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ASDIR-II
VOLUME II
PROGRAM DESCRIPTION

AD B 009669

January 1975

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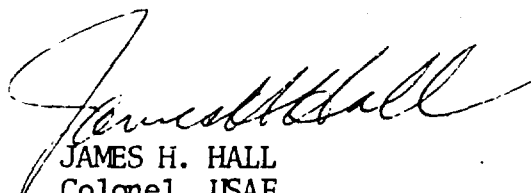
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Deputy for Development Planning

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ASDIR-II PROGRAM DESCRIPTION

INTRODUCTION

This Program Description outlines the structure of ASDIR-II in order to give the users the essential knowledge required for program implementation, use and modification. Simplified structural and flow diagrams of the major programs and short functional descriptions of all programs and subroutines are given to help describe ASDIR. The level of detail presented in this manual is consistent with the availability of reference and documentation material, program difficulty or program impact on overall computational accuracy.

Essentially this manual is written in the same order as the calling sequences in ASDIR, with modification only when structural considerations and clarity dictate.

Please note, this manual is intended as an aid to the user to allow better understanding of each program's function and not as a users manual (see ASDIR-II, Volume I - USERS MANUAL).

GENERAL PROGRAM DESCRIPTION

The Aeronautical Systems Division's InfraRed Signature Prediction Model (ASDIR) is a computer code utilizing the overlay structure shown in figure 1. These overlays are organized into three major functionally modularized computational groupings, figure 2: (1) Hot Parts Analysis; (2) Plume Gas Dynamics; and (3) Signature Prediction. A fourth overlay element establishes the required data initialization and input/output operational capabilities.

This volume is organized in the following functional format:

1. ASDIR 2 - Program Control
2. Data Initialization & I/O
3. Hot Parts Analysis
4. Plume Gas Dynamics
5. Signature Prediction
6. Program Listing in Overlay Form

PROGRAM: ASDIR 2 (Page A-4)

FUNCTION: This program is the main controlling routine of ASDIR (the Aeronautical Systems Division InfraRed Signature Prediction model). ASDIR's prime function is to provide a logical sequence of calls to the functional programs.

INPUT: None

OUTPUT: None

SUBROUTINES: All overlays and data blocks

DESCRIPTION: See figures 1 and 2 and program listing on page A-4.

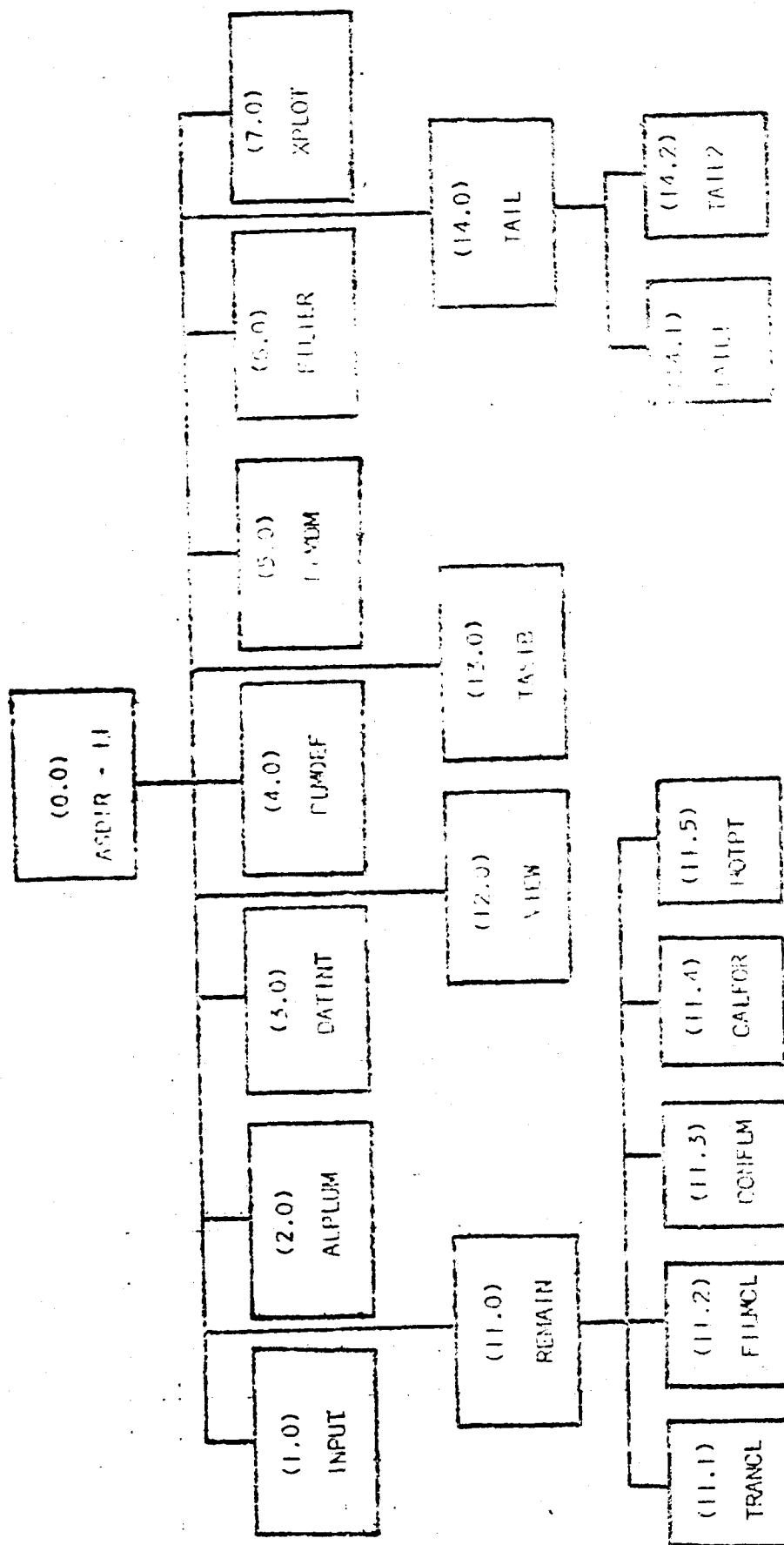


FIGURE 1. ASDIR-II OVERLAY STRUCTURE

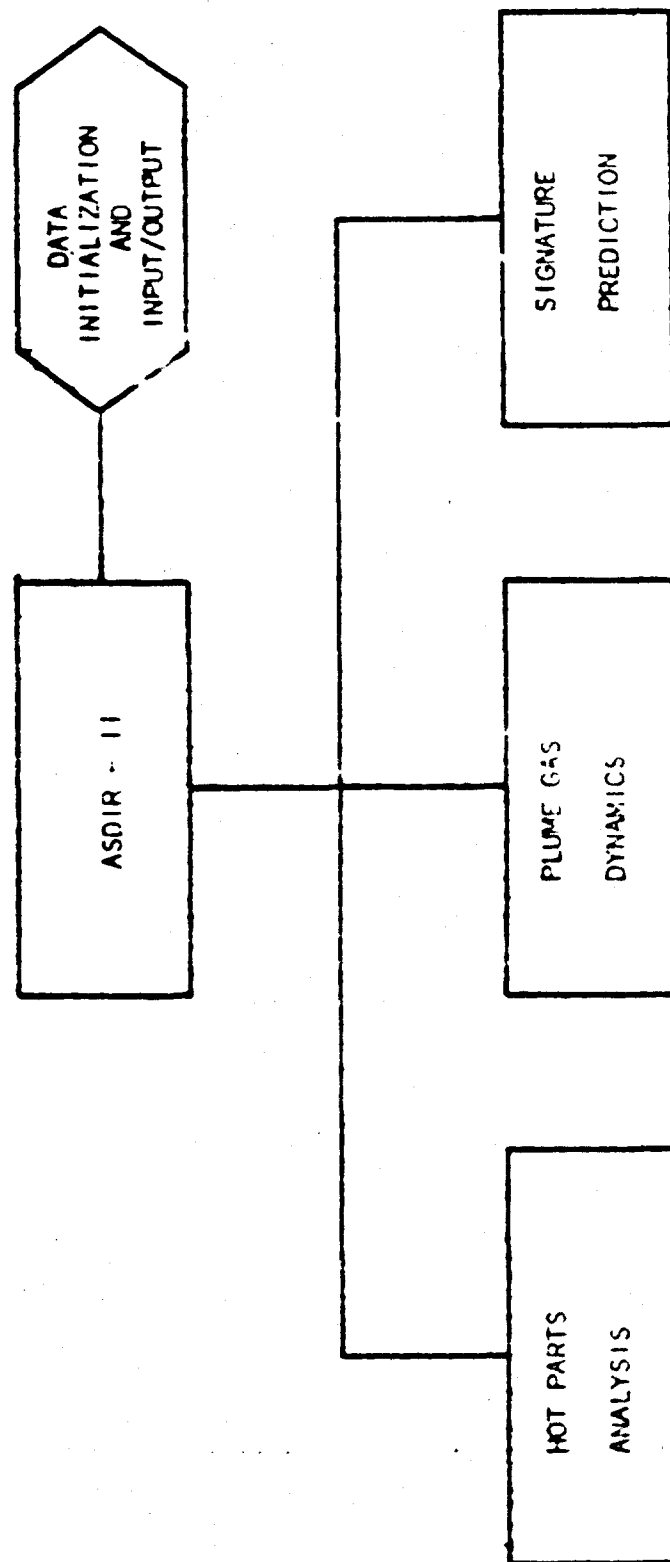


FIGURE 2. ASDIR-II FUNCTIONAL STRUCTURE

PROGRAM: INPUT (Page A-43)

FUNCTION: Provide a vehicle by which the desired calculation parameters, case definition and data initialization can be read into ASDIR.

INPUT: All control and computational variables in the CASE namelist.

OUTPUT: Computationally compatible case and dimensional data.

SUBROUTINES: None

DESCRIPTION: See ASDIR-II Volume I, User's Guide, for complete description of the namelist variables.

PROGRAM: DATINT (Page A-79)

FUNCTION: To initialize the calculation parameters.

INPUT: None

OUTPUT: Initialized calculation parameters

SUBROUTINES: None

DESCRIPTION: This program has been written to initialize the common block data to the default case. See ASDIR-II, Volume I, User's Guide for default options. A secondary function of this program is to allow use of ASDIR on systems in which a zero core initialization is not available.

PROGRAM: FILTER (Page A-106)

FUNCTION: Provides a means of accessing stored filter response data or entering a filter response of the user's choice.

INPUT: Filter number or filter band width and response.

OUTPUT: Filter response.

SUBROUTINES: None

DESCRIPTION: Stored filter responses are in data statements with modification possible through namelist FILT. This program also can be used to initialize the wavenumber calculation intervals.

PROGRAM: XPLOT (Page A-109)

FUNCTION: To provide a means of file manipulation for
either punching or printing spatial signature
data.

INPUT: Calculated spatial signature data.

OUTPUT: Punched or printed spatial data.

SUBROUTINES: None

DESCRIPTION: This program requires the use of a punch file
and an addition file TAPE 8.

PROGRAM: Block Data H2O (Page A-15)

FUNCTION: Data Block for water vapor band parameters.

INPUT: None

OUTPUT: None

SUBROUTINES: None

DESCRIPTION: See References [1, 2, 3]

PROGRAM: Block Data CO2 (Page A-7)

FUNCTION: Data Block for carbon dioxide band parameters.

INPUT: None

OUTPUT: None

SUBROUTINES: None

DESCRIPTION: See References [1, 2, 3]

PROGRAM: SIGNIR

FUNCTION: To calculate the hot parts signature and descriptive parameters required in ASDIR.

INPUT: Engine description, gas properties and case definition (See ASDIR-II, Volume I, User's Manual).

OUTPUT: Primarily the information which is transferred from the SIGNIR link to ASDIR is an equivalent black body area and equivalent black body temperature.

SUBROUTINES: See Figure 3.

DESCRIPTION: With the exception of the modifications required to adapt SIGNIR to the ASDIR format the hot parts calculations are performed with the original LTV/SIGNIR-I computer code. This code was chosen for only one reason; it has proven to be the best available methodology to predict engine hot metals signatures regardless of program size, operating cost or complexity.

The description of the infrared signature prediction program (SIGNIR) is provided by the following discussions which cover a general description of the program, the program computational procedure and the analytical methods utilized in obtaining the solution.

The program SIGNIR is a digital computer program written for the purpose of providing predictions of the hot metal infrared emission from aircraft engine exhaust systems. The program is designed to be applicable to axi-symmetric turbojet, turbofan, or turboshaft engine exhaust systems. It predicts the spectral intensity of the radiant energy emitted from exhaust system hot metal in the wavelength band of from one to 15 microns. In general, the information required by the program is as follows:

- . Exhaust system physical characteristics
- . Engine operating conditions
- . Special surface cooling flow conditions
- . Exhaust system surface properties

The predictions provided by the program for the combination of a selected maximum of 20 engine off-axis angles are:

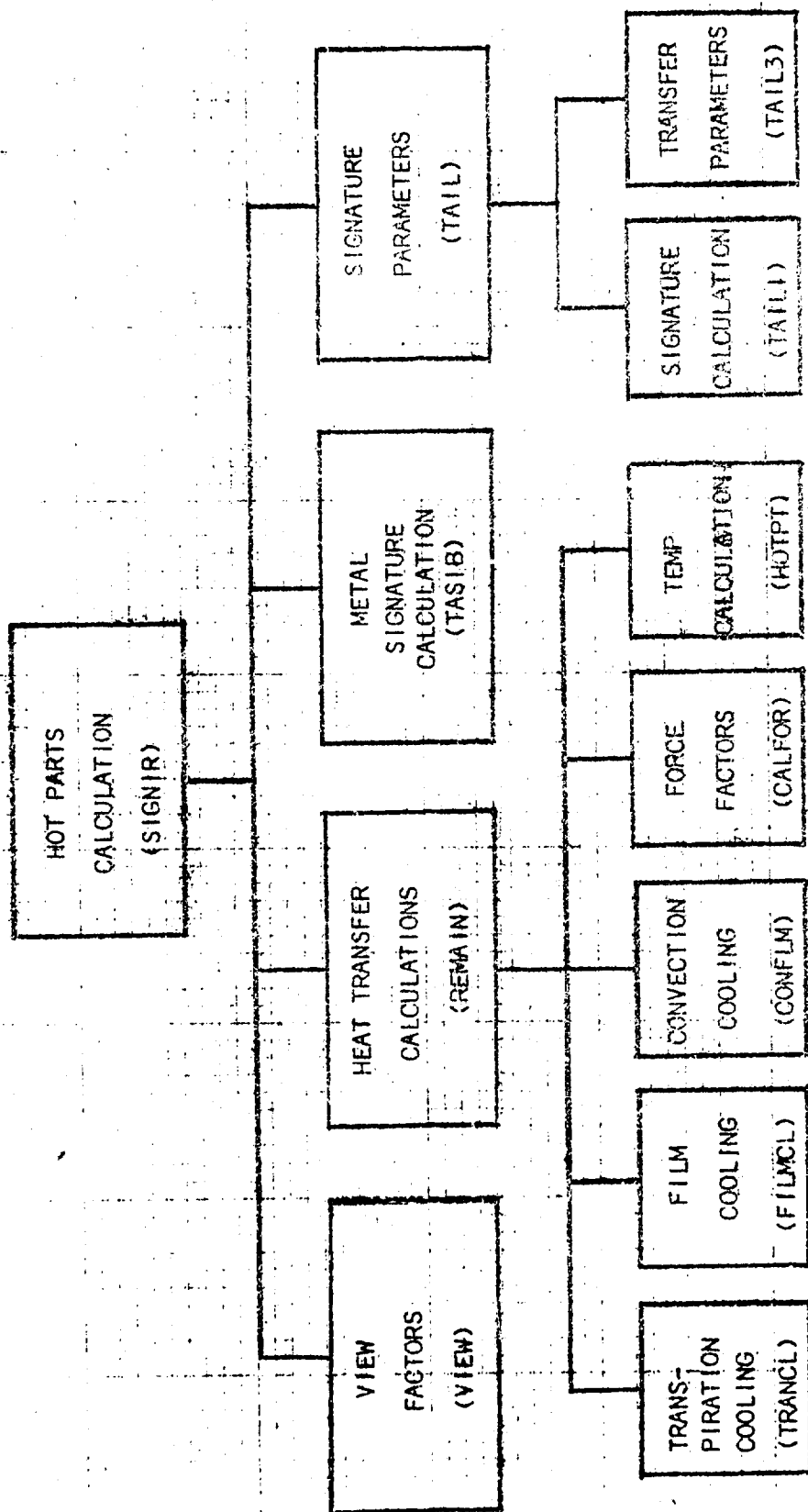


FIGURE 3. HOT PARTS ANALYSES

- . Spectral radiant intensity nonattenuated by the atmosphere
- . Selected radiant intensity bandwidth summations nonattenuated by the atmosphere

Optional exhaust system information which can be requested from the program is:

- . Internal fluid flow properties
- . Surface boundary layer data
- . Internal and external geometric radiation view factors
- . Surface temperature distribution
- . Thrust information

The process of computing the intensity of the infrared energy emitted from aircraft exhaust system hot metal requires a knowledge of the metallic surfaces temperature, emissive properties and their relative physical positioning within the system. From this information, the radiant energy emitted and reflected from the exhaust system to a point in space can be determined. The computational procedure established by this program for the prediction of exhaust system hot metal infrared radiation is shown by major subjects in the general block diagram presented on figure 3.

The input data required by the program provides a physical model (nodal system) of the exhaust system configuration, the properties and conditions of the exhaust gases entering the system, band width and location relative to the exhaust system. The program undertakes a one-dimensional, isentropic, compressible flow analysis which generates the axial distribution of exhaust gas flow conditions and properties within the system. Where two gas streams at different temperatures flow within a single passage, compound flow considerations are utilized. The program adjusts the flow at the nozzle throat to balance with the ambient pressure or a choked condition dependent on the system's entrance flow data.

With the internal flow properties defined, a surface boundary layer analysis is conducted to obtain the coefficients of convection and friction along each surface within the system. This analysis is primarily dependent on the surface's axial static pressure distribution and the upstream boundary layer conditions. An area weighted average coefficient of convection for each of the model's surface nodes (isothermal regions established by the input data) is computed for the system thermal analysis. The axial force on each surface, internal to the system, is computed utilizing both the frictional and pressure-area forces.

Descriptions of the routines associated with SIGNIR are presented in Table 1. Further definitions of the routines can be found in ASDIR-II, Volume III, Reference Documentation or in Reference [4].

The program SIGNIR, other than a few minor programming changes, remains as developed by LTV. The only link between SIGNIR and ASDIR-II is Common Block OUT, containing the following information:

- . Equivalent Black Body Area, CM^2
- . Equivalent Black Body Temperature, deg-K
- . Viewing Aspect Angles, degrees off tail
- . Number of Aspect Angles

TABLE 1
DESCRIPTION OF SIGNIP ROUTINES

<u>ROUTINE NAME</u>	<u>BASIC FUNCTION</u>	<u>PAGE</u>
ARCCOS	Determines the angle, in radians, corresponding to a given cosine value. The angle will be from zero to $\pi/2$ radians.	A-176
ARRAY	Describes in two-dimensional coordinates the inner and outer surfaces of the flow streams using the surface node coordinates.	A-38
AVFR	Averages the cooling wall temperatures for the surface nodes along the cooled portion of the configuration surfaces; prints these averages.	A-118
AVERFS	Determines the average values of the parameters necessary for force factor (pressure area and friction forces) calculations for each surface node along the configuration surfaces.	A-160
AVERHT	Determines and prints the average heat transfer coefficient for each surface node along the configuration surfaces.	A-151
AXAREA	Determines the cross-sectional area of the fluid flow streams as a function of the configuration axial distance.	A-126
BODY	Determines for the internal view factors, if the line of sight between points on two nodes is tangent to a shadowing body.	A-186
CALFOR	Prints the average force factor for each surface node and calculates and prints the total net surface force factor for the configuration.	A-148
CANSEE	Checks, for internal view factors, the visibility between two nodes to determine if shadowing may occur.	A-184
CEDIT	Selects the convection and conduction heat paths from input data and forms the conduction matrix.	A-203
CHECK	Checks the data returned from routine BODY for extraneous solutions.	A-188

TABLE 1 (Cont)

<u>ROUTINE NAME</u>	<u>BASIC FUNCTION</u>	<u>PAGE</u>
CODE	Analyzes the results provided by routine FINDIT to describe the nature of shadowing between two nodes.	A-183
COFLOW	Calculates the compressible flow properties for the flow streams as a function of pressure. Adjusts the flow for cooling or ambient pressure at the exit of the configuration.	A-122
COND	Reads in those values of heat transfer and fluid lump temperatures for nodes whose thermal paths are not connected with the fluid streams.	A-40
CONFLM	Calculates a pressure balance and surface temperatures for a surface cooled by convection-film cooling for either counter or parallel flow. Prints the coolant mass flow rate and pressure.	A-139
CPAGMA	Calculates the specific heat at constant pressure as a function of temperature for routine HEAT and the specific heat ratio as a function of Mach number of routines RIMAIN and HEAT.	A-128
CRODEL	Computes Kroneker Delta for matrix solutions.	A-196
CUBIC	Determines the real roots of a third order equation.	A-178
DINVRT	Computes the matrix inversion and accompanying solution for linear equations.	A-199
DIS	Computes the distance between two given coordinates.	A-215
FEDIT	Selects the radiation view factor data from the input data and forms the radiation matrix.	A-202
FILMCL	Calculates a pressure balance and surface temperatures for a film cooled surface. Prints the coolant mass flow rate and pressure.	A-134

TABLE I (Cont)

<u>ROUTINE NAME</u>	<u>BASIC FUNCTION</u>	<u>PAGE</u>
FINDIT	Locates the axial positions of two nodes with respect to the axial positions of the configurations surfaces.	A-182
FLOWNO	Checks the resulting pressure for surface cooling against the static pressure along the cooled surface. Prints a warning diagnostic for areas of no cooling flow.	A-119
GATHER	Combines data from routines AXAREA and COFLOW to form the compressible flow properties for the configuration flow streams.	A-127
HEAT	Calculates the initial conditions necessary for the boundary layer calculations.	A-153
HEATTR	Calculates the convection heat transfer coefficient.	A-159
HOTPT	Routine to control the calculation of surface boundary layers and heat transfer coefficients.	A-149
MATPOS	Checks to ensure that all the elements for convection and radiation matrices are positive.	A-197
MATSYM	Completes the matrices for the convection heat paths and the radiation view factor area product.	A-198
MINV	Inverts the "Script F" matrix.	A-222
ORDER	Arranges two-dimensional coordinate arrays into increasing order according to a selected variable.	A-39
PICMAX	Determines the maximum value of an array of up to twenty numbers.	A-190
PICMIN	Determines the minimum value of an array of up to twenty numbers.	A-191
PLANCK	PLANCK Black body function.	A-219
PLOT1	Generates a plot of radiant intensity vs. wavelength for both the non attenuated and the atmospheric attenuated radiation data.	A-206

TABLE 1 (Cont)

<u>ROUTINE NAME</u>	<u>BASIC FUNCTION</u>	<u>PAGE</u>
PRNDT1	Calculate the Prandtl number as a function of temperature for routine CONFLM.	A-147
PRNDTL	Calculates the Prandtl number as a function of temperature for routines TURBLT and RIMAIN.	A-129
PSOLN	Generates surface cooling flow supply and discharge characteristics and solves these simultaneously for calculation of the available surface cooling mass flow rate and pressure.	A-120
QUAD	Determines the roots of a second order equation.	A-177
REDI	Computes the spectral radiant intensity (watts/Steradian) for each engine off-axis angle.	A-220
REDII	Computes and prints geometric view factors for a detector to the configurations surface nodes as a function of engine off-axis angle.	A-210
REMAIN	Control routine for the fluid flow, heat transfer, surface cooling and surface force factor calculations. Prints the fluid flow information.	A-110
RING	Determines the intersection of a shadowing body with the "cone of vision" that a point on one node sees another node.	A-189
RITE	Used to print the heading information for routine REDII.	A-216
RITER1	Prints the surface radiation information.	A-224
SCRPTF	Computes internal radiation interchange factors for the thermal analyzer.	A-204
SETFLO	Determines the pressure balance for the surface cooling routines if a cooling mass flow rate is specified.	A-133, A-138
SHADOW	Describes the configuration surfaces used for shadowing in routine VIEW in a manner compatible for shadowing surface description of routine REDII.	A-209

TABLE 1 (Cont)

<u>ROUTINE NAME</u>	<u>BASIC FUNCTION</u>	<u>PAGE</u>
SIGNIR	The programs main routine. Controls the flow throughout the entire program.	A-32
STORE	Temporarily stores information necessary for average heat transfer coefficient calculations.	A-125
STORE1	Temporarily stores information necessary for force factor calculations.	A-124
STRATE	Computes solution utilizing linear interpolation routine used in describing the configuration surface data for boundary layer calculations.	A-121
SUMAT1	Summates and prints the radiant intensity for selected wavelength bands.	A-225
TABLEL	Computes solution utilizing second order interpolation of data and provides the first derivative of the interpolated function.	A-36
TAIL	Interface parameter generation and I/O program control routine.	A-205
TAIL1	Metal signature calculation control routing.	A-208
TAIL2	I/O and interface parameter calculation control routine.	A-218
TAS1R	Controls program flow and data involved in calculating the radiation interchange factor matrix, conduction matrix, performing the thermal balance and printing the wall temperature for each node.	A-193
TEST1	Tests the possibility of one node being shadowed by a second node which has the same axial location.	A-180
TEST2	Determines whether a point lies between two other points.	A-181
TESTN	Computes the last computed value of geometric view factor with the previously computed value to determine whether the view factor needs to be recalculated using finer divisions of the nodes. This routine also sets these divisions.	A-192

TABLE 1 (Cont)

<u>ROUTINE NAME</u>	<u>BASIC FUNCTION</u>	<u>PAGE</u>
TITLA	Controls output printing of the title page.	A-41
TRANCL	Calculates a pressure balance and wall temperatures for a transpiration cooled surface. Prints the coolant mass flow rate and pressure.	A-130
TURBLT	Calculates and prints the boundary layer and heat transfer information as a function of configuration axial distance.	A-154
VECANG	Calculates the angle of a node relative to the configuration center line.	A-217
VIEW	Calculates and prints for each configuration node, internal geometric view factors.	A-162
WRIT14	Transfers a two-dimensional array into a single dimensional array.	A-201

The equivalent Black Body Area and Temperature are extracted from the data generated by SIGNIR. The first step is to determine the equivalent Black Body Temperature. This is accomplished by searching the generated spectral data for the maximum intensity, figure 4, and applying the Wien Displacement Law:

$$T_{BB} = \frac{2897.9}{\lambda_{max}} \quad \text{K}$$

The equivalent Black Body Area is found by dividing the integrated signature obtained from SIGNIR by the Radiant Exitance over the band of interest.

$$A_{BB} = \int_{\lambda_1}^{\lambda_2} M_e(\text{SIGNIR}) / \int_{\lambda_1}^{\lambda_2} M_e(T_{BB})$$

Figure 5 shows a typical correlation between the predicted spectral signature and the spectral signature of the equivalent black body. These resultant temperatures and areas are the only parameters transferred back to ASDIR.

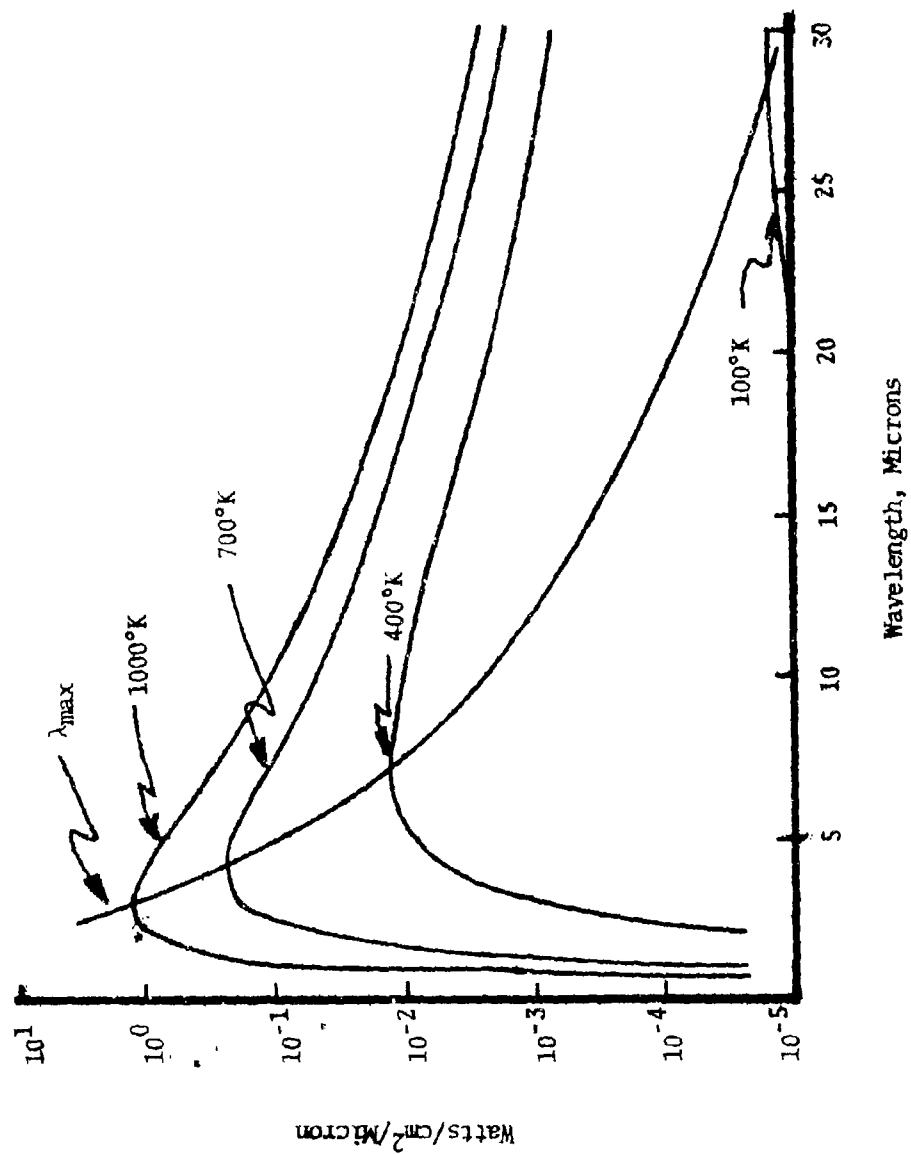


Figure 4. Black Body Curve

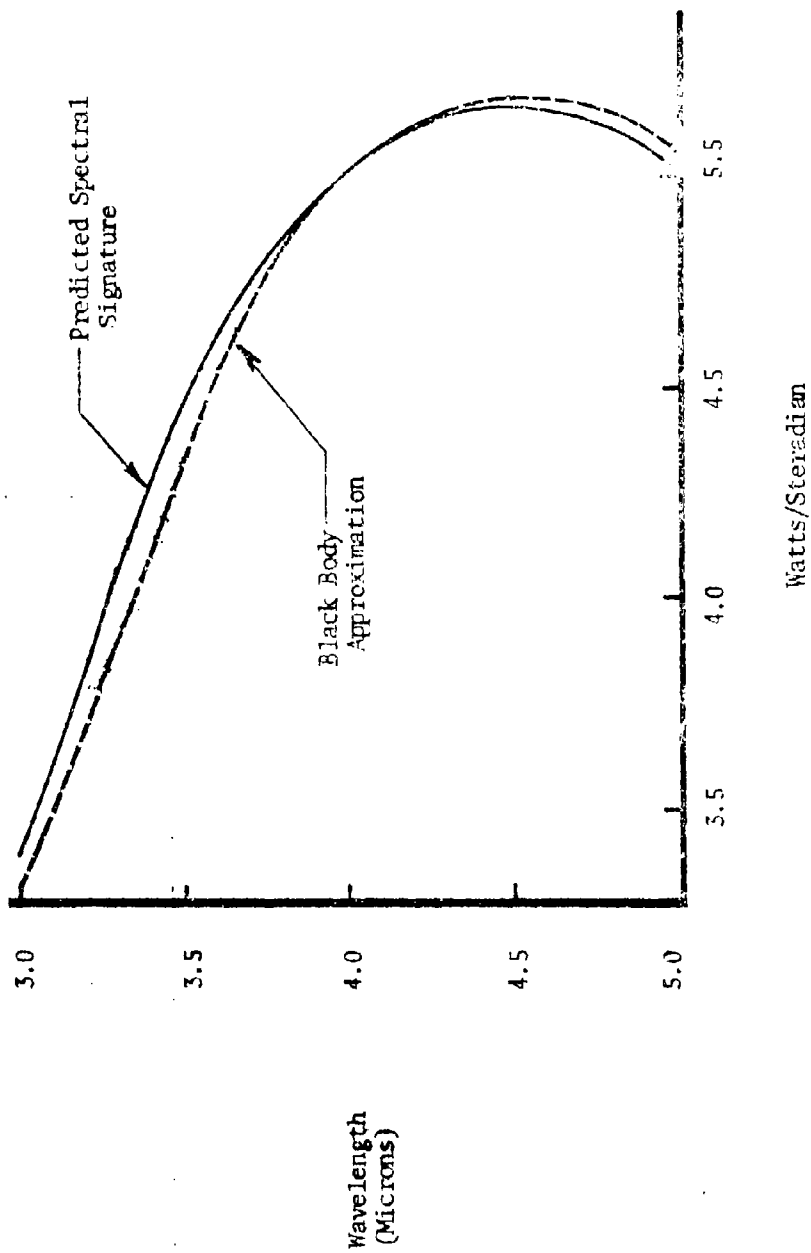


Figure 5. Black Body Correlation

PROGRAM: PLMDEF (Page A-81)

FUNCTION: Plume definition and gas data array development.

INPUT: Engine nozzle exit flow properties (velocity, pressure, temperature, and species [H2O, CO2] concentrations) as a function of radius.

OUTPUT: Plume gas data array. At this point, velocity (ft/sec) and pressure (atm x 10⁻³) are multiplexed into common registers.

SUBROUTINES: FLINP

DESCRIPTION: The gas dynamic calculations made for the plume in this program, figure 6, are applicable to axisymmetric turbojet and turbofan engine with mixed or separate co-annular co-planar exhaust jets. The finite difference calculations were developed to express the conservation (mass, momentum, energy, and species) laws for numerical integration by General Electric in their early SCORPIO work reported in reference [5]. Two effective kinematic viscosities were retained, one for physical mixing and the other for thermal mixing. The conservation laws were simplified for axisymmetric flow whereby all gradients in rotation about the centerline were not to zero, and all radial components of momentum were neglected as being small. Second axial derivatives and axial gradients divided by the radius were also neglected in momentum. Thermal radiative heat transfer and thermal generation were also neglected. In the derivation of the energy conservation and transfer functions the effects of the second viscosity, the square of axial gradients, dependence upon radial velocity, and gradients divided by the radius were minimized. The radial coordinate system was transformed into a stream function coordinate system after Von Mises. The transformation functions and the transformed conservation relations to which the finite difference procedure was applied are as follows:

Stream Function

$$\psi \frac{\partial \psi}{\partial r} = p u r \quad ; \quad \psi \frac{\partial \psi}{\partial x} = -p v r$$

$$\text{wherein: } \frac{\partial \psi}{\partial r} = -\frac{u}{r} \quad ; \quad \frac{\partial \psi}{\partial x} = \frac{v}{r}$$

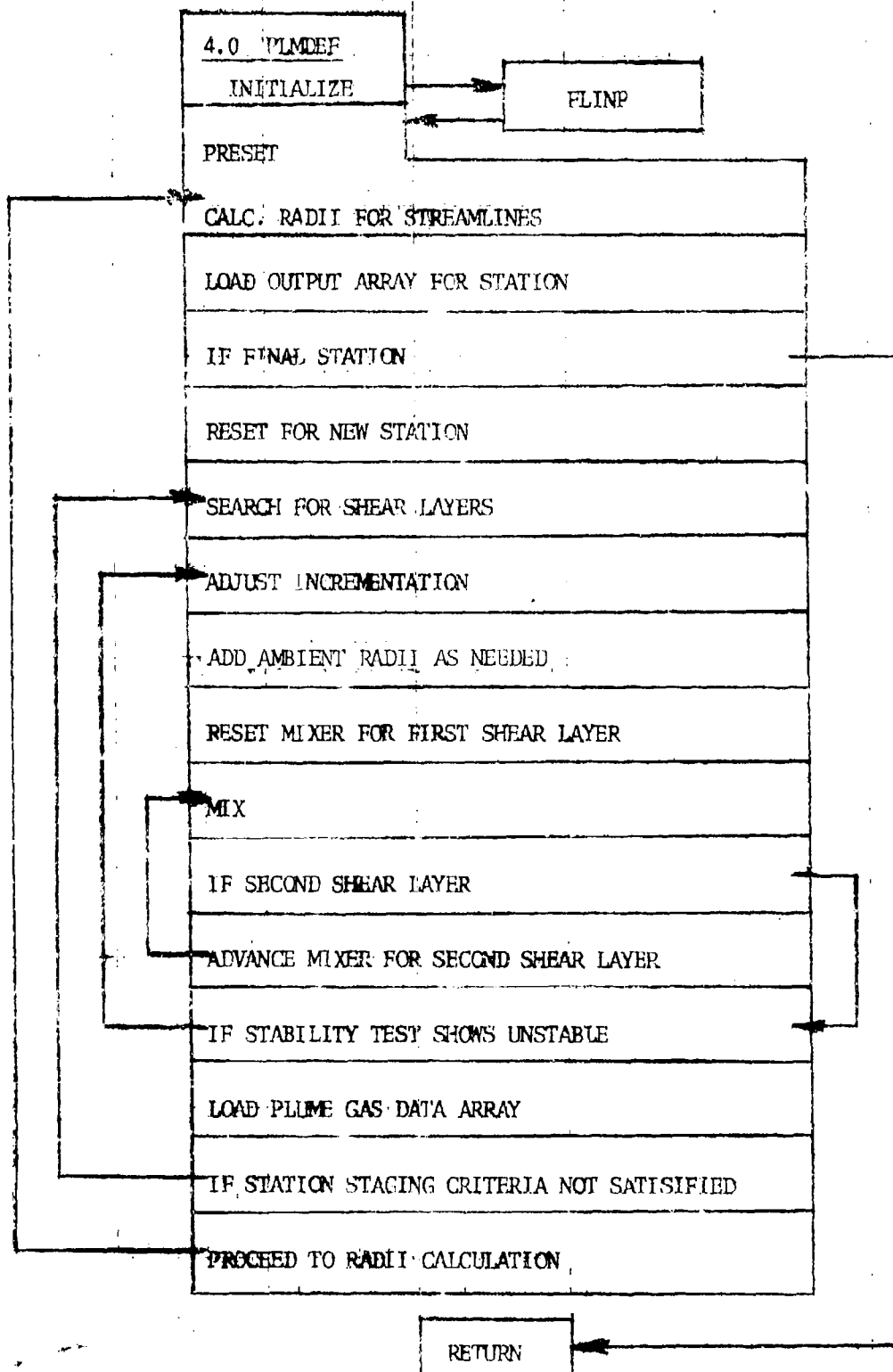


Figure 6. PLMDEF Flow Diagram

CONTINUITY:

for the stream function:

$$\Psi \frac{\partial^2 \Psi}{\partial x \partial r} + \frac{\partial \Psi}{\partial r} \frac{\partial \Psi}{\partial x} - \frac{\Psi \partial^2 \Psi}{\partial r \partial x} - \frac{\partial \Psi}{\partial x} \frac{\partial \Psi}{\partial r} = 0$$

and after the transformation:

$$-\frac{\partial}{\partial x} \left(\frac{\Psi}{\rho u r} \right) + \frac{\partial}{\partial \Psi} \left(\frac{\rho v r}{\rho u r} \right) = 0$$

MOMENTUM:

$$\frac{\partial u}{\partial x} = \frac{1}{\Psi} \frac{\partial}{\partial \Psi} \left(\frac{\rho^2 u r^2}{\Psi} \epsilon \frac{\partial u}{\partial \Psi} \right) - \frac{dp}{\rho u dx}$$

ENERGY:

$$\begin{aligned} \frac{\partial T}{\partial x} = & \left(\frac{\rho^2 u r^2}{\Psi} \epsilon_T \right) \left(\frac{1}{c_p \Psi} \right) \left(\frac{\partial u}{\partial \Psi} \right)^2 + \frac{\partial}{\partial \Psi} \left(\frac{\rho^2 u r^2}{\Psi} \epsilon_T \frac{\partial T}{\partial \Psi} \right) + \frac{dp}{\rho c_p dx} \\ & + \left(\frac{\rho^2 u r^2}{\Psi} \epsilon_T \right) \left(\frac{1}{c_p \Psi} \right) \frac{\partial T}{\partial \Psi} \left(c_{p1} \frac{\partial \alpha_1}{\partial \Psi} \right) \end{aligned}$$

DIFFUSION:

$$\frac{\partial \alpha_1}{\partial x} = \frac{\partial}{\partial \Psi} \left(\frac{\rho^2 u r^2}{\Psi} \epsilon \frac{\partial \alpha_1}{\partial \Psi} \right)$$

where:

T = gas static temperature or thermal subscript

u = gas axial velocity

v = gas radial velocity

Prandtl number = $c_p \rho \epsilon / k = 1$

Schmidt number = $\epsilon / D = 1$; in which D is the binary diffusion coefficient

ϵ = effective kinematic viscosity

α_1 = species concentration

$\frac{\partial c_p}{\partial r}$ is an assumed radial dependence for the gradient
of the specific heat of a mixture of gases = c_p/r .

Other quantities and terms are conventional.

The effective viscosity adopted for ASDIR includes the Donaldson and Gray treatment for the compressible free mixing of two dissimilar gases as reported in the AIAA journal, Vol 4, no. 11, in November 1966 and as applied by General Electric in SCORPIO-II [5].

Overall, the plume model appears to reflect the essential features of measured plume data in those regions where the gas is hot. The regions where the model tends to lose accuracy are toward the outer edges where the gas shear appears to be too small thus allowing the plume to spread excessively. However, the plume temperatures and species concentration are essentially ambient in value so that the radiance and transmittance errors are small.

Viscosity Model

The choice of the turbulent viscosity, ϵ , is critical to the plume flow field. Past models, available in the literature (Schlichting, Abramovich, Warren and Applied Science Laboratories), show the turbulent viscosity as a function of axial distance and velocities in the mixing region. Preliminary results for the flow field showed that the analysis using these models did not agree with jet engine test data. A modified temperature dependent model for viscosity was formulated to include the temperature effects of hot flow.

The model being used in this analysis is:

$$\epsilon = x \cdot \{U_1 - U_2\} / [CNST \cdot (T_1/T_2)^2] \cdot \gamma$$

where

$$\gamma = 1 ; M_c < 0.6$$

$$\gamma = 1.6 / (1 + M_c) ; M_c > 0.6$$

The value for γ is from a paper by Donaldson and Gray. The value of CNST depends on the nozzle exit Mach number (M_c) and the centerline temperature. (See Page A-85).

Stability and Print Criteria

In order to insure stability, the axial step size, Δx , must be kept small. It was found that the system became unstable when the influence parameter

$$cz = \{\Delta x \cdot \epsilon \cdot u \cdot r^2 \cdot p^2\} / \{2 \cdot \psi^2 \cdot T^2 \cdot r^2\} \geq 0.20$$

To achieve a solution in a reasonable length of time, the step size Δx should be as large as possible. Accordingly, c_{zm} , the maximum value of c_z for each axial location is examined. If c_{zm} is too great, Δx is reduced for ensuing calculations. If c_{zm} is too small, Δx is increased for ensuing calculations.

Flow parameters are not entered into the data array at every value of Δx calculated. The calculation step sizes are too small. Tabulation occurs whenever the number of Δx increments from the previous calculation exceeds NBS or the sum of the Δx 's exceed Δx_p . Δx_p is incremented after each tabulation such that

$$\Delta x_{pN} = x_{p0} (0.5N)$$

Excessive static pressure at the nozzle exit plane is treated in a pseudo convergent-divergent nozzle manner which reduces the pressure to ambient value while accelerating and expanding the plume core to supersonic velocity over an axial distance of one nozzle diameter.

The program develops a plume gas data array containing the velocity, pressure, temperature, CO_2 concentration, H_2O concentration, and radius for up to 30 radii over an axial span of 49 stations. The velocity and pressure are multiplexed to share common registers. (See PLMDM for demultiplexing).

PROGRAM: FLINP (Page A-87)

FUNCTION: Provide a vehicle by which the required calculation parameters, nozzle exit flow quantities and data initialization can be read into ASDTR.

INPUT: All control and computational variables in the PLUMIN namelist.

OUTPUT: Computationally compatible engine nozzle exit plane flow quantity data. Nozzle and ambient data are printed.

SUBROUTINES: CHEM, THRUST

DESCRIPTION: The flow diagram of Program FLINP is shown in Figure 7. The function of this program is to initialize engine operational input and control quantities. The control function is derived from the input data. If the engine operational input quantities are not of the proper form, certain operations and additional reads are invoked to put the input into a form compatible with the PLMDEF program. Details can be found in ASDIR-II, Volume I, Users Manual.

In general, if PA is contained in namelist PLUMIN, the Mil Std 210 standard atmosphere in subroutine THRUST is bypassed. The inference is that an off-standard or test facility ambient condition is being simulated and the other ambient quantities are required in PLUMIN. Similarly, this program will bypass the default engine sample case if a nozzle exit velocity U8(1) is given greater than 1 ft per sec or if an ambient velocity UA is given greater than 11 ft per sec. Further, if U8(1) is greater than 1 the volume for T8T, P8, PQ, XCO2, XH2O will be accepted as given in PLUMIN. Again, if XCO2 has been omitted or given a small value (i.e. $\leq$ XCO2A), the XCO2, XH2O, R, GAMMA, etc. will be calculated in CHEM for the fuel type (TANE) and stoichiometric equivalent ratio (EQR). Finally, if a gas quantity distribution for U8, T8T, XCO2, and XH2O is given in PLUMIN, they will be accepted unchanged since the load array key is taken from a test on U8(2).

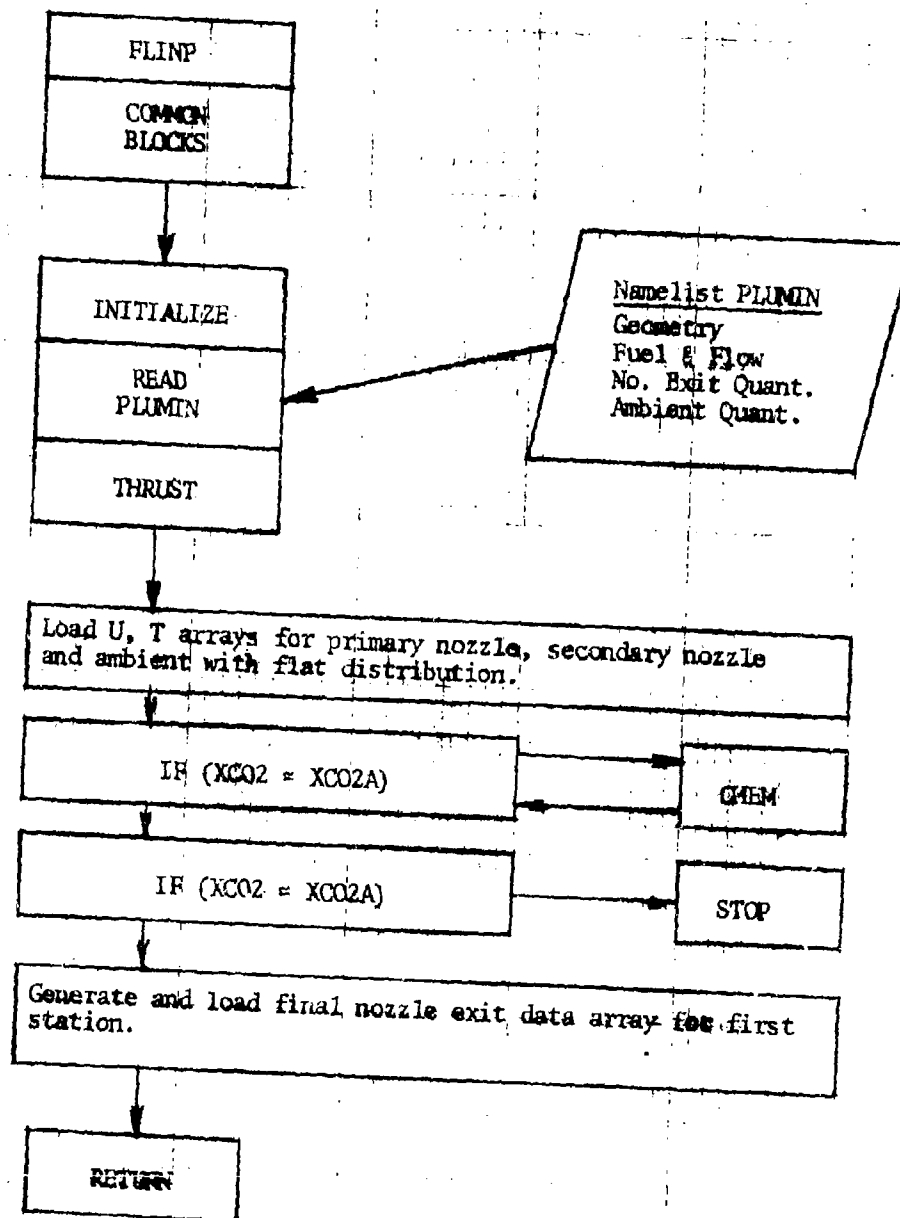


Figure 7. FLINP Flow Diagram

PROGRAM: CHEM (Page A-91)

FUNCTION: Generate the post combustion gas description (gas constant, specific heat and specific heat ratio, molecular weight, species conservation, etc) for a given fuel type, TANE, stoichiometric equivalence ratio, EQR.

INPUT: TANE, EQR

OUTPUT: Fuel to air ratio, gas constant, specific heat, gamma, CO₂ concentration, and H₂O concentration.

SUBROUTINES: None

DESCRIPTION: This program calculates the gas properties for the products of combustion with ideal combustion. Since combustion products properties vary only slightly with pressure and tend to chemically freeze near 2500°F in typical nozzle flow, the precision of this simple college chemistry approach is adequate and the fast calculation makes it a worthwhile approach.

PROGRAM: THRUST (Page A-93)

FUNCTION: Provide a vehicle by which the required calculation parameters and engine operating quantities can be read into ASDIR.

INPUT: All control and computational variables in the POWER namelist.

OUTPUT: Computationally compatible engine nozzle exit plane flow quantities not provided in FLINP input namelist PLUMIN. Flight condition data is printed.

SUBROUTINES: CHEM

DESCRIPTION: The flow diagram of subroutine THRUST is shown in figure 8. The function of this program is to read atmospheric, engine type, data type code, and engine specific performance data. The program control functions described for Program FLINP apply throughout this program.

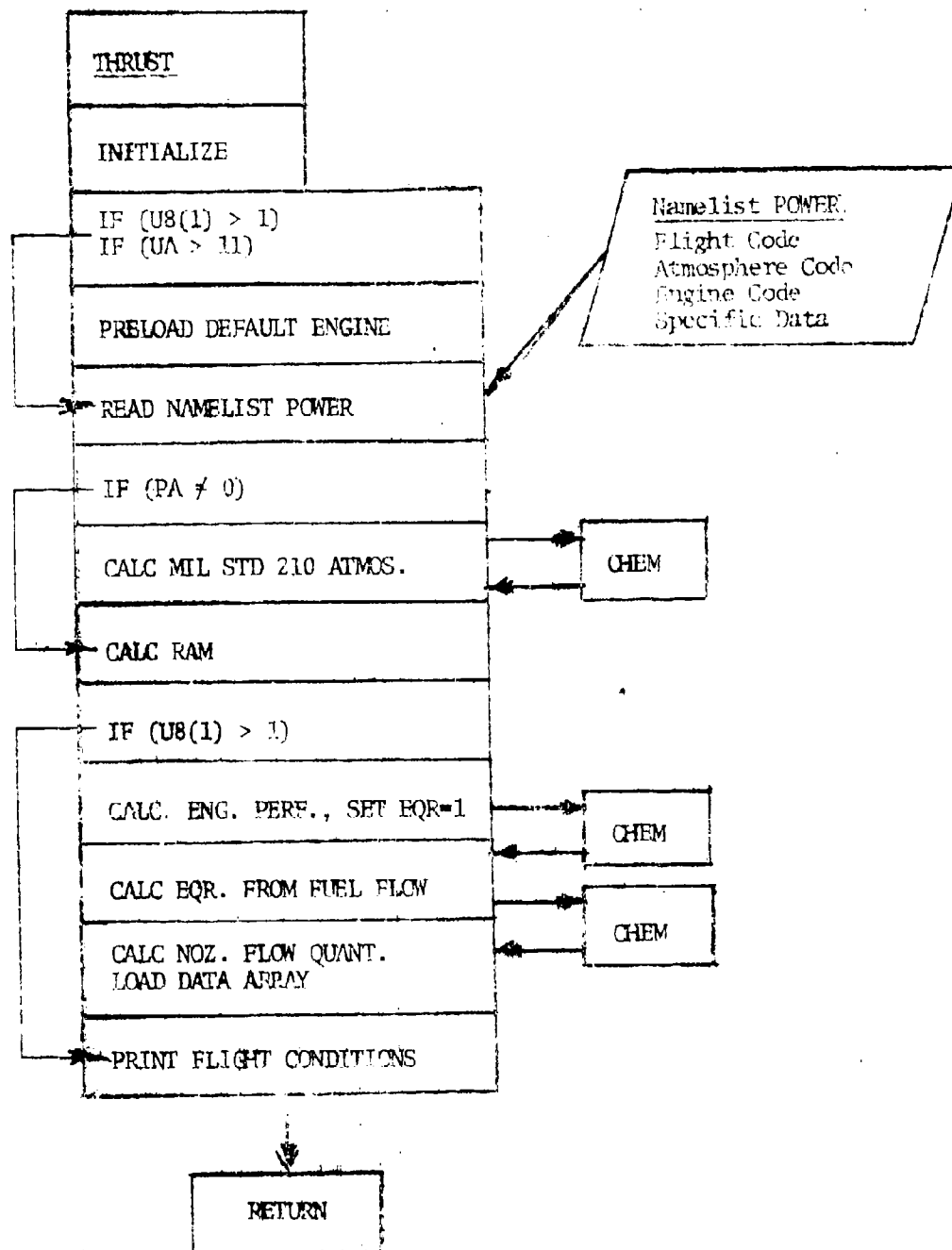


Figure 8. THRUST Flow Diagram

PROGRAM: PLMDM (Page A-98)

FUNCTION: To manage the plume gas data. An input control parameter, KDATA, controls the dispatch of the plume gas data.

INPUT: Plume gas data and the control code KDATA.

OUTPUT: Plume gas data output to cards, tape, printer, or printer plot in any combination.

SUBROUTINES: PLMPLT, PLMPRNT

DESCRIPTION: Each digit of the five digit integer KDATA controls an I/O function. KDATA is represented by the value:

KDATA = A B C D E

If A = 0, a new plume will be calculated. If A = 1*, an old plume previously filed will be brought in and plume calculations will be bypassed. If A > 1, plume gas data will be read from input cards.

If B = 1*, the plume gas data array is filed in the computer for later or repeated analysis. If B ≠ 1, the filing operation is bypassed.

If C = 1*, the plume gas data array is punched into output cards for later or repeated analysis. If C ≠ 1, the punch operation is bypassed.

If D = 1, the plume gas data array is printed in output by subroutine PLMPRNT. If D ≠ 1, the print operation is bypassed.

The subroutine PLMPLT is called with the final value E in the KDATA code. The E value has a different pattern than exhibited by A through D, see PLMPLT.

In addition to breaking down the code carried by KDATA, this program adds a layer of ambient data all around the plume data. The ambient data blanket is necessary to contain the interpolation exercises performed in the ray tracing calculations. The program then searches the plume gas data array to locate the tip of the core and

record such other parameters such as plume length AL, plume diameter REND, plume edge tangent TNB, etc. The minimum output RB, XC, REND, and AL is printed.

The PLMDM flow chart is shown in Figure 9.

*This code represents a machine dependent operation and may require further development for satisfactory operation.

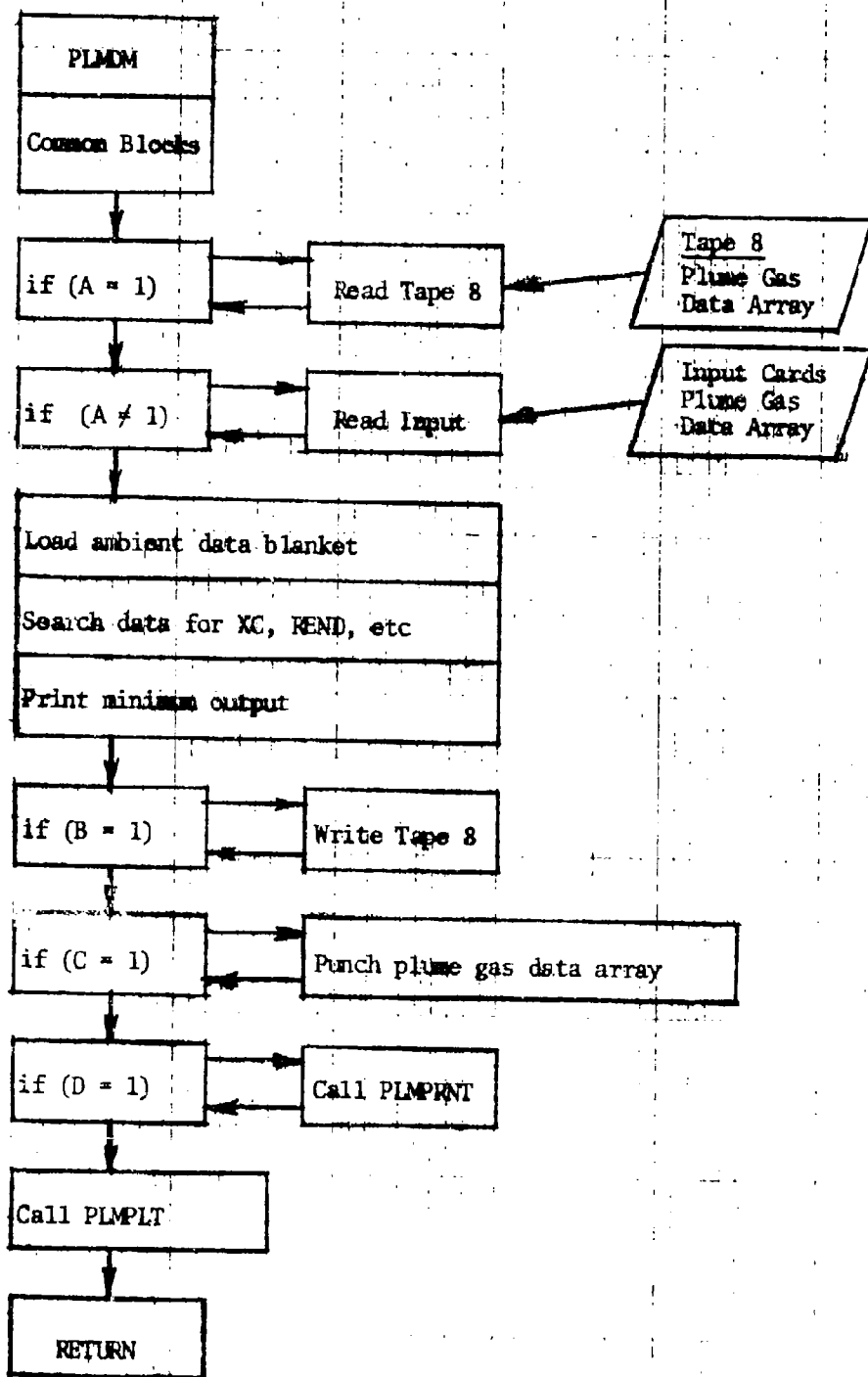


Figure 9. PLMDM Flow Diagram

PROGRAM: PLMPRNT (See Page A-100)

FUNCTION: Print the contents of the plume gas data array on the output printer.

INPUT: The plume gas data array

OUTPUT: The plume gas data

SUBROUTINE: None

DESCRIPTION: Print the plume gas data array. The plume gas data is printed in the following sequence:

- general caption
- plume station number and location
- centerline and edge Mach numbers
- radius, velocity, pressure, temperature, and CO2 and H2O concentration

Units are printed in the captions. The quantities printed are all self explanatory except the edge Mach number. The edge Mach number is that value at the outer edge of the innermost shear plane. This quantity will tend to oscillate due to the stepping and clipping process which occurs in the finite differencing procedure.

PROGRAM: PLMPLT (See Page A-101)

FUNCTION: Plot selected plume gas data quantities on the output printer.

INPUT: The plume gas data array and the final digit of the KDATA control code.

OUTPUT: Selected arguments of the plume gas data plotted on the output printer.

SUBROUTINES: None

DESCRIPTION: The output printer has 136 characters horizontally and more than 60 lines vertically. The grid represented by lines and characters are assigned one of the letters in the word plume (P L U M E) with the addition of # to permit the plotting of six ranges. A space is assigned the first character portion after a change in range. The nozzle exit plane value establishes the separator between # for values greater than the nozzle exit value and P for values between 80% and 100% of the nozzle exit value. Values in the 60% to 80% range are assigned L. Values between 40% and 60% are assigned U, etc. Each line represents a radius, and the interstation distance accumulates a number of characters. With two way interpolation a printer line is compiled and printed. After the data has been plotted, the axial scale is compiled and printed.

The code designating the plume gas data to be plotted is provided by the single digit value remaining in KDATA after having been stripped in program PLMDM. Up to four plots can be generated. In their plotting sequence, they are temperature, XO2 concentration, H2O concentration, and plume velocity. The appropriate captions are included. All four data arguments are plotted if the E value of KDATA is given as 0. If E = 1, no plots are printed. If E = 2, the last three are printed, if E = 3, the last two are printed, if E = 4, the last plot only is printed, and if E is greater than 4, the program will fail. For the general breakdown of KDATA, see program PLMDM.

The final activity accomplished in program PLMPLT is the de-multiplexing of the velocity and pressure. The pressure is brought up from the back of each velocity-pressure register and replaces the velocity. The velocity is no longer retained in the plume gas data array.

PROGRAM: ALPLUM (See Page A-47)

FUNCTION: Calculate total apparent spectral radiance of exhaust plume and hot engine parts as received by an observer with plume and atmospheric emissions and attenuation, including background contributions considered.

INPUT: Flight conditions, engine hot parts and plume parameters.

OUTPUT: Engine/Plume IR Signature

SUBROUTINES: RAYCAL, PLURAY, PLUSIG

DESCRIPTION: The flow diagram of program ALPLUM is shown in figure 10. The prime function of this routine is to be the controlling program to allow calculation of aircraft infrared signatures. Description of the working programs controlled by ALPLUM are contained under the individual program titles.

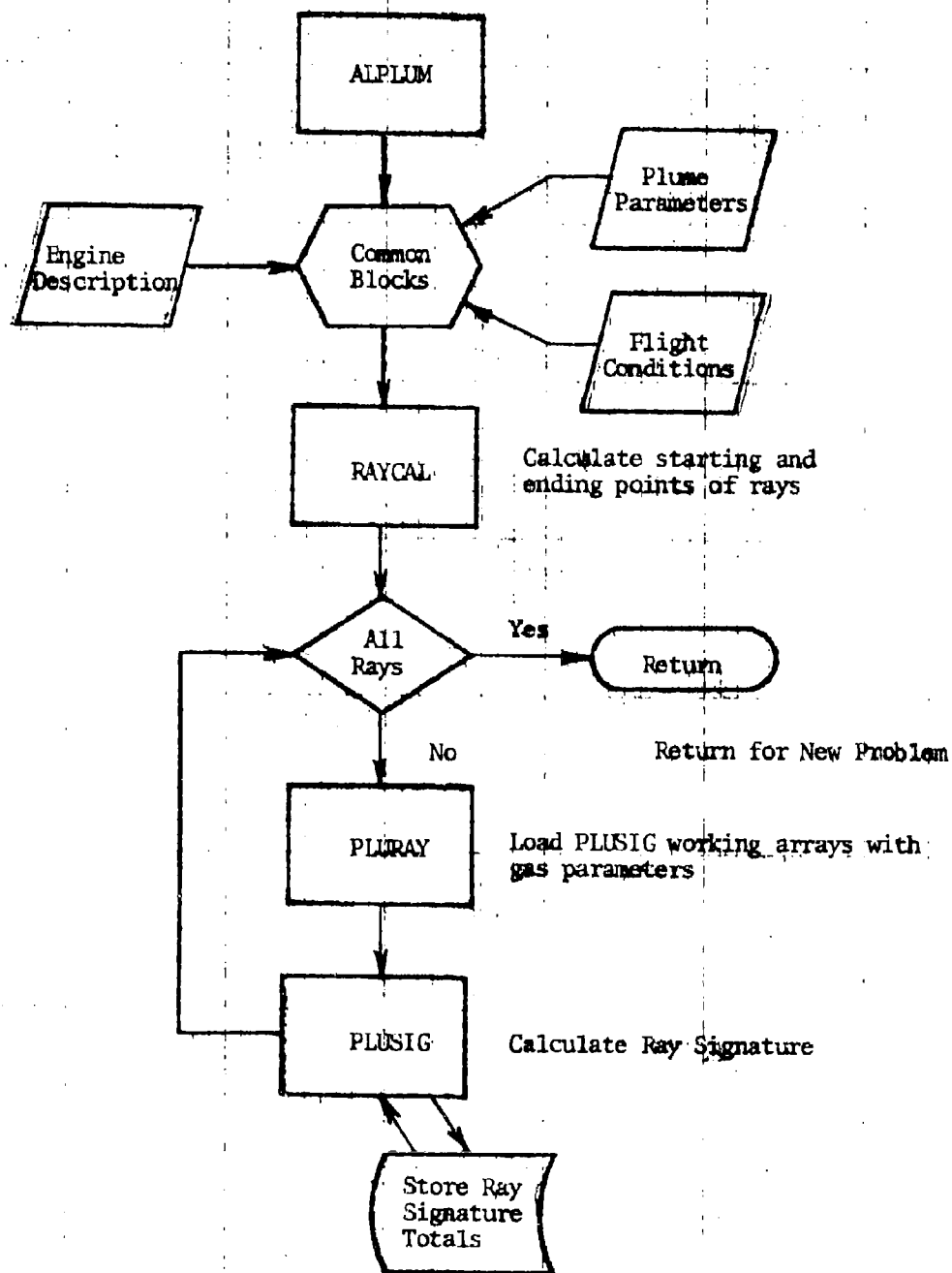


Figure 10. Total IR Signature Calculation.

PROGRAM: RAYCAL (Page A-50)

FUNCTION: To segment plume into discrete areas for signature analysis in other routines.

INPUT: Plume and engine geometry.

OUTPUT: Array of plume segment parameters.

SUBROUTINES: None

DESCRIPTION: RAYCAL, being basically geometric, is a relatively simple program. However, since signature prediction accuracy is dependent upon the geometric representation of the engine nozzle and the plume, graphical detail will be presented for this routine.

The engine nozzle and plume are characterized as a series of planar area segments each representing the termination of a ray or beam of radiated energy. Each segment represents either free (background) space or a black surface. The cross-sectional shape and area of each ray is defined by the segmentation scheme and is constant along the ray centerline. The segmentation scheme takes full advantage of symmetry as described with reference to the six accompanying figures.

Rectangular coordinates provide, figure 11, the framework for the ray definition. The X axis represents the engine nozzle centerline. The D axis, in the nozzle exit and perpendicular to the centerline X, is free to rotate about X so that the plane D-X will contain the centerline ray. The lateral axis, Z, is normal to both D and X. The angle of view, known as the aspect angle or ASPDEG, A8, is measured from the centerline X and lies in the D-X plane as shown in figure 12.

Dimensions on D represent the normal intercept of the ray centerline on plane D-Z from the Z axis.

Dimensions on Z represent the lateral intercept of the ray centerline on plane D-Z from the D axis.

Dimensions on X represent the axial intercept of the ray centerline on plane X-Z from the Z axis.

The simplified plume geometry adopted for use in this program is shown in figure 13. The plume is analyzed in three independent but adjoining regions:

(1) The plume core is segmented in the X-Z plane into a number of radial and angular segments shown in figure 14. Segmentation begins at the extremity of the nozzle exit projection on the X-Z plane and continues to the extremity of the core.

(2) The plume skirt is segmented in the X-Z plane into a number of radial and angular segments shown in figure 15. Segmentation begins at the extremity of the core and continues to the extremity of the plume.

(3) The engine nozzle is segmented in the D-Z plane into a number of radial and angular segments shown in figure 16.

Each planar segment so generated also defines a ray segment. The D-Z or D-X ray segment centerline intercept is centrally located, see asterisks, in each planar segment. Further, each segment is considered to be the ray segments own projection on the D-Z and D-X planes from which the ray segment cross section area, RAR, is calculated.

The ray segments are generated on the first call to RAYCAL. Successive calls simply transfer previously generated data.

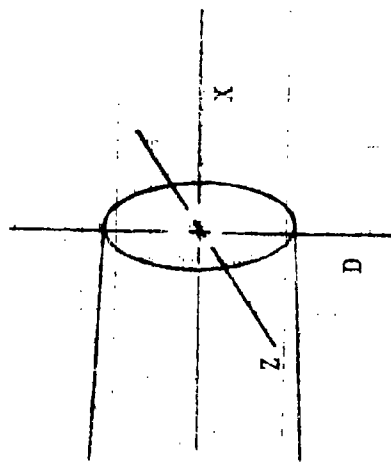


Figure 11. Ray Coordinate System

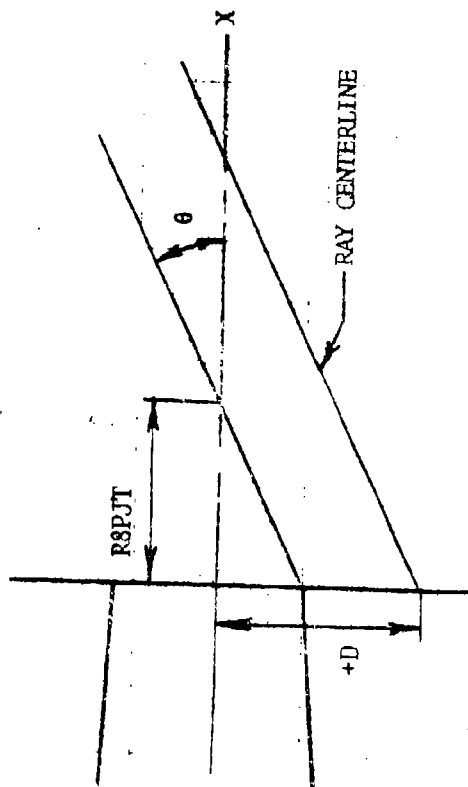


Figure 12. (D, X) Plane

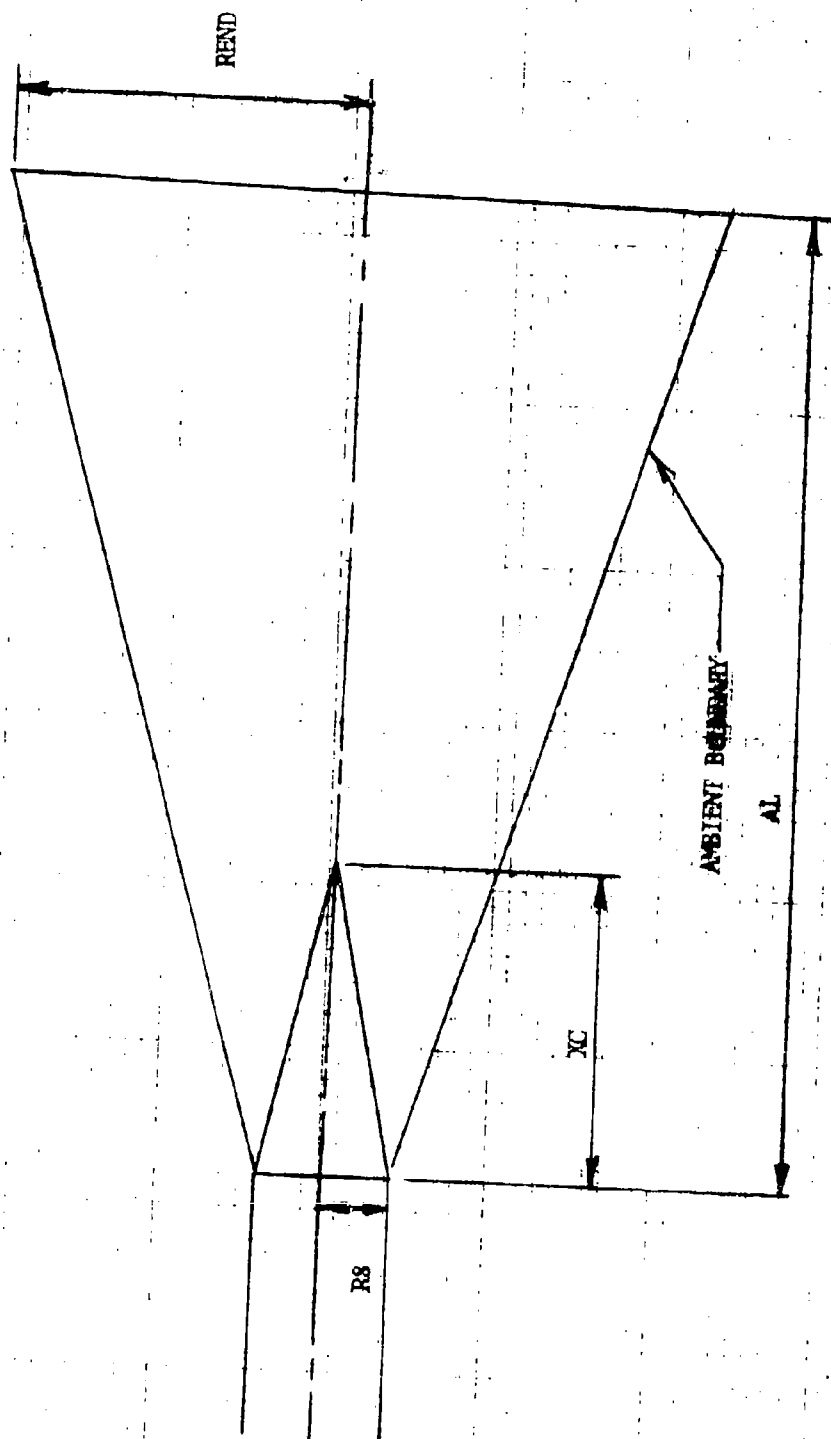


Figure 13. Plume Geometry

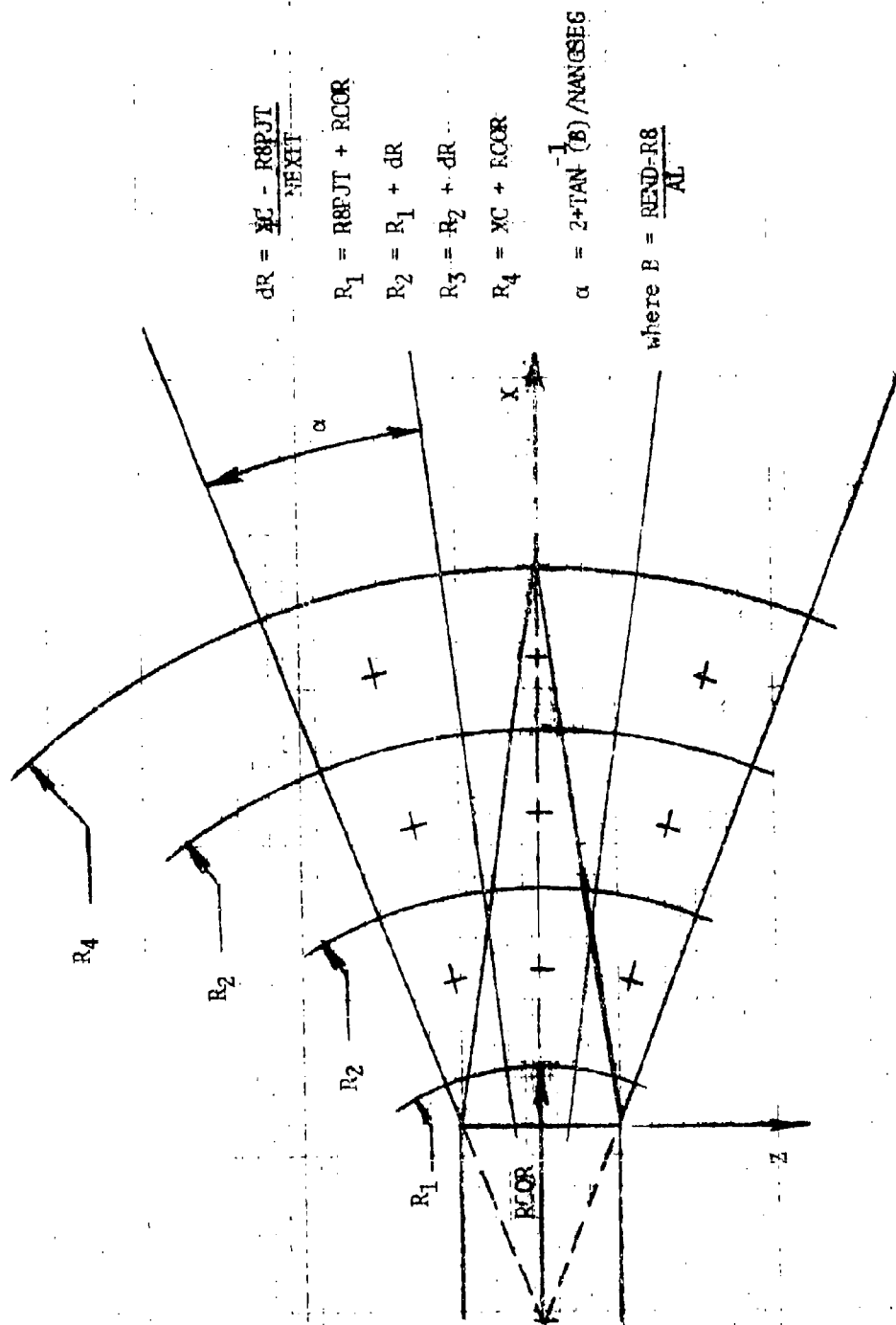
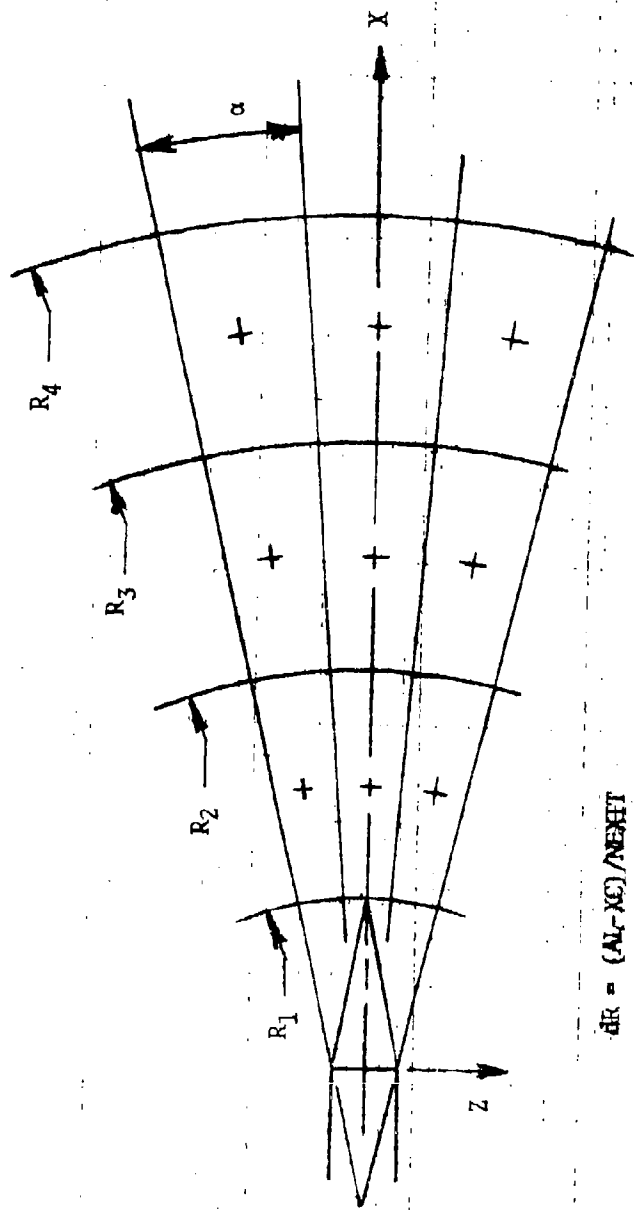


Figure 14. Segmentation of Core Region (X, Z) Plume



$$dR = (AL - XC) / NEHT$$

$$R_1 = XC + R_{COR}$$

$$R_2 = R_1 + dR$$

$$R_3 = R_2 + dR$$

$$R_4 = AL + R_{COR}$$

Figure 15. Segmentation of Non-Core Region (X, Z) Plume

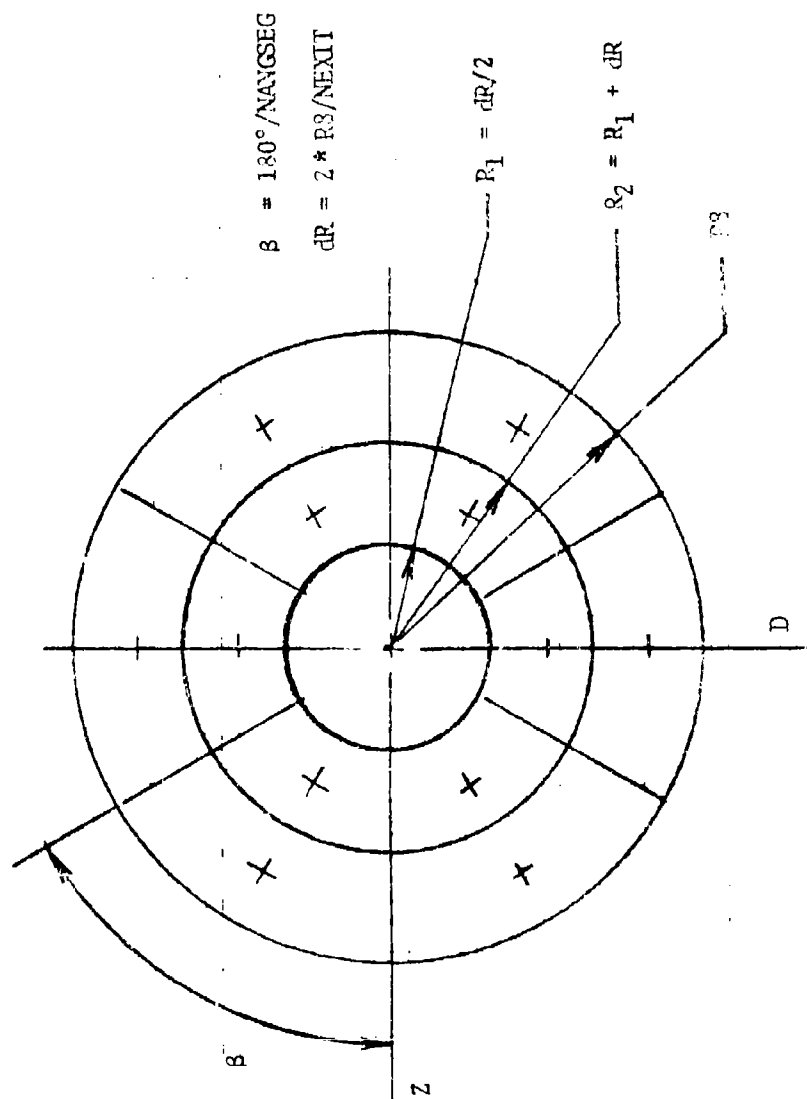


Figure 16. Nozzle Exit Segmentation

PROGRAM: PLURAY (Page A-54)

FUNCTION: Generate the parameters describing the ray which are required in the signature analysis routines.

INPUT: Ray starting geometry, plume gas parameters.

OUTPUT: Ray geometry, gas partial pressures and gas static temperature arrays.

SUBROUTINES: INTERP, START

DESCRIPTION: By referencing the plume gas data and the ray definition parameters, this routine fills the pressure, temperature, and length array with the proper data for ray signature analysis, see figure 17.

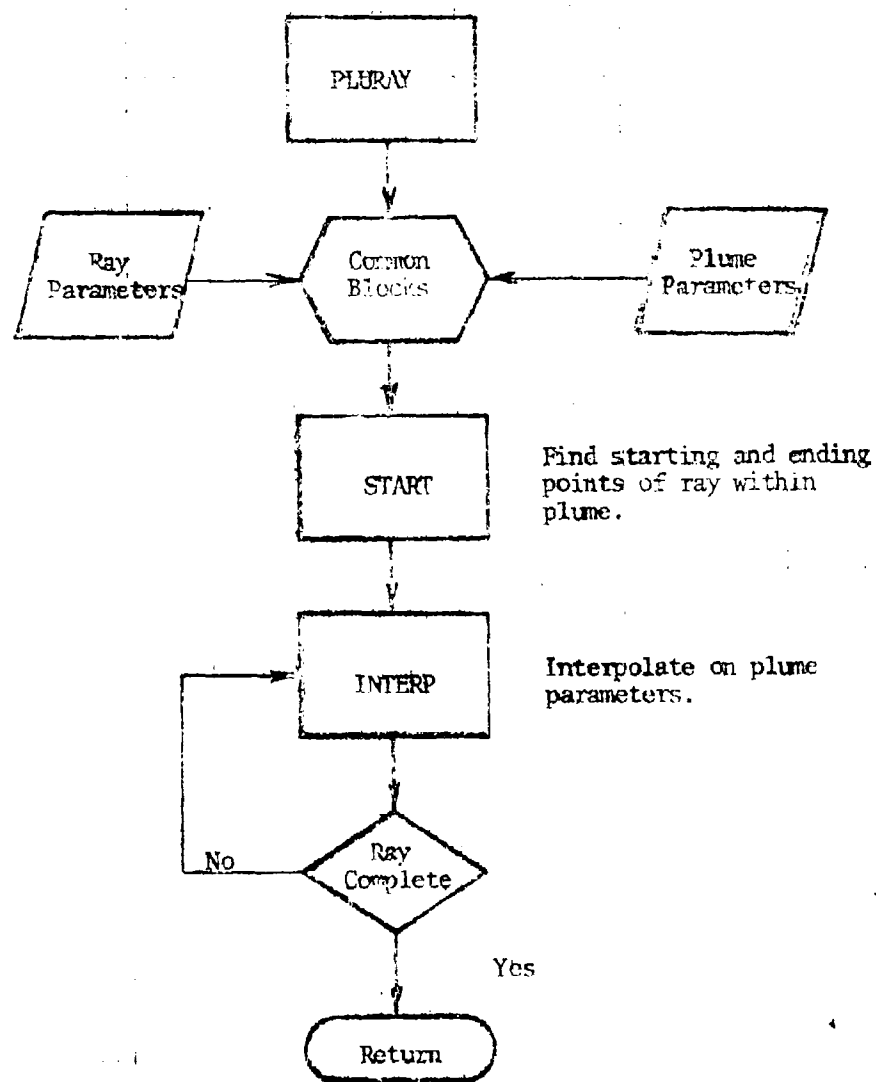


Figure 17. PLURAY Flow Diagram

PROGRAM: START (Page A-57)

FUNCTION: To calculate the starting and ending points of a ray through the plume.

INPUT: Plume geometry, ray intersections

OUTPUT: Starting and ending dimensions of ray

SUBROUTINES: None

DESCRIPTION: The starting and ending points are banded by engine geometry, engine plug geometry and flow field boundaries.

PROGRAM: INTERP (Page A-61)

FUNCTION: Interpolate on gas parameters to find values at a given point within the plume.

INPUT: Gas parameters and coordinates of point in plume.

OUTPUT: Concentration and temperature at input point.

SUBROUTINES: None

DESCRIPTION: This program interpolates between stations along the centerline of the plume and along the radial dimension of the plume to find the static temperature, mole concentrations of water vapor and carbon dioxide and gas pressure at the input coordinate.

PROGRAM: PLUSIG (Page A-63)

FUNCTION: Evaluate the spectral signature and transmittance of a nonuniform gaseous path of NT segments.

INPUT: Ray properties (temp, pressures and lengths), and frequency interval.

OUTPUT: Spectral signature of gaseous ray and spectral transmittance of ray.

SUBROUTINES: ATMOS, KBCAL, PLANCK, INTERPO, SETTAU, TAUCAL, TAUN20, ERF, DAH20, DCO2

DESCRIPTION: The flow diagram for PLUSIG is shown in figure 18. The prime function of this program is to calculate the spectral signatures of nonuniform gas paths with various end conditions. The gaseous ray is divided into NT nonuniform segments with each segment defined by the partial pressures of H_2O (PH_i), CO_2 (PC_i) and broadening gas (PN_i), length (D_i) and static temperature (T_i). A brief discussion of spectral radiators follows:

Continuum radiation is obtained from liquids and solids because the molecules of the substance are in direct contact and exert forces on each other causing all levels of molecular emissions to occur. However, in the case of gas molecules, the intermolecular spacing is large and the free molecular vibrations and rotations result in discrete spectral emissions.

The intensity of these discrete gaseous emissions obeys the PLANCK radiation law as modified by Kirchoff's law. However, the emissivity of the gas is spectrally dependent and radiation is emitted or absorbed only in narrow wavelength intervals called spectral lines. These spectral lines are clustered into tightly spaced sets called bands. The emissivity of the gas is zero outside these bands and dependent upon line spacing and intensity within the bands.

The inhomogeneous gas band-model expressions used in this program were developed at the University of Michigan and are based on the Curtis-Godson approximation. Rather than attempting to fully explain the excellent work performed at the University of Michigan Infrared and Optics Laboratory (now ERIM) in the areas of gaseous emission and absorptions, see references [5, 6, 7, 8, 9, 10].

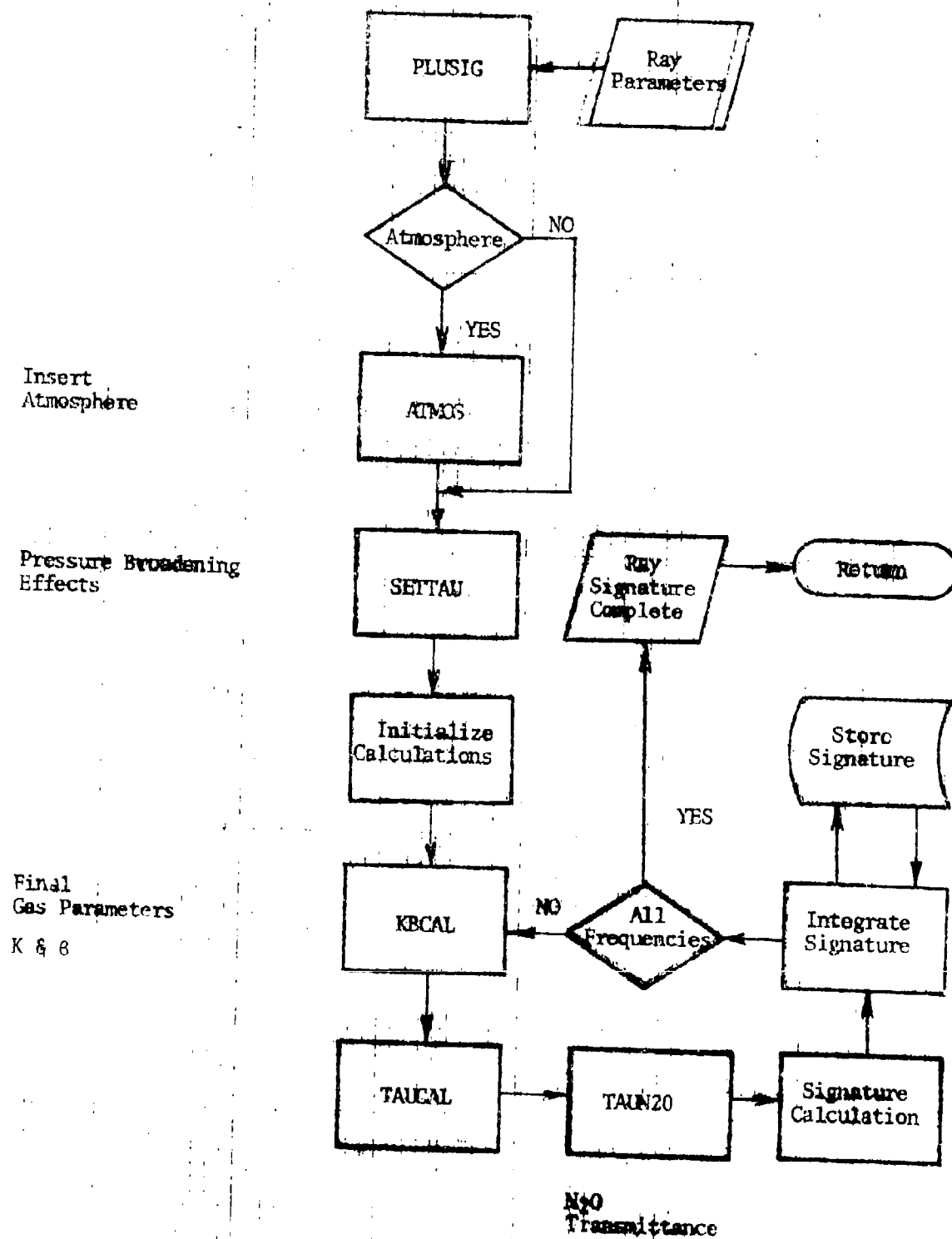


Figure 18. PLUSIG Flow Diagram

A simplified discussion of the function of the program PLUSIG follows: A ray of NT segments, NA of which are atmospheric, of cross sectional area A is entered into the program, figure 19. Each of the NT-NA segments, representing the exhaust plume gas, are described by the gaseous partial pressures, temperatures, and lengths. The atmospheric segments are front loaded in the ray array through the use of the subroutine ATMOS and the range between, and altitudes of the observer and vehicle. The transmissions of each ray segment are calculated in PLUSIG using subroutines KBCAL, INTERPO, SETTAU, TAUCAL, TAUN20, ERF and data contained in Data Blocks DAH20 and DC02.

Figure 19 depicts the information available for a given frequency interval after the exercise of the transmittance calculation subroutines. The signature of the ray is found from

$$L_{ev_ray} = \sum_{i=1}^{NT} L_{ev}(T_i) \cdot \alpha_{vi}$$

where L_{ev} is the PLANCK function and α_{vi} is the absorptance when

$$\alpha_{vi} = (1 - \tau_{vi}) \cdot \prod_{j=1}^i \tau_{vj}$$

The total transmittance, τ , for the gaseous path containing NT elements is extractable,

$$\tau_{v_ray} = \prod_{i=1}^{NT} \tau_{vi}$$

Thus the spectral transmittance can be used to determine the plume and atmospheric attenuation of a black surface at the terminus of the ray, figure 20.

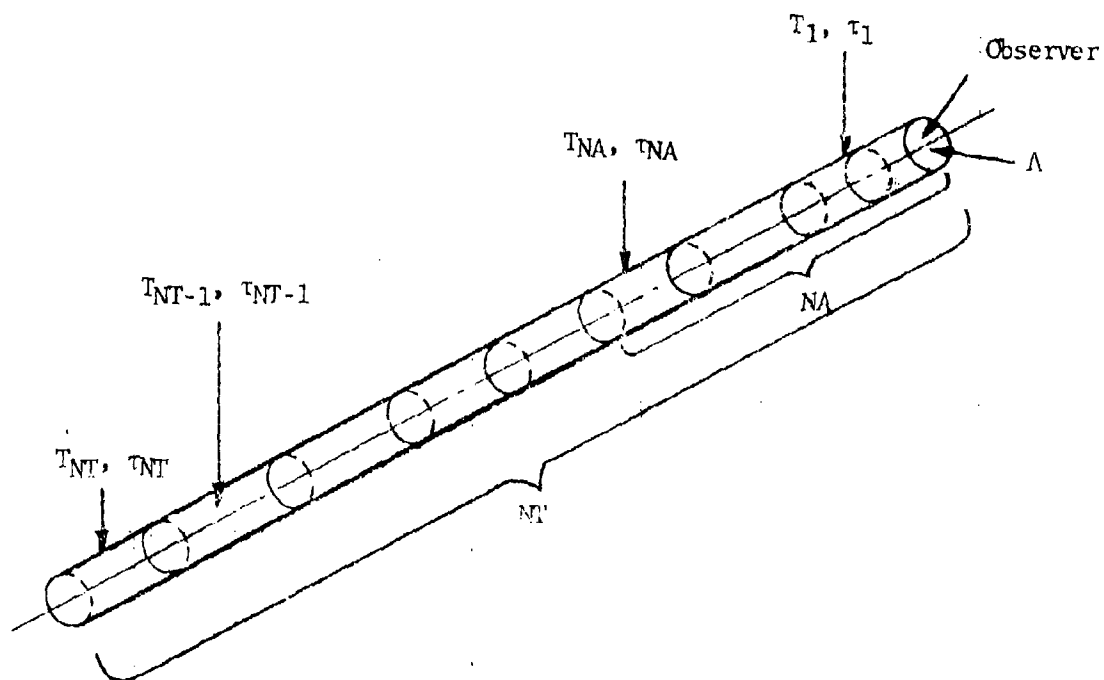


Figure 19. Ray Geometry

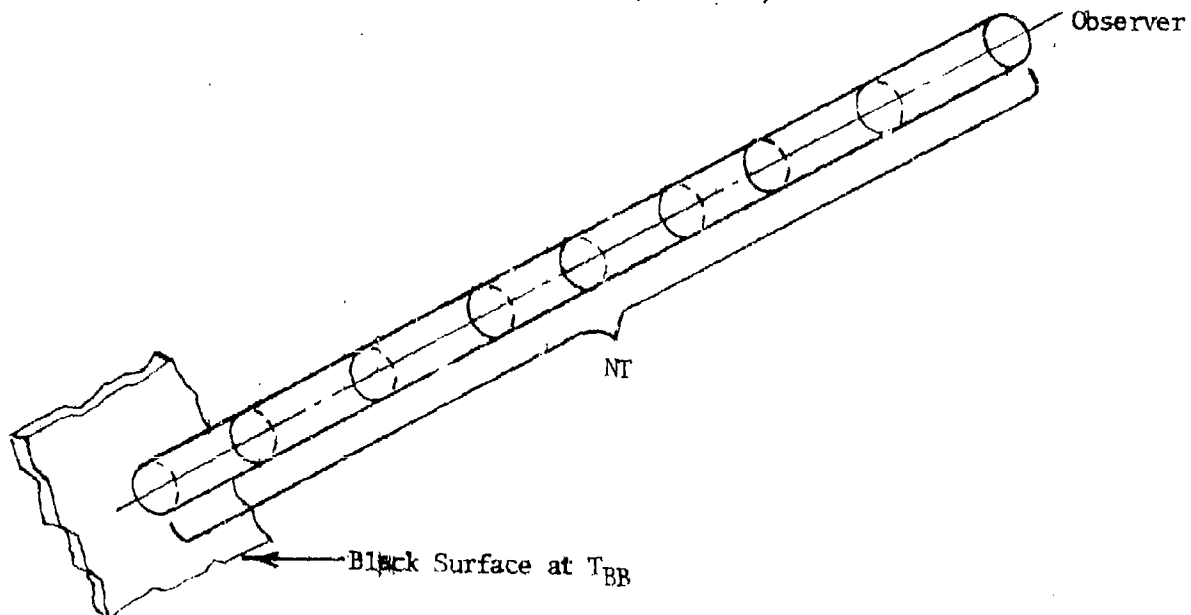


Figure 20. Ray Geometry with Terminating Black Surface

PROGRAM: ATMOS (Page A-69)

FUNCTION: Generate temperatures and partial pressures along an atmospheric path of NA elements and front load the ray pressure and temperature array with the atmospheric data.

INPUT: Range, altitude of plume and observer, number of atmospheric segments

OUTPUT: H₂O, CO₂ and N₂ Pressures

SUBROUTINES: None

DESCRIPTION: Given the geometry of figure 21, the altitude at point r is generated and the temperature and pressures are found from the empirical curve fits used in the computer code. References [8, 11, 12, 13].

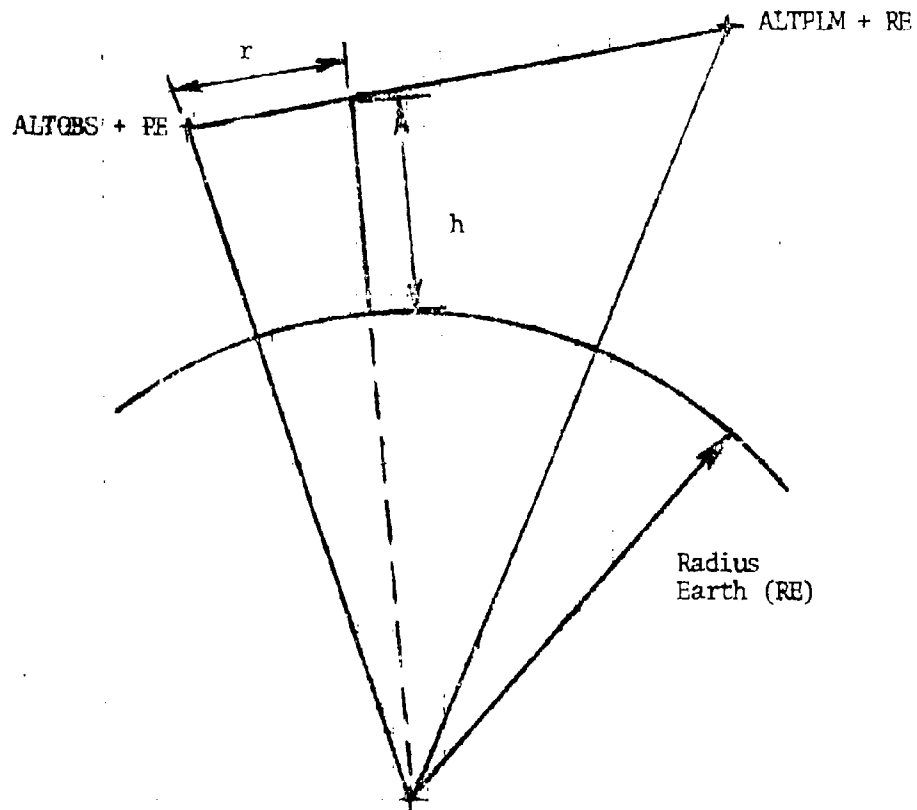


Figure 21. Geometry used in Atmospheric Model

PROGRAM: SETTAU (Page A-70)

FUNCTION: Insert pressure broadening effect of broadening gas by modifying effective gas pressures.

INPUT: H₂O or CO₂ and N₂ gas pressures

OUTPUT: Modified gas pressures (H₂O-N₂ and CO₂-N₂ mixtures)

SUBROUTINE: None

DESCRIPTION: References [6, 7, 8, 9, 10]

PROGRAM: TAUCAL (Page A-71)

FUNCTION: Calculate the gaseous transmittance in a given frequency interval.

INPUT: Pressures, temperatures, gas parameters (X & β)

OUTPUT: Gaseous Transmittances, $\tau(\nu)$

SUBROUTINES: INTERPO

DESCRIPTION: Calculate transmittance of gaseous substance over a given frequency interval using overlapping line approximations.

$$\tau(\nu) = \exp[-\beta_e \cdot f]$$

Where β_e is the effective value of β and f is the Ladenburg-Reiche function. References [6, 10].

PROGRAM: KBCAL (Page A-73)

FUNCTION: To look-up and interpolate on the band model parameters for a given frequency.

INPUT: Frequency, gas type

OUTPUT: K, β , temp and number of temperatures

SUBROUTINES: None

DESCRIPTION: The average line width to spacing ratio multiplied by $1/2 \pi$ called β , and the average line strength to spacing ratio called K are generated in this subroutine. These parameters are found at a given input frequency for H₂O and CO₂ over the temperature range from 300°K to 3000°K.

PROGRAM: Function PLANCK (Page A-75)

FUNCTION: Calculate PLANCK's blackbody function

INPUT: Frequency (cm^{-1}), temperature ($^{\circ}\text{K}$).

OUTPUT: Watts/Steradian/ cm^3

SUBROUTINES: None

DESCRIPTION: From the classical expression for the radiant emittance into a Lambertian hemisphere

$$M_{\text{ev}} = \frac{2\pi(\kappa T)^4}{c^2 h^3} \left(\frac{x^3}{\exp(x) - 1} \right)$$

where

$$x = h\nu/\kappa T$$

the spectral radiant sterance for a given frequency and temperature can be found

$$L_{\text{ev}} = 2hc^2\nu^3/(\exp(x) - 1)$$

See Reference [14].

PROGRAM: Function INTERPO (Page A-76)

FUNCTION: Interpolate over the N dimensional set (X, Y) to find the value at a given point (ARG).

INPUT: X, Y, N, ARG

OUTPUT: INTERPO

SUBROUTINES: None

DESCRIPTION: See Page A-76.

PROGRAM: TAUN20 (Page A-77)

FUNCTION: Calculate transmittance of N_2O in the atmosphere
over selected frequency intervals.

INPUT: Frequency, atmospheric N_2O .

OUTPUT: Transmittance of N_2O in atmosphere.

SUBROUTINES: ERF, INTERFO

DESCRIPTION: See Page A-77.

PROGRAM: Function ERF (Page A-78)

FUNCTION: To evaluate the error function, erf(x).

INPUT: X

OUTPUT: ERF (x)

SUBROUTINES: None

DESCRIPTION: Evaluates the error function.

$$\text{erf}(x) = \frac{2}{\sqrt{\pi}} \int_0^x \exp(-t^2) dt$$

References

1. Ludwig, C. B., "Measurements of the Curves-of-Growth of Hot Water Vapor", APPLIED OPTICS, Vol. 10, No. 5, May 1971, pgs 1957-1973.
2. Huffaker, R. M. and M. J. Dask, "A General Program for the Calculation of Radiation from an Inhomogeneous, Non-isobaric, Non-isothermal Rocket Exhaust Plume". Aero-Astrodynamics Laboratory, George C. Marshall Space Flight Center, National Aeronautics and Space Administration, NASA TM X-55622, June 19, 1967.
3. Parcels, R. F., A. N. Blaser and T. E. Mouritsen, "Aircraft Engine Infrared Signature Prediction Program (SIGNER-2). USER'S MANUAL", Vought Aeronautics, LTV Aerospace Corporation, TR No. 2-53390/3R-3997, 25 June 1973.
4. Parcels, R. F., A. N. Blaser and T. E. Mouritsen, "Aircraft Engine Infrared Signature Prediction Program (SIGNER), USER'S MANUAL", Vought Aeronautics, LTV Aerospace Corporation, TR No. R2-53390/1R-2947, 30 Sept 1971.
5. Wilton, M. E., "An Analytical Technique for Spectral Calculation of Radiation in a Plume Including Obstructions (SCORPIO)", General Electric Report No. R7QAFG209, April 1970.
6. Lindquist, G., "How to Use FS + TAUS", University of Michigan, MEMO, 28 Jan 1970 (see ASDIR-II, Volume III, Reference Documentation).
7. Lindquist, G., "Additions and Changes to FS", University of Michigan, MEMO, 17 April 1970 (see Volume III).
8. Lindquist, G., "How to Use the Program Plumes", University of Michigan, MEMO, 22 July 1970 (see Volume III).
9. Simmons, F. S., and G. Lindquist, "IR Radiation from Rocket Exhaust Plumes in Space", University of Michigan, R3211-1-B, Oct 1970 (see Volume III).
10. Lindquist, G., and F. S. Simmons, "A Band Model Formulation for Very Nonuniform DATAS", J. Quant. Spectral Radiant Transfer, Vol 12, Pgs 807-820, Pergamon Press 1972.
11. Altshuler, T. L., "Infrared Transmission and Background Radiation by Clear Atmosphere", General Electric Document No. 61SD199, Dec 1961 (AD401923).
12. U.S. Standard Atmosphere Supplements, 1966, ESSA, NASA, USAF, 1966.
13. Byers, H. B., General Meteorology, McGraw-Hall Book Co., 1959.
14. Handbook of Military Infrared Technology, Office of Naval Research, Dept. of the Navy, 1965.

APPENDIX

ASDIR-II

PROGRAM LISTING

APPENDIX

This appendix contains a listing of the Aeronautical Systems Division's Infrared Signature Predicting Model (ASDIR). The computer code was developed in the structural form shown in figure 22. The overlays are organized in three major functional groupings with a fourth overlay dedicated to data initialization. The prime functions of each overlay are:

Overlay

(0,0)	Program Control
(1,0)	Data Input & Initialization
(2,0)	Plume Signature Calculations
(3,0)	Data Initialization
(4,0)	Plume Gas Dynamics
(5,0)	Plume Data I/O
(6,0)	Spectral Filter Data Initialization
(7,0)	Spatial Output
(11,0)	Hot Parts Temperature Calculation
(12,0)	View Factor Calculations
(13,0)	Hot Part Radiation Calculations
(14,0)	Hot Part Data Control

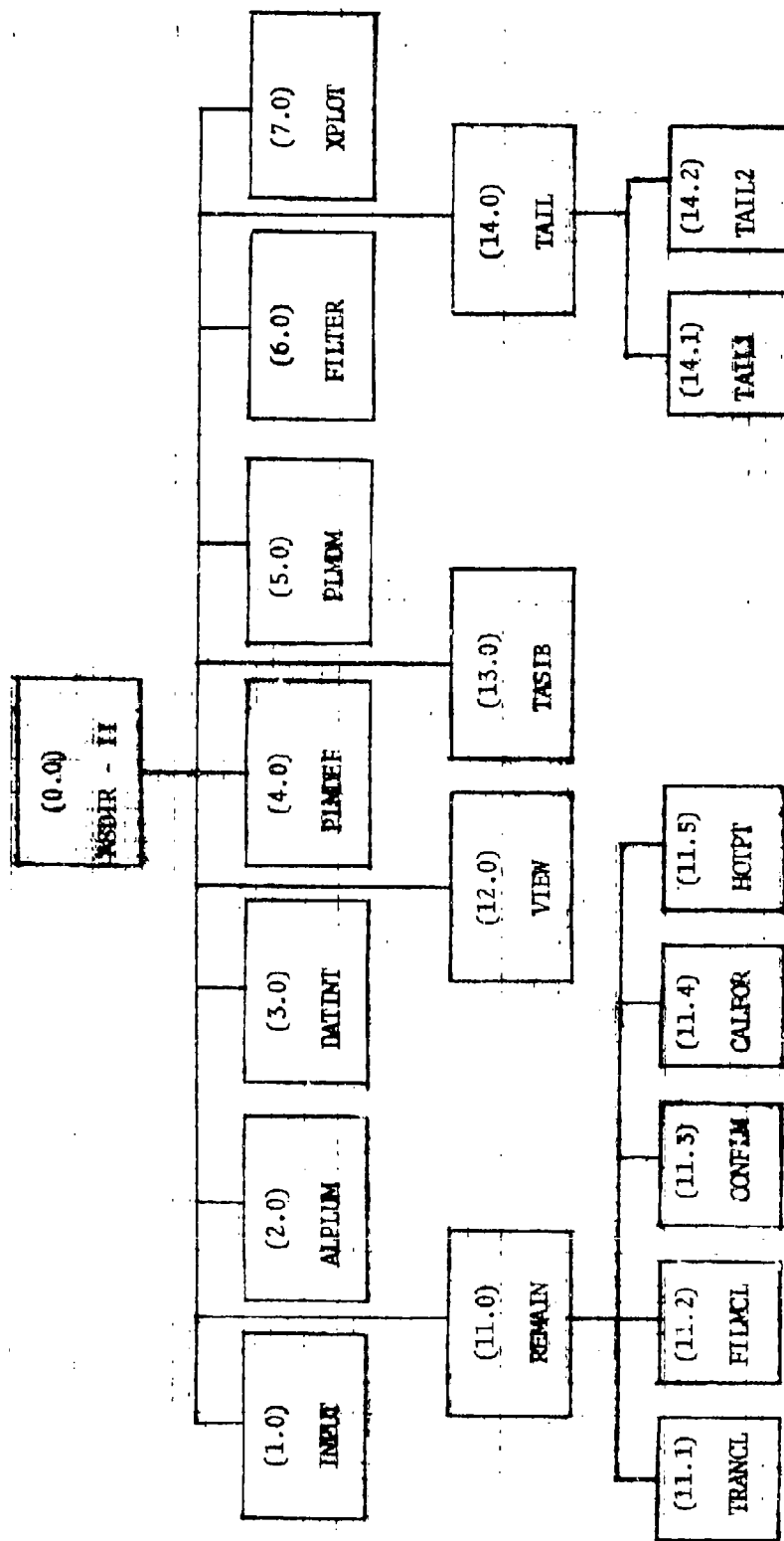


Figure 22. ASDIR-II Overlay Structure

Line	Code	Text	ASCI
1	GE	COMMON /GE/	ASCI123
2	1	AL	ASCI123
3	2	RO	ASCI123
4	3	RP	ASCI123
5	4	TP	ASCI123
6	5	REMO	ASCI123
7	6	REMO	ASCI123
8	7	REMO	ASCI123
9	8	REMO	ASCI123
10	9	REMO	ASCI123
11	10	REMO	ASCI123
12	11	REMO	ASCI123
13	12	REMO	ASCI123
14	13	REMO	ASCI123
15	14	REMO	ASCI123
16	15	REMO	ASCI123
17	16	REMO	ASCI123
18	17	REMO	ASCI123
19	18	REMO	ASCI123
20	19	REMO	ASCI123
21	20	REMO	ASCI123
22	21	REMO	ASCI123
23	22	REMO	ASCI123
24	23	REMO	ASCI123
25	24	REMO	ASCI123
26	25	REMO	ASCI123
27	26	REMO	ASCI123
28	27	REMO	ASCI123
29	28	REMO	ASCI123
30	29	REMO	ASCI123
31	30	REMO	ASCI123
32	31	REMO	ASCI123
33	32	REMO	ASCI123
34	33	REMO	ASCI123
35	34	REMO	ASCI123
36	35	REMO	ASCI123
37	36	REMO	ASCI123
38	37	REMO	ASCI123
39	38	REMO	ASCI123
40	39	REMO	ASCI123
41	40	REMO	ASCI123
42	41	REMO	ASCI123
43	42	REMO	ASCI123
44	43	REMO	ASCI123
45	44	REMO	ASCI123
46	45	REMO	ASCI123
47	46	REMO	ASCI123
48	47	REMO	ASCI123
49	48	REMO	ASCI123
50	49	REMO	ASCI123
51	50	REMO	ASCI123
52	51	REMO	ASCI123
53	52	REMO	ASCI123
54	53	REMO	ASCI123
55	54	REMO	ASCI123
56	55	REMO	ASCI123
57	56	REMO	ASCI123
58	57	REMO	ASCI123
59	58	REMO	ASCI123
60	59	REMO	ASCI123

60	C	CALL ALPLUMS GO TO 270	ASDIR28 59
	271	CONTINUE	ASDIR28 60
		IF(MCFLOW,EO,1) GO TO 180	ASDIR28 61
		IF(FILTER,ME,0) CALL OVERLAY(MXHP,6,8)	ASDIR28 62
	C	IF(FILTER,ME,0) CALL FILTER	ASDIR28 63
			ASDIR28 64
65	C		ASDIR28 65
			ASDIR28 66
	C	FLOW FIELD IN MAIN REGION	ASDIR28 67
	C		ASDIR28 68
			ASDIR28 69
70		IREAD=DATA/1000000000	ASDIR28 70
		IF(IREAD,EO,400) WRITE(6,400)	ASDIR28 71
		IF(IREAD,EO,400) WRITE(6,400)	ASDIR28 72
		IF(IREAD,EO,400) WRITE(6,400)	ASDIR28 73
		6300 FORMAT(//33M** PLUME DATA IS CALCULATED, **)	ASDIR28 74
75		4431 FORMAT(//33M** PLUME DATA READ FROM INPUT, **)	ASDIR28 75
		4432 FORMAT(//33M** PLUME DATA READ FROM INPUT, **)	ASDIR28 76
		IF(IREAD,ME,400) GO TO 15	ASDIR28 77
		CALL OVERLAY(MXHP,4,0)	ASDIR28 78
	C	CALL PLMDEF8	ASDIR28 79
		IF(IREAD,EO,400) GO TO 15	ASDIR28 80
80		READ(1)	ASDIR28 81
		WRITE(8)	ASDIR28 82
	15	CONTINUE	ASDIR28 83
		CALL OVERLAY(MXHP,5,0)	ASDIR28 84
	C	CALL PLMDEF8	ASDIR28 85
85		OPDX=(PA-P8)/12.08)	ASDIR28 86
		RENINEN+1)=REN(10)	ASDIR28 87
		XENINEN+1)=0.9	ASDIR28 88
		ZIST=REN0	ASDIR28 89
90	C	INITIALIZE CALCULATION PARAMETERS	ASDIR28 90
	C		ASDIR28 91
		AL=AMT(2)	ASDIR28 92
		IF(AL,CT,XY(49)) AL=XY(49)	ASDIR28 93
		REN0=INB*AL*P8	ASDIR28 94
95		IF(A5,EO,100.1) DTST =ZTST	ASDIR28 95
		BOS=QDS	ASDIR28 96
		ZM=N02-1	ASDIR28 97
		N0FLON=1	ASDIR28 98
	100	CONTINUE	ASDIR28 99
		A=A5*.0174532926	ASDIR28 101
100	1000	SC=COS(A)	ASDIR28 101
		SS=SIN(A)	ASDIR28 102
		IF(A3,EO,99.08,A8,EO,0.1,60 TO 200	ASDIR28 103
		TANA=SS/SC	ASDIR28 104
105		DTST=AL*TANA	ASDIR28 105
		D=XY(49)/SC	ASDIR28 106
		IF(D,LT,DTST) DTST=D	ASDIR28 107
	200	CONTINUE	ASDIR28 108
		N0Z=36/Z4	ASDIR28 109
110		IF(N0Z,EO,0.1) GO TO 100	ASDIR28 110
		N0=N0Z/2	ASDIR28 111
		ADS=10S	ASDIR28 112
	C	CALL OVERLAY(MXHP,2,0)	ASDIR28 113
		CALL ALPLUMS	ASDIR28 114
			ASDIR28 115

115

IF ISPA, L, 81 GO TO 270
CALL OVERLAY (AHR-P, 7, 01
C CALL NPLGT
1804 GO TO 270
END

ASDIR23 116

ASDIR24 117

ASDIR25 118

ASDIR26 119

ASDIR27 120

A-6

[illegible]

[illegible]

298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320	321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352	353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384	385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416	417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468	469	470	471	472	473	474	475	476	477	478	479	480	481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499	500	501	502	503	504	505	506	507	508	509	510	511	512	513	514	515	516	517	518	519	520	521	522	523	524	525	526	527	528	529	530	531	532	533	534	535	536	537	538	539	540	541	542	543	544	545	546	547	548	549	550	551	552	553	554	555	556	557	558	559	560	561	562	563	564	565	566	567	568	569	570	571	572	573	574	575	576	577	578	579	580	581	582	583	584	585	586	587	588	589	590	591	592	593	594	595	596	597	598	599	600	601	602	603	604	605	606	607	608	609	610	611	612	613	614	615	616	617	618	619	620	621	622	623	624	625	626	627	628	629	630	631	632	633	634	635	636	637	638	639	640	641	642	643	644	645	646	647	648	649	650	651	652	653	654	655	656	657	658	659	660	661	662	663	664	665	666	667	668	669	670	671	672	673	674	675	676	677	678	679	680	681	682	683	684	685	686	687	688	689	690	691	692	693	694	695	696	697	698	699	700	701	702	703	704	705	706	707	708	709	710	711	712	713	714	715	716	717	718	719	720	721	722	723	724	725	726	727	728	729	730	731	732	733	734	735	736	737	738	739	740	741	742	743	744	745	746	747	748	749	750	751	752	753	754	755	756	757	758	759	760	761	762	763	764	765	766	767	768	769	770	771	772	773	774	775	776	777	778	779	780	781	782	783	784	785	786	787	788	789	790	791	792	793	794	795	796	797	798	799	800	801	802	803	804	805	806	807	808	809	810	811	812	813	814	815	816	817	818	819	820	821	822	823	824	825	826	827	828	829	830	831	832	833	834	835	836	837	838	839	840	841	842	843	844	845	846	847	848	849	850	851	852	853	854	855	856	857	858	859	860	861	862	863	864	865	866	867	868	869	870	871	872	873	874	875	876	877	878	879	880	881	882	883	884	885	886	887	888	889	890	891	892	893	894	895	896	897	898	899	900	901	902	903	904	905	906	907	908	909	910	911	912	913	914	915	916	917	918	919	920	921	922	923	924	925	926	927	928	929	930	931	932	933	934	935	936	937	938	939	940	941	942	943	944	945	946	947	948	949	950	951	952	953	954	955	956	957	958	959	960	961	962	963	964	965	966	967	968	969	970	971	972	973	974	975	976	977	978	979	980	981	982	983	984	985	986	987	988	989	990	991	992	993	994	995	996	997	998	999	1000
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345	5521E+01	6284E+01	6975E+01	7706E+01	8493E+01	DC02	364
	9294E+01	1016E+02	1090E+02	1105E+02	1276E+02	DC02	365
	1351E+02	1439E+02	1521E+02	1505E+02	1640E+02	DC02	366
	1697E+02	1735E+02	1769E+02	1793E+02	1817E+02	DC02	367
	1546E+02	1605E+02	1649E+02	1649E+02	1817E+02	DC02	368
	DATA (K002(5,J),J=61,120)					DC02	369
350	1775E+02	1765E+02	1745E+02	1785E+02	1654E+02	DC02	370
	1580E+02	1706E+02	1555E+02	1464E+02	1223E+03	DC02	371
	115E+02	6492E+01	6427E+01	3314E+01	2496E+01	DC02	372
	0	0	0	0	0	DC02	373
	0	0	0	0	0	DC02	374
	0	0	0	0	0	DC02	375
355	0	0	0	5917E+03	1103E+02	DC02	376
	1661E+02	2267E+02	1003E+02	3053E+02	4705E+02	DC02	377
	6350E+02	7675E+02	9785E+02	1225E+01	1519E+01	DC02	378
	1211E+01	2105E+01	2639E+01	3111E+01	3726E+01	DC02	379
	6405E+01	5102E+01	5966E+01	7100E+01	8066E+01	DC02	380
360	9166E+01	1064E+00	1185E+00	1354E+00	1511E+00	DC02	381
	DATA (K0016,J),J=121,176)					DC02	382
	1681E+00	1012E+00	2052E+00	2143E+00	2242E+00	DC02	383
	2442E+00	2649E+00	2665E+00	2698E+00	2772E+00	DC02	384
	2593E+00	3037E+00	2637E+00	2643E+00	2740E+00	DC02	385
365	2836E+00	2892E+00	2782E+00	3004E+00	3226E+00	DC02	386
	3264E+00	3301E+00	3345E+00	3397E+00	3385E+00	DC02	387
	3177E+00	3706E+00	4035E+00	4180E+00	4325E+00	DC02	388
	4533E+00	4746E+00	4803E+00	4859E+00	4841E+00	DC02	389
	4422E+00	5005E+00	5107E+00	5214E+00	5241E+00	DC02	390
370	5332E+00	4822E+00	4554E+00	4286E+00	4337E+00	DC02	391
	3408E+00	4542E+00	5496E+00	5735E+00	5973E+00	DC02	392
	5457E+00	4342E+00	3246E+00	2734E+00	1594E+00	DC02	393
	4508E+01					DC02	394
	DATA (K0016,J),J=1, 60)					DC02	395
375	0	0	0	0	0	DC02	396
	1203E+00	1727E+00	2244E+00	2905E+00	6443E+01	DC02	397
	5332E+00	6403E+00	8320E+00	1059E+01	1331E+01	DC02	398
	1663E+01	2058E+01	2509E+01	3083E+01	3717E+01	DC02	399
380	4521E+01	4899E+01	5276E+01	5722E+01	6169E+01	DC02	400
	6652E+01	7136E+01	7724E+01	8313E+01	8829E+01	DC02	401
	9142E+01	9705E+01	1040E+02	1090E+02	1140E+02	DC02	402
	1200E+02	1261E+02	1296E+02	1366E+02	1366E+02	DC02	403
	1395E+02	1479E+02	1562E+02	1525E+02	1489E+02	DC02	404
385	1403E+02	1477E+02	1462E+02	1447E+02	1510E+02	DC02	405
	1574E+02	1434E+02	1474E+02	1594E+02	1364E+02	DC02	406
	DATA (K0016,J),J=61,120)					DC02	407
	1126E+02	1271E+02	1202E+02	1305E+02	1039E+02	DC02	408
	1113E+02	1177E+02	9080E+01	6851E+01	6587E+01	DC02	409
390	6127E+01	2566E+01	3500E+01	1505E+01	4502E+01	DC02	410
	0	0	0	0	0	DC02	411
	0	0	0	0	0	DC02	412
	0	0	0	0	0	DC02	413
395	1131E+01	1324E+01	6799E+02	8290E+02	9782E+02	DC02	414
	2450E+01	2755E+01	1565E+01	1065E+01	2132E+01	DC02	415
	6509E+01	5179E+01	3025E+01	3505E+01	3958E+01	DC02	416
	7927E+01	8682E+01	5726E+01	6296E+01	7520E+01	DC02	417
	1334E+02	1425E+01	9940E+01	1071E+00	1179E+00	DC02	418
	1451E+02	1495E+00	1495E+00	1782E+00	1763E+00	DC02	419
	1451E+02	2063E+00	2116E+00	2250E+00	2471E+00	DC02	420

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DATA	CEP2/	DATA	CEP3/	DATA	CEP4/
1.1050E-2	2.160E-0	1.450E+1	2.748E+1	3.190E+1	3.070E+1
1.350E-3	1.40E-0	1.100E+1	2.200E+1	3.300E+1	3.810E+1
1.260E-3	8.20E-1	9.100E-9	5.040E+1	2.700E+1	2.090E+1
1.430E-4	4.450E-1	5.900E-0	4.740E+1	2.400E+1	2.750E+1
1.507E-4	2.49E-1	4.270E-0	1.450E+1	2.200E+1	1.260E+1
1.510E-5	1.270E-1	2.940E-0	1.100E+1	1.900E+1	2.410E+1
1.173E-5	6.30E-2	2.000E-0	6.500E-1	1.690E+1	2.210E+1
1.5710E-5	3.01E-2	1.340E-0	7.40E-1	1.600E+1	2.290E+1
1.1950E-6	1.40E-2	9.720E-1	1.930E-0	1.200E+1	1.700E+1
1.600E-7	6.20E-3	5.900E-1	4.430E-1	1.030E+1	1.360E+1
1.670E-7	2.750E-3	3.1500E-1	3.300E-1	6.450E-1	1.170E+1
1.113E-6	5.00E-3	2.690E-1	1.1740E-1	5.600E-1	1.000E+1
1.137E-6	2.70E-3	2.450E-1	1.230E-1	4.500E-1	8.550E-1
1.1720E-6	1.030E-3	2.140E-1	1.100E-0	3.500E-1	7.160E-1
1.500E-6	4.60E-3	1.690E-1	1.000E-1	2.700E-1	1.950E-1
1.950E-6	2.930E-3	1.1750E-1	1.730E-1	2.390E-1	1.930E-1
1.100E-5	1.100E-3	5.166E-1	1.6650E-1	2.110E-1	4.050E-1
1.750E-5	1.350E-3	1.650E-1	6.00E-1	1.590E-1	3.520E-1
DATA CEP3/					
1.473E-5	9.570E-5	1.1670E-1	1.6200E-1	1.990E-1	3.120E-1
1.110E-5	2.430E-4	1.1750E-1	1.6300E-1	1.540E-1	2.890E-1
1.110E-5	5.700E-4	1.1000E-1	1.6750E-1	1.1900E-1	2.810E-1
1.2350E-5	1.50E-3	1.2000E-1	1.750E-1	2.600E-1	2.630E-1
1.100E-4	3.00E-3	2.330E-1	1.6650E-1	2.210E-1	3.140E-1
1.600E-4	9.50E-3	3.260E-1	1.8220E-1	2.600E-1	3.600E-1
1.120E-3	2.450E-2	3.430E-1	1.1760E-1	3.200E-1	4.630E-1
1.100E-3	4.20E-2	2.630E-1	1.2510E-1	4.100E-1	5.110E-1
1.3650E-3	1.463E-1	1.1070E-1	1.3900E-1	4.550E-1	5.540E-1
1.630E-3	3.70E-1	1.1660E-1	1.4050E-1	4.800E-1	5.710E-1
1.130E-2	6.94E-1	1.244E-1	1.6590E-1	5.300E-1	5.570E-1
1.250E-2	1.230E-1	3.410E-1	1.6770E-1	5.020E-1	5.620E-1
1.500E-2	2.120E-1	4.470E-1	1.5470E-1	5.160E-1	5.760E-1
1.100E-1	2.850E-1	1.4830E-1	1.5920E-1	4.970E-1	4.860E-1
1.1219E-1	3.20E-1	4.910E-1	1.5580E-1	4.670E-1	4.440E-1
1.1350E-1	3.40E-1	5.050E-1	1.6210E-1	4.770E-1	4.540E-1
1.1145E-1	3.610E-1	5.360E-1	1.6630E-1	5.030E-1	5.020E-1
1.1290E-1	4.600E-1	6.210E-1	1.6240E-1	5.300E-1	5.380E-1
1.3971E-1	5.80E-1	7.490E-1	1.7600E-1	5.010E-1	5.650E-1
DATA CEP4/					
1.1150E-1	1.5270E-2	1.9240E-1	8.490E-1	1.640E-1	1.5440E-1
1.1463E-1	1.250E-1	1.1130E+1	9.400E-1	8.070E-1	6.630E-1
1.1650E-1	1.1550E+1	1.0110E+1	1.6760E-1	5.600E-1	4.630E-1
1.142E-1	6.750E-1	5.570E-1	3.490E-1	2.700E-1	2.630E-1
1.1510E-1	2.030E-1	1.130E-1	1.190E-1	1.300E-1	1.560E-1
1.16030E-1	5.80E-1	1.6630E-1	1.1120E-1	1.200E-1	1.250E-

[illegible]

230	1.2100E-4..6680E-4..270E-3..1520E-2..5730E-2..1488E-1..1470E-1..	DAH20	239
	1.2150E-4..6710E-4..280E-3..1540E-2..580E-2..1500E-1..1480E-1..	DAH20	239
	1.2170E-4..6730E-4..2850E-3..1560E-2..590E-2..1520E-1..1500E-1..	DAH20	239
	1.2190E-4..6750E-4..290E-3..1580E-2..600E-2..1540E-1..1520E-1..	DAH20	239
	1.2210E-4..6770E-4..2950E-3..1600E-2..610E-2..1560E-1..1540E-1..	DAH20	239
	1.2230E-4..6790E-4..300E-3..1620E-2..620E-2..1580E-1..1560E-1..	DAH20	239
	1.2250E-4..6810E-4..3050E-3..1640E-2..630E-2..1600E-1..1580E-1..	DAH20	239
	1.2270E-4..6830E-4..3100E-3..1660E-2..640E-2..1620E-1..1600E-1..	DAH20	239
	1.2290E-4..6850E-4..3150E-3..1680E-2..650E-2..1640E-1..1620E-1..	DAH20	239
	1.2310E-4..6870E-4..3200E-3..1700E-2..660E-2..1660E-1..1640E-1..	DAH20	239
235	1.2300E-4..6860E-4..3190E-3..1690E-2..650E-2..1650E-1..1630E-1..	DAH20	239
	1.2310E-4..6870E-4..3200E-3..1700E-2..660E-2..1660E-1..1640E-1..	DAH20	239
	1.2320E-4..6880E-4..3210E-3..1710E-2..670E-2..1670E-1..1650E-1..	DAH20	239
	1.2330E-4..6890E-4..3220E-3..1720E-2..680E-2..1680E-1..1660E-1..	DAH20	239
	1.2340E-4..6900E-4..3230E-3..1730E-2..690E-2..1690E-1..1670E-1..	DAH20	239
	1.2350E-4..6910E-4..3240E-3..1740E-2..700E-2..1700E-1..1680E-1..	DAH20	239
	1.2360E-4..6920E-4..3250E-3..1750E-2..710E-2..1710E-1..1690E-1..	DAH20	239
	1.2370E-4..6930E-4..3260E-3..1760E-2..720E-2..1720E-1..1700E-1..	DAH20	239
	1.2380E-4..6940E-4..3270E-3..1770E-2..730E-2..1730E-1..1710E-1..	DAH20	239
	1.2390E-4..6950E-4..3280E-3..1780E-2..740E-2..1740E-1..1720E-1..	DAH20	239
245	1.2400E-4..6960E-4..3290E-3..1790E-2..750E-2..1750E-1..1730E-1..	DAH20	245
	1.2410E-4..6970E-4..3300E-3..1800E-2..760E-2..1760E-1..1740E-1..	DAH20	245
	1.2420E-4..6980E-4..3310E-3..1810E-2..770E-2..1770E-1..1750E-1..	DAH20	245
	1.2430E-4..6990E-4..3320E-3..1820E-2..780E-2..1780E-1..1760E-1..	DAH20	245
	1.2440E-4..7000E-4..3330E-3..1830E-2..790E-2..1790E-1..1770E-1..	DAH20	245
	1.2450E-4..7010E-4..3340E-3..1840E-2..800E-2..1800E-1..1780E-1..	DAH20	245
	1.2460E-4..7020E-4..3350E-3..1850E-2..810E-2..1810E-1..1790E-1..	DAH20	245
	1.2470E-4..7030E-4..3360E-3..1860E-2..820E-2..1820E-1..1800E-1..	DAH20	245
	1.2480E-4..7040E-4..3370E-3..1870E-2..830E-2..1830E-1..1810E-1..	DAH20	245
	1.2490E-4..7050E-4..3380E-3..1880E-2..840E-2..1840E-1..1820E-1..	DAH20	245
255	1.2500E-4..7060E-4..3390E-3..1890E-2..850E-2..1850E-1..1830E-1..	DAH20	255
	1.2510E-4..7070E-4..3400E-3..1900E-2..860E-2..1860E-1..1840E-1..	DAH20	255
	1.2520E-4..7080E-4..3410E-3..1910E-2..870E-2..1870E-1..1850E-1..	DAH20	255
	1.2530E-4..7090E-4..3420E-3..1920E-2..880E-2..1880E-1..1860E-1..	DAH20	255
	1.2540E-4..7100E-4..3430E-3..1930E-2..890E-2..1890E-1..1870E-1..	DAH20	255
	1.2550E-4..7110E-4..3440E-3..1940E-2..900E-2..1900E-1..1880E-1..	DAH20	255
	1.2560E-4..7120E-4..3450E-3..1950E-2..910E-2..1910E-1..1890E-1..	DAH20	255
	1.2570E-4..7130E-4..3460E-3..1960E-2..920E-2..1920E-1..1900E-1..	DAH20	255
	1.2580E-4..7140E-4..3470E-3..1970E-2..930E-2..1930E-1..1910E-1..	DAH20	255
	1.2590E-4..7150E-4..3480E-3..1980E-2..940E-2..1940E-1..1920E-1..	DAH20	255
265	1.2600E-4..7160E-4..3490E-3..1990E-2..950E-2..1950E-1..1930E-1..	DAH20	265
	1.2610E-4..7170E-4..3500E-3..2000E-2..960E-2..1960E-1..1940E-1..	DAH20	265
	1.2620E-4..7180E-4..3510E-3..2010E-2..970E-2..1970E-1..1950E-1..	DAH20	265
	1.2630E-4..7190E-4..3520E-3..2020E-2..980E-2..1980E-1..1960E-1..	DAH20	265
	1.2640E-4..7200E-4..3530E-3..2030E-2..990E-2..1990E-1..1970E-1..	DAH20	265
	1.2650E-4..7210E-4..3540E-3..2040E-2..1000E-2..2000E-1..1980E-1..	DAH20	265
	1.2660E-4..7220E-4..3550E-3..2050E-2..1010E-2..2010E-1..1990E-1..	DAH20	265
	1.2670E-4..7230E-4..3560E-3..2060E-2..1020E-2..2020E-1..2000E-1..	DAH20	265
	1.2680E-4..7240E-4..3570E-3..2070E-2..1030E-2..2030E-1..2010E-1..	DAH20	265
	1.2690E-4..7250E-4..3580E-3..2080E-2..1040E-2..2040E-1..2020E-1..	DAH20	265
275	1.2700E-4..7260E-4..3590E-3..2090E-2..1050E-2..2050E-1..2030E-1..	DAH20	275
	1.2710E-4..7270E-4..3600E-3..2100E-2..1060E-2..2060E-1..2040E-1..	DAH20	275
	1.2720E-4..7280E-4..3610E-3..2110E-2..1070E-2..2070E-1..2050E-1..	DAH20	275
	1.2730E-4..7290E-4..3620E-3..2120E-2..1080E-2..2080E-1..2060E-1..	DAH20	275
	1.2740E-4..7300E-4..3630E-3..2130E-2..1090E-2..2090E-1..2070E-1..	DAH20	275
	1.2750E-4..7310E-4..3640E-3..2140E-2..1100E-2..2100E-1..2080E-1..	DAH20	275
	1.2760E-4..7320E-4..3650E-3..2150E-2..1110E-2..2110E-1..2090E-1..	DAH20	275
	1.2770E-4..7330E-4..3660E-3..2160E-2..1120E-2..2120E-1..2100E-1..	DAH20	275
	1.2780E-4..7340E-4..3670E-3..2170E-2..1130E-2..2130E-1..2110E-1..	DAH20	275
	1.2790E-4..7350E-4..3680E-3..2180E-2..1140E-2..2140E-1..2120E-1..	DAH20	275
285	1.2800E-4..7360E-4..3690E-3..2190E-2..1150E-2..2150E-1..2130E-1..	DAH20	285
	1.2810E-4..7370E-4..3700E-3..2200E-2..1160E-2..2160E-1..2140E-1..	DAH20	285
	1.2820E-4..7380E-4..3710E-3..2210E-2..1170E-2..2170E-1..2150E-1..	DAH20	285
	1.2830E-4..7390E-4..3720E-3..2220E-2..1180E-2..2180E-1..2160E-1..	DAH20	285
	1.2840E-4..7400E-4..3730E-3..2230E-2..1190E-2..2190E-1..2170E-1..	DAH20	285
	1.2850E-4..7410E-4..3740E-3..2240E-2..1200E-2..2200E-1..2180E-1..	DAH20	285
	1.2860E-4..7420E-4..3750E-3..2250E-2..1210E-2..2210E-1..2190E-1..	DAH20	285
	1.2870E-4..7430E-4..3760E-3..2260E-2..1220E-2..2220E-1..2200E-1..	DAH20	285
	1.2880E-4..7440E-4..3770E-3..2270E-2..1230E-2..2230E-1..2210E-1..	DAH20	285
	1.2890E-4..7450E-4..3780E-3..2280E-2..1240E-2..2240E-1..2220E-1..	DAH20	285

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345	1.1175E-1..3690E-1..3850E-1..2490E-1..2120E-1..2080E-1..2000E-1..	DAM20	344
	1.1400E-1..3700E-1..4190E-1..2720E-1..2280E-1..2130E-1..2240E-1..	DAM20	345
	1.1250E-1..4130E-1..4680E-1..2400E-1..2400E-1..2290E-1..2430E-1..	DAM20	346
	1.1680E-1..4630E-1..4270E-1..2500E-1..2638E-1..2380E-1..2600E-1..	DAM20	347
	1.1305E-1..3450E-1..3740E-1..2590E-1..2350E-1..2340E-1..2600E-1..	DAM20	348
	1.1820E-1..1735E-1..2025E-1..2310E-1..2110E-1..2140E-1..2430E-1..	DAM20	349
	1.1700E-1..6100E-2..1910E-1..1750E-1..1810E-1..1340E-1..2100E-1..	DAM20	350
	1.1413E-1..3700E-2..1054E-1..1276E-1..1520E-1..1370E-1..1800E-1..	DAM20	351
	1.1451E-1..1700E-2..5540E-2..8550E-2..1130E-1..1310E-1..1500E-1..	DAM20	352
	1.1751E-2..1450E-2..3850E-2..5595E-2..6030E-2..9450E-2..1200E-1..	DAM20	353
350	1.1722E-3..7540E-3..3840E-2..5750E-2..5370E-2..5940E-2..8000E-2..	DAM20	354
	1.1431E-3..6030E-3..3810E-2..4530E-2..3400E-2..4140E-2..6200E-2..	DAM20	355
	1.1275E-3..4180E-3..1930E-2..3680E-2..3190E-2..3320E-2..5000E-2..	DAM20	356
	1.1453E-3..2000E-3..1310E-2..2320E-2..2470E-2..2560E-2..4200E-2..	DAM20	357
	1.1310E-3..1600E-3..9150E-3..1500E-2..1860E-2..1970E-2..3700E-2..	DAM20	358
	DATA COEF17	DAM20	359
	1.6313E-4..1105E-3..5650E-3..1140E-2..2050E-2..1920E-2..3400E-2..	DAM20	360
	1.4743E-4..7571E-4..1187E-2..1240E-2..1750E-2..1870E-2..3200E-2..	DAM20	361
	1.1353E-4..5950E-4..5280E-3..1140E-2..1600E-2..1850E-2..3000E-2..	DAM20	362
	1.2403E-4..4930E-4..2530E-3..8420E-3..1410E-2..1840E-2..2900E-2..	DAM20	363
365	1.1703E-4..3630E-4..1230E-3..4350E-3..1240E-2..1620E-2..2920E-2..	DAM20	364
	1.1201E-4..2490E-4..1210E-3..4350E-3..1180E-2..1670E-2..2910E-2..	DAM20	365
	1.1810E-5..1700E-4..1030E-3..4390E-3..1260E-2..1920E-2..2930E-2..	DAM20	366
	1.1557E-5..1200E-4..660E-4..3670E-3..1195E-2..1930E-2..3000E-2..	DAM20	367
	1.1391E-5..9030E-5..7160E-4..3510E-3..1160E-2..1940E-2..3030E-2..	DAM20	368
	1.2953E-5..8300E-5..3735E-4..2540E-3..1140E-2..1960E-2..3100E-2..	DAM20	369
	1.1230E-5..5030E-5..4450E-4..2500E-3..1170E-2..2010E-2..3200E-2..	DAM20	370
	1.1251E-5..4200E-5..3670E-4..2520E-3..1160E-2..2150E-2..3300E-2..	DAM20	371
	1.1223E-5..6430E-5..3710E-4..2680E-3..11270E-2..2110E-2..3400E-2..	DAM20	372
	1.1223E-5..9200E-5..3960E-4..2730E-3..1280E-2..2160E-2..3550E-2..	DAM20	373
370	1.2350E-5..1030E-4..4150E-4..2630E-3..1210E-2..2210E-2..3650E-2..	DAM20	374
	1.2801E-5..1250E-4..6330E-4..3630E-3..1360E-2..2310E-2..3800E-2..	DAM20	375
	1.1310E-5..1500E-4..9790E-4..4920E-3..1580E-2..2410E-2..4000E-2..	DAM20	376
	1.1370E-5..1800E-4..1200E-3..5400E-3..1670E-2..2510E-2..4100E-2..	DAM20	377
	1.1420E-5..2000E-4..9870E-4..5890E-3..1710E-2..2570E-2..4200E-2..	DAM20	378
	DATA COEF18	DAM20	379
	1.5182E-5..2600E-4..1340E-3..5470E-3..1730E-2..2670E-2..4400E-2..	DAM20	380
	1.6403E-5..2700E-4..1210E-3..5340E-3..1720E-2..2740E-2..4570E-2..	DAM20	381
	1.1720E-5..3000E-4..2040E-3..6840E-3..1840E-2..2850E-2..4680E-2..	DAM20	382
	1.1920E-5..3300E-4..2780E-3..8190E-3..1990E-2..2970E-2..4790E-2..	DAM20	383
385	1.1103E-4..3030E-4..3170E-3..8590E-3..2140E-2..3080E-2..4350E-2..	DAM20	384
	1.1253E-4..4200E-4..2400E-3..8180E-3..2200E-2..3170E-2..4500E-2..	DAM20	385
	1.1453E-4..5000E-4..4520E-3..1090E-2..2300E-2..2930E-2..4990E-2..	DAM20	386
	1.1751E-4..5600E-4..3010E-3..9410E-3..2430E-2..3420E-2..5000E-2..	DAM20	387
	1.1981E-4..6300E-4..2800E-3..1070E-2..2600E-2..3530E-2..5310E-2..	DAM20	388
	1.2301E-4..7100E-4..2760E-3..1090E-2..2720E-2..3650E-2..5020E-2..	DAM20	389
	1.2603E-4..8300E-4..3160E-3..1270E-2..2950E-2..3770E-2..5100E-2..	DAM20	390
	1.3307E-4..8900E-4..4130E-3..1390E-2..3660E-2..3850E-2..5500E-2..	DAM20	391
	1.3601E-4..9500E-4..4710E-3..1350E-2..3080E-2..3840E-2..6990E-2..	DAM20	392
	1.3905E-4..9800E-4..4340E-3..1470E-2..3160E-2..3850E-2..6950E-2..	DAM20	393
395	1.4201E-4..9900E-4..3970E-3..1430E-2..3180E-2..3840E-2..6900E-2..	DAM20	394
	1.4301E-4..9800E-4..3640E-3..1410E-2..3170E-2..3810E-2..6800E-2..	DAM20	395
	1.3900E-4..9400E-4..3903E-3..1420E-2..3140E-2..3760E-2..6750E-2..	DAM20	396
	1.3801E-4..9000E-4..3100E-3..1450E-2..3180E-2..3750E-2..6630E-2..	DAM20	397
	1.3301E-4..7500E-4..3580E-3..1360E-2..3100E-2..3720E-2..6550E-2..	DAM20	398
	DATA COEF19	DAM20	399
	1.3301E-4..6930E-4..1430E-3..1360E-2..3090E-2..3690E-2..6430E-2..	DAM20	400

575	0.3.02E+2..5052E+0..0520E+0..1550E+0..3890E+1..5074E+1..187E+2..	DAM20	572
	0.3.07E+0..3039E+0..6102E+0..1290E+1..279E+1..610E+1..118E+2..	DAM20	573
	0.3.05E+0..5574E+0..8339E+0..1505E+1..3131E+1..6305E+1..1163E+2..	DAM20	574
	0.3.12E+0..6311E+0..8139E+0..1444E+1..280E+1..6745E+1..155E+2..	DAM20	575
	0.3.15E+0..7279E+0..9830E+0..1779E+1..372E+1..988E+1..246E+2..	DAM20	576
	0.3.12E+0..5595E+0..7961E+0..1697E+1..327E+1..988E+1..207E+2..	DAM20	577
	0.3.16E+0..7002E+0..9291E+0..1667E+1..356E+1..932E+1..237E+2..	DAM20	578
	0.3.14E+0..3346E+0..5891E+0..1273E+1..206E+1..720E+1..151E+2..	DAM20	579
	0.3.45E+0..3718E+0..6165E+0..1347E+1..316E+1..782E+1..172E+2..	DAM20	580
	0.3.59E+0..4316E+0..727E+0..1459E+1..317E+1..698E+1..175E+2..	DAM20	581
DATA CREF27			582
580	0.372E+0..477E+0..8101E+0..1544E+1..305E+1..659E+1..119E+2..	DAM20	583
	0.3.7E+0..250E+0..462E+0..117E+1..255E+1..542E+1..108E+2..	DAM20	584
	0.6.1E+0..278E+0..469E+0..105E+0..221E+1..475E+1..103E+2..	DAM20	585
	0.4.42E+0..342E+0..529E+0..107E+0..211E+1..445E+1..993E+1..	DAM20	586
	0.5.0E+0..318E+0..503E+0..113E+1..235E+1..431E+1..110E+2..	DAM20	587
	0.476E+0..357E+0..578E+0..120E+1..262E+1..562E+1..118E+2..	DAM20	588
	0.5.7E+0..427E+0..624E+0..123E+1..242E+1..636E+1..146E+2..	DAM20	589
	0.5.1E+0..437E+0..717E+0..125E+1..213E+1..537E+1..151E+2..	DAM20	590
	0.5.7E+0..492E+0..744E+0..134E+1..232E+1..522E+1..127E+2..	DAM20	591
	0.6.2E+0..702E+0..1061E+0..154E+1..235E+1..703E+1..377E+2..	DAM20	592
598	0.5.5E+0..731E+0..145E+1..189E+1..281E+1..924E+1..493E+2..	DAM20	593
	0.718E+0..774E+0..149E+1..198E+1..319E+1..102E+2..527E+2..	DAM20	594
	0.824E+0..811E+0..126E+1..230E+1..371E+1..124E+2..595E+2..	DAM20	595
	0.803E+0..857E+0..172E+1..251E+1..401E+1..134E+2..637E+2..	DAM20	596
	0.9.6E+0..848E+0..134E+1..272E+1..427E+1..150E+2..679E+2..	DAM20	597
	0.132E+1..494E+0..136E+1..294E+1..425E+1..165E+2..721E+2..	DAM20	598
	0.179E+1..822E+0..147E+1..319E+1..526E+1..182E+2..768E+2..	DAM20	599
	0.116E+1..953E+0..144E+1..347E+1..574E+1..204E+2..819E+2..	DAM20	600
DATA CREF307			601
603	0.121E+1..9849E+0..1537E+1..379E+1..624E+1..224E+2..873E+2..	DAM20	602
	0.124E+1..105E+1..156E+1..405E+1..681E+1..244E+2..933E+2..	DAM20	603
	0.134E+1..115E+1..161E+1..437E+1..746E+1..250E+2..992E+2..	DAM20	604
	0.140E+1..129E+1..189E+1..472E+1..801E+1..235E+2..106E+3..	DAM20	605
	0.154E+1..141E+1..174E+1..510E+1..803E+1..326E+2..112E+3..	DAM20	606
	0.150E+1..1177E+1..179E+1..553E+1..954E+1..350E+2..119E+3..	DAM20	607
	0.154E+1..1025E+1..171E+1..526E+1..920E+1..339E+2..109E+3..	DAM20	608
	0.158E+1..1036E+1..163E+1..530E+1..892E+1..319E+2..100E+3..	DAM20	609
	0.160E+1..970E+1..154E+1..472E+1..850E+1..301E+2..91E+2..	DAM20	610
	0.161E+1..515E+1..140E+1..454E+1..820E+1..284E+2..835E+2..	DAM20	611
615	0.162E+1..557E+1..140E+1..431E+1..791E+1..254E+2..764E+2..	DAM20	612
	0.161E+1..231E+0..134E+1..411E+1..753E+1..252E+2..696E+2..	DAM20	613
	0.159E+1..772E+1..128E+1..331E+1..727E+1..235E+2..617E+2..	DAM20	614
	0.157E+1..743E+1..129E+1..329E+1..77E+1..223E+2..570E+2..	DAM20	615
	0.151E+1..740E+1..110E+1..355E+1..64E+1..211E+2..527E+2..	DAM20	616
	0.149E+1..491E+1..114E+1..330E+1..649E+1..190E+2..435E+2..	DAM20	617
	0.147E+1..475E+1..102E+1..326E+1..615E+1..182E+2..443E+2..	DAM20	618
	0.143E+1..463E+1..105E+1..365E+1..592E+1..176E+2..405E+2..	DAM20	619
	0.142E+1..422E+1..101E+1..291E+1..572E+1..164E+2..369E+2..	DAM20	620
DATA CREF317			621
628	0.125E+1..433E+1..974E+0..276E+1..549E+1..150E+2..337E+2..	DAM20	622
	0.119E+1..582E+0..319E+0..263E+1..528E+1..147E+2..308E+2..	DAM20	623
	0.112E+1..507E+0..924E+0..259E+1..501E+1..139E+2..261E+2..	DAM20	624
	0.115E+1..463E+0..870E+0..239E+1..482E+1..131E+2..257E+2..	DAM20	625
	0.984E+0..526E+1..455E+0..278E+1..467E+1..121E+2..234E+2..	DAM20	626
	0.930E+0..539E+1..455E+0..216E+1..469E+1..118E+2..214E+2..	DAM20	627
		DAM20	628

[illegible]

685	*.1F 21E+1..419E+0..1439E+1..5949E+1..2580E+2..6158E+2..1189E+3..	DAH20	686
	*.1822E+1..3738E+0..1281E+1..5159E+1..2310E+2..5474E+2..1060E+3..	DAH20	687
	*.1613E+1..3311E+0..1138E+1..4475E+1..2086E+2..4858E+2..9625E+2..	DAH20	688
	*.1594E+1..2954E+0..1005E+1..3866E+1..1841E+2..4311E+2..8739E+2..	DAH20	689
	*.1565E+1..2623E+0..889E+0..3365E+1..1647E+2..3827E+2..7979E+2..	DAH20	690
690	*.1525E+1..2128E+0..787E+0..2925E+1..1472E+2..3392E+2..7219E+2..	DAH20	691
	*.1482E+1..2036E+0..6973E+0..2538E+1..1319E+2..3011E+2..6586E+2..	DAH20	692
	*.1433E+1..1835E+0..6175E+0..2203E+1..1178E+2..2674E+2..5953E+2..	DAH20	693
	*.1371E+1..1619E+0..5472E+0..1913E+1..1049E+2..2370E+2..5404E+2..	DAH20	694
	*.1309E+1..1465E+0..4843E+0..1640E+1..9331E+1..2102E+2..4939E+2..	DAH20	695
695	*.1245E+1..1230E+0..4285E+0..1371E+1..8384E+1..1867E+2..4475E+2..	DAH20	696
	*.1177E+1..1156E+0..3802E+0..1254E+1..7735E+1..1952E+2..4392E+2..	DAH20	697
	*.1105E+1..1032E+0..3361E+0..1079E+1..6694E+1..1471E+2..3711E+2..	DAH20	698
	*.1022E+1..9147E+0..2983E+0..9379E+0..5980E+1..1305E+2..3173E+2..	DAH20	699
	*.9753E+0..2816E+0..4495E+0..9156E+0..2591E+1..1075E+2..3449E+2..	DAH20	700
700	*.9123E+0..2557E+0..4153E+0..9007E+0..2990E+1..1007E+2..3677E+2..	DAH20	701
	DATA CCEP37	DAH20	702
	*.8509E+0..4000E+0..1041E+0..8858E+0..2386E+1..8933E+1..1434E+2..	DAH20	703
	*.7925E+0..2869E+0..4159E+0..6748E+0..2728E+1..9873E+1..4222E+2..	DAH20	704
	*.7331E+0..2475E+0..3689E+0..8710E+0..2709E+1..9433E+1..3774E+2..	DAH20	705
705	*.6871E+0..2197E+0..3539E+0..6561E+0..2351E+1..8504E+1..3251E+2..	DAH20	706
	*.6401E+0..2428E+0..3658E+0..8466E+0..2163E+1..7478E+1..2930E+2..	DAH20	707
	*.5973E+0..1577E+0..3204E+0..8337E+0..2310E+1..8113E+1..2651E+2..	DAH20	708
	*.5573E+0..1242E+0..2710E+0..1263E+0..2415E+1..1826E+1..2384E+2..	DAH20	709
710	*.5221E+0..1030E+0..2415E+0..6188E+0..2779E+1..9140E+1..2517E+2..	DAH20	710
	*.4815E+0..7574E+0..12121E+0..7891E+0..2720E+1..8139E+1..2140E+2..	DAH20	711
	*.4365E+0..1199E+0..2710E+0..6188E+0..2697E+1..8260E+1..2204E+2..	DAH20	712
	*.3953E+0..1289E+0..2741E+0..7748E+0..2527E+1..7758E+1..2140E+2..	DAH20	713
715	*.3788E+0..1602E+0..3172E+0..8710E+0..2650E+1..8456E+1..2515E+2..	DAH20	714
	*.3651E+0..2295E+0..4012E+0..1005E+1..2726E+1..8522E+1..2516E+2..	DAH20	715
	*.3531E+0..2361E+0..4190E+0..1159E+1..2685E+1..9140E+1..2706E+2..	DAH20	716
	*.3499E+0..1205E+0..2731E+0..9454E+0..2720E+1..9286E+1..2596E+2..	DAH20	717
	*.3385E+0..5188E+0..1701E+0..8040E+0..2814E+1..8944E+1..2254E+2..	DAH20	718
720	*.3339E+0..5508E+0..1676E+0..7445E+0..2474E+1..6843E+1..1921E+2..	DAH20	719
	DATA CCEP16	DAH20	720
	*.3319E+0..4590E+0..1449E+0..6752E+0..2245E+1..6598E+1..1786E+2..	DAH20	721
	*.3314E+0..7148E+0..1785E+0..6796E+0..2140E+1..7136E+1..2242E+2..	DAH20	722
	*.3309E+0..7918E+0..1932E+0..7109E+0..2310E+1..7478E+1..2461E+2..	DAH20	723
725	*.3379E+0..1228E+0..2531E+0..8263E+0..2761E+1..9629E+1..3998E+2..	DAH20	724
	*.3343E+0..5590E+0..5350E+0..1124E+1..3916E+1..1214E+2..3523E+3..	DAH20	725
	*.3532E+0..1103E+1..7372E+0..1340E+1..5165E+1..5376E+2..1406E+4..	DAH20	726
	*.3624E+0..5623E+0..4883E+0..1102E+1..4731E+1..4340E+2..1022E+4..	DAH20	727
	*.3776E+0..9705E+0..5976E+0..9520E+0..3043E+1..9824E+1..3069E+3..	DAH20	728
730	*.3934E+0..2609E+0..1634E+0..6188E+0..2392E+1..6305E+1..4559E+2..	DAH20	729
	*.4128E+0..2197E+0..3287E+0..8114E+0..2468E+1..6549E+1..3685E+2..	DAH20	730
	*.4344E+0..1526E+0..2686E+0..8114E+0..2345E+1..6452E+1..2191E+2..	DAH20	731
	*.4585E+0..1705E+0..3258E+0..9082E+0..2638E+1..7574E+1..2575E+2..	DAH20	732
	*.4679E+0..1579E+0..3571E+0..1087E+1..3096E+1..8211E+1..1955E+2..	DAH20	733
735	*.5194E+0..1202E+0..3476E+0..1295E+1..4145E+1..1202E+2..2579E+2..	DAH20	734
	*.5544E+0..1120E+0..3508E+0..1422E+1..5752E+1..1540E+2..4032E+2..	DAH20	735
	*.5849E+0..9902E+0..3198E+0..1458E+1..6566E+1..2353E+2..5446E+2..	DAH20	736
	*.6167E+0..1059E+0..3623E+0..1608E+1..7739E+1..2624E+2..46670E+2..	DAH20	737
	*.6835E+0..1135E+0..3958E+0..1787E+1..9088E+1..2854E+2..6190E+2..	DAH20	738
740	*.7339E+0..1216E+0..4337E+0..1985E+1..1067E+2..3168E+2..1005E+3..	DAH20	739
	DATA CCEP37	DAH20	740

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801			DAM20	801
802			DAM20	802
803			DAM20	803
804			DAM20	804
805			DAM20	805
806			DAM20	806
807			DAM20	807
808			DAM20	808
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854			DAM20	854
855			DAM20	855
856			DAM20	856

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*5899E+00.6103E+00.1629E+01.7072E+01.3862E+01.6344E+01.8096E+01.
*4791E+01.5718E+01.9688E+01.1967E+01.3638E+01.9963E+01.8656E+01.
*4519E+00.5410E+00.9119E+00.1887E+01.3428E+01.5828E+01.7978E+01.
*4209E+00.5123E+00.8634E+00.1739E+01.5328E+01.7553E+01.
*4473E+00.4572E+00.8110E+00.1636E+01.3088E+01.5064E+01.7101E+01.
DATA CODES/
*3089E+00.4656E+00.7546E+00.1590E+01.2946E+01.4841E+01.6064E+01.
*3737E+00.4470E+00.7535E+00.1451E+01.2228E+01.4649E+01.6590E+01.
*3604E+00.4314E+00.7277E+00.1466E+01.2733E+01.4490E+01.6366E+01.
*3503E+00.4193E+00.7069E+00.1424E+01.2654E+01.4361E+01.6140E+01.
*3422E+00.4090E+00.6907E+00.1351E+01.2593E+01.4261E+01.6041E+01.
*3367E+00.4029E+00.6814E+00.1335E+01.2590E+01.4189E+01.5948E+01.
*3331E+00.3935E+00.6714E+00.1335E+01.2628E+01.4145E+01.5877E+01.
*3314E+00.3899E+00.6692E+00.1347E+01.2518E+01.4127E+01.5811E+01.
*3242E+00.3977E+00.6704E+00.1370E+01.2510E+01.4136E+01.5864E+01.
*3232E+00.4014E+00.6761E+00.1362E+01.2539E+01.4172E+01.5915E+01.
*3102E+00.4072E+00.6851E+00.1382E+01.2577E+01.4234E+01.6003E+01.
*3074E+00.4159E+00.7019E+00.1432E+01.2635E+01.4325E+01.6110E+01.
*3063E+00.4274E+00.7202E+00.1491E+01.2705E+01.4444E+01.6299E+01.
*3038E+00.4415E+00.7444E+00.1499E+01.2795E+01.4593E+01.6510E+01.
*3034E+00.4450E+00.7737E+00.1589E+01.2905E+01.4773E+01.6767E+01.
*4065E+00.4795E+00.8083E+00.1628E+01.3035E+01.4985E+01.7071E+01.
*4207E+00.5034E+00.8467E+00.1710E+01.3186E+01.5235E+01.7422E+01.
*4436E+00.5317E+00.8951E+00.1807E+01.3361E+01.5523E+01.7827E+01.
*4693E+00.5623E+00.9478E+00.1938E+01.3598E+01.5846E+01.8231E+01.
DATA CODES/
*4992E+00.5977E+00.1007E+01.2009E+01.3762E+01.6217E+01.8811E+01.
*5326E+00.6372E+00.1074E+01.2163E+01.4033E+01.6528E+01.9393E+01.
*5684E+00.6810E+00.1143E+01.2312E+01.4310E+01.7082E+01.1004E+02.
*5939E+00.7293E+00.1230E+01.2477E+01.4616E+01.7306E+01.1078E+02.
*6135E+00.7625E+00.1310E+01.2667E+01.4952E+01.8138E+01.1153E+02.
*7145E+00.8400E+00.1416E+01.2835E+01.5316E+01.8734E+01.1234E+02.
*7517E+00.9023E+00.1521E+01.3063E+01.5710E+01.9364E+01.1333E+02.
*8091E+00.9688E+00.1631E+01.3290E+01.6133E+01.1007E+02.1428E+02.
*8686E+00.1040E+01.1752E+01.3524E+01.6578E+01.1081E+02.1532E+02.
*9301E+00.1114E+01.1874E+01.3782E+01.7647E+01.1158E+02.1842E+02.
*9351E+00.1191E+01.2019E+01.4046E+01.7540E+01.1239E+02.1751E+02.
*1122E+01.1352E+01.2279E+01.4589E+01.8554E+01.1406E+02.1993E+02.
*1197E+01.1433E+01.2414E+01.4864E+01.9086E+01.1490E+02.2112E+02.
*1261E+01.1512E+01.2549E+01.5135E+01.9574E+01.1573E+02.2229E+02.
*1324E+01.1590E+01.2679E+01.5398E+01.1008E+02.1653E+02.2343E+02.
*1389E+01.1662E+01.2803E+01.5646E+01.1056E+02.1729E+02.2452E+02.
*1466E+01.1731E+01.2916E+01.5875E+01.1095E+02.1800E+02.2551E+02.
*1496E+01.1798E+01.3018E+01.6030E+01.1133E+02.1862E+02.2640E+02.
DATA CODES/
*1541E+01.1663E+01.3106E+01.6257E+01.1166E+02.1916E+02.2717E+02.
*1579E+01.1685E+01.3177E+01.6400E+01.1193E+02.1968E+02.2779E+02.
*1631E+01.1916E+01.3299E+01.6505E+01.1212E+02.1993E+02.2825E+02.
*1617E+01.1936E+01.3265E+01.6572E+01.1225E+02.2013E+02.2853E+02.
*1623E+01.1943E+01.3275E+01.6595E+01.1229E+02.2020E+02.2864E+02.
*1613E+01.1938E+01.3265E+01.6578E+01.1226E+02.2015E+02.2856E+02.
*1604E+01.1920E+01.3236E+01.6516E+01.1215E+02.1996E+02.2830E+02.
*1579E+01.1930E+01.3185E+01.6476E+01.1196E+02.1968E+02.2786E+02.
*1545E+01.1949E+01.3117E+01.6280E+01.1171E+02.1923E+02.2727E+02.
*1503E+01.1798E+01.3032E+01.6198E+01.1139E+02.1907E+02.2652E+02.
*1451E+01.1733E+01.2932E+01.5977E+01.1101E+02.1809E+02.2505E+02.

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915	914	913	912	911	910	909	908	907	906	905	904	903	902	901	900	899	898	897	896	895	894	893	892	891	890	889	888	887	886	885	884	883	882	881	880	879	878	877	876	875	874	873	872	871	870	869	868	867	866	865	864	863	862	861	860	859	858	857	856	855	854	853	852	851	850	849	848	847	846	845	844	843	842	841	840	839	838	837	836	835	834	833	832	831	830	829	828	827	826	825	824	823	822	821	820	819	818	817	816	815	814	813	812	811	810	809	808	807	806	805	804	803	802	801	800	799	798	797	796	795	794	793	792	791	790	789	788	787	786	785	784	783	782	781	780	779	778	777	776	775	774	773	772	771	770	769	768	767	766	765	764	763	762	761	760	759	758	757	756	755	754	753	752	751	750	749	748	747	746	745	744	743	742	741	740	739	738	737	736	735	734	733	732	731	730	729	728	727	726	725	724	723	722	721	720	719	718	717	716	715	714	713	712	711	710	709	708	707	706	705	704	703	702	701	700	699	698	697	696	695	694	693	692	691	690	689	688	687	686	685	684	683	682	681	680	679	678	677	676	675	674	673	672	671	670	669	668	667	666	665	664	663	662	661	660	659	658	657	656	655	654	653	652	651	650	649	648	647	646	645	644	643	642	641	640	639	638	637	636	635	634	633	632	631	630	629	628	627	626	625	624	623	622	621	620	619	618	617	616	615	614	613	612	611	610	609	608	607	606	605	604	603	602	601	600	599	598	597	596	595	594	593	592	591	590	589	588	587	586	585	584	583	582	581	580	579	578	577	576	575	574	573	572	571	570	569	568	567	566	565	564	563	562	561	560	559	558	557	556	555	554	553	552	551	550	549	548	547	546	545	544	543	542	541	540	539	538	537	536	535	534	533	532	531	530	529	528	527	526	525	524	523	522	521	520	519	518	517	516	515	514	513	512	511	510	509	508	507	506	505	504	503	502	501	500	499	498	497	496	495	494	493	492	491	490	489	488	487	486	485	484	483	482	481	480	479	478	477	476	475	474	473	472	471	470	469	468	467	466	465	464	463	462	461	460	459	458	457	456	455	454	453	452	451	450	449	448	447	446	445	444	443	442	441	440	439	438	437	436	435	434	433	432	431	430	429	428	427	426	425	424	423	422	421	420	419	418	417	416	415	414	413	412	411	410	409	408	407	406	405	404	403	402	401	400	399	398	397	396	395	394	393	392	391	390	389	388	387	386	385	384	383	382	381	380	379	378	377	376	375	374	373	372	371	370	369	368	367	366	365	364	363	362	361	360	359	358	357	356	355	354	353	352	351	350	349	348	347	346	345	344	343	342	341	340	339	338	337	336	335	334	333	332	331	330	329	328	327	326	325	324	323	322	321	320	319	318	317	316	315	314	313	312	311	310	309	308	307	306	305	304	303	302	301	300	299	298	297	296	295	294	293	292	291	290	289	288	287	286	285	284	283	282	281	280	279	278	277	276	275	274	273	272	271	270	269	268	267	266	265	264	263	262	261	260	259	258	257	256	255	254	253	252	251	250	249	248	247	246	245	244	243	242	241	240	239	238	237	236	235	234	233	232	231	230	229	228	227	226	225	224	223	222	221	220	219	218	217	216	215	214	213	212	211	210	209	208	207	206	205	204	203	202	201	200	199	198	197	196	195	194	193	192	191	190	189	188	187	186	185	184	183	182	181	180	179	178	177	176	175	174	173	172	171	170	169	168	167	166	165	164	163	162	161	160	159	158	157	156	155	154	153	152	151	150	149	148	147	146	145	144	143	142	141	140	139	138	137	136	135	134	133	132	131	130	129	128	127	126	125	124	123	122	121	120	119	118	117	116	115	114	113	112	111	110	109	108	107	106	105	104	103	102	101	100	99	98	97	96	95	94	93	92	91	90	89	88	87	86	85	84	83	82	81	80	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64	63	62	61	60	59	58	57	56	55	54	53	52	51	50	49	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
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55	DO 110 I=2,NO	SIGNIR
56	IFIX10(I).GT.X10(INO) INO=I	SIGNIR
57	110 CONTINUE	SIGNIR
58	IMIN=1	SIGNIR
59	DO 120 I=2,N	SIGNIR
60	IFIX2(I).LT.V2(IMIN) IMIN=I	SIGNIR
61	120 CONTINUE	SIGNIR
62	JJ=0	SIGNIR
63	DO 130 I=1,N	SIGNIR
64	IFIXSURF(I).ME.ISURF(IMIN) GO TO 138	SIGNIR
65	JJ=JJ+1	SIGNIR
66	130 CONTINUE	SIGNIR
67	KUR(JJ)=Y2(I)	SIGNIR
68	Y2(I)=V2(I)	SIGNIR
69	130 CONTINUE	SIGNIR
70	CALL ORDEP (KUR,YU2,JJ)	SIGNIR
71	IFIXU2(JJ).LE.X10(INO) GO TO 150	SIGNIR
72	XP=YU2(JJ)-X10(INO)	SIGNIR
73	AN=X10(INO)	SIGNIR
74	CALL TABLE(XU2,YU2,X10(INO),RP,OXOY,JJ)	SIGNIR
75	DO 101 I=1,NO	SIGNIR
76	TEMPO(I)=TEMPO(I)-480.0	SIGNIR
77	101 NTOT1=N*NO	SIGNIR
78	READ(5,1) KXI,KXI	SIGNIR
79	CALL YTPA (YTPLE,KXI)	SIGNIR
80	IFIXK .EQ. 01 GO TO 4	SIGNIR
81	READ(5,1) NMAX	SIGNIR
82	NTOT2=NTOT1+NMAX	SIGNIR
83	IFIXJUCT .NE. 01 NTOT2=NTOT2+1	SIGNIR
84	READ(5,1043) (TM(I),I=1,NTOT2)	SIGNIR
85	FORMAT(6,1014) I,TM(I)	SIGNIR
86	1003	SIGNIR
87	5	SIGNIR
88	FORMAT(10,105)	SIGNIR
89	1013	SIGNIR
90	FORMAT(10,124X,"SYSTEM MODE TEMPERATURES",//)	SIGNIR
91	1014	SIGNIR
92	FORMAT(135X,"MODE NO. ",I2,/,26X,"TEMPERATURE=",F7.2," DEG. R",//)	SIGNIR
93	IFIPRINT7 .EQ. 3) GO TO 6	SIGNIR
94	WRITE(6,1013)	SIGNIR
95	1005	SIGNIR
96	DO 211 I=1,NTOT2	SIGNIR
97	IFILINECT .LE. 56) GO TO 203	SIGNIR
98	WRITE(6,1013)	SIGNIR
99	1006	SIGNIR
100	203	SIGNIR
101	WRITE(6,1014) I,TM(I)	SIGNIR
102	1007	SIGNIR
103	201	SIGNIR
104	CONTINUE	SIGNIR
105	IFIXKXI.LE. 01 GO TO 9	SIGNIR
106	IFIPRINT6 .EQ. 0) GO TO 60	SIGNIR
107	WRITE(6,1010)	SIGNIR
108	1010	SIGNIR
109	FORMAT(10,126X,20HSYSTEM INTERNAL VIEW FACTORS,//)	SIGNIR
110	1008	SIGNIR
111	60	SIGNIR
112	IFIXJUCT .NE. 01 NTOT1=NTOT1+1	SIGNIR
113	DO 733 I=1,NTOT1	SIGNIR
114	READ(5,5) (FI(I),J=I,NTOT1)	SIGNIR
115	733	SIGNIR
116	READ(5,5) AREA(I)	SIGNIR
117	DO 57 I=1,NTOT1	SIGNIR
118	IFIPRINT6 .EQ. 01 GO TO 53	SIGNIR
119	DO 53 J=I,NTOT1	SIGNIR
120	IFILINEV .LT. 56) GO TO 55	SIGNIR
121	WRITE(6,1010)	SIGNIR

115	LINEV=6		SIGNR	116
55	WRITE(6,1011) I,J,F(I,J)		SIGNR	117
1011	FORMAT(3X,'F',I2,'-',J2,'-',F7.9)		SIGNR	118
58	LINEV=LINEV+1		SIGNR	119
59	CONTINUE		SIGNR	120
120	IFERRITE.EQ.0) GO TO 53		SIGNR	121
1012	WRITE(6,1012) I,AREALL		SIGNR	122
57	FORMAT(20,'AREALL',I2,'-',F7.2,' 50. IN',///)		SIGNR	123
57	LINEV=LINEV+2		SIGNR	124
57	IFERRI.EQ.0) GO TO 57		SIGNR	125
57	AREALL=AREALL/144.0		SIGNR	126
57	CONTINUE		SIGNR	127
9	IFERRI.EQ.0) GO TO 10		SIGNR	128
9	DO 6 I=1,N		SIGNR	129
6	READ(5,2) Y(I)		SIGNR	130
6	READ(5,11) (SURF(I),I=1,I=1,2)		SIGNR	131
6	GO TO 11		SIGNR	132
10	CALL OVERLAY(HERF,9,0)		SIGNR	133
C10	CALL REMIN3		SIGNR	134
35	NOTE=NOTE+NMAT		SIGNR	135
35	DO 36 I=1,40		SIGNR	136
36	TIMEI=0.0		SIGNR	137
36	DO 37 I=1,NMAT		SIGNR	138
37	IJ=MOD(I,11)		SIGNR	139
37	TIMEIJ=TIMEI+I		SIGNR	140
37	DO 38 I=1,N		SIGNR	141
38	IJ=MOD(I,11)		SIGNR	142
39	TIMEIJ=TIMEI+I		SIGNR	143
39	IF(XCCLT.EQ.0) GO TO 11		SIGNR	144
00 39	I=1,40		SIGNR	145
39	IJ=MOD(I,11)		SIGNR	146
39	TIMEIJ=TIMEI+I		SIGNR	147
00 40	I=1,N		SIGNR	148
40	CALL AFRAYIX(I,Y1,X2,Y2,XF,M,I,SURF,SURF,XU1,YU1,XU2,YU2,KK,		SIGNR	149
40	KKK,1)		SIGNR	150
41	1		SIGNR	151
150	ISUR=JSURF(I,J)		SIGNR	152
150	NPISUR=KK		SIGNR	153
155	DO 46 J=1,KK		SIGNR	154
46	VF(I,SUR,J)=XU(I,J)		SIGNR	155
46	RF(I,SUR,J)=YU(I,J)*0.015		SIGNR	156
46	1-2		SIGNR	157
156	ISUR=JSURF(I,J)		SIGNR	158
156	NPISUR=KKK		SIGNR	159
47	DO 47 J=1,KKK		SIGNR	160
47	VF(I,SUR,J)=XU2(J,J)		SIGNR	161
47	RF(I,SUR,J)=YU2(J,J)*0.015		SIGNR	162
47	IF(I,PFISUR,KKK)*0.0		SIGNR	163
47	RF(I,SUR,KKK)=0.0		SIGNR	164
47	VF(I,SUR,KKK)=VF(I,SUR,KKK)-0.015		SIGNR	165
165	CONTINUE		SIGNR	166
165	NOBS=N+1		SIGNR	167
165	110=0		SIGNR	168
165	DO 42 I=100,NTOT1		SIGNR	169
170	110=110+1		SIGNR	170
170	110=110+1		SIGNR	171
170	110=110+1		SIGNR	172

173	X2(I)=X20(I,I)	SIGNR	173
	V2(I)=V20(I,I)	SIGNR	174
	VECT(I)=VECT0(I,I)	SIGNR	175
175	NOJE(I)=NODE0(I,I)	SIGNR	176
176	IF(KKI.LY.1) GO TO 59	SIGNR	177
	CALL OVERLAY(SHXRHP,18,0)	SIGNR	178
	CALL VIEWS	SIGNR	179
180	IF(IGUCT.NE.0) NTOT2=NTOT2+1	SIGNR	180
	IF(KKI.NE.0) GO TO 56	SIGNR	181
	READ(5,1) MCK	SIGNR	182
	IF(MCK.EQ.0) GO TO 600	SIGNR	183
	CALL CONDINCK(KKI)	SIGNR	184
185	400 NTOT3=NTOT1+1	SIGNR	185
	00 72 I=NTOT3,NTOT2	SIGNR	186
	AREA(I)=0	SIGNR	187
	EM(I)=0.0	SIGNR	188
190	56 READ(5,5)(EM(I),I=1,NTOT1)	SIGNR	189
	IF(KKI.EQ.0) GO TO 70	SIGNR	190
	CALL OVERLAY(SHXRHP,11,0)	SIGNR	191
	CALL TASI8	SIGNR	192
	6 70 CALL OVERLAY(SHXRHP,12,0)	SIGNR	193
	070 CALL TAIL8	SIGNR	194
	RETURN	SIGNR	195
195	END	SIGNR	196

	SUBROUTINE TABLE(X1,X2,X3,DVDT,NT)		
	DIMENSION NT(1), VT(1)	TABLE	2
	IF(NT-2) 300,200,100	TABLE	3
5	100 IF(NT,CT,3) GO TO 150	TABLE	4
	DECLSIGND,GO1,NT(1)-X(1)	TABLE	5
	NT(1)=CT(1)+DEL	TABLE	6
	VT(1)=(VT(1)-VT(2))*VT(1)/(NT(1)-VT(2))+VT(2)	TABLE	7
	I=3	TABLE	8
10	IF(DEL) 4,300,13	TABLE	9
	NT=NT-1	TABLE	10
	IF(VT(1),1,NTINT) GO TO 6	TABLE	11
	DO 12 1,3,NT	TABLE	12
	IF(X-VT(1)) 12,13,13	TABLE	13
15	CONTINUE	TABLE	14
	I=NT	TABLE	15
	I=I-1	TABLE	16
20	X=X+VT(1+2)	TABLE	17
	Y=Y+VT(1+2)	TABLE	18
	X=X+VT(1+1)	TABLE	19
	Y=Y+VT(1+1)	TABLE	20
	X=X+VT(1)	TABLE	21
	Y=Y+VT(1)	TABLE	22
	X=X+VT(1)	TABLE	23
	Y=Y+VT(1)	TABLE	24
25	GO TO 15	TABLE	25
	DO 1 1,3,NT	TABLE	26
	IF(X-VT(1)) 6,6,1	TABLE	27
	CONTINUE	TABLE	28
	I=NT	TABLE	29
	I=I-1	TABLE	30
	X=X+VT(1-1)	TABLE	31
	Y=Y+VT(1-1)	TABLE	32
	X=X+VT(1-1)	TABLE	33
	Y=Y+VT(1-1)	TABLE	34
	X=X+VT(1)	TABLE	35
	Y=Y+VT(1)	TABLE	36
35	X=X+VT(1+1)	TABLE	37
	Y=Y+VT(1+1)	TABLE	38
	X=X+VT(1+1)	TABLE	39
	Y=Y+VT(1+1)	TABLE	40
40	A = Y/(X-X1)*(X2-X3)*(X3-X1)	TABLE	41
	B = Y/(X-X1)*(X2-X3)*(X3-X1)	TABLE	42
	C = Y/(X-X1)*(X2-X3)*(X3-X1)	TABLE	43
	D = Y/(X-X1)*(X2-X3)*(X3-X1)	TABLE	44
	E = A*(X-X1)*(X2-X3)*(X3-X1)	TABLE	45
	F = C*(X-X1)*(X2-X3)*(X3-X1)	TABLE	46
	G = D*(X-X1)*(X2-X3)*(X3-X1)	TABLE	47
45	DVDT=A*(1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44,45,46,47,48,49,50,51,52,53,54,55,56,57,58,59,60,61,62,63,64,65,66,67,68,69,70,71,72,73,74,75,76,77,78,79,80,81,82,83,84,85,86,87,88,89,90,91,92,93,94,95,96,97,98,99,100)	TABLE	48
	DVDT=A*(1,2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26,27,28,29,30,31,32,33,34,35,36,37,38,39,40,41,42,43,44,45,46,47,48,49,50,51,52,53,54,55,56,57,58,59,60,61,62,63,64,65,66,67,68,69,70,71,72,73,74,75,76,77,78,79,80,81,82,83,84,85,86,87,88,89,90,91,92,93,94,95,96,97,98,99,100)	TABLE	49
50	RETURN	TABLE	50
	X=X+VT(1)	TABLE	51
	X=X+VT(1)	TABLE	52
	X=X+VT(1)	TABLE	53
	X=X+VT(1)	TABLE	54
55	X=X+VT(1)	TABLE	55
	X=X+VT(1)	TABLE	56
	X=X+VT(1)	TABLE	57
	X=X+VT(1)	TABLE	58
	X=X+VT(1)	TABLE	59
	X=X+VT(1)	TABLE	60
	X=X+VT(1)	TABLE	61
	X=X+VT(1)	TABLE	62
	X=X+VT(1)	TABLE	63
	X=X+VT(1)	TABLE	64
	X=X+VT(1)	TABLE	65
	X=X+VT(1)	TABLE	66
	X=X+VT(1)	TABLE	67
	X=X+VT(1)	TABLE	68
	X=X+VT(1)	TABLE	69
	X=X+VT(1)	TABLE	70
	X=X+VT(1)	TABLE	71
	X=X+VT(1)	TABLE	72
	X=X+VT(1)	TABLE	73
	X=X+VT(1)	TABLE	74
	X=X+VT(1)	TABLE	75
	X=X+VT(1)	TABLE	76
	X=X+VT(1)	TABLE	77
	X=X+VT(1)	TABLE	78
	X=X+VT(1)	TABLE	79
	X=X+VT(1)	TABLE	80
	X=X+VT(1)	TABLE	81
	X=X+VT(1)	TABLE	82
	X=X+VT(1)	TABLE	83
	X=X+VT(1)	TABLE	84
	X=X+VT(1)	TABLE	85
	X=X+VT(1)	TABLE	86
	X=X+VT(1)	TABLE	87
	X=X+VT(1)	TABLE	88
	X=X+VT(1)	TABLE	89
	X=X+VT(1)	TABLE	90
	X=X+VT(1)	TABLE	91
	X=X+VT(1)	TABLE	92
	X=X+VT(1)	TABLE	93
	X=X+VT(1)	TABLE	94
	X=X+VT(1)	TABLE	95
	X=X+VT(1)	TABLE	96
	X=X+VT(1)	TABLE	97
	X=X+VT(1)	TABLE	98
	X=X+VT(1)	TABLE	99
	X=X+VT(1)	TABLE	100

300 WRITE(6,310)
310 FORMAT(10INSUFFICIENT TABLE SIZE --- TABLE#)
STOP
END

TABLE 59
TABLE 60
TABLE 61
TABLE 62

		SUBROUTINE ARRAT(X1,Y1,Y2,X2,XF,N,I,ISURF,JSURF,XU1,YU1,XU2,YU2, KK,KX,KJ)	ARRAT	2
		DIMENSION X1(1),X2(1),Y1(1),Y2(1),ISURF(1),JSURF(15,2),XFI(1)	ARRAT	3
		DIMENSION KU1(20),KU2(20),YU1(20),YU2(20),XU1(1),XU2(1),	ARRAT	4
		YU2(1)	ARRAT	5
5	1	DO 20 I=1,2	ARRAT	6
		KU1=1	ARRAT	7
		JJ=0	ARRAT	8
		DO 6 J=1,N	ARRAT	9
10	5	IF(JSURF(I,11)-ISURF(J)) 6,5,6	ARRAT	10
		JJ=JJ+1	ARRAT	11
		XU1(JJ)=X1(J)	ARRAT	12
		XU2(JJ)=X2(J)	ARRAT	13
		YU1(JJ)=Y1(J)	ARRAT	14
15	6	YU2(JJ)=Y2(J)	ARRAT	15
		CONTINUE	ARRAT	16
		IF(JJ,1,2) GO TO 3	ARRAT	17
		CALL ODERAT(X1,Y1,XJ)	ARRAT	18
		CALL ODERAT(X2,Y2,XJ)	ARRAT	19
20	3	IF(I=1,1) GO TO 10	ARRAT	20
		GO 2,3,1,1,1	ARRAT	21
		IF(XJ,1,GT,XF) KU1=1	ARRAT	22
		XU1(JJ)=XU1(J)	ARRAT	23
25	2	CONTINUE	ARRAT	24
		IF(KU1,GT,0) GO TO 14	ARRAT	25
		KX=J+1	ARRAT	26
		KU1(KX)=XU2(JJ)	ARRAT	27
		YU1(KX)=YU2(JJ)	ARRAT	28
		GO TO 20	ARRAT	29
30	13	DO 13 J=1,20	ARRAT	30
		IF(X1,NE,0) GO TO 25	ARRAT	31
		IF(Y1,GT,0,ST,XFI) KU1=1	ARRAT	32
		XU2(JJ)=XU1(J)	ARRAT	33
35	25	YU2(JJ)=YU1(J)	ARRAT	34
		IF(KU1,GT,0) GO TO 15	ARRAT	35
		CONTINUE	ARRAT	36
		KX=J+1	ARRAT	37
		KU2(KX)=XU2(JJ)	ARRAT	38
40	40	YU2(KX)=YU2(JJ)	ARRAT	39
		GO TO 20	ARRAT	40
		KX=J	ARRAT	41
		GO TO 20	ARRAT	42
45	15	CONTINUE	ARRAT	43
		RETURN	ARRAT	44
		END	ARRAT	45
			ARRAT	46
			ARRAT	47
			ARRAT	48

A-38

	SUBROUTINE ORDER(X,Y,NUM)				2
	DIMENSION X(1),Y(1)				3
	K=NUM-1				4
	DO 10 I=1,K				5
5	M=NUM-I				6
	DO 10 J=1,M				7
	IF(X(J)-X(J+1)) 10,10,5				8
	TEMP=X(J)				9
	TEMPY=Y(J)				10
10	X(J)=X(J+1)				11
	Y(J)=Y(J+1)				12
	X(J+1)=TEMP				13
	Y(J+1)=TEMPY				14
	CONTINUE				15
15	RETURN				16
	END				17

```

SUBROUTINE COMDEN,KCTB
COMMON /ITPACK/ INT(63),INTARY(40),INTS
COMMON /TMY/CT(60),NTOT2
DO 11 I=1,N
  INTS=INTS+1
  READ(5,2) N,DEANODE2,MYARY(INTS)
  INIT(1:NTOT2)=MODEL+100*NODE2
  FORMAT(2X,2I2,4X,F10.5)
  IF(IK1.GT.8) GO TO 20
  READ(5,2) MY
  IF(MY.EQ.0) GO TO 20
  NTOT2=NTOT2+1
  DO 15 I=1,N
    READ(5,4) MODEL,I
    CT(NODE1)=I*ED.
    FORMAT(2X,12,5),F10.5)
    RETURN
  END

```

```

COND 2
COND 3
COND 4
COND 5
COND 6
COND 7
COND 8
COND 9
COND 10
COND 11
COND 12
COND 13
COND 14
COND 15
COND 16
COND 17
COND 18
COND 19

```

Line	Code	Statement	Column
2		TITLE	1
3		TITLE	2
4		TITLE	3
5		TITLE	4
6		TITLE	5
7		TITLE	6
8		TITLE	7
9		TITLE	8
10		TITLE	9
11		TITLE	10
12		TITLE	11
13		TITLE	12
14		TITLE	13
15		TITLE	14
16		TITLE	15
17		TITLE	16
18		TITLE	17
19		TITLE	18
20		TITLE	19
21		TITLE	20
22		TITLE	21
23		TITLE	22
24		TITLE	23
25		TITLE	24
26		TITLE	25
27		TITLE	26
28		TITLE	27
29		TITLE	28
30		TITLE	29
31		TITLE	30
32		TITLE	31
33		TITLE	32
34		TITLE	33
35		TITLE	34
36		TITLE	35
37		TITLE	36
38		TITLE	37
39		TITLE	38
40		TITLE	39
41		TITLE	40
42		TITLE	41
43		TITLE	42
44		TITLE	43
45		TITLE	44
46		TITLE	45
47		TITLE	46
48		TITLE	47
49		TITLE	48
50		TITLE	49
51		TITLE	50
52		TITLE	51
53		TITLE	52
54		TITLE	53
55		TITLE	54
56		TITLE	55
57		TITLE	56
58		TITLE	57
59		TITLE	58

38	FORMAT(17X,12,". SYSTEM RADIATION PATTERNS.")	TITLE	59
	NO-NO+1	TITLE	60
68	WRITE(6,39) NO	TITLE	61
	FORMAT(17X,12,". SYSTEM RADIATION LEVEL BANDWIDTHS.")	TITLE	62
39	RETURN	TITLE	63
	END	TITLE	64

LINE	CODE	DATA	INPUTS
2	OVERLAY/IMP,1,81		INPUTS
3	PROGRAM INPUT		INPUTS
4			INPUTS
5	C IMP		INPUTS
6	COMMON/IMP/ D,00Z,0X,0TST,0Z,MANGSEG,MEXIT, RAYPNT, ZTST		INPUTS
7	C GEO		INPUTS
8	COMMON /GEO/		INPUTS
9	1 A1, 88, DDS, MEN, MP,		INPUTS
10	2 R1, R80, REM(10), RF, RO, YANA,		INPUTS
11	3 R2, RZ, RP, SC, SS, KO,		INPUTS
12	4 TMB, TAMP, XC, X2, REMO		INPUTS
13			INPUTS
14			INPUTS
15	C PLM		INPUTS
16	COMMON/PLM/PLMGO(13),RCH,ST(50),NRD(50),PLMIS,20,50,NFLM,PA,PA,		INPUTS
17	1 D0Y,KDATA,ISHK,JSNK,TANE,EQR		INPUTS
18	DIMENSION YV(150)		INPUTS
19	EQUIVALENCE (NOFLON,NFLW), (XY(1),ST(1))		INPUTS
20	C DBST		INPUTS
21	COMMON /DBST/ NL(10), NU(10),		INPUTS
22	1 NR,EXTN(15),AMS(5),AME(5)		INPUTS
23	2, NO, KO		INPUTS
24	1 XI(5),KE(5),DI(5),DE(5),VI(5),WE(5)		INPUTS
25	DIMENSION XEN(4),XPR(4)		INPUTS
26	DIMENSION NU(30),DN(100)		INPUTS
27	REAL NUINC		INPUTS
28	COMMON/CHUCK/NT,NA,NFREQ,NU,NJFRST,NUINC,DNU		INPUTS
29	COMMON/STAN/ALTDBS(5),ALTPCN,RANGE(5),IATMO,TBB,CSOI(4),TBACK		INPUTS
30	COMMON/ATMC/NATMC,NRANG,ASDEG		INPUTS
31	COMMON/HALT/ITYPE,ITAU,IL,DZZ,A88,CSS(4)		INPUTS
32	COMMON/SPATIAL/ISPAI		INPUTS
33	COMMON/EXTMS/ZEANE(20),ETEMP(20),NEXT,XCC,SEXT(5,1)		INPUTS
34	COMMON/FILT/IFILTER,BFILTR(300)		INPUTS
35	COMMON /CUT/ ATX(20), AAR(20), MANG, INOT		INPUTS
36	COMMON /EXIT/ EXIT(5)		INPUTS
37	COMMON /ICHEX/ ICHECK		INPUTS
38	COMMON/GAS/IRACK		INPUTS
39	DIMENSION AB(5),AC(5)		INPUTS
40	LOGICAL TERN		INPUTS
41	DATA AB/1,9,3,75,3,6,2,6,2,5/		INPUTS
42	DATA AC/4,1,4,85,5,6,4,8,4,7/		INPUTS
43	NAMELIST/CASE/		INPUTS
44	1 ABB, AL, ALTDBS, ALTPCN, AMF, ANI,		INPUTS
45	2 ASPDEG, DDS, EAREA, ETEMP, IFILTER, IL, IMP,		INPUTS
46	3 IRACK, ISPAT, ITAU, KDATA, MA, MP,		INPUTS
47	4 MANGSEG, NATMO, NEXIT, NFLM, NPT,		INPUTS
48	5 NRANG, NUINC, RANGE, RAYPNT, TBACK, TBB,		INPUTS
49	6 TERM, NJFRST, RPN, RTE, ANL, RSM, XP, RP		INPUTS
50	C ASPDEG ASPECT ANGLE IN DEGREES		INPUTS
51	C AL AXIAL CALCULATION LIMIT FT		INPUTS
52	C AMF BAND FINISH MICRONS		INPUTS
53	C ANI BAND INCEPTION MICRONS		INPUTS
54	C DDS NUMBER OF RAY SEGMENTS		INPUTS
55	C RPN RADIUS OF THE PRIMARY NOZZLE		INPUTS
56	C RTE RADIUS AT THE TURBINE EXIT		INPUTS
57	C ANL AXIAL NOZZLE LENGTH		INPUTS
58	C RSM RADIUS OF THE SECONDARY NOZZLE		INPUTS
59	C XP EXTENSION LENGTH OF THE NOZZLE PLUG BEYOND THE NOZZLE PLANE		INPUTS

Line	Code	Text	Input	Output
68	C	RP RADIUS OF THE NOZZLE PLUG AT THE NOZZLE EXIT PLANE.	INPUT 59	
	C	KDATA PLUME PRINT OPTION	INPUT 60	
	C	RATPM PRINT GAS PARAMETERS ALONG RAY	INPUT 61	
	C	MA NUMBER OF ATMOSPHERIC SEGMENTS IN RAY	INPUT 62	
	C	NUING STEP SIZE OF RADIATION CALCULATIONS, CM-1	INPUT 63	
	C	ALLOSINL ALTITUDE OF SENSOR FT	INPUT 64	
65	C	ALTPLM ALTITUDE OF VEHICLE FT	INPUT 65	
	C	RANGCIN RANGE FOR EACH SENSOR ALTITUDE FT	INPUT 66	
	C	T33CN BLACK BODY TEMP DEG K	INPUT 67	
	C	TBACK BACKGROUND TEMP DEG K	INPUT 68	
	C	MAIHO ATMOSPHERIC TYPE	INPUT 69	
	C	NRANG NUMBER OF RANGES	INPUT 70	
70	C	IL SPECIAL PRINT OPTION FOR EACH RAY	INPUT 71	
	C	AC3(R) AGEN OF BLACK BODY RADIATOR SQ CM	INPUT 72	
	C	TYPE	INPUT 73	
	C	ITAU SPECTRAL PRINT OF TOTAL PLUME	INPUT 74	
	C		INPUT 75	
	C		INPUT 76	
75		IF(ISO)01,EO,01,ICHECKED	INPUT 77	
		IF(ISO)01,EO,01,ANL=RSN=J.	INPUT 78	
		XENREN(1)=XEN(1)	INPUT 79	
		XENREN(2)=XEN(2)	INPUT 80	
		XENREN(3)=XEN(3)	INPUT 81	
		XENREN(4)=XEN(4)	INPUT 82	
		XENREN(5)=XEN(5)	INPUT 83	
		XENREN(6)=XEN(6)	INPUT 84	
		ANL=ANL(1)	INPUT 85	
		ANL=ANL(1)	INPUT 86	
		TERE=FA*SE	INPUT 87	
		AL=1300.	INPUT 88	
		IF(ISO)01,EO,01,GO TO 278	INPUT 89	
		RSN=EXIT(1)	INPUT 90	
		RPN=EXIT(2)	INPUT 91	
		R=EXIT(3)	INPUT 92	
		XP=EXIT(4)	INPUT 93	
		ANL=EXIT(5)	INPUT 94	
		RPN=EXIT(6)	INPUT 95	
		READIS,CASE)	INPUT 96	
95		IF(ISO)01,EO,01,WRITE(6,CASE)	INPUT 97	
		IF(ISO)01,EO,01,GO TO 691	INPUT 98	
		ICHECK=ICHECK+1	INPUT 99	
		IF(ISO)01,EO,01,GO TO 3788	INPUT 100	
		ASB=AY(1)ICHECK	INPUT 101	
		T33=ATX(1)ICHECK	INPUT 102	
		ASPDIC=ASB(1)ICHECK	INPUT 103	
		691 CONTINUE	INPUT 104	
		IF(ITER) GO TO 3700	INPUT 105	
		AM(12)=AL	INPUT 106	
		IF(ISO)01,EO,01,GO TO 801	INPUT 107	
		IF(ISO)01,EO,01,GO TO 691	INPUT 108	
		XENREN(1)=ANL/12.0	INPUT 109	
		XENREN(2)=RTE/12.0	INPUT 110	
		XENREN(3)=0.	INPUT 111	
		XENREN(4)=RPN/12.0	INPUT 112	
		XENREN(5)=0.	INPUT 113	
		IF(ISO)01,EO,01,RSN=RPN	INPUT 114	
		XENREN(6)=RPN/12.0	INPUT 115	
		RP=RP/12.0	INPUT 116	
			INPUT 117	

115	RP=RP/12.0	INPUT\$	116
	690 CONTINUE	INPUT\$	117
	IF (FILTER.LE.0) GO TO 808	INPUT\$	118
	AMF=AB(FILTER)	INPUT\$	119
	AMF=AC(FILTER)	INPUT\$	120
		INPUT\$	121
122	CONTINUE	INPUT\$	122
	IF (SPAT.GT.0) WRITE (8) NRANG	INPUT\$	123
	IF (SPAT.GT.0) WRITE (8) (NRANGE(I),I=1,NRANGE)	INPUT\$	124
	DO 131 I=1,NRANG	INPUT\$	125
	ALTOSS(I)=ALTOSS(I)*30.48	INPUT\$	126
125	RANGE(I)=RANGE(I)*30.48	INPUT\$	127
	PLMG(I)=ALIELM	INPUT\$	128
	ALPLM=ALPLM+30.48	INPUT\$	129
	IF (PAQCK.GT.0) GO TO 802	INPUT\$	130
130	CONTINUE	INPUT\$	131
	WRITE (6,5000)	INPUT\$	132
	A9=ASPOEG	INPUT\$	133
	IF (QFLOW.EQ.1) GO TO 802	INPUT\$	134
	C	INPUT\$	135
	C	INPUT\$	136
135	NEN=2	INPUT\$	137
	M=2*NEN+2	INPUT\$	138
	DO 210 I=1,M+2	INPUT\$	139
	J = (I+1) / 2	INPUT\$	140
	XEN(J) = XENREN(I)	INPUT\$	141
140	REN(J) = XENREN(I+1)	INPUT\$	142
	210 CONTINUE	INPUT\$	143
	595 WRITE (6, 2002) (XEN(I), REN(I), I=1,NEN)	INPUT\$	144
	IF (XP.LE.0.1) GO TO 195	INPUT\$	145
	XF=XP	INPUT\$	146
145	RF=RP	INPUT\$	147
	TANP=RF/XF	INPUT\$	148
	WRITE (6,2001) XP,RP	INPUT\$	149
195	CONTINUE	INPUT\$	150
	R8=REN(NEN)	INPUT\$	151
198	R8=2.*R8	INPUT\$	152
	CONTINUE	INPUT\$	153
	WRITE (6,2600)	INPUT\$	154
	IF (NDFLOW.EQ.1) GO TO 808	INPUT\$	155
	AMS(1)=AMI	INPUT\$	156
195	AME(1)=AMF	INPUT\$	157
	WRITE (6,2800) AMS(1),AME(1),ASPOES	INPUT\$	158
	C	INPUT\$	159
	C	INPUT\$	160
160	GO TO 3800	INPUT\$	161
	3788 STOP	INPUT\$	162
	C	INPUT\$	163
	2881 FORMAT(1X,18H** PLUG DEFINITION//	INPUT\$	164
	12X,30HAXIAL	INPUT\$	165
165	25(5X,2F20.4//)	INPUT\$	166
	2882 FORMAT(1X, 20H** ENGINE DEFINITION//	INPUT\$	167
	120X,16HAXIAL	INPUT\$	168
	210(51,2F20.4//)	INPUT\$	169
170	2888 FORMAT(2X,18H** CASE DEFINITION//	INPUT\$	170
	1)	INPUT\$	171
	2889 FORMAT(2X,10HNAVELENGTH,2F15.4,8H MICRONS/	INPUT\$	172

22X, 10KASP ANGLE °15.4, 2X, 7H0EGREES)
 5800 FORMAT (IHL, 25X, 2IN° ° ° A S D I R ° ° ° //
 129X, 14H, PLUME ANALYSIS//
 3800 CONTINUE
 NJ

INPUTS 173
 INPUT 1 174
 INPUTS 175
 INPUT 1 176
 INPUTS 177

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5	OVERLAYIRHP,2,81	ALPLUM\$	2
	PR-GRAM ALPLUM	ALPLUM\$	3
	COMMON/LINK2/ AL,MD,MD2	ALPLUM\$	4
	* GEO	ALPLUM\$	5
	COMMON /GEO/	ALPLUM\$	6
	1 AL	ALPLUM\$	7
	2 R1	ALPLUM\$	8
	3 R0Z	ALPLUM\$	9
	4 TMB	ALPLUM\$	10
	5 XP	ALPLUM\$	11
	* TAB	ALPLUM\$	12
	REIL NU	ALPLUM\$	13
	DIMENSION NUT300,OHU(300)	ALPLUM\$	14
	DIRECTION NEA(3)	ALPLUM\$	15
15	COMMON/CHUCK/NE,NA,NFREQ,NU,NUFREQ,NUINC,OMU	ALPLUM\$	16
	COMMON/LOS/DY(50),XY(50),P1(50),P2(50),P3(50)	ALPLUM\$	17
	COMMON/OBST/XTRA(20),MRC,XTRA(15),AMI(5),AME(5),YTRA(2)	ALPLUM\$	18
	COMMON/MAL/ITYPE,ITAU,IL,DA,ABUS	ALPLUM\$	19
	COMMON/STAN/ALTOBS(5),ALTPM,XRANGE(5),TATMO,TBB(5),TBACK	ALPLUM\$	20
	COMMON/ATMO/NATMC,NRANG,ASPOEG	ALPLUM\$	21
	COMMON/BETAK1/COEF(7,070)	ALPLUM\$	22
	COMMON/BETAK/ARK(2030)	ALPLUM\$	23
	COMMON/SSIG/SPSIG(1,5,300)	ALPLUM\$	24
	COMMON/SPATIAL/ISPAI	ALPLUM\$	25
25	COMMON/SIG/SGAS(5,1),SANTL(5,1),SMTL(5,1),SBER(5,1)	ALPLUM\$	26
	COMMON/EXTENS/EA/EA(20),ETEMP(20),NEXT,VCC,SEXT(5,1)	ALPLUM\$	27
	COMMON/FILSIG/FHP(5),FAMP(5),FGAS(5),FBG(5),FEXT(5)	ALPLUM\$	28
	COMMON/FILTR/IFILTER,8FILTR(300)	ALPLUM\$	29
	COMMON/GAS/IRADCK	ALPLUM\$	30
30	* RAY	ALPLUM\$	31
	COMMON/RAY/	ALPLUM\$	32
	1 AOS, ATST, AQA, DO, OS, LI	ALPLUM\$	33
	* IMP	ALPLUM\$	34
	COMMON /IMP/	ALPLUM\$	35
35	1 D, DDZ, OX, OTST, OZ, MDZ, MOP, MPRINT, ZTST	ALPLUM\$	36
	DATA MEN/3HORY,HNOR,3HWEI/	ALPLUM\$	37
	MTNO=0	ALPLUM\$	38
	ASPOFG=AB	ALPLUM\$	39
	DO 51 I=1,5	ALPLUM\$	40
40	DO 51 J=1,300	ALPLUM\$	41
	SPSIG(I,J)=0.	ALPLUM\$	42
51	SGAS(I,J)=0.	ALPLUM\$	43
	SANTL(I,J)=0.	ALPLUM\$	44
	FHP(I)=0.	ALPLUM\$	45
45	FAMP(I)=0.	ALPLUM\$	46
	FGAS(I)=0.	ALPLUM\$	47
	FBG(I)=0.	ALPLUM\$	48
	FEXT(I)=0.	ALPLUM\$	49
	SEXT(I,J)=0.	ALPLUM\$	50
50	SMTL(I,J)=0.	ALPLUM\$	51
	ROP(I,J)=0.	ALPLUM\$	52
52	IF(IRADCK,LE,0) GO TO 451	ALPLUM\$	53
	CALL PLUEAY	ALPLUM\$	54
	IF(IRADCK,0,2) XCC=1	ALPLUM\$	55
55	CALL PLUSIG	ALPLUM\$	56
	GO TO 150	ALPLUM\$	57
	CONTINUE	ALPLUM\$	58

	C	TEND=	ALPLUMS	59
68	C	RETURN FOR NEW DZ PLANE	ALPLUMS	60
	C	INITIALIZE FOR COMPONENT CALCULATIONS	ALPLUMS	61
268	C	CALL RAYCAL(IEND)	ALPLUMS	62
		IF(IEND.EQ.1000) GO TO 638	ALPLUMS	63
		DOS=ADS	ALPLUMS	64
65		RPZ=RE*2-.07*2	ALPLUMS	65
		IF(RPZ.LT.0.) RPZ=0.	ALPLUMS	66
		RPZ=SQRT(RPZ)	ALPLUMS	67
298		87=83*2-12*021*2	ALPLUMS	68
		Y(187,1,0.) 87*0.	ALPLUMS	69
70		82=5*Y(187)	ALPLUMS	70
265		82=32/2.	ALPLUMS	71
		ESTABLISH STARTING VALUES	ALPLUMS	72
75	C	Y(1A,EO,0.,08.A0.EQ.100.) GO TO 360	ALPLUMS	73
		Y(1A,EO,0.,0.) GO TO 361	ALPLUMS	74
		Y(1A,EO,0.,0.) GO TO 365	ALPLUMS	75
		Y(1A,EO,0.,0.) GO TO 365	ALPLUMS	76
		Y(1A,EO,0.,0.) ADS=ADS/2.	ALPLUMS	77
		GO TO 360	ALPLUMS	78
80	361	DOCK=ABS(XC *YAH)	ALPLUMS	79
		Y(0,1,DOCK) GO TO 360	ALPLUMS	80
		Y(1A,EO,0.,0.) ADS=ADS/2.	ALPLUMS	81
			ALPLUMS	82
			ALPLUMS	83
			ALPLUMS	84
			ALPLUMS	85
			ALPLUMS	86
			ALPLUMS	87
			ALPLUMS	88
			ALPLUMS	89
			ALPLUMS	90
			ALPLUMS	91
			ALPLUMS	92
			ALPLUMS	93
			ALPLUMS	94
			ALPLUMS	95
			ALPLUMS	96
			ALPLUMS	97
			ALPLUMS	98
			ALPLUMS	99
			ALPLUMS	100
			ALPLUMS	101
			ALPLUMS	102
			ALPLUMS	103
			ALPLUMS	104
			ALPLUMS	105
			ALPLUMS	106
			ALPLUMS	107
			ALPLUMS	108
			ALPLUMS	109
			ALPLUMS	110
			ALPLUMS	111
			ALPLUMS	112
			ALPLUMS	113
			ALPLUMS	114
			ALPLUMS	115

115	XW=1.E4/(SMU*1.1)	ALPLUMS	116
	XW=(XW-XW)*OSNU	ALPLUMS	117
118	RWL=SPSIG(1,1,K)*SMU*SMU*1.E-4/DMU(K)	ALPLUMS	118
119	WRITE(16,105) XW,XW,SPSIG(1,1,K),SMU,OSMU,RWL	ALPLUMS	119
120	SMU=SMTL(1,1)*SCAS(1,1)*SBRG(1,1)	ALPLUMS	120
121	SMU=SMU*SEVI(1,1)	ALPLUMS	121
122	WRITE(16,106) AB(1,1),TBB(1,1),TRACK,SMU,SMTL(1,1),SMTL(1,1),	ALPLUMS	122
123	SCAS(1,1),SBRG(1,1)	ALPLUMS	123
124	IF(NEXT.NE.0) WRITE(6,108) SENT(1,1)	ALPLUMS	124
125	IF(FILTER.EQ.0) GO TO 182	ALPLUMS	125
126	WRITE(16,109) IFILTER	ALPLUMS	126
127	IF(174V.LI.0) GO TO 182	ALPLUMS	127
128	WRITE(6,103)	ALPLUMS	128
129	DO 431 I=1,NREQ	ALPLUMS	129
130	K=NREQ/1-II	ALPLUMS	130
131	SMU=NU(K)	ALPLUMS	131
132	OSMU=OSNU(K)	ALPLUMS	132
133	XWL=1.E+4/SMU	ALPLUMS	133
134	SSS=SPSIG(1,1,K)*BFLTR(K)	ALPLUMS	134
135	XW=1.E+4/(SMU*1.1)	ALPLUMS	135
136	XW=(XW-XW)*OSNU	ALPLUMS	136
137	RWL=SPSIG(1,1,K)*SMU*SMU*1.E-4*BFLTR(K)/DMU(K)	ALPLUMS	137
138	WRITE(16,105) XW,XW,SSS,SMU,OSMU,RWL	ALPLUMS	138
139	SMU=SMU*SEVI(1,1)*FAS(1,1)*FEXT(1,1)	ALPLUMS	139
140	WRITE(6,106) AB(1,1),TBB(1,1),TRACK,SMU,FAS(1,1),FMP(1,1),FAS(1,1),FEXT(1,1)	ALPLUMS	140
141	IF(NEXT.NE.0) WRITE(6,108) FEXT(1,1)	ALPLUMS	141
142	CONTINUE	ALPLUMS	142
143	FORMAT(140//6X,3H***,TOTAL SIGNATURE OVER THE SPECTRAL BAND *	ALPLUMS	143
144	*F4.2* TO *F6.2* MICRONS AT A RANGE OF *F10.3* KM/6X*FOR AN	ALPLUMS	144
145	*ASPECT ANGLE OF *F5.1* DEGREES IN A *F4.2* ATMOSPHERE*3H***/140	ALPLUMS	145
146	ALPLUMS	ALPLUMS	146
147	FORMAT(140,9X,3AND CENTER BAND WIDTH APPARENT RADIANCE HAVEN	ALPLUMS	147
148	*UMBER INCREMENT SPECTRAL RADIANCE*/12X,*MICRONS MICRONS	ALPLUMS	148
149	* WATTS/STERADIAN (CENTER)CM-1 CM-1 WATTS/MICRON/SR*/1	ALPLUMS	149
150	FORMAT(12X,F6.4,7X,F6.4,7X,F12.4,5X,F10.2,5X,F5.1,5X,F12.4)	ALPLUMS	150
151	FORMAT(10X,3X,PLUME POINT-SOURCE SIGNATURE*/	ALPLUMS	151
152	GT20*EFFECTIVE BLACK BODY AREA - AB = *F10.4* CM20*/	ALPLUMS	152
153	GT20*EFFECTIVE 33 TEMPERATURE - T89 = *F10.4* DEGR*/	ALPLUMS	153
154	GT20*EFFECTIVE BACKGROUND TEMP.-TBACK= *F10.4* DEGR*/	ALPLUMS	154
155	GT20*APPARENT RADIANCE = *F10.4* WATTS/STERADIAN*/	ALPLUMS	155
156	GT20*ATTENUATED METALS = *F10.4* WATTS/STERADIAN*/	ALPLUMS	156
157	GT20*METALS = *F10.4* WATTS/STERADIAN*/	ALPLUMS	157
158	GT20*PLUME GAS SPECIES = *F10.4* WATTS/STERADIAN*/	ALPLUMS	158
159	GT20*BACKGROUND = *F10.4* WATTS/STERADIAN*/	ALPLUMS	159
160	FORMAT(16X,4H*,VEHICLE ALTITUDE = *F6.2* KM AND OBSERVER ALTITU	ALPLUMS	160
161	DE = *F6.2* KM)	ALPLUMS	161
162	FORMAT(18X,*EXTERNAL EMISSIONS = *F10.4)	ALPLUMS	162
163	FORMAT(140//6X,3H***,TOTAL FILTERED SIGNATURE FOR FILTER 0 *F11)	ALPLUMS	163
164	CONTINUE	ALPLUMS	164
165	END	ALPLUMS	165

[illegible]

		GO TO 8	RAYCAL 59
	7	RDJ(KI)=RDD(KI)=8.	RAYCAL 60
	8	CONTINUE	RAYCAL 61
60		D=0+DEL	RAYCAL 62
		IF(A3S(DI).LT.1.E-10) D=8.0	RAYCAL 63
	1	CONTINUE	RAYCAL 64
		GO TO 15	RAYCAL 65
65	14	G=REPJT	RAYCAL 66
		DELR=0.	RAYCAL 67
		N9=0	RAYCAL 68
		GO TO 16	RAYCAL 69
70	15	N9=EXIT	RAYCAL 70
	16	CONTINUE	RAYCAL 71
		IF(A3OFI.EQ.0) GO TO 3	RAYCAL 72
		D=0-(DELR-DR8)/2.	RAYCAL 73
		DO 2 I=1,NCOR	RAYCAL 74
		R8=GAMB*ORAD/80	RAYCAL 75
75		R1=D+DR8/2.+RCOR	RAYCAL 76
		R2=D-DR8/2.+RCOR	RAYCAL 77
		AREA=PIE*P9*RI**2-R2**2)/360.	RAYCAL 78
		DO 9 J=1,NESEG	RAYCAL 79
		K=X+1	RAYCAL 80
80		XY=2.	RAYCAL 81
		THETA=J	RAYCAL 82
		THETA=(THETA-1.1*PI)/ORAD	RAYCAL 83
		RDJ(KI)=(10+FCOR)*SIN(THETA)	RAYCAL 84
		RDJ(KI)=(10+RCOR)*COS(THETA)-(RCOR)*TAN8	RAYCAL 85
85	9	IF(IJ.EQ.1) XY=1.	RAYCAL 86
		RAL(KI)=AREA*XY*TAN9+COST	RAYCAL 87
		D=D+DR8	RAYCAL 88
	2	CONTINUE	RAYCAL 89
		DXZ=0.	RAYCAL 90
90		D=D-DR8/2.	RAYCAL 91
		GO TO 4	RAYCAL 92
	3	D=D-DELR/2.	RAYCAL 93
	4	NTMO=EXIT	RAYCAL 94
		DIV=NTMO	RAYCAL 95
95		R8=GAMB*OFAD/80	RAYCAL 96
		DAL=DAL/2IV	RAYCAL 97
		DELR=RCOR+7ZZ	RAYCAL 98
		DEL=DELR	RAYCAL 99
		DYL=DAL	RAYCAL 100
100		DAL=J.	RAYCAL 101
		DO 111 I=1,NTMO	RAYCAL 102
		DAL=DAL+DYL	RAYCAL 103
		R1=DAL+DEL	RAYCAL 104
		R2=DELF	RAYCAL 105
105		DELTA=(R1-P2)/2.	RAYCAL 106
		AREA=PIE*(PI**2-R2**2)*R8/360.	RAYCAL 107
		DELR=P1	RAYCAL 108
		D=02+DELTA	RAYCAL 109
		DO 111 J=1,NESEG	RAYCAL 110
110		K=X+1	RAYCAL 111
		XY=2.	RAYCAL 112
		THETA=J	RAYCAL 113
		THETA=(THETA-1.1*PI)/ORAD	RAYCAL 114
		RDJ(KI)=0+SIN(THETA)	RAYCAL 115

Line	Code	Text	Value
115		RDD(K)=((COS(THETA1)-RCOR)*TANB	RAYCAL 115
		IF(LE=0,1) NV=1,	RAYCAL 117
		RAR(K)=AREA*Y*TANB/COST	RAYCAL 118
		GO TO 23	RAYCAL 119
120		DAL=REN-98	RAYCAL 120
		DIVEL=	RAYCAL 121
		DO 41 I=1,NEXTI	RAYCAL 122
		DI=I	RAYCAL 123
		DIV=DIV*DI	RAYCAL 124
		NDIV=INEXIT-11/2	RAYCAL 125
125		DAL=DAL/DIV	RAYCAL 126
		IF(IA9,FO,168,1,50,10,44	RAYCAL 127
		RAR(K)=PIE+DELK*DELK/6.	RAYCAL 128
		RQZ(K)=RQD(13)=3.	RAYCAL 129
		K=1	RAYCAL 130
		DO 42 I=1,NDIV	RAYCAL 131
		K=K+1	RAYCAL 132
		A=1	RAYCAL 133
		D=AY*DELK	RAYCAL 134
		R1=D+DELK/2,	RAYCAL 135
		R2=D-DELK/2,	RAYCAL 136
		APL=PIE*(21**2-R2**2)	RAYCAL 137
		RAR(K)=AREA	RAYCAL 138
		RQZ(K)=0.	RAYCAL 139
		RDD(K)=0	RAYCAL 140
		DELK=R6	RAYCAL 141
		DO 43 I=1,NEXTI	RAYCAL 142
		DAL=DAL+1	RAYCAL 143
		R1=DAL+R6	RAYCAL 144
		R2=DELK	RAYCAL 145
		DELTA=(R1-R2)/2.	RAYCAL 146
		ARC=PIE*(R1**2-R2**2)	RAYCAL 147
		DELP=R1	RAYCAL 148
		D=R1-DELTA	RAYCAL 149
		K=K+1	RAYCAL 150
		RDD(K)=0	RAYCAL 151
		RQZ(K)=0	RAYCAL 152
		RAR(K)=AREA	RAYCAL 153
		GO TO 23	RAYCAL 154
		R8=GAMB*ORAD	RAYCAL 155
		DXYZ=R8*RCOR/2.	RAYCAL 156
		DXYZ=DXYZ-PIE*R3*RCOR**2/360.	RAYCAL 157
		R3=R3/PD	RAYCAL 158
		NCOR=NEWIT	RAYCAL 159
		CORE=NCOR	RAYCAL 160
		DR=0.	RAYCAL 161
		KL=0.	RAYCAL 162
		IF(CORE,50,0,1,50,10,71	RAYCAL 163
		YL=YC	RAYCAL 164
		DELK=X/C/CORE	RAYCAL 165
		DO 72 I=1,NCOR	RAYCAL 166
		DR=DR+DELK*RCOR	RAYCAL 167
		D=UB-DELK/2.-RCOR	RAYCAL 168
		R1=D**2	RAYCAL 169
		R2=(DP-DELK)**2	RAYCAL 170
		ARC=ARC+PI*(21-22)*PIE/360.	RAYCAL 171
		DE=DP-RCOR	RAYCAL 172

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00 72 J=1,MESEG
K=K+1
THETA=J
THETA=(THETA-1)*RB/DRAD
R02(K)=(D*RCOR)*SIN(THETA)
R03(K)=(D*RCOR)*COS(THETA)-RCOR
AREA=AREA
IF(I,EO,1,AND,J,EO,MESEG) AREA=AREA-DIVZ
XV=2.
IF(IJ,EO,1) XY=1.
72 RAR(K)=AREB*XY
DQ=XZ
71 DAL=AL-OR
MTWO=NEKIT
DIV=NTWO
DAL=DAL/DIV
DELR=XL*RCOR
DYL=DAL
DAL=0.
00 74 I=1,MTWO
DAL=DAL+DYL
R1=DAL*XL*RCOR
R2=DELR
DELTA=(R1-R2)/2.
AREA=PIE*RB*(R1+2-R2+21/360.
DELP=R1
D=R1-DELTA
00 74 J=1,MESEG
K=K+1
THETA=J
THETA=(THETA-1)*RB/DRAD
R02(K)=D*SIN(THETA)
R03(K)=D*COS(THETA)-RCOR
AREB=AREA
XV=2.
IF(IJ,EO,1) XY=1.
74 RAR(K)=AREB*XY
IEND=0
28 IF(TSPAT,LE,0) GO TO 12
WRITE (8) R8,REND,YC,AL,RCOR
WRITE (8) K
00 120 I=1,K
A=AR*(1-3C+46*33.48
B=K00(I)
C=ROZ(I)
188 WRITE (4) A,B,C
12 IEND=IEND+1
IF(IEND,GT,X) GO TO 25
002=RAR(IEND)*144.
D=ROZ(IEND)
DZ=ROZ(IEND)
RETURN
IEND=1000
25 RETURN
END
RAYCAL 173
RAYCAL 174
RAYCAL 175
RAYCAL 176
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RAYCAL 178
RAYCAL 179
RAYCAL 180
RAYCAL 181
RAYCAL 182
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RAYCAL 225
RAYCAL 226
RAYCAL 227

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IF(RAYPNT,NE,8.) WRITE(6,781) AQ,02,XO,R50
NTP=2
S=ACH-050/2.
60 C
C BEGIN S LOOP
C
754 X8=XO+SC*S
R=SQRT((200-SS)*S)
IF(X8,GE,0.1) S=
IF(R50,EQ,0.1) GO TO 61
R=287/R50
GO TO 824
78 825 824
X8=1.
GO TO 800
820 CONTINUE
IF(R,GT,88) GO TO 800
75 C
C DETERMINE AVERAGE FLOW PROPERTIES
C
GX=2*OS
S=2*GX
LK=1
858 X8=XO+SC*S
IF(X8,LT,0.1) GO TO 855
R=SQRT((250-SS)*S)*2*07**2)
CALL INTERP(X8,R,KN)
85 855 860 L=1.4
860 GG(L)=GG(L)/5.
LK=LK+1
S=S-GX
IF(LK,LE,5) GO TO 850
S=S+3.*GX
80 870 L=L+4
O(L)=GG(L)/5.
870 GG(L)=0.
GO TO 8301
888 CALL INTERP(X8,R,KN)
8381 CONTINUE
Q(2)=Q(2)*Q(4)
Q(3)=Q(3)*Q(4)
IF(RAYPNT,EQ,0.1) GO TO 830
108 WRITE(6,780) X8,R,050,Q(1),Q(2),Q(3),Q(4)
GO TO 830
158 IF(12ADCK,GT,1) GO TO 1000
READY,STONEI
AGA=100.
OY(1)=100.
105 WRITE(6,751) P(1),P(2),P(3),P(4),XT(1)
FORMAT(6X,'PH20 =',F6.4,' PCO2 =',F6.4,' PGAS =',F6.4,' TEMP =',F7.2)
A,7,21
RETURN
110 C
838 CONTINUE
876 NTP=NTP+1
NE=NTP
P(1,NE)=Q(2)
PLURAYS 59
PLURAYS 60
PLURAYS 61
PLURAYS 62
PLURAYS 63
PLURAYS 64
PLURAYS 65
PLURAYS 66
PLURAYS 67
PLURAYS 68
PLURAYS 69
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PLURAYS 108
PLURAYS 109
PLURAYS 110
PLURAYS 111
PLURAYS 112
PLURAYS 113
PLURAYS 114
PLURAYS 115

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* SUBROUTINE START(XSTART, YSTART, DS)

```

3  START
4  START
5  START
6  START
7  START
8  START
9  START
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59 START

* GEO
COMMON /GEO/
1  AB, AL, BB, DOS, MEN, MP,
2  RA, RAO, RBZ, REN(10), RF, RO,
3  R0Z, RPZ, SC, SS, YANA,
4  TNG, TAMP, MCC, MEN(18), XF, XO,
5  XP, REND

* IMP
COMMON /IMP/
1  D, DOZ, OY, DIST, OZ, NOZ, NOP, MPRINT, ZTST
EQUIVALENCE(RO, R0Z), (RBZ, R0Z)
EQUIVALENCE(CA8, ALPHA)

C ROUTINE TO PRODUCE STARTING AND ENDING POINTS OF RAY THROUGH
C PLUME.
C
IXX=YANA
YANA=ABS(YANA)
AL99=0.
OZ = ABS( O )
XSTART=0
OZ90 = OZ * OZ
XZ = REND*2-OZ90
IF(XZ.LE.0.) XZ=0.
XZ=SQRT(XZ)
TNGP=(REND-RBZ)/AL
IF(TNGP.EQ.0) GO TO 112H
TAP=RPZ/XF
XC=0.
112H XC=0.
IF(DZ.GT.RB) XC=(DZ-RB)/TNGP
TANG=(XZ-RBZ)/(AL-XC)
10 IF ( ALPHA - 90. ) 20, 609, 609
20 IF ( ALPHA .GT. 90. ) GO TO 20H

30 C
C
C ALPHA .EQ. 0.0
30 YSTART = D
YFINSH = D
50 XFINSH = AL
90 IF (OZ .GE. RBZ ) GO TO 115
IF(118.EQ.1.) GO TO 115
IF(RPZ.EQ.0.) GO TO 120
IF(13101.GE.RPZ) GO TO 120
XSTART=RPZ-ABS(OI)/TAP
GO TO 250
115 XSTART=(OZ-RBZ)/TANG+XC
GO TO 250
120 R1 = RBZ
100 DO 210 J=2, MEN
150 K = MEN - J + 1
R2 = REN(K) * REN(K) - OZ90
R2 = SIGN( SQRT( ABS( R2 ) ), R2 )
IF ( R2 .LT. 0.0 ) GO TO 240
IF (OZ .GE. R2 ) GO TO 240
R1 = R2
210 CONTINUE

```

	XSTART = XENI 1)	START	60
	GO TO 250	START	61
60	XSTART = (OQ-R2) * (XENI K+1) - XENI(K) / (R1 - R2) +	START	62
	1 XENI(K)	START	63
250	IF XSTART-GE,ALP GO TO 345	START	64
	IF 1 XSTART-ALT, XENI(K) XSTART = XENI(K)	START	65
65	IF 1 AND, EQ, 1.) GO TO 830	START	66
	GO TO 890	START	67
	0.0,LT, ALPHA,LT, 90.	START	68
	C	START	69
	C	START	70
	C	START	71
260	IF 1 RZ,ALP, D.0) GO TO 340	START	72
	XK=0.	START	73
70	IF(D,GE,RPZ) XK=D/TANA	START	74
	IF(XK,GE,YE) GO TO 1104	START	75
	IF 1-D,GE,PEZ) GO TO 1100	START	76
	XSTART=(D+PEZ)/(TANA*YAP)	START	77
75	GO TO 450	START	78
	XSTART=-RPZ	START	79
1100	XSTART=(D+RPZ)/TANA	START	80
	GO TO 1103	START	81
1104	IF(D,GE,RPZ) GO TO 340	START	82
	XSTART=(D-RPZ)/(TANA*YAP)	START	83
	GO TO 490	START	84
	340 IF 1 DQ,GE, RPZ) GO TO 500	START	85
	350 R1 = R2	START	86
	DO 410 J=2,NEX	START	87
85	K = XEN - J + 1	START	88
	R0 = D - TANA * XENI(K)	START	89
	R2 = XENI(K) * XENI(K) - DZSO	START	90
	R2 = SIGNI SORT(ABS(R2)) * R2)	START	91
90	IF (R2,LT,0.0) GO TO 460	START	92
	IF (RD,GT, R2) GO TO 460	START	93
	R1 = R2	START	94
	430 CONTINUE	START	95
	XSTART = XENI(K)	START	96
55	GO TO 490	START	97
	TANE = (R2 - R1) / (XENI(K) - XENI(K+1))	START	98
	XSTART = XENI(K) + (RD - R2) / (TANE + TANA)	START	99
99	XSTART = D - XSTART * TANA	START	100
100	IF(TANA,EQ,TANB) GO TO 508	START	101
	XFINSM=(D+R2)/(TANA-TANB)	START	102
	IF(XFINSM,LT,AL) GO TO 508	START	103
102	GO TO 509	START	104
	IF(DZ,GT,RB) GO TO 560	START	105
501	XSTART=(D-R2)/(TANA-TANB)	START	106
	XSTART=D-XSTART*TANA	START	107
105	IF(TANA,EQ,TANB) GO TO 509	START	108
	XFINSM=(D+R2)/(TANA-TANB)	START	109
	IF(XFINSM,GT,AL) GO TO 569	START	110
	GO TO 509	START	111
110	XK=D/TANA	START	112
	IF(XK,LT,XC) GO TO 345	START	113
345	XSTART=(XC+TANB+D)/(TANA-TANB)	START	114
	XSTART=D-XSTART-TANA	START	115
	IF(TANA,GT,TANB) GO TO 509	START	116

A-58

115	XFIMSH=(D-XC*TANB)/(TANA-TANB)	START	117
517	IF(XFIMSH.LT.AL) GO TO 588	START	118
589	XFIMSH = AL	START	119
588	XFIMSH=D-XFIMSH*TANA	START	120
	GO TO 890	START	121
120	C	START	122
	ALPHA = 90.	START	123
	C	START	124
	C	START	125
608	IF(RPZ.LE.0.0) GO TO 658	START	126
	IF(D.GE.XF) GO TO 650	START	127
125	YSTART=R0Z*TANB*XSTART	START	128
	YFIMSH=RPZ-TAP*XSTART	START	129
	GO TO 660	START	130
658	YSTART=R0Z*TANB*(XSTART-XC)	START	131
	IF(YSTART.GT.0.) GO TO 651	START	132
130	345 DS=0.	START	133
	GO TO 500	START	134
651	YFIMSH = -YSTART	START	135
660	YFIMSH = XSTART	START	136
	GO TO 390	START	137
135	680 IF (ALPHA .GE. 180.) GO TO 828	START	138
	C	START	139
	C	START	140
	C	START	141
	90.0 .LT. ALPHA .LT. 180.0	START	142
148	IF(RPZ.EQ.0.0) GO TO 681	START	143
	XK=D/TANA	START	144
	IF(XK.GE.XF) GO TO 681	START	145
	YSTART=(D-RPZ)/(TANA-TAP)	START	146
	GO TO 725	START	147
681	I91=IAN9	START	148
145	IF(DZ.GT.R8) GO TO 891	START	149
	IF(TANA.LE.TANB) GO TO 715	START	150
	YSTART=(D+R0Z)/(TANA-TANB)	START	151
	IF(XSTART.LE.AL) GO TO 725	START	152
715	XSTART=AL	START	153
725	YSTART=D-XSTART*TANA	START	154
	XFIMSH=(D-R0Z)/(TANA-TANB)	START	155
	IF(XFIMSH.GT.AL) GO TO 345	START	156
	YFIMSH=D-XFIMSH*TANA	START	157
	GO TO 890	START	158
155	891	START	159
	XK=D/TANA	START	160
	IF(XK.LT.XC) GO TO 345	START	161
	IF(TANA.LE.TANB) GO TO 893	START	162
	XSTART=(D-XC*TANB)/(TANA-TANB)	START	163
168	893	START	164
	YSTART=D-XSTART*TANA	START	165
892	XFIMSH=(D+XC*TANB)/(TANA-TANB)	START	166
	IF(XFIMSH.GT.AL) GO TO 345	START	167
	YFIMSH=D-TANA*XFIMSH	START	168
165	GO TO 890	START	169
	C	START	170
	C	START	171
	C	START	172
170	828 A190 = 1.	START	173
	GO TO 30	START	
	830 A190 = XSTART	START	


```

      SUBROUTINE INTERP( O, X, R, KA )
      PLM
      COMMON/PLM/PLMG(J),RCM,ST(50),NRD(50),PLM(3,30,50),NFLM,PA,P8,
      1 DPOX,KDATA,ISHK,JSKH,TANE,EOB
      DIMENSION XY(50),NBX(50),XX(5,30,50)
      EQUIVALENCE (NBX(1),NRD(1)),(XX(1,1,1)),PLM(1,1,1)),(XY(1,1),ST(1))
      DIMENSION O(4)
      3 INTERP
      4 INTERP
      5 INTERP
      6 INTERP
      7 INTERP
      8 INTERP
      9 INTERP
      10 INTERP
      11 INTERP
      12 INTERP
      13 INTERP
      14 INTERP
      15 INTERP
      16 INTERP
      17 INTERP
      18 INTERP
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      55 INTERP
      56 INTERP
      57 INTERP
      58 INTERP
      59 INTERP

      C ROUTINE TO INTERPOLATE BETWEEN STATIONS ALONG CENTERLINE OF
      C PLUME AND ALONG RADIAL DIMENSION OF PLUME.
      C RETURNS THE FOLLOWING ARGUMENTS
      C D(1) STATIC TEMP IN DEGREE R
      C D(2) MOLE CONCENTRATION OF H2O
      C D(3) MOLE CONCENTRATION OF CO2
      C D(4) GAS PRESSURE ATMO
      C
      IF(X,LT,XY(49)) GO TO 20
      120 DO 125 I=2,5
      125 D(I)= XX(I,1,49)
      M=I-1
      20 RETURN
      INCR = 1
      N1= 1
      30 L = 2
      K1=N1+INCR
      IF ( X ,LT, XY( 1,1 ) ) GO TO 120
      IF ( X ,GE, XY( N1 ) ) GO TO 40
      K = N1
      K1 = N1
      GO TO 140
      40 DO 110 KK=L,49
      KML=K1-INCR
      IF(4-X*(K1))50,55,60
      50 IF ( X ,GE, XY( KML ) ) GO TO 70
      GO TO 100
      60 IF ( X ,LE, XY( KML ) ) GO TO 70
      100 K1=K1+INCR
      110 CONTINUE
      GO TO 120
      55 K=K1
      GO TO 140
      70 K=K1
      140 N = NBX( K1 )
      141 L = K
      DO 190 JJ=2,N
      IF(2-XY(1,JJ1,K1))150,169,160
      150 IF(2-GE,XK(1,JJ1-1,K1))GO TO 210
      GO TO 190
      160 IF(2-LE,XY(1,JJ1-1,K1))GO TO 210
      190 CONTINUE
      GO TO 120
      169 JJ=JJ1
      GO TO 220
      210 JJ=JJ1-1
      220 N = NBX( K1 )
      DO 240 JJ=2,N
      IF(2-XY(1,JJ1,K1)) 230,249,240

```

238	IF (R, GE, XX(I, J1 - L, K1))	GOTO 365	INTERP	60
	GO TO 260		INTERP	61
243	IF (R, LE, XX(I, J1 - L, K1))	GOTO 305	INTERP	62
280	CONTINUE		INTERP	63
	GO TO 120		INTERP	64
249	J=J1		INTERP	65
	GO TO 310		INTERP	66
65	385 J = J1 - 1		INTERP	67
	310 DO 330 N=1, 4		INTERP	68
	I = M + 1		INTERP	69
	IF (K, NE, K1)	GO TO 329	INTERP	70
	IF (J, NE, J1)	GO TO 327	INTERP	71
78	O(M) = XX(I, J, K)		INTERP	72
	GO TO 332		INTERP	73
327	O(M) = XX(I, J, K) + (R - XX(I, J, K1)) / (XX(I, J1, K) - XX(I, J, K1))		INTERP	74
	GO TO 332		INTERP	75
75	329 O(M) =	$\frac{XX(I, J, K1) + (XX(I, J1, K) - XX(I, J, K1))}{XX(I, J1, K1) - XX(I, J, K1)}$	INTERP	76
	3 * (R - XX(I, J, K1)) / (XX(I, J1, K) - XX(I, J, K1))		INTERP	77
	4 * (R - XX(I, J, K1)) + (XX(I, J1, K1) - O(M)) = D(M)		INTERP	78
	1 * XX(I, J, K1) / (XX(I, J1, K1) - XX(I, J, K1)) *		INTERP	79
	2 * (R - XX(I, J, K1)) - D(M)		INTERP	80
	4 * (R - XX(I, J, K1)) - (XX(I, J1, K1) - XX(I, J, K1))		INTERP	81
	5 * (R - XX(I, J, K1))		INTERP	82
	330 CONTINUE		INTERP	83
	RETURN		INTERP	84
	END		INTERP	85
			INTERP	86
			INTERP	87

LINE	CODE	TEXT	PLUSIG
2		SUBROUTINE PLUSIG	PLUSIG
3			PLUSIG
4		APPARENT SPECTRAL RADIANCES OF PLUMES	PLUSIG
5		REAL L,MU,N,FREQ,NOZ,MUING	PLUSIG
6		REAL KH2O,KCO2	PLUSIG
7			PLUSIG
8			PLUSIG
9			PLUSIG
10		INSERT THE FOLLOWING CARD AND REMOVE APPROPRIATE CARD FOR	PLUSIG
11		MULTIPLE WAVELENGTHS	PLUSIG
12			PLUSIG
13			PLUSIG
14		DIMENSION YN2O12(1),GAS(4),MU19,3001,ALPHA(2),	PLUSIG
15		1 TAU1(50),TAUV1(50),TAUV4(50),OMU15,3001,	PLUSIG
16		DIMENSION YN2O12(1),GAS(4),MU13001,ALPHA(2),	PLUSIG
17		1 TAU1(50),TAUV1(50),TAUV4(50),OMU13001,	PLUSIG
18		2 WEA(5),PA(50),PA1(50),PB1(50),	PLUSIG
19		3 K(2),B(2),IMP1(7),K1(7),B1(7),IMP1(7)	PLUSIG
20			PLUSIG
21		COMMON/BETA1/KH2O(7,439),6H2O17,439)	PLUSIG
22		COMMON/BETA1/KCO2(7,176),8CO2(7,114)	PLUSIG
23		COMMON/CHJCK/NT,NE,NFREQ,MU,NUFIRST,MUING,DMU	PLUSIG
24			PLUSIG
25		REMOVE COMMENT CARDS FOR SPECTRAL DISTRIBUTION OF SIGNATURES	PLUSIG
26		AT ALL RANGES AND ALL WAVELENGTHS	PLUSIG
27			PLUSIG
28		COMMON/STAN/ALTOBS(5),ALTPLM,XRANGE(5),IATMO,TBACK(5),TBACKC	PLUSIG
29		COMMON/MAL/ITYPE,ITAU,IL,OA,ASB(5)	PLUSIG
30		COMMON/ATMO/NATHG,NRANG,ASPOEG	PLUSIG
31		COMMON/OST/XTTRA(20),NRG,XTTRA1(5),AMI(5),AME(5),YTRA(2)	PLUSIG
32		COMMON/DHLOLO/EXTTRA(250)	PLUSIG
33		COMMON/EXTENS/EXTTRA(20),ETEMP(20),NEXT,XCC,SENT(5,1)	PLUSIG
34			PLUSIG
35		INSERT FOLLOWING CARDS FOR MULTIPLE WAVELENGTHS	PLUSIG
36			PLUSIG
37		COMMON/SSIG/SGAS(5,5),SAMILL(5,5),SMTL(5,5),SBSR(5,5)	PLUSIG
38		COMMON/SSIG/SPSIG(5,5,300)	PLUSIG
39			PLUSIG
40		COMMON/SSIG/SPSIG(1,5,300)	PLUSIG
41		COMMON/SSIG/SGAS(5,1),SMTL(5,1),SBSR(5,1)	PLUSIG
42		COMMON/SPATIAL/ISPAT	PLUSIG
43		COMMON/LOS/DS(50),I(50),PL(50),P2(50),P3(50)	PLUSIG
44		COMMON/FILTER/FILTER,BFILTR(300)	PLUSIG
45		COMMON/FILESIG/FMP(5),FAMP(5),FGAS(5),FBC(5),FEXT(5)	PLUSIG
46		COMMON/GAS/IRADCK	PLUSIG
47		DATA WEA/THORY,4HNR,4HMET/	PLUSIG
48		DATA EXPO/-9, /	PLUSIG
49		DATA ALPHA(1),ALPHA(2)/0.2,0.769/	PLUSIG
50		DATA GAS/3H2O,3HCO2,2H2,3HN2O/	PLUSIG
51			PLUSIG
52		ROUTINE TO COMPUTE APPARENT SPECTRAL RADIANCES OF THE PLUME	PLUSIG
53		RAY, LOGIC AND A MAJORITY OF DATA BASED ON THE UNIVERSITY	PLUSIG
54		OF MICHIGAN PLUMES MODEL	PLUSIG
55		COMPUTES RADIANT INTENSITY IN WATTS/SR FOR THE 2.0 - 10	PLUSIG
56		EACH OF THE NRG WAVELENGTHS	PLUSIG
57		SUMS GAS RADIANCE	PLUSIG
58		SUMS BACKGROUND RADIANCE	PLUSIG

66	C	SUMP ATTENUATED METALS	PLUSIG	59
	C	SNAP BLACK BODY RADIANCE	PLUSIG	60
	C	THIS ROUTINE INITIALIZES NU AND OMU FOR EACH WAVELENGTH	PLUSIG	61
	C		PLUSIG	62
	C		PLUSIG	63
	C		PLUSIG	64
	C	REMOVE THE FOLLOWING CARD FOR MULTIPLE WAVELENGTHS	PLUSIG	65
65	C	NRG=1	PLUSIG	66
		IF IRADCK.LE.01 GO TO 151	PLUSIG	67
		NT=1	PLUSIG	68
		IF EAREALLD.GT.0.C.AND. IRADCK.EQ.21 NT=0	PLUSIG	69
		IF EAREALLD.GT.0.C.AND. IRADCK.EQ.21 NT=0	PLUSIG	70
70	151	CONTINUE	PLUSIG	71
	C	98C=1ATMD	PLUSIG	72
	C		PLUSIG	73
	C		PLUSIG	74
	C		PLUSIG	75
	C		PLUSIG	76
75		MOD=ENT	PLUSIG	77
		DO 2000 EQ=1,NRANG	PLUSIG	78
		MT=N*DLT	PLUSIG	79
		PANG=XRANGGET(I)	PLUSIG	80
		IF (2*USE.NE.0.1) GO TO 55	PLUSIG	81
		NA=E	PLUSIG	82
		GO TO 57	PLUSIG	83
85	55	NA=NE	PLUSIG	84
		CALL ATPOS(191)	PLUSIG	85
		KCAL=0.	PLUSIG	86
		DO 45 J=1,NA	PLUSIG	87
		KCAL=XCAL+(P1(I)+P2(I)+P3(I))+273.15*OS(11*8.808036/7(I))	PLUSIG	88
		KNOCI=XCAL	PLUSIG	89
		CONTINUE	PLUSIG	90
		DO 2000 I=1,NF2	PLUSIG	91
		IF IL.LI.01 GO TO 332	PLUSIG	92
		XPENRANG=1/DE+5	PLUSIG	93
		ALT=ALTPLM/1.DE+5	PLUSIG	94
		ALC=ALTDOB(I)/1.DE+5	PLUSIG	95
		WRITE(6,331) XYRAN,ASPOEG	PLUSIG	96
		WRITE(6,333) MEALNATMO	PLUSIG	97
		WRITE(6,334) ALT,ALC	PLUSIG	98
		WRITE(6,335)	PLUSIG	99
		CONTINUE	PLUSIG	100
95	332	CONTINUE	PLUSIG	101
	C		PLUSIG	102
	C	SETUP WU AND OMU FOR WAVELENGTH OF CALCULATION (EIK)	PLUSIG	103
	C		PLUSIG	104
	C		PLUSIG	105
	C		PLUSIG	106
	C		PLUSIG	107
	C		PLUSIG	108
	C		PLUSIG	109
	C		PLUSIG	110
	C		PLUSIG	111
	C		PLUSIG	112
	C		PLUSIG	113
	C		PLUSIG	114
	C		PLUSIG	115

LINE	CODE	TEXT	PLUSIG
115	C	INCREMENTS BASED ON MAXIMUM RESOLUTION OF DATA INCLUDED IN	116
116	C	THE UNIVERSITY OF MICHIGAN PLUMES PROGRAM	117
117	C		118
118	C		119
119	C		120
120	C		121
121	C		122
122	C		123
123	C		124
124	C		125
125	C		126
126	C		127
127	C		128
128	C		129
129	C		130
130	C		131
131	C		132
132	C		133
133	C		134
134	C		135
135	C		136
136	C		137
137	C		138
138	C		139
139	C		140
140	C		141
141	C		142
142	C		143
143	C		144
144	C		145
145	C		146
146	C		147
147	C		148
148	C		149
149	C		150
150	C		151
151	C		152
152	C		153
153	C		154
154	C		155
155	C		156
156	C		157
157	C		158
158	C		159
159	C		160
160	C		161
161	C		162
162	C		163
163	C		164
164	C		165
165	C		166
166	C		167
167	C		168
168	C		169
169	C		170
170	C		171
171	C		172

118	CALL SETTAU(NT,DS,T,P2,P3,ALPHA(2),PA,PB)	PLUSIG	173
	DO 230 IF=1,NPE2	PLUSIG	174
	CALL KOCAL(NU(11),GAS(1),K1	PLUSIG	175
	CALL KOCAL(NU(11),GAS(2),K	PLUSIG	176
175	NAME=GAS(1)	PLUSIG	177
	NUFE(NU(11))	PLUSIG	178
	CALL TAUCAL(K1	PLUSIG	179
	AT,TYPE,EXP,TAU(1)	PLUSIG	181
	NAME=GAS(2)	PLUSIG	182
188	CALL TAUCAL(K	PLUSIG	183
	TEMP,TAU(1)	PLUSIG	184
	NAME=GAS(1)	PLUSIG	185
	CALL TAUN2D(NUFREQ,HA,NT,NM2,TAUV)	PLUSIG	186
	SUMS=0	PLUSIG	187
	IF(FA,EG,NT) GO TO 191	PLUSIG	188
	IF(FA,GT,0) GO TO 132	PLUSIG	189
	SUMS=FLA(CKIT(1),NUFREQ*(1.-TAUV(1)*TAUV(1)*TAUV(1))	PLUSIG	190
	IF(NT,11,2) GO TO 159	PLUSIG	191
	MISS=NA(1	PLUSIG	192
	IF(FA,EG,0) MISS=2	PLUSIG	193
	DO 195 I=MISS,NT	PLUSIG	194
	TAUCAL=TAUV(1)*TAUV(1-1)*TAUV(1-1)*TAUV(1)*TAUV(1)	PLUSIG	195
	IF(TAUCAL,LT,0,1) TAUCAL=0	PLUSIG	196
	SUMS=SUMS+PLA(US(11),NUFREQ)*TAUCAL	PLUSIG	197
	CONTINUE	PLUSIG	198
	TAUCAL=1	PLUSIG	199
	IF(TAUCAL,GT,0,1) IF(US=TAUCAL)*TAUV(1)*TAUV(1)	PLUSIG	200
	L=SUMS*DA*DN(11)	PLUSIG	201
	NO2=1/2*(L1)+NO	PLUSIG	202
	SUMS=0	PLUSIG	203
	IF(TAUCAL,GT,0) SUMS=L.-TAUV(1)*TAUV(1)*TAUV(1)	PLUSIG	204
	FP=0	PLUSIG	205
	FA=0	PLUSIG	206
	FG=0	PLUSIG	207
	FX=0	PLUSIG	208
	SMP=J	PLUSIG	209
	SRO=0	PLUSIG	210
	SEX=J	PLUSIG	211
	IF(KOC,EG,0,1) GO TO 214	PLUSIG	212
	DO 215 K=1,NEXT	PLUSIG	213
	SE=PLA(CKIT(EMP(K),NUF	PLUSIG	214
	SE=SEX+SEV*TAUVS	PLUSIG	215
	CONTINUE	PLUSIG	216
	IF(KOZ,LE,0,1) GO TO 191	PLUSIG	217
	SMP=PLA(CK(KOZ,NUFREQ)*DN(11)*AB(1(K)*B(0	PLUSIG	218
	SMP=SMP+TAUV(NT)*TAUV(NT)*TAUV(NT)	PLUSIG	219
	IF(1/3*(KOC,LE,0,1) GO TO 310	PLUSIG	220
	SRO=PLA(CK(ITACKC,NUFREQ)*DN(11)*DA	PLUSIG	221
	IF(L,LT,0) GO TO 210	PLUSIG	222
	WRITE(6,100) NU(11),DN(11),L,SMP,SMP,SBC,DA,AB(1(K),TAUVS	PLUSIG	223
	SUMS=SUMP+SMP	PLUSIG	224
	SUMS=SUMS+SNAP+SNMP	PLUSIG	225
	SUMS=SUMS+L	PLUSIG	226
	SUMS=SUMS+1	PLUSIG	227
	SUMS=SUMS+1	PLUSIG	228
	SUMS=SUMS+1	PLUSIG	229

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230 SPSIG(IK,IR,II)=L-SBG*SNP+SPSIG(IK,IR,II) PLUSIG 230
SPSIG(IK,IR,II)=SPSIG(IK,IR,II)+SEX PLUSIG 231
IF(IFILTER.EQ.0) GO TO 200 PLUSIG 232
FGS=L*BFILTR(II) PLUSIG 233
FK=SEX*BFILTR(II) PLUSIG 234
ED=SNP*BFILTR(II) PLUSIG 235
FAP=SNP*BFILTR(II) PLUSIG 236
FG=SIC*BFILTR(II) PLUSIG 237
SFP=SFAP*FP PLUSIG 238
SFAP=SFAP*FAP PLUSIG 239
SFGS=SFGS+FGS PLUSIG 240
SFBG=SFBG+FG PLUSIG 241
SFK=SFAP*FY PLUSIG 242
C 243
CONTINUE PLUSIG 243
ZZZ=SUMHP-SUMBG+SUMGS PLUSIG 244
IF(ISPAT.GT.0) WRITE (0) ZZZ PLUSIG 245
IF(ILL.LT.0) GO TO 211 PLUSIG 246
WRITE(6,212) ZZZ,SUMHP,SNAMP,SUMGS,SUMBG PLUSIG 247
IF(YCO.NE.0) WRITE(6,216) SUMEX PLUSIG 248
CONTINUE PLUSIG 249
C 250
IR,IK IMPLIES RANGE AND WAVELENGTH PLUSIG 250
C INTEGRATING OVER THE ENTIRE PLUME PLUSIG 251
C 252
SGASTR(IK)=SGAS(IR,IK)+SUMGS PLUSIG 253
SMTLIR(IK)=SMTL(IR,IK)+SUMHP PLUSIG 254
SMBGR(IK)=SMBG(IR,IK)+SNAMP PLUSIG 255
SMBGR(IK)=SMBG(IR,IK)+SUMBG PLUSIG 256
SEX(IK,II)=SEX(IR,IK)+SUMEX PLUSIG 257
IF(FILTER.EQ.0) GO TO 401 PLUSIG 258
ZZZ=SGS-SFBG+SFAP PLUSIG 259
IF(ISPAT.GT.0) WRITE (0) ZZZ PLUSIG 260
FHP(IR)=FHP(IR)+SFP PLUSIG 261
FAMPIRI=FAMPIRI+SFAP PLUSIG 262
FGASTRI=FGASTRI+SGS PLUSIG 263
FBG(IR)=FBG(IR)+SFBG PLUSIG 264
FEXTIR)=FEXTIR)+SFX PLUSIG 265
CONTINUE PLUSIG 266
IF(II.NE.NRG) GO TO 2000 PLUSIG 267
IF(II.EQ.NRANG) GO TO 2000 PLUSIG 268
IF(RANGE.EQ.0) GO TO 2000 PLUSIG 269
NT=N*HOLD PLUSIG 270
DO 400 I=1,NT PLUSIG 271
P1(I)=P1(I)+NA PLUSIG 272
P2(I)=P2(I)+NA PLUSIG 273
P3(I)=P3(I)+NA PLUSIG 274
DS(I)=DS(I)+NA PLUSIG 275
T(I)=T(I)+NA PLUSIG 276
CONTINUE PLUSIG 277
C 278
FORMAT(15X,F10.2,2X,F10.3,6(2X,210.4),2X,F10.5) PLUSIG 278
FOR MAT(15X,8X,NU*.7X,DELTA (U*.6X,RAY COMPONENT RADIANT INTENSI PLUSIG 279
11Y WATTS/SE*.9X,DA*.X,NOT PARTS*.5X,ATMO*2X,CM-1*.8X,CM-1*. PLUSIG 280
2X,IAS*.8X,METALS*.4X,ATIN METAL*.2X,BACKGROUND*.5X,SD CM*.7X PLUSIG 281
3*.50 CM*.6X,TRANS*) PLUSIG 282
FORMAT(10X,3H***RAY DATA FOR A RANGE OF *.F10.3*. KM AND AN ASPE PLUSIG 283
10T ANGLE OF *.F5.1*. DEGREES*,3H***) PLUSIG 284
C 285

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333	FORMAT124,2M00,ATMOSPHERIC TYPE = 0,Ab,2M00	PLUSIG	37
212	FORMAT110,3X,RAY TOTALS APPARENT RADIANCE = 0,F10,5/16X,ATTENU	PLUSIG	288
	1AT10 METAL = 0,F10,5/16X,METALS = 0,F10,5/16X,GAS = 0,F10,5/16X,	PLUSIG	289
298	2*8ACCGROUND = 0,F10,5/16X	PLUSIG	290
316	FORMAT12X,1M0,VEHICLE ALTITUDE = 0,F6,2,0 K4 AND OBSERVER ALTITUD	PLUSIG	291
	1E = 0,F6,2,0 KM1	PLUSIG	292
216	FORMAT116X,EXTERNAL EMISSIONS = 0,F10,5/16X	PLUSIG	293
	END	PLUSIG	294

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SUBROUTINE ATMOS(IR)
  DIMENSION NU(300),XA(50),XB(50),XC(50),XD(50),XE(50),XNU(300)
  DIMENSION A(3,3),B(3,3)
  COMMON/DIM12/XA,XB,XC,XD,XE
  COMMON/STAN/ALTB(5),ALPLM,XRANGE(5),IATMO,TBACK(9),TBACKG
  COMMON/ATMO/ATMO,NRANG,ASPDG
  COMMON/CHUCK/NT,NA,NREQ,NU,NUPRST,NUTNC,DNU
  COMMON/LOS/DS(50),Y(50),Z(50),P(50),P(50)
  DATA A/-.7,515,6.985,22.83,-7.622,6.968,
    128.491,-5.745,6.928,17.267,
    287,-.01446,-.00423,-.2221,-.01295,-.084106,
    3,-.219,-.01337,-.00413,-.2151/
  DATA B/6.44E8/
  RANGE=XRANGE(IR)
  ALTOS=ALTOS(IR)
  IF (ALTOS.EQ.0) GO TO 100
  DO 101 I=1,NT
    XA(I)=DS(I)
    XB(I)=Y(I)
    XC(I)=Z(I)
    XD(I)=P(I)
    XE(I)=P(I)
  101 CONTINUE
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SUBROUTINE SETTAUINDIV,DL,TMP,PABSOR,PBROAD,ALPHA,PA,PB)	SETTAU	4
DIMENSION PA(50),PB(50),DL(50),TMP(50),PABSOR(50),PBROAD(50)	SETTAU	5
DO 100 I=1,NDIV	SETTAU	6
PA(I)=273.15*DL(I)*PABSOR(I)/TMP(I)	SETTAU	7
PB(I)=PABSOR(I)*ALPHA*PBROAD(I)	SETTAU	8
CONTINUE	SETTAU	9
RETURN	SETTAU	10
END	SETTAU	11

```

SUBROUTINE TAUCAL(K,8,TEMP,NTEMP,NDIV,PA,PB,TMP,ITYPE,EXPO,TAU)
C
C TRANSMITTANCE CALCULATION
C
5      DIMENSION PA(50),PB(50),TAU(50),TEMP(10),TMP(50),AI(7),
1      AI(7),DI(7),KI(7),BI(7),BR(7),CJ(7),PK(50),F(50)
      REAL INTERPO,K
      COMMON/DHOLD/PK,F,EXTRA(150)
      DATA BR/C,2,5,10,20,50,100,1
      DATA AI/-675,-37,6,3,19,9,1,29,1,105,3,
11     DATA BI/-349,62,3,15,9,25,22,8,67,1,209,2,
12     DATA CJ/632,712,692,1,15,1,53,2,76,4,055,
13     DATA DI/.07,428,700,1,3,2,26,4,56,7,09/
      DATA BI,DI,0.428,700,1,3,2,26,4,56,7,09/
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C COMPUTE 3E 1 ELEMENTS OF SUMS
81     SUMN=0.
      SUMD=0.
      DO 82 I=1,NDIV
      IF(TMP(I)).GT.300.160 TO 81
      PK(I)=KI(I)*PA(I)
      F(I)=PK(I)*BI(I)+28(I)
      GO TO 83
81     IF(TMP(I)).LT.300.160 TO 84
      PK(I)=K(INTERP)*PA(I)
      F(I)=PK(I)*BI(INTERP)*PB(I)
      GO TO 43
84     PK(I)=INTERP*(TEMP,K,NTEMP,TMP(I))*PA(I)
      F(I)=PK(I)*INTERP*(TEMP,9,NTEMP,TMP(I))*PB(I)
83     SUMD=SUMD+PK(I)
      SUMN=SUMN+F(I)
      TAUCAL 30
      TAUCAL 31
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C BEGINNING OF TAU CALC. LOOP
      K=3.
      DO 630 I=1,NDIV
      C COMPUTE B/8E 1 DETERMINE WHERE WE ARE IN ETA FAMILY
      IF(PK(I).LE.0.)OR.(BETEFF.LE.0.)160 TO 240
      BSC=F(I)/(BETEFF*PK(I))
      DI=PK(I)/BETEFF
      IF(DI.LE.0.160 TO 240
      IF(EXPO.LE.1.)AND.(EXPO.GE.0.1160 TO 120
      ARG=X*(DI*188E+1.1)/2.
      IF(ARG.LE.0.1160 TO 100
      IF(ARG.LE.1.)AND.(ARG.GE.10.1160 TO 110
      IF(139E.LE.1.05).AND.(188E.GE.95.1160 TO 100
      GO TO 200
      C COMPUTATION OF K FOR LIMITING ETA VALUES
      X=X*DY
      GO TO 240
      X=X*OX*83E
      GO TO 240
      X=X*OX*(188E**EXPO)
      GO TO 240
      C CALCULATION OF ETA
      TAUCAL 50
      TAUCAL 51
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      TAUCAL 57
      TAUCAL 58

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208	XIS=1.0,185*88E	TAUCAL	59
	DO 210 J=1,7	TAUCAL	61
68	IF(88E.LE.(8R(J))GO TO 220	TAUCAL	62
210	CONTINUE	TAUCAL	63
	J=6	TAUCAL	64
	RESID=0.	TAUCAL	65
	GO TO 221	TAUCAL	66
65	RESID=(88E-(8R(J)-1))/(8R(J)-(8R(J)-1))	TAUCAL	67
221	IF(ARG.GE.XIS)GO TO 230	TAUCAL	68
	C=CI(J-1)*(1.-RESID)+CI(J)*RESID	TAUCAL	69
	D=DI(J-1)*(1.-RESID)+DI(J)*RESID	TAUCAL	70
70	ETA=2*ARG/(XIS+2*ARG)	TAUCAL	71
	X=X+3*(88E*ETA)	TAUCAL	72
	GO TO 240	TAUCAL	73
230	A=AI(J-1)*(1.-RESID)+AI(J)*RESID	TAUCAL	74
	9A=9I(J-1)*(1.-RESID)+9I(J)*RESID	TAUCAL	75
	ETA=(ARG+A)/(ARG+B)	TAUCAL	76
75	X=X+3*(9A*ETA)	TAUCAL	77
	C CALCULATION OF TAU	TAUCAL	78
240	IF(X.GT.0.)GO TO 242	TAUCAL	79
	TAU(1)=1.	TAUCAL	80
	GO TO 63.	TAUCAL	81
60	8FACT=-8CTEFP*(SORT(1.+1.57879*E))	TAUCAL	82
300	GO 3 (300,500),TYPE	TAUCAL	83
	TAU(1)=EXP(8FACT)	TAUCAL	84
	GO TO 630	TAUCAL	85
680	TAU(1)=1.+8FACT	TAUCAL	86
680	CONTINUE	TAUCAL	87
680	RETURN	TAUCAL	88
680	UNUSUAL VALUES OF ARGUMENTS TAU IS SET TO 1.	TAUCAL	89
700	DO 710 I=1,NDIV	TAUCAL	90
	TAU(I)=1.	TAUCAL	91
90	CONTINUE	TAUCAL	92
	RETURN	TAUCAL	93
	END		

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SUBROUTINE KBCAL(MUFREQ,GAS,K,B,TEMP,MTEMP)
COMMON/BETAK/KC02(7),1761,8C02(7),1491
COMMON/BETAK1/KH20(7),4391,8H20(7),6391
DIMENSION WILIM(4),LOLIM(4),TH20(7),TC02(7),NT(14),K(10),B(18)
1,13(4),TEMP(10)
REAL LOLIM,MUFREQ, K,KH20,KC02
REAL ID
DATA ID/3MH20,3HC02,2MHF,2HCO/
DATA WILIM/11000.,.3770,7,LOLIM/50.,.1900,7
DATA TH20/300.,500.,1000.,1500.,2000.,2500.,3000.,/NT/7,77
DATA TC02/300.,600.,1200.,1500.,1800.,2400.,3000.,/
C SEE GAS INDEX & CHECK IF MUFREQ IS WITHIN LIMITS OF B. N. PARAMETERS
DO 13 I=1,4
IF(GAS.EQ.ID(I))GO TO 20
CONTINUE
GO TO 17
12 MTEMP=NT(I)
GO TO 13(15,17,12),I
20 DO 14 J=1,MTEMP
TEMP(J)=TH20(J)
K(J)=C.
14 R(J)=1.
GO TO 19
15 DO 16 J=1,MTEMP
TEMP(J)=TC02(J)
K(J)=0.
16 R(J)=1.
GO TO 19
17 MTEMP=2
DO 18 I=1,2
K(J)=C.
18 R(J)=1.
TEMP(1)=300.
TEMP(2)=3000.
35 RETURN
21 IF(MUFREQ.GT.WILIM(1),OR,MUFREQ.LT.LOLIM(1))GO TO 12
C
C SET K,B APPAYS FOR APPROPRIATE MUFREQ & GAS
GO TO 30(43,60,70),I
30 FINDEX=((MUFREQ-50.)/25.)*1+1,
INDEX=FINDEX
FRACT=INDEX-FLOAT(INDEX)
FRAC1=1.-FRACT
MTEMP=NT(I)
DO 32 J=1,MTEMP
TEMP(J)=TH20(J)
K(J)=KH20(J,INDEX)*FRAC1+KH20(J,INDEX+1)*FRACT
B(J)=BH20(J,INDEX)*FRAC1+BH20(J,INDEX+1)*FRACT
32 CONTINUE
GO TO 60
60 IF(MUFREQ.LT.3000.)GO TO 41
FINDEX=45.+(MUFREQ-3000.)/10.
GO TO 43
41 IF(MUFREQ.LT.3000.)GO TO 42
FINDEX=44.+(MUFREQ-3000.)/80.
GO TO 44

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42	IF(INUFREQ,LT,2400.)GO TO 43	KBCAL	59
	FINDX=83.+(INUFREQ-2400)/600.)	KBCAL	60
60	GO TO 48	KBCAL	61
43	IF(INUFREQ,LT,2000.)GO TO 44	KBCAL	62
	FINDX=3.+(INUFREQ-2000.)/10.)	KBCAL	63
	GO TO 49	KBCAL	64
65	FINDX=1.+(INUFREQ-1900.)/50.)	KBCAL	65
44	INDEX=FINDX	KBCAL	66
48	FRACT=FINDX-FLOAT(INDEX)	KBCAL	67
	FRAM=1.-FRACT	KBCAL	68
	MEM=INT(1)	KBCAL	69
70	DO 59 J=1,NTEMP	KBCAL	70
	BLU=3C02(IJ,INDEX)*FRAM+8C02(IJ,INDEX*1)*FRACT	KBCAL	71
	TEMP(IJ)=TC02(IJ)	KBCAL	72
	CONTINUE	KBCAL	73
49	IF(INUFREQ,LT,1500.)GO TO 51	KBCAL	74
	FINDX=13.+(INUFREQ-1500.)/5.)	KBCAL	75
75	GO TO 53	KBCAL	76
51	IF(INUFREQ,LT,2900.)GO TO 52	KBCAL	77
	FINDX=77.+(INUFREQ-2900.)/10.)	KBCAL	78
	GO TO 59	KBCAL	79
52	IF(INUFREQ,LT,2400.)GO TO 53	KBCAL	80
	FINDX=76.+(INUFREQ-2400.)/50.)	KBCAL	81
60	GO TO 59	KBCAL	82
53	IF(INUFREQ,LT,2150.)GO TO 54	KBCAL	83
	FINDX=26.+(INUFREQ-2150.)/5.)	KBCAL	84
	GO TO 59	KBCAL	85
85	FINDX=1.+(INUFREQ-1900.)/10.)	KBCAL	86
82	INDEX=FINDX	KBCAL	87
54	FRACT=FINDX-FLOAT(INDEX)	KBCAL	88
53	FRAM=1.-FRACT	KBCAL	89
	DO 59 J=1,NTEMP	KBCAL	90
90	K(IJ)=K02(IJ,INDEX)*FRAM+K02(IJ,INDEX*1)*FRACT	KBCAL	91
	CONTINUE	KBCAL	92
59	GO TO 80	KBCAL	93
		KBCAL	94
		KBCAL	95
		KBCAL	96
95	GO TO 12	KBCAL	97
70	GO TO 12	KBCAL	98
80	RETURN	KBCAL	99
	END	KBCAL	100

```

FUNCTION PLANK(T,M)
DATA C1,C2/1.1909E-12,1.4388/
IF T.LE.0.160 TO 5
  X=C2*M/T
  IF X.LT.172.160 TO 10
    PLANK=0
  RETURN
  10 PLANK=(C1*M*M*M)/(EXP(X)-1.)
  RETURN
END

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	REAL FUNCTION INTERPOL(V,M,ARG)		
	DIMENSION Y(5),Y(5)		INTERPO 2
	IF(X(1),LT,X(1)) GO TO 9		INTERPC 3
	IF(ARG,LT,X(1)) GO TO 15		INTERPO 4
5	IF(ARG,GT,X(1)) GO TO 16		INTERPO 5
	DO 1 I=1,N		INTERPO 6
	IF(ARG-Y(I)) 1,2,3,3		INTERPO 7
	CONTINUE		INTERPO 8
	GO TO 15		INTERPO 9
10	IF(ARG,LT,X(1)) GO TO 15		INTERPO 10
	DO 10 I=1,N		INTERPO 11
	IF(X(I)-ARG) 10,20,10		INTERPO 12
	CONTINUE		INTERPO 13
	INTERPC=ARG		INTERPO 14
15	RETURN		INTERPO 15
	INTERPC=-ARG		INTERPO 16
	RETURN		INTERPO 17
	INTERPC=Y(I)		INTERPO 18
20	RETURN		INTERPO 19
	INTERPC=Y(1)-10*(Y(1)-Y(1-1))*ARG-X(1-1)		INTERPO 20
	1 / (Y(1)-X(1-1))		INTERPO 21
	RETURN		INTERPO 22
	END		INTERPO 23
			INTERPO 24

```

SUBROUTINE TAUN20(FREQ,NA,NT,XN20,TAU)
C SUBROUTINE TO COMPUTE TRANSMITTANCE DUE TO N2O IN PLUMES
DIMENSION XN20(20),TAU(50),FN20(23),SN20(23)
REAL INTERPO
DATA FN20/2114.,2126.,2146.,2174.,2186.,2208.,2220.,
12230.,2240.,2245.,2250.,2255.,2260.,2265.,2278.,
2275.,2280.,2300.,2340.,2350.,2355.,2360.,2365./
DATA SN20/1.5E-4,9.29E-4,1.035E-2,4.15E-1,6.4E-5,4.
15E-2,7.1E-3,5.15E-3,5.02E-3,7.2E-3,3.5E-3,2.3E-3,1.7E-3,
21.72E-3,1.4E-3,9.4E-4,5.E-4,1.E-4,MFSN20/23/
IF (NA.EQ.0) GO TO 210
IF (FREQ.GT.2355) GO TO 201
IF (FREQ.LT.2114) GO TO 203
CON=INTERPO(FN20,SN20,MFSN20,FREQ)
DO 100 I=1,NA
100 TAU(I)=1.-ERF(SQRT(CON*XN20(I)))
IF (NA.EQ.0) GO TO 210
NR=NA+1
DO 150 I=NR,NT
150 TAU(I)=TAU(NA)
210 CONTINUE
RETURN
C FREQ OUT OF RANGE OR NO ATMOSPHERE
DO 200 DO 250 I=1,NT
200 DO 250 TAU(I)=1.0
250 RETURN
END

```

	FUNCTION	ERF	ERF
1	ERF=1.0	ERF	2
2	IF(X.GT.1.95) RETURN	ERF	1
3	FACN = 1.	ERF	4
4	SUM = (1. - X**2)/3.	ERF	5
5	MYX = (1. - X**2)/3.	ERF	6
6	DO 100 N=2,NMAX	ERF	7
7	FACN = FACN*N	ERF	8
8	NM = 2*N+1	ERF	9
9	SUM = SUM + X**NM/(FACN*NM)	ERF	10
10	ERF = 1. + 12637916709471 * SUM	ERF	11
11	RETURN	ERF	12
12	END	ERF	13
13		ERF	14

	MP=NO=NOFLOW=8				
	REN(1)=.6			DATINIS	59
60	REN(2)=.5			DATINIS	60
	REN(3)=REN(2)			DATINIS	61
	REN(1)=-1.			DATINIS	62
	REN(2)=0.			DATINIS	63
65	NRG=<OATA=1			DATINIS	64
	XP=PP=0.			DATINIS	65
	DX=PF=XF=0.			DATINIS	66
	NOZ=.			DATINIS	67
	AL=1000.			DATINIS	68
	XCA=21.00033			DATINIS	69
70	ZTST=900.			DATINIS	70
	NEU=2			DATINIS	71
	NDZ=3			DATINIS	72
	NOP=5			DATINIS	73
	AM(13)=2.0			DATINIS	74
75	AM(11)=2.1			DATINIS	75
	NYS			DATINIS	76
	END			DATINIS	77
				DATINIS	78

5	OVERLAY(RRHP,5,0)	PLMDEF3	2
	PROGRAM PLMDEF	PLMDEF1	3
	C PLUM DEFINITION	PLMDEF3	4
	* FEL	PLMDEF3	5
	COMMON/FEL/R2,NO,M950,CP(4),RX,P,NS,72,	PLMDEF3	6
	1 PPA,RC6,A1,CR,DX,N30,K,TM,XCOZME,	PLMDEF3	7
	2GNB,PR(5),DPS,AM2,KERR,ORO,X(5,100),Y(5,100),NR,CNST	PLMDEF3	8
	* PLM	PLMDEF3	9
	COMMON/PLM/PLMGD(43),RCN,ST(50),NR(150),PLN(5,30,50),MFLN,PA,P8,	PLMDEF3	10
10	1 DDDX,KDATA,ISHK,JSNK,TANG,EQR	PLMDEF3	11
	DIMENSION X(5,3,59)	PLMDEF3	12
	EQUIVALENCE (X(1,1,1),PLM(1,1,1))	PLMDEF3	13
	* FL	PLMDEF3	14
	COMMON/FL/UA,TA,XCOZA,XH20A,BX(50)	PLMDEF3	15
15	* GEO	PLMDEF3	16
	COMMON /GEO/	PLMDEF3	17
	1 AS, AL, BA, DDS, MEN, NP,	PLMDEF3	18
	2 R3, P80, RZ, REN(10), RE, RO,	PLMDEF3	19
	3 R02, RP, RPZ, SC, SS, TANA,	PLMDEF3	20
20	4 TNR, TANP, XC, XEN(10), XF, XQ,	PLMDEF3	21
	5 YP, REN0	PLMDEF3	22
	DATA NSL/0,0	PLMDEF3	23
	DATA CZMIN/.01/	PLMDEF3	24
	DATA CZMAX/.05/	PLMDEF3	25
25	C	PLMDEF3	26
	KERR=0	PLMDEF3	27
	CZMIN=.05	PLMDEF3	28
	CZMAX=.11	PLMDEF3	29
	IP=5	PLMDEF3	30
30	ARX=1,	PLMDEF3	31
	NO=0	PLMDEF3	32
	NR=0	PLMDEF3	33
	CNST=10,	PLMDEF3	34
	AXX=0,	PLMDEF3	35
35	CALL OVERLAY(RRHP,4,1)	PLMDEF3	36
	CALL PLUM	PLMDEF3	37
	IF(R6,NE,0,0) GO TO 11	PLMDEF3	38
	WRITE(6,4000)	PLMDEF3	39
40	FORMAT(/2X,27H***EXHAUST RADIUS NOT GIVEN//)	PLMDEF3	40
	GO TO 401	PLMDEF3	41
41	CONTINUE	PLMDEF3	42
	AMIX=0,	PLMDEF3	43
	QOX = 1,	PLMDEF3	44
	OXPO=.5*(R6-RZ)	PLMDEF3	45
45	ASO=NS*10+1	PLMDEF3	46
	NRX=NSO+2	PLMDEF3	47
	PCODE=FLOAT(MR)/FLOAT(NSO-1)	PLMDEF3	48
	IF(P7,11,2200,PAI PCODE=1,	PLMDEF3	49
	JNW=1+(NSO-1)*PCODE	PLMDEF3	50
50	X(1,1,53)=AM2	PLMDEF3	51
	XK(2,1,53)=X(1,NRX)/SQRT(2403.*X(2,NRX))	PLMDEF3	52
	PZ=P	PLMDEF3	53
	NSK=5	PLMDEF3	54
	CZAV=(CZMIN+CZMAX)/2,	PLMDEF3	55
55	CZR=(CZMAX-CZMIN)/2,	PLMDEF3	56
	DX = OXPO/5,	PLMDEF3	57
	IG = 0	PLMDEF3	58

		X0=9.			PLNDEF3	59
		K=1			PLNDEF3	60
		CCJN=0.			PLNDEF3	61
		CCPN=8.			PLNDEF3	62
		CCJ=1.			PLNDEF3	63
		CCP=1P-PAI/CC1			PLNDEF3	64
		70 DPX=0FS+2*RG/2.			PLNDEF3	65
		P=P7*DDPX*XQ			PLNDEF3	66
		C1=DPX/P			PLNDEF3	67
		Q=C1*(X(2,2)/X(1,2))			PLNDEF3	68
		KL=3			PLNDEF3	69
		AK=3			PLNDEF3	70
		CO=Q2**2			PLNDEF3	71
		X(1,2)=AINT(X(1,2))+P/2116216.			PLNDEF3	72
		DO11J=3,M2			PLNDEF3	73
		CO=CO+C*(AK+.3333)			PLNDEF3	74
		IF(J,L,I,M) GO TO 80			PLNDEF3	75
		IF(J,G,I,M) GO TO 80			PLNDEF3	76
		P=P-CCP			PLNDEF3	77
		C1=DPX/P			PLNDEF3	78
		AK=AK+1.			PLNDEF3	79
		Q=C1*(X(2,J)/X(1,J))			PLNDEF3	80
		CO=CO+Q*(AK+.3333)			PLNDEF3	81
		X(2,XL)=SQRT(CO)			PLNDEF3	82
		X(1,J)=AINT(X(1,J))+P/2116216.			PLNDEF3	83
		KL=KL+1			PLNDEF3	84
		IF(1J113,111,112			PLNDEF3	85
		DPS=DPS+SOR(I12*2-R2**2)/(X(15,NSO)**2-R2**211			PLNDEF3	86
		PS10=DPS*(NSO-1)*PCODE			PLNDEF3	87
		IG=1			PLNDEF3	88
		GO TO 70			PLNDEF3	89
		113 16=1			PLNDEF3	90
		ADK=(X(15,MR-1)-RX)/2.			PLNDEF3	91
		112 IK=1			PLNDEF3	92
		LM=1			PLNDEF3	93
		X(5,1)=X0			PLNDEF3	94
		X(5,2)=R2			PLNDEF3	95
		IF(140,GE,201)LM=2			PLNDEF3	96
		IF(140,GE,55)LM=3			PLNDEF3	97
		IF(140,GE,82)LM=4			PLNDEF3	98
		L=MR+LM			PLNDEF3	99
		KL=L+1			PLNDEF3	100
		100 DO 534, IZ=KL,100			PLNDEF3	101
		514 X(5,IZ)=C.			PLNDEF3	102
		DO 127 J=2,L,LM			PLNDEF3	103
		X(11,I,K,K)=X(5,J)			PLNDEF3	104
		X(15,I,K,K)=X(1,J)			PLNDEF3	105
		IF(X(1,J),L,0.) KER2=1			PLNDEF3	106
		DO 126 I=2,4			PLNDEF3	107
		IF(X(11,J),L,0.) KER2=1			PLNDEF3	108
		126 X(11,I,K,K)=X(1,J)			PLNDEF3	109
		127 IK=IK+1			PLNDEF3	110
		NRJ(K)=IK-1			PLNDEF3	111
		IK=NRJ(K)			PLNDEF3	112
		X(11,I,K,K)=X(15,I,K,K)*1.01			PLNDEF3	113
		IF(1000,EO,0.) DX(K)=PA			PLNDEF3	114
		ST(K)=XC			PLNDEF3	115

115	IF(DPOX,GT,0.1) KERR=200 IF(KERP,GT,0) GO TO 488 K=K+1 IF(K,GT,40) GO TO 400	PLMDEF3 116 PLMDEF3 117 PLMDEF3 118 PLMDEF3 119 PLMDEF3 120 PLMDEF3 121
128	C C EVALUATE ALL PARAMETERS AT N+1 AND STORE	PLMDEF3 122 PLMDEF3 123 PLMDEF3 124 PLMDEF3 125 PLMDEF3 126 PLMDEF3 127
125	AXX = AXX+HXY*DXPO ABX=ABX+.5 NB=1 IF(N,LE,0) GO TO 121 DAJY=JC/PJ*ADR IF(DAJX,LE,0.) GO TO 121 NJ=C 121 CONTINUE IP=2 NC=MP UP=X(I,1) UP=UP-1. UP=UP+1. DO 115 I=3,MR NRX=101 IF(X(I,1),GE,UN) GO TO 119 UP=X(I,1)-1. NC=1 119 IF(X(I,1),LE,UP) GO TO 114 UP=X(I,1) IP=1 114 IF(NRX,GT,NC+1) GO TO 116 115 CONTINUE 116 IF(K,GT,2) GO TO 125 AM2=X(I,1)/SOK(A,X(2,1P)) GO TO 125 121 X0 = XC-DX 123 OX = OX+OXX 125 X0=X0+DX OO 10 IZ= 6,500 18 Y(I,1) = 0. IF(INSL,GT,1) GO TO 131 IF(MR,LE,NRO) GO TO 131 LO=NR/NRO+1 MR=NR/LO+1 NSQ=(NSO-2)/LO+2 NRX=(NFX-2)/LO+2 OXX=LO ORU=OX*OPO DPS=OXX*OPS NSL=NSK OO 513 I=1,4 OO 511 J=2,MR L=LO*(J-2)+2 X(I,J)=X(I,1) IZ=NR+1 OO 502 J=17,180 182 X(I,J)=0. 503 X(I,1)=X(I,3) MR=MR+1	PLMDEF3 134 PLMDEF3 135 PLMDEF3 136 PLMDEF3 137 PLMDEF3 138 PLMDEF3 139 PLMDEF3 140 PLMDEF3 141 PLMDEF3 142 PLMDEF3 143 PLMDEF3 144 PLMDEF3 145 PLMDEF3 146 PLMDEF3 147 PLMDEF3 148 PLMDEF3 149 PLMDEF3 150 PLMDEF3 151 PLMDEF3 152 PLMDEF3 153 PLMDEF3 154 PLMDEF3 155 PLMDEF3 156 PLMDEF3 157 PLMDEF3 158 PLMDEF3 159 PLMDEF3 160 PLMDEF3 161 PLMDEF3 162 PLMDEF3 163 PLMDEF3 164 PLMDEF3 165 PLMDEF3 166 PLMDEF3 167 PLMDEF3 168 PLMDEF3 169 PLMDEF3 170 PLMDEF3 171 PLMDEF3 172

216	17=NR*QDx+5 00 210 1=NR.17 X(1,1)=AINT(UAI)+PA/1080. X(2,1)=TA X(3,1)=XC02A X(4,1)=YH20A	PLNDEF3 173 PLNDEF3 174 PLNDEF3 175 PLNDEF3 176 PLNDEF3 177 PLNDEF3 178
218	CONTINUE IF(NDY,EO,C.) GO TO 450 GO TO 123	PLNDEF3 179 PLNDEF3 180 PLNDEF3 181 PLNDEF3 182 PLNDEF3 183 PLNDEF3 184
180	131 JC=1 CZM=0. IF(YF,LE,D,1) GO TO 128 Z7=CZ-NY*BF/YF IF(W2,LT,0,187=9. PSI=3. AX=C. IF(NY,LT,PR) GO TO 129 NO=3	PLNDEF3 185 PLNDEF3 186 PLNDEF3 187 PLNDEF3 188 PLNDEF3 189 PLNDEF3 190
105	120	PLNDEF3 191 PLNDEF3 192 PLNDEF3 193 PLNDEF3 194 PLNDEF3 195 PLNDEF3 196
190	129 LS=2 LF=NX IF(DP0X,EO,3.) GO TO 153 P=27+DP0X*10 IF(P-PA)152,152,156	PLNDEF3 197 PLNDEF3 198 PLNDEF3 199 PLNDEF3 200 PLNDEF3 201 PLNDEF3 202
195	152 P=PPA DP0X=C. P7=P GC=0. CT=0. CU=D.	PLNDEF3 203 PLNDEF3 204 PLNDEF3 205 PLNDEF3 206 PLNDEF3 207 PLNDEF3 208
A-84	153	PLNDEF3 209 PLNDEF3 210 PLNDEF3 211 PLNDEF3 212 PLNDEF3 213 PLNDEF3 214
200	154 CC=DP0Y*QD*RG8/P 0X(X)=P/2116.216 CT=CC*X(2,2) CU=CT*32.17/X(1,2) CT=CT/776.2/CP(1,1)	PLNDEF3 215 PLNDEF3 216 PLNDEF3 217 PLNDEF3 218 PLNDEF3 219 PLNDEF3 220
205	159 CONTINUE C1=P7*RG8/2. 0=C1*X(2,2)/X(1,2) CO=1+2*P/RG81**2 JN=NR	PLNDEF3 221 PLNDEF3 222 PLNDEF3 223 PLNDEF3 224 PLNDEF3 225 PLNDEF3 226
210	176 CONTINUE TN=X(2,LS)/X(2,LF+1) AMH=50*TX(1,LS)**2/(X(2,LS)*A11) IF(U3,GT,1) AMH=AMH*SQRT(A1/2403.) J=2*X+JC-2 X(XJ,1,50)=AMH AMCH=1. IF(AMH,GT,.6) AMCH=1.6/(AMH+1.0) AMU=YO*(X(1,LS)-X(1,LF+1))/AMCH/TN**2 AMU=185*(AMU/CNST) LS=LS+1 DO1AJJ=LS,LF CO=CO+X(1X+.3333) PSI=PSI+DPS CGJ=3. CGP=3.	PLNDEF3 227 PLNDEF3 228 PLNDEF3 229 PLNDEF3 230 PLNDEF3 231 PLNDEF3 232
215	228	PLNDEF3 233 PLNDEF3 234 PLNDEF3 235 PLNDEF3 236 PLNDEF3 237 PLNDEF3 238
225	225	PLNDEF3 239 PLNDEF3 240 PLNDEF3 241 PLNDEF3 242 PLNDEF3 243 PLNDEF3 244

230	IF(J,LT,JNH) GO TO 191 IF(J,GT,JNH) GO TO 192 CCJ=CCJNH CCP=CCPNH GO TO 192	PLMDEF3 230 PLMDEF3 231 PLMDEF3 232 PLMDEF3 233 PLMDEF3 234 PLMDEF3 235
235	191 CONTINUE IF(I,BS,(PSI-PSIO)-DPS/2)* (2-JG).GE.8) GO TO 192 JNH=J CCJ=CC CCP=(P-PPI) CCPNH=CCP CCJNH=CCJ	PLMDEF3 235 PLMDEF3 237 PLMDEF3 238 PLMDEF3 239 PLMDEF3 240 PLMDEF3 241
240	192 CONTINUE P=P-CCP C1=P/RG8/2. Q=C1*Y(2,J)/X(1,J) AK=AK+1. C=C3+Q*IAK-.3333 CZ=D*AQ*Y(1,J)+C0/(2.*(PSI*X(2,J))**2) IF(C7.LE.C7M) GO TO 193 CZM=CZ LU=J+1	PLMDEF3 241 PLMDEF3 242 PLMDEF3 243 PLMDEF3 244 PLMDEF3 245 PLMDEF3 246 PLMDEF3 247
245		PLMDEF3 248 PLMDEF3 249 PLMDEF3 250 PLMDEF3 251 PLMDEF3 252 PLMDEF3 253
250	193 CONTINUE LO=J-1 CC=CC-CCJ CJ=CC*X(2,J) CX=0. DO 190 I=3,6 CX=CX+X(I,LU)-X(I,LO)*CP(I)	PLMDEF3 253 PLMDEF3 254 PLMDEF3 255 PLMDEF3 256 PLMDEF3 257 PLMDEF3 258 PLMDEF3 259
255	190 DO 232 I=1,6 Y(I,J-1)=Y(I,J-1)+CZ*(X(I,J)-X(I,LO))/PR(I) Y(I,J)=Y(I,J)+CZ*(X(I,LU)+X(I,LO)- 12.*X(I,J))/PR(I)+X(I,J) 200 Y(I,J+1)=CZ*(X(I,J)-Y(I,LU))/PR(I) Y(I,J)=Y(I,J)-CJ*32.17/Y(I,J) Y(I,J)=Y(I,J)-XC02A1/(XC02NE-XC02A) CP(I)=.25*(1.-Y(I,XI)+CP(I2)*XIX Y(2,J)=Y(2,J)+CJ/778.2/CP(I) Y(2,J)=Y(2,J)+CZ*(X(I,LU)-X(I,LO))**2/ 1250*FA+CX*(X(2,LU)-X(2,LO))/CP(I2)/2./PR(I2)	PLMDEF3 260 PLMDEF3 261 PLMDEF3 262 PLMDEF3 263 PLMDEF3 264 PLMDEF3 265 PLMDEF3 266 PLMDEF3 267 PLMDEF3 268 PLMDEF3 269 PLMDEF3 270 PLMDEF3 271
260	180 CONTINUE IF(J,GE,2) GO TO 179 X(12*X(1,50)=X(2*X(2,1,50) LS=LF LF=MR JG=2 GO TO 176	PLMDEF3 271 PLMDEF3 272 PLMDEF3 273 PLMDEF3 274 PLMDEF3 275 PLMDEF3 276 PLMDEF3 277
265	179 CONTINUE CCJ=CCJNH CCP=CCPNH NOX=1. NCZ =CZNV/CZM CZ=AB5(CZM-CZAV) IF(C7.LT.C7R) GO TO 181 NOX=1.2+.9*QCZ/(1.+1*QCZ) GO TO 123	PLMDEF3 277 PLMDEF3 279 PLMDEF3 280 PLMDEF3 281 PLMDEF3 282 PLMDEF3 283 PLMDEF3 284 PLMDEF3 285
270	181 NSL=NSL-1	PLMDEF3 286

	00 215 I=1,4		PLNDEF3	287
	DOE10J=3,4R		PLNDEF3	288
	210 X(I,1)=Y(I,J)		PLNDEF3	289
	X(I,2)=X(I,2)+Y(I,2)		PLNDEF3	290
290	X(I,3)=X(I,3)+Y(I,2)		PLNDEF3	291
	X(I,1)=2		PLNDEF3	292
	V(I,1)=C		PLNDEF3	293
215	X(I,1)=X(I,3)		PLNDEF3	294
	X(I,2)=AINT(X(I,2)-CU)		PLNDEF3	295
295	X(I,2)=X(I,2)+CT		PLNDEF3	296
	G=ABS(X(I,2)+NR)-TA-4,1		PLNDEF3	297
	IF(G,GT,5) NR=NR+1		PLNDEF3	298
	IF(N,LE,NR50) 50 TO 250		PLNDEF3	299
	AXX=CO-DY		PLNDEF3	300
300	NR=NR+1		PLNDEF3	301
	DOX=0		PLNDEF3	302
	IF(V(I,1),NR,2),LT,0,1) 60 TO 216		PLNDEF3	303
	550 CONTINUE		PLNDEF3	304
305	IF(XO-AXY)121,121,78		PLNDEF3	305
	CONTINUE		PLNDEF3	306
	IF(IG,DX,LT,0,AND,AN2,LT,1,1) WRITE(6,2280)PA,P6,AN2		PLNDEF3	307
	481 CONTINUE		PLNDEF3	308
	WRITE(6,2100) DPOY		PLNDEF3	309
310	2100 FOR=41,112,*,DPOY=*,F12,6)		PLNDEF3	310
	2200 FOR=41,114,110X,31MINCOMPATIBLE EXHAUST CONDITIONS//		PLNDEF3	311
	110X,1=DA,F0,3,3=PS,F0,3,3=HACH NO=F0,3)		PLNDEF3	312
	END		PLNDEF3	313

LINE	CODE	TEXT	PLUM
5	C	OVERLAY (XOMP,4,1)	PLUM
10	C	PROGRAM FLIMP	PLUM
15	C	FLOW FIELD INPUT	PLUM
20	C	COMMON/LINK2/STAN(3)	PLUM
25	C	COMMON/FFL/R7,XQ,NBSO,CPI(4),RX,P,NS,PZ,	PLUM
30	C	1 PPA,PG,AL,OP,DX,NRO,4,TMX,XC02NE,	PLUM
35	C	20M,PR(5),SFS,MZ,KERR,DXO,XIS,100),V(5,100),MR,CNST	PLUM
40	C	PLM	PLUM
45	C	COMMON/PLN/PLM(3,43),RCN,ST(50),NRD(50),PLM(5,30,50),NFLM,PA,P8,	PLUM
50	C	1 DRY,XGATA,ISHK,JSBK,TANE,EQ	PLUM
55	C	ATNOS	PLUM
60	C	COMMON/ATNOS/ALT,FLIN,MEIEC,RREC,RAMP,RANT,DEL12,TMET2	PLUM
65	C	COMMON/FLZUA,TA,XC02A,XH20A,RX(53)	PLUM
70	C	GEO	PLUM
75	C	COMMON /GEO/	PLUM
80	C	1 A6, AL, BB, DCS, NEM, MP,	PLUM
85	C	2 R1, R81, R82, REM(10), RF, RO,	PLUM
90	C	3 R2, RP, RP2, SC, SS, TANA,	PLUM
95	C	4 TND, TNP, XC, XEN(10), XF, XO,	PLUM
100	C	5 XP, REND	PLUM
105	C	DIMENSION PS(1,10),IAT(1,10),XC02(1,10),XH20(1,10),U8(1,10),TS(1,10)	PLUM
110	C	EQUIVALENCE (TS(1,1),PLM(1,1,1,1)),CUR(1,1),PLM(2,1,1,1))	PLUM
115	C	EQUIVALENCE (XC02(1,1),PLM(3,1,1,1)),(XH20(1,1),PLM(4,1,1,1))	PLUM
120	C	NAMLIST/PLUMIN/ RPN, RSN, RP, KOATA,	PLUM
125	C	1 TANE, EOP, XC02, XC02A, XH20A,	PLUM
130	C	2 UA, TAT, P8, PG, UA, TA, PA	PLUM
135	C	3 GIVE RPN,RCN,XP,RP,KOATA ONLY IF "INPUT" IS NOT USED.	PLUM
140	C	4 GIVE XC02,UP, ONLY IF XH20,TST, P8,PG, ARE ALSO GIVEN.	PLUM
145	C	5 GIVE UA,TA,PA XC02A,XH20A ONLY IF ALTPLM IS NOT GIVEN IN	PLUM
150	C	"INPUT" & DEFAULT IS NOT DESIRED.	PLUM
155	C	IF XC02 ONLY IS OMITTED, XC02 & XH20 WILL BE CALCULATED.	PLUM
160	C	GIVE TANE & OR EOP ONLY IF DEFAULT VALUES ARE NOT DESIRED.	PLUM
165	C	INITIALIZE	PLUM
170	C	00 100 IZ=1,50	PLUM
175	C	8X(I2)=0.	PLUM
180	C	ST(1)=XO	PLUM
185	C	00 300 IZ=1,1000	PLUM
190	C	300 X(I2,1)=6.	PLUM
195	C	TA=519.	PLUM
200	C	NBS=200	PLUM
205	C	PQ=P5	PLUM
210	C	KERR=0	PLUM
215	C	XH20A=.00033	PLUM
220	C	XC02A=.00033	PLUM
225	C	EQR=.250	PLUM
230	C	TANE=.9,0	PLUM
235	C	TMW=.30,9665	PLUM
240	C	00 311 I=1,100	PLUM
245	C	XC02(1)=XC02A	PLUM
250	C	301 XH20(1)=XH20A	PLUM
255	C	RPN=5CN(2)	PLUM
260	C	QSN=5CN(3)	PLUM

LINE	CODE	TEXT	PLUME
115		M=K20+2-J	116
		AK=0.	117
		DO 7 L=1,NS	118
		LK=K+1-L	119
		UB(LK)=U5	120
120		UB(LK)=U5*(1.-AK)+AK*UB(M-1)	121
		TAT(LK)=TAT(M)*(1.-AK)+AK*TAT(M-1)	122
		XC02(LK)=XC02(M)*(1.-AK)+AK*XC02(M-1)	123
		XM2C(LK)=XM2C(M)*(1.-AK)+AK*XM2C(M-1)	124
		AK=AK+1/NS	125
125		3 IG=IG+NS-1	126
		PPA=2116.216*PA	127
		P=2116.216*P1	128
		IF (PPA,EO,C,1) PD=PA	129
		PDQ=2116.216*PD	130
		PDQY=PPA-P1/12.*R3	131
130		IF (2.*PDY+ARGSDPDY)/P,ALT,0.81) OPDX=0.0	132
		P1=PPQ	133
		TS(1)=TAT(1)-A*U2(1)**2	134
		AM2=SQRT(U2(1)**2+1/TS(1))	135
		WRITE(6,1020)	136
135		RAD=P2	137
		DX=(PA-P2)/(NS*10.)	138
		DO 4 I=1,NS	139
		RAD=RAD+DP*NS	140
140		WRITE(6,3200)	141
		3200 FORMAT(1X,21H** AMBIENT CONDITIONS/)	142
		WRITE(6,100) RAD,UA,TA,XC02A,XM20A	143
		WRITE(6,3300)P,PA,CPI1,RCG8,CM3,AM2	144
145		3300 FORMAT(1X,13H** INPUT PARAMETERS//	145
		130X,17HPLUME AMBIENT//	146
		25X,17HPRESSURE, P,2(F13,31,7H ATMOS./	147
		35X,17HSPECIFIC HEAT, CP,F13,3,9H BTU/LB-F/	148
		45X,17HGRAS CONSTANT, R ,F13,3,5H FT/FF/	149
		55X,17HMP. HY. RATIO ,F13,3/	150
		65X,17HMECH NUMBER ,F13,3/	151
150		IF (NR,LT,NS*10+2) GO TO 5	152
		WRITE(6,3400) P2	153
3400		FORMAT(5X,17HSECONDARY PRESS.=F13,3,7H ATMOS.)	154
		NRQ=NR/2+5	155
155		ORO=OR	156
		EVALUATE PSI(OR)	157
		Q=U5(1)/TS(1)	158
160		PS(1)=Q.	159
		AX=PPQ/P	160
		DO 11 J=2,NR	161
		IF (J,GT,10*NS+1) A=PLMCO(29)	162
		TS(J)=TAT(J)-UB(J)*2*A	163
165		PS(J)=PS(J-1)+2*13.*DN*OR)	164
		RNE=V*CR	165
		Q=U5(J)/TS(J)	166
		IF (J,GT,NS*10+2) Q=Q*AX	167
170		PS(J)=PS(J)+Q*(1.*KN-OR)	168
		DO 15 J=1,NR	169
		PS(J)=SQRT(PS(J))	170
		18 PS(J)=PS(J)+Q*(1.*KN-OR)	171
		19 PS(J)=SQRT(PS(J))	172

SUBROUTINE CHEM					
C	C	SIMPLE CHEMICAL ANALYSIS TO YIELD THE COMPOSITION AND BASIC		CHEM	2
C	C	THERMODYNAMIC PROPERTIES OF THE CORE NOZZLE EXIT PLANE EXHAUST		CHEM	3
C	C	GAS ASSUMING IDEAL COMBUSTION.		CHEM	4
5	C	SET.		CHEM	5
	C			CHEM	6
	C			CHEM	7
10	C	COMMON/FEL/RZNO,NESQ,CP(4),EX,P,NS,PZ,		CHEM	8
	C	1 PPA,RQ,AL,OR,OX,NPO,K,TN,XCO2NE,		CHEM	9
	C	2GMS,PR(5),DPSA42,KEFR,DRO,X(5,100),Y(5,100),MR,CNST		CHEM	10
	C	PLM		CHEM	11
	C	COMMON/PLM/PLM2D(43),RCN,ST(5),NEQ(50),PLMIS(31,52),NFLW,PA,PI,		CHEM	12
	C	1 OPGX,PCAT,ISPK,JSHK,TANE,EOR		CHEM	13
15	C	A LIGHT KEROSENE FUEL IS ASSUMED TO BE BURNED WITH 600% SET,		CHEM	14
	C	THEORETICAL AIR FLOW. IE, TANE = 9.8 AND EOR = 0.25,		CHEM	15
	C			CHEM	16
	C			CHEM	17
20	C	DIMENSION SPNV(7),SPMH(7),CPE(7),XC02(100),X420(100)		CHEM	18
	C	EQUIVALENCE XCO2(1),PLM(31,1,1),XN20(1),PLM(40,1,1,1)		CHEM	19
	C	DATA SPNV(4,0),18,008,20,316,39,944,32,008,12,016,2,016/		CHEM	20
	C	DATA CPE(7,31),55,29,17,28,40,3,8/		CHEM	21
	C	CHEM ENGR'S HNDOK, 3RD ED, 2ND IMP, 1950		CHEM	22
	C	SPNV(1)=XC02(100)		CHEM	23
	C	SPNV(2)=X420(100)		CHEM	24
25	C	SPNV(3)=7AC001		CHEM	25
	C	SPNV(4)=009324		CHEM	26
	C	SPNV(5)=209495		CHEM	27
	C	TAN=1.		CHEM	28
	C	TMV=1.		CHEM	29
30	C	DO 1 I=1,5		CHEM	30
	C	TMV=TMV+SPNV(I)		CHEM	31
	C	1 TMV=TMV+SPMH(I)*SPMH(I)		CHEM	32
	C	DO 1 J=1,5		CHEM	33
	C	10 SPNV(I)=SPNV(I)/TMV		CHEM	34
	C	CH2K=SPNV(5)*TANE/(1.5*TANE+.5)		CHEM	35
	C	SPNV(4)=CH2K*MAX(1,EOR-1,0)		CHEM	36
	C	SPNV(7)=SPNV(5)*(TANE+1.)/TANE		CHEM	37
	C	SPNV(5)=SPNV(5)*AMAX(1,-EOR,0.)		CHEM	38
	C	SPNV(2)=CH2K*(TANE+1.)*EOR/TANE+SPNV(2)		CHEM	39
	C	SPNV(1)=CH2K*EOR+SPNV(1)		CHEM	40
40	C	FARW=CH2K*EOR		CHEM	41
	C	FARW=FARW-(SPMH(6)*ITANE+1.)*SPMH(7)/TANE/TMV		CHEM	42
	C	PLM2D(12)=FARW		CHEM	43
45	C	TCPE=0.0		CHEM	44
	C	TMV=1.		CHEM	45
	C	TMV=1.		CHEM	46
	C	DO 1 I=1,7		CHEM	47
	C	TMV=TMV+SPNV(I)		CHEM	48
	C	SPNV=SPMH(I)*SPMH(I)		CHEM	49
50	C	TMV=TMV+SPM		CHEM	50
	C	11 TCPE=TCPE+SPNV*CP(I)		CHEM	51
	C	TMV=TMV+SPNV(6)		CHEM	52
	C	TMV=TMV/TMV		CHEM	53
	C	TCPE=TCPE/TMV		CHEM	54
55	C	DO 1 J=1,7		CHEM	55
	C	100 SPNV(I)=SPNV(I)/TMV		CHEM	56
	C	TMV=1.		CHEM	57
	C			CHEM	58

	RG0=1565.8146/TM	CHEM	59
	CP(1)=TCPF/TM	CHEM	60
60	GM0=1./11.-1.98580/TCPFI	CHEM	61
	CP(2)=CP(1)	CHEM	62
	DO 101 J=1,11	CHEM	63
	XC(21,J)=SPV(1)	CHEM	64
	TM20(1)=SPV(2)	CHEM	65
65	XC02=SPV(1)	CHEM	66
	RETURN	CHEM	67
	END	CHEM	68

	C	FFL *	SUBROUTINE THRUST	THRUST	2
	C	* * *		THRUST	3
	C	COMMON/FEL/PZ,NQ,M9S0,CP(6),RX,P,NS,PZ,		THRUST	4
5	1	PPA,XGB,AI,OR,DY,KRO,K,TMM,XC02NE,		THRUST	5
		ZGMS,PRI51,DPS,AMS,KERR,DRO,XIS,1081,Y15,1801,MR,CN51		THRUST	6
	C	PLM *		THRUST	7
	C	COMMON/PLM/PLMG0143J,RCN,ST(501),PLM(5,30,501),MFLW,PA,PR,		THRUST	8
	1	DPCX,KDATA,ISHK,JSHK,TANE,EQR		THRUST	9
10	C	ATMOS *		THRUST	10
	C	COMMON/ATHOS/ALT,FLTH,METEC,RREC,RAMP,PANT,DELT2,THEY2		THRUST	11
	C	FL *		THRUST	12
	C	COMMON/FL/UUA,IA,XC02A,VH20A,BX(50)		THRUST	13
15	C	OIMENSION DAV(3),VICON(4)		THRUST	14
	C	INPUT PARAMETERS- METEC MTL STD 210- *-1=COLO,0=STANDARD,*1=MOT>ALT=FE		THRUST	15
	C	NORM = 0 FOR RESOLUTION=1 FOR NORMALIZED,JET = 0.1, OR 2 COANNULAR JETS		THRUST	16
	C	ELIMEMACH,TSFC=TSFC/SRTHT2(LB/LRML,RSEC=RA,FACI,ENE=THRUST/DELT2LB		THRUST	17
	C	FRATE/NAT/DELT2(LSS),-PP=PT7/PI2,FPS=PI2,5/PI2,TPPN=177/THET2(GRI,VTSN=		THRUST	18
20	C	TI2,5/THET2(GRI)MAPAC=WPASCTHT2 /UCLT2(LBS/SEC),WASAC=WS*SRTHT2 /DELT2		THRUST	19
	C	GAMP & GAMS=SP HT PAYIO, ZCPP 1 *-5=SP HT (BTU/LBGR)>><S E TATE OCT 2		THRUST	20
	C			THRUST	21
	C		JET, NORM, FNR, WASAC	THRUST	22
25	1	FLTH, TSFC, PREC, FN, MAPAC,		THRUST	23
	2	EPR, FPR, TTPN, TTSN,		THRUST	24
	METEC=0			THRUST	25
	NORM=1			THRUST	26
	JET=1			THRUST	27
	ALT=PLMG015			THRUST	28
30	GAMSE=1.5			THRUST	29
	RS=51.			THRUST	30
	CPS=CP(1)*25028.26			THRUST	31
	RREC=1.			THRUST	32
35	FLTH=UA/SCRT(.4*CPS*TA)			THRUST	33
	IF(PLM(201,1),1,G7,1.) GO TO 200			THRUST	34
	IF(UUA,GT,11,1) GO TO 200			THRUST	35
	FLTH=.2			THRUST	36
	TSFC=.996			THRUST	37
	RREC=1.0			THRUST	38
40	FN=2593.			THRUST	39
	FNR=2593.			THRUST	40
45	EPR=2.3235			THRUST	41
	FPA=0.			THRUST	42
	TTPN=1758.			THRUST	43
	TTSN=0.			THRUST	44
	MAPAC=43.9			THRUST	45
	WASAC=0.			THRUST	46
50	READ(15,POWER)			THRUST	47
	IF(NFLW.EQ.0) WRITE(16,POWER)			THRUST	48
	IF(P.NE.0.1) ALT=1.08			THRUST	49
	IF(PA.NE.3.1) GO TO 210			THRUST	50
	EQ=0.			THRUST	51
	CALL CHEM			THRUST	52
55	ZDPS=CP(11)			THRUST	53
	RS=208			THRUST	54
	CS=208			THRUST	55
				THRUST	56
				THRUST	57
				THRUST	58

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115	113 TAC=374.7 GO TO 10	THRUST	116
	114 TAC=374.7-31602*(H-12894.)	THRUST	117
	GO TO 10	THRUST	118
	115 TAC=374.7	THRUST	119
	GO TO 10	THRUST	120
120	116 TAC=374.7+00051.3*(H-18587.)	THRUST	121
	GO TO 10	THRUST	122
	117 TAC=365.7-0011355*(H-22229.)	THRUST	123
	GO TO 10	THRUST	124
125	17 TA=3	THRUST	125
	C	THRUST	126
	C	THRUST	127
	C	THRUST	128
	C	THRUST	129
	IF (H-11909.1110.118.106	THRUST	130
130	118 TAC=374.7-31602*(H-12894.)	THRUST	131
	GO TO 10	THRUST	132
	119 TAC=374.7-31602*(H-12894.)	THRUST	133
	GO TO 10	THRUST	134
135	120 TAC=374.7-31602*(H-12894.)	THRUST	135
	GO TO 10	THRUST	136
	C	THRUST	137
	C	THRUST	138
	C	THRUST	139
	C	THRUST	140
140	210 CONTINUE	THRUST	141
	PAGE=PAC	THRUST	142
	DELAM=PA/14.690	THRUST	143
	THLAE=TA/518.648	THRUST	144
	IF (JET-2155.51.50	THRUST	145
145	50 CONTINUE	THRUST	146
	FOR = 1.	THRUST	147
	WASAC = 0.	THRUST	148
	51 RAMTR=1.+(GAMS-1.1)*FLTM*FLTM/2.	THRUST	149
	FCAMS=(GAMS-1.1)/GAMS	THRUST	150
	RAMPR=(RAMTR*(1./FGAMS))*RREC	THRUST	151
150	DEL12=DELAM*RAMPR	THRUST	152
	THE12=THEAM*RAMTR	THRUST	153
	SRHT2=SRHT1*THE12	THRUST	154
	UA=FLTM*SRHT1*(CPS*TA)	THRUST	155
155	RAM1=518.648*DEL12	THRUST	156
	RAMP=14.690*DEL12	THRUST	157
	IF (INOP152.52.53	THRUST	158
	52 TSFC=TSFC/SRT412	THRUST	159
	FN = FN /DEL12	THRUST	160
	FNRT=FNRT/DEL12	THRUST	161
160	EPK=EPK/(PA*PR*PAMB)	THRUST	162
	FPK=FPK/(PA*PR*PAMB)	THRUST	163
	ITPN = ITPN/PA*PR	THRUST	164
	ITSN = ITSN/PA*PR	THRUST	165
165	WAPAC = WAPAC*SRHT2/DEL12	THRUST	166
	WASAC = WASAC*SRHT2/DEL12	THRUST	167
	IF (JET.NE.2) FFR=1.	THRUST	168
	53 CONTINUE	THRUST	169
	WP=WAPAC*DEL12/SRHT2	THRUST	170
	WS=WASAC*DEL12/SRHT2	THRUST	171
170	PNRT = FN*133./FNRT	THRUST	172
	FN = FN*DEL12	THRUST	173

	MF=TSFC*FA*SRMT2	THRUST	173
	FOR=1.	THRUST	174
	CALL CHEM	THRUST	175
175	WSTOIC=MP*3600./PLMGO(12)	THRUST	176
	FOR=MF/WSTOIC	THRUST	177
	221 CONTINUE	THRUST	178
	CALL CHEM	THRUST	179
180	GAMP=G*3	THRUST	180
	FGAMP=(GAMP-1.)/(GAMP	THRUST	181
	ZOPP=CP(1)	THRUST	182
	RP=0.9	THRUST	183
	CP=ZOPP*25229.26	THRUST	184
	W=WD+MF/3(03)	THRUST	185
185	PUPP=EP*24*MP	THRUST	186
	PTP=PNP*FAM8	THRUST	187
	CNT=(GAMP+1.)/2.	THRUST	188
	CNPP=CNTP*(1./FGAMP)	THRUST	189
	IF(PNP.GE.CNPP)PNP=CNPP	THRUST	190
190	PNTR=PNP*FGAMP	THRUST	191
	PNMQ=SCOT(2.)*(PNTR-1.)/(GAMP-1.)/	THRUST	192
	SNPP=FP*24*MP	THRUST	193
	PTS=SNPP*FAM8	THRUST	194
	CSP=(FGAMP+1.)/2.)*(1./FGAMP)	THRUST	195
195	IF(SNP.GE.CSP)SNP=CSP	THRUST	196
	SNP=SNP*FGAMP	THRUST	197
	SNMCH=SCOT(2.)*(SNP-1.)/(GAMP-1.)/	THRUST	198
	PNM=(GAMP-1.)*(CPP+TPN*THET2/PNTR	THRUST	199
	IF(PT.NE.PNTSY)=510.608	THRUST	200
200	SNM=(GAMP-1.)*(CPS+TTSN*THET2/SNP	THRUST	201
	PNMEL=FN*CM*SCOT(PNM)	THRUST	202
	SNMEL=SNMCH+SCOT(SNM)	THRUST	203
	TTP=TPN*THET2	THRUST	204
	TTS=TTSN*THET2	THRUST	205
205	RECT=RECT*100.	THRUST	206
	DAV(1)=10M	THRUST	207
	DAV(2)=10M	THRUST	208
	DAV(3)=10M	THRUST	209
	WICOW(1)=10M	THRUST	210
210	WICOW(2)=10M	THRUST	211
	WICOW(3)=10M	THRUST	212
	WICOW(4)=10M	THRUST	213
	PA=0.5	THRUST	214
	PB=PIP/PNPR/14.6359	THRUST	215
215	WICOW(5)=10M	THRUST	216
	IF(TA.LT.1600.AND.XH2O.AGT.0.0085) WICOW=1	THRUST	217
	WICOW(6)=10M	THRUST	218
	WICOW(7)=10M	THRUST	219
	WICOW(8)=10M	THRUST	220
220	WICOW(9)=10M	THRUST	221
	WICOW(10)=10M	THRUST	222
	WICOW(11)=10M	THRUST	223
	WICOW(12)=10M	THRUST	224
225	WICOW(13)=10M	THRUST	225
	WICOW(14)=10M	THRUST	226
	WICOW(15)=10M	THRUST	227
	WICOW(16)=10M	THRUST	228
	WICOW(17)=10M	THRUST	229

230	PLMG0(15)=PTP	THRUST	230
	PLMG0(16)=PTS	THRUST	231
	PLMG0(17)=TTP	THRUST	232
	PLMG0(18)=TTS	THRUST	233
	PLMG0(19)=FN	THRUST	234
	PLMG0(20)=PNWACH	THRUST	235
235	PLMG0(21)=CNMACH	THRUST	236
	PLMG0(22)=CNVEL	THRUST	237
	PLMG0(23)=SNVEL	THRUST	238
	PLMG0(24)=PA	THRUST	239
	PLMG0(25)=PTS/SNPR/14.69594	THRUST	240
240	PLMG0(26)=RP	THRUST	241
	PLMG0(27)=RS	THRUST	242
	PLMG0(28)=EGAMP/(64.34*RP)	THRUST	243
	PLMG0(29)=EGAMS/(64.34*RS)	THRUST	244
	WRITE(15,24)	THRUST	245
245	IF(ALT,GE,1.E7) GO TO 23	THRUST	246
	WRITE(15,25) ALT,DAY('ETEC+21,XH20A	THRUST	247
	WRITE(15,26) (VICONID),I=ICGM,NCONI	THRUST	248
	WRITE(15,27) FLTH,PAHS,TA,UA	THRUST	249
	WRITE(15,28) EOP	THRUST	250
250	IF(EOP,GT,1.05) WRITE(16,40) F'R	THRUST	251
	FORMAT(//23H** FLIGHT CONDITIONS **)	THRUST	252
25	FORMAT(//5X,*,ALTITUDE IS *,F6.0,*, FEET,*,25X,*,WEATHER IS ICAD MIL S	THRUST	253
	*TO 210 *,R13,*,AY*,/10X,*, WITH *,F10.6,*, WATER CONTENT,*,	THRUST	254
26	FORMAT(15X,*,VISIBLE CONTRAIL IS *,2A10)	THRUST	255
27	FORMAT(15X,*,CASE MACH NUMBER IS *,F4.2,*, AT AMBIENT*,/10X,*,PRESSUR THRUST	THRUST	256
	*E OF *,F6.2,*, PSTA,*,/10X,*,TEMPERATURE OF *,F5.0,*, DEGR,*,/10X,	THRUST	257
	*VELOCITY OF *,F5.0,*, FT/SEC,*///)	THRUST	258
28	FORMAT(15X,*,ENGINE IS RUNNING WITH A FUEL EQUIVALENCE RATIO (EOP) O	THRUST	259
	*F *,F6.3//)	THRUST	260
260	50 FORMAT(30X,*SMOKEY ENGINE OPERATION -> EOP. *,G14.4)	THRUST	261
	RETURN	THRUST	262
	END	THRUST	263

[illegible]

	00 22 K=1.49	PLM0M3	59
	J=HIND(30,NRO(K))+1	PLM0M3	60
68	NRO(K)=J	PLM0M3	61
	IF(K.EQ.49) NRO(K)=NFO(K-1)	PLM0M3	62
	J=HIND(30,NRO(K))	PLM0M3	63
	00 22 J=J+JE	PLM0M3	64
	PLM(1,J,K)=1.2*PLM(1,NB,49)	PLM0M3	65
65	IF(K.EQ.49) PLM(1,J,K)=PLM(1,J,K-1)	PLM0M3	66
	00 22 I=2.5	PLM0M3	67
	22 PLM(I,J,K)=PLM(I,JREF,1)	PLM0M3	68
	101 CONTINUE	PLM0M3	69
	20 110 K=1.49	PLM0M3	70
70	J=J+K*2(K)	PLM0M3	71
	70111 J=2.5E06	PLM0M3	72
	VEL=PLM(5,1,K)-1.	PLM0M3	73
	VEL=PLM(5,J,K)	PLM0M3	74
	IF(VEL.GE.VELT160 TO 118	PLM0M3	75
75	IF(J.LE.2) GO TO 111	PLM0M3	76
	110 CONTINUE	PLM0M3	77
	111 K=K-1	PLM0M3	78
	XC=ST(K)	PLM0M3	79
	REN(101)=REN	PLM0M3	80
80	RB=REN	PLM0M3	81
	RG=REN	PLM0M3	82
	AL=ST(48)	PLM0M3	83
	NB=NDO(48)-2	PLM0M3	84
	REND=PLM(1,NB,48)	PLM0M3	85
	TN3=(REND-POI)/AL	PLM0M3	86
85	WRITE(16,90111) RB,NC,REND,AL	PLM0M3	87
	90111 FORMAT(5X,4H RB=E8.3,4H NC=E8.3,6H REND=E8.3,4H AL=E8.3)	PLM0M3	88
	C * * PLUME GAS DATA IS IN CORE * *	PLM0M3	89
90	IFILE=KDATA/1030	PLM0M3	90
	KDATA=KDATA-IFILE*1000	PLM0M3	91
	IPNCH=KDATA/100	PLM0M3	92
	KDATA=KDATA-IPNCH*100	PLM0M3	93
95	IPRNT=KDATA/10	PLM0M3	94
	IPLOT=KDATA-IPRNT*10	PLM0M3	95
	IF(IFILE.NE.1) GO TO 1008	PLM0M3	96
	WRITE(19) (PLMGO(I),I=1,7644)	PLM0M3	97
	1008 IF(IPNCH.NE.1) GO TO 1001	PLM0M3	98
100	PUNC=9013.(PLMGO(1),I=1,7644)	PLM0M3	99
	1001 IF(IPRNT.NE.1) GO TO 1010	PLM0M3	100
	CALL PLMPRNT	PLM0M3	101
	1010 KDATA=IPLOT	PLM0M3	102
	CALL PLMPLOT	PLM0M3	103
105	END	PLM0M3	104
		PLM0M3	105
		PLM0M3	106

C	OBJECTIVE TO PLOT ON THE PRINTER FROM TABLE PLM ANY ARGUMENT(I,PLOT)	PLMPLT	3
C	FROM 2 THROUGH 5 OR ALL ARGUMENTS 2 THROUGH 5 (I,PLOT=0), OR	PLMPLT	4
C	NONE AT ALL (I,PLOT=1).	PLMPLT	5
C		PLMPLT	6
C		PLMPLT	7
C	PLMST * * * PLUME STRUCTURE DATA * *	PLMPLT	8
C	COMMON/PLM/PLMG(143),RCM,ST(50),NPD(50),PLM(5,30,50),NPLM,PA,PA,	PLMPLT	9
C	1 OPD,K,ORATA,ISM,K,ISM,K,TANE,ENG	PLMPLT	10
C	INTEGER SM(133),GM(7),LAB(11)	PLMPLT	11
C	DIMENSION FNT(11),AKS(6),VAR(4),PM(54)	PLMPLT	12
C	DATA FNT/104(25),4 > 8,1H,10H,* > P > 8,1H,10H,* > E > 8,1H,2H/1/	PLMPLT	13
C	1H,10H,* > U > 8,1H,10H,* > M > 8,1H,10H,* > 8,1H,2H/1/	PLMPLT	14
C	DATA PGO/4HE5,6,2HE15,4,5HE10,4,4HE5,0/	PLMPLT	15
C	DATA VAR/4,EMSTAT TEMP,1CM CO2 CONC,10M H2O CONC,10M VELOCITY /	PLMPLT	16
C	DATA LAB/1H,1H2,1H3,1H4,1H5,1H6,1H7,1H8,1H9,1H0,1H /	PLMPLT	17
C	DATA GYM/1H,1HE,1HM,1HU,1HL,1HP,1H0/	PLMPLT	18
C	DATA FPD/1CM(3),130A1/	PLMPLT	19
C	DATA LPX,KM,K,LCN/24,119,11/	PLMPLT	20
C		PLMPLT	21

Line	Code	Text	Label
22		IPLOT=DATA	PLMPLT
23		JIG=IPLOT	PLMPLT
24		IF(IPLLOT.GT.1) GO TO 0011	PLMPLT
25		JIG=1	PLMPLT
26		JIG=JIG+1	PLMPLT
27	0010	IF(JIG.GT.5)IPLLOT=1	PLMPLT
28			PLMPLT
29	C		PLMPLT
30		IF(IPLLOT.NE.1) GO TO 0011	PLMPLT
31		GO TO 2502	PLMPLT

[illegible]

```

48      ANS(I)=AMN+AINC*(16-I)
      FMV(LIFILL)=DMG(IJ)
      9919 WRITE(6,2009)
      WRITE(6,2009) VAR(J)
      WRITE(6,2000) RCN
      WRITE(6,FMV)IANS
      45      DO 1003 NSF=2,48
      AKSF=PLMHJIG(I,NSF)
      IF(AKSF.LE.AMN+.6*AINC) GO TO 9030
      9903 CONTINUE
      PLMPLT 42
      PLMPLT 43
      PLMPLT 44
      PLMPLT 45
      PLMPLT 46
      PLMPLT 47
      PLMPLT 48
      PLMPLT 49
      PLMPLT 50

```

50	C	* SET SCALES L & K			
	0030	SCLK=STINSF/KMX			PLMPLT
		SCLL=SCLK/.60			PLMPLT
		LCN=RCN/SCLL*1.0			PLMPLT
		IF (LCN.LE.1) GO TO 0000			PLMPLT
		SCLL=RCN/(LCN-1)			PLMPLT
		SCLK=.6*SCLL			PLMPLT
		NSF=NSF+1			PLMPLT
55					

		IF(LCM,GE,5) GO TO 0033	PLMPLT	59
	0004	NSF=NSF-2	PLMPLT	60
	60	GO TO 0030	PLMPLT	61
	0033	IF(NSF,EO,40) GO TO 0100	PLMPLT	62
		IF(LCM,LE,15) GO TO 0300	PLMPLT	63
		NSF=NSF+5	PLMPLT	64
		IF(NSF,GT,40) NSF=40	PLMPLT	65
	65	GO TO 0030	PLMPLT	66
	0100	NSF=NSF+NSF-2	PLMPLT	67
		REF=PLMPLT,NSF,NSF	PLMPLT	68
		GR=REF/CON	PLMPLT	69
		LMTEL,CM,NSF,PL	PLMPLT	70
	70	IF(LMTEL,GE,20) GO TO 0103	PLMPLT	71
		LMTEL=LMTEL	PLMPLT	72
	0103	CONTINUE	PLMPLT	73
		LT=2*LMTEL	PLMPLT	74
	75		PLMPLT	75
		* SET UP PRINTER (LINE LOOP)	PLMPLT	76
		DO 1111 L=1,LT	PLMPLT	77
		LR=IABS(L-LMTEL)	PLMPLT	78
		CL=LR*SCCL	PLMPLT	79
		PRMD=PLMPLT,1,1)	PLMPLT	80
	80	STOP	PLMPLT	81
		SL=2	PLMPLT	82
		DO 0001 IZ=1,130	PLMPLT	83
	0001	SYN(17)=14	PLMPLT	84
		* SET UP PRINT CHARACTER K LOOP	PLMPLT	85
	85	DO 1110 K=1,NSF	PLMPLT	86
		SL=ST	PLMPLT	87
		KS=ST/SLK+1	PLMPLT	88
		NR=NRD(KPO)-2	PLMPLT	89
	90	RM=PLMPLT,NR,KPO	PLMPLT	90
		IF(OR,GE,PL) GO TO 0100	PLMPLT	91
		A=NR-5*SLK	PLMPLT	92
		LEVEL	PLMPLT	93
		GO TO 1000	PLMPLT	94
	95		PLMPLT	95
		* ARNO=0.0	PLMPLT	96
	0100	PR=PLMPLT,1,1,KPO	PLMPLT	97
		LEV=2	PLMPLT	98
		A=0.0	PLMPLT	99
	100	RM=3	PLMPLT	100
		C SEARCH RAD NO TO FIT RAD RL	PLMPLT	101
		DO 0101 NR=1,NR	PLMPLT	102
		RK=PLMPLT,NR,KPO	PLMPLT	103
	105	AK=PLMPLT,IG,NR,KPO	PLMPLT	104
		IF(RK,GT,PL) GO TO 0110	PLMPLT	105
		RM=RX	PLMPLT	106
		ARNO=AK	PLMPLT	107
	0110	OR=(PL-RD)/(RK-RMD)	PLMPLT	108
		IF(NR,EO,1) GO TO 1000	PLMPLT	109
		IF(KPO,EO,1) GR=0.0	PLMPLT	110
		A=OR*(AK-RMD)*ARNO	PLMPLT	111
	110		PLMPLT	112
		C SEARCH LEVEL OF ADJUSTMENT	PLMPLT	113
			PLMPLT	114
			PLMPLT	115

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115	DO 0111 LEV=1.6 AT=AM+AINC*(LEV-1) IF(A.LT.AT) GO TO 1000 B111 CONTINUE C FALLS OUT WITH A>AM	PLMPLT 116 PLMPLT 117 PLMPLT 118 PLMPLT 119 PLMPLT 120 PLMPLT 121 PLMPLT 122 PLMPLT 123 PLMPLT 124 PLMPLT 125 PLMPLT 126 PLMPLT 127
120	LEV=7 AT=AT+ENC 1000 IF(KS.GT.1) GO TO 1001 LEVMO=LEV 1001 STAT=STA IF(LEV.EQ.LEVMO) GO TO 1010 IF(LEVMO.LT.LEV) AT=AT+INC IF(A-AM)/AINC.LT.0.1) AMO=A-.1*AINC OK=AT-AMO/(A-AMO) IF(LEVMO.EQ.0) OK=OK*(1-PRMO)/(PR-PRMO) IF(OK.LE.0.0) OK=0.0 IF(OK.GE.1.0) OK=1.0 STAT=STL*OK*(STA-STL) IF(EL.GE.RCM) GO TO 1018 IF(PPR.O.LT.RCM/100.1) GO TO 1010 IF(PP.GT.RCM/100.1) STOP=STL*PRMO*(STA-STL)/(PRMO-PR) STAT = MIN(STOP,STAT)	PLMPLT 128 PLMPLT 129 PLMPLT 130 PLMPLT 131 PLMPLT 132 PLMPLT 133 PLMPLT 134 PLMPLT 135 PLMPLT 136 PLMPLT 137 PLMPLT 138 PLMPLT 139 PLMPLT 140 PLMPLT 141 PLMPLT 142 PLMPLT 143 PLMPLT 144 PLMPLT 145
135	1010 KT=STAT/SOLK*1 KS=MIN(KS,120) KT=MIN(KT,120) MK=0 N=KT LV=LEVMO C C SET UP TO LOAD PRINT LINE	PLMPLT 146 PLMPLT 147 PLMPLT 148 PLMPLT 149 PLMPLT 150 PLMPLT 151 PLMPLT 152 PLMPLT 153 PLMPLT 154 PLMPLT 155 PLMPLT 156 PLMPLT 157 PLMPLT 158 PLMPLT 159 PLMPLT 160 PLMPLT 161 PLMPLT 162 PLMPLT 163 PLMPLT 164 PLMPLT 165 PLMPLT 166 PLMPLT 167 PLMPLT 168 PLMPLT 169 PLMPLT 170 PLMPLT 171 PLMPLT 172
140	1011 CONTINUE IF(M.GT.120) GO TO 1101 DO 1100 K=M,N SYN(K+10)=DYN(LVL) IF(LVL.GT.0) GO TO 1100 SYN(K+10)=1W* SYN(101)=1W* 1100 CONTINUE IF(M.GE.KS) GO TO 1101 SYN(11*KT)=1W M=M+2 N=N+5 LVL=LEV IF(M.LE.N) GO TO 1011 C C * REINITIALIZE K LOOP	PLMPLT 164 PLMPLT 165 PLMPLT 166 PLMPLT 167 PLMPLT 168 PLMPLT 169 PLMPLT 170 PLMPLT 171 PLMPLT 172
150	1101 STL=STA KMO=KS*1 LEVMO=LEV AMO=A PRMO=PR 1110 CONTINUE C C * CLOSE K LOOP	PLMPLT 170 PLMPLT 171 PLMPLT 172
155	OLR=FLCAT(OLR)/(LCM-1) OLT=INT(OLF) OLRT=ABS(OLR-OLT)	

	IF(OLRT.GT.0.01) GO TO 0022		
	NRAD=OLY		
175	SYN(1)=LABINRAD)		PLMPLT 173
	SYN(5)=IMP		PLMPLT 174
	SYN(6)=IMA		PLMPLT 175
	SYN(7)=IMD		PLMPLT 176
	SYN(10)=IM-		PLMPLT 177
	SYN(11)=IM-		PLMPLT 178
180	IF(INRAD.NE.1) GO TO 0020		PLMPLT 179
	SYN(11)=IM-		PLMPLT 180
	SYN(10)=IM-		PLMPLT 181
0020	IF(INRAD.NE.0) GO TO 0022		PLMPLT 182
	SYN(11)=IM-		PLMPLT 183
105	0022 IF(OLG.LE.1.01SYN(9))=IMP		PLMPLT 184
	PRINT FMP,SYN		PLMPLT 185
	1111 CONTINUE		PLMPLT 186
	C CLOSE L COOP		PLMPLT 187
	C		PLMPLT 188
190	LA=1		PLMPLT 189
	OK=2.*RON/SCLK		PLMPLT 190
	IP=1		PLMPLT 191
	IS=1		PLMPLT 192
	IO=11		PLMPLT 193
195	0202 LA=11		PLMPLT 194
	LB=11		PLMPLT 195
	0220 CONTINUE		PLMPLT 196
	IF(17.0E.129) IO=129		PLMPLT 197
	DO 0222 I=IS,IO,2		PLMPLT 198
200	LA=LAB(LA)		PLMPLT 199
	LB=LAB(LB)		PLMPLT 200
	SYN(11)=LAB		PLMPLT 201
	0222 SYN(11)=LBH		PLMPLT 202
	IF(17.0E.129) GO TO 2200		PLMPLT 203
205	GO TO (2000,2002,2020)IP		PLMPLT 204
	C		PLMPLT 205
	2000 IS=IO-1		PLMPLT 206
	IP=2		PLMPLT 207
	LBH=LABS(LB-5)-5		PLMPLT 208
210	IF(137.0E.5)LB=10		PLMPLT 209
	GO TO 0220		PLMPLT 210
	C		PLMPLT 211
	2102 IS=IO+1		PLMPLT 212
	IO=12.*OK+LABH		PLMPLT 213
	IP=3		PLMPLT 214
215	GO TO 0202		PLMPLT 215
	C		PLMPLT 216
	2222 CONTINUE		PLMPLT 217
	LB=LABH		PLMPLT 218
	LA=LAB(LA+1)		PLMPLT 219
220	IF(LABH.NE.1)		PLMPLT 220
	IF(LABH.NE.10) GO TO 2000		PLMPLT 221
	LB=L-10		PLMPLT 222
	LA=1		PLMPLT 223
222	IF(13.7.LT.10) GO TO 2004		PLMPLT 224
	LA=LA+1		PLMPLT 225
225	LB=L-10		PLMPLT 226
	GO TO 2022		PLMPLT 227
	C		PLMPLT 228
	2200 PRINT FMP,SYN		PLMPLT 229

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230 WRITE(6,9098)
    IF(IPILOT.GT.1)IPILOT=1
    GO TO 8018
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	OVERLAY(RMP,5,1)		
	PROGRAM FILTER		
	COMMON/FILTER/FILTER,9(FILTER300)		
	COMMON/COMMON/NT,NA,NT,NU(300),NU(300),NU(300),NU(300)		
	COMMON/COMMON/NT,NA,NT,NU(300),NU(300),NU(300),NU(300)		
	DIMENSION F(5,100),F(5,100)		
	DIMENSION F(5,100),F(5,100)		
	REAL N(100)		
	DATA F(1,1)=1.751/3*0.005		
10	* 0.01,0.02,0.03,0.04,0.05,0.06,0.07,0.08,0.09,0.10,0.11,0.12,0.13,0.14,0.15,0.16,0.17,0.18,0.19,0.20,0.21,0.22,0.23,0.24,0.25,0.26,0.27,0.28,0.29,0.30,0.31,0.32,0.33,0.34,0.35,0.36,0.37,0.38,0.39,0.40,0.41,0.42,0.43,0.44,0.45,0.46,0.47,0.48,0.49,0.50,0.51,0.52,0.53,0.54,0.55,0.56,0.57,0.58,0.59,0.60,0.61,0.62,0.63,0.64,0.65,0.66,0.67,0.68,0.69,0.70,0.71,0.72,0.73,0.74,0.75,0.76,0.77,0.78,0.79,0.80,0.81,0.82,0.83,0.84,0.85,0.86,0.87,0.88,0.89,0.90,0.91,0.92,0.93,0.94,0.95,0.96,0.97,0.98,0.99,1.00	FILTER	2
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60	C	INCREMENTS BASED ON MAXIMUM RESOLUTION OF DATA INCLUDED IN	59	FILTER
	C	THE UNIVERSITY OF MICHIGAN PLUMES PROGRAM	60	FILTER
	C		61	FILTER
		I=1	62	FILTER
		ON=25	63	FILTER
		IF(XUC.LT.2000.) GO TO 602	64	FILTER
65		IF(XUC.GT.2400.) AND XUC.LT.3000.) GO TO 602	65	FILTER
		IF(XUC.GT.3770.) GO TO 602	66	FILTER
		ON=13	67	FILTER
		NUO=INT(12.*WBEG/ON)+1	68	FILTER
682		XUC=FLOAT(NUO)*ON/2	69	FILTER
			70	FILTER
70	C	ONU(IK,1)=XUC-WBEG*ON/2	71	FILTER
	C	NU(IK,1)=XUC	72	FILTER
	C		73	FILTER
	C	DO THE SAME FOR ALL NU AND ONU CARDS IF MULTIPLE WAVELENGTHS TO	74	FILTER
	C	BE UTILIZED	75	FILTER
75	C		76	FILTER
		ONU(1)=XUC-WBEG*ON/2	77	FILTER
		NU(1)=XUC	78	FILTER
		ON=ON	79	FILTER
80		GO TO 41	80	FILTER
		I=I+1	81	FILTER
	58	ONU(I)=ON	82	FILTER
		NU(I)=XUC	83	FILTER
		XUC=XUC+ON/2	84	FILTER
85	41	ON=25	85	FILTER
		IF(XUC.LT.2000.) GO TO 601	86	FILTER
		IF(XUC.GT.2400.) AND XUC.LT.3000.) GO TO 601	87	FILTER
		IF(XUC.GT.3770.) GO TO 601	88	FILTER
		ON=13	89	FILTER
90	601	XUC=XUC+ON/2	90	FILTER
		ON=ON	91	FILTER
		IF(XUC.LT.WEND) GO TO 40	92	FILTER
		MFREQ=I	93	FILTER
		ONU(1)=WEND-NU(I)-0.5*ONU(I)-1	94	FILTER
95		GO TO 58	95	FILTER
			96	FILTER
			97	FILTER
	C	INCREMENTS AND FREQUENCY CENTERS BASED ON NUINC (DEFAULT=50CM-1)	98	FILTER
	C		99	FILTER
	52	MFREQ=INT((WEND-WBEG)/NUINC)+1	100	FILTER
100		XUC=XUC+NUINC/2	101	FILTER
		DO 43 I=1,MFREQ	102	FILTER
		NU(I)=XUC	103	FILTER
		ONU(I)=NUINC	104	FILTER
105	43	XUC=XUC+NUINC	105	FILTER
	44	ONU(MFREQ)=WEND-NU(MFREQ)+NUINC/2	106	FILTER
	50	CONTINUE	107	FILTER
		NUFRST=1	108	FILTER
		GO TO (11,12,13,14,15) IFILTER	109	FILTER
110	C	BAND ONE	110	FILTER
	11	INDEX=3	111	FILTER
		GO TO 15	112	FILTER
	C	BAND TWO	113	FILTER
	12	INDEX=37	114	FILTER
		GO TO 16	115	FILTER

115	C	BAND THREE	FILTER	116
	13	INDEX=10	FILTER	117
		GO TO 16	FILTER	118
	C	BAND FOUR	FILTER	119
	16	INDEX=16	FILTER	121
120		GO TO 16	FILTER	121
	C	BAND FIVE	FILTER	122
	15	INDEX=12	FILTER	123
	16	DO 17 11=1,NFREQ	FILTER	124
		FCMK=10000,/MU(11)	FILTER	125
		IK=INT((FCMK-AM(11))/0.05+1.01) + INDEX	FILTER	126
125		AL=31*ARTE(1,00)*FLOAT(IK(11))	FILTER	127
		FRAC=(FCMK-AL)/0.35	FILTER	128
	17	AFILTER(11)=FIFILTER,IK(1)+FRAC*(FIFILTER,IK(1)-FIFILTER,IK(1))	FILTER	129
		END	FILTER	130

```

OVERLAY(XOMP,7,0)
PROGRAM NPLOT
DIMENSION RANGE(5),RAN(200),ROO(200),ROZ(200),SIG(4,200)
DIMENSION - 4)
COMMON/SPATIAL/ISPAT
IF(ISPAT,0,2) GO TO 300
REWIND 0
READ(0) NRANG
READ (2) I(RANGE(1),I=1,NRANG)
READ (4) R1,R2,R3,NC,AL,RCOR
READ (6) K
DO 11 I=1,K
DO 10 J=1,K
READ(0) PAR(1),ROO(1),FOZ(1)
NR=2*NRANG
DO 9 I=1,K
DO 9 J=1,NK
READ (8) SIG(J,I)
WRITE(6,10) NPANG,R3,WMEND,NC,AL,RCOR,K
WRITE(6,21) I(RANGE(1),I=1,NRANG)
FORMAT(11,F10.1)
FORMAT(1F,12,5F13.6,13)
DO 11 I=1,K
DO 11 J=1,NK
SIG(J,I)=SIG(J,I)/PAR(1)
DO 12 I=1,K
WRITE(6,13) PAR(1),ROO(1),FOZ(1), (SIG(J,I),J=1,NK)
FORMAT(11,F14.7)
DO 21 J=1,NK
ACJ=0.
DO 19 I=1,K
DO 13 J=1,NK
ACJ=SIG(J,I)/PAR(1)+ACJ
WRITE(6,13) I(1),J=1,NK)
IF(ISPAT,1,2) GO TO 300
PUNCH 10 , NRANG,R3,WMEND,NC,AL,RCOR,K
PUNCH 21 , I(RANGE(1),I=1,NRANG)
DO 220 I=1,K
PUNCH 13 , PAR(1),ROO(1),FOZ(1), (SIG(J,I),J=1,NK)
CONTINUE
END

```


115	40	CONTINUE	RIMAIN3	116
	18	CONTINUE	RIMAIN3	117
		NNAT=3	RIMAIN3	118
		DO 11 I=1,NM	RIMAIN3	119
120	11	NNAT=NNAT+NNAT(I)	RIMAIN3	120
		PEAD(5,1),ICS	RIMAIN3	121
		IF(ICS) 501,501,502	RIMAIN3	122
	502	READ(5,500) (ICSORF(IJJA),JJA=1,ICS)	RIMAIN3	123
	503	FOR-MAT(24,512)	RIMAIN3	124
	501	READ(5,4) PTP,TP,RP,GAMMAP,MP	RIMAIN3	125
		READ(5,4) PIS,TIS,RS,GAMMAS,MS	RIMAIN3	126
125		READ(5,1) PAM3	RIMAIN3	127
		FOR-MAT(8F12.5)	RIMAIN3	128
		DO 700 I=1,NMN	RIMAIN3	129
		MSAT=2.0	RIMAIN3	130
		AT=0.0	RIMAIN3	131
		FPAT=0.0	RIMAIN3	132
130		FFP=1.1	RIMAIN3	133
		CALL STORE(GCAT,AT,1.0)	RIMAIN3	134
		CALL STORE(FPAT,FFI,1.0)	RIMAIN3	135
135	701	CONTINUE	RIMAIN3	136
		IM=0	RIMAIN3	137
		DO 500 JUU=1,ICS	RIMAIN3	138
	001	NM(JUU)=0	RIMAIN3	139
		LLI=3	RIMAIN3	140
		READ(5,6C6) (NODEM(I),NODEF(I),I=1,MTOT1;	RIMAIN3	141
		DO 15 I=1,NM	RIMAIN3	142
		READ(5,1) IA	RIMAIN3	143
		IF(IA) 17,17,16	RIMAIN3	144
		READ(5,7) (V(I),AREAM(I),J=1,IA)	RIMAIN3	145
145	15	FOR-MAT(6F10.2)	RIMAIN3	146
	17	CALL ACPLV(X1,V1,X2,V2),F=NOPI,ISURF,JSURF,XU1,VU1,XU2,VU2,M1	RIMAIN3	147
		IN2,K(I1)	RIMAIN3	148
		CALL AXAPFA(X1(I1),Y(I1),XA,AREAM,IA,N1,N2,X1,VU1,XU2,VU2)	RIMAIN3	149
		IF(K(I1)-1) 20,21,22	RIMAIN3	150
150	20	PIP1=PI5	RIMAIN3	151
		TP1=TP5	RIMAIN3	152
		GAMM2=GAMMAS	RIMAIN3	153
		RP1=RS	RIMAIN3	154
		MS1=MS/2.	RIMAIN3	155
155		MP1=MS1	RIMAIN3	156
		CALL COFLW(PIP1,PT5,TP1,TIS,GAMM2,GAMMAS,RP1,RS,MP1,MS1,PAMB,	RIMAIN3	157
		1A(I1),K(I1))	RIMAIN3	158
		GO TO 23	RIMAIN3	159
160	21	PT5=PTP	RIMAIN3	160
		TIS=TP	RIMAIN3	161
		GAMM2=GAMMAP	RIMAIN3	162
		RS1=RP	RIMAIN3	163
		MP1=MP/2.	RIMAIN3	164
		MS1=MP1	RIMAIN3	165
165		CALL CO -X(PTP,PT5,TP,TIS,GAMM2,GAMMAS,RP,RS,MP1,MS1,PAMB,	RIMAIN3	166
		1A(I1),K(I1))	RIMAIN3	167
		GO TO 23	RIMAIN3	168
170	22	CALL COFLW(PIP1,PT5,TP,TIS,GAMM2,GAMMAS,RP,RS,MP1,MS1,PAMB,	RIMAIN3	169
		1A(I1),K(I1))	RIMAIN3	170
		DO 25 J=1,LL	RIMAIN3	171
	23	CALL FENOTL(TPR(J),PR2)	RIMAIN3	172

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	MACD NO	MACD NO	MACD NO	TEMP	REC TEMP	VELOCITY	VELOCITY	D	REMAIN
	DENSITY	DENSITY	DENSITY	(INCHES)	(INCHES)	(SOIN)	(FT/SEC)	(FT/SEC)	
	53/COIN	53/COIN	53/COIN	(DEG R.)	(DEG R.)	(FT/SEC)	(FT/SEC)		
232	6	113/COFT	118/COFT	1/1					233
	LINE=9								234
	00,310,351,1								235
235	312	IF(LINE=50)	311,311,312						236
	WRITE(6,107)								237
	WRITE(6,106)								238
240	311	WRITE(6,302)	XL(J),YL(J),YL2(J),ACROSS(J),PT(J),XMT(J),XNST(J),Y						241
	1PT(J),TST(J),VPT(J),VST(J),DEPT(J),DENSE(J)								242
308	FOR=41(2),F6,2,21,212K,55,2,31,21,F7,2,31,F5,2,31,212K,F6,4,2K,14								243
	112K,17,2,1V,212K,F6,4,2V,1,7)								244
	LINE=LINE+2								245
245	313	CONTINUE							246
	IF(LINE=50)	LINE=J,1) GO TO 400							247
	CALL CAC=AC=ACOT(1),TTP,CP,GMAPL								248
	CALL AC=AC=ACOT(1),YL,XZ,Y2,XF,NOP,I,ISURF,JSURF,XUL,YUL,XU2,YU2,								249
250	314	IF(LINE=50)	WRITE(6,2004) KSN,RFN,RPL,XP,AWL,RT						251
	111,12,1K(11)								252
	FOR=41(2) RADIUS SECOND, NOZLE=FO,3,* INCHES*/* RADIUS PRIMA								253
	1RY NOZLE=FB,3,* INCHES*/* RADIUS PLUS=FO,3,* INCHES*/* LENG								254
	214 PLUS=FB,3,* INCHES*/* NOZLE LENGTH=FB,2,* INCHES*/								255
	3 * LURINE RADIUS=FO,3,* INCHES*/								256
255	IF(XU2(N2) .LE. XPT(J) GO TO 403								257
	IF(XK(1) .EQ. 0) GO TO 401								258
	DIF=VU2(N2)-XPT(J)								259
	123=L+DIF+1								260
	12=L+1								261
260	00 410 11=12,123								262
	XL(11)=XPT(J)+11-L								263
	IF(11 .EQ. 123) GO TO 409								264
	00 407 125=1,N2								265
	IF(XU2(125) .GT. XL(11)) GO TO 400								266
265	407	CONTINUE							267
	409	XL(11)=XU2(N2)							268
	YL2(11)=VU2(N2)								269
	GO TO 405								270
270	405	YL2(11)=STRATE(XU2(125-1),XU2(125),VU2(125-1),VU2(125)*X 1101							271
	405	PT(11)=PT(J)							272
	XMT(11)=XMT(J)								273
	XNST(11)=XNST(J)								274
	1PT(11)=1PT(J)								275
	TST(11)=TST(J)								276
	VPT(11)=VPT(J)								277
275	405	VST(11)=VST(J)							278
	405	DENSE(11)=DENSE(J)							279
	405	DEPT(11)=DEPT(J)							280
	405	XF1=XU2(N)							281
	GO TO 402								282
280	401	XF1=XF(1)							283

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287 RIMAINS 287
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343 RIMAINS 343

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IF(NODE1(I9) .EQ. NODEM(I8)) GO TO 952
 951 CONTINUE
 WRITE(6,1081) NODE1(I9)
 1081 FORMAT('99999 CHECK INPUT FOR NODE-I4')
 288 IS=NIOT1
 952 IM=INTS+1
 IM(ITMS)=NODE1(I9)*100+NODEF(I8)
 HTAB(IM)=HT1(I9)
 950 CONTINUE
 DO 750 KUU=1,NNM
 IF(JSURF(I,II) .EQ. KSURF(KUU)) GO TO 751
 750 CONTINUE
 GO TO 30
 751 IF(COOL(KUU) .GT. 0) GO TO 752
 GO TO 30
 752 DO 753 JUU=1,ICS
 IF(KSURF(KUU) .EQ. ICSURF(JUU)) GO TO 755
 753 CONTINUE
 IM=IM+1
 INDIC(IM)=KSURF(KUU)
 DO 756 IWM=1,L
 XX(IIM,IWM)=XL(IWM)
 XXP(IIM,IWM)=PT(IWM)
 XX(IIM,IWM)=TPT(IWM)
 XX(IIM,IWM)=VPT(IWM)
 XX(IIM,IWM)=HT1(IWM)
 XX(IIM,IWM)=DEPT(IWM)
 IND(IIM)=L
 GO TO 30
 756 IF(NOD(JUU) .GT. 0) GO TO 818
 IM=IM+1
 INDIC(IM)=KSURF(KUU)
 DO 758 IWM=1,L
 XX(IIM,IWM)=XL(IWM)
 XXP(IIM,IWM)=PT(IWM)
 XX(IIM,IWM)=TPT(IWM)
 XX(IIM,IWM)=VPT(IWM)
 XX(IIM,IWM)=HT1(IWM)
 XX(IIM,IWM)=DEPT(IWM)
 IND(IIM)=L
 NOD(JUU)=L-1
 GO TO 30
 758 DO 820 IM=1,2
 IF(KSURF(KUU) .EQ. INDIC(IM)) GO TO 821
 818 CONTINUE
 IO=NOD(JUU)+1
 IO=1
 LJ=LJ+IO-1
 DO 830 IWM=10,LJ
 XX(IIM,IWM)=XL(IO1)
 XXP(IIM,IWM)=PT(IO1)
 XX(IIM,IWM)=TPT(IO1)
 XX(IIM,IWM)=VPT(IO1)
 XX(IIM,IWM)=HT1(IO1)
 XX(IIM,IWM)=DEPT(IO1)
 IO1=IO1+1
 IND(IIM)=LJ
 830

345	32	NUM(JUB)=LJ-1 CONTINUE IF (PDATE .GT. 0) WRITE(6,060) NU=NU+1 LINEFL=4 DO 376 IM=1,NU IF (K(1)-1) 051,052,053 IF (K(1),IM .EQ. 1) GO TO 052 CALL TABLE1X,TS,X2(1,IM),TR11,DUM,L) GO TO 055 052 CALL TABLE1X,PT,X2(1,IM),TR11,DUM,L) IF (PDATE .EQ. 0) GO TO 062 IF (LINEFL .LE. 50) GO TO 061 WRITE(6,060) LINEFL=6 061 WRITE(6,061) NODEN2(1,IM),TR11 LINEFL=LINEFL+3 062 LI=L+1 NODEN2(1,IM)=NODEN2(1,IM) TR11(1)=TR11-460.0 065 CONTINUE FORMATT(1)=1,20X,"FLUID LUMP TEMPERATURES",// FORMAT(1)=1,20X,"TEMPERATURE",//,2X,"DEG. R.",// CONTINUE IN=IND(IM) JABT=0 IM=5 DO 1009 J=1,NM DO 1010 II=1,2 CO 1011 IAB=LNMH IF (JUB=1,II) .EQ. KSUB(IAB)) GO TO 1015 CONTINUE IF (JUB=1,II) .NE. JAB(1) GO TO 1016 GO TO 1010 1010 IF (KOL(IAB) .GT. 0) GO TO 1016 GO TO 1010 1016 IM=I+1 JAB(1)=JUB(I,II) IN=IND(IM) IMOVE=IM DO 1214 ISF=1,14 SHIFT(ISF)=TS(IMOVE) IMOVE=IMOVE+2 1234 IMOVE=IMOVE+2 MADDE=NA(1,IM) NUM(JE)=NUM(IM) MADDE=NA(1,IM) KOLSF=KCOL(IAB) DO 1060 JEN=1,IM K(JEN)=XX(1,IM,JEN) PT(JEN)=XX(1,IM,JEN) TPT(JEN)=XX(1,IM,JEN) VPT(JEN)=XX(1,IM,JEN) M11(JEN)=XX(1,IM,JEN) DEPT(JEN)=XX(1,IM,JEN) IF (KOL(IAB)-2) 1012,1013,1014 1012 CALL OVERLAY(IMP,9,1,6,RCALL) 1013 CALL TPARC	344 345 346 347 348 349 350 351 352 353 354 355 356 357 358 359 360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375 376 377 378 379 380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395 396 397 398 399 400 401 402 403
345	32	NUM(JUB)=LJ-1 CONTINUE IF (PDATE .GT. 0) WRITE(6,060) NU=NU+1 LINEFL=4 DO 376 IM=1,NU IF (K(1)-1) 051,052,053 IF (K(1),IM .EQ. 1) GO TO 052 CALL TABLE1X,TS,X2(1,IM),TR11,DUM,L) GO TO 055 052 CALL TABLE1X,PT,X2(1,IM),TR11,DUM,L) IF (PDATE .EQ. 0) GO TO 062 IF (LINEFL .LE. 50) GO TO 061 WRITE(6,060) LINEFL=6 061 WRITE(6,061) NODEN2(1,IM),TR11 LINEFL=LINEFL+3 062 LI=L+1 NODEN2(1,IM)=NODEN2(1,IM) TR11(1)=TR11-460.0 065 CONTINUE FORMATT(1)=1,20X,"FLUID LUMP TEMPERATURES",// FORMAT(1)=1,20X,"TEMPERATURE",//,2X,"DEG. R.",// CONTINUE IN=IND(IM) JABT=0 IM=5 DO 1009 J=1,NM DO 1010 II=1,2 CO 1011 IAB=LNMH IF (JUB=1,II) .EQ. KSUB(IAB)) GO TO 1015 CONTINUE IF (JUB=1,II) .NE. JAB(1) GO TO 1016 GO TO 1010 1010 IF (KOL(IAB) .GT. 0) GO TO 1016 GO TO 1010 1016 IM=I+1 JAB(1)=JUB(I,II) IN=IND(IM) IMOVE=IM DO 1214 ISF=1,14 SHIFT(ISF)=TS(IMOVE) IMOVE=IMOVE+2 1234 IMOVE=IMOVE+2 MADDE=NA(1,IM) NUM(JE)=NUM(IM) MADDE=NA(1,IM) KOLSF=KCOL(IAB) DO 1060 JEN=1,IM K(JEN)=XX(1,IM,JEN) PT(JEN)=XX(1,IM,JEN) TPT(JEN)=XX(1,IM,JEN) VPT(JEN)=XX(1,IM,JEN) M11(JEN)=XX(1,IM,JEN) DEPT(JEN)=XX(1,IM,JEN) IF (KOL(IAB)-2) 1012,1013,1014 1012 CALL OVERLAY(IMP,9,1,6,RCALL) 1013 CALL TPARC	344 345 346 347 348 349 350 351 352 353 354 355 356 357 358 359 360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375 376 377 378 379 380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395 396 397 398 399 400 401 402 403

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REMAINS	401
REMAINS	402
REMAINS	403
REMAINS	404
REMAINS	405
REMAINS	406
REMAINS	407
REMAINS	408
REMAINS	409
REMAINS	410
REMAINS	411
REMAINS	412
REMAINS	413
REMAINS	414

A-1118

	SUBROUTINE AVERIA,TM,EX,NODE,M,IX,PRINTS)		
	DIMENSION A(1),TM(1),LY(1),NODE(2,10)		
	COMMON/CC/ NODEN(10),MT(10),LUU,KODLT		
	INTEGER PRINTS		
5	K=1	AVR	2
	DO 110 I=1,N	AVR	3
	K=LY(I)+K	AVR	4
	AT=3.0	AVR	5
10	TAX=D.0	AVR	6
	DO 51 J=K,K	AVR	7
	TAUX=TAO+(A(I)-TM(I))	AVR	8
	AT=AT+TAU	AVR	9
15	CONTINUE	AVR	10
	MT=TAUX/AT	AVR	11
	K=K+1	AVR	12
	IF (PRINTS .GT. 8) WRITE(6,101) NODE(I),MT	AVR	13
	LU=LUU+1	AVR	14
20	NODEN=(LUU)+NODE(I),IT	AVR	15
	MT*(LUU)=MT+50.0	AVR	16
101	FORMAT(13X,34)AVERAGE WALL TEMPERATURE FOR NODE ,I2.4H IS ,F7.2,	AVR	17
	15H DEG. R.1	AVR	18
102	CONTINUE	AVR	19
	RETURN	AVR	20
25	END	AVR	21

	SUBROUTINE FLOWND(PTEZ,PS3A,XX,L,KOOL)	
	DIMENSION PS3A(3),XX(1)	2 FLOWND
	K=0	3 FLOWND
	KK=0	4 FLOWND
5	M=1	5 FLOWND
	IF(KOOL.EQ.5) M=2	6 FLOWND
	GO 2,1=M,L	7 FLOWND
	IF(PTEZ-PS3A(1)) 3,3,4	8 FLOWND
	IF(K) 2,2,5	9 FLOWND
10	IF(K) 6,6,7	10 FLOWND
6	XLOC1=XX(1)	11 FLOWND
	IF(1-L) 8,8,9	12 FLOWND
8	K=1	13 FLOWND
	GO 10 2	14 FLOWND
15	IF(1-L) 2,9,9	15 FLOWND
9	XLOC2=XX(1)	16 FLOWND
	IF(KK) 2,2,20,21	17 FLOWND
20	WRITE(6,1)	18 FLOWND
21	IF(KOOL.GT.1) GO 10 25	19 FLOWND
22	WRITE(6,2) XLOC1,XLOC2	20 FLOWND
	FORMAT(5X,20HFROM AXIAL LOCATION ,F5.1,40H THRU END OF COOLING SUR	21 FLOWND
	FACE LOCATED AT ,F5.1,1H,,//)	22 FLOWND
	GO 10 2	23 FLOWND
25	WRITE(6,23) XLOC1,XLOC2	24 FLOWND
23	FORMAT(6X,21HFROM SLOT LOCATED AT ,F5.1,35H THRU LAST COOLING SLOT	25 FLOWND
	LOCATED AT ,F5.1,1H,,//)	26 FLOWND
	GO 10 2	27 FLOWND
5	XLOC2=XX(1)	28 FLOWND
	IF(KK) 11,11,12	29 FLOWND
31	WRITE(6,11)	30 FLOWND
	KK=1	31 FLOWND
12	IF(KOOL.GT.1) GO 10 15	32 FLOWND
	WRITE(6,15) XLOC1,XLOC2	33 FLOWND
	GO 10 16	34 FLOWND
35	WRITE(6,17) XLOC1,XLOC2	35 FLOWND
16	K=2	36 FLOWND
17	FORMAT(5X,21HFROM SLOT LOCATED AT ,F5.1,40H TO (BUT NOT INCLUDING)	37 FLOWND
	SLOT LOCATED AT ,F5.1,1H,,//)	38 FLOWND
2	CONTINUE	39 FLOWND
1	FORMAT(//,21X,10HPROGRAM PREDICTS REVERSE COOLANT FLOW,,/28X,2	40 FLOWND
	10HPROGRAM UTILIZES ZERO FLOW,,//)	41 FLOWND
14	FORMAT(15X,12HFROM AXIAL LOCATION ,F5.1,19H TO AXIAL LOCATION ,F5.	42 FLOWND
	11,1H,,//)	43 FLOWND
	RETURN	44 FLOWND
45	END	45 FLOWND
		46 FLOWND


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FUNCTION STRATE(X1,X2,Y1,Y2,M)
  STRATE=((Y2-Y1)/(X2-X1))*(X-X1))+Y1
RETURN
END

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  STRATE 2
  STRATE 3
  STRATE 4
  STRATE 5

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Line	Code	Statement	Flow
1	SUBROUTINE	COFLOW (PT,PTS,TIP,ITS,GAMP,GAMS,RP,RS,MP,MS,PAMB,	COFLOW
2	1A(1,K1)		COFLOW
3	DIMENSION	BTA(150)	COFLOW
4	COMMON	X(100),ACROSS(60),	COFLOW
5	1Y(1,60),VL2(80),P(150),AA(150),XNM1(150),XNM2(150),TSS(150),	COFLOW	
6	20CNP(1150),VBP(150),TP(150),DEMS1(50),SS(150),PT(100),	COFLOW	
7	3XNST(60),ISI(60),DEMS1(60),NST(60),HPT(60),TPT(100),	COFLOW	
8	4DEMT(100),VPT(100)	COFLOW	
9	COMMON	L(1)	COFLOW
10	COMMON/EXT/	RSN,RPN,RPL,YP,ANL,RTE	COFLOW
11	GO TO 134		COFLOW
12	1	OPDX,KDATA,ISNK,JSNK,TANE,ECR	COFLOW
13	CFZ=1.0		COFLOW
14	FV=MS*SORT(TTSI)/IMP*SORT(TTP)*CFZ		COFLOW
15	TF(P-P-PTS)320,320,330		COFLOW
16	PSI=PI		COFLOW
17	GO TO 134		COFLOW
18	PSI=PI		COFLOW
19	PSI=PI		COFLOW
20	PSI=PI		COFLOW
21	PSI=PI		COFLOW
22	PSI=PI		COFLOW
23	PSI=PI		COFLOW
24	PSI=PI		COFLOW
25	PSI=PI		COFLOW
26	PSI=PI		COFLOW
27	PSI=PI		COFLOW
28	PSI=PI		COFLOW
29	PSI=PI		COFLOW
30	PSI=PI		COFLOW
31	PSI=PI		COFLOW
32	PSI=PI		COFLOW
33	PSI=PI		COFLOW
34	PSI=PI		COFLOW
35	PSI=PI		COFLOW
36	PSI=PI		COFLOW
37	PSI=PI		COFLOW
38	PSI=PI		COFLOW
39	PSI=PI		COFLOW
40	PSI=PI		COFLOW
41	PSI=PI		COFLOW
42	PSI=PI		COFLOW
43	PSI=PI		COFLOW
44	PSI=PI		COFLOW
45	PSI=PI		COFLOW
46	PSI=PI		COFLOW
47	PSI=PI		COFLOW
48	PSI=PI		COFLOW
49	PSI=PI		COFLOW
50	PSI=PI		COFLOW
51	PSI=PI		COFLOW
52	PSI=PI		COFLOW
53	PSI=PI		COFLOW
54	PSI=PI		COFLOW
55	PSI=PI		COFLOW
56	PSI=PI		COFLOW
57	PSI=PI		COFLOW
58	PSI=PI		COFLOW
59	PSI=PI		COFLOW
60	PSI=PI		COFLOW
61	PSI=PI		COFLOW
62	PSI=PI		COFLOW
63	PSI=PI		COFLOW
64	PSI=PI		COFLOW
65	PSI=PI		COFLOW
66	PSI=PI		COFLOW
67	PSI=PI		COFLOW
68	PSI=PI		COFLOW
69	PSI=PI		COFLOW
70	PSI=PI		COFLOW
71	PSI=PI		COFLOW
72	PSI=PI		COFLOW
73	PSI=PI		COFLOW
74	PSI=PI		COFLOW
75	PSI=PI		COFLOW
76	PSI=PI		COFLOW
77	PSI=PI		COFLOW
78	PSI=PI		COFLOW
79	PSI=PI		COFLOW
80	PSI=PI		COFLOW
81	PSI=PI		COFLOW
82	PSI=PI		COFLOW
83	PSI=PI		COFLOW
84	PSI=PI		COFLOW
85	PSI=PI		COFLOW
86	PSI=PI		COFLOW
87	PSI=PI		COFLOW
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89	PSI=PI		COFLOW
90	PSI=PI		COFLOW
91	PSI=PI		COFLOW
92	PSI=PI		COFLOW
93	PSI=PI		COFLOW
94	PSI=PI		COFLOW
95	PSI=PI		COFLOW
96	PSI=PI		COFLOW
97	PSI=PI		COFLOW
98	PSI=PI		COFLOW
99	PSI=PI		COFLOW
100	PSI=PI		COFLOW

60	VSS(I)=VS TPP(I)=TP IF(8TAL) .LE. 0.) GO TO 1000 IF(6-POSTOP) 300,340,340 1000 IF(KX) 998,998,1001 998 IF(8TAL) .LE. 84) I=I-1 GO TO 999	COFLOW	59
65	1001 IF(8TAL) -0.1 1003,1003,1002 1003 CALL TABLE(8TA,AA,0.8,AAA,0UM,I) J=I-1	COFLOW	60
70	1012 CALL TABLE(IPP,AA,PAMB ,AAA,0UM,I) J=I 1010 CF2=AAA/AACT DO 1117 I=I,J 1117 AA(I)=AA(I)/CF2 I=J PPN=SQRT(AS/13.1415927*CF2)*REF**2) PTE=RPN*1.1 RPN=SQRT(AP/13.1415927*CF2)*RPN**2) P8=P/14.7 RETURN END	COFLOW	61
75		COFLOW	62
80		COFLOW	63
		COFLOW	64
		COFLOW	65
		COFLOW	66
		COFLOW	67
		COFLOW	68
		COFLOW	69
		COFLOW	70
		COFLOW	71
		COFLOW	72
		COFLOW	73
		COFLOW	74
		COFLOW	75
		COFLOW	76
		COFLOW	77
		COFLOW	78
		COFLOW	79
		COFLOW	80
		COFLOW	81

	SUBROUTINE STORE(FP,FF,I,M)							
	DIMENSION FPI(5),FFI(5)							
	IFEN .GT. 0) GO TO 50							
5	FPI(I)=FP							
	FFI(I)=FF							
	GO TO 100							
58	FP=FFI(I)							
	FF=FFI(I)							
100	RETURN							
10	END							
		STORE1	2					
		STORE1	3					
		STORE1	4					
		STORE1	5					
		STORE1	6					
		STORE1	7					
		STORE1	8					
		STORE1	9					
		STORE1	10					
		STORE1	11					

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SUBROUTINE STORE(HGAT,AT,I,N)

DIMENSION HG(5),A(5)

IF(N.GT.0) GO TO 50

A(I)=AT

HG(I)=HGAT

GO TO 100

HGAT=HG(I)

AT=A(I)

RETURN

END

STORE 2

STORE 3

STORE 4

STORE 5

STORE 6

STORE 7

STORE 8

STORE 9

STORE 10

STORE 11

		SUBROUTINE AAREAT(XF,XA,AREAM,IA,KK,KKK,XU1,YU1,XU2,YU2)		AXAREA	2
		DIMENSION XA(1),AREAM(1),XU1(1),YU1(1),XU2(1),YU2(1)		AXAREA	3
		COMMON XL(100),ACROSS(100)		AXAREA	4
5		1YLL(80),YLT(50),PT(150),AA(150),XMH1(150),XMH2(150),TRS(150),		AXAREA	5
		2DENP(150),VPP(150),TRP(150),DENST(150),VSS(150),PT(100),		AXAREA	6
		3XVSTL(60),VSTL(60),DENST(60),VSTL(60),VSTL(60),VSTL(60),		AXAREA	7
		4DENP(100),VPT(100)		AXAREA	8
		COMMON L,LL		AXAREA	9
10		KCH=IXF-XI		AXAREA	10
		KXCH		AXAREA	11
		KCH=K		AXAREA	12
		IF(XCH1.EQ. KCH) GO TO 50		AXAREA	13
15	53	K=K+2		AXAREA	14
	51	GO TO 51		AXAREA	15
		K=K+1		AXAREA	16
		L=3		AXAREA	17
		YL(1)=YL		AXAREA	18
		DO 22 I=1,K		AXAREA	19
20		DO 3 J=1,KK		AXAREA	20
		IF(XL(I).EQ.YU1(J)) GO TO 9		AXAREA	21
		IF(XL(I).GT.XU1(J)) GO TO 10		AXAREA	22
		YL(I)=STRATE(XU1(J)-1,XU1(J),YU1(J)-1,YU1(J),XL(I))		AXAREA	23
		GO TO 11		AXAREA	24
25	9	YL(I)=YU1(I)		AXAREA	25
		GO TO 11		AXAREA	26
	10	CONTINUE		AXAREA	27
	11	DO 23 J=1,KKK		AXAREA	28
		IF(YL(I).EQ.XU2(J)) GO TO 19		AXAREA	29
		IF(YL(I).GT.XU2(J)) GO TO 20		AXAREA	30
30		YL2(I)=STRATE(YU2(J)-1,YU2(J),YU2(J)-1,YU2(J),YL(I))		AXAREA	31
		GO TO 21		AXAREA	32
	19	YL2(I)=YU2(I)		AXAREA	33
		GO TO 21		AXAREA	34
35	20	CONTINUE		AXAREA	35
	21	L=L+1		AXAREA	36
		ACROSS=3.14159*(A05(YL(I)+YL2(I))-YL2(I)*YL2(I))		AXAREA	37
		IF(IA.EQ. 0) GO TO 15		AXAREA	38
		IF(XL(I)-YA(I)) 15,16,16		AXAREA	39
40	16	IF(XL(I)-XA(I)) 17,17,15		AXAREA	40
	15	AMINUS=0.0		AXAREA	41
		GO TO 16		AXAREA	42
45	17	CALL TABL(IA,AREAM,XL(I),AMINUS,DUM,IA)		AXAREA	43
	18	ACROSS(I)=ACROSS-AMINUS		AXAREA	44
		IF(IA1.GE.K) GO TO 23		AXAREA	45
		XL(I+1)=XL(I)+1.0		AXAREA	46
		GO TO 22		AXAREA	47
50	23	XL(K)=XF		AXAREA	48
	22	CONTINUE		AXAREA	49
		RETURN		AXAREA	50
	50	END		AXAREA	51

	SUBROUTINE CPAGNA (MO, TIO, CP, GM)		
	REAL MO		CPAGNA 2
	DIMENSION TT(16), CPT(16), GMT(16)		CPAGNA 3
	DATA TT/100., 250., 500., 600., 700., 800., 900., 1000., 1150., 1300., 1500., 1800., 2000.,		CPAGNA 4
5	1, 2500., 3500., 4500., 4520., /		CPAGNA 5
	DATA CPT/1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, /		CPAGNA 6
	1275., 2867., 2935., 298., 302., 3035., /		CPAGNA 7
	DATA GMT/1, 402, 1, 602, 1, 603, 1, 399, 1, 397, 1, 392, 1, 386, 1, 381, 1, 365, 1, 3		CPAGNA 8
10	15, 1, 329, 1, 315, 1, 305, 1, 298, 1, 293, 1, 282, /		CPAGNA 9
	NCP=16		CPAGNA 10
	GM=1, 4		CPAGNA 11
	SM=10, 4		CPAGNA 12
	DO 5 I=1, NCP		CPAGNA 13
15	GM=GM		CPAGNA 14
	CG=10, 1, 0, 1, 2, /		CPAGNA 15
	TO=TIO/11, 60, 540, /		CPAGNA 16
	CALL TABLELFTI, GM, TO, GM, DUN, NCP, /		CPAGNA 17
	IF (ABS(10-C-GM)/GM) = 0.03, 5, 9, 5		CPAGNA 18
20	5 CONTINUE		CPAGNA 19
6	CALL TABLELFTI, CPT, TO, CP, DUN, NCP, /		CPAGNA 20
	RETURN		CPAGNA 21
	END		CPAGNA 22
			CPAGNA 23

SUBROUTINE PRNOTL (I,PR)

IF (I-900.) 1,1,2

1 PR=.76-.0001*I

GO TO 3

2 IF (I-1400.) 4,4,5

4 PR=.705-.0001*I

GO TO 3

5 PR=.65

3 CONTINUE

RETURN

END

PRNOTL 2
PRNOTL 3
PRNOTL 4
PRNOTL 5
PRNOTL 6
PRNOTL 7
PRNOTL 8
PRNOTL 9
PRNOTL 10
PRNOTL 11
PRNOTL 12

	OVERLAYINRHP,11,11	TRANCL	2
	PROGRAM TRANCL	TRANCL	3
	COMMON /CDPCG/ CPG	TRANCL	4
	COMMON /SMIT/ IS,US,K12,K13,P11,T11,DUM1,K23,N23,NSET,CPC,DUM2	TRANCL	5
5	DUM3,P0P5,M1,M,DUM4,K00L	TRANCL	6
	* DIMENSION A(96),TM(93),LX(181),	TRANCL	7
	MZ(MD),KX(51),XX(180),PS(180),TANOA(180),TISE(180),	TRANCL	8
	3 XMT(3),XMT(3),XP(3)	TRANCL	9
10	COMMON/CC/ NODEM(110),MT(110),LUU,KOOLY	TRANCL	10
	COMMON /LINKS/ HOT(100), NM(20), YMT(20), NODE(2,20), IM, IABC	TRANCL	11
	COMMON X1(1840),PSST(500),TAKOT(1000),RHOT(1000),VGT(1000)	TRANCL	12
	COMMON /PRINT/ PRINT1, PRINT2, PRINT3, PRINT4, PRINT5,	TRANCL	13
	PRINT6, PRINT7, PRINT8, PRINT9, PRINT0	TRANCL	14
15	* INTEGER PRINT1,PRINT2,PRINT3,PRINT4,PRINT5,PRINT6,PRINT7,PRINT8	TRANCL	15
	1,PRINT9,PRINT0	TRANCL	16
	REAL K12,K23 *M2,N23	TRANCL	17
	IJK=1	TRANCL	18
	LEV	TRANCL	19
20	J=1	TRANCL	20
	JU=J	TRANCL	21
	XX11=XX(1M,1)	TRANCL	22
	DO 400 I=1,M	TRANCL	23
	XL=SQRT((XN(1M,I)-XN(1M,I+1))*(XN(1M,I)-XN(1M,I+1)))+(YN(1M,I)-	TRANCL	24
25	YN(1M,I+1))*(YN(1M,I)-YN(1M,I+1)))	TRANCL	25
	LX(I)=XL	TRANCL	26
	L=L+LX(I)	TRANCL	27
	L1=LX(I)	TRANCL	28
	COST=(XN(1M,I+1)-XN(1M,I))/XL	TRANCL	29
30	Z=(YN(1M,I+1)-YN(1M,I))/(XN(1M,I+1)-XN(1M,I))	TRANCL	30
36	DX=X/LX(I)	TRANCL	31
	M=1	TRANCL	32
	DO 401 K=1,LL	TRANCL	33
	J=J+1	TRANCL	34
35	XX(J)=XN(1M,I)+(M*DX+COSTM)	TRANCL	35
	M=M+1	TRANCL	36
	CONTINUE	TRANCL	37
	DO 402 K=1,LL	TRANCL	38
	J=J+1	TRANCL	39
40	YY=Z*(XX(J)-XN(1M,I))+YN(1M,I)	TRANCL	40
	YYV=Z*(XX(J+1)-XN(1M,I))+YN(1M,I)	TRANCL	41
	A(J)=3.14159*DX*(YY+YYV)	TRANCL	42
	XX(J)=YX(J)+XX(J+1))/2.	TRANCL	43
	CONTINUE	TRANCL	44
482	CONTINUE	TRANCL	45
488	CONTINUE	TRANCL	46
45	PS3T=0.0	TRANCL	47
	DO 12 J=1,L	TRANCL	48
	CALL TABLE(IT1,PSGT,YXX(J),PSA(J),DUM,M)	TRANCL	49
	CALL TABLE(IT1,TANOA,XX(J),TANOA(J),DUM,M)	TRANCL	50
50	PS3T=PS3T+PSA(J)	TRANCL	51
	TISE(J)=(TANOA(J)+T11)/2.	TRANCL	52
54	CONTINUE	TRANCL	53
12	CONTINUE	TRANCL	54
	AL=L	TRANCL	55
	PS3AT=PS3T/AL	TRANCL	56
55	PT2E=PT1-(C,25*(PT1-PS3AT))	TRANCL	57
	SMALL=10000.0	TRANCL	58
	DO 70 I=1,L	TRANCL	59
	SMALL=AMIN1(SMALL,PSA(I))	TRANCL	60

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Line	Code	Statement	Address
115	206	CALL PSOLNINAT,XMT,XF,MT,DUM,31	116
		M=MT	117
		PIZE=PI-(IK12/SIGM12)*(M*N12)	118
		LL=1	119
		GO TO 13	120
120	22	DO 10 J=1,L	121
		CALL TABLE(IT1,MOT,XMT(J),HGO,DUM,M1)	122
		CALL TABLE(IT1,MOT,XXX(J),HGO,DUM,M1)	123
		CALL TABLE(IT1,MOT,XXX(J),HGO,DUM,M1)	124
		STO=HGO/(HMO*VG*GPC*3600.)	125
		IF(M7(J)) 173,170,171	126
125	172	IF(M7(J)) 173,170,171	127
		IF(M7(J)) 173,170,171	128
		GO TO 36	129
		F=(M2(J)/(A(J)*POSS)/(RHO*VG)	130
		Z=Z/F/STO	131
		F=53*(10.5*Z2)+(0.5*Z2)*1.-8.5*Z2	132
		ETIA=(F*HGO*(A(J)/(M7(J))*GPC*144.*3600.)	133
		ETIA=(ETIA*(144*(A(J)*Z2)/(ETIA+1.))	134
		CONTINUE	135
		IF(ILL-21) 24,25	136
		LL=1	137
		DO 35 J=1,L	138
		TY3E(J)=(TM(J)+T3E(J))/2.	139
		CONTINUE	140
		M=MT	141
		KX=1	142
		LL=3	143
		KK=0	144
		IF(MSET=0) 13,13,451	145
		IF(MPRINTS=0) 13,13,451	146
		FORMAT(I1,/,23,/,21)TRANSPIRATION COOLING,/,27,/,28)SURFACE NO.,*12	147
		FORMAT(I1,/,23,/,21)TRANSPIRATION COOLING,/,27,/,28)SURFACE NO.,*12	148
		CALL VERBIA,PM,LANODE,M,IN,PRINTS)	149
		IF(MPRINTS=0) 13,13,451	150
		FORMAT(I1,/,22,/,22)TOTAL COOLANT FLOW IS ,F6,2,6M (LB/SEC.)	151
		IF(MPRINTS=0) 13,13,451	152
		FORMAT(I1,/,22,/,22)TOTAL COOLANT FLOW IS ,F6,2,6M (LB/SEC.)	153
		CALL FLOWNOPIZE,PS3A,XX,L,KCOLL	154
		CONTINUE	155

		SUBROUTINE SETFLO(IJK,L,PS3MIN,MT,UA,CPC,TT1,TS,PTZE,TTZE,K23,N23, 1A,PSJA,NZ,FR,TTZE) DIMENSION MT1(16),PTZE(16),PSJA(1),A(1),TTZE(1),WZ(60) REAL K23,N23 J=1 K=1 MT=0 TZ=EXP(UA/MT)*CPC*(600.1) TTZE=TS-(TTTS-TT1)/TZ PTZE=PSJA(1) PTZE=PTZE*(1./J) MT1=0 IF(IJK-2) 40,61,81 DO 100 I=1,L TZ=PSJA(1)/PTZE IF(I77-1) 101,102,102 WZ(1)=0 GO TO 103 101 SQ4CH=12./(K23-1.1)*(177*(11.-K23)/K23)-1.1 ZA=(PTZE*A(I)*N23*144.0)/SORT(TTZE) WZ=11.+(11*(K23-1.1)/2.1)*SQ4CH)**(11*(K23-1.1) WZ(1)=SORT(132.174*K23*SQ4CH)/IRR*Z(61)*ZA MT1=MT1+WZ(1) CONTINUE GO TO 110 100 DO 51 I=1,L IF(PTZE-PSJA(1)) 51,51,52 MOA=0 GO TO 53 51 S12N23=117.6415*PSJA(1)/(1172E*TTZE(1)) MOA=(S12N23*(PTZE-PSJA(1))/K23)*(1./H23) WZ(1)=(MOA*MT1)/144.0 MT1=MT1+WZ(1) CONTINUE IF(ABS(MT-WT1)-.01) 55,55,56 IF(ABS(J1)-101.5750155 MT=MT+1 MT1(MT)=MT PTZE(MT)=PTZE IF(MT-WT1) 58,55,59 IF(ABS(J1)-101.60,61,60 IF(ABS(J1)-1) 63,63,5 J=J-3 GO TO 5 K=1 IF(MT-4) 5,64,64 IF(K-1) 5,65,65 CALL TABLE(MT1,PTZE,MT,PTZE,DM,MT) J=1 GO TO 6 59 IF(ABS(J1)-101.65,5,66 65 IF(ABS(J1)-1) 5,5,67 J=J+6 GO TO 5 55 RETURN END	2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57
--	--	---	--

2=7,30X, (SUBROUTINE FILMCL1=)		
	KOOL=0	FILMCL 59
68	GO TO 999	FILMCL 61
933	IF(MSET=0.0) 450,453,451	FILMCL 62
451	CALL SETFLOIDJ(N,SMALL,MSET,UA,CPC,TT1,TS,PT,TC,GAMMA,CDX,A,PS,	FILMCL 63
	1N2,R3,X11	FILMCL 64
	MT=MSET	FILMCL 65
65	GO TO 285	FILMCL 66
	N=1.	FILMCL 67
458	KM=0	FILMCL 68
	L1L=9	FILMCL 69
	KKA=2	FILMCL 70
70	KKA=0	FILMCL 71
	ZE=EXP(UA/(M*CPC*3600.0))	FILMCL 72
13	TC=TS-((TS-TT1)/ZE)	FILMCL 73
	SIGM12=(70.55*PT1)/(TC*TT1)	FILMCL 74
	WT=(SIGM12*(PT1-PT)/K12)**(1./N12)	FILMCL 75
75	IF(KKA=0) 51. 01 50 TO 237	FILMCL 76
	KKA=1	FILMCL 77
	M=MT	FILMCL 79
	GO TO 13	FILMCL 79
237	MTT=0.0	FILMCL 80
88	DO 202 I=1,N	FILMCL 81
	ZZ=PS(I)/PT	FILMCL 82
	IF(ZZ-1.) 300,381,301	FILMCL 83
381	NZ(I)=0.0	FILMCL 84
	GO TO 302	FILMCL 85
85	SQMACH=(2./(GAMMA-1.))*(ZZ**((1.-GAMMA)/GAMMA))-1.1	FILMCL 86
	ZA=(PT*AL1)*CDX*144.01/SQRT(TC)	FILMCL 87
	ZB=11.+(1/(GAMMA-1.))*(2.-SQMACH)**((1-GAMMA)/GAMMA)-1.1	FILMCL 88
	N7(I)=SQRT((32.174*GAMMA*SQMACH)/(RR*ZB))**ZA	FILMCL 89
302	MTT=ATT*N7(I)	FILMCL 90
282	CONTINUE	FILMCL 91
98	IF(L1L) 180,180,205	FILMCL 92
	KM=KM+1	FILMCL 93
188	IF(KM-3) 181,181,182	FILMCL 94
182	KM=1	FILMCL 95
95	KMT(KM)=MT	FILMCL 96
	KMT(KM)=MTT	FILMCL 97
	PT(KM)=PT	FILMCL 98
	IF((ABS(KMT-MTT))-0.1) 205,205,185	FILMCL 99
185	IF(KK) 402,402,400	FILMCL 100
402	IF(MTT-MT) 400,40,60	FILMCL 101
60	MTMAX=(SIGM12*(PT1-SMALL)/K12)**(1./N12)	FILMCL 102
	IF(MTT-MTMAX) 401,401,61	FILMCL 103
61	MTT=MTMAX	FILMCL 104
481	N=0.25*MTT+.75*MT	FILMCL 105
105	PT=PT1-((K12/SIGM12)*(N**N12))	FILMCL 106
	GO TO 13	FILMCL 107
480	PCR=1.1	FILMCL 108
805	PT=XP(KM)+PCR	FILMCL 109
	IF(PT .LT. PT1) GO TO 804	FILMCL 110
	PCR=PCR/10.0	FILMCL 111
110	GO TO 405	FILMCL 112
	KK=KK+1	FILMCL 113
884	N=(SIGM12*(PT1-PT)/K12)**(1./N12)	FILMCL 114
	IF(KK-2) 13,13,405	FILMCL 115

115	485	IF(MTI-MT) 13,13,106	FILMCL	116
	486	CALL PSOLW(XMT,XMTI,XD,MT,DU,M,3)	FILMCL	117
		M=MT	FILMCL	118
		PT=PT1-(K12/5.0M2)*(M**N22)	FILMCL	119
		LL=1	FILMCL	120
120		GO TO 13	FILMCL	121
	285	RH01=(144.*PT)/(R*TC)	FILMCL	122
		DO 3 I=1,N	FILMCL	123
		LL=0	FILMCL	124
		IF(V2(I).LE.0.1) GO TO 601	FILMCL	125
		RH05=RH01*(PS(I)/PT)**1./GAMMA(I)	FILMCL	126
125		WC=Z(I)/(A(I)*RH05)	FILMCL	127
		CALL TABLE(X1,XVC,XL(I),V,DU,M,K)	FILMCL	128
		IF(V2-VOL,4,5	FILMCL	129
		FV=1.+4.*AFAN(WG/VCI-1.0)	FILMCL	130
130		GO TO F	FILMCL	131
		FV=(V3/WG)**41.5*(WG/C)-1.01	FILMCL	132
		PAR12=1.+(R-R05)*C*OPC*511W,11/360R,1	FILMCL	133
	681	DO 11 K=1,N	FILMCL	134
		IF(ILL-0) 20,21,60	FILMCL	135
135		JA=1	FILMCL	136
		GO TO 22	FILMCL	137
	20	JA=2	FILMCL	138
		TRG(K,1)=TRG(K-1,3)	FILMCL	139
	22	DO 7 J=1,9	FILMCL	140
		XX=XL(KD)+X(K,J)*COSTH(K)	FILMCL	141
		CALL TABLE(X1,XMG,XR,MG,DU,M,K)	FILMCL	142
		IF(I-1) 6,9,8	FILMCL	143
		CALL TABLE(X1,XTRG,XR,TRG,DU,M,K)	FILMCL	144
		TRG5=TRG	FILMCL	145
		GO TO 25	FILMCL	146
145		TRG6=TRG(K,J)	FILMCL	147
	8	IF(JA-1) 27,26,27	FILMCL	148
	25	XX=X(I,J)	FILMCL	149
		GO TO 10	FILMCL	150
150	27	XX=(X-XL(I))/COSTH(K)	FILMCL	151
	18	IF(M2(I)-0.0) 602,602,683	FILMCL	152
	602	TRG6=TRG6	FILMCL	153
		GO TO 604	FILMCL	154
	683	PAR11=(TRG6/TC)**0.6667	FILMCL	155
155		PAR13=PAR11*PAR12*FV	FILMCL	156
		TRG6=11TC-TRG6/11.0*3.6*(PAR13*XX*HQ11)+TRG6	FILMCL	157
	696	TRG(K,J)=TRG6	FILMCL	158
		IF(K-1)7,12,7	FILMCL	159
	12	TRG6=TRG6	FILMCL	160
160		R(I)=((X-XL(I))*(YU(I,M,1+J)-VL(I)))/(XU(I,M,1+J)-VL(I))	FILMCL	161
	7	CONTINUE	FILMCL	162
		IF(K-1) 11,15,11	FILMCL	163
	16	LL=1	FILMCL	164
		DO 14 M=1,8	FILMCL	165
165		LL=1	FILMCL	166
		DVA(L)=PIF*DX(I)*(R(M)*R(M+1))	FILMCL	167
		TA(I,1)=11TRG6/11.0*TRG6(I,M+1)/2.0	FILMCL	168
	14	CONTINUE	FILMCL	169
	11	CONTINUE	FILMCL	170
170	3	DO 5 J I=1,M,N	FILMCL	171
			FILMCL	172

175	LXLX(1)=LX(1M,I)*8	FILMCL	173
582	CONTINUE	FILMCL	174
	FORCE=0.0	FILMCL	175
	SEC1=(GAMMA-1.0)/GAMMA	FILMCL	176
	SEC2=((R*Y1)/(32.174*166.0)	FILMCL	177
	DO 720 I=1,N	FILMCL	178
	PRATE=(PS11)/PT 1)*SEC1	FILMCL	179
	FORCE=FORCE+((CNZ(1)*WZ(1))/(AI1)*PS(11))*SEC2*PRAT*COSTH(11)	FILMCL	180
180	CONTINUE	FILMCL	181
780	IFIPRINTS .GT. 0) WRITE(6,733) IABC	FILMCL	182
731	FORMAT(1H1,/,20X,12H FILM COOLING,/,27X,12H SURFACE NO. ,I2,/)	FILMCL	183
	CALL AVEP(CXA,FAT1,LXLX,MODE,MN,IN,PRINT5)	FILMCL	184
	IFIPRINTS .GT. 0) WRITE(6,160) WY	FILMCL	185
185	FORMAT(//,22X,22H TOTAL COOLANT FLOW IS ,F6,2,0H LB/SEC,1	FILMCL	186
	IFIPRINTS .GT. 0) WRITE(6,165) PT	FILMCL	187
165	FORMAT(//,20X,26H TOTAL COOLANT PRESSURE IS ,F6,2,0H LB/SQIN,1	FILMCL	188
	IFIPRINTS .GT. 0) WRITE(6,735) FORCE	FILMCL	189
785	FORMAT(//,13X,12H TOTAL RESULTANT SLOT COOLANT MOMENTUM FLUX IS "	FILMCL	191
190	1F7,2,0 LB,1	FILMCL	192
	CALL FLOWNC(PT,PS,XL,N,KOOL)	FILMCL	193
	PS11= FORCE	FILMCL	194
	999 CONTINUE	FILMCL	195
	END		


```

      ASI(J) = 3.14159*(R(IW,J)-SH(IW,J)*COS(ANG(J)*(RIW,J+1))*SL(J)
      ASI = ASI + ASI(J)
      DO 71 I=1,NM1
        REN(I) = ALOG(REN(I))
        FL(I) = ALOG(FL(I))
        WPL(I) = ALOG(WPL(I))
      71 * * * COCLANT FLOW BALANCE * * *
      M1=1
      PMAX=PS(I1)
      PMIN=PS(I1)
      DO 262 I=2,N
        IF(PS(I1)-PMIN) 265,263,261
        IF(PS(I1)-PMAX) 262,262,264
      265 PMIN=PS(I1)
      263 IF(PS(I1)-PMAX) 262,262,264
      264 PMAX=PS(I1)
      262 CONTINUE
      IF(PS(I1)-GT,0.01) GO TO 1300
      IF(PI,LT,PMIN) GO TO 203
      IF(PI,LT,4) GO TO 275
      DO 271 J=1,N2
        SH(IW,J) = SH(IW,J+1)
        KS(IW,J) = KS(IW,J+1)
      271 KS(IW,J) = KS(IW,J+1)
      275 K=1
      M=0
      L=1
      J=1
      * * * SOURCE FLOW PRESSURE-FLOW BALANCE * * *
      IF(PS(I1)-GT,0.1) GO TO 219
      IF(PI,GT,1) GO TO 201
      KKK=J
      M=10
      PI2(I1)=PI1-0.2*(PI1-PMIN)
      201 M=M+3
      KKK=KKK+1
      IT2=IS-(IS-IT1)/EXP(UAS/(864.0*MA))
      SI2=SI*(SI*(PI1+PI2(J))/(IT1+IT2))
      M3=(SI2*(PI1-PI2(J))/(K12)*0.1)/N12
      CX=(I49-MA)/M3
      IF(I49STCK)-01) 204,204,202
      202 IF(KKK,LT,20) GO TO 201
      207 WRITE (6,117)
      STOP
      100 213 WRITE(6,116)
      MTC=0
      GO TO 70
      214 MTC(J)=M3
      KKK=J
      105 MAXX=(SI2*(PI1-PMIN)/K12)*0.1/N12
      * * * DISCHARGE PRESSURE-FLOW BALANCE * * *
      254 MCT(J)=0.0
      DO 225 I=1,N2
        K1=J
        IF(PI2(J)-PS6(I)) 206,206,207
      206 MCT(I)=0.0
      IF(M1,EO,1) TSS(I)=T12
      GO TO 213

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115	207 IF(M1-1) 208,209,209	CONFIRM	116
	208 IF(K-1) 210,210,209	CONFIRM	117
	210 MCO=WT(J)*AS(I)/AST	CONFIRM	118
	TS5(I) = Y12	CONFIRM	119
	GO TO 211	CONFIRM	120
121	209 IF(WCII,GI,0,00W1) GO TO 256	CONFIRM	121
	WCII = 0.1	CONFIRM	122
	256 MCO=WC(I)	CONFIRM	123
	211 S5=35.31*PS6(I)/TS5(I)	CONFIRM	124
125	255 FM=MCO*SORT(TT2)/(AHX(I)*AP*PT2(J))	CONFIRM	125
	K1J=K10+1	CONFIRM	126
	CALL TABLE(MCF1,MN1,FM,MN,QU,MN3)	CONFIRM	127
	TR=1/(1+.2*MN**2)	CONFIRM	128
	PR=TR**3.5	CONFIRM	129
	PEN=ALCG(51840C,HD*MCO/(AHX(I)*.0005336*(TT2*Y12)**.70411)	CONFIRM	130
130	IF(PEN,GT,FENL(MN1)) REN=REN(MN1)	CONFIRM	131
	IF(PEN,LT,FENL(I)) REN=REN(I)	CONFIRM	132
	CALL TABLE(PEML,FL,PEN,FF,QU,MN1)	CONFIRM	133
	MY=SL(I)*Y12*TR*EXPIFF(13.621*MO*PT2(J)*PR*(AHX(I)*AR)**2)	CONFIRM	134
135	WCII=SO*Y12*PT2(J)*PS6(I)/(HMF+K5(MN,II/S5))	CONFIRM	135
	CK=WC(I)*WCII/MC(I)	CONFIRM	136
	IF(M3SICK)-.005) 213,213,261	CONFIRM	137
	MCO = MC(I)	CONFIRM	138
	261 MCO = MC(I)	CONFIRM	139
	IF(XIC-20) 255,307,307	CONFIRM	140
140	213 MCT(I) = MCT(J)+MC(I)	CONFIRM	141
	205 CONTINUE	CONFIRM	142
	IF(K-2) 214,214,215	CONFIRM	143
145	214 CK=(MCT(J)-WT(J))/MCT(J)	CONFIRM	144
	IF(M3SICK)-0.003) 215,215,216	CONFIRM	145
	216 IF(MSET,GT,0.0) GO TO 218	CONFIRM	146
	IF(K-1) 220,220,221	CONFIRM	147
	220 K=2	CONFIRM	148
	IF (MCT(J)-WT(J)) 222,222,223	CONFIRM	149
	222 LO=2	CONFIRM	150
	GO TO 224	CONFIRM	151
150	223 LO=1	CONFIRM	152
	234 IF (MCT(J)-WMAX) 224,224,225	CONFIRM	153
	224 M9=14*Y12*(J)/2.	CONFIRM	154
	GO TO 235	CONFIRM	155
155	225 M9=14*Y12*(J)+WMAX)/2.	CONFIRM	156
	235 J=J+1	CONFIRM	157
	IF(J-4) 226,227,227	CONFIRM	158
	227 GO 228 JJ=1,2	CONFIRM	159
	WT(JJ)=WT(JJ+1)	CONFIRM	160
	PT2(JJ)=PT2(JJ+1)	CONFIRM	161
160	228 MCT(JJ)=MCT(JJ+1)	CONFIRM	162
	J=3	CONFIRM	163
	226 IF(LL,GT,1) GO TO 240	CONFIRM	164
	PT2(JJ)=PT1-K12*(M8*M12)/S12	CONFIRM	165
	GO TO 201	CONFIRM	166
165	240 PT2(JJ)=PT2(JJ-1) + 7	CONFIRM	167
	IF(PT2(J),LT,P11) GO TO 231	CONFIRM	168
	Z=Z/1.0	CONFIRM	169
	GO TO 240	CONFIRM	170
170	221 IF (LO-1) 229,229,230	CONFIRM	171
	229 IF(MCT(J)-WT(J)) 231,231,232	CONFIRM	172
	232 IF(LL-1) 234,234,235	CONFIRM	173

233	IF(LJ-3) 231,236,236	CONFIRM	173
236	DO 933 JA=313	CONFIRM	174
	MT50(JA)=MT(JA)	CONFIRM	175
175	MT53/JA=MT(JA)	CONFIRM	176
933	PS(JA)=PT2(JA)	CONFIRM	177
	CALL PSOL(MT50,MT53,PSA,PSB,PS3)	CONFIRM	178
	PT2(J)=P	CONFIRM	179
	K=3	CONFIRM	180
180	GO TO 254	CONFIRM	181
	Z=C+1	CONFIRM	182
231	LL=2	CONFIRM	183
	Z=C+1	CONFIRM	184
	M=MT(J)	CONFIRM	185
185	GO TO 235	CONFIRM	186
230	IF (LL-1) 237,237,238	CONFIRM	187
237	IF(LJ-1) KCF(J)=1 238,239,224	CONFIRM	188
239	LL=2	CONFIRM	189
	Z=C+1	CONFIRM	190
	M=MT(J)	CONFIRM	191
190	GO TO 235	CONFIRM	192
239	IF(LJ-1) KCF(J)=1 235,235,241	CONFIRM	193
241	IF(LJ-3) 235,236,236	CONFIRM	194
243	IF(LJ-1) 242,242,243	CONFIRM	195
	MT(J)=MCT	CONFIRM	196
195	IF(LJ-1) KCF(J)=1 242,242,243	CONFIRM	197
	PT2(J)=PRAX+1	CONFIRM	198
240	GO TO 254	CONFIRM	199
242	K=2	CONFIRM	200
245	IF(MCT(J)-MSET) 244,244,245	CONFIRM	201
245	LO=2	CONFIRM	202
	Z=J+249	CONFIRM	203
246	IF(J-EO,4) GO TO 267	CONFIRM	204
	J=J+1	CONFIRM	205
205	GO TO 269	CONFIRM	206
267	DO 269 I=2,4	CONFIRM	207
	MCT(I)=13	CONFIRM	208
268	PT2(I)=PT2(I)	CONFIRM	209
269	MT(J)=MSET	CONFIRM	210
210	PT2(J)=PT2(J-1)+2	CONFIRM	211
	GO TO 254	CONFIRM	212
245	LO=1	CONFIRM	213
	Z=J+249	CONFIRM	214
215	GO TO 246	CONFIRM	215
243	IF(LJ-1) 247,247,248	CONFIRM	216
247	IF(MCT(J)-MSET) 249,249,250	CONFIRM	217
249	LL=2	CONFIRM	218
	Z=C+1	CONFIRM	219
220	GO TO 246	CONFIRM	220
250	IF(LJ-1) 246,246,251	CONFIRM	221
251	IF(MCT(J)-MSET) 250,250,252	CONFIRM	222
252	IF(LJ-1) 251,251,252	CONFIRM	223
253	IF(LJ-1) 253,253,270	CONFIRM	224
254	IF(LJ-1) 253,253,270	CONFIRM	225
255	LL=2	CONFIRM	226
256	Z=C+1	CONFIRM	227
257	GO TO 246	CONFIRM	228
258	IF(LJ-1) 258,258,259	CONFIRM	229

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238      DO 257 I=1,N
          JJ = 5-I
          TA(I)=WCT(JJ)
257      A(I)=PT2(JJ)
          DO 258 I=1,N
              WCT(I)=TA(I)
235      258 PT2(I)=A(I)
          259 CALL TABLE(MCT,PI2,HSET,P,DUM,N)
              PT2(I)=P
              K=3
              GO TO 254
240      255 WCT(I)=MCT(J)
              PT2(I)=PT2(J)
              DO 242 J=1,M
                  DO 241 I=1,INC
245      241 TG(J,I) = TG(J,I)
                  242 CONTINUE
                      MYE=0
                      DO 21 J=1,NC
                          IF(MC(J).GT. 0.0003) GO TO 295
                      DO 296 I=1,INC
                          296 TM(J,I)=TG(J,I)
                          GO TO 21
295      ASHX=SVHX*AMX(J)*SL(J)/12.
                          CALL TABLE(M1,MG1,XIM,J),MG,DUM,MN4)
                          KKS = 0
                          C * * * BRANCH FOR TYPE CONFIGURATION - PARALLEL OR COUNTERFLOW * * *
                          IF (MTC=1) 2,3,3
                          C * * * PARALLEL FLOW THERMAL ANALYSIS * * * * *
                          3 TC(J,I) = TCS
                          IF(J.GT.1) GO TO 4
                          IF(J,1) = TG(J,1)
                          4 SX=0.0
                          DO 7 I=2,INC
                              VIS = 0.005536*TC(J,I-1)**.7861
                              REN=ALOG(518400./WD*MC(J)/VIS)*AMX(J)*AR(I)
                              IF(IPEN.GT.PENL(MN3)) REN=RENL(MN3)
                              IF(IPEN.LT.PENL(1)) REN=RENL(1)
                              CALL TABLE(REN,MXP,DUM,MN3)
                              CALL PRDTH(TC(J,I-1),PR)
                              MHX=.24*MC(J)*EXP(MHXPI)/(AMX(J)*AR*(PR)**.6667)
                              UA = 1./((1/(MHX*AEFF*ASHX)) + 518400./((MG*AS(J))))
                              C=UA*OSL(J)/(.24*SL(J)*MC(J))
                              IF(J.GT.1) GO TO 10
                              TFC(J,I) = TG(J,I)
275      10 TFB = (TFC(J,I)+TFC(J,I-1))/2.
                              TC(J,I) = TFB-(TFB-TC(J,I-1))/(EXP(DI))
                              TM(J,I) = UA*(TFC(J,I)/(MHX*AEFF*ASHX)+518400./((MG*AS(J))))
                              IF(I.GT.2) GO TO 7
                              TM(J,I)=UA*(TFC(J,I)/(MHX*AEFF*ASHX)+518400./((MG*AS(J))))
                              7 CONTINUE
                              IF(MC.GT.J) GO TO 8
                              IF(M.GT.MC) GO TO 8
                              ANG(J,I) = 0.0
285      8 ACD= 78310*(PI(M,J)-.5*SH(M,J))*COS(ANG(J,I-1))*SH(M,J)
                              TFC(J,I)=TFC(J,I-1)/1.93*ACD*PS(J)
                              MCF=MC(J)*CONT(TFC(J,I-1))/1.93*ACD*PS(J)

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345      UA = 1./I1/(IMX*AEFF*ASHX) + 510400./(HGP*AS(J))
      C = UA*DSL(J)/I1.24*SL(J)*WC(J)
      TC(J,I)=TFB - (TFB-TC(J,I-1))*EXP(C)
      19  TC(J,I) = UA*(TF(J,I)/(IMX*AEFF*ASHX) + 510400./(HGP*AS(J)))
      DTCS = TC(J,INC)-TCS
      KKK = KKK + 1
      IF (ABS(DTCS) - J.123.23.24
350      TF(J,I) = TC(J,I) - .0*DTCS
      TC(J,I) = TC(J,I)
      IF (KKK-20) 25,62,62
      62  WRITE (6,101)
      STOP
355      23  TMI(J,I) = TF(J,I)
      TC(J,INC) = TCS
      IF (N-J) 21,21,41
      41  SXX = SX
      JJ = J+1
      DO 34 M=JJ,M
360      SXX = SXX - DSL(M)
      DO 34 K = 1,INC
      SXX = SXX + DSL(M)
      EFF = 1./I1.43.5*5XX*(TG(M,K)/(TF(J,I))*.6667*FY*CC)
365      34  TG(M,K) = TG(M,K) - EFF*(TG(M,K) - TF(J,I))
      21  CONTINUE
      M2=5*NC
      IF (MTC,LT,4) GO TO 293
      JK3=1
      JK2=NC
      GO TO 294
      293  JK3=2
      JK2=NC+1
      294  IF (M1-1) 273,273,276
      276  DO 272 I=JK1,JK2
      IF (ABS(TF(I,1)-TCX(I,1))-5.1 272,272,273
      272  CONTINUE
      GO TO 283
      273  M1=M1+1
      DO 274 I=JK1,JK2
      274  TCX(I)=TF(I,1)
      IF (M1-M2) 279,279,288
      279  GO TO 275
      280  WRITE (6,101)
      STOP
      385      283  IF (MTC-4) 35,13,13
      35  IF (MTC-EO,N) GO TO 36
      TMIN,1) = TM (N-1,INC)
      DO 37 K=2,INC
      37  TMIN,K) = TG(M,K)
      GO TO 36
      13  IF (MTC-EO,N) GO TO 36
      DO 6 I=1,INC
      6  TMIN,I)=TF(M,I)
      395      C * * * SURFACE TEMPERATURE AVERAGING * * * * *
      36  K = INC - 1
      DO 17 J=1,M
      TSUM=C.C
      DO 15 I=2,K

```

400	18	TSM=TSUM+T*(U,I)+R*(M,J+1)+SL*(J)-DSL*(J)*I-1)*SIN(ANG(J))	CONF.LM	401
		T*(M(J)+1)+R*(M,J)+SL*(J)-DSL*(J)*I-1)*SIN(ANG(J))	CONF.LM	402
		T*(M(J)+1)+R*(M,J)+SL*(J)-DSL*(J)*I-1)*SIN(ANG(J))	CONF.LM	403
		A(J)=SL*(J)+R*(M,J+1)+SL*(J)*SIN(ANG(J))/2.*6.28	CONF.LM	404
405	17	T*(M(J)+1)+R*(M,J)+SL*(J)-DSL*(J)*I-1)*SIN(ANG(J))	CONF.LM	405
		I*(P*INIS-6T, 0) *M*IE(6,104) I*PC	CONF.LM	406
	186	FORMAT(IH,/,23X,23HCONVECTION-FILM COOLING,27X,12H5U-FACE NO. ,	CONF.LM	407
		A12,/) /	CONF.LM	408
		DO 410 1=1,M	CONF.LM	409
410	433	LCN(I)=L*(I,M,1)	CONF.LM	410
		CALL AVER(4,1A,LCN,MODE,MAB,IM,PRINT9)	CONF.LM	411
		I*(P*INIS-6T, 0) *M*IE(6,104) M*IE(11,121211),M	CONF.LM	412
	105	FORMAT(I/,22X,22H100% COOLANT FLOW IS ,F6.2,8H LB/SEC.	CONF.LM	413
	2	/,20X,20H100% COOLANT PRESSURE IS ,F5.2,9H LB/SQIN.	CONF.LM	414
	3	/,13X,13H100% TIDAL RESULTANT SLOT COOLANT MOMENTUM FLUX IS ,	CONF.LM	415
415		F57.2,7 LE,7)	CONF.LM	416
		PSI(M)=M	CONF.LM	417
		DO 431 1=1,M	CONF.LM	418
		T*(M(J)+1)+R*(M,J)+SL*(J)-DSL*(J)*I-1)*SIN(ANG(J))	CONF.LM	419
420	434	M*(I)=M*(I,M,1)	CONF.LM	420
		I*(P*INIS-6T, 0) *M*IE(6,104) M*IE(11,121211),M	CONF.LM	421
		DO 436 1=1,M	CONF.LM	422
	436	PSI(I)=I*(I,M,1)	CONF.LM	423
	433	CALL FLOW(1,2,11,PSI,M,1,M,NIC)	CONF.LM	424
	72	CONTINUE	CONF.LM	425
425		END	CONF.LM	426

SUBROUTINE PRND11 (T,PR)

IF (T-900.1) 1,1.2

1 PR=.76-.0001*T

GO TO 3

2 IF (T-1400.1) 4,4.5

4 PR=.705-.00004*T

GO TO 3

5 PR=.65

3 CONTINUE

RETURN

END

PRND11 2
PRND11 3
PRND11 4
PRND11 5
PRND11 6
PRND11 7
PRND11 8
PRND11 9
PRND11 10
PRND11 11
PRND11 12

	OVERLAYIRNO,11,N1	CALFOR	2
	PROGRAM CALFOR	CALFOR	3
	COMMON/ALL/ H,NM,NM,ISURF(50),NODE(55),JSURF(5,20),X(15),NTOT(1,	CALFOR	4
5	NO,NPID(1), AREA(80)	CALFOR	5
	COMMON /LINK6/ A(11100), K(12,20), VM(2,20), LX(2,20), IM, IXBC	CALFOR	6
	COMMON /KOC/ KOC(12)	CALFOR	7
	COMMON /RAB/ NODE(15(50),FT(150),LUI	CALFOR	8
	COMMON /CCG/ FS(2)	CALFOR	9
	FORCE=0.0	CALFOR	10
10	J=1	CALFOR	11
	WRITE(6,1)	CALFOR	12
	FORMAT(14,1,7,20X,"SYSTEM SURFACE FORCE FACTORS"/,7,20X,"NODE NO,"	CALFOR	13
	1,15X,"FORCE FACTOR (LB,")	CALFOR	14
15	FORMAT(23,12,21X,F9.3)	CALFOR	15
	LINE=6	CALFOR	16
	DO 5 I=1,LUI	CALFOR	17
	IF(I,FO, NODE(15(I)) GO TO 10	CALFOR	18
	CONTINUE	CALFOR	19
20	IF(LINE,50,59) GO TO 3	CALFOR	20
	WRITE(6,2) NODE(15(I),FT(11)	CALFOR	21
	FORCE=FORCE+FT(11)	CALFOR	22
	J=J+1	CALFOR	23
	LINE=LINE+1	CALFOR	24
25	IF(J,GT,LUI) GO TO 58	CALFOR	25
	GO TO 7	CALFOR	26
	WRITE(6,11)	CALFOR	27
	LINE=6	CALFOR	28
	GO TO 11	CALFOR	29
	DO 61 K=1,NM	CALFOR	30
	IF(KO,L(K),GT,1) GO TO 51	CALFOR	31
	CONTINUE	CALFOR	32
	GO TO 70	CALFOR	33
	FORMAT(16,"COOLANT SLOT DISCHARGE FLOW FACTOR")	CALFOR	34
	WRITE(6,N)	CALFOR	35
35	DO 65 K=1,IM	CALFOR	36
	WRITE(6,3) FS(K)	CALFOR	37
	FORMAT(45X,F9.3)	CALFOR	38
	FORCE=FORCE+FS(K)	CALFOR	39
	WRITE(6,9) FORCE	CALFOR	40
40	FORMAT(15,"TOTAL NET SURFACE FORCE FACTOR",BY,F9.3)	CALFOR	41
42	END	CALFOR	42

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OVERLAY(XRHP,11,3)
PROGRAM HOTPT
COMMON XL(100),ACROSS(80),
1YLI( 80),YLC( 80),PPI(50),AA(150),XMM1(150),XMM2(150),TRS(150),
2DEMP1(150),VPP(150),TRP(150),DEMS1(150),VSS(150),PT(100),
3XMSI( 80),ISI( 80),DENSE( 80),VSI( 80),XMPI( 80),TPI(100),
4DEMP(100),VPT(100),L,LL
COMMON/ALL/ N,MN,NN,XSURF(50),MODE(50),JSURF(5,2),XF(5),XTOTA,
NOP,NP(10), AREA(80)
COMMON /LINK6/ MII(100), YN(2,20), YN2(20), LY(2,20), IW, IABG
COMMON /PRINT/ PRINT1, PRINT2, PRINT3, PRINT4, PRINT5, PRINT6, PRINT7, PRINT8
COMMON /MOT/ AT,CF(100),CHIA(5),CTHIA(5),FFT,FPAT,MGAT,MIA(5,2),
1ICS,ICSUFF(5),II,IKJ,ISTREM(5),KK(5),KCSURF(5),MODEN(5,20),M1,M2,
2PTP,PTS,THETA(5,2),TTP,TTT,XF1,XI(5),YU1(20),YU2(20),X11(60),
3YU1(20),YU2(20),Y11(20),I,KAI(5,2)
INTEGER PRINT1,PRINT2,PRINT3,PRINT4,PRINT5,PRINT6,PRINT7,PRINT8
1,PRINT9,PRINT0
IF(XI(1,1)) 31,31,32
IF(II-1) 33,33,34
31 CALL MEAT(XI(1,1),XF(1),TTT,PTS,THETA(1,1),MIA(1,1),YL,Y11,XMST,
33 1TST,CTHETA,CHIA,X11,Y11,MT11,IKJ, ISTREM(1),JSURF(1,1),
2IGSURF,ICS,PRINT2,II,CF(1)
CALL AVERMT(X11,Y11,MT11,YU1,YU2,ICS,ICSURE,M1,IKJ,JSURF(1,1),
1KSURF,MODEN,MN,PRINT3,MGAT,AT)
IF(PRINT0 .EQ. 0) GO TO 850
CALL AVERF(X11,Y11,CF(1),YU1,YU2,ICS,ICSURE,M1,IKJ,JSURF(1,1),
1KSURF,MODEN,MN,XMST,PT,1,4,II,FPAT,FFT)
GO TO 850
31 34 CALL MEAT(XI(1,1),XF1 ,TTT,PTS,THETA(1,1),MIA(1,1),YL,Y12,XMST,
1TST,CTHETA,CHIA,X11,Y11,MT11,IKJ, ISTREM(1),JSURF(1,1),
2IGSURF,ICS,PRINT2,II,CF(1)
CALL AVERMT(X11,Y11,MT11,YU2,YU2,ICS,ICSURE,M2,IKJ,JSURF(1,1),
1KSURF,MODEN,MN,PRINT3,MGAT,AT)
IF(PRINT0 .EQ. 0) GO TO 850
CALL AVERF(X11,Y11,CF(1),YU2,YU2,ICS,ICSURE,M2,IKJ,JSURF(1,1),
1KSURF,MODEN,MN,XMST,PT,1,4,II,FPAT,FFT)
GO TO 850
32 35 IF(II-1) 35,35,360
CALL MEAT(XI(1,1),XF(1),TTP,PTP,THETA(1,1),MIA(1,1),YL,Y11,XMPI,
1TPI,CTHETA,CHIA,X11,Y11,MT11,IKJ, ISTREM(1),JSURF(1,1),
2IGSURF,ICS,PRINT2,II,CF(1)
CALL AVERMT(X11,Y11,MT11,XU1,YU1,ICS,ICSURE,M1,IKJ,JSURF(1,1),
1KSURF,MODEN,MN,PRINT3,MGAT,AT)
IF(PRINT0 .EQ. 0) GO TO 850
CALL AVERF(X11,Y11,CF(1),XU1,YU1,ICS,ICSURE,M1,IKJ,JSURF(1,1),
1KSURF,MODEN,MN,XMPI,PT,1,35,II,FPAT,FFT)
GO TO 850
360 IF(XNOP .EQ. N) GO TO 36
IF(XK(1)) .EQ. 0) GO TO 36
M2=N2-1
IF(XI(1)) .GE. YU2(N2)) GO TO 850
XF1=YU2(N2)
35 36 CALL MEAT(XI(1),XF1 ,TTP,PTP,THETA(1,1),MIA(1,1),YL,Y12,XMPI,
1TPI,CTHETA,CHIA,X11,Y11,MT11,IKJ, ISTREM(1),JSURF(1,1),
2IGSURF,ICS,PRINT2,II,CF(1)
CALL AVERMT(X11,Y11,MT11,YU2,YU2,ICS,ICSURE,M2,IKJ,JSURF(1,1),

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SUBROUTINE AVERHT(X,Y,HC,KU,YU,ICS,ICSURF,M,KP,IRF,KSURF,

INODE,NNN,PRINTS,HGAT,AT)

1 DIMENSION X(1),Y(1),HC(1),YU(1),YU(1),KSURF(1),NCOE(15,20),

1 ICSURF(1)

1 INTEGER PRINTS

1 COMMON/AA/ NMODE(150),NII(150),LU

1 LU=0

1 IF(P=INT3,EO,0) GO TO 300

1 WRITE(6,101)

10 101 FORMAT(1H1,/,2X,3HAREA, E,5AT TRANS, R COEFFICIENTS,/,31X,10H10

1 TU/SQFT,HR,DEGFI,/,)

1 KP=KP-1

1 KK=1

1 DO 73 JJJ=1,NNN

15 IF(KSURF(JJJ),EQ,JSURF) GO TO 71

1 CONTINUE

17 IF(ICS,GT,0) GO TO 200

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223

224

13	KL=SQRT(((X(K)-XU(JJ+1))*(X(K)-XU(JJ+1)))+(Y(K)-YU(JJ+1))*(Y(K)-YU(JJ+1)))	AVERHT	59
66	1YU(JJ+1))	AVERHT	60
	A=3.14159*XL*(Y(K)+YU(JJ+1))	AVERHT	61
	HGAT=HGAT+(HGAT+1)/2.0	AVERHT	62
	HGAT=HGAT+(HGAT+1)	AVERHT	63
	AL=AL+A	AVERHT	64
65	HGAT=HGAT/AT	AVERHT	65
	IF(PRINTS.EQ.0) GO TO 302	AVERHT	66
	WRITE(6,100) NODE(JJJ,JJJ,HGAT,AT	AVERHT	67
302	LU=LU+1	AVERHT	68
	MODEL(LU)=NODE(JJJ,JJJ)	AVERHT	69
	HILLU)=HGAT/ALAN.0	AVERHT	70
70	HGAT=D.3	AVERHT	71
	AT=D.0	AVERHT	72
	KL=SQRT((X(K+1)-XU(JJ+1))*(X(K+1)-XU(JJ+1)))+(Y(K+1)-YU(JJ+1))*(Y(K+1)-YU(JJ+1)))	AVERHT	73
	1Y(K+1)-YU(JJ+1))	AVERHT	74
75	A=3.14159*KL*(Y(K+1)+YU(JJ+1))	AVERHT	75
	HGAT=HGAT+(HGAT+1)	AVERHT	76
	AT=AT+A	AVERHT	77
	M=1	AVERHT	78
	KX=HILLU*(K+1,KP)	AVERHT	79
80	GO TO 10	AVERHT	80
	IF(X(KP+1).LT.XU(JJ+1)) GO TO 40	AVERHT	81
	GO TO 12	AVERHT	82
47	M=1	AVERHT	83
	CALL STORE(HGAT,AT,JJJ,0)	AVERHT	84
	IF(X.EQ.KP) GO TO 60	AVERHT	85
85	CONTINUE	AVERHT	86
	CONTINUE	AVERHT	87
59	AT=D.0	AVERHT	88
	HGAT=D.0	AVERHT	89
	CALL STORE(HGAT,AT,JJJ,0)	AVERHT	90
53	RETURN	AVERHT	91
	END	AVERHT	92

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SUBROUTINE HEAT(XI,XF,ITO,PTO,THET,MI,XI,XT,YT,XMT,TMT,CTHETA,CHIA,
1 XI,VT,MT,IKJ, ISTRM,JSURF,ICS,IPRNT2,II,CF11)
2
3 HEAT
4
5 DIMENSION CTHETA(11),CHIA(11)
6
7 DIMENSION XI(11),VT(11),MT(11),CF11(11)
8
9 DIMENSION XT(11),YT(11),XMT(11),TMT(11),ICSURF(11)
10
11 REAL MU,MUO,M1,MUO
12
13 MU=MI*XT(11)
14
15 IF(TNET) 50,51,53
16
17 DO 51 J=1,ICS
18
19 IF(JSURF-ICSURF(J)) 53,55,53
20
21 CONTINUE
22
23 THET=CTHETA(J)
24
25 MI=CHIA(J)
26
27 THET=THET/12.0
28
29 CHK=XF-XI
30
31 KKP=CHK
32
33 CHK1=KKP
34
35 IF(CHK1.EQ. CHK1) GO TO 300
36
37 KP=KKP+2
38
39 GO TO 301
40
41 KP=KKP+1
42
43 KK=KP
44
45 DO 100 I=1,KK
46
47 XI=XT(I)/12.0
48
49 XT(I)=YT(I)/12.0
50
51 XF=XF/12.0
52
53 DX=C.0633333333333333
54
55 L=1
56
57 XI=XT(I)-DX
58
59 KKK=0
60
61 KKK=1
62
63 DO 100 KKK=-1
64
65 GO=IGM-1.1/2.
66
67 HO=CP*TTG
68
69 AO=41.4266*SORT(IGM*TTG)
70
71 RHOO=2.7*PTO/ITO
72
73 MUO=(7.31E-07*ITO**1.51)/(ITO+198.6)
74
75 MUO=MUO/RHOO
76
77 SM1=XMT(11)*XMT(11)
78
79 H=MI*(1.0+CG*SM1)*CG*SM1
80
81 CALL TURBL(XT,YT,XMT,TMT,XI,XF,ITO,PTO,AG,MUO,CG,HO,GM,DX,
82 1 MI,CP,THET,MI,H,CTHETA,CHIA,XI,YT,MT,IPRNT2,II,IKJ,KKK,
83 2 KKK,KK,I,ISTRM,JSURF,ICS,IKJ,CF11)
84
85 IF(KKK)200,201,201
86
87 IF(TNET=0.0001)
88
89 MI=1.3
90
91 MU=MI
92
93 GO TO 1000
94
95 DO 500 I=1,KK
96
97 XT(I)=XT(11)*12.0
98
99 RETURN
1000
101 END

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SUBROUTINE TURBL(TX,VT,XMT,MT,MT,M, XF,TID,PTD,AD,MUO, MUO,
1CG, NO, SM,DX,M,CP, TMT,M,M,
2 CMTA,CHIA,XI,VI,MTI,PRINTZ,II,T,KK,KP,KKK,
3 KKKK,L,ISIREK,JSURF,ISUPF,ICG,IK,CFALL)
4
5 DIMENSION X(11),V(11),MT(11),CFALL(11),
6 DIMENSION XT(11),VT(11),XMT(11),MTI(11),ISORF(11)
7 REAL MUO,M1,LAM3D,MU1,MUO,M2,MUR,MU2
8 INTEGER PRINTZ
9
10 FORMAT(///6X,"BOUNDARY LAYER FLAT PLATE SHAPE FACTOR ITERATION PA
11 LLED TO CONVERGE",-7.425X,"PROGRAM EXECUTION IS STOPPED",-7.30X,"IS
12 20300 LINE 7028(11)")
13
14 FORMATT(11,7X,11,9X,11,7X,11,MACM,7X,3DEL,10X,4H$KIN,11X,2MT,75
15 1X,SMIN,1,5X,SMIN,1,6X,2HNO,7X,SMIN,1,7X,4H$FRICTION,4X,18H191U/5
16 2FT,4R,0EFT,1,7)
17 FORMATT(11,72X,11,6H$FLOW STREAM NO.,11,26H HEAT TRANSFER INFORMATI
18 10N,41X,12-SURFACE NO.,11,7)
19 FORAT(11,77,11X,3H1MT,7X,4HMACM,7X,3DEL,11X,4H$KIN,11X,2H1,45X,5
20 1MTI,1,5X,SMIN,1,6X,2HNO,7X,SMIN,1,7X,4H$FRICTION,4X,18H191U/SOFT
21 2HRO,0EFT,1,7)
22 FORMATT(12,4X,16,31,4X,15,3,21,4X,19,61,10X,19,3,7)
23 CEL=0.1
24 X2=X1
25
26 VZ=VT(11)
27 IF(TKKKK15001,5001,5001)
28 KKKKK=3
29 GO TO 5002
30
31 IF(PRINTZ.EQ.3) GO TO 7001
32 WRITE(6,7) ISIREK,JSURF
33 WRITE(15,10)
34
35 LINE=7
36 J=0
37
38 KKK=1
39 EI=IGM+1.1/12.*(GM-1.01)
40
41 M2=5.0
42 DO 25 I=L,MP
43
44 TX=MT
45 XI=X1+DX
46 IF(XI-XF)131,50,50
47
48 XI=XF
49
50 L=KP+1
51 CALL TABLE (XT,XMT,XI,M1,DNOX,KK)
52 CALL TABFL (XT,VT,XI,YI,DOX,KK)
53 IF(II.EQ.1) DTEX=-DOX
54 IF(KKKK13001,3001,3301)
55 IF(IV-M1)3002,3002,3000
56
57 L=1
58 XI=X1-0X
59 KKKKK=-1
60
61 KKKKK=-1
62
63 SM1=X1*M1
64 VLA=1.5*(V2+V1)
65 IF (VLA) 131,132,133
66
67 VLA=L,6
68 TEL=TV/V1,0+CG*SM1)
69 CALL ENCTL (TEL,PR)

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IF(KKK)3006,3007,3007
3007 CALL HEATP(MT,CP,CF,PR,HI,MI,TT0,TEL,PT0,GM)
LINE=LINE+2
IF(LINE-60)3008,3009,3009
3009 WRITE(6,6000)
LINE=3
3008 XI=VI/12.0
VI=VI/12.0
DEL=DEL/12.0
WRITE(6,11) XI,VI,MI,DEL,CF,MT
IKJ=IKJ+1
XII(IKJ)=XI
XIII(IKJ)=VI
XIV(IKJ)=MT
CF1(IKJ)=CF
XI=VI/12.0
VI=VI/12.0
DEL=DEL/12.0
GO TO 25
3006 XI=CP*TEL
NAME (1,CG*PP*,333*SM1)*HX1
CALL TABLEL(XT,MT,XI,TM1,DTMX,KK)
IF(TT1)14,14,15
14 HM1=HAM
TM1=HM1/CP
GO TO 16
15 HM1=CP*TM1
16 TER=0.5*TM1+.22*PR*,333*TT0+(0.5-.22*PR*,333)*TEL
TER=TER
LAMBDA=TT0+.198+.8*SORT(TM1/TT0)/(HM1+198.6)
MU=LAMBDA*TEL+MU0/TT0
MUR=LAMBDA*TER+MU0/TT0
W2=.5*(M1+M2)*AO/NUO
W31=(TEL/TT0)*EL
W41=MUR/MU0+.268
W1=TT0/TER)*W31
C1=SORT(TEL/TT0)
AE=W1+.4266*SORT(GM*TEL)
U1=W1*AE
CU1=(.5*(U1+U2))/(.5*(C1+C2))
IF(UJ-1)101,19,19
101 J=1
IF(TMF)102,102,103
103 IF(DEL)103,103,103
1035 THELM=THEL
OTRLN=OTR
OO 1033 II=1.2
VPLF=OTR
OO 1031 III=1.50
VPLF=OTR-3.0-2.5/VPLF
IF(AGC(VPLF-VPLF)/VPLF)-.001 1032,1032,1031
1031 VPLF=VPLF
1032 NT=(2.5*VPLF)/VPLF
0-01*(1.0*HM1)/(H1+1.))
THEL=DEL/O
OTR=OTRLN*THEL/THELM
1033 H=CG*SM1*HM1*HJ*(1.0+CG*SM1)/HO
1034
TURBLT 59
TURBLT 60
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TURBLT 112
TURBLT 113
TURBLT 114
TURBLT 115

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1812	KKKK=0	TURBLT	173
	THRL=THTR	TURBLT	174
	MIC=111.00	TURBLT	175
172	GO TO 252	TURBLT	176
1810	01=HIA*(HIA+1.0)*(HIA+1.0)*(HIA-1.0)	TURBLT	177
	02=1.0*(HIA-1.0)*(HIA+1.0)*(HIA-1.0)/(HIA+1.0)*(HIA+3.0)	TURBLT	178
	03=HIA*(HIA-1.0)*(HIA-1.0)*A1*TER/TTO/THTRA	TURBLT	179
	04=(HIA*(HIA-1.0)*(HIA+1.0)*(TER/TTO)+(0.003075*(HIA-0.003352)/THTRA	TURBLT	180
180	04=0.5*(HIA+1.0)	TURBLT	181
	05=0.5*(HIA+1.0)	TURBLT	182
	06=0.5*(HIA+1.0)	TURBLT	183
	MIC=H12*CHQ*DCS	TURBLT	184
	IF (MIC) 245,245,246	TURBLT	185
185	MIC=1.0	TURBLT	186
	GO TO 249	TURBLT	187
246	IF (IC-2.5) 1002,1002,248	TURBLT	188
1802	KKK=-1	TURBLT	189
248	GO TO 247	TURBLT	190
249	IF (K1) 1000,247,247	TURBLT	191
1833	KKK=1	TURBLT	192
247	IF (A3) (HIC-MI)/MI-.005) 250,250,249	TURBLT	193
249	H1=HIC	TURBLT	194
	WRITE (6,5)	TURBLT	195
195	STOP	TURBLT	196
250	IF (A3) (THRL-THTR)/THTR-.005) 252,252,251	TURBLT	197
251	THRL=THTR	TURBLT	198
252	THTR=THTR/M31	TURBLT	199
	MI=HIC	TURBLT	200
200	CF=0.246*(TER/TER1)*H1/EXP(1.561*H1)/((CUI*THTR/NUO)**0.268)	TURBLT	201
	AMSQA=5*(M1*M2*M2)	TURBLT	202
	H=CG*AMSQA*H1*(1.0*CG*AMSQA)	TURBLT	203
	THTR=THTR	TURBLT	204
	DSTAR=H*THTR	TURBLT	205
205	AM=2.0/(H1-1.0)	TURBLT	206
	OTR=(2.0*AM)*H1.0*AM/AM	TURBLT	207
	DEL=THTR*(OTS*CG*AMSQA*(H1+1.0))	TURBLT	208
26	X2=Y1	TURBLT	209
	CALL HEATTR(HT,CP,CF,PR,MI,M1,TTO,TE1,P10,GM)	TURBLT	210
210	Y2=Y1	TURBLT	211
	M2=M1	TURBLT	212
	TE2=TE1	TURBLT	213
	HM2=HM1	TURBLT	214
215	TER2=TER1	TURBLT	215
	THTR2=THTR	TURBLT	216
	H12=H1	TURBLT	217
	A2=B1	TURBLT	218
	C2=C1	TURBLT	219
	U2=U1	TURBLT	220
220	CU2=CU1	TURBLT	221
	MU2=MU1	TURBLT	222
	M12=M11	TURBLT	223
	M4=M41	TURBLT	224
	IF (PRINT2.EQ. 0) GO TO 502	TURBLT	225
225	LINE=LINE+2	TURBLT	226
	IF (LINE-60) 501,502,501	TURBLT	227
	501 WRITE (6,5000)	TURBLT	228
	LINE=3	TURBLT	229

230	582	X1=X1/12.0	TURBLT	232
		V1=V1+12.0	TURBLT	231
		IF(P1=12.0, EQ, 1) GO TO 7801	TURBLT	232
		DEL=DEL+12.0	TURBLT	233
		WRITE(6,11) X1,V1,W1,DEL,CF,MT	TURBLT	234
		DEL=DEL/12.0	TURBLT	235
235	7001	KJ=1/KJ+1	TURBLT	235
		X111(KJ)=X1	TURBLT	237
		V111(KJ)=V1	TURBLT	238
		W111(KJ)=W1	TURBLT	239
		CF111(KJ)=CF	TURBLT	240
240		X1=X1/12.0	TURBLT	241
		V1=V1/12.0	TURBLT	242
		IF(L,CF, KP) GO TO 731	TURBLT	243
	25	CONTINUE	TURBLT	244
	731	KKK=-1	TURBLT	245
245		I=1	TURBLT	246
		IF(DOS) 703,703,705	TURBLT	247
	785	DO 701 JAA=1,ICS	TURBLT	249
		IF(DOS)-ICS=CF(JAA) 701,702,701	TURBLT	250
250	702	CTHETA(JAA)=THET+12.0	TURBLT	251
		CHIA(JAA)=HI	TURBLT	252
		GO TO 703	TURBLT	253
	701	CONTINUE	TURBLT	254
	703	RETURN	TURBLT	255
		END	TURBLT	

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SUBROUTINE	WEATTR(HT,CP,CF,PR,MI,NI,ITO,TEL,PTO,GM)	WEATTR	2
REAL MI		WEATTR	3
GM1=ICM+1.0/(12.0*GM)-2.1		WEATTR	4
GM2=-GM/(CM-1.1)		WEATTR	5
TR=ITO/TEL		WEATTR	6
SOR1=MI*MI		WEATTR	7
EXP=1.561*(MI-(1.3*TR))-150MI/5.1)		WEATTR	8
PRND=PR*(1-.5557)		WEATTR	9
WT=231428.972*CF*PTO*MI*CP*PRND*(TEL*GM1)*(ITO*GM2)*EXP(EXPP)		WEATTR	10
RETURN		WEATTR	11
END		WEATTR	12

		SUBROUTINE AVERFS(X,Y,CF,XU,YU,ICS,ICSURF,M,KP,JSURF,KSURF,NODE, 1NMN,XMN,P,GAM,IT,CPAT,FTI DIMENSION X(1),Y(1),CF(1),KU(1),YU(1),KSURF(1),NODE(5,20), 1ICSURF(1),XMN(1),P(1) COMMON/BB3/ NODE(500),FTI(50),LUI K=1	AVERS	2
5		DO 71 J=1,NMN IF(KSURF(J)) .EQ. JSURF GO TO 71 CONTINUE IF(ICS .GT. 0) GO TO 200 M=J	AVERS	3
10	71	GO TO 72	AVERS	4
		DO 201 KU=1,ICS IF(ICSURF(KU)) .EQ. JSURF GO TO 202 CONTINUE M=J	AVERS	5
15	201	GO TO 72	AVERS	6
		CALL STGSEL(FPAT,FTI,JU,1)	AVERS	7
20	72	M=1 DO 5 J=1,M IF(X(J)) .LT. XU(J) GO TO 7 CONTINUE J=J-1 DO 12 J=J,M IF(M .GT. 0) GO TO 514 FPAT=0.0 FFT=0.0 DEL=VU(J+1)-VU(J) IM=AIAN(IARSIDEL)/IXU(J+1)-XU(J+1) STM=JNIMTH CIN=COS(TH) IF(1) .EQ. 2) GO TO 500 IF(DEL-0.0) 501,502,503 COEL=+1.0 GO TO 2 COEL=0.0 GO TO 2 COEL=-1.0 GO TO 2 IF(DEL-0.0) 503,502,501 DO 12 K=KK,KP IF(X(K+1) .GT. XU(J+1)) GO TO 33 X1=50PT((X(K)-X(K+1))/(X(K)-X(K+1))) + ((Y(M)-Y(K+1)) * (Y(K)-Y(K+1))) 1)	AVERS	8
25	503	A=3.14159*XL*(Y(K)+Y(K+1)) CPAV=(CF(K)+CF(K+1))/2.0 PAV=(P(K)+P(K+1))/2.0 XMAV=(XMN(K)+XMN(K+1))/2.0 FPAT=FPAT+(PAV*A) FFT=FFT+(PAV*A*CPAV*XMAV*XMAV*GAM/2.0) DIFF=ABS(X(K+1)-XU(J+1)) IF(DIFF .LT. 0.01) GO TO 50 GO TO 11 FOATAV=FOATAV+CIN FPAV=FFT+CIN FT=FT+PAV FT=FT+PAV FT=FT+PAV	AVERS	9
30	502		AVERS	10
35	501		AVERS	11
40	500		AVERS	12
45	11		AVERS	13
50			AVERS	14
55			AVERS	15
60			AVERS	16
65			AVERS	17
70			AVERS	18
75			AVERS	19
80			AVERS	20
85			AVERS	21
90			AVERS	22
95			AVERS	23
100			AVERS	24
105			AVERS	25
110			AVERS	26
115			AVERS	27
120			AVERS	28
125			AVERS	29
130			AVERS	30
135			AVERS	31
140			AVERS	32
145			AVERS	33
150			AVERS	34
155			AVERS	35
160			AVERS	36
165			AVERS	37
170			AVERS	38
175			AVERS	39
180			AVERS	40
185			AVERS	41
190			AVERS	42
195			AVERS	43
200			AVERS	44
205			AVERS	45
210			AVERS	46
215			AVERS	47
220			AVERS	48
225			AVERS	49
230			AVERS	50
235			AVERS	51
240			AVERS	52
245			AVERS	53
250			AVERS	54
255			AVERS	55
260			AVERS	56
265			AVERS	57
270			AVERS	58
275			AVERS	59

Line	Code	Instruction	Register
59	AVERFS	LUI=LUI+1	59
60	AVERFS	JN=NODE(JJJ,JJ)	60
61	AVERFS	MODE15(JNI)=JN	61
62	AVERFS	FT1(JNI)=FT	62
63	AVERFS	M=0	63
64	AVERFS	IF(K.EQ.KPI) GO TO 59	64
65	AVERFS	KK=MING(KK+1,KPI)	65
66	AVERFS	GO TO 10	66
67	AVERFS	XL=SQRT((X(K)-XU(JJ+1)) ² +Y(K)-YU(JJ+1)) ²	67
68	AVERFS	YU(JJ+1)=YU(JJ+1)	68
69	AVERFS	A=J.L159*XL*(Y(K)+YU(JJ+1))	69
70	AVERFS	CPAY=ICF(K)+CF(K+1)/2.0	70
71	AVERFS	PAV=(PI(K)+PI(K+1))/2.0	71
72	AVERFS	XNAV=(X(MN(K))+X(MN(K+1)))/2.0	72
73	AVERFS	FPAT=FPAT+PAV*A	73
74	AVERFS	FFT=FFT+(PAV*A*CFAY*XNAV*GM/2.0)	74
75	AVERFS	FPAT=FFT+STH	75
76	AVERFS	M=FFT*CM	76
77	AVERFS	FPAT=FPAT+MDEL	77
78	AVERFS	FT=FT+FPAT+FPATAV	78
79	AVERFS	LUI=LUI+1	79
80	AVERFS	JN=NODE(JJJ,JJ)	80
81	AVERFS	MODE15(JNI)=JN	81
82	AVERFS	FT1(JNI)=FT	82
83	AVERFS	FPAT=0.0	83
84	AVERFS	FFT=0.0	84
85	AVERFS	XL=SQRT((X(K)-XU(JJ+1)) ² +Y(K)-YU(JJ+1)) ²	85
86	AVERFS	YU(JJ+1)=YU(JJ+1)	86
87	AVERFS	A=J.L159*XL*(Y(K)+YU(JJ+1))	87
88	AVERFS	PAV=(PI(K)+PI(K+1))/2.0	88
89	AVERFS	FFT=FFT+(PAV*A*CFAY*XNAV*GM/2.0)	89
90	AVERFS	M=1	90
91	AVERFS	KK=MING(KK+1,KPI)	91
92	AVERFS	GO TO 10	92
93	AVERFS	IF(K(KP+1).LT.XU(JJ+1)) GO TO 40	93
94	AVERFS	GO TO 12	94
95	AVERFS	M=1	95
96	AVERFS	CALL STORE1(FPAT,FFT,JJJ,3)	96
97	AVERFS	IF(K.EQ.KPI) GO TO 60	97
98	AVERFS	CONTINUE	98
99	AVERFS	CONTINUE	99
100	AVERFS	FPAT=0.0	100
101	AVERFS	FFT=0.0	101
102	AVERFS	CALL STORE1(FPAT,FFT,JJJ,8)	102
103	AVERFS	RETURN	103
104	AVERFS	END	104

60	1100	CALL PICMIN(YOUCT,LOUMHY,MVERD,YMINO)	VIENS	59
		IF (YU(1)-YU(2)) 1100,1100,1105	VIENS	60
		YMIN= YU(1)	VIENS	61
		GO TO 1110	VIENS	62
	1105	YMIN= YU(2)	VIENS	63
	1110	IF (YU(1)-YU(2)) 1115,1115,1120	VIENS	64
	1115	YMIN= YU(2)	VIENS	65
		GO TO 1125	VIENS	66
65		YMIN= YU(1)	VIENS	67
	1120	CALL TEST2(YMIN,YMAX,YMINO,IF)	VIENS	68
	1125	IF (IFY-1) 1130,1130,1135	VIENS	69
	1130	CALL TEST2(YMIN,YMAX,YMAXO,IF)	VIENS	70
	1135	IF (IFY-1) 1130,1130,1135	VIENS	71
70		CALL TEST2(YMINO,YMAXO,YMIN,IF)	VIENS	72
	1145	IF (IFY-1) 1130,1130,1150	VIENS	73
	1150	SMAO=2.0	VIENS	74
		GO TO 15	VIENS	75
75	1130	SMAO=1.0	VIENS	76
		PHIL= 2.0*PIE/DOCT	VIENS	77
		OPHIL= PHIL/COIV	VIENS	78
		PHIL= (2.5-5*CK1)*OPHIL	VIENS	79
		ANGUC(1)= PHIL	VIENS	80
		DOUC= DOUC-1	VIENS	81
80		DC 1155 JON=11DOUC	VIENS	82
		FJON= JON	VIENS	83
1155		ANGUC(JON+1)= 2.0*PIE*(FJON+1.0)/DOUC	VIENS	84
15		J=1	VIENS	85
85		A(J)= PIE*(RU(J)+RO(J))*SORT((RO(J)-RU(J))**2+(YU(J)-	VIENS	86
		YU(J))**2)	VIENS	87
		B1=(YU(J)-YU(J))/SORT((YU(J)-YU(J))**2+(RO(J)-RU(J))**2)	VIENS	88
		A1= -(RO(J)-RU(J))/SORT((YU(J)-YU(J))**2+(RO(J)-RU(J))**2)	VIENS	89
		IF (VECT(J) 1 20,30,30	VIENS	90
90	20	B1= -B1	VIENS	91
		A1= -A1	VIENS	92
30		IF (YU(J)-YU(J)) 32,34,32	VIENS	93
34		OR1= (RO(J)-RU(J))/DIV(J)	VIENS	94
		GO TO 36	VIENS	95
32		E1= (RU(J)+YU(J)-RO(J)+YU(J))/(YU(J)-YU(J))	VIENS	96
95		H1= (RO(J)-RU(J))/(YU(J)-YU(J))	VIENS	97
		OY1= (YU(J)-YU(J))/DIV(J)	VIENS	98
36		MYO1= DIV(J)	VIENS	99
		MYL= DIV(J)	VIENS	100
361		K=2	VIENS	101
		A(K)= PIE*(RU(K)+RO(K))*SORT((RO(K)-RU(K))**2+(YU(K)-	VIENS	102
1		YU(K))**2)	VIENS	103
		B2= (YU(K)-YU(K))/SORT((YU(K)-YU(K))**2+(RO(K)-RU(K))**2)	VIENS	104
		A2= -(RO(K)-RU(K))/SORT((YU(K)-YU(K))**2+(RO(K)-RU(K))**2)	VIENS	105
105		IF (VECT(K) 1 50,50,50	VIENS	106
		B2= -B2	VIENS	107
80		A2= -A2	VIENS	108
		IF (YU(K)-YU(K)) 52,54,52	VIENS	109
94		OR2= (RU(K)-RU(K))/DIV(K)	VIENS	110
		GO TO 56	VIENS	111
52		F2= (RU(K)+YU(K)-RO(K)+YU(K))/(YU(K)-YU(K))	VIENS	112
		F2= (RO(K)-RU(K))/(YU(K)-YU(K))	VIENS	113
		OY2= (YU(K)-YU(K))/DIV(K)	VIENS	114
56		FF=3.0	VIENS	115

115		NVD2 = DIV(K)			VIEW5	116
		LV = 1			VIEW5	117
		LP = 1			VIEW5	118
120	77	SPI = SIN(PHIL)			VIEW5	119
		CPI = COS(PHIL)			VIEW5	120
		DO F03 L=1,NY01			VIEW5	121
		PL = L			VIEW5	122
125	88	IF(B1) 01,02,00			VIEW5	123
		VJ = VU(J) + (PL-1)*DY1			VIEW5	124
		V1 = OV1*(1.5-1.5*CK1)+VJ			VIEW5	125
		R1 = E1 + Y1*H1			VIEW5	126
		GO TO 87			VIEW5	127
		RJ = RU(J) + (PL-1)*DR1			VIEW5	128
		R1 = RJ+DR1*(1.5-1.5*CK1)			VIEW5	129
		V1 = VU(J)			VIEW5	130
130	87	X1 = R1+CPI			VIEW5	131
		Z1 = R1*SPI			VIEW5	132
		CAL = B1*SPI			VIEW5	133
		CBI = A1			VIEW5	134
135		CG1 = B1*SPI			VIEW5	135
		R=0.0			VIEW5	136
		M=1			VIEW5	137
		DO 50C M=1,NY02			VIEW5	138
		P1 = M			VIEW5	139
		IF(B2) 08,09,06			VIEW5	140
		VK = VU(K)+(PM-1)*DY2			VIEW5	141
		V2 = VK+DY2*(1.5-1.5*CK1)			VIEW5	142
		R2 = E2 + F2*V2			VIEW5	143
		GO TO 405			VIEW5	144
		RK = RU(K)+(PM-1)*DR2			VIEW5	145
		R2 = RK+DR2*(1.5-1.5*CK1)			VIEW5	146
		V2 = VU(K)			VIEW5	147
		IF(B2*R1) 66,65,66			VIEW5	148
		IF(1 B2*R2 + (V2-V1)*A2) 6605,6610,6605			VIEW5	149
		CP2PI = P2/3.14 + A2*(V2-V1)/(B2*R1)			VIEW5	150
		CAL = ARCCOS(CP2PI,AP2PI,ITAI)			VIEW5	151
		IF(ITAI-1170,70,6605			VIEW5	152
		6605 X2=R2+COS(PHIL+PIE/3.1)			VIEW5	153
		Z2=R2*SIN(PHIL+PIE/3.1)			VIEW5	154
		RH02 = (R2-X1)*2+(V2-V1)*2+(Z2-Z1)*2			VIEW5	155
		IF(RH021,6610,6610,6615			VIEW5	156
		6610 GT=0.0			VIEW5	157
		GO TO 409			VIEW5	158
		6615 RH0=SQRT(RH02)			VIEW5	159
		CST = (B2*R1)*3.5-B2*R2+A2*(V1-V2)/RH0			VIEW5	160
		IF(CST) 6610,6610,6620			VIEW5	161
		6620			VIEW5	162
		IND1 = 1			VIEW5	163
		GO TO 7001			VIEW5	164
		70 IF (-R2*SIN(AP2PI)) 601,603,602			VIEW5	165
		603 CST = R2*F1+COS(AP2PI + 0.174) -B2*R2 + A2*(V1-V2)			VIEW5	166
		IF(CST) 6610,6610,6620			VIEW5	167
		661			VIEW5	168
		IND1 = 1			VIEW5	169
		GO TO 7001			VIEW5	170
		IND1 = 2			VIEW5	171
		IF(B1*R2) 72,7010,72			VIEW5	172
		IF((V2-V1)*A1 -R1*B1) 7030,7040,7030			VIEW5	173
		7010			VIEW5	174
		7010			VIEW5	175

173	72	DP2P1 = R1/R2 - A1*(Y2-Y1)/(R1*R2) CALL APCOS(DP2P1, BP2P1, ITA1) IF (ITA1 - 1) 90, 90, 7030	VIEM3	173
			VIEM3	174
175	7330	R2=R2-COS(PH11+PIE/3.) Z2=R2*SIN(PH11+PIE/3.) RHO2 = (Z2-X1)*2+(Y2-Y1)*2+(Z2-Z1)*2 IF (RHO2) 7045, 7045, 7050	VIEM3	175
			VIEM3	176
			VIEM3	177
			VIEM3	178
180	7443	GI=0.0 GO TO 409	VIEM3	179
			VIEM3	180
			VIEM3	181
	7050	RHO = SORT(RHO2) CST = (C2*81*.5 - R1*31 + (Y2-Y1)*A1)/RHO IF (CST) 7045, 7045, 7060	VIEM3	182
			VIEM3	183
			VIEM3	184
185	7060	IND2 = 3 GO TO 901	VIEM3	185
			VIEM3	186
	90	IF (-81*(IM1BP2P1)) 901, 903, 902	VIEM3	187
	903	CST = A1*(C2*COS(BP2P1 + 0.174) - 01*R1*(Y2-Y1)*A1 IF (CST) 7045, 7045, 7060	VIEM3	188
			VIEM3	189
	931	IND2 = 1 GO TO 901	VIEM3	190
190			VIEM3	191
			VIEM3	192
	902	IND2 = 2 GO TO 901, 921, 931, IND1	VIEM3	193
	901	GO TO 940, 950, 960, IND2	VIEM3	194
	910	GO TO 970, 980, 993, IND2	VIEM3	195
	920	GO TO 971, 988, 999, IND2	VIEM3	196
195	933	IF (AP2P1-BP2P1) 941, 941, 942	VIEM3	197
	940	PHIL=0.0 PHIU= AP2P1	VIEM3	198
	941	GO TO 91	VIEM3	199
200	942	PHIL = 0.00+0.0 PHIU= BP2P1	VIEM3	200
			VIEM3	201
			VIEM3	202
			VIEM3	203
205	950	IF (AP2P1 - BP2P1) 9010, 9010, 9012	VIEM3	204
	9010	GI=0.0	VIEM3	205
	9012	GO TO 409	VIEM3	206
		PHIU = AP2P1	VIEM3	207
		PHIL = BP2P1	VIEM3	208
		GO TO 90	VIEM3	209
210	960	PHIU = AP2P1	VIEM3	210
		PHIL=0.0	VIEM3	211
		GO TO 90	VIEM3	212
	970	IF (AP2P1 - BP2P1) 9010, 9010, 9010	VIEM3	213
	9010	PHIL = AP2P1	VIEM3	214
		PHIU = BP2P1	VIEM3	215
215		GO TO 90	VIEM3	216
	980	IF (AP2P1 - BP2P1) 9010, 9010, 9020	VIEM3	217
	9010	PHIL = BP2P1	VIEM3	218
		PHIU=PIE	VIEM3	219
		GO TO 90	VIEM3	220
220	9020	PHIL = AP2P1	VIEM3	221
		PHIU = PIE	VIEM3	222
		GO TO 90	VIEM3	223
	993	PHIU = PIE	VIEM3	224
		PHIL = AP2P1	VIEM3	225
		GO TO 90	VIEM3	226
225	977	PHIL=0.0 PHIU = BP2P1	VIEM3	227
		GO TO 90	VIEM3	228
			VIEM3	229

	KIL= NP(II)-1	VIEWS	287
	GO TO 1308	VIEWS	288
1288	IF(V1-Y2) 1310,1318,1315	VIEWS	289
1318	KI=NY1	VIEWS	290
298	KIL = NY2	VIEWS	291
	GO TO 1302	VIEWS	292
1315	KI= NY2	VIEWS	293
	KIL= NY1	VIEWS	294
1295	GO TO 1308	VIEWS	295
	KI= NY2	VIEWS	296
1318	KIL= NP(II) -1	VIEWS	297
	CALL CAUSEE(Y1,R1,Y2,R2,YF,RF,KI,KIL,IJ,ISEE)	VIEWS	298
	GO TO (1295,1399,1699,7138,1399), ISEE	VIEWS	299
1399	LUM= C	VIEWS	300
300	DO 1460 LOLA= KI-KIL	VIEWS	301
	IF(V1-Y2) 1428,1420,1418	VIEWS	302
1418	KILE=KIL-(LOLA-KI)	VIEWS	303
	KILEP = KILE+1	VIEWS	304
305	RFURRF(JJ,KILL)	VIEWS	305
	RFD = RF(JJ,KI-EP)	VIEWS	306
	YFU= YF(JJ,KILE)	VIEWS	307
	YFO= YF(JJ,VILEP)	VIEWS	308
	GO TO 1540	VIEWS	309
1428	RFURRF(JJ,LOLA)	VIEWS	310
318	RFO= RF(JJ,LOLA+1)	VIEWS	311
	YFU= YF(JJ,LOLA)	VIEWS	312
	YFO= YF(JJ,LOLA+1)	VIEWS	313
	IF(LOLA-KI) 1430,1430,1440	VIEWS	314
1430	IF(V1-YFO) 1450,1450,1460	VIEWS	315
1450	CALL PING(Y1,R1,Y2,R2,YFU,RFU,ANG,LOIS)	VIEWS	316
	IF(LOIS-3) 1450,1455,1470	VIEWS	317
1470	LUM= LUM+1	VIEWS	318
	PHEQ(LUM)= ANG	VIEWS	319
	GO TO 1460	VIEWS	320
1465	WRITE(6,1467)	VIEWS	321
1467	FORMAT(1M1,/,/,/,9X,"THE ANGLE FOR THE LIMIT OF INTEGRATION IS UND	VIEWS	322
	DEFINED.,/,25X,"THE COSINE IS GREATER THAN 1.",/,25X,"PROGRAM EXEC	VIEWS	323
	UTION IS STOPPED.",/,30X, "(SUBROUTINE RINGI)")	VIEWS	324
	STOP	VIEWS	325
325	IF(LOLA-KIL) 1450,1450,1460	VIEWS	326
1460	IF(V2-YFO) 1450,1450,1452	VIEWS	327
1462	CALL PING(Y1,R1,Y2,R2,YFO,RFU,ANG,LOIS)	VIEWS	328
1495	GO TO(1430,1430,1495,1500),LOIS	VIEWS	329
	WRITE(6,1467)	VIEWS	330
330	STOP	VIEWS	331
1500	LUM=LUM+1	VIEWS	332
	PHEQ(LUM)= ANG	VIEWS	333
1492	CALL 90DY(Y1,Y2,R1,R2,YFU,RFU,PFI,PHI,ION)	VIEWS	334
1525	IF(ION-2) 1450,1510,1460	VIEWS	335
1510	LUM=LUM+1	VIEWS	336
	PHEQ(LUM)= PHI	VIEWS	337
	GO TO 1400	VIEWS	338
1480	IF(V2-YFO) 1515,1515,1520	VIEWS	339
1528	CALL PING(Y1,R1,Y2,R2,YFU,RFU,ANG,LOIS)	VIEWS	340
1530	GU TO(1515,1400,1495,1530),LOIS	VIEWS	341
	LUM=LUM+1	VIEWS	342
	PHEQ(LUM)= ANG	VIEWS	343

1515	CALL BODY(V1,V2,R1,R2,YFU,RFU,YFD,RFD,PHIO,PHIL,ION)	VIEW#	344
	GO TO 1525	VIEW#	345
345	IF(LOLA-KI) 1550,1550,1545	VIEW#	345
1550	IF(V1-YFD) 1560,1560,1555	VIEW#	347
1555	CALL SING(V1,R1,Y2,R2,YFD,RFD,ANG,LOIS)	VIEW#	343
	IF(LOIS-3) 1560,1565,1565	VIEW#	349
358	LUM=LUM+1	VIEW#	350
1565	PHIO(LUM)=ANG	VIEW#	351
1560	IF(V2-YFU) 1562,1560,1560	VIEW#	352
1562	CALL SING(V1,R1,Y2,R2,YFU,RFU,ANG,LOIS)	VIEW#	351
	GO TO(1580,1400,1495,1570),LOIS	VIEW#	354
1572	LUM=LUM+1	VIEW#	355
355	PHIO(LUM)=ANG	VIEW#	356
1568	CALL BODY(V1,V2,R1,R2,YFU,RFU,YFD,RFD,PHIO,PHIL,ION)	VIEW#	357
	GO TO 1525	VIEW#	358
1545	IF(LOLA-KI) 1562,1565,1565	VIEW#	359
1545	IF(V2-YFU) 1590,1595,1595	VIEW#	360
1532	CALL SING(V1,R1,Y2,R2,YFU,RFU,ANG,LOIS)	VIEW#	361
	GO TO(1595,1400,1495,1600),LOIS	VIEW#	362
1555	LUM=LUM+1	VIEW#	363
1535	PHIO(LUM)=ANG	VIEW#	364
365	CALL BODY(V1,V2,R1,R2,YFU,RFU,YFD,RFD,PHIO,PHIL,ION)	VIEW#	365
	GO TO 1525	VIEW#	366
1562	CONTINUE	VIEW#	367
A-168	IF(LUM-1) 1295,1601,1601	VIEW#	368
378	IF(SEE-5) 1623,1602,1602	VIEW#	369
1601	CALL PICMIN(PHIO,LUKE,LUM,PHIS)	VIEW#	370
1602	PHIO(LUKE)=PHIS	VIEW#	371
	LUKE=LUKE-1	VIEW#	372
	CALL PICMIN(PHIO,LUKE,LUM,PHIS)	VIEW#	373
	PHIO(LUKE)=PHIS	VIEW#	374
375	GO TO 1295	VIEW#	375
1603	CALL PICMIN(PHIO,LUKE,LUM,PHIS)	VIEW#	376
	PHIO(LUKE)=PHIS	VIEW#	377
	GO TO 1295	VIEW#	378
1699	LUM=LUM+1	VIEW#	379
380	DO 1700 NELL=KI,KIL	VIEW#	380
	IF(V1-Y2) 1720,1720,1710	VIEW#	381
1710	MILE=KIL-INELL-KI	VIEW#	382
	MILEP=MILE+1	VIEW#	383
	RFU=RFU+MILEP	VIEW#	384
385	RFD=RFU+MILEP	VIEW#	385
	YFU=YFU+MILEP	VIEW#	386
	YFD=YFU+MILEP	VIEW#	387
	GO TO 1690	VIEW#	388
1720	RFU=RFU+MILEP	VIEW#	389
	RFD=RFU+MILEP	VIEW#	390
390	YFU=YFU+MILEP	VIEW#	391
	YFD=YFU+MILEP	VIEW#	392
	IF(HELL-KI) 1730,1730,1760	VIEW#	393
1730	IF(V1-YFU) 1750,1760,1760	VIEW#	394
1750	CALL SING(V1,R1,Y2,R2,YFU,RFU,ANG,LOIS)	VIEW#	395
	IF(LOIS-3) 1700,1765,1770	VIEW#	396
1770	LUM=LUM+1	VIEW#	397
	PHIO(LUM)=ANG	VIEW#	398
	GO TO 1760	VIEW#	399
1765	WRITE(6,14,17)	VIEW#	401

400	STOP	IF(Y2-YFD) 1700,1700,1762	VIEW\$	401
1700		CALL BING(Y1,X1,Y2,R2,YFD,ANG,ANG,LOIS)	VIEW\$	402
1702		GO TO(1780,1760,1795,1680,LOIS	VIEW\$	403
1705	WRITE(16,1667)		VIEW\$	404
405	STOP		VIEW\$	405
1000	LIM=LIM+1		VIEW\$	406
	PHIS(LIM) = ANG		VIEW\$	407
	GO TO 1721		VIEW\$	408
1000	IF(INELL-K1) 1050,1050,1060		VIEW\$	409
1050	IF(Y1-YFD) 1060,1060,1055		VIEW\$	410
1055	CALL RING(Y1,X1,Y2,R2,YFD,ANG,ANG,LOIS)		VIEW\$	411
	IF(LOIS-J) 1000,1765,1065		VIEW\$	412
1065	LIM=LIM+1		VIEW\$	413
	PHIS(LIM) = ANG		VIEW\$	414
1060	IF(Y2-YFD) 1062,1700,1700		VIEW\$	415
1062	CALL RING(Y1,X1,Y2,R2,YFD,ANG,ANG,LOIS)		VIEW\$	416
	GO TO(1700,1720,1795,1070,LOIS		VIEW\$	417
1070	LIM=LIM+1		VIEW\$	418
	PHIS(LIM) = ANG		VIEW\$	419
1700	CONTINUE		VIEW\$	420
	IF(LIM-1) 1295,1075,1075		VIEW\$	421
1075	CALL PICMAX(PHIS,LARRY,LIM,PHI6)		VIEW\$	422
	PHAM(LARRY) = PHI6		VIEW\$	423
1295	CONTINUE		VIEW\$	424
2100	IF(LUKF-1) 2100,2110,2110		VIEW\$	425
	CALL PICMIN(PHIM,LUKE,LUKE,PHIOUT)		VIEW\$	426
2110	IF(LAPRY-1) 2120,2130,2130		VIEW\$	427
2120	PHISL=8.0		VIEW\$	428
	PHISU=PHIOUT		VIEW\$	429
430	GO TO 2140		VIEW\$	430
2130	CALL PICMAX(PHAM,LARRY,LARRY,PHIIM)		VIEW\$	431
	IF(PHIOUT-PHIIM) 7130,7130,2150		VIEW\$	432
2150	PHISL=PHIIM		VIEW\$	433
	PHISU=PHIOUT		VIEW\$	434
435	GO TO 2140		VIEW\$	435
2100	IF(LAFRY-1) 2225,2160,2160		VIEW\$	436
2100	CALL PICMAX(PHAM,LARRY,LARRY,PHIIM)		VIEW\$	437
	PHISL=PHIIM		VIEW\$	438
2160	PHISU=PIE		VIEW\$	439
2160	IF(PHIU-PHISL) 7130,7130,2100		VIEW\$	440
2100	IF(PHISU-PHIL) 7130,7130,2100		VIEW\$	441
2100	IF(PHISL-PHIL) 2210,2210,2200		VIEW\$	442
2200	PHIL=PHISL		VIEW\$	443
2210	IF(PHISU-PHIU) 2220,2225,2225		VIEW\$	444
2220	PHIU=PHISU		VIEW\$	445
2225	IF(ISHAD) 2230,2230,2240		VIEW\$	446
2240	PHU=1		VIEW\$	447
2270	JACVL= NVEPD-1		VIEW\$	448
	DOUCANG= ANGDOC(JOM)		VIEW\$	449
450	LOUC= 8		VIEW\$	450
	DO 2600 JACX=1,JACKL		VIEW\$	451
	YJUI= YJUCY(JACK)		VIEW\$	452
	YJUC= YJUCY(JACK+1)		VIEW\$	453
	ROUJ= PUCY(JACK)		VIEW\$	454
	ROUJ= PUCY(JACK+1)		VIEW\$	455
455	IF(1-LOUC) 10, 1) IF(PHOUTUI)=1		VIEW\$	456
			VIEW\$	457

Line	Code	Text	Address
458	IF FIRENE-11	2610,2610,2600	VIEW3 458
459	LDUC= LDUC+1		VIEW3 459
460	PHCU(LDUC) = PHIX		VIEW3 460
461	CONTINUE		VIEW3 461
462	YDU2= YDUCT(INVERP)		VIEW3 462
463	YDU2= YDUCT(I1)		VIEW3 463
464	RDUI= RDUCT(INVERP)		VIEW3 464
465	RDUI= RDUCT(I1)		VIEW3 465
466	IF FIRENE, EO, I1	ICFV(D(IUI))=1	VIEW3 466
467	IF FIRENE-11	2620,2620,2630	VIEW3 467
468	LDUC= LDUC+1		VIEW3 468
469	PHCU(LDUC) = PHIX		VIEW3 469
470	IF LDUC-11	2640,2650,2650	VIEW3 470
471	CALL PICMAX(PHOU,LUCK,LDUC,PHI7)		VIEW3 471
472	PHCU(LUCK) = PHI7		VIEW3 472
473	LUCK=LUCK-1		VIEW3 473
474	CALL PICMIN(PHOU,LUCK,LDUC,PHI7)		VIEW3 474
475	PHCU(LUCK) = PHI7		VIEW3 475
476	IF PHCU(LUCK) = PHUI	2640,2640,2630,2630	VIEW3 476
477	IF LDUC-10UCI	2650,2630,2630	VIEW3 477
478	JCN= JCN+1		VIEW3 478
479	IF I (ANJDU(JCN)-PHI1) -PIE1	2670,2670,2630	VIEW3 479
480	IF LUCK-11	2250,2260,2260	VIEW3 480
481	ICINE=1		VIEW3 481
482	PHCU(I1) = PHIL		VIEW3 482
483	PHCU(I1) = PHUI		VIEW3 483
484	GO TO 2270		VIEW3 484
485	LUCK= LUCK-1		VIEW3 485
486	DO 2290 IPR=1,LUCK		VIEW3 486
487	IPR= IPR+1		VIEW3 487
488	DO 2290 JPH= IPR,LUCK		VIEW3 488
489	IF PHCU(IIPR)-PHCU(JPH)	2290,2290,2300	VIEW3 489
490	TEMP= PHCU(IIPR)		VIEW3 490
491	PHCU(IIPR) = PHCU(JPH)		VIEW3 491
492	PHCU(JPH) = TEMP		VIEW3 492
493	TEMP= PHCU(IIPR)		VIEW3 493
494	PHCU(IIPR)= PHCU(JPH)		VIEW3 494
495	PHCU(JPH) = TEMP		VIEW3 495
496	CONTINUE		VIEW3 496
497	LOCK= 1		VIEW3 497
498	PHMA(LOCK) = PHCU(I1)		VIEW3 498
499	PHMA(LOCK) = PHCU(I1)		VIEW3 499
500	JG= 2		VIEW3 500
501	IF JG-LUCK	2320,2320,2330	VIEW3 501
502	CALL TEST2(PHMA(LOCK),PHMA(LOCK),PHCU(JG),IFP)		VIEW3 502
503	IF IFP-11	2340,2340,2350	VIEW3 503
504	CALL TEST2(PHMA(LOCK),PHMA(LOCK),PHCU(JG),IFP)		VIEW3 504
505	IF IFP-11	2360,2360,2360	VIEW3 505
506	PHMA(LOCK) = PHCU(JG)		VIEW3 506
507	JG= JG+1		VIEW3 507
508	GO TO 2370		VIEW3 508
509	LOCK=LOCK+1		VIEW3 509
510	PHMA(LOCK) = PHCU(JG)		VIEW3 510
511	PHMA(LOCK) = PHCU(JG)		VIEW3 511
512	GO TO 2360		VIEW3 512
513	ICINE=0		VIEW3 513
514	J1=1		VIEW3 514

515	2398	PHILL(1)=PHIL	VIEW\$	515
	2400	IF (JI-LOCK) 2410,2410,2400	VIEW\$	516
		PHIU(1)= PHIU	VIEW\$	517
		ICIN=1	VIEW\$	518
		GO TO 2270	VIEW\$	519
520	2410	IF (PHIMA(JI)-PHIL) 2440,2440,2430	VIEW\$	520
	2440	IF (PHAMA(JI)-PHIL) 2460,2450,2450	VIEW\$	521
	2450	IF (PHAMA(JI)-PHIU) 2460,7130,7130	VIEW\$	522
	2460	JI=JI+1	VIEW\$	523
		GO TO 2390	VIEW\$	524
525	2430	IF (PHIMA(JI)-PHIU) 2432,2431,2431	VIEW\$	525
	2431	PHIU(1)= PHIU	VIEW\$	526
		ICIN=1	VIEW\$	527
		GO TO 2470	VIEW\$	528
	2432	PHIU(1)= PHIMA(JI)	VIEW\$	529
		ICIN= 1	VIEW\$	530
530	2470	IF (PHAMA(JI)-PHIU) 2480,2270,2270	VIEW\$	531
	2480	ICIN= ICIN+1	VIEW\$	532
		PHILL(1)= PHAMA(JI)	VIEW\$	533
		IF (JI-LOCK) 2490,2500,2500	VIEW\$	534
535	2490	JI= JI+1	VIEW\$	535
		IF (PHIU-PHIMA(JI)) 2500,2500,2510	VIEW\$	536
	2510	PHIU(1)= PHIMA(JI)	VIEW\$	537
		GO TO 2470	VIEW\$	538
	2500	PHIU(1)= PHIU	VIEW\$	539
540	2270	C = R2+2 + R1+2 + (V2-Y1)+2	VIEW\$	540
		O = 2. *R2+21	VIEW\$	541
		CMD = C - O	VIEW\$	542
		SPEC=0.0	VIEW\$	543
		IF (CMD-1.0E-5) 7670,7070,99	VIEW\$	544
545	7070	IF (R1) 7130,7130,7090	VIEW\$	545
	7090	SPEC=1.0	VIEW\$	546
		GI=0.0	VIEW\$	547
		GO TO 7145	VIEW\$	548
	99	CPD=C+O	VIEW\$	549
550	7130	IF (CPD) 7130,7130,7140	VIEW\$	550
		GO TO 409	VIEW\$	551
	7140	O1=CPD/CMD	VIEW\$	552
		Q2 = CMD/CPD	VIEW\$	553
		Q1 = SORT(Q1)	VIEW\$	554
		Q2 = SORT(Q2)	VIEW\$	555
555		Q3 = 2. *C/(CPD + CMD+2)	VIEW\$	556
		Q4 = 2. * O/(CPD + CMD+2)	VIEW\$	557
		E120=0.0	VIEW\$	558
560	7145	GO 150 JA=1,ICIN	VIEW\$	559
		PHIU = PHIU(JA)	VIEW\$	560
		PHIL = PHILL(JA)	VIEW\$	561
		IF (SPEC) 7150,7150,7160	VIEW\$	562
565	7150	IF (PHIU -PIE) 100,110,110	VIEW\$	563
	100	SU2 = SIN(PHIU/2.0)	VIEW\$	564
		CU2 = COS(PHIU/2.0)	VIEW\$	565
		TU2 = SU2/CU2	VIEW\$	566
		ATU2 = SU1 *TU2	VIEW\$	567
		AU = ATAN(ATU2)	VIEW\$	568
		OSU = TU2/11.+ O1*TU2*TU2)	VIEW\$	569
570		GO TO 170	VIEW\$	570

630	672	688	692	698	702	708	712	718	722	728	732	738	742	748	752	758	762	768	772	778	782	788	792	798	802	808	812	818	822	828	832	838	842	848	852	858	862	868	872	878	882	888	892	898	902	908	912	918	922	928	932	938	942	948	952	958	962	968	972	978	982	988	992	998	1002	1008	1012	1018	1022	1028	1032	1038	1042	1048	1052	1058	1062	1068	1072	1078	1082	1088	1092	1098	1102	1108	1112	1118	1122	1128	1132	1138	1142	1148	1152	1158	1162	1168	1172	1178	1182	1188	1192	1198	1202	1208	1212	1218	1222	1228	1232	1238	1242	1248	1252	1258	1262	1268	1272	1278	1282	1288	1292	1298	1302	1308	1312	1318	1322	1328	1332	1338	1342	1348	1352	1358	1362	1368	1372	1378	1382	1388	1392	1398	1402	1408	1412	1418	1422	1428	1432	1438	1442	1448	1452	1458	1462	1468	1472	1478	1482	1488	1492	1498	1502	1508	1512	1518	1522	1528	1532	1538	1542	1548	1552	1558	1562	1568	1572	1578	1582	1588	1592	1598	1602	1608	1612	1618	1622	1628	1632	1638	1642	1648	1652	1658	1662	1668	1672	1678	1682	1688	1692	1698	1702	1708	1712	1718	1722	1728	1732	1738	1742	1748	1752	1758	1762	1768	1772	1778	1782	1788	1792	1798	1802	1808	1812	1818	1822	1828	1832	1838	1842	1848	1852	1858	1862	1868	1872	1878	1882	1888	1892	1898	1902	1908	1912	1918	1922	1928	1932	1938	1942	1948	1952	1958	1962	1968	1972	1978	1982	1988	1992	1998	2002	2008	2012	2018	2022	2028	2032	2038	2042	2048	2052	2058	2062	2068	2072	2078	2082	2088	2092	2098	2102	2108	2112	2118	2122	2128	2132	2138	2142	2148	2152	2158	2162	2168	2172	2178	2182	2188	2192	2198	2202	2208	2212	2218	2222	2228	2232	2238	2242	2248	2252	2258	2262	2268	2272	2278	2282	2288	2292	2298	2302	2308	2312	2318	2322	2328	2332	2338	2342	2348	2352	2358	2362	2368	2372	2378	2382	2388	2392	2398	2402	2408	2412	2418	2422	2428	2432	2438	2442	2448	2452	2458	2462	2468	2472	2478	2482	2488	2492	2498	2502	2508	2512	2518	2522	2528	2532	2538	2542	2548	2552	2558	2562	2568	2572	2578	2582	2588	2592	2598	2602	2608	2612	2618	2622	2628	2632	2638	2642	2648	2652	2658	2662	2668	2672	2678	2682	2688	2692	2698	2702	2708	2712	2718	2722	2728	2732	2738	2742	2748	
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685	578	LP = 3	PHI1 = PHI1 + .5 * CXL * DPHI1	VIENS	686
		LV = 1		VIENS	687
		GO TO 77		VIENS	688
690	580	DO 590 NM = 1, NYL		VIENS	689
		NM = 3 * NM - 2		VIENS	690
		NM1 = 3 * NM - 1		VIENS	691
		NM2 = 3 * NM		VIENS	692
695	582	1 * (DPHI1/8, 1) * (F1(NM, 1) * F1(NM, 3) * F1(NM2, 1) + F1(NM2, 3))		VIENS	693
		2 * (DPHI1/6, 1) * (F1(NM1, 1) + F1(NM1, 3) + F1(NM2, 1) + F1(NM2, 3))		VIENS	694
		IF (N1) 582, 589, 582		VIENS	695
		FF = FF + C * DVI		VIENS	696
705	585	GO TO 590		VIENS	697
		FF = FF + C * DVI		VIENS	698
		CONTINUE		VIENS	699
		LV = 1		VIENS	700
		LP = 1		VIENS	701
705	607	PHI1 = PHI1 + (1 - C * XL * DPHI1)		VIENS	702
		IF (ABS(PHI1 - PHI1) - 1, 0E-2) 630, 630, 607		VIENS	703
	607	IF (PHI1 - PHI1) 77, 630, 630		VIENS	704
	620	F1(J, K) = FF * 2 * PI * C / A(J)		VIENS	705
		F1(K, J) = F1(J, K) * A(J) / A(K)		VIENS	706
		GO TO 642		VIENS	707
710	630	F1(J, K) = FF * D * C / A(J)		VIENS	708
		F1(K, J) = FF * D * C / A(K)		VIENS	709
	642	IF (COUNT - 4) 642, 643, 643		VIENS	710
	643	COUNT = 3		VIENS	711
		COUNT = 1		VIENS	712
715	644	GO TO 641		VIENS	713
		CALL TEST(F1(J, K), DIV, COUNT, R, COUNT, R)		VIENS	714
	644	IF (COUNT) 644, 644, 5300		VIENS	715
		IF (F1(J, K) * (1 - 0.01 * F1(J, K)) = 0.0		VIENS	716
		IF (F1(J, K) * (1 - 0.01 * F1(K, J)) = 0.0		VIENS	717
720		NODE = NODE + 1		VIENS	718
		NODE = NODE + 1		VIENS	719
		FFSR(NODE1, NODE2) = F1(J, K)		VIENS	720
		FFSR(NODE2, NODE1) = F1(K, J)		VIENS	721
725	15800	CONTINUE		VIENS	722
		AR1(NODE1) = A(J) / 144.0		VIENS	723
	15800	CONTINUE		VIENS	724
	15800	IF (PRINT, EQ, 0) GO TO 670		VIENS	725
		WRITE(6, 15001)		VIENS	726
730	15001	FORMAT(14, 26X, 26H SYSTEM INTERNAL VIEW FACTORS, //)		VIENS	727
		DO 16001 I = 1, NTOT		VIENS	728
		DO 16001 J = 1, NTOT		VIENS	729
		IF (CLINEI, GE, 50) GO TO 15002		VIENS	730
	15004	WRITE(6, 652) I, J, FFSR(I, J), J, FFSR(J, I)		VIENS	731
	650	FORMAT(14X, 2MF(1, 12, 14), 12, 3M) = , F7.5, 107, 2MF(1, 12, 14), 12, 3M) = , F7.5		VIENS	732
735	1)	LINE1 = LINE1 + 1		VIENS	733
		GO TO 16002		VIENS	734
	15802	WRITE(6, 15001)		VIENS	735
		LINE1 =		VIENS	736
740	15000	CONTINUE		VIENS	737
		GO TO 15004		VIENS	738
		CONTINUE		VIENS	739
				VIENS	740
				VIENS	741
				VIENS	742

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745 LINE7=LINET*1
    ARE2=ARE1(I)*144.8
    WRITE(6,15005) I,ARE2
    15005 FORMAT(28X,5MAREAT,12,3H)=.FT,2.0M,50. IN,2//1
    LINE7=LINET*2
    16001 CONTINUE
    670 IF(IKKKI.EQ.0) GO TO 671
    DO 572 I=1,NTOT
    PUNCH 673, IFFSR(I,I),I=1,NTOT)
    ARE2=ARE1(I)*144.8
    672 PUNCH 673, ARE2
    673 FORMAT(8F17.5)
    IF(IISTOPTI.EQ.3) STOP
    671 CONTINUE
    END

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VIEWS 743
VIEWS 744
VIEWS 745
VIEWS 746
VIEWS 747
VIEWS 748
VIEWS 749
VIEWS 750
VIEWS 751
VIEWS 752
VIEWS 753
VIEWS 754
VIEWS 755
VIEWS 756
VIEWS 757

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	SUBROUTINE ARCCOSICS,ANG,ITA)	ARCCOS	2
	PIEI = 3.141592653589793	ARCCOS	3
	TABSTICS) - 1.0	ARCCOS	4
	IFIT) 67.6601.6602	ARCCOS	5
	IFICS) 6603.6603.6606	ARCCOS	6
	ANG = PIEI	ARCCOS	7
	GO TO 70	ARCCOS	8
	ANG=2.0	ARCCOS	9
	GO TO 70	ARCCOS	10
10	6602 IF(ABS(PI-1.0E-5)) 6603,6604,6605	ARCCOS	11
	NO SOLUTION	ARCCOS	12
	ITA=2	ARCCOS	13
	RETURN	ARCCOS	14
	IFICS) 6720,6710,6720	ARCCOS	15
15	5710 ANG = PIEI/2.	ARCCOS	16
	GO TO 70	ARCCOS	17
	6720 TP2PI=SQRT(1.-CS**2)/CS	ARCCOS	18
	ANG=ATAN(TP2PI)	ARCCOS	19
	IF(TP2PI) 60,70,70	ARCCOS	20
20	60 ANG = ANG+PIEI	ARCCOS	21
	A SOLUTION WAS FOUND	ARCCOS	22
	ITA=1	ARCCOS	23
	RETURN	ARCCOS	24
	END	ARCCOS	25

A-176

SUBROUTINE QUAD(A,B,C,RP1,RI1,RR2,RI2,IOR)

IF(A*B*(A-1-BE-4) 5,5,30

IF(A*B*(B-1-BE-4) 10,10,15

NO SOLUTION

5

IOR=4

RETURN

ONE REAL SOLUTION

RR1=-C/B

IOR=2

RETURN

DISC = B*B-A*A+C

IF(DISC) 40,30,60

COMPLEX ROOTS

IOR=3

RR1 = -B/(2.*A)

RI1 = C.5*SQR((-DISC))/A

RR2= RP1

RI2 = -RI1

RETURN

IDENTICAL ROOTS

IOR = 2

RR1 = -B/(2.*A)

RETURN

TWO REAL ROOTS

IOR = 1

RR1 = 0.5*(-B+SQR(DISC))/A

RR2 = 0.5*(-B-SQR(DISC))/A

RETURN

END

QUAD 2
QUAD 3
QUAD 4
QUAD 5
QUAD 6
QUAD 7
QUAD 8
QUAD 9
QUAD 10
QUAD 11
QUAD 12
QUAD 13
QUAD 14
QUAD 15
QUAD 16
QUAD 17
QUAD 18
QUAD 19
QUAD 20
QUAD 21
QUAD 22
QUAD 23
QUAD 24
QUAD 25
QUAD 26
QUAD 27
QUAD 28
QUAD 29
QUAD 30

Line	Code	Statement	Variable	Value
5	C	IF (ABS(SIAA)-1.0E-04) 5,5,10		
5	C	CALL QVAD(188,CC,00,RR1,RR1,RR2,RR2,1023)		
15	C	IF (IDP3-2) 30,23,15		
15	C	NO PEAL SOLUTIONS		
15	C	IC3 = 4	IC3	4
15	C	RETURN		
15	C	ONE REAL SOLUTION		
15	C	IC3 = 3	IC3	3
15	C	RR1 = RR2	RR1	RR2
15	C	RETURN		
15	C	TWO REAL SOLUTIONS		
15	C	RR1 = RR2	RR1	RR2
15	C	RR2 = RR2	RR2	RR2
15	C	IC3 = 2	IC3	2
15	C	RETURN		
15	C	RR1 = RR2	RR1	RR2
15	C	RETURN		
15	C	TWO REAL SOLUTIONS		
15	C	RR1 = RR2	RR1	RR2
15	C	RR2 = RR2	RR2	RR2
15	C	IC3 = 2	IC3	2
15	C	RETURN		
15	C	RR1 = RR2	RR1	RR2
15	C	RETURN		
15	C	TWO REAL SOLUTIONS		
15	C	RR1 = RR2	RR1	RR2
15	C	RR2 = RR2	RR2	RR2
15	C	IC3 = 2	IC3	2
15	C	RETURN		
15	C	RR1 = RR2	RR1	RR2
15	C	RETURN		
15	C	TWO REAL SOLUTIONS		
15	C	RR1 = RR2	RR1	RR2
15	C	RR2 = RR2	RR2	RR2
15	C	IC3 = 2	IC3	2
15	C	RETURN		
15	C	RR1 = RR2	RR1	RR2
15	C	RETURN		
15	C	TWO REAL SOLUTIONS		
15	C	RR1 = RR2	RR1	RR2
15	C	RR2 = RR2	RR2	RR2
15	C	IC3 = 2	IC3	2
15	C	RETURN		
15	C	RR1 = RR2	RR1	RR2
15	C	RETURN		
15	C	TWO REAL SOLUTIONS		
15	C	RR1 = RR2	RR1	RR2
15	C	RR2 = RR2	RR2	RR2
15	C	IC3 = 2	IC3	2
15	C	RETURN		
15	C	RR1 = RR2	RR1	RR2
15	C	RETURN		
15	C	TWO REAL SOLUTIONS		
15	C	RR1 = RR2	RR1	RR2
15	C	RR2 = RR2	RR2	RR2
15	C	IC3 = 2	IC3	2
15	C	RETURN		
15	C	RR1 = RR2	RR1	RR2
15	C	RETURN		
15	C	TWO REAL SOLUTIONS		
15	C	RR1 = RR2	RR1	RR2
15	C	RR2 = RR2	RR2	RR2
15	C	IC3 = 2	IC3	2
15	C	RETURN		
15	C	RR1 = RR2	RR1	RR2
15	C	RETURN		
15	C	TWO REAL SOLUTIONS		
15	C	RR1 = RR2	RR1	RR2
15	C	RR2 = RR2	RR2	RR2
15	C	IC3 = 2	IC3	2
15	C	RETURN		
15	C	RR1 = RR2	RR1	RR2
15	C	RETURN		
15	C	TWO REAL SOLUTIONS		
15	C	RR1 = RR2	RR1	RR2
15	C	RR2 = RR2	RR2	RR2
15	C	IC3 = 2	IC3	2
15	C	RETURN		
15	C	RR1 = RR2	RR1	RR2
15	C	RETURN		
15	C	TWO REAL SOLUTIONS		
15	C	RR1 = RR2	RR1	RR2
15	C	RR2 = RR2	RR2	RR2
15	C	IC3 = 2	IC3	2
15	C	RETURN		
15	C	RR1 = RR2	RR1	RR2
15	C	RETURN		
15	C	TWO REAL SOLUTIONS		
15	C	RR1 = RR2	RR1	RR2
15	C	RR2 = RR2	RR2	RR2
15	C	IC3 = 2	IC3	


```

SUBROUTINE TEST1(R1T,R2T,PM1OT,PM1IT,X1T,Z1T,TEST1)
  DEMO= R2T**2+R1T**2-2.*R2T*R1T*COS(PM1OT)
  IF (DEMO) 20,20,10
  PM1Z= PM1IT+PM1OT
  XE=R1T*R2T*SIN(PM1OT)*(R2T*SIN(PM1Z)-R1T*SIN(PM1IT))/DEMO
  ZE=R1T*R2T*SIN(PM1OT)*(R2T*COS(PM1Z)-R1T*COS(PM1IT))/DEMO
  XZ=R2T*COS(PM1Z)
  ZT=R2T*SIN(PM1Z)
  D1F= SQRT((X1T-XE)**2+(Z1T-ZF)**2)
  D2F= SQRT((X2T-XE)**2+(Z2T-ZF)**2)
  D1Z= SQRT((X2T-X1T)**2+(Z2T-Z1T)**2)
  IF (A3SID1F-D1Z) -1,D2-D3) 11,11,11Z
  11 01F,01Z
  12 IF (A3SID2F-D1Z)-1,D2-D3) 13,13,11Y
  13 D2F=D1Z
  14 IF (A3F-D1Z) 15,15,20
  15 IF (D2F-D1Z) 25,25,20
  SOLUTION IS NOT VALID FOR THIS PROBLEM
  20 TEST1 = 2
  RETURN
  25 SOLUTION IS VALID FOR THIS PROBLEM
  TEST1 = 1
  RETURN
  END

```

TEST1	2
TEST1	3
TEST1	4
TEST1	5
TEST1	6
TEST1	7
TEST1	8
TEST1	9
TEST1	10
TEST1	11
TEST1	12
TEST1	13
TEST1	14
TEST1	15
TEST1	16
TEST1	17
TEST1	18
TEST1	19
TEST1	20
TEST1	21
TEST1	22
TEST1	23
TEST1	24
TEST1	25

				TEST2	2
				TEST2	3
				TEST2	4
				TEST2	5
				TEST2	6
				TEST2	7
				TEST2	8
				TEST2	9
				TEST2	10
				TEST2	11
				TEST2	12
				TEST2	13
				TEST2	14
				TEST2	15
				TEST2	16
				TEST2	17
				TEST2	18


```

SUBROUTINE TEST2(YU,YD,YF,IFYF)
  YUD=ABS(YD-YU)
  YFD=ABS(YD-YF)
  YFU=ABS(YU-YF)
  IF(ABS(YUD-YFD)-1.0E-03) 1,1,2
  1 YFD=YUD
  2 IF(ABS(YUD-YFU)-1.0E-03) 3,3,4
  3 YFU=YUD
  4 IF(YFD-YUD) 5,5,10
  5 IF(YFU-YUD) 15,15,10
  IF IS NOT A VALID SOLUTION FOR THIS PROBLEM
  10 IF YE=2
  RETURN
  IF IS A VALID SOLUTION FOR THIS PROBLEM
  IFYF = 1
  RETURN
  END
  
```

	SUBROUTINE FINDITV,YF,I,NPS,NVU1		FINDIT	
	DIMENSION YF(10,20)		FINDIT	2
	DO 100 J=1,NPS		FINDIT	3
	IF(Y-YF(I,J)) 10,40,50		FINDIT	4
5	IF(J-1) 20,20,30		FINDIT	5
	NVU=0		FINDIT	6
	GO TO 119		FINDIT	7
	NVU=J-1		FINDIT	8
	GO TO 110		FINDIT	9
10	NVU=J		FINDIT	10
	GO TO 110		FINDIT	11
	IF(J-NPS)100,60,60		FINDIT	12
	NVU=J		FINDIT	13
	GO TO 113		FINDIT	14
15	CONTINUE		FINDIT	15
	RETURN		FINDIT	16
	END		FINDIT	17
			FINDIT	18

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```

SUBROUTINE CODE(NY1,NY2,NPS,ICODE)
  IF(NY1) 18,19,15
  IF(NY2) 20,21,25
  BOTH Y1 AND Y2 ARE UPSTREAM OF THE SHADOWING BODY
  ICODE=9
  RETURN
  5
  25 IF(NY2-NPS) 30,35,35
  Y1 IS UPSTREAM AND Y2 IS DOWNSTREAM OF THE SHADOWING BODY
  ICODE=1
  RETURN
  10
  30 Y1 IS UPSTREAM AND Y2 IS WITHIN Y BAND OF BODY
  ICODE=2
  RETURN
  15
  45 IF(NY1-NPS) 40,45,45
  IF(NY2) 50,50,55
  Y1 IS WITHIN Y BAND OF BODY AND Y2 IS UPSTREAM OF IT
  ICODE=3
  RETURN
  20
  55 IF(NY2-NPS) 60,65,65
  Y1 IS WITHIN Y BAND OF BODY AND Y2 IS DOWNSTREAM OF IT
  ICODE=4
  RETURN
  25
  65 Y1 IS WITHIN Y BAND OF BODY AND Y2 IS ALSO WITHIN THAT BAND
  ICODE=5
  RETURN
  30
  75 IF(NY2-NPS) 75,70,70
  BOTH Y1 AND Y2 LIE DOWNSTREAM OF THE SHADOWING BODY
  ICODE=8
  RETURN
  35
  85 IF(NY2) 90,90,85
  Y1 IS DOWNSTREAM OF BODY AND Y2 IS WITHIN THE Y BAND OF THE BODY
  ICODE=6
  RETURN
  40
  95 Y1 IS DOWNSTREAM OF BODY AND Y2 IS UPSTREAM OF IT
  ICODE=7
  RETURN
  END

```

		SUBROUTINE CANSEE(Y1,R1,Y2,R2,VF,Rf,K1,KIL,JJ,ISSEI)			
		DIMENSION VF(13,20),Rf(10,20)			
		IO=0		CANSEE 2	
		JD=0		CANSEE 3	
		KICK=1		CANSEE 4	
		KSE=K1		CANSEE 5	
5		R2T=R2		CANSEE 6	
		RJT=RF(JJ,KK)		CANSEE 7	
		RJT=RF(JJ,KK+1)		CANSEE 8	
		VOT=VF(JJ,KK)		CANSEE 9	
		VOT=VF(JJ,KK+1)		CANSEE 10	
		GO TO 10		CANSEE 11	
10		PUT=RF(JJ,KK)		CANSEE 12	
		PUT=RF(JJ,KK+1)		CANSEE 13	
		VOT=VF(JJ,KK)		CANSEE 14	
		VOT=VF(JJ,KK+1)		CANSEE 15	
15		VOT=VF(JJ,KK)		CANSEE 16	
		VOT=VF(JJ,KK+1)		CANSEE 17	
		VOT=VF(JJ,KK)		CANSEE 18	
		VOT=VF(JJ,KK+1)		CANSEE 19	
20		VOT=VF(JJ,KK)		CANSEE 20	
		VOT=VF(JJ,KK+1)		CANSEE 21	
		VOT=VF(JJ,KK)		CANSEE 22	
		VOT=VF(JJ,KK+1)		CANSEE 23	
		VOT=VF(JJ,KK)		CANSEE 24	
		VOT=VF(JJ,KK+1)		CANSEE 25	
25		VOT=VF(JJ,KK)		CANSEE 26	
		VOT=VF(JJ,KK+1)		CANSEE 27	
		VOT=VF(JJ,KK)		CANSEE 28	
		VOT=VF(JJ,KK+1)		CANSEE 29	
		VOT=VF(JJ,KK)		CANSEE 30	
		VOT=VF(JJ,KK+1)		CANSEE 31	
30		VOT=VF(JJ,KK)		CANSEE 32	
		VOT=VF(JJ,KK+1)		CANSEE 33	
		VOT=VF(JJ,KK)		CANSEE 34	
		VOT=VF(JJ,KK+1)		CANSEE 35	
		VOT=VF(JJ,KK)		CANSEE 36	
		VOT=VF(JJ,KK+1)		CANSEE 37	
35		VOT=VF(JJ,KK)		CANSEE 38	
		VOT=VF(JJ,KK+1)		CANSEE 39	
		VOT=VF(JJ,KK)		CANSEE 40	
		VOT=VF(JJ,KK+1)		CANSEE 41	
		VOT=VF(JJ,KK)		CANSEE 42	
		VOT=VF(JJ,KK+1)		CANSEE 43	
40		VOT=VF(JJ,KK)		CANSEE 44	
		VOT=VF(JJ,KK+1)		CANSEE 45	
		VOT=VF(JJ,KK)		CANSEE 46	
		VOT=VF(JJ,KK+1)		CANSEE 47	
		VOT=VF(JJ,KK)		CANSEE 48	
		VOT=VF(JJ,KK+1)		CANSEE 49	
45		VOT=VF(JJ,KK)		CANSEE 50	
		VOT=VF(JJ,KK+1)		CANSEE 51	
		VOT=VF(JJ,KK)		CANSEE 52	
		VOT=VF(JJ,KK+1)		CANSEE 53	
		VOT=VF(JJ,KK)		CANSEE 54	
		VOT=VF(JJ,KK+1)		CANSEE 55	
50		VOT=VF(JJ,KK)		CANSEE 56	
		VOT=VF(JJ,KK+1)		CANSEE 57	
		VOT=VF(JJ,KK)		CANSEE 58	
		VOT=VF(JJ,KK+1)		CANSEE 59	
55		VOT=VF(JJ,KK)		CANSEE 60	
		VOT=VF(JJ,KK+1)		CANSEE 61	
		VOT=VF(JJ,KK)		CANSEE 62	
		VOT=VF(JJ,KK+1)		CANSEE 63	
		VOT=VF(JJ,KK)		CANSEE 64	
		VOT=VF(JJ,KK+1)		CANSEE 65	
		VOT=VF(JJ,KK)		CANSEE 66	
		VOT=VF(JJ,KK+1)		CANSEE 67	
		VOT=VF(JJ,KK)		CANSEE 68	
		VOT=VF(JJ,KK+1)		CANSEE 69	
		VOT=VF(JJ,KK)		CANSEE 70	
		VOT=VF(JJ,KK+1)		CANSEE 71	
		VOT=VF(JJ,KK)		CANSEE 72	
		VOT=VF(JJ,KK+1)		CANSEE 73	
		VOT=VF(JJ,KK)		CANSEE 74	
		VOT=VF(JJ,KK+1)		CANSEE 75	
		VOT=VF(JJ,KK)		CANSEE 76	
		VOT=VF(JJ,KK+1)		CANSEE 77	
		VOT=VF(JJ,KK)		CANSEE 78	
		VOT=VF(JJ,KK+1)		CANSEE 79	
		VOT=VF(JJ,KK)		CANSEE 80	
		VOT=VF(JJ,KK+1)		CANSEE 81	
		VOT=VF(JJ,KK)		CANSEE 82	
		VOT=VF(JJ,KK+1)		CANSEE 83	
		VOT=VF(JJ,KK)		CANSEE 84	
		VOT=VF(JJ,KK+1)		CANSEE 85	
		VOT=VF(JJ,KK)		CANSEE 86	
		VOT=VF(JJ,KK+1)		CANSEE 87	
		VOT=VF(JJ,KK)		CANSEE 88	
		VOT=VF(JJ,KK+1)		CANSEE 89	
		VOT=VF(JJ,KK)		CANSEE 90	
		VOT=VF(JJ,KK+1)		CANSEE 91	
		VOT=VF(JJ,KK)		CANSEE 92	
		VOT=VF(JJ,KK+1)		CANSEE 93	
		VOT=VF(JJ,KK)		CANSEE 94	
		VOT=VF(JJ,KK+1)		CANSEE 95	
		VOT=VF(JJ,KK)		CANSEE 96	
		VOT=VF(JJ,KK+1)		CANSEE 97	
		VOT=VF(JJ,KK)		CANSEE 98	
		VOT=VF(JJ,KK+1)		CANSEE 99	
		VOT=VF(JJ,KK)		CANSEE 100	

```

60      C      193,190,220
      THE BODY CAUSES NO SHADOWING
      ISEE=1
      RETURN
      201      RC= (Y2-YUT)*R1/(Y2-V1)
      RHO= R2*(YU1-Y1)/(Y2-Y1)
      X1= RC+PHO
      Y2= RC-RHO
      IF1 ABS(UT-Y1)-1.0E-03) 193,195,205
      IF1 ABS(X2+PUT)-1.0E-03) 195,195,210
      205      IF(X1-PUT) 220,220,230
      210      IF(X2+PUT) 220,220,240
      230      C THE FRUSTUM SHADOWS WITH ITS OUTSIDE SURFACE BUT SHADOWING DOES NOT E
      C FOR PH12= 100 DEGREES AS IT DOES FOR ISEE=2
      240      ISEE= 5
      RETURN
      75      C THE BODY CAUSES SHADOWING WITH ITS OUTSIDE SURFACE
      ISEE= 2
      RETURN
      165      IF(JDI) 100,100,105
      C THE BODY CAUSES SHADOWING WITH ITS INSIDE SURFACE
      ISEE=3
      RETURN
      105      C THE BODY CAUSES COMPLETE SHADOWING
      ISEE= 4
      RETURN
      END

```

CANSEE 59
 CANSEE 60
 CANSEE 61
 CANSEE 62
 CANSEE 63
 CANSEE 64
 CANSEE 65
 CANSEE 66
 CANSEE 67
 CANSEE 68
 CANSEE 69
 CANSEE 70
 CANSEE 71
 CANSEE 72
 CANSEE 73
 CANSEE 74
 CANSEE 75
 CANSEE 76
 CANSEE 77
 CANSEE 78
 CANSEE 79
 CANSEE 80
 CANSEE 81
 CANSEE 82
 CANSEE 83
 CANSEE 84
 CANSEE 85

	SUBROUTINE BODY(V1,V2,R1,R2,VFU,BFU,VFO,RFO,PHIO,PHIL,IOM)	BODY	2
	EF= (RFU*VFO-RFO*VFU)/(VFO-VFU)	BODY	3
	FF= (RFO-RFU)/(VFO-VFU)	BODY	4
	FC= EF*FF*V1	BODY	5
5	RC= EF*FF*V2	BODY	6
	IF (ABS(PC1-R1)-1,DE-31,10,12,20	BODY	7
10	IF (ABS(PC2-R2)-1,DE-31,10,12,20	BODY	8
11	IF (ABS(PC3-R3)-1,DE-31,10,12,20	BODY	9
12	IF (ABS(PC4-R4)-1,DE-31,10,12,20	BODY	10
13	IF (ABS(PC5-R5)-1,DE-31,10,12,20	BODY	11
14	IF (ABS(PC6-R6)-1,DE-31,10,12,20	BODY	12
15	IF (ABS(PC7-R7)-1,DE-31,10,12,20	BODY	13
16	IF (ABS(PC8-R8)-1,DE-31,10,12,20	BODY	14
17	IF (ABS(PC9-R9)-1,DE-31,10,12,20	BODY	15
18	IF (ABS(PC10-R10)-1,DE-31,10,12,20	BODY	16
19	IF (ABS(PC11-R11)-1,DE-31,10,12,20	BODY	17
20	IF (ABS(PC12-R12)-1,DE-31,10,12,20	BODY	18
21	IF (ABS(PC13-R13)-1,DE-31,10,12,20	BODY	19
22	IF (ABS(PC14-R14)-1,DE-31,10,12,20	BODY	20
23	IF (ABS(PC15-R15)-1,DE-31,10,12,20	BODY	21
24	IF (ABS(PC16-R16)-1,DE-31,10,12,20	BODY	22
25	IF (ABS(PC17-R17)-1,DE-31,10,12,20	BODY	23
26	IF (ABS(PC18-R18)-1,DE-31,10,12,20	BODY	24
27	IF (ABS(PC19-R19)-1,DE-31,10,12,20	BODY	25
28	IF (ABS(PC20-R20)-1,DE-31,10,12,20	BODY	26
29	IF (ABS(PC21-R21)-1,DE-31,10,12,20	BODY	27
30	IF (ABS(PC22-R22)-1,DE-31,10,12,20	BODY	28
31	IF (ABS(PC23-R23)-1,DE-31,10,12,20	BODY	29
32	IF (ABS(PC24-R24)-1,DE-31,10,12,20	BODY	30
33	IF (ABS(PC25-R25)-1,DE-31,10,12,20	BODY	31
34	IF (ABS(PC26-R26)-1,DE-31,10,12,20	BODY	32
35	IF (ABS(PC27-R27)-1,DE-31,10,12,20	BODY	33
36	IF (ABS(PC28-R28)-1,DE-31,10,12,20	BODY	34
37	IF (ABS(PC29-R29)-1,DE-31,10,12,20	BODY	35
38	IF (ABS(PC30-R30)-1,DE-31,10,12,20	BODY	36
39	IF (ABS(PC31-R31)-1,DE-31,10,12,20	BODY	37
40	IF (ABS(PC32-R32)-1,DE-31,10,12,20	BODY	38
41	IF (ABS(PC33-R33)-1,DE-31,10,12,20	BODY	39
42	IF (ABS(PC34-R34)-1,DE-31,10,12,20	BODY	40
43	IF (ABS(PC35-R35)-1,DE-31,10,12,20	BODY	41
44	IF (ABS(PC36-R36)-1,DE-31,10,12,20	BODY	42
45	IF (ABS(PC37-R37)-1,DE-31,10,12,20	BODY	43
46	IF (ABS(PC38-R38)-1,DE-31,10,12,20	BODY	44
47	IF (ABS(PC39-R39)-1,DE-31,10,12,20	BODY	45
48	IF (ABS(PC40-R40)-1,DE-31,10,12,20	BODY	46
49	IF (ABS(PC41-R41)-1,DE-31,10,12,20	BODY	47
50	IF (ABS(PC42-R42)-1,DE-31,10,12,20	BODY	48
51	IF (ABS(PC43-R43)-1,DE-31,10,12,20	BODY	49
52	IF (ABS(PC44-R44)-1,DE-31,10,12,20	BODY	50
53	IF (ABS(PC45-R45)-1,DE-31,10,12,20	BODY	51
54	IF (ABS(PC46-R46)-1,DE-31,10,12,20	BODY	52
55	IF (ABS(PC47-R47)-1,DE-31,10,12,20	BODY	53
56	IF (ABS(PC48-R48)-1,DE-31,10,12,20	BODY	54
57	IF (ABS(PC49-R49)-1,DE-31,10,12,20	BODY	55
58	IF (ABS(PC50-R50)-1,DE-31,10,12,20	BODY	56
59	IF (ABS(PC51-R51)-1,DE-31,10,12,20	BODY	57
60	IF (ABS(PC52-R52)-1,DE-31,10,12,20	BODY	58
61	IF (ABS(PC53-R53)-1,DE-31,10,12,20	BODY	59
62	IF (ABS(PC54-R54)-1,DE-31,10,12,20	BODY	60
63	IF (ABS(PC55-R55)-1,DE-31,10,12,20	BODY	61
64	IF (ABS(PC56-R56)-1,DE-31,10,12,20	BODY	62
65	IF (ABS(PC57-R57)-1,DE-31,10,12,20	BODY	63
66	IF (ABS(PC58-R58)-1,DE-31,10,12,20	BODY	64
67	IF (ABS(PC59-R59)-1,DE-31,10,12,20	BODY	65
68	IF (ABS(PC60-R60)-1,DE-31,10,12,20	BODY	66
69	IF (ABS(PC61-R61)-1,DE-31,10,12,20	BODY	67
70	IF (ABS(PC62-R62)-1,DE-31,10,12,20	BODY	68
71	IF (ABS(PC63-R63)-1,DE-31,10,12,20	BODY	69
72	IF (ABS(PC64-R64)-1,DE-31,10,12,20	BODY	70
73	IF (ABS(PC65-R65)-1,DE-31,10,12,20	BODY	71
74	IF (ABS(PC66-R66)-1,DE-31,10,12,20	BODY	72
75	IF (ABS(PC67-R67)-1,DE-31,10,12,20	BODY	73
76	IF (ABS(PC68-R68)-1,DE-31,10,12,20	BODY	74
77	IF (ABS(PC69-R69)-1,DE-31,10,12,20	BODY	75
78	IF (ABS(PC70-R70)-1,DE-31,10,12,20	BODY	76
79	IF (ABS(PC71-R71)-1,DE-31,10,12,20	BODY	77
80	IF (ABS(PC72-R72)-1,DE-31,10,12,20	BODY	78
81	IF (ABS(PC73-R73)-1,DE-31,10,12,20	BODY	79
82	IF (ABS(PC74-R74)-1,DE-31,10,12,20	BODY	80
83	IF (ABS(PC75-R75)-1,DE-31,10,12,20	BODY	81
84	IF (ABS(PC76-R76)-1,DE-31,10,12,20	BODY	82
85	IF (ABS(PC77-R77)-1,DE-31,10,12,20	BODY	83
86	IF (ABS(PC78-R78)-1,DE-31,10,12,20	BODY	84
87	IF (ABS(PC79-R79)-1,DE-31,10,12,20	BODY	85
88	IF (ABS(PC80-R80)-1,DE-31,10,12,20	BODY	86
89	IF (ABS(PC81-R81)-1,DE-31,10,12,20	BODY	87
90	IF (ABS(PC82-R82)-1,DE-31,10,12,20	BODY	88
91	IF (ABS(PC83-R83)-1,DE-31,10,12,20	BODY	89
92	IF (ABS(PC84-R84)-1,DE-31,10,12,20	BODY	90
93	IF (ABS(PC85-R85)-1,DE-31,10,12,20	BODY	91
94	IF (ABS(PC86-R86)-1,DE-31,10,12,20	BODY	92
95	IF (ABS(PC87-R87)-1,DE-31,10,12,20	BODY	93
96	IF (ABS(PC88-R88)-1,DE-31,10,12,20	BODY	94
97	IF (ABS(PC89-R89)-1,DE-31,10,12,20	BODY	95
98	IF (ABS(PC90-R90)-1,DE-31,10,12,20	BODY	96
99	IF (ABS(PC91-R91)-1,DE-31,10,12,20	BODY	97
100	IF (ABS(PC92-R92)-1,DE-31,10,12,20	BODY	98
101	IF (ABS(PC93-R93)-1,DE-31,10,12,20	BODY	99
102	IF (ABS(PC94-R94)-1,DE-31,10,12,20	BODY	100
103	IF (ABS(PC95-R95)-1,DE-31,10,12,20	BODY	101
104	IF (ABS(PC96-R96)-1,DE-31,10,12,20	BODY	102
105	IF (ABS(PC97-R97)-1,DE-31,10,12,20	BODY	103
106	IF (ABS(PC98-R98)-1,DE-31,10,12,20	BODY	104
107	IF (ABS(PC99-R99)-1,DE-31,10,12,20	BODY	105
108	IF (ABS(PC100-R100)-1,DE-31,10,12,20	BODY	106
109	IF (ABS(PC101-R101)-1,DE-31,10,12,20	BODY	107
110	IF (ABS(PC102-R102)-1,DE-31,10,12,20	BODY	108
111	IF (ABS(PC103-R103)-1,DE-31,10,12,20	BODY	109
112	IF (ABS(PC104-R104)-1,DE-31,10,12,20	BODY	110
113	IF (ABS(PC105-R105)-1,DE-31,10,12,20	BODY	111
114	IF (ABS(PC106-R106)-1,DE-31,10,12,20	BODY	112
115	IF (ABS(PC107-R107)-1,DE-31,10,12,20	BODY	113
116	IF (ABS(PC108-R108)-1,DE-31,10,12,20	BODY	114
117	IF (ABS(PC109-R109)-1,DE-31,10,12,20	BODY	115
118	IF (ABS(PC110-R110)-1,DE-31,10,12,20	BODY	116
119	IF (ABS(PC111-R111)-1,DE-31,10,12,20	BODY	117
120	IF (ABS(PC112-R112)-1,DE-31,10,12,20	BODY	118
121	IF (ABS(PC113-R113)-1,DE-31,10,12,20	BODY	119
122	IF (ABS(PC114-R114)-1,DE-31,10,12,20	BODY	120
123	IF (ABS(PC115-R115)-1,DE-31,10,12,20	BODY	121
124	IF (ABS(PC116-R116)-1,DE-31,10,12,20	BODY	122
125	IF (ABS(PC117-R117)-1,DE-31,10,12,20	BODY	123
126	IF (ABS(PC118-R118)-1,DE-31,10,12,20	BODY	124
127	IF (ABS(PC119-R119)-1,DE-31,10,12,20	BODY	125
128	IF (ABS(PC120-R120)-1,DE-31,10,12,20	BODY	126
129	IF (ABS(PC121-R121)-1,DE-31,10,12,20	BODY	127
130	IF (ABS(PC122-R122)-1,DE-31,10,12,20	BODY	128
131	IF (ABS(PC123-R123)-1,DE-31,10,12,20	BODY	129
132	IF (ABS(PC124-R124)-1,DE-31,10,12,20	BODY	130
133	IF (ABS(PC125-R125)-1,DE-31,10,12,20	BODY	131
134	IF (ABS(PC126-R126)-1,DE-31,10,12,20	BODY	132
135	IF (ABS(PC127-R127)-1,DE-31,10,12,20	BODY	133
136	IF (ABS(PC128-R128)-1,DE-31,10,12,20	BODY	134
137	IF (ABS(PC129-R129)-1,DE-31,10,12,20	BODY	135
138	IF (ABS(PC130-R130)-1,DE-31,10,12,20	BODY	136
139	IF (ABS(PC131-R131)-1,DE-31,10,12,20	BODY	137
140	IF (ABS(PC132-R132)-1,DE-31,10,12,20	BODY	138
141	IF (ABS(PC133-R133)-1,DE-31,10,12,20	BODY	139
142	IF (ABS(PC134-R134)-1,DE-31,10,12,20	BODY	140
143	IF (ABS(PC135-R135)-1,DE-31,10,12,20	BODY	141
144	IF (ABS(PC136-R136)-1,DE-31,10,12,20	BODY	142
145	IF (ABS(PC137-R137)-1,DE-31,10,12,20	BODY	143
146	IF (ABS(PC138-R138)-1,DE-31,10,12,20	BODY	144
147	IF (ABS(PC139-R139)-1,DE-31,10,12,20	BODY	145
148	IF (ABS(PC140-R140)-1,DE-31,10,12,20	BODY	146
149	IF (ABS(PC141-R141)-1,DE-31,10,12,20	BODY	147
150	IF (ABS(PC142-R142)-1,DE-31,10,12,20	BODY	148
151	IF (ABS(PC143-R143)-1,DE-31,10,12,20	BODY	149
152	IF (ABS(PC144-R144)-1,DE-31,10,12,20	BODY	150
153	IF (ABS(PC145-R145)-1,DE-31,10,12,20	BODY	151
154	IF (ABS(PC146-R146)-1,DE-31,10,12,20	BODY	152
155	IF (ABS(PC147-R147)-1,DE-31,10,12,20	BODY	153
156	IF (ABS(PC148-R148)-1,DE-31,10,12,20	BODY	154
157	IF (ABS(PC149-R149)-1,DE-31,10,12,20	BODY	155
158	IF (ABS(PC150-R150)-1,DE-31,10,12,20	BODY	156
159	IF (ABS(PC151-R151)-1,DE-31,10,12,20	BODY	157
160	IF (ABS(PC152-R152)-1,DE-31,10,12,20	BODY	158
161	IF (ABS(PC153-R153)-1,DE-31,10,12,20	BODY	159
162	IF (ABS(PC154-R154)-1,DE-31,10,12,20	BODY	160
163	IF (ABS(PC155-R155)-1,DE-31,10,12,20	BODY	161
164	IF (ABS(PC156-R156)-1,DE-31,10,12,20	BODY	162
165	IF (ABS(PC157-R157)-1,DE-31,10,12,20	BODY	163
166	IF (ABS(PC158-R158)-1,DE-31,10,12,20	BODY	164
167	IF (ABS(PC159-R159)-1,DE-31,10,12,20	BODY	165
168	IF (ABS(PC160-R160)-1,DE-31,10,12,20	BODY	166
169	IF (ABS(PC161-R161)-1,DE-31,10,12,20	BODY	167
170	IF (ABS(PC162-R162)-1,DE-31,10,12,20	BODY	168
171	IF (ABS(PC163-R163)-1,DE-31,10,12,20	BODY	169
172	IF (ABS(PC164-R164)-1,DE-31,10,12,20	BODY	170
173	IF (ABS(PC165-R165)-1,DE-31,10,12,20	BODY	171
174	IF (ABS(PC166-R166)-1,DE-31,10,12,20	BODY	172
175	IF (ABS(PC167-R167)-1,DE-31,10,12,20	BODY	173
176	IF (ABS(PC168-R168)-1,DE-31,10,12,20	BODY	174
177	IF (ABS(PC169-R169)-1,DE-31,10,12,20	BODY	175
178	IF (ABS(PC170-R170)-1,DE-31,10,12,20	BODY	176
179	IF (ABS(PC171-R171)-1,DE-31,10,12,20	BODY	177
180	IF (ABS(PC172-R172)-1,DE-31,10,12,20	BODY	178
181	IF (ABS(PC173-R173)-1,DE-31,10,12,20	BODY	179
182	IF (ABS(PC174-R174)-1,DE-31,10,12,20	BODY	180
183	IF (ABS(PC175-R175)-1,DE-31,10,12,20	BODY	181
184	IF (ABS(PC176-R176)-1,DE-31,10,12,20	BODY	182
185	IF (ABS(PC177-R177)-1,DE-31,10,12,20	BODY	183
186	IF (ABS(PC178-R178)-1,DE-31,10,12,20	BODY	184
187	IF (ABS(PC179-R179)-1,DE-31,10,12,20	BODY	185
188	IF (ABS(PC180-R180)-1,DE-31,10,12,20	BODY	186
189	IF (ABS(PC181-R181)-1,DE-31,10,12,20	BODY	187
190	IF (ABS(PC182-R182)-1,DE-31,10,12,20	BODY	188
191	IF (ABS(PC183-R183)-1,DE-31,10,12,20	BODY	189
192	IF (ABS(PC184-R184)-1,DE-31,10,12,20	BODY	190
193	IF (ABS(PC185-R185)-1,DE-31,10,12,20	BODY	191
194	IF (ABS(PC186-R186)-1,DE-31,10,12,20	BODY	192
195	IF (ABS(PC187-R187)-1,DE-31,10,12,20	BODY	193
196	IF (ABS(PC188-R188)-1,DE-31,10,12,20	BODY	194
197	IF (ABS(PC189-R189)-1,DE-31,10,12,20	BODY	195
198	IF (ABS(PC190-R190)-1,DE-31,10,12,20	BODY	196
199	IF (ABS(PC191-R191)-1,DE-31,10,12,20	BODY	197
200	IF (ABS(PC192-R192)-1,DE-31,10,12,20	BODY	198
201	IF (ABS(PC193-R193)-1,DE-31,10,12,20</		

9862	DED=C3-C4*RR1		800Y	59
	IF(AS(DED).LE.1.0E-5)	GO TO 9830	800Y	50
60	VF=(C1-C2*RR1)/DED		800Y	61
	CALL TEST2(VF,VF,VF,IFV)		800Y	62
	IF(IFY - 1) 9863, 9863, 9830		800Y	63
	CALL TEST2(Y1,Y2,YE,ALOU1)		800Y	64
	IF(LOU1-1) 520,520,9830		800Y	65
65	523	CALL CHECK(PHIO,PHI1,Y1,R1,Y2,R2,VF,AF,BF,EF,FF,IG0)	800Y	66
	IF(IG0-1) 9850,9850,9830		800Y	67
	C A VALID SOLUTION HAS BEEN FOUND.		800Y	68
	9850	ION=2	800Y	69
	RETURN		800Y	70
70	C NO VALID SOLUTION WAS FOUND.		800Y	71
	9830	ION=3	800Y	72
	RETURN		800Y	73
	END		800Y	74

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		SUBROUTINE CHECK(PH10,PH11,VA,RI,V2,R2,VF,AF,BF,EF,FF,IGOI)		
		PH12=PH11+PH10	CHECK	2
		X1=R1*COB(PH12)	CHECK	3
		X2=R2*COB(PH12)	CHECK	4
5		XF=X1+VF-Y11*(X2-X1)/(V2-V1)	CHECK	5
		Z1=R1*SIN(PH11)	CHECK	6
		Z2=R2*SIN(PH12)	CHECK	7
		ZF=Z1+VF-Y11*(Z2-Z1)/(V2-V1)	CHECK	8
		BF=EF+FF*VF	CHECK	9
10		RCFS=XF**2+ZF**2	CHECK	10
		IF(RCFS) 10,10,20	CHECK	11
		RETURN	CHECK	12
		100 = 2	CHECK	13
15		NO BLUCKAGE INDICATED BY THIS SOLUTION	CHECK	14
		RETURN	CHECK	15
		RCF=5021(RCFS)	CHECK	16
20		IF(ABS(REF-BF)-1.0E-03) 30,30,40	CHECK	17
		100 = 2	CHECK	18
		THE SOLUTION IS AN EXTRANEIOUS SOLUTION FOR THIS PROBLEM	CHECK	19
		RETURN	CHECK	20
25		CANS = (R2-X1)*BF*VF/RF*AF+(V2-V1)*(Z2-Z1)*BF*ZF/RF	CHECK	21
		IF(ABS(CANS)-1.0E-03) 60,60,50	CHECK	22
		THE SOLUTION IS AN EXTRANEIOUS SOLUTION FOR THIS PROBLEM	CHECK	23
		100 = 2	CHECK	24
		RETURN	CHECK	25
25		C THE SOLUTION IS THE CORRECT SOLUTION TO THE PROBLEM	CHECK	26
		100 = 1	CHECK	27
		RETURN	CHECK	28
		END	CHECK	29

	SUBROUTINE RING(Y1,P1,Y2,R2,YF,R2,YF,RF,PHI,LOU)		
	Q2=(Y2-YF)*P1/(Y2-Y1)		RING
	RM0= P2*(YF-Y1)/(Y2-Y1)		RING
	IF (PF-(FC-RM0)) < .1E-20		RING
5	C THE CONE OF VISION DOES NOT INTERSECT THE SHADOWING FRUSTUM FOR THIS Y		RING
	R THIS APPLIES TO OUTSIDE SHADOWING ONLY.		RING
	LOU=2		RING
	RETURN		RING
10	WF= 0.5*(XC+RF+PF/PC-RM0*PH0/R0)		RING
	ZFS= RF**2-XF**2		RING
15	IF (ZFS) 30,40,40		RING
	C THE CONE OF VISION COMPLETELY SURROUNDS THE SHADOWING FRUSTUM FOR THIS RING		RING
	C FOR OUTSIDE SHADOWING OF THE CONE OF VISION LIES INSIDE THE SHADOWING		RING
	C FRUSTUM FOR THIS YF FOR INSIDE SHADOWING		RING
	LOU= 1		RING
	RETURN		RING
	Y2R= R1*(Y2-Y1)*(XF-R1)/(YF-Y1)		RING
	CS= X2E/R2		RING
	CALL ARCCOS(CS,P41,IDA)		RING
20	IF (IDA-1) 50,50,60		RING
	C SOMETHING IS WRONG WITH THE SOLUTION OBTAINED FOR X2R.		RING
	LOU=3		RING
	RETURN		RING
	C A SOLUTION FOR RING SHADOWING HAS BEEN FOUND.		RING
25	LOU= 4		RING
	RETURN		RING
	END		RING

		SUBROUTINE PICMAT(PHIS, LARRY, LIM, PHAM)			
DIMENSION PHIS(20)		PICMAX	2		
IF (LIM-1) 1295, 1290, 1095		PICMAX	3		
LARRY=LARRY+1		PICMAX	4		
PHAM=PHIS(1)		PICMAX	5		
GO TO 1297		PICMAX	6		
1095 LARRY = LIP + 1		PICMAX	7		
PHAM=PHIS1		PICMAX	8		
DO 1017 L		PICMAX	9		
IF (PHAM-1) 1297, 1290, 1097		PICMAX	10		
PHAM=PHIS(LIKE)		PICMAX	11		
CONTINUE		PICMAX	12		
RETURN		PICMAX	13		
END		PICMAX	14		
		PICMAX	15		

	SUBROUTINE PICMIN(PHEO,LUKE,LUM,PHIM)	
	DIMENSION PHEO(20)	PICMIN 2
	IF(LU4 -1) 1295,1620,1630	PICMIN 3
1620	LUKE=LUKE+1	PICMIN 4
5	PHIM= PHEO(1)	PICMIN 5
	GO TO 1295	PICMIN 6
1630	LUKE=LUKE+1	PICMIN 7
	PHIM= PHEO(1)	PICMIN 8
	DO 1640 LINK=2,LUM	PICMIN 9
1650	IF(PHIM-PHEO(LINK)) 1640,1650,1650	PICMIN 10
1650	PHIM= PHEO(LINK)	PICMIN 11
1650	CONTINUE	PICMIN 12
1295	RETURN	PICMIN 13
	END	PICMIN 14
		PICMIN 15

	SUBROUTINE TESTING FT, DIV, KOUNT R, COUNT R)	TESTN	2
	DIMENSION DIV(2)	TESTN	3
	IF(KOUNT R) 2, 2, 10	TESTN	4
5	2 FT1=FT	TESTN	5
	3 DO 5 I=1, 2	TESTN	6
	5 DIV(I)=DIV(I)+DIV(I)	TESTN	7
	KOUNT R=1	TESTN	8
	COUNT R=COUNT R+1	TESTN	9
	RETURN	TESTN	10
10	10 IF(ABS(FT1-FT))=0.001, 5, 6, 6	TESTN	11
	6 FT1=FT	TESTN	12
	6 FT1=FT	TESTN	13
15	15 KOUNT R=0	TESTN	14
	COUNT R=0	TESTN	15
15	RETURN	TESTN	16
	END	TESTN	17

Line	Code	Statement	Label
2		OVERLAY(XR4P,13,3)	TAS193
3		PROGRAM TASER	TAS194
4		COMMON /TMY/ TF(80),N	TAS195
5		COMMON /PRINT/ PRINT1, PRINT2, PRINT3, PRINT4, PRINT5, PRINT6, PRINT7, PRINT8, PRINT9, PRINT0	TAS196
6		INTEGER PRINT1,PRINT2,PRINT3,PRINT4,PRINT5,PRINT6,PRINT7,PRINT8	TAS197
7		1,PRINT9,PRINT0	TAS198
8		COMMON /TAIL/ NFILL1(122),EIR(60)	TAS199
9		COMMON /ALL/ NFILL2(135), F(60)	TAS200
10		COMMON F	TAS201
11		DIMENSION F (60,80)	TAS202
12		DIMENSION EA (60,60)	TAS203
13		DIMENSION C (60,60)	TAS204
14		DIMENSION BHAT (20,60)	TAS205
15		DATA STCP BHAT (20,60)	TAS206
16		DIMENSION SHAT (20,60)	TAS207
17		EQUIVALENCE (F,EA)	TAS208
18		EQUIVALENCE (F,EA)	TAS209
19		EQUIVALENCE (F,EA)	TAS210
20		EQUIVALENCE (F,EA)	TAS211
21		EQUIVALENCE (F,EA)	TAS212
22		EQUIVALENCE (F,EA)	TAS213
23		DIMENSION P (60)	TAS214
24		DIMENSION QTOTAL(60)	TAS215
25		DIMENSION ALPHA (60)	TAS216
26		DIMENSION T (60)	TAS217
27		DIMENSION CY (60)	TAS218
28		DIMENSION TSTART(60)	TAS219
29		DIMENSION SA (240)	TAS220
30		DIMENSION S2 (60)	TAS221
31		DIMENSION BUFFER(240)	TAS222
32		EQUIVALENCE (BUFFER,SA)	TAS223
33		NAMELIST/INPUT/ C	TAS224
34		NDIM=60	TAS225
35		BOLT?=0.1714E-8	TAS226
36		RETCOL=.00001	TAS227
37		TNOTSP=61.	TAS228
38		DO 101 I=1,NDIM	TAS229
39		P(1)=0	TAS230
40		CT(1)=TF(1)	TAS231
41		TSTART(1)=500.	TAS232
42		NY2=N*2	TAS233
43		NY3=N*3	TAS234
44		CALL CEDIT (NOTM,N)	TAS235
45		CALL WP114 (C,N,NY2,NY3,1,BUFFER)	TAS236
46		CALL FEOT (NOTM,N, NFILL2(124))	TAS237
47		CALL WP114 (F,N,NY2,NY3,2,BUFFER)	TAS238
48		DO 120 I=1,N	TAS239
49		IF (CY - (I).NE.-580.) GO TO 116	TAS240
50		IF (NCASE-GT,1) GO TO 128	TAS241
51		IF (TSTART(I).NE.-580.) GO TO 114	TAS242
52		TF(I)=TNOTSP	TAS243
53		GO TO 118	TAS244
54		TF(I)=TSTART(I)	TAS245
55		GO TO 118	TAS246
56		TF(I)=CT(I)	TAS247
57		118 T(1)=TF(1)+650.	TAS248
58		120 CONTINUE	TAS249

Line	Code	Statement	Address
68	CALL	CLASS, N2, N3, BUFFER)	59
68	CALL	WRITE14 (F, N, NX2, NX3, J, BUFFER)	60
68	DO	509 INDEX=1,15	61
68	REMYND 2		62
65	IF	(INDEX.EQ.1) GO TO 505	63
65	CALL	DIVRT (INDIM, SMAT, N, ALPHA, I, S1, S2)	64
65	DO	508 I=1, N	65
65	IF	(I=1) ALPHA(I)=460.	66
65	IF	(I=ALPHA(I))	67
65	IF	(I=ALPHA(I))	68
65	IF	(I=ALPHA(I))	69
65	IF	(I=ALPHA(I))	70
65	IF	(I=ALPHA(I))	71
65	IF	(I=ALPHA(I))	72
65	IF	(I=ALPHA(I))	73
65	IF	(I=ALPHA(I))	74
65	IF	(I=ALPHA(I))	75
65	IF	(I=ALPHA(I))	76
65	IF	(I=ALPHA(I))	77
65	IF	(I=ALPHA(I))	78
65	IF	(I=ALPHA(I))	79
65	IF	(I=ALPHA(I))	80
65	IF	(I=ALPHA(I))	81
65	IF	(I=ALPHA(I))	82
65	IF	(I=ALPHA(I))	83
65	IF	(I=ALPHA(I))	84
65	IF	(I=ALPHA(I))	85
65	IF	(I=ALPHA(I))	86
65	IF	(I=ALPHA(I))	87
65	IF	(I=ALPHA(I))	88
65	IF	(I=ALPHA(I))	89
65	IF	(I=ALPHA(I))	90
65	IF	(I=ALPHA(I))	91
65	IF	(I=ALPHA(I))	92
65	IF	(I=ALPHA(I))	93
65	IF	(I=ALPHA(I))	94
65	IF	(I=ALPHA(I))	95
65	IF	(I=ALPHA(I))	96
65	IF	(I=ALPHA(I))	97
65	IF	(I=ALPHA(I))	98
65	IF	(I=ALPHA(I))	99
65	IF	(I=ALPHA(I))	100
65	IF	(I=ALPHA(I))	101
65	IF	(I=ALPHA(I))	102
65	IF	(I=ALPHA(I))	103
65	IF	(I=ALPHA(I))	104
65	IF	(I=ALPHA(I))	105
65	IF	(I=ALPHA(I))	106
65	IF	(I=ALPHA(I))	107
65	IF	(I=ALPHA(I))	108
65	IF	(I=ALPHA(I))	109
65	IF	(I=ALPHA(I))	110
65	IF	(I=ALPHA(I))	111
65	IF	(I=ALPHA(I))	112
65	IF	(I=ALPHA(I))	113
65	IF	(I=ALPHA(I))	114
65	IF	(I=ALPHA(I))	115

115

LINECT=LINECT+3

201 CONTINUE
200 CONTINUE
END

TAS103 116
TAS104 117
TAS105 118
TAS106 119

FUNCTION CROCEL(I,J)
IF (I.NE.J) GO TO 1
CROCEL=1.
RETURN
1 CROCEL=0.
RETURN
END

CROCEL 2
CROCEL 3
CROCEL 4
CROCEL 5
CROCEL 6
CROCEL 7
CROCEL 8

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```

SUBROUTINE MATPOS (NDIM,A,M)
  DIMENSION A(NDIM,NDIM)
  DO 1 I=1,M
    DO 1 J=1,M
      A(I,J)=ABS(A(I,J))
1 CONTINUE
  RETURN
  END

```

```

2 MATPOS
3 MATPOS
4 MATPOS
5 MATPOS
6 MATPOS
7 MATPOS
8 MATPOS
9 MATPOS

```

SUBROUTINE MATSYM (NDIM,F,N)		
DIMENSION F(NDIM,NDIM)		
1	MM=N-1	MATSYM 2
2	DO 3 I=1,MM	MATSYM 3
3	IP=I+1	MATSYM 4
4	DO 5 J=IP,N	MATSYM 5
5	IF (F(I,J).EQ.(0.0)) GO TO 2	MATSYM 6
6	1 F(I,I)=F(I,J)	MATSYM 7
7	GO TO 3	MATSYM 8
8	2 IF (F(I,J).EQ.(0.0)) GO TO 3	MATSYM 9
9	3 CONTINUE	MATSYM 10
10	RETURN	MATSYM 11
11	END	MATSYM 12
12		MATSYM 13
13		MATSYM 14
14		MATSYM 15

```

SUBROUTINE DINVRT (NDIM,A,NIN ,B,MIN ,S1,S2)
  DIMENSION A(NDIM,NDIM),B(NDIM,2)
  DIMENSION S1(2),S2(2)
  INTEGER Z1,Z2,S1
  EQUIVALENCE (IPDM,JRCM), (ICOLM,JCOLM), (AMAX,I,SWAP)
  N=NIN
  M=MIM
  DO 20 J=1,M
    S1(J)=0
    DO 550 I=1,N
      Z1=I+N
      Z2=Z1+N
      AMAX=0.0
      DO 15 J=1,N
        IF (S1(J).EQ.1) GO TO 105
        DO 100 K=1,N
          IF (S1(K)-1) 00,100,740
          IF (ABS(AMAX)-ABS(S1(J,K))) 80,100,108
          80 IF DM=J
          85 IF DM=K
          ICOLM=K
          AMAX=A(J,K)
          100 CONTINUE
          105 CONTINUE
          S1(ICOLM)=S1(Z2OLM)+1
          IF (IROM.EQ.ICOLM) GO TO 260
          DO 200 L=1,N
            SWAP=A(I:DM,L)
            A(I:DM,L)=A(ICOLM,L)
            A(ICOLM,L)=SWAP
          200 A(ICOLM,L)=SWAP
          IF (M.LE.C) GO TO 260
          DO 250 L=1,M
            SWAP=B(I:DM,L)
            B(I:DM,L)=B(ICOLM,L)
            B(ICOLM,L)=SWAP
          250 B(ICOLM,L)=SWAP
          S1(Z1)=IROM
          S1(Z2)=ICOLM
          S2(I)=A(ICOLM,ICOLM)
          A(ICOLM,ICOLM)=1.0
          DO 350 L=1,N
            A(ICOLM,L)=A(ICOLM,L)/S2(I)
          350 A(ICOLM,L)=A(ICOLM,L)/S2(I)
          IF (M.LE.C) GO TO 340
          DO 370 L=1,M
            B(ICOLM,L)=B(ICOLM,L)/S2(I)
          370 B(ICOLM,L)=B(ICOLM,L)/S2(I)
          DO 550 L=1,N
            IF (L1.EQ.ICOLM) GO TO 550
            T=A(L1,ICOLM)
            A(L1,ICOLM)=0.0
            DO 450 L=1,N
              A(L1,L)=A(L1,L)-A(ICOLM,L)*T
            450 A(L1,L)=A(L1,L)-A(ICOLM,L)*T
            DO 500 L=1,M
              B(L1,L)=B(L1,L)-B(ICOLM,L)*T
            500 B(L1,L)=B(L1,L)-B(ICOLM,L)*T
            550 CONTINUE
            DO 710 I=1,N
              L=N+1-I
              L1=L+N
              L2=L1+N

```

IF (S1(L1),EQ,S1(L2)) GO TO 710

JROM=S1(L1)

JCOLU=S1(L2)

DO 705 K=1,N

SNAP=AK,JROM)

AK,JROM)=AK,JCOLU)

AK,JCOLU)=SNAP

705 CONTINUE

710 CONTINUE

760 RETURN

END

D1NVR1 59

D1NVR1 60

D1NVR1 61

D1NVR1 62

D1NVR1 63

D1NVR1 64

D1NVR1 65

D1NVR1 66

D1NVR1 67

D1NVR1 68

D1NVR1 69

A-200

	SUBROUTINE WRIT14	(MATRIX,M,NX2,NX3,MATNO,BUFFER)	WRIT14	2
	REAL MATRIX(80,80),	BUFFER(248)	WRIT14	3
	REIND 2		WRIT14	4
5	REIND 4		WRIT14	5
	DO 7 I=1,M		WRIT14	6
	GO TO (1,2,3) MATNO		WRIT14	7
	1 DO 4 J=1,N		WRIT14	8
	4 BUFFER(J)=MATRIX(I,J)		WRIT14	9
10	WRITE(2) (BUFFER(J),J=1,M)		WRIT14	10
	GO TO 7		WRIT14	11
	2 READ(2) (BUFFER(J), J=1,M)		WRIT14	12
	DO 5 J=1,N		WRIT14	13
	J2=J+N		WRIT14	14
15	5 BUFFER(J2)=MATRIX(I,J)		WRIT14	15
	WRITE(4) (BUFFER(J),J=1,NX2)		WRIT14	16
	GO TO 7		WRIT14	17
	3 READ(4) (BUFFER(J), J=1,NX2)		WRIT14	18
	DO 6 J=1,N		WRIT14	19
	J3=J+NX2		WRIT14	20
20	6 BUFFER(J3)=MATRIX(I,J)		WRIT14	21
	WRITE(2) (BUFFER(J),J=1,NX3)		WRIT14	22
	7 CONTINUE		WRIT14	23
	RETURN		WRIT14	24
	END		WRIT14	25

	SUBROUTINE FEQIT (NOIM,N,M)	FEQIT	2
	COMMON /ALL/ NFILE(135), A(6)	FEQIT	3
	COMMON /PLN/ 2(1500)	FEQIT	4
5	DIMENSION F (50,50)	FEQIT	5
	DIMENSION FA (80,80)	FEQIT	6
	EQUIVALENCE (F(150),F(1,1))	FEQIT	7
	DO 5 I=1,N	FEQIT	8
	DO 5 J=1,N	FEQIT	9
	DO 5 J=1,N	FEQIT	10
10	FA(I,J)=0.	FEQIT	11
	DO 6 I=1,M	FEQIT	12
	DO 6 J=1,N	FEQIT	13
	FA(I,J)=F(I,J)	FEQIT	14
15	DO 6 I=1,M	FEQIT	15
	DO 6 J=1,N	FEQIT	16
	FA(I,J)=FA(I)*FA(I,J)	FEQIT	17
	CALL NTPDS (NOIM,FA,M)	FEQIT	18
	CALL MATSYM (NOIM,FA,M)	FEQIT	19
	DO 9 I=1,M	FEQIT	20
20	IF (A(I),EQ,0.) GO TO 9	FEQIT	21
	DO 9 J=1,N	FEQIT	22
	FA(I,J)=FA(I,J)/A(I)	FEQIT	23
	CONTINUE	FEQIT	24
	RETURN	FEQIT	25
25	END	FEQIT	26

A-202

	SUBROUTINE CEDIT (NDIM,M)				
	COMMON C			CE01T	2
	DIMENSION C(80,93)			CE01T	3
	COMMON /HTPACK/ INT(80),MT(80), IM,			CE01T	4
5	DO 4 I=1,M			CE01T	5
	DO 3 J=1,N			CE01T	6
	6 C(I,J)=0.			CE01T	7
	DO 130 I=1,IM			CE01T	8
	I9=INT(I)/100			CE01T	9
10	I8=INT(I)-I9*100			CE01T	10
	C(I9,I8)=MT(I9)			CE01T	11
	100 C(I9,I8)=MT(I9)			CE01T	12
	CALL MATPOS (NDIM,C,M)			CE01T	13
	CALL MATSYM (NDIM,C,M)			CE01T	14
15	RETURN			CE01T	15
	END			CE01T	16

	SUBROUTINE SCRIPT (NDIM,F,N,E,A,BOLIZ,	S1,S2,NX2,NX3,BUFFER)	SCRIPT	
	DIMENSION F(100,80)	(60)	SCRIPT	2
	DIMENSION E	(190)	SCRIPT	4
	DIMENSION A	(190)	SCRIPT	5
5	DIMENSION S1	(240)	SCRIPT	6
	DIMENSION S2	(100)	SCRIPT	7
	DIMENSION BUFFER(240)		SCRIPT	8
	DO 1 I=1,N		SCRIPT	9
	DO 1 J=1,N		SCRIPT	11
10	F(I,J)=CODEL(I,J)-((I,-E(I)))*F(I,J)		SCRIPT	11
	CALL DWRITE (NDIM,F,N,E,6,S1,S2)		SCRIPT	12
	K=4102		SCRIPT	13
	REWRITE		SCRIPT	14
	DO 6 I=1,N		SCRIPT	15
15	READ(4) (BUFFER(I),J=1,NX2)		SCRIPT	16
	DO 7 J=1,N		SCRIPT	17
	S2(J)=C		SCRIPT	18
	DO 7 K=1,N		SCRIPT	19
	K2=K+N		SCRIPT	20
20	S2(J)=S2(J)+BUFFER(K2)*F(I,J)		SCRIPT	21
	CONTINUE		SCRIPT	22
	WRITE(2) (S2(J),J=1,N)		SCRIPT	23
	CONTINUE		SCRIPT	24
	REWRITE 2		SCRIPT	25
25	DO 130 I=1,N		SCRIPT	26
	READ(2) (S2(J),J=1,N)		SCRIPT	27
	DO 130 J=1,N		SCRIPT	28
	F(I,J)=S2(J)		SCRIPT	29
	CONTINUE		SCRIPT	30
30	DO 11 I=1,N		SCRIPT	31
	PARF=E(I)*A(I)*BOLIZ		SCRIPT	32
	DO 11 J=1,N		SCRIPT	33
	F(I,J)=F(I,J)+E(J)*PARF		SCRIPT	34
	CONTINUE		SCRIPT	35
35	END		SCRIPT	36

A-204

	OVERLAY(RHP,14,0)	TAILS	2
	PROGRAM TAIL	TAILS	3
	COMMON/T/ TNA(20),KSC,NAS,NWL,NPLOT	TAILS	4
	CALL OVERLAY(RHP,12,1)	TAILS	5
S	CALL TAIL1	TAILS	6
	CALL OVERLAY(RHP,12,2)	TAILS	7
C	CALL TAIL2	TAILS	8
	END	TAILS	9

60	1.46X, "OFF-AXIS ANGLE",	
	2 F4.1, "DISC.", /, 47X, "TARGET ALTITUDE", F7.1, " FT.", /, 47X,	PLOT1 59
	3 "SENSOR ALTITUDE", F7.1, " FT.", /, 47X, "TARGET TO SENSOR RANGE",	PLOT1 60
	4 F7.1, " FT.", /, 47X, "MICRONS",	PLOT1 61
7	FORMAT(15,1MI,16(10)-----1)	PLOT1 62
2	FORMAT(12,11F7.3,1X1, /, 55X, "RADIANI INTENSITY", /, 55X, "WAIT/SIF	PLOT1 63
	1RADIANI",	PLOT1 64
63	300 RETURN	PLOT1 65
	END	PLOT1 66
		PLOT1 67

Line	Code	Statement	Line
1	OVERLAY	COMP,14,11	TAIL1
2	PROGRAM	TAIL1	TAIL1
3	COMMON/PLM/	34(5000)	TAIL1
4	COMMON/ALL/	N,NH,NV,N,ISURF(50),MODE(55),JSURF(5,2),N(15),NTOTL,	TAIL1
5		MOD,NP(10),AREA(60),	TAIL1
6		COMMON/ITAL/	TAIL1
7		NF,YF,A(130),YF(141),REAL(130),REAL(130),TFL,FML(150)	TAIL1
8		COMMON/ITW/	TAIL1
9		TW(63)	TAIL1
10	COMMON/PRINT/	PRINT6,PRINT7,PRINT8,PRINT9,PRINT5,	TAIL1
11		PRINT6,PRINT7,PRINT8,PRINT9,PRINT5,	TAIL1
12		F(50,5),X(155),Y(155),Z(155),	TAIL1
13	DIMENSION	F(10,50),X(155),Y(155),Z(155),	TAIL1
14		V(155),VECT(155),VF(10,20),RF(10,23)	TAIL1
15	INTEGER	PRINT1,PRINT2,PRINT3,PRINT4,PRINT5,PRINT6,PRINT7,	TAIL1
16		PRINT8,PRINT9	TAIL1
17	EQUAL	VALANCE(10(41),F(11),10(11,10),F(11),10(4(10),X(11)),	TAIL1
18		110(4(55),Y(11),10(4(11),Z(11),10(4(46),Y(11),10(4(22),	TAIL1
19		Z(11),10(4(20),Y(11),10(4(61),P(11))	TAIL1
20	COMMON/IT	TA(12),K(5),N(5),N(1),N(1)	TAIL1
21		FOR(12,212,F(11))	TAIL1
22		FOR(12,212,F(11))	TAIL1
23		CALL S-10KIN(NH,NP,VF,RF,NF,VFA,VF9,VFA,RF9)	TAIL1
24		READ(5,1) N(5)	TAIL1
25		READ(5,5) TA(11),I(1),N(5)	TAIL1
26		CALL RECT(11,1,Y1,Y2,Z2,VECT,NTOTL,NF,RFA,RF8,VFA,VFB,MODE,TPL,	TAIL1
27		N(5),N(1),TA(1),F(1)	TAIL1
28		READ(5,1) K(5),N(1),N(1)	TAIL1
29		IF(ML,LT,1,0) ML=16	TAIL1
30		N(1)=(ML-1,1)/0.12+1.005	TAIL1
31		IF(150,NF,0) GO TO 303	TAIL1
32		PRINT 9=1	TAIL1
33		CONTINUE	TAIL1
34		END	TAIL1

[illegible]

[illegible]

60	YAN=ST YAP=CT ZAN=3.0 GO 7 I= NAF,NAL IF (IOUTI) 612,612, 610 IF (YS111) -YCOR2 1.200,612,612	RE011 59 RE011 60 RE011 61 RE011 62 RE011 63 RE011 64 RE011 65 RE011 66 RE011 67 RE011 68 RE011 69 RE011 70 RE011 71 RE011 72 RE011 73 RE011 74 RE011 75 RE011 76
65	611 2000 GO TO 628 SHAD=0.0 TAU=THU)*PIE/100.0 CT=CESTAU ST=CHITAU DJ= (PZ211)-YS111)/NDIV(I) DVS= (YS211)-YS111)/NDIV(I) YB=YS111)-5*DYB NAB=NDIV(I) FAB=0.0 D43=SQRT(CB3**2 + DYB**2) R3B=YS111) - 0.5*OR3 YBN = - ST GO 25 ISR= 1,NAB YB=YB*DYB RS9=RS9+OR3 QA=QPHI*RCB*DMA PHI=-.5*QPHI GO 5 J = 1,NDIV PHI=PHI+QPHI SP= SIN(PHI) CP= COS(PHI) KB=RS9*CP ZB=RS9*SP XBN=CT*CP ZBN=CT*SP DX=Y1-YA DY=Y1-YA DZ=Z1-ZA R2=OX*OY*OY*OZ*OZ IF(R2) 4,4,16 R1 = SORT(R2) ACOS= (DX*YAN+OY*YAN+OZ*ZAN)/R1 BCOS= (DX*XBN+OY*YBN+OZ*ZBN)/R1 IF (ACOS) 41,41,2 IF (ABS(TH(I))-90.) 43,4,4 F1=J.C GO TO 212 IF(ACOS) 47,47,3 IF (ABS(TH(I))-90.) 43,4,4 OYB=0.0 IF(OY) 19,24,19 OY=1.CE-3*CH3 OYB=OY YB=YA+OY*F XV= (XAYB-YA*XV)/OY ZV= (ZAYB-YA*ZV)/OY GO 116 K = 1, NF R011 = REAK) + (RER(K)-REAK)*(YS111)-YFA(K))	RE011 59 RE011 60 RE011 61 RE011 62 RE011 63 RE011 64 RE011 65 RE011 66 RE011 67 RE011 68 RE011 69 RE011 70 RE011 71 RE011 72 RE011 73 RE011 74 RE011 75 RE011 76 RE011 77 RE011 78 RE011 79 RE011 80 RE011 81 RE011 82 RE011 83 RE011 84 RE011 85 RE011 86 RE011 87 RE011 88 RE011 89 RE011 90 RE011 91 RE011 92 RE011 93 RE011 94 RE011 95 RE011 96 RE011 97 RE011 98 RE011 99 RE011 100 RE011 101 RE011 102 RE011 103 RE011 104 RE011 105 RE011 106 RE011 107 RE011 108 RE011 109 RE011 110 RE011 111 RE011 112 RE011 113 RE011 114 RE011 115
65	612 628	
70		
75		
80		
85		
90		
95	15	
100	51 53	
105	2 47 3	
110	20 19	

115	115	IF (ABS12 - PFAIK) + (RFBK) - RFAIK) * (VS211) - VFAIK) / (VFBK) - VFAIK)	REOI1	116
	116	IF (ABS12C11 - RS1111) - 1.0E-3) 110,118,208	REOI1	117
	117	IF (ABS12C12 - RS2111) - 1.0E-3) 100,108,208	REOI1	118
	118	GO TO 116	REOI1	119
120	200	DF = RFRK) - RFAIK)	REOI1	120
		DF = VFAIK) - VFAIK)	REOI1	121
		RV = (RFAIK) * VFBK) - VFAIK) * RFAIK) / DF	REOI1	122
		AF = (VFAIK) * VFBK) - VFAIK) * RFAIK) / DF	REOI1	123
		3F = 2.0 * (XV / DV) + 0.2 * (Y / DV) - DF * RAV / DV	REOI1	124
		CF = Y * XV + 2 * YZ - RY	REOI1	125
		DF = 8 * AF - 4 * AF * CF	REOI1	126
125		IF (DF) 116,111,11	REOI1	127
	11	DF12 = SCRT(CF)	REOI1	128
		VFI11 = 2.5 * (3F + DF12) / AF	REOI1	129
		VFI12 = 2.5 * (3F + DF12) / AF	REOI1	130
130		DO 15 L=1,2	REOI1	131
		IF (VFI1) - YB) 15,13,13	REOI1	132
	13	IF (VFI1) - VFAIK) 15,13,13	REOI1	133
	14	IF (VFI1) - VFAIK) 15,13,13	REOI1	134
	15	CONTINUE	REOI1	135
135	116	CONTINUE	REOI1	136
	1060	IF (SMA1) 57,1057,1069	REOI1	137
		DO 3001 JANG = 1,10000	REOI1	138
		SANG = SIN(THET(JANG))	REOI1	139
		CANG = COS(THET(JANG))	REOI1	140
		IF (ABS1SANG) - 1.0E-4) 1120,1120,1130	REOI1	141
		IF (THET(JANG) - 1.5708) 1121,1121,1122	REOI1	142
		SANG = 0.000000	REOI1	143
		CANG = 1.000000	REOI1	144
		GO TO 1123	REOI1	145
145	1122	SANG = 0.000000	REOI1	146
	1123	IF (Z3 - ZA) 11,10,3000,1140	REOI1	147
	1140	YPP = YA - (YB - YA) * ZA / (ZB - ZA)	REOI1	148
		XPP = XA - (XB - XA) * ZA / (ZB - ZA)	REOI1	149
150	1142	IF (THET(JANG) - 0.01) 1142,1142,1144	REOI1	150
	1144	IF (XPP) 3000,3000,1310	REOI1	151
	1133	IF (ABS1SANG) - 0.9999) 1150,1150,1150	REOI1	152
	1150	IF (THET(JANG) - PIE) 1151,1151,1152	REOI1	153
	1151	SANG = 1.000000	REOI1	154
		CANG = 0.000000	REOI1	155
		GO TO 1153	REOI1	156
	1152	SANG = -1.000000	REOI1	157
		CANG = 0.000000	REOI1	158
160	1153	IF (X3 - XA) 1170,3000,1170	REOI1	159
	1170	YPP = YA - XA * YB - YAI / (XB - XA)	REOI1	160
		ZPP = ZB - XA * ZB - ZAI / (XB - XA)	REOI1	161
		XPP = 0.0	REOI1	162
		IF (SANG) 1172,1172,1174	REOI1	163
	1174	IF (ZPP) 3000,3000,1310	REOI1	164
	1172	IF (XPP) 1310,3000,3000	REOI1	165
	1160	IF (X3 - XA) 1160,1160,1160	REOI1	166
	1190	IF (Y3 - YAI) 1200,1210,1220	REOI1	167
	1200	IF (ZB - ZA) 1230,3000,1230	REOI1	168
	1200	ZPP = XA * SANG / CANG	REOI1	169
	1230	YPP = YA - (YB - YAI) * ZPP - ZAI / (ZB - ZA)	REOI1	170
170			REOI1	171
			REOI1	172

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175	1231	IF (SANG) 1231,1231,1232	REDI	173
	1231	IF (ZPP) 1233,3000,3000	REDI	174
	1231	IF (CANG) 1234,1234,1235	REDI	175
	1234	IF (VPI) 1310,3000,3000	REDI	176
	1234	IF (VPP) 3000,3000,1310	REDI	177
	1232	IF (VPP) 3000,3000,1233	REDI	178
	1232	IF (ZB -ZAI) 1240,3000,1240	REDI	179
180	1240	ZPP = YA*SANG/CANG	REDI	180
		YPP = YA	REDI	181
		YPP = YA	REDI	182
		GO TO 1238	REDI	183
	1180	IF (YB -YAI) 1250,1260,1250	REDI	184
	1250	IF (Z3 -ZAI) 1270,1280,1270	REDI	185
	1270	DEAI = (YB -YAI)*SANG/CANG - (ZB -ZAI)	REDI	186
		IF (END) 1290,3000,1290	REDI	187
	1290	YPP = (ZAI*Y3 -ZB*YAI)/GENO	REDI	188
		YPP = YA + (Y3 -YAI)*YPP-XAI/IXB-XAI	REDI	189
190		ZPP = ZA + (ZB -ZAI)*(YPP -XAI)/(X3-XAI)	REDI	190
		GO TO 1238	REDI	191
	1280	XPO = ZA*CANG/SANG	REDI	192
		YPO = YA + (XPP -YAI)*(Y3 -YAI)/(X3 -XAI)	REDI	193
		ZPP = ZA	REDI	194
		GO TO 1239	REDI	195
195	1260	IF (ZB -ZAI) 1270,1300,1270	REDI	196
	1300	YPP = YA	REDI	197
		ZPO = ZA	REDI	198
		XPO = ZA*CANG/SANG	REDI	199
200		GO TO 1238	REDI	200
	1310	RPP = SPT(YPP*2*ZPP*2)	REDI	201
		AA = (RCOR1 -RCOR2)/(YCOR2 -YCOR1)	REDI	202
		CC = (RCOR2*YCOR1 -RCOR1*YCOR2)/(YCOR2 -YCOR1)	REDI	203
		DIST = DIS(AA,CC,YPP,RPP)	REDI	204
205		IF (DIST) 3000,1335,1320	REDI	205
	1320	AA = (RCOR1 -RCOR3)/(YCOR3 -YCOR1)	REDI	206
		CC = (RCOR3*YCOR1 -RCOR1*YCOR3)/(YCOR3 -YCOR1)	REDI	207
		DIST = DIS(AA,CC,YPP,RPP)	REDI	208
		IF (DIST) 1325,1335,3000	REDI	209
210	1325	AA = (PCOR4 -RCOR1)/(YCOR1 -YCOR4)	REDI	210
		CC = (PCOR4*YCOR1 -RCOR1*YCOR4)/(YCOR1 -YCOR4)	REDI	211
		DIST = DIS(AA,CC,YPP,RPP)	REDI	212
		IF (DIST) 3000,1335,1310	REDI	213
215	1330	AA = (RCOR3 -RCOR2)/(YCOR2 -YCOR3)	REDI	214
		CC = (RCOR2*YCOR3 -RCOR3*YCOR2)/(YCOR2 -YCOR3)	REDI	215
		DIST = DIS(AA,CC,YPP,RPP)	REDI	216
		IF (DIST) 1335,1335,3000	REDI	217
	1335	IF (YPP -YB) 3000,4,4	REDI	218
	1335	CONTINUE	REDI	219
220	1057	FI = ACOS(BCOS*OA /PIE*R2)	REDI	220
		GO TO 5	REDI	221
	4	FI=0.0	REDI	222
	5	FAR = FAR + FI	REDI	223
	212	YB = Y3 - DYNP	REDI	224
225	25	UNIMIN	REDI	225
		FAR=2.0*FAR	REDI	226
		IF (PI*TA -FO, 0) GO TO 20001	REDI	227
		IF (LINEF .CL. 981 CALL RITE(LINEF))	REDI	228

239	WRITE(1,10002) MODE(1),FAB	REC1	230
	LINEF=LINEF+1	REC1	231
	20001 LLELL+1	REC1	232
	FEIN,ALLI=FA3*1,DES	REC1	233
	7 CONTINUE	REC1	234
235	30 CONTINUE	REC1	235
	RETURN	REC1	236
	END	REC1	237

A-214

FUNCTION DISUAL,CCI,VPPI,PPPI
OFU-SOPT/ARI*02,1,0)

COA-AA1/OEO

SIA=1,0/OEO

PP = - 1,0 CCI/OEO

DIS = VPPI*COA +PPPI*SIA -PP

RETURN

END

DIS 2
DIS 3
DIS 4
DIS 5
DIS 6
DIS 7
DIS 8
DIS 9

SUBROUTINE RIECTIME
MPTG(5,1)
FORMAT(1,25,"SYSTEM EXTERNAL VIEW FACTORS-")
LINE=4
RETURN
END

RIE 2
RIE 3
RIE 4
RIE 5
RIE 6
RIE 7

A-216

		SUBROUTINE VECANG(X1,X2,Y1,X2,Y2,VECT,THETA,NTOT1)		VECANG	2
		DIMENSION XL(1),Y1(1),Y2(1),Y2(1),VECT(1),THETA(1)		VECANG	3
		DO 1 I=1,NTOT1		VECANG	4
		IF(X2(I).NE.X1(I)) GO TO 2		VECANG	5
5		IF(VECT(I).GT.0.0) GO TO 3		VECANG	6
		THETA(I)=90.0		VECANG	7
		GO TO 1		VECANG	8
	3	THETA(I)=0.0		VECANG	9
		GO TO 1		VECANG	10
10	2	IF(Y2(I).NE.Y1(I)) GO TO 4		VECANG	11
		IF(VECT(I).GT.0.0) GO TO 5		VECANG	12
		THETA(I)=180.0		VECANG	13
		GO TO 1		VECANG	14
15	5	THETA(I)=3.0		VECANG	15
		GO TO 1		VECANG	16
	4	THETA(I)=(ABS(Y2(I)-Y1(I))/ABS(X2(I)-X1(I)))*100.0/3.14159		VECANG	17
		IF(Y1(I).GT.Y2(I)) GO TO 6		VECANG	18
		IF(VECT(I).GT.0.0) GO TO 7		VECANG	19
		THETA(I)=180.0+THET		VECANG	20
20		GO TO 1		VECANG	21
	7	THETA(I)=THET		VECANG	22
		GO TO 1		VECANG	23
	6	IF(VECT(I).GT.0.0) GO TO 8		VECANG	24
		THETA(I)=180.0-THET		VECANG	25
25		GO TO 1		VECANG	26
	8	THETA(I)=THET		VECANG	27
	1	CONTINUE		VECANG	28
		RETURN		VECANG	29
		END		VECANG	30

		FUNCTION PLANCK(T,M)			
		DATA C1,C2/1.5989E-12,1.4388/		PLANCK2	2
		X=C2*M/T		PLANCK2	3
		IF(X,LT,172,160 TO 10		PLANCK2	4
5	5	PLANCK=0.		PLANCK2	5
		RETURN		PLANCK2	6
	10	PLANCK=(C1*M*M*M)/(T*EXP(X))-1.)		PLANCK2	7
		RETURN		PLANCK2	8
		END		PLANCK2	9
				PLANCK2	10

Line	Code	Statement	Address
5		SUBROUTINE REDIM,NANG,TH,AR,F,FE,PH,T,OB,NML,NPLOT)	REOT 2
10		IMLIS(0),P(4),U(4),A(45),50),F(50,50),AR(1),PH(1),ILLIS(0),ER(20),	REOT 3
15		DIMENSION TH(50), T(80)	REOT 4
20		COMMON /PRINT/ PRINT1, PRINT2, PRINT3, PRINT4, PRINT5, PRINT6, PRINT7, PRINT8,	REOT 5
25		PRINT9, PRINT10, PRINT11, PRINT12, PRINT13, PRINT14, PRINT15, PRINT16, PRINT17, PRINT18,	REOT 6
30		PRINT19, PRINT20	REOT 7
35		COMMON /OUT/ AREAR(20),THAR(20),ANG(20),IT0	REOT 8
40		DATA ER(20)/M /	REOT 9
45		DATA -P / .1739374, .1260726, .1260726, .1739374 /	REOT 10
50		DATA U / .4315642, -.1599375, .1699375, .4335642 /	REOT 11
55		DATA SD(0,02 /	REOT 12
60		DO 210 I=1,N	REOT 13
65		PH(I)=1.0-CH(I)	REOT 14
70		DI=1.1977/12.0*81/3.41276	REOT 15
75		Q2=25*DI	REOT 16
80		RE(6,0)	REOT 17
85		RS=25*E/144,	REOT 18
90		CF=1./110.**5)	REOT 19
95		NS=N	REOT 20
100		REAR(5,49) BAND1,BAND2	REOT 21
105		FORWARD(12,12,5)	REOT 22
110		DO 2 I=2,NS	REOT 23
115		IF=1-I	REOT 24
120		DO 1 J=1,IP	REOT 25
125		1 F(I,J)=AR(I)*F(I,J)/AR(I)	REOT 26
130		2 CONTINUE	REOT 27
135		DO 3 I=1,NS	REOT 28
140		IF(I-J) 4,5,4	REOT 29
145		4 DIJ=)	REOT 30
150		5 GO TO 3	REOT 31
155		5 DIJ=1.	REOT 32
160		3 AM(I,J)=DIJ-RH(I)*F(I,J)	REOT 33
165		CALL MINV (AM,N,50,ILL,MLL)	REOT 34
170		DO 4 J=1,NS	REOT 35
175		ONCM=1.0-RH(J)	REOT 36
180		DO 6 I=1,NS	REOT 37
185		6 AM(I,J)=AM(I,J)*ONCM	REOT 38
190		DO 10 I=1,NANG	REOT 39
195		DO 95 J=1,NS	REOT 40
200		EDI,I)=0.	REOT 41
205		DO 9 K=1,NS	REOT 42
210		9 E(I,J)=E(I,J)*FE(I,K)*AM(K,J)	REOT 43
215		95 E(I,J)=CF* E(I,J)	REOT 44
220		18 CONTINUE	REOT 45
225		DO 120 I=1,NANG	REOT 46
230		OBK=0,J	REOT 47
235		ML=1.0	REOT 48
240		DO 21 M=1,NML	REOT 49
245		QRL=J,CO	REOT 50
250		DO 14 J=1,NS	REOT 51
255		VI=0.0	REOT 52
260		DO 98 IO=1,4	REOT 53
265		X=(5)*X(101)ML	REOT 54
270			REOT 55
275			REOT 56
280			REOT 57
285			REOT 58
290			REOT 59
295			REOT 60
300			REOT 61
305			REOT 62
310			REOT 63
315			REOT 64
320			REOT 65
325			REOT 66
330			REOT 67
335			REOT 68
340			REOT 69
345			REOT 70
350			REOT 71
355			REOT 72
360			REOT 73
365			REOT 74
370			REOT 75
375			REOT 76
380			REOT 77
385			REOT 78
390			REOT 79
395			REOT 80
400			REOT 81
405			REOT 82
410			REOT 83
415			REOT 84
420			REOT 85
425			REOT 86
430			REOT 87
435			REOT 88
440			REOT 89
445			REOT 90
450			REOT 91
455			REOT 92
460			

```

VIP=1-B/(IX**5)*(EXPIC2/(X*Y(JJ))-1.8))
98 VI=V1(RTO)*VIP
VI=CI*V1
10 QPL=CI*(C1,I)*V1*RS)
QBIM=QBL
IF(Q3,LT,QBMY) GO TO 22
QBMY=QBL
QBMY=QBL
20 MLSAVE=ML
ML=ML*SO
IF IPRINT9,EO,0) GO TO 100
CALL RITER(IG,TH(I),NML)
180 TH(I)=2*97.9/MLSAVE
IF(MLSAVE*SO*GT, ML-SO) ERI(I)=10H-*** CHECK
CALL SUMAT1(TH(I),Q3,NML,I,PRINT9,MPL0T)
120 CONTINUE
ITOT=MANG
WRITE(6,FO) QANQ1,BAND2
51 FORMAT(1M1/1M079X*NOT METALS:
3
A1M15X*OFF AXIS BANDWIDTH*33X*F6.2,*-F6.2,* MICRONS*
B1X*ANGLE RADIATION*319*BLACK BODY*/
C1X*(DUG.) (W/ST.) AREA (CM**2)
80 D RADIATION (W/ST.*)
DO 61 I=1,ITOT
61 WRITE (6,62) ANG(I), SUR(I), THAX(I), SUM(I), ERI(I)
62 FORMAT(1H0,F10.1,F10.3,2F19.2,F19.3,6X,A10)
RETURN
END
85

```

	SUBROUTINE MINVIA,N,M,L,N		
	DIMENSION A(1),L(1),M(1)		
	NR=NR		
5	DO 5 K=1,N		
	NR=NR+M		
	L(1)=K		
	M(1)=K		
	KV=K+K		
	SIGA=A(K)		
10	DO 20 J=1,N		
	IJ=J+J		
	DO 21 I=1,N		
	IJ=IJ+I		
15	IF(A(I,SIGAI)-ABS(A(I,I))) 15,20,20		
	SIGA=A(I,I)		
	L(I)=I		
	M(I)=J		
20	CONTINUE		
	J=L(I)		
25	IF(J-K) 35,35,25		
	KI=K-NM		
	DO 30 I=1,N		
	KI=KI+NM		
	HOLD=A(KI)		
25	IF(KI-K) 25,25,25		
	A(KI)=A(I)		
	A(I)=HOLD		
30	I=I+K		
35	IF(I-K) 45,45,38		
	JP=J+I-1		
38	DO 40 J=1,N		
	JK=K+J		
	JI=J+J		
	HOLD=A(IK)		
	A(IK)=A(JI)		
35	A(JI)=HOLD		
40	IF(BIGAI) 45,45,40		
45	DO 55 I=1,N		
	IF(I-K) 50,55,50		
50	IK=K+I		
	AI(K)=A(IK)/(1-BIGAI)		
55	CONTINUE		
	DO 65 I=1,N		
	IK=K+I		
45	IJ=I-NM		
	DO 65 J=1,N		
	IJ=IJ+NM		
	IF(I-K) 60,65,60		
50	IF(IJ-K) 62,65,62		
	KJ=IJ-I+K		
	A(IJ)=A(IK)+A(KJ)+A(IJ)		
65	CONTINUE		
	KJ=K-NM		
55	DO 70 J=1,N		
	KJ=K+NM		
	IF(IJ-K) 70,75,70		
70	A(IJ)=A(IJ)+SIGA		

MINV	2
MINV	3
MINV	4
MINV	5
MINV	6
MINV	7
MINV	8
MINV	9
MINV	10
MINV	11
MINV	12
MINV	13
MINV	14
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MINV	36
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MINV	38
MINV	39
MINV	40
MINV	41
MINV	42
MINV	43
MINV	44
MINV	45
MINV	46
MINV	47
MINV	48
MINV	49
MINV	50
MINV	51
MINV	52
MINV	53
MINV	54
MINV	55
MINV	56
MINV	57
MINV	58

```

75 CONTINUE
  A ( K K ) = 1. / 81 GA
60 CONTINUE
  K=N
180 K=(K-1)
  IF(K) 150,150,185
105 I=L(K)
  IF(I-K) 120,128,108
108 J=NM*(K-1)
  J=NM*(I-1)
  DO 110 J=1,M
    JK=J+J
    HOLD=J(JK)
    JI=J+J
    A(JK)=-A(JI)
110 A(JI)=HOLD
120 J=N(K)
75 IF(J-K) 100,108,125
125 KI=K+NM
  DO 130 I=1,M
    KI=KI+NM
    HOLD=A(KI)
    JI=KI-K+J
    A(KI)=-A(JI)
130 A(JI)=HOLD
  GO TO 100
150 RETURN
  END

```

MINV	59
XINV	60
MINV	61
MINV	62
MINV	63
MINV	64
MINV	65
MINV	66
MINV	67
MINV	68
MINV	69
MINV	70
MINV	71
MINV	72
MINV	73
MINV	74
MINV	75
MINV	76
MINV	77
MINV	78
MINV	79
MINV	80
MINV	81
MINV	82
MINV	83
MINV	84
MINV	85
MINV	86


```

SUBROUTINE SUMAT1 (TH,Q8,NML,I,IPT,IPLT)
  DIMENSION OB(1)
  COMMON /OUT/ AREA(20),TMAX(20),ANG(20),ITOT
  COMMON /EE/ BAND1,BAND2, SUM(20)
  NMS=1000./BAND2
  NME=1000./BAND1
  DEL=4NE-MNS
  NP=DEL/50.*1
  SS=DEL/NP
  NME-MNS=0.5*SS
  AREA(1)=0.0
  DO 200 L=1,NP
    WN=WN+SS
    200 AREA(L)=AREA(L)+PLANKC(TMAX(L),WN)*SS
    ANG(L)=TH
    IS=(BAND1-1.0)/0.02+1.00000035
    IE=(BAND2-1.0)/0.02+0.00000035
    WL=0.5*(IS+IE)
    OIFF=WL-BAND1
    VAL=0.5*(EO.*OIFF)
    SUM(1) = VAL*OB(1S)
    L=1S+1
    DO 103 LL=L,IE
      103 SUM(LL) = SUM(LL)+OB(LL)
      L=IE+1
      MLE=0.9*(L+0.02)
      OIFF=ML-BAND2
      VAL=3.5*(50.*OIFF)
      SUM(1) = SUM(1)+VAL*OB(LL)
      AREA(1)=SUM(1)/AREA(1)
      IF(IPT.EQ.0) GO TO 100
      WRITE(6,15) BAND1, BAND2, SUM(1)
      15 FORMAT(1H0,9, 'BANDWIDTH SUMMATION',5X,'BANDWIDTH*F6.2M -,F6.2,
      15, 'RADIATION',F8.3, ' W/ST. ')
      103 IF(IPLT.EQ.0 .OR. TH.GT.89.5) RETURN
      ML=0.9*(IS+0.02)
      NP=IE-IS+2
      DO 60 L=1,NP
        LL=L+999
        OB(LL)=WL
        LL=LL+NP
        L=L+1S
        OB(LL)=OB(1S)
        MN=10000./ML
        LL=LL+NP
        SS=10000./ (ML-0.01)-10000./ (ML+0.01)
        OB(LL)=PLANKC(TMAX(L),WN)+AREA(1)*SS
        60 ML=ML+0.02
      CALL PLOT1 (TH,Q8(1000),NP,3,40.0)
      RETURN
    END
  END

```

SUMAT1	2
SUMAT1	3
SUMAT1	4
SUMAT1	5
SUMAT1	6
SUMAT1	7
SUMAT1	8
SUMAT1	9
SUMAT1	10
SUMAT1	11
SUMAT1	12
SUMAT1	13
SUMAT1	14
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