MASTER

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THERMAL ANALYSIS OF LOFT MODULAR

DTT FOR LOCE TRANSIENT

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DEPARTMENT OF ENERGY

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THERMAL ANALYSIS

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DTT FOR LOCE TRANSIENT

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SUMMARY

A thermal analysis was performed on the LOFT modular drag-disc turbine transducer (MDTT) modular assembly (Figure 1). The purpose of this analysis was to determine the maximum temperature difference between the MDTT shroud and end cap during a LOCE. This temperature difference is needed for stress analysis of the MDTT endcap to fairing welds.*

The thermal analysis was done using TRIPLE (Reference 9) a three dimensional finite element code. A three dimensional model of the MDTT was made and transient temperature solutions were found for the different MDTT locations. The fluid temperature transients used for the solutions at all locations were from RELAP4 predictions of the LOFT L2-4 test (Reference 7) which is considered the most severe temperature transient. Results of these calculations show the maximum temperature difference is 92°C (165°F) and occurs in the intact loop cold leg (PC-1 location). This value and those found at other locations (PC-2, PC-3, B1-1, B1-2, all shown in Figure 15) are evaluated from the best available RELAP predicted temperatures during a nuclear LOCE. The maximum temperature difference, at the PC-1 location, shows an improvement of 30°C (55°F) over the temperature difference found for the current DTT assemblies at the same conditions in Reference 1. This drop in temperature difference combined with the improved disassembly and less welding area indicates an improvement in the modular DTT assembly over the current design. A stress analysis of the improved design using the lower temperature difference should be undertaken to evaluate the improvement of the new design.

* Note that the weld referred to above was never used on any modular drag-disk turbine hardware. Early preproduction designs employed welded two piece end caps but no hardware was ever produced using this design. EG&G drawings 208197, Rev. B and 208198, Rev. C eliminated the subject weld.

Bert L. Barnes 2/24/78

IDAHO NATIONAL ENGINEERING LABORATORY
LOFT TECHNICAL REPORT
LOFT PROGRAM

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1.0 INTRODUCTION

Modular drag-disc turbine transducers (MDTT) are located in several areas of the LOFT LOCA piping and reactor areas, and are shown in Figure 15. These MDTT's are used to collect data of coolant momentum flux (ρV^2) from the drag-disc, and coolant velocity from the turbine. The disc and turbine can be seen in Figure 1^[10]. The MDTT's are placed in a rake assembly which is mounted in the LOFT piping at the desired locations.

During LOFT LOCE's, end cap-to-fairing welds are highly stressed due to ΔT 's between the body and shroud. These high ΔT 's arise from the thin shroud closely following the fluid temperatures, unlike the larger massed body which stays hot. In the current DTT design, the shroud to body weld runs the length of the body, and the DTT is one piece. A modular DTT assembly was designed as a possible solution to the weld stress problem. As shown in Figure 1, most of the DTT is fitted together without need for welds. There is only an end cap-to-fairing weld in the end cap sections. This should be an improvement over the old design as the weld area is reduced and the end cap section should closely follow the fluid temperature. This analysis will calculate the average end cap temperature during a LOCE at the different DTT locations and compare results to the transient shroud temperatures to obtain a temperature difference.

2.0 ANALYSIS

There should be no difference in the shroud temperature of the modular DTT and the current model DTT during a LOCE. Therefore, the shroud temperature response from Reference (1) will be used. The model used in this analysis will be only of the DTT body since it is not unnecessary to model

the shroud. Since the DTT body will have convection on all sides, a three dimensional model will result in the best thermal analysis. It is also apparent that a two dimensional model such as used in Reference 1 would be unable to accurately model the end cap region of the modular DTT (see Figure 2). Also other two dimensional axisymmetric geometries in which the end cap could be modeled would not have enough convection surface to correctly model the DTT body.

The DTT body was simplified to the solid symmetrical, three dimensional model shown in Figure 3. Since this model is symmetrical about three axes, a one-eighth section, shown shaded in Figure 3, will give the same average temperature as the whole body. The model is also symmetrical in that the same convection boundary condition exists on all exterior surfaces. The convection coefficient used is a constant $2270 \text{ W/m}^2\text{-}^\circ\text{C}$ ($400 \text{ Btu/hr-ft}^2\text{-}^\circ\text{F}$) shown in Figure 4. This convection coefficient is low to keep calculations conservative and was used for all locations. The three dimensional finite element code TRIPLE MOD-1 (Reference 9) was used for this analysis and the code input is presented in Appendix A.

By observing data from nonnuclear Test L1-1, L1-2, L1-3, L1-4 (References 3, 4, 5 and 6) it was seen that the L1-4 test had the most severe fluid temperature transient. So for calculations of the most severe nuclear temperature transients, values from RELAP4 predictions for L2-4 were used (Reference 7). Calculations were also made using fluid temperature transient from ANS Specification No. MS-201, Rev. 7 for the hot leg nozzle (Reference 8). However, this temperature transient is from an old specification and is considered to be too severe.

A supplemental subroutine for TRIPLE MOD-1 was written in order to find the average temperature of the end cap. This subroutine calculates a volume weighted temperature average of the elements in the end cap. A copy of this subroutine is shown in Appendix B.

3.0 RESULTS AND RECOMMENDATIONS

Illustrated in Figures 5 through 9 are the temperature profiles for the fluid, shroud and average end cap temperatures during a nuclear LOCE for the fluid transient used. Figures 10 through 14 show the temperature difference between the shroud and end cap during the transient. The water temperature transients for the downcomer, upper plenum, and core support region are shown in Figures 16, 17, and 18. These temperature profiles illustrate that the maximum temperature difference between the fairing and end cap for these locations will be less severe than that found in the PC-1 location.

The maximum temperature difference for the L2-4 RELAP4 predictions occurred at the intact loop cold leg (PC-1) location. As shown in Table I, this temperature difference was 92°C (165°F) at 26 seconds. This temperature difference is 30°C (55°F) below that found in Reference 1. This drop in temperature can be attributed to a change in the DTT geometry looking at only the end cap, and the added convection surface in a three dimensional model. Node temperatures through all LOCE's are in Record Storage Receipt No. 2738.

TABLE I

MAXIMUM TEMPERATURE DIFFERENCE BETWEEN FAIRING AND END CAP

Location	ΔT (°F)	Time (sec.)
PC-1	165	26
PC-2	109	32
PC-3	101	38
BL-1	93	31
BL-2	109	32

4.0 REFERENCES

1. G. Kyllingstad, Fluid Loads on LOFT DTT Shrouds Located in Reactor Vessel Downcomer and DTT Thermal Load During Nuclear LOCE, LOFT Technical Report 141-67 (July 7, 1977).
2. R. T. French, An Evaluation of Piping Heat Transfer, Piping Flow Regimes and Steam Generator Heat Transfer For Semiscale Mod-1 Isothermal Tests, ANC-1229 (August 1975).
3. J. R. Chapell, Experimental Data Report For LOFT Nonnuclear Test L1-1, TREE-NUREG-1025 (January 1977).
4. H. C. Robinson, Experimental Data Report For LOFT Nonnuclear Test L1-2, TREE-NUREG-1026 (January 1977).
5. G. M. Millar, Experimental Data Report For LOFT Nonnuclear Test L1-3, TREE-NUREG-1065 (April 1977).
6. D. L. Batt, Experimental Data Report For LOFT Nonnuclear Test L1-4, TREE-NUREG-1084 (July 1977).
7. Personal Communication with J. R. White, "Expected Thermocouple Response for Nuclear Test" (August 4, 1977).
8. Reactor Vessel Loss-of-Fluid Test Reactor, ANC Specification No. MS-201, Rev. 7 (June 22, 1972).
9. E. C. Lemmon, TRIPLE/MOD1 - A Three-Dimensional Finite Element Steady-State and Transient Heat Conduction Code For Use On A CDC Cyber 76/Cyber 173 Computer, RE-A-77-030 (July 15, 1977).
10. LOFT Drag Disc Turbine Modular Assembly, EG&G Drawing Number 20819 (1977).

Figure 1: LOFT Modular DTT Assembly
(Ref. 10)

Figure 2: Two Dimensional Model of Current
DTT From Ref. 1

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(Simplified)

(Computer)

Figure 3: Simplified Three Dimensional Model
Showing Volume for Computer Model
in Shaded Area

Figure 4: Heat Transfer Coefficient (Semiscale Intack Loop Cold Leg)
(From Reference 2)

Figure 5. Temperature Transient For The Intact Loop Cold Leg

$\Delta T_{max} \approx 165^{\circ}F$
AT 26 sec.

Figure 6. Temperature Transient For The Intact Loop Hot Leg - Same As Broken Loop Hot Leg

$\Delta T_{max} \approx 109^{\circ}F$
AT 32 sec.

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Figure 7. Temperature Transient For The Intact Loop Between Steam Generator and Pump

$\Delta T_{max} \approx 101^{\circ}F$
AT 38 SEC.

Figure 8. Temperature Transient of the Broken Loop Cold Leg

$\Delta T_{max} \approx 93^{\circ}\text{F}$
AT 31 SEC.

Figure 9. Temperature Transient From Reference (8)

$\Delta T_{max} \approx 291^{\circ}F$
AT 11 sec.

DIFFERENCE TEMPERATURE (°F)

160

140

120

100

80

60

40

20

0

Figure 10. Temperature Difference Between Shroud
And End Cap For Intact Loop Cold Leg

PC-1

TIME (SECONDS)

40

30

20

10

DIFFERENCE TEMPERATURE (°F)

120

100

80

60

40

20

0

10

20

30

40

TIME (SECONDS)

Figure 12. Temperature Difference Between Shroud
And End Cap Between Steam Generator
And Pump

PC-3

DIFFERENCE TEMPERATURE ($^{\circ}\text{F}$)

120

100

80

60

40

20

0

10

20

30

40

BL-1

TIME (SECONDS)

Figure 13. Temperature Difference Between Shroud
And End Cap For Broken Loop Cold Leg

DIETZGEN CORPORATION
MADE IN U.S.A.
NO. 341-10 DIETZGEN GRAPH PAPER
10 X 10 PER INCH

Figure 14. Temperature Difference Between Shroud
And End Cap Using Fluid Temperatures
From Reference (8)

DIFFERENCE TEMPERATURE (°F)

300

200

100

0

10

20

30

40

TIME (SECONDS)

Figure 15: DTT Locations in LOFT - PC-1, PC-2, PC-3, BL-1, and BL-2 - Shown Circled

Figure 16. Fluid Temperature Transient
for Downcomer

Figure 17. Fluid Temperature Transient
for Upper Plenum

Figure 18. Fluid Temperature Transient
for Core Support Region

APPENDIX A

SUMMARY OF MODEL

A THERMAL ANALYSIS OF THE MODULAR DTT BODY WAS DONE USING A THREE-DIMENSIONAL FINITE ELEMENT CODE - TRIPLE MOD-1 (REFERENCE 9)

THE MESH USED FOR THE SHADED SECTION IN FIG. 3, MAIN REPORT, IS SHOWN IN FIGURES A-1, 2, 3.

DIMENSIONS FOR MAKING THIS MESH WERE TAKEN FROM E, G, 9G DRAWING 20819.

FIGURES A-4, 5 SHOW THE SECTION OF THE MESH WHICH REPRESENTS THE END CAP IN THE MODULAR DTTs. THE DATA INPUT FOR THIS CODE IS LISTED LATER. THIS DATA INCLUDES MESH GENERATION, MATERIAL PROPERTIES, AND BOUNDARY CONDITIONS.

THE SUBROUTINE USERP WAS USED WITH THIS CODE TO FIND THE AVERAGE END CAP TEMPERATURE IN THE MESH AT EACH TIME STEP. TO FIND THE AVERAGE TEMPERATURE, ELEMENT TEMPERATURES WERE VOLUME WEIGHTED. SUBROUTINE SOLIDC WAS USED IN THE USERP TO OBTAIN THE VOLUMES OF THE ELEMENTS. THE "E" VALUES SHOWN IN THE SUBROUTINE ARE PART OF SOLIDC BUT WERE NOT USED FOR THE CALCULATIONS HERE. ALSO IN THE USERP SUBROUTINE IS AN ATTEMPT

TO REPRESENT THE SHROUD TEMPERATURE BY AN OUTSIDE ELEMENT TEMPERATURE IN THE MESH. SINCE THIS TEMPERATURE TURNED OUT TO BE HIGHER THAN THE VALUES FOUND IN REFERENCE 1, THE SHROUD TEMPERATURES FROM REFERENCE 1 WERE USED BEING THE MORE CONSERVATIVE. THEREFORE THE SHROUD TEMPERATURES AND TEMPERATURE DIFFERENCES FOUND IN USERP WERE NOT USED.

LEFT EYE VIEW

CENTER OF EYES LOCATION

X = 0.54832144E+03

Y = -0.25184576E+04

Z = 0.89635120E+03

PLOT OF LOS: DTT 3-D MODEL

VIEW POINT LOCATION

X = 0.44076160E+02

Y = 0.89107184E+01

Z = 0.11458420E+02

ROLL ANGLE = 180.0 DEG

RUN NO. = DTT

DATE = 15SE77

FIGURE A-1 DTT BODY MODEL - SIDE VIEW

LEFT EYE VIEW

CENTER OF EYES LOCATION

X = 0.41832208E+03

Y = -0.32156288E+03

Z = 0.26771232E+04

PLOT OF LOFT DTT 3-D MODEL

VIEW POINT LOCATION

X = 0.44076160E+02

Y = 0.89107184E+01

Z = 0.11458420E+02

ROLL ANGLE = 180.0 DEG

RUN NO. = DTT

DATE = 15SE77

FIGURE A-2 DTT BODY MODEL - TOP VIEW

CENTER OF EYES LOCATION

X = 0.54832144E+03

Y = -0.25184576E+04

Z = 0.89635120E+03

PLOT OF LOFT DTT 3-D MODEL

VIEW POINT LOCATION

X = 0.44076160E+02

Y = 0.89107184E+01

Z = 0.11458420E+02

ROLL ANGLE = 180.0 DEG

RUN NO. = DTT

DATE = 15SE77

FIGURE A-3 DTT BODY MODEL - SIDE VIEW WITH
NODE NUMBERS.

LEFT EYE VIEW

CENTER OF EYES LOCATION

X = 0.24628512E+03

Y = -0.85740352E+03

Z = 0.67778880E+03

PLOT OF LOFT DTT 3-D MODEL

VIEW POINT LOCATION

X = 0.63630464E+02

Y = 0.10289037E+02

Z = 0.11458241E+02

ROLL ANGLE = 180.0 DEG

RUN NO. = DTT

DATE = 15SE77

FIGURE A-4 DTT END CAP SECTION

LEFT EYE VIEW

CENTER OF EYES LOCATION

X = 0.24628E+03

Y = -0.85765552E+03

Z = 0.67778880E+03

PLOT OF DTT DTT 3-D MODEL

VIEW POINT LOCATION

X = 0.63630464E+02

Y = 0.10289037E+02

Z = 0.11458241E+02

ROLL ANGLE = 180.0 DEG

RUN NO. = DTT

DATE = 15SE77

FIGURE A-5 DTT END CAP WITH NODE NUMBERS

APPENDIX B

SUBROUTINE USERP

SUBROUTINE USERP

76/76

OPT=2

FTN 4.6+439

09/19/77

```

1  SUBROUTINE USERP(N,NP,NDF,MAT,RHO,COND,CAPC,ITRAN,TBAR,TIME,XX,T,  USERSUB
    *      KA,AK)  USERSUB
    T=VECTOR OF NODE TEMPERATURES  **DO NOT CHANGE**  USERSUB
    KA=0,ISOTROPIC CONDUCTIVITY  USERSUB
    *      1,ANISOTROPIC CONDUCTIVITY  YOU MAY CHANGE  USERSUB
    AK(3,3)=ANISOTROPIC CONDUCTIVITY TENSOR,  USERSUB
    *      K(2,3)=KYZ,K(1,2)=KXY,ETC.,  USERSUB
    LEVEL 2,T  USERSUB
    N=ELEMENT NUMBER  **DO NOT CHANGE**  USERSUB
    NP(1)=1TH NODE OF ELEMENT  **DO NOT CHANGE**  USERSUB
    NDF=6-WEDGE, 8-BRICK  **DO NOT CHANGE**  USERSUB
    MAT=MATERIAL NUMBER  **DO NOT CHANGE**  USERSUB
    RHO=DENSITY  YOU MAY CHANGE  USERSUB
    COND=ISOTROPIC CONDUCTIVITY IF KA=0  YOU MAY CHANGE  USERSUB
    CAPC=SPECIFIC HEAT  YOU MAY CHANGE  USERSUB
    ITRAN=C,TBAR MEANINGLESS ;=1, TBAR OK  **DO NOT CHANGE**  USERSUB
    TBAR=AVERAGE ELEMENT TEMPERATURE  **DO NOT CHANGE**  USERSUB
    TIME=TIME  **DO NOT CHANGE**  USERSUB
    XX(1,1)=X CO-ORDINATE OF NODE NP(1)  **DO NOT CHANGE**  USERSUB
    XX(2,1)=Y CO-ORDINATE OF NODE NP(1)  **DO NOT CHANGE**  USERSUB
    XX(3,1)=Z CO-ORDINATE OF NODE NP(1)  **DO NOT CHANGE**  USERSUB
    *      YOU MUST FILL AK ARRAY IF YOU SET KA=1  USERSUB
    DIMENSION T(1),NP(8),XX(3,8),AK(3,3),VOL(8),E(4)  USERSUB
    INSERT USER SUPPLIED PORTION OF USERP AT THIS POINT  USERSUB
    E(1)=1.  USERSUB
    E(2)=1.  USERSUB
    E(3)=1.  USERSUB
    E(4)=1.  USERSUB
    IF(N.NE.1) GO TO 5  USERSUB
    VT=0.  USERSUB
    VV=0.  USERSUB
    5  CONTINUE  USERSUB
    INT=2  USERSUB
    IF(N.LT.145) GO TO 20  USERSUB
    CALL SOLIDC (NDF,XX,E,INT,VOL,N)  USERSUB
    IF (NDF.EQ.6) VOLUME=VOL(1)/6.  USERSUB
    IF (NDF.EQ.8) VOLUME=VOL(1)/8.  USERSUB
    VT=(TBAR*VOLUME)+VT  USERSUB
    VV=VOLUME+VV  USERSUB
    IF(N.EQ.197) S=TBAR  USERSUB
    IF(N.NE.200) GO TO 20  USERSUB
    TAVE=VT/VV  USERSUB
    PRINT 10,TAVE  USERSUB
    10  FORMAT(1H0,/,/,20X,"THE FRONT SECTION AVERAGE TEMP. IS",F12.4)  USERSUB
    PRINT 15,S  USERSUB
    15  FORMAT(1H0,/,/,20X,"THE SHROUD TEMPERATURE IS",F12.4)  USERSUB
    DELT=TAVE-S  USERSUB
    PRINT 17,DELT  USERSUB
    17  FORMAT(1H0,/,/,20X,"DELTA-T BETWEEN SHROUD AND BODY IS",F12.4)  USERSUB
    20  CONTINUE  USERSUB
    RETURN  USERSUB
    END  USERSUB

```

APPENDIX C

TRIPLE INPUT DATA

CLARK LEMMON - MAINTENANCE SUPERVISOR

0 1 2 3 4 5 6 7 8
1234567890123456789 23456789012345678901234567890123456789012345678901234567890

TITLE
3-D MODEL OF DTT
SEP. 3, 1977

NODES
325

1	5	0.	0.	0.	4
2	5	0.	0.	0.55	4
3	2	0.	0.1	0.55	4
4	5	0.	0.2	0.	4
5	3	0.	0.2	0.55	4
6	5	0.	0.3	0.	4
7	4	0.	0.3	0.55	4
8	5	0.	0.4	0.	4
9	5	0.	0.4	0.55	4
10	26	0.276	0.	0.	4
11	5	0.276	0.	0.55	4
12	27	0.276	0.1	0.	4
13	5	0.276	0.1	0.55	4
14	28	0.276	0.2	0.	4
15	5	0.276	0.2	0.55	4
16	29	0.276	0.3	0.	4
17	5	0.276	0.3	0.55	4
18	30	0.276	0.4	0.	4
19	5	0.276	0.4	0.55	4
20	51	0.552	0.	0.	4
21	5	0.552	0.	0.55	4
22	52	0.552	0.1	0.	4
23	5	0.552	0.1	0.55	4
24	53	0.552	0.2	0.	4
25	5	0.552	0.2	0.55	4
26	54	0.552	0.3	0.	4
27	5	0.552	0.3	0.55	4
28	55	0.552	0.4	0.	4
29	5	0.552	0.4	0.55	4
30	76	0.828	0.	0.	4
31	5	0.828	0.	0.55	4
32	77	0.828	0.1	0.	4
33	5	0.828	0.1	0.55	4
34	78	0.828	0.2	0.	4
35	5	0.828	0.2	0.55	4
36	79	0.828	0.3	0.	4
37	5	0.828	0.3	0.55	4
38	80	0.828	0.4	0.	4
39	5	0.828	0.4	0.55	4
40	101	0.966	0.	0.	4
41	5	0.966	0.	0.55	4
42	102	0.966	0.1	0.	4
43	5	0.966	0.1	0.55	4
44	103	0.966	0.2	0.	4
45	5	0.966	0.2	0.55	4
46	104	0.966	0.3	0.	4
47	5	0.966	0.3	0.55	4
48	105	0.966	0.4	0.	4

0 1 2 3 4 5 6 7 8
1234567890123456789012345678901234567890123456789012345678901234567890

	0	1	2	3	4	5	6	7	8
56	5	0.966	0.4	0.55					
57	126	1.104	0.0	0.0	4				
58	5	1.104	0.0	0.55					
59	127	1.104	0.1	0.0	4				
60	5	1.104	0.1	0.55					
61	128	1.104	0.2	0.0	4				
62	5	1.104	0.2	0.55					
63	129	1.104	0.3	0.0	4				
64	5	1.104	0.3	0.55					
65	130	1.104	0.4	0.0	4				
66	5	1.104	0.4	0.55					
67	151	1.18	0.0	0.0	4				
68	5	1.18	0.0	0.55					
69	152	1.18	0.1	0.0	4				
70	5	1.18	0.1	0.55					
71	153	1.18	0.2	0.0	4				
72	5	1.18	0.2	0.55					
73	154	1.18	0.3	0.0	4				
74	5	1.18	0.3	0.55					
75	155	1.18	0.4	0.0	4				
76	5	1.18	0.4	0.55					
77	176	1.26	0.0	0.0	4				
78	5	1.26	0.0	0.55					
79	177	1.26	0.1	0.0	4				
80	5	1.26	0.1	0.55					
81	178	1.26	0.2	0.0	4				
82	5	1.26	0.2	0.55					
83	179	1.26	0.3	0.0	4				
84	5	1.26	0.3	0.55					
85	180	1.26	0.4	0.0	4				
86	5	1.26	0.4	0.55					
87	201	1.32	0.0	0.0	4				
88	5	1.32	0.0	0.55					
89	202	1.32	0.1	0.0	4				
90	5	1.32	0.1	0.55					
91	203	1.32	0.2	0.0	4				
92	5	1.32	0.2	0.55					
93	204	1.32	0.3	0.0	4				
94	5	1.32	0.3	0.55					
95	205	1.32	0.4	0.0	4				
96	5	1.32	0.4	0.55					
97	226	1.38	0.0	0.0	4				
98	5	1.38	0.0	0.55					
99	227	1.38	0.1	0.0	4				
100	5	1.38	0.1	0.55					
101	228	1.38	0.2	0.0	4				
102	5	1.38	0.2	0.55					
103	229	1.38	0.3	0.0	4				
104	5	1.38	0.3	0.55					
105	230	1.38	0.4	0.0	4				
106	5	1.38	0.4	0.55					
107	251	1.44	0.0	0.0	4				
108	5	1.44	0.0	0.55					
109	252	1.44	0.1	0.0	4				
110	5	1.44	0.1	0.55					
	0	1	2	3	4	5	6	7	8
	1234567890	1234567890	1234567890	1234567890	1234567890	1234567890	1234567890	1234567890	1234567890

111	253	1.44	0.2	0.	4
112	5	1.44	0.2	0.55	
113	254	1.44	0.3		4
114	5	1.44	0.3	0.55	
115	255	1.44	0.4	0.	4
116	5	1.44	0.4	0.55	
117	276	1.54	0.1	0.	4
118	4	1.54	0.1	0.55	
119	277	1.54	0.2	0.	4
120	4	1.54	0.2	0.55	
121	278	1.54	0.3	0.	4
122	4	1.54	0.3	0.55	
123	279	1.54	0.4	0.	4
124	4	1.54	0.4	0.55	
125	296	1.64	0.2	0.	4
126	3	1.64	0.2	0.55	
127	297	1.64	0.3	0.	4
128	3	1.64	0.3	0.55	
129	298	1.64	0.4	0.	4
130	3	1.64	0.4	0.55	
131	311	1.74	0.3	0.	4
132	2	1.74	0.3	0.55	
133	312	1.74	0.4	0.	4
134	2	1.74	0.4	0.55	
135	321	1.84	0.4	0.	4
136	1	1.84	0.4	0.55	

1
1
1.0E-4

$$1.0 \overset{1.0}{E-2}$$

1

304
2.

STAINLESS STEEL

ELEMENTS

[illegible]

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221 197 311 321 312 313 322 314
222 198 313 322 314 315 323 316
223 199 315 323 316 317 324 318
224 200 317 324 318 319 325 320

0 1 0
0 1 0
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0 1 0

STEPS

0.0 50. 0.5 1 550. -10 1

FUNCTIONS

4

1 13

2 70.

200.

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2 13

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200.

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500.

650.

3 53

0.0

4.5

8.0

11.0

14.0

17.0

18.4

19.6

21.4

23.5

25.0

27.0

29.0

30.6

32.0

33.8

35.8

37.8

4 2

0.0

CONVECTSETS

1

1.9290E-6

4

1.0

3

BC

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1

5

9

13

2

+1

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0

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16

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0

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+1

9

16

+1

0

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16

0 1 2 3 4 5 6 7 8
1234567890123456789012345678901234567890123456789012345678901234567890

END

0 1 2 3 4 5 6 7 8
123456789012345678901234567890123456789012345678901234567890

APPENDIX D

MODEL NODE AND ELEMENT LISTING

ORDERED NODE DATA
RIPLE MOD 1 (MAR-07,77)

UPDATE 1 (MAR-07,77) ECL

3-D MODEL OF DTT
SEP. 3, 1977

NO.	GLOBAL X-ORD	GLOBAL Y-ORD	GLOBAL Z-ORD	NODE NO.	GLOBAL X-ORD	GLOBAL Y-ORD	GLOBAL Z-ORD	NODE NO.	GLOBAL X-ORD	GLOBAL Y-ORD	GLOBAL Z-ORD
1	0.000	0.000	0.000	51	.552	0.000	0.000	101	.966	0.000	0.000
2	0.000	.100	0.000	52	.552	.100	0.000	102	.966	.100	0.000
3	0.000	.200	0.000	53	.552	.200	0.000	103	.966	.200	0.000
4	0.000	.300	0.000	54	.552	.300	0.000	104	.966	.300	0.000
5	0.000	.400	0.000	55	.552	.400	0.000	105	.966	.400	0.000
6	0.000	0.000	.138	56	.552	0.000	.138	106	.966	0.000	.138
7	0.000	.100	.138	57	.552	.100	.138	107	.966	.100	.138
8	0.000	.200	.138	58	.552	.200	.138	108	.966	.200	.138
9	0.000	.300	.138	59	.552	.300	.138	109	.966	.300	.138
10	0.000	.400	.138	60	.552	.400	.138	110	.966	.400	.138
11	0.000	0.000	.275	61	.552	0.000	.275	111	.966	0.000	.275
12	0.000	.100	.275	62	.552	.100	.275	112	.966	.100	.275
13	0.000	.200	.275	63	.552	.200	.275	113	.966	.200	.275
14	0.000	.300	.275	64	.552	.300	.275	114	.966	.300	.275
15	0.000	.400	.275	65	.552	.400	.275	115	.966	.400	.275
16	0.000	0.000	.413	66	.552	0.000	.413	116	.966	0.000	.413
17	0.000	.100	.413	67	.552	.100	.413	117	.966	.100	.413
18	0.000	.200	.413	68	.552	.200	.413	118	.966	.200	.413
19	0.000	.300	.413	69	.552	.300	.413	119	.966	.300	.413
20	0.000	.400	.413	70	.552	.400	.413	120	.966	.400	.413
21	0.000	0.000	.550	71	.552	0.000	.550	121	.966	0.000	.550
22	0.000	.100	.550	72	.552	.100	.550	122	.966	.100	.550
23	0.000	.200	.550	73	.552	.200	.550	123	.966	.200	.550
24	0.000	.300	.550	74	.552	.300	.550	124	.966	.300	.550
25	0.000	.400	.550	75	.552	.400	.550	125	.966	.400	.550
26	.276	0.000	0.000	76	.828	0.000	0.000	126	1.104	0.000	0.000
27	.276	.100	0.000	77	.828	.100	0.000	127	1.104	.100	0.000
28	.276	.200	0.000	78	.828	.200	0.000	128	1.104	.200	0.000
29	.276	.300	0.000	79	.828	.300	0.000	129	1.104	.300	0.000
30	.276	.400	0.000	80	.828	.400	0.000	130	1.104	.400	0.000
31	.276	0.000	.138	81	.828	0.000	.138	131	1.104	0.000	.138
32	.276	.100	.138	82	.828	.100	.138	132	1.104	.100	.138
33	.276	.200	.138	83	.828	.200	.138	133	1.104	.200	.138
34	.276	.300	.138	84	.828	.300	.138	134	1.104	.300	.138
35	.276	.400	.138	85	.828	.400	.138	135	1.104	.400	.138
36	.276	0.000	.275	86	.828	0.000	.275	136	1.104	0.000	.275
37	.276	.100	.275	87	.828	.100	.275	137	1.104	.100	.275
38	.276	.200	.275	88	.828	.200	.275	138	1.104	.200	.275
39	.276	.300	.275	89	.828	.300	.275	139	1.104	.300	.275
40	.276	.400	.275	90	.828	.400	.275	140	1.104	.400	.275
41	.276	0.000	.413	91	.828	0.000	.413	141	1.104	0.000	.413
42	.276	.100	.413	92	.828	.100	.413	142	1.104	.100	.413
43	.276	.200	.413	93	.828	.200	.413	143	1.104	.200	.413
44	.276	.300	.413	94	.828	.300	.413	144	1.104	.300	.413
45	.276	.400	.413	95	.828	.400	.413	145	1.104	.400	.413
46	.276	0.000	.550	96	.828	0.000	.550	146	1.104	0.000	.550
47	.276	.100	.550	97	.828	.100	.550	147	1.104	.100	.550
48	.276	.200	.550	98	.828	.200	.550	148	1.104	.200	.550
49	.276	.300	.550	99	.828	.300	.550	149	1.104	.300	.550
50	.276	.400	.550	100	.828	.400	.550	150	1.104	.400	.550

UPL 4 1 76

ORDERED NODE DATA
 R I P L E MOD 1 (MAR-07,77)

UPDATE 1 (MAR-07,77) ECL

3-D MODEL OF DTT
 SEP. 3, 1977

ODE NO.	GLOBAL X-ORD	GLOBAL Y-ORD	GLOBAL Z-ORD	NODE NO.	GLOBAL X-ORD	GLOBAL Y-ORD	GLOBAL Z-ORD	NODE NO.	GLOBAL X-ORD	GLOBAL Y-ORD	GLOBAL Z-ORD
151	1.180	0.000	0.000	201	1.320	0.000	0.000	251	1.440	0.000	0.000
152	1.180	.100	0.000	202	1.320	.100	0.000	252	1.440	.100	0.000
153	1.180	.200	0.000	203	1.320	.200	0.000	253	1.440	.200	0.000
154	1.180	.300	0.000	204	1.320	.300	0.000	254	1.440	.300	0.000
155	1.180	.400	0.000	205	1.320	.400	0.000	255	1.440	.400	0.000
156	1.180	0.000	.138	206	1.320	0.000	.138	256	1.440	0.000	.138
157	1.180	.100	.138	207	1.320	.100	.138	257	1.440	.100	.138
158	1.180	.200	.138	208	1.320	.200	.138	258	1.440	.200	.138
159	1.180	.300	.138	209	1.320	.300	.138	259	1.440	.300	.138
160	1.180	.400	.138	210	1.320	.400	.138	260	1.440	.400	.138
161	1.180	0.000	.275	211	1.320	0.000	.275	261	1.440	0.000	.275
162	1.180	.100	.275	212	1.320	.100	.275	262	1.440	.100	.275
163	1.180	.200	.275	213	1.320	.200	.275	263	1.440	.200	.275
164	1.180	.300	.275	214	1.320	.300	.275	264	1.440	.300	.275
165	1.180	.400	.275	215	1.320	.400	.275	265	1.440	.400	.275
166	1.180	0.000	.413	216	1.320	0.000	.413	266	1.440	0.000	.413
167	1.180	.100	.413	217	1.320	.100	.413	267	1.440	.100	.413
168	1.180	.200	.413	218	1.320	.200	.413	268	1.440	.200	.413
169	1.180	.300	.413	219	1.320	.300	.413	269	1.440	.300	.413
170	1.180	.400	.413	220	1.320	.400	.413	270	1.440	.400	.413
171	1.180	0.000	.550	221	1.320	0.000	.550	271	1.440	0.000	.550
172	1.180	.100	.550	222	1.320	.100	.550	272	1.440	.100	.550
173	1.180	.200	.550	223	1.320	.200	.550	273	1.440	.200	.550
174	1.180	.300	.550	224	1.320	.300	.550	274	1.440	.300	.550
175	1.180	.400	.550	225	1.320	.400	.550	275	1.440	.400	.550
176	1.260	0.000	0.000	226	1.380	0.000	0.000	276	1.540	.100	0.000
177	1.260	.100	0.000	227	1.380	.100	0.000	277	1.540	.200	0.000
178	1.260	.200	0.000	228	1.380	.200	0.000	278	1.540	.300	0.000
179	1.260	.300	0.000	229	1.380	.300	0.000	279	1.540	.400	0.000
180	1.260	.400	0.000	230	1.380	.400	0.000	280	1.540	.100	.138
181	1.260	0.000	.138	231	1.380	0.000	.138	281	1.540	.200	.138
182	1.260	.100	.138	232	1.380	.100	.138	282	1.540	.300	.138
183	1.260	.200	.138	233	1.380	.200	.138	283	1.540	.400	.138
184	1.260	.300	.138	234	1.380	.300	.138	284	1.540	.100	.275
185	1.260	.400	.138	235	1.380	.400	.138	285	1.540	.200	.275
186	1.260	0.000	.275	236	1.380	0.000	.275	286	1.540	.300	.275
187	1.260	.100	.275	237	1.380	.100	.275	287	1.540	.400	.275
188	1.260	.200	.275	238	1.380	.200	.275	288	1.540	.100	.413
189	1.260	.300	.275	239	1.380	.300	.275	289	1.540	.200	.413
190	1.260	.400	.275	240	1.380	.400	.275	290	1.540	.300	.413
191	1.260	0.000	.413	241	1.380	0.000	.413	291	1.540	.400	.413
192	1.260	.100	.413	242	1.380	.100	.413	292	1.540	.100	.550
193	1.260	.200	.413	243	1.380	.200	.413	293	1.540	.200	.550
194	1.260	.300	.413	244	1.380	.300	.413	294	1.540	.300	.550
195	1.260	.400	.413	245	1.380	.400	.413	295	1.540	.400	.550
196	1.260	0.000	.550	246	1.380	0.000	.550	296	1.640	.200	0.000
197	1.260	.100	.550	247	1.380	.100	.550	297	1.640	.300	0.000
198	1.260	.200	.550	248	1.380	.200	.550	298	1.640	.400	0.000
199	1.260	.300	.550	249	1.380	.300	.550	299	1.640	.200	.138
200	1.260	.400	.550	250	1.380	.400	.550	300	1.640	.300	.138

ORDERED NODE DATA
R I P L E MOD I (MAR-07,77)

UPDATE 1 (MAR-07,77) ECL

3-D MODEL OF DTT
SEP. 3, 1977

NODE NO.	GLOBAL X-ORD	GLOBAL Y-ORD	GLOBAL Z-ORD	NODE NO.	GLOBAL X-ORD	GLOBAL Y-ORD	GLOBAL Z-ORD	NODE NO.	GLOBAL X-ORD	GLOBAL Y-ORD	GLOBAL Z-ORD
301	1.640	.400	.138								
302	1.640	.200	.275								
303	1.640	.300	.275								
304	1.640	.400	.275								
305	1.640	.200	.413								
306	1.640	.300	.413								
307	1.640	.400	.413								
308	1.640	.200	.550								
309	1.640	.300	.550								
310	1.640	.400	.550								
311	1.740	.300	0.000								
312	1.740	.400	0.000								
313	1.740	.300	.138								
314	1.740	.400	.138								
315	1.740	.300	.275								
316	1.740	.400	.275								
317	1.740	.300	.413								
318	1.740	.400	.413								
319	1.740	.300	.550								
320	1.740	.400	.550								
321	1.840	.400	0.000								
322	1.840	.400	.138								
323	1.840	.400	.275								
324	1.840	.400	.413								
325	1.840	.400	.550								

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ORDERED ELEMENT DATA
TRIPLE MOD 1 (MAR-07,77) UPDATE 1 (MAR-07,77) ECL

3-D MODEL OF DTT
SEP. 3, 1977

SOLID ELEMENT NUMBER	-- S O L I D NODE 1	N O D E NODE 2	E L E M E N T NODE 3	N O D E NODE 4	N O D E NODE 5	N O D E NODE 6	N U M B E R S NODE 7	-- NODE 8	INTEGRA- TION ORDER	MATER- IAL NUMBER
1	1	26	27	2	6	31	32	7	2	1
2	6	31	32	7	11	36	37	12	2	1
3	11	36	37	12	16	41	42	17	2	1
4	16	41	42	17	21	46	47	22	2	1
5	2	27	28	3	7	32	33	8	2	1
6	7	32	33	8	12	37	38	13	2	1
7	12	37	38	13	17	42	43	18	2	1
8	17	42	43	18	22	47	48	23	2	1
9	3	28	29	4	8	33	34	9	2	1
10	8	33	34	9	13	38	39	14	2	1
11	13	38	39	14	18	43	44	19	2	1
12	18	43	44	19	23	48	49	24	2	1
13	4	29	30	5	9	34	35	10	2	1
14	9	34	35	10	14	39	40	15	2	1
15	14	39	40	15	19	44	45	20	2	1
16	19	44	45	20	24	49	50	25	2	1
17	26	51	52	27	31	56	57	32	2	1
18	31	56	57	32	36	61	62	37	2	1
19	36	61	62	37	41	66	67	42	2	1
20	41	66	67	42	46	71	72	47	2	1
21	27	52	53	28	32	57	58	33	2	1
22	32	57	58	33	37	62	63	38	2	1
23	37	62	63	38	42	67	68	43	2	1
24	42	67	68	43	47	72	73	48	2	1
25	28	53	54	29	33	58	59	34	2	1
26	33	58	59	34	38	63	64	39	2	1
27	38	63	64	39	43	68	69	44	2	1
28	43	68	69	44	48	73	74	49	2	1
29	29	54	55	30	34	59	60	35	2	1
30	34	59	60	35	39	64	65	40	2	1
31	39	64	65	40	44	69	70	45	2	1
32	44	69	70	45	49	74	75	50	2	1
33	51	76	77	52	56	81	82	57	2	1
34	56	81	82	57	61	86	87	62	2	1
35	61	86	87	62	66	91	92	67	2	1
36	66	91	92	67	71	96	97	72	2	1
37	52	77	78	53	57	82	83	58	2	1
38	57	82	83	58	62	87	88	63	2	1
39	62	87	88	63	67	92	93	68	2	1
40	67	92	93	68	72	97	98	73	2	1
41	53	78	79	54	58	83	84	59	2	1
42	58	83	84	59	63	88	89	64	2	1
43	63	88	89	64	68	93	94	69	2	1
44	68	93	94	69	73	98	99	74	2	1
45	54	79	80	55	59	84	85	60	2	1

T R I P L E M O D 1 (M A R - 0 7 , 7 7) U P D A T E 1 (M A R - 0 7 , 7 7) E C L

3-D MODEL OF DTT
SEP. 3, 1977

SOLID ELEMENT NUMBER	S O L I D E L E M E N T N O D E N U M B E R S								I N T E G R A - T I O N M A T E R - O R D E R I A L N U M B E R	
	N O D E 1	N O D E 2	N O D E 3	N O D E 4	N O D E 5	N O D E 6	N O D E 7	N O D E 8		
46	59	84	85	60	64	89	90	65	2	1
47	64	89	90	65	69	94	95	70	2	1
48	69	94	95	70	74	99	100	75	2	1
49	76	101	102	77	81	106	107	82	2	1
50	81	106	107	82	86	111	112	87	2	1
51	86	111	112	87	91	116	117	92	2	1
52	91	116	117	92	96	121	122	97	2	1
53	77	102	103	78	82	107	108	83	2	1
54	82	107	108	83	87	112	113	88	2	1
55	87	112	113	88	92	117	118	93	2	1
56	92	117	118	93	97	122	123	98	2	1
57	78	103	104	79	83	108	109	84	2	1
58	83	108	109	84	88	113	114	89	2	1
59	88	113	114	89	93	118	119	94	2	1
60	93	118	119	94	98	123	124	99	2	1
61	79	104	105	80	84	109	110	85	2	1
62	84	109	110	85	89	114	115	90	2	1
63	89	114	115	90	94	119	120	95	2	1
64	94	119	120	95	99	124	125	100	2	1
65	101	126	127	102	106	131	132	107	2	1
66	106	131	132	107	111	136	137	112	2	1
67	111	136	137	112	116	141	142	117	2	1
68	116	141	142	117	121	146	147	122	2	1
69	102	127	128	103	107	132	133	108	2	1
70	107	132	133	108	112	137	138	113	2	1
71	112	137	138	113	117	142	143	118	2	1
72	117	142	143	118	122	147	148	123	2	1
73	103	128	129	104	108	133	134	109	2	1
74	108	133	134	109	113	138	139	114	2	1
75	113	138	139	114	118	143	144	119	2	1
76	118	143	144	119	123	148	149	124	2	1
77	104	129	130	105	109	134	135	110	2	1
78	109	134	135	110	114	139	140	115	2	1
79	114	139	140	115	119	144	145	120	2	1
80	119	144	145	120	124	149	150	125	2	1
81	126	151	152	127	131	156	157	132	2	1
82	131	156	157	132	136	161	162	137	2	1
83	136	161	162	137	141	166	167	142	2	1
84	141	166	167	142	146	171	172	147	2	1
85	127	152	153	128	132	157	158	133	2	1
86	132	157	158	133	137	162	163	138	2	1
87	137	162	163	138	142	167	168	143	2	1
88	142	167	168	143	147	172	173	148	2	1
89	128	153	154	129	133	158	159	134	2	1
90	133	158	159	134	138	163	164	139	2	1

T R I P L E M O D 1 (M A R - 0 7 , 7 7) U P D A T E 1 (M A R - 0 7 , 7 7) E C L

3-D MODEL OF DTT
SEP. 3, 1977

SOLID ELEMENT NUMBER	-- S O L I D --		E L E M E N T		N O D E		N U M B E R S		--		I N T E G R A -	M A T E R -
	N O D E 1	N O D E 2	N O D E 3	N O D E 4	N O D E 5	N O D E 6	N O D E 7	N O D E 8			T I O N	I A L
											O R D E R	N U M B E R
91	138	163	164	139	143	168	169	144			2	1
92	143	168	169	144	148	173	174	149			2	1
93	129	154	155	130	134	159	160	135			2	1
94	134	159	160	135	139	164	165	140			2	1
95	139	164	165	140	144	169	170	145			2	1
96	144	169	170	145	149	174	175	150			2	1
97	151	176	177	152	156	181	182	157			2	1
98	156	181	182	157	161	186	187	162			2	1
99	161	186	187	162	166	191	192	167			2	1
100	166	191	192	167	171	196	197	172			2	1
101	152	177	178	153	157	182	183	158			2	1
102	157	182	183	158	162	187	188	163			2	1
103	162	187	188	163	167	192	193	168			2	1
104	167	192	193	168	172	197	198	173			2	1
105	153	178	179	154	158	183	184	159			2	1
106	158	183	184	159	163	188	189	164			2	1
107	163	188	189	164	168	193	194	169			2	1
108	158	193	194	169	173	198	199	174			2	1
109	154	179	180	155	159	184	185	160			2	1
110	159	184	185	160	164	189	190	165			2	1
111	164	189	190	165	169	194	195	170			2	1
112	169	194	195	170	174	199	200	175			2	1
113	176	201	202	177	181	206	207	182			2	1
114	181	206	207	182	186	211	212	187			2	1
115	186	211	212	187	191	216	217	192			2	1
116	191	216	217	192	196	221	222	197			2	1
117	177	202	203	178	182	207	208	183			2	1
118	182	207	208	183	187	212	213	188			2	1
119	187	212	213	188	192	217	218	193			2	1
120	192	217	218	193	197	222	223	198			2	1
121	178	203	204	179	183	208	209	184			2	1
122	183	208	209	184	188	213	214	189			2	1
123	188	213	214	189	193	218	219	194			2	1
124	193	218	219	194	198	223	224	199			2	1
125	179	204	205	180	184	209	210	185			2	1
126	184	209	210	185	189	214	215	190			2	1
127	189	214	215	190	194	219	220	195			2	1
128	194	219	220	195	199	224	225	200			2	1
129	201	226	227	202	206	231	232	207			2	1
130	206	231	232	207	211	236	237	212			2	1
131	211	236	237	212	216	241	242	217			2	1
132	216	241	242	217	221	246	247	222			2	1
133	202	227	228	203	207	232	233	208			2	1
134	207	232	233	208	212	237	238	213			2	1
135	212	237	238	213	217	242	243	218			2	1

T R I P L E M O D 1 (M A R - 0 7 , 7 7) U P D A T E 1 (M A R - 0 7 , 7 7) E C L

3-0 MODEL OF DTT
SEP. 3, 1977

SOLID ELEMENT NUMBER	-- S O L I D NODE 1	N O D E 2	E L E M E N T NODE 3	N O D E 4	N O D E 5	N O D E 6	N U M B E R S NODE 7	N O D E 8	INTEGRA- TION ORDER	MATER- IAL NUMBER
136	217	242	243	218	222	247	248	223	2	1
137	203	228	229	204	208	233	234	209	2	1
138	208	233	234	209	213	238	239	214	2	1
139	213	238	239	214	218	243	244	219	2	1
140	218	243	244	219	223	248	249	224	2	1
141	204	229	230	205	209	234	235	210	2	1
142	209	234	235	210	214	239	240	215	2	1
143	214	239	240	215	219	244	245	220	2	1
144	219	244	245	220	224	249	250	225	2	1
145	226	251	252	227	231	256	257	232	2	1
146	231	256	257	232	236	261	262	237	2	1
147	236	261	262	237	241	266	267	242	2	1
148	241	266	267	242	246	271	272	247	2	1
149	227	252	253	228	232	257	258	233	2	1
150	232	257	258	233	237	262	263	238	2	1
151	237	262	263	238	242	267	268	243	2	1
152	242	267	268	243	247	272	273	248	2	1
153	228	253	254	229	233	258	259	234	2	1
154	233	258	259	234	238	263	264	239	2	1
155	238	263	264	239	243	268	269	244	2	1
156	243	268	269	244	248	273	274	249	2	1
157	229	254	255	230	234	259	260	235	2	1
158	234	259	260	235	239	264	265	240	2	1
159	239	264	265	240	244	269	270	245	2	1
160	244	269	270	245	249	274	275	250	2	1
161	251	276	252	256	280	257	0	0	2	1
162	256	280	257	261	284	262	0	0	2	1
163	261	284	262	266	288	267	0	0	2	1
164	266	288	267	271	292	272	0	0	2	1
165	252	276	277	253	257	280	281	258	2	1
166	257	280	281	258	262	284	285	263	2	1
167	262	284	285	263	267	288	289	268	2	1
168	267	288	289	268	272	292	293	273	2	1
169	253	277	278	254	258	281	282	259	2	1
170	258	281	282	259	263	285	286	264	2	1
171	263	285	286	264	268	289	290	269	2	1
172	268	289	290	269	273	293	294	274	2	1
173	254	278	279	255	259	282	283	260	2	1
174	259	282	283	260	264	286	287	265	2	1
175	264	286	287	265	269	290	291	270	2	1
176	269	290	291	270	274	294	295	275	2	1
177	276	296	277	280	277	281	0	0	2	1
178	280	299	281	284	302	285	0	0	2	1
179	284	302	285	288	305	289	0	0	2	1
180	288	305	289	292	308	293	0	0	2	1

TRIPLE MOD 1 (MAR-07,77) UPDATE 1 (MAR-07,77) ECL

3-D MODEL OF OTT
SEP. 3, 1977

SOLID ELEMENT NUMBER	-- SOLID NODE 1	NODE 2	ELEMENT NODE 3	NODE 4	NODE 5	NODE 6	NODE 7	NODE 8	INTEGRA- TION ORDER	MATER- IAL NUMBER
181	277	296	297	278	281	299	300	282	2	1
182	281	299	300	282	285	302	303	286	2	1
183	285	302	303	286	289	305	306	290	2	1
184	289	305	306	290	293	308	309	294	2	1
185	278	297	298	279	282	300	301	283	2	1
186	282	300	301	283	286	303	304	287	2	1
187	286	303	304	287	290	306	307	291	2	1
188	290	306	307	291	294	309	310	295	2	1
189	296	311	297	299	313	300	0	0	2	1
190	299	313	300	302	315	303	0	0	2	1
191	302	315	303	305	317	306	0	0	2	1
192	305	317	306	308	319	309	0	0	2	1
193	297	311	312	298	300	313	314	301	2	1
194	300	313	314	301	303	315	316	304	2	1
195	303	315	316	304	306	317	318	307	2	1
196	306	317	318	307	309	319	320	310	2	1
197	311	321	312	313	322	314	0	0	2	1
198	313	322	314	315	323	316	0	0	2	1
199	315	323	316	317	324	318	0	0	2	1
200	317	324	318	319	325	320	0	0	2	1
BANDWIDTH = 32										

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3-D MODEL OF DTT
SEP. 3, 1977

TOTAL, NUMBER OF FUNCTION TABLES • 4

FUNCTION NUMBER	NUMBER OF PAIRS/FLAG	IV POINT NUMBER	IV VALUE	FUNCTION VALUE
1	13/2	1	70.0000	1.9329
		2	100.0000	1.9444
		3	150.0000	2.0069
		4	200.0000	2.0602
		5	250.0000	2.1111
		6	300.0000	2.1644
		7	350.0000	2.2130
		8	400.0000	2.2685
		9	450.0000	2.3148
		10	500.0000	2.3681
		11	550.0000	2.4190
		12	600.0000	2.4769
		13	650.0000	2.5231
2	13/2	1	70.0000	3.2258
		2	100.0000	3.2516
		3	150.0000	3.2901
		4	200.0000	3.3272
		5	250.0000	3.3659
		6	300.0000	3.4052
		7	350.0000	3.4556
		8	400.0000	3.4793
		9	450.0000	3.5308
		10	500.0000	3.5685
		11	550.0000	3.5911
		12	600.0000	3.6275
		13	650.0000	3.6652
3	53/1	1	0.0000	550.0000
		2	2.0000	550.0000
		3	3.5000	550.0000
		4	4.5000	560.0000
		5	6.0000	554.0000
		6	7.0000	550.0000
		7	8.0000	545.0000
		8	9.0000	540.0000
		9	10.0000	535.0000
		10	11.0000	530.0000
		11	12.0000	522.0000
		12	13.0000	516.0000
		13	14.0000	508.0000
		14	15.0000	500.0000
		15	16.0000	490.0000
		16	17.0000	480.0000
		17	17.8000	470.0000
		18	18.1000	440.0000
		19	18.4000	418.0000
		20	18.7000	400.0000
		21	19.0000	381.0000
4	2/1	22	19.5000	350.0000
		24	21.0000	274.0000
		25	21.4000	258.0000
		26	22.0000	240.0000
		27	22.7000	225.0000
		28	23.5000	212.0000
		29	24.0000	200.0000
		30	24.5000	192.0000
		31	25.0000	178.0000
		32	26.0000	173.0000
		33	26.5000	193.0000
		34	27.0000	178.0000
		35	27.6000	160.0000
5	2/1	36	28.6000	158.0000
		37	29.0000	170.0000
		38	29.3000	170.0000
		39	29.6000	195.0000
		40	30.6000	170.0000
		41	30.9000	159.0000
		42	31.5000	159.0000
		43	32.0000	148.0000
		44	32.7000	150.0000
		45	33.2000	147.0000
		46	33.8000	160.0000
		47	34.3000	250.0000
		48	35.2000	200.0000
6	2/1	49	35.9000	185.0000
		50	36.3000	200.0000
		51	37.2000	155.0000
		52	37.8000	220.0000
		53	39.0000	180.0000
		54	0.0000	400.0000
		55	50.0000	400.0000