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THE PUFF AND P PUFF COMPUTER PROGRAMS

Richard N. Brodie
Captain USAF

James W. Aubrey, Jr.

TECHNICAL REPORT NO. AFWL-TR-65-24



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Research and Technology Division
AIR FORCE WEAPONS LABORATORY
Air Force Systems Command
Kirtland Air Force Base
New Mexico

March 1965

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FOREWORD

This report was prepared in support of Project 5710, Task 571015, Program Element 7.60.06.01.5.

Inclusive dates of research were January 1964 through February 1965. The report was submitted by the authors 23 February 1965.

The authors wish to thank Lt. Colonel Ralph H. Pennington for his direction and supervision in the preparation of this report.

This technical report has been reviewed and is approved.



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ABSTRACT

The report describes the one-dimensional Lagrangian hydrodynamics computer program, PUFF. The code is used primarily in the study of X-ray effects. In the past year it has been extensively revised and is now quite different from versions used outside the Air Force Weapons Laboratory. The major calculations in each subroutine are explained with a complete description of all input-output variables. Sample problems with the appropriate data deck are included to allow a user to become familiar with data arrangement and to check the program on his computer.

CONTENTS

			<u>Page</u>
SECTION	I	Introduction	1
	II	Main Program	3
	III	Generator	4
	IV	Rezone	6
	V	Edit	9
	VI	Equation of State	12
	VII	Input Variables	15
REFERENCES			20
APPENDIX	I	FORTRAN Listing of PUFF	21
	II	FORTRAN Listing of P PUFF	39
	III	Test Problem 1 (PUFF)	55
	IV	Test Problem 2 (PUFF)	73
	V	Test Problem 3 (P PUFF)	87
DISTRIBUTION			99

SECTION I

INTRODUCTION

The purpose of this report is to provide users of the PUFF code with an explanation of the latest version of the program. Several sample problems are included so that the user may become familiar with data input procedures and, at the same time, calibrate the program for his machine. The sample problems were designed to demonstrate a variety of input conditions and should be examined only in that context.

PUFF is a one-dimensional Lagrangian hydrodynamics program used primarily in the study of X-ray effects. The code uses finite difference methods to solve the equations of hydrodynamics using slab geometry and assuming one-dimensional flow through a 1-centimeter-square pipe (reference 1). One may follow a pressure pulse which is propagated through a sample consisting of up to six separate materials. A grid or mesh is superimposed on the materials in the sample. The grid areas are called zones and the grid lines are called zone boundaries. The mesh is numbered, increasing from left to right. The pressure pulse normally starts from the left and progresses through the mesh to the right. When we speak of the front of the mesh, we are referring to the larger zone numbers. When we speak of the back of the mesh, we are referring to the smaller zone numbers.

The index J is consistently used in the code to denote zone numbers. The materials in the sample are numbered consecutively from left to right. The index M is used when a material number is needed.

The original PUFF was a derivative of a Livermore code (reference 2). Extensive work on PUFF was done at the Air Force Weapons Laboratory and additional work was done under contract by McAllister and Associates, Inc. During this development the code became quite large for its degree of sophistication. Many options as to types of problems run were incorporated and an extremely complicated and time-consuming edit routine was developed. Since this development took place over a span of several years, many different

people made separate changes and no concentrated effort was made to delete options that were no longer used. This made the program almost impossible to use for one not intimately familiar with it.

In January of 1964 it was decided to make a version which would retain the essential elements of PUFF but eliminate all options which were not currently in use; and also to make the input-output as straightforward as possible. The monitor subroutine was eliminated and the edit routine was simplified by using the premise that it is more efficient to dump large amounts of required output on binary tape for later edit and plotting and to print only essential data during problem run time.

Since the code was designed to be driven by one of two dissimilar methods, flyer plate (plate slap) and energy deposition, it was decided that a considerable amount of computer time could be saved if the two options were handled in separate codes. The energy deposition code is now called PUFF and the plate slap code is called P PUFF. A great simplification in FORTRAN coding resulted from this division as well as a reduction in core space and computer time required. During this revision cgs units were incorporated and the equation of state was completely divorced from the hydro loop.

The present code consists of a main program where the hydrodynamics is accomplished and from which the other subroutines are called as needed. Each routine has been extensively rewritten and simplified with the exception of rezone where only minor corrections have been made.

PUFF and P PUFF are essentially the same except for the generator subroutines. The section dealing with the generator subroutine points out the major differences between the program.

SECTION II

MAIN PROGRAM

Variables and counters used only in the main program are initialized there instead of in the generator subroutine. Except for local variables being initialized, all calculations in the main program are contained in the time or cycle loop. The time loop begins with the main hydro loop. This loop starts with the first zone, advances in time all quantities associated with that zone, and proceeds with each zone in sequence until all zones have been advanced to the new time. After the hydro loop is completed, numerous checks are made to determine if the problem is complete, if a rezone is possible, or if one of the edit options is desired. If the problem is not complete, a new time step is calculated, the cycle counter N is advanced by 1, and a new cycle is started.

The velocity U , the ordinate of the zone boundary X , the specific volume V , and the artificial viscosity Q are computed in a standard Lagrangian manner. The pressure P , energy E , and sound speed CS are calculated by use of an interpolation method using values returned from an equation-of-state subroutine. This method was developed at the Air Force Weapons Laboratory and eliminates the requirement that the equation of state be in an analytic form.

A tentative time step is computed using the Courant condition modified for the use of artificial viscosity. The actual time step used is the minimum of the tentative time step, 120 percent of the old time step, or 1 one-hundredth of the energy deposit time.

The Lagrangian edit records the time-pressure history of the first zone in the material to the immediate right (downstream) of the chosen zone boundary. This edit is accomplished in the main program since it is exercised every cycle. The zone designated as a JEDIT is not allowed to collapse in rezone. Experience has shown it best not to designate consecutive zones as JEDITS unless one is very careful with the initial zone size.

SECTION III

GENERATOR

1. Introduction

The generator subroutine is called at the start of a problem to read all input data and initialize quantities needed in the problem. It is arranged in independent segments which are executed sequentially. All input values are printed out as a check of the data arrangement and for future reference.

The zoning for both PUFF and P PUFF is computed using a sequence of geometric progressions. This is accomplished using two sets of variables RZ and NZ. The RZs are the common ratios and the NZs are the zone indexes which terminate each progression.

The only essential difference in the generators of PUFF and P PUFF is that PUFF determines an energy deposit rate SS while P PUFF sets a velocity profile. These items are discussed below.

2. Energy Deposition (PUFF)

The absorption coefficients are computed using the formula

$$\mu = \rho \cdot AA \cdot (h \cdot v)^B$$

The values of AA and B are input numbers referenced to 1 key that change with material and absorption edges.

One may use the energy spectrum obtained from a multiple black body source or may input an arbitrary spectrum. The arbitrary spectrum may be described by as many as 109 values of energy and corresponding $h \cdot v$ intervals. PUFF now uses 109 values of $h \cdot v / KT$ in the black body calculations instead of the 100 used in previous versions. This change was made to improve the high energy section of the curve. An energy deposit rate, SS, is computed for each zone using the above values in the standard exponential absorption formula.

3. Plate Slap (P PUFF)

P PUFF is designed to simulate the reactions caused by hitting a stationary plate with a piece of material (the flyer plate) moving at a given velocity

upon impact. The starting conditions for the problem simulate those at the instant of impact.

The velocity of each zone in the flyer plate, excluding the last, is set equal to the input variable UZERO. Provision is made to smear the velocity drop, from UZERO to ZERO, over five zones. The velocity of the first zone in the target is set at an input fraction (UFACE) of the flyer velocity. UFACE is used to match the acoustical impedances of the flyer plate and the target.

It may be computed from
$$UFACE = \frac{Z_{FP}}{Z_{FP} + Z_T}$$
, where $Z = \rho_0 \cdot \text{sound speed}$.

The velocity in the last zone of the flyer plate is the average of the flyer plate velocity and the velocity of the first zone in the target. The velocity of the second zone in the target is one-half that of the first. A print of the calculated velocity profile is given.

SECTION IV

REZONE

1. Introduction

At its best, rezone will introduce small perturbations in the solution. At its worst, rezone can completely destroy a problem. It is hoped that with judicious use the errors introduced will not affect the result by more than a few percent. The computer time saved is substantial.

The rezone routine was designed for a single pulse moving through a mesh having initial zone size increasing with zonal index. Since available computer time limits a problem to a few hundred zones, rezone tries to distribute the zones where they are most needed. The routine attempts to keep the resolution under the pulse constant by reducing zone size as the pressure peak approaches. Certain sections of the mesh are relatively inactive and will allow larger zone sizes. The collapse routine will combine two neighboring zones into one if certain conditions are met. The dividing and combining of zones is done in the divide and collapse routines respectively.

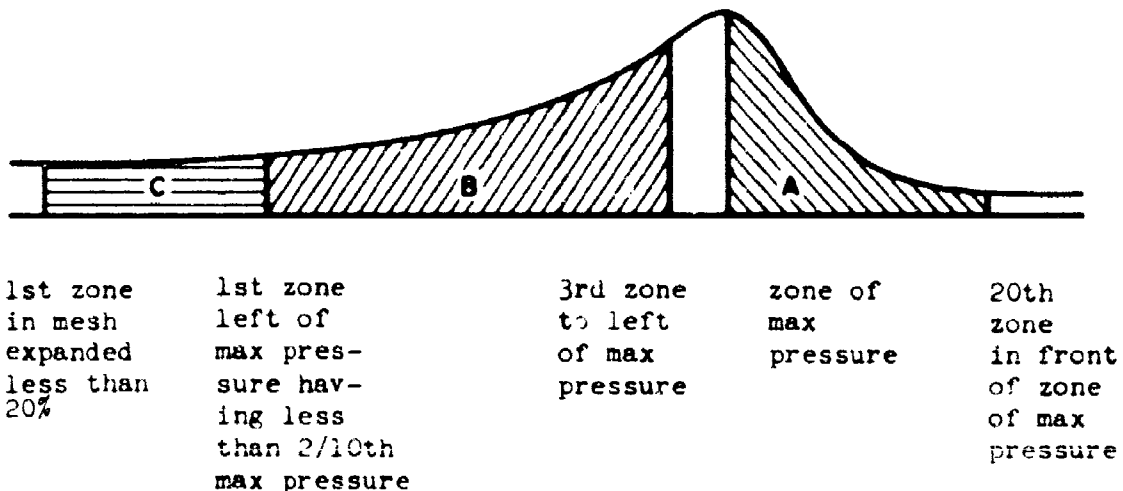


Figure 1. Rezone Regions

2. Divide Routine

The divide routine operates on twenty zones immediately in front of the zone of maximum pressure (region A, figure 1). To determine an appropriate size for a test zone, the positive momentum of the main pulse and the maximum pressure are used to construct a theoretical triangular pulse which is assumed to be moving with velocity equal to the sound speed of the zone of maximum pressure. The pulse length of this theoretical triangular pulse is found and divided by an input number, ZPUL. This distance is used as the "optimum" zone size in the region. Any zone larger than this check size is divided in half. The divided zone is then checked to see if it should be redivided.

3. Collapse Routine

The collapse routine combines adjoining zones in regions B and C in figure 1. Region B is assumed to be more active than C. Region B extends from three zones to the left of the zone having maximum pressure to the first zone to the left having a pressure less than two-tenths maximum pressure. Region C begins at the left boundary of B and extends to the first zone in the mesh which is expanded less than 20 percent, or to the first zone if no zone is expanded 20 percent. In region B the optimum zone size computed in the divide routine is multiplied by one-half the relative volume (ρ_0/ρ) of the zone of maximum pressure and this quantity is used for the optimum zone size in the region. Each zone in the region smaller than this check size is combined with an adjoining one. Region C uses a rather arbitrarily determined length for its zone size check. The length of the region is divided by the input variable JRZL and used as the optimum zone size. Each zone in the region smaller than this check size is combined with an adjoining zone. Zones designated as material boundaries or JEDITS are not collapsed. The collapse routine is presently entered only once every 100 cycles.

4. Comments

If one is interested in the back part of the mesh (reflected shocks, etc.) at later times, JRZL should be increased to something like 100. A JRZL of 20 will allow very large zones at late times which will effectively damp pulse movement. A ZPUL of 40 is adequate for most problems.

AFWL-TR-65-24

The divide routine may be bypassed in a problem by initializing ZPUL to zero. The collapse routine may be bypassed in a problem by initializing JRZL to zero.

SECTION V

EDIT

1. Introduction

Elaborate edit routines usually consume a sizable percentage of the computer time used by a problem. This fact leads to a conflict between obtaining sufficient edits to ensure adequate knowledge at all points of interest in the problem and the computer time that is available for the problem. Complicated edit routines also prove difficult in converting from one computer to another.

The present edit routine is divided into two parts. The first part stores, at designated intervals during the problem, all zonal variables and other selected variables on binary tape for later processing. The second part of the routine prints a sufficient number of key variables to enable the user to determine during run time that the problem is progressing satisfactorily, and, after problem completion, to determine points where more detailed edits are wanted. This method has the advantage of using the minimum amount of computer time while providing the maximum amount of available data. It has the disadvantage of requiring the user to wait longer for the final edits and plots.

The Air Force Weapons Laboratory uses the Cal Comp automatic plotter for most PUFF data presentation. The most commonly used plot program simply plots the pressure versus distance for a given time, although more complicated programs exist.

2. Output Variables

All variables printed in the edit routine are defined below.

N	Cycle number.
TIME	Present problem time.
DTNH	Present time step.
JSTAR	Zone number of the last zone in the mesh (from left to right) that has a velocity greater than 10^{-3} cm/sec.

PMAX	The maximum pressure contained in the mesh.
XJPMAX	Coordinate of the zone boundary of the zone having maximum pressure.
JPMAX	Zone number of the zone having the maximum pressure present in the mesh.
MVPULSE	Sum of the momentum of each zone from JPMAX+3 back to the first zone which has a negative velocity.
MVPREC	Sum of the momentum of each zone from JPMAX+4 out to JSTAR+1.
MOMENTUM	Sum of MVPULSE and MVPREC. This expression is computed by averaging the zone mass of two adjoining zones and using the velocity of the boundary between.
DTPP	Pulse width computed using the expression $EMVFP/PMAX$.
DTPULS	Pulse width computed using the expression $EMVPL/PMAX$.
ETOTAL	Total energy of the problem, computed by summing the kinetic and internal energy for each zone. The units are calories.
EMVNEG	Total negative momentum in the mesh. This expression is computed by averaging the velocities of two adjacent zone boundaries and using the zone mass of the zone between.
EMVPOS	Total positive momentum in the mesh. This expression is computed by averaging the velocities of two adjacent zone boundaries and using the zone mass of the zone between.
L-BOUND	Coordinate of the left material boundary (X(1)).

X(JBND1)	Coordinate of the boundary between the first and second material. It will be zero for one-material problems.
X(JBND2)	Coordinate of the boundary between the second and third material. It will be zero for two-material problems.
R-BOUND	Coordinate of the right material boundary.
JFIN	Zone number of the last zone in the problem.

SECTION VI

EQUATION OF STATE

1. Introduction

PUFF can now use any equation-of-state subroutine that will return a pressure when presented an energy, density, and material index.

The present equation of state is probably the greatest source of error in PUFF other than rezone. The pressure is computed using one of two functional equations: one for solid regions and one for vapor regions. If the zone is compressed relative to ambient conditions, the solid state equation is used. If the zone is expanded relative to ambient conditions, the vapor state equation is used.

2. Solid Phase

The solid phase equation is based on the Mie-Grüneisen equation of state (reference 3). This equation appears in PUFF as

$$P = C\mu + D\mu^2 + S\mu^3 + G\rho E \quad ,$$

where μ is $\rho/\rho_0 - 1$, G is the Grüneisen parameter and E is energy density. C is determined by the product of ambient density and the weak wave velocity squared. Each of the Hugoniot pressures is multiplied by the expression $(1 - \frac{G \cdot \mu}{2})$ and these points are least squares fit for D and S using C as a known parameter.

3. Vapor Phase

The vapor equation of state is a fit to the Thomas-Fermi-Dirac model in conjunction with a modified γ -law gas equation of state (reference 4).

The equation appears in PUFF as

$$P = n[H + (G-H)n^{1/2}] [E - E_S(1 - \exp\frac{N}{n}(1 - \frac{1}{n}))] \quad ,$$

where η is ρ/ρ_0 , H is $(\gamma-1)$ effective for small η 's, E_s is the sublimation energy, and N is determined from the expression

$$N = \frac{C}{G(E \cdot \rho_0)} .$$

C , G , and E are defined above.

It is easy to show that the vapor and solid equations have a common limit of $G\rho E$ as the limits $\eta \rightarrow 1^-$ and $\eta \rightarrow 1^+$ are taken respectively.

4. Two-Wave Formulation

The most current version of PUFF contains an option for a two-wave structure in the solid phase equation. See figure 2.

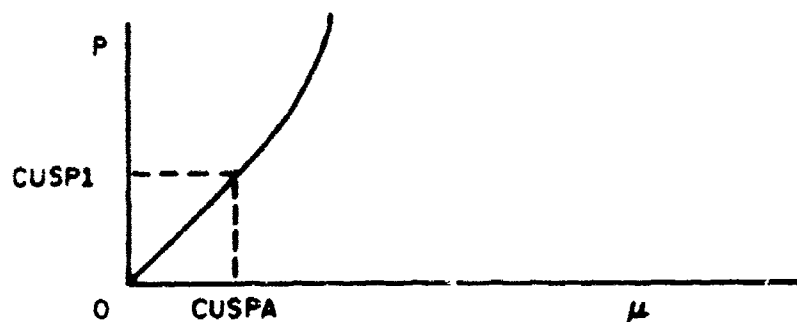


Figure 2. Two-Wave Structure

For μ 's such that $0 \leq \mu \leq \text{CUSPA}$, the pressure is computed by the normal solid equation. For μ 's such that $\text{CUSPA} < \mu$, the pressure is computed using the expression

$$P = \text{CUSP1} + C_1(\mu - \text{CUSPA}) + D_1(\mu - \text{CUSPA})^2 + S_1(\mu - \text{CUSPA})^3 + G \cdot \rho \cdot E .$$

C_1 , D_1 , and S_1 are computed in the same manner as C , D , and S after translating the origin to the point $(CUSPA, CUSP1)$.

SECTION VII

INPUT VARIABLES

This section gives a workable definition of all input variables used in both PUFF and P PUFF. Those followed with a number 1 are used only in PUFF. Those followed with a number 2 are used only in P PUFF. All other variables are common to both codes.

AA(M,I)	(1)	Constants used in computing absorption coefficients. The dimensions are cm^2/gm . See section on Generator sub-routine.
ANGLE	(1)	Angle in degrees of the X-ray path measured from the normal of the material. A zero value indicates perpendicular alignment.
B (M,I)	(1)	Dimensionless constants used in computing absorption coefficients. See section on Generator subroutine.
CKP		A problem stop parameter. The problem will terminate when the maximum pressure reaches this distance in centimeters.
CUSPA(M)		$\mu, \frac{\rho}{\rho_0} - 1$, corresponding to an inflection point in the Hugoniot data.
CUSPC(M) CUSPD(M) CUSPS(M)		Equation-of-state constants used in the two-wave solid phase equation. The units are dynes/cm^2 . See section on Equation of State.
CUSPG(M)		Grüneisen parameter for the two-wave solid phase equation. It is dimensionless.
CUSPI(M)		Value of the pressure in dynes/cm^2 corresponding to an inflection point in the Hugoniot data.

DISCPT		Description of the problem. Up to 80 permissible Hollerith characters may be used.
DX		Size of the first zone in centimeters.
EE(I)	(1)	Total energy in cal/cm^2 of each black body. For problems where $\text{ANGLE} \neq 0$, the total energy for each black body should be multiplied by $\cos(\text{ANGLE})$.
EDGE(M,I)	(1)	Values of $h\nu$ where the absorption coefficients are discontinuous.
EI(I)	(1)	Energy in cal/cm^2 corresponding to each interval of $h\nu$ in an arbitrary spectrum problem. For problems where $\text{ANGLE} \neq 0$, each value of EI should be multiplied by $\cos(\text{ANGLE})$. EI is computed in a black body problem.
EQSTC(M)	}	Equation-of-state constants used in the solid phase equation. The units are dynes/cm^2 . See section on Equation of State.
EQSTD(M)		
EQSTS(M)		
EQSTE(M)		Sublimation energy of material M in ergs/gm .
EQSTG(M)		Grüneisen parameter. It is dimensionless.
EQSTH(M)		$(\gamma-1)$ effective for low values of ρ/ρ_0 . It is dimensionless.
JBND(M)		Zone number of the last zone in a material (M). The JBND of the last material should be initialized as zero for the code, i.e., $\text{JBND}(\text{NMTRLS})=0$. In a plate slap, if the flyer and target

are the same material, the
JBND(1) = JFIN2.

JCYCS A problem stop parameter. The problem
will terminate after running this many
cycles.

JEDIT(I) Zone number where Lagrangian edits are
desired.

JFIN Zone number of the last zone in the
problem.

JRZL Arbitrary number of zones desired in
the collapse region of rezone. Should
be 20 to 50 for one-pulse problems, 40
to 100 for two-pulse problems, and 20
to 100 for plate slap problems.

JZPUL Zoning number used in rezone for di-
viding in front of the pulse. A value
of 40 is good for all problems. ZPUL
is set equal to JZPUL.

LOZHIZ (1) Flag used to allow use of rezone in a
two-pulse problem. Set to zero for
one-pulse problems. Set to 1 if the
right pulse is predicted to be dominant
in two-pulse problems.

MATL(M) Material name or description.

NBB (1) Number of black bodies used. Should be
1 for an arbitrary spectrum problem

NHNU (1) Number of matched values of $h\nu$
intervals and energy used in the arbi-
trary spectrum input. If zero, used as
a flag to select black body energy
computation.

NJEDIT		Number of Lagrangian edits selected.
NMTRLS		Number of materials. In a plate slap, if the flyer and target are of the same material, then NMTRLS = 2.
NOE(M)	(1)	Number of edges (discontinuities in absorption coefficients) for each material.
NPRIN		Controls the frequency of printed edits. Edits will be printed at cycles which are integer multiples of this number.
NRZ		Number of zoning ratios used in initial zoning.
NTAPE		Controls frequency of data dumps on binary tape. Information will be stored at cycles which are integer multiples of this number.
NTEDT		Number of time edits selected.
NTEST		A read check variable. Should always be set to 30. If there are too few or too many data cards, the problem will stop.
NZ(I)		Zoning number which changes the zoning ratio (RZ). The code requires this number to be 1 less than the zone where the ratio is wished to be changed.
PMIN(M)		Minimum pressure in dynes/cm ² allowed in the mesh for material M. Approximates the dynamic tensile strength.
RHO(M)		Ambient density in gm/cm ³ of the material M.
RZ(I)		Zoning ratio used in geometrically zoning a problem.

SDUR	(1)	X-ray shine time in seconds.
T(I)	(1)	Temperature in kev of each black body. May be read as zero in an arbitrary spectrum problem.
TBL(I)	(1)	Storage for $h \cdot v / KT$ values for black body problems or $h \cdot v$ values for arbitrary spectrum problems.
TEDIT(I)		Problem times in seconds where edits are desired.
TIME		First time step in seconds. This variable is later used for total problem time. 10^{-12} seconds is a reasonable figure for most problems.
TS		A problem stop parameter. The problem will terminate when TIME reaches this time in seconds.
UFACE	(2)	A constant used to smear the velocity discontinuity between the flyer and the target over five zones. See section on Generator.
UFIN	(2)	Last zone of the flyer plate.
UZERO	(2)	Velocity of the flyer plate.

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APPENDIX I

FORTRAN LISTING OF PUFF

PROGRAM PUFF	10
THIS IS PUFF FOR DEPOSITION ONLY FOR THE AFWL 1604 *****	20
	30
COMMON AA(6,20),AC(10,109,6),B(6,20),CUSPI(6),CUSPA(6),CUSPC(6),	40
1CUSPD(6),CUSPG(6),CUSPS(6),DISCPT(12),EE(10),EDGE(6,20),EI(10,109)	50
2,EQSTC(6),EQSTD(6),EQSTE(6),EQSTG(6),EQSTH(6),EQSTN(6),EQSTS(6),	60
3JBN(6),JEDIT(10),JORG(10),MATL(6),NOE(6),NZ(20),PMIN(6),RHO(6),	70
4RZ(20),SS(801),T(10),TBL(109),TEDIT(25),X(801)	80
	90
COMMON CKP,DTNH,DTN,JCK,JCYCS,JFIN,JPMAX,JPMAXI,JREL,JSTAR,JXXO,JZ	100
1PUL,LINE,LCZHI7,N,NBR,NJEDIT,NMTRLS,NPRIN,NRZ,NTAPE,NTEDT,PMAX,	110
2SDUR,TIME,TS,WTAPE,ZPUL	120
	130
DIMENSION P(1),Q(1),CS(1),E(1),V(1),ZM(1),U(1)	140
	150
EQUIVALENCE (AC,P),(AC(802),Q),(AC(1603),CS),(AC(2404),E),(AC(3205	160
1),V),(AC(4006),ZM),(AC(4807),U)	170
	180
ZEROES COMMON	190
DO 1 K=1,9954	200
AA(K)=0.	210
CALL GENRAT	220
	230
INITIALIZE COUNTERS AND CONSTANTS	240
	250
LINE=0	260
FLAG=0.	270
CC=1.8	280
C1=.25	290
TWOC1=2.*C1	300
COSQ=C1*CC	310
FORCOSQ=4.*COSQ	320
I1=1	330
N=1	340
SSCK=0.	350
DTN=TIME	360
DTNH=TIME	370
HYDRO STARTS HERE	380
	390
TIME LOOP	400
	410
SK2M=0.	420
PMAX=0.	430
M=1	440
LL=1	450
DETERMINE THE LEFT BOUNDARY CONDITIONS	460
U(1)=U(1)-DTN*(Q(2)+P(2))/ZM(2)	470
X(1)=X(1)+DTNH*U(1)	480
	490
MAIN LOOP FOR HYDRO CALCULATION	500

```

30 IF (TIME-JU) IN=1
31 C1=1.0E1,UF1NM1
32 VOL=V(J+1)
33 QOL=Q(J+1)
34 PCL=P(J+1)
35 IF (JU+1-JUNV(M)) 4,3,4
36 LLTLL+1
37 IF (JU-JTAR) 5,6,5
38 E(J+2)=MINIF(TIME-LTNH,UF(J+2))*S(J+2)
39 IF (V(J+2)) 7,7,6
40 E=1./V(J+2)
41 GO TO 1
42 C=1.
43 CALL LGT1 (E(J+2),D2,P(J+2),LL)
44 U(J+1)=U(J+1)-DTN*(P(J+2)+U(J+2)-P(J+1)-U(J+1))/(Z-(J+1)+ZM(J+1))
45 IF (U(J+1)-1.) 10,10,11
46 U(J+1)=0.
47 X(J+1)=X(J+1)+L*TNH*U(J+1)
48 DU=U(J+1)-U(J)
49 V(J+1)=(X(J+1)-X(J))/ZM(J+1)
50 VAVG=(V(J+1)+VOLD)/2.0
51 DV=DTNH*DU/2*(J+1)
52 IF (DU+1.) 12,13,13
53 U(J+1)=(DU*QJSG-C1*CS(J+1))*DU/VAVG
54 IF (U(J+1)-1.) 13,14,14
55 U(J+1)=0.
56 DU=0.
57 U(J+1)=0.
58 IF (TIME-SPUR) 15,15,16
59 F(J+1)=F(J+1)+FS(J+1)*DTNH
60 GO TO 18
61 IF (SSCK) 17,17,18
62 E(J+1)=F(J+1)+FS(J+1)*(SPUR-(TIME-DTNH))
63 SSCK=1.
64 LNEW=1./V(J+1)
65 OLD=F(J+1)
66 CALL LGT1 (E(J+1),LNEW,P2,V)
67 L1=E(J+1)-P(J+1)*LV
68 CALL LGST (L1,LNEW,P1,M)
69 E(J+1)=F(J+1)-(P2+P(J+1)+O(J+1)+OLD)*LV/(2.-(P1-P2)/P(J+1))
70 O(J+1)=P2+(P2-P1)*(E(J+1)-OLD)/OLD/LV
71 OLTD=.01*LNEW
72 IF (DV) 2,19,19
73 DFUDG=DNEW+OLTD
74 GO TO 21
75 DFUDG=LNEW-OLTD
76 CALL LGST (E(J+1),DFUDG,PFUDG,M)
77 UPDRHO=(PFUDG-P(J+1))/(DFUDG-DNEW)
78 IF (OPDRHO) 22,22,23
79 SPEED=1.
80 GO TO 24
81 SPEED=SQRTE(OPDRHO)
82 SP2M1=(SPEED+TWOC1*CS(J+1)-FORCSG*DU)/(X(J+1)-X(J))
83 O(J+1)=SPEED
84 IF (P(J+1)-PMAX) 26,26,26
85 PMAX=P(J+1)

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	JPMAX=J+1	1090
26	IF (SK2M-SK2M1) 27,27,28	1090
27	SK2M=SK2M1	1100
28	M=LL	1110
	IF (U(J+1)) 33,29,33	1120
29	IF (N=1) 30,30,31	1130
30	JPMAX1=JPMAX+10	1140
	IF (LOZH(Z) 31,32,31	1150
31	IF (J-JSTAR) 33,32,32	1160
32	JSTAR=J	1170
	GO TO 34	1180
33	CONTINUE	1190
C	MAIN LOOP ENDS HERE	1200
C		1210
	JSTAR=JFINM1	1220
C		1230
C	EXIT AND EDIT CONTROL	1240
C		1250
34	IF (TIME-TS) 35,37,37	1260
35	IF (N=JCYCS) 36,37,37	1270
36	IF (X(JPMAX)-CKP) 41,37,37	1280
37	FLAG=1.	1290
38	WTAPE=1.	1300
	CALL EDIT	1310
	END FILE 4	1320
	END FILE 6	1330
	REWIND 4	1340
	REWIND 6	1350
	IF (FLAG) 39,40,39	1360
39	REWIND 45	1370
	STOP	1380
40	CALL DOTF	1390
	PAUSE	1400
41	IF (SENSE SWITCH 2) 42,44	1410
42	PRINT 43,N	1420
43	FORMAT (31H SENSE SWITCH 2 IS ON AT CYCLE 110)	1430
	GO TO 38	1440
44	IF (XMODF(N,NTAPE)) 46,45,46	1450
45	WTAPE=1.	1460
	CALL EDIT	1470
	GO TO 48	1480
46	IF (XMODF(N,NPRIN)) 48,47,48	1490
47	WTAPE=1.	1500
	CALL EDIT	1510
C	CYCLE ADVANCE	1520
C		1530
48	SK2M=MINIF(.9/SK2M,1.2*DTNH)	1540
	IF (NJEDIT) 49,51,49	1550
49	WRITE TAPE 4,NJEDIT,N,TIME	1560
	DO 50 I=1,NJEDIT	1570
	JB=NJEDIT(I)	1580
50	WRITE TAPE 4,JORG(I),JFEDIT(I),R(JB+1)	1590
51	IF (SDUR-TIME) 53,53,52	1600
52	SK2M=MINIF(.01*SDUR,SK2M)	1610
53	DTNH=DTNH	1620
	DTNH=SK2M	1630
	CALL REZONE	1640

	IF (TEDIT(11)) 58,58,54	1650
54	IF (NTEDT) 55,57,55	1660
55	IF (TIME+DTNH-TEDIT(11)) 58,58,56	1670
56	DTNH=TEDIT(11)-TIME	1680
	NTEDT=1	1690
	GO TO 58	1700
57	WTAPE=1.	1710
	CALL EDIT	1720
	II=II+1	1730
	NTEDT=1	1740
58	TIME=TIME+DTNH	1750
	DTN=DTN+DTNH	1760
	N=N+1	1770
	IF (DTNH) 59,59,2	1780
59	PAUSE25	1790
	GO TO 2	1800
	END	1810

GENERATOR SUBROUTINE FOR THE PUFF HYDRO CODE

SUBROUTINE GENRAT

COMMON AA(6,20),AC(10,109,6),B(6,20),CUSP1(6),CUSPA(6),CUSPC(6),
1CUSPD(6),CUSPG(6),CUSPS(6),DISCPT(12),EE(10),EDGE(6,20),EI(10,109),
2,EQSTC(6),EQSTD(6),EQSTE(6),EQSTG(6),EQSTH(6),EQSTN(6),EQSTS(6),
3JBND(6),JEDIT(10),JORG(10),MATL(6),NCE(6),NZ(20),PMIN(6),RHO(6),
4RZ(20),SS(801),T(10),TEL(109),TEDIT(25),X(801)

COMMON CKP,DTNH,DTN,UCK,JCYCS,JFIN,JPMAX,JPMAX1,JRZL,JSTAR,JXXO,JT
1PUL,LINE,LOZHIZ,N,NBB,NJEDIT,NMTRLS,NPRIN,NRZ,NTAPE,NTEUT,PMAX,
2SDUR,TIME,TS,WTAPE,7PUL

DIMENSION P(1),Q(1),CS(1),E(1),V(1),ZM(1),U(1)

EQUIVALENCE (AC,P),(AC(802),Q),(AC(1603),CS),(AC(2404),E),(AC(3205
1),V),(AC(4006),ZM),(AC(4807),U)

1 FORMAT(10A8)
2 FORMAT(8I10)
3 FORMAT(8E10,3)
4 FORMAT(2E15,7)
5 FORMAT(1H07HEITOT =E15,7)
6 FORMAT(1H08HLOZHIZ =I10)
7 FORMAT(45H ERROR--INPUT CARDS ARE NOT PROPERLY PREPARED)
8 FORMAT(25H INPUT PARAMETERS FOR - -/1H010A8)
9 FORMAT(46H ***** THIS PROGRAM WAS RUN ON PUFF/1604 *****)
10 FORMAT(13H TABLE VALUES/(10E10,3,/))
11 FORMAT(1H06X,3HNB6X,4HNRC4X,6HNMTRL36X,4HJRZL5X,5HJZPUL5X,5HNPR
1IIN6X,5HANGLE/6I10,6E10,3)
12 FORMAT(//17H ZONING CONSTANTS//)
13 FORMAT(3X,6H RA110E10,3,8H TO ZONE16)
14 FORMAT(//45H BLACK BODY TEMPERATURE AND ASSOCIATED ENERGY)
15 FORMAT(12H TEMPERATURE,5X,8H ENERGY)
16 FORMAT(1H E10,3,6X,E10,3)
17 FORMAT(1H05X,4HJFIN5X,5HJCYCS5X,5HNTEST5X,5HNTAPE7X,3HCKP6X,2HTSE
1X,4HTIME6X,4HSDUR/4I10,4E10,3)
18 FORMAT(25H MATERIAL PROPERTIES FOR A8,5X,4HRHO=E10,3,5X,7HFROM J-
115,2X,5HTO J=15)
19 FORMAT(1H09X,5HEQSTC10X,5HEQSTD10X,5HEQSTE10X,5HEQSTG10X,5HEQSTH
1X,5HEQSTS10X,5HEQSTN11X,4HPMIN/8E15,5)
20 FORMAT(1H09X,5HCUSP110X,5HCUSPA10X,5HCUSPC10X,5HCUSPD10X,5HCUSPG
110X,5HCUSPS/6E15,5)
21 FORMAT(///5H NOE=15,23X,3H AA,16X,2H B,20X,3H EDGE//)
22 FORMAT(E37,5,E20,5,E25,5)
23 FORMAT(1H1,10A8,/5H J 6X,2HDX13X,1HX11X,4HERGS10X,3HCAL10X,
17HSUM CAL7X,7HERGS/GM7X,8HVELOCITY5X,9HZONE MASS4X,1HJ//)
24 FORMAT(1H 13,8E14,5,14)
25 FORMAT(1H1)
26 FORMAT(1H010X,14HTHE TEDITS ARE/10E10,3/)
27 FORMAT(1H010X,14HTHE JEDITS ARE/10I10)
28 FORMAT(21H MATERIAL THICKNESS =L10,3)

READ DATA

	READ 3,NHNU,NTEDT,NJEDIT,LOZHI2	140
	IF (NHNU) 29,30,29	140
29	READ 4,(TBL(I),I=1,10),I=1,NHNU)	1410
	GO TO 31	1410
30	READ 3,(TBL(I),I=1,109)	1430
31	READ 1,(DISCPT(I),I=1,10)	1440
	IF (NTEDT) 33,33,32	1450
32	READ 3,(TEDIT(I),I=1,NTEDT) —	1460
33	IF (NJEDIT) 35,35,34	1470
34	READ 2,(JEDIT(I),I=1,NJEDIT)	1480
35	READ 2,NBS,NRZC,NMTRLS,JRZL,JZPOL,NPRIN,NTAPE	1490
	ZPOL=JZPOL	1500
	READ 3,ANGLE	1510
	NMT=NMTRLS-1	1520
	READ 2,(NOE(M),M=1,NMTRLS)	1530
	READ 3,SOUR,(T(L),EF(L),L=1,NBS)	1540
	IF (NMT) 37,37,36	1550
36	READ 2,(JBND(M),M=1,NMT)	1560
37	READ 2,JFIN,(NZ(L),L=1,NRZC)	1570
	READ 3,DX,TIME,(RZ(M),M=1,NRZC)	1580
	DX=DX/RZ(1)	1590
	DO 38 M=1,NMTRLS	1600
	READ 1,MATL(M)	1610
	READ 3,RHO(M),EQSTC(M),EQSTD(M),EQSTE(M),EQSTG(M),EQSTH(M),EQSTS(M)	1620
	1),PMIN(M)	1630
	READ 3,CUSPI(M),CUSPA(M),CUSPC(M),CUSPD(M),CUSPG(M),CUSPS(M)	1640
	EQSTN(M)=EQSTC(M)/EQSTG(M)/(EQSTE(M)*RHO(M))	1650
	NOED=NCE(M)	1660
38	READ 3,(AA(M,I),B(M,I),EDGE(M,I),I=1,NCE)	1670
	READ 3,CKP,TS	1680
	READ 2,JCYCS,NTST	1690
	IF (NTST=30) 39,40,39	1700
39	PRINT 7	1710
	STOP	1720
40	JCK=0	1730
	JXX0=0	1740
	NRZ=-5	1750
	ANGLE=COSF(ANGLE/57.2957795)	1760
	IF (NJEDIT) 43,4,41	1770
41	DO 42 I=1,NJEDIT	1780
42	JORG(I)=JEDIT(I)	1790
		1800
		1810
		1820
		1830
43	IF (NHNU) 44,50,44	1840
44	DO 48 M=1,NMTRLS	1850
	K=1	1860
	DO 48 I=1,NHNU	1870
45	IF (EDGE(M,K)-TBL(I)) 46,46,47	1880
46	K=K+1	1890
	GO TO 45	1900
47	AC(I,I,M)=-RHO(M)*AA(M,K)*(TBL(I)**B(M,K))/ANGLE	1910
48	CONTINUE	1920
	EITOT=0	1930
	DO 49 I=1,NHNU	1940
49	EITOT=EITOT+E I(I,I)	1950
	GO TO 50	

CALCULATE ABSORPTION COEFFICIENTS

50	EITOT=0.	2960
	DO 54 M=1,NMTRLS	2970
	DO 54 L=1,NBB	2980
	K=1	2990
	DO 54 I=1,109	3000
51	IF (EDGE(M,K)-TBL(I)*T(L)) 52,52,53	3010
52	K=K+1	3020
	GO TO 51	3030
53	AC(L,I,M)=-RHO(M)*AA(M,K)*(TBL(I)*T(L))*B(M,K)/ANGLE	3040
54	CONTINUE	3050
	DO 57 L=1,NBB	3060
	DO 57 I=1,109	3070
	IF (I-99) 55,55,56	3080
55	EI(L,I)=EE(L)*.01	3090
	GO TO 57	3100
56	EI(L,I)=EE(L)*.001	3110
57	CONTINUE	3120
C		3130
C	COMPUTE DX USING ZONEING CONSTANTS	3140
C		3150
58	LZ=1	3160
	DO 61 J=1,JFIN	3170
	IF (J-1-NZ(LZ)) 60,59,60	3180
59	LZ=LZ+1	3190
60	DX=DX+RZ(LZ)	3200
61	X(J+1)=X(J)+DX	3210
C		3220
C	ZONE DEPOSITION	3230
C		3240
	M=1	3250
	DO 71 J=1,JFIN	3260
	ESUM=C.	3270
	IF (J-JBND(M)) 63,62,63	3280
62	M=M+1	3290
63	IF (NHNU) 64,67,64	3300
64	DO 66 I=1,NHNU	3310
	IF (EI(1,I)-1.E-20) 66,65,65	3320
65	EIZ=EI(1,I)*(1.-EXP(-AC(1,I,M)*(X(J+1)-X(J))))	3330
	EI(1,I)=EI(1,I)-EIZ	3340
	ESUM=ESUM+EIZ	3350
66	CONTINUE	3360
	GO TO 71	3370
67	DO 69 L=1,NBB	3380
	DO 69 I=1,109	3390
	IF (EI(L,I)-1.E-20) 69,68,68	3400
68	EIZ=EI(L,I)*(1.-EXP(-AC(L,I,M)*(X(J+1)-X(J))))	3410
	EI(L,I)=EI(L,I)-EIZ	3420
	ESUM=ESUM+EIZ	3430
69	CONTINUE	3440
70	SS(J+1)=ESUM*4.186E7/RHO(M)/(X(J+1)-X(J))/SDUR	3450
	IF (SS(J+1)-1.E12/RHO(M)) 72,71,71	3460
71	CONTINUE	3470
		3480
	CLEAR STORAGE TO ZERO FOR HYDRO	3490
		3500
72	DO 73 I=1,560P	3510
73	AC(I)=C.	3520

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		SET UP ZONING FOR HYDRO	3530
			3540
		M=1	3550
		DO 75 J=2,JFIN	3570
		V(J)=1./RHO(M)	3580
		ZN(J)=(X(J)-X(J-1))/V(J)	3590
		IF (J-JRND(M)) 75,74,75	3600
74		M=M+1	3610
75		CONTINUE	3620
			3630
		START INPUT EDIT	3640
			3650
		PRINT 1	3660
		PRINT 1,(DISCPT(K),K=1,10)	3670
		PRINT 2	3680
		PRINT 10,(THL(I),I=1,109)	3690
		PRINT 11,NBB,NRZC,NMTLS,JRZL,JZPUL,NPRIN,ANGLE	3700
		PRINT 5,HITOT	3710
		PRINT 6,L07HIZ	3720
		PRINT 12	3730
		PRINT 13,(RZ(I),NZ(I),I=1,NRZC)	3740
		PRINT 14	3750
		PRINT 15	3760
		PRINT 16,(T(I),EE(I),I=1,NBB)	3770
		PRINT 17,JFIN,JCYCC,NTEST,NTAPE,CKP,TS,TIME,SDUR	3780
		IF (NJEDIT) 77,77,76	3790
76		PRINT 27,(JEDIT(I),I=1,NJEDIT)	3800
77		IF (NTEDT) 78,79,76	3810
78		PRINT 26,(TEDIT(I),I=1,NTEDT)	3820
79		JB1=1	3830
		PRINT 28	3840
		DO 85 M=1,NMTLS	3850
		IF (JRND(M)) 81,80,81	3860
80		JR2=JFIN	3870
		GO TO 82	3880
81		JR2=JRND(M)	3890
82		THKNS=X(JR2)-X(JB1)	3900
		PRINT 19,MATL(M),RHO(M),JB1,JB2	3910
		JB1=JB2	3920
		PRINT 29,THKNS	3930
		PRINT 19,EOSTC(M),EGSTD(M),EGSTL(M),EGSTG(M),EOSTH(M),EOSTS(M),EOS	3940
		ITN(M),PRIN(M)	3950
		IF (CUSPA(M)) R4,R4,R3	3960
83		PRINT 20,CUSP1(M),CUSPA(M),CUSPC(M),CUSPD(M),CUSPG(M),CUSPS(M)	3970
84		NOED=NOE(M)	3980
		PRINT 21,NOED	3990
		PRINT 22,(AA(M,I),B(M,I),EDGE(M,I),I=1,NOED)	4000
		CONTINUE	4010
			4020
		START DEPOSITION EDIT	4030
			4040
		PRINT 23,(DISCPT(I),I=1,10)	4050
		M=1	4060
		SUMCAL=0.	4070
		DO 92 J=2,JFIN	4080
		EDGE=Z(J)+SDUR	4090

IF (J-J NCM)+1) 47,46,87	4100
MEN+1	4110
IF (FPI*10STN(M)-1.07) 48,44,90	4120
IF (USTAR) 89,94,90	4130
USTAR=	4140
DX=X(J)-X(J-1)	4150
ER(PA=ERG*RHQ(M)*DX	4160
CALPA=ERGPA*1.E-7/4.186	4170
SUMCAL=SUMCAL+CALPA	4180
PRINT 24,J,DX,X(J),ERGPA,CALPA,SUMCAL,ERG,U(J),ZM(J),J	4190
IF (XZCOR(J,10)) 92,91,92	4200
PRINT 23,(DIRCT(I),I=1,10)	4210
CONTINUE	4220
IF (J-TAL) 43,93,94	4230
USTAR=JFIN	4240
PRINT 25	4250
RETURN	4260
END	4270

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      REZONE SUBROUTINE FOR THE PUFF HYDRO CODE
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18	IF (J-JPMAX-20) 16,48,48	4850
19	IF (J-JXX0) 48,48,20	4850
20	CALL EDIT	4870
	SCRNCH=1.	4880
	JFINO=JFIN	4890
	JXX0=J	4900
	DO 22 MCK=1,NMTRLS	4910
	IF (J=1-JBND(MCK)) 23,21,22	4920
21	JCK=MCK	4930
22	CONTINUE	4940
	MCK=NMTRLS	4950
23	ME=MCK	4960
24	IF (JCK) 25,25,26	4970
25	RZR=(.5*(X(J-1)+X(J))-X(J-2))/(X(J)-X(J-2))	4980
	EL=E(J-1)+RZR*(E(J)-E(J-1))	4990
	VL=V(J-1)+RZR*(V(J)-V(J-1))	5000
	SSL=SS(J-1)+RZR*(SS(J)-SS(J-1))	5010
	IF (J-JBND(ME)) 26,27,26	5020
26	RZR=(X(J+1)-.5*(X(J)+X(J-1)))/(X(J+1)-X(J-1))	5030
	ER=E(J+1)+RZR*(E(J)-E(J+1))	5040
	VR=V(J+1)+RZR*(V(J)-V(J+1))	5050
	SSR=SS(J+1)+RZR*(SS(J)-SS(J+1))	5060
	IF (JCK) 29,29,28	5070
27	RZR=(.5*(X(J)-X(J-1)))/(X(J)-X(J-2))	5080
	ER=E(J)+RZR*(E(J)-E(J-1))	5090
	VR=V(J)+RZR*(V(J)-V(J-1))	5100
	SSR=SS(J)+RZR*(SS(J)-SS(J-1))	5110
	GO TO 29	5120
28	RZR=(.5*(X(J)-X(J-1)))/(X(J+1)-X(J-1))	5130
	EL=E(J)+RZR*(E(J)-E(J+1))	5140
	VL=V(J)+RZR*(V(J)-V(J+1))	5150
	SSL=SS(J)+RZR*(SS(J)-SS(J+1))	5160
29	XR=X(J)	5170
	XL=.5*(X(J)+X(J-1))	5180
	ZMR=(XR-XL)/VR	5190
	ZML=(XR-XL)/VL	5200
	UR=U(J)	5210
	UL=((ZM(J)-ZML)*U(J-1)+(ZM(J)-ZMR)*U(J))/(ZML+ZMR)	5220
	DEN=1./VL	5230
	CALL EQST (EL,DEN,PL,ME)	5240
	DEN=1./VR	5250
	CALL EQST (ER,DEN,PR,ME)	5260
	QL=Q(J)	5270
	QR=Q(J)	5280
	CSL=CS(J)	5290
	CSR=CS(J)	5300
	JDO=J	5310
	J1=ME	5320
	DO 31 NME=JDO,JFIN	5330
	IF (NME-JBND(J1)) 31,30,31	5340
30	JBND(J1)=NME+1	5350
	J1=J1+1	5360
31	CONTINUE	5370
	JXX=J	5380
	J=JFIN	5390
32	X(J+1)=X(J)	5400
	U(J+1)=U(J)	5410

	ZV(U+1)=ZV(U)	5420
	V(U+1)=V(U)	5430
	W(U+1)=W(U)	5440
	P(U+1)=P(U)	5450
	Q(U+1)=Q(U)	5460
	CS(U+1)=CS(U)	5470
	SS(U+1)=SS(U)	5480
	U=U-1	5490
	IF (U-JXX) 33,33,32	5500
33	X(U+1)=XR	5510
	X(U)=XL	5520
	U(U+1)=UR	5530
	U(U)=UL	5540
	ZV(U+1)=ZMR	5550
	ZV(U)=ZVL	5560
	V(U+1)=VR	5570
	V(U)=VL	5580
	W(U+1)=WR	5590
	W(U)=WL	5600
	P(U+1)=PR	5610
	P(U)=PL	5620
	Q(U+1)=QR	5630
	Q(U)=QL	5640
	CS(U+1)=CSR	5650
	CS(U)=CSL	5660
	SS(U+1)=SSR	5670
	SS(U)=SSL	5680
	IF (NJEDIT) 37,37,34	5690
34	DO 36 I=1,NJEDIT	5700
	IF (U-JEDIT(I)) 35,35,36	5710
35	JEDIT(I)=JEDIT(I)+1	5720
36	CONTINUE	5730
37	IF (U-USTAR) 38,38,39	5740
38	USTAR=USTAR+1	5750
39	UFIN=UFIN+1	5760
	IF (X(U)-X(U-1)-R7DX) 40,24,24	5770
40	IF (U-JXX0-20) 41,47,47	5780
41	U=U+2	5790
	IF (U-JFIN) 42,47,47	5800
42	IF (E(U+1)) 43,43,44	5810
43	S(U+1)=V(N)IF (TIME-DTNH,SPUR)*SS(U+1)	5820
44	IF (U-1-JBND(MF)) 45,46,45	5830
45	JCK=0	5840
	GO TO 25	5850
46	ME=ME+1	5860
	JCK=1	5870
	GO TO 26	5880
47	JRZ=UFIN0-JFIN	5890
	PRINT 1,TIME,N,JRZ,USTAR	5900
		5910
	REZONE BEHIND MAIN PRESSURE PULSE	5920
		5930
48	IF (JRZL) 49,87,49	5940
49	IF (N-NRZ-100) 87,87,50	5950
50	JRZV=1	5960
	NRZ=1	5970
	UFIN0=UFIN	5980

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1	JP INSE JP IN+1	6090
2	M=MR7	6000
3	KR7=0	6010
4	JP JPMAX	6020
5	J=J-1	6030
6	IF (P(J)/PMAX-.2) 52,52,51	6040
7	JPLC=J	6050
8	IF (JPLC-JV-JRZL) 53,53,60	6060
9	IF (JPMAX-JPLC-JZPUL) 54,54,55	6070
10	IF (KR7) 47,47,46	6080
11	J=JL+1	6090
12	DO 56 MM=1,NMTLS	6100
13	IF (JMLC+1-JEND(MM)) 57,57,56	6110
14	CONTINUE	6120
15	MM=NMTLS	6130
16	M=MM	6140
17	DO 58 MM=1,NMTLS	6150
18	IF (JPMAX-JEND(MM)) 59,59,58	6160
19	CONTINUE	6170
20	MM=NMTLS	6180
21	RZR=RZRX*.5*V(JPMAX)*RHO(MM)	6190
22	KR7=-1	6200
23	GO TO 63	6210
24	KR7=1	6220
25	DO 61 MM=1,NMTLS	6230
26	IF (JMV+1-JEND(MM)) 62,62,61	6240
27	CONTINUE	6250
28	MM=NMTLS	6260
29	M=MM	6270
30	RZR=(X(JPLC)-X(JV))/FLOATE(JRZL)	6280
31	J=JV+1	6290
32	IF (SCNCH) 64,64,65	6300
33	CALL EDIT	6310
34	SCNCH=1.	6320
35	IF (X(J+1)-X(J)-RZR) 66,61,61	6330
36	IF (J+1-JEND(M)) 67,61,67	6340
37	IF (NJ=1) 70,70,68	6350
38	DO 69 I=1,NJEDIT	6360
39	IF (J+1-JEDIT(I)) 69,61,69	6370
40	CONTINUE	6380
41	ZMINV=1/(ZM(J+1)+ZM(J+2))	6390
42	S(J+1)=(S(J+1)+ZM(J+1)+S(J+2)*Z(J+2))*ZMINV	6400
43	V(J+1)=(V(J+1)+ZM(J+1)+V(J+2)*Z(J+2))*ZMINV	6410
44	E(J+1)=(E(J+1)+ZM(J+1)+E(J+2)*Z(J+2))*ZMINV	6420
45	DEN=1/V(J+1)	6430
46	CALL EDIT (J(J+1)+DEN*P(J+1),M)	6440
47	JAE=(ZM(J)+Z(J)+ZM(J+1)*(U(J)+U(J+1)))/(ZM(J+2)+ZM(J+1))	6450
48	ZM=ZM(J+3)+2.*ZM(J+2)	6460
49	IF (ZM) 71,72,71	6470
50	JAE=(ZM(J+3)+U(J+2)+ZM(J+2)*(U(J+2)+U(J+1)))/ZMC	6480
51	GO TO 73	6490
52	J=J+1	6500
53	ZM(J+1)=ZM(J+1)+ZM(J+2)	6510
54	S(J+1)=(S(J+1)+S(J+2))/2.0	6520
55	V(J+1)=(V(J+1)+V(J+2))/2.0	6530
56	E(J)=EA	6540
57	J(J+1)=J	6550

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	X(J+1)=X(J+2)	6560
	JX=J+2	6570
	DO 74 JC=JX,JFIN	6580
	X(JC)=X(JC+1)	6590
	U(JC)=U(JC+1)	6600
	ZV(JC)=ZV(JC+1)	6610
	V(JC)=V(JC+1)	6620
	E(JC)=E(JC+1)	6630
	P(JC)=P(JC+1)	6640
	Q(JC)=Q(JC+1)	6650
	CS(JC)=CS(JC+1)	6660
	SS(JC)=SS(JC+1)	6670
74	CONTINUE	6680
	JFIN=JFIN-1	6690
	IF (NJEDIT) 78,78,75	6700
75	DO 77 II=1,NJEDIT	6710
	IF (J-JEDIT(II)) 76,77,77	6720
76	JEDIT(II)=JEDIT(II)-1	6730
77	CONTINUE	6740
78	JPMAX=JPMAX-1	6750
	JSTAR=JSTAR-1	6760
	JPLC=JPLC-1	6770
	JXXO=JXXO-1	6780
	DO 80 M=1,NMTRLS	6790
	IF (JBND(M)-J-2) 80,79,79	6800
79	JBND(M)=JBND(M)-1	6810
80	CONTINUE	6820
81	END COLLAPSE	6830
82	IF (KR7) 83,87,82	6840
83	IF (J-JPLC) 84,83,83	6850
84	IF (J+4-JPMAX) 84,86,86	6860
	J=J+1	6870
	IF (J-JBND(M)) 65,85,65	6880
85	M=M+1	6890
	GO TO 65	6900
86	JRZ=JFIN-JFIN	6910
	JPMAX=JPMAX-JRZ	6920
	NZ=N	6930
	PRINT 1,TIME,N,JRZ,JSTAR	6940
	CONTINUE	6950
87	IF (SCRNCH) 89,89,86	6960
88	CALL EDIT	6970
89	RETURN	6980
	END	6990

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	IF JMAX+3	7670
	EMVPL=0.	7680
11	EMVPL=EMVPL+U(JM)*.5*(ZY(JM+1)+ZM(JM))	7690
	IF (JM-JPMAX) 13,14,14	7600
13	IF (U(JM-1)) 16,16,14	7610
14	IF (JM-1) 16,16,15	7620
15	JM=JM-1	7630
	GO TO 12	7640
16	JM=JPMAX+4	7650
	EMVPR=0.	7660
17	EMVPR=EMVPR+U(JM)/2.*(ZY(JM)+ZM(JM+1))	7670
	IF (JM-JSTAR) 18,18,19	7680
18	JM=JM+1	7690
	GO TO 17	7700
19	EMVPR=EMVPL+EMVPR	7710
	ETPR=EMVPR/HMAX	7720
	ETPOL=EMVPL/PMAX	7730
	PRINT OUTPUT VARIABLES	7740
	JM=JEND(1)	7750
	JM=JEND(2)	7760
	PRINT 1,N,TIME,LTNH,JSTAR,JPMAX,PMAX,XJPMAX,EMVPL,EMVPR,EMVPR,ETPR	7770
10	IF (MULT,ETOTAL,EMVNEG,EMVPOS,X(1),X(JEND1),X(JEND2),X(JFIN),JFIN	7780
	LTNH=LINE+5	7790
	IF (XCODE(LINE,50)) 21,20,21	7800
20	PRINT 2	7810
21	RETURN	7820
	END	7830

Best Available Copy

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      EQUATION OF STATE - EQUATION FOR THE REAL HYDRODYNAMIC CODE
      SUBROUTINE EQUATION (I, J, K, L, M, N)
      COMMON AA(6,20),AC(10,100,6),H(6,20),C(6,6),PI(6),CUPA(6),CUPC(6),
      1CUPB(6),CUPPG(6),CUPPH(6),DISCPT(12),LE(10),EDGE(6,20),EI(10,10),
      2EQSTC(6),EQSTG(6),EQSTB(6),EQSTB(6),EQSTH(6),EQSTN(6),EQSTS(6),
      3PQNT(6),JQNT(10),JQPG(10),WATL(6),NCF(6),NZ(20),PMIN(6),RHO(6),
      4XZ(20),C(6,6),T(6,10),P(6,10),TLC(10),TLC(10),X(50)
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APPENDIX II

FORTRAN LISTING OF P PUFF

	PROGRAM P PUFF	10
C	THIS IS PUFF FOR PLATE SLAPS ONLY FOR THE AWFL 1604 *****	20
	COMMON CS(500),CUSP1(6),CUSPA(6),CUSPC(6),CUSPD(6),CUSPG(6),	30
	1CUSPS(6),DISCPT(12),E(500),EQSTC(6),EQSTD(6),EQSTE(6),EQSTG(	40
	26),EQSTH(6),EQSTN(6),EQSTS(6),JBND(6),JEDIT(10),JORG(10),MATL(6),N	50
	3Z(20),P(500),PMIN(6),Q(500),RHO(6),RZ(20),TEDIT(25),U(500),V(500),	60
	4X(500),ZM(500)	70
C		80
	COMMON CKP,DTN,DTNH,JCK,JCYCS,JFIN,JFIN2,JPMAX,JRZL,JSTAR,JXXC,JUL	90
	1UL,LINE,N,NJEDIT,NMTRL5,NPRIN,NRZ,NTAPE,NTEDT,PMAX,TIME,TS,UZERO,	100
	2WTAPE,ZPUL	110
C		120
C	ZERGES COMMON	130
C		140
	DO 1 K=1,4225	150
1	CS(K)=0.	160
	CALL GENRAT	170
C		180
C	INITIALIZE COUNTERS AND CONSTANTS	190
C		200
	LINE=0	210
	FLAG=0.	220
	CC=1.8	230
	C1=.25	240
	TWOC1=2.*C1	250
	COSQ=C0*C0	260
	FORCSQ=4.*COSQ	270
	II=1	280
	N=1	290
	DTN=TIME	300
	DTNH=TIME	310
	JSTAR=JBND(1)+3	320
C		330
C	HYDRO STARTS HERE	340
C	TIME LOOP	350
C		360
2	SK2M=0.	370
	PMAX=0.	380
	M=1	390
	LL=1	400
C	DETERMINE THE LEFT BOUNDARY CONDITIONS	410
	U(1)=U(1)-DTN*(Q(2)+P(2))/ZM(2)	420
	X(1)=X(1)+DTNH*U(1)	430
C		440
C	MAIN LOOP FOR HYDRO CALCULATION	450
C		460
	JFINM1=JFIN-1	470
	DO 22 J=1,JFINM1	480
	QOLD=Q(J+1)	490
	POLD=P(J+1)	500

	VOLD=V(J+1)	510
	IF (J+1-JBND(M)) 4,3,4	510
3	LL=LL+1	520
4	U(J+1)=U(J+1)-DTN*(P(J+2)+Q(J+2)-P(J+1)-Q(J+1))/(ZM(J+1)+ZM(J+2))	530
	IF(ABS(U(J+1))-1.E-3) 5,5,6	530
5	U(J+1)=0.0	540
6	X(J+1)=X(J+1)+DTNH*U(J+1)	550
	DU=U(J+1)-U(J)	560
	V(J+1)=(X(J+1)-X(J))/ZM(J+1)	570
	VAVG=(V(J+1)+VOLD)/2.0	580
	DV=DTNH*DU/ZM(J+1)	590
	IF (DU+.) 7,8,8	600
7	Q(J+1)=(DU*CSO-C1*CS(J+1))*DU/VAVG	610
	IF (Q(J+1)-1.) 8,9,9	620
8	Q(J+1)=0.0	630
	DU=0.0	640
	CS(J+1)=0.0	650
9	DNEW=1./V(J+1)	660
	EOLD=E(J+1)	670
	CALL EQST (E(J+1),DNEW,P2,M)	680
	E1=E(J+1)-P(J+1)*DV	690
	CALL EQST (E1,DNEW,P1,M)	700
	E(J+1)=E(J+1)-(P2+P(J+1)+Q(J+1)+GOLD)*DV/(2.-(P1-P2)/P(J+1))	710
	P(J+1)=P2+(P2-P1)*(E(J+1)-EOLD)/POLD/DV	720
	DLTD=.001*DNEW	730
	IF (DV) 11,11,10	740
10	DFUDG=DNEW+DLTD	750
	GO TO 12	760
11	DFUDG=DNEW-DLTD	770
12	CALL EQST (E(J+1),DFUDG,PFUDG,M)	780
	DPDRHO=(PFUDG-P(J+1))/(DFUDG-DNEW)	790
	IF (DPDRHO) 13,13,14	800
13	SPEED=C	810
	GO TO 15	820
14	SPEED=SQRT(DPDRHO)	830
15	SK2M1=(SPEED+TWOC1*CS(J+1)-FORCSO*DU)/(X(J+1)-X(J))	840
	CS(J+1)=SPEED	850
C		860
	IF (P(J+1)-PMAX) 17,16,16	870
16	PMAX=P(J+1)	880
	JPMAX=J+1	890
17	IF (SK2M-SK2M1) 18,18,19	900
18	SK2M=SK2M1	910
19	M=LL	920
	IF (U(J+1)) 22,20,22	930
20	IF (J-JSTAR) 22,21,21	940
21	JSTAR=J	950
	GO TO 23	960
22	CONTINUE	970
C		980
	MAIN LOOP ENDS HERE	1000
	JSTAR=JFINM1	1010
C		1020
C		1030
C	EXIT AND EDIT CONTROL	1040
C		1050
23	IF (TIME-TS) 24,26,26	1060
24	IF (N-JCYCS) 25,26,26	1070

25	IF (X(JPMAK)-CKP) 30,26,26	10
26	FLAG=1.	10.1
27	WTAPE=1.	11.00
	CALL EDIT	11.10
	END FILE 4	11.20
	END FILE 6	11.30
	REWIND 4	11.40
	REWIND 6	11.50
	IF(FLAG) 28,29,28	11.60
28	REWIND 45	11.70
	STOP	11.80
29	CALL DDTF	11.90
	PAUSE	12.00
30	IF (SENSE SWITCH 2) 31,33	12.10
31	PRINT 32,N	12.20
32	FORMAT (31H SENSE SWITCH 2 IS ON AT CYCLE 110)	12.30
	GO TO 27	12.40
33	IF (XMODF(N,NTAPE)) 35,34,35	12.50
34	WTAPE=1.	12.60
	CALL EDIT	12.70
	GO TO 37	12.80
35	IF (XMODF(N,NPRIN)) 37,36,37	12.90
36	WTAPE=0.	13.00
	CALL EDIT	13.10
	CYCLE ADVANCE	13.20
37	SK2M=MINIF(.6/SK2M,1.2*DTNH)	13.30
	IF(NJEDIT) 38,40,38	13.40
38	WRITE TAPE 4,NJEDIT,N,TIME	13.50
	DO 39 I=1,NJEDIT	13.60
	JB=JEDIT(I)	13.70
39	WRITE TAPE 4,JORG(I),JEDIT(I),P(JB+1)	13.80
40	DTN=DTNH	13.90
	DTNH=SK2M	14.00
	CALL REZONE	14.10
	IF (TEDIT(11)) 45,45,41	14.20
41	IF (NTEDT) 42,44,42	14.30
42	IF (TIME+DTNH-TEDIT(11)) 45,45,43	14.40
43	DTNH=TEDIT(11)-TIME	14.50
	NTEDT=0	14.60
	GO TO 45	14.70
44	WTAPE=1.	14.80
	CALL EDIT	14.90
	II=II+1	15.00
	NTEDT=1	15.10
45	TIME=TIME+DTNH	15.20
	DTN=DTN+DTNH	15.30
	N=N+1	15.40
	IF (DTNH) 46,46,2	15.50
46	PAUSE2	15.60
	GO TO 2	15.70
	END	15.80

GENERATOR SUBROUTINE FOR THE PUFF HYDRO CODE

SUBROUTINE GENRAT

COMMON (S(500),CUSP1(6),CUSPA(6),CUSPC(6),CUSPD(6),CUSPG(6),
1CUSPS(6),DISCPT(12),E(500),EQSTC(6),EQSTD(6),EQSTE(6),EQSTG(
26),EQSTH(6),EQSTN(6),EQSTS(6),JBND(6),JEDIT(10),JCS(10),MATL(6),
3Z(20),P(500),PMIN(6),Q(500),PHO(6),RZ(20),TEDIT(25),JCNOC(6),V(500),
4X(500),ZM(500)
COMMON CKP,DTN,DTNH,JCK,JCYCS,JFIN,JFIN2,JPMAX,JRZL,JRTAP,JXXG,JFR
IUL,LINE,N,NJEDIT,NMTRLS,NPRIN,NRZ,NTAPE,NTEDT,PMAX,TIME,TI,JZLRO,
ZWTAP,ZPUL

FORMAT(10A8)
FORMAT(8I10)
FORMAT(8E10.3)
FORMAT(45H ERROR--INPUT CARDS ARE NOT PROPERLY PREPARED)
FORMAT(25H INPUT PARAMETERS FOR - PUFF/1604
FORMAT(46H *** THIS PROBLEM WAS RUN ON P-PUFF/1604 ***)
FORMAT(1H05X,4HNRC4X,6HNMTRLS6X,4HJRZL5X,5HJZPUL5X,5HNPRIN6X,
15HUFACE5X,5HUZERO5X,5HJFIN2/5I10,2E10.3,1I10)
FORMAT(//17H ZONING CONSTANTS//)
FORMAT(3X,6H RATIOE10.3,8H TO ZONE16)
FORMAT(1H05X,4HJFIN5X,5HJCYCS5X,5HNTTEST5X,5HNTAPE7X,3HCKP8X,PHOTO6
1X,4HTIME/4I10,3E10.3)
FORMAT(25H MATERIAL PROPERTIES FOR A6,5X,4HPRHO=E10.3,5X,7HFRONT J=
115.2X,5HTO J=15)
FORMAT(1H09X,5HEQSTC10X,5HEQSTD10X,5HEQSTE10X,5HEQSTG10X,5HEQSTH1
10X,5HEQSTS10X,5HEQSTN11X,4HPPMIN/3E15.5)
FORMAT(1H09X,5HCUSP110X,5HCUSPA10X,5HCUSPC10X,5HCUSPD10X,5HCUSPG
110X,5HCUSPS/6E15.5)
FORMAT(1H1,10A8/5H0 J 6X,1HXPX,8HVELOCITY5X,9HZONE MASS//)
FORMAT(1H 13,3E14.5)
FORMAT(1H1)
FORMAT(1H010X,14H THE TEDITS ARE/10E10.3//)
FORMAT(1H010X,14H THE JEDITS ARE/10I10)
FORMAT(21H MATERIAL THICKNESS =E10.3)

READ DATA

READ 1,(DISCPT(I),I=1,10)
READ 2,NRZC,NMTRLS,JRZL,JZPUL,NPRIN,NTAPE,NJEDIT,NTEDT
IF(NTEDT) 21,21,20
READ 3,(TEDIT(I),I=1,NTEDT)
IF(NJEDIT) 23,23,22
READ 2,(JEDIT(I),I=1,NJEDIT)
ZPUL=JZPUL
NMT=NMTRLS-1
READ 3,UFACE,UZERO,UFIN2
JFIN2=UFIN2
IF(NMT) 25,25,24
READ 2,(JBND(M),M=1,NMT)
READ 2,JFIN,(NZ(L),L=1,NRZC)
READ 3,DX,TIME,(RZ(M),M=1,NRZC)
DX=DX/RZ(1)
DO 26 M=1,NMTRLS

	READ 1,RATL(M)	2130
	READ 3,RHO(M),EQSTC(M),EQSTD(M),EQSTE(M),EQSTG(M),FRATH(M),P,DT,1,0)	2140
	1),PFIN(M)	2150
	READ 3,CUSP1(M),CUSPA(M),CUSPC(M),CUSPD(M),CUSPG(M),CUSPS(M)	2160
26	EQSTN(M)=EQSTC(M)/EQSTG(M)/(EQSTE(M)*RHO(M))	2210
	READ 3,CKP,TC	2220
	READ 2,JCYCS,NTST	2230
	IF (NTST-30) 27,28,27	2240
27	PRINT 4	2250
	STOP	2260
28	CONTINUE	2270
	IF (NJEDIT) 31,31,29	2280
29	DO 30 I=1,NJEDIT	2290
30	JORG(I)=JEDIT(I)	2300
31	JCK=0	2310
	JXX0=0	2320
	NP7=-50	2330
C		2340
C	SET PLATE VELOCITY	2350
C		2360
	DO 32 J=1,JFIN2	2370
	U(J)=UZERO	2380
32	CONTINUE	2390
	U(JFIN2)=UZERO*(1.+UFACE)/2.	2400
	U(JFIN2+1)=UZERO*UFACE	2410
	U(JFIN2+2)=U(JFIN2+1)/2.0	2420
C		2430
C	COMPUTE DX USING ZONEING CONSTANTS	2440
C		2450
	LZ=1	2460
	DO 35 J=1,JFIN	2470
	IF (J-1-N7(LZ)) 34,33,34	2480
33	LZ=LZ+1	2490
34	DX=DX*Q7(LZ)	2500
35	X(J+1)=X(J)+DX	2510
C		2520
C	SET UP ZONING FOR HYDRO	2530
C		2540
	M=1	2550
	DO 37 J=2,JFIN	2560
	V(J)=1./RHO(M)	2570
	DM(J)=(X(J)-X(J-1))/V(J)	2580
	IF (J-JEND(M)) 37,36,37	2590
36	M=M+1	2600
37	CONTINUE	2610
C		2620
C	START INPUT EDIT	2630
C		2640
	PRINT 5	2650
	PRINT 1,(DISCPT(K),K=1,10)	2660
	PRINT 6	2670
	PRINT 7,NRZC,NMTRLC,JRZL,JRPUL,NPFIN,UFACE,UZERO,JFIN2	2680
	PRINT 8	2690
	PRINT 9,(RZ(I),NZ(I),I=1,NRZC)	2700
	PRINT 10,JFIN,JCYCS,NTST,NTAPE,CKP,TC,TIME	2710
	IF (NJEDIT) 31,30,39	2720
	PRINT 13,(JEDIT(I),I=1,NJEDIT)	2730

3	IF (XMOD(J,50)) 40,41,42	2740
37	PRINT 17,(TDIT(I),I=1,NTEI)	2750
41	JB1=1	2760
	PRINT 16	2770
	DO 47 J=1,NMTELS	2780
	IF (JMOD(N)) 42,42,43	2790
42	JB2=JFIN	2800
	GO TO 44	2810
43	JB2=JEND(M)	2820
44	THNG=X(JB2)-X(JB1)	2830
	PRINT 11,MATL(M),RHO(M),JB1,JB2	2840
	PRINT 19,THNS	2850
	PRINT 12,EQSTC(M),EQSTN(M),EQSTH(M),EQSTA(M),EQSTB(M),EQSTS(M),EQ	2860
	ITN(M),PMIN(M)	2870
	IF (CUMPA(M)) 46,46,45	2880
45	PRINT 13,CUMPI(M),CUMPA(M),CUMPC(M),CUMPM(M),CUMPG(M),CUMPS(M)	2890
46	JB1=JB2	2900
47	CONTINUE	2910
		2920
	START VELOCITY EDIT	2930
		2940
	PRINT 14,(DISCPT(I),I=1,10)	2950
	JSDX=JFIN2+3	2960
	DO 49 J=1,JSDX	2970
	PRINT 15,J,X(J),U(J),ZM(J)	2980
	IF (XMOD(J,50)) 49,48,47	2990
48	PRINT 14,(DISCPT(I),I=1,10)	3000
49	CONTINUE	3010
	PRINT 16	3020
	RETURN	3030
	END	3040

	ROUTINE FOR THE ...	800
	ROUTINE BEZONE	801
		802
	COMMON C(500),CUSR(6),CUTRA(6),CUSER(6),CUTPR(6),CUTPG(6),	803
	100PR(6),RISCRP(12),E(500),EQSTG(6),EQSTE(6),EQSTG(	804
	26),EQSTH(6),EQSTN(6),EQSTS(6),JRNIN(6),JRNIT(10),JORS(10),MATL(6),N	805
	32(1),P(500),PMIN(6),Q(500),RHO(6),RZ(20),TEDIT(25),U(500),V(500),	806
	4X(500),ZV(500)	807
	COMMON CKP,DTN,DTNH,CK,JCVC,UFIN,UFIN2,JPMAX,JRZL,JSTAR,JXXO,JZP	808
	1UL,LINE,N,NEDIT,NMTLS,NPRIN,NRZ,NTAPE,NTEDT,PMAX,TIME,TE,UZERO,	809
	2XTAPE,ZPUL	810
		811
1	FORMAT (F10.3,3I10)	812
2		813
3	BEZONE AHEAD OF MAIN PRESSURE PULSE	814
		815
	SCRNCH=0.	816
	WTAPF=1.	817
	IF (JPMAX-JZPUL-JRZL-10) 85,85,7	818
8	JV=1	819
	M=1	820
	DO 6 J=1,JSTAR	821
	IF (J-JRND(M)) 4,3,4	822
3	M=M+1	823
4	IF (RHO(M)*V(J+1)-1.2) 7,5,5	824
	JV=J	825
	CONTINUE	826
7	IF (ZPUL) 46,46,7	827
	JM=JPMAX+7	828
	XJPMAX=X(JPMAX)	829
	EMVPL=0.	830
9	EMVPL=EMVPL+U(JM)*.5*(7*(JM+1)+ZM(JM))	831
	IF (JM-1) 12,12,10	832
10	IF (JM-1) 12,12,11	833
11	JM=J-1	834
	GO TO 2	835
12	JM=JPMAX+4	836
	EMVPR=0.	837
13	EMVPR=EMVPR+U(JM)/2*(7*(JM)+ZM(JM+1))	838
	IF (JM-JSTAR) 14,14,15	839
14	JM=JM+1	840
	GO TO 13	841
15	EMVPR=EMVPL+EMVPR	842
	QTPP=EMVPR/PMAX	843
	QTNX=2.*QTPP*CC(JPMAX)/ZPUL	844
	J=JPMAX	845
16	J=J+1	846
	IF (J+1-JFIN) 17,46,46	847
17	IF (X(J)-X(J-1)-RZDX) 18,18,19	848
18	IF (J-JPMAX-20) 16,46,46	849
19	IF (J-JXXO) 46,46,20	850
20	CALL EDIT	851
	SCRNCH=1.	852
	JFINO=JFIN	853
	JXXO=J	854
	DO 22 MCK=1,NMTLS	855

	IF (J-1-JBND(ME)) 23,21,22	3650
21	JXX=JCK	3660
22	CONTINUE	3670
	MCK=INITALS	3680
23	ME=MCK	3690
24	IF (JCK) 25,25,26	3670
25	RZR=(.5*(X(J-1)+X(J))-X(J-2))/(X(J)-X(J-2))	3680
	EL=E(J-1)+RZR*(E(J)-E(J-1))	3690
	VL=V(J-1)+RZR*(V(J)-V(J-1))	3700
	IF (J-JBND(ME)) 26,27,26	3710
26	RZR=(X(J+1)-.5*(X(J)+X(J-1)))/(X(J+1)-X(J-1))	3720
	FR=E(J+1)+RZR*(E(J)-E(J+1))	3730
	VR=V(J+1)+RZR*(V(J)-V(J+1))	3740
	IF (JCK) 28,29,28	3750
27	RZR=(.5*(X(J)-X(J-1)))/(X(J)-X(J-2))	3760
	FR=E(J)+RZR*(E(J)-E(J-1))	3770
	VR=V(J)+RZR*(V(J)-V(J-1))	3780
	GO TO 29	3790
28	RZR=(.5*(X(J)-X(J-1)))/(X(J+1)-X(J-1))	3800
	EL=E(J)+RZR*(E(J)-E(J+1))	3810
	VL=V(J)+RZR*(V(J)-V(J+1))	3820
29	XR=X(J)	3830
	XL=.5*(X(J)+X(J-1))	3840
	ZMR=(XR-XL)/VP	3850
	ZML=(XR-XL)/VL	3860
	UR=U(J)	3870
	UL=((ZM(J)-ZML)*U(J-1)+(ZM(J)-ZMR)*U(J))/(ZML+ZMR)	3880
	DEN=1./VL	3890
	CALL ECST (EL,DEN,PL,ME)	3900
	DEN=1./VP	3910
	CALL ECST (ER,DEN,PR,ME)	3920
	GL=G(J)	3930
	GR=G(J)	3940
	CSL=CS(J)	3950
	CSR=CS(J)	3960
	JDO=J	3970
	JI=ME	3980
	DO 31 NME=JDO,JFIN	3990
	IF (NME-JBND(JI)) 31,30,31	4000
30	JBND(JI)=NME+1	4010
	JI=JI+1	4020
31	CONTINUE	4030
	JXX=J	4040
	J=JFIN	4050
32	X(J+1)=X(J)	4060
	U(J+1)=U(J)	4070
	ZM(J+1)=ZM(J)	4080
	V(J+1)=V(J)	4090
	E(J+1)=E(J)	4100
	P(J+1)=P(J)	4110
	Q(J+1)=Q(J)	4120
	CS(J+1)=CS(J)	4130
	J=J-1	4140
	IF (J-JXX) 33,33,32	4150
33	X(J+1)=XR	4160
	X(J)=XL	4170
	U(J+1)=UR	4180

	U(J)=UL	4140
	ZM(J+1)=ZMR	4150
	ZM(J)=ZML	4160
	V(J+1)=VR	4170
	V(J)=VL	4180
	E(J+1)=ER	4190
	E(J)=EL	4200
	R(J+1)=RR	4210
	R(J)=RL	4220
	Q(J+1)=QR	4230
	Q(J)=QL	4240
	CS(J+1)=CSR	4250
	CS(J)=CSL	4260
	IF (NJEDIT) 37,37,34	4270
34	DO 36 II=1,NJEDIT	4280
	IF (J-JEDIT(II)) 35,35,36	4290
35	JEDIT(II)=JEDIT(II)+1	4300
36	CONTINUE	4310
37	IF (J-USTAR) 38,38,39	4320
38	USTAR=USTAR+1	4330
39	JFIN=JFIN+1	4340
	IF (X(J)-X(J-1)-RZDX) 40,24,24	4350
40	IF (J-JXX0-20) 41,45,45	4360
41	J=J+2	4370
	IF (J-JFIN) 42,45,45	4380
42	IF (J-1-JRND(MF)) 43,44,43	4390
43	JCK=0	4400
	GO TO 26	4410
44	ME=ME+1	4420
	JCK=1	4430
	GO TO 26	4440
45	JRZ=JFINO-JFIN	4450
	PRINT 1,TIME,N,JRZ,USTAR	4460
		4470
	REZONE BEHIND MAIN PRESSURE PULSE	4480
		4490
		4500
46	IF (JRZL) 45,45,47	4510
47	IF (N-NRZ-100) 45,45,48	4520
48	JRZV=1	4530
	MRZ=1	4540
	JFINO=JFIN	4550
	JFINS=JFIN+1	4560
	M=MRZ	4570
	KRZ=0	4580
	J=JPMAX	4590
49	J=J-1	4600
	IF (P(J)/PMAX-.2) 50,50,49	4610
50	JPLC=J	4620
	IF (JPLC-JV-JRZL) 51,51,58	4630
51	IF (JPMAX-JPLC-JZFUL) 52,52,53	4640
52	IF (KRZ) 45,45,54	4650
53	J=JPLC+1	4660
	DO 54 MM=1,NMTRLS	4670
	IF (JPLC+1-JBND(MM)) 55,55,54	4680
54	CONTINUE	4690
	MM=NMTRLS	4700
	M=MM	4710
		4720
		4730
		4740
		4750

	DO 56 MM=1,NMTRLS	4760
	IF (JPMAX-JRND(MM)) 57,57,56	4770
56	CONTINUE	4780
	MM=NMTRLS	4790
57	RZR=RZDX*.5*V(JPMAX)*RHO(NM)	4800
	KRZ=-1	4810
	GO TO 61	4820
58	KRZ=1	4830
	DO 59 MM=1,NMTRLS	4840
	IF (JVV+1-JRND(MM)) 60,60,59	4850
59	CONTINUE	4860
	MM=NMTRLS	4870
60	M=MM	4880
	RZR=(X(JPLC)-X(JV))/FLOATF(JRZL)	4890
	J=JV+1	4900
61	IF (SCRNCH) 62,62,63	4910
62	CALL EDIT	4920
	SCRNCH=1.	4930
63	IF (X(J+1)-X(J)-RZR) 64,79,79	4940
64	IF (J+1-JRND(M)) 65,79,65	4950
65	IF (NJEDIT) 68,68,66	4960
66	DO 67 II=1,NJEDIT	4970
	IF (J+1-JEDIT(II)) 67,79,67	4980
67	CONTINUE	4990
68	ZMINV=1./ZM(J+1)+ZM(J+2)	5000
	V(J+1)=(V(J+1)*ZM(J+1)+V(J+2)*ZM(J+2))*ZMINV	5010
	E(J+1)=(E(J+1)*ZM(J+1)+E(J+2)*ZM(J+2))*ZMINV	5020
	DEN=1./V(J+1)	5030
	CALL EGST (E(J+1),DEN,P(J+1),M)	5040
	UA=(ZM(J)*U(J)+ZM(J+1)*(U(J)+U(J+1)))/(ZM(J)+2.*ZM(J+1))	5050
	ZMC=ZM(J+3)+2.*ZM(J+2)	5060
	IF (ZMC) 69,70,69	5070
69	UB=(ZM(J+3)*U(J+2)+7*ZM(J+2)*(U(J+2)+U(J+1)))/ZMC	5080
	GO TO 71	5090
70	UB=0.	5100
71	ZM(J+1)=ZM(J+1)+ZM(J+2)	5110
	Q(J+1)=(Q(J+1)+Q(J+2))/2.0	5120
	CS(J+1)=(CS(J+1)+CS(J+2))/2.0	5130
	U(J)=UA	5140
	U(J+1)=UB	5150
	X(J+1)=X(J+2)	5160
	JX=J+2	5170
	DO 72 JC=JX,JFINS	5180
	X(JC)=X(JC+1)	5190
	U(JC)=U(JC+1)	5200
	ZM(JC)=ZM(JC+1)	5210
	V(JC)=V(JC+1)	5220
	E(JC)=E(JC+1)	5230
	P(JC)=P(JC+1)	5240
	Q(JC)=Q(JC+1)	5250
	CS(JC)=CS(JC+1)	5260
72	CONTINUE	5270
	JFIN=JFIN-1	5280
	IF (NJEDIT) 76,76,73	5290
73	DO 75 II=1,NJEDIT	5300
	IF (J-JEDIT(II)) 74,74,75	5310
74	JEDIT(II)=JEDIT(II)-1	5320

75	CONTINUE	5330
76	JPMAX=JPMAX-1	5340
	JSTAR=JSTAR-1	5350
	JPLC=JPLC-1	5360
	JXXO=JXXO-1	5370
	DO 7H M1=1,NITPLS	5380
	IF (JEND(M1)-J-2) 7H,77,77	5390
77	JEND(M1)=JEND(M1)-1	5400
78	CONTINUE	5410
	END COLLAPS	5420
79	IF (K07) 81,85,80	5430
80	IF (J-JPLC) 82,81,81	5440
81	IF (J+4-JPMAX) 82,84,84	5450
82	J=J+1	5460
	IF (J-JEND(M1)) 63,83,63	5470
83	M=M+1	5480
	GO TO 63	5490
84	JRZ=JFINO-JFIN	5500
	NJZ=N	5510
	PRINT 1,TIME,N,JRZ,JSTAR	5520
	CONTINUE	5530
85	IF (SCRNCH) 87,87,86	5540
86	CALL EDIT	5550
87	RETURN	5560
	END	5570

C	EDIT SUBROUTINE FOR THE BUFF HYDRODYNAMIC CODE	5580
C	SUBROUTINE EDIT	5590
	COMMON (S(500),CUSP1(6),CUSPA(6),CUSPC(6),CUSPD(6),CUSPG(6),	5600
	ICU-PS(6),DISCPT(12),E(500),EOSTC(6),EOSTD(6),EOSTE(6),EOSTG(	5610
	26),EOSTH(6),EOSTN(6),EOSTS(6),JBND(6),JEDIT(10),JORG(10),MATL(6),N	5620
	37(20),P(500),PMIN(6),Q(500),PHO(6),RZ(20),TEDIT(25),U(500),V(500),	5630
	4X(500),7M(500)	5640
	COMMON CKP,DTN,DTNH,JCK,JCYLS,JFIN,JFIN2,JPMAX,JRZL,JSTAR,JXXO,JZF	5650
	IDL,LINE,N,NJEDIT,NMTRLS,NPRIN,NRZ,NTAPE,NTEDT,PMAX,TIME,TS,UZERO,	5660
	2WTAPE,7PUL	5670
		5680
	FORMAT(1H6X,5HCYCLE8X,4HTIME8X,4HDTNH7X,5HJSTAR7X,5HJPMAX8X,4HPMA	5690
	1X6X,6HXJPMAX5X,7HMVPULSE6X,6HMVPREC4X,8HMOMENTUM/2X,110,2E12,4,	5700
	22112,5E12,4/8X4HDTTP6X,6HDTTPULS6X,6HETOTAL6X,6HEMVNEG6X,6HEMVPOS5X	5710
	3,7HL-BOUND4X,8HX(JBND1)4X,8HX(JBND2)5X,7HR-BOUND8X,4HJFIN/9E12,4,	5720
	4112)	5730
	FORMAT(1H1)	5740
	BINARY DATA STORAGE	5750
	XJPMAX=X(JPMAX)	5760
	IF (NTAPE) 3,7,3	5770
	JSTARD=JSTAR+1	5780
	WRITE TAPE 6,N,TIME,(DISCPT(1),I=1,10),JSTAR,JFIN,JPMAX,JSTARD	5790
	IF (EOF,6) 5,4	5800
	WRITE TAPE 6,(J,X(J),U(J),P(J),Q(J),E(J),V(J),CS(J),J=1,JSTARD)	5810
	IF (EOF,6) 5,7	5820
	PRINT 6,N	5830
	FORMAT (16H NEW 06 AT CYCLE110)	5840
	END FILE 6	5850
	REWIND 6	5860
	PAUSE12345	5870
	GO TO 3	5880
		5890
		5900
	MOMENTUM AND ENERGY CALCULATION	5910
		5920
	EMVNEG=0.	5930
	EMVPOS=0.	5940
	ESUM=0.	5950
	EKSUM=0.	5960
	JSTAR1=JSTAR+1	5970
	DO 11 J=2,JSTAR1	5980
	EMV=7M(J)*(U(J)+U(J-1))/2.	5990
	IF (EMV) 8,9,9	6000
	EMVNEG=EMVNEG+EMV	6010
	GO TO 10	6020
	EMVPOS=EMVPOS+EMV	6030
	CONTINUE	6040
	ESUM=ESUM+E(J)*7M(J)/4,186E7	6050
	EKSUM=EKSUM+7M(J)*(U(J)+U(J-1))*2/4,186E7/9.	6060
	CONTINUE	6070
	ETOTAL=ESUM+EKSUM	6080
	JM=JPMAX+3	6090
	JMPL=1.	6100
	EMVPL=EMVPL+U(JM)*.5*(7M(JM+1)+7M(JM))	6110
	IF (JM-JPMAX) 13,14,14	6120
	IF (U(JM-1)) 16,16,14	6130
	IF (JM-1) 15,16,15	6140

15	JM=JM-1	6150
	GO TO 12	6160
16	JM=JPMAX+4	6170
	EMVPR=0.	6180
17	EMVPR=EMVPR+U(JM)*2.*(ZM(JM)+ZM(JM+1))	6190
	IF (JM-JFIN) 18,18,19	6200
18	JM=JM+1	6210
	GO TO 17	6220
19	EMVPR=EMVPL+EMVPR	6230
	DTPR=EMVPR/PMAX	6240
	DTPULS=EMVPL/PMAX	6250
		6260
	PRINT OUTPUT VARIABLES	6270
		6280
	JEND1=JEND(1)	6290
	JEND2=JEND(2)	6300
	PRINT 1,N,TIME,DTHH,USTAR,JPMAX,PMAX,XJPMAX,EMVPL,EMVPR,EMVPR,ETOP	6310
	1,DTPULS,ETOTAL,EMVNEG,EMVPOS,X(1),X(JEND1),X(JEND2),X(JFIN),JFIN	6320
	LINE=LINE+5	6330
	IF(XMOD(LINE,50)) 21,20,21	6340
20	PRINT 2	6350
21	RETURN	6360
	END	6370

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C	EQUATION OF STATE SUBROUTINE FOR THE PUFF HYDRODYNAMIC CODE	6370
	SUBROUTINE EQST (E1,D,P1,M)	6370
		6400
	COMMON CS(500),CUSP1(6),CUSPA(6),CUSPC(6),CUSPD(6),CUSPG(6),	6410
	1CUSPS(6),DISCPT(12),E(500),EQSTC(6),EQSTD(6),EQSTE(6),EQSTG(	6420
	26),EQSTH(6),EQSTN(6),EQSTS(6),JBND(6),JEDIT(10),JORG(10),MATL(6),	6430
	3Z(20),P(500),PMIN(6),Q(500),RHO(6),R7(20),TEDIT(25),U(500),V(500),	6440
	4X(500),ZP(500)	6450
	COMMON CKP,DTN,DTNH,JCK,JCYCS,JFIN,JFIN2,JPMAX,JRZL,JSTAR,JXX0,JZP	6460
	1UL,LINE,N,NJEDIT,NMTPLS,NPRIN,NRZ,NTAPE,NTEDT,PMAX,TIME,TS,UZEPO,	6470
	2WTAPE,ZPUL	6480
		6490
	ENUEQ=DPAQ(M)	6500
	EMU=ENUE-1.	6510
	V1=DPAQ(M)/D	6520
	IF (EMU) 1,5,5	6530
		6540
		6550
		6560
		6570
		6580
		6590
		6600
		6610
		6620
		6630
		6640
		6650
		6660
		6670
		6680
		6690
		6700
		6710
		6720
		6730
		6740
		6750
		6760
		6770
		6780
		6790
		6800

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APPENDIX III

TEST PROBLEM 1

(PUFF)

10

NATL(1)
MATL 1

9

DX	TIME	RZ(1)	RZ(2)	RZ(3)
1-3	1-12	1.02	1	103



JFIN	NZ(1)	NZ(2)	NZ(3)
282	81	82	281

7

JBND(1)
82

6

SPUR 3-8	T(1) 0	EE(1) 0
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5

NØE (1)	NØE (2)
11	7

4

ANGLE
0.

3

NBB	NRZC	NMTRLS	JRZL	JZPUL	NPRIN	TAPE
1	3	2	100	40	25	25

2

DISCPT (I), I=1,10
*** TEST PROBLEM NO 1 *** TWO MATERIAL *** ARBITRARY SPECTRUM

TABLE DECK FOR PROBLEM 1

1

NHNU	NTEDT	NJEDIT	LØZHIZ
109	0	0	1

22	EDGE(2,3)	AA(2,4)	B(2,4)	EDGE(2,4)	AA(2,5)	B(2,5)	EDGE(2,5)	AA(2,6)
	4.132+1	8.951+2	-1.984	4.958+1	1723+2	-1.562	6.198+1	2.793+1
21	AA(2,1)	B(2,1)	EDGE(2,1)	AA(2,2)	B(2,2)	EDGE(2,2)	AA(2,3)	B(2,3)
	2.267+2	-2.606	1.559	1.535+4	-2.78	3.099+1	3.161+3	-2.323
20	CUSP1(2)	CUSPA(2)	CUSPC(2)	CUSPD(2)	CUSPG(2)	CUSPS(2)		
	0.	0.	0.	0.	0.	0.		
19	RH(2)	EQSTC(2)	EQSTD(2)	EQSTE(2)	EQSTG(2)	EQSTH(2)	EQSTS(2)	PMIN(2)
	2.639	8.5+11	-1.232+12	1.22+11	2.04	.25	0.	-8.+9
18	MATL(2)							
	MATL 2							
	EDGE(1,1)							
	1.50+2							

16	AA(1,9)	B(1,9)	EDGE(1,9)	AA(1,10)	B(1,10)	EDGE(1,10)	AA(1,11)	B(1,11)
	1.7121	-5.6565-1	4.9384+1	7.4648-1	-3.5298-1	6.198+1	5.8627-1	-2.9836-1
15	B(1,6)	EDGE(1,6)	AA(1,7)	B(1,7)	EDGE(1,7)	AA(1,8)	B(1,8)	EDGE(1,8)
	-1.5975	2.4792+1	1.4021+1	-1.1633	3.099+1	3.3035	-7.4228-1	4.132+1
14	EDGE(1,3)	AA(1,4)	B(1,4)	EDGE(1,4)	AA(1,5)	B(1,5)	EDGE(1,5)	AA(1,6)
	1.2396+1	2.259+2	-2.0539	1.5495+1	2.251+2	-2.0539	2.066+1	5.6508+1
13	AA(1,1)	B(1,1)	EDGE(1,1)	AA(1,2)	B(1,2)	EDGE(1,2)	AA(1,3)	B(1,3)
	6.565+2	-2.8569	1.870-1	6.612+2	-2.8571	2.840-1	1.878+3	-2.8588
2	CUSP1(1)	CUSPA(1)	CUSPC(1)	CUSPD(1)	CUSPG(1)	CUSPS(1)		
	0.	0.	0.	0.	0.	0.		
	RH(1)	EQSTC(1)	EQSTD(1)	EQSTE(1)	EQSTG(1)	EQSTH(1)	EQSTS(1)	PMIN(1)
	2.2	2.513+11	1.668+11	7.59+10	.75	.25	1.748+13	-1.+9

25	JCYCS	NTEST			
	250	30			
24	CKP	TS			
	1.0	2.-6			
23	B(2,6)	EDGE(2,6)	AA(2,7)	B(2,7)	EDGE(2,7)
	-1.121	8.264+1	2.581	-5.876-1	1.50+2

TABLE DECK FOR TLST PROBLEM 1

2E15.7 FORMAT

<u>TBL(I)</u>	<u>LI(I)</u>	<u>TBL CASE #</u>
0.5972897E 00	0.	1
0.7712318E 00	0.	2
0.8991189E 00	0.	3
0.1004823E 01	0.	4
0.1097018E 01	0.	5
0.1179999E 01	0.	6
0.1256234E 01	0.	7
0.1327283E 01	0.	8
0.1394228E 01	0.	9
0.1457829E 01	0.	10
0.1518656E 01	0.	11
0.1577137E 01	0.	12
0.1633631E 01	0.	13
0.1688417E 01	0.	14
0.1741701E 01	0.	15
0.1793693E 01	0.	16
0.1844536E 01	0.	17
0.1894372E 01	0.5026790E-30	18
0.1943309E 01	0.9455565E-28	19
0.1991455E 01	0.1016467E-25	20
0.2038900E 01	0.6780110E-24	21
0.2085728E 01	0.3002525E-22	22
0.2132004E 01	0.9325856E-21	23
0.2177796E 01	0.2127423E-19	24
0.2223151E 01	0.3701496E-18	25
0.2268135E 01	0.5078059E-17	26
0.2312798E 01	0.5645669E-16	27
0.2357167E 01	0.5202916E-15	28
0.2401296E 01	0.4058228E-14	29
0.2445216E 01	0.2725063E-13	30
0.2488976E 01	0.1600093E-12	31
0.2532594E 01	0.8319149E-12	32
0.2576116E 01	0.3876429E-11	33
0.2619573E 01	0.1635183E-10	34
0.2662981E 01	0.6297824E-10	35
0.2706380E 01	0.2233014E-09	36
0.2749789E 01	0.7338907E-09	37
0.2793255E 01	0.2250884E-08	38
0.2836786E 01	0.6475984E-08	39
0.2880413E 01	0.1756749E-07	40

<u>TBL(1)</u>	<u>EX(1)</u>	<u>TBL CALL #</u>
0.2924104E 01	0.4513999E-07	41
0.2968060E 01	0.1103210E-06	42
0.3012138E 01	0.2573599E-06	43
0.3056410E 01	0.5750408E-06	44
0.3100912E 01	0.1234469E-05	45
0.3145668E 01	0.2553265E-05	46
0.3190700E 01	0.5100153E-05	47
0.3236046E 01	0.0863331E-05	48
0.3281714E 01	0.1850221E-04	49
0.3327763E 01	0.3374433E-04	50
0.3374200E 01	0.5992323E-04	51
0.3421056E 01	0.1037839E-03	52
0.3468368E 01	0.1755874E-03	53
0.3516174E 01	0.2906129E-03	54
0.3564503E 01	0.4711179E-03	55
0.3613382E 01	0.7489089E-03	56
0.3662859E 01	0.1168785E-02	57
0.3712972E 01	0.1792640E-02	58
0.3763772E 01	0.2704874E-02	59
0.3815276E 01	0.4017908E-02	60
0.3867541E 01	0.5881003E-02	61
0.3920633E 01	0.8489657E-02	62
0.3974597E 01	0.1209454E-01	63
0.4029484E 01	0.1701714E-01	64
0.4085385E 01	0.2366086E-01	65
0.4142310E 01	0.3253191E-01	66
0.4200384E 01	0.4425427E-01	67
0.4259677E 01	0.5959707E-01	68
0.4320261E 01	0.7948911E-01	69
0.4382229E 01	0.1050552E-00	70
0.4445692E 01	0.1376467E-00	71
0.4510757E 01	0.1788674E-00	72
0.4577551E 01	0.2306213E-00	73
0.4646193E 01	0.2951281E-00	74
0.4716850E 01	0.3750174E-00	75
0.4789699E 01	0.4733590E-00	76
0.4864916E 01	0.5936806E 00	77
0.4942714E 01	0.7400929E 00	78
0.5023361E 01	0.9173987E 00	79
0.5107114E 01	0.1131043E 01	80
0.5194313E 01	0.1387413E 01	81
0.5285303E 01	0.1693737E 01	82
0.5380537E 01	0.2058509E 01	83
0.5480544E 01	0.2491589E 01	84
0.5585897E 01	0.3004178E 01	85

<u>TBL(1)</u>	<u>LI(1)</u>	<u>TBL C/M #</u>
0.5697338E 01	0.3609566E 01	86
0.5815793E 01	0.4323557E 01	87
0.5942340E 01	0.5164528E 01	88
0.6078354E 01	0.6154630E 01	89
0.6225589E 01	0.7320720E 01	90
0.6366413E 01	0.8696603E 01	91
0.6563949E 01	0.1032499E 02	92
0.6762600E 01	0.1226171E 02	93
0.6988700E 01	0.1458224E 02	94
0.7252136E 01	0.1739563E 02	95
0.7559328E 01	0.2086893E 02	96
0.7970381E 01	0.2528069E 02	97
0.8523455E 01	0.3119787E 02	98
0.9445122E 01	0.4017112E 02	99
0.9582477E 01	0.4139209E 01	100
0.9735226E 01	0.4271261E 01	101
0.9907640E 01	0.4415586E 01	102
0.1010589E 02	0.4575369E 01	103
0.1033809E 02	0.4690531E 01	104
0.1062301E 02	0.4836915E 01	105
0.1098729E 02	0.5014182E 01	106
0.1149872E 02	0.5244322E 01	107
0.12237049E 02	0.5593458E 01	108
0.1425600E 02	0.6181078E 01	109

INPUT PARAMETERS FOR - -

*** TEST PROBLEM NO. 1 *** TWO MATERIAL *** ARBITRARY SPECTRUM
 ***** THIS PROBLEM WAS RUN ON PUFF/1604 *****

TABLE VALUES

5.973E-01	7.712E-01	8.991E-01	1.005E 00	1.097E 00	1.180E 00	1.256E 00	1.327E 00	1.394E 00	1.458E 00
1.519E 00	1.577E 00	1.634E 00	1.688E 00	1.742E 00	1.794E 00	1.845E 00	1.894E 00	1.943E 00	1.991E 00
2.039E 00	2.086E 00	2.132E 00	2.178E 00	2.223E 00	2.268E 00	2.313E 00	2.357E 00	2.401E 00	2.445E 00
2.489E 00	2.533E 00	2.576E 00	2.620E 00	2.663E 00	2.706E 00	2.750E 00	2.793E 00	2.837E 00	2.880E 00
2.924E 00	2.968E 00	3.012E 00	3.056E 00	3.101E 00	3.146E 00	3.191E 00	3.236E 00	3.282E 00	3.328E 00
3.374E 00	3.421E 00	3.468E 00	3.516E 00	3.565E 00	3.613E 00	3.663E 00	3.713E 00	3.764E 00	3.815E 00
3.868E 00	3.921E 00	3.975E 00	4.029E 00	4.085E 00	4.142E 00	4.200E 00	4.260E 00	4.320E 00	4.382E 00
4.446E 00	4.511E 00	4.578E 00	4.646E 00	4.717E 00	4.790E 00	4.865E 00	4.943E 00	5.023E 00	5.107E 00
5.194E 00	5.285E 00	5.381E 00	5.481E 00	5.586E 00	5.697E 00	5.816E 00	5.942E 00	6.078E 00	6.226E 00
6.386E 00	6.564E 00	6.763E 00	6.989E 00	7.252E 00	7.569E 00	7.970E 00	8.523E 00	9.445E 00	9.582E 00
9.735E 00	9.908E 00	1.011E 01	1.034E 01	1.062E 01	1.099E 01	1.150E 01	1.238E 01	1.425E 01	

NBB	NRZC	NMTRLS	JRZL	JZPUL	NPRIN	ANGLE
1	3	2	100	40	25	1.000E 00

EITOT = 2.7242272E 02

LOZHIZ = 1

ZONING CONSTANTS

RATIO 1.020E 00 TO ZONE	81
RATIO 1.000E-01 TO ZONE	82
RATIO 1.030E 00 TO ZONE	281

BLACK BODY TEMPERATURE AND ASSOCIATED ENERGY

TEMPERATURE	ENERGY
0	0

JFIN	JCYCS	NTEST	NTAPE	CKP	TS	TIME	SDUR
282	250	30	25	1.000E 00	2.000E-06	1.000E-12	3.000E-08

MATERIAL PROPERTIES FOR MATL 1 RHO= 2.200E 00 FROM J= 1 TO J= 82
 MATERIAL THICKNESS = 1.986E-01

EQSTC	EQSTD	EQSTG	EQSTH	EQSTS	EQSTM	PMTM
2.51300E 11	1.66800E 11	7.59000E 10	7.50000E-01	2.50000E-01	1.74800E 13	2.00663E 00

NOE= 11 AA B EDGE

6.56500E 02	-2.85690E 00	1.87000E-01
6.61200E 02	-2.85710E 00	2.84000E-01
1.87800E 03	-2.85680E 00	1.23960E 01
2.25900E 02	-2.05390E 00	1.54950E 01
2.25100E 02	-2.05390E 00	2.06600E 01
5.65080E 01	-1.59750E 00	2.47920E 01
1.40210E 01	-1.16330E 00	3.09900E 01
3.30350E 00	-7.42280E-01	4.13200E 01
1.71210E 00	-5.65650E-01	4.95840E 01
7.46480E-01	-3.52980E-01	6.19800E 01
5.86270E-01	-2.99360E-01	1.50000E 02

MATERIAL PROPERTIES FOR MATL 2 RHO= 2.699E 00 FROM J= 82 TO J= 282

EQSTC	EQSTD	EQSTG	EQSTH	EQSTS	EQSTM	PMTM
8.50000E 11	-1.23200E 12	1.22000E 11	2.04000E 00	2.50000E-01	1.26539E 00	-6.00000E 09

NOE= 7 AA B EDGE

9.26700E 02	-2.60800E 00	1.55900E 00
1.53500E 04	-2.78000E 00	3.09900E 01
3.16100E 03	-2.32300E 00	4.13200E 01
8.95100E 02	-1.98400E 00	4.95800E 01
1.72300E 02	-1.56200E 00	6.19800E 01
2.79300E 01	-1.12100E 00	8.26400E 01
2.58100E 00	-5.87600E-01	1.50000E 02

*** TEST PROBLEM NO. 1 *** TMC MATERIAL *** ARBITRARY SPECTRUM

J	DX	K	FRCS	CAL	SUM CAL	FRCS/GM	VELOCITY	PCNE MASS	J
2	1.00000E-03	1.00000E-03	1.52023E 08	3.63171E 00	3.63171E 00	6.91015E 10	0	2.20000E-03	2
3	1.02000E-03	2.07000E-03	1.52081E 08	3.63308E 00	7.26479E 00	6.77721E 10	0	2.24400E-03	3
4	1.04040E-03	3.06040E-03	1.52099E 08	3.63352E 00	1.03983E 01	6.64514E 10	0	2.28888E-03	4
5	1.06121E-03	4.12161E-03	1.52079E 08	3.63304E 00	1.45313E 01	6.51398E 10	0	2.33466E-03	5
6	1.08243E-03	5.20404E-03	1.52020E 08	3.63163E 00	1.81630E 01	6.38377E 10	0	2.38135E-03	6
7	1.10408E-03	6.30812E-03	1.51921E 08	3.62928E 00	2.17922E 01	6.25454E 10	0	2.42898E-03	7
8	1.12616E-03	7.43428E-03	1.51784E 08	3.62598E 00	2.54182E 01	6.12634E 10	0	2.47756E-03	8
9	1.14869E-03	8.56297E-03	1.51606E 08	3.62174E 00	2.90400E 01	5.99919E 10	0	2.52711E-03	9
10	1.17166E-03	9.75463E-03	1.51389E 08	3.61656E 00	3.26565E 01	5.87314E 10	0	2.57765E-03	10
11	1.19509E-03	1.09497E-02	1.51132E 08	3.61042E 00	3.62669E 01	5.74871E 10	0	2.62920E-03	11
12	1.21895E-03	1.21687E-02	1.50835E 08	3.60333E 00	3.98703E 01	5.62443E 10	0	2.68179E-03	12
13	1.24337E-03	1.34121E-02	1.50499E 08	3.59528E 00	4.34656E 01	5.50184E 10	0	2.73542E-03	13
14	1.26824E-03	1.46803E-02	1.50122E 08	3.58629E 00	4.70518E 01	5.38047E 10	0	2.79011E-03	14
15	1.29361E-03	1.59739E-02	1.49706E 08	3.57635E 00	5.06282E 01	5.26034E 10	0	2.84593E-03	15
16	1.31948E-03	1.72934E-02	1.49250E 08	3.56546E 00	5.41937E 01	5.14149E 10	0	2.90285E-03	16
17	1.34587E-03	1.86393E-02	1.48755E 08	3.55362E 00	5.77473E 01	5.02395E 10	0	2.96091E-03	17
18	1.37276E-03	2.00121E-02	1.48220E 08	3.54085E 00	6.12881E 01	4.90774E 10	0	3.02011E-03	18
19	1.40024E-03	2.14123E-02	1.47646E 08	3.52714E 00	6.48153E 01	4.79288E 10	0	3.08053E-03	19
20	1.42825E-03	2.28406E-02	1.47033E 08	3.51250E 00	6.83278E 01	4.67940E 10	0	3.14214E-03	20
21	1.45681E-03	2.42974E-02	1.46382E 08	3.49694E 00	7.18247E 01	4.56732E 10	0	3.20498E-03	21
22	1.48595E-03	2.57833E-02	1.45692E 08	3.48047E 00	7.53052E 01	4.45667E 10	0	3.26908E-03	22
23	1.51567E-03	2.72990E-02	1.44965E 08	3.46309E 00	7.87683E 01	4.34747E 10	0	3.33447E-03	23
24	1.54598E-03	2.88450E-02	1.44200E 08	3.44482E 00	8.22131E 01	4.23974E 10	0	3.40116E-03	24
25	1.57690E-03	3.04219E-02	1.43398E 08	3.42566E 00	8.56387E 01	4.13348E 10	0	3.46918E-03	25
26	1.60844E-03	3.20303E-02	1.42559E 08	3.40562E 00	8.90444E 01	4.02874E 10	0	3.53856E-03	26
27	1.64061E-03	3.36709E-02	1.41685E 08	3.38473E 00	9.24291E 01	3.92551E 10	0	3.60933E-03	27
28	1.67342E-03	3.53443E-02	1.40774E 08	3.36298E 00	9.57921E 01	3.82381E 10	0	3.68152E-03	28
29	1.70689E-03	3.70512E-02	1.39829E 08	3.34040E 00	9.91325E 01	3.72366E 10	0	3.75515E-03	29
30	1.74102E-03	3.87922E-02	1.38850E 08	3.31700E 00	1.02449E 02	3.62508E 10	0	3.83035E-03	30
31	1.77584E-03	4.05681E-02	1.37836E 08	3.29279E 00	1.05742E 02	3.52806E 10	0	3.90586E-03	31
32	1.81136E-03	4.23794E-02	1.36790E 08	3.26780E 00	1.09010E 02	3.43262E 10	0	3.98500E-03	32
33	1.84759E-03	4.42270E-02	1.35711E 08	3.24203E 00	1.12252E 02	3.33878E 10	0	4.06470E-03	33
34	1.88454E-03	4.61116E-02	1.34601E 08	3.21550E 00	1.15468E 02	3.24653E 10	0	4.14599E-03	34
35	1.92223E-03	4.80338E-02	1.33460E 08	3.18824E 00	1.18656E 02	3.15589E 10	0	4.22891E-03	35
36	1.96068E-03	4.99945E-02	1.32289E 08	3.16026E 00	1.21816E 02	3.06686E 10	0	4.31349E-03	36
37	1.99989E-03	5.19944E-02	1.31084E 08	3.13158E 00	1.24948E 02	2.97944E 10	0	4.39976E-03	37
38	2.03989E-03	5.40343E-02	1.29459E 08	3.10223E 00	1.28050E 02	2.89364E 10	0	4.48775E-03	38
39	2.08069E-03	5.61149E-02	1.28503E 08	3.07221E 00	1.31122E 02	2.80945E 10	0	4.57751E-03	39
40	2.12230E-03	5.82372E-02	1.27320E 08	3.04156E 00	1.34164E 02	2.72688E 10	0	4.66906E-03	40
41	2.16474E-03	6.04020E-02	1.26011E 08	3.01029E 00	1.37174E 02	2.64593E 10	0	4.76244E-03	41
42	2.20804E-03	6.26100E-02	1.24677E 08	2.97843E 00	1.40152E 02	2.56659E 10	0	4.85769E-03	42
43	2.25220E-03	6.48622E-02	1.23319E 08	2.94600E 00	1.43098E 02	2.48887E 10	0	4.95444E-03	43
44	2.29724E-03	6.71595E-02	1.21939E 08	2.91302E 00	1.46011E 02	2.41275E 10	0	5.05394E-03	44
45	2.34319E-03	6.95027E-02	1.20536E 08	2.87951E 00	1.48891E 02	2.33823E 10	0	5.15502E-03	45
46	2.39005E-03	7.18927E-02	1.19113E 08	2.844551E 00	1.51736E 02	2.26531E 10	0	5.25812E-03	46
47	2.43785E-03	7.43306E-02	1.17669E 08	2.81102E 00	1.54547E 02	2.19398E 10	0	5.36328E-03	47
48	2.48661E-03	7.68172E-02	1.16207E 08	2.77609E 00	1.57324E 02	2.12423E 10	0	5.47054E-03	48
49	2.53634E-03	7.93535E-02	1.14727E 08	2.74073E 00	1.60064E 02	2.05605E 10	0	5.57996E-03	49
50	2.58707E-03	8.19406E-02	1.13230E 08	2.70496E 00	1.62769E 02	1.93943E 10	0	5.69155E-03	50

J	DX	X	ERGS	CAL	SUM CAL	ERGS/GM	VELOCITY	ZONE	MASS	J
51	2.63881E-03	8.45794E-02	1.11717E 08	2.66881E 00	1.65438E 02	1.92436E 10	0	5.80539E-03	0	51
52	2.69159E-03	8.72710E-02	1.10189E 08	2.63231E 00	1.68070E 02	1.86083E 10	0	5.92149E-03	0	52
53	2.74542E-03	9.00164E-02	1.08647E 08	2.59549E 00	1.70666E 02	1.79882E 10	0	6.03092E-03	0	53
54	2.80033E-03	9.28167E-02	1.07093E 08	2.55836E 00	1.73224E 02	1.73832E 10	0	6.16072E-03	0	54
55	2.85633E-03	9.56731E-02	1.05527E 08	2.52095E 00	1.75745E 02	1.67931E 10	0	6.29394E-03	0	55
56	2.91346E-03	9.85865E-02	1.03950E 08	2.48329E 00	1.78228E 02	1.62173E 10	0	6.40952E-03	0	56
57	2.97173E-03	1.01558E-01	1.02364E 08	2.44540E 00	1.80674E 02	1.56573E 10	0	6.53181E-03	0	57
58	3.03117E-03	1.04589E-01	1.00770E 08	2.40730E 00	1.83081E 02	1.51111E 10	0	6.66456E-03	0	58
59	3.09179E-03	1.07681E-01	9.91676E 07	2.36903E 00	1.85450E 02	1.45793E 10	0	6.80193E-03	0	59
60	3.15362E-03	1.10835E-01	9.75592E 07	2.33061E 00	1.87781E 02	1.40616E 10	0	6.93197E-03	0	60
61	3.21670E-03	1.14052E-01	9.59453E 07	2.29205E 00	1.90073E 02	1.35579E 10	0	7.07673E-03	0	61
62	3.28103E-03	1.17333E-01	9.43271E 07	2.25339E 00	1.92326E 02	1.30678E 10	0	7.21827E-03	0	62
63	3.34665E-03	1.20679E-01	9.27055E 07	2.21466E 00	1.94541E 02	1.25913E 10	0	7.36763E-03	0	63
64	3.41358E-03	1.24093E-01	9.10815E 07	2.17586E 00	1.96717E 02	1.21282E 10	0	7.50999E-03	0	64
65	3.48186E-03	1.27575E-01	8.94562E 07	2.13703E 00	1.98854E 02	1.16782E 10	0	7.66008E-03	0	65
66	3.55149E-03	1.31126E-01	8.78305E 07	2.09820E 00	2.00952E 02	1.12412E 10	0	7.81129E-03	0	66
67	3.62252E-03	1.34749E-01	8.62053E 07	2.05937E 00	2.03011E 02	1.08168E 10	0	7.96455E-03	0	67
68	3.69497E-03	1.38444E-01	8.45817E 07	2.02058E 00	2.05032E 02	1.04050E 10	0	8.12894E-03	0	68
69	3.76887E-03	1.42213E-01	8.29605E 07	1.98186E 00	2.07014E 02	1.00055E 10	0	8.29152E-03	0	69
70	3.84425E-03	1.46057E-01	8.13426E 07	1.94321E 00	2.08957E 02	9.61798E 09	0	8.45735E-03	0	70
71	3.92114E-03	1.49978E-01	7.97290E 07	1.90466E 00	2.10862E 02	9.24234E 09	0	8.62650E-03	0	71
72	3.99956E-03	1.53977E-01	7.81206E 07	1.86623E 00	2.12728E 02	8.87832E 09	0	8.79493E-03	0	72
73	4.07955E-03	1.58057E-01	7.65181E 07	1.82795E 00	2.14556E 02	8.52569E 09	0	8.97501E-03	0	73
74	4.16114E-03	1.62218E-01	7.49224E 07	1.78983E 00	2.16346E 02	8.18421E 09	0	9.15451E-03	0	74
75	4.24436E-03	1.66463E-01	7.33344E 07	1.75190E 00	2.18098E 02	7.85357E 09	0	9.33760E-03	0	75
76	4.32925E-03	1.70792E-01	7.17549E 07	1.71416E 00	2.19812E 02	7.53383E 09	0	9.52435E-03	0	76
77	4.41584E-03	1.75208E-01	7.01845E 07	1.67665E 00	2.21488E 02	7.22447E 09	0	9.71484E-03	0	77
78	4.50415E-03	1.79712E-01	6.86241E 07	1.63937E 00	2.23128E 02	6.92534E 09	0	9.90413E-03	0	78
79	4.59424E-03	1.84306E-01	6.70745E 07	1.60235E 00	2.24730E 02	6.63623E 09	0	1.01073E-02	0	79
80	4.68612E-03	1.88942E-01	6.55362E 07	1.56560E 00	2.26296E 02	6.35690E 09	0	1.03095E-02	0	80
81	4.77984E-03	1.93772E-01	6.40100E 07	1.52915E 00	2.27825E 02	6.08712E 09	0	1.05157E-02	0	81
82	4.87544E-03	1.98647E-01	6.24966E 07	1.49299E 00	2.29318E 02	5.82667E 09	0	1.07260E-02	0	82
83	4.97544E-04	1.99135E-01	7.06529E 07	1.68879E 00	2.31007E 02	5.37229E 10	0	1.31588E-03	0	83
84	5.02170E-04	1.99637E-01	6.91742E 07	1.65251E 00	2.32659E 02	5.10376E 10	0	1.35536E-03	0	84
85	5.17235E-04	2.00154E-01	6.76286E 07	1.61559E 00	2.34275E 02	4.84439E 10	0	1.37607E-03	0	85
86	5.32752E-04	2.00687E-01	6.60588E 07	1.57809E 00	2.35853E 02	4.59412E 10	0	1.43790E-03	0	86
87	5.48735E-04	2.01236E-01	6.44675E 07	1.54007E 00	2.37393E 02	4.35287E 10	0	1.48104E-03	0	87
88	5.65197E-04	2.01801E-01	6.28575E 07	1.50161E 00	2.38894E 02	4.12054E 10	0	1.52447E-03	0	88
89	5.82153E-04	2.02383E-01	6.12316E 07	1.46277E 00	2.40357E 02	3.89705E 10	0	1.57123E-03	0	89
90	5.99618E-04	2.02983E-01	5.95925E 07	1.42361E 00	2.41781E 02	3.68226E 10	0	1.61837E-03	0	90
91	6.17606E-04	2.03600E-01	5.79431E 07	1.38421E 00	2.43165E 02	3.47806E 10	0	1.66692E-03	0	91
92	6.36124E-04	2.04237E-01	5.62860E 07	1.34463E 00	2.44510E 02	3.27830E 10	0	1.71693E-03	0	92
93	6.55218E-04	2.04892E-01	5.46241E 07	1.30492E 00	2.45815E 02	3.08894E 10	0	1.76843E-03	0	93
94	6.74875E-04	2.05567E-01	5.29601E 07	1.26517E 00	2.47080E 02	2.90752E 10	0	1.82149E-03	0	94
95	6.95121E-04	2.06262E-01	5.12967E 07	1.22544E 00	2.48305E 02	2.73418E 10	0	1.87613E-03	0	95
96	7.15975E-04	2.06978E-01	4.96367E 07	1.18578E 00	2.49491E 02	2.56863E 10	0	1.93242E-03	0	96
97	7.37454E-04	2.07715E-01	4.79825E 07	1.14626E 00	2.50637E 02	2.41071E 10	0	1.99039E-03	0	97
98	7.59578E-04	2.08475E-01	4.63368E 07	1.10695E 00	2.51744E 02	2.26022E 10	0	2.05010E-03	0	98
99	7.82365E-04	2.09257E-01	4.47021E 07	1.06789E 00	2.52812E 02	2.11697E 10	0	2.11160E-03	0	99
100	8.05836E-04	2.10063E-01	4.30808E 07	1.02916E 00	2.53841E 02	1.99077E 10	0	2.17495E-03	0	100

*** TEST PROBLEM NO. 1 *** TWO MATERIAL *** ARBITRARY SPECTRUM

J	DX	X	FRGS	CAL	SUM CAL	FRGS/GM	VELOCITY	ZONE MASS	J
101	8.30011E-04	2.10893E-01	4.14753E 07	9.90309E-01	2.54832E 02	1.85141E 10	0	2.24020E-03	101
102	8.54911E-04	2.11748E-01	3.98873E 07	9.52887E-01	2.55785E 02	1.72859E 10	0	2.30741E-03	102
103	8.80559E-04	2.12628E-01	3.83207E 07	9.15449E-01	2.56700E 02	1.61240E 10	0	2.37663E-03	103
104	9.06975E-04	2.13525E-01	3.67759E 07	8.78545E-01	2.57579E 02	1.50233E 10	0	2.44793E-03	104
105	9.34185E-04	2.14470E-01	3.52555E 07	8.42223E-01	2.58421E 02	1.39827E 10	0	2.52136E-03	105
106	9.62210E-04	2.15432E-01	3.37613E 07	8.06529E-01	2.59228E 02	1.30201E 10	0	2.59701E-03	106
107	9.91076E-04	2.16423E-01	3.22952E 07	7.71505E-01	2.59999E 02	1.20733E 10	0	2.67492E-03	107
108	1.02081E-03	2.17444E-01	3.08588E 07	7.37191E-01	2.60736E 02	1.12004E 10	0	2.75516E-03	108
109	1.05143E-03	2.18495E-01	2.94537E 07	7.03624E-01	2.61440E 02	1.03790E 10	0	2.83782E-03	109
110	1.08298E-03	2.19578E-01	2.80813E 07	6.70839E-01	2.62111E 02	9.60717E 09	0	2.92295E-03	110
111	1.11547E-03	2.20694E-01	2.67429E 07	6.38866E-01	2.62750E 02	8.88281E 09	0	3.01064E-03	111
112	1.14893E-03	2.21843E-01	2.54398E 07	6.07735E-01	2.63357E 02	8.20385E 09	0	3.10096E-03	112
113	1.18340E-03	2.23026E-01	2.41729E 07	5.77471E-01	2.63935E 02	7.56825E 09	0	3.19399E-03	113
114	1.21890E-03	2.24245E-01	2.29432E 07	5.48094E-01	2.64483E 02	6.97403E 09	0	3.2981E-03	114
115	1.25547E-03	2.25500E-01	2.17515E 07	5.19625E-01	2.65003E 02	6.41921E 09	0	3.38850E-03	115
116	1.29313E-03	2.26793E-01	2.05984E 07	4.92079E-01	2.65495E 02	5.90186E 09	0	3.49015E-03	116
117	1.33192E-03	2.28125E-01	1.94845E 07	4.65468E-01	2.65960E 02	5.42009E 09	0	3.59496E-03	117
118	1.37188E-03	2.29497E-01	1.84101E 07	4.39801E-01	2.66400E 02	4.97206E 09	0	3.70271E-03	118
119	1.41304E-03	2.30910E-01	1.73755E 07	4.15085E-01	2.66815E 02	4.55596E 09	0	3.81379E-03	119
120	1.45543E-03	2.32366E-01	1.63807E 07	3.91322E-01	2.67206E 02	4.17003E 09	0	3.92820E-03	120
121	1.49909E-03	2.33865E-01	1.54259E 07	3.68512E-01	2.67575E 02	3.81259E 09	0	4.04605E-03	121
122	1.54406E-03	2.35409E-01	1.45103E 07	3.46652E-01	2.67922E 02	3.48197E 09	0	4.16743E-03	122
123	1.59039E-03	2.36999E-01	1.36353E 07	3.25736E-01	2.68247E 02	3.17658E 09	0	4.29245E-03	123
124	1.63810E-03	2.38637E-01	1.27989E 07	3.05754E-01	2.68553E 02	2.89487E 09	0	4.42123E-03	124
125	1.68724E-03	2.40325E-01	1.20011E 07	2.86695E-01	2.68840E 02	2.63536E 09	0	4.55386E-03	125
126	1.73786E-03	2.42062E-01	1.12413E 07	2.68545E-01	2.69108E 02	2.39662E 09	0	4.69048E-03	126
127	1.78999E-03	2.43852E-01	1.05188E 07	2.51286E-01	2.69360E 02	2.17727E 09	0	4.83119E-03	127
128	1.84369E-03	2.45696E-01	9.83291E 06	2.34900E-01	2.69595E 02	1.97601E 09	0	4.97613E-03	128
129	1.89900E-03	2.47595E-01	9.18264E 06	2.19365E-01	2.69814E 02	1.79159E 09	0	5.12541E-03	129
130	1.95598E-03	2.49551E-01	8.56705E 06	2.04660E-01	2.70019E 02	1.62280E 09	0	5.27918E-03	130
131	2.01465E-03	2.51566E-01	7.98515E 06	1.90758E-01	2.70209E 02	1.46852E 09	0	5.43755E-03	131
132	2.07509E-03	2.53641E-01	7.43581E 06	1.77635E-01	2.70387E 02	1.32766E 09	0	5.60068E-03	132
133	2.13735E-03	2.55778E-01	6.91790E 06	1.65263E-01	2.70552E 02	1.19921E 09	0	5.76870E-03	133
134	2.20147E-03	2.57980E-01	6.43024E 06	1.53613E-01	2.70706E 02	1.08221E 09	0	5.94176E-03	134
135	2.26751E-03	2.60247E-01	5.97162E 06	1.42657E-01	2.70848E 02	9.75753E 08	0	6.12001E-03	135
136	2.33554E-03	2.62583E-01	5.54081E 06	1.32365E-01	2.70981E 02	8.78989E 08	0	6.30361E-03	136
137	2.40560E-03	2.64988E-01	5.13655E 06	1.22708E-01	2.71104E 02	7.91125E 08	0	6.49272E-03	137
138	2.47777E-03	2.67466E-01	4.75760E 06	1.13655E-01	2.71217E 02	7.11417E 08	0	6.68750E-03	138
139	2.55210E-03	2.70018E-01	4.40272E 06	1.05177E-01	2.71322E 02	6.39175E 08	0	6.88813E-03	139
140	2.62867E-03	2.72647E-01	4.07066E 06	9.72466E-02	2.71420E 02	5.73755E 08	0	7.09477E-03	140
141	2.70753E-03	2.75354E-01	3.76022E 06	8.98285E-02	2.71509E 02	5.14562E 08	0	7.30761E-03	141
142	2.78875E-03	2.78143E-01	3.47021E 06	8.29005E-02	2.71592E 02	4.61046E 08	0	7.52684E-03	142
143	2.87242E-03	2.81016E-01	3.19949E 06	7.64331E-02	2.71669E 02	4.12696E 08	0	7.75255E-03	143
144	2.95859E-03	2.83974E-01	2.94694E 06	7.03998E-02	2.71739E 02	3.69048E 08	0	7.98523E-03	144
145	3.04735E-03	2.87021E-01	2.71148E 06	6.47750E-02	2.71804E 02	3.29672E 08	0	8.22479E-03	145
146	3.13877E-03	2.90160E-01	2.49211E 06	5.95343E-02	2.71863E 02	2.94174E 08	0	8.47153E-03	146
147	3.23293E-03	2.93393E-01	2.28733E 06	5.46544E-02	2.71918E 02	2.62195E 08	0	8.72567E-03	147
148	3.32992E-03	2.96723E-01	2.09773E 06	5.01130E-02	2.71968E 02	2.33407E 08	0	8.98744E-03	148
149	3.42991E-03	3.00153E-01	1.92093E 06	4.58894E-02	2.72014E 02	2.07510E 08	0	9.25076E-03	149
150	3.53271E-03	3.03686E-01	1.75660E 06	4.19638E-02	2.72056E 02	1.84231E 08	0	9.53478E-03	150

*** TEST PROBLEM NO. 1 *** TWO MATERIAL *** ARBITRARY SPECTRUM

J	DX	X	FRGS	CAL	SUM CAL	ERGS/GM	VELOCITY	ZONE	MASS	J
151	3.63869E-03	3.07324E-01	1.60398E 06	3.83177E-02	2.72094E 02	1.63324E 08	0	9.82082E-03	151	
152	3.74785E-03	3.11072E-01	1.46233E 06	3.49337E-02	2.72129E 02	1.44564E 08	0	1.01154E-02	152	
153	3.86023E-03	3.14932E-01	1.33096E 06	3.17956E-02	2.72161E 02	1.27745E 08	0	1.04189E-02	153	
154	3.97609E-03	3.18909E-01	1.20926E 06	2.88882E-02	2.72190E 02	1.12683E 08	0	1.07315E-02	154	
155	4.09538E-03	3.23004E-01	1.09662E 06	2.51973E-02	2.72216E 02	9.92107E 07	0	1.10534E-02	155	
156	4.21824E-03	3.27222E-01	9.92481E 05	2.37095E-02	2.72240E 02	8.71743E 07	0	1.13850E-02	156	
157	4.34479E-03	3.31567E-01	8.96331E 05	2.14126E-02	2.72261E 02	7.64435E 07	0	1.17666E-02	157	
158	4.47513E-03	3.36042E-01	8.07679E 05	1.92948E-02	2.72281E 02	6.68698E 07	0	1.20784E-02	158	
159	4.60938E-03	3.40651E-01	7.26064E 05	1.73451E-02	2.72298E 02	5.83622E 07	0	1.24407E-02	159	
160	4.74766E-03	3.45399E-01	6.51069E 05	1.55535E-02	2.72314E 02	5.08094E 07	0	1.28139E-02	160	
161	4.89009E-03	3.50289E-01	5.82275E 05	1.39100E-02	2.72327E 02	4.41172E 07	0	1.31984E-02	161	
162	5.03680E-03	3.55326E-01	5.19302E 05	1.24057E-02	2.72340E 02	3.81999E 07	0	1.35843E-02	162	
163	5.18790E-03	3.60514E-01	4.61787E 05	1.10317E-02	2.72351E 02	3.29797E 07	0	1.40021E-02	163	
164	5.34354E-03	3.65857E-01	4.09382E 05	9.77979E-03	2.72361E 02	2.83855E 07	0	1.44727E-02	164	
165	5.50384E-03	3.71361E-01	3.61758E 05	8.64208E-03	2.72369E 02	2.43528E 07	0	1.49549E-02	165	
166	5.66896E-03	3.77030E-01	3.18597E 05	7.61107E-03	2.72377E 02	2.08226E 07	0	1.53005E-02	166	
167	5.83903E-03	3.82869E-01	2.79598E 05	6.67936E-03	2.72384E 02	1.77415E 07	0	1.57595E-02	167	
168	6.01420E-03	3.88883E-01	2.44470E 05	5.84019E-03	2.72389E 02	1.50607E 07	0	1.62323E-02	168	
169	6.19463E-03	3.95078E-01	2.12935E 05	5.08684E-03	2.72395E 02	1.27359E 07	0	1.67193E-02	169	
170	6.38046E-03	4.01459E-01	1.84725E 05	4.41292E-03	2.72399E 02	1.07768E 07	0	1.72209E-02	170	
171	6.57188E-03	4.08030E-01	1.59584E 05	3.81231E-03	2.72403E 02	8.99696E 06	0	1.77375E-02	171	
172	6.76903E-03	4.14799E-01	1.37265E 05	3.27914E-03	2.72406E 02	7.51329E 06	0	1.82696E-02	172	
173	6.97211E-03	4.21772E-01	1.17534E 05	2.80779E-03	2.72409E 02	6.24593E 06	0	1.88177E-02	173	
174	7.18127E-03	4.28953E-01	1.00166E 05	2.39289E-03	2.72411E 02	5.16795E 06	0	1.93827E-02	174	
175	7.39671E-03	4.36350E-01	8.49483E 04	2.02934E-03	2.72413E 02	4.25514E 06	0	1.99637E-02	175	
176	7.61861E-03	4.43968E-01	7.16768E 04	1.72130E-03	2.72415E 02	3.48578E 06	0	2.05626E-02	176	
177	7.84717E-03	4.51815E-01	6.01601E 04	1.43718E-03	2.72416E 02	2.84050E 06	0	2.11795E-02	177	
178	8.08258E-03	4.59898E-01	5.02185E 04	1.19968E-03	2.72418E 02	2.30203E 06	0	2.18149E-02	178	
179	8.32506E-03	4.68223E-01	4.16821E 04	9.95750E-04	2.72419E 02	1.85507E 06	0	2.24693E-02	179	
180	8.57481E-03	4.76798E-01	3.43937E 04	8.21637E-04	2.72419E 02	1.48611E 06	0	2.31434E-02	180	
181	8.83205E-03	4.85630E-01	2.82071E 04	6.73845E-04	2.72420E 02	1.18330E 06	0	2.38377E-02	181	
182	9.09702E-03	4.94727E-01	2.29876E 04	5.49155E-04	2.72421E 02	9.36257E 05	0	2.45528E-02	182	
183	9.36993E-03	5.04097E-01	1.86118E 04	4.44621E-04	2.72421E 02	7.35052E 05	0	2.52804E-02	183	
184	9.65102E-03	5.13748E-01	1.49673E 04	3.57555E-04	2.72421E 02	5.74600E 05	0	2.60481E-02	184	
185	9.94056E-03	5.23688E-01	1.19523E 04	2.85531E-04	2.72422E 02	4.45491E 05	0	2.68296E-02	185	
186	1.02388E-02	5.33927E-01	9.47581E 03	2.26369E-04	2.72422E 02	3.42899E 05	0	2.76344E-02	186	
187	1.05459E-02	5.44473E-01	7.45634E 03	1.78126E-04	2.72422E 02	2.61962E 05	0	2.84635E-02	187	
188	1.08623E-02	5.55335E-01	5.82199E 03	1.39082E-04	2.72422E 02	1.98585E 05	0	2.93174E-02	188	
189	1.11882E-02	5.66524E-01	4.50963E 03	1.07731E-04	2.72422E 02	1.49361E 05	0	3.01969E-02	189	
190	1.15238E-02	5.78047E-01	3.46433E 03	8.27599E-05	2.72422E 02	1.11383E 05	0	3.10784E-02	190	
191	1.18695E-02	5.89917E-01	2.63869E 03	6.30361E-05	2.72423E 02	8.23667E 04	0	3.20359E-02	191	
192	1.22256E-02	6.02143E-01	1.99218E 03	4.75914E-05	2.72423E 02	6.03745E 04	0	3.29970E-02	192	
193	1.25924E-02	6.14735E-01	1.49043E 03	3.56052E-05	2.72423E 02	4.38532E 04	0	3.39469E-02	193	
194	1.29702E-02	6.27705E-01	1.10463E 03	2.63886E-05	2.72423E 02	3.15550E 04	0	3.49065E-02	194	
195	1.33593E-02	6.41064E-01	8.10759E 02	1.93691E-05	2.72423E 02	2.24865E 04	0	3.60567E-02	195	
196	1.37601E-02	6.54824E-01	5.89189E 02	1.40752E-05	2.72423E 02	1.58667E 04	0	3.71384E-02	196	
197	1.41729E-02	6.68997E-01	4.23759E 02	1.01232E-05	2.72423E 02	1.10779E 04	0	3.82525E-02	197	
198	1.45980E-02	6.83595E-01	0	0	2.72423E 02	0	0	3.94001E-02	198	
199	1.50360E-02	6.98631E-01	0	0	2.72423E 02	0	0	4.05421E-02	199	
200	1.54871E-02	7.14118E-01	0	0	2.72423E 02	0	0	4.17966E-02	200	

*** TEST PROBLEM NO. 1 *** TWO MATERIAL *** ARBITRARY SPECTRUM

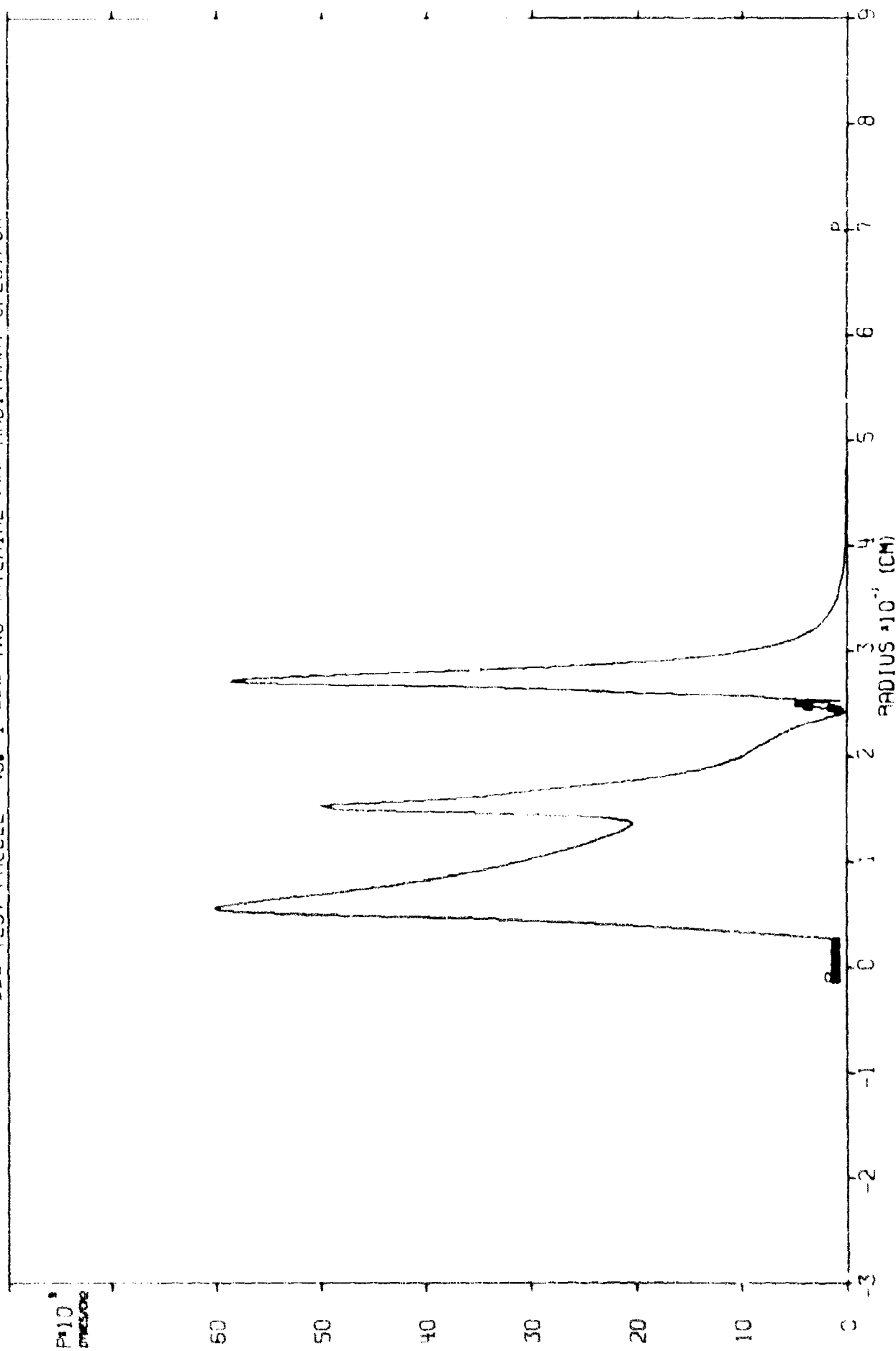
J	DX	X	ERGS	CAL	SUM CAL	ERGS/GM	VELOCITY	ZONE MASS	J
201	1.59517E-02	7.30070E-01	0	0	2.72423E 02	0	0	4.30536E-02	201
202	1.64302E-02	7.46500E-01	0	0	2.72423E 02	0	0	4.43452E-02	202
203	1.69231E-02	7.63423E-01	0	0	2.72423E 02	0	0	4.56755E-02	203
204	1.74308E-02	7.80854E-01	0	0	2.72423E 02	0	0	4.70458E-02	204
205	1.79537E-02	7.98808E-01	0	0	2.72423E 02	0	0	4.84572E-02	205
206	1.84924E-02	8.17300E-01	0	0	2.72423E 02	0	0	4.99109E-02	206
207	1.90471E-02	8.35347E-01	0	0	2.72423E 02	0	0	5.14087E-02	207
208	1.96185E-02	8.55966E-01	0	0	2.72423E 02	0	0	5.29505E-02	208
209	2.02071E-02	8.76173E-01	0	0	2.72423E 02	0	0	5.45390E-02	209
210	2.08133E-02	8.96986E-01	0	0	2.72423E 02	0	0	5.61751E-02	210
211	2.14377E-02	9.18424E-01	0	0	2.72423E 02	0	0	5.78604E-02	211
212	2.20808E-02	9.40505E-01	0	0	2.72423E 02	0	0	5.95962E-02	212
213	2.27433E-02	9.63248E-01	0	0	2.72423E 02	0	0	6.13841E-02	213
214	2.34256E-02	9.86674E-01	0	0	2.72423E 02	0	0	6.32256E-02	214
215	2.41283E-02	1.01080E 00	0	0	2.72423E 02	0	0	6.51234E-02	215
216	2.48522E-02	1.03565E 00	0	0	2.72423E 02	0	0	6.70761E-02	216
217	2.55978E-02	1.06125E 00	0	0	2.72423E 02	0	0	6.90883E-02	217
218	2.63657E-02	1.08762E 00	0	0	2.72423E 02	0	0	7.11610E-02	218
219	2.71567E-02	1.11477E 00	0	0	2.72423E 02	0	0	7.32958E-02	219
220	2.79714E-02	1.14275E 00	0	0	2.72423E 02	0	0	7.54947E-02	220
221	2.88105E-02	1.17156E 00	0	0	2.72423E 02	0	0	7.77595E-02	221
222	2.96748E-02	1.20123E 00	0	0	2.72423E 02	0	0	8.00923E-02	222
223	3.05651E-02	1.23180E 00	0	0	2.72423E 02	0	0	8.24951E-02	223
224	3.14820E-02	1.26328E 00	0	0	2.72423E 02	0	0	8.49693E-02	224
225	3.24265E-02	1.29570E 00	0	0	2.72423E 02	0	0	8.75190E-02	225
226	3.33993E-02	1.32910E 00	0	0	2.72423E 02	0	0	9.01446E-02	226
227	3.44012E-02	1.36351E 00	0	0	2.72423E 02	0	0	9.28348E-02	227
228	3.54333E-02	1.39894E 00	0	0	2.72423E 02	0	0	9.56344E-02	228
229	3.64963E-02	1.43543E 00	0	0	2.72423E 02	0	0	9.85034E-02	229
230	3.75912E-02	1.47303E 00	0	0	2.72423E 02	0	0	1.01459E-01	230
231	3.87189E-02	1.51174E 00	0	0	2.72423E 02	0	0	1.04502E-01	231
232	3.98805E-02	1.55163E 00	0	0	2.72423E 02	0	0	1.07637E-01	232
233	4.10769E-02	1.59270E 00	0	0	2.72423E 02	0	0	1.10866E-01	233
234	4.23092E-02	1.63501E 00	0	0	2.72423E 02	0	0	1.14192E-01	234
235	4.35785E-02	1.67859E 00	0	0	2.72423E 02	0	0	1.17614E-01	235
236	4.48858E-02	1.72348E 00	0	0	2.72423E 02	0	0	1.21147E-01	236
237	4.62324E-02	1.76971E 00	0	0	2.72423E 02	0	0	1.24781E-01	237
238	4.76194E-02	1.81733E 00	0	0	2.72423E 02	0	0	1.28525E-01	238
239	4.90479E-02	1.86630E 00	0	0	2.72423E 02	0	0	1.32380E-01	239
240	5.05194E-02	1.91689E 00	0	0	2.72423E 02	0	0	1.36352E-01	240
241	5.20350E-02	1.96893E 00	0	0	2.72423E 02	0	0	1.40442E-01	241
242	5.35960E-02	2.02253E 00	0	0	2.72423E 02	0	0	1.44655E-01	242
243	5.52039E-02	2.07773E 00	0	0	2.72423E 02	0	0	1.48995E-01	243
244	5.68600E-02	2.13459E 00	0	0	2.72423E 02	0	0	1.53465E-01	244
245	5.85658E-02	2.19316E 00	0	0	2.72423E 02	0	0	1.58069E-01	245
246	6.03228E-02	2.25348E 00	0	0	2.72423E 02	0	0	1.62811E-01	246
247	6.21327E-02	2.31561E 00	0	0	2.72423E 02	0	0	1.67696E-01	247
248	6.39964E-02	2.37961E 00	0	0	2.72423E 02	0	0	1.72726E-01	248
249	6.59163E-02	2.44552E 00	0	0	2.72423E 02	0	0	1.77908E-01	249
250	6.78938E-02	2.51342E 00	0	0	2.72423E 02	0	0	1.83245E-01	250

*** TEST PROBLEM NO. 1 *** TWO MATERIAL *** ARBITRARY SPECTRUM

J	OX	X	ERGS	CAL	SUM CAL	ERGS/GM	VELOCITY	ZONE MASS	J
251	6.99306E-02	2.58335E 00	0	0	2.72423E 02	0	0	1.88743E-01	251
252	7.20286E-02	2.65538E 00	0	0	2.72423E 02	0	0	1.94405E-01	252
253	7.41894E-02	2.72957E 00	0	0	2.72423E 02	0	0	2.00237E-01	253
254	7.64151E-02	2.80598E 00	0	0	2.72423E 02	0	0	2.06246E-01	254
255	7.87075E-02	2.88469E 00	0	0	2.72423E 02	0	0	2.12432E-01	255
256	8.10688E-02	2.96576E 00	0	0	2.72423E 02	0	0	2.18905E-01	256
257	8.35008E-02	3.04926E 00	0	0	2.72423E 02	0	0	2.25369E-01	257
258	8.60059E-02	3.13526E 00	0	0	2.72423E 02	0	0	2.32130E-01	258
259	8.85860E-02	3.22385E 00	0	0	2.72423E 02	0	0	2.39094E-01	259
260	9.12436E-02	3.31509E 00	0	0	2.72423E 02	0	0	2.46267E-01	260
261	9.39809E-02	3.40907E 00	0	0	2.72423E 02	0	0	2.53655E-01	261
262	9.68004E-02	3.50587E 00	0	0	2.72423E 02	0	0	2.61264E-01	262
263	9.97044E-02	3.60558E 00	0	0	2.72423E 02	0	0	2.69102E-01	263
264	1.02695E-01	3.70827E 00	0	0	2.72423E 02	0	0	2.77175E-01	264
265	1.05776E-01	3.81405E 00	0	0	2.72423E 02	0	0	2.85490E-01	265
266	1.08950E-01	3.92300E 00	0	0	2.72423E 02	0	0	2.94055E-01	266
267	1.12218E-01	4.03522E 00	0	0	2.72423E 02	0	0	3.02877E-01	267
268	1.15585E-01	4.15080E 00	0	0	2.72423E 02	0	0	3.11963E-01	268
269	1.19052E-01	4.26986E 00	0	0	2.72423E 02	0	0	3.21322E-01	269
270	1.22624E-01	4.39248E 00	0	0	2.72423E 02	0	0	3.30962E-01	270
271	1.26303E-01	4.51878E 00	0	0	2.72423E 02	0	0	3.40890E-01	271
272	1.30092E-01	4.64887E 00	0	0	2.72423E 02	0	0	3.51117E-01	272
273	1.33994E-01	4.78287E 00	0	0	2.72423E 02	0	0	3.61651E-01	273
274	1.38014E-01	4.92088E 00	0	0	2.72423E 02	0	0	3.72500E-01	274
275	1.42155E-01	5.06304E 00	0	0	2.72423E 02	0	0	3.83675E-01	275
276	1.46419E-01	5.20946E 00	0	0	2.72423E 02	0	0	3.95185E-01	276
277	1.50812E-01	5.36027E 00	0	0	2.72423E 02	0	0	4.07041E-01	277
278	1.55336E-01	5.51560E 00	0	0	2.72423E 02	0	0	4.19252E-01	278
279	1.59966E-01	5.67560E 00	0	0	2.72423E 02	0	0	4.31830E-01	279
280	1.64796E-01	5.84040E 00	0	0	2.72423E 02	0	0	4.44785E-01	280
281	1.69740E-01	6.01014E 00	0	0	2.72423E 02	0	0	4.58128E-01	281
282	1.74832E-01	6.18497E 00	0	0	2.72423E 02	0	0	4.71872E-01	282

CYCLE DTPP	TIME DTPULS	DTNH ETOTAL	JSTAR EMVNEG	JPMAX EMVPOS	PHAX L-BOUND	XJPMAX X(JBND1)	MVPULSE X(JBND2)	MVPREC R-BOUND	MOMENTUM JFIN
25	4.7198E-10	7.9497E-11	175	83	4.5949E 09	1.9913E-01	-7.0702E-01	7.3859E-01	3.1565E-02
6.8695E-12	-1.5387E-10	4.2858E 00	-1.2048E 00	1.2023E 00	-5.9711E-08	1.9865E-01	0	6.1450E 00	282
CYCLE DTPP	TIME DTPULS	DTNH ETOTAL	JSTAR EMVNEG	JPMAX EMVPOS	PHAX L-BOUND	XJPMAX X(JBND1)	MVPULSE X(JBND2)	MVPREC R-BOUND	MOMENTUM JFIN
50	7.1041E-09	3.0000E-10	186	89	5.0040E 10	2.0240E-01	4.3799E 01	1.3928E 02	1.6307E 02
3.6585E-09	8.7527E-10	6.4493E 01	-2.6028E 02	2.6027E 02	-1.2190E-04	1.9859E-01	0	6.1450E 00	282
CYCLE DTPP	TIME DTPULS	DTNH ETOTAL	JSTAR EMVNEG	JPMAX EMVPOS	PHAX L-BOUND	XJPMAX X(JBND1)	MVPULSE X(JBND2)	MVPREC R-BOUND	MOMENTUM JFIN
75	1.4604E-08	3.0000E-10	188	96	7.4505E 10	2.0706E-01	1.9282E 02	4.0224E 02	5.9507E 02
7.9869E-09	2.5881E-09	1.3258E 02	-9.1505E 02	9.1504E 02	-5.1313E-04	1.9838E-01	0	6.1850E 00	282
CYCLE DTPP	TIME DTPULS	DTNH ETOTAL	JSTAR EMVNEG	JPMAX EMVPOS	PHAX L-BOUND	XJPMAX X(JBND1)	MVPULSE X(JBND2)	MVPREC R-BOUND	MOMENTUM JFIN
100	2.2104E-08	3.0000E-10	193	101	8.6487E 10	2.1109E-01	3.8071E 02	6.9457E 02	1.0753E 03
1.2433E-08	4.4019E-09	2.0067E 02	-1.7711E 03	1.7711E 03	-1.1739E-03	1.9808E-01	0	6.1850E 00	282
CYCLE DTPP	TIME DTPULS	DTNH ETOTAL	JSTAR EMVNEG	JPMAX EMVPOS	PHAX L-BOUND	XJPMAX X(JBND1)	MVPULSE X(JBND2)	MVPREC R-BOUND	MOMENTUM JFIN
125	2.9604E-08	3.0000E-10	191	106	9.2405E 10	2.1576E-01	6.5675E 02	9.1635E 02	1.5731E 03
1.7024E-08	7.1073E-09	2.6876E 02	-2.7531E 03	2.7530E 03	-2.1088E-03	1.9775E-01	0	6.1850E 00	282
CYCLE DTPP	TIME DTPULS	DTNH ETOTAL	JSTAR EMVNEG	JPMAX EMVPOS	PHAX L-BOUND	XJPMAX X(JBND1)	MVPULSE X(JBND2)	MVPREC R-BOUND	MOMENTUM JFIN
150	4.7895E-08	7.2876E-10	195	19	8.0638E 10	2.1764E-02	3.5406E 02	2.3624E 03	2.7165E 03
3.3688E-08	4.3908E-09	2.7149E 02	-4.6566E 03	4.6565E 03	-4.9237E-03	1.9716E-01	0	6.1850E 00	282
CYCLE DTPP	TIME DTPULS	DTNH ETOTAL	JSTAR EMVNEG	JPMAX EMVPOS	PHAX L-BOUND	XJPMAX X(JBND1)	MVPULSE X(JBND2)	MVPREC R-BOUND	MOMENTUM JFIN
175	6.8827E-08	9.2583E-10	197	25	7.2557E 10	3.1174E-02	5.9193E 02	3.3689E 03	3.9608E 03
5.4589E-08	8.1581E-09	2.7150E 02	-5.8770E 03	5.8770E 03	-7.8300E-03	1.9688E-01	0	6.1850E 00	282
CYCLE DTPP	TIME DTPULS	DTNH ETOTAL	JSTAR EMVNEG	JPMAX EMVPOS	PHAX L-BOUND	XJPMAX X(JBND1)	MVPULSE X(JBND2)	MVPREC R-BOUND	MOMENTUM JFIN
200	8.8289E-08	7.7466E-10	197	30	6.7043E 10	3.9970E-02	8.1549E 02	4.0846E 03	4.9001E 03
7.3089E-08	1.2164E-08	2.7151E 02	-6.5541E 03	6.5541E 03	-1.0496E-02	1.9681E-01	0	6.1850E 00	282
CYCLE DTPP	TIME DTPULS	DTNH ETOTAL	JSTAR EMVNEG	JPMAX EMVPOS	PHAX L-BOUND	XJPMAX X(JBND1)	MVPULSE X(JBND2)	MVPREC R-BOUND	MOMENTUM JFIN
225	1.0582E-07	6.4538E-10	198	34	6.3193E 10	4.7695E-02	1.0076E 03	4.6040E 03	5.6116E 03
8.8901E-08	1.5945E-08	2.7152E 02	-7.0274E 03	7.0274E 03	-1.2773E-02	1.9682E-01	0	6.1850E 00	282
CYCLE DTPP	TIME DTPULS	DTNH ETOTAL	JSTAR EMVNEG	JPMAX EMVPOS	PHAX L-BOUND	XJPMAX X(JBND1)	MVPULSE X(JBND2)	MVPREC R-BOUND	MOMENTUM JFIN
250	1.2309E-07	6.3603E-10	198	38	6.0194E 10	5.5995E-02	1.2518E 03	4.9579E 03	6.2097E 03
1.0316E-07	2.0797E-08	2.7153E 02	-7.4190E 03	7.4190E 03	-1.4978E-02	1.9686E-01	0	6.1850E 00	282

CYCLE = 250 TIME = 1.231×10^{-7}
*** TEST PROBLEM NO. 1 *** TWO MATERIAL *** ARBITRARY SPECTRUM



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APPENDIX IV

TEST PROBLEM 2

(PUFF)

10	RH0(1)	EQSTC(1)	EQSTD(1)	EQSTE(1)	EQSTG(1)	EQSTH(1)	EQSTS(1)	PMIN(1)
	157	9.4+10	2.193+10	1.12+11	1.0	.25	0.	-1.+9
9	MATL(1)							
	MATL1							
8	DX	TIME	RZ(1)					
	1.-3	1.-12	1.03					
7	JFIN	NZ(1)						
	110	109						
6	SDUR	T(1)	EE(1)	T(2)	EE(2)			
	3.-8	4	35.	8.	25.			
5	N0E(1)							
	9							

4	ANGLE							
	0.							
3	NRB	NRZC	NMTRLS	JRZL	JEPUL	NPRIN	NTAPE	
	2	1	1	20	40	25	25	
2	DISCPT(1), I = 1, 10							
	*** TEST PROBLEM N02 *** TWO BLACK BODY SPECTRUM ***							
	TABLE DECK FOR PROBLEM 2							
1	NHNU	NTEDT	NJEDIT	L0ZH12				
	0	0	0	0				

17	JCYCS	NTEST						
	550	30						
16	CKP	TS						
	7	1.-6						
15	AA(1,9)	B(1,9)	EDGE(1,9)					
	2.3134	-5.7037-1	1.50+2					
14	B(1,8)	EDGE(1,8)	AA(1,7)	B(1,7)	EDGE(1,7)	AA(1,6)	B(1,6)	EDGE(1,6)
	-2.1308	4.1320+1	1.0427+2	-1.5074	4.9584+1	1.6230+1	-1.0334	6.1980+1
13	EDGE(1,5)	AA(1,4)	B(1,4)	EDGE(1,4)	AA(1,3)	B(1,3)	EDGE(1,3)	AA(1,2)
	5.32-1	2.9339+3	-2.8099	1.8424	9.0442+3	-2.8151	1.2396+1	1.0073+3
12	AA(1,1)	B(1,1)	EDGE(1,1)	AA(1,2)	B(1,2)	EDGE(1,2)	AA(1,3)	B(1,3)
	9.0515+2	-2.4056	1.18-1	7.1461+2	-2.6191	2.84-1	9.971+2	-2.5835
11	CUSP1(1)	CUSPA(1)	CUSPC(1)	CUSPD(1)	CUSPG(1)	CUSPS(1)		
	0.	0.	0.	0.	0.	0.		

TABLE DECK TOP TEST FIGURE 2

FORMAT 8E10.3

.629	.812	.946	1.06	1.15	1.24	1.32	1.40	TBL CAMP 1
1.47	1.53	1.60	1.66	1.72	1.78	1.83	1.89	TBL CAMP 2
1.94	1.99	2.05	2.10	2.15	2.20	2.24	2.29	TBL CAMP 3
2.34	2.39	2.43	2.48	2.53	2.57	2.62	2.67	TBL CAMP 4
2.71	2.76	2.80	2.85	2.89	2.94	2.99	3.03	TBL CAMP 5
3.08	3.12	3.17	3.22	3.26	3.31	3.36	3.41	TBL CAMP 6
3.45	3.50	3.55	3.60	3.65	3.70	3.75	3.80	TBL CAMP 7
3.86	3.91	3.96	4.02	4.07	4.13	4.18	4.24	TBL CAMP 8
4.30	4.36	4.42	4.48	4.55	4.61	4.68	4.75	TBL CAMP 9
4.82	4.89	4.97	5.04	5.12	5.20	5.29	5.38	TBL CAMP 10
5.47	5.56	5.66	5.77	5.88	6.00	6.12	6.26	TBL CAMP 11
6.40	6.55	6.72	6.91	7.12	7.36	7.63	7.97	TBL CAMP 12
8.39	8.97	9.94	10.1	10.2	10.4	10.6	10.9	TBL CAMP 13
11.2	11.6	12.1	13.0	15.0				

INPUT PARAMETERS FOR - -

*** TEST PROBLEM NO. 2 *** TWO BLACK BODY SPECTRUM ***
 ***** THIS PROBLEM WAS RUN ON PUFF/1604 *****

TABLE VALUES

6.287E-01	8.118E-01	9.464E-01	1.058E 00	1.155E 00	1.242E 00	1.322E 00	1.397E 00	1.468E 00	1.535E 00
1.599E 00	1.660E 00	1.720E 00	1.777E 00	1.833E 00	1.888E 00	1.942E 00	1.994E 00	2.046E 00	2.096E 00
2.145E 00	2.196E 00	2.244E 00	2.292E 00	2.340E 00	2.388E 00	2.435E 00	2.481E 00	2.528E 00	2.574E 00
2.620E 00	2.666E 00	2.712E 00	2.757E 00	2.803E 00	2.849E 00	2.895E 00	2.940E 00	2.986E 00	3.032E 00
3.078E 00	3.124E 00	3.171E 00	3.217E 00	3.264E 00	3.311E 00	3.359E 00	3.406E 00	3.454E 00	3.503E 00
3.552E 00	3.601E 00	3.651E 00	3.701E 00	3.752E 00	3.804E 00	3.856E 00	3.908E 00	3.962E 00	4.016E 00
4.071E 00	4.127E 00	4.184E 00	4.242E 00	4.300E 00	4.360E 00	4.421E 00	4.484E 00	4.548E 00	4.613E 00
4.680E 00	4.748E 00	4.818E 00	4.891E 00	4.965E 00	5.042E 00	5.121E 00	5.202E 00	5.288E 00	5.376E 00
5.468E 00	5.563E 00	5.664E 00	5.769E 00	5.880E 00	5.997E 00	6.122E 00	6.255E 00	6.398E 00	6.553E 00
6.723E 00	6.909E 00	7.119E 00	7.357E 00	7.634E 00	7.968E 00	8.390E 00	8.972E 00	9.942E 00	1.009E 01
1.025E 01	1.043E 01	1.064E 01	1.088E 01	1.118E 01	1.157E 01	1.210E 01	1.303E 01	1.500E 01	

NBB	NRZC	NMTRES	JRZL	JZPUL	MPRIN	ANGLE
2	1	1	20	40	25	1.000E 00

ERROR = 0

LOZMIZ = 0

ZONING CONSTANTS

RATIO 1.030E 00 TO ZONE 109

BLACK BODY TEMPERATURE AND ASSOCIATED ENERGY

TEMPERATURE	ENERGY
4.000E 00	3.500E 01
8.000E 00	2.500E 01

JFIN	JCVCS	NTEST	NTAPE	CKP	TS	TIME	SOUR
110	550	30	25	7.000E-01	1.000E-06	1.000E-12	3.000E-08

MATERIAL PROPERTIES FOR MATL 1
 MATERIAL THICKNESS = 9.025E-01
 EQSTC 9.40000E 10 2.19300E 10 EQSTD 1.12000E 11 EQSTG 1.00000E 00 EQSTM 2.50000E-01 EQSTS 0 EQSTN 5.34577E-01 PMIN -1.00000E 00

NDE= 9
 AA B EDGE
 9.05150E 02 -2.40560E 00 1.18000E-01
 7.14610E 02 -2.61910E 00 2.84000E-01
 9.97100E 02 -2.68850E 00 5.32000E-01
 2.93390E 03 -2.80990E 00 1.84240E 00
 9.04420E 03 -2.81510E 00 1.23960E 01
 1.00730E 03 -2.13040E 00 4.13200E 01
 1.04270E 02 -1.50740E 00 4.95840E 01
 1.62300E 01 -1.03340E 00 6.19800E 01
 2.31340E 00 -5.70370E-01 1.50000E 02

J	DX	A	ERGS	CAL	SUM CAL	ERGS/GM	VELOCITY	ZONE	MASS
2	1.00000E-03	1.00000E-03	5.57191E 07	1.33108E 00	1.33108E 00	3.54898E 10	0	1.57000E-03	2
3	1.03000E-03	2.03000E-03	4.41541E 07	9.05490E 00	2.38598E 00	2.73045E 10	0	1.61710E-03	3
4	1.06090E-03	3.09090E-03	3.78997E 07	9.05391E 01	3.29128E 00	2.27542E 10	0	1.66561E-03	4
5	1.09207E-03	4.18363E-03	3.40457E 07	8.13322E-01	4.10460E 00	1.98450E 10	0	1.71559E-03	5
6	1.12551E-03	5.30914E-03	3.13833E 07	7.49721E-01	4.85432E 00	1.77603E 10	0	1.76705E-03	6
7	1.15927E-03	6.46841E-03	2.93869E 07	7.02025E-01	5.55635E 00	1.61460E 10	0	1.82006E-03	7
8	1.19405E-03	7.66246E-03	2.78075E 07	6.64299E-01	6.22064E 00	1.48334E 10	0	1.87466E-03	8
9	1.22987E-03	8.89234E-03	2.65148E 07	6.33416E-01	6.85406E 00	1.37318E 10	0	1.93093E-03	9
10	1.26677E-03	1.01591E-02	2.54314E 07	6.07353E-01	7.46159E 00	1.27871E 10	0	1.98883E-03	10
11	1.30477E-03	1.14639E-02	2.45076E 07	5.85466E-01	8.04706E 00	1.19637E 10	0	2.04849E-03	11
12	1.34392E-03	1.28078E-02	2.37093E 07	5.66396E-01	8.61346E 00	1.12369E 10	0	2.10995E-03	12
13	1.38423E-03	1.41920E-02	2.30120E 07	5.49737E-01	9.16319E 00	1.05888E 10	0	2.17325E-03	13
14	1.42576E-03	1.56178E-02	2.23973E 07	5.35054E-01	9.69825E 00	1.00058E 10	0	2.23844E-03	14
15	1.46853E-03	1.70863E-02	2.18516E 07	5.22015E-01	1.02203E 01	9.47761E 09	0	2.30560E-03	15
16	1.51259E-03	1.85989E-02	2.13639E 07	5.10365E-01	1.07306E 01	8.99620E 09	0	2.37477E-03	16
17	1.55797E-03	2.01569E-02	2.09257E 07	4.99898E-01	1.12305E 01	8.55504E 09	0	2.44601E-03	17
18	1.60471E-03	2.17616E-02	2.05302E 07	4.90450E-01	1.17210E 01	8.14889E 09	0	2.51939E-03	18
19	1.65285E-03	2.34144E-02	2.01718E 07	4.81897E-01	1.22029E 01	7.77341E 09	0	2.59497E-03	19
20	1.70243E-03	2.51169E-02	1.98457E 07	4.74099E-01	1.26770E 01	7.42502E 09	0	2.67282E-03	20
21	1.75351E-03	2.68704E-02	1.95482E 07	4.66991E-01	1.31439E 01	7.10069E 09	0	2.75300E-03	21
22	1.80611E-03	2.86765E-02	1.92760E 07	4.60497E-01	1.36044E 01	6.79786E 09	0	2.83559E-03	22
23	1.86029E-03	3.05368E-02	1.90262E 07	4.54520E-01	1.40590E 01	6.51435E 09	0	2.92066E-03	23
24	1.91610E-03	3.24529E-02	1.87966E 07	4.49035E-01	1.45080E 01	6.24828E 09	0	3.00828E-03	24
25	1.97359E-03	3.44265E-02	1.85851E 07	4.43983E-01	1.49520E 01	5.99804E 09	0	3.09853E-03	25
26	2.03279E-03	3.64593E-02	1.83900E 07	4.39322E-01	1.53913E 01	5.76220E 09	0	3.19149E-03	26
27	2.09378E-03	3.85530E-02	1.82098E 07	4.35016E-01	1.58263E 01	5.53955E 09	0	3.28723E-03	27
28	2.15659E-03	4.07096E-02	1.80431E 07	4.31035E-01	1.62573E 01	5.32898E 09	0	3.38585E-03	28
29	2.22129E-03	4.29309E-02	1.78889E 07	4.27351E-01	1.66847E 01	5.12955E 09	0	3.48742E-03	29
30	2.28793E-03	4.52189E-02	1.77462E 07	4.23944E-01	1.71086E 01	4.94041E 09	0	3.59205E-03	30
31	2.35657E-03	4.75754E-02	1.76140E 07	4.20784E-01	1.75294E 01	4.76080E 09	0	3.69981E-03	31
32	2.42726E-03	5.00027E-02	1.74917E 07	4.17862E-01	1.79473E 01	4.59004E 09	0	3.81080E-03	32
33	2.50008E-03	5.25028E-02	1.73786E 07	4.15160E-01	1.83624E 01	4.42752E 09	0	3.92513E-03	33
34	2.57508E-03	5.50776E-02	1.72740E 07	4.12661E-01	1.87751E 01	4.27270E 09	0	4.04289E-03	34
35	2.65234E-03	5.77302E-02	1.71775E 07	4.10355E-01	1.91855E 01	4.12507E 09	0	4.16417E-03	35
36	2.73191E-03	6.04621E-02	1.70895E 07	4.08230E-01	1.95937E 01	3.98418E 09	0	4.28909E-03	36
37	2.81386E-03	6.32759E-02	1.70067E 07	4.06276E-01	2.00000E 01	3.84962E 09	0	4.41776E-03	37
38	2.89828E-03	6.61742E-02	1.69317E 07	4.04483E-01	2.04045E 01	3.72100E 09	0	4.55030E-03	38
39	2.98523E-03	6.91594E-02	1.68630E 07	4.02844E-01	2.08073E 01	3.59798E 09	0	4.68681E-03	39
40	3.07478E-03	7.22342E-02	1.68005E 07	4.01350E-01	2.12086E 01	3.48023E 09	0	4.82741E-03	40
41	3.16703E-03	7.54013E-02	1.67438E 07	3.99995E-01	2.16086E 01	3.36746E 09	0	4.97274E-03	41
42	3.26204E-03	7.86633E-02	1.66926E 07	3.98772E-01	2.20074E 01	3.25938E 09	0	5.12140E-03	42
43	3.35990E-03	8.20232E-02	1.66467E 07	3.97675E-01	2.24051E 01	3.15574E 09	0	5.27504E-03	43
44	3.46070E-03	8.54830E-02	1.66058E 07	3.96698E-01	2.28018E 01	3.05630E 09	0	5.43299E-03	44
45	3.56452E-03	8.90484E-02	1.65697E 07	3.95836E-01	2.31976E 01	2.96083E 09	0	5.59629E-03	45
46	3.67145E-03	9.27199E-02	1.65382E 07	3.95083E-01	2.35927E 01	2.86913E 09	0	5.76414E-03	46
47	3.78160E-03	9.65015E-02	1.65110E 07	3.94435E-01	2.39871E 01	2.78099E 09	0	5.93711E-03	47
48	3.89504E-03	1.00397E-01	1.64881E 07	3.93886E-01	2.43810E 01	2.69623E 09	0	6.11522E-03	48
49	4.01190E-03	1.04408E-01	1.64690E 07	3.93431E-01	2.47745E 01	2.61448E 09	0	6.29469E-03	49
50	4.13225E-03	1.08541E-01	1.64538E 07	3.93067E-01	2.51675E 01	2.53617E 09	0	6.48764E-03	50

*** TEST PROBLEM NO. 2 *** TWO BLACK BODY SPECTRUM ***

J	DX	X	ERGS	CAL	SUM CAL	ERGS/GM	VELOCITY	ZONE MASS	J
51	4.25622E-03	1.12797E-01	1.54420E 07	3.92784E-01	2.55603E 01	2.46055E 04	0	6.64226E-03	51
52	4.38391E-03	1.17181E-01	1.64336E 07	3.92586E-01	2.59529E 01	2.38766E 04	0	6.88273E-03	52
53	4.51542E-03	1.21596E-01	1.64284E 07	3.92460E-01	2.63454E 01	2.31738E 04	0	7.08921E-03	53
54	4.65049E-03	1.26347E-01	1.64260E 07	3.92404E-01	2.67378E 01	2.24956E 04	0	7.30189E-03	54
55	4.79041E-03	1.31137E-01	1.64264E 07	3.92412E-01	2.71302E 01	2.18408E 04	0	7.52095E-03	55
56	4.93412E-03	1.36072E-01	1.64292E 07	3.92480E-01	2.75227E 01	2.12083E 04	0	7.74658E-03	56
57	5.08215E-03	1.41154E-01	1.64343E 07	3.92631E-01	2.79153E 01	2.05970E 04	0	7.97897E-03	57
58	5.23461E-03	1.46388E-01	1.64413E 07	3.92770E-01	2.83080E 01	2.00057E 04	0	8.21834E-03	58
59	5.39165E-03	1.51780E-01	1.64502E 07	3.92930E-01	2.87010E 01	1.94334E 04	0	8.46489E-03	59
60	5.55340E-03	1.57333E-01	1.64605E 07	3.93227E-01	2.90942E 01	1.88792E 04	0	8.71824E-03	60
61	5.72000E-03	1.63053E-01	1.64720E 07	3.93503E-01	2.94877E 01	1.83422E 04	0	8.94040E-03	61
62	5.89160E-03	1.68945E-01	1.64846E 07	3.93802E-01	2.98815E 01	1.78215E 04	0	9.24982E-03	62
63	6.06835E-03	1.75013E-01	1.64978E 07	3.94119E-01	3.02757E 01	1.73163E 04	0	9.52731E-03	63
64	6.25040E-03	1.81264E-01	1.65114E 07	3.94444E-01	3.06701E 01	1.68258E 04	0	9.81131E-03	64
65	6.43791E-03	1.87702E-01	1.65251E 07	3.94772E-01	3.10649E 01	1.63493E 04	0	1.01075E-02	65
66	6.63105E-03	1.94333E-01	1.65387E 07	3.95095E-01	3.14600E 01	1.58861E 04	0	1.04108E-02	66
67	6.82998E-03	2.01163E-01	1.65517E 07	3.95406E-01	3.18554E 01	1.54356E 04	0	1.07231E-02	67
68	7.03488E-03	2.08198E-01	1.65639E 07	3.95698E-01	3.22511E 01	1.49971E 04	0	1.10448E-02	68
69	7.24593E-03	2.15444E-01	1.65750E 07	3.95963E-01	3.26470E 01	1.45700E 04	0	1.13761E-02	69
70	7.46331E-03	2.22907E-01	1.65847E 07	3.96193E-01	3.30432E 01	1.41539E 04	0	1.17174E-02	70
71	7.68721E-03	2.30594E-01	1.65925E 07	3.96381E-01	3.34396E 01	1.37481E 04	0	1.20689E-02	71
72	7.91782E-03	2.38512E-01	1.65983E 07	3.96519E-01	3.38361E 01	1.33524E 04	0	1.24310E-02	72
73	8.15536E-03	2.46667E-01	1.66017E 07	3.96600E-01	3.42327E 01	1.29661E 04	0	1.28039E-02	73
74	8.40002E-03	2.55067E-01	1.66023E 07	3.96615E-01	3.46293E 01	1.25889E 04	0	1.31880E-02	74
75	8.65202E-03	2.63719E-01	1.65999E 07	3.96557E-01	3.50259E 01	1.22205E 04	0	1.35937E-02	75
76	8.91158E-03	2.72631E-01	1.65941E 07	3.96420E-01	3.54223E 01	1.18604E 04	0	1.39912E-02	76
77	9.17893E-03	2.81810E-01	1.65847E 07	3.96195E-01	3.58185E 01	1.15085E 04	0	1.44109E-02	77
78	9.45429E-03	2.91264E-01	1.65714E 07	3.95877E-01	3.62144E 01	1.11643E 04	0	1.48432E-02	78
79	9.73792E-03	3.01002E-01	1.65539E 07	3.95458E-01	3.66098E 01	1.08276E 04	0	1.52885E-02	79
80	1.00301E-02	3.11032E-01	1.65319E 07	3.94932E-01	3.70049E 01	1.04983E 04	0	1.57472E-02	80
81	1.03310E-02	3.21363E-01	1.65052E 07	3.94294E-01	3.73991E 01	1.01760E 04	0	1.62196E-02	81
82	1.06409E-02	3.32004E-01	1.64735E 07	3.93538E-01	3.77925E 01	9.86072E 03	0	1.67062E-02	82
83	1.09601E-02	3.42964E-01	1.64367E 07	3.92659E-01	3.81853E 01	9.55213E 03	0	1.72074E-02	83
84	1.12889E-02	3.54253E-01	1.63946E 07	3.91653E-01	3.85769E 01	9.25014E 03	0	1.77236E-02	84
85	1.16276E-02	3.65881E-01	1.63470E 07	3.90515E-01	3.89674E 01	8.95463E 03	0	1.82553E-02	85
86	1.19764E-02	3.77857E-01	1.62937E 07	3.89242E-01	3.93567E 01	8.6549E 03	0	1.88070E-02	86
87	1.23357E-02	3.90193E-01	1.62347E 07	3.87832E-01	3.97445E 01	8.38262E 03	0	1.93671E-02	87
88	1.27058E-02	4.02898E-01	1.61698E 07	3.86282E-01	4.01308E 01	8.10594E 03	0	1.99481E-02	88
89	1.30870E-02	4.15985E-01	1.60990E 07	3.84591E-01	4.05154E 01	7.83538E 03	0	2.05655E-02	89
90	1.34796E-02	4.29465E-01	1.60222E 07	3.82757E-01	4.08981E 01	7.57089E 03	0	2.11629E-02	90
91	1.38839E-02	4.43349E-01	1.59395E 07	3.80780E-01	4.12789E 01	7.31242E 03	0	2.17979E-02	91
92	1.43005E-02	4.57649E-01	1.58508E 07	3.78661E-01	4.16576E 01	7.05992E 03	0	2.24517E-02	92
93	1.47295E-02	4.72379E-01	1.57561E 07	3.76400E-01	4.20340E 01	6.81334E 03	0	2.31253E-02	93
94	1.51714E-02	4.87550E-01	1.56556E 07	3.73999E-01	4.24080E 01	6.57271E 03	0	2.38199E-02	94
95	1.56265E-02	5.03177E-01	1.55492E 07	3.71458E-01	4.27794E 01	6.33793E 03	0	2.45336E-02	95
96	1.60953E-02	5.19272E-01	1.54372E 07	3.68782E-01	4.31482E 01	6.10992E 03	0	2.52656E-02	96
97	1.65782E-02	5.35850E-01	1.53196E 07	3.65973E-01	4.35142E 01	5.89598E 03	0	2.60277E-02	97
98	1.70755E-02	5.52924E-01	1.51966E 07	3.63034E-01	4.38772E 01	5.66856E 03	0	2.68085E-02	98
99	1.75878E-02	5.70513E-01	1.50653E 07	3.59696E-01	4.42372E 01	5.45700E 03	0	2.76129E-02	99
100	1.81154E-02	5.88629E-01	1.49350E 07	3.56793E-01	4.45940E 01	5.25117E 03	0	2.84412E-02	100

*** TEST PROBLEM NO. 2 *** TWO BLACK BODY SPECTRUM ***

J	DX	X	ERGS	CAL	SUM CAL	ERGS/GM	VELOCITY	ZONE MASS	J
101	1.86589E-02	6.07288E-01	1.47967E 07	3.53451E-01	4.49475E 01	5.05103E 08	0	2.97944E-02	101
102	1.92186E-02	6.26506E-01	1.46538E 07	3.50066E-01	4.52915E 01	4.85654E 08	0	3.01733E-02	102
103	1.97952E-02	6.46302E-01	1.45063E 07	3.46544E-01	4.56441E 01	4.66765E 08	0	3.10784E-02	103
104	2.03890E-02	6.66691E-01	1.43547E 07	3.42921E-01	4.59870E 01	4.48432E 08	0	3.20108E-02	104
105	2.10007E-02	6.87691E-01	1.41990E 07	3.39202E-01	4.63262E 01	4.30649E 08	0	3.29711E-02	105
106	2.16307E-02	7.09322E-01	1.40395E 07	3.35392E-01	4.66616E 01	4.13410E 08	0	3.39603E-02	106
107	2.22797E-02	7.31602E-01	1.38745E 07	3.31497E-01	4.69911E 01	3.96707E 08	0	3.49791E-02	107
108	2.29481E-02	7.54550E-01	1.37101E 07	3.27522E-01	4.73206E 01	3.80535E 08	0	3.60234E-02	108
109	2.36365E-02	7.78186E-01	1.35406E 07	3.23473E-01	4.76441E 01	3.64884E 08	0	3.71093E-02	109
110	2.43456E-02	8.02532E-01	1.33683E 07	3.19356E-01	4.79614E 01	3.49748E 08	0	3.82226E-02	110

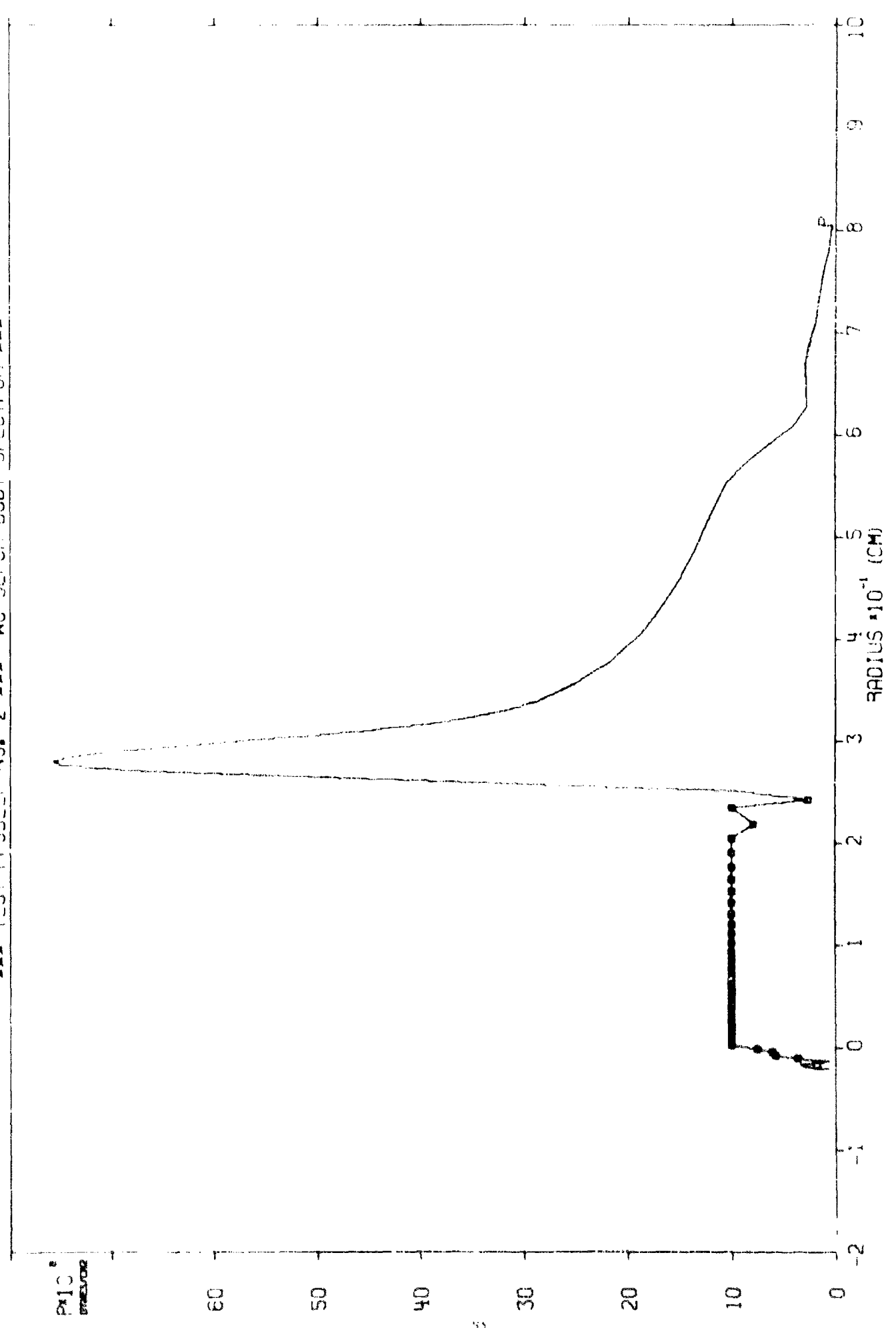
CYCLE DTPP	TIME DTPULS	DTNH ETOTAL	JSTAR EMVNEG	JPMAX EMVPOS	PHAX L-ROUND	XJPMAX X(JBND1)	MVPULSE X(JBND2)	MVPREC R-ROUND	MOMENTUM JFIN
25	4.7198E-10	7.9497E-11	100	2	8.7225E 08	1.0000E-03	-8.6107E-02	8.1221E-02	-4.8853E-03
-5.6009E-12	-9.8718E-11	7.0714E-01	-1.5238E-01	1.4749E-01	-4.0932E-08	0	0	8.0253E-01	110
CYCLE DTPP	TIME DTPULS	DTNH ETOTAL	JSTAR EMVNEG	JPMAX EMVPOS	PHAX L-ROUND	XJPMAX X(JBND1)	MVPULSE X(JBND2)	MVPREC R-ROUND	MOMENTUM JFIN
50	7.1041E-09	3.0000E-10	109	3	8.8265E 09	2.0375E-03	4.2791E 00	2.0560E 01	2.4839E 01
2.8142E-09	4.8480E-10	1.1354E 01	-3.1435E 01	3.1430E 01	-9.8675E-05	0	0	8.0253E-01	110
CYCLE DTPP	TIME DTPULS	DTNH ETOTAL	JSTAR EMVNEG	JPMAX EMVPOS	PHAX L-ROUND	XJPMAX X(JBND1)	MVPULSE X(JBND2)	MVPREC R-ROUND	MOMENTUM JFIN
75	1.4604E-08	3.0000E-10	109	5	1.4918E 10	4.2177E-03	3.7882E 01	7.6222E 01	1.1410E 02
7.6489E-09	2.5394E-09	2.3344E 01	-1.1286E 02	1.1285E 02	-3.9257E-04	0	0	8.0253E-01	110
CYCLE DTPP	TIME DTPULS	DTNH ETOTAL	JSTAR EMVNEG	JPMAX EMVPOS	PHAX L-ROUND	XJPMAX X(JBND1)	MVPULSE X(JBND2)	MVPREC R-ROUND	MOMENTUM JFIN
100	2.2104E-08	3.0000E-10	109	7	1.9476E 10	6.5430E-03	7.1662E 01	1.5437E 02	2.2603E 02
1.1606E-08	3.6794E-09	3.5333E 01	-2.2049E 02	2.2049E 02	-8.0308E-04	0	0	8.0253E-01	110
CYCLE DTPP	TIME DTPULS	DTNH ETOTAL	JSTAR EMVNEG	JPMAX EMVPOS	PHAX L-ROUND	XJPMAX X(JBND1)	MVPULSE X(JBND2)	MVPREC R-ROUND	MOMENTUM JFIN
125	2.9604E-08	3.0000E-10	109	9	2.3100E 10	9.0175E-03	1.0779E 02	2.4748E 02	3.5527E 02
1.5380E-08	4.6664E-09	4.7323E 01	-3.5421E 02	3.5420E 02	-1.3023E-03	0	0	8.0254E-01	110
CYCLE DTPP	TIME DTPULS	DTNH ETOTAL	JSTAR EMVNEG	JPMAX EMVPOS	PHAX L-ROUND	XJPMAX X(JBND1)	MVPULSE X(JBND2)	MVPREC R-ROUND	MOMENTUM JFIN
150	7.6735E-08	2.3019E-09	109	19	1.7129E 10	2.3932E-02	2.8285E 02	6.6286E 02	9.4572E 02
5.5212E-08	1.6513E-08	4.7806E 01	-9.3875E 02	9.3875E 02	-4.0210E-03	0	0	8.0258E-01	110
CYCLE DTPP	TIME DTPULS	DTNH ETOTAL	JSTAR EMVNEG	JPMAX EMVPOS	PHAX L-ROUND	XJPMAX X(JBND1)	MVPULSE X(JBND2)	MVPREC R-ROUND	MOMENTUM JFIN
175	1.4503E-07	3.2275E-09	109	29	1.4295E 10	4.3950E-02	4.2203E 02	1.0018E 03	1.4239E 03
9.9604E-08	2.9522E-08	4.7809E 01	-1.4188E 03	1.4188E 03	-7.0607E-03	0	0	8.0272E-01	110
CYCLE DTPP	TIME DTPULS	DTNH ETOTAL	JSTAR EMVNEG	JPMAX EMVPOS	PHAX L-ROUND	XJPMAX X(JBND1)	MVPULSE X(JBND2)	MVPREC R-ROUND	MOMENTUM JFIN
200	2.1357E-07	2.6840E-09	109	37	1.2745E 10	6.4627E-02	5.4678E 02	1.2019E 03	1.7487E 03
1.3721E-07	4.2902E-08	4.7809E 01	-1.7455E 03	1.7455E 03	-9.4889E-03	0	0	8.0285E-01	110
CYCLE DTPP	TIME DTPULS	DTNH ETOTAL	JSTAR EMVNEG	JPMAX EMVPOS	PHAX L-ROUND	XJPMAX X(JBND1)	MVPULSE X(JBND2)	MVPREC R-ROUND	MOMENTUM JFIN
225	2.8084E-07	2.6931E-09	109	43	1.1775E 10	8.3684E-02	6.3273E 02	1.3615E 03	1.9942E 03
1.6935E-07	5.3733E-08	4.7809E 01	-1.9913E 03	1.9913E 03	-1.1493E-02	0	0	8.0294E-01	110
CYCLE DTPP	TIME DTPULS	DTNH ETOTAL	JSTAR EMVNEG	JPMAX EMVPOS	PHAX L-ROUND	XJPMAX X(JBND1)	MVPULSE X(JBND2)	MVPREC R-ROUND	MOMENTUM JFIN
250	6.4040E-08	4.7809E 01	-2.1919E 03	2.1919E 03	-1.3114E-02	0	0	8.0303E-01	110

CYCLE DTPP	TIME DTPULS	DTNH ETOTAL	JSTAR EMVNEG	JPMAX EMVPOS	PMAX L-BOUND	XJPMAX X(JBND1)	MVPULSE X(JBND2)	MVPREC P-BOUND	MOMENTUM JFIN
275	4.1437E-07	2.9713E-09	109	52	1.0380E 10	1.1943E-01	7.4714E 02	1.5227E 03	2.3609E 03
2.2831E-07	7.1978E-08	4.7809E 01	-2.3625E 03	2.3625E 03	-1.4611E-02	0	0	2.0314E-01	110
CYCLE DTPP	TIME DTPULS	DTNH ETOTAL	JSTAR EMVNEG	JPMAX EMVPOS	PMAX L-BOUND	XJPMAX X(JBND1)	MVPULSE X(JBND2)	MVPREC P-BOUND	MOMENTUM JFIN
300	4.8169E-07	2.7669E-09	109	56	9.9014E 09	1.3850E-01	9.2052E 02	1.7004E 03	2.5209E 03
2.5460E-07	8.2870E-08	4.7809E 01	-2.5153E 03	2.5153E 03	-1.5869E-02	0	0	8.0326E-01	110
CYCLE DTPP	TIME DTPULS	DTNH ETOTAL	JSTAR EMVNEG	JPMAX EMVPOS	PMAX L-BOUND	XJPMAX X(JBND1)	MVPULSE X(JBND2)	MVPREC P-BOUND	MOMENTUM JFIN
325	5.5191E-07	2.6651E-09	109	60	9.4463E 09	1.5944E-01	9.2103E 02	1.7397E 03	2.6597E 03
2.8155E-07	9.7496E-08	4.7809E 01	-2.6554E 03	2.6554E 03	-1.7073E-02	0	0	8.0339E-01	110
CYCLE DTPP	TIME DTPULS	DTNH ETOTAL	JSTAR EMVNEG	JPMAX EMVPOS	PMAX L-BOUND	XJPMAX X(JBND1)	MVPULSE X(JBND2)	MVPREC P-BOUND	MOMENTUM JFIN
350	6.1926E-07	2.6823E-09	109	63	9.0781E 09	1.7773E-01	9.6300E 02	1.8134E 03	2.7764E 03
3.0583E-07	1.0608E-07	4.7809E 01	-2.7763E 03	2.7763E 03	-1.8012E-02	0	0	8.0345E-01	110
CYCLE DTPP	TIME DTPULS	DTNH ETOTAL	JSTAR EMVNEG	JPMAX EMVPOS	PMAX L-BOUND	XJPMAX X(JBND1)	MVPULSE X(JBND2)	MVPREC P-BOUND	MOMENTUM JFIN
375	6.8803E-07	2.6368E-09	109	66	8.7178E 09	1.9713E-01	1.0306E 03	1.8584E 03	2.8892E 03
3.3142E-07	1.1822E-07	4.7809E 01	-2.8870E 03	2.8870E 03	-1.8967E-02	0	0	8.0363E-01	110
CYCLE DTPP	TIME DTPULS	DTNH ETOTAL	JSTAR EMVNEG	JPMAX EMVPOS	PMAX L-BOUND	XJPMAX X(JBND1)	MVPULSE X(JBND2)	MVPREC P-BOUND	MOMENTUM JFIN
400	7.5661E-07	2.8794E-09	109	69	8.3002E 09	2.1831E-01	1.1275E 03	1.8691E 03	2.9956E 03
3.6091E-07	1.3584E-07	4.7809E 01	-2.9819E 03	2.9819E 03	-1.9742E-02	0	0	8.0376E-01	110
CYCLE DTPP	TIME DTPULS	DTNH ETOTAL	JSTAR EMVNEG	JPMAX EMVPOS	PMAX L-BOUND	XJPMAX X(JBND1)	MVPULSE X(JBND2)	MVPREC P-BOUND	MOMENTUM JFIN
425	8.2528E-07	2.7194E-09	109	71	8.1350E 09	2.3379E-01	1.1204E 03	1.9626E 03	3.0834E 03
3.7902E-07	1.3777E-07	4.7809E 01	-3.0796E 03	3.0796E 03	-2.0504E-02	0	0	8.0390E-01	110
CYCLE DTPP	TIME DTPULS	DTNH ETOTAL	JSTAR EMVNEG	JPMAX EMVPOS	PMAX L-BOUND	XJPMAX X(JBND1)	MVPULSE X(JBND2)	MVPREC P-BOUND	MOMENTUM JFIN
442	8.7133E-07	2.8330E-09	109	73	7.8481E 09	2.4977E-01	1.2110E 03	1.9243E 03	3.1453E 03
4.0077E-07	1.5430E-07	4.7809E 01	-3.1326E 03	3.1326E 03	-2.0889E-02	0	0	8.0399E-01	110
8.713E-07	442	-13	122						
8.713E-07	442	32	90						
CYCLE DTPP	TIME DTPULS	DTNH ETOTAL	JSTAR EMVNEG	JPMAX EMVPOS	PMAX L-BOUND	XJPMAX X(JBND1)	MVPULSE X(JBND2)	MVPREC P-BOUND	MOMENTUM JFIN
442	8.7133E-07	2.8330E-09	90	41	7.8481E 09	2.4977E-01	9.4474E 02	2.1774E 03	3.1221E 03
3.9782E-07	1.2038E-07	4.7793E 01	-3.0958E 03	3.0926E 03	-2.0889E-02	0	0	8.0399E-01	91
CYCLE DTPP	TIME DTPULS	DTNH ETOTAL	JSTAR EMVNEG	JPMAX EMVPOS	PMAX L-BOUND	XJPMAX X(JBND1)	MVPULSE X(JBND2)	MVPREC P-BOUND	MOMENTUM JFIN
445	8.7983E-07	2.7230E-09	90	41	7.9026E 09	2.4991E-01	8.9102E 02	2.2284E 03	3.1194E 03
3.9479E-07	1.1275E-07	4.7793E 01	-3.1135E 03	3.102E 03	-2.0974E-02	0	0	8.0401E-01	91

*** TEST PROBLEM NO. 2 *** TWO BLACK BODY SPECTRUM ***

TIME = 498

TIME = 1.000E+10



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APPENDIX V

TEST PROBLEM 3

(F PUFF)

12	CUSPI(2)	CUSPA(2)	CUSPC(2)	CUSPD(2)	CUSPG(2)	CUSPS(2)	
	6.33+9	.006	75+12	3096+12	1.59	0.	
11	RHO(2)	EQSTC(2)	EQSTD(2)	EQSTE(2)	EQSTG(2)	EQSTH(2)	EQSTS(2)
	2.78	1.04833+12	0.0	1.17+11	1.59	20	0.0
							PMIN(2)
							-1.+10
10	MATL(2)						
	MATL 2						
9	CUSPI(1)	CUSPA(1)	CUSPC(1)	CUSPD(1)	CUSPG(1)	CUSPS(1)	
	6.33+9	.006	75+12	3096+12	1.59	0.	
8	RHO(1)	EQSTC(1)	EQSTD(1)	EQSTE(1)	EQSTG(1)	EQSTH(1)	EQSTS(1)
	2.78	1.04833+12	0.0	1.17+11	1.59	20	0.0
							PMIN(1)
							-1.+10
7	MATL(1)						
	MATL 1						

6	DX	TIME	RZ(1)	RZ(2)	RZ(3)	RZ(4)	
	22-2	1-12	1.0	1.04	.451	1.0	
5	JFIN	NZ(1)	NZ(2)	NZ(3)	NZ(4)		
	201	100	160	161	200		
4	JBND(1)	JBND(2)					
	101	169					
3	UFACE	UZERO	UFIN2				
	.5	1.79+4	101.				
2	NRZC	NMTR_S	JRZL	JEPUL	NPRIN	NTAPE	NJEDIT
	4	3	20	40	50	25	0
1	DISCPT(I), I = 1, 10						
	*** TEST PROBLEM NO. 3 *** TWO-WAVE EQUATION OF STATE *** PLATE SLAP						

17	JCYCS 600	NTEST 30						
16	CKP 20	TS 24-6						
15	CUSP1(3) 0	CUSPA(3) 0	CUSPC(3) 0	CUSPD(3) 0	CUSPG(3) 0	CUSPS(3) 0		
14	RH0(3) 265	EQSTC(3) 8.6+11	EQSTD(3) -2.232+11	EQSTE(3) 887+10	EQSTG(3) .621	EQSTH(3) 25	EQSTS(3) 0.0	PWYN(3) -4. +09
13	MATL(3) MATL 3							

INPUT PARAMETERS FOR - -

** TEST PROBLEM NO. 3 *** TWO-WAVE EQUATION OF STATE *** PLATE SLAP
 *** THIS PROBLEM HAS RUN ON P-PUFF/1624 ****

NRZC	4	NMTRLS	3	JRZL	20	JZPUL	40	MPRTN	50	UFACE	5.000E-01	UZERO	1.700E-04	JFIN2	101
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ZONING CONSTANTS

RATIO	1.000E 00 TO ZONE	100
RATIO	1.040E 00 TO ZONE	160
RATIO	4.510E-01 TO ZONE	161
RATIO	1.000E 00 TO ZONE	200

JFIN	201	JCYCS	600	NTEST	30	NTAPE	75	CODE	00	CKP	15	TIME	2.400E-06	1.000E-12
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MATERIAL PROPERTIES FOR MATL 1									
MATERIAL THICKNESS = 2.200E-01									
EQSTC	EQSTD		EQSTE	EQSTG	EQSTH	EQSTS	EQSTN	PMIN	
1-04833E 12	0		1-17000E 11	1-59000E 00	2-00000E-01	0	2-02703E 00	-1-00000E 10	
CUSP1	CUSPA		CUSPC	CUSPD	CUSPG	CUSPS			
6-33000E 09	6-00000E-03		7-50000E 11	3-09600E 11	1-59000E 00	0			
MATERIAL PROPERTIES FOR MATL 2									
MATERIAL THICKNESS = 6.280E-01									
EQSTC	EQSTD		EQSTE	EQSTG	EQSTH	EQSTS	EQSTN	PMIN	
1-04833E 12	0		1-17000E 11	1-59000E 00	2-00000E-01	0	2-02703E 00	-1-00000E 10	
CUSP1	CUSPA		CUSPC	CUSPD	CUSPG	CUSPS			
6-33000E 09	6-00000E-03		7-50000E 11	3-09600E 11	1-59000E 00	0			
MATERIAL PROPERTIES FOR MATL 3									
MATERIAL THICKNESS = 3-340E-01									
EQSTC	EQSTD		EQSTE	EQSTG	EQSTH	EQSTS	EQSTN	PMIN	
8-60000E 11	-2-23200E 11		8-87000E 10	6-21000E-01	2-50000E-01	0	5-89145E 00	-4-00000E 00	

*** TEST PROBLEM NO. 3 *** TWO-WAVE EQUATION OF STATE *** PLATE SLAP

J	X	VELOCITY	ZONE	MASS
1	0	1.79000E-04	0	0
2	2.20000E-03	1.79000E-04	6.11600E-03	0
3	4.40000E-03	1.79000E-04	6.11600E-03	0
4	6.60000E-03	1.79000E-04	6.11600E-03	0
5	8.80000E-03	1.79000E-04	6.11600E-03	0
6	1.10000E-02	1.79000E-04	6.11600E-03	0
7	1.32000E-02	1.79000E-04	6.11600E-03	0
8	1.54000E-02	1.79000E-04	6.11600E-03	0
9	1.76000E-02	1.79000E-04	6.11600E-03	0
10	1.98000E-02	1.79000E-04	6.11600E-03	0
11	2.20000E-02	1.79000E-04	6.11600E-03	0
12	2.42000E-02	1.79000E-04	6.11600E-03	0
13	2.64000E-02	1.79000E-04	6.11600E-03	0
14	2.86000E-02	1.79000E-04	6.11600E-03	0
15	3.08000E-02	1.79000E-04	6.11600E-03	0
16	3.30000E-02	1.79000E-04	6.11600E-03	0
17	3.52000E-02	1.79000E-04	6.11600E-03	0
18	3.74000E-02	1.79000E-04	6.11600E-03	0
19	3.96000E-02	1.79000E-04	6.11600E-03	0
20	4.18000E-02	1.79000E-04	6.11600E-03	0
21	4.40000E-02	1.79000E-04	6.11600E-03	0
22	4.62000E-02	1.79000E-04	6.11600E-03	0
23	4.84000E-02	1.79000E-04	6.11600E-03	0
24	5.06000E-02	1.79000E-04	6.11600E-03	0
25	5.28000E-02	1.79000E-04	6.11600E-03	0
26	5.50000E-02	1.79000E-04	6.11600E-03	0
27	5.72000E-02	1.79000E-04	6.11600E-03	0
28	5.94000E-02	1.79000E-04	6.11600E-03	0
29	6.16000E-02	1.79000E-04	6.11600E-03	0
30	6.38000E-02	1.79000E-04	6.11600E-03	0
31	6.60000E-02	1.79000E-04	6.11600E-03	0
32	6.82000E-02	1.79000E-04	6.11600E-03	0
33	7.04000E-02	1.79000E-04	6.11600E-03	0
34	7.26000E-02	1.79000E-04	6.11600E-03	0
35	7.48000E-02	1.79000E-04	6.11600E-03	0
36	7.70000E-02	1.79000E-04	6.11600E-03	0
37	7.92000E-02	1.79000E-04	6.11600E-03	0
38	8.14000E-02	1.79000E-04	6.11600E-03	0
39	8.36000E-02	1.79000E-04	6.11600E-03	0
40	8.58000E-02	1.79000E-04	6.11600E-03	0
41	8.80000E-02	1.79000E-04	6.11600E-03	0
42	9.02000E-02	1.79000E-04	6.11600E-03	0
43	9.24000E-02	1.79000E-04	6.11600E-03	0
44	9.46000E-02	1.79000E-04	6.11600E-03	0
45	9.68000E-02	1.79000E-04	6.11600E-03	0
46	9.90000E-02	1.79000E-04	6.11600E-03	0
47	1.01200E-01	1.79000E-04	6.11600E-03	0
48	1.03400E-01	1.79000E-04	6.11600E-03	0
49	1.05600E-01	1.79000E-04	6.11600E-03	0
50	1.07800E-01	1.79000E-04	6.11600E-03	0

J	X	VELOCITY	ZONE	MASS
51	1.1000E-01	1.7900E 04	04	6.1160E-03
52	1.1220E-01	1.7900E 04	04	6.1160E-03
53	1.1440E-01	1.7900E 04	04	6.1160E-03
54	1.1660E-01	1.7900E 04	04	6.1160E-03
55	1.1880E-01	1.7900E 04	04	6.1160E-03
56	1.2100E-01	1.7900E 04	04	6.1160E-03
57	1.2320E-01	1.7900E 04	04	6.1160E-03
58	1.2540E-01	1.7900E 04	04	6.1160E-03
59	1.2760E-01	1.7900E 04	04	6.1160E-03
60	1.2980E-01	1.7900E 04	04	6.1160E-03
61	1.3200E-01	1.7900E 04	04	6.1160E-03
62	1.3420E-01	1.7900E 04	04	6.1160E-03
63	1.3640E-01	1.7900E 04	04	6.1160E-03
64	1.3860E-01	1.7900E 04	04	6.1160E-03
65	1.4080E-01	1.7900E 04	04	6.1160E-03
66	1.4300E-01	1.7900E 04	04	6.1160E-03
67	1.4520E-01	1.7900E 04	04	6.1160E-03
68	1.4740E-01	1.7900E 04	04	6.1160E-03
69	1.4960E-01	1.7900E 04	04	6.1160E-03
70	1.5180E-01	1.7900E 04	04	6.1160E-03
71	1.5400E-01	1.7900E 04	04	6.1160E-03
72	1.5620E-01	1.7900E 04	04	6.1160E-03
73	1.5840E-01	1.7900E 04	04	6.1160E-03
74	1.6060E-01	1.7900E 04	04	6.1160E-03
75	1.6280E-01	1.7900E 04	04	6.1160E-03
76	1.6500E-01	1.7900E 04	04	6.1160E-03
77	1.6720E-01	1.7900E 04	04	6.1160E-03
78	1.6940E-01	1.7900E 04	04	6.1160E-03
79	1.7160E-01	1.7900E 04	04	6.1160E-03
80	1.7380E-01	1.7900E 04	04	6.1160E-03
81	1.7600E-01	1.7900E 04	04	6.1160E-03
82	1.7820E-01	1.7900E 04	04	6.1160E-03
83	1.8040E-01	1.7900E 04	04	6.1160E-03
84	1.8260E-01	1.7900E 04	04	6.1160E-03
85	1.8480E-01	1.7900E 04	04	6.1160E-03
86	1.8700E-01	1.7900E 04	04	6.1160E-03
87	1.8920E-01	1.7900E 04	04	6.1160E-03
88	1.9140E-01	1.7900E 04	04	6.1160E-03
89	1.9360E-01	1.7900E 04	04	6.1160E-03
90	1.9580E-01	1.7900E 04	04	6.1160E-03
91	1.9800E-01	1.7900E 04	04	6.1160E-03
92	2.0020E-01	1.7900E 04	04	6.1160E-03
93	2.0240E-01	1.7900E 04	04	6.1160E-03
94	2.0460E-01	1.7900E 04	04	6.1160E-03
95	2.0680E-01	1.7900E 04	04	6.1160E-03
96	2.0900E-01	1.7900E 04	04	6.1160E-03
97	2.1120E-01	1.7900E 04	04	6.1160E-03
98	2.1340E-01	1.7900E 04	04	6.1160E-03
99	2.1560E-01	1.7900E 04	04	6.1160E-03
100	2.1780E-01	1.7900E 04	04	6.1160E-03

*** TEST PROBLEM NO. 3 *** TWO-WAVE EQUATION OF STATE *** PLATE SLAP

J	X	VELOCITY	ZONE	MASS
101	2.2000E-01	1.74250E 04	6.11600E-03	
102	2.22288E-01	8.95000E 03	6.36064E-03	
103	2.24668E-01	4.47500E 03	6.61507E-03	
104	2.27142E-01	0	6.87967E-03	

CYCLE	TIME	DTNH	JSTAR	JPMAX	PMAX	XJPMAX	MVPULSE	MVPRFC	MOMENTUM
25	4.7198E-11	7.9497E-09	106	101	9.4988E-03	2.2001E-01	1.1065E-04	1.1381E-02	1.1065E-04
DTPP	DTPULS	ETOTAL	EMVNEG	EMVPOS	L-ROUND	X(JBND1)	X(JBND2)	R-ROUND	JFIN
1.1167E-05	1.1167E-05	2.3488E-00	0	1.1065E-04	3.4495E-06	2.2001E-01	8.4802E-01	1.1920E-00	201
CYCLE	TIME	DTNH	JSTAR	JPMAX	PMAX	XJPMAX	MVPULSE	MVPRFC	MOMENTUM
50	2.5444E-08	1.8651E-09	114	103	1.4186E-10	2.2486E-01	1.0977E-04	9.0577E-01	1.1065E-04
DTPP	DTPULS	ETOTAL	EMVNEG	EMVPOS	L-ROUND	X(JBND1)	X(JBND2)	R-ROUND	JFIN
7.8000E-07	7.7362E-07	2.3528E-00	0	1.1065E-04	4.5546E-04	2.2026E-01	8.4802E-01	1.1920E-00	201
CYCLE	TIME	DTNH	JSTAR	JPMAX	PMAX	XJPMAX	MVPULSE	MVPRFC	MOMENTUM
51	2.7309E-08	1.8670E-09	115	103	1.4187E-10	2.2487E-01	1.0954E-04	1.1114E-02	1.1065E-04
DTPP	DTPULS	ETOTAL	EMVNEG	EMVPOS	L-ROUND	X(JBND1)	X(JBND2)	R-ROUND	JFIN
7.7991E-07	7.7207E-07	2.3528E-00	0	1.1065E-04	4.8893E-04	2.2028E-01	8.4802E-01	1.1920E-00	201
2.731E-08	51	46	69						
CYCLE	TIME	DTNH	JSTAR	JPMAX	PMAX	XJPMAX	MVPULSE	MVPRFC	MOMENTUM
51	2.7309E-08	1.8670E-09	69	57	1.4187E-10	2.2487E-01	1.0954E-04	1.1114E-02	1.1065E-04
DTPP	DTPULS	ETOTAL	EMVNEG	EMVPOS	L-ROUND	X(JBND1)	X(JBND2)	R-ROUND	JFIN
7.7991E-07	7.7207E-07	2.3526E-00	0	1.1065E-04	4.8883E-04	2.2028E-01	8.4802E-01	1.1920E-00	155
CYCLE	TIME	DTNH	JSTAR	JPMAX	PMAX	XJPMAX	MVPULSE	MVPRFC	MOMENTUM
75	7.9672E-08	2.2119E-09	79	59	1.4425E-10	2.3031E-01	1.0368E-04	6.9712E-02	1.1065E-04
DTPP	DTPULS	ETOTAL	EMVNEG	EMVPOS	L-ROUND	X(JBND1)	X(JBND2)	R-ROUND	JFIN
7.6707E-07	7.1874E-07	2.3529E-00	0	1.1065E-04	1.4261E-03	2.2075E-01	8.4802E-01	1.1920E-00	155
CYCLE	TIME	DTNH	JSTAR	JPMAX	PMAX	XJPMAX	MVPULSE	MVPRFC	MOMENTUM
100	1.3684E-07	2.3944E-09	87	69	1.4349E-10	2.6245E-01	1.0475E-04	5.8966E-02	1.1065E-04
DTPP	DTPULS	ETOTAL	EMVNEG	EMVPOS	L-ROUND	X(JBND1)	X(JBND2)	R-ROUND	JFIN
7.7114E-07	7.3005E-07	2.3532E-00	0	1.1065E-04	2.4495E-03	2.2126E-01	8.4802E-01	1.1920E-00	155
CYCLE	TIME	DTNH	JSTAR	JPMAX	PMAX	XJPMAX	MVPULSE	MVPRFC	MOMENTUM
125	2.0342E-07	2.6569E-09	93	77	1.4298E-10	2.9897E-01	1.0564E-04	5.0080E-02	1.1065E-04
DTPP	DTPULS	ETOTAL	EMVNEG	EMVPOS	L-ROUND	X(JBND1)	X(JBND2)	R-ROUND	JFIN
7.7385E-07	7.3883E-07	2.3536E-00	0	1.1065E-04	3.6413E-03	2.2186E-01	8.4802E-01	1.1920E-00	155
CYCLE	TIME	DTNH	JSTAR	JPMAX	PMAX	XJPMAX	MVPULSE	MVPRFC	MOMENTUM
150	2.7336E-07	2.8567E-09	99	83	1.4264E-10	3.3499E-01	1.0571E-04	4.9390E-02	1.1065E-04
DTPP	DTPULS	ETOTAL	EMVNEG	EMVPOS	L-ROUND	X(JBND1)	X(JBND2)	R-ROUND	JFIN
7.7574E-07	7.4111E-07	2.3538E-00	0	1.1065E-04	4.8931E-03	2.2248E-01	8.4802E-01	1.1920E-00	155
CYCLE	TIME	DTNH	JSTAR	JPMAX	PMAX	XJPMAX	MVPULSE	MVPRFC	MOMENTUM
152	2.7823E-07	2.8667E-09	99	83	1.4261E-10	3.3504E-01	1.0513E-04	5.5228E-02	1.1065E-04
DTPP	DTPULS	ETOTAL	EMVNEG	EMVPOS	L-ROUND	X(JBND1)	X(JBND2)	R-ROUND	JFIN
7.7586E-07	7.3714E-07	2.3535E-00	0	1.1065E-04	4.9803E-03	2.2253E-01	8.4802E-01	1.1920E-00	155
2.782E-07	152	34	65						
CYCLE	TIME	DTNH	JSTAR	JPMAX	PMAX	XJPMAX	MVPULSE	MVPRFC	MOMENTUM
152	2.7823E-07	2.8667E-09	65	49	1.4261E-10	3.3504E-01	1.0513E-04	5.5228E-02	1.1065E-04
DTPP	DTPULS	ETOTAL	EMVNEG	EMVPOS	L-ROUND	X(JBND1)	X(JBND2)	R-ROUND	JFIN
7.7586E-07	7.3714E-07	2.3527E-00	0	1.1065E-04	4.9803E-03	2.2253E-01	8.4802E-01	1.1920E-00	121

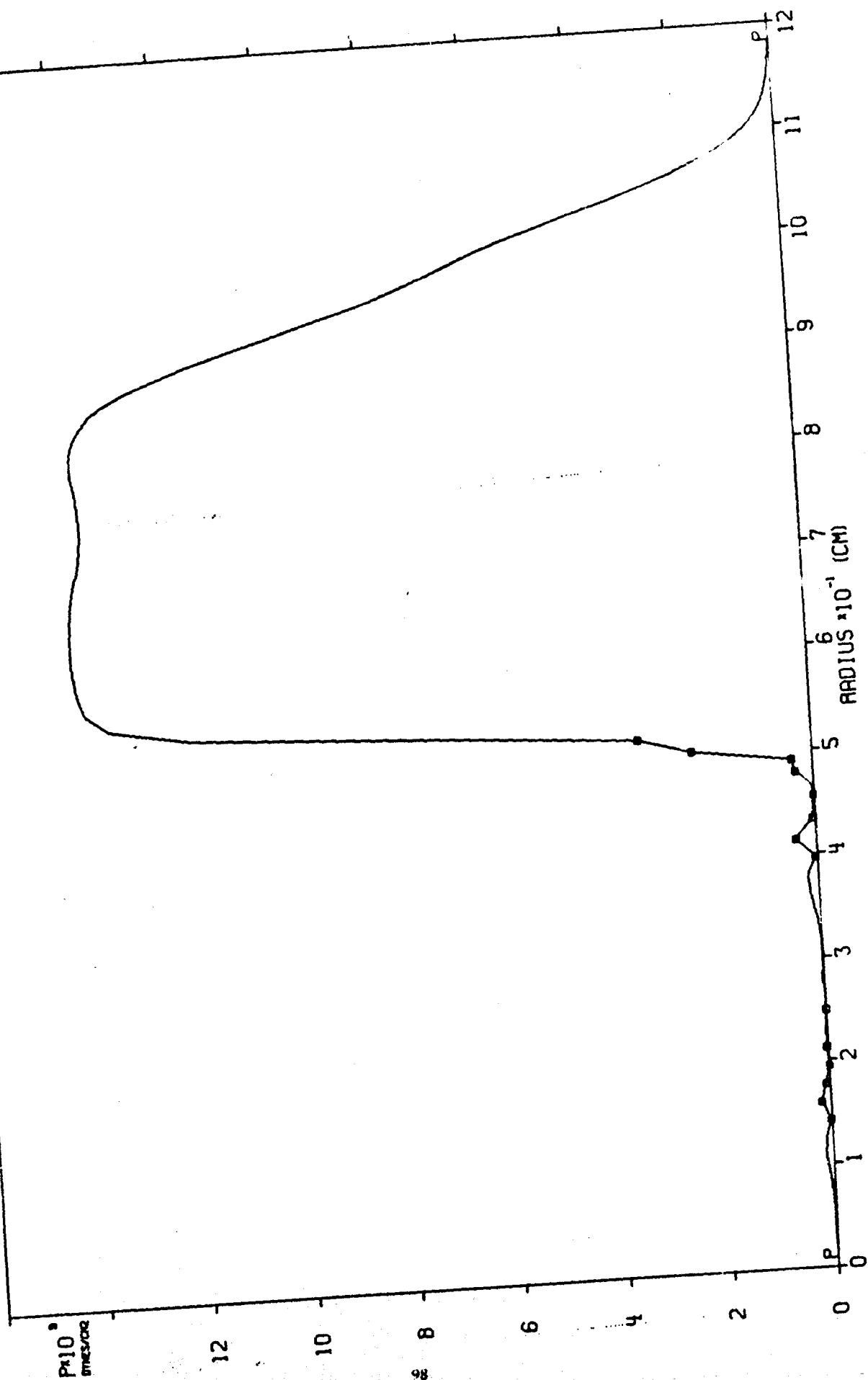
CYCLE	TIME	DTNH	JSTAR	JPMAX	PMAX	XJPMAX	M/PULSE	MVPREC	MOMENTUM
175	3.2447E-07	1.9101E-09	69	52	1.4237E 10	3.5653E-01	1.0455E 04	5.2945E 02	1.1065E 04
DTPP	DTPULS	ETOTAL	EMVNEG	EMVPOS	L-ROUND	X(JRND1)	X(JRND2)	P-ROUND	JFIN
7.7721E-07	7.3439E-07	2.3517E 00	0	1.1065E 04	5.7940E-03	2.2294E-01	8.4402E-01	1.1820E 00	121
CYCLE	TIME	DTNH	JSTAR	JPMAX	PMAX	XJPMAX	M/PULSE	MVPREC	MOMENTUM
200	3.0108E-07	2.8654E-09	71	22	1.4226E 10	1.3901E-01	4.2465E 03	5.8184E 03	1.1065E 04
DTPP	DTPULS	ETOTAL	EMVNEG	EMVPOS	L-ROUND	X(JRND1)	X(JRND2)	P-ROUND	JFIN
7.7779E-07	2.9850E-07	2.3518E 00	0	1.1065E 04	6.5634E-03	2.2345E-01	8.4402E-01	1.1820E 00	121
CYCLE	TIME	DTNH	JSTAR	JPMAX	PMAX	XJPMAX	M/PULSE	MVPREC	MOMENTUM
225	4.3673E-07	2.8649E-09	74	25	1.4219E 10	1.6549E-01	4.1142E 03	6.9594E 03	1.1065E 04
DTPP	DTPULS	ETOTAL	EMVNEG	EMVPOS	L-ROUND	X(JRND1)	X(JRND2)	P-ROUND	JFIN
7.7816E-07	2.8934E-07	2.3491E 00	0	1.1065E 04	6.5944E-03	2.2394E-01	8.4402E-01	1.1820E 00	121
CYCLE	TIME	DTNH	JSTAR	JPMAX	PMAX	XJPMAX	M/PULSE	MVPREC	MOMENTUM
250	4.9869E-07	1.9111E-09	77	29	1.4216E 10	2.0068E-01	3.8310E 03	7.2341E 03	1.1065E 04
DTPP	DTPULS	ETOTAL	EMVNEG	EMVPOS	L-ROUND	X(JRND1)	X(JRND2)	P-ROUND	JFIN
7.7836E-07	2.6949E-07	2.3482E 00	-1.0311E-01	1.1065E 04	6.9904E-03	2.2450E-01	8.4402E-01	1.1820E 00	121
CYCLE	TIME	DTNH	JSTAR	JPMAX	PMAX	XJPMAX	M/PULSE	MVPREC	MOMENTUM
275	5.5725E-07	2.8662E-09	79	35	1.4213E 10	2.2961E-01	3.7275E 03	7.3439E 03	1.1071E 04
DTPP	DTPULS	ETOTAL	EMVNEG	EMVPOS	L-ROUND	X(JRND1)	X(JRND2)	P-ROUND	JFIN
7.7896E-07	2.6226E-07	2.3480E 00	-7.6949E 00	1.1073E 04	6.9879E-03	2.2502E-01	8.4402E-01	1.1820E 00	121
CYCLE	TIME	DTNH	JSTAR	JPMAX	PMAX	XJPMAX	M/PULSE	MVPREC	MOMENTUM
300	6.1329E-07	2.2931E-09	82	40	1.4212E 10	2.5936E-01	3.9070E 03	7.1692E 03	1.1076E 04
DTPP	DTPULS	ETOTAL	EMVNEG	EMVPOS	L-ROUND	X(JRND1)	X(JRND2)	P-ROUND	JFIN
7.7936E-07	2.7491E-07	2.3478E 00	-1.1212E 01	1.1076E 04	6.9347E-03	2.2552E-01	8.4402E-01	1.1820E 00	121
CYCLE	TIME	DTNH	JSTAR	JPMAX	PMAX	XJPMAX	M/PULSE	MVPREC	MOMENTUM
325	6.7554E-07	2.8668E-09	86	44	1.4208E 10	2.9313E-01	4.0581E 03	7.0240E 03	1.1082E 04
DTPP	DTPULS	ETOTAL	EMVNEG	EMVPOS	L-ROUND	X(JRND1)	X(JRND2)	P-ROUND	JFIN
7.7997E-07	2.8562E-07	2.3476E 00	-1.6223E 01	1.1081E 04	6.9314E-03	2.2608E-01	8.4402E 01	1.1820E 00	121
CYCLE	TIME	DTNH	JSTAR	JPMAX	PMAX	XJPMAX	M/PULSE	MVPREC	MOMENTUM
350	7.3532E-07	2.7520E-09	90	47	1.4205E 10	3.2639E-01	3.7152E 03	7.3629E 03	1.1095E 04
DTPP	DTPULS	ETOTAL	EMVNEG	EMVPOS	L-ROUND	X(JRND1)	X(JRND2)	P-ROUND	JFIN
7.8036E-07	2.6154E-07	2.3474E 00	-2.0994E 01	1.1086E 04	6.9792E-03	2.2659E-01	8.4402E-01	1.1820E 00	121
CYCLE	TIME	DTNH	JSTAR	JPMAX	PMAX	XJPMAX	M/PULSE	MVPREC	MOMENTUM
375	8.0053E-07	2.8594E-09	94	52	1.4203E 10	3.6079E-01	3.7859E 03	7.3728E 03	1.1099E 04
DTPP	DTPULS	ETOTAL	EMVNEG	EMVPOS	L-ROUND	X(JRND1)	X(JRND2)	P-ROUND	JFIN
7.8143E-07	2.6656E-07	2.3479E 00	-3.7061E 01	1.1102E 04	6.9764E-03	2.2698E-01	8.4402E-01	1.1820E 00	121
CYCLE	TIME	DTNH	JSTAR	JPMAX	PMAX	XJPMAX	M/PULSE	MVPREC	MOMENTUM
400	8.5479E-07	2.7509E-09	97	56	1.4201E 10	3.9352E-01	3.9645E 03	7.1471E 03	1.1112E 04
DTPP	DTPULS	ETOTAL	EMVNEG	EMVPOS	L-ROUND	X(JRND1)	X(JRND2)	P-ROUND	JFIN
7.8245E-07	2.7916E-07	2.3471E 00	-4.4685E 01	1.1110E 04	6.9746E-03	2.2698E-01	8.4403E-01	1.1820E 00	121

CYCLE	TIME	DTNH	JSTAR	JPMAX	PMAX	XJPMAX	MVPULSE	MVPREC	MOMENTUM
425	9.1265E-07	1.9110E-09	101	59	1.4200E 10	4.2173E-01	3.9657E 03	7.1619E 03	1.1116E 04
OTPP	OTPULS	ETOTAL	EMVNEG	EMVPOS	L-ROUND	X(JBND1)	X(JBND2)	R-ROUND	JFIN
7.6422E-07	2.7935E-07	2.3460E 00	-5.9131E 01	1.1124E 04	5.9722E-03	2.2696E-01	5.4904E-01	1.1820E 00	121
CYCLE	TIME	DTNH	JSTAR	JPMAX	PMAX	XJPMAX	MVPULSE	MVPREC	MOMENTUM
450	9.7051E-07	1.9111E-09	104	62	1.4198E 10	4.5349E-01	4.0805E 03	7.0845E 03	1.1145E 04
OTPP	OTPULS	ETOTAL	EMVNEG	EMVPOS	L-ROUND	X(JBND1)	X(JBND2)	R-ROUND	JFIN
7.8638E-07	2.8740E-07	2.3456E 00	-7.9253E 01	1.1144E 04	5.9597E-03	2.2697E-01	5.4907E-01	1.1820E 00	121
CYCLE	TIME	DTNH	JSTAR	JPMAX	PMAX	XJPMAX	MVPULSE	MVPREC	MOMENTUM
475	1.0268E-06	1.9111E-09	108	65	1.4196E 10	4.5909E-01	4.3064E 03	6.3553E 03	1.1172E 04
OTPP	OTPULS	ETOTAL	EMVNEG	EMVPOS	L-ROUND	X(JBND1)	X(JBND2)	R-ROUND	JFIN
7.8699E-07	3.0336E-07	2.3473E 00	-9.7331E 01	1.1162E 04	5.9669E-03	2.2697E-01	5.4921E-01	1.1820E 00	121
CYCLE	TIME	DTNH	JSTAR	JPMAX	PMAX	XJPMAX	MVPULSE	MVPREC	MOMENTUM
500	1.0791E-06	1.9109E-09	111	67	1.4193E 10	5.1536E-01	4.3350E 03	6.3572E 03	1.1192E 04
OTPP	OTPULS	ETOTAL	EMVNEG	EMVPOS	L-ROUND	X(JBND1)	X(JBND2)	R-ROUND	JFIN
7.8856E-07	3.0543E-07	2.3467E 00	-1.1225E 02	1.1177E 04	5.9629E-03	2.2697E-01	5.4940E-01	1.1820E 00	121
CYCLE	TIME	DTNH	JSTAR	JPMAX	PMAX	XJPMAX	MVPULSE	MVPREC	MOMENTUM
525	1.1281E-06	2.7514E-09	114	68	1.4181E 10	5.2948E-01	4.0625E 03	7.1467E 03	1.1209E 04
OTPP	OTPULS	ETOTAL	EMVNEG	EMVPOS	L-ROUND	X(JBND1)	X(JBND2)	R-ROUND	JFIN
7.9044E-07	2.8648E-07	2.3460E 00	-1.2173E 02	1.1197E 04	5.9607E-03	2.2696E-01	5.4967E-01	1.1820E 00	121
CYCLE	TIME	DTNH	JSTAR	JPMAX	PMAX	XJPMAX	MVPULSE	MVPREC	MOMENTUM
550	1.1842E-06	1.9114E-09	119	70	1.4142E 10	5.5900E-01	4.1267E 03	7.0985E 03	1.1225E 04
OTPP	OTPULS	ETOTAL	EMVNEG	EMVPOS	L-ROUND	X(JBND1)	X(JBND2)	R-ROUND	JFIN
7.9373E-07	2.9180E-07	2.3451E 00	-1.3342E 02	1.1195E 04	5.9622E-03	2.2696E-01	5.4993E-01	1.1820E 00	121
CYCLE	TIME	DTNH	JSTAR	JPMAX	PMAX	XJPMAX	MVPULSE	MVPREC	MOMENTUM
554	1.1918E-06	1.9109E-09	119	71	1.4135E 10	5.7446E-01	4.4535E 03	6.7583E 03	1.1212E 04
OTPP	OTPULS	ETOTAL	EMVNEG	EMVPOS	L-ROUND	X(JBND1)	X(JBND2)	R-ROUND	JFIN
7.9371E-07	3.1507E-07	2.3452E 00	-1.4710E 02	1.1212E 04	5.9620E-03	2.2696E-01	5.4999E-01	1.1820E 00	121
1.192E-06	554	-11	129						
1.192E-06	554	30	99						
CYCLE	TIME	DTNH	JSTAR	JPMAX	PMAX	XJPMAX	MVPULSE	MVPREC	MOMENTUM
554	1.1918E-06	1.9109E-09	99	41	1.4135E 10	5.7446E-01	4.4535E 03	6.7583E 03	1.1205E 04
OTPP	OTPULS	ETOTAL	EMVNEG	EMVPOS	L-ROUND	X(JBND1)	X(JBND2)	R-ROUND	JFIN
7.9273E-07	3.1459E-07	2.3378E 00	-1.0533E 02	1.1169E 04	5.9620E-03	2.2696E-01	5.4999E-01	1.1820E 00	102
CYCLE	TIME	DTNH	JSTAR	JPMAX	PMAX	XJPMAX	MVPULSE	MVPREC	MOMENTUM
575	1.2503E-06	2.8661E-09	101	43	1.4123E 10	6.0763E-01	4.5852E 03	6.6712E 03	1.1206E 04
OTPP	OTPULS	ETOTAL	EMVNEG	EMVPOS	L-ROUND	X(JBND1)	X(JBND2)	R-ROUND	JFIN
7.9350E-07	3.2467E-07	2.3396E 00	-1.3716E 02	1.1200E 04	5.9597E-03	2.2696E-01	5.4940E-01	1.1820E 00	102
CYCLE	TIME	DTNH	JSTAR	JPMAX	PMAX	XJPMAX	MVPULSE	MVPREC	MOMENTUM
600	1.3187E-06	2.8667E-09	101	45	1.4052E 10	6.4356E-01	4.5627E 03	6.6727E 03	1.1215E 04
OTPP	OTPULS	ETOTAL	EMVNEG	EMVPOS	L-ROUND	X(JBND1)	X(JBND2)	R-ROUND	JFIN
7.9952E-07	3.2468E-07	2.3384E 00	-1.5586E 02	1.1219E 04	6.9552E-03	2.2696E-01	5.4999E-01	1.1820E 00	102

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1 ORIGINATING ACTIVITY (Corporate author) AFWL (WLRT) Kirtland AFB, NM		2a REPORT SECURITY CLASSIFICATION Unclassified	
		2b GROUP	
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d.			
10 AVAILABILITY/LIMITATION NOTICES DDC release to OTS is authorized			
11 SUPPLEMENTARY NOTES		12 SPONSORING MILITARY ACTIVITY AFWL (WLRT) Kirtland AFB, NM	
13 ABSTRACT The report describes the one-dimensional Lagrangian hydrodynamics computer program, PUFF. The code is used primarily in the study of X-ray effects. In the past year, it has been extensively revised and is now quite different from versions used outside the Air Force Weapons Laboratory. The major calculations in each subroutine are explained with a complete description of all input-output variables. Sample problems with the appropriate data deck are included to allow a user to become familiar with data arrangement and to check the program on his computer.			

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KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
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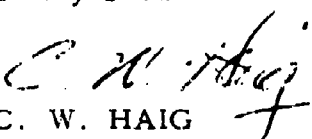
THE PUFF AND P PUFF COMPUTER PROGRAMS
Unclassified report, March 1965

When the P PUFF Fortran listing is updated with the Addendum changes, JPMAXI must be added to each of the COMMON blocks.

On page 18 the 5th variable defined should read NRZC instead of NRZ.

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ADDENDUM

AFWL TR-65-24

THE PUFF AND P PUFF COMPUTER PROGRAMS

This addendum is to notify users of recent improvements and changes to the PUFF and P PUFF programs and to correct two minor discrepancies in AFWL TR-65-24.

The improvements are related mostly to REZONE and should help to improve pulse resolution in poorly zoned problems. The major changes are found in the Equation of State Subroutine. The solid phase equation of state is now fit to raw Hugoniot data.

These additions will affect the solutions to the three sample problems slightly. If one wishes to check the code conversion to his computer, we suggest adding the following changes after the initial conversion has been checked.

On page 23, delete the first statement past statement number 17, SSCK=1..

On page 24, delete statement number 53 and substitute the following three statements:

GO TO 531
53 SSCK=1.
531 DTN=DTNH .

On page 31, change the first statement before statment number 2,

IF(JPMAX-JZPUL-JRZL-JPMAXI) 87, 87, 2

to read

IF(JPMAX-JZPUL-JPMAXI) 87, 87, 2 .

On page 33, delete statement number 50 and one statement past, JRZV=1 and MRZ=1. Number the next statement, JFINO=JFIN, 50; 50 JFINO=JFIN.

Change the second statement on page 34 to M=1 .

On page 34, delete the first statement past statement number 52 and substitute the following four statements:

```

      IF(TIME-SDUR) 520, 530, 530
520 KRZ=1
      GO TO 53
530 IF(JPLC-JV-JRZL) 53, 53, 60 .

```

On page 34, change the first statement before statement number 56 to read

```

      IF(JPLC+1-JBND(MM)) 57, 56, 56 .

```

On page 35, delete the second statement past statement number 86, NRZ=N, and substitute the following three statements:

```

      IF(JPMAXI) 860, 860, 870
860 JPMAXI=0
870 NRZ=N .

```

On page 38, change statement number 7 and one statement past to read

```

      7 TS2=(CUSP1(M)+((CUSPS(M)*ARG+CUSPD(M))*ARG
        +CUSPC(M))*ARG)*(1.-(CUSPG(M)* EMU)/2.)
      P1=TS2+CUSPG(M)*D*E1,

```

and change statement number 8 to read

```

      8 TS2 = ((EQSTS(M)*EMU+EQSTD(M))*EMU+EQSTC(M))
        *EMU*(1.-(EQSTG(M)*EMU)/2.) .

```

On page 41, delete statement number 20 and substitute the following three statements:

```

      20 IF(N-1) 200, 200, 210
      200 JPMAXI=JPMAX+10
      210 IF(J-JSTAR) 22, 21, 21 .

```

On page 44, change the second statement past statement number 31, NRZ=-50, to read NRZ=50.

On page 46, change the first statement before statement number 2 to read

```

      IF(JPMAX-JPMAXI) 85, 85, 2 .

```

On page 48, change the first statment before statement 54 to read

```

      IF(JPLC+1-JBND(MM))55, 54, 54 .

```

On page 50, delete the first statement past statement number 84, NRZ=N, and substitute the following four statements:

```

      JPMAXI=JPMAXI-JRZ
      IF(JPMAXI) 840, 840, 850
840 JPMAXI=0
850 NRZ=N .

```

On page 53, delete the first executable statement, $ENU=D/RHO(M)$, and substitute the following five statements:

```
IF(E1) 10, 10, 20
10 E1=0.
P1=0.
GO TO 9
20  $ENU=D/RHO(M)$  .
```

Also, there are two more changes on page 53. Statement number 7 and one statement past are changed to

```
7  $TS2=(CUSP1(M)+((CUSPS(M)*ARG+CUSPD(M))*ARG$   
   $+CUSPC(M))*ARG)*(1.-(CUSPG(M)*EMU)/2.)$   
   $P1=TS2+CUSPD(M)*D*E1,$ 
```

and statement number 8 is changed to

```
8  $TS2=((EQSTS(M)*EMU+EQSTD(M))*EMU+EQSTC(M))*EMU*(1.-(EQSTG(M)*EMU)/2.)$  .
```

This addendum has been reviewed and is approved.


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