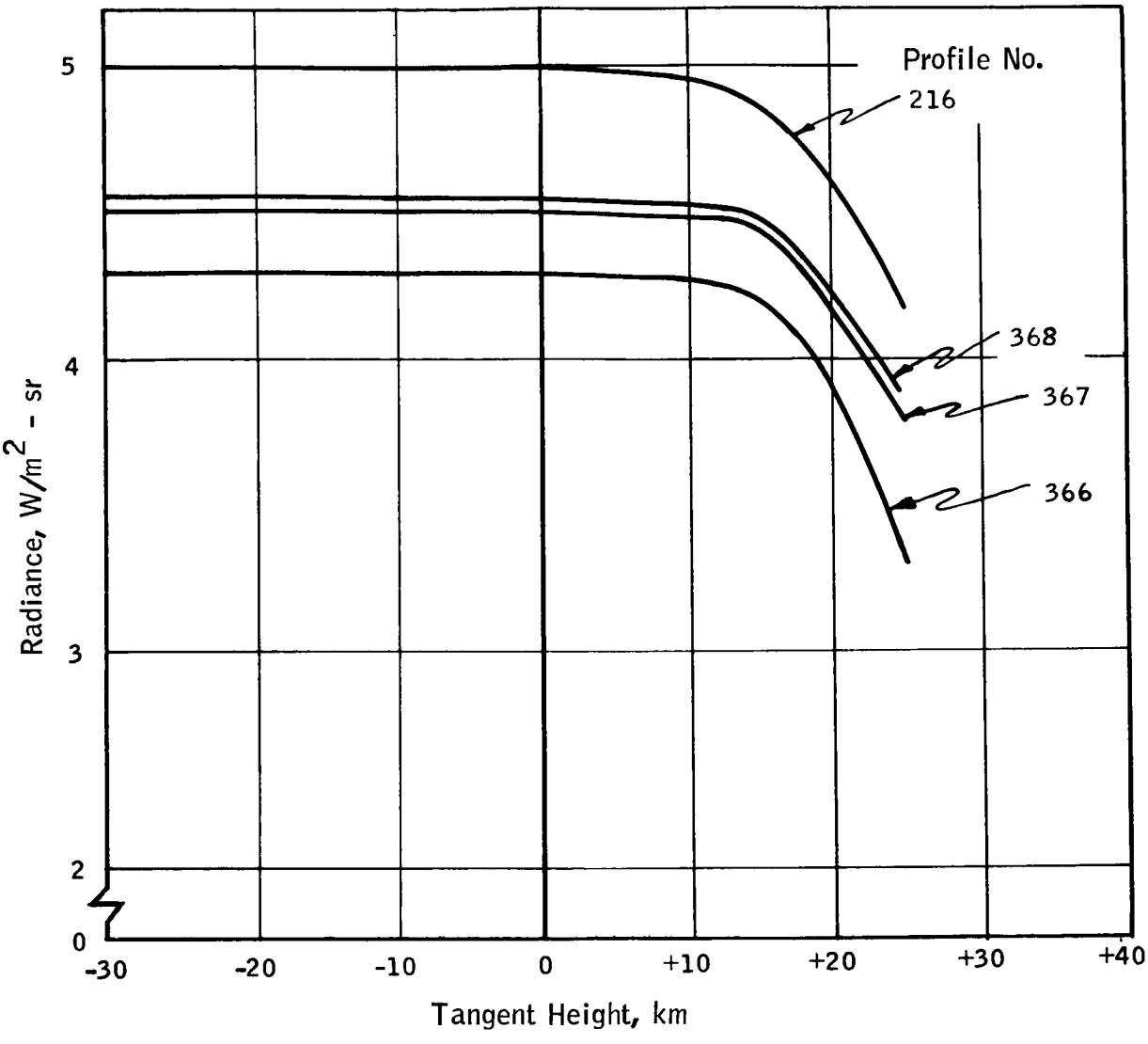


Figure 35. Profiles with Most Severe Limb Darkening

SELECTION OF LOCATORS FOR TIME SERIES ANALYSIS AND DATA REQUIREMENTS

Based on experimental results of the last section and the previously discussed locator selection criteria, locators and input constants to be operated on by the statistical analyzers were selected. Based on preliminary statistical experiments, certain of these locators and input constants were selected for further analysis in the determination of data requirements.

The following paragraphs present a discussion of the two selection procedures mentioned above.

LOCATORS FOR TIME SERIES ANALYZER

To satisfy the horizon sensor applications criteria of locator selection, locators representative of existing and proposed horizon sensors and locators exhibiting potential stability regardless of mechanization state-of-the-art were considered for time series analysis. Threshold constants were selected to obtain the most stable horizon within state-of-the-art constraints, and, where applicable, thresholds giving a less stable horizon were selected for general interest. Where two different locators showed similar stability, both were selected if they represented popular locators in operational sensors so that any differences which might exist would be obtained in time series analysis.

Future SOA thresholds were determined by applying a constant improvement factor to all SOA thresholds. The factor selected was based on the fact that state-of-the-art advancement usually takes place gradually rather than in orders of magnitude; therefore, something less than an order of magnitude improvement should be used. At the same time, the factor of advancement should be large enough such that effects of the advancement can be seen. A factor of five advancement in SOA was used. All SOA input thresholds were divided by five to obtain future SOA thresholds.

Locators useful in describing the shape and amplitude of the profile curve were selected in addition to those meeting the horizon sensing application criteria. To produce sufficient results from which to study variations in the curve shape and amplitude, several inputs to locator L2 (normalized radiance) and the value of peak radiance and slope at zero tangent height were selected.

To satisfy the third selection criteria, i.e., ensuring that effects caused by variations in the several atmospheric identifiers are not suppressed, locators selected under the first two categories were examined to determine if

all of the tangent height regions which the several atmospheric identifiers affect had been included. The region of effect of each of the six atmospheric identifiers is covered by at least two locators (or input constants) as shown in Table 5 which lists the identifiers, their region of effect, and the applicable locators. The locators shown in Table 5 produce located horizons at altitudes in the vicinity of the altitude of the atmospheric identifiers.

TABLE 5. - LOCATORS FOR ATMOSPHERIC IDENTIFIER EFFECTS

Identifier	Region of Effect	Locator
Tropopause temp.	15 km	No locator identified shows high correlation with this identifier
10 mb temp.	30 km	L2, normalized radiance, 0.7 and 0.95 L7 inflection point
Stratopause temp.	50 km	L1, radiance, 1.0, L7 slope extrapolation
Lapse rate 500 mb/ trop	5 to 15 km	SL1, magnitude of peak radiance SL2, slope at zero tangent height
Lapse rate trop/ 10 mb	15 to 30 km	L2, normalized radiance, 0.70 and 0.95
Lapse rate 10 mb/ strat	30 to 50 km	L1, radiance, 2.0 and 3.0 L2, normalized radiance, several L7, slope extrapolation L8, slope extrapolation, normalized radiance and others

Table 6 shows a comparison of all locators and threshold constants selected and the standard deviation of located horizon from the previous section. The discussion that follows gives the basis of selection or rejection for each.

TABLE 6. - LOCATORS AND INPUT CONSTANTS FOR TIME SERIES ANALYZER

Locator	State-of-art		Future	
	Input	σ	Input	σ
L1, radiance				
1	1.0 W/m^2-sr	2.662	0.20 W/m^2-sr	1.200
2	2.0 W/m^2-sr	3.559		
3	3.0 W/m^2-sr	4.362		
L2, normalized radiance	0.3	1.892	0.06	0.950
L3, integral	7.5 W-km/m^2-sr	1.900	1.50 W-km/m^2-sr	1.200
L4, integral norm. radiance	2.5 km	1.200	0.50 km	0.800
L5, slope	-0.05 W/m^2-sr-km	2.335	-0.01 W/m^2-sr-km	1.707
L6, slope, norm. radiance	Not used	2.000		1.000
L7, slope extrapolation	0.75, 1.5 W/m^2-sr	1.654		
L8, slope ext., norm. radiance	0.3, 0.6		0.06, 0.5	0.966
L9, average radiance	Not used	4.052		
L10, average radiance, norm.	Not used	4.052		
L11, radiance centroid (between zero and N_m)	Not used	2.807		
L12, centroid of normalized radiance	Not used	2.807		
L13, mean h between 2 slopes	Not used	2.944		2.052
L14, mean h between 2 slopes, normalized radiance	Not used	2.944		2.052
L15, mean altitude	Not used	1.987		
L16, altitude centroid	Not used	9.124		
L17, inflection point	No inputs required	3.027		

TABLE 6. LOCATORS AND INPUT CONSTANTS FOR TIME SERIES ANALYZER - Continued

Locator	State-of-art		Future	
	Input	σ	Input	σ
L18, multicolor	Not used			
L19, percent of peak integrated radiance	Not used	3.966		
L20, corrected integrated normalized radiance	Not used			
B2, three-point slope extrapolation	0.75, 1.0 1.5 W/m^2-sr	1.700		

L2, normalized radiance	Curve description locators
1	0.06
2	0.30 from L2 above
3	0.50
4	0.70
5	0.95
SL1, peak radiance	No input required
SL2, slope at zero tangent height	No input required

- L1 Radiance — Minimum SOA threshold is 1.0 W/m^2-sr. This value is selected. Since this is a very popular locator in the horizon sensing industry, with a variety of thresholds used, two more threshold constants were selected as shown. For future SOA, the threshold was set at 1/5 of current SOA threshold.

- L2 Normalized Radiance — The minimum SOA threshold is 0.3. Future SOA threshold is 1/5 of this, or 0.06. These two and three other values, 0.5, 0.7, and 0.9 were selected to describe profile shape variations.

- L3 Slope — Minimum SOA threshold is 7.5 $W \cdot km/m^2$-sr; future SOA threshold is 1/5 of this. Both were selected because of extensive use in horizon sensors and potential stability.

- L4 Integral of Normalized Radiance — Since minimum peak radiance is 3.352, the integral of normalized radiance minimum threshold must be 2.5 to be consistent with SOA integral threshold of 7.5. Future SOA threshold is 1/5 of this. These were selected because of use in horizon sensors and potential stability.

- L5 Slope — While stability of this locator is less than some others and is about the same as L1 for current SOA, it is sufficiently popular in the horizon sensor community to be of interest. Current SOA minimum threshold is -0.05; future SOA threshold is 1/5 of current.

- L6 Slope, Normalized Radiance — The horizon stability is similar to other selected locators, and this locator is not of sufficient interest to warrant further study. Not to be used.

- L7 Slope Extrapolation — In Table 4, the horizon stability is improved as one or the other of the two required threshold values is reduced. When both values are high, poor stability results. Thus, to obtain stability, the lower value threshold is selected just below minimum SOA threshold and the upper well above it. Since only slight improvement is achieved by lowering the thresholds, no future SOA thresholds were selected; however, further investigation into optimizing the pair of threshold constants for this locator seems to be warranted since a definite trend towards increased stability exists and the magnitude should be determined.

- L8 Slope Extrapolation, Normalized Radiance — Unfortunately, the values selected for the experiment did not include the minimum SOA threshold on normalized radiance since the minimum value of peak radiance was unknown at the time. This locator does exhibit stability and should be run through time series analysis. The minimum SOA threshold of 0.3 was selected and the value of 0.6 as the upper point was arbitrarily chosen. The data in Table 4 shows that as the lower value of threshold is reduced, horizon stability increases; however, for a small lower value, stability is only a weak function of the upper point. Thus, the future SOA thresholds selected were 1/5 of minimum current SOA for the lower value, and 0.5 arbitrarily, for the upper.

- L9 through L16 — These were not selected because they do not exhibit stability, or they exhibit insufficiently different stability from other locators already selected and are not representative of either current mechanizations or simple future mechanizations.

- L17 Multicolor — Not used since only one spectral region is being analyzed, and this locator requires two.

- L19 Percent of Peak Integrated Radiance — Not used because of large instability.

- L20 Corrected Integrated Normalized Radiance — Not used; see explanation in locator definition and mathematical description section

- B1 Signal Harmonics — Previously rejected; too heavily dependent on mechanization details.

- B2 Three-Point Slope Extrapolation — Selected because it is representative of recently proposed sensors. Constants shown were supplied by Barnes Engineering Company.

- B3 Corrected Slope Extrapolation — Not used; see explanation in locator definition and mathematical description section

- B4 Modified Normalized Radiance — Not used; see explanation in locator definition and mathematical description section

- B5-B8 — Not used because of large instability.
- B9-B10 Two-Color Locators — Not used; see L17 above.

LOCATORS FOR DATA REQUIREMENTS DETERMINATION

One of the analyses performed early in the time series analyzer was the development of correlation coefficients between any two of the input variables. A matrix of these correlation coefficients representing all locators and input constants selected for the time series analyzer and the six atmospheric identifiers is shown in Table 7. The matrix is symmetric, therefore, only one-half is shown. Selection of a row or column from the matrix shows the correlation of this element heading with every other element in the columns or rows, respectively. Also shown are the mean and standard deviation of the atmospheric identifier, peak radiance, slope at zero tangent height, and the located horizons.

The input radiance profiles which comprised the complete primary body of data, with the exception of the climatological set, were used in obtaining Table 7. The number of profiles used were 839 for calculating correlation coefficients, r_{xx}, and 1039 for mean value and standard deviation. Based on correlation coefficients, standard deviations and engineering judgment, 14 of the 22 locators were selected for determination of data requirements. This was done by first listing the locators in order of increasing standard deviation and then comparing correlation coefficients. Table 8 shows this list. Each locator was then considered for retention on the basis of its own merits, its standard deviation, and its correlation with other locators having similar stability, as discussed below. In the locator numbering system below, the second digit identifies the input constant used, e.g., L4, 1 identifies locator L4, integral of normalized radiance, first (smallest) input constant.

Locators selected to be the primary basis for determining data requirements are listed in Table 9. This table also shows the inputs and the resulting mean located horizon, and indicates full coverage of the three locator selection criteria described in the locator selection criteria section. All but two locators (or input values) satisfy more than one selection criteria, and each selection criteria, including each of the six atmospheric identifiers, is satisfied by more than one locator.

TABLE 7. - CORRELATION MATRIX

	10 mb temp	Tropo-pause temp	Strato-pause temp	LR1	LR2	LR3	L1,1	L1,2	L1,3	L1,4	L2,1	L2,2	L2,3	L2,4	L2,5	L3,1	L3,2	L4,1	L4,2	L5,1	L5,2	L7	L8,1	L8,2	L17	B2	SL1	SL2	Mean Value	Std. deviation
10 mb temp	-24	26	-38	67	-5	72	79	82	85	48	65	69	75	83	72	77	34	59	76	73	58	35	47	31	59	28	84	227.9738	8.3
Tropopause temp		-6	11	-86	-16	-11	-22	-30	-24	-21	-45	-46	-47	-64	-9	-16	-21	-37	-17	-16	4	-10	-36	-10	3	-12	6	208.1367	9.5
Stratopause temp			-6	18	46	60	62	54	50	64	59	51	41	27	51	63	55	68	57	58	67	62	63	30	66	16	42	273.2229	7.6
LR1. 500mb/trop				-26	-2	-27	-31	-32	-34	-19	-29	-29	-32	-38	-25	-30	-12	-25	-30	-31	-22	-16	-24	-6	-21	-47	-31	-5.3816	1.7
LR2. trop/10 mb					8	44	56	63	61	40	67	70	73	90	42	50	34	58	50	48	25	26	52	24	26	24	36	1.3241	1.0
LR3. 10 mb/Strat						30	29	33	28	38	43	43	33	13	23	29	35	42	24	25	20	32	40	39	17	10	15	2.6300	0.6
L1,1. radiance, 0.2							93	91	91	91	82	82	79	66	95	98	81	88	96	91	86	85	69	50	83	25	84	60.1471	1.3
L1,2. radiance, 1.0								97	95	82	91	89	87	77	87	97	68	92	95	94	84	71	78	51	85	28	84	48.5626	2.2
L1,3. radiance, 2.0									97	78	93	94	92	83	86	95	65	89	93	90	73	65	77	52	72	30	85	41.3993	3.1
L1,4. radiance, 3.0										74	87	91	92	82	86	94	59	84	93	90	75	61	66	55	74	30	89	35.9114	3.7
L2,1. norm. radiance 0.06											82	78	71	56	85	88	94	92	88	83	80	97	75	47	76	19	58	57.3184	0.9
L2,2. norm. radiance 0.30												96	91	80	76	88	72	96	85	85	66	69	90	50	65	26	64	44.1544	1.8
L2,3. norm. radiance 0.50													95	84	76	86	67	91	84	82	62	62	77	58	61	28	68	37.9308	2.1
L2,4. norm. radiance 0.70														88	75	84	60	85	82	80	60	55	66	57	60	29	70	32.4929	2.2
L2,5. norm. radiance 0.95															64	72	46	72	72	70	47	40	60	36	47	26	61	23.2653	2.6
L3,1. integral 1.5																93	83	82	91	86	80	80	64	46	77	24	81	58.5755	0.9
L3,2. integral 7.5																	76	91	97	95	88	80	75	51	86	27	86	48.3069	1.5
L4,1. integral, norm. radiance 0.5																		84	74	69	69	94	68	40	64	14	41	55.2685	0.6
L4,2. integral, norm. radiance 2.5																			88	88	78	83	88	50	77	24	62	44.0113	1.1
L5,1. derivative-0.01																				93	85	80	71	49	83	26	83	68.0813	1.3
L5,2. derivative-0.05																					88	75	74	48	86	26	79	56.9505	2.2
L7. slope extrapolation. (1.5, 0.75)																						95	75	48	97	21	72	57.5908	1.4
L8,1. slope extrapolation, normalized radiance (0.3, 0.6)																							81	44	74	18	48	59.9607	0.8
L8,2. slope extrapolation, normalized radiance (0.06, 0.5)																								42	58	20	45	53,1000	1.7
L17. inflection point																									40	17	44	34.8248	3.5
B2. three-point slope extra. (0.75, 1.0, 1.5)																										20	71	56.9889	1.5
SL1. peak radiance magnitude																											28	5.3027	0.6
SL2. slope at zero tangent height																												0.0025	0

TABLE 8.- LISTING BY STANDARD DEVIATION

Locator	Input no.	Constant value	$\bar{h}_\ell$	σ	Correlated with	Correlation coefficient
L4, integral, norm. rad.	1	0.50	55.27	0.6	L8,1	0.90
L8, slope ext., norm. rad.	1	0.3 0.6	60.00	0.8	L3,1	0.80
L3, integral	1	1.50	58.58	0.9	L2,1	0.85
L2, norm. rad.	1	0.06	57.32	0.9	L4,2	0.92
L4, integral, norm. rad.	2	2.5	44.01	1.1	L5,1	0.88
L5, derivative	1	-0.01	68.08	1.3	L1,1	0.96
L1, radiance	1	0.20	60.15	1.3	L7	0.86
L7, slope extrapolation	-	0.75 1.5	57.51	1.4	L3,2	0.88
L3, integral	2	7.5	48.31	1.5	B2	0.86
B2, three-pt. slope extrap.	-	0.75 1.0 1.5	56.99	1.5	L8,2 L7	0.58 0.97
L8, slope ext., norm. rad.	2	0.06 0.5	53.10	1.7	L2,2	0.90
L2, norm. rad.	2	0.3	44.10	1.8	L2,3	0.96
L2, norm. rad.	3	0.5	37.93	2.1	L2,4	0.95
L2, norm. rad.	4	0.7	32.49	2.2	L5,2	0.80
L5, derivative	2	-0.05	56.95	2.2	L1,2	0.94
L1, radiance	2	1.0	48.56	2.2	L2,5	0.77
L2, norm. rad.	5	0.95	23.26	2.6	L1,3	0.83
L1, radiance	3	2.0	41.40	3.1	L1,7	0.52
L17, inflection point	-	--	34.82	3.5	L1,4	0.55
L1, radiance	4	3.0	35.91	3.7		

TABLE 9. - LOCATORS FOR DATA REQUIREMENTS

Locator	Input no.	Value	Mean altitude - km	Criteria for choice								
				Curve description	Horizon sensors		Atmospheric identifiers					
					Present	Future	1	2	3	4	5	6
L1, radiance	1	0.2	60.15			X						
	2	1.0	48.56		X				X			X
	3	2.0	41.40		X							X
	4	3.0	35.91		X							X
L2, normalized radiance	1	0.06	57.32	X		X						
	2	0.3	44.10	X	X				X			X
	3	0.5	37.93	X	X							X
	5	0.95	23.26	X			X	X			X	
L4, integral normalized radiance	1	0.50	55.27			X						
	2	2.50	44.01		X							X
L7, slope extrapolation		0.75 1.50	57.51		X							
L17, inflection point	-	-	34.82		X			X				X
SL1, peak radiance	-	-	--	X				X		X	X	
SL2, slope at zero tangent height	-	-	--	X			X			X		

- L4, 1 Retained because it exhibits the best potential stability.
- L8, 1 Discarded because it has nearly the same σ as L4, 1, is well correlated with L4, 1, and is not as convenient a locator to mechanize as L4, 1.
- L2, 1 Retained because it describes shape of the profile near the lower knee of the curve and represents future state-of-the-art of a widely used locator.
- L3, 1 Discarded because it has the same σ as L2, 1, is reasonably well correlated with L2, 1, and is nearly the same in mechanization principles as L4, 1, which is much more stable.
- L4, 2 Retained because it is the most stable state-of-the-art locator.
- L5, 1 Discarded because it is highly correlated with L4, 2, is future state-of-the-art, and is not as stable as present state-of-the-art L4, 2.
- L1, 1 Retained because it represents future state-of-the-art of locators operating on radiance magnitude.
- L7, B2 These two are highly correlated (0.97), have nearly the same σ and are nearly identical locators. One should be retained since these are representative of recently proposed horizon sensor mechanizations. Retain L7, discard B2.
- L3, 2 Discarded because it is nearly the same as L4, 2 and is less stable.
- L8, 2 Discarded because it is the same type locator as L7 though not as stable.
- L2, 2
L2, 3
L2, 4
L2, 5 These are the normalized radiance input thresholds and should be retained because of their curve shape description properties. However, L2, 4 (70 percent of peak) has nearly the same σ and correlates well with L2, 3 (50 percent), so it can safely be discarded.
- L1, 2 Retained because it represents current state-of-the-art of radiance threshold.
- L5, 2 Discarded because it is well correlated with and has nearly the same σ as L1, 2.
- L1, 3
L1, 4 Retained because they represent recent state-of-the-art.
- L1, 7 Retained because of large σ.

CONCLUSIONS AND RECOMMENDATIONS

The primary objective of the locator study was to identify and define locators which would be analyzed statistically to determine the systematic and non-systematic variations in located horizons from which the data requirements for a horizon definition study were to be defined. Thirty-eight locators, each based on a different characteristic of the radiance profile shape and amplitude, were defined. Twelve combinations of locators and threshold constants were selected for data requirements determination based on their ability to describe variations in the profile shape and amplitude, on their applicability to the horizon sensing problem, and on their ability to define effects of the many atmospheric phenomena and anomalies.

A second objective of the locator study was to identify the locator resulting in the most stable sharp reference horizon. The most stable locator considered during this study is integral of normalized radiance for both state-of-the-art thresholds and future state-of-the-art threshold. The located horizon standard deviation over 1039 radiance profiles is 1.0905 km at present SOA and 0.5936 km for a factor of 5 advancement in instrument SOA. The angular uncertainty in located horizon is a function of orbit altitude; for a 150 n. mi. (280 km) orbit altitude, the angular standard deviation would be 0.032 degrees currently and 0.019 degrees at future SOA.

Based on computational results, certain locators identified during the study could not be defined completely because of time limitations. For example, with locator B4 suggested by Barnes Engineering Company, a compensation scheme is involved in which the located horizon obtained by slope extrapolation would be modified by some function of peak radiance. The exact form of the function remained undetermined during the study. Since slope extrapolation is one of the more stable locators, any compensation scheme which could potentially increase the stability significantly should be examined.

Those locators which are dependent on area considerations such as averages, centroids, etc., were defined to operate over an area bounded by the magnitude and location of peak radiance. Because of wide variations in location of peak radiance values, these locators did not exhibit stability. However, if the areas of interest were bounded by the 5 and 95 percent of peak radiance values, then perhaps the centroid of that area would be highly stable. Time did not permit such an investigation during the current study.

The following recommendations are made:

- To obtain the highest instrument accuracy horizon sensor mechanizations should be based on the integral of normalized radiance for locating a reference horizon, provided that the spectral region used closely approximates the region used in the study, namely from 615 cm^{-1} to 715 cm^{-1}.

- Further study devoted to identifying and defining locators exhibiting a greater degree of stability, and based on the results of this study, should be defined completely, and area locators should be reinvestigated with modified area limits.

APPENDIX A
PROOF OF IDENTICAL LOCATORS

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PROOF OF IDENTICAL LOCATORS

While studying locators, it was noted that locators 9 and 10 would give identical results and that locators 11 and 12 would give identical results. It is the purpose of this appendix to prove these identities.

Let N(h) denote a radiance profile and h(N) its functional inverse. The inverse is only defined for N between zero and peak radiance, N_m. It follows from this definition that

$$N[h(N)] \equiv N \tag{A1}$$

and

$$h[N(h)] \equiv h. \tag{A2}$$

Let M(H) denote a radiance profile normalized to peak radiance and H(M) its functional inverse. H(M) is defined for M between zero and one. From this definition it follows

$$M[H(M)] \equiv M \tag{A3}$$

and

$$H[M(H)] \equiv H. \tag{A4}$$

From the definitions of the functions N and M, we have that

$$N(h) \equiv N_m M(h). \tag{A5}$$

Substituting h(N) for h gives

$$N[h(N)] \equiv N_m M[h(N)].$$

Using Identiy (A1) we may write

$$N \equiv N_m M[h(N)]$$

or

$$\frac{N}{N_m} \equiv M[h(N)].$$

From this identity we have that

$$H\left(\frac{N}{N_m}\right) \equiv H\{M[h(N)]\}.$$

Using Identity (A4) we may write

$$H\left(\frac{N}{N_m}\right) \equiv h(N) \,. \tag{A6}$$

Identities (A5) and (A6) are basic for all that follows.

EQUIVALENCE OF LOCATORS 9 AND 10

Locator 9 computes

$$\overline{N} = \frac{\int_{h(N_m)}^{h(0)} N(h)\, dh}{h(0) - h(N_m)} \,,$$

and

$$h_\ell(9) = h(\overline{N}) \,.$$

Locator 10 computes

$$\overline{M} = \frac{\int_{H(1)}^{H(0)} M(H)\, dH}{H(0) - H(1)} \,,$$

and

$$h_\ell(10) = H(\overline{M}) \,.$$

Therefore,

$$h_\ell(9) = h(\overline{N})$$

$$= H\left(\frac{\overline{N}}{N_m}\right)$$

$$= H\left[\frac{1}{N_m} \frac{\int_{h(N_m)}^{h(0)} N(h\ dh}{h(0) - h(N_m)}\right]$$

$$= H\left[\frac{\int_{h(N_m)}^{h(0)} \frac{N(h)}{N_m} dh}{h(0) - h(N_m)}\right]$$

$$= H\left[\frac{\int_{H(1)}^{H(0)} \frac{N(h)}{N_m}\, dh}{H(0) - H(1)}\right]$$

$$= H\left[\frac{\int_{H(1)}^{H(0)} M(h)\, dh}{H(0) - H(1)}\right]$$

$$= H(\overline{M})$$

$$= h_{\ell}(10) .$$

EQUIVALENCE OF LOCATORS 11 AND 12

Locator 11 computes

$$N_{cg} = \frac{\int_0^{N_m} Nh(N)\, dN}{\int_0^{N_m} h(N)\, dn} ,$$

and

$$h_{\ell}(11) = h(N_{cg}) .$$

Locator 12 computes

$$M_{cg} = \frac{\int_0^1 MH(M)\, dM}{\int_0^1 H(M)\, dM} ,$$

and

$$h_{\ell}(12) = H(M_{cg}) .$$

Therefore,

$$h_{\ell}(11) = h(N_{cg})$$

$$= H\left(\frac{N_{cg}}{N_m}\right)$$

$$= H\left(\frac{1}{N_m} \quad \frac{\int_0^{N_m} Nh(N)\, dN}{\int_0^{N_m} h(N)\, dN}\right)$$

$$= H\left(\frac{\int_0^{N_m} \frac{N}{N_m} H\left(\frac{N}{N_m}\right) d\frac{N}{N_m}}{\int_0^{N_m} H\left(\frac{N}{N_m}\right) d\frac{N}{N_m}}\right)$$

$$= H\left(\frac{\int_0^{1} MH(M)\, dM}{\int_0^{1} H(M)\, dM}\right)$$

$$= H(M_{cg})$$

$$= h_{\ell}(12) .$$

APPENDIX B

LOCATOR PROCESSOR EXPERIMENT COMPLETE RESULTS

APPENDIX B

LOCATOR PROCESSOR EXPERIMENT COMPLETE RESULTS

This appendix contains the results of the locator processor experiment, discussed in Locator Processor Experimental Runs section, in which 120 profiles were operated on by 76 combinations of locators and input constants to obtain 8880 located horizons. In Table B1, the 120 profiles are identified by profile number, date, latitude and longitude. The results are presented in tabular form, one table for each locator, and within each table one column of located horizons for each input constant or for each set of constants for those locators requiring two or more inputs. Units of located horizon are kilometers and units of each of the input constants are shown in Table 2.

TABLE B1.- PROFILE IDENTIFICATION

Profile number	Date	Latitude	Longitude
1	8 April 1964	63.75	165
3		75.00	150
5		45.00	150
7		52.50	135
9		26.25	135
10		75.00	120
12		60.00	120
14		37.50	120
16		15.00	120
17		63.75	105
19		48.75	105
21		33.75	105
23		22.50	105
24		90.00	90
26		82.50	90
28		75.00	90
30		67.50	90
32		56.25	90
34		48.75	90
36		41.25	90

TABLE B1.- PROFILE IDENTIFICATION - Continued

Profile number	Date	Latitude	Longitude
38	8 April 1964	33.75	90
40	↓	26.25	90
42		18.75	90
44		11.25	90
46		3.75	90
48		56.25	75
50		41.25	75
52		26.25	75
53		75.00	60
55		60.00	60
113	12 August 1964	63.75	165
115	↓	75.00	150
117		45.00	150
119		52.50	135
121		26.25	135
122		75.00	120
124		60.00	120
126		37.50	120
128		15.00	120
129		63.75	105
131		48.75	105
133		33.75	105
135		22.50	105
136		90.00	90
138		82.50	90
140		75.00	90
142		67.50	90
144		56.25	90
146		48.75	90
148		41.25	90
150		33.75	90

TABLE B1.- PROFILE IDENTIFICATION - Continued

Profile number	Date	Latitude	Longitude
152	12 August 1964	26.25	90
154		18.75	90
156		11.25	90
158		3.75	90
160		56.25	75
162		41.25	75
164		26.25	75
165		75.00	60
167		60.00	60
169	21 October 1964	63.75	165
171		75.00	150
173		45.00	150
175		52.50	135
177		26.25	135
178		75.00	120
180		60.00	120
182		37.50	120
184		15.00	120
185		63.75	105
187		48.75	105
189		33.75	105
191		22.50	105
192		90.00	90
194		82.50	90
196		75.00	90
198		67.50	90
200		56.25	90
202		48.75	90
204		41.25	90
206		33.75	90
208		26.25	90

TABLE B1.- PROFILE IDENTIFICATION - Continued

Profile number	Date	Latitude	Longitude
210	21 October 1964	18.75	90
212		11.25	90
214		3.75	90
216		56.25	75
218		41.25	75
220		26.25	75
221		75.00	60
223		60.00	60
337	20 January 1965	63.75	165
339		75.00	150
341		45.00	150
343		52.50	135
345		26.25	135
346		75.00	120
348		60.00	120
350		37.50	120
352		15.00	120
353		63.75	105
355		48.75	105
357		33.75	105
359		22.50	105
360		90.00	90
362		82.50	90
364		75.00	90
366		67.50	90
368		56.25	90
370		48.75	90
372		41.25	90
374		33.75	90
376		26.25	90
378		18.75	90

TABLE B1.- PROFILE IDENTIFICATION - Concluded

Profile number	Date	Latitude	Longitude
380	20 January 1965	11.25	90
382	↓	3.75	90
384		56.25	75
386		41.25	75
388		26.25	75
389		75.00	60
391		60.00	60

LOCATOR (1) FIXED VALUE OF RADIANCE

PROFILE									
	C =	.50	1.00	1.50	2.00	3.00	4.00	5.00	6.00
1	LM =	55.37	50.34	45.18	42.09	35.78	30.35	24.35*	999999
3	LM =	55.45	50.37	45.30	41.92	36.08	30.70	25.40*	999999
5	LM =	55.16	50.38	45.70	42.76	37.80	31.92	24.87*	999999
7	LM =	55.26	50.41	45.74	42.55	37.24	31.51	24.49*	999999
9	LM =	55.02	50.34	46.39	43.54	38.47	33.97	28.17*	999999
10	LM =	55.74	50.76	46.38	42.86	37.23	31.57	26.19*	999999
12	LM =	55.49	50.56	45.98	42.83	37.58	31.99	26.07*	999999
14	LM =	55.16	50.09	46.25	43.17	37.92	33.33	26.83*	999999
16	LM =	55.20	50.67	47.06	44.25	38.97	35.21	30.70*	999999
17	LM =	55.84	50.85	46.41	43.40	38.27	32.86	27.00	15.06
19	LM =	55.65	50.70	46.71	43.57	38.80	33.72	27.11*	999999
21	LM =	55.29	50.33	46.75	43.80	38.65	33.51	28.11*	999999
23	LM =	55.28	50.40	47.08	44.10	38.59	34.24	30.09*	999999
24	LM =	56.02	50.89	45.81	42.61	37.05	31.60	27.02	17.66
26	LM =	55.93	50.77	45.87	42.73	37.22	31.72	26.78	17.28
28	LM =	55.87	50.81	46.10	43.01	37.69	32.28	26.94	18.02
30	LM =	55.96	50.94	46.47	43.41	38.51	33.36	27.64	18.84
32	LM =	56.01	51.04	46.81	43.82	39.30	34.52	28.25	16.18
34	LM =	55.90	50.94	46.71	43.87	39.50	34.98	28.53*	999999
36	LM =	55.85	50.82	47.17	44.25	40.00	35.56	29.31*	999999
38	LM =	55.87	50.89	47.45	44.53	40.01	35.62	30.03*	999999
40	LM =	55.94	50.90	47.53	44.70	39.71	35.29	30.94*	999999
42	LM =	55.54	50.65	47.35	44.61	39.29	34.94	30.41*	999999
44	LM =	55.38	50.49	47.10	44.50	39.02	34.88	30.50*	999999
46	LM =	55.27	50.30	46.92	44.42	38.84	34.79	30.33*	999999
48	LM =	56.34	51.39	47.41	44.77	40.10	35.96	29.95	20.00
50	LM =	56.12	51.15	47.59	44.69	40.47	36.73	30.85*	999999
52	LM =	55.87	51.08	47.51	44.82	40.38	36.16	32.08*	999999
53	LM =	56.14	51.17	46.59	43.48	38.27	33.68	27.49	18.65
55	LM =	56.43	51.44	47.26	44.20	39.85	35.95	29.15	20.11
113	LM =	55.71	50.94	47.16	44.35	39.79	35.27	30.57	23.12
115	LM =	56.11	51.39	47.71	44.80	40.18	35.81	31.27	24.34
117	LM =	55.13	49.93	46.23	43.46	39.03	34.60	28.97*	999999
119	LM =	56.03	50.38	46.84	44.25	39.67	34.61	29.49*	999999
121	LM =	55.13	49.18	45.34	42.14	37.85	33.29	26.41*	999999
122	LM =	56.39	51.44	47.89	45.05	40.45	36.04	31.71	25.16
124	LM =	56.47	50.92	47.43	44.81	40.31	35.13	30.44	23.04
126	LM =	55.74	49.67	46.20	43.31	37.84	33.43	27.98*	999999
128	LM =	55.18	49.25	45.04	41.13	37.25	32.06	26.82*	999999
129	LM =	56.37	51.08	47.65	44.95	40.39	35.53	31.01	23.46
131	LM =	55.79	50.27	46.89	44.27	39.32	34.79	29.63	17.50
133	LM =	55.13	49.98	46.20	43.03	37.57	34.34	27.75*	999999
135	LM =	54.78	49.85	45.55	41.57	37.33	32.52	26.70*	999999
136	LM =	56.17	51.54	48.07	45.07	40.15	35.93	31.99	26.06
138	LM =	56.29	51.47	48.04	45.09	40.22	36.04	32.01	25.56
140	LM =	56.34	51.34	47.94	45.09	40.27	35.90	31.49	24.73
142	LM =	56.18	51.06	47.65	44.84	40.10	35.51	30.80	23.62
144	LM =	55.74	50.53	46.92	44.23	39.60	35.00	30.09	22.08
146	LM =	55.26	50.06	46.53	43.85	38.83	34.87	29.51	19.53
148	LM =	54.59	49.46	46.01	43.17	37.84	34.27	28.35*	999999
150	LM =	53.96	48.93	45.42	42.26	37.11	32.87	26.58*	999999
152	LM =	53.80	48.70	44.97	41.16	36.46	31.29	24.82*	999999
154	LM =	53.99	48.98	44.85	40.72	36.41	30.79	23.10*	999999

LOCATOR (1) FIXED VALUE OF RADIANCE - Continued

156	LM =	54,09	49,12	44,70	40,59	36,34	30,65	22,74*	999999
158	LM =	54,37	49,35	44,76	40,67	36,51	30,75	23,49*	999999
160	LM =	55,18	50,34	46,54	43,73	38,89	34,76	29,89	20,36
162	LM =	53,93	48,77	44,95	42,17	37,46	33,29	27,80*	999999
164	LM =	53,42	47,86	44,27	40,68	35,78	31,00	24,18*	999999
165	LM =	56,20	51,22	47,83	44,85	39,67	35,44	30,73	23,43
167	LM =	55,05	50,38	46,52	43,62	38,58	34,69	29,49	20,00
169	LM =	53,51	47,28	42,76	39,34	33,33	28,67	23,61*	999999
171	LM =	53,08	46,62	42,27	38,81	32,56	26,86	16,13*	999999
173	LM =	55,26	48,31	43,63	40,16	34,93	29,60	19,52*	999999
175	LM =	54,55	47,68	43,43	39,96	33,65	27,84*	999999*	999999
177	LM =	55,99	49,99	45,17	41,85	36,50	31,62	24,47*	999999
178	LM =	52,76	46,12	41,63	38,00	31,85	25,10*	999999*	999999
180	LM =	53,76	46,98	43,17	39,94	32,37	26,52*	999999*	999999
182	LM =	55,27	49,27	45,16	41,92	36,01	30,63	22,25*	999999
184	LM =	55,86	50,14	46,41	43,48	37,10	32,80	26,88*	999999
185	LM =	53,06	46,50	42,29	38,28	31,70	24,90*	999999*	999999
187	LM =	54,53	47,98	44,11	40,67	34,18	27,80*	999999*	999999
189	LM =	54,67	49,31	45,79	42,76	36,76	31,46	24,86*	999999
191	LM =	55,55	49,99	46,74	43,88	38,25	33,30	27,14*	999999
192	LM =	52,36	45,33	40,26	35,69	30,92	22,59*	999999*	999999
194	LM =	52,26	45,31	40,41	35,98	30,48	22,47*	999999*	999999
196	LM =	52,15	45,50	40,79	36,59	30,48	23,03*	999999*	999999
198	LM =	52,34	45,88	41,33	37,36	31,17	23,57*	999999*	999999
200	LM =	53,37	47,25	42,92	39,09	32,84	25,37*	999999*	999999
202	LM =	53,87	47,77	43,81	40,36	33,89	27,50*	999999*	999999
204	LM =	54,43	48,95	45,24	41,98	35,86	30,07	21,34*	999999
206	LM =	54,63	49,54	46,09	42,98	37,11	31,61	25,25*	999999
208	LM =	54,97	49,95	46,75	43,78	38,34	32,99	27,16*	999999
210	LM =	55,26	50,32	47,03	44,23	39,13	34,22	27,91*	999999
212	LM =	56,08	51,10	47,41	44,64	39,86	35,37	29,30*	999999
214	LM =	56,38	51,32	47,53	44,74	40,03	35,96	29,97*	999999
216	LM =	53,00	47,38	42,85	39,30	33,17	26,32	-10,00*	999999
218	LM =	53,86	48,76	45,34	42,02	36,37	30,98	23,48*	999999
220	LM =	54,79	50,00	47,30	43,97	39,02	34,08	27,98*	999999
221	LM =	51,98	45,20	40,38	36,18	29,89	21,64*	999999*	999999
223	LM =	52,47	46,93	42,14	38,68	32,82	25,15*	999999*	999999
337	LM =	52,51	45,56	40,47	36,70	31,56	25,50*	999999*	999999
339	LM =	51,14	43,86	39,02	35,23	28,99	19,76*	999999*	999999
341	LM =	53,36	47,21	41,51	37,54	32,84	27,60	18,00*	999999
343	LM =	52,28	45,91	40,11	36,45	31,30	25,90*	999999*	999999
345	LM =	54,12	49,09	44,63	41,07	34,83	30,16*	999999*	999999
346	LM =	50,11	43,02	38,43	34,31	27,43	17,65*	999999*	999999
348	LM =	51,07	44,06	38,79	35,30	30,41	24,92*	999999*	999999
350	LM =	52,80	47,65	42,60	38,86	33,35	27,93*	999999*	999999
352	LM =	54,91	49,86	46,48	42,58	36,54	31,74	24,78*	999999
353	LM =	49,98	42,95	38,08	34,15	28,79	21,88*	999999*	999999
355	LM =	50,96	43,90	39,22	35,10	30,13	23,74*	999999*	999999
357	LM =	53,05	47,92	43,83	40,48	34,22	28,89*	999999*	999999
359	LM =	54,49	49,51	46,19	42,62	36,88	31,14	25,41*	999999
360	LM =	47,90	40,73	35,15	31,30	19,25*	999999*	999999*	999999
362	LM =	48,51	41,38	36,20	32,22	21,62*	999999*	999999*	999999
364	LM =	48,94	41,88	37,07	32,74	24,69*	999999*	999999*	999999
366	LM =	49,47	42,71	37,51	33,39	27,11	18,77*	999999*	999999
368	LM =	50,43	43,27	38,30	34,39	28,74	21,82*	999999*	999999
370	LM =	51,02	44,09	39,12	35,42	29,86	23,11*	999999*	999999
372	LM =	51,94	46,33	41,66	37,94	31,99	25,83*	999999*	999999
374	LM =	53,01	47,62	43,64	40,41	34,44	28,97*	999999*	999999
376	LM =	53,89	48,80	45,23	42,09	35,91	30,85	22,92*	999999
378	LM =	54,83	49,73	46,17	42,89	39,78	31,27	24,96*	999999
380	LM =	55,66	50,72	47,35	43,74	37,69	32,95	27,17*	999999
382	LM =	55,87	50,90	47,50	43,69	37,75	32,98	27,21*	999999
384	LM =	50,59	43,77	38,52	34,25	28,33	21,57*	999999*	999999
386	LM =	52,54	46,63	42,69	39,03	32,50	26,50*	999999*	999999
388	LM =	54,47	49,23	45,67	42,91	36,94	31,65	24,34*	999999
389	LM =	48,54	41,76	36,44	31,84	21,97*	999999*	999999*	999999
391	LM =	50,38	43,76	38,67	34,47	27,22	18,49*	999999*	999999
MEAN	=	54,248	48,681	44,559	41,225	35,692*	999999*	999999*	999999
SIGMASQ	=	3,975	7,085	9,845	12,670	19,029*	999999*	999999*	999999
SIGMA	=	1,994	2,662	3,138	3,559	4,362*	999999*	999999*	999999
MAX.	=	56,470	51,540	48,072	45,091	40,473*	999999*	999999*	999999
MIN.	=	47,897	40,726	35,151	31,304	19,247*	999999*	999999*	999999

LOCATOR (2) FIXED PERCENT OF PEAK RADIANCE

PROFILE	C =	.05	.10	.20	.30	.50	.70	.90
1	LM =	59.11	54.42	48.82	43.93	37.04	30.57	23.44
3	LM =	58.94	54.32	48.42	43.69	36.99	30.42	23.58
5	LM =	58.94	54.50	49.41	44.68	39.11	32.61	25.26
7	LM =	58.94	54.62	49.44	44.61	38.80	32.29	24.87
9	LM =	58.62	54.40	49.43	45.48	39.91	34.52	28.41
10	LM =	59.00	54.48	49.11	44.24	37.33	30.76	23.92
12	LM =	58.94	54.62	49.12	44.43	38.26	31.87	24.59
14	LM =	58.82	54.53	49.27	45.22	39.12	34.07	27.24
16	LM =	58.62	54.33	49.58	45.84	39.59	35.29	29.80
17	LM =	59.00	54.64	49.00	44.50	38.26	31.67	23.76
19	LM =	59.11	54.87	49.50	45.24	39.53	33.77	26.00
21	LM =	58.94	54.62	49.46	45.71	39.85	34.09	28.13
23	LM =	58.71	54.41	49.35	45.79	39.34	34.24	29.15
24	LM =	59.16	54.52	48.70	43.81	36.91	30.69	23.87
26	LM =	59.11	54.50	48.50	43.85	37.08	30.67	23.40
28	LM =	59.00	54.46	48.57	44.00	37.45	30.91	23.23
30	LM =	59.00	54.59	48.81	44.28	38.19	31.55	23.69
32	LM =	59.16	54.83	49.26	44.87	39.27	33.27	25.11
34	LM =	59.16	54.87	49.32	45.00	39.71	34.25	26.05
36	LM =	59.22	54.86	49.50	45.67	40.35	35.17	27.53
38	LM =	59.26	54.93	49.69	46.13	40.50	35.47	28.62
40	LM =	59.16	54.93	49.63	46.16	40.14	34.98	29.10
42	LM =	59.00	54.67	49.52	46.16	39.97	34.88	29.39
44	LM =	58.94	54.55	49.44	46.03	39.82	34.93	29.52
46	LM =	58.82	54.43	49.28	45.91	39.68	34.89	29.48
48	LM =	59.26	54.97	49.50	45.53	39.79	34.37	25.47
50	LM =	59.37	55.00	49.76	46.03	40.67	36.24	28.39
52	LM =	59.16	54.83	49.71	46.03	40.63	35.71	29.75
53	LM =	59.11	54.74	49.12	44.36	37.95	31.61	23.45
55	LM =	59.30	55.03	49.53	45.00	39.51	34.35	25.72
113	LM =	58.59	54.08	48.84	44.81	38.97	33.47	26.00
115	LM =	58.89	54.67	49.32	45.37	39.41	34.14	26.88
117	LM =	58.59	53.81	48.40	44.58	39.20	33.86	26.57
119	LM =	59.20	54.75	48.91	45.32	39.85	33.94	27.25
121	LM =	59.11	54.21	48.30	44.38	38.82	34.19	26.87
122	LM =	59.11	54.93	49.44	45.70	39.79	34.41	27.89
124	LM =	59.20	54.88	48.96	45.43	39.74	33.59	26.57
126	LM =	59.30	54.60	48.68	45.00	38.74	33.69	27.36
128	LM =	59.30	54.53	48.65	44.32	38.44	34.00	27.74
129	LM =	59.05	54.69	49.08	45.50	39.66	33.78	26.48
131	LM =	59.00	54.42	48.78	45.23	39.30	33.97	26.91
133	LM =	59.00	54.10	49.05	45.07	38.34	34.82	27.80
135	LM =	58.94	54.00	49.10	44.64	38.31	34.33	27.82
136	LM =	58.71	54.41	49.21	45.17	38.62	33.63	26.33
138	LM =	58.78	54.55	49.21	45.29	38.89	33.87	26.33
140	LM =	58.89	54.59	49.20	45.44	39.16	33.81	26.33
142	LM =	58.89	54.48	49.08	45.33	39.19	33.58	26.17
144	LM =	58.71	54.08	48.60	44.85	38.97	33.30	26.21
146	LM =	58.47	53.81	48.38	44.73	38.65	33.59	26.44
148	LM =	58.37	53.55	48.24	44.67	38.33	34.11	27.00
150	LM =	58.25	53.40	48.10	44.52	37.98	33.93	27.05
152	LM =	58.27	53.42	48.15	44.39	37.78	32.76	26.48
154	LM =	58.71	53.82	48.74	44.58	38.16	32.80	27.16

LOCATOR (2) FIXED PERCENT OF PEAK RADIANCE - Continued

156		LM =	58.82	53.94	48.94	44.50	38.25	32.71	27.32
158		LM =	58.94	54.18	49.10	44.46	38.32	32.67	27.31
160		LM =	58.37	53.76	48.53	44.56	38.64	33.39	26.39
162		LM =	57.88	53.16	47.50	43.82	38.12	33.43	26.96
164		LM =	57.88	53.13	47.90	43.84	37.55	32.44	27.00
165		LM =	58.89	54.48	49.29	45.40	38.76	33.64	26.16
167		LM =	58.25	53.67	48.58	44.52	38.35	33.42	26.29
169		LM =	57.37	52.86	46.38	41.32	34.37	29.38	23.94
171		LM =	57.37	53.03	46.54	42.12	34.59	29.68	23.00
173		LM =	59.40	55.00	48.00	43.23	37.36	31.81	25.10
175		LM =	59.26	54.78	47.90	43.69	37.30	31.20	24.89
177		LM =	59.64	55.57	49.25	44.54	37.85	33.00	27.14
178		LM =	57.50	53.03	46.46	42.17	34.72	29.40	22.32
180		LM =	58.82	54.00	47.32	43.56	36.08	30.18	23.65
182		LM =	59.40	55.08	49.05	44.90	38.48	32.86	26.71
184		LM =	59.50	55.31	49.46	45.59	38.73	33.94	27.88
185		LM =	58.25	53.42	46.96	43.04	35.55	29.53	22.73
187		LM =	59.26	54.75	48.20	44.34	37.63	31.66	24.33
189		LM =	58.89	54.18	48.92	45.19	38.97	32.92	27.08
191		LM =	59.26	54.89	49.31	45.86	40.22	34.16	27.65
192		LM =	56.67	52.83	46.09	41.25	34.10	28.98	21.38
194		LM =	57.07	52.79	46.10	41.45	34.19	28.69	21.29
196		LM =	57.20	52.65	46.24	41.75	34.40	28.46	21.90
198		LM =	57.63	52.80	46.52	42.18	34.90	28.97	21.61
200		LM =	58.50	53.71	47.64	43.42	36.34	30.21	22.77
202		LM =	58.62	53.92	47.81	43.89	37.13	30.94	23.55
204		LM =	58.82	54.17	48.68	44.86	38.32	32.31	25.45
206		LM =	58.62	54.08	49.04	45.32	39.08	32.91	26.76
208		LM =	58.71	54.30	49.26	45.79	40.00	33.84	27.90
210		LM =	58.89	54.62	49.56	46.13	40.63	34.89	28.13
212		LM =	59.50	55.35	50.05	46.34	40.81	35.63	28.81
214		LM =	59.62	55.53	50.19	46.34	40.63	36.09	28.96
216		LM =	57.88	53.00	47.33	42.80	35.91	29.73	21.12
218		LM =	58.37	53.41	48.34	44.60	38.32	32.53	25.85
220		LM =	58.50	54.00	49.38	46.30	40.10	34.63	27.95
221		LM =	57.07	52.56	46.15	41.50	34.39	28.13	20.59
223		LM =	57.65	52.87	47.50	42.84	36.14	30.70	22.45
337		LM =	57.47	52.71	45.87	40.76	34.24	29.16	22.43
339		LM =	57.33	52.38	45.76	40.86	34.53	29.21	21.74
341		LM =	58.00	53.27	47.06	41.29	34.79	30.08	23.48
343		LM =	57.20	52.38	46.12	40.30	33.92	28.91	22.67
345		LM =	58.75	54.15	49.12	44.71	37.79	32.75	27.00
346		LM =	56.71	51.63	45.11	40.50	33.90	28.14	21.15
348		LM =	56.91	51.38	44.60	39.24	33.15	28.62	22.36
350		LM =	57.76	53.03	47.88	42.96	36.10	31.51	25.13
352		LM =	59.06	54.59	49.57	45.91	38.85	33.30	27.61
353		LM =	56.00	50.80	44.11	39.29	32.64	27.84	21.20
355		LM =	56.62	51.64	45.36	40.46	33.63	29.08	23.00
357		LM =	57.88	53.13	48.00	43.97	37.32	31.70	25.77
359		LM =	58.62	54.00	49.07	45.46	38.62	32.38	27.19
360		LM =	56.50	51.38	45.00	40.68	33.80	27.26	19.04
362		LM =	56.71	51.56	45.92	40.93	34.08	27.98	20.13
364		LM =	56.17	51.08	44.71	40.18	33.14	27.00	20.00
366		LM =	55.87	50.72	44.35	39.57	32.44	27.02	20.04
368		LM =	56.17	51.15	44.28	39.45	32.58	27.60	20.88
370		LM =	56.71	51.70	45.21	40.37	33.66	28.71	22.08
372		LM =	57.33	52.38	46.95	42.32	35.69	30.44	23.74
374		LM =	57.87	53.10	47.73	43.77	37.46	31.88	25.77
376		LM =	58.40	53.70	48.54	44.90	37.79	32.91	26.87
378		LM =	58.94	54.44	49.32	45.64	37.94	32.72	27.27
380		LM =	59.37	55.07	49.93	46.40	39.14	33.83	27.75
382		LM =	59.50	55.27	50.13	46.54	39.17	33.83	27.78
384		LM =	56.46	51.31	44.70	39.90	32.29	27.29	20.57
386		LM =	57.63	52.86	46.96	43.15	36.21	30.54	23.45
388		LM =	58.82	54.16	48.90	45.34	39.32	33.66	27.43
389		LM =	56.33	51.26	45.32	41.04	33.87	26.78	19.30
391		LM =	56.62	51.63	45.37	40.80	33.41	27.31	20.20
	MEAN	=	58.415	53.833	48.163	44.005	37.590	32.133	25.336
	SIGMASQ	=	.888	1.312	2.350	3.581	5.048	5.715	7.029
	SIGMA	=	.942	1.145	1.533	1.892	2.247	2.391	2.651
	MAX.	=	59.636	55.571	50.190	46.542	40.806	36.238	29.750
	MIN.	=	55.867	50.720	44.111	39.240	32.286	26.781	19.042

LOCATOR (3) FIXED VALUE OF INTEGRATED RADIANCE

PROFILE									
	C =	1.00	10.00	20.00	40.00	60.00	80.00	120.00	160.00
1	LM =	61.61	47.30	41.27	33.93	28.68	24.41	16.97	9.88
3	LM =	61.70	47.36	41.31	33.95	28.78	24.59	17.31	10.40
5	LM =	61.56	47.28	41.50	34.61	29.53	25.27	17.66	10.39
7	LM =	61.54	47.35	41.50	34.47	29.36	25.07	17.48	10.23
9	LM =	61.65	47.28	41.79	35.11	30.41	26.37	18.99	11.71
10	LM =	61.75	47.75	41.92	34.77	29.65	25.45	18.20	11.46
12	LM =	61.73	47.55	41.71	34.74	29.68	25.48	18.11	11.14
14	LM =	61.74	47.27	41.67	34.87	30.05	25.98	18.43	11.14
16	LM =	61.76	47.57	42.24	35.67	31.20	27.33	20.20	13.17
17	LM =	61.99	47.86	42.10	35.25	30.28	26.11	18.99	12.19
19	LM =	61.92	47.75	42.14	35.47	30.60	26.44	19.01	11.97
21	LM =	61.73	47.45	42.02	35.32	30.47	26.42	19.05	11.82
23	LM =	61.81	47.52	42.18	35.46	30.81	26.94	19.85	12.79
24	LM =	61.96	47.87	41.84	34.63	29.54	25.46	18.40	11.75
26	LM =	61.99	47.80	41.83	34.70	29.64	25.51	18.40	11.77
28	LM =	61.98	47.82	41.94	34.94	29.95	25.81	18.68	12.08
30	LM =	62.07	47.95	42.18	35.39	30.48	26.36	19.24	12.67
32	LM =	62.13	48.05	42.41	35.82	31.03	26.93	19.74	13.05
34	LM =	62.14	47.96	42.35	35.87	31.16	27.09	19.85	13.05
36	LM =	62.09	47.92	42.51	36.15	31.52	27.50	20.28	13.38
38	LM =	62.05	47.96	42.64	36.25	31.66	27.69	20.53	13.56
40	LM =	62.02	47.98	42.71	36.18	31.99	27.73	20.72	13.80
42	LM =	61.99	47.75	42.51	35.92	31.34	27.46	20.38	13.34
44	LM =	61.99	47.61	42.35	35.74	31.20	27.32	20.19	13.08
46	LM =	62.02	47.49	42.23	35.60	31.07	27.19	20.04	12.90
48	LM =	62.24	48.36	42.93	36.49	31.85	27.79	20.49	14.12
50	LM =	62.18	48.19	42.84	36.60	32.15	28.22	21.09	14.28
52	LM =	62.15	48.07	42.81	36.47	32.03	28.22	21.28	14.46
53	LM =	62.03	48.11	42.32	35.43	30.54	26.40	19.25	12.69
55	LM =	62.24	48.40	42.78	36.30	31.69	27.64	20.45	14.00
113	LM =	61.61	47.85	42.49	36.05	31.47	27.60	20.40	14.47
115	LM =	61.89	48.27	42.93	36.49	31.93	28.09	21.34	14.97
117	LM =	61.36	47.12	41.67	35.28	30.63	26.66	19.58	12.81
119	LM =	61.81	47.72	42.34	35.89	31.17	27.20	20.15	13.37
121	LM =	61.40	46.78	41.00	34.40	29.63	25.59	19.04	10.72
122	LM =	62.05	48.41	43.10	36.69	32.14	28.34	21.64	15.21
124	LM =	62.06	48.17	42.84	36.45	31.75	27.85	21.01	14.59
126	LM =	61.65	47.25	41.69	34.89	30.11	26.07	18.91	11.68
128	LM =	61.27	46.79	40.77	33.97	29.12	25.01	17.41	9.83
129	LM =	62.01	48.22	42.94	36.56	31.92	28.06	21.24	14.88
131	LM =	61.75	47.61	42.29	35.77	31.12	27.18	20.18	13.90
133	LM =	61.23	47.12	41.54	34.74	30.09	26.04	18.70	11.46
135	LM =	60.94	46.87	41.00	34.20	29.40	25.32	17.82	10.37
136	LM =	61.92	48.39	43.12	36.60	32.08	28.33	21.76	15.67
138	LM =	61.97	48.39	43.12	36.63	32.13	28.35	21.72	15.56
140	LM =	61.98	48.34	43.07	36.62	32.05	28.23	21.53	15.29
142	LM =	61.91	48.13	42.85	36.40	31.78	27.91	21.12	14.78
144	LM =	61.68	47.68	42.32	35.87	31.23	27.34	20.48	14.02
146	LM =	61.43	47.26	41.90	35.41	30.79	26.88	19.92	13.32
148	LM =	61.16	46.73	41.31	34.72	30.08	26.19	18.93	11.98
150	LM =	60.80	46.25	40.72	34.00	29.26	25.18	17.76	10.42
152	LM =	60.56	46.04	40.31	33.39	28.48	24.32	16.67	9.10
154	LM =	60.52	46.23	40.30	33.33	28.30	24.07	16.20	8.38

LOCATOR (3) FIXED VALUE OF INTEGRATED RADIANCE - Continued

156	LM =	60,49	46,30	40,27	33,27	28,22	23,98	16,06	8,18
158	LM =	60,60	46,49	40,42	33,43	28,37	24,14	16,28	8,47
160	LM =	61,35	47,33	41,91	35,42	30,80	26,91	19,98	13,42
162	LM =	60,84	46,13	40,57	34,02	29,38	25,42	18,20	11,13
164	LM =	60,29	45,50	39,71	32,79	27,91	23,77	16,04	8,33
165	LM =	61,85	48,21	42,91	36,31	31,70	27,83	21,03	14,70
167	LM =	61,26	47,29	41,84	35,28	30,68	26,77	19,83	13,25
169	LM =	59,97	45,18	38,93	31,47	26,41	22,30	14,84	7,55
171	LM =	59,58	44,72	38,47	30,78	25,50	21,04	12,86	5,02
173	LM =	61,17	46,44	40,03	32,74	27,60	23,24	15,24	7,47
175	LM =	60,83	45,92	39,65	32,10	26,73	22,22	13,90	5,70
177	LM =	61,44	47,43	41,30	34,06	29,09	24,90	17,20	9,62
178	LM =	59,41	44,36	38,01	30,24	24,76	20,11	11,45	3,32
180	LM =	60,31	45,36	39,14	31,35	25,87	21,30	12,93	4,66
182	LM =	61,08	46,84	40,95	33,75	28,61	24,29	16,96	8,54
184	LM =	61,27	47,49	41,91	34,88	29,96	25,83	18,32	10,87
185	LM =	59,77	44,73	38,44	30,60	25,00	20,30	11,72	3,27
187	LM =	60,83	46,00	39,99	32,50	27,09	22,49	14,15	5,94
189	LM =	60,87	46,66	41,13	34,15	29,10	24,89	17,19	9,57
191	LM =	61,35	47,38	42,02	35,31	30,40	26,25	18,81	11,47
192	LM =	58,62	43,60	37,01	29,14	23,51	18,70	9,89	1,17
194	LM =	58,84	43,63	37,06	29,15	23,49	18,67	9,85	1,13
196	LM =	59,01	43,73	37,27	29,37	23,69	18,90	10,15	1,52
198	LM =	59,34	44,05	37,67	29,86	24,22	19,45	10,76	2,20
200	LM =	59,96	45,13	38,94	31,29	25,70	20,97	12,46	4,09
202	LM =	60,53	45,61	39,63	32,16	26,76	22,18	13,92	5,85
204	LM =	60,70	46,38	40,70	33,55	28,35	23,96	16,03	8,29
206	LM =	60,75	46,74	41,29	34,37	29,32	25,10	17,48	9,98
208	LM =	60,96	47,10	41,83	35,16	30,23	26,10	18,88	11,36
210	LM =	61,11	47,39	42,16	35,63	30,82	26,71	19,30	11,98
212	LM =	61,59	48,05	42,72	36,23	31,37	27,54	20,26	13,08
214	LM =	61,68	48,26	42,87	36,44	31,65	27,86	20,64	13,54
216	LM =	59,79	44,98	38,87	31,36	25,91	21,25	12,41	4,74
218	LM =	60,61	46,12	40,57	33,62	28,58	24,32	16,56	9,02
220	LM =	60,86	47,14	41,96	35,45	30,66	26,57	19,20	11,94
221	LM =	58,80	43,51	36,95	29,05	23,28	18,38	9,45	.65
223	LM =	59,48	44,53	38,33	30,82	25,32	20,58	11,95	3,49
337	LM =	60,32	44,15	37,39	29,68	24,37	19,85	11,55	3,33
339	LM =	59,78	42,78	35,97	28,12	22,33	17,31	7,45	-1,58
341	LM =	60,89	45,22	38,47	30,79	25,63	21,25	13,25	5,36
343	LM =	60,50	44,14	37,28	29,53	24,29	19,83	11,62	3,50
345	LM =	61,13	46,37	40,41	32,99	27,89	23,59	15,44	7,36
346	LM =	59,71	41,95	35,18	27,12	21,22	16,12	6,42	-3,25
348	LM =	60,29	42,94	35,99	28,38	23,18	18,79	10,10	1,97
350	LM =	60,70	45,03	38,79	31,30	26,11	21,63	13,26	5,00
352	LM =	61,37	47,09	41,47	34,27	29,24	25,03	17,27	9,58
353	LM =	60,05	41,96	35,07	27,25	21,78	17,05	8,11	-.76
355	LM =	60,13	42,93	36,12	28,35	23,00	18,37	9,56	.76
357	LM =	60,93	45,35	39,51	32,17	26,99	22,58	14,37	6,25
359	LM =	61,34	46,76	41,22	34,20	29,09	24,92	17,29	9,74
360	LM =	58,24	39,94	32,85	23,96	17,06	10,91	-1,12	-13,11
362	LM =	58,61	40,50	33,53	24,84	18,18	12,27	.71	-10,82
364	LM =	59,15	40,95	34,05	25,62	19,44	14,05	3,69	-6,63
366	LM =	59,58	41,53	34,60	26,46	20,69	15,72	6,29	-3,06
368	LM =	60,06	42,27	35,38	27,44	21,91	17,18	8,29	-.53
370	LM =	60,10	42,91	36,12	28,31	22,87	18,17	9,45	.58
372	LM =	60,51	44,13	37,86	30,30	24,96	20,35	11,77	3,28
374	LM =	61,04	45,21	39,37	32,14	26,99	22,57	14,36	6,24
376	LM =	61,38	46,20	40,61	33,46	28,43	24,17	16,29	8,53
378	LM =	61,41	46,96	41,41	34,05	28,97	24,77	17,07	9,44
380	LM =	61,69	47,78	42,30	35,24	30,28	26,14	18,70	11,33
382	LM =	61,70	47,93	42,42	35,32	30,34	26,20	18,76	11,37
384	LM =	59,83	42,47	35,60	27,44	21,87	17,11	8,21	-.61
386	LM =	60,75	44,57	38,53	30,97	25,61	21,02	12,57	4,25
388	LM =	61,62	46,61	41,12	34,20	29,19	24,97	17,16	9,42
389	LM =	58,50	40,59	33,64	24,78	18,13	12,29	.97	-10,30
391	LM =	59,44	42,29	35,55	27,24	21,33	16,27	6,81	-2,60
MEAN	=	61,005	46,212	40,345	33,246	28,187	23,895	16,088	8,477
SIGMASQ	=	.959	4,158	6,395	9,373	12,428	15,467	23,633	34,626
SIGMA	=	.979	2,039	2,529	3,064	3,525	3,933	4,861	5,884
MAX.	=	62,238	48,406	43,120	36,695	32,150	28,353	21,759	15,666
MIN.	=	58,244	39,938	32,849	23,960	17,096	10,912	-1,123	-13,110

LOCATOR (4) FIXED PERCENT OF NORMALIZED INTEGRATED RADIANCE

PROFILE								
	C =	.10	1.00	5.00	10.00	20.00	30.00	50.00
1	LM =	64.33	51.37	37.86	29.50	18.22	8.19	-12.05
3	LM =	64.31	51.27	37.54	29.23	17.99	7.94	-12.26
5	LM =	64.46	51.40	38.55	30.66	19.45	9.41	-10.81
7	LM =	64.43	51.45	38.45	30.49	19.24	9.20	-11.09
9	LM =	64.60	51.32	38.85	31.47	20.76	10.72	-9.71
10	LM =	64.18	51.34	37.99	29.74	18.35	8.31	-11.42
12	LM =	64.39	51.41	38.28	30.26	19.01	8.97	-11.32
14	LM =	64.65	51.41	38.72	31.17	20.26	10.22	-10.14
16	LM =	64.49	51.29	38.99	31.76	21.20	11.14	-9.38
17	LM =	64.36	51.43	38.28	30.27	18.88	8.83	-11.41
19	LM =	64.52	51.61	38.91	31.27	20.07	10.03	-10.96
21	LM =	64.57	51.46	39.08	31.47	20.68	10.64	-9.76
23	LM =	64.53	51.30	38.92	31.40	20.84	10.75	-9.88
24	LM =	64.23	51.42	37.69	29.42	18.22	8.19	-11.99
26	LM =	64.29	51.36	37.71	29.50	18.19	8.16	-11.97
28	LM =	64.28	51.31	37.82	29.70	18.31	8.27	-11.84
30	LM =	64.32	51.39	38.14	30.18	18.77	8.73	-11.40
32	LM =	64.41	51.59	38.70	31.01	19.71	9.66	-10.72
34	LM =	64.52	51.62	38.86	31.36	20.17	10.13	-10.17
36	LM =	64.52	51.62	39.22	31.89	20.88	10.83	-9.42
38	LM =	64.56	51.69	39.44	32.16	21.36	11.31	-9.17
40	LM =	64.51	51.64	39.36	31.95	21.33	11.25	-9.38
42	LM =	64.58	51.50	39.28	31.88	21.30	11.20	-9.42
44	LM =	64.68	51.44	39.18	31.84	21.28	11.17	-9.46
46	LM =	64.72	51.37	39.08	31.75	21.20	11.09	-9.53
48	LM =	64.38	51.68	39.09	31.53	20.20	10.14	-10.18
50	LM =	64.50	51.76	39.50	32.38	21.47	11.43	-8.99
52	LM =	64.55	51.63	39.46	32.24	21.64	11.57	-8.99
53	LM =	64.26	51.49	38.19	30.23	18.78	8.73	-11.43
55	LM =	64.35	51.70	38.86	31.33	19.99	9.94	-10.33
113	LM =	63.81	50.95	38.37	30.76	19.69	9.66	-10.64
115	LM =	64.01	51.36	38.83	31.28	20.30	10.25	-10.10
117	LM =	64.01	50.81	38.22	30.80	19.85	9.82	-10.54
119	LM =	64.20	51.43	38.88	31.31	20.38	10.34	-9.92
121	LM =	64.30	51.21	38.10	30.77	19.90	9.86	-10.47
122	LM =	64.12	51.54	39.08	31.56	20.69	10.63	-9.74
124	LM =	64.16	51.49	38.91	31.23	20.19	10.15	-10.26
126	LM =	64.29	51.43	38.51	30.90	20.09	10.05	-10.31
128	LM =	64.28	51.42	38.02	30.66	19.96	9.90	-10.44
129	LM =	64.08	51.39	38.89	31.25	20.18	10.14	-10.19
131	LM =	64.17	51.22	38.69	31.11	20.17	10.15	-10.18
133	LM =	64.07	51.18	38.38	31.03	20.24	10.17	-10.27
135	LM =	64.02	51.14	38.07	30.72	20.01	9.95	-10.41
136	LM =	63.83	51.14	38.53	30.86	19.84	9.81	-10.51
138	LM =	63.90	51.23	38.64	31.02	19.97	9.94	-10.39
140	LM =	63.95	51.29	38.75	31.11	20.04	10.00	-10.30
142	LM =	63.98	51.23	38.70	31.02	19.93	9.89	-10.39
144	LM =	63.95	50.97	38.38	30.74	19.70	9.66	-10.40
146	LM =	63.95	50.75	38.15	30.64	19.67	9.64	-10.61
148	LM =	64.02	50.59	37.96	30.60	19.77	9.75	-10.54
150	LM =	64.06	50.46	37.75	30.39	19.63	9.58	-10.76
152	LM =	64.02	50.53	37.61	30.09	19.34	9.33	-10.86
154	LM =	64.07	50.93	37.69	30.34	19.59	9.58	-10.60

LOCATOR (4) FIXED PERCENT OF NORMALIZED INTEGRATED RADIANCE - Continued

156	LM =	64,04	51,05	37,94	30,38	19,66	9,65	-10,49
158	LM =	64,03	51,18	38,00	30,42	19,70	9,69	-10,48
160	LM =	63,86	50,70	38,10	30,56	19,60	9,56	-10,78
162	LM =	64,01	50,18	37,42	30,08	19,36	9,33	-10,99
164	LM =	64,06	50,18	37,20	29,69	19,05	9,00	-11,25
165	LM =	63,91	51,27	38,67	30,97	19,89	9,89	-10,47
167	LM =	63,81	50,65	37,99	30,47	19,50	9,46	-10,90
169	LM =	63,65	49,70	35,72	27,58	16,70	6,68	-13,48
171	LM =	63,66	49,86	36,06	27,88	16,77	6,75	-13,33
173	LM =	64,36	51,59	37,52	29,64	18,56	8,52	-11,64
175	LM =	64,39	51,48	37,65	29,55	18,46	8,43	-11,74
177	LM =	64,32	52,01	38,46	30,67	19,80	9,74	-10,65
178	LM =	63,73	49,92	36,10	27,88	16,64	6,61	-13,45
180	LM =	64,23	50,98	37,17	28,85	17,69	7,66	-12,46
182	LM =	64,27	51,69	38,58	30,71	19,79	9,77	-10,48
184	LM =	64,10	51,79	39,12	31,31	20,31	10,44	-10,01
185	LM =	64,04	50,46	36,69	28,39	17,09	7,07	-12,97
187	LM =	64,42	51,45	38,00	29,95	18,72	8,69	-11,48
189	LM =	64,12	51,14	38,59	30,80	19,95	9,92	-10,40
191	LM =	64,20	51,55	39,24	31,57	20,70	10,64	-9,78
192	LM =	63,40	49,57	35,49	27,34	16,03	6,01	-14,02
194	LM =	63,55	49,64	35,57	27,35	16,00	5,98	-14,03
196	LM =	63,59	49,62	35,69	27,42	16,07	6,04	-13,97
198	LM =	63,79	49,85	36,03	27,81	16,46	6,43	-13,58
200	LM =	64,12	50,67	37,11	28,94	17,55	7,52	-12,58
202	LM =	64,26	50,89	37,50	29,41	18,11	8,08	-12,06
204	LM =	64,12	51,04	38,26	30,36	19,23	9,20	-11,02
206	LM =	63,99	51,01	38,63	30,82	19,90	9,87	-10,48
208	LM =	63,99	51,12	39,00	31,35	20,47	10,40	-10,09
210	LM =	64,06	51,35	39,37	31,89	21,03	10,94	-9,59
212	LM =	64,17	51,69	39,73	32,37	21,59	11,50	-9,04
214	LM =	64,15	51,99	39,74	32,52	21,74	11,65	-8,89
216	LM =	63,79	50,02	36,60	28,45	16,88	6,65	-13,45
218	LM =	64,03	50,51	37,94	30,20	19,19	9,19	-11,01
220	LM =	63,89	50,94	39,07	31,64	20,80	10,72	-9,78
221	LM =	63,50	49,52	35,54	27,29	15,80	5,71	-14,35
223	LM =	63,85	49,94	36,66	28,69	17,37	7,33	-12,68
337	LM =	64,83	49,88	35,25	27,21	16,16	6,14	-13,96
339	LM =	65,79	49,79	35,33	27,34	16,11	6,09	-13,96
341	LM =	64,76	50,42	35,87	27,87	16,90	6,89	-13,15
343	LM =	64,96	49,69	35,02	26,94	15,98	5,97	-14,05
345	LM =	64,75	51,23	38,25	30,37	19,59	9,55	-10,66
346	LM =	66,44	49,31	34,82	26,67	15,44	5,42	-14,59
348	LM =	65,56	48,94	34,02	26,14	15,27	5,24	-14,78
350	LM =	64,96	50,26	36,84	28,97	18,07	8,04	-12,06
352	LM =	64,55	51,48	38,89	31,04	20,24	10,20	-10,09
353	LM =	66,34	48,63	33,72	25,68	14,65	4,57	-15,49
355	LM =	65,80	49,25	34,71	26,74	15,91	5,89	-14,17
357	LM =	65,00	50,37	37,46	29,59	18,70	8,67	-11,48
359	LM =	64,56	51,08	38,54	30,68	19,86	9,83	-10,47
360	LM =	66,80	49,17	34,79	26,54	14,86	4,72	-15,38
362	LM =	66,80	49,33	35,06	26,84	15,33	5,26	-14,77
364	LM =	66,55	48,87	34,35	25,99	14,62	4,53	-15,53
366	LM =	66,18	48,53	33,78	25,48	14,25	4,13	-15,97
368	LM =	66,07	48,84	33,92	25,73	14,61	4,50	-15,61
370	LM =	65,73	49,25	34,69	26,62	15,61	5,56	-14,48
372	LM =	65,45	49,79	36,19	28,26	17,25	7,23	-12,86
374	LM =	65,26	50,35	37,35	29,59	18,69	8,67	-11,41
376	LM =	64,89	50,87	38,15	30,40	19,56	9,54	-10,68
378	LM =	64,61	51,40	38,77	30,71	19,91	9,89	-10,39
380	LM =	64,44	51,79	39,33	31,48	20,63	10,57	-9,91
382	LM =	64,41	51,91	39,41	31,54	20,69	10,59	-9,98
384	LM =	65,56	48,92	34,12	25,73	14,55	4,46	-15,63
386	LM =	65,36	50,10	36,70	28,66	17,56	7,53	-12,55
388	LM =	64,93	51,28	38,76	31,09	20,32	10,30	-9,96
389	LM =	66,50	49,01	34,91	26,46	14,82	4,70	-15,37
391	LM =	65,46	49,14	34,85	26,37	14,99	4,92	-15,13
MEAN	=	64,479	50,811	37,661	29,860	18,836	8,789	-11,467
SIGMASQ	=	,504	,759	2,408	3,242	3,801	3,809	3,287
SIGMA	=	,710	,871	1,552	1,801	1,950	1,952	1,813
MAX.	=	66,803	52,007	39,745	32,517	21,741	11,654	-8,885
MIN.	=	63,398	48,535	33,721	25,481	14,248	4,129	-15,971

LOCATOR (5) FIXED VALUE OF PROFILE SLOPE

PROFILE					
	C =	=.01	=.05	=.10	=.15
1	LH =	68.85	58.50	52.92	44.72
3	LH =	68.93	58.57	52.87	44.43
5	LH =	68.75	58.29	53.33	45.24
7	LH =	68.75	58.38	53.33	44.63
9	LH =	68.64	58.00	53.65	47.07
10	LH =	68.93	58.82	53.30	44.13
12	LH =	68.85	58.55	53.33	44.91
14	LH =	68.75	58.20	52.62	45.90
16	LH =	68.75	58.19	54.07	47.75
17	LH =	68.93	58.87	53.47	45.93
19	LH =	68.93	58.70	53.38	45.46
21	LH =	68.75	58.36	53.06	47.60
23	LH =	68.75	58.29	53.33	48.75
24	LH =	69.29	59.00	53.29	45.38
26	LH =	69.29	58.96	53.08	45.50
28	LH =	69.00	58.87	53.26	45.60
30	LH =	69.29	58.96	53.47	45.73
32	LH =	69.29	59.00	53.67	46.30
34	LH =	69.29	58.87	53.67	46.73
36	LH =	69.29	58.87	53.26	47.76
38	LH =	69.23	58.88	53.40	48.91
40	LH =	69.23	58.96	53.26	49.13
42	LH =	69.17	58.55	53.37	49.12
44	LH =	68.75	58.38	53.33	48.56
46	LH =	68.75	58.29	53.00	48.33
48	LH =	69.33	59.17	54.10	47.62
50	LH =	69.29	59.00	53.64	48.36
52	LH =	69.23	58.83	53.90	48.25
53	LH =	69.29	59.08	53.68	45.73
55	LH =	69.33	59.23	54.00	46.58
113	LH =	69.23	58.75	53.73	47.46
115	LH =	69.29	59.08	54.45	48.33
117	LH =	68.75	58.45	52.38	47.09
119	LH =	69.29	59.04	51.88	47.93
121	LH =	68.85	58.55	50.25	44.85
122	LH =	69.64	59.21	54.11	49.19
124	LH =	69.33	59.29	52.14	48.89
126	LH =	68.93	58.87	50.95	47.53
128	LH =	68.85	58.64	50.53	41.70
129	LH =	69.33	59.19	53.00	49.18
131	LH =	69.23	58.83	52.00	48.31
133	LH =	68.85	58.55	52.48	46.50
135	LH =	68.75	58.30	52.56	41.51
136	LH =	69.64	59.08	54.58	49.29
138	LH =	69.64	59.15	54.29	49.43
140	LH =	69.64	59.19	53.79	49.44
142	LH =	69.29	59.08	53.30	49.17
144	LH =	69.23	58.83	52.76	47.76
146	LH =	68.85	58.45	52.45	47.62
148	LH =	68.64	58.00	51.73	47.45
150	LH =	68.50	56.86	51.20	47.05
152	LH =	68.50	56.33	50.92	41.10
154	LH =	68.50	57.20	51.64	41.25

LOCATOR (5) FIXED VALUE OF PROFILE SLOPE - Continued

156	LM =	68.64	57.33	52.07	41.33	
158	LM =	68.64	58.00	52.20	41.44	
160	LM =	69.09	58.38	53.04	47.13	
162	LM =	68.33	57.00	50.75	45.87	
164	LM =	67.78	56.00	48.40	45.00	
165	LM =	69.33	59.11	53.62	49.29	
167	LM =	68.75	58.20	53.29	46.80	
169	LM =	67.78	56.57	47.44	41.04	
171	LM =	67.50	56.00	47.00	40.19	
173	LM =	68.85	58.64	48.56	41.55	
175	LM =	68.33	58.20	47.39	41.36	
177	LM =	69.00	59.08	47.61	44.23	
178	LM =	66.87	55.58	46.61	35.36	
180	LM =	68.18	56.40	47.19	35.05	
182	LM =	68.85	58.57	49.62	44.24	
184	LM =	68.93	58.96	51.17	47.07	
185	LM =	67.78	55.57	46.80	35.42	
187	LM =	68.33	58.10	45.69	41.00	
189	LM =	68.64	58.19	51.22	47.00	
191	LM =	68.85	58.70	51.53	48.53	
192	LM =	65.83	55.58	46.19	35.35	
194	LM =	66.43	55.33	46.08	35.30	
196	LM =	66.43	55.00	46.05	35.36	
198	LM =	66.87	54.94	46.00	35.61	
200	LM =	67.78	56.00	47.67	35.96	
202	LM =	68.18	57.00	49.22	41.29	
204	LM =	68.64	58.00	50.12	44.17	
206	LM =	68.64	58.00	51.76	47.25	
208	LM =	68.75	58.19	52.50	48.83	
210	LM =	68.75	58.45	53.00	48.77	
212	LM =	69.29	59.08	53.60	48.00	
214	LM =	69.33	59.26	53.76	47.81	
216	LM =	67.78	55.43	47.83	35.60	
218	LM =	68.50	56.50	50.62	49.00	
220	LM =	68.64	58.00	52.87	49.70	
221	LM =	66.43	54.95	45.00	35.46	
223	LM =	66.87	55.00	44.79	38.00	
337	LM =	66.87	55.20	42.56	36.57	
339	LM =	65.00	53.64	41.64	35.54	
341	LM =	67.78	56.00	41.91	38.24	
343	LM =	66.43	54.86	41.12	37.60	
345	LM =	68.18	57.27	51.14	42.27	
346	LM =	64.17	52.40	41.48	34.68	
348	LM =	65.00	53.50	41.12	35.93	
350	LM =	66.87	55.47	49.69	38.13	
352	LM =	68.75	58.10	52.40	48.50	
353	LM =	64.17	52.20	41.31	34.95	
355	LM =	65.00	53.38	42.83	35.46	
357	LM =	67.50	55.73	49.81	42.25	
359	LM =	68.50	57.67	51.89	48.60	
360	LM =	62.00	48.75	35.43*	999999	
362	LM =	62.50	49.67	40.57*	999999	
364	LM =	63.00	50.40	40.89*	999999	
366	LM =	64.00	51.60	40.00	34.14	
368	LM =	65.00	52.73	41.45	34.56	
370	LM =	65.00	53.50	42.12	35.80	
372	LM =	66.43	54.57	48.17	38.06	
374	LM =	67.50	55.60	49.44	42.75	
376	LM =	68.00	56.83	50.71	45.14	
378	LM =	68.64	58.10	52.11	47.09	
380	LM =	68.93	58.73	53.30	49.13	
382	LM =	69.29	58.87	53.43	49.18	
384	LM =	65.00	52.91	41.00	32.93	
386	LM =	66.87	55.14	47.58	35.63	
388	LM =	68.50	57.67	51.00	47.14	
389	LM =	62.00	50.00	38.00*	999999	
391	LM =	64.17	52.91	41.37	28.13	
MEAN	=	68.018	57.152	49.966*	999999	
SIGMASQ	=	2.912	5.493	19.451*	999999	
SIGMA	=	1.707	2.335	4.410*	999999	
MAX.	=	69.643	59.286	54.583*	999999	
MIN.	=	62.000	48.750	35.433*	999999	

LOCATOR (6) DERIVATIVE OF NORMALIZED PROFILE

PROFILE					
	C =	-.0060	-.0300	-.0600	-.0900
1	LM =	60.37	42.25*	999999*	999999
3	LM =	60.06	38.49*	999999*	999999
5	LM =	59.90	44.54*	999999*	999999
7	LM =	59.99	43.92*	999999*	999999
9	LM =	59.69	46.21*	999999*	999999
10	LM =	60.39	38.97*	999999*	999999
12	LM =	59.96	43.60*	999999*	999999
14	LM =	59.90	44.57*	999999*	999999
16	LM =	59.69	46.57*	999999*	999999
17	LM =	60.31	44.10*	999999*	999999
19	LM =	60.28	44.50*	999999*	999999
21	LM =	59.88	45.25*	999999*	999999
23	LM =	59.78	44.61*	999999*	999999
24	LM =	60.52	38.97*	999999*	999999
26	LM =	60.51	38.97*	999999*	999999
28	LM =	60.11	41.18*	999999*	999999
30	LM =	60.37	42.99*	999999*	999999
32	LM =	60.61	44.58*	999999*	999999
34	LM =	60.52	45.10*	999999*	999999
36	LM =	60.68	45.16*	999999*	999999
38	LM =	60.48	45.35*	999999*	999999
40	LM =	60.36	47.41*	999999*	999999
42	LM =	59.96	47.75*	999999*	999999
44	LM =	59.89	47.55*	999999*	999999
46	LM =	59.81	47.53*	999999*	999999
48	LM =	60.92	46.46*	999999*	999999
50	LM =	60.83	45.52*	999999*	999999
52	LM =	60.21	47.08*	999999*	999999
53	LM =	60.63	41.90*	999999*	999999
55	LM =	60.88	44.63*	999999*	999999
113	LM =	59.74	44.86*	999999*	999999
115	LM =	60.02	44.77*	999999*	999999
117	LM =	59.77	44.93*	999999*	999999
119	LM =	60.75	46.67*	999999*	999999
121	LM =	60.38	42.52*	999999*	999999
122	LM =	60.39	44.86*	999999*	999999
124	LM =	60.73	47.02*	999999*	999999
126	LM =	60.99	45.21*	999999*	999999
128	LM =	61.03	41.54*	999999*	999999
129	LM =	60.32	45.47*	999999*	999999
131	LM =	60.00	46.73*	999999*	999999
133	LM =	60.20	39.96	36.84*	999999
135	LM =	60.20	41.27*	999999*	999999
136	LM =	59.87	43.71*	999999*	999999
138	LM =	59.97	43.58*	999999*	999999
140	LM =	60.05	44.27*	999999*	999999
142	LM =	59.98	44.71*	999999*	999999
144	LM =	59.88	45.32*	999999*	999999
146	LM =	59.69	45.44*	999999*	999999
148	LM =	59.54	45.28*	999999*	999999
150	LM =	59.45	44.36*	999999*	999999
152	LM =	59.56	40.71*	999999*	999999

LOCATOR (6) DERIVATIVE OF NORMALIZED PROFILE - Continued

154	LM =	59,81	41,18*	999999*	999999
156	LM =	59,94	41,29*	999999*	999999
158	LM =	60,09	41,37*	999999*	999999
160	LM =	59,65	44,76*	999999*	999999
162	LM =	59,22	44,60*	999999*	999999
164	LM =	59,21	41,16*	999999*	999999
165	LM =	59,99	42,57*	999999*	999999
167	LM =	59,54	44,37*	999999*	999999
169	LM =	58,88	40,65*	999999*	999999
171	LM =	58,90	40,14*	999999*	999999
173	LM =	61,36	41,44*	999999*	999999
175	LM =	60,95	41,49*	999999*	999999
177	LM =	61,92	39,31*	999999*	999999
178	LM =	59,02	35,47*	999999*	999999
180	LM =	59,99	35,28*	999999*	999999
182	LM =	61,42	44,02*	999999*	999999
184	LM =	61,42	45,12*	999999*	999999
185	LM =	59,55	35,75*	999999*	999999
187	LM =	60,64	41,84*	999999*	999999
189	LM =	59,94	44,72*	999999*	999999
191	LM =	60,70	47,46*	999999*	999999
192	LM =	58,53	35,49*	999999*	999999
194	LM =	58,68	35,49*	999999*	999999
196	LM =	58,80	35,58*	999999*	999999
198	LM =	59,07	35,88*	999999*	999999
200	LM =	59,68	38,24*	999999*	999999
202	LM =	59,91	41,44*	999999*	999999
204	LM =	59,89	43,72*	999999*	999999
206	LM =	59,79	44,53*	999999*	999999
208	LM =	59,81	47,26*	999999*	999999
210	LM =	59,99	47,62*	999999*	999999
212	LM =	61,33	47,18*	999999*	999999
214	LM =	61,73	47,02*	999999*	999999
216	LM =	59,32	38,50*	999999*	999999
218	LM =	59,68	46,28*	999999*	999999
220	LM =	59,67	49,31*	999999*	999999
221	LM =	58,60	35,74*	999999*	999999
223	LM =	59,09	41,19*	999999*	999999
337	LM =	58,82	36,83*	999999*	999999
339	LM =	58,58	39,42*	999999*	999999
341	LM =	59,19	38,17*	999999*	999999
343	LM =	58,63	37,82*	999999*	999999
345	LM =	59,80	42,35*	999999*	999999
346	LM =	58,04	39,72*	999999*	999999
348	LM =	57,76	36,41*	999999*	999999
350	LM =	58,99	38,45*	999999*	999999
352	LM =	59,96	41,81*	999999*	999999
353	LM =	56,94	35,40*	999999*	999999
355	LM =	57,90	35,80*	999999*	999999
357	LM =	59,12	42,49*	999999*	999999
359	LM =	59,69	41,77*	999999*	999999
360	LM =	57,56	35,41*	999999*	999999
362	LM =	58,03	39,89*	999999*	999999
364	LM =	57,22	35,05*	999999*	999999
366	LM =	56,86	35,09*	999999*	999999
368	LM =	57,52	35,42*	999999*	999999
370	LM =	58,10	37,19*	999999*	999999
372	LM =	58,57	38,56*	999999*	999999
374	LM =	59,05	42,99*	999999*	999999
376	LM =	59,42	44,65*	999999*	999999
378	LM =	59,95	44,05*	999999*	999999
380	LM =	61,06	41,63*	999999*	999999
382	LM =	61,39	41,85*	999999*	999999
384	LM =	58,10	34,28*	999999*	999999
386	LM =	58,88	38,30*	999999*	999999
388	LM =	59,78	46,89*	999999*	999999
389	LM =	57,46	35,53*	999999*	999999
391	LM =	58,07	33,00*	999999*	999999
MEAN	=	59,718	42,099*	999999*	999999
SIGMASQ	=	1,009	15,421*	999999*	999999
SIGMA	=	1,004	3,927*	999999*	999999
MAX.	=	61,915	49,308*	999999*	999999
MIN.	=	56,861	32,999*	999999*	999999

LOCATOR (7) LINEAR EXTRAPOLATION TO ZERO RADIANCE

PROFILE						
	C1 =	.75	.50	.50	.50	1.00
	C2 =	1.50	1.50	2.00	2.50	2.00
1	LM =	59.82	60.47	59.80	59.44	58.59
3	LM =	59.86	60.52	59.95	59.63	58.52
5	LM =	59.34	59.89	59.30	58.87	58.01
7	LM =	59.50	60.02	59.50	59.09	58.27
9	LM =	58.63	59.33	58.84	58.61	57.13
10	LM =	59.46	60.42	60.03	59.70	58.67
12	LM =	59.69	60.25	59.71	59.31	58.28
14	LM =	58.67	59.61	59.15	58.84	57.02
16	LM =	58.39	59.27	58.85	58.69	57.09
17	LM =	59.80	60.56	59.99	59.61	58.30
19	LM =	59.29	60.13	59.68	59.28	57.82
21	LM =	58.42	59.56	59.12	58.81	56.87
23	LM =	58.21	59.38	59.01	58.79	56.71
24	LM =	60.20	61.12	60.49	60.13	59.18
26	LM =	60.05	60.96	60.33	59.97	58.80
28	LM =	59.99	60.76	60.16	59.80	58.61
30	LM =	59.92	60.71	60.15	59.74	58.46
32	LM =	59.81	60.62	60.08	59.66	58.26
34	LM =	59.73	60.49	59.90	59.47	58.01
36	LM =	58.93	60.19	59.72	59.32	57.39
38	LM =	58.72	60.07	59.64	59.31	57.25
40	LM =	58.74	60.15	59.69	59.40	57.10
42	LM =	58.39	59.63	59.18	58.96	56.69
44	LM =	58.36	59.53	59.01	58.83	56.48
46	LM =	58.20	59.44	58.88	58.72	56.18
48	LM =	59.75	60.81	60.20	59.84	58.00
50	LM =	59.02	60.38	59.93	59.54	57.60
52	LM =	58.90	60.05	59.56	59.19	57.35
53	LM =	60.09	60.92	60.37	59.99	58.85
55	LM =	59.98	61.01	60.50	60.07	58.68
113	LM =	58.92	59.99	59.50	59.15	57.54
115	LM =	59.38	60.31	59.88	59.54	57.98
117	LM =	57.94	59.58	59.02	58.63	56.39
119	LM =	58.81	60.62	59.96	59.55	56.50
121	LM =	57.86	60.02	59.46	58.96	56.21
122	LM =	59.47	60.64	60.17	59.82	57.83
124	LM =	59.40	60.99	60.36	59.96	57.04
126	LM =	57.93	60.51	59.88	59.54	56.03
128	LM =	58.25	60.26	59.87	59.23	57.36
129	LM =	59.19	60.73	60.18	59.81	57.20
131	LM =	58.47	60.24	59.63	59.26	56.26
133	LM =	57.78	59.60	59.17	58.95	56.94
135	LM =	58.14	59.40	59.19	58.72	58.14
136	LM =	59.12	60.22	59.87	59.58	58.01
138	LM =	59.17	60.41	60.02	59.73	57.85
140	LM =	59.13	60.55	60.09	59.78	57.58
142	LM =	58.95	60.45	59.96	59.63	57.28
144	LM =	58.65	60.16	59.58	59.20	56.82
146	LM =	58.08	59.62	59.06	58.73	56.27
148	LM =	57.35	58.89	58.40	58.16	55.74
150	LM =	56.93	58.24	57.86	57.67	55.60
152	LM =	57.05	58.22	58.02	57.66	56.24

LOCATOR (7) LINEAR EXTRAPOLATION TO ZERO RADIANCE - Continued

154	LM =	57.72	58.56	58.41	57.88	57.24
156	LM =	58.12	58.79	58.59	58.01	57.64
158	LM =	58.41	59.18	58.94	58.33	58.03
160	LM =	58.27	59.50	59.00	58.65	56.94
162	LM =	57.46	58.42	57.85	57.50	55.38
164	LM =	56.73	57.99	57.66	57.26	55.05
165	LM =	58.83	60.38	59.98	59.70	57.59
167	LM =	58.23	59.31	58.86	58.55	57.14
169	LM =	57.65	58.89	58.23	57.95	55.22
171	LM =	57.94	58.49	57.90	57.68	54.64
173	LM =	59.05	61.07	60.29	59.63	56.46
175	LM =	58.17	60.11	59.42	58.96	55.40
177	LM =	60.52	61.39	60.70	60.32	58.12
178	LM =	57.90	58.33	57.69	57.39	54.23
180	LM =	57.53	59.05	58.60	58.31	54.71
182	LM =	58.68	60.33	59.72	59.38	56.61
184	LM =	59.00	60.59	59.99	59.59	56.80
185	LM =	57.47	58.44	57.98	57.65	54.72
187	LM =	57.44	59.73	59.14	58.84	55.28
189	LM =	57.32	59.11	58.64	58.36	55.86
191	LM =	58.26	59.96	59.44	59.04	56.09
192	LM =	57.42	58.42	57.92	57.12	54.98
194	LM =	56.90	58.19	57.69	57.00	54.65
196	LM =	56.86	57.83	57.34	56.81	54.42
198	LM =	56.95	57.85	57.33	56.91	54.40
200	LM =	56.99	58.59	58.13	57.80	55.40
202	LM =	56.39	58.90	58.38	58.09	55.18
204	LM =	57.30	59.02	58.57	58.31	55.91
206	LM =	57.40	58.90	58.51	58.21	56.09
208	LM =	57.56	59.08	58.70	58.36	56.11
210	LM =	58.06	59.38	58.94	58.60	56.41
212	LM =	59.29	60.42	59.90	59.54	57.56
214	LM =	59.55	60.80	60.26	59.94	57.91
216	LM =	57.05	58.08	57.57	57.26	55.45
218	LM =	56.11	58.12	57.81	57.52	55.50
220	LM =	56.84	58.54	58.40	58.14	56.03
221	LM =	56.81	57.78	57.24	56.64	54.23
223	LM =	57.23	57.64	57.07	56.77	55.18
337	LM =	57.65	58.54	57.79	57.15	54.43
339	LM =	55.27	57.20	56.45	55.78	52.48
341	LM =	59.08	59.29	58.64	57.97	56.89
343	LM =	57.77	58.36	57.55	56.91	55.36
345	LM =	58.02	58.87	58.48	58.23	57.11
346	LM =	53.83	55.94	55.37	54.83	51.74
348	LM =	56.26	57.21	56.33	55.67	52.81
350	LM =	56.89	57.90	57.45	57.08	56.44
352	LM =	57.67	59.13	59.02	58.76	57.15
353	LM =	54.36	55.93	55.26	54.62	51.75
355	LM =	56.35	56.83	56.25	55.57	52.69
357	LM =	56.09	57.66	57.24	57.03	55.36
359	LM =	57.14	58.64	58.44	58.22	56.39
360	LM =	52.66	54.27	53.43	53.50	50.15
362	LM =	52.87	54.67	53.94	53.46	50.55
364	LM =	53.01	54.88	54.34	53.96	51.01
366	LM =	53.96	55.46	54.84	54.29	52.02
368	LM =	54.74	56.49	55.77	55.18	52.15
370	LM =	55.92	56.96	56.22	55.68	52.76
372	LM =	56.05	57.09	56.61	56.22	54.72
374	LM =	56.12	57.69	57.21	56.94	54.83
376	LM =	56.90	58.22	57.83	57.81	55.52
378	LM =	57.79	59.16	58.81	58.79	56.56
380	LM =	58.47	59.81	59.63	59.41	57.69
382	LM =	58.66	60.05	59.92	59.68	58.12
384	LM =	54.91	56.63	56.04	55.46	53.30
386	LM =	55.81	57.46	57.04	56.78	54.23
388	LM =	57.54	58.87	58.32	58.10	55.55
389	LM =	53.11	54.60	54.11	54.00	51.69
391	LM =	54.64	56.23	55.68	55.30	53.04
MEAN	=	57.823	59.092	58.589	58.222	56.136
SIGMASQ	=	2.736	2.324	2.398	2.442	3.784
SIGMA	=	1.654	1.525	1.548	1.563	1.945
MAX.	=	60.520	61.394	60.698	60.320	59.183
MIN.	=	52.660	54.270	53.427	53.497	50.149

LOCATOR (8) SLOPE EXTRAPOLATION ON NORMALIZED CURVES

PROFILE						
	C1 =	.50	.10	.10	.10	.40
	C2 =	.70	.20	.50	.80	.80
1	LM =	53.21	60.02	58.76	58.24	53.54
3	LM =	52.01	60.22	58.75	58.14	52.21
5	LM =	55.37	59.59	58.35	58.10	54.12
7	LM =	54.36	59.80	58.63	58.31	54.03
9	LM =	51.99	59.37	58.12	57.57	52.24
10	LM =	53.75	59.85	58.77	58.32	53.52
12	LM =	54.25	60.12	58.71	58.34	53.89
14	LM =	51.73	59.79	58.39	57.90	53.00
16	LM =	50.55	59.08	58.02	57.35	51.76
17	LM =	54.76	60.29	58.74	58.41	54.22
19	LM =	53.93	60.23	58.70	58.38	54.08
21	LM =	54.49	59.78	58.31	57.93	53.84
23	LM =	52.11	59.48	58.18	57.59	52.73
24	LM =	52.47	60.34	58.92	58.32	52.11
26	LM =	53.12	60.50	58.85	58.33	52.71
28	LM =	53.80	60.35	58.72	58.29	53.28
30	LM =	54.80	60.37	58.69	58.37	53.94
32	LM =	54.27	60.39	58.72	58.46	54.31
34	LM =	53.36	60.42	58.66	58.35	53.93
36	LM =	53.29	60.21	58.48	58.16	53.77
38	LM =	53.07	60.16	58.54	58.10	53.37
40	LM =	53.03	60.23	58.63	58.10	53.28
42	LM =	52.69	59.81	58.34	57.78	53.18
44	LM =	52.06	59.66	58.23	57.61	52.89
46	LM =	51.64	59.58	58.12	57.48	52.78
48	LM =	53.34	60.43	58.76	58.54	55.21
50	LM =	51.76	60.24	58.58	58.11	52.90
52	LM =	52.91	59.95	58.38	57.88	52.99
53	LM =	53.81	60.36	58.94	58.55	53.88
55	LM =	52.43	60.54	58.91	58.66	54.36
113	LM =	52.72	59.31	57.85	57.51	53.54
115	LM =	52.56	60.02	58.48	58.06	53.67
117	LM =	52.54	59.21	57.46	57.14	52.92
119	LM =	54.62	60.59	58.47	58.14	54.09
121	LM =	50.38	60.12	58.06	57.56	51.40
122	LM =	53.22	60.43	58.72	58.28	53.64
124	LM =	55.10	60.80	58.67	58.36	54.54
126	LM =	51.36	60.52	58.56	57.99	52.83
128	LM =	49.56	60.40	58.55	57.90	50.18
129	LM =	54.36	60.30	58.45	58.13	54.34
131	LM =	52.60	60.05	58.20	57.78	53.98
133	LM =	47.16	59.15	58.04	57.34	51.51
135	LM =	48.24	58.90	57.92	57.30	50.29
136	LM =	51.08	59.62	58.36	57.86	53.31
138	LM =	51.43	59.90	58.47	57.99	53.37
140	LM =	52.52	59.99	58.45	58.05	53.86
142	LM =	53.20	59.88	58.30	57.94	54.08
144	LM =	53.14	59.57	57.86	57.51	53.79
146	LM =	51.30	59.23	57.60	57.17	53.07
148	LM =	48.88	58.86	57.35	56.81	52.08
150	LM =	48.12	58.70	57.25	56.65	51.37
152	LM =	50.34	58.69	57.33	56.74	50.72

LOCATOR (8) SLOPE EXTRAPOLATION ON NORMALIZED CURVES - Continued

154	LM =	51,57	58,91	57,74	57,19	50,65
156	LM =	52,10	58,94	57,87	57,32	50,52
158	LM =	52,46	59,26	58,15	57,60	50,97
160	LM =	51,77	58,99	57,54	57,12	52,90
162	LM =	49,86	58,82	56,92	56,40	51,11
164	LM =	50,31	58,77	57,03	56,42	50,20
165	LM =	51,58	59,67	58,41	57,95	53,74
167	LM =	50,59	58,75	57,50	57,03	52,97
169	LM =	46,85	59,33	57,48	56,57	49,73
171	LM =	46,87	59,52	57,64	56,80	50,38
173	LM =	51,24	62,00	59,41	58,74	50,87
175	LM =	52,55	61,67	59,15	58,56	52,11
177	LM =	49,99	61,89	60,00	59,15	51,87
178	LM =	48,02	59,60	57,61	56,87	50,95
180	LM =	50,63	60,68	58,48	57,82	52,07
182	LM =	52,55	61,11	59,22	58,64	53,16
184	LM =	50,69	61,16	59,45	58,78	54,40
185	LM =	50,59	59,88	57,89	57,29	51,83
187	LM =	52,55	61,30	59,03	58,52	53,54
189	LM =	54,08	59,45	57,99	57,58	53,91
191	LM =	55,38	60,47	58,56	58,28	54,84
192	LM =	47,04	59,58	57,52	56,75	49,83
194	LM =	47,94	59,48	57,44	56,71	50,12
196	LM =	49,23	59,05	57,21	56,55	50,54
198	LM =	49,75	59,08	57,27	56,69	51,05
200	LM =	51,69	59,79	58,06	57,58	52,86
202	LM =	52,61	60,03	58,12	57,67	53,20
204	LM =	53,34	59,65	58,13	57,75	54,08
206	LM =	54,48	59,12	57,83	57,50	54,29
208	LM =	55,40	59,33	57,87	57,65	54,81
210	LM =	54,97	59,69	58,12	57,88	54,71
212	LM =	53,75	60,66	58,99	58,57	54,03
214	LM =	52,07	60,88	59,26	58,73	53,52
216	LM =	51,34	58,67	57,27	56,83	52,28
218	LM =	52,81	58,47	57,18	56,83	53,22
220	LM =	53,79	58,62	57,47	57,21	54,04
221	LM =	50,04	58,97	57,11	56,53	50,60
223	LM =	49,76	58,23	57,05	56,97	51,88
337	LM =	46,91	59,56	57,33	56,51	47,95
339	LM =	47,83	59,00	56,85	56,19	49,33
341	LM =	46,55	59,47	57,89	56,99	47,94
343	LM =	46,46	58,65	57,00	56,12	47,04
345	LM =	50,38	59,19	58,25	57,56	52,01
346	LM =	48,29	58,15	56,06	55,43	49,22
348	LM =	44,48	58,17	55,94	55,02	45,64
350	LM =	47,56	58,18	57,27	56,52	50,00
352	LM =	52,75	59,61	58,53	57,99	53,13
353	LM =	44,66	57,49	55,34	54,50	45,76
355	LM =	45,00	57,92	56,15	55,24	46,43
357	LM =	51,39	58,27	57,09	56,55	52,12
359	LM =	54,21	58,93	57,85	57,41	53,45
360	LM =	50,16	57,77	55,78	55,38	50,76
362	LM =	49,38	57,80	55,93	55,46	50,91
364	LM =	48,50	57,44	55,56	54,98	49,04
366	LM =	45,96	57,09	55,29	54,57	46,75
368	LM =	45,03	58,03	55,80	54,97	46,69
370	LM =	46,03	58,19	56,22	55,41	47,36
372	LM =	48,83	57,82	56,56	55,92	49,82
374	LM =	51,40	58,48	57,02	56,51	51,83
376	LM =	49,97	58,85	57,67	57,05	53,12
378	LM =	50,98	59,57	58,57	57,89	54,11
380	LM =	52,43	60,20	59,05	58,51	54,16
382	LM =	52,50	60,40	59,29	58,74	53,99
384	LM =	44,78	57,92	56,06	55,17	46,55
386	LM =	50,38	58,75	57,02	56,46	51,55
388	LM =	53,48	59,42	57,87	57,48	54,05
389	LM =	51,58	57,20	55,61	55,26	51,17
391	LM =	48,68	57,89	56,18	55,57	49,70
MEAN	=	51,232	59,503	57,894	57,365	52,107
SIGMASQ	=	7,048	,942	,934	1,081	4,717
SIGMA	=	2,655	,971	,966	1,040	2,172
MAX.	=	55,403	62,000	60,001	59,149	55,207
MIN.	=	44,482	57,090	55,291	54,502	45,638

LOCATOR (9) ALTITUDE AT WHICH RADIANCE IS EQUAL TO AVERAGE VALUE BETWEEN ZERO AND PEAK RADIANCE

PROFILE		
1	LM =	41.67
3	LM =	41.23
5	LM =	42.10
7	LM =	42.22
9	LM =	43.74
10	LM =	41.31
12	LM =	42.15
14	LM =	42.37
16	LM =	44.15
17	LM =	41.96
19	LM =	42.86
21	LM =	43.94
23	LM =	44.18
24	LM =	40.86
26	LM =	40.72
28	LM =	40.90
30	LM =	41.80
32	LM =	42.45
34	LM =	42.30
36	LM =	42.34
38	LM =	43.95
40	LM =	44.34
42	LM =	44.75
44	LM =	45.04
46	LM =	45.01
48	LM =	42.70
50	LM =	43.12
52	LM =	44.54
53	LM =	41.48
55	LM =	42.21
113	LM =	42.41
115	LM =	42.90
117	LM =	43.05
119	LM =	42.83
121	LM =	42.92
122	LM =	42.75
124	LM =	43.17
126	LM =	43.59
128	LM =	42.88
129	LM =	42.86
131	LM =	43.05
133	LM =	43.79
135	LM =	42.70
136	LM =	42.38
138	LM =	42.43
140	LM =	42.63
142	LM =	42.70
144	LM =	42.54
146	LM =	42.32
148	LM =	43.04
150	LM =	43.24
152	LM =	42.57
154	LM =	42.31

LOCATOR (9) ALTITUDE AT WHICH RADIANCE IS EQUAL TO AVERAGE VALUE BETWEEN ZERO AND PEAK RADIANCE - Continued)

```
158      LM =   42.55
160      LM =   42.49
162      LM =   42.43
164      LM =   42.69
165      LM =   42.88
167      LM =   42.36
169      LM =   39.63
171      LM =   39.65
173      LM =   40.35
175      LM =   41.41
177      LM =   43.11
178      LM =   39.49
180      LM =   41.14
182      LM =   42.21
184      LM =   44.24
185      LM =   40.61
187      LM =   41.81
189      LM =   43.80
191      LM =   44.12
192      LM =   39.03
194      LM =   38.82
196      LM =   32.11
198      LM =   39.18
200      LM =   40.94
202      LM =   41.30
204      LM =   42.12
206      LM =   43.56
208      LM =   44.41
210      LM =   44.56
212      LM =   44.53
214      LM =   44.44
216      LM =   32.99
218      LM =   41.62
220      LM =   44.46
221      LM =   32.19
223      LM =   38.91
337      LM =   38.91
339      LM =   38.69
341      LM =   38.11
343      LM =   31.52
345      LM =   43.20
346      LM =   32.56
348      LM =   31.06
350      LM =   39.98
352      LM =   43.83
353      LM =   30.65
355      LM =   39.10
357      LM =   40.91
359      LM =   43.83
360      LM =   31.61
362      LM =   31.73
364      LM =   30.64
366      LM =   30.18
368      LM =   30.53
370      LM =   31.21
372      LM =   39.79
374      LM =   41.10
376      LM =   41.80
378      LM =   43.82
380      LM =   44.56
382      LM =   44.51
384      LM =   30.23
386      LM =   40.45
388      LM =   43.96
389      LM =   30.89
391      LM =   30.54
    MEAN      =  40.851
    SIGMASQ   =  16.420
    SIGMA     =   4.052
    MAX.      =  45.041
    MIN.      =  30.176
```

LOCATOR (11) ALTITUDE OF PEAK CENTROID

PROFILE		
1	LM =	41.80
3	LM =	41.28
5	LM =	42.41
7	LM =	42.40
9	LM =	43.31
10	LM =	41.67
12	LM =	42.28
14	LM =	42.58
16	LM =	43.55
17	LM =	42.24
19	LM =	43.02
21	LM =	43.65
23	LM =	43.58
24	LM =	41.10
26	LM =	41.13
28	LM =	41.35
30	LM =	42.05
32	LM =	42.70
34	LM =	42.70
36	LM =	42.92
38	LM =	43.77
40	LM =	43.92
42	LM =	44.16
44	LM =	44.32
46	LM =	44.28
48	LM =	43.23
50	LM =	43.37
52	LM =	44.05
53	LM =	41.90
55	LM =	42.65
113	LM =	42.51
115	LM =	42.99
117	LM =	42.67
119	LM =	43.04
121	LM =	42.29
122	LM =	43.04
124	LM =	43.27
126	LM =	43.13
128	LM =	41.83
129	LM =	43.11
131	LM =	43.07
133	LM =	43.06
135	LM =	41.81
136	LM =	42.53
138	LM =	42.63
140	LM =	42.86
142	LM =	42.90
144	LM =	42.63
146	LM =	42.33
148	LM =	42.46
150	LM =	42.40
152	LM =	41.73
154	LM =	41.58

LOCATOR (11) ALTITUDE OF PEAK CENTROID - Continued

156	LM	=	41.70
158	LM	=	41.67
160	LM	=	42.35
162	LM	=	41.74
164	LM	=	41.55
165	LM	=	42.95
167	LM	=	42.19
169	LM	=	39.24
171	LM	=	39.48
173	LM	=	40.50
175	LM	=	41.33
177	LM	=	42.67
178	LM	=	39.49
180	LM	=	41.03
182	LM	=	42.37
184	LM	=	43.85
185	LM	=	40.52
187	LM	=	41.99
189	LM	=	43.39
191	LM	=	43.90
192	LM	=	38.87
194	LM	=	38.83
196	LM	=	35.84
198	LM	=	39.34
200	LM	=	41.02
202	LM	=	41.46
204	LM	=	42.34
206	LM	=	43.30
208	LM	=	43.96
210	LM	=	44.21
212	LM	=	44.29
214	LM	=	44.21
216	LM	=	37.73
218	LM	=	41.84
220	LM	=	43.91
221	LM	=	35.85
223	LM	=	39.67
337	LM	=	38.36
339	LM	=	38.51
341	LM	=	38.04
343	LM	=	35.15
345	LM	=	42.62
346	LM	=	35.54
348	LM	=	34.36
350	LM	=	40.03
352	LM	=	43.42
353	LM	=	33.94
355	LM	=	38.05
357	LM	=	41.13
359	LM	=	43.32
360	LM	=	35.27
362	LM	=	35.61
364	LM	=	34.69
366	LM	=	33.90
368	LM	=	34.11
370	LM	=	35.03
372	LM	=	39.63
374	LM	=	41.14
376	LM	=	42.10
378	LM	=	43.92
380	LM	=	44.13
382	LM	=	44.08
384	LM	=	33.96
386	LM	=	40.46
388	LM	=	43.56
389	LM	=	35.64
391	LM	=	35.21
MEAN		=	41.237
SIGMASQ		=	7.881
SIGMA		=	2.807
MAX.		=	44.316
MIN.		=	33.901

LOCATOR (13) MEAN ALTITUDE BETWEEN 2 GIVEN SLOPES

PROFILE		C = -.010	-.050	-.100
1	LM =	42.209	38.632	51.362
3	LM =	41.964	38.397	51.344
5	LM =	42.275	39.000	51.417
7	LM =	42.413	38.913	51.354
9	LM =	44.402	40.625	39.977
10	LM =	41.742	38.381	37.048
12	LM =	42.368	38.678	51.359
14	LM =	43.125	40.298	39.228
16	LM =	44.764	41.445	40.746
17	LM =	41.964	38.485	51.279
19	LM =	42.631	39.201	39.615
21	LM =	44.208	40.619	39.623
23	LM =	45.025	41.536	40.143
24	LM =	42.143	38.969	51.492
26	LM =	41.929	38.578	51.385
28	LM =	41.625	38.335	51.427
30	LM =	42.087	38.428	51.233
32	LM =	42.688	39.091	39.410
34	LM =	42.643	39.328	39.667
36	LM =	43.143	40.480	39.901
38	LM =	44.615	41.011	40.085
40	LM =	45.252	41.751	40.165
42	LM =	45.583	41.542	40.205
44	LM =	45.466	41.405	40.263
46	LM =	45.466	41.357	40.093
48	LM =	42.556	39.194	39.708
50	LM =	43.698	40.818	40.427
52	LM =	45.479	41.724	40.617
53	LM =	41.865	38.417	51.492
55	LM =	42.292	39.171	39.589
113	LM =	43.252	39.429	39.447
115	LM =	42.929	40.715	39.689
117	LM =	43.575	39.593	38.859
119	LM =	42.571	41.091	38.595
121	LM =	44.055	39.866	37.800
122	LM =	45.979	41.436	39.672
124	LM =	43.517	40.011	38.593
126	LM =	44.229	40.506	38.194
128	LM =	44.523	40.636	38.133
129	LM =	43.083	39.893	39.125
131	LM =	43.651	40.042	38.667
133	LM =	44.398	40.314	39.106
135	LM =	44.342	40.539	39.213
136	LM =	43.371	39.686	39.000
138	LM =	43.238	39.713	38.989
140	LM =	43.121	39.759	38.828
142	LM =	42.743	39.629	38.817
144	LM =	42.553	39.667	38.881
146	LM =	42.923	39.727	38.807
148	LM =	43.703	39.750	38.512
150	LM =	44.066	39.275	38.252
152	LM =	43.750	39.167	38.087
154	LM =	43.932	39.743	38.609

LOCATOR (13) MEAN ALTITUDE BETWEEN 2 GIVEN SLOPES - Continued

156	LM =	44.131	39.979	50.580
158	LM =	44.247	40.315	50.700
160	LM =	42.858	39.554	39.105
162	LM =	43.667	39.250	49.875
164	LM =	43.675	38.969	36.852
165	LM =	42.979	39.597	39.308
167	LM =	42.750	39.369	39.243
169	LM =	41.222	38.619	45.410
171	LM =	40.821	37.062	45.190
173	LM =	41.823	40.096	36.867
175	LM =	41.939	39.782	35.623
177	LM =	44.052	39.780	37.094
178	LM =	40.271	52.289	44.912
180	LM =	41.813	37.833	34.858
182	LM =	43.645	40.310	37.537
184	LM =	44.607	40.861	45.677
185	LM =	41.139	36.619	34.448
187	LM =	42.095	38.831	36.869
189	LM =	44.068	40.186	38.318
191	LM =	44.938	40.636	38.505
192	LM =	39.560	52.467	45.041
194	LM =	39.857	52.280	44.907
196	LM =	39.798	36.053	44.640
198	LM =	40.152	36.102	33.667
200	LM =	41.139	37.000	34.965
202	LM =	41.591	37.850	36.083
204	LM =	42.418	39.312	37.618
206	LM =	43.881	39.893	38.486
208	LM =	44.375	40.232	39.000
210	LM =	44.559	40.569	39.500
212	LM =	45.043	41.372	40.300
214	LM =	45.100	41.519	40.424
216	LM =	39.389	36.864	46.917
218	LM =	42.125	38.917	37.933
220	LM =	44.402	40.262	39.342
221	LM =	39.714	35.740	44.312
223	LM =	40.271	36.591	33.726
337	LM =	40.625	36.544	31.706
339	LM =	39.417	35.568	32.193
341	LM =	41.389	37.595	31.955
343	LM =	40.381	36.662	31.187
345	LM =	43.903	39.636	48.696
346	LM =	38.833	34.858	31.128
348	LM =	39.400	35.893	31.196
350	LM =	40.937	38.033	48.212
352	LM =	44.308	40.300	39.120
353	LM =	38.655	34.837	30.952
355	LM =	40.333	36.159	32.263
357	LM =	42.750	38.367	37.538
359	LM =	43.983	39.958	38.680
360	LM =	37.000	32.413	33.067
362	LM =	37.417	33.208	39.411
364	LM =	37.500	33.486	39.244
366	LM =	38.125	34.262	38.857
368	LM =	39.167	34.895	30.818
370	LM =	39.600	35.750	31.835
372	LM =	40.464	37.021	47.583
374	LM =	42.550	38.193	37.451
376	LM =	43.187	39.560	38.140
378	LM =	43.929	40.330	38.759
380	LM =	44.714	40.703	39.381
382	LM =	45.000	40.774	39.445
384	LM =	39.000	34.812	39.850
386	LM =	40.604	37.229	35.817
388	LM =	43.972	40.254	38.500
389	LM =	36.750	33.154	34.000
391	LM =	38.583	34.688	30.646
MEAN	=	42.444	39.186	40.042
SIGMASQ	=	4.213	8.664	28.721
SIGMA	=	2.052	2.944	5.359
MAX.	=	45.979	52.467	51.492
MIN.	=	36.750	32.413	30.646

LOCATOR (14) MEAN ALTITUDE BETWEEN 2 GIVEN SLOPES NORMALIZED CURVE

PROFILE				
	C =	-.0060	-.0300	-.0600
1	LH =	39,054	41,437*	999999
3	LH =	38,643	36,583*	999999
5	LH =	39,134	41,278*	999999
7	LH =	39,124	40,702*	999999
9	LH =	41,014	44,784*	999999
10	LH =	38,772	37,002*	999999
12	LH =	39,035	40,314*	999999
14	LH =	40,450	38,136*	999999
16	LH =	41,318	45,191*	999999
17	LH =	38,792	39,431*	999999
19	LH =	39,484	38,851*	999999
21	LH =	40,828	37,667*	999999
23	LH =	41,597	37,374*	999999
24	LH =	39,302	37,079*	999999
26	LH =	38,948	36,948*	999999
28	LH =	38,623	38,056*	999999
30	LH =	38,804	38,997*	999999
32	LH =	39,450	39,693*	999999
34	LH =	39,998	39,645*	999999
36	LH =	40,480	39,455*	999999
38	LH =	41,287	38,964*	999999
40	LH =	41,775	46,760*	999999
42	LH =	41,651	39,677*	999999
44	LH =	41,638	45,359*	999999
46	LH =	41,592	45,410*	999999
48	LH =	39,607	40,695*	999999
50	LH =	40,990	39,875*	999999
52	LH =	41,804	39,707*	999999
53	LH =	38,861	38,273*	999999
55	LH =	39,547	39,726*	999999
113	LH =	39,466	38,479*	999999
115	LH =	40,672	38,638*	999999
117	LH =	39,972	39,131*	999999
119	LH =	41,551	38,948*	999999
121	LH =	40,384	37,748*	999999
122	LH =	41,876	38,440*	999999
124	LH =	40,404	42,326*	999999
126	LH =	40,912	37,388*	999999
128	LH =	41,368	37,951*	999999
129	LH =	39,782	41,255*	999999
131	LH =	40,219	43,481*	999999
133	LH =	40,550	36,704	36,407
135	LH =	40,721	37,875*	999999
136	LH =	39,694	37,994*	999999
138	LH =	39,562	38,189*	999999
140	LH =	39,928	38,343*	999999
142	LH =	39,432	38,446*	999999
144	LH =	39,471	38,167*	999999
146	LH =	39,650	39,315*	999999
148	LH =	39,965	44,178*	999999
150	LH =	40,058	44,167*	999999

LOCATOR (14) MEAN ALTITUDE BETWEEN 2 GIVEN SLOPES NORMALIZED CURVE - Continued

152	LM =	40,092	37,466*	999999
154	LM =	40,434	37,855*	999999
156	LM =	40,799	37,987*	999999
158	LM =	40,967	38,089*	999999
160	LM =	39,281	37,155*	999999
162	LM =	39,985	36,741*	999999
164	LM =	40,009	34,479*	999999
165	LM =	39,968	37,473*	999999
167	LM =	39,223	38,058*	999999
169	LM =	38,006	39,455*	999999
171	LM =	37,912	39,419*	999999
173	LM =	39,100	34,648*	999999
175	LM =	39,253	39,427*	999999
177	LM =	40,886	34,116*	999999
178	LM =	37,569	32,844*	999999
180	LM =	38,563	30,628*	999999
182	LM =	40,897	36,086*	999999
184	LM =	41,655	43,202*	999999
185	LM =	37,911	32,877*	999999
187	LM =	39,280	41,210*	999999
189	LM =	40,458	42,494*	999999
191	LM =	41,280	46,836*	999999
192	LM =	36,851	33,324*	999999
194	LM =	36,870	33,288*	999999
196	LM =	36,950	33,461*	999999
198	LM =	37,260	33,645*	999999
200	LM =	37,925	35,128*	999999
202	LM =	38,249	40,964*	999999
204	LM =	39,339	41,869*	999999
206	LM =	40,165	42,407*	999999
208	LM =	40,537	47,046*	999999
210	LM =	40,865	43,852*	999999
212	LM =	41,879	40,019*	999999
214	LM =	42,118	40,001*	999999
216	LM =	36,210	38,042*	999999
218	LM =	39,484	47,957*	999999
220	LM =	40,631	48,018*	999999
221	LM =	36,700	33,620*	999999
223	LM =	37,665	39,185*	999999
337	LM =	37,712	31,955*	999999
339	LM =	37,042	38,434*	999999
341	LM =	38,455	32,212*	999999
343	LM =	37,694	31,680*	999999
345	LM =	40,282	41,364*	999999
346	LM =	36,619	39,072*	999999
348	LM =	37,103	30,905*	999999
350	LM =	38,949	32,958*	999999
352	LM =	40,638	35,221*	999999
353	LM =	36,234	30,071*	999999
355	LM =	37,471	30,632*	999999
357	LM =	39,346	41,539*	999999
359	LM =	40,379	38,293*	999999
360	LM =	35,571	33,085*	999999
362	LM =	36,133	39,334*	999999
364	LM =	35,776	29,898*	999999
366	LM =	35,773	29,824*	999999
368	LM =	36,623	30,074*	999999
370	LM =	37,132	31,290*	999999
372	LM =	38,163	32,985*	999999
374	LM =	39,231	35,415*	999999
376	LM =	40,143	43,294*	999999
378	LM =	40,787	43,989*	999999
380	LM =	41,962	41,211*	999999
382	LM =	41,726	35,266*	999999
384	LM =	36,483	29,407*	999999
386	LM =	38,305	37,925*	999999
388	LM =	40,769	43,526*	999999
389	LM =	35,398	33,996*	999999
391	LM =	36,343	29,072*	999999
MEAN	=	39,359	38,204*	999999
SIGMASQ	=	2,772	18,194*	999999
SIGMA	=	1,665	4,265*	999999
MAX.	=	42,118	48,018*	999999
MIN.	=	35,398	29,072*	999999

LOCATOR (15) AVERAGE H BETWEEN N = 0 AND N (MAX)

PROFILE	ABSOLUTE MAX.		
1	5.650	LH =	38.206
3	5.805	LH =	37.968
5	5.914	LH =	39.413
7	5.922	LH =	39.212
9	5.914	LH =	40.755
10	5.958	LH =	38.318
12	5.746	LH =	38.986
14	5.901	LH =	40.239
16	5.715	LH =	41.198
17	6.004	LH =	38.842
19	5.701	LH =	40.043
21	5.949	LH =	40.678
23	5.716	LH =	40.844
24	6.056	LH =	38.198
26	6.062	LH =	38.165
28	6.110	LH =	38.271
30	6.138	LH =	38.741
32	6.008	LH =	39.682
34	5.907	LH =	40.133
36	5.627	LH =	40.835
38	5.762	LH =	41.355
40	5.822	LH =	41.330
42	5.736	LH =	41.296
44	5.689	LH =	41.283
46	5.670	LH =	41.201
48	6.148	LH =	40.150
50	5.890	LH =	41.442
52	5.894	LH =	41.637
53	6.143	LH =	38.733
55	6.168	LH =	39.941
113	6.348	LH =	39.672
115	6.325	LH =	40.267
117	5.921	LH =	39.847
119	5.932	LH =	40.340
121	5.490	LH =	39.897
122	6.291	LH =	40.639
124	6.254	LH =	40.177
126	5.638	LH =	40.090
128	5.320	LH =	39.964
129	6.329	LH =	40.157
131	6.003	LH =	40.161
133	5.972	LH =	40.242
135	5.409	LH =	40.008
136	6.624	LH =	39.820
138	6.561	LH =	39.950
140	6.472	LH =	40.013
142	6.370	LH =	39.903
144	6.239	LH =	39.667
146	6.076	LH =	39.650
148	5.759	LH =	39.771
150	5.488	LH =	39.628

LOCATOR (15) AVERAGE H BETWEEN N = 0 AND N (MAX) - Continued

152	5.293	LH =	39.338
154	5.130	LH =	39.590
156	5.084	LH =	39.661
158	5.126	LH =	39.698
160	6.116	LH =	39.578
162	5.671	LH =	39.362
164	5.217	LH =	39.045
165	6.357	LH =	39.866
167	6.099	LH =	39.482
169	5.492	LH =	36.693
171	5.042	LH =	36.757
173	5.153	LH =	38.526
175	4.890	LH =	38.436
177	5.312	LH =	39.795
178	4.807	LH =	36.613
180	4.850	LH =	37.672
182	5.124	LH =	39.783
184	5.409	LH =	40.505
185	4.734	LH =	37.073
187	4.888	LH =	38.698
189	5.273	LH =	39.951
191	5.483	LH =	40.695
192	4.593	LH =	36.011
194	4.592	LH =	35.980
196	4.635	LH =	36.032
198	4.674	LH =	36.434
200	4.788	LH =	37.521
202	4.965	LH =	38.085
204	5.176	LH =	39.210
206	5.352	LH =	39.901
208	5.507	LH =	40.471
210	5.922	LH =	41.032
212	5.626	LH =	41.587
214	5.687	LH =	41.739
216	5.016	LH =	36.525
218	5.310	LH =	39.158
220	5.556	LH =	40.794
221	4.566	LH =	35.641
223	4.728	LH =	37.332
337	4.678	LH =	36.153
339	4.249	LH =	36.094
341	5.075	LH =	36.891
343	4.928	LH =	35.949
345	4.972	LH =	39.586
346	4.137	LH =	35.411
348	4.809	LH =	35.210
350	4.843	LH =	38.042
352	5.226	LH =	40.240
353	4.532	LH =	34.493
355	4.556	LH =	35.907
357	4.937	LH =	38.674
359	5.317	LH =	39.860
360	3.352	LH =	34.605
362	3.474	LH =	35.222
364	3.891	LH =	34.460
366	4.308	LH =	34.011
368	4.573	LH =	34.375
370	4.575	LH =	35.514
372	4.714	LH =	37.232
374	4.935	LH =	38.670
376	5.160	LH =	39.549
378	5.254	LH =	39.909
380	5.470	LH =	40.634
382	5.474	LH =	40.687
384	4.567	LH =	34.359
386	4.807	LH =	37.536
388	5.182	LH =	40.313
389	3.560	LH =	34.616
391	4.267	LH =	34.860

MEAN	= 38.802
SIGMASQ	= 3.950
SIGMA	= 1.987
MAX.	= 41.739
MIN.	= 34.011

LOCATOR (16) ALTITUDE CENTROID

PROFILE		
1	LM =	28.965
3	LM =	28.870
5	LM =	29.218
7	LM =	29.796
9	LM =	32.240
10	LM =	28.434
12	LM =	29.732
14	LM =	29.856
16	LM =	32.864
17	LM =	29.158
19	LM =	30.577
21	LM =	32.327
23	LM =	32.818
24	LM =	28.308
26	LM =	27.733
28	LM =	27.794
30	LM =	29.121
32	LM =	29.916
34	LM =	29.385
36	LM =	28.930
38	LM =	32.470
40	LM =	32.999
42	LM =	33.562
44	LM =	34.145
46	LM =	34.106
48	LM =	29.475
50	LM =	30.777
52	LM =	33.628
53	LM =	28.553
55	LM =	29.411
113	LM =	29.706
115	LM =	30.477
117	LM =	31.449
119	LM =	29.899
121	LM =	32.062
122	LM =	29.983
124	LM =	30.501
126	LM =	32.160
128	LM =	32.697
129	LM =	29.911
131	LM =	30.398
133	LM =	32.740
135	LM =	32.026
136	LM =	29.763
138	LM =	29.819
140	LM =	29.860
142	LM =	29.839
144	LM =	29.712
146	LM =	29.620
148	LM =	31.334
150	LM =	31.871
152	LM =	31.218
154	LM =	31.333

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156        LM =  31,974
158        LM =  32,005
160        LM =  30,195
162        LM =  31,109
164        LM =  31,659
165        LM =  30,435
167        LM =  30,169
169        LM =  27,514
171        LM =  27,065
173        LM =  28,304
175        LM =  29,517
177        LM =  32,247
178        LM =  26,494
180        LM =  28,704
182        LM =  29,785
184        LM =  32,961
185        LM =  27,940
187        LM =  29,031
189        LM =  32,155
191        LM =  32,366
192        LM =  26,300
194        LM =  25,723
196        LM =   4,101
198        LM =  25,888
200        LM =  28,114
202        LM =  28,234
204        LM =  29,070
206        LM =  31,544
208        LM =  32,896
210        LM =  33,010
212        LM =  33,158
214        LM =  33,187
216        LM =   4,505
218        LM =  28,346
220        LM =  32,898
221        LM =   4,004
223        LM =  24,390
337        LM =  27,475
339        LM =  26,307
341        LM =  26,485
343        LM =   3,999
345        LM =  32,085
346        LM =   8,988
348        LM =   3,625
350        LM =  27,360
352        LM =  32,277
353        LM =   3,382
355        LM =  27,860
357        LM =  27,573
359        LM =  32,153
360        LM =   3,624
362        LM =   3,803
364        LM =   3,457
366        LM =   3,256
368        LM =   3,400
370        LM =   3,824
372        LM =  27,140
374        LM =  28,140
376        LM =  28,422
378        LM =  31,596
380        LM =  33,057
382        LM =  33,098
384        LM =   3,399
386        LM =  27,315
388        LM =  32,212
389        LM =   3,607
391        LM =   3,639
     MEAN       =  26,692
     SIGMASQ    =  83,240
     SIGMA      =   9,124
     MAX.       =  34,145
     MIN.       =   3,256
```

LOCATOR (17) INFLECTION POINT

PROFILE	ABSOLUTE MIN.		
1	-.210	LH =	31.000
3	-.222	LH =	31.000
5	-.216	LH =	41.000
7	-.199	LH =	41.000
9	-.251	LH =	34.000
10	-.211	LH =	31.000
12	-.198	LH =	41.000
14	-.223	LH =	35.000
16	-.291	LH =	35.000
17	-.206	LH =	38.000
19	-.221	LH =	41.000
21	-.234	LH =	34.000
23	-.289	LH =	34.000
24	-.255	LH =	31.000
26	-.227	LH =	31.000
28	-.227	LH =	37.000
30	-.224	LH =	38.000
32	-.235	LH =	41.000
34	-.241	LH =	41.000
36	-.252	LH =	41.000
38	-.241	LH =	41.000
40	-.260	LH =	34.000
42	-.290	LH =	34.000
44	-.311	LH =	34.000
46	-.313	LH =	34.000
48	-.252	LH =	38.000
50	-.273	LH =	38.000
52	-.283	LH =	36.000
53	-.247	LH =	37.000
55	-.266	LH =	38.000
113	-.246	LH =	34.000
115	-.255	LH =	35.000
117	-.243	LH =	38.000
119	-.223	LH =	41.000
121	-.261	LH =	38.000
122	-.252	LH =	35.000
124	-.247	LH =	34.000
126	-.233	LH =	35.000
128	-.285	LH =	38.000
129	-.260	LH =	34.000
131	-.247	LH =	35.000
133	-.336	LH =	36.000
135	-.315	LH =	37.000
136	-.282	LH =	35.000
138	-.275	LH =	35.000
140	-.255	LH =	35.000
142	-.239	LH =	35.000
144	-.226	LH =	35.000
146	-.266	LH =	37.000
148	-.305	LH =	37.000
150	-.301	LH =	37.000
152	-.268	LH =	37.000

154	=.252	LH =	38.000
156	=.252	LH =	38.000
158	=.256	LH =	38.000
160	=.250	LH =	37.000
162	=.255	LH =	37.000
164	=.233	LH =	32.000
165	=.258	LH =	35.000
167	=.266	LH =	37.000
169	=.255	LH =	33.000
171	=.239	LH =	33.000
173	=.213	LH =	39.000
175	=.176	LH =	34.000
177	=.255	LH =	36.000
178	=.212	LH =	33.000
180	=.184	LH =	31.000
182	=.191	LH =	35.000
184	=.266	LH =	36.000
185	=.172	LH =	34.000
187	=.175	LH =	34.000
189	=.213	LH =	32.000
191	=.221	LH =	43.000
192	=.262	LH =	33.000
194	=.227	LH =	33.000
196	=.206	LH =	34.000
198	=.193	LH =	34.000
200	=.185	LH =	34.000
202	=.173	LH =	34.000
204	=.178	LH =	35.000
206	=.199	LH =	32.000
208	=.212	LH =	42.000
210	=.218	LH =	36.000
212	=.241	LH =	37.000
214	=.269	LH =	39.000
216	=.189	LH =	34.000
218	=.191	LH =	34.000
220	=.215	LH =	41.000
221	=.204	LH =	34.000
223	=.209	LH =	34.000
337	=.217	LH =	34.000
339	=.196	LH =	34.000
341	=.238	LH =	34.000
343	=.211	LH =	32.000
345	=.232	LH =	34.000
346	=.168	LH =	33.000
348	=.226	LH =	31.000
350	=.228	LH =	34.000
352	=.232	LH =	34.000
353	=.200	LH =	31.000
355	=.209	LH =	31.000
357	=.213	LH =	31.000
359	=.258	LH =	31.000
360	=.141	LH =	33.000
362	=.142	LH =	33.000
364	=.140	LH =	33.000
366	=.165	LH =	32.000
368	=.198	LH =	31.000
370	=.205	LH =	31.000
372	=.193	LH =	31.000
374	=.203	LH =	31.000
376	=.235	LH =	36.000
378	=.228	LH =	34.000
380	=.219	LH =	35.000
382	=.217	LH =	35.000
384	=.193	LH =	31.000
386	=.191	LH =	31.000
388	=.199	LH =	31.000
389	=.111	LH =	35.000
391	=.151	LH =	28.000

MEAN	=	35.033
SIGMASQ	=	9.166
SIGMA	=	3.027
MAX.	=	43.000
MIN.	=	28.000

LOCATOR (19) INTEGRATED RADIANCE NORMALIZED TO INTEGRATED RADIANCE UP TO PEAK RADIANCE

PROFILE	C =	.010	.060	.150	.250	.500	.750
1	LM =	59,61	48,81	41,02	35,7?	26,81	20,11
3	LM =	59,59	48,75	40,89	35,56	26,70	20,06
5	LM =	59,41	48,58	41,05	36,10	27,32	20,41
7	LM =	59,65	48,96	41,47	36,48	27,63	21,13
9	LM =	60,33	49,58	42,70	38,04	30,42	24,49
10	LM =	59,27	48,49	40,76	35,44	26,36	19,39
12	LM =	59,65	48,94	41,41	36,39	27,73	21,07
14	LM =	59,56	48,59	41,31	36,39	28,04	21,34
16	LM =	60,41	49,72	43,05	38,44	31,08	25,35
17	LM =	59,49	48,69	41,09	36,02	27,19	20,29
19	LM =	59,81	49,15	41,89	37,09	28,76	22,11
21	LM =	60,44	49,71	42,89	38,31	30,44	24,49
23	LM =	60,59	49,80	43,12	38,52	30,69	25,25
24	LM =	59,40	48,55	40,55	35,17	26,17	19,34
26	LM =	59,20	48,18	40,17	34,80	25,65	18,58
28	LM =	59,11	48,11	40,19	34,91	25,76	18,61
30	LM =	59,47	48,66	40,99	35,95	27,15	20,26
32	LM =	59,63	48,91	41,47	36,62	28,07	21,25
34	LM =	59,42	48,54	41,07	36,24	27,63	20,59
36	LM =	59,13	48,12	40,83	36,01	27,29	19,99
38	LM =	60,35	49,74	42,93	38,40	30,75	24,65
40	LM =	60,58	49,99	43,29	38,74	31,16	25,38
42	LM =	60,99	50,20	43,62	39,14	31,70	26,13
44	LM =	61,39	50,49	43,93	39,53	32,26	26,90
46	LM =	61,46	50,44	43,86	39,47	32,22	26,86
48	LM =	59,37	48,62	41,32	36,44	27,72	20,60
50	LM =	59,64	48,93	41,86	37,25	29,18	22,41
52	LM =	60,89	50,24	43,55	39,17	31,86	26,28
53	LM =	59,28	48,51	40,74	35,56	26,99	19,50
55	LM =	59,40	48,70	41,17	36,30	27,64	20,55
113	LM =	58,97	48,29	41,11	36,28	27,91	21,21
115	LM =	59,33	48,84	41,73	36,91	28,69	22,14
117	LM =	59,70	48,93	41,92	37,39	29,65	23,55
119	LM =	59,37	48,48	41,33	36,55	28,12	21,39
121	LM =	60,45	49,57	42,34	37,69	30,21	24,33
122	LM =	59,24	48,63	41,49	36,61	28,23	21,48
124	LM =	59,56	48,87	41,79	37,04	28,67	22,09
126	LM =	60,51	49,74	42,67	37,98	30,23	24,35
128	LM =	60,87	50,13	42,90	38,04	30,68	25,07
129	LM =	59,27	48,55	41,45	36,61	28,13	21,34
131	LM =	59,47	48,61	41,59	36,80	28,60	22,08
133	LM =	60,41	49,85	42,99	38,26	30,88	25,17
135	LM =	60,03	49,59	42,50	37,60	30,10	24,31
136	LM =	59,02	48,48	41,30	36,31	27,94	21,25
138	LM =	59,10	48,52	41,35	36,40	28,02	21,29
140	LM =	59,17	48,54	41,42	36,50	28,06	21,30
142	LM =	59,19	48,48	41,38	36,49	28,03	21,28
144	LM =	59,12	48,25	41,10	36,28	27,90	21,23
146	LM =	59,02	48,02	40,91	36,08	27,84	21,21
148	LM =	59,68	48,75	41,84	37,14	29,51	23,51
150	LM =	59,92	48,98	42,14	37,45	30,00	24,24

LOCATOR (19) INTEGRATED RADIANCE NORMALIZED TO INTEGRATED RADIANCE UP TO PEAK RADIANCE - Continued

152	LM =	59,77	48,83	41,82	36,96	29,27	23,40
154	LM =	59,85	49,17	42,04	37,14	29,36	23,45
156	LM =	60,13	49,60	42,53	37,63	29,96	24,23
158	LM =	60,17	49,72	42,60	37,68	29,98	24,23
160	LM =	59,15	48,36	41,24	36,48	28,39	21,97
162	LM =	59,59	48,48	41,39	36,79	29,26	23,40
164	LM =	59,96	48,91	41,88	37,17	29,66	24,08
165	LM =	59,38	48,85	41,80	36,87	28,60	22,04
167	LM =	59,12	48,36	41,23	36,41	28,35	21,94
169	LM =	58,53	47,12	39,17	33,82	25,32	18,97
171	LM =	58,29	47,00	39,11	33,66	24,93	18,23
173	LM =	59,51	48,36	40,17	34,95	26,29	19,44
175	LM =	59,89	48,95	41,10	35,97	27,39	20,94
177	LM =	60,80	50,56	43,05	38,05	30,17	24,33
178	LM =	58,18	46,80	38,81	33,32	24,38	17,44
180	LM =	59,54	48,38	40,59	35,32	26,52	19,98
182	LM =	59,63	48,89	41,41	36,34	27,82	21,22
184	LM =	60,59	50,42	43,47	38,87	30,99	25,21
185	LM =	59,10	47,79	39,98	34,65	25,77	19,09
187	LM =	59,65	48,54	40,92	35,76	27,00	20,23
189	LM =	60,15	49,55	42,73	38,13	30,20	24,32
191	LM =	60,15	49,75	42,95	38,45	30,51	24,48
192	LM =	57,77	46,63	38,54	32,96	24,17	17,31
194	LM =	57,78	46,37	38,21	32,62	23,58	16,53
196	LM =	52,24	38,14	27,55	19,71	3,02	-13,49
198	LM =	58,07	46,48	38,44	32,93	23,77	16,64
200	LM =	59,17	47,86	40,18	34,90	26,03	19,20
202	LM =	59,27	47,83	40,27	35,07	26,21	19,33
204	LM =	59,17	48,14	40,89	35,85	27,15	20,39
206	LM =	59,74	49,16	42,38	37,73	29,63	23,54
208	LM =	60,10	49,74	43,19	38,79	31,05	25,22
210	LM =	60,06	49,82	43,28	38,89	31,25	25,35
212	LM =	60,32	50,25	43,49	39,01	31,42	25,46
214	LM =	60,33	50,33	43,51	38,96	31,47	25,50
216	LM =	52,75	38,86	28,48	20,49	3,36	-13,35
218	LM =	58,74	47,40	40,20	35,19	26,50	19,57
220	LM =	59,88	49,50	43,14	38,71	31,14	25,29
221	LM =	52,14	38,04	27,50	19,57	2,88	-13,58
223	LM =	57,42	45,72	37,61	32,11	22,48	14,59
337	LM =	59,51	47,44	39,10	33,65	25,23	18,94
339	LM =	59,37	46,65	38,26	32,88	24,15	17,31
341	LM =	59,07	47,17	38,63	33,01	24,33	17,49
343	LM =	52,62	37,56	27,08	19,57	2,99	-13,51
345	LM =	60,96	49,79	42,83	37,95	30,00	24,23
346	LM =	53,66	38,95	29,04	21,95	7,72	-6,14
348	LM =	52,05	36,64	26,42	19,05	2,63	-13,69
350	LM =	59,11	47,13	39,34	33,98	25,40	18,54
352	LM =	60,64	49,86	43,10	38,29	30,27	24,38
353	LM =	51,94	36,48	26,10	18,65	2,31	-13,86
355	LM =	60,15	47,23	39,11	33,71	25,57	19,53
357	LM =	59,03	47,07	39,63	34,41	25,66	18,69
359	LM =	60,58	49,55	42,83	38,11	30,14	24,29
360	LM =	52,48	37,44	26,97	18,96	2,40	-13,83
362	LM =	52,55	37,59	27,14	19,22	2,65	-13,69
364	LM =	52,18	37,05	26,46	18,68	2,29	-13,87
366	LM =	51,90	36,64	26,01	18,41	2,11	-13,97
368	LM =	52,12	36,70	26,19	18,65	2,30	-13,88
370	LM =	52,33	37,24	26,85	19,32	2,80	-13,61
372	LM =	59,27	46,79	38,97	33,71	25,09	18,35
374	LM =	59,33	47,26	39,53	34,77	26,22	19,45
376	LM =	59,23	47,62	40,37	35,17	26,96	19,65
378	LM =	60,40	49,56	42,70	37,81	29,53	23,52
380	LM =	60,90	50,44	43,75	39,00	31,08	25,24
382	LM =	60,91	50,58	43,86	39,06	31,11	25,25
384	LM =	52,16	36,95	26,19	18,61	2,26	-13,89
386	LM =	59,28	46,95	39,32	34,07	25,27	18,42
388	LM =	60,90	49,58	42,71	38,13	30,29	24,40
389	LM =	52,29	37,54	26,90	18,89	2,38	-13,83
391	LM =	52,27	37,49	26,74	18,93	2,48	-13,77
MEAN	=	58,693	47,220	39,506	34,210	24,869	17,160
SIGMASQ	=	6,695	15,728	26,135	37,032	78,717	146,985
SIGMA	=	2,588	3,966	5,112	6,085	8,872	12,206
MAX.	=	61,464	50,578	43,926	39,532	32,263	26,900
MIN.	=	51,902	36,478	26,013	18,407	2,107	-13,974

LOCATOR (20) INTEGRATED NORMALIZED RADIANCE COMPENSATED BY FIXED RADIANCE

PROFILE					
	C1 =	1.000	2.000	1.000	2.000
	C2 =	30.000	30.000	60.000	60.000
1	LM =	42.146	33.895	72.584	64.333
3	LM =	42.412	33.966	72.811	64.365
5	LM =	40.978	33.355	71.384	63.761
7	LM =	41.213	33.356	71.735	63.879
9	LM =	39.617	32.819	70.402	63.604
10	LM =	42.448	34.543	72.712	64.806
12	LM =	41.587	33.862	72.123	64.399
14	LM =	39.870	32.947	70.539	63.617
16	LM =	39.532	33.113	70.470	64.051
17	LM =	42.017	34.568	72.475	65.026
19	LM =	40.672	33.545	71.383	64.256
21	LM =	39.691	33.155	70.431	63.896
23	LM =	39.657	33.349	70.754	64.446
24	LM =	42.703	34.414	73.032	64.743
26	LM =	42.606	34.571	72.864	64.829
28	LM =	42.541	34.737	72.761	64.957
30	LM =	42.207	34.682	72.638	65.114
32	LM =	41.376	34.156	72.076	64.856
34	LM =	40.815	33.745	71.381	64.311
36	LM =	39.985	33.416	70.499	63.930
38	LM =	39.574	33.217	70.460	64.103
40	LM =	39.655	33.456	70.755	64.557
42	LM =	39.454	33.416	70.533	64.495
44	LM =	39.317	33.325	70.413	64.421
46	LM =	39.210	33.328	70.294	64.411
48	LM =	41.247	34.632	71.863	65.248
50	LM =	39.715	33.260	70.510	64.055
52	LM =	39.512	33.250	70.522	64.260
53	LM =	42.437	34.754	72.738	65.055
55	LM =	41.506	34.266	72.020	64.780
113	LM =	41.283	34.688	71.835	65.241
115	LM =	41.139	34.547	71.785	65.194
117	LM =	40.108	33.642	70.762	64.296
119	LM =	40.042	33.915	70.533	64.406
121	LM =	39.317	32.285	69.902	62.870
122	LM =	40.810	34.421	71.489	65.099
124	LM =	40.769	34.655	71.513	65.399
126	LM =	39.626	33.265	70.267	63.907
128	LM =	39.342	31.228	69.957	61.843
129	LM =	40.934	34.809	71.557	65.431
131	LM =	40.120	34.126	70.721	64.727
133	LM =	39.818	32.859	70.578	63.620
135	LM =	39.905	31.617	70.537	62.248
136	LM =	41.733	35.262	72.313	65.843
138	LM =	41.534	35.153	72.139	65.758
140	LM =	41.333	35.088	71.904	65.659
142	LM =	41.164	34.946	71.694	65.476
144	LM =	40.868	34.575	71.357	65.064
146	LM =	40.418	34.204	70.898	64.685
148	LM =	39.704	33.416	70.250	63.962
150	LM =	39.355	32.689	69.950	63.283

LOCATOR (20) INTEGRATED NORMALIZED RADIANCE COMPENSATED BY FIXED RADIANCE - Continued

152	LM =	39.370	31.830	69.768	62.000
154	LM =	39.405	31.143	69.746	61.484
156	LM =	39.463	30.938	69.755	61.230
158	LM =	39.659	30.978	69.981	61.299
160	LM =	40.779	34.177	71.392	64.791
162	LM =	39.440	32.834	70.008	63.403
164	LM =	38.858	31.674	69.310	62.126
165	LM =	41.368	34.997	71.961	65.560
167	LM =	40.920	34.157	71.558	64.795
169	LM =	40.598	32.653	70.882	62.937
171	LM =	39.868	31.853	70.027	62.012
173	LM =	39.791	31.641	70.092	61.941
175	LM =	39.254	31.538	69.549	61.833
177	LM =	40.245	32.108	70.938	62.801
178	LM =	39.505	31.389	69.626	61.510
180	LM =	39.314	31.577	69.532	61.795
182	LM =	39.493	32.151	69.965	62.623
184	LM =	39.698	33.037	70.499	63.838
185	LM =	39.429	31.213	69.511	61.294
187	LM =	39.286	31.982	69.586	62.282
189	LM =	39.396	32.845	69.982	63.432
191	LM =	39.346	33.242	70.104	64.001
192	LM =	39.324	29.677	69.380	59.732
194	LM =	39.332	29.997	69.395	60.020
196	LM =	39.467	30.556	69.473	60.562
198	LM =	39.447	30.925	69.471	60.949
200	LM =	39.731	31.576	69.907	61.752
202	LM =	39.692	32.285	69.952	62.546
204	LM =	39.744	32.751	70.162	63.199
206	LM =	39.665	33.113	70.308	63.756
208	LM =	39.549	33.380	70.400	64.231
210	LM =	39.381	33.293	70.309	64.221
212	LM =	39.601	33.141	70.554	64.094
214	LM =	39.668	33.052	70.626	64.040
216	LM =	40.723	32.648	70.850	62.775
218	LM =	39.604	32.864	69.926	63.186
220	LM =	39.284	33.257	70.156	64.130
221	LM =	39.495	30.466	69.562	60.534
223	LM =	39.594	31.343	69.624	61.373
337	LM =	39.417	30.551	69.597	60.730
339	LM =	37.766	29.139	67.852	59.225
341	LM =	40.324	30.650	70.407	60.732
343	LM =	39.941	30.486	69.956	60.501
345	LM =	39.546	31.527	69.921	61.902
346	LM =	37.605	28.892	67.614	58.901
348	LM =	38.813	30.062	68.845	60.094
350	LM =	39.611	30.822	69.792	61.004
352	LM =	39.665	32.376	70.203	62.915
353	LM =	38.477	29.575	68.455	59.654
355	LM =	38.001	29.209	68.112	59.319
357	LM =	39.250	31.808	69.542	62.100
359	LM =	39.676	32.793	70.232	63.390
360	LM =	36.905	26.583	66.119	56.697
362	LM =	36.122	26.958	66.162	56.998
364	LM =	37.346	28.211	67.417	58.282
366	LM =	38.576	29.261	68.693	59.377
368	LM =	38.772	29.894	68.896	60.018
370	LM =	38.528	29.855	68.574	59.901
372	LM =	39.104	30.714	69.260	60.870
374	LM =	38.956	31.745	69.287	62.077
376	LM =	39.259	32.545	69.692	62.978
378	LM =	39.831	33.000	70.367	63.536
380	LM =	40.147	33.171	70.990	64.013
382	LM =	40.313	33.099	71.300	64.086
384	LM =	39.315	29.790	69.412	59.887
386	LM =	39.097	31.496	69.258	61.657
388	LM =	38.927	32.605	69.430	63.108
389	LM =	37.065	27.142	67.147	57.224
391	LM =	38.834	29.548	68.894	59.608
MEAN	=	39.892	32.436	70.352	62.897
SIGMASQ	=	1.451	3.394	1.713	4.181
SIGMA	=	1.205	1.842	1.309	2.045
MAX.	=	42.703	35.262	73.032	65.843
MIN.	=	36.905	26.583	66.119	56.697

LOCATOR (B2) 3 POINT SLOPE EXTRAPOLATION

PROFILE						
	C1 =	.500	.500	1.000	1.000	1.000
	C2 =	1.000	1.500	1.500	2.000	3.000
	C3 =	1.500	2.500	2.000	3.000	5.000
1	LM =	60.525	58.412	56.532	56.637	56.092
3	LM =	60.520	58.733	57.117	56.214	55.708
5	LM =	59.845	57.846	56.266	55.343	56.852
7	LM =	59.933	58.147	56.780	55.719	56.786
9	LM =	58.961	57.888	56.044	55.406	55.488
10	LM =	60.123	58.984	57.808	56.390	56.284
12	LM =	60.075	58.377	56.845	55.810	56.317
14	LM =	58.999	58.063	56.251	55.346	55.638
16	LM =	58.807	58.125	56.292	55.959	54.802
17	LM =	60.284	58.666	56.868	55.979	56.485
19	LM =	59.645	58.423	56.968	55.470	56.538
21	LM =	58.872	58.052	56.246	55.483	55.607
23	LM =	58.610	58.187	56.362	55.907	54.654
24	LM =	61.098	59.136	57.306	56.454	55.905
26	LM =	60.831	58.986	57.039	56.287	55.988
28	LM =	60.585	58.833	56.994	56.128	56.184
30	LM =	60.430	58.776	57.056	55.839	56.377
32	LM =	60.250	58.693	57.010	55.563	56.562
34	LM =	60.130	58.451	56.615	55.315	56.425
36	LM =	59.501	58.443	56.658	55.069	56.162
38	LM =	59.304	58.543	56.727	55.412	55.878
40	LM =	59.312	58.652	56.552	55.805	55.282
42	LM =	58.838	58.279	56.126	55.968	54.992
44	LM =	58.772	58.124	55.697	55.971	54.745
46	LM =	58.644	57.994	55.313	55.883	54.555
48	LM =	60.320	58.864	56.658	56.059	56.766
50	LM =	59.677	58.701	56.937	55.365	55.959
52	LM =	59.444	58.328	56.463	55.529	55.232
53	LM =	60.725	59.056	57.372	56.377	56.560
55	LM =	60.613	59.122	57.552	55.792	56.795
113	LM =	59.494	58.301	56.566	55.500	55.549
115	LM =	59.793	58.760	57.213	56.011	55.846
117	LM =	58.831	57.685	55.461	54.363	54.956
119	LM =	59.268	58.477	55.553	54.957	55.468
121	LM =	58.964	57.895	55.569	53.465	54.899
122	LM =	59.939	59.004	57.122	56.038	55.804
124	LM =	59.960	58.921	56.170	55.421	55.807
126	LM =	59.211	58.577	55.449	55.141	54.606
128	LM =	59.389	58.207	57.064	53.127	54.858
129	LM =	59.795	58.887	56.478	55.636	55.772
131	LM =	59.168	58.267	55.504	55.222	55.112
133	LM =	58.914	58.311	56.333	55.437	54.896
135	LM =	59.087	58.036	57.821	54.092	55.168
136	LM =	59.637	58.942	57.544	56.457	55.622
138	LM =	59.716	59.049	57.379	56.339	55.575
140	LM =	59.743	59.021	57.024	56.162	55.722
142	LM =	59.589	58.805	56.679	55.800	55.706
144	LM =	59.356	58.245	55.891	55.164	55.301
146	LM =	58.790	57.845	55.422	55.081	54.720
148	LM =	58.044	57.441	55.132	54.781	54.205
150	LM =	57.478	57.100	55.236	54.083	54.198
152	LM =	57.529	57.093	56.331	53.303	54.517

LOCATOR (B2) 3 POINT SLOPE EXTRAPOLATION - Continued

154		LM =	58.118	57.207	57.244	53.202	55.633
156		LM =	58.510	57.233	57.326	53.364	55.916
158		LM =	58.959	57.478	57.541	53.498	55.856
160		LM =	58.974	57.791	55.953	55.177	54.938
162		LM =	57.747	56.571	54.349	53.473	53.602
164		LM =	57.012	56.537	55.041	52.758	53.662
165		LM =	59.988	59.021	57.179	56.393	55.690
167		LM =	58.908	57.783	56.186	55.412	54.925
169		LM =	58.034	57.020	54.121	53.286	52.140
171		LM =	57.434	56.869	53.944	52.667	54.840
173		LM =	59.943	58.184	55.241	53.540	56.020
175		LM =	58.802	57.813	54.615	53.997*	999999
177		LM =	60.803	59.246	56.628	55.338	56.005
178		LM =	57.253	56.451	53.371	52.265*	999999
180		LM =	57.559	57.576	54.845	53.846*	999999
182		LM =	59.377	58.426	55.737	55.185	56.142
184		LM =	59.590	58.587	56.007	56.519	55.250
185		LM =	57.270	56.852	54.504	53.098*	999999
187		LM =	58.390	57.947	54.855	54.463*	999999
189		LM =	58.194	57.610	55.371	55.312	55.262
191		LM =	58.803	58.122	55.694	55.618	55.539
192		LM =	57.439	55.827	54.477	50.097*	999999
194		LM =	57.162	55.822	54.181	50.809*	999999
196		LM =	56.864	55.792	53.901	51.617*	999999
198		LM =	56.894	55.973	53.819	52.072*	999999
200		LM =	57.699	57.004	54.894	53.500*	999999
202		LM =	57.831	57.278	54.671	54.242*	999999
204		LM =	58.132	57.608	55.460	55.072	56.201
206		LM =	58.073	57.528	55.747	55.408	55.469
208		LM =	58.165	57.644	55.898	55.383	55.537
210		LM =	58.549	57.833	55.924	55.421	55.930
212		LM =	59.781	58.654	56.630	55.882	56.385
214		LM =	60.164	59.074	56.918	56.025	56.352
216		LM =	57.529	56.452	54.468	53.509	68.963
218		LM =	57.281	56.923	55.394	54.401	55.204
220		LM =	57.492	57.745	56.653	54.954	55.518
221		LM =	56.809	55.500	53.607	51.488*	999999
223		LM =	57.262	55.893	53.849	52.785*	999999
337		LM =	57.609	55.769	53.106	50.694*	999999
339		LM =	55.976	54.351	51.446	50.096*	999999
341		LM =	59.068	56.647	55.154	51.916	54.633
343		LM =	58.076	55.461	53.218	51.054*	999999
345		LM =	58.590	57.580	56.202	55.340*	999999
346		LM =	54.699	53.708	51.266	49.904*	999999
348		LM =	56.334	54.132	51.033	48.951*	999999
350		LM =	57.854	56.268	55.120	53.162*	999999
352		LM =	58.298	58.388	57.664	55.899	55.745
353		LM =	54.848	53.309	50.823	48.309*	999999
355		LM =	55.636	54.310	52.131	48.867*	999999
357		LM =	57.138	56.398	54.626	54.178*	999999
359		LM =	57.804	57.807	56.642	55.247	55.245
360		LM =	53.472	52.725	48.420	52.783*	999999
362		LM =	53.697	53.048	49.338	51.990*	999999
364		LM =	53.748	53.049	50.535	49.934*	999999
366		LM =	54.670	53.117	50.946	48.987*	999999
368		LM =	55.402	53.869	51.079	48.931*	999999
370		LM =	55.986	54.387	51.496	49.645*	999999
372		LM =	56.621	55.344	53.760	52.287*	999999
374		LM =	56.990	56.190	54.078	53.596*	999999
376		LM =	57.464	57.397	55.090	54.983	55.296
378		LM =	58.384	58.421	56.281	56.836	55.137
380		LM =	59.020	59.010	57.942	56.762	55.980
382		LM =	59.264	59.318	58.532	56.840	56.174
384		LM =	55.845	54.298	52.318	49.685*	999999
386		LM =	56.480	56.105	53.947	53.160*	999999
388		LM =	58.031	57.331	54.749	55.194	55.526
389		LM =	53.869	53.407	50.960	52.031*	999999
391		LM =	55.459	54.379	52.162	51.003*	999999
	MEAN	=	58.370	57.351	55.348	54.214*	999999
	SIGMASQ	=	2.739	2.671	3.898	4.466*	999999
	SIGMA	=	1.655	1.634	1.974	2.113*	999999
	MAX.	=	61.098	59.318	58.532	56.840*	999999
	MIN.	=	53.472	52.725	48.420	48.309*	999999

LOCATOR (B5) MODIFIED INFLECTION POINT

PROFILE		
1	LM =	49,769
3	LM =	34,521
5	LM =	49,989
7	LM =	50,629
9	LM =	37,772
10	LM =	36,932
12	LM =	50,833
14	LM =	38,219
16	LM =	39,786
17	LM =	50,748
19	LM =	38,995
21	LM =	38,767
23	LM =	38,748
24	LM =	35,758
26	LM =	34,412
28	LM =	34,385
30	LM =	34,801
32	LM =	37,052
34	LM =	37,488
36	LM =	38,801
38	LM =	39,444
40	LM =	39,067
42	LM =	40,193
44	LM =	39,930
46	LM =	39,812
48	LM =	40,857
50	LM =	41,282
52	LM =	40,181
53	LM =	36,239
55	LM =	40,500
113	LM =	38,656
115	LM =	37,974
117	LM =	37,738
119	LM =	38,140
121	LM =	37,450
122	LM =	38,315
124	LM =	37,995
126	LM =	37,881
128	LM =	37,943
129	LM =	38,408
131	LM =	38,120
133	LM =	36,700
135	LM =	37,895
136	LM =	38,338
138	LM =	38,385
140	LM =	38,505
142	LM =	38,503
144	LM =	38,425
146	LM =	37,669
148	LM =	37,833
150	LM =	44,761
152	LM =	45,520
154	LM =	44,356

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156        LM =  37.949
158        LM =  38.023
160        LM =  38.231
162        LM =  37.010
164        LM =  36.767
165        LM =  38.771
167        LM =  37.259
169        LM =  39.486
171        LM =  43.757
173        LM =  46.174
175        LM =  35.556
177        LM =  36.823
178        LM =  44.936
180        LM =  34.813
182        LM =  37.616
184        LM =  44.498
185        LM =  34.250
187        LM =  35.989
189        LM =  38.069
191        LM =  38.082
192        LM =  37.851
194        LM =  39.456
196        LM =  43.812
198        LM =  33.646
200        LM =  35.123
202        LM =  35.958
204        LM =  37.500
206        LM =  38.507
208        LM =  38.802
210        LM =  39.346
212        LM =  39.137
214        LM =  40.138
216        LM =  35.836
218        LM =  38.025
220        LM =  39.205
221        LM =  43.100
223        LM =  34.349
337        LM =  31.671
339        LM =  32.155
341        LM =  31.750
343        LM =  31.102
345        LM =  48.258
346        LM =  31.933
348        LM =  31.214
350        LM =  46.271
352        LM =  38.733
353        LM =  30.952
355        LM =  32.243
357        LM =  37.559
359        LM =  38.215
360        LM =  31.684
362        LM =  32.183
364        LM =  32.433
366        LM =  31.740
368        LM =  30.841
370        LM =  31.793
372        LM =  46.743
374        LM =  37.441
376        LM =  44.738
378        LM =  45.180
380        LM =  39.088
382        LM =  39.204
384        LM =  30.953
386        LM =  35.235
388        LM =  38.540
389        LM =  33.022
391        LM =  32.600
     MEAN       =  38.340
     SIGMASQ    =  19.896
     SIGMA      =   4.461
     MAX.       =  50.833
     MIN.       =  30.841


 END OF PROGRAM SYSCAN
0000000
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LOCATOR (B6) MINIMUM CURVATURE

PROFILE	ABSOLUTE MIN.		
1	-.022	LM =	27.000
3	-.023	LM =	27.000
5	-.036	LM =	38.000
7	-.019	LM =	27.000
9	-.041	LM =	32.000
10	-.025	LM =	35.000
12	-.021	LM =	27.000
14	-.022	LM =	33.000
16	-.064	LM =	33.000
17	-.020	LM =	27.000
19	-.021	LM =	27.000
21	-.025	LM =	27.000
23	-.039	LM =	32.000
24	-.034	LM =	35.000
26	-.035	LM =	35.000
28	-.033	LM =	35.000
30	-.022	LM =	35.000
32	-.019	LM =	27.000
34	-.019	LM =	27.000
36	-.021	LM =	27.000
38	-.031	LM =	33.000
40	-.037	LM =	32.000
42	-.056	LM =	32.000
44	-.070	LM =	32.000
46	-.070	LM =	32.000
48	-.035	LM =	35.000
50	-.034	LM =	34.000
52	-.043	LM =	33.000
53	-.039	LM =	35.000
55	-.045	LM =	35.000
113	-.029	LM =	33.000
115	-.038	LM =	33.000
117	-.022	LM =	21.000
119	-.025	LM =	25.000
121	-.024	LM =	34.000
122	-.034	LM =	25.000
124	-.027	LM =	32.000
126	-.020	LM =	27.000
128	-.051	LM =	35.000
129	-.035	LM =	33.000
131	-.029	LM =	33.000
133	-.069	LM =	35.000
135	-.081	LM =	35.000
136	-.038	LM =	33.000
138	-.042	LM =	33.000
140	-.034	LM =	33.000
142	-.026	LM =	33.000
144	-.021	LM =	29.000
146	-.033	LM =	35.000
148	-.058	LM =	35.000
150	-.058	LM =	35.000
152	-.053	LM =	35.000

LOCATOR (B6) MINIMUM CURVATURE - Continued

154	-.049	LH =	35.000
156	-.045	LH =	35.000
158	-.043	LH =	35.000
160	-.022	LH =	29.000
162	-.020	LH =	34.000
164	-.028	LH =	27.000
165	-.028	LH =	33.000
167	-.026	LH =	34.000
169	-.042	LH =	22.000
171	-.029	LH =	32.000
173	-.021	LH =	27.000
175	-.022	LH =	22.000
177	-.040	LH =	35.000
178	-.027	LH =	32.000
180	-.019	LH =	22.000
182	-.022	LH =	27.000
184	-.051	LH =	41.000
185	-.018	LH =	22.000
187	-.014	LH =	26.000
189	-.022	LH =	27.000
191	-.038	LH =	41.000
192	-.062	LH =	32.000
194	-.043	LH =	32.000
196	-.037	LH =	32.000
198	-.027	LH =	32.000
200	-.026	LH =	32.000
202	-.014	LH =	27.000
204	-.018	LH =	27.000
206	-.022	LH =	27.000
208	-.026	LH =	41.000
210	-.024	LH =	41.000
212	-.026	LH =	34.000
214	-.025	LH =	33.000
216	-.020	LH =	32.000
218	-.021	LH =	27.000
220	-.021	LH =	47.000
221	-.041	LH =	32.000
223	-.037	LH =	32.000
337	-.018	LH =	20.000
339	-.029	LH =	32.000
341	-.021	LH =	31.000
343	-.019	LH =	20.000
345	-.022	LH =	31.000
346	-.016	LH =	32.000
348	-.021	LH =	27.000
350	-.021	LH =	31.000
352	-.024	LH =	27.000
353	-.018	LH =	20.000
355	-.020	LH =	20.000
357	-.021	LH =	27.000
359	-.033	LH =	29.000
360	-.018	LH =	31.000
362	-.016	LH =	31.000
364	-.013	LH =	19.000
366	-.019	LH =	18.000
368	-.019	LH =	20.000
370	-.017	LH =	28.000
372	-.019	LH =	28.000
374	-.020	LH =	27.000
376	-.022	LH =	34.000
378	-.025	LH =	27.000
380	-.024	LH =	27.000
382	-.024	LH =	27.000
384	-.020	LH =	26.000
386	-.016	LH =	20.000
388	-.023	LH =	27.000
389	-.014	LH =	16.000
391	-.016	LH =	18.000

MEAN	= 30.142
SIGMASQ	= 29.086
SIGMA	= 5.393
MAX.	= 47.000
MIN.	= 16.000

LOCATOR (B7) MAXIMUM CURVATURE

PROFILE	ABSOLUTE MAX.		
1	.025	LH =	47.000
3	.027	LH =	32.000
5	.040	LH =	35.000
7	.018	LH =	35.000
9	.027	LH =	41.000
10	.027	LH =	32.000
12	.016	LH =	45.000
14	.012	LH =	48.000
16	.030	LH =	41.000
17	.020	LH =	47.000
19	.021	LH =	44.000
21	.027	LH =	35.000
23	.031	LH =	35.000
24	.046	LH =	33.000
26	.036	LH =	32.000
28	.026	LH =	32.000
30	.019	LH =	47.000
32	.020	LH =	45.000
34	.022	LH =	45.000
36	.022	LH =	44.000
38	.016	LH =	44.000
40	.016	LH =	49.000
42	.023	LH =	35.000
44	.029	LH =	35.000
46	.028	LH =	35.000
48	.027	LH =	47.000
50	.021	LH =	45.000
52	.034	LH =	38.000
53	.022	LH =	47.000
55	.022	LH =	45.000
113	.018	LH =	45.000
115	.017	LH =	45.000
117	.018	LH =	45.000
119	.020	LH =	48.000
121	.032	LH =	41.000
122	.017	LH =	45.000
124	.032	LH =	35.000
126	.019	LH =	38.000
128	.050	LH =	41.000
129	.030	LH =	35.000
131	.025	LH =	38.000
133	.066	LH =	38.000
135	.042	LH =	32.000
136	.026	LH =	38.000
138	.018	LH =	38.000
140	.016	LH =	49.000
142	.015	LH =	49.000
144	.017	LH =	48.000
146	.029	LH =	38.000
148	.050	LH =	38.000
150	.053	LH =	38.000
152	.034	LH =	39.000

LOCATOR (B7) MAXIMUM CURVATURE - Continued

154	.043	LH =	41.000
156	.048	LH =	41.000
158	.052	LH =	41.000
160	.019	LH =	38.000
162	.020	LH =	38.000
164	.023	LH =	33.000
165	.022	LH =	38.000
167	.027	LH =	38.000
169	.061	LH =	35.000
171	.057	LH =	35.000
173	.033	LH =	41.000
175	.018	LH =	35.000
177	.042	LH =	38.000
178	.044	LH =	35.000
180	.025	LH =	47.000
182	.012	LH =	45.000
184	.070	LH =	38.000
185	.022	LH =	47.000
187	.013	LH =	49.000
189	.014	LH =	44.000
191	.034	LH =	38.000
192	.074	LH =	35.000
194	.055	LH =	35.000
196	.041	LH =	35.000
198	.026	LH =	35.000
200	.017	LH =	35.000
202	.017	LH =	49.000
204	.016	LH =	49.000
206	.020	LH =	44.000
208	.021	LH =	44.000
210	.025	LH =	38.000
212	.021	LH =	38.000
214	.029	LH =	41.000
216	.017	LH =	35.000
218	.023	LH =	49.000
220	.023	LH =	49.000
221	.037	LH =	35.000
223	.028	LH =	35.000
337	.027	LH =	35.000
339	.029	LH =	35.000
341	.024	LH =	38.000
343	.016	LH =	39.000
345	.028	LH =	35.000
346	.026	LH =	35.000
348	.020	LH =	35.000
350	.026	LH =	35.000
352	.030	LH =	35.000
353	.025	LH =	35.000
355	.030	LH =	35.000
357	.017	LH =	32.000
359	.055	LH =	32.000
360	.025	LH =	35.000
362	.024	LH =	35.000
364	.019	LH =	35.000
366	.024	LH =	35.000
368	.017	LH =	32.000
370	.018	LH =	32.000
372	.012	LH =	44.000
374	.013	LH =	32.000
376	.048	LH =	38.000
379	.026	LH =	38.000
380	.022	LH =	38.000
382	.017	LH =	38.000
384	.021	LH =	32.000
386	.013	LH =	48.000
388	.020	LH =	47.000
389	.007	LH =	28.000
391	.009	LH =	29.000

MEAN	= 39.200
SIGMASQ	= 30.010
SIGMA	= 5.478
MAX.	= 49.000
MIN.	= 28.000

LOCATOR (B8) MEAN BETWEEN MAXIMUM AND MINIMUM CURVATURE

PROFILE	ABSOLUTE MIN.	ABSOLUTE MAX.		
1	-.022	.025	LM =	37.000
3	-.023	.027	LM =	29.500
5	-.036	.040	LM =	36.500
7	-.019	.018	LM =	31.000
9	-.041	.027	LM =	36.500
10	-.025	.027	LM =	33.500
12	-.021	.016	LM =	36.000
14	-.022	.012	LM =	40.500
16	-.064	.030	LM =	37.000
17	-.020	.020	LM =	37.000
19	-.021	.021	LM =	35.500
21	-.025	.027	LM =	31.000
23	-.039	.031	LM =	33.500
24	-.034	.046	LM =	34.000
26	-.035	.036	LM =	33.500
28	-.033	.026	LM =	33.500
30	-.022	.019	LM =	41.000
32	-.019	.020	LM =	36.000
34	-.019	.022	LM =	36.000
36	-.021	.022	LM =	35.500
38	-.031	.016	LM =	38.500
40	-.037	.016	LM =	40.500
42	-.056	.023	LM =	33.500
44	-.070	.029	LM =	33.500
46	-.070	.028	LM =	33.500
48	-.035	.027	LM =	41.000
50	-.034	.021	LM =	39.500
52	-.043	.034	LM =	35.500
53	-.039	.022	LM =	41.000
55	-.045	.022	LM =	40.000
113	-.029	.018	LM =	39.000
115	-.038	.017	LM =	39.000
117	-.022	.018	LM =	33.000
119	-.025	.020	LM =	36.500
121	-.024	.032	LM =	37.500
122	-.034	.017	LM =	35.000
124	-.027	.032	LM =	33.500
126	-.020	.019	LM =	32.500
128	-.051	.050	LM =	38.000
129	-.035	.030	LM =	34.000
131	-.029	.025	LM =	35.500
133	-.069	.066	LM =	36.500
135	-.041	.042	LM =	33.500
136	-.038	.026	LM =	35.500
138	-.042	.018	LM =	35.500
140	-.034	.016	LM =	41.000
142	-.026	.015	LM =	41.000
144	-.021	.017	LM =	38.500
146	-.033	.029	LM =	36.500
148	-.058	.050	LM =	36.500
150	-.058	.053	LM =	36.500
152	-.053	.034	LM =	37.000

LOCATOR (B8) MEAN BETWEEN MAXIMUM AND MINIMUM CURVATURE - Continued

154	-.049	.043	LM =	38.000
156	-.045	.048	LM =	38.000
158	-.043	.052	LM =	38.000
160	-.022	.019	LM =	33.500
162	-.020	.020	LM =	36.000
164	-.028	.023	LM =	30.000
165	-.028	.022	LM =	35.500
167	-.026	.027	LM =	36.000
169	-.042	.061	LM =	28.500
171	-.029	.057	LM =	33.500
173	-.021	.033	LM =	34.000
175	-.022	.018	LM =	28.500
177	-.040	.042	LM =	36.500
178	-.027	.044	LM =	33.500
180	-.019	.025	LM =	34.500
182	-.022	.012	LM =	36.000
184	-.051	.070	LM =	39.500
185	-.018	.022	LM =	34.500
187	-.014	.013	LM =	37.500
189	-.022	.014	LM =	35.500
191	-.038	.034	LM =	39.500
192	-.062	.074	LM =	33.500
194	-.043	.055	LM =	33.500
196	-.037	.041	LM =	33.500
198	-.027	.026	LM =	33.500
200	-.026	.017	LM =	33.500
202	-.014	.017	LM =	38.000
204	-.018	.016	LM =	38.000
206	-.022	.020	LM =	35.500
208	-.026	.021	LM =	42.500
210	-.024	.025	LM =	39.500
212	-.026	.021	LM =	36.000
214	-.025	.029	LM =	37.000
216	-.020	.017	LM =	33.500
218	-.021	.023	LM =	38.000
220	-.021	.023	LM =	48.000
221	-.041	.037	LM =	33.500
223	-.037	.028	LM =	33.500
337	-.018	.027	LM =	27.500
339	-.029	.029	LM =	33.500
341	-.021	.024	LM =	34.500
343	-.019	.016	LM =	29.500
345	-.022	.028	LM =	33.000
346	-.016	.026	LM =	33.500
348	-.021	.020	LM =	31.000
350	-.021	.028	LM =	33.000
352	-.024	.030	LM =	31.000
353	-.018	.025	LM =	27.500
355	-.020	.030	LM =	27.500
357	-.021	.017	LM =	29.500
359	-.033	.055	LM =	30.500
360	-.018	.025	LM =	33.000
362	-.016	.024	LM =	33.000
364	-.013	.019	LM =	27.000
366	-.019	.024	LM =	26.500
368	-.019	.017	LM =	26.000
370	-.017	.018	LM =	30.000
372	-.019	.012	LM =	36.000
374	-.020	.013	LM =	29.500
376	-.022	.048	LM =	36.000
378	-.025	.026	LM =	32.500
380	-.024	.022	LM =	32.500
382	-.024	.017	LM =	32.500
384	-.020	.021	LM =	29.000
386	-.016	.013	LM =	34.000
388	-.023	.020	LM =	37.000
389	-.014	.007	LM =	22.000
391	-.016	.009	LM =	23.500

MEAN	= 34.671
SIGMA-SQ	= 15.885
SIGMA	= 3.986
MAX.	= 48.000
MIN.	= 22.000

LOCATOR (SL1) PEAK RADIANCE

PROFILE	ABSOLUTE MAX.		
1	5.650	LH =	14,000
3	5.805	LH =	14,000
5	5.514	LH =	14,000
7	5.522	LH =	15,000
9	5.514	LH =	19,000
10	5.958	LH =	13,000
12	5.746	LH =	15,000
14	5.901	LH =	15,000
16	5.715	LH =	20,000
17	6.004	LH =	14,000
19	5.701	LH =	16,000
21	5.549	LH =	19,000
23	5.716	LH =	20,000
24	6.056	LH =	13,000
26	6.062	LH =	12,000
28	6.110	LH =	12,000
30	6.138	LH =	14,000
32	6.008	LH =	15,000
34	5.907	LH =	14,000
36	5.827	LH =	13,000
38	5.762	LH =	19,000
40	5.822	LH =	20,000
42	5.736	LH =	21,000
44	5.689	LH =	22,000
46	5.670	LH =	22,000
48	6.148	LH =	14,000
50	5.890	LH =	16,000
52	5.894	LH =	21,000
53	6.143	LH =	13,000
55	6.168	LH =	14,000
113	6.348	LH =	15,000
115	6.325	LH =	16,000
117	5.921	LH =	18,000
119	5.932	LH =	15,000
121	5.490	LH =	19,000
122	6.291	LH =	15,000
124	6.254	LH =	16,000
126	5.638	LH =	19,000
128	5.320	LH =	20,000
129	6.329	LH =	15,000
131	6.003	LH =	16,000
133	5.572	LH =	20,000
135	5.409	LH =	19,000
136	6.624	LH =	15,000
138	6.561	LH =	15,000
140	6.472	LH =	15,000
142	6.370	LH =	15,000
144	6.239	LH =	15,000
146	6.076	LH =	15,000
148	5.759	LH =	18,000
150	5.488	LH =	19,000
152	5.293	LH =	18,000
154	5.130	LH =	18,000

156	5.084	LM =	19.000
158	5.126	LM =	19.000
160	6.116	LM =	16.000
162	5.671	LM =	18.000
164	5.217	LM =	19.000
165	6.357	LM =	16.000
167	6.099	LM =	16.000
169	5.492	LM =	13.000
171	5.042	LM =	12.000
173	5.193	LM =	13.000
175	4.890	LM =	15.000
177	5.312	LM =	19.000
178	4.807	LM =	11.000
180	4.850	LM =	14.000
182	5.124	LM =	15.000
184	5.409	LM =	20.000
185	4.734	LM =	13.000
187	4.888	LM =	14.000
189	5.273	LM =	19.000
191	5.483	LM =	19.000
192	4.593	LM =	11.000
194	4.592	LM =	10.000
196	4.635	LM =	-30.000
198	4.674	LM =	10.000
200	4.788	LM =	13.000
202	4.985	LM =	13.000
204	5.176	LM =	14.000
206	5.392	LM =	18.000
208	5.507	LM =	20.000
210	5.522	LM =	20.000
212	5.626	LM =	20.000
214	5.687	LM =	20.000
216	5.016	LM =	-30.000
218	5.310	LM =	13.000
220	5.558	LM =	20.000
221	4.566	LM =	-30.000
223	4.728	LM =	7.000
337	4.878	LM =	13.000
339	4.249	LM =	11.000
341	5.075	LM =	11.000
343	4.928	LM =	-30.000
345	4.972	LM =	19.000
346	4.137	LM =	-20.000
348	4.809	LM =	-30.000
350	4.843	LM =	12.000
352	5.226	LM =	19.000
353	4.532	LM =	-30.000
355	4.556	LM =	14.000
357	4.937	LM =	12.000
359	5.317	LM =	19.000
360	3.352	LM =	-30.000
362	3.474	LM =	-30.000
364	3.691	LM =	-30.000
366	4.308	LM =	-30.000
368	4.573	LM =	-30.000
370	4.575	LM =	-30.000
372	4.714	LM =	12.000
374	4.935	LM =	13.000
376	5.160	LM =	13.000
378	5.254	LM =	18.000
380	5.470	LM =	20.000
382	5.474	LM =	20.000
384	4.567	LM =	-30.000
386	4.807	LM =	12.000
388	5.182	LM =	19.000
389	3.560	LM =	-30.000
391	4.267	LM =	-30.000

MEAN = 9.875
SIGMASQ = 246.593
SIGMA = 15.703
MAX. = 22.000
MIN. = -30.000

LOCATOR (SL2) SLOPE AT ZERO TANGENT HEIGHT

PROFILE		
1	LH =	.002
3	LH =	.002
5	LH =	.003
7	LH =	.003
9	LH =	.004
10	LH =	.002
12	LH =	.003
14	LH =	.004
16	LH =	.005
17	LH =	.003
19	LH =	.004
21	LH =	.004
23	LH =	.005
24	LH =	.002
26	LH =	.002
28	LH =	.002
30	LH =	.003
32	LH =	.004
34	LH =	.004
36	LH =	.004
38	LH =	.005
40	LH =	.005
42	LH =	.005
44	LH =	.005
46	LH =	.004
48	LH =	.004
50	LH =	.005
92	LH =	.005
53	LH =	.002
55	LH =	.004
113	LH =	.004
115	LH =	.004
117	LH =	.004
119	LH =	.004
121	LH =	.003
122	LH =	.005
124	LH =	.004
126	LH =	.003
128	LH =	.003
129	LH =	.004
131	LH =	.004
133	LH =	.003
135	LH =	.003
136	LH =	.004
138	LH =	.004
140	LH =	.004
142	LH =	.004
144	LH =	.003
146	LH =	.003
148	LH =	.003
150	LH =	.003
152	LH =	.002
154	LH =	.002
156	LH =	.002

LOCATOR (SL2) SLOPE AT ZERO TANGENT HEIGHT - Continued

158	LM	=	.002
160	LM	=	.004
162	LM	=	.003
164	LM	=	.002
165	LM	=	.004
167	LM	=	.004
169	LM	=	.002
171	LM	=	.001
173	LM	=	.002
175	LM	=	.002
177	LM	=	.003
178	LM	=	.001
180	LM	=	.001
182	LM	=	.003
184	LM	=	.004
185	LM	=	.000
187	LM	=	.002
189	LM	=	.003
191	LM	=	.004
192	LM	=	.000
194	LM	=	.000
196	LM	=	.000
198	LM	=	.000
200	LM	=	.001
202	LM	=	.001
204	LM	=	.002
206	LM	=	.003
208	LM	=	.004
210	LM	=	.004
212	LM	=	.004
214	LM	=	.004
216	LM	=	-.002
218	LM	=	.002
220	LM	=	.004
221	LM	=	-.001
223	LM	=	.000
337	LM	=	.001
339	LM	=	.000
341	LM	=	.001
343	LM	=	.000
345	LM	=	.002
346	LM	=	.000
348	LM	=	-.000
350	LM	=	.001
352	LM	=	.003
353	LM	=	-.001
355	LM	=	.000
357	LM	=	.002
359	LM	=	.003
360	LM	=	-.001
362	LM	=	-.000
364	LM	=	-.001
366	LM	=	-.001
368	LM	=	-.001
370	LM	=	-.000
372	LM	=	.001
374	LM	=	.002
376	LM	=	.003
378	LM	=	.003
380	LM	=	.004
382	LM	=	.004
384	LM	=	-.001
386	LM	=	.001
388	LM	=	.003
389	LM	=	-.001
391	LM	=	-.001
MEAN		=	.002
SIGMASQ		=	.000
SIGMA		=	.002
MAX.		=	.005
MIN.		=	-.002

REFERENCES AND BIBLIOGRAPHY

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REFERENCES

1. Duncan, J.; Wolfe, W.; Oppel, G.; and Burn, J.: Infrared Horizon Sensors. IRIA State-of-the-Art Report (NAVSO P-2481), Institute of Science and Technology, University of Michigan and Lockheed Missiles and Space Company, April 1965.

2. Duncan, J.: Horizon Detector Techniques Providing 0.05° Accuracy at Low Satellite Altitudes. Proceedings of the IRIS, Volume 9, No. 1, pp. 155-159.

3. Earle, M. D.: Infrared Horizon Sensor Accuracy in the Atmospheric Absorption Bands. ASTIA No. AD460971, June 1964.

4. Schwarz, F.; Ward, K. A.; and Falk, T.: A High Accuracy Conical Scan Horizon Sensor Operating in the 15μ CO_2 Band. Proceedings of the First Symposium on Infrared Sensors for Spacecraft Guidance and Control, Barnes Engineering Company, June 1965, pp. 75-88.

5. Wark, D. Q.: Horizon Sensing, in the Infrared - Theoretical Considerations of Spectral Radiance. Torques and Attitude Sensing in Earth Satellites, S. F. Singer, Editor, Academic Press (New York), 1964, pp. 207-220.

6. Astheimer, R. W.: Historical Background and Classification of Infrared Horizon Sensor Systems. Proceedings of the First Symposium on Infrared Sensors for Spacecraft Guidance and Control, Barnes Engineering Company, June 1965, pp. 29-34.

BIBLIOGRAPHY

Alder, J. E.: A Meteorological Study of Cold Clouds as Related to Satellite Infrared Horizon Sensors. Scientific Report No. 1, Stanford Research Institute.

Anthony, R.; and Smiley, V. N.: Infrared Horizon Measurements from near Orbiting Altitudes. SR No. 2, N63-10069, 15 August 1962.

Arck, M. H.: Horizon Sensors for Spin Stabilized Spacecraft. Proceedings of the first Symposium on Infrared Sensors for Spacecraft Guidance and Control, Barnes Engineering Company, June 1965, pp. 101-115.

Baxter, W. F.: Simulation of an Attitude Determining System Utillzing Magnetometers and Earth's Horizon Sensor. Army Missile Command, N65-29104, 31 May 1965.

Burn, J. W.: Electro-optical Design of Horizon Sensors. Annual East Coast Conference on Aerospace and Navigational Electronics, 11th (IEEE), 21-23 October 1964, pp. 1.4.5.1 - 1.4.5.10 (A65-14939).

Burn, J. W.: IEEE Transactions on Aerospace-Support Conference Procedures, Volume AS-1, August 1963, pp. 1115-1126.

Conrath, B. J.: Earth Scan Analog Signal Relationships in the Tiros Radiation Experiment and their Application to the Problem of Horizon Sensing. Torques and Attitude Sensing in Earth Satellites, S. F. Singer, Editor, Academic Press (New York), 1964, pp. 235-254.

Caveney, R.: Second Harmonic Edge - Tracking Horizon Sensor, Fixed Point Type. Proceedings of the First Symposium on Infrared Sensors for Spacecraft Guidance and Control, Barnes Engineering Company, June 1965, pp. 117-131.

Falbel, G.: High Accuracy Horizon Sensor Using FIRM. Proceedings of the First Symposium on Infrared Sensors for Spacecraft Guidance and Control, Barnes Engineering Company, June 1965, pp. 159-174.

Falbel, G.; and Astheimer, R. W.: Infrared Horizon Sensor Techniques for Lunar and Planetary Approaches. Paper 63-358, AIAA, August 12-14, 1963.

Fowler, R. Z.: Attitude Control Study for Nimbus Meteorological Satellites, MR No. 13, X65-18670, 10 May 1965.

Fowler, R. Z.: Attitude Control Study for Nimbus Meteorological Satellites, MR No. 16, X66-10818, 10 August 1965.

Fowler, R. Z.: Attitude Control Study for Nimbus Meteorological Satellites, MR No. 17, X66-10819, 20 September 1965.

Fowler, R. Z.: Attitude Control Study for Nimbus Meteorological Satellites, MR No. 18, X66-10824, 8 October 1965.

Frazier, M.; Kriegsman, B.; and Nesline, Jr., F. W.: Self-contained Satellite Navigation Systems. Paper 2683-62. ARS Annual Meeting, 17th Space Flight Exposition, 13-18 November 1962.

Griep, D. J.: Electronics Program Satellite Attitude Control System Experiments. W-64-22324, 15 May 1964.

Hanel, R. A.: The Infrared Horizon of the Planet Earth. Journal of Atmospheric Sciences, Volume 20, No. 2, March 1963, pp. 73-86.

Hanel, R. A.: The Infrared Horizon of the Planet Earth, N64-27275, August 1962.

Hanel, R. A.: The Infrared Horizon of the Planet Earth, N63-20603, Septempber 1963.

Hatcher, N. M.; Newcomb, Jr., A. L.; and Groom, N. J.: Development and Testing of a Proposed Infrared Horizon Scanner for use in Spacecraft Attitude Determination, N65-33844, September 1965.

Hergenrother, K. M.; Persky, M. J.; and Lavery, A. L.: Infrared Horizon Studies. ASTIA No. AD416773, 30 June 1963.

Herring, J. R.: Vibration and Shock Testing on Prototype Horizon Sensor for Space, Inc. N63-18158.

Horan, J. J.: Performance and Systems Applications of Horizon Sensors on Spin Stabilized Spacecraft. Proceedings of the First Symposium on Infrared Sensors for Spacecraft Guidance and Control, Barnes Engineering Company, June 1965, pp. 89-100.

Hurtt, J. E.; and Francis, R. N.: Project HYDRA-IRIS. U. S. Naval Ordnance Test Station, China Lake, California. ASTIA No. AD431792, February 1964.

Jones, R.: Theoretical Method for Deriving an Earth Centered Datum From Optical Observation of the Earth Horizon From an Earth Satellite. NASA TN D-3367, April 1966.

Knoll, A. L.; and Edelstein, M. M.: Estimation of Local Vertical and Orbital Parameters for an Earth Satellite Using Horizon Sensor Measurements. AIAA J., Volume 3, February 1965, pp. 338-345.

Kuhn, K. H.; and Stark, E. W.: Horizon Trackers for Lunar Guidance and Control. American Astronomical Society Lunar Flight Symposium, New York Planum Press, 1962, pp. 108-152 (A63-12471).

Langton, W. G.: Horizon Scanner Development. ASTIA No. AD343500, 20 September 1956.

Lavan, J. T.: Infrared Horizon Scanning for Attitude Control. AGARD Paris, Light and Heat Sensing, 1963, pp. 411-435. (N64-15478 in N64-15452).

Lilley, A. E.: Oxygen Horizon Seeker, Theoretical Analysis. N64-25598, 14 February 1964.

Lunde, B. K.: Horizon Sensing for Attitude Determination. Paper presented at the AAS Goddard Memorial Symposium (Washington, D. C.), 16-17 March 1962.

McArthur, W. G.: Horizon Sensor Navigation Errors Resulting from Statistical Variations in the CO_2 14-16 Micron Radiation Band. Aerospace Corp. Transactions of the 9th Symposium, on Ballistic Missile and Space Technology, Volume 1, 1964, pp. 261-289 (X65-13593, X65-13584).

MacLaren, A. P.: Automatic Control in the Peaceful Use of Space - Part 3. Control, Volume 9, November 1965, pp. 632-635 (A66-13258).

Meditch, J. S.: A Study of Optimal Linear Estimation for a Horizon Scanner. ASTIA No. AD 604180, 25 August 1964.

Merlen, M. M.: Infrared and Electro-optics Phase I: Lunar and Planetary Horizon Sensor. N64-12397, 25 June 1963.

Mohr, E. I.: Horizon Sensor: Ratio of Signal to Noise. N66-14105 in N66-14101, 1964.

Morales, E.: Second Harmonic Edge-Tracking Horizon Sensor, Azimuth Scanning Type. Proceedings of the First Symposium on Infrared Sensors for Spacecraft Guidance and Control, Barnes Engineering Company, June 1965, pp. 133-157.

Newcomb, Jr., A. L : Groom, N. J.; and Hatcher, N. M.: A Novel Moon and Planet Seeking Attitude Sensor for Use in Spacecraft Orientation and Control. IEEE International Convention Record, Volume 13, 1965, pp. 48-54. (A65-22149).

Palser, W. E.: Investigation of Problems Associated with the Detection of the Lunar Horizon From a Space Vehicle, NASA CR-58762, 7 May 1964.

Palser, W. E.: A Wide-Angle Linear-Output Horizon Sensor Optical System. Applied Optics, Volume 3, No. 1, January 1964, pp. 63-67.

Priore, K. C.: Development of Information Processing Circuitry for an All-Electronic Infrared Horizon Scanner. ASTIA No. AD 607576, December 1960.

Schwarz, F.: Horizon Sensor for Orbiting Spacecraft. Electronic Products, Volume 6, No. 6, November 1963, pp. 44-46.

Spielberger, S. C.: Conical Scan Horizon Sensor. Proceedings of the First Symposium on Infrared Sensors for Spacecraft Guidance and Control, Barnes Engineering Company, June 1965, pp. 55-71.

Stanfill, D. F.; and Pasternak, J. M.: Horizon Scanner for Venus and Mars, BEC Model 13-170. N64-27910, March 1964.

Szirmay, S.: A Science Instrument Support Scanning Platform. JPL Space Programs Summary, Volume IV (N65-32523 in N65-32410), Jet Propulsion Laboratory, California Institute of Technology, 30 June 1965, pp. 54-56.

Vanderkerckhove, J.; and Renard, M.: Attitude Reconstitution Through Conical Horizon Scanning. European Space Technology Center (Netherlands), October 1964 (N65-25365).

Wilcox, J. C.: Self-contained Orbital Navigation Systems with Correlated Measurement Errors. AIAA/ION Guidance and Control Conference, A66-10024, in A66-10001, 16-18 August 1965, pp. 231-247.

Wilkins, G. A.; and Hoyem, J. A.: The Terrestrial Horizon Night and Sky - 4.3 Micron Radiance Data Generated by the HITAB-IRIS Experiments. N64-33724, June 1964.

Anonymous: Horizon Sensors. American Standard Radiator Company, November 1964.

Anonymous: High Accuracy Infrared Horizon Sensors. American Standard Radiator Company, February 1965.

Anonymous: The Bunker-Ramo Horizon Sensor, Bunker-Ramo Corporation, 1964.

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