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NASA Contractor Report 168342

THERMTRAJ: A Fortran Program to Compute the Trajectory and Gas Film Temperatures of Zero Pressure Balloons

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National Aeronautics and Space Administration

Goddard Space Flight Center
Wallops Flight Facility
Wallops Island, Virginia 23337

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THERMTRAJ: A Fortran Program to Compute the Trajectory and Gas Film Temperatures of Zero Pressure Balloons

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Prepared Under Contract No. NAS6-3072

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THERMTRAJ: A FORTRAN PROGRAM TO COMPUTE THE TRAJECTORY AND GAS AND FILM TEMPERATURES OF ZERO PRESSURE BALLOONS

By

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SUMMARY

A FORTRAN computer program called THERMTRAJ is presented which can be used to compute the trajectory of high altitude scientific zero pressure balloons from launch through all subsequent phases of the balloon flight. In addition, balloon gas and film temperatures can be computed at every point of the flight. The program has the ability to account for ballasting, changes in cloud cover, variable atmospheric temperature profiles, and both unconditional valving and scheduled valving of the balloon gas. The program has been verified for an extensive range of balloon sizes (from 0.5-41.47 million cubic feet). Instructions on program usage, listing of the program source deck, input data deck and printed and plotted output for a verification case are included.

INTRODUCTION

The program described in this report was developed under NASA Contract NAS6-3072 to accurately compute the trajectory of high altitude scientific zero pressure balloons, and to compute the balloon film and gas temperature. A set of five ordinary differential equations based upon the dynamics and thermodynamics of the balloon system have been formulated. These equations are solved using a fourth order Runge-Kutta solution scheme with a variable time step. The program allows the user to specify a ballast schedule, to select from five atmospheric models (or supply his own) to adjust for changes in cloud cover and to account for balloon gas valving.

The background analysis for the computer program is contained in the reference, "A Unified Thermal and Trajectory Model for the Prediction of High Altitude Balloon Performance." The purpose of this report is to detail the use of the computer program. The following section is a presentation of the governing ordinary differential equations and the details of the options available to the user of the program. Subsequent sections will deal with the input data requirements and formats, the output format (both printed and plotted), a program listing, and the results of a verification study conducted during the development of the program.

PROBLEM DESCRIPTION

The trajectory of a balloon system is dependent upon the dynamics of the system and the thermal contributions from its atmospheric environment. Figure 1 contains a schematic of a typical zero-pressure balloon system indicating the source of thermal loading on the system. The results of the analyses are reported in the Reference. They show that the vertical motion of the balloon is governed by the following set of five ordinary differential equations:

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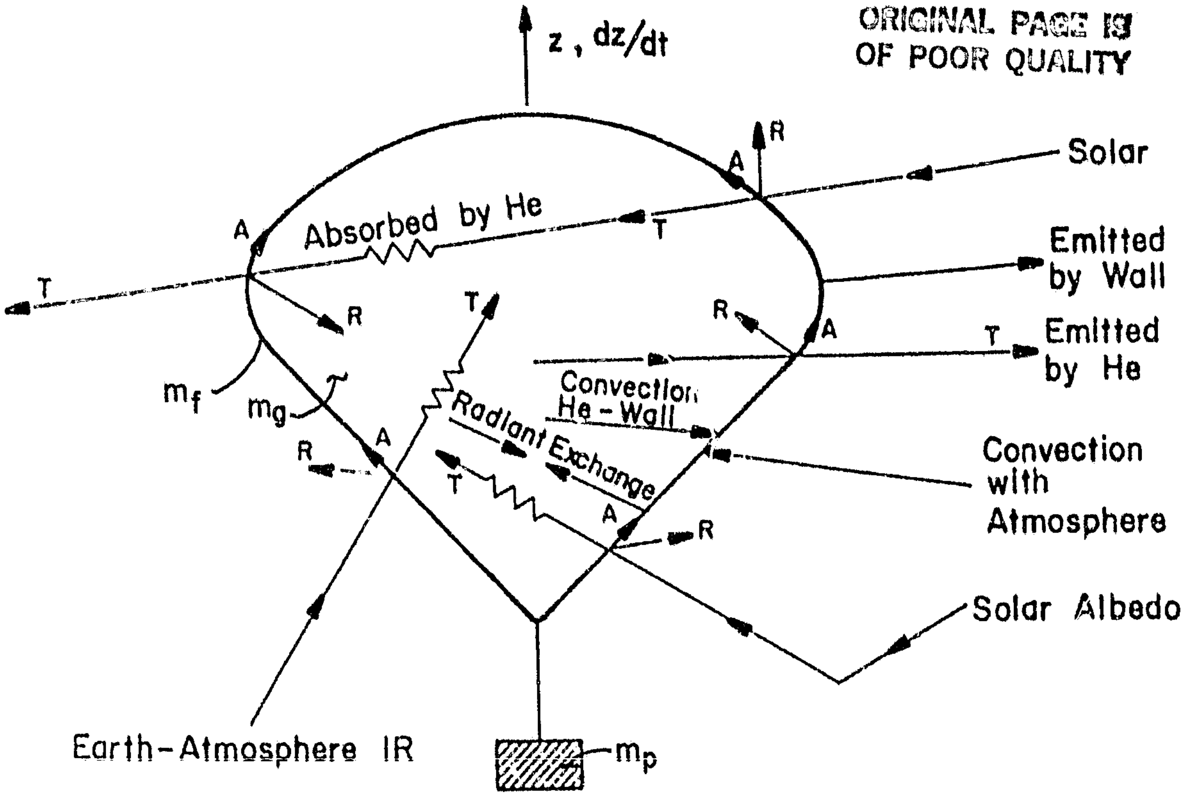

Symbols: T = Energy transmitted

R = Energy reflected

A = Energy absorbed

m_p = Mass of payload plus ballast

m_f = Mass of balloon film

m_g = Mass of balloon gas

Figure 1. Schematic of typical balloon system with the thermal inputs to the balloon.

$$\frac{dv}{dt} = \frac{g(\rho_a V_g - m_f - m_g - m_p) - (\rho_a C_D v^2 \overline{A})/2}{m_g + m_f + m_p + 1/2\ \rho_a V_g} \tag{1}$$

$$\frac{dz}{dt} = v \tag{2}$$

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$$\frac{dm_g}{dt} = \frac{p_g M_g}{RT_g}\ \dot{e}_g - \dot{e}_v \tag{3}$$

$$\frac{dT_f}{dt} = \frac{Q_f}{C_f m_f} \tag{4}$$

$$\frac{dT_g}{dt} = \frac{1}{C_{p_g} m_g} \left[Q_G - \frac{g M_a m_g T_g v}{T_a M_g} \right] \tag{5}$$

where: t = time

v = vertical velocity of the balloon system

g = acceleration due to gravity

ρ_a = density of air

V_g = volume of the balloon

m_f = mass of the balloon film

m_g = mass of gas

m_p = mass of the payload = mass of the balloon system - $(m_f + m_g)$

C_D = coefficient of drag

$\overline{A}$ = effective balloon cross-sectional area = 1.2089 $V_g^{2/3}$

z = balloon altitude

p_g = balloon gas pressure

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M_g = molecular weight of balloon gas

R = universal gas constant

T_g = temperature of the balloon gas

$\dot{e}_g$ = volume flow rate of gas exhausted at entry into float

$\dot{e}_v$ = mass flow rate of balloon gas during controlled valving operation

T_f = temperature of balloon film

Q_f = net heat flux to film

C_f = specific heat of balloon film

C_{p_g} = specific heat of balloon gas

Q_G = net heat flux to balloon gas

M_a = molecular weight of air

T_a = temperature of the air

and the radiative heat transfer to the balloon film can be expressed as

$$Q_F = \Big[1/4\ G\ \alpha_{w,\ eff} + 1/2\ G\ r_e \alpha_{w,eff} + \varepsilon_{int} \sigma (T_g{}^4 - T_f{}^4) +$$

$$CH_{gf}\ (T_g - T_f) + CH_{fa} (T_a - T_f) - \varepsilon_{w,eff}\ \sigma (T_f{}^4 - T_{BB}{}^4) \Big]\ S \quad . \tag{6}$$

while the radiative heat transfer to the balloon gas can be expressed as

$$Q_G = \Big[G\alpha_{g,eff}\ (1+r_e) - \varepsilon_{int}\ \sigma (T_g{}^4 - T_f{}^4) - CH_{gf} (T_g - T_f)$$

$$- \varepsilon_{g,eff}\ \sigma T^4 + \varepsilon_{g,eff}\ \sigma T_{BB}{}^4 \Big] S \tag{7}$$

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Where the effective coefficient of absorptivity of the balloon film, the effective coefficient of infrared interchange between the balloon film and gas, the effective coefficient of emissivity of the balloon film, the effective coefficient of absorptivity of the balloon gas, and the effective coefficient of emissivity of the balloon gas are expressed in terms of the gas and film radiative properties as:

$$\alpha_{w,eff} = \alpha_w \left[1 + \frac{\tau_{w,sol}\ (1-\alpha_g)}{1 - r_{w,sol}\ (1-\alpha_g)} \right] \tag{8}$$

$$\varepsilon_{int} = \frac{\varepsilon_g\ \varepsilon_w}{1 - r_w\ (1-\varepsilon_g)} \tag{9}$$

$$\varepsilon_{w,eff} = \varepsilon_w \left[1 + \frac{\tau_w\ (1-\varepsilon_g)}{1 - r_w\ (1-\varepsilon_g)} \right] \tag{10}$$

$$\alpha_{g,eff} = \frac{\alpha_g\ \tau_{w,sol}}{1 - r_{w,sol}\ (1-\alpha_g)} \tag{11}$$

$$\varepsilon_{g,eff} = \frac{\varepsilon_g\ \tau_w}{1 - r_w\ (1-\varepsilon_g)} \tag{12}$$

where G = solar constant

r_e = earth reflectivity (albedo)

σ = Stefan-Boltzman constant

CH_{gf} = convective heat transfer coefficient between the balloon film and gas

CH_{fa} = convective heat transfer coefficient between the balloon film and air

T_{BB} = black ball temperature

S = balloon surface area = $4.835976\ V_g^{2/3}$

α_w = coefficient of absorptivity of the balloon film in the infrared spectrum

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$\tau_{w,sol}$ = coefficient of transmissivity of the balloon film in the solar spectrum

α_g = coefficient of absorptivity of the balloon gas

$r_{w,sol}$ = coefficient of reflectivity of the balloon film in the solar spectrum

ε_g = coefficient of emissivity of the balloon gas

ε_w = coefficient of emissivity of the balloon film

r_w = coefficient of reflectivity of the balloon film in the infrared spectrum

τ_w = coefficient of transmissivity of the balloon film in the infrared spectrum

Differential equations 1 through 5, along with the defining equations 6 through 12, are solved using a Kutta-Simpson, one-third rule, fourth order Runge-Kutta solution technique.

The atmospheric properties are computed using any of five "standard" atmosphere models or a user supplied model. The five standard models are the 1962 Standard Atmosphere model and four models based upon NSBF temperature-altitude profiles measured during the winter, spring, summer and fall of the year.

Ballasting is accomplished by providing a ballast rate-time schedule corresponding to the actual ballast schedule of the balloon flight being simulated. This schedule represents the ballasting rate at all times during the flight; therefore, each ballasting operation is represented with an entry at both the beginning and the end of the ballast drop.

Controlled balloon gas valving operations are modelled in a manner similar to that for ballast drops. That is, a valving mass flow rate-time schedule is provided for every point of the flight. Therefore, every valving operation is represented by two entries in the valving schedule; one at the beginning of the valving operation and one at the end. Valving of the balloon gas at the entry into float is handled automatically by the program by monitoring the volume of the balloon. When the balloon volume exceeds the maximum volume of the balloon during a time step in the solution, a sufficient volume of gas is expelled to prevent the volume of the balloon from exceeding the maximum volume of the balloon and a smaller time step is used in the solution.

Cloud cover conditions are specified by a time schedule of albedo values and black-ball temperature profile adjustments at every point in the flight. Therefore, if accurate cloud cover information is available for the balloon flight being simulated it can be modelled within the program.

A variable time step solution of the governing differential equations was developed to economize the solution scheme. Basically, the procedure followed was to double the time step if the computed values of the increment of the balloon altitude, velocity, and film temperature and gas temperature were less than some user provided tolerance for the previous three steps in the solution. In a similar manner, the time step was reduced by a factor of 0.5 if the computed values of the same increments mentioned above exceed the user provided tolerance during any step of the solution and that solution step was repeated.

PROGRAM USAGE

The computer program is written in FORTRAN IV programming language and is operational on the Texas A&M Amdahl 470 V/6 and Amdahl 470 V/7B computers. The program uses plotting subroutines developed by California Computer Products, Inc. (Cal-Comp) which are available on the Texas A&M computer system.

This section gives an outline of the procedure for using the THERMTRAJ program for solving the equations, developed in Reference 1 and summarized in the previous section of this report, governing the vertical motion of the balloon system. Table 1 contains a summary of the input data cards necessary to run a flight simulation and Table 2 contains a summary of the units of the input data. Table 3 contains a list of the default values of the input variables for the program. Only those variables that are to be modified need to be assigned values on the data card associated with the READ (5, FIPUT) statement of line 91 of the source program listing of Appendix A. Table 4 contains a list of the FORTRAN variable names used in the program and their definitions. Table 5 contains a summary of the output of the program.

Figure 2 contains a typical four segment atmospheric temperature-altitude profile used to define the atmospheric properties at each point in the balloon flight and Figure 3 contains a summary plot of the five optional profiles that are contained in the THERMTRAJ program. A typical three segment black-ball temperature-altitude profile is presented in Figure 4 indicating the FORTRAN symbolic names of the coordinates of each of the break-points on the profile.

The user may begin the balloon simulation at any point of the balloon flight. The following input data in the NAMELIST FIPUT must be modified to correspond to the conditions which exist at the point the simulation is initialized:

TIMOL - Time of initialization of simulation (hrs)

CUTDT - Length of flight from the point the simulation was initiated (hrs)

ASCRT and HFLIT - Must be adjusted so that

$$\frac{\text{HFLIT - BALT}}{\text{ASCRT}}$$

yields either the time from initial start to the estimated time of float or the time when TBBC(I) is to be used instead of the three segment TBB profile

MGAS - Mass of gas at the start of the simulation (g)

MPAYI- Mass of payload, including remaining ballast at the start of the simulation (g)

All other NAMELIST variables are as if the computations were started at the original launch time and altitude.

The variables of the ballast drop schedule, the cloud cover schedule and the valving schedule must also be modified to correspond to the initial start time of the simulation. Specifically, the times in the arrays TBDRP(I), TCLDC(I), and TVALVE(I) must be times measured from the time of the initialization of the flight simulation, not from the launch time of the balloon.

All input experimental data (EMB, EAIRT, EFILMT, EGAST) must be for times which occur after the time of the start of the simulation.

Finally, the value of four variables within the body of the main program must be altered to correspond to the actual beginning of the simulation. The initial values of TR, TS, Z1, and Z2 (see lines 281-284 of the source deck of Appendix A) must be balloon gas temperature, film temperature, altitude, and velocity at the time of the beginning of the simulation.

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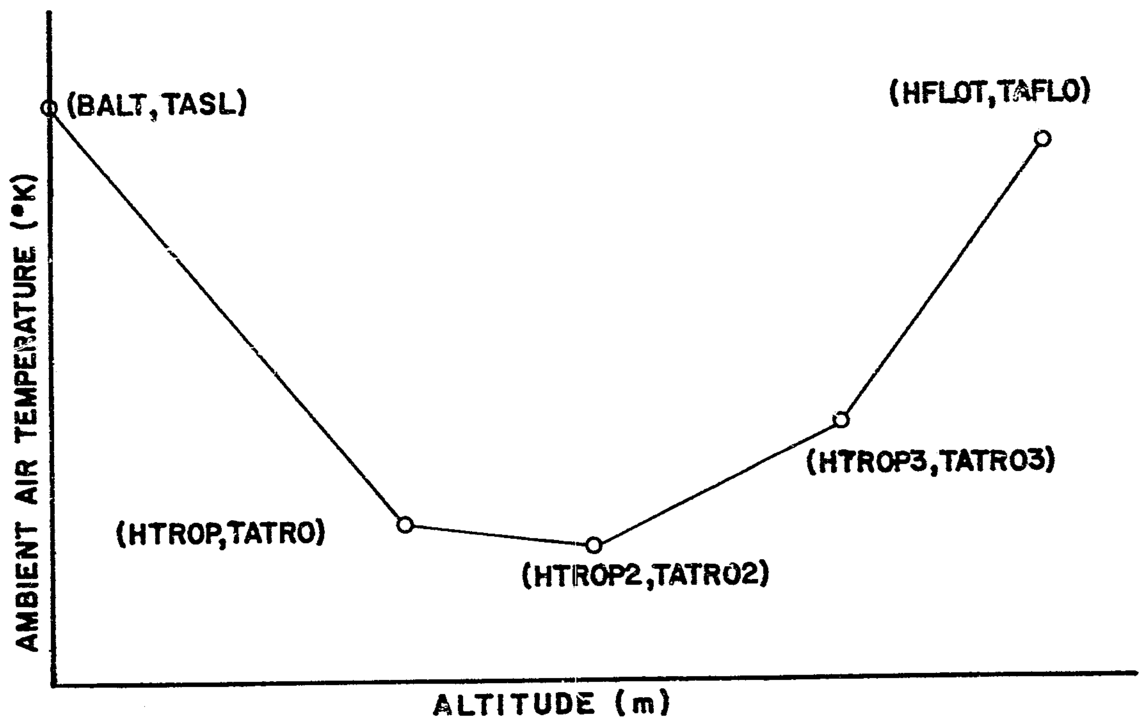

Figure 2. Typical Atmospheric Temperature Model

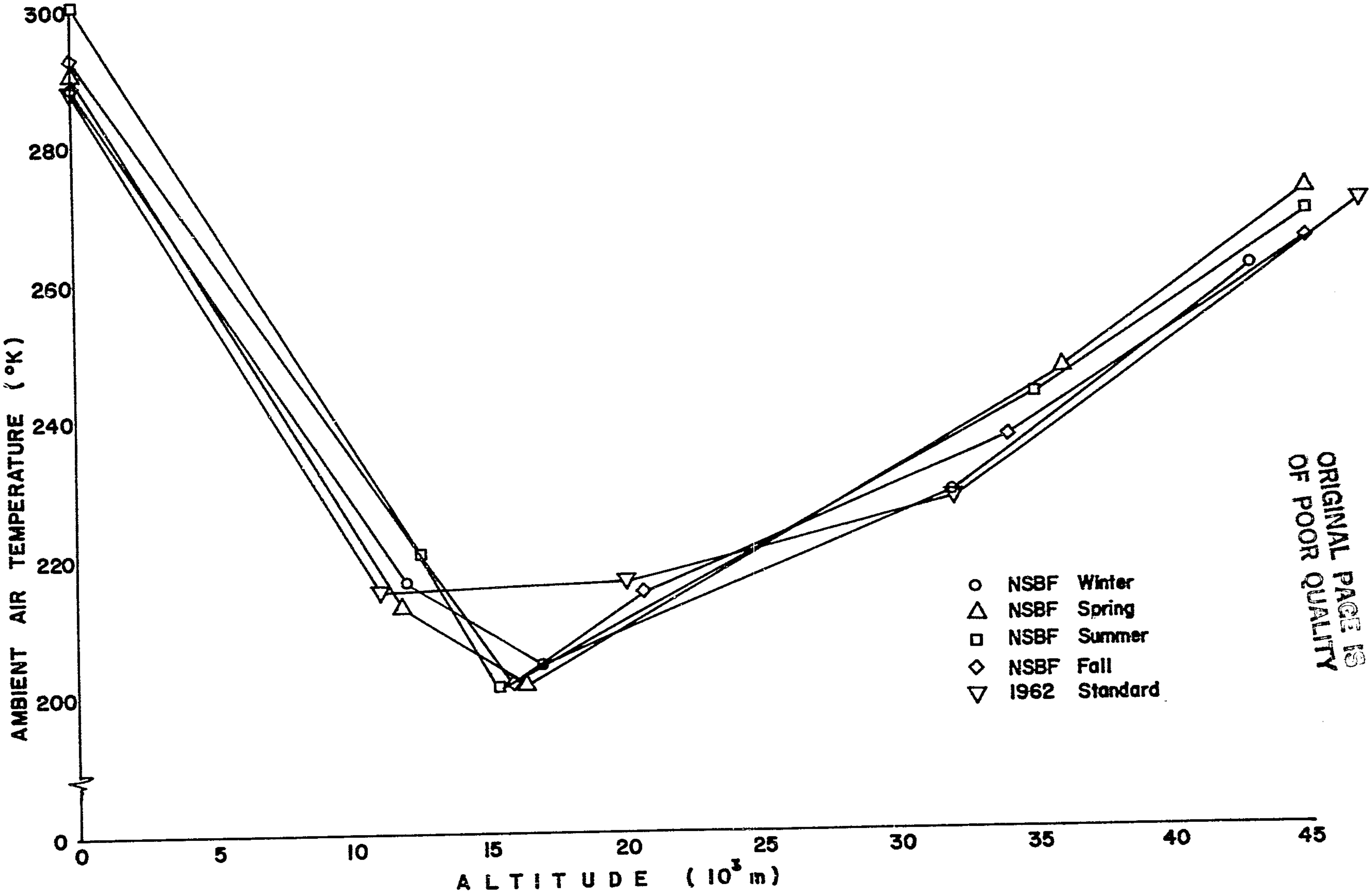

Figure 3. Five optional atmospheric temperature profiles available in the THERMTRAJ program

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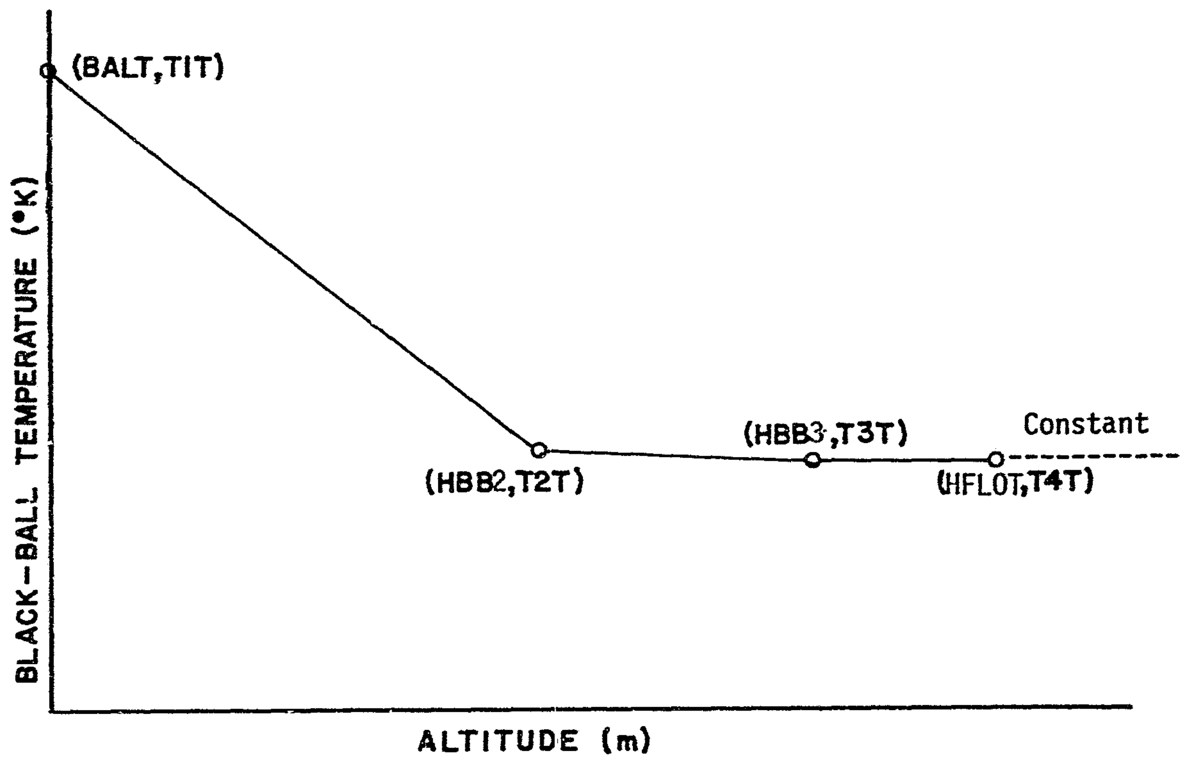

Figure 4. Typical black-ball temperature profile

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Table 1. Summary of Input Cards

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Read Order	Variables	Format
1	NTITLE	20A4
2	NAMELIST/FIPUT/TIMOL,CUTDT,BALT,ASCRT,HFLIT, PASL,MASSF,MGAS,MPAYI,VOLMAX,DAYL,TWILT,ALBED, FLSOD,PTINC,DTMAX,SPHTW,SPHTG,MOLA,MOLG,ALFRES, EG,ALFSO,TWSOL,RWSOL,EW,RW,TAUW,TASL,HTROP,TATRO, HTROP2,TATRO2,HTROP3,TATRO3,HFLOT,TAFLO,HBB2,HBB3, T2T,T3T,T4T,DPLT,IATMS	Namelist
3	NBDRP	
4	TBDRP(I) and BRATE(I); I=1,NBDRP (omitted if NBDRP=0)	2F10.2
5	NCLDC	I5
6	TCLDC(I),ALBC(I) and TBBC(I) (omitted if NCLDC=0)	3F10.2
7	NVALVE	
8	TVALVE(I) and VALVRT(I) (omitted if NVALVE=0)	2F10.2
9	NEX	I3
10	ELN1,ELN2,ELN3 (omitted if NEX=0)	3F3.0
11	TT(J),J=1,3; EMB(I),EAIRT(I),EFILMT(I),EGAST(I) (omitted if NEX=0)	3F3.0,1X, 4F10.4

Table 2 Summary of Units of Input Data

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TIMOL -	hrs.
CUTOT -	hrs.
BALT -	m
ASCRT -	m/min.
HFLIT -	m
PASL -	millibars
MASSF -	g
MGAS -	g
MPAYI -	g
VOLMAX -	m^3
DAYL -	hrs.
TWILT -	hrs.
ALBED -	dimensionless
FLSOD -	$cal/m^2/min.$
PTINC -	hrs.
DTMAX -	min.
SPHTW -	cal/g/°K
SPHTG -	cal/g/°K
MOLA -	dimensionless
MOLG -	dimensionless
ALFRES -	dimensionless
EG -	dimensionless
ALFSO -	dimensionless
TWSOL -	dimensionless
RWSOL -	dimensionless
EW -	dimensionless
RW -	dimensionless
TAUW -	dimensionless
TASL -	°K
HTROP -	m
TATRO -	°K
HTROP2 -	m
TATROP2 -	°K
HTROP3 -	m
TATROP3 -	°K
HFLOT -	m
TAFLO -	°K
HBB2 -	m
HBB3 -	m
T2T -	°K
T3T -	°K
T4T -	°K
DPLT -	dimensionless
IATMS -	dimensionless
NBDRP -	dimensionless
TBDRP -	min.
BRATE -	g/min.
NCLDC -	dimensionless
TCLDC -	min.
ALBC -	dimensionless
TBBC -	°K
NVALVE -	dimensionless
TVALVE -	min.
VALVRT -	g/sec.
NEX -	dimensionless
ELN1 -	hrs.
ELN2 -	min.
ELN3 -	sec.
TT(1) -	hrs.
TT(2) -	min.
TT(3) -	sec.
EMB -	millibars
EAIRT -	°C
EFILMT -	°C
EGAST -	°C

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Table 3. Summary of Input Default Values

TIMOL = 18.0	TWSOL = 0.885
CUTDT = 24.0	RWSOL = 0.114
BALT = 120.0	EW = 0.031
ASCRT = 304.8	RW = 0.127
HFLIT = 36700.0	TAUW = 0.842
PASL = 1013.3	TASL = 288.15
MASSF = 1.842E5	HTROP = 11000.0
MGAS = 6.9221E4	TATROP = 215.65
MPAYI = 1.9682E5	HTROP2 = 20000.0
VOLMAX = 6.6375E4	TATRO2 = 216.65
DAYL = 12.0	HTROP3 = 32000.0
TWILT = 0.75	TATRO3 = 228.65
ALBED = 0.18	HFLOT = 47000.0
FLSOD = 1.9892E4	TAFLO = 270.65
PTINC = 0.01666	HBB2 = 11000.0
DTMAX = 5.0	HBB3 = 20000.0
SPHTW = 0.55	T2T = 214.4
SPHTG = 1.24119	T3T = 214.4
MOLA = 28.9644	T4T = 214.4
MOLG = 4.0026	DPLT = -1.0
ALFRES = 0.0026	IATMS = 5
EG = 0.000312	RGAS = 8.31432E7
ALFSO = 0.001	EDOTG = 0.0

Table 4. List of FORTRAN variable names used within the program

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FORTRAN Variable		Description
ABAL	-	Surface area of balloon (m^2)
AG	-	Acceleration due to gravity (m/min^2)
AGEF	-	Effective infrared absorptance of balloon gas
ALBC(I)	-	Array of Albedo factors corresponding to times TCLDC(I)
ALBED	-	Current Albedo factor (0.18 for clear skies; 0.57 maximum)
ALFRES	-	Absorptance of balloon gas
ALFSO	-	Absorptance of balloon film
ASCRT	-	Estimated balloon ascent rate (m/min)
ATMOS2	-	Subroutine to compute balloon altitude in meters when the altitude is given in millibars of pressure
AWEF	-	Effective infrared absorptance of balloon film
AXIS1	-	Plotting subroutine (plots axes)(Local)
BALT	-	Launch altitude (m)
BRATE(I)	-	Array of ballast rates corresponding to times TBDRP(I)(g/min.)
C	-	Thermal conductivity of air (calorie/min/m/°K)
CD	-	Coefficient of drag
CFH	-	Function subprogram to compute the heat transfer coefficient between the balloon film and air
CG	-	Thermal conductivity of helium
CH	-	Heat transfer coefficient between balloon film and air

FORTRAN Variable	Description
CHF	- Forced convection coefficient between balloon film and air
CHN	- Natural convection coefficient between the balloon film and air
CHR	- Heat transfer coefficient between the balloon film and gas
CHRES	- Function subprogram to compute the heat transfer coefficient between the balloon film and gas
CIT	- Parameter used to determine relationship of the sun to the balloon (day/night)
CUTDT	- Length of flight to be simulated (hrs.)
DAYL	- Length of daylight (hrs.input; converted to min. within program)
DINCH	- Time of day (hrs.)
DPLT	- Positive value of DPLT generates plotted output
DTIME	- Time increment (min.)
DTIMEN	- Minimum time increment (min.)
DTMAX	- Maximum time increment (min.)
DTMIN	- Plotting time scale increment (min./inch of plot)
DX1	- Plotting time scale increment (min./inch of plot)
EAIRT(I)	- Array of measured ambient air temperature (°C) corresponding to the array of times ETIME(I)
EALT(I)	- Array of measured altitudes (m) corresponding to the array of times ETIME(I)
EDOTG	- Gas volume flow rate for "burping" of gas when float altitude is exceeded (m^3/sec)
EDOTV(I)	- Array of gas mass flow rate during valving operation (g/sec.) corresponding to the array of time TVALVE(I)

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FORTRAN Variable	Description
EFILMT(I)	- Array of measured balloon film temperature (°C) corresponding to the array of times ETIME(I)
EG	- Emissivity of the balloon gas
EGAST(I)	- Array of measured balloon gas temperature (°C) corresponding to the array of times ETIME(I)
EGEF	- Effective emissivity of the balloon gas
EINT	- Effective interchange emissivity between the balloon gas and film
ELANCH	- Launch time (sec.) = 3600.*ELN1+60.*ELN2+ELN3
ELN1	- See ELANCH (hrs.)
ELN2	- See ELANCH (min.)
ELN3	- See ELANCH (sec.)
EMB(I)	- Array of measured altitude (millibars) corresponding to the array of times ETIME(I)
EMB1(I)	- Array of ln (pressure at launch site/EMB(I)); plotting parameter
ETIME(I)	- Array of times for which measured temperature and altitude data have been input (sec) = 3600.*TT(1)+60.*TT(2)+T(3)-ELAUNCH
EW	- Emissivity of the balloon film
EWEF	- Effective emissivity of the balloon film
EXPO	- Exponent used in computing the pressure, density and temperature as a function of balloon altitude
EXPT	- Exponent used in computing the pressure, density and temperature as a function of balloon altitude
EXP2	- Exponent used in computing the pressure, density and temperature as a function of balloon altitude

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FORTRAN Variable	Description
EXP3	- Exponent used in computing the pressure, density and temperature as a function of balloon altitude
FK1,FK2,FK3,FK4,FL1,FL2,FL3,FL4,FM1,FM2,FM3,FM4,FN1,FN2,FN3,FN4,FO1,FO2,FO3,FO4	- Runge Kutta parameters of the general form: $y_i(t+dt)=y_i(t)+1/6\ (Fi1+2Fi2+2Fi3+Fi4)$ for $i = K,L,M,N,O$
FLIFT	- Free lift on the balloon (kg)
FLSOD	- Solar radiation constant ($1.9892\ 10^4$ cal/m^2/min)
FLXSD	- Solar radiation flux adjusted for the time of day
FMTOT	- Total mass of balloon system minus the mass of gas (kg)
F1, F2, F3, F4, F5	- Right hand sides of the five governing first order ordinary differential equations.
GR	- Grashof Number
GY	- Acceleration due to gravity (m/sec^2) in Subroutine ATMOS2
H	- Parameter in subroutine ATMOS2 to designate altitude (m)

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FORTRAN Variable		Description
HB	-	Parameter in subroutine ATMOS2 to designate the base altitude of the various layers of the standard atmosphere (m)
HBAL	-	Altitude of balloon (m)
HBB2	-	Black ball altitude corresponding to black ball temperature T2T in a black ball temperature-altitude three segment profile (m)
HBB3	-	Black ball altitude corresponding to black ball temperature T3T in a black ball temperature-altitude three segment profile (m)
HFLIT	-	Estimated float altitude (m) used to determine TIMFL. When time exceeds TIMFL, TBBC(I) used instead of three segment TBB profile.
HFLOT	-	Nominal float altitude (m)
HMGAS	-	Duplicate storage location for the mass of gas during each time increment (g)
HTR	-	Duplicate storage location for the balloon gas temperature during each time increment (°K)
HTROP	-	Altitude corresponding to the atmosphere temperature TATRO in a four segment temperature-altitude profile (m)
HTROP2	-	Altitude corresponding to the atmosphere temperature TATRO2 in a four segment temperature-altitude profile (m)
HTROP3	-	Altitude corresponding to the atmosphere temperature TATRO3 in a four segment temperature-altitude profile (m)
HTS	-	Duplicate storage location for the balloon film temperature during each time increment (°K)
HVOLG	-	Duplicate storage location for the balloon volume during each time increment (m^3)

FORTRAN Variable		Description
HZ1	-	Balloon altitude during each time increment (m)
HZ2	-	Balloon velocity during each time increment (m/sec)
IATMS	-	Parameter to choose atmospheric model, i.e., IATMS = 1 NSBF Winter Atmosphere 2 NSBF Spring Atmosphere 3 NSBF Summer Atmosphere 4 NSBF Fall Atmosphere 5 1962 Standard Atmosphere 6 User supplied atmosphere
IPC	-	Printer control character
ITC	-	Parameter used in varying the time increment of the solution of the governing differential equations
IVOL	-	Parameter used to identify regions of the flight that "burping" of balloon gas is required
IVT	-	Parameter used to adjust the volume flow rate of the gas during the "burping" process
KUTTA	-	Parameter used to direct the Runge-Kutta solution of the governing ordinary differential equations
LINE	-	Local system subroutine used in the plot portion of the program
LP	-	Lapse rate of the layers of the 1962 standard atmosphere as contained in subroutine ATMOS2
MA	-	Molecular weight of air (Subroutine ATMOS2 parameter)
MASSF	-	Mass of balloon film (g)

FORTRAN Variable		Description
MGAS	-	Mass of gas(g)
MGASD	-	Increment of the mass of gas for each time step of the solution
MOLA	-	Molecular weight of air (main program)
MOLG	-	Molecular weight of balloon gas
MPAY	-	Mass of the balloon payload (g)
MPAYI	-	Mass of the balloon payload at launch including ballast (g)
MPD(I)	-	Array of mass of balloon payload associated with time of ballast drops TBDRP(I)
NBDRP	-	(Number of ballast drops + 1) * 2; input number of ballast drops required
NCLDC	-	(Number of cloud cover and/or black ball regions in the flight simulation) + 1; input number of cloud cover or black ball regions required for the simulation
NEX	-	Number of measured data points input
NEX1	-	NEX + 1
NEX2		NEX + 2
NPC	-	Printer control character
NPSUN	-	Parameter to eliminate the influence of the sun during the night portion of the flight simulation
NSUN	-	Parameter to eliminate the influence of the sun during the night portion of the flight simulation
NTITLE(I)	-	Array for storage of an 80 character title
NVALVE	-	(Number of gas valvings during the flight +1) * 2; input number of valvings required for the flight simulation
NYC	-	Number of data points collected for plotting
NYCP1	-	NYC + 1
NYCP2	-	NYC + 2
PA	-	Atmospheric pressure in subroutine ATMOS2 (millibars)

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FORTRAN Variable		Description
PASL	-	Ambient air pressure at the launch site (mb)
PATRO	-	Ambient air pressure at HTROP (mb)
PATRO2	-	Ambient air pressure at HTROP2 (mb)
PATRO3	-	Ambient air pressure at HTROP3 (mb)
PB	-	Balloon gas pressure (mb)
PB1(I)	-	Array of pressure altitude parameters corresponding to the array of times XPTT(I). PB1 = ln (PASL/PB)
PLOT	-	System subroutine used in plotting phase of program
PLOTS	-	System subroutine used in plotting phase of program
PR	-	Prandtl Number
PTIMH	-	Time of day in hours } Data are printed and saved for plotting in time increments of PTINC
PTINC	-	Time increment in hours } Data are printed and saved for plotting in time increments of PTINC
QF	-	Rate of heat transfer to the balloon film
QG	-	Rate of heat transfer to the balloon gas
R	-	Radius of balloon (Main program and subprograms CFH and CHRES)
	-	Universal gas constant (subprogram ATMOS2)
REY	-	Reynold's number
RGAS	-	Universal gas constant
RHOB	-	Air density at the base of the layers of the 1962 Standard
	-	Altitude in subprogram ATMOS2
RRES	-	Diameter of the balloon (subprogram CHRES)
RW	-	Infrared reflectivity of the balloon film
RWSOL	-	Ultraviolet reflectivity of the balloon film
SIGMA	-	Stefan-Boltzmann constant
SPHTG	-	Specific heat of the balloon gas

FORTRAN Variable		Description
SPHTW	-	Specific heat of the balloon film
STOR	-	Temporary storage location for the balloon gas viscosity
TA	-	Ambient air temperature (°K)
TAFLO	-	Air temperature corresponding to altitude HFLOT in the four segment air temperature profile (°K)
TAK	-	Ambient air temperature (°C)
TASL	-	Air temperature at launch (°K)
TATRO	-	Air temperature corresponding to altitude HTROP in a four segment air temperature profile (°K)
TATRO2	-	Air temperature corresponding to altitude HTROP2 in a four segment air temperature profile (°K)
TATRO3		Air temperature corresponding to altitude HTROP3 in a four segment air temperature profile (°K)
TAUW	-	Infrared transmittance of the balloon film
TB	-	Air temperature at the base of the atmospheric layer of the 1962 Standard Atmosphere in subprogram ATMOS2
TBB	-	Black ball temperature (°K)
TBBC(I)	-	Array of black ball temperatures corresponding to the cloud cover array ALBC(I) and the array of times TCLDC(I). Used when time exceeds TIMFL. (°K)
TBDRP(I)	-	Array of times associated with the ballast drops of the simulated flight (min.)
TCLDC(I)	-	Array of times associated with the cloud cover factors ALBC(I) and TBBC(I) (min.)
TIME	-	Time of day at each point of the flight simulation (min)

FORTRAN Variable		Description
TIMFL	-	Estimated time to float. Computed from ASCRT and HFLIT.
TIMH	-	Time of day at each point of the flight simulation (hrs)
TIMH1	-	Time from launch at each point of the flight simulation (min)
TIMIO	-	Temporary storage of time of launch (min)
TIMM	-	Time from launch of each point of the flight simulation (min)
TIMOL	-	Time of launch (hrs. local standard time input; converted to minutes within program)
TIMSR	-	Time of sunrise (min)
TIMSS	-	Time of sunset (min)
TOHIGH	-	A parameter in subroutine ATMOS2 which indicates when the atmospheric pressure input is less than the capability of the subroutine and thus corresponds to an altitude that is too high to be accurately modeled by the subroutine
TR	-	Temperature of the balloon gas (°K)
TRDEL	-	Increment of the gas temperature during each step of the Runge-Kutta solution of the governing ordinary differential equations (°K)
TRK	-	Temperature of the balloon gas (°C)
TS	-	Temperature of the balloon film (°K)
TSDEL	-	Increment of the film temperature during each step of the Runge-Kutta solution of the governing ordinary differential equations (°K)

FORTRAN Variable		Description
TSK	-	Temperature of the balloon film (°C)
TSL	-	Maximum allowable change in balloon film temperature during each solution step
TT(I)	-	See ETIME(I)
TTIME	-	Time from sunset or sunrise (min.)
TTMIN	-	Plotting parameter. Minimum temperature to be plotted (°C)
TTS	-	Time associated with starting conditions (min.)
TVALVE(I)	-	An array of times corresponding to changes in valving rates (min)
TWILT	-	Length of twilight (hrs)
TWSOL	-	Ultraviolet transmittance of the balloon film
T1	-	Temperature of the air in subprogram CFH (°K)
T1T	-	Black ball temperature corresponding to altitude BALT in the black ball temperature profile (°K)
T2T	-	Black ball temperature corresponding to altitude HBB2 in the black ball temperature profile (°K)
T3T	-	Black ball temperature corresponding to altitude HBB3 in the black ball temperature profile (°K)
T4T	-	Black ball temperature corresponding to altitude HFLOT in the black ball temperature profile (°K). Used for altitudes above HFLOT
UMU	-	Viscosity of the balloon gas or ambient air, as appropriate
VALVRT(I)	-	Array of valving mass flow rates corresponding to the times TVALVE(I) (g/sec)

FORTRAN Variable		Description
VOLG	-	Volume of the balloon (m^3)
VOLMAX	-	Maximum volume of the balloon (m^3)
X	-	Intermediate value in the computation of both the heat transfer coefficient between the film and gas (subprogram CHRES) and the heat transfer coefficient between the film and air (subprogram CFH)
XLT	-	Physical length of the time axis on all plots (in)
XLT1	-	Physical spacing between sets of axes in the plotting (in)
XLT2	-	Physical spacing between sets of axes in the plotting (in)
XPTT(I)	-	Array of times corresponding to the arrays of computed values of gas temperature, YPT3; air temperature, YPT1; film temperature, YPT2; balloon altitude, YPH; and the pressure altitude parameter, PB1 (min)
YPH(I)	-	Array of balloon altitudes, corresponding to the array of times XPTT(I), to be plotted(m)
YPT1(I)	-	Array of air temperatures, corresponding to the array of times XPTT(I), to be plotted (°C)
YPT2(I)	-	Array of balloon film temperatures, corresponding to the array of times XPTT(I), to be plotted (°C)
YPT3(I)	-	Array of balloon gas temperatures, corresponding to the array of times XPTT(I), to be plotted (°C)
ZSL	-	Maximum allowable change in balloon altitude during each time step of the solution (m)
Z1	-	Balloon altitude (m)

FORTRAN Variable		Description
Z1DEL	-	Increment of balloon altitude during each time step of the solution (m)
Z2	-	Balloon vertical velocity (m/min)
Z2DEL	-	Increment of balloon vertical velocity during each time step of the solution (m/min)

Table 5. Summary of Program Output

Printed Output

1.) Heading

2.) Listing of input data in namelist FIPUT

3.) Tabular listing of the input ballast drop schedule:

Time of ballast drop (sec) Ballast rate (g/min)

(NBDRP values printed)

4.) Tabular listing of the input cloud cover details:

Time of cloud cover (sec) Albedo Blackball Temp. (°K)

(NCLDC values printed)

5.) Tabular listing of the input valving schedule:

Time of the valving (sec) Valve rate (g/min)

(NVALVE values printed)

6.) Tabular listing of the input measured data from the balloon flight being simulated:

Time (sec.) Altitude (m) Air Temp. (°C) Film Temp. (°C) Gas Temp. (°C)

(NEX values printed)

7.) The computed values of the effective emissivity of the balloon gas, the effective emissivity of the balloon film, and the effective interchange emissivity between the balloon gas and film.

8.) The computed values of the effective infrared absorptance of the balloon gas and the effective infrared absorptance of the balloon film.

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9.) Tabular listing of the computed results:

Time(min), Altitude(m), Velocity(m/min), Air Temp. (^oC), Film Temp. (^oC), Balloon volume(m^3), Solar Flux, Blackball Temp. (^oK), Free lift (kg), Pressure altitude (millibars), Mass of gas (g), Reynold's number, Coefficient of Drag, Payload mass (g)

10.) The total number of data points saved for plotting (NYC).

Plotted Output (Requires local subroutines equivalent to AXIS1, PLOT, PLOTS, LINE)

1.) A plot of the computed balloon altitude-time history and a plot of the measured balloon altitude-time history (if NEX is not 0), on a single set of axes.

2.) Plots of the computed balloon film and gas temperature and the ambient air temperature as functions of flight time. Also plots of measured values of film, gas and air temperature if NEX is not 0.

3.) A plot of the computed balloon pressure altitude parameter, $\ln(P_{launch\ site}/P_{altitude})$, as a function of time, and a similar plot of the measured pressure altitude parameter if NEX is not 0.

Reference

1. Carlson, L.A. and Horn, W.J., "A Unified Thermal and Vertical Trajectory Model for the Prediction of High Altitude Balloon Performance," Texas Engineering Experiment Station Report TAMRF-4217-81-02, June, 1981.

APPENDIX A

PROGRAM LISTING

```
C*********************************************************************
C*********************************************************************
C*                                                                   *
C*      P R O G R A M     T H E R M T R A J                          *
C*                                                                   *
C*********************************************************************
C*     A FORTRAN PROGRAM TO COMPUTE THE TRAJECTORY AND THE           *
C*     GAS AND FILM TEMPERATURES AS A FUNCTION OF TIME FOR           *
C*     ZERO PRESSURE BALLOONS.                                       *
C********************************************************************
C*      DEVELOPED BY THE AEROSPACE ENGINEERING DEPT. OF TEXAS        *
C*      A&M UNIVERSITY, COLLEGE STATION, TX. 77843                   *
C*      FOR INFORMATION CALL DR. L.A. CARLSON, 713-845-7541          *
C********************************************************************
C*      DEVELOPMENT OF THIS PROGRAM WAS SPONSORED BY NASA            *
C*      WALLOPS FLIGHT CENTER UNDER CONTRACT NAS6-3072               *
C********************************************************************
      REAL MGAS,MOLA,MOLG,MASSF,MPAY,MPAYI,MPD(100),BRATE(100),
     1  TBDRP(100),TCLDC(10),ALBC(10),TBBC(10),TVALVE(25),VALVRT(25)
      NAMELIST /INPUT/ TIMOL,CUTDT,BALT,ASCRT,HFLIT,PASL,MASSF,MGAS,
     1  MPAYI,VOLMAX,DAYL,TWILT,ALBED,FLSCD,PTINC,DTMAX,SPHTW,SPHTG,
     2  MOLA,MOLG,ALFRES,EG,ALFSO,TWSOL,RWSOL,EW,RW,TAUW,TASL,HTROP,
     3  TATRO,HTROP2,TATRO2,HTROP3,TATRO3,HFLOT,TAFLO,HBB2,HBB3,T2T,T3T,
     4  T4T,DPLT,IATMS
      DIMENSION NTITLE(20), YPT1(1000), YPT2(1000), YPT3(1000),
     1  YPH(1000), XPT(1000)
      DIMENSION ETIME(400), EALT(400), EAIRT(400), EFILMT(400),
     1  EGAST(400), EMB(400), TT(3),  EMB1(400), PB1(1000)
      COMMON /AA/ R,UML,RO,AG,PR,C
      COMMON /CALAC/ RRES
C*********************************************************************
C*    SECTION ONE --INPUT AND INITIALIZATION                         *
C*********************************************************************
      PRINT 710
      READ 560, (NTITLE(IN),IN=1,20)
      WRITE (6,570) (NTITLE(IN),IN=1,20)
      ITC=0
      TSL=1.0
      NYC=0
      ZSL=50.00
      DTIMEN=0.025
C DEFAULT VALUES
      TIMOL=18.0
      CUTDT=24.0
      BALT=120.0
      ASCRT=304.8
      HFLIT=36700.0
      PASL=1013.3
      MASSF=1.842E5
      MGAS=6.9221E4
      MPAYI=1.9682E5
      VOLMAX=6.6375E4
      DAYL=12.0
```

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```
      TWILT=0.75
      ALBED=0.18
      FLSOD=1.9892E4
      PTINC=0.01666
      DTMAX=5.0
      SPHTW=0.55
      SPHTG=1.24119
      MOLA=28.9644
      MOLG=4.0026
      ALFRES=0.0026
      EG=0.000312
      ALFSO=0.001
      TWSOL=0.885
      RWSOL=0.114
      EW=0.031
      RW=0.127
      TAUW=0.842
      TASL=288.15
      HTROP=11000.0
      TATRO=215.65
      HTROP2=20000.0
      TATRO2=216.65
      HTROP3=32000.0
      TATRO3=228.65
      HFLOT=47000.0
      TAFLO=270.65
      HBB2=11000.0
      HBB3=20000.0
      T2T=214.4
      T3T=214.4
      T4T=214.4
      DPLT=-1.0
      IATMS=5
      RGAS=8.31432E7
      EDOTG=0.0
      READ (5,FIPUT)
      GO TO (100,110,120,130,140,150), IATMS
C*********************************************************************
C    W I N T E R   A T M O S P H E R E
C*********************************************************************
  100 TASL=288.55
      HTROP=12000.0
      TATRO=216.15
      HTROP2=16900.0
      TATRO2=204.65
      HTROP3=32000.0
      TATRO3=229.35
      HFLOT=43000.0
      TAFLO=261.55
      HBB2=16900.0
      HBB3=20000.0
      GO TO 150
C*********************************************************************
C    S P R I N G   A T M O S P H E R E
C*********************************************************************
  110 TASL=291.15
      HTROP=11810.0
      TATRO=212.85
```

```
      HTROP2=16230.0
      TATRO2=203.85
      HTROP3=36000.0
      TATRO3=247.05
      HFLOT=45000.0
      TAFLO=272.35
      HBB2=16230.0
      HBB3=20000.0
      GO TO 150
C**********************************************************************
C    S U M M E R     A T M O S P H E R E
C**********************************************************************
  120 TASL=304.55
      HTROP=12500.0
      TATRO=220.65
      HTROP2=15300.0
      TATRO2=201.35
      HTROP3=35000.0
      TATRO3=243.25
      HFLOT=45000.0
      TAFLO=269.25
      HBB2=15300.0
      HBB3=20000.0
      GO TO 150
C**********************************************************************
C    F A L L     A T M O S P H E R E
C**********************************************************************
  130 TASL=293.85
      HTROP=15800.0
      TATRO=202.55
      HTROP2=20640.0
      TATRO2=215.25
      HTROP3=34000.0
      TATRO3=237.65
      HFLOT=45000.0
      TAFLO=265.65
      HBB2=15800.0
      HBB3=20000.0
      GO TO 150
C**********************************************************************
C    1 9 6 2     S T A N D A R D     A T M O S P H E R E
C**********************************************************************
  140 TASL=288.15
      HTROP=11000.0
      TATRO=215.65
      HTROP2=20000.0
      TATRO2=216.65
      HTROP3=32000.0
      TATRO3=228.65
      HFLOT=47000.0
      TAFLO=270.65
      HBB2=11000.0
      HBB3=20000.0
  150 CONTINUE
      WRITE (6,FIPUT)
      READ 580, NBDRP
      TBDRP(1)=0.
      TBDRP(2)=1.
```

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      TBDRP(3)=2.
      DO 160 I=1,3
         TCLDC(I)=TBDRP(I)
         BRATE(I)=0.
         TVALVE(I)=TBDRP(I)
         VALVRT(I)=0.0
         ALBC(I)=ALBED
         TBBC(I)=214.4
         IF (ALBED.GT.0.3) TBBC(I)=194.4
  160 CONTINUE
      IF (NBDRP.EQ.0) GO TO 180
      PRINT 590
      DO 170 I=1,NBDRP
         READ 600, TBDRP(I),BRATE(I)
         PRINT 600, TBDRP(I),BRATE(I)
  170 CONTINUE
  180 CONTINUE
      READ 580, NCLDC
      IF (NCLDC.EQ.0) GO TO 200
      PRINT 610
      DO 190 I=1,NCLDC
         READ 600, TCLDC(I),ALBC(I),TBBC(I)
         PRINT 600, TCLDC(I),ALBC(I),TBBC(I)
  190 CONTINUE
  200 CONTINUE
      READ 580, NVALVE
      IF (NVALVE.EQ.0) GO TO 220
      PRINT 620
      DO 210 I=1,NVALVE
         READ 600, TVALVE(I),VALVRT(I)
         PRINT 600, TVALVE(I),VALVRT(I)
  210 CONTINUE
  220 CONTINUE
C*****************************************************************
C     SECTION TWO -- EXPERIMENTAL DATA INPUT FOR PLOTS          *
C*****************************************************************
      IF (DPLT.LE.0.) GO TO 260
      READ 630, NEX
C
  230 CONTINUE
      IF (NEX.EQ.0) GO TO 260
      READ 750, ELN1,ELN2,ELN3
      ELANCH=3600.*ELN1+60.*ELN2+ELN3
      DO 240 I=1,NEX
C
         READ 750, (TT(J),J=1,3),EMB(I),EAIRT(I),EFILMT(I),EGAST(I)
         ETIME(I)=TT(1)*3600.+TT(2)*60.+TT(3)-ELANCH
         CALL ATMOS2 (EMB(I),EALT(I),TOHIGH)
  240 CONTINUE
C
      WRITE (6,740)
      DO 250 J=1,NEX
         WRITE (6,760) ETIME(J),EALT(J),EAIRT(J),EFILMT(J),EGAST(J)
  250 CONTINUE
  260 CONTINUE
C*****************************************************************
C    SECTION THREE -- PARAMETER SETUP                           *
C*****************************************************************
```

```
      IPC=-1
      NPC=0
      C=2.90544E-01
      ROSL=1.2248
      SIGMA=8.1346049E-07
      AG=3.5303886E+04
      TIMCL=TIMOL*60.0
      TIMIO=TIMOL
      DO 270 I=1,NBDRP
         TBDRP(I)=TBDRP(I)+TIMOL
  270 CONTINUE
      DO 280 I=1,NCLDC
         TCLDC(I)=TCLDC(I)+TIMOL
  280 CONTINUE
      DO 290 I=1,NVALVE
         TVALVE(I)=TVALVE(I)+TIMCL
  290 CONTINUE
      MPD(1)=MPAYI
      DO 300 I=2,NBDRP
         MPD(I)=MPD(I-1)-BRATE(I-1)*(TBDRP(I)-TBDRP(I-1))
  300 CONTINUE
      PR=0.74
      DAYL=DAYL*60.0
      TWILT=TWILT*60.0
      HBAL=BALT
      CUTDT=CUTDT*60.0
      TIMSR=720-DAYL/2.0
      TIMSS=TIMSR+DAYL
      TIMFL=TIMOL+(HFLIT-BALT)/ASCRT
      EXPO=-(TASL-TATRO)/(HTROP-BALT)
      EXPO=AG*MOLA/RGAS/EXPO/0.36
      EXPT=(TATRO2-TATRO)/(HTROP2-HTROP)
      EXPT=AG*MOLA/RGAS/EXPT/0.36
      EXPT2=(TATRO3-TATRO2)/(HTROP3-HTROP2)
      EXPT2=AG*MOLA/RGAS/EXPT2/0.36
      EXPT3=(TAFLO-TATRO3)/(HFLOT-HTROP3)
      EXPT3=AG*MOLA/RGAS/EXPT3/0.36
      PATRO=PASL/((TATRO/TASL)**EXPO)
      PATRO2=PATRO/((TATRO2/TATRO)**EXPT)
      PATRO3=PATRO2/((TATRO3/TATRO2)**EXPT2)
C     INITIALIZE TEMPS TO SURFACE TEMP
      TR=TASL
      TS=TASL
      Z1=BALT
      Z2=0.0
      VOLG=MGAS*RGAS*TR/(PASL*MOLG)/(1.E09)
      EINT=EG*EW/(1.-RW*(1.-EG))
      EGEF=EG*TAUW/(1.-RW*(1.-EG))
      EWEF=EW*(1.+TAUW*(1.-EG)/(1.-RW*(1.-EG)))
      PRINT 640, EGEF,EWEF,EINT
      AGEF=ALFRES*TWSOL/(1.-RWSOL*(1.-ALFRES))
      AWEF=ALFSO*(1.+TWSOL*(1.-ALFRES)/(1.-RWSOL*(1.-ALFRES)))
      PRINT 650, AGEF,AWEF
      RO=ROSL
      T1T=TASL-5.5
      DTIME=DTIMEN
      NSUN=0
      TTS=TIMIO
```

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```
      IF (TIMIO.GT.TIMCL) TTS=TIMOL
      IF (TTS.GE.TIMSR.AND.TTS.LE.TIMSS) NSUN=1
      TIME=TTS
      TTIME=1440.0-TIMSS+TIME
      IF (NSUN.EQ.1) TTIME=TIME-TIMSR
      IF (TIME.GE.TIMSS) TTIME=TIME-TIMSS
      DINCH=TIME/60.0
      PTIMH=TIME/60.0
C*****************************************************************
C     SECTION FOUR -- START OF COMPUTATION LOOP                  *
C*****************************************************************
  310 CONTINUE
C     SOLAR FLUX
      IF (NSUN.EQ.0) GO TO 320
      FLXSO=FLSOD*TTIME/TWILT
      IF (TTIME.GE.TWILT) FLXSO=FLSOD
      IF (TTIME.GE.(DAYL-TWILT).AND.NSUN.EQ.1) FLXSO=
     1  FLSOD-(FLSOD/TWILT)*(TTIME-(DAYL-TWILT))
      IF (TTIME.GT.DAYL) FLXSO=0.0
      GO TO 330
  320 CONTINUE
      FLXSO=0.0
C*****************************************************************
C     SECTION FIVE -- VARIABLE STORE FOR ITERATION               *
C*****************************************************************
  330 CONTINUE
      HTS=TS
      HTR=TR
      HZ1=Z1
      HZ2=Z2
      HMGAS=MGAS
      HVOLG=VOLG
      HBAL=Z1
C*****************************************************************
C     SECTION SIX -- TA,UMU,RHO, AND P3 AS FUNCTIONS OF ALTITUDE *
C*****************************************************************
      IF (TIME.LE.TIMCL) HEAL=BALT
      IF (HBAL.LE.HTROP) TA=TASL-(TASL-TATRO)*(HEAL-BALT)/(HTROP-BALT)
      IF (HBAL.GT.HTROP) TA=TATRO+(TATRO2-TATRO)*(HBAL-HTROP)/
     1  (HTROP2-HTROP)
      IF (HEAL.GT.HTROP2) TA=TATRO2+(TATRO3-TATRO2)*(HBAL-HTROP2)/
     1  (HTROP3-HTROP2)
      IF (HBAL.GT.HTROP3) TA=TATRO3+(TAFLO-TATRO3)*(HEAL-HTROP3)/
     1  (HFLOT-HTROP3)
      IF (HBAL.LE.HTROP) PB=PASL/((TA/TASL)**EXPO)
      IF (HBAL.GT.HTROP) PB=PATRO/((TA/TATRO)**EXPT)
      IF (HEAL.GT.HTROP2) PB=PATRO2/((TA/TATRO2)**EXPT2)
      IF (HBAL.GT.HTROP3) PB=PATRO3/((TA/TATRO3)**EXPT3)
      RO=MOLA*PB/(RGAS*TA)*1.E06
C     VISCOSITY OF AIR
      UMU=(1.8296390C1E-05-HBAL*5.06805747E-10+HBAL*HBAL*1.82009519E-14-
     1  HBAL**3.0*1.72287567E-19)*60.0
      IVOL=0
      IVT=1
  340 CONTINUE
      IVOL=0
      KUTTA=1
  350 CONTINUE
```

```
C*********************************************************************
C         SECTION SEVEN -- HEAT TRANSFER AND DRAG                     *
C*********************************************************************
      VOLG=MGAS*RGAS*TR/(PE*MOLG)/(1.E+09)
C        VOLG IN M CUBED
      ASCRT=Z2
      R=0.62035*VOLG**(1./3.)
      RRES=R
      CHN=CFH(TA,TS)
      REY=ABS(ASCRT)*RC*2.0*R/UMU
      CHF=C/(2.*R)*.37*REY**0.6
      IF (VOLMAX.GT.5.38E5) CHF=2.*CHF
      CH=CHN
      IF (CHF.GT.CH) CH=CHF
      ROTEMP=RO
      RO=4.81E-02*PE/TR
      CHR=CHRES(TR,TS)
      RO=ROTEMP
      DO 360 I=1,NCLDC
         IF (TIME.GE.TCLDC(I)) ALBED=ALBC(I)
         IF (TIME.LE.TIMFL) GO TO 360
         IF (TIME.GE.TCLDC(I)) T4T=TEBC(I)
         T3T=T4T
         T2T=T4T
  360 CONTINUE
      EDOTV=0.0
      DO 370 I=1,NVALVE
         IF (TIME.GE.TVALVE(I)) EDOTV=VALVRT(I)
  370 CONTINUE
      QF=FLXSO*AWEF*(0.25+0.5*ALBED)
      QF=QF+EINT*SIGMA*(TR**4-TS**4)
      QF=QF+CHR*(TR-TS)
      QF=QF+CH*(TA-TS)
      IF (HBAL.LE.HBB2) TBB=T1T-(HBAL-BALT)*(T1T-T2T)/(HBB2-BALT)
      IF (HBAL.GT.HBB2) TBB=T2T+(HBAL-HBB2)*(T3T-T2T)/(HBB3-HBB2)
      IF (HBAL.GT.HBB3) TBB=T3T+(HBAL-HBB3)*(T4T-T3T)/(HFLOT-HBB3)
      IF (HBAL.GE.HFLOT) TBB=T4T
      QF=QF-EWEF*SIGMA*(TS**4-TBB**4)
      QF=4.83598*QF*VOLG**(2./3.)
      QG=FLXSO*AGEF*(1.+ALBED)
      QG=QG-EINT*SIGMA*(TR**4-TS**4)
      QG=QG-CHR*(TR-TS)
      QG=QG-EGEF*SIGMA*(TR**4-TBB**4)
      QG=4.83598*QG*VOLG**(2./3.)
      REY=RC*ABS(Z2)*2*R/UMU
      IF (REY.LT.0.01) CD=2400.
      IF (REY.GE.0.01.AND.REY.LT.1.) CD=24./REY
      IF (REY.GE.1.0.AND.REY.LT.10.0) CD=24.*REY**(-0.757)
      IF (REY.GE.10.0.AND.REY.LT.100.) CD=16.04*REY**(-0.582)
      IF (REY.GE.100.0.AND.REY.LT.1000.) CD=6.025*REY**(-0.369)
      IF (REY.GE.1000.0.AND.REY.LT.1.E05) CD=0.47
      IF (REY.GE.1.E5.AND.REY.LT.3.E5) CD=0.5
C     IF(REY.GE.1.E5.AND.REY.LT.3.E5)CD=5.035E6*REY**(-1.406)
      IF (REY.GE.3.E5) CD=0.5
      IF (REY.GE.2.5E6) CD=6.7297E-20*REY**2.9495
      IF (Z2.LT.0.0) CD=2.*CD
C*********************************************************************
C       SECTION EIGHT -- BEGIN DIFFERENTIAL EQUATION SOLUTION         *
```


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```
C*********************************************************************
      F1=QF/(MASSF*SPHTW)
      F2=(QG-AG*MOLA*MGAS*TR/(TA*MOLG)*ASCRT*6.63588E-08)/(MGAS*SPHTG)
      ABAL=1.20899*VOLG**(2./3.)
      DO 380 I=2,NEDRP
         IF (TIME.GE.TBDRP(I-1).AND.TIME.LT.TBDRP(I)) MPAY=
     1      MPD(I-1)-ERATE(I-1)*(TIME-TBDRP(I-1))
  380 CONTINUE
      FMTOT=(MGAS+MASSF+MPAY)/1000.0
      F3=Z2
      F4=AG*(RO*VOLG-FMTOT)-0.5*RO*CD*ABS(Z2)*Z2*ABAL
      F4=F4/(FMTOT+0.5*RO*VOLG)
      F5=PB*MOLG*1.E09/(RGAS*TR)*EDOTG-EDOTV
      FLIFT=RO*VOLG-FMTOT
      IF (KUTTA.NE.1) GO TO 390
      FK1=DTIME*F1
      FL1=DTIME*F2
      FM1=DTIME*F3
      FN1=DTIME*F4
      FO1=DTIME*F5
      MGAS=HMGAS+0.5*FO1
      Z1=HZ1+0.5*FM1
      Z2=HZ2+0.5*FN1
      TS=HTS+0.5*FK1
      TR=HTR+0.5*FL1
      KUTTA=2
      IF (ABS(TS-HTS).GT.TSL) GO TO 420
      IF (ABS(TR-HTR).GT.TSL) GO TO 420
      IF (ABS(Z1-HZ1).GT.ZSL) GO TO 420
      IF (ABS(Z2-HZ2).GT.25.) GO TO 420
      GO TO 350
  390 IF (KUTTA.NE.2) GO TO 400
      FK2=DTIME*F1
      FL2=DTIME*F2
      FM2=DTIME*F3
      FN2=DTIME*F4
      FO2=DTIME*F5
      MGAS=HMGAS+0.5*FO2
      Z1=HZ1+0.5*FM2
      Z2=HZ2+0.5*FN2
      TS=HTS+0.5*FK2
      TR=HTR+0.5*FL2
      KUTTA=3
      IF (ABS(TS-HTS).GT.TSL) GO TO 420
      IF (ABS(TR-HTR).GT.TSL) GO TO 420
      IF (ABS(Z1-HZ1).GT.ZSL) GO TO 420
      IF (ABS(Z2-HZ2).GT.25.) GO TO 420
      GO TO 350
  400 IF (KUTTA.NE.3) GO TO 410
      FK3=DTIME*F1
      FL3=DTIME*F2
      FM3=DTIME*F3
      FN3=DTIME*F4
      FO3=DTIME*F5
      MGAS=HMGAS+FO3
      Z1=HZ1+FM3
      Z2=HZ2+FN3
      TS=HTS+FK3
```

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```
      TR=HTR+FL3
      KUTTA=4
      IF (ABS(TS-HTS).GT.TSL) GO TO 420
      IF (ABS(TR-HTR).GT.TSL) GO TO 420
      IF (ABS(Z1-HZ1).GT.ZSL) GO TO 420
      IF (ABS(Z2-HZ2).GT.25.) GO TO 420
      GO TO 350
  410 FK4=DTIME*F1
      FL4=DTIME*F2
      FM4=DTIME*F3
      FN4=DTIME*F4
      FO4=DTIME*F5
      MGASD=(FO1+2.*FO2+2.*FO3+FO4)/6.0
      Z1DEL=(FM1+2.*FM2+2.*FM3+FM4)/6.0
      Z2DEL=(FN1+2.*FN2+2.*FN3+FN4)/6.0
      TRDEL=(FL1+2.*FL2+2.*FL3+FL4)/6.0
      TSDEL=(FK1+2.*FK2+2.*FK3+FK4)/6.0
      IF (ABS(Z2DEL).GT.25.) GO TO 420
      IF (ABS(Z1DEL).GT.ZSL) GO TO 420
      IF (ABS(TSDEL).LE.TSL.AND.ABS(TRDEL).LE.TSL) GO TO 430
  420 DTIME=DTIME/2.0
      IF (IVOL.EQ.1) CTIME=2.0*DTIME
      IF (IVOL.EQ.0) ITC=0
      IF (DTIME.LT.0.00001) GO TO 520
      TS=HTS
      TR=HTR
      Z1=HZ1
      Z2=HZ2
      MGAS=HMGAS
      VOLG=HVOLG
      GO TO 340
C*********************************************************************
C     SECTION NINE -- SETUP FOR PRINT AND PLOTS                      *
C*********************************************************************
  430 CONTINUE
      IVOL=0
      VOLG=(HMGAS+MGASD)*RGAS*(HTR+TRDEL)/(PB*MOLG)/(1.E09)
      IF (VOLG.LE.VOLMAX) GO TO 460
      IVOL=1
      IVT=IVT+1
      IF (IVT.GT.20) GO TO 460
      IF (IVT.GT.2) GO TO 440
      EDOTG=(VOLMAX-VOLG)/DTIME*2.0
      GO TO 450
  440 EDOTG=EDOTG*2.0
  450 CONTINUE
      GO TO 420
  460 IF (IVOL.EQ.0) EDOTG=0.0
      ITC=ITC+1
      TR=HTR+TRDEL
      TS=HTS+TSDEL
      Z1=HZ1+Z1DEL
      Z2=HZ2+Z2DEL
      MGAS=HMGAS+MGASD
      ASCRT=Z2
      TIME=TIME+DTIME
      TTIME=TTIME+DTIME
      HBAL=Z1
```

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```
      TIMH=TIME/60.
      IF ((TIMH-DINCH).LE.0.25) GO TO 470
      DINCH=TIMH
  470 CONTINUE
      IF (IPC.NE.-1.AND.ABS(TIMH-PTIMH).LT.PTINC) GO TO 500
      IF (IPC.EQ.-1) IPC=0
      IF (IPC.EQ.0) PRINT 670
      IPC=IPC+1
      NPC=NPC+1
      TAK=TA-273.15
      TSK=TS-273.15
      TRK=TR-273.15
      R=0.62035*VOLG**(1./3.)
      DO 480 I=1,NCLDC
         IF (TIME.GE.TCLDC(I)) ALBED=ALBC(I)
         IF (TIME.LE.TIMFL) GO TO 480
         IF (TIME.GE.TCLDC(I)) T4T=TBBC(I)
         T3T=T4T
         T2T=T4T
  480 CONTINUE
      IF (HBAL.LE.HBB2) TBB=T1T-(HBAL-BALT)*(T1T-T2T)/(HBB2-BALT)
      IF (HBAL.GT.HBB2) TBB=T2T+(HBAL-HBB2)*(T3T-T2T)/(HBB3-HBB2)
      IF (HBAL.GT.HBB3) TBB=T3T+(HBAL-HBB3)*(T4T-T3T)/(HFLOT-HBB3)
      IF (HBAL.GE.HFLOT) TBB=T4T
      REY=RO*ABS(Z2)*2*R/UMU
      IF (REY.LT.0.01) CD=2400.
      IF (REY.GE.0.01.AND.REY.LT.1.) CD=24./REY
      IF (REY.GE.1.0.AND.REY.LT.10.0) CD=24.*REY**(-0.757)
      IF (REY.GE.10.0.AND.REY.LT.100.) CD=16.04*REY**(-0.582)
      IF (REY.GE.100.0.AND.REY.LT.1000.) CD=6.025*REY**(-0.369)
      IF (REY.GE.1000.0.AND.REY.LT.1.E05) CD=0.47
      IF (REY.GE.1.E5.AND.REY.LT.3.E5) CD=0.5
C     IF(REY.GE.1.E5.AND.REY.LT.3.E5)CD=5.035E6*REY**(-1.406)
      IF (REY.GE.3.E5) CD=0.5
      IF (REY.GE.2.5E6) CD=6.7297E-20*REY**2.9495
      IF (Z2.LT.0.0) CD=2*CD
      FLIFT=RO*VOLG-FMTOT
      TIMM=TIME-TIMOL
      PRINT 690, TIMM,HBAL,Z2,TAK,TSK,TRK,VOLG,FLXSC,TBB,FLIFT,PB,MGAS,
     1  REY,CD,MPAY
      IF (NYC.GE.998) GO TO 490
      NYC=NYC+1
      YPT1(NYC)=TAK
      YPT2(NYC)=TSK
      YPT3(NYC)=TRK
      YPH(NYC)=HBAL
      PB1(NYC)=ALOG(PASL/PB)
      TIMH1=TIMH*60.0-TIMOL
      XPTT(NYC)=TIMH1
  490 CONTINUE
C***************************************************************************
C     SECTION TEN -- SOLAR COMPUTATIONS                                    *
C***************************************************************************
      PTIMH=TIMH
      IF (NPC.LT.5) GO TO 500
      NPC=0
      IF (IPC.GE.50) IPC=0
      PRINT 680
```

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```
  500 CONTINUE
      IF (DTIME.GT.DTMAX) GO TO 510
      IF (ITC.LT.2) GO TO 510
      DTIME=2.0*DTIME
      ITC=0
  510 CONTINUE
      IF (DTIME.GE.DTMAX) DTIME=DTMAX
      NPSUN=NSUN
      IF (TIME.GE.(CLTDT+TIMCL)) GO TO 530
      NSUN=0
      CIT=TIME-1440.0*INT(TIME/1440.0)
      IF (CIT.GE.TIMSR.AND.CIT.LE.TIMSS) NSUN=1
      IF (NSUN.EQ.NPSUN) GO TO 310
      IF (NSUN.EQ.1) TTIME=CIT-TIMSR
      IF (NSUN.EQ.0) TTIME=CIT-TIMSS
      GO TO 310
  520 CONTINUE
      PRINT 660
      STOP
  530 WRITE (6,700)
      PRINT 710
C*********************************************************************
C     SECTION ELEVEN -- PLOT  CALLS AND PLOT OUTPUT                  *
C*********************************************************************
      IF (DPLT.LE.0.0) GO TO 550
      DO 540 J=1,NEX
         ETIME(J)=(ETIME(J)/60.0)
         EMBI(J)=ALOG(PASL/EMB(J))
  540 CONTINUE
      CALL PLOTS (0,0,0)
      TTMIN=-120.0
      DTMIN=20.0
      DX1=40.0
      NYCP1=NYC+1
      NYCP2=NYC+2
      XPTT(NYCP1)=0.0
      XPTT(NYCP2)=40.0
      IF(NEX.LE.0)GO TO 542
      NEX1=NEX+1
      NEX2=NEX+2
      ETIME(NEX1)=0.0
      ETIME(NEX2)=40.0
      EALT(NEX1)=0.0
      EALT(NEX2)=5000.0
      EGAST(NEX1)=TTMIN
      EGAST(NEX2)=DTMIN
      EAIRT(NEX1)=TTMIN
      EAIRT(NEX2)=DTMIN
      EFILMT(NEX1)=TTMIN
      EFILMT(NEX2)=DTMIN
      EMBI(NEX1)=0.0
      EMBI(NEX2)=1.0
  542  CONTINUE
      XLT=XPTT(NYC)/XPTT(NYCP2)
      XLT=INT(XLT)+1
      CALL PLOT (1.0,0.5,-3)
      YPH(NYCP1)=0.0
      YPH(NYCP2)=5000.00
```

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```
      CALL AXIS1 (0.0,0.0,'TIME-MIN',-8,XLT,0.0,0.0,DX1,20.0)             00000644
      CALL AXIS1 (0.,0.,'ALTITUDE-M',10,9.0,90.,0.,YPH(NYCP2),20.)        00000645
      CALL LINE (XPTT,YPH,NYC,1,0,0)                                       00000646
      IF(NEX.LE.0)GO TO 543
      CALL LINE (ETIME,EALT,NEX,1,-1,2)                                    00000647
  543 CONTINUE
      XLT1=XLT+3                                                           00000648
      CALL PLOT (XLT1,0.,-3)                                               00000649
      YPT1(NYCP1)=TTMIN                                                    00000652
      YPT1(NYCP2)=DTMIN                                                    00000653
      YPT2(NYCP1)=TTMIN                                                    00000654
      YPT2(NYCP2)=DTMIN                                                    00000655
      YPT3(NYCP1)=TTMIN                                                    00000656
      YPT3(NYCP2)=DTMIN                                                    00000657
      CALL AXIS1 (0.,0.,'TIME-MIN',-8,XLT,0.,0.,DX1,20.0)                 00000664
      CALL AXIS1 (0.,0.,'TEMPERATURE-C',13,8.0,90.0,TTMIN,DTMIN,20.0)     00000665
      CALL LINE (XPTT,YPT1,NYC,1,0,0)                                      00000666
      CALL LINE (XPTT,YPT2,NYC,1,0,0)                                      00000667
      CALL LINE (XPTT,YPT3,NYC,1,0,0)                                      00000668
      IF(NEX.LE.0)GO TO 545
      CALL LINE (ETIME,ECAST,NEX,1,-1,2)                                   00000669
      CALL LINE (ETIME,EAIFT,NEX,1,-1,3)                                   00000670
      CALL LINE (ETIME,EFILMT,NEX,1,-1,4)                                  00000671
  545  CONTINUE
      XLT2=XLT+3.0                                                         00000672
      PB1(NYCP1)=0.0                                                       00000677
      PB1(NYCP2)=1.0                                                       00000678
      CALL PLOT (XLT2,-.5,-3)                                              00000679
      CALL AXIS1 (0.,0.,'TIME-MIN',-8,XLT,0.,0.,DX1,20.0)                 00000680
      CALL AXIS1 (0.,0.,'LN(PASL/PE)',11,10.0,90.0,0.0,EMB1(NEX2),        00000681
     1  20.)                                                               00000682
      IF(NEX.LE.0)GO TO 547
      CALL LINE (ETIME,EMB1,NEX,1,-1,5)                                    00000683
  547 CONTINUE
      CALL LINE (XPTT,PB1,NYC,1,0,0)                                       00000684
      PRINT 730, NYC                                                       00000685
      CALL PLOT (0.,0.,999)                                                00000686
      STOP                                                                 00000687
  550 CONTINUE                                                             00000688
      PRINT 720                                                            00000689
      STOP                                                                 00000690
C                                                                          00000691
  560 FORMAT (20A4)                                                        00000692
  570 FORMAT (1H1,20A4)                                                    00000693
  580 FORMAT (I5)                                                          00000694
  590 FORMAT ('0','  TEDRP     BALLAST RATE(GM/MIN)')                      00000695
  600 FORMAT (3F10.2)                                                      00000696
  610 FORMAT ('0','  TCLOC       ALEEDO   BLACKBALL(DEG-K)')               00000697
  620 FORMAT ('0','  TVALVE    VALVE RATE (GM/MIN)')                       00000698
  630 FORMAT (I3)                                                          00000699
  640 FORMAT ('0','EFEG = ',F10.4,' EWEF = ',F10.4,' EINT = ',F10.4)      00000700
  650 FORMAT ('0',5X,' ALPHA GASEFF = ',F10.4,' ALPHA WALL EFFECTIVE = ' 00000701
     1,F10.4)                                                              00000702
  660 FORMAT (1H1,5X,44HPROGRAM CUT ON ABNORMAL EXIT IN MAIN ROUTINE)     00000703
  670 FORMAT (1H1,' TIME',2X,'ALT(M)',1X,'V(M/MIN)',3X,'TA(C)',3X,        00000704
     1  'TS(C)',3X,'TG(C)',3X,'VOLUME(M3)',1X,'FLXSC',5X,'TBB(K)',1X,     00000705
     2  'FL(KG)',2X,'P(MB)',1X,'GAS(GM)',2X,'REY NO',3X,'CD',4X,          00000706
     3  'PAY(GM)')                                                         00000707
```

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```
680 FORMAT (1X)
690 FORMAT (' ',F6.1,F8.0,4F8.2,E13.5,E9.2,F6.1,F7.2,F7.1,F8.0,E10.2,
   1  F6.3,F9.0)
700 FORMAT (33H PROGRAM COMPLETED ON NORMAL EXIT)
710 FORMAT (1H1)
720 FORMAT ('0',' OUT ON IVT')
730 FORMAT (' ','NYC=',I5)
740 FORMAT (1H0,8X,'ETIME',12X,'EALT',11X,'EAIRT',10X,'EFILMT',11X,
   1   'EGAST')
750 FORMAT (3F3.0,1X,6F10.4)
760 FORMAT (' ',7F16.3)
    END
```

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```
      FUNCTION CFH (T1,T2)
C***********************************************************************
C     HEAT TRANSFER COEFFICIENT BETWEEN FILM AND AIR                   *
C***********************************************************************
      COMMON /AA/ R,UMU,RO,AG,PR,C
      GR=(1.0/T1)*R**3.0*(1.0/UMU**2.0)*ABS(T1-T2)*RO*RO*AG
      IF (GR.LE.1.40E-05) GR=1.4E-05
      X=2.0+0.6*(GR*PR)**0.25
      CFH=(C/R)*X
      RETURN
      END
```

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```
      FUNCTION CHRES (T1,T2)
C***********************************************************************
C     HEAT TRANSFER COEFFICIENT BETWEEN FILM AND GAS                   *
C***********************************************************************
      CCMMON /AA/ R,UML,RO,AG,PR,C
      CCMMON /CALAC/ RRES
      RI=2.*RRES
      STOR=UMU
      UMU=1.577545E-04*(T1**1.5)/(1.8*T1+143.0)
      GR=(1.0/T1)*RI**3.0*(1.C/UMU**2.0)*ABS(T1-T2)*RO*RO*AG
      IF ((GR*.67).LT.C.15E9) GO TC 10
      X=0.13*(GR*0.67)**0.333333
      GO TO 20
   10 X=2.0+0.6*(GR*0.67)**0.25
   20 IF (GR.LE.1.40E-C5) GR=1.4E-05
      CG=.833*9.0864E-2*(T1*1.8)**0.682
      CHRES=CG/RI*X
      UMU=STOR
      RETURN
      END
```

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```
      SUBROUTINE ATMOS2 (PA,H,TOHIGH)
C******************************************************************
C   STANDARD ATMOSPHERE, USED TO OBTAIN ALTITUDE FROM PRESSURE     *
C   IN MILLIBARS.  USED WITH EXPERIMENTAL DATA ONLY FOR PLOTS.     *
C******************************************************************
      REAL MA,LP
      TOHIGH=1
      MA=28.9664
      R=8.31432E03
      GY=9.80665
      IF (PA.LT.226.32) GO TO 10
      PB=1013.25
      HB=0.0
      TB=288.15
      LP=-0.0065
      RHOB=1.225
      GO TO 70
   10 IF (PA.LT.54.749) GO TO 20
      PB=226.32
      HB=11000.
      TB=216.65
      LP=0.0
      RHOB=0.36392
      GO TO 70
   20 IF (PA.LT.8.680) GO TO 30
      PB=54.749
      HB=20000.
      TB=216.65
      LP=0.001
      RHOB=0.088035
      GO TO 70
   30 IF (PA.LT.1.109) GO TO 40
      PB=8.680
      HB=32000.
      TB=228.65
      LP=0.0028
      RHOB=0.013225
      GO TO 70
   40 IF (PA.LT.0.590) GO TO 50
      PB=1.109
      HB=47000.
      TB=270.65
      LP=0.0
      RHOB=0.0014275
      GO TO 70
   50 IF (PA.LT.0.01828) GO TO 60
      PB=0.59
      HB=52000.
      TB=270.65
      LP=-0.002
      RHOB=0.0007594
      GO TO 70
   60 CONTINUE
```

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```
      TOHIGH=-1
      GO TO 90
   70 IF (LP.EQ.0.0) GO TO 80
      H=HB+TB/LP*((PB/PA)**(LP*R/GY/MA)-1.0)
      GO TO 90
   80 H=ALOG(PB/PA)*R*TB/GY/MA+HB
   90 RETURN
      END
```

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APPENDIX B

SAMPLE CASE

The input and output for a sample case is presented on the following pages. The 167N flight launched from Palestine, Texas on July 24, 1980, was chosen because it involves most of the features of the THERMTRAJ program with the exception of programmed valving. The plotted output should provide a good indication of the accuracy of the program in terms of predicted altitude as well as balloon gas and film temperature.

Table 1.B. THERMTRAJ input data for the 167N flight
(* Designates the column numbers of the data cards)

```
* 12345678901234567890123456789012345678901234567890123456789012345678901234567890
  FLIGHT 167-N NUMBER 12 WITH DOUBLE CD ON DESCENT AND HIGH CIRUS
  &FIPUT  TIMOL=10.58,CUTDT=18.50,ASCRT=297.3,HFLIT=35800.,PASL=1000.,
  MASSF=1.842E5,MGAS=6.9221E4,MPAYI=1.9682E5,VCLMAX=6.6375E4,CAYL=16.,
  ALBED=0.2775,TASL=304.55,HTROP=12500.,TATRO=220.65,HTROP2=15300.,
  TATRO2=201.35,HTROP3=20000.,TATRO3=211.52,HFLOT=35800.,TAFLO=245.73,
  HBB2=15300.,HBB3=20000.,T2T=209.4,T3T=209.4,T4T=209.4,DPLT=1.0,
  IATMS=6,&END
```

4

0.0	0.0
673.	7257.44
676.125	0.0
1200.0	0.0

4

0.0	0.2775	209.4
170.	0.2775	204.4
545.0	0.18	214.4
1200.	0.18	214.4

0

83

16.40.00.						
16.40.00.	1000.0	31.4	31.4	31.4	31.4	31.4
16.46.00.	782.					
16.51.00.	670.		9.0	-8.5	11.5	
16.58.00.	527.					
17.03.02.	428.					
17.07.14.	360.					
17.11.12.	301.		-34.0	-47.5	-31.0	-28.0
17.16.00.	233.	-44.				
17.19.20.	206.5					
17.23.28.	170.0					
17.27.00.	134.	-67.	-60.		-53.5	-55.0
17.30.34.	116.0					
17.35.00.	96.0	-67.5	-60.0		-58.5	-57.5
17.40.00.	75.0		-54.0	-75.0	-53.0	-49.0
17.44.57.	59.0					
17.51.13.	45.7	-53.9	-48.7	-51.3	-44.9	-42.7
18.00.49.	29.8	-47.1	-45.1	-50.1	-60.9	-39.4
18.08.49.	20.2	-45.3	-43.9	-49.2	-57.7	-35.5
18.20.49.	11.8	-37.5	-39.3	-49.3	-50.1	-52.9
18.32.49.	7.03	-30.9	-36.4	-42.1	-44.5	-43.7
18.42.49.	5.04	-29.5	-34.0	-36.4	-37.7	-40.4
18.50.48.	4.85	-28.8	-31.7	-25.9	-27.7	-25.5
19.04.48.	4.78	-29.5	-30.4	-20.0	-21.4	-16.8
19.10.49.	4.79	-28.5	-31.5	-19.5	-20.8	-16.8
19.20.49.	4.91	-26.2	-31.2	-17.9	-19.2	-15.1
19.32.48.	4.86	-27.0	-31.2	-18.6	-19.6	-17.4
19.44.49.	4.97	-27.0	-31.2	-18.1	-19.6	-16.1
19.56.48.	5.13	-24.5	-31.3	-16.8	-18.1	-14.6
20.08.49.	5.58	-24.9	-31.5	-16.2	-17.4	-15.3
20.29.45.	5.85	-26.5	-33.0	-19.0	-19.0	-19.7
20.45.28.	6.20	-28.3	-34.8	-18.2	-18.1	-19.6
21.06.48.	5.82	-31.7	-35.3	-22.2	-21.8	-20.3
21.14.08.	5.61	-34.8	-35.1	-24.1	-23.6	-23.0
21.30.48.	5.62	-32.7	-34.7	-21.7	-21.4	-21.3
21.45.04.	5.82	-30.6	-34.6	-19.7	-19.5	-18.9
22.04.47.	5.88	-32.7	-34.8	-20.3	-19.6	-19.6
22.15.03.	5.36	-33.5	-34.2	-21.2	-21.0	-20.8
22.30.39.	6.22	-30.6	-34.1	-18.9	-19.6	-18.3
22.45.04.	6.24	-30.0	-33.8	-19.8	-19.8	-18.7
23.03.52.	6.19	-32.7	-34.3	-21.0	-21.2	-19.2
23.15.52.	6.06	-33.1	-34.6	-22.2	-23.6	-21.5
23.27.51.	6.14	-31.5	-36.0	-21.2	-22.6	-19.6
23.46.16.	6.37	-30.8	-34.8	-20.1	-21.8	-18.5
24.01.52.	6.86	-30.2	-35.7	-18.2	-19.6	-14.8
24.15.36.	6.97	-34.1	-37.2	-19.6	-21.9	-16.3
24.30.47.	7.28	-35.6	-37.7	-20.2	-22.1	-16.6
24.44.48.	7.70	-34.8	-39.3	-20.6	-22.3	-17.0
25.00.48.	6.69	-35.4	-39.1	-21.5	-21.6	-16.3
25.16.39.	6.69	-36.2	-39.6	-22.8	-22.4	-17.9
25.30.47.	8.70	-37.8	-39.7	-23.3	-22.4	-18.9
25.45.59.	9.60	-35.3	-41.2	-23.0	-21.8	-18.1
26.01.27.	10.5	-36.7	-44.6	-29.1	-25.2	-27.3
26.30.55.	15.5	-42.8	-47.9	-34.9	-19.0	-43.5
26.45.27.	18.0	-43.6	-48.4	-37.0	-22.9	-45.6
27.00.31.	20.6	-46.5	-48.3	-38.6	-27.0	-46.4
27.14.47.	22.9	-47.3	-48.8	-41.4	-30.2	-47.4
27.30.23.	25.8	-49.1	-49.3	-43.7	-36.4	-48.3
27.47.51.	29.3	-50.4	-49.9	-46.0	-42.4	-49.3
28.03.51.	26.1	-49.4	-50.8	-48.8	-49.2	-49.2
28.15.51.	26.1	-49.7	-51.5	-49.2	-49.8	-49.3
28.29.51.	26.1	-49.7	-52.6	-49.7	-50.4	-50.1
28.46.46.	26.5	-50.2	-52.3	-49.9	-50.7	-50.4
29.06.47.	26.3	-49.1	-51.6	-49.8	-50.8	-50.0
29.18.47.	26.7	-48.2	-51.0	-49.1	-50.1	-49.3
29.30.47.	27.0	-49.1	-51.3	-48.9	-49.8	-49.1
29.47.59.	27.8	-48.8	-51.1	-48.2	-49.1	-49.0
30.03.57.	28.1	-48.3	-51.7	-48.1	-49.6	-49.0
30.37.58.	69.8	-49.4	-52.0	-49.7	-50.5	-50.3
30.44.56.	28.7	-48.8	-51.6	-49.1	-50.0	-49.8
31.00.56.	29.2	-49.8	-51.6	-48.7	-49.6	-49.5
31.20.58.	29.0	-51.8	-52.8	-50.1	-51.3	-50.5
31.32.58.	29.3	-51.6	-53.3	-50.2	-51.3	-50.7
31.44.56.	29.8	-52.0	-53.5	-50.1	-51.3	-50.9
32.00.58.	30.8	-51.2	-53.3	-49.8	-51.0	-50.8
32.16.55.	70.3	-51.1	-53.2	-49.4	-50.7	-50.7
33.01.01.	3.90	-52.3	-55.4	-51.3	-52.8	-52.3
33.15.58.	35.8	-52.6	-56.4	-51.8	-53.6	-53.1
33.31.58.	37.8	-53.5	-57.3	-51.7	-53.9	-53.4
33.47.57.	38.2	-54.7	-56.7	-51.7	-49.8	-52.9
34.03.57.	39.1	-55.7	-57.1	-52.9	-56.0	-53.9
34.16.01.	74.3	-52.9	-53.7	-50.9	-56.2	-47.1
34.27.59.	40.7	-54.1	-52.5	-51.1	-56.2	-50.8
34.44.59.	16.9	-59.1				

ORIGINAL PAGE IS
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Table 2.B. THERMTRAJ printed output for the 167N flight

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FLIGHT 167-N NUMBER 12 WITH DOUBLE CD ON DESCENT AND HIGH CIRUS
&FIPUT
TIMCL=  10.5799999    ,CUTDT=  18.5000000    ,BALT=  120.000000    ,ASCRT=  297.300049    ,FFLIT=  35800.0000    ,PASL=
  1000.00000    ,MASSF=  184200.000    ,MGAS=  69221.0000    ,MPAYI=  196820.000    ,VOLMAX=  66375.0000    ,DAYL=  16.0000000    ,
TWILT=  .750000000    ,ALBED=  .277499974    ,FLSCD=  19892.0000    ,PTINC=  .166600011E-01,CTMAX=  5.00000300    ,SPHTW=
  .550000012    ,SPHTG=  1.24118996    ,MOLA=  28.9644012    ,MOLG=  4.00259972    ,ALFRES=  .260000001E-02,EG=  .312000047E-03,
ALFSO=  .599999931E-03,TMSOL=  .884999990    ,RWSOL=  .114000022    ,EW=  .309999995E-01,RW=  .126999974    ,TAUW=  .842000008    ,
TASL=  304.550049    ,HTROP=  12500.0000    ,TATFC=  220.649994    ,HTROP2=  15300.0000    ,TATR02=  201.350006    ,HTROP3=
  20000.0000    ,TATR03=  211.520004    ,HFLCT=  35800.0000    ,TAFLO=  245.729996    ,HBB2=  15300.0000    ,HBB3=  20000.0000    ,
T2T=  209.399994    ,T3T=  209.399994    ,T4T=  209.399994    ,DFLT=  1.00000000    ,IATMS=          6
&END
```

TBURP	BALLAST RATE(GM/MIN)
0.0	0.0
673.00	7257.44
676.12	0.0
1200.00	0.0

TCLDC	ALBEDO	BLACKBALL(DEG-K)
0.0	0.28	209.40
170.00	0.28	204.40
545.00	0.18	214.40
1200.00	0.18	214.40

ETIME	EALT	EAIRT	EFILMT	EGAST
0.0	110.872	31.400	31.400	31.400
360.000	2131.948	0.0	0.0	0.0
650.000	3354.871	0.0	8.000	-8.500
1080.000	5184.336	0.0	0.0	0.0
1392.000	6703.738	0.0	0.0	0.0
1634.000	7922.141	0.0	0.0	0.0
1872.000	9141.109	0.0	-34.000	-47.500
2160.000	10678.723	-44.000	0.0	0.0
2360.000	11581.164	0.0	0.0	0.0
2608.000	12814.535	0.0	0.0	0.0
2820.000	14323.469	-67.000	-60.000	0.0
3034.000	15238.184	0.0	0.0	0.0
3300.000	16438.203	-67.500	-60.000	0.0
3600.000	18003.586	0.0	-54.000	-78.000
3897.000	19525.152	0.0	0.0	0.0
4273.000	21148.562	-53.500	-48.700	-51.300
4849.000	23891.562	-47.100	-45.100	-50.100
5329.000	26415.762	-45.300	-43.500	-49.200
6049.000	29953.398	-37.500	-39.300	-49.300
6769.000	33423.215	-30.500	-36.400	-42.100
7369.000	35720.371	-29.500	-34.000	-36.400
7848.000	35989.672	-28.800	-31.700	-25.900
8688.000	36091.770	-28.500	-30.400	-20.000
9049.000	36077.051	-28.500	-31.500	-19.500
9649.000	35903.383	-26.200	-31.200	-17.900
10368.000	35975.187	-27.000	-31.200	-18.600
11089.000	35818.266	-27.000	-31.200	-18.100
11808.000	35528.871	-24.500	-31.300	-16.800
12529.000	35011.141	-24.900	-31.500	-16.200
13785.000	34683.820	-26.500	-33.000	-19.000
14728.000	34283.137	-28.300	-34.800	-18.200
16008.000	34719.410	-31.700	-35.300	-22.200
16448.000	34973.914	-34.800	-35.100	-24.100
17448.000	34961.531	-32.700	-34.700	-21.700
18304.000	34719.410	-30.600	-34.600	-19.700
19487.000	34648.461	-32.700	-34.800	-20.300
20103.000	34672.059	-33.500	-34.200	-21.200
21039.000	34261.020	-30.600	-34.100	-18.900
21504.000	34238.902	-30.000	-33.800	-19.800
23032.000	34294.273	-32.700	-34.300	-21.000
23752.000	34440.375	-33.100	-34.600	-22.200
24471.000	34350.035	-31.500	-36.000	-21.200
25576.000	34097.246	-30.800	-34.800	-20.100
26512.000	33590.105	-30.200	-35.700	-18.200

ORIGINAL PAGE IS
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TABLE 2.B. (continued) THERMTRAJ PRINTED OUTPUT

ORIGINAL PAGE IS
OF POOR QUALITY

TIME	ALT(M)	V(M/MIN)	TA(C)	TS(C)	TG(C)	VOLUME(M3)	FLXSC	TEB(K)	FL(KG)	P(MB)	GAS(GM)	REY NO	CD	PAY(GM)
108.2	33237.	381.07	-33.05	-46.19	-49.21	0.41365E+05	0.20E+05	209.4	16.95	7.8	69221.	0.20E+06	0.500	196820.
109.3	33659.	386.70	-32.14	-45.50	-48.25	0.44098E+05	0.20E+05	209.4	17.09	7.3	69221.	0.20E+06	0.500	196820.
110.4	34087.	392.47	-31.21	-44.81	-47.36	0.47044E+05	0.20E+05	209.4	17.24	6.9	69221.	0.19E+06	0.500	196820.
111.5	34522.	398.40	-30.27	-44.12	-46.41	0.50224E+05	0.20E+05	209.4	17.39	6.5	69221.	0.18E+06	0.500	196820.
112.6	34964.	404.51	-29.32	-43.44	-45.44	0.53658E+05	0.20E+05	209.4	17.54	6.1	69221.	0.18E+06	0.500	196820.
113.7	35412.	410.83	-28.35	-42.76	-44.46	0.57372E+05	0.20E+05	209.4	17.71	5.7	69221.	0.17E+06	0.500	196820.
114.8	35868.	417.40	-27.36	-42.10	-43.45	0.61392E+05	0.20E+05	209.4	17.88	5.4	69221.	0.17E+06	0.500	196820.
115.9	36330.	424.28	-26.36	-41.45	-42.43	0.65749E+05	0.20E+05	209.4	18.07	5.0	69221.	0.16E+06	0.500	196820.
117.0	36696.	218.36	-25.50	-41.13	-40.41	0.66328E+05	0.20E+05	209.4	-0.87	4.8	65535.	0.78E+05	0.470	196820.
118.0	36769.	-70.74	-25.31	-40.91	-35.88	0.66270E+05	0.20E+05	209.4	-5.03	4.7	63429.	0.25E+05	0.940	196820.
119.1	36661.	-60.42	-25.54	[illegible]	-31.25	0.66254E+05	0.20E+05	209.4	2.12	4.8	63125.	0.22E+05	0.940	196820.
120.3	36711.	114.45	-25.49	-37.19	-29.43	0.66301E+05	0.20E+05	209.4	1.66	4.8	62517.	0.41E+05	0.470	196820.
121.4	36787.	-11.98	-25.28	-36.07	-27.94	0.66371E+05	0.20E+05	209.4	-3.08	4.7	61365.	0.42E+04	0.940	196820.
122.5	36714.	-78.27	-25.37	-34.74	[illegible]	0.66324E+05	0.20E+05	209.4	-0.41	4.7	60995.	0.28E+05	0.940	196820.
123.5	36674.	12.58	-25.53	-33.51	[illegible]	0.66042E+05	0.20E+05	209.4	2.45	4.8	60595.	0.45E+04	0.470	196820.
124.7	36768.	104.17	-25.37	-32.66	-23.69	0.66331E+05	0.20E+05	209.4	0.03	4.7	60623.	0.37E+05	0.470	196820.
125.8	36803.	-59.18	-25.24	-32.25	-22.63	0.66369E+05	0.20E+05	209.4	-2.96	4.7	59950.	0.21E+05	0.940	196820.
127.1	36659.	-59.13	-25.41	-31.22	-20.52	0.66112E+05	0.20E+05	209.4	0.59	4.7	59822.	0.21E+05	0.940	196820.
128.1	36678.	20.61	-25.52	-30.52	-20.03	0.65771E+05	0.20E+05	209.4	1.66	4.8	59822.	0.74E+04	0.470	196820.
129.1	36734.	81.25	-25.46	-30.23	-20.27	0.65971E+05	0.20E+05	209.4	1.13	4.8	59822.	0.29E+05	0.470	196820.
130.2	36817.	32.62	-25.23	-30.22	-20.42	0.66373E+05	0.20E+05	209.4	-2.70	4.7	59329.	[illegible]	0.470	196820.
131.5	36751.	-88.63	-25.29	-29.84	-18.86	0.66315E+05	0.20E+05	209.4	-1.13	4.7	59136.	0.31E+05	0.940	196820.
132.7	36673.	-34.88	-25.49	-29.17	-17.58	0.65677E+05	0.20E+05	209.4	0.76	4.8	59136.	0.12E+05	0.940	196820.
133.9	36659.	25.79	-25.55	-28.81	-18.01	0.65406E+05	0.20E+05	209.4	0.81	4.8	59136.	0.92E+04	0.470	196820.
135.1	36716.	44.70	-25.51	-28.81	-18.37	0.65494E+05	0.20E+05	209.4	0.12	4.8	59136.	0.16E+05	0.470	196820.
137.5	36781.	11.46	-25.37	-28.92	-18.34	0.66100E+05	0.20E+05	209.4	-0.09	4.7	59136.	0.41E+04	0.470	196820.
138.7	36782.	-15.32	-25.29	-28.85	-18.05	0.66346E+05	0.20E+05	209.4	-0.71	4.7	58583.	0.54E+04	0.940	196820.
139.9	36752.	-24.88	-25.31	-28.64	-17.58	0.66358E+05	0.20E+05	209.4	0.14	4.7	58583.	0.88E+04	0.940	196820.
141.5	36741.	13.26	-25.39	-28.41	-17.49	0.66064E+05	0.20E+05	209.4	0.42	4.7	58583.	0.47E+04	0.470	196820.
143.9	36791.	17.05	-25.35	-28.49	-17.78	0.66157E+05	0.20E+05	209.4	-0.15	4.7	58583.	0.60E+04	0.470	196820.
145.1	36780.	-40.18	-25.27	-28.47	-17.44	0.66356E+05	0.20E+05	209.4	-0.92	4.7	58795.	0.14E+05	0.940	196820.
146.3	36727.	-38.10	-25.34	-28.23	-16.90	0.66219E+05	0.20E+05	209.4	0.13	4.7	58795.	0.13E+05	0.940	196820.
147.9	36700.	3.30	-25.46	-28.00	-16.89	0.65703E+05	0.20E+05	209.4	0.37	4.8	58795.	0.12E+04	0.470	196820.
150.3	36724.	3.04	-25.45	-28.10	-17.22	0.65645E+05	0.20E+05	209.4	-0.20	4.8	58795.	0.18E+04	0.470	196820.
151.9	36718.	-10.22	-25.42	-28.13	-17.11	0.65820E+05	0.20E+05	209.4	-0.08	4.8	58795.	0.36E+04	0.940	196820.
155.1	36711.	-20.40	-25.43	-28.16	-17.06	0.65776E+05	0.20E+05	209.4	0.03	4.8	58795.	0.73E+04	0.940	196820.
156.7	36692.	-4.12	-25.45	-28.05	-16.97	0.65740E+05	0.20E+05	209.4	0.21	4.8	58795.	0.15E+04	0.940	196820.
158.3	36658.	8.37	-25.49	-28.06	-17.13	0.65524E+05	0.20E+05	209.4	0.01	4.8	58795.	0.30E+04	0.470	196820.
159.9	36705.	0.55	-25.48	-28.12	-17.23	0.65560E+05	0.20E+05	209.4	-0.13	4.8	58795.	0.20E+03	0.859	196820.
161.5	36658.	-7.13	-25.46	-28.12	-17.12	0.65646E+05	0.20E+05	209.4	-0.03	4.8	58795.	0.25E+04	0.940	196820.
164.7	36691.	-10.92	-25.47	-28.12	-17.09	0.65595E+05	0.20E+05	209.4	0.05	4.8	58795.	0.39E+04	0.940	196820.
166.3	36682.	-0.51	-25.49	-28.08	-17.07	0.65531E+05	0.20E+05	209.4	0.11	4.8	58795.	0.18E+03	1.768	196820.
167.9	36686.	4.31	-25.51	-28.10	-17.17	0.65426E+05	0.20E+03	209.4	-0.02	4.8	58795.	0.15E+04	0.470	196820.
171.1	36685.	8.66	-25.50	-28.09	-17.23	0.65450E+05	0.20E+05	204.4	-0.14	4.8	58795.	0.31E+04	0.470	196820.
172.7	36679.	-20.17	-25.50	-28.80	-17.46	0.65406E+05	0.20E+05	204.4	-0.54	4.8	58795.	0.72E+04	0.940	196820.
174.3	36626.	-40.88	-25.57	-29.00	-17.42	0.65133E+05	0.20E+05	204.4	-0.35	4.8	58795.	0.15E+05	0.940	196820.
175.9	36564.	-35.20	-25.70	-29.03	-17.47	0.64558E+05	0.20E+05	204.4	-0.19	4.8	58795.	0.13E+05	0.940	196820.
177.5	36512.	-31.71	-25.82	-29.08	-17.61	0.64025E+05	0.20E+05	204.4	-0.22	4.9	58795.	0.11E+05	0.940	196820.
179.1	36462.	-31.90	-25.93	-29.14	-17.73	0.63550E+05	0.20E+05	204.4	-0.23	4.9	58795.	0.12E+05	0.940	196820.
180.7	36411.	-31.43	-26.04	-29.20	-17.83	0.63083E+05	0.20E+05	204.4	-0.21	4.9	58795.	0.12E+05	0.940	196820.

TABLE 2.B. (continued) THERMTRAJ PRINTED OUTPUT

27336.000	33481.621	-34.100	-37.200	-19.600
28247.000	33185.627	-35.600	-37.700	-20.200
29088.000	32805.723	-34.800	-38.300	-20.600
30048.000	33761.516	-35.400	-39.100	-21.500
30599.000	33761.515	-36.200	-39.600	-22.800
31847.000	31983.996	-37.800	-39.700	-23.300
32759.000	31326.141	-35.300	-41.200	-23.000
33687.000	30728.820	-36.700	-44.600	-29.100
35455.000	28151.730	-42.800	-47.900	-34.900
36327.000	27169.902	-43.600	-48.400	-37.000
37231.000	26287.867	-46.500	-48.300	-38.600
38087.000	25598.191	-47.300	-48.800	-41.400
39023.000	24824.012	-45.100	-49.300	-43.700
40071.000	24225.246	-50.400	-49.980	-46.000
41031.000	24749.012	-45.400	-50.800	-48.800
41751.000	24749.012	-45.700	-51.500	-49.200
42591.000	24749.012	-45.700	-52.600	-49.700
43606.000	24650.457	-50.200	-52.300	-49.900
44807.000	24695.629	-45.100	-51.600	-49.800
45527.000	24601.695	-48.200	-51.000	-49.100
46247.000	24529.379	-45.100	-51.300	-48.900
47278.000	24340.535	-48.800	-51.100	-48.200
48237.000	24271.113	-48.300	-51.700	-48.100
50278.000	18459.223	-49.400	-52.000	-49.700
50656.000	24134.543	-48.800	-51.600	-49.100
51656.000	24022.969	-45.600	-51.600	-48.700
52858.000	24067.391	-51.800	-52.800	-50.100
53578.000	24000.863	-51.600	-53.300	-50.200
54296.000	23891.562	-52.000	-53.500	-50.100
55258.000	23676.547	-51.200	-53.300	-49.800
56215.000	18063.047	-51.100	-53.200	-49.400
58861.000	37533.676	-52.300	-55.400	-51.300
59758.000	22710.562	-52.600	-56.400	-51.800
60718.000	22361.797	-53.500	-57.300	-51.700
61677.000	22294.441	-54.700	-56.700	-51.700
62637.000	22145.266	-55.700	-57.100	-52.900
63361.000	18063.047	-52.900	-53.700	-50.900
64078.000	21888.445	-54.100	-52.580	-51.100
65098.000	27583.336	-59.100	0.0	0.0

EFEG = 0.0003 EWEF = 0.0609 EINT = 0.0000

ALPHA GASEFF = 0.0026 ALPHA WALL EFFECTIVE = 0.0020

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TABLE 2.B. (continued) THERMTRAJ PRINTED OUTPUT

TIME	ALT(M)	V(M/MIN)	TA(C)	TS(C)	TG(C)	VOLUME(M3)	FLXSD	TBB(K)	FL(KG)	P(MB)	GAS(GM)	REY NO	CD	PAY(GM)
0.0	120.	15.94	31.40	31.40	31.40	0.43791E+03	0.20E+05	299.0	50.67	1000.0	69221.	0.16E+06	0.500	196820.
1.1	390.	263.47	29.75	30.84	28.37	0.44556E+03	0.20E+05	297.5	48.38	973.0	69221.	0.26E+07	0.543	196820.
2.1	675.	271.63	27.73	29.40	25.93	0.45715E+03	0.20E+05	295.8	47.67	940.7	69221.	0.26E+07	0.576	196820.
3.2	976.	268.72	25.79	27.52	23.71	0.46881E+03	0.20E+05	294.0	47.18	910.5	69221.	0.26E+07	0.541	196820.
4.2	1265.	274.31	23.74	25.60	21.68	0.48205E+03	0.20E+05	292.3	47.20	879.4	69221.	0.26E+07	0.557	196820.
5.3	1556.	265.53	21.86	23.65	19.67	0.49431E+03	0.20E+05	290.6	46.95	851.8	69221.	0.25E+07	0.500	196820.
6.3	1849.	280.01	19.78	21.67	17.67	0.50876E+03	0.20E+05	288.8	47.06	821.9	69221.	0.26E+07	0.556	196820.
7.4	2144.	281.57	17.78	19.68	15.65	0.52301E+03	0.20E+05	287.1	47.01	794.0	69221.	0.26E+07	0.547	196820.
8.5	2457.	274.48	15.76	17.58	13.52	0.53769E+03	0.20E+05	285.3	46.79	766.6	69221.	0.25E+07	0.500	196820.
9.5	2757.	285.04	13.62	15.56	11.48	0.55420E+03	0.20E+05	283.5	46.92	738.5	69221.	0.25E+07	0.529	196820.
10.6	3061.	289.71	11.57	13.52	9.42	0.57049E+03	0.20E+05	281.7	46.88	712.2	69221.	0.26E+07	0.536	196820.
11.7	3382.	286.52	9.49	11.36	7.24	0.58735E+03	0.20E+05	279.8	46.67	686.4	69221.	0.25E+07	0.500	196820.
12.7	3691.	294.42	7.30	9.29	5.14	0.60635E+03	0.20E+05	278.0	46.81	659.9	69221.	0.25E+07	0.520	196820.
13.8	4004.	298.74	5.18	7.20	3.02	0.62516E+03	0.20E+05	276.1	46.78	635.2	69221.	0.25E+07	0.522	196820.
14.9	4335.	298.06	3.04	4.98	0.78	0.64467E+03	0.20E+05	274.2	46.56	611.0	69221.	0.25E+07	0.500	196820.
16.0	4668.	296.63	0.78	2.75	-1.47	0.66639E+03	0.20E+05	272.2	46.55	586.2	69221.	0.24E+07	0.500	196820.
17.1	5004.	303.92	-1.49	0.51	-3.73	0.68918E+03	0.20E+05	270.2	46.53	562.1	69221.	0.25E+07	0.500	196820.
18.2	5345.	311.32	-3.80	-1.76	-6.04	0.71330E+03	0.20E+05	268.2	46.50	538.4	69221.	0.25E+07	0.500	196820.
19.3	5690.	314.62	-6.13	-4.06	-8.37	0.73884E+03	0.20E+05	266.2	46.47	515.3	69221.	0.25E+07	0.500	196820.
20.4	6037.	316.49	-8.49	-6.39	-10.71	0.76573E+03	0.20E+05	264.1	46.47	492.8	69221.	0.24E+07	0.500	196820.
21.5	6387.	318.42	-10.85	-8.72	-13.05	0.79404E+03	0.20E+05	262.0	46.47	471.0	69221.	0.24E+07	0.500	196820.
22.6	6738.	320.40	-13.24	-11.07	-15.41	0.82387E+03	0.20E+05	260.0	46.47	449.8	69221.	0.24E+07	0.500	196820.
23.7	7092.	322.45	-15.63	-13.44	-17.79	0.85532E+03	0.20E+05	257.9	46.48	429.3	69221.	0.24E+07	0.500	196820.
24.8	7448.	324.55	-18.04	-15.81	-20.17	0.88850E+03	0.20E+05	255.8	46.49	409.4	69221.	0.23E+07	0.500	196820.
25.9	7807.	326.71	-20.47	-18.21	-22.57	0.92353E+03	0.20E+05	253.7	46.51	390.1	69221.	0.23E+07	0.500	196820.
27.0	8168.	328.93	-22.92	-20.61	-24.98	0.96058E+03	0.20E+05	251.5	46.53	371.5	69221.	0.23E+07	0.500	196820.
28.0	8531.	331.21	-25.38	-23.03	-27.41	0.99977E+03	0.20E+05	249.4	46.55	353.4	69221.	0.22E+07	0.500	196820.
29.1	8897.	333.56	-27.86	-25.47	-29.86	0.10413E+04	0.20E+05	247.2	46.58	336.0	69221.	0.22E+07	0.500	196820.
30.2	9266.	335.98	-30.35	-27.92	-32.32	0.10853E+04	0.20E+05	245.0	46.61	319.1	69221.	0.22E+07	0.500	196820.
31.3	9637.	338.47	-32.87	-30.39	-34.80	0.11320E+04	0.20E+05	242.8	46.64	302.8	69221.	0.21E+07	0.500	196820.
32.4	10011.	341.03	-35.40	-32.88	-37.29	0.11816E+04	0.20E+05	240.6	46.68	287.0	69221.	0.21E+07	0.500	196820.
33.5	10388.	343.67	-37.95	-35.39	-39.81	0.12344E+04	0.20E+05	238.4	46.72	271.8	69221.	0.21E+07	0.500	196820.
34.6	10768.	346.40	-40.53	-37.91	-42.34	0.12906E+04	0.20E+05	236.2	46.77	257.1	69221.	0.20E+07	0.500	196820.
35.7	11151.	349.21	-43.12	-40.45	-44.89	0.13506E+04	0.20E+05	233.9	46.82	243.0	69221.	0.20E+07	0.500	196820.
36.8	11537.	352.11	-45.73	-43.02	-47.46	0.14146E+04	0.20E+05	231.6	46.87	229.4	69221.	0.20E+07	0.500	196820.
37.9	11926.	355.11	-48.37	-45.60	-50.05	0.14830E+04	0.20E+05	229.3	46.93	216.3	69221.	0.19E+07	0.500	196820.
39.0	12319.	358.22	-51.03	-48.20	-52.66	0.15563E+04	0.20E+05	227.0	47.00	203.7	69221.	0.19E+07	0.500	196820.
40.1	12715.	361.58	-53.73	-50.83	-55.29	0.16348E+04	0.20E+05	224.7	47.12	191.6	69221.	0.19E+07	0.500	196820.
41.2	13115.	365.25	-56.49	-53.48	-57.95	0.17193E+04	0.20E+05	222.3	47.29	180.0	69221.	0.18E+07	0.500	196820.
42.3	13519.	369.02	-59.27	-56.17	-60.64	0.18101E+04	0.20E+05	219.9	47.46	168.8	69221.	0.18E+07	0.500	196820.
43.4	13928.	372.89	-62.08	-58.89	-63.36	0.19081E+04	0.20E+05	217.5	47.63	158.1	69221.	0.17E+07	0.500	196820.
44.5	14341.	376.88	-64.93	-61.64	-66.12	0.20139E+04	0.20E+05	215.1	47.80	147.8	69221.	0.17E+07	0.500	196820.
45.6	14758.	381.01	-67.80	-64.43	-68.91	0.21285E+04	0.20E+05	212.6	47.97	138.0	69221.	0.17E+07	0.500	196820.
46.7	15180.	385.28	-70.70	-67.24	-71.72	0.22527E+04	0.20E+05	210.1	48.15	128.6	69221.	0.16E+07	0.500	196820.
47.8	15600.	369.87	-71.23	-69.83	-74.44	0.23867E+04	0.20E+05	209.4	42.72	119.7	69221.	0.15E+07	0.500	196820.
48.9	15991.	343.12	-70.38	-71.61	-76.50	0.25246E+04	0.20E+05	209.4	35.56	112.0	69221.	0.13E+07	0.500	196820.
50.0	16356.	320.41	-69.59	-72.85	-77.93	0.26655E+04	0.20E+05	209.4	30.12	105.3	69221.	0.12E+07	0.500	196820.
51.1	16697.	301.62	-68.84	-73.70	-78.89	0.28096E+04	0.20E+05	209.4	26.03	99.4	69221.	0.11E+07	0.500	196820.
52.2	17020.	286.31	-68.14	-74.25	-79.49	0.29569E+04	0.20E+05	209.4	22.94	94.2	69221.	0.96E+06	0.500	196820.
53.3	17328.	274.04	-67.47	-74.57	-79.82	0.31076E+04	0.20E+05	209.4	20.59	89.5	69221.	0.89E+06	0.500	196820.

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TABLE 2.B. (continued) THERMTRAJ PRINTED OUTPUT

TIME	ALT(M)	V(M/MIN)	TA(C)	TS(C)	TG(C)	VOLUME(M3)	FLXSC	TBB(K)	FL(KG)	P(MB)	GAS(GM)	REY NC	CD	PAY(GM)
54.4	17624.	264.35	-66.83	-74.71	-79.95	0.32622E+04	0.20E+05	209.4	18.81	85.2	69221.	0.83E+06	0.500	196820.
55.5	17911.	256.86	-66.21	-74.70	-79.93	0.34212E+04	0.20E+05	209.4	17.45	81.2	69221.	0.78E+06	0.500	196820.
56.6	18190.	251.20	-65.60	-74.58	-79.79	0.35553E+04	0.20E+05	209.4	16.43	77.5	69221.	0.74E+06	0.500	196820.
57.7	18464.	247.58	-65.06	-74.38	-79.56	0.37398E+04	0.20E+05	209.4	15.76	74.4	69221.	0.70E+06	0.500	196820.
58.7	18710.	244.65	-64.53	-74.13	-79.30	0.38994E+04	0.20E+05	209.4	15.20	71.5	69221.	0.68E+06	0.500	196820.
59.7	18953.	243.02	-64.00	-73.83	-78.99	0.40647E+04	0.20E+05	209.4	14.77	68.7	69221.	0.65E+06	0.500	196820.
60.7	19196.	241.93	-63.48	-73.50	-78.64	0.42363E+04	0.20E+05	209.4	14.44	66.0	69221.	0.63E+06	0.500	196820.
61.7	19437.	241.46	-62.95	-73.12	-78.26	0.44147E+04	0.20E+05	209.4	14.20	63.5	69221.	0.61E+06	0.500	196820.
62.7	19678.	241.50	-62.43	-72.72	-77.85	0.46006E+04	0.20E+05	209.4	14.01	61.0	69221.	0.60E+06	0.500	196820.
63.7	19920.	241.98	-61.91	-72.30	-77.42	0.47945E+04	0.20E+05	209.4	13.88	58.7	69221.	0.58E+06	0.500	196820.
64.7	20162.	242.80	-61.38	-71.86	-76.98	0.49569E+04	0.20E+05	209.4	13.79	56.4	69221.	0.57E+06	0.500	196820.
65.7	20405.	243.92	-60.86	-71.40	-76.51	0.52086E+04	0.20E+05	209.4	13.73	54.3	69221.	0.55E+06	0.500	196820.
66.7	20649.	245.28	-60.33	-70.92	-76.04	0.54301E+04	0.20E+05	209.4	13.70	52.2	69221.	0.54E+06	0.500	196820.
67.7	20895.	246.86	-59.80	-70.44	-75.55	0.56620E+04	0.20E+05	209.4	13.68	50.2	69221.	0.53E+06	0.500	196820.
68.7	21143.	248.61	-59.26	-69.94	-75.05	0.59052E+04	0.20E+05	209.4	13.69	48.2	69221.	0.52E+06	0.500	196820.
69.8	21417.	250.17	-58.62	-69.38	-74.49	0.62110E+04	0.20E+05	209.4	13.60	46.0	69221.	0.50E+06	0.500	196820.
70.9	21693.	252.51	-58.02	-68.81	-73.92	0.65086E+04	0.20E+05	209.4	13.65	44.0	69221.	0.49E+06	0.500	196820.
72.0	21972.	254.99	-57.41	-68.22	-73.33	0.68226E+04	0.20E+05	209.4	13.70	42.1	69221.	0.48E+06	0.500	196820.
73.1	22254.	257.55	-56.81	-67.64	-72.74	0.71545E+04	0.20E+05	209.4	13.77	40.3	69221.	0.47E+06	0.500	196820.
74.2	22539.	260.21	-56.19	-67.04	-72.14	0.75051E+04	0.20E+05	209.4	13.83	38.5	69221.	0.46E+06	0.500	196820.
75.3	22826.	262.95	-55.57	-66.44	-71.54	0.78756E+04	0.20E+05	209.4	13.90	36.8	69221.	0.45E+06	0.500	196820.
76.4	23117.	265.76	-54.94	-65.83	-70.92	0.82678E+04	0.20E+05	209.4	13.98	35.2	69221.	0.44E+06	0.500	196820.
77.5	23411.	268.65	-54.30	-65.21	-70.30	0.86827E+04	0.20E+05	209.4	14.05	33.6	69221.	0.43E+06	0.500	196820.
78.6	23708.	271.61	-53.66	-64.59	-69.67	0.91220E+04	0.20E+05	209.4	14.14	32.1	69221.	0.42E+06	0.500	196820.
79.7	24008.	274.64	-53.01	-63.96	-69.03	0.95875E+04	0.20E+05	209.4	14.22	30.6	69221.	0.41E+06	0.500	196820.
80.8	24312.	277.74	-52.35	-63.33	-68.38	0.10081E+05	0.20E+05	209.4	14.30	29.2	69221.	0.40E+06	0.500	196820.
81.9	24619.	280.91	-51.69	-62.69	-67.73	0.10604E+05	0.20E+05	209.4	14.39	27.9	69221.	0.39E+06	0.500	196820.
83.0	24930.	284.14	-51.02	-62.05	-67.07	0.11159E+05	0.20E+05	209.4	14.48	26.6	69221.	0.38E+06	0.500	196820.
84.1	25244.	287.45	-50.34	-61.40	-66.39	0.11749E+05	0.20E+05	209.4	14.57	25.3	69221.	0.37E+06	0.500	196820.
85.2	25562.	290.82	-49.65	-60.75	-65.72	0.12375E+05	0.20E+05	209.4	14.66	24.1	69221.	0.36E+06	0.500	196820.
86.3	25884.	294.26	-48.95	-60.09	-65.03	0.13040E+05	0.20E+05	209.4	14.75	22.9	69221.	0.36E+06	0.500	196820.
87.4	26210.	297.77	-48.25	-59.42	-64.33	0.13747E+05	0.20E+05	209.4	14.85	21.8	69221.	0.35E+06	0.500	196820.
88.5	26539.	301.36	-47.54	-58.75	-63.63	0.14499E+05	0.20E+05	209.4	14.95	20.8	69221.	0.34E+06	0.500	196820.
89.6	26872.	305.01	-46.82	-58.08	-62.91	0.15300E+05	0.20E+05	209.4	15.04	19.8	69221.	0.33E+06	0.500	196820.
90.7	27210.	308.74	-46.09	-57.40	-62.19	0.16152E+05	0.20E+05	209.4	15.14	18.8	69221.	0.32E+06	0.500	196820.
91.8	27552.	312.55	-45.35	-56.71	-61.46	0.17061E+05	0.20E+05	209.4	15.24	17.8	69221.	0.31E+06	0.500	196820.
92.9	27897.	316.43	-44.60	-56.03	-60.72	0.18029E+05	0.20E+05	209.4	15.34	16.9	69221.	0.30E+06	0.500	196820.
94.0	28248.	320.39	-43.84	-55.33	-59.97	0.19063E+05	0.20E+05	209.4	15.44	16.1	69221.	0.30E+06	0.500	196820.
95.1	28602.	324.43	-43.07	-54.64	-59.21	0.20165E+05	0.20E+05	209.4	15.54	15.3	69221.	0.29E+06	0.500	196820.
96.2	28961.	328.54	-42.30	-53.94	-58.44	0.21343E+05	0.20E+05	209.4	15.65	14.5	69221.	0.28E+06	0.500	196820.
97.3	29325.	332.75	-41.51	-53.24	-57.66	0.22601E+05	0.20E+05	209.4	15.75	13.7	69221.	0.27E+06	0.500	196820.
98.4	29693.	337.04	-40.72	-52.53	-56.87	0.23946E+05	0.20E+05	209.4	15.85	13.0	69221.	0.26E+06	0.500	196820.
99.5	30066.	341.41	-39.91	-51.83	-56.07	0.25386E+05	0.20E+05	209.4	15.96	12.3	69221.	0.26E+06	0.500	196820.
100.6	30444.	345.88	-39.09	-51.12	-55.26	0.26926E+05	0.20E+05	209.4	16.07	11.6	69221.	0.25E+06	0.500	196820.
101.7	30827.	350.44	-38.26	-50.41	-54.44	0.28576E+05	0.20E+05	209.4	16.18	11.0	69221.	0.24E+06	0.500	196820.
102.8	31215.	354.99	-37.42	-49.70	-53.61	0.30344E+05	0.20E+05	209.4	16.27	10.4	69221.	0.24E+06	0.500	196820.
103.9	31608.	359.86	-36.57	-48.99	-52.76	0.32242E+05	0.20E+05	209.4	16.40	9.8	69221.	0.23E+06	0.500	196820.
105.0	32006.	364.96	-35.71	-48.29	-51.89	0.34280E+05	0.20E+05	209.4	16.53	9.3	69221.	0.22E+06	0.500	196820.
106.1	32411.	370.21	-34.84	-47.59	-51.01	0.36471E+05	0.20E+05	209.4	16.67	8.8	69221.	0.21E+06	0.500	196820.
107.1	32821.	375.58	-33.95	-46.89	-50.12	0.38828E+05	0.20E+05	209.4	16.81	8.3	69221.	0.21E+06	0.500	196820.

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TABLE 2.B. (continued) THERMTRAJ PRINTED OUTPUT

TIME	ALT(M)	V(M/MIN)	TA(C)	TS(C)	TG(C)	VOLUME(M3)	FLXSC	TBB(K)	FL(KG)	P(MB)	GAS(GM)	REY NO	CD	PAY(GM)
182.3	36363.	-30.38	-26.15	-29.25	-17.93	0.62625E+05	0.20E+05	204.4	-0.20	5.0	58795.	0.11E+05	0.940	196820.
183.9	36315.	-29.53	-26.25	-29.31	-18.04	0.62183E+05	0.20E+05	204.4	-0.19	5.0	58795.	0.11E+05	0.940	196820.
185.5	36269.	-28.80	-26.36	-29.36	-18.14	0.61758E+05	0.20E+05	204.4	-0.18	5.0	58795.	0.11E+05	0.940	196820.
187.1	36222.	-29.40	-26.40	-29.40	-18.22	0.61542E+05	0.20E+05	204.4	-0.23	5.1	58795.	0.11E+05	0.940	196820.
188.7	36177.	-27.30	-26.51	-29.44	-18.30	0.61125E+05	0.20E+05	204.4	-0.20	5.1	58795.	0.10E+05	0.940	196820.
190.3	36134.	-25.82	-26.60	-29.49	-18.41	0.60716E+05	0.20E+05	204.4	-0.20	5.1	58795.	0.97E+04	0.940	196820.
191.9	36093.	-25.58	-26.70	-29.54	-18.50	0.60337E+05	0.20E+05	204.4	-0.20	5.2	58795.	0.97E+04	0.940	196820.
193.5	36052.	-25.25	-26.79	-29.59	-18.59	0.59972E+05	0.20E+05	204.4	-0.19	5.2	58795.	0.96E+04	0.940	196820.
195.1	36012.	-24.45	-26.87	-29.63	-18.67	0.59614E+05	0.20E+05	204.4	-0.18	5.2	58795.	0.93E+04	0.940	196820.
196.7	35974.	-23.72	-26.96	-29.68	-18.76	0.59265E+05	0.20E+05	204.4	-0.17	5.2	58795.	0.91E+04	0.940	196820.
198.3	35936.	-23.17	-27.04	-29.72	-18.84	0.58929E+05	0.20E+05	204.4	-0.17	5.3	58795.	0.89E+04	0.940	196820.
199.9	35899.	-22.65	-27.13	-29.77	-18.92	0.58604E+05	0.20E+05	204.4	-0.16	5.3	58795.	0.88E+04	0.940	196820.
201.5	35863.	-22.07	-27.21	-29.81	-19.00	0.58288E+05	0.20E+05	204.4	-0.15	5.3	58795.	0.86E+04	0.940	196820.
203.1	35829.	-21.51	-27.28	-29.85	-19.07	0.57981E+05	0.20E+05	204.4	-0.15	5.4	58795.	0.84E+04	0.940	196820.
204.7	35795.	-20.96	-27.36	-29.89	-19.15	0.57684E+05	0.20E+05	204.4	-0.14	5.4	58795.	0.82E+04	0.940	196820.
206.3	35761.	-20.47	-27.43	-29.93	-19.22	0.57396E+05	0.20E+05	204.4	-0.14	5.4	58795.	0.80E+04	0.940	196820.
207.9	35729.	-19.96	-27.50	-29.97	-19.29	0.57116E+05	0.20E+05	204.4	-0.13	5.4	58795.	0.79E+04	0.940	196820.
209.5	35698.	-19.48	-27.57	-30.01	-19.36	0.56844E+05	0.20E+05	204.4	-0.13	5.5	58795.	0.77E+04	0.940	196820.
211.1	35667.	-19.01	-27.64	-30.04	-19.43	0.56580E+05	0.20E+05	204.4	-0.12	5.5	58795.	0.75E+04	0.940	196820.
212.7	35637.	-18.55	-27.71	-30.08	-19.50	0.56324E+05	0.20E+05	204.4	-0.12	5.5	58795.	0.74E+04	0.940	196820.
214.3	35608.	-18.09	-27.77	-30.11	-19.56	0.56075E+05	0.20E+05	204.4	-0.11	5.5	58795.	0.72E+04	0.940	196820.
215.9	35579.	-17.66	-27.84	-30.15	-19.62	0.55833E+05	0.20E+05	204.4	-0.11	5.5	58795.	0.71E+04	0.940	196820.
217.5	35551.	-17.24	-27.90	-30.18	-19.69	0.55598E+05	0.20E+05	204.4	-0.10	5.6	58795.	0.69E+04	0.940	196820.
219.1	35524.	-16.81	-27.96	-30.21	-19.75	0.55370E+05	0.20E+05	204.4	-0.10	5.6	58795.	0.68E+04	0.940	196820.
220.7	35498.	-16.43	-28.02	-30.25	-19.80	0.55148E+05	0.20E+05	204.4	-0.10	5.6	58795.	0.66E+04	0.940	196820.
222.3	35472.	-16.02	-28.07	-30.28	-19.86	0.54932E+05	0.20E+05	204.4	-0.09	5.6	58795.	0.65E+04	0.940	196820.
223.9	35447.	-15.64	-28.13	-30.31	-19.92	0.54723E+05	0.20E+05	204.4	-0.09	5.7	58795.	0.64E+04	0.940	196820.
225.5	35422.	-15.28	-28.19	-30.34	-19.97	0.54519E+05	0.20E+05	204.4	-0.09	5.7	58795.	0.62E+04	0.940	196820.
227.1	35398.	-14.92	-28.24	-30.37	-20.03	0.54321E+05	0.20E+05	204.4	-0.08	5.7	58795.	0.61E+04	0.940	196820.
228.7	35374.	-14.57	-28.29	-30.40	-20.08	0.54128E+05	0.20E+05	204.4	-0.08	5.7	58795.	0.60E+04	0.940	196820.
230.3	35352.	-14.21	-28.34	-30.42	-20.13	0.53940E+05	0.20E+05	204.4	-0.08	5.7	58795.	0.58E+04	0.940	196820.
231.9	35329.	-13.88	-28.39	-30.45	-20.18	0.53758E+05	0.20E+05	204.4	-0.08	5.7	58795.	0.57E+04	0.940	196820.
233.5	35307.	-13.56	-28.44	-30.48	-20.23	0.53580E+05	0.20E+05	204.4	-0.07	5.8	58795.	0.56E+04	0.940	196820.
235.1	35286.	-13.25	-28.49	-30.51	-20.27	0.53407E+05	0.20E+05	204.4	-0.07	5.8	58795.	0.55E+04	0.940	196820.
236.7	35265.	-12.92	-28.53	-30.53	-20.32	0.53239E+05	0.20E+05	204.4	-0.07	5.8	58795.	0.54E+04	0.940	196820.
238.3	35245.	-12.63	-28.58	-30.56	-20.37	0.53075E+05	0.20E+05	204.4	-0.07	5.8	58795.	0.52E+04	0.940	196820.
239.9	35225.	-12.34	-28.62	-30.58	-20.41	0.52916E+05	0.20E+05	204.4	-0.06	5.8	58795.	0.51E+04	0.940	196820.
241.5	35206.	-12.06	-28.66	-30.61	-20.45	0.52760E+05	0.20E+05	204.4	-0.06	5.8	58795.	0.50E+04	0.940	196820.
243.1	35187.	-11.78	-28.71	-30.63	-20.49	0.52609E+05	0.20E+05	204.4	-0.06	5.9	58795.	0.49E+04	0.940	196820.
244.7	35169.	-11.48	-28.75	-30.65	-20.54	0.52461E+05	0.20E+05	204.4	-0.06	5.9	58795.	0.48E+04	0.940	196820.
246.3	35151.	-11.25	-28.79	-30.68	-20.58	0.52318E+05	0.20E+05	204.4	-0.05	5.9	58795.	0.47E+04	0.940	196820.
249.5	35104.	-1.24	-28.83	-30.62	-20.60	0.52181E+05	0.20E+05	204.4	-0.03	5.9	58795.	0.52E+03	1.157	196820.
251.1	35103.	-2.39	-28.93	-30.73	-20.77	0.51809E+05	0.20E+05	204.4	-0.15	5.9	58795.	0.10E+04	0.940	196820.
252.7	35089.	-13.98	-28.93	-30.79	-20.77	0.51798E+05	0.20E+05	204.4	-0.14	6.0	58795.	0.59E+04	0.940	196820.
255.9	35049.	-20.61	-28.96	-30.81	-20.74	0.51701E+05	0.20E+05	204.4	-0.04	6.0	58795.	0.87E+04	0.940	196820.
257.5	35027.	-6.65	-29.05	-30.78	-20.76	0.51413E+05	0.20E+05	204.4	0.09	6.0	58795.	0.29E+04	0.940	196820.
259.1	35021.	-2.98	-29.09	-30.82	-20.90	0.51229E+05	0.20E+05	204.4	-0.07	6.0	58795.	0.13E+04	0.940	196820.
260.7	35010.	-10.08	-29.11	-30.88	-20.94	0.51176E+05	0.20E+05	204.4	-0.11	6.0	58795.	0.43E+04	0.940	196820.
262.3	34992.	-12.20	-29.13	-30.89	-20.92	0.51105E+05	0.20E+05	204.4	-0.03	6.0	58795.	0.52E+04	0.940	196820.
263.9	34976.	-8.50	-29.17	-30.89	-20.94	0.50969E+05	0.20E+05	204.4	-0.00	6.0	58795.	0.36E+04	0.940	196820.

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TABLE 2.B. (continued) THERMTRAJ PRINTED OUTPUT

TIME	ALT(M)	V(M/MIN)	TA(C)	TS(C)	TG(C)	VOLUME(M3)	FLXSO	TBB(K)	FL(KG)	P(MB)	GAS(GM)	REY NC	CD	PAY(GM)
265.5	34964.	-6.85	-29.20	-30.91	-21.00	0.50841E+05	0.20E+05	204.4	-0.04	6.1	58795.	0.29E+04	0.940	196820.
268.7	34931.	-0.16	-29.23	-30.87	-21.04	0.50749E+05	0.20E+05	204.4	-0.07	6.1	58795.	0.68E+02	2.756	196820.
270.3	34929.	-3.68	-29.30	-30.96	-21.14	0.50456E+05	0.20E+05	204.4	-0.12	6.1	58795.	0.16E+04	0.940	196820.
271.9	34916.	-11.07	-29.31	-31.00	-21.13	0.50481E+05	0.20E+05	204.4	-0.08	6.1	58795.	0.48E+04	0.940	196820.
275.1	34884.	-12.60	-29.33	-30.98	-21.10	0.50397E+05	0.20E+05	204.4	0.01	6.1	58795.	0.54E+04	0.940	196820.
276.7	34872.	-3.00	-29.40	-30.99	-21.16	0.50158E+05	0.20E+05	204.4	0.04	6.1	58795.	0.13E+04	0.940	196820.
278.3	34868.	-3.45	-29.43	-31.03	-21.25	0.50057E+05	0.20E+05	204.4	-0.08	6.1	58795.	0.15E+04	0.940	196820.
279.9	34858.	-8.90	-29.44	-31.07	-21.26	0.50026E+05	0.20E+05	204.4	-0.07	6.1	58795.	0.39E+04	0.940	196820.
281.5	34843.	-8.80	-29.46	-31.07	-21.24	0.49957E+05	0.20E+05	204.4	-0.00	6.2	58795.	0.38E+04	0.940	196820.
283.1	34832.	-5.77	-29.49	-31.07	-21.27	0.49850E+05	0.20E+05	204.4	-0.00	6.2	58795.	0.25E+04	0.940	196820.
284.7	34823.	-5.36	-29.52	-31.09	-21.32	0.49763E+05	0.20E+05	204.4	-0.04	6.2	58795.	0.23E+04	0.940	196820.
287.9	34799.	-1.57	-29.53	-31.07	-21.35	0.49698E+05	0.20E+05	204.4	-0.05	6.2	58795.	0.68E+03	1.064	196820.
289.5	34795.	-3.08	-29.59	-31.12	-21.41	0.49512E+05	0.20E+05	204.4	-0.07	6.2	58795.	0.13E+04	0.940	196820.
291.1	34786.	-7.76	-29.60	-31.15	-21.41	0.49499E+05	0.20E+05	204.4	-0.06	6.2	58795.	0.34E+04	0.940	196820.
294.3	34762.	-8.45	-29.62	-31.15	-21.40	0.49426E+05	0.20E+05	204.4	-0.01	6.2	58795.	0.37E+04	0.940	196820.
295.9	34754.	-2.63	-29.67	-31.16	-21.44	0.49254E+05	0.20E+05	204.4	0.02	6.2	58795.	0.12E+04	0.940	196820.
297.5	34749.	-3.25	-29.69	-31.19	-21.50	0.49183E+05	0.20E+05	204.4	-0.05	6.2	58795.	0.14E+04	0.940	196820.
300.7	34731.	-0.26	-29.69	-31.18	-21.55	0.49143E+05	0.20E+05	204.4	-0.12	6.3	58795.	0.11E+03	2.105	196820.
303.9	34713.	5.87	-29.73	-31.14	-21.63	0.49003E+05	0.20E+05	204.4	-0.19	6.3	58795.	0.26E+04	0.470	196820.
306.4	34704.	-0.68	-29.77	-31.19	-21.65	0.48877E+05	0.20E+05	204.4	-0.14	6.3	58795.	0.30E+03	1.471	196820.
308.9	34691.	-4.07	-29.79	-31.22	-21.63	0.48816E+05	0.20E+05	204.4	-0.08	6.3	58795.	0.18E+04	0.940	196820.
311.4	34677.	-2.55	-29.82	-31.23	-21.63	0.48725E+05	0.20E+05	204.4	-0.02	6.3	58795.	0.13E+04	0.940	196820.
313.9	34667.	-0.91	-29.85	-31.25	-21.66	0.48629E+05	0.20E+05	204.4	-0.02	6.3	58795.	0.40E+03	1.319	196820.
316.4	34658.	-0.81	-29.87	-31.27	-21.69	0.48550E+05	0.20E+05	204.4	-0.04	6.3	58795.	0.36E+03	1.377	196820.
318.9	34648.	-1.79	-29.89	-31.29	-21.71	0.48485E+05	0.20E+05	204.4	-0.04	6.3	58795.	0.79E+03	1.026	196820.
321.4	34639.	-2.40	-29.91	-31.31	-21.73	0.48419E+05	0.20E+05	204.4	-0.03	6.3	58795.	0.11E+04	0.940	196820.
323.9	34629.	-2.31	-29.93	-31.32	-21.74	0.48349E+05	0.20E+05	204.4	-0.02	6.4	58795.	0.10E+04	0.940	196820.
326.4	34620.	-1.95	-29.96	-31.33	-21.76	0.48280E+05	0.20E+05	204.4	-0.02	6.4	58795.	0.87E+03	0.992	196820.
328.9	34611.	-1.83	-29.98	-31.34	-21.78	0.48214E+05	0.20E+05	204.4	-0.02	6.4	58795.	0.81E+03	1.016	196820.
331.4	34603.	-1.89	-29.99	-31.36	-21.80	0.48153E+05	0.20E+05	204.4	-0.02	6.4	58795.	0.84E+03	1.003	196820.
333.9	34595.	-1.91	-30.01	-31.37	-21.82	0.48093E+05	0.20E+05	204.4	-0.02	6.4	58795.	0.85E+03	0.959	196820.
336.4	34587.	-1.89	-30.03	-31.38	-21.84	0.48035E+05	0.20E+05	204.4	-0.02	6.4	58795.	0.84E+03	1.003	196820.
338.9	34579.	-1.80	-30.05	-31.39	-21.85	0.47979E+05	0.20E+05	204.4	-0.02	6.4	58795.	0.81E+03	1.020	196820.
341.4	34572.	-1.75	-30.06	-31.40	-21.87	0.47925E+05	0.20E+05	204.4	-0.01	6.4	58795.	0.78E+03	1.031	196820.
343.9	34565.	-1.73	-30.08	-31.41	-21.89	0.47872E+05	0.20E+05	204.4	-0.01	6.4	58795.	0.77E+03	1.036	196820.
346.4	34558.	-1.68	-30.09	-31.42	-21.90	0.47823E+05	0.20E+05	204.4	-0.01	6.4	58795.	0.75E+03	1.047	196820.
348.9	34552.	-1.65	-30.11	-31.43	-21.92	0.47773E+05	0.20E+05	204.4	-0.01	6.4	58795.	0.74E+03	1.054	196820.
351.4	34545.	-1.60	-30.12	-31.44	-21.93	0.47727E+05	0.20E+05	204.4	-0.01	6.4	58795.	0.72E+03	1.064	196820.
353.9	34539.	-1.55	-30.14	-31.45	-21.95	0.47681E+05	0.20E+05	204.4	-0.01	6.4	58795.	0.70E+03	1.077	196820.
356.4	34533.	-1.50	-30.15	-31.45	-21.96	0.47637E+05	0.20E+05	204.4	-0.01	6.4	58795.	0.67E+03	1.091	196820.
358.9	34527.	-1.42	-30.16	-31.46	-21.97	0.47595E+05	0.20E+05	204.4	-0.01	6.4	58795.	0.64E+03	1.112	196820.
361.4	34522.	-1.39	-30.18	-31.47	-21.99	0.47554E+05	0.20E+05	204.4	-0.01	6.5	58795.	0.62E+03	1.120	196820.
363.9	34517.	-1.37	-30.19	-31.48	-22.00	0.47515E+05	0.20E+05	204.4	-0.01	6.5	58795.	0.62E+03	1.126	196820.
366.4	34511.	-1.33	-30.20	-31.48	-22.01	0.47477E+05	0.20E+05	204.4	-0.01	6.5	58795.	0.60E+03	1.139	196820.
368.9	34506.	-1.28	-30.21	-31.49	-22.02	0.47440E+05	0.20E+05	204.4	-0.01	6.5	58795.	0.58E+03	1.154	196820.
371.4	34501.	-1.23	-30.22	-31.50	-22.03	0.47404E+05	0.20E+05	204.4	-0.01	6.5	58795.	0.55E+03	1.171	196820.
373.9	34497.	-1.22	-30.23	-31.50	-22.04	0.47370E+05	0.20E+05	204.4	-0.01	6.5	58795.	0.55E+03	1.174	196820.
376.4	34492.	-1.16	-30.24	-31.51	-22.05	0.47337E+05	0.20E+05	204.4	-0.01	6.5	58795.	0.52E+03	1.197	196820.
378.9	34488.	-1.12	-30.25	-31.52	-22.06	0.47304E+05	0.20E+05	204.4	-0.01	6.5	58795.	0.51E+03	1.210	196820.
381.4	34484.	-1.11	-30.26	-31.52	-22.07	0.47274E+05	0.20E+05	204.4	-0.01	6.5	58795.	0.50E+03	1.215	196820.

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TABLE 2.B. (continued) THERMTRAJ PRINTED OUTPUT

TIME	ALT(M)	V(M/MIN)	TA(C)	TS(C)	TG(C)	VOLUME(M3)	FLXSC	TBB(K)	FL(KG)	P(MB)	GAS(GM)	REY NO	CC	PAY(GM)
383.9	34480.	-1.07	-30.27	-31.53	-22.08	0.47244E+05	0.20E+05	204.4	-0.01	6.5	58795.	0.48E+03	1.232	196820.
386.4	34476.	-1.04	-30.28	-31.53	-22.09	0.47215E+05	0.20E+05	204.4	-0.01	6.5	58795.	0.47E+03	1.246	196820.
388.9	34472.	-1.02	-30.29	-31.54	-22.10	0.47187E+05	0.20E+05	204.4	-0.01	6.5	58795.	0.46E+03	1.254	196820.
391.4	34468.	-0.99	-30.30	-31.54	-22.11	0.47160E+05	0.20E+05	204.4	-0.01	6.5	58795.	0.45E+03	1.269	196820.
393.9	34465.	-0.92	-30.30	-31.55	-22.12	0.47134E+05	0.20E+05	204.4	-0.01	6.5	58795.	0.42E+03	1.300	196820.
396.4	34461.	-0.91	-30.31	-31.55	-22.12	0.47109E+05	0.20E+05	204.4	-0.01	6.5	58795.	0.41E+03	1.308	196820.
398.9	34458.	-0.89	-30.32	-31.56	-22.13	0.47085E+05	0.20E+05	204.4	-0.01	6.5	58795.	0.40E+03	1.315	196820.
401.4	34455.	-0.87	-30.33	-31.56	-22.14	0.47061E+05	0.20E+05	204.4	-0.00	6.5	58795.	0.39E+03	1.329	196820.
403.9	34451.	-0.81	-30.33	-31.57	-22.15	0.47038E+05	0.20E+05	204.4	-0.00	6.5	58795.	0.37E+03	1.360	196820.
408.9	34426.	20.43	-30.34	-31.38	-22.11	0.47025E+05	0.20E+05	204.4	0.08	6.5	58795.	0.93E+04	0.470	196820.
410.2	34450.	16.27	-30.40	-31.53	-22.32	0.46815E+05	0.20E+05	204.4	-0.20	6.5	58795.	0.74E+04	0.470	196820.
411.4	34457.	-4.17	-30.34	-31.63	-22.30	0.46980E+05	0.20E+05	204.4	-0.25	6.5	58795.	0.19E+04	0.940	196820.
412.7	34445.	-12.44	-30.33	-31.63	-22.14	0.47055E+05	0.20E+05	204.4	-0.01	6.5	58795.	0.56E+04	0.940	196820.
413.9	34434.	-4.20	-30.35	-31.57	-22.08	0.46987E+05	0.20E+05	204.4	0.14	6.5	58795.	0.19E+04	0.940	196820.
416.4	34435.	4.10	-30.38	-31.57	-22.15	0.46904E+05	0.20E+05	204.4	0.06	6.5	58795.	0.19E+04	0.470	196820.
418.9	34437.	2.67	-30.38	-31.59	-22.20	0.46895E+05	0.20E+05	204.4	-0.03	6.5	58795.	0.12E+04	0.470	196820.
421.4	34435.	-0.49	-30.37	-31.60	-22.21	0.46911E+05	0.20E+05	204.4	-0.04	6.5	58795.	0.22E+03	1.638	196820.
423.9	34432.	-1.81	-30.37	-31.61	-22.19	0.46904E+05	0.20E+05	204.4	-0.01	6.5	58795.	0.82E+03	1.013	196820.
428.9	34426.	-12.24	-30.38	-31.63	-22.15	0.46888E+05	0.20E+05	204.4	0.08	6.5	58795.	0.56E+04	0.940	196820.
431.4	34417.	-0.58	-30.40	-31.58	-22.13	0.46852E+05	0.20E+05	204.4	0.13	6.5	58795.	0.26E+03	1.543	196820.
433.9	34420.	5.75	-30.41	-31.58	-22.21	0.46778E+05	0.20E+05	204.4	0.03	6.6	58795.	0.26E+04	0.470	196820.
436.4	34423.	2.53	-30.41	-31.61	-22.25	0.46789E+05	0.20E+05	204.4	-0.05	6.5	58795.	0.12E+04	0.470	196820.
438.9	34421.	-0.88	-30.40	-31.62	-22.24	0.46811E+05	0.20E+05	204.4	-0.04	6.5	58795.	0.40E+03	1.321	196820.
441.4	34417.	-1.78	-30.41	-31.62	-22.22	0.46801E+05	0.20E+05	204.4	-0.01	6.5	58795.	0.81E+03	1.019	196820.
443.9	34415.	-1.07	-30.41	-31.62	-22.22	0.46779E+05	0.20E+05	204.4	0.01	6.6	58795.	0.49E+03	1.227	196820.
446.4	34413.	-0.43	-30.42	-31.62	-22.23	0.46759E+05	0.20E+05	204.4	0.00	6.6	58795.	0.19E+03	1.726	196820.
448.9	34411.	-0.30	-30.42	-31.62	-22.24	0.46746E+05	0.20E+05	204.4	-0.00	6.6	58795.	0.14E+03	1.970	196820.
453.9	34397.	12.42	-30.43	-31.52	-22.23	0.46738E+05	0.20E+05	204.4	0.02	6.6	58795.	0.57E+04	0.470	196820.
455.2	34412.	9.16	-30.46	-31.61	-22.35	0.46623E+05	0.20E+05	204.4	-0.13	6.6	58795.	0.42E+04	0.470	196820.
456.4	34415.	-3.21	-30.43	-31.67	-22.32	0.46722E+05	0.20E+05	204.4	-0.15	6.6	58795.	0.15E+04	0.940	196820.
458.9	34408.	-7.37	-30.42	-31.67	-22.24	0.46758E+05	0.20E+05	204.4	-0.02	6.6	58795.	0.34E+04	0.940	196820.
461.4	34401.	-3.40	-30.43	-31.64	-22.21	0.46716E+05	0.20E+05	204.4	0.06	6.6	58795.	0.16E+04	0.940	196820.
463.9	34400.	0.58	-30.45	-31.63	-22.24	0.46670E+05	0.20E+05	204.4	0.04	6.6	58795.	0.27E+03	0.769	196820.
466.4	34401.	0.96	-30.45	-31.64	-22.26	0.46658E+05	0.20E+05	204.4	-0.00	6.6	58795.	0.44E+03	0.638	196820.
468.9	34400.	-0.04	-30.45	-31.64	-22.27	0.46661E+05	0.20E+05	204.4	-0.01	6.6	58795.	0.20E+02	5.593	196820.
471.4	34399.	-0.62	-30.45	-31.65	-22.27	0.46657E+05	0.20E+05	204.4	-0.01	6.6	58795.	0.28E+03	1.502	196820.
476.4	34394.	-0.38	-30.45	-31.63	-22.27	0.46646E+05	0.20E+05	204.4	-0.01	6.6	58795.	0.17E+03	1.805	196820.
478.9	34394.	0.61	-30.46	-31.63	-22.28	0.46617E+05	0.20E+05	204.4	-0.00	6.6	58795.	0.28E+03	0.754	196820.
481.4	34393.	0.55	-30.47	-31.64	-22.28	0.46611E+05	0.20E+05	204.4	-0.01	6.6	58795.	0.25E+03	0.767	196820.
486.4	34380.	19.96	-30.47	-31.42	-22.39	0.46589E+05	0.20E+05	204.4	-0.20	6.6	58795.	0.91E+04	0.470	196820.
487.7	34397.	7.45	-30.49	-31.61	-22.42	0.46497E+05	0.20E+05	204.4	-0.19	6.6	58795.	0.34E+04	0.470	196820.
488.9	34397.	-5.35	-30.46	-31.68	-22.34	0.46621E+05	0.20E+05	204.4	-0.11	6.6	58795.	0.24E+04	0.940	196820.
491.4	34390.	-5.89	-30.46	-31.67	-22.27	0.46635E+05	0.20E+05	204.4	0.01	6.6	58795.	0.27E+04	0.940	196820.
493.9	34386.	-1.36	-30.47	-31.65	-22.26	0.46591E+05	0.20E+05	204.4	0.05	6.6	58795.	0.62E+03	1.124	196820.
496.4	34386.	1.35	-30.48	-31.65	-22.28	0.46560E+05	0.20E+05	204.4	0.02	6.6	58795.	0.62E+03	0.563	196820.
498.9	34387.	0.88	-30.48	-31.66	-22.30	0.46560E+05	0.20E+05	204.4	-0.01	6.6	58795.	0.40E+03	0.658	196820.
503.9	34392.	19.68	-30.48	-31.59	-22.50	0.46528E+05	0.20E+05	204.4	-0.37	6.6	58795.	0.90E+04	0.470	196820.
505.2	34399.	-5.09	-30.47	-31.72	-22.45	0.46568E+05	0.20E+05	204.4	-0.28	6.6	58795.	0.23E+04	0.940	196820.
506.4	34386.	-13.26	-30.45	-31.70	-22.26	0.46655E+05	0.20E+05	204.4	0.01	6.6	58795.	0.60E+04	0.940	196820.
508.9	34376.	-2.91	-30.48	-31.64	-22.21	0.46575E+05	0.20E+05	204.4	0.14	6.6	58795.	0.13E+04	0.940	196820.

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TABLE 2.B. (continued) THERMTRAJ PRINTED OUTPUT

TIME	ALT(M)	V(M/MIN)	TA(C)	TS(C)	TG(C)	VOLUME(M3)	FLXSC	TBB(K)	FL(KG)	P(MB)	GAS(GM)	REY NO	CD	PAY(GM)
511.4	34379.	5.19	-30.50	-31.64	-22.28	0.46499E+05	0.20E+05	204.4	0.06	6.6	58795.	0.24E+04	0.470	196820.
513.9	34384.	3.36	-30.50	-31.66	-22.33	0.46508E+05	0.20E+05	204.4	-0.03	6.6	58795.	0.15E+04	0.470	196820.
516.4	34384.	0.02	-30.49	-31.67	-22.33	0.46538E+05	0.20E+05	204.4	-0.04	6.6	58795.	0.74E+01	5.264	196820.
518.9	34382.	-1.26	-30.49	-31.67	-22.31	0.46542E+05	0.20E+05	204.4	-0.01	6.6	58795.	0.58E+03	1.154	196820.
521.4	34380.	-0.83	-30.49	-31.67	-22.30	0.46531E+05	0.20E+05	204.4	0.01	6.6	58795.	0.38E+03	1.349	196820.
522.7	34376.	-7.25	-30.49	-31.72	-22.41	0.46501E+05	0.19E+05	204.4	-0.17	6.6	58795.	0.33E+04	0.940	196820.
523.9	34358.	-21.45	-30.50	-31.80	-22.49	0.46457E+05	0.19E+05	204.4	-0.30	6.6	58795.	0.98E+04	0.940	196820.
525.2	34325.	-32.67	-30.54	-31.88	-22.56	0.46329E+05	0.18E+05	204.4	-0.36	6.6	58795.	0.15E+05	0.940	196820.
526.4	34280.	-39.11	-30.61	-31.96	-22.69	0.46086E+05	0.18E+05	204.4	-0.45	6.6	58795.	0.18E+05	0.940	196820.
527.7	34229.	-45.13	-30.76	-32.09	-22.92	0.45599E+05	0.17E+05	204.4	-0.57	6.7	58795.	0.21E+05	0.940	196820.
528.9	34167.	-54.11	-30.89	-32.24	-23.14	0.45198E+05	0.16E+05	204.4	-0.75	6.8	58795.	0.25E+05	0.940	196820.
530.2	34095.	-61.47	-31.03	-32.40	-23.38	0.44730E+05	0.16E+05	204.4	-0.91	6.8	58795.	0.29E+05	0.940	196820.
531.4	34015.	-67.87	-31.20	-32.58	-23.65	0.44204E+05	0.15E+05	204.4	-1.07	6.9	58795.	0.32E+05	0.940	196820.
532.7	33927.	-74.03	-31.38	-32.77	-23.94	0.43630E+05	0.15E+05	204.4	-1.26	7.0	58795.	0.35E+05	0.940	196820.
533.9	33831.	-79.98	-31.58	-32.97	-24.25	0.43014E+05	0.14E+05	204.4	-1.45	7.1	58795.	0.39E+05	0.940	196820.
535.2	33729.	-84.64	-31.85	-33.19	-24.61	0.42200E+05	0.13E+05	204.4	-1.59	7.2	58795.	0.41E+05	0.940	196820.
536.4	33620.	-90.68	-32.08	-33.43	-24.97	0.41501E+05	0.13E+05	204.4	-1.81	7.3	58795.	0.45E+05	0.940	196820.
537.7	33503.	-96.02	-32.33	-33.68	-25.35	0.40769E+05	0.12E+05	204.4	-2.01	7.4	58795.	0.48E+05	0.940	196820.
538.9	33380.	-100.91	-32.59	-33.94	-25.73	0.40010E+05	0.12E+05	204.4	-2.22	7.6	58795.	0.51E+05	0.940	196820.
540.2	33251.	-105.52	-32.87	-34.21	-26.13	0.39229E+05	0.11E+05	204.4	-2.43	7.7	58795.	0.54E+05	0.940	196820.
541.4	33117.	-109.87	-33.16	-34.48	-26.55	0.38429E+05	0.11E+05	204.4	-2.64	7.8	58795.	0.57E+05	0.940	196820.
542.7	32977.	-113.97	-33.45	-34.77	-26.97	0.37614E+05	0.10E+05	204.4	-2.85	8.0	58795.	0.60E+05	0.940	196820.
543.9	32833.	-117.84	-33.77	-35.06	-27.41	0.36787E+05	0.96E+04	204.4	-3.05	8.2	58795.	0.63E+05	0.940	196820.
545.2	32683.	-121.49	-34.09	-35.36	-27.65	0.35952E+05	0.90E+04	214.4	-3.26	8.3	58795.	0.66E+05	0.940	196820.
546.4	32530.	-122.43	-34.42	-34.92	-28.17	0.35130E+05	0.84E+04	214.4	-3.21	8.5	58795.	0.68E+05	0.940	196820.
547.7	32381.	-116.80	-34.74	-34.84	-28.35	0.34354E+05	0.79E+04	214.4	-2.94	8.7	58795.	0.66E+05	0.940	196820.
548.9	32238.	-113.21	-35.06	-34.91	-28.61	0.33614E+05	0.73E+04	214.4	-2.82	8.9	58795.	0.65E+05	0.940	196820.
550.2	32097.	-112.36	-35.36	-35.08	-28.92	0.32899E+05	0.68E+04	214.4	-2.83	9.1	58795.	0.66E+05	0.940	196820.
551.4	31957.	-113.20	-35.67	-35.29	-29.28	0.32194E+05	0.62E+04	214.4	-2.91	9.3	58795.	0.67E+05	0.940	196820.
552.7	31814.	-114.94	-35.97	-35.54	-29.66	0.31495E+05	0.57E+04	214.4	-3.03	9.4	58795.	0.69E+05	0.940	196820.
553.9	31670.	-117.11	-36.28	-35.82	-30.06	0.30797E+05	0.51E+04	214.4	-3.17	9.6	58795.	0.72E+05	0.940	196820.
555.2	31522.	-119.45	-36.60	-36.11	-30.47	0.30101E+05	0.46E+04	214.4	-3.32	9.8	58795.	0.74E+05	0.940	196820.
556.4	31372.	-121.83	-36.93	-36.41	-30.89	0.29405E+05	0.40E+04	214.4	-3.48	10.1	58795.	0.77E+05	0.940	196820.
557.7	31218.	-124.16	-37.26	-36.72	-31.31	0.28712E+05	0.35E+04	214.4	-3.63	10.3	58795.	0.80E+05	0.940	196820.
558.9	31062.	-126.40	-37.59	-37.04	-31.75	0.28021E+05	0.29E+04	214.4	-3.79	10.5	58795.	0.83E+05	0.940	196820.
560.2	30903.	-128.54	-37.94	-37.36	-32.18	0.27335E+05	0.24E+04	214.4	-3.95	10.8	58795.	0.85E+05	0.940	196820.
561.4	30741.	-130.56	-38.29	-37.68	-32.63	0.26654E+05	0.18E+04	214.4	-4.10	11.0	58795.	0.88E+05	0.940	196820.
562.7	30577.	-132.45	-38.64	-38.02	-33.07	0.25979E+05	0.13E+04	214.4	-4.25	11.3	58795.	0.91E+05	0.940	196820.
563.9	30411.	-134.23	-39.00	-38.35	-33.52	0.25312E+05	0.71E+03	214.4	-4.40	11.6	58795.	0.94E+05	0.940	196820.
565.2	30242.	-135.88	-39.36	-38.69	-33.97	0.24652E+05	0.16E+03	214.4	-4.54	11.8	58795.	0.97E+05	0.940	196820.
566.4	30072.	-136.84	-39.73	-39.03	-34.39	0.24005E+05	0.0	214.4	-4.62	12.1	58795.	0.10E+06	0.940	196820.
567.7	29904.	-135.22	-40.10	-39.33	-34.77	0.23380E+05	0.0	214.4	-4.64	12.5	58795.	0.10E+06	1.000	196820.
568.9	29737.	-134.12	-40.46	-39.62	-35.12	0.22780E+05	0.0	214.4	-4.59	12.8	58795.	0.10E+06	1.000	196820.
570.2	29572.	-131.32	-40.82	-39.88	-35.44	0.22203E+05	0.0	214.4	-4.51	13.1	58795.	0.10E+06	1.000	196820.
571.4	29410.	-128.24	-41.17	-40.13	-35.76	0.21649E+05	0.0	214.4	-4.43	13.4	58795.	0.10E+06	1.000	196820.
572.7	29252.	-126.31	-41.51	-40.37	-36.06	0.21120E+05	0.0	214.4	-4.34	13.7	58795.	0.10E+06	1.000	196820.
573.9	29095.	-124.25	-41.85	-40.61	-36.35	0.20611E+05	0.0	214.4	-4.23	14.0	58795.	0.10E+06	1.000	196820.
575.2	28942.	-122.06	-42.19	-40.83	-36.63	0.20123E+05	0.0	214.4	-4.12	14.4	58795.	0.10E+06	1.000	196820.
576.4	28791.	-119.84	-42.51	-41.05	-36.90	0.19654E+05	0.0	214.4	-4.00	14.7	58795.	0.10E+06	1.000	196820.
577.7	28643.	-117.63	-42.84	-41.26	-37.17	0.19203E+05	0.0	214.4	-3.89	15.0	58795.	0.10E+06	1.000	196820.

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TABLE 2.B. (continued) THERMTRAJ PRINTED OUTPUT

TIME	ALT(M)	V(M/MIN)	TA(C)	TS(C)	TG(C)	VOLUME(M3)	FLXSO	TBB(K)	FL(KG)	P(MB)	GAS(GM)	REY NO	CD	PAY(GM)
578.9	28498.	-115.43	-43.15	-41.47	-37.43	0.18771E+05	0.0	214.4	-3.77	15.3	58795.	0.10E+06	1.000	196820.
580.2	28355.	-114.75	-43.46	-41.68	-37.69	0.18355E+05	0.0	214.4	-3.66	15.7	58795.	0.10E+06	1.000	196820.
581.4	28214.	-112.06	-43.77	-41.88	-37.94	0.17954E+05	0.0	214.4	-3.53	15.0	58795.	0.10E+06	1.000	196820.
582.7	28075.	-110.59	-44.07	-42.08	-38.18	0.17567E+05	0.0	214.4	-3.41	16.3	58795.	0.10E+06	1.000	196820.
583.9	27940.	-108.30	-44.37	-42.27	-38.42	0.17155E+05	0.0	214.4	-3.30	16.7	58795.	0.10E+06	1.000	196820.
585.2	27806.	-106.18	-44.66	-42.46	-38.66	0.16838E+05	0.0	214.4	-3.19	17.0	58795.	0.10E+06	1.000	196820.
586.4	27676.	-104.37	-44.94	-42.65	-38.91	0.16493E+05	0.0	214.4	-3.11	17.3	58795.	0.10E+06	0.940	196820.
587.7	27547.	-102.58	-45.22	-42.83	-39.15	0.16160E+05	0.0	214.4	-3.03	17.7	58795.	0.10E+06	0.940	196820.
588.9	27421.	-100.87	-45.49	-43.02	-39.38	0.15840E+05	0.0	214.4	-2.93	18.0	58795.	0.99E+05	0.940	196820.
590.2	27296.	-99.58	-45.77	-43.21	-39.61	0.15530E+05	0.0	214.4	-2.83	18.4	58795.	0.10E+06	0.940	196820.
591.4	27173.	-97.56	-46.03	-43.39	-39.83	0.15229E+05	0.0	214.4	-2.73	18.7	58795.	0.99E+05	0.940	196820.
592.7	27052.	-95.66	-46.30	-43.56	-40.05	0.14940E+05	0.0	214.4	-2.64	19.1	58795.	0.98E+05	0.940	196820.
593.9	26934.	-93.92	-46.55	-43.74	-40.28	0.14661E+05	0.0	214.4	-2.56	19.4	58795.	0.98E+05	0.940	196820.
595.2	26818.	-92.27	-46.81	-43.92	-40.50	0.14392E+05	0.0	214.4	-2.49	19.7	58795.	0.97E+05	0.940	196820.
596.4	26704.	-90.69	-47.05	-44.10	-40.71	0.14131E+05	0.0	214.4	-2.42	20.1	58795.	0.97E+05	0.940	196820.
597.7	26592.	-89.16	-47.30	-44.27	-40.93	0.13880E+05	0.0	214.4	-2.36	20.4	58795.	0.97E+05	0.940	196820.
598.9	26481.	-87.70	-47.54	-44.44	-41.14	0.13637E+05	0.0	214.4	-2.30	20.8	58795.	0.96E+05	0.940	196820.
600.2	26373.	-86.27	-47.77	-44.62	-41.36	0.13401E+05	0.0	214.4	-2.24	21.1	58795.	0.96E+05	0.940	196820.
601.4	26266.	-84.89	-48.01	-44.79	-41.56	0.13173E+05	0.0	214.4	-2.18	21.5	58795.	0.95E+05	0.940	196820.
602.7	26161.	-83.65	-48.23	-44.96	-41.77	0.12952E+05	0.0	214.4	-2.12	21.8	58795.	0.95E+05	0.940	196820.
603.9	26058.	-82.24	-48.46	-45.12	-41.97	0.12738E+05	0.0	214.4	-2.07	22.2	58795.	0.95E+05	0.940	196820.
605.2	25956.	-80.98	-48.68	-45.29	-42.17	0.12531E+05	0.0	214.4	-2.02	22.5	58795.	0.94E+05	0.940	196820.
606.4	25856.	-79.74	-48.90	-45.45	-42.37	0.12330E+05	0.0	214.4	-1.97	22.9	58795.	0.94E+05	0.940	196820.
607.7	25757.	-78.54	-49.11	-45.61	-42.57	0.12135E+05	0.0	214.4	-1.92	23.2	58795.	0.94E+05	0.940	196820.
608.9	25659.	-77.46	-49.32	-45.77	-42.75	0.11945E+05	0.0	214.4	-1.86	23.6	58795.	0.93E+05	0.940	196820.
610.2	25563.	-77.49	-49.48	-45.92	-42.94	0.11804E+05	0.0	214.4	-1.91	23.8	58795.	0.96E+05	0.940	196820.
611.4	25468.	-76.16	-49.69	-46.08	-43.13	0.11623E+05	0.0	214.4	-1.86	24.2	58795.	0.94E+05	0.940	196820.
612.7	25374.	-74.91	-49.89	-46.23	-43.31	0.11447E+05	0.0	214.4	-1.81	24.5	58795.	0.93E+05	0.940	196820.
613.9	25282.	-73.75	-50.09	-46.38	-43.49	0.11277E+05	0.0	214.4	-1.76	24.9	58795.	0.93E+05	0.940	196820.
615.2	25192.	-72.65	-50.29	-46.53	-43.68	0.11112E+05	0.0	214.4	-1.72	25.2	58795.	0.92E+05	0.940	196820.
616.4	25102.	-71.59	-50.49	-46.68	-43.86	0.10951E+05	0.0	214.4	-1.68	25.6	58795.	0.92E+05	0.940	196820.
617.7	25014.	-70.56	-50.68	-46.83	-44.03	0.10795E+05	0.0	216.4	-1.64	25.9	58795.	0.91E+05	0.940	196820.
618.9	24928.	-69.56	-50.87	-46.98	-44.21	0.10643E+05	0.0	214.4	-1.61	26.3	58795.	0.91E+05	0.940	196820.
620.2	24842.	-68.59	-51.05	-47.12	-44.38	0.10495E+05	0.0	214.4	-1.57	26.6	58795.	0.91E+05	0.940	196820.
621.4	24758.	-67.64	-51.24	-47.26	-44.55	0.10350E+05	0.0	214.4	-1.54	27.0	58795.	0.90E+05	0.940	196820.
622.7	24675.	-66.72	-51.42	-47.41	-44.72	0.10210E+05	0.0	214.4	-1.50	27.3	58795.	0.90E+05	0.940	196820.
623.9	24593.	-65.82	-51.60	-47.55	-44.89	0.10074E+05	0.0	214.4	-1.47	27.7	58795.	0.90E+05	0.940	196820.
625.2	24512.	-64.94	-51.77	-47.69	-45.06	0.99405E+04	0.0	214.4	-1.44	28.0	58795.	0.89E+05	0.940	196820.
626.4	24432.	-64.08	-51.95	-47.82	-45.22	0.98109E+04	0.0	214.4	-1.41	28.4	58795.	0.89E+05	0.940	196820.
627.7	24353.	-63.24	-52.12	-47.96	-45.38	0.96844E+04	0.0	214.4	-1.38	28.7	58795.	0.88E+05	0.940	196820.
628.9	24275.	-62.42	-52.29	-48.10	-45.54	0.95611E+04	0.0	214.4	-1.35	29.1	58795.	0.88E+05	0.940	196820.
630.2	24198.	-61.62	-52.46	-48.23	-45.70	0.94408E+04	0.0	214.4	-1.32	29.4	58795.	0.88E+05	0.940	196820.
631.4	24122.	-60.83	-52.62	-48.36	-45.85	0.93234E+04	0.0	214.4	-1.29	29.8	58795.	0.87E+05	0.940	196820.
632.7	24047.	-60.06	-52.79	-48.49	-46.01	0.92088E+04	0.0	214.4	-1.27	30.1	58795.	0.87E+05	0.940	196820.
633.9	23973.	-59.31	-52.95	-48.62	-46.16	0.90970E+04	0.0	214.4	-1.24	30.5	58795.	0.87E+05	0.940	196820.
635.2	23900.	-58.57	-53.11	-48.75	-46.31	0.89878E+04	0.0	214.4	-1.22	30.8	58795.	0.86E+05	0.940	196820.
636.4	23828.	-57.84	-53.26	-48.88	-46.46	0.88812E+04	0.0	214.4	-1.19	31.2	58795.	0.86E+05	0.940	196820.
637.7	23757.	-57.13	-53.42	-49.01	-46.61	0.87771E+04	0.0	214.4	-1.17	31.5	58795.	0.86E+05	0.940	196820.
638.9	23687.	-56.44	-53.57	-49.12	-46.76	0.86754E+04	0.0	214.4	-1.15	31.9	58795.	0.85E+05	0.940	196820.
640.2	23617.	-55.76	-53.72	-49.25	-46.90	0.85760E+04	0.0	214.4	-1.12	32.2	58795.	0.85E+05	0.940	196820.

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TABLE 2.B. (continued) THERMTRAJ PRINTED OUTPUT

TIME	ALT(M)	V(M/MIN)	TA(C)	TS(C)	TG(C)	VOLUME(M3)	FLXSO	TEB(K)	FL(KG)	P(MB)	GAS(GM)	REY NO	CC	PAY(GM)
641.4	23548.	-55.09	-53.87	-49.38	-47.04	0.84788E+04	0.0	214.4	-1.10	32.6	58795.	0.85E+05	0.940	196820.
642.7	23480.	-54.44	-54.02	-49.50	-47.19	0.83838E+04	0.0	214.4	-1.08	32.9	58795.	0.84E+05	0.940	196820.
643.9	23413.	-53.80	-54.17	-49.62	-47.33	0.82908E+04	0.0	214.4	-1.06	33.3	58795.	0.84E+05	0.940	196820.
645.2	23347.	-53.17	-54.31	-49.74	-47.46	0.81999E+04	0.0	214.4	-1.04	33.6	58795.	0.84E+05	0.940	196820.
646.4	23282.	-52.55	-54.45	-49.85	-47.60	0.81110E+04	0.0	214.4	-1.02	34.0	58795.	0.83E+05	0.940	196820.
647.7	23217.	-51.95	-54.60	-49.97	-47.74	0.80239E+04	0.0	214.4	-1.00	34.3	58795.	0.83E+05	0.940	196820.
648.9	23153.	-51.35	-54.73	-50.09	-47.87	0.79389E+04	0.0	214.4	-0.98	34.7	58795.	0.83E+05	0.940	196820.
650.2	23089.	-50.77	-54.87	-50.20	-48.00	0.78556E+04	0.0	214.4	-0.96	35.0	58795.	0.82E+05	0.940	196820.
651.4	23027.	-50.20	-55.01	-50.31	-48.14	0.77739E+04	0.0	214.4	-0.95	35.4	58795.	0.82E+05	0.940	196820.
652.7	22965.	-49.64	-55.14	-50.42	-48.27	0.76941E+04	0.0	214.4	-0.93	35.7	58795.	0.82E+05	0.940	196820.
653.9	22904.	-49.08	-55.28	-50.54	-48.40	0.76158E+04	0.0	214.4	-0.91	36.0	58795.	0.81E+05	0.940	196820.
655.2	22843.	-48.54	-55.41	-50.65	-48.52	0.75392E+04	0.0	214.4	-0.90	36.4	58795.	0.81E+05	0.940	196820.
656.4	22783.	-48.01	-55.54	-50.76	-48.65	0.74641E+04	0.0	214.4	-0.88	36.7	58795.	0.81E+05	0.940	196820.
657.7	22724.	-47.51	-55.67	-50.86	-48.77	0.73904E+04	0.0	214.4	-0.87	37.1	58795.	0.80E+05	0.940	196820.
658.9	22665.	-47.02	-55.80	-50.97	-48.90	0.73183E+04	0.0	214.4	-0.85	37.4	58795.	0.80E+05	0.940	196820.
660.2	22607.	-46.56	-55.92	-51.08	-49.02	0.72475E+04	0.0	214.4	-0.84	37.8	58795.	0.80E+05	0.940	196820.
661.4	22550.	-46.11	-56.05	-51.19	-49.14	0.71780E+04	0.0	214.4	-0.83	38.1	58795.	0.80E+05	0.940	196820.
662.7	22493.	-45.70	-56.17	-51.30	-49.27	0.71098E+04	0.0	214.4	-0.81	38.5	58795.	0.79E+05	0.940	196820.
663.9	22437.	-45.31	-56.29	-51.41	-49.39	0.70428E+04	0.0	214.4	-0.80	38.8	58795.	0.79E+05	0.940	196820.
665.2	22381.	-44.93	-56.41	-51.52	-49.51	0.69770E+04	0.0	214.4	-0.79	39.1	58795.	0.79E+05	0.940	196820.
666.4	22325.	-44.56	-56.54	-51.62	-49.63	0.69123E+04	0.0	214.4	-0.78	39.5	58795.	0.79E+05	0.940	196820.
667.7	22270.	-44.20	-56.66	-51.73	-49.75	0.68487E+04	0.0	214.4	-0.77	39.8	58795.	0.79E+05	0.940	196820.
668.9	22215.	-43.84	-56.77	-51.84	-49.86	0.67861E+04	0.0	214.4	-0.76	40.2	58795.	0.79E+05	0.940	196820.
670.2	22161.	-43.50	-56.89	-51.94	-49.98	0.67245E+04	0.0	214.4	-0.75	40.5	58795.	0.78E+05	0.940	196820.
671.4	22108.	-43.17	-57.01	-52.05	-50.10	0.66639E+04	0.0	214.4	-0.74	40.9	58795.	0.78E+05	0.940	196820.
672.7	22054.	-42.84	-57.12	-52.15	-50.21	0.66043E+04	0.0	214.4	-0.74	41.2	58795.	0.78E+05	0.940	196820.
673.7	22020.	8.80	-57.26	-52.24	-50.42	0.65347E+04	0.0	214.4	3.41	41.6	58795.	0.16E+05	0.470	192534.
674.7	22127.	167.02	-57.08	-52.73	-52.30	0.65634E+04	0.0	214.4	6.15	41.1	58795.	0.30E+06	0.500	185730.
675.8	22332.	201.76	-56.65	-53.68	-55.00	0.66908E+04	0.0	214.4	7.91	39.8	58795.	0.36E+06	0.500	177792.
676.9	22558.	190.99	-56.16	-54.81	-57.30	0.68608E+04	0.0	214.4	6.08	38.4	58795.	0.33E+06	0.500	174140.
678.0	22737.	138.46	-55.80	-55.87	-58.57	0.69989E+04	0.0	214.4	2.91	37.4	58795.	0.23E+06	0.500	174140.
679.2	22878.	91.02	-55.46	-56.78	-59.20	0.71524E+04	0.0	214.4	1.02	36.5	58795.	0.15E+06	0.500	174140.
680.5	22969.	58.10	-55.29	-57.40	-59.39	0.72373E+04	0.0	214.4	0.32	36.1	58795.	0.95E+05	0.470	174140.
682.3	23048.	30.39	-55.13	-57.94	-59.36	0.73210E+04	0.0	214.4	0.07	35.7	58795.	0.49E+05	0.470	174140.
683.6	23079.	20.42	-55.03	-58.11	-59.27	0.73780E+04	0.0	214.4	0.05	35.4	58795.	0.33E+05	0.470	174140.
684.8	23102.	17.88	-54.96	-58.18	-59.18	0.74164E+04	0.0	214.4	0.10	35.2	58795.	0.29E+05	0.470	174140.
686.1	23124.	18.53	-54.91	-58.20	-59.13	0.74449E+04	0.0	214.4	0.11	35.1	58795.	0.30E+05	0.470	174140.
687.3	23146.	17.70	-54.87	-58.20	-59.10	0.74721E+04	0.0	214.4	0.07	35.0	58795.	0.28E+05	0.470	174140.
688.6	23167.	15.81	-54.82	-58.19	-59.06	0.74996E+04	0.0	214.4	0.06	34.9	58795.	0.25E+05	0.470	174140.
691.1	23213.	13.11	-54.77	-58.15	-59.06	0.75235E+04	0.0	214.4	-0.03	34.8	58795.	0.21E+05	0.470	174140.
692.3	23224.	7.23	-54.67	-58.12	-58.91	0.75834E+04	0.0	214.4	0.08	34.5	58795.	0.11E+05	0.470	174140.
693.6	23237.	15.05	-54.65	-58.07	-58.83	0.75991E+04	0.0	214.4	0.19	34.4	58795.	0.24E+05	0.470	174140.
694.8	23259.	19.55	-54.62	-58.03	-58.85	0.76144E+04	0.0	214.4	0.09	34.4	58795.	0.31E+05	0.470	174140.
696.1	23281.	15.73	-54.57	-58.00	-58.85	0.76409E+04	0.0	214.4	0.01	34.3	58795.	0.25E+05	0.470	174140.
697.3	23298.	12.33	-54.53	-57.97	-58.78	0.76693E+04	0.0	214.4	0.05	34.1	58795.	0.19E+05	0.470	174140.
698.6	23314.	13.79	-54.49	-57.93	-58.72	0.76916E+04	0.0	214.4	0.10	34.0	58795.	0.22E+05	0.470	174140.
701.1	23356.	13.88	-54.46	-57.88	-58.71	0.77109E+04	0.0	214.4	0.05	34.0	58795.	0.22E+05	0.470	174140.
702.3	23370.	10.26	-54.36	-57.84	-58.62	0.77645E+04	0.0	214.4	0.06	33.7	58795.	0.16E+05	0.470	174140.
703.6	23384.	13.84	-54.33	-57.80	-58.55	0.77842E+04	0.0	214.4	0.13	33.7	58795.	0.21E+05	0.470	174140.
706.1	23425.	14.74	-54.30	-57.74	-58.54	0.78024E+04	0.0	214.4	0.09	33.6	58795.	0.23E+05	0.470	174140.

TABLE 2.B. (continued) THERMTRAJ PRINTED OUTPUT

TIME	ALT(M)	V(M/MIN)	TA(C)	TS(C)	TG(C)	VOLUME(M3)	FLXSO	TBB(K)	FL(KG)	P(MB)	CAS(GM)	REY NC	CC	PAY(GM)
707.3	23440.	11.45	-54.21	-57.71	-58.48	0.78545E+04	0.0	214.4	0.04	33.4	58795.	0.18E+05	0.470	174140.
708.6	23455.	13.05	-54.18	-57.66	-58.42	0.78756E+04	0.0	214.4	0.10	33.3	58795.	0.20E+05	0.470	174140.
711.1	23495.	13.37	-54.15	-57.61	-58.41	0.78942E+04	0.0	214.4	0.05	33.2	58795.	0.20E+05	0.470	174140.
712.3	23509.	9.93	-54.06	-57.57	-58.32	0.79470E+04	0.0	214.4	0.05	33.0	58795.	0.15E+05	0.470	174140.
713.6	23523.	13.22	-54.03	-57.53	-58.26	0.79659E+04	0.0	214.4	0.12	32.9	58795.	0.20E+05	0.470	174140.
716.1	23562.	14.05	-54.00	-57.48	-58.25	0.79837E+04	0.0	214.4	0.08	32.9	58795.	0.21E+05	0.470	174140.
717.3	23577.	10.81	-53.92	-57.44	-58.19	0.80349E+04	0.0	214.4	0.04	32.7	58795.	0.16E+05	0.470	174140.
718.6	23591.	12.53	-53.89	-57.40	-58.13	0.80556E+04	0.0	214.4	0.10	32.6	58795.	0.19E+05	0.470	174140.
721.1	23629.	12.94	-53.86	-57.35	-58.12	0.80736E+04	0.0	214.4	0.05	32.5	58795.	0.20E+05	0.470	174140.
722.3	23642.	9.58	-53.77	-57.32	-58.04	0.81151E+04	0.0	214.4	0.05	32.3	58795.	0.14E+05	0.470	174140.
723.6	23656.	12.62	-53.74	-57.28	-57.98	0.81439E+04	0.0	214.4	0.11	32.3	58795.	0.19E+05	0.470	174140.
726.1	23693.	13.39	-53.71	-57.23	-57.97	0.81612E+04	0.0	214.4	0.07	32.2	58795.	0.20E+05	0.470	174140.
727.3	23707.	10.15	-53.63	-57.19	-57.91	0.82115E+04	0.0	214.4	0.04	32.0	58795.	0.15E+05	0.470	174140.
728.6	23721.	12.01	-53.60	-57.16	-57.85	0.82315E+04	0.0	214.4	0.09	31.9	58795.	0.18E+05	0.470	174140.
731.1	23757.	12.52	-53.57	-57.11	-57.85	0.82489E+04	0.0	214.4	0.05	31.9	58795.	0.19E+05	0.470	174140.
732.3	23770.	9.23	-53.49	-57.07	-57.77	0.82992E+04	0.0	214.4	0.04	31.7	58795.	0.14E+05	0.470	174140.
733.6	23783.	11.99	-53.47	-57.03	-57.71	0.83179E+04	0.0	214.4	0.10	31.6	58795.	0.18E+05	0.470	174140.
736.1	23819.	12.71	-53.44	-56.99	-57.71	0.83346E+04	0.0	214.4	0.06	31.6	58795.	0.19E+05	0.470	174140.
737.3	23832.	9.60	-53.36	-56.96	-57.64	0.83839E+04	0.0	214.4	0.04	31.4	58795.	0.14E+05	0.470	174140.
738.6	23845.	11.53	-53.33	-56.92	-57.59	0.84032E+04	0.0	214.4	0.09	31.3	58795.	0.17E+05	0.470	174140.
741.1	23880.	12.09	-53.31	-56.87	-57.58	0.84201E+04	0.0	214.4	0.05	31.3	58795.	0.18E+05	0.470	174140.
742.3	23892.	8.87	-53.23	-56.84	-57.51	0.84692E+04	0.0	214.4	0.04	31.1	58795.	0.13E+05	0.470	174140.
743.6	23905.	11.40	-53.20	-56.80	-57.46	0.84875E+04	0.0	214.4	0.10	31.0	58795.	0.17E+05	0.470	174140.
746.1	23939.	12.07	-53.18	-56.76	-57.45	0.85038E+04	0.0	214.4	0.06	31.0	58795.	0.18E+05	0.470	174140.
747.3	23951.	9.09	-53.10	-56.73	-57.39	0.85519E+04	0.0	214.4	0.03	30.8	58795.	0.13E+05	0.470	174140.
748.6	23964.	11.04	-53.07	-56.69	-57.34	0.85705E+04	0.0	214.4	0.09	30.8	58795.	0.16E+05	0.470	174140.
751.1	23997.	11.62	-53.05	-56.65	-57.33	0.85868E+04	0.0	214.4	0.04	30.7	58795.	0.17E+05	0.470	174140.
752.3	24009.	8.45	-52.97	-56.62	-57.27	0.86346E+04	0.0	214.4	0.03	30.5	58795.	0.12E+05	0.470	174140.
753.6	24021.	10.84	-52.95	-56.58	-57.21	0.86525E+04	0.0	214.4	0.09	30.5	58795.	0.16E+05	0.470	174140.
756.1	24054.	11.48	-52.92	-56.54	-57.21	0.86682E+04	0.0	214.4	0.05	30.4	58795.	0.16E+05	0.470	174140.
757.3	24065.	8.60	-52.85	-56.51	-57.15	0.87152E+04	0.0	214.4	0.03	30.3	58795.	0.12E+05	0.470	174140.
758.6	24077.	10.56	-52.83	-56.48	-57.10	0.87331E+04	0.0	214.4	0.08	30.2	58795.	0.15E+05	0.470	174140.
761.1	24109.	11.16	-52.80	-56.43	-57.09	0.87489E+04	0.0	214.4	0.04	30.2	58795.	0.16E+05	0.470	174140.
762.3	24120.	8.08	-52.73	-56.41	-57.03	0.87953E+04	0.0	214.4	0.03	30.0	58795.	0.11E+05	0.470	174140.
763.6	24131.	10.28	-52.71	-56.37	-56.98	0.88127E+04	0.0	214.4	0.09	30.0	58795.	0.15E+05	0.470	174140.
766.1	24163.	10.89	-52.68	-56.33	-56.98	0.88279E+04	0.0	214.4	0.05	29.9	58795.	0.15E+05	0.470	174140.
767.3	24174.	8.11	-52.62	-56.31	-56.92	0.88736E+04	0.0	214.4	0.03	29.8	58795.	0.11E+05	0.470	174140.
768.6	24185.	10.09	-52.59	-56.27	-56.87	0.88908E+04	0.0	214.4	0.08	29.7	58795.	0.14E+05	0.470	174140.
771.1	24216.	10.69	-52.57	-56.23	-56.87	0.89060E+04	0.0	214.4	0.04	29.7	58795.	0.15E+05	0.470	174140.
772.3	24227.	7.69	-52.50	-56.21	-56.81	0.89512E+04	0.0	214.4	0.03	29.5	58795.	0.11E+05	0.470	174140.
773.6	24237.	9.77	-52.48	-56.17	-56.76	0.89680E+04	0.0	214.4	0.08	29.5	58795.	0.14E+05	0.470	174140.
776.1	24267.	10.36	-52.46	-56.13	-56.75	0.89827E+04	0.0	214.4	0.04	29.4	58795.	0.15E+05	0.470	174140.
777.3	24278.	7.65	-52.39	-56.11	-56.70	0.90270E+04	0.0	214.4	0.03	29.3	58795.	0.11E+05	0.470	174140.
778.6	24288.	9.59	-52.37	-56.08	-56.65	0.90437E+04	0.0	214.4	0.08	29.2	58795.	0.13E+05	0.470	174140.
781.1	24317.	10.18	-52.35	-56.04	-56.65	0.90582E+04	0.0	214.4	0.04	29.2	58795.	0.14E+05	0.470	174140.
782.3	24328.	7.30	-52.28	-56.02	-56.59	0.91020E+04	0.0	214.4	0.03	29.1	58795.	0.10E+05	0.470	174140.
783.6	24338.	9.29	-52.26	-55.99	-56.54	0.91183E+04	0.0	214.4	0.08	29.0	58795.	0.13E+05	0.470	174140.
786.1	24366.	9.83	-52.24	-55.95	-56.54	0.91324E+04	0.0	214.4	0.04	29.0	58795.	0.14E+05	0.470	174140.
787.3	24376.	7.20	-52.18	-55.92	-56.49	0.91753E+04	0.0	214.4	0.03	28.8	58795.	0.99E+04	0.470	174140.
788.6	24386.	9.13	-52.15	-55.89	-56.44	0.91914E+04	0.0	214.4	0.07	28.8	58795.	0.13E+05	0.470	174140.

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TABLE 2.B. (continued) THERMTRAJ PRINTED OUTPUT

TIME	ALT(M)	V(M/MIN)	TA(C)	TS(C)	TG(C)	VOLUME(M3)	FLXSO	TBB(K)	FL(KG)	P(MB)	GAS(GM)	REY NO	CC	PAY(GM)
891.1	25144.	4.68	-50.53	-54.51	-54.89	0.10392E+05	0.0	214.4	-0.01	25.7	58795.	0.59E+04	0.470	174140.
893.6	25159.	6.01	-50.49	-54.48	-54.89	0.10418E+05	0.0	214.4	-0.08	25.6	58795.	0.76E+04	0.470	174140.
894.8	25162.	0.55	-50.46	-54.47	-54.82	0.10446E+05	0.0	214.4	-0.00	25.5	58795.	0.69E+03	0.539	174140.
896.1	25164.	4.28	-50.45	-54.45	-54.76	0.10454E+05	0.0	214.4	0.10	25.5	58795.	0.54E+04	0.470	174140.
898.6	25181.	3.32	-50.45	-54.44	-54.77	0.10457E+05	0.0	214.4	0.08	25.5	58795.	0.42E+04	0.470	174140.
901.1	25196.	3.53	-50.41	-54.41	-54.78	0.10483E+05	0.0	214.4	-0.01	25.4	58795.	0.49E+04	0.470	174140.
903.6	25211.	5.35	-50.38	-54.38	-54.78	0.10509E+05	0.0	214.4	-0.08	25.4	58795.	0.67E+04	0.470	174140.
904.8	25213.	0.19	-50.35	-54.38	-54.71	0.10535E+05	0.0	214.4	0.00	25.3	58795.	0.24E+03	0.800	174140.
906.1	25216.	4.22	-50.34	-54.36	-54.65	0.10542E+05	0.0	214.4	0.10	25.3	58795.	0.53E+04	0.470	174140.
908.6	25231.	3.26	-50.34	-54.34	-54.66	0.10545E+05	0.0	214.4	0.08	25.3	58795.	0.41E+04	0.470	174140.
911.1	25246.	3.74	-50.30	-54.32	-54.67	0.10570E+05	0.0	214.4	-0.00	25.2	58795.	0.47E+04	0.470	174140.
913.6	25260.	5.26	-50.27	-54.30	-54.67	0.10594E+05	0.0	214.4	-0.07	25.2	58795.	0.66E+04	0.470	174140.
914.8	25262.	0.42	-50.24	-54.29	-54.61	0.10620E+05	0.0	214.4	-0.00	25.1	58795.	0.52E+03	0.600	174140.
916.1	25264.	3.85	-50.24	-54.27	-54.55	0.10626E+05	0.0	214.4	0.09	25.1	58795.	0.48E+04	0.470	174140.
918.6	25279.	2.87	-50.23	-54.26	-54.56	0.10630E+05	0.0	214.4	0.07	25.1	58795.	0.36E+04	0.470	174140.
921.1	25293.	3.57	-50.20	-54.24	-54.57	0.10653E+05	0.0	214.4	-0.01	25.1	58795.	0.44E+04	0.470	174140.
923.6	25306.	5.12	-50.17	-54.21	-54.57	0.10676E+05	0.0	214.4	-0.08	25.0	58795.	0.64E+04	0.470	174140.
924.8	25308.	0.06	-50.14	-54.20	-54.51	0.10700E+05	0.0	214.4	-0.00	25.0	58795.	0.77E+02	1.285	174140.
926.1	25310.	3.48	-50.14	-54.19	-54.46	0.10706E+05	0.0	214.4	0.09	24.9	58795.	0.43E+04	0.470	174140.
928.6	25324.	2.43	-50.13	-54.18	-54.46	0.10709E+05	0.0	214.4	0.07	24.9	58795.	0.30E+04	0.470	174140.
931.1	25338.	3.06	-50.10	-54.16	-54.48	0.10732E+05	0.0	214.4	-0.01	24.9	58795.	0.38E+04	0.470	174140.
933.6	25350.	4.70	-50.07	-54.13	-54.48	0.10754E+05	0.0	214.4	-0.08	24.8	58795.	0.58E+04	0.470	174140.
934.8	25352.	-0.11	-50.05	-54.13	-54.42	0.10777E+05	0.0	214.4	-0.00	24.8	58795.	0.14E+03	1.968	174140.
936.1	25353.	3.35	-50.04	-54.11	-54.36	0.10782E+05	0.0	214.4	0.09	24.8	58795.	0.41E+04	0.470	174140.
938.6	25367.	2.30	-50.04	-54.10	-54.37	0.10785E+05	0.0	214.4	0.07	24.8	58795.	0.28E+04	0.470	174140.
941.1	25379.	2.86	-50.01	-54.08	-54.38	0.10806E+05	0.0	214.4	-0.01	24.7	58795.	0.35E+04	0.470	174140.
943.6	25391.	4.56	-49.98	-54.06	-54.39	0.10827E+05	0.0	214.4	-0.07	24.7	58795.	0.56E+04	0.470	174140.
946.1	25401.	5.84	-49.96	-54.03	-54.38	0.10846E+05	0.0	214.4	-0.10	24.6	58795.	0.72E+04	0.470	174140.
947.3	25403.	-0.56	-49.94	-54.03	-54.32	0.10866E+05	0.0	214.4	-0.03	24.6	58795.	0.69E+03	1.079	174140.
948.6	25403.	2.04	-49.93	-54.02	-54.26	0.10873E+05	0.0	214.4	0.09	24.6	58795.	0.25E+04	0.470	174140.
951.1	25417.	0.78	-49.93	-54.01	-54.27	0.10873E+05	0.0	214.4	0.06	24.6	58795.	0.96E+03	0.478	174140.
953.6	25429.	1.63	-49.90	-54.00	-54.29	0.10894E+05	0.0	214.4	-0.03	24.5	58795.	0.20E+04	0.470	174140.
956.1	25440.	3.35	-49.88	-53.97	-54.30	0.10914E+05	0.0	214.4	-0.10	24.5	58795.	0.41E+04	0.470	174140.
957.3	25440.	-1.44	-49.85	-53.97	-54.22	0.10936E+05	0.0	214.4	0.01	24.5	58795.	0.18E+04	0.940	174140.
958.6	25441.	3.36	-49.85	-53.95	-54.17	0.10938E+05	0.0	214.4	0.10	24.4	58795.	0.41E+04	0.470	174140.
961.1	25453.	2.37	-49.85	-53.94	-54.18	0.10940E+05	0.0	214.4	0.09	24.4	58795.	0.29E+04	0.470	174140.
963.6	25464.	2.07	-49.82	-53.93	-54.19	0.10959E+05	0.0	214.4	0.02	24.4	58795.	0.25E+04	0.470	174140.
966.1	25474.	3.54	-49.80	-53.91	-54.20	0.10977E+05	0.0	214.4	-0.05	24.4	58795.	0.43E+04	0.470	174140.
968.6	25483.	5.26	-49.78	-53.89	-54.19	0.10995E+05	0.0	214.4	-0.08	24.3	58795.	0.64E+04	0.470	174140.
971.1	25491.	6.82	-49.76	-53.87	-54.17	0.11011E+05	0.0	214.4	-0.08	24.3	58795.	0.83E+04	0.470	174140.
973.6	25499.	8.36	-49.74	-53.85	-54.14	0.11026E+05	0.0	214.4	-0.06	24.3	58795.	0.10E+05	0.470	174140.
976.1	25506.	9.67	-49.72	-53.83	-54.11	0.11040E+05	0.0	214.4	-0.03	24.2	58795.	0.12E+05	0.470	174140.
978.6	25513.	10.59	-49.71	-53.82	-54.08	0.11054E+05	0.0	214.4	0.01	24.2	58795.	0.13E+05	0.470	174140.
981.1	25520.	10.76	-49.69	-53.81	-54.04	0.11068E+05	0.0	214.4	0.06	24.2	58795.	0.13E+05	0.470	174140.
983.6	25526.	10.05	-49.68	-53.80	-53.99	0.11082E+05	0.0	214.4	0.12	24.2	58795.	0.12E+05	0.470	174140.
984.8	25539.	7.86	-49.66	-53.80	-54.09	0.11088E+05	0.0	214.4	-0.09	24.1	58795.	0.95E+04	0.470	174140.
986.1	25542.	-1.33	-49.64	-53.80	-54.06	0.11110E+05	0.0	214.4	-0.08	24.1	58795.	0.16E+04	0.940	174140.
987.3	25539.	-1.29	-49.63	-53.79	-53.97	0.11121E+05	0.0	214.4	0.07	24.1	58795.	0.16E+04	0.940	174140.
988.6	25542.	5.79	-49.64	-53.77	-53.97	0.11116E+05	0.0	214.4	0.09	24.1	58795.	0.70E+04	0.470	174140.
991.1	25551.	4.99	-49.63	-53.76	-53.95	0.11122E+05	0.0	214.4	0.10	24.1	58795.	0.60E+04	0.470	174140.

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TABLE 2.B. (continued) THERMTRAJ PRINTED OUTPUT

TIME	ALT(M)	V(M/MIN)	TA(C)	TS(C)	TG(C)	VOLUME(M3)	FLXSC	TBB(K)	FL(KG)	P(MB)	GAS(GM)	REY NO	CC	PAY(GM)
791.1	24414.	9.70	-52.13	-55.86	-56.44	0.92053E+04	0.0	214.4	0.03	28.8	58795.	0.13E+05	0.470	174140.
793.6	24441.	9.31	-52.07	-55.81	-56.45	0.92450E+04	0.0	214.4	-0.10	28.6	58795.	0.13E+05	0.470	174140.
794.8	24447.	2.27	-52.01	-55.79	-56.33	0.92890E+04	0.0	214.4	0.02	28.5	58795.	0.31E+04	0.470	174140.
796.1	24453.	8.34	-52.00	-55.76	-56.25	0.93003E+04	0.0	214.4	0.15	28.5	58795.	0.11E+05	0.470	174140.
798.6	24479.	8.24	-51.99	-55.73	-56.24	0.93095E+04	0.0	214.4	0.14	28.5	58795.	0.11E+05	0.470	174140.
801.1	24506.	8.84	-51.93	-55.69	-56.24	0.93478E+04	0.0	214.4	0.03	28.3	58795.	0.12E+05	0.470	174140.
803.6	24531.	8.89	-51.07	-55.64	-56.25	0.93855E+04	0.0	214.4	-0.09	28.2	58795.	0.12E+05	0.470	174140.
804.8	24537.	2.29	-51.82	-55.63	-56.14	0.94275E+04	0.0	214.4	0.02	28.1	58795.	0.31E+04	0.470	174140.
806.1	24543.	7.88	-51.81	-55.59	-56.07	0.94387E+04	0.0	214.4	0.14	28.1	58795.	0.11E+05	0.470	174140.
808.6	24568.	7.60	-51.79	-55.56	-56.06	0.94475E+04	0.0	214.4	0.13	28.1	58795.	0.10E+05	0.470	174140.
811.1	24593.	8.20	-51.74	-55.53	-56.06	0.94844E+04	0.0	214.4	0.02	28.0	58795.	0.11E+05	0.470	174140.
813.6	24617.	8.32	-51.68	-55.48	-56.07	0.95210E+04	0.0	214.4	-0.09	27.8	58795.	0.11E+05	0.470	174140.
814.8	24622.	1.81	-51.63	-55.47	-55.96	0.95614E+04	0.0	214.4	0.02	27.7	58795.	0.24E+04	0.470	174140.
816.1	24628.	7.52	-51.62	-55.43	-55.89	0.95718E+04	0.0	214.4	0.14	27.7	58795.	0.10E+05	0.470	174140.
818.6	24652.	7.22	-51.61	-55.41	-55.88	0.95800E+04	0.0	214.4	0.13	27.7	58795.	0.97E+04	0.470	174140.
821.1	24676.	7.77	-51.56	-55.37	-55.88	0.96155E+04	0.0	214.4	0.03	27.6	58795.	0.10E+05	0.470	174140.
823.6	24699.	8.21	-51.51	-55.33	-55.89	0.96507E+04	0.0	214.4	-0.08	27.5	58795.	0.11E+05	0.470	174140.
824.8	24704.	1.98	-51.46	-55.32	-55.79	0.96893E+04	0.0	214.4	0.01	27.4	58795.	0.26E+04	0.470	174140.
826.1	24709.	6.93	-51.45	-55.28	-55.72	0.96598E+04	0.0	214.4	0.12	27.4	58795.	0.92E+04	0.470	174140.
828.6	24732.	6.41	-51.43	-55.26	-55.72	0.97075E+04	0.0	214.4	0.11	27.4	58795.	0.85E+04	0.470	174140.
831.1	24754.	7.01	-51.38	-55.23	-55.72	0.97419E+04	0.0	214.4	0.01	27.3	58795.	0.93E+04	0.470	174140.
833.6	24776.	7.44	-51.34	-55.19	-55.73	0.97759E+04	0.0	214.4	-0.09	27.2	58795.	0.98E+04	0.470	174140.
834.8	24780.	1.22	-51.29	-55.17	-55.62	0.98132E+04	0.0	214.4	0.01	27.1	58795.	0.16E+04	0.470	174140.
836.1	24785.	6.76	-51.28	-55.14	-55.56	0.98222E+04	0.0	214.4	0.13	27.1	58795.	0.89E+04	0.470	174140.
838.6	24806.	6.31	-51.27	-55.12	-55.55	0.98294E+04	0.0	214.4	0.12	27.0	58795.	0.83E+04	0.470	174140.
841.1	24828.	6.76	-51.22	-55.09	-55.56	0.98624E+04	0.0	214.4	0.02	26.9	58795.	0.89E+04	0.470	174140.
843.6	24849.	7.58	-51.18	-55.05	-55.56	0.98949E+04	0.0	214.4	-0.07	26.9	58795.	0.99E+04	0.470	174140.
844.8	24853.	1.79	-51.13	-55.04	-55.47	0.99301E+04	0.0	214.4	0.01	26.8	58795.	0.23E+04	0.470	174140.
846.1	24858.	6.05	-51.12	-55.01	-55.41	0.99402E+04	0.0	214.4	0.11	26.8	58795.	0.79E+04	0.470	174140.
848.6	24879.	5.37	-51.11	-54.99	-55.41	0.99470E+04	0.0	214.4	0.09	26.7	58795.	0.70E+04	0.470	174140.
851.1	24899.	6.02	-51.07	-54.96	-55.42	0.99788E+04	0.0	214.4	-0.00	26.6	58795.	0.78E+04	0.470	174140.
853.6	24918.	6.76	-51.02	-54.92	-55.42	0.10010E+05	0.0	214.4	-0.09	26.6	58795.	0.88E+04	0.470	174140.
854.8	24922.	0.75	-50.98	-54.91	-55.32	0.10044E+05	0.0	214.4	0.01	26.5	58795.	0.97E+03	0.477	174140.
856.1	24925.	5.55	-50.97	-54.88	-55.26	0.10052E+05	0.0	214.4	0.12	26.5	58795.	0.77E+04	0.470	174140.
858.6	24945.	5.36	-50.97	-54.87	-55.26	0.10058E+05	0.0	214.4	0.11	26.5	58795.	0.69E+04	0.470	174140.
861.1	24965.	5.73	-50.92	-54.84	-55.26	0.10089E+05	0.0	214.4	0.02	26.4	58795.	0.74E+04	0.470	174140.
863.6	24983.	6.79	-50.88	-54.80	-55.27	0.10119E+05	0.0	214.4	-0.07	26.3	58795.	0.87E+04	0.470	174140.
864.8	24987.	1.48	-50.84	-54.79	-55.19	0.10151E+05	0.0	214.4	0.00	26.2	58795.	0.19E+04	0.470	174140.
866.1	24991.	5.39	-50.83	-54.77	-55.13	0.10160E+05	0.0	214.4	0.10	26.2	58795.	0.69E+04	0.470	174140.
868.6	25010.	4.62	-50.82	-54.75	-55.13	0.10166E+05	0.0	214.4	0.08	26.2	58795.	0.59E+04	0.470	174140.
871.1	25028.	5.33	-50.78	-54.72	-55.14	0.10195E+05	0.0	214.4	-0.01	26.1	58795.	0.68E+04	0.470	174140.
873.6	25045.	6.35	-50.74	-54.69	-55.14	0.10224E+05	0.0	214.4	-0.09	26.0	58795.	0.81E+04	0.470	174140.
874.8	25048.	0.45	-50.71	-54.68	-55.06	0.10255E+05	0.0	214.4	0.00	26.0	58795.	0.58E+03	0.576	174140.
876.1	25051.	5.07	-50.70	-54.65	-55.00	0.10263E+05	0.0	214.4	0.11	26.0	58795.	0.65E+04	0.470	174140.
878.6	25070.	4.27	-50.69	-54.64	-55.00	0.10267E+05	0.0	214.4	0.10	25.9	58795.	0.54E+04	0.470	174140.
881.1	25087.	4.65	-50.65	-54.61	-55.00	0.10295E+05	0.0	214.4	0.01	25.9	58795.	0.59E+04	0.470	174140.
883.6	25103.	5.92	-50.62	-54.58	-55.01	0.10323E+05	0.0	214.4	-0.07	25.8	58795.	0.75E+04	0.470	174140.
884.8	25107.	0.90	-50.58	-54.57	-54.93	0.10352E+05	0.0	214.4	0.01	25.7	58795.	0.11E+04	0.470	174140.
886.1	25110.	4.88	-50.57	-54.55	-54.88	0.10360E+05	0.0	214.4	0.10	25.7	58795.	0.62E+04	0.470	174140.
888.6	25127.	4.01	-50.57	-54.53	-54.88	0.10365E+05	0.0	214.4	0.08	25.7	58795.	0.51E+04	0.470	174140.

TABLE 2.B. (continued) THERMTRAJ PRINTED OUTPUT

TIME	ALT(M)	V(M/MIN)	TA(C)	TS(C)	TG(C)	VOLUME(M3)	FLXSO	TBL(K)	FL(KG)	P(MB)	GAS(GM)	REY NO	CC	PAY(GM)
993.6	25559.	4.06	-49.61	-53.75	-53.94	0.11137E+05	0.0	214.4	0.08	24.0	58795.	0.49E+04	0.470	174140.
995.1	25568.	3.15	-49.59	-53.74	-53.94	0.11151E+05	0.0	214.4	0.05	24.0	58795.	0.38E+04	0.470	174140.
998.6	25576.	2.96	-49.57	-53.73	-53.94	0.11166E+05	0.0	214.4	0.02	24.0	58795.	0.36E+04	0.470	174140.
1001.1	25584.	3.88	-49.56	-53.71	-53.94	0.11180E+05	0.0	214.4	-0.02	23.9	58795.	0.47E+04	0.470	174140.
1003.6	25591.	5.25	-49.54	-53.69	-53.92	0.11194E+05	0.0	214.4	-0.03	23.9	58795.	0.63E+04	0.470	174140.
1006.1	25597.	6.44	-49.52	-53.68	-53.91	0.11207E+05	0.0	214.4	-0.02	23.9	58795.	0.77E+04	0.470	174140.
1008.6	25603.	7.10	-49.51	-53.67	-53.88	0.11219E+05	0.0	214.4	0.01	23.9	58795.	0.85E+04	0.470	174140.
1011.1	25609.	6.98	-49.50	-53.66	-53.85	0.11231E+05	0.0	214.4	0.04	23.8	58795.	0.84E+04	0.470	174140.
1013.6	25615.	6.02	-49.49	-53.6[illegible]	-53.83	0.11243E+05	0.0	214.4	0.07	23.8	58795.	0.72E+04	0.470	174140.
1016.1	25621.	4.97	-49.47	-53.64	-53.80	0.11254E+05	0.0	214.4	0.09	23.8	58795.	0.60E+04	0.470	174140.
1018.6	25628.	3.96	-49.46	-53.63	-53.79	0.11265E+05	0.0	214.4	0.09	23.8	58795.	0.47E+04	0.470	174140.
1021.1	25635.	2.90	-49.44	-53.62	-53.79	0.11277E+05	0.0	214.4	0.07	23.8	58795.	0.35E+04	0.470	174140.
1023.6	25643.	2.07	-49.43	-53.61	-53.79	0.11289E+05	0.0	214.4	0.04	23.7	58795.	0.25E+04	0.470	174140.
1028.6	25661.	-22.18	-49.41	-53.64	-53.78	0.11303E+05	0.0	214.4	0.03	23.7	58795.	0.26E+05	0.940	174140.
1029.8	25645.	-2.57	-49.37	-53.60	-53.56	0.11346E+05	0.0	214.4	0.37	23.6	58795.	0.31E+04	0.940	174140.
1031.1	25658.	18.04	-49.41	-53.57	-53.72	0.11310E+05	0.0	214.4	0.13	23.7	58795.	0.22E+05	0.470	174140.
1032.3	25675.	7.94	-49.38	-53.58	-53.88	0.11323E+05	0.0	214.4	-0.23	23.6	58795.	0.94E+04	0.470	174140.
1033.6	25673.	-8.29	-49.34	-53.58	-53.78	0.11358E+05	0.0	214.4	-0.11	23.6	58795.	0.98E+04	0.940	174140.
1034.8	25664.	-3.40	-49.35	-53.56	-53.64	0.11362E+05	0.0	214.4	0.16	23.6	58795.	0.40E+04	0.940	174140.
1036.1	25669.	9.12	-49.37	-53.54	-53.68	0.11345E+05	0.0	214.4	0.12	23.6	58795.	0.11E+05	0.470	174140.
1037.3	25680.	7.42	-49.36	-53.54	-53.79	0.11348E+05	0.0	214.4	-0.09	23.6	58795.	0.88E+04	0.470	174140.
1038.6	25683.	-2.02	-49.33	-53.55	-53.76	0.11369E+05	0.0	214.4	-0.09	23.6	58795.	0.24E+04	0.940	174140.
1039.8	25679.	-2.32	-49.33	-53.54	-53.67	0.11378E+05	0.0	214.4	0.07	23.6	58795.	0.28E+04	0.940	174140.
1041.1	25681.	4.87	-49.33	-53.52	-53.67	0.11372E+05	0.0	214.4	0.09	23.6	58795.	0.58E+04	0.470	174140.
1043.6	25687.	4.05	-49.33	-53.52	-53.65	0.11376E+05	0.0	214.4	0.11	23.6	58795.	0.48E+04	0.470	174140.
1046.1	25693.	3.18	-49.32	-53.52	-53.65	0.11387E+05	0.0	214.4	0.10	23.5	58795.	0.38E+04	0.470	174140.
1048.6	25709.	1.95	-49.30	-53.50	-53.66	0.11397E+05	0.39E+03	214.4	0.05	23.5	58795.	0.23E+04	0.470	174140.
1049.8	25716.	10.73	-49.27	-53.45	-53.54	0.11430E+05	0.15E+04	214.4	0.22	23.5	58795.	0.13E+05	0.470	174140.
1051.1	25737.	22.22	-49.25	-53.40	-53.54	0.11442E+05	0.21E+04	214.4	0.19	23.4	58795.	0.26E+05	0.470	174140.
1052.3	25766.	23.33	-49.21	-53.35	-53.55	0.11479E+05	0.26E+04	214.4	0.09	23.4	58795.	0.28E+05	0.470	174140.
1053.6	25793.	22.01	-49.15	-53.30	-53.46	0.11534E+05	0.32E+04	214.4	0.13	23.3	58795.	0.26E+05	0.470	174140.
1054.8	25823.	26.26	-49.09	-53.23	-53.35	0.11588E+05	0.37E+04	214.4	0.24	23.2	58795.	0.31E+05	0.470	174140.
1056.1	25859.	32.63	-49.02	-53.15	-53.26	0.11645E+05	0.43E+04	214.4	0.29	23.1	58795.	0.38E+05	0.470	174140.
1057.3	25902.	36.20	-48.94	-53.07	-53.18	0.11714E+05	0.48E+04	214.4	0.29	22.9	58795.	0.42E+05	0.470	174140.
1058.6	25948.	38.38	-48.85	-52.98	-53.07	0.11756E+05	0.54E+04	214.4	0.33	22.8	58795.	0.44E+05	0.470	174140.
1059.8	25996.	40.48	-48.70	-52.87	-52.90	0.11931E+05	0.62E+04	214.4	0.36	22.5	58795.	0.46E+05	0.470	174140.
1061.1	26050.	45.62	-48.59	-52.75	-52.75	0.12032E+05	0.67E+04	214.4	0.45	22.4	58795.	0.53E+05	0.470	174140.
1062.3	26111.	50.96	-48.47	-52.63	-52.61	0.12145E+05	0.73E+04	214.4	0.48	22.2	58795.	0.58E+05	0.470	174140.
1063.6	26176.	53.90	-48.33	-52.50	-52.45	0.12271E+05	0.79E+04	214.4	0.52	22.0	58795.	0.61E+05	0.470	174140.
1064.8	26245.	57.54	-48.18	-52.34	-52.27	0.12407E+05	0.84E+04	214.4	0.60	21.7	58795.	0.64E+05	0.470	174140.
1066.1	26319.	61.73	-48.03	-52.17	-52.08	0.12553E+05	0.90E+04	214.4	0.68	21.5	58795.	0.68E+05	0.470	174140.
1067.3	26398.	65.87	-47.86	-51.99	-51.88	0.12712E+05	0.95E+04	214.4	0.75	21.3	58795.	0.72E+05	0.470	174140.
1068.6	26483.	70.01	-47.69	-51.79	-51.66	0.12883E+05	0.10E+05	214.4	0.83	21.0	58795.	0.76E+05	0.470	174140.
1069.8	26572.	74.26	-47.50	-51.58	-51.43	0.13068E+05	0.11E+05	214.4	0.92	20.7	58795.	0.80E+05	0.470	174140.
1071.1	26667.	78.61	-47.30	-51.35	-51.18	0.13266E+05	0.11E+05	214.4	1.02	20.4	58795.	0.84E+05	0.470	174140.
1072.3	26766.	81.72	-47.03	-51.11	-50.90	0.13531E+05	0.12E+05	214.4	1.06	20.1	58795.	0.86E+05	0.470	174140.
1073.6	26872.	87.10	-46.81	-50.86	-50.61	0.13762E+05	0.12E+05	214.4	1.19	19.7	58795.	0.91E+05	0.470	174140.
1074.8	26984.	91.93	-46.57	-50.60	-50.32	0.14011E+05	0.13E+05	214.4	1.30	19.4	58795.	0.94E+05	0.470	174140.
1076.1	27101.	96.48	-46.32	-50.32	-50.01	0.14278E+05	0.14E+05	214.4	1.41	19.1	58795.	0.98E+05	0.470	174140.
1077.3	27224.	100.59	-46.06	-50.04	-49.68	0.14564E+05	0.14E+05	214.4	1.54	18.7	58795.	0.10E+06	0.500	174140.

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TABLE 2.B. (continued) THERMTRAJ PRINTED OUTPUT

TIME	ALT(M)	V(M/MIN)	TA(C)	TS(C)	TG(C)	VOLUME(M3)	FLXSC	TBB(K)	FL(KG)	P(MB)	GAS(GM)	REY NC	CC	PAY(GM)
1078.6	27352.	104.03	-45.78	-49.75	-49.32	0.14867E+05	0.15E+05	214.4	1.71	18.4	58795.	0.10E+06	0.500	174140.
1079.8	27485.	109.55	-45.50	-49.44	-48.95	0.15188E+05	0.15E+05	214.4	1.87	18.0	58795.	0.11E+06	0.500	174140.
1081.1	27625.	114.72	-45.20	-49.12	-48.58	0.15533E+05	0.16E+05	214.4	2.02	17.7	58795.	0.11E+06	0.500	174140.
1082.3	27771.	119.67	-44.88	-48.79	-48.18	0.15901E+05	0.16E+05	214.4	2.18	17.3	58795.	0.11E+06	0.500	174140.
1083.6	27923.	124.70	-44.56	-48.45	-47.78	0.16293E+05	0.17E+05	214.4	2.34	16.9	58795.	0.12E+06	0.500	174140.
1084.8	28082.	129.83	-44.22	-48.10	-47.35	0.16711E+05	0.17E+05	214.4	2.51	16.5	58795.	0.12E+06	0.500	174140.
1086.1	28247.	135.07	-43.86	-47.73	-46.90	0.17158E+05	0.18E+05	214.4	2.69	16.1	58795.	0.12E+06	0.500	174140.
1087.3	28419.	140.40	-43.50	-47.36	-46.44	0.17634E+05	0.18E+05	214.4	2.87	15.7	58795.	0.12E+06	0.500	174140.
1088.6	28598.	145.87	-43.11	-46.96	-45.96	0.18143E+05	0.19E+05	214.4	3.07	15.3	58795.	0.13E+06	0.500	174140.
1089.8	28783.	151.46	-42.71	-46.56	-45.45	0.18685E+05	0.20E+05	214.4	3.27	14.9	58795.	0.13E+06	0.500	174140.
1091.1	28976.	156.92	-42.30	-46.14	-44.55	0.19264E+05	0.20E+05	214.4	3.45	14.5	58795.	0.13E+06	0.500	174140.
1092.2	29149.	159.71	-41.87	-45.79	-44.53	0.19869E+05	0.20E+05	214.4	3.44	14.1	58795.	0.13E+06	0.500	174140.
1093.3	29324.	161.44	-41.50	-45.44	-44.12	0.20427E+05	0.20E+05	214.4	3.51	13.7	58795.	0.13E+06	0.500	174140.
1094.4	29502.	163.61	-41.11	-45.10	-43.71	0.21005E+05	0.20E+05	214.4	3.57	13.3	58795.	0.13E+06	0.500	174140.
1095.5	29682.	165.43	-40.72	-44.77	-43.30	0.21605E+05	0.20E+05	214.4	3.61	13.0	58795.	0.13E+06	0.500	174140.
1096.6	29864.	167.03	-40.33	-44.45	-42.85	0.22228E+05	0.20E+05	214.4	3.64	12.7	58795.	0.12E+06	0.500	174140.
1097.7	30047.	168.51	-39.93	-44.12	-42.48	0.22874E+05	0.20E+05	214.4	3.67	12.3	58795.	0.12E+06	0.500	174140.
1098.7	30232.	169.91	-39.53	-43.80	-42.08	0.23542E+05	0.20E+05	214.4	3.70	12.0	58795.	0.12E+06	0.500	174140.
1099.8	30419.	171.26	-39.13	-43.48	-41.66	0.24235E+05	0.20E+05	214.4	3.72	11.7	58795.	0.12E+06	0.500	174140.
1100.9	30606.	172.57	-38.72	-43.16	-41.25	0.24952E+05	0.20E+05	214.4	3.74	11.4	58795.	0.12E+06	0.500	174140.
1102.0	30796.	173.84	-38.31	-42.84	-40.84	0.25695E+05	0.20E+05	214.4	3.76	11.0	58795.	0.12E+06	0.500	174140.
1103.1	30987.	175.08	-37.90	-42.53	-40.42	0.26464E+05	0.20E+05	214.4	3.77	10.7	58795.	0.11E+06	0.500	174140.
1104.2	31179.	176.30	-37.49	-42.21	-40.00	0.27260E+05	0.20E+05	214.4	3.79	10.4	58795.	0.11E+06	0.500	174140.
1105.3	31372.	177.50	-37.07	-41.89	-39.58	0.28084E+05	0.20E+05	214.4	3.80	10.2	58795.	0.11E+06	0.500	174140.
1106.4	31567.	178.68	-36.65	-41.57	-39.16	0.28938E+05	0.20E+05	214.4	3.81	9.9	58795.	0.11E+06	0.500	174140.
1107.5	31763.	179.84	-36.22	-41.26	-38.73	0.29821E+05	0.20E+05	214.4	3.83	9.6	58795.	0.11E+06	0.500	174140.
1108.6	31960.	180.98	-35.80	-40.94	-38.30	0.30736E+05	0.20E+05	214.4	3.83	9.3	58795.	0.11E+06	0.500	174140.
1109.7	32158.	182.10	-35.37	-40.63	-37.87	0.31682E+05	0.20E+05	214.4	3.84	9.1	58795.	0.10E+06	0.500	174140.

PROGRAM COMPLETED ON NORMAL EXIT

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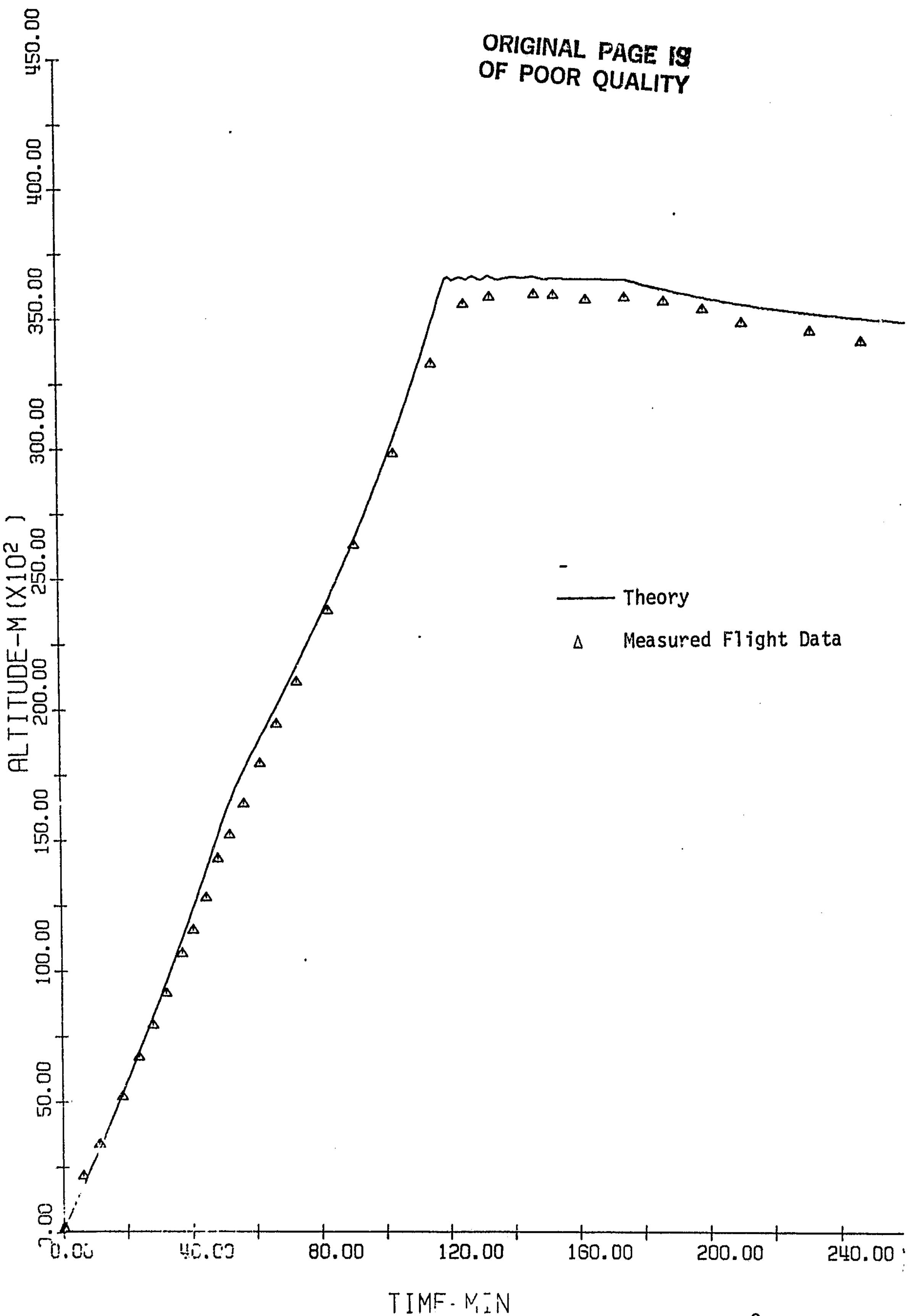

Figure 1.8. Altitude Trajectory for Flight 167N (66375 m^3 balloon launched 1135 CDT, 24 July, 1980)

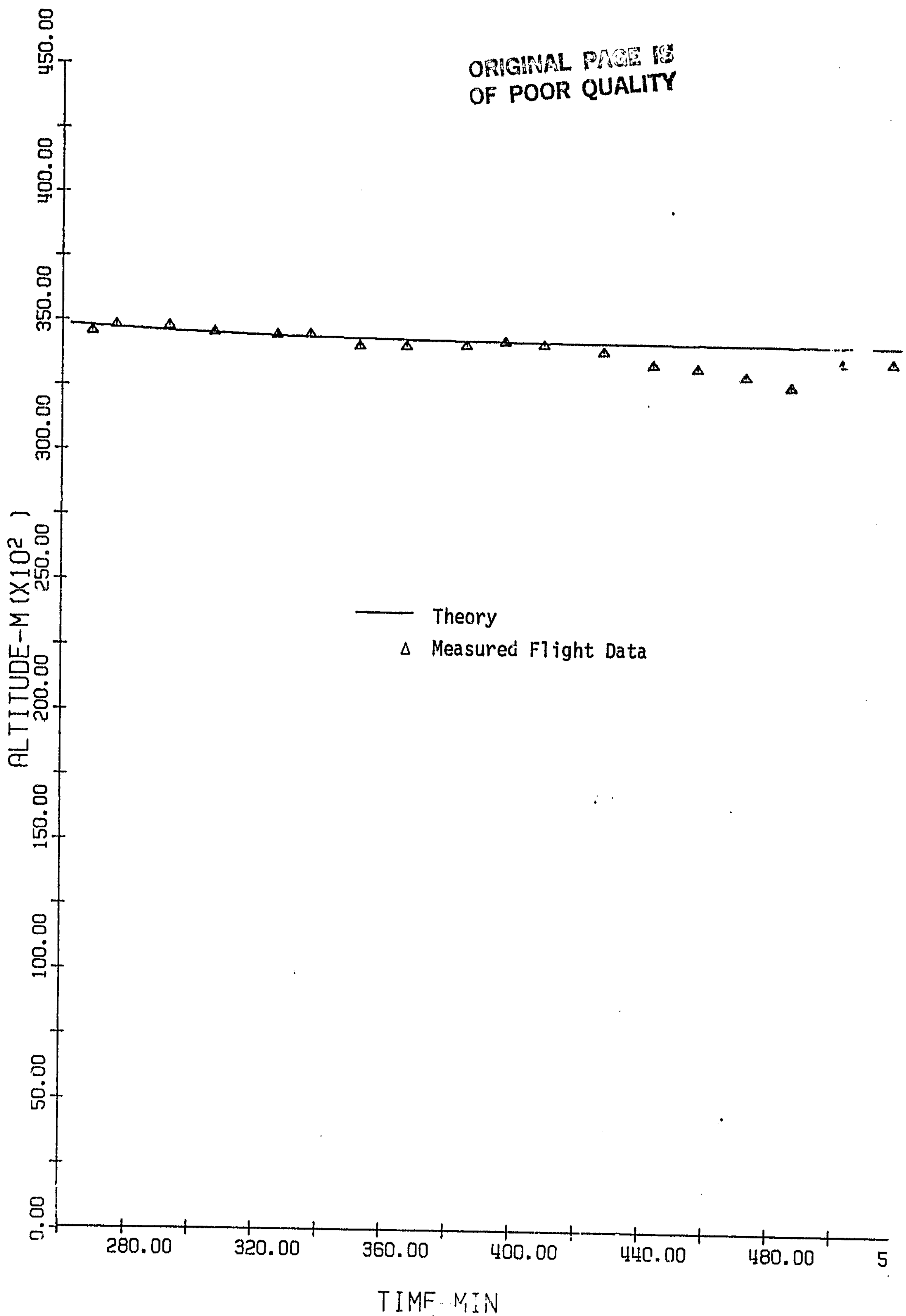

Figure 1.B. (continued) Altitude Trajectory for Flight 167N (66375 m^3 balloon launched 1135 CDT, 24 July, 1980)

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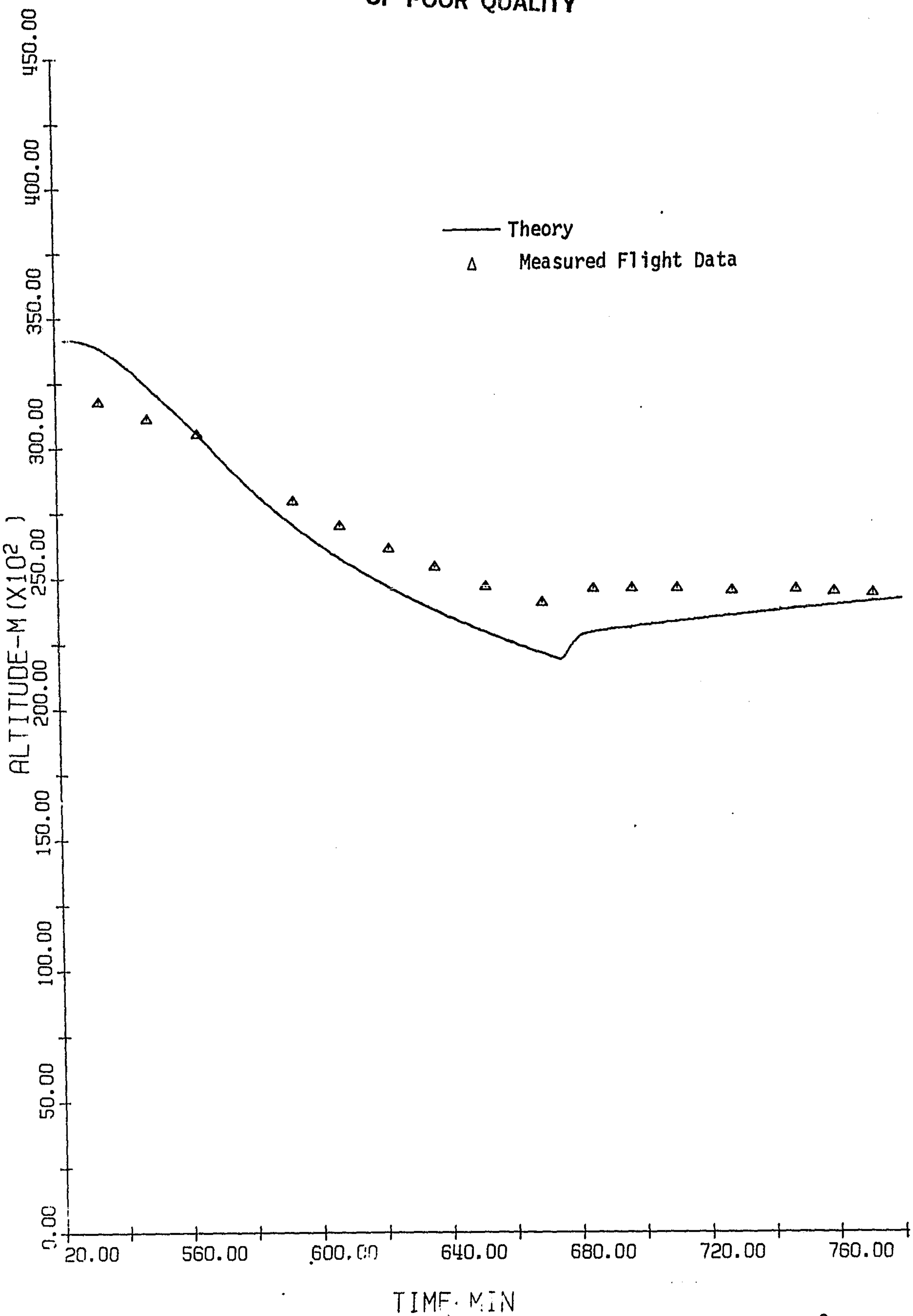

Figure 1.B. (continued) Altitude Trajectory for Flight 167N (66375 m^3 balloon launched 1135 CDT, 24 July 1980)

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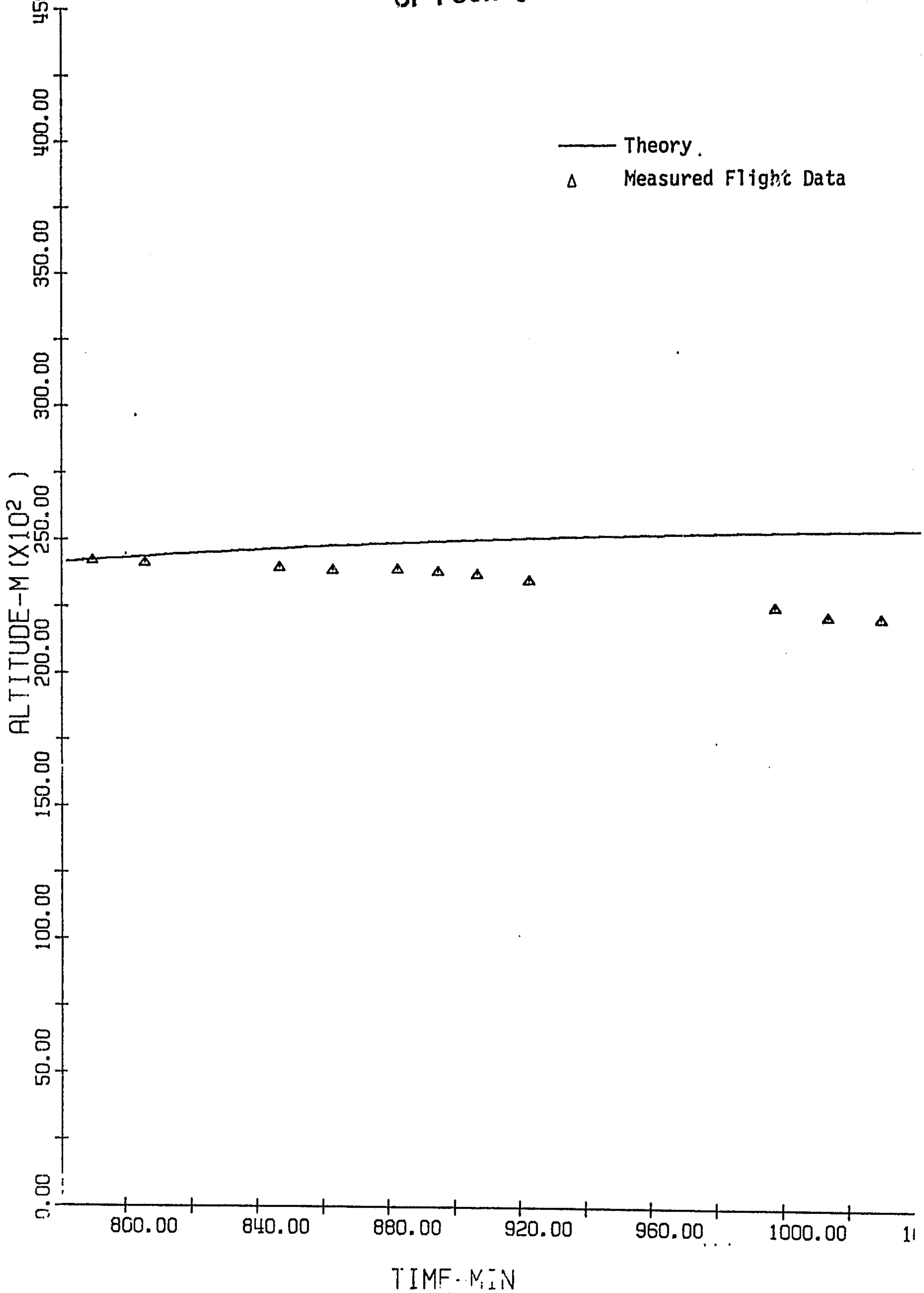

Figure 1.B. (continued) Altitude Trajectory for Flight 167N(66375 m^3 balloon launched 1135 CDT, 24 July, 1980)

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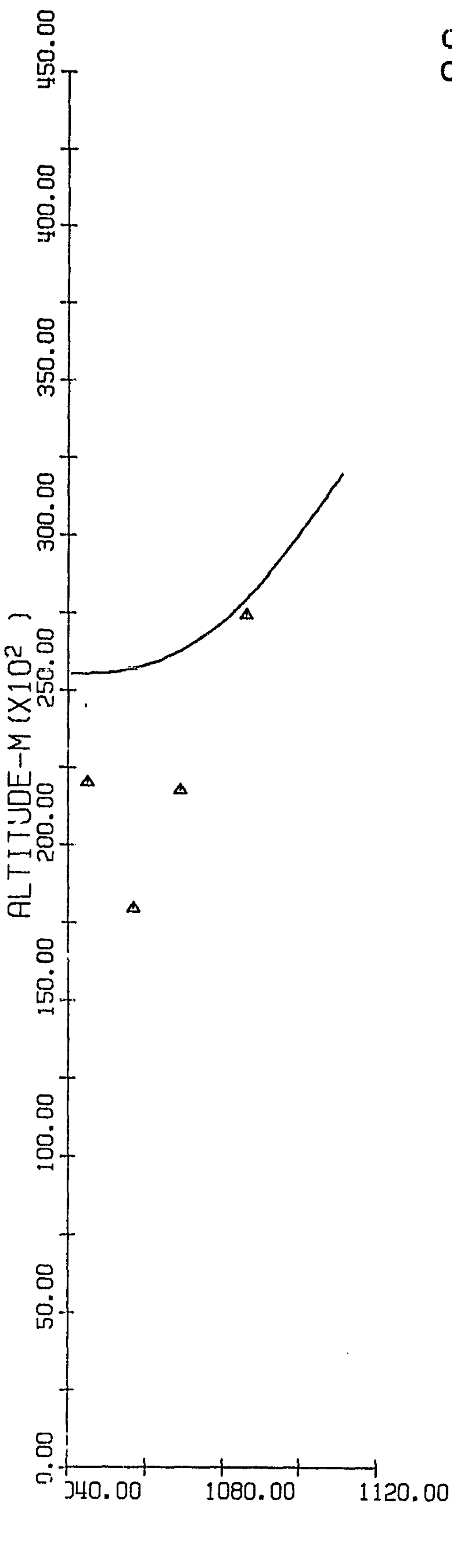

Figure 1.B. (continued) Altitude Trajectory for Flight 167N (66375 m^3 balloon launched 1135 CDT, 24 July, 1980)

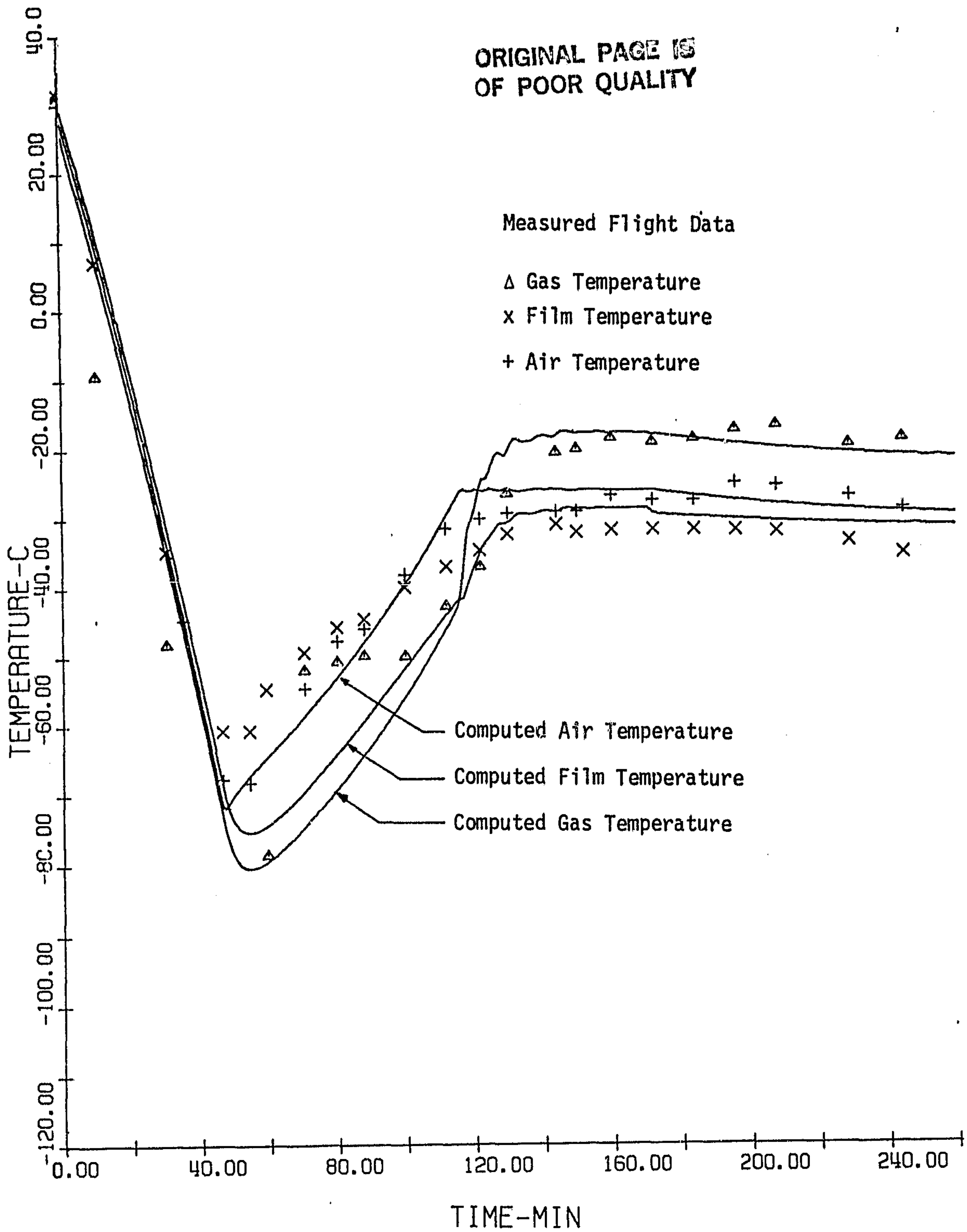

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Figure 2.B. Temperature Profile for Flight 167N (66375 m^3 balloon launched 1135 CDT, 24 July, 1980)

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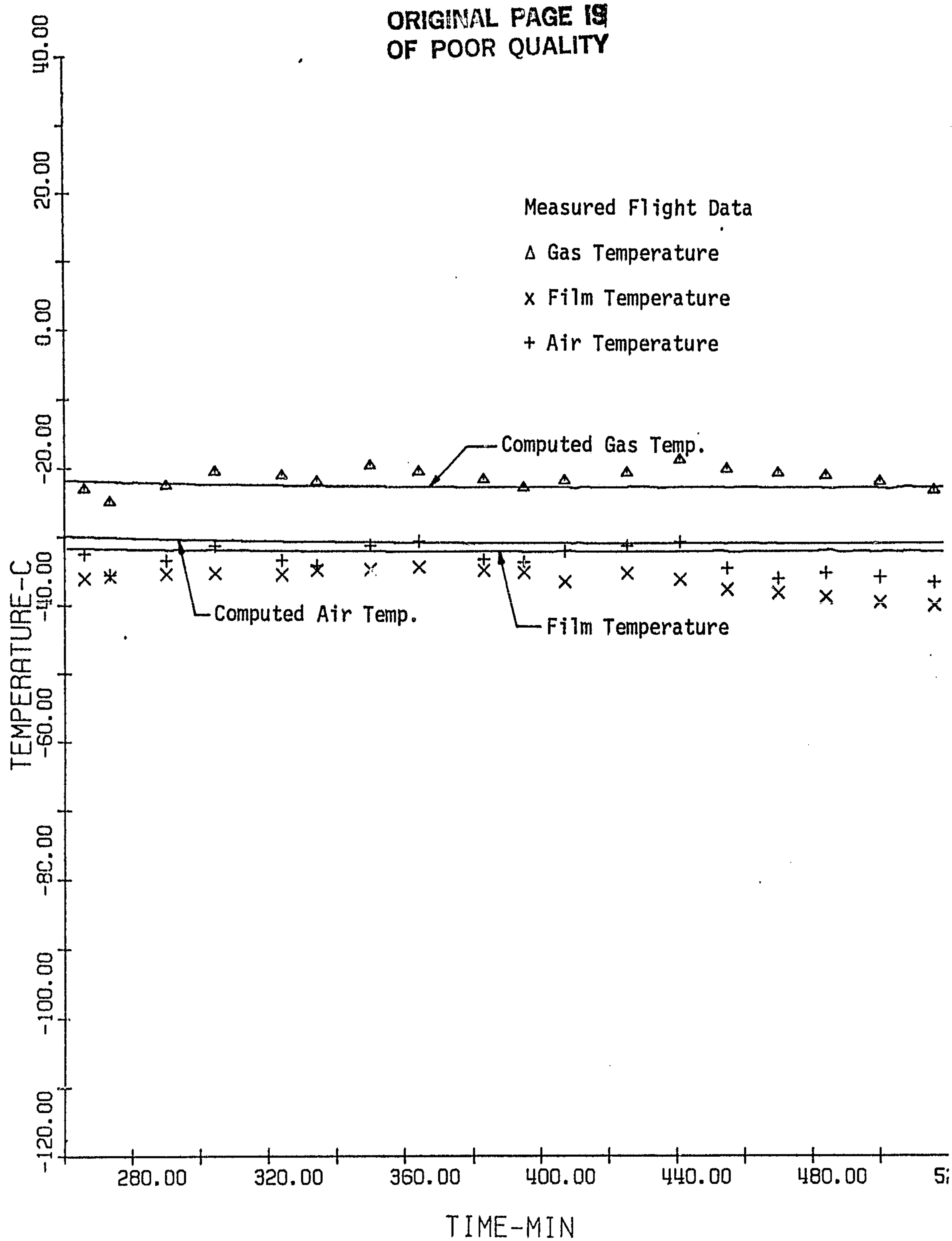

Figure 2.B. (continued) Temperature Profile for Flight 167N(66375 m^3 balloon launched 1135 CDT, 24 July, 1980)

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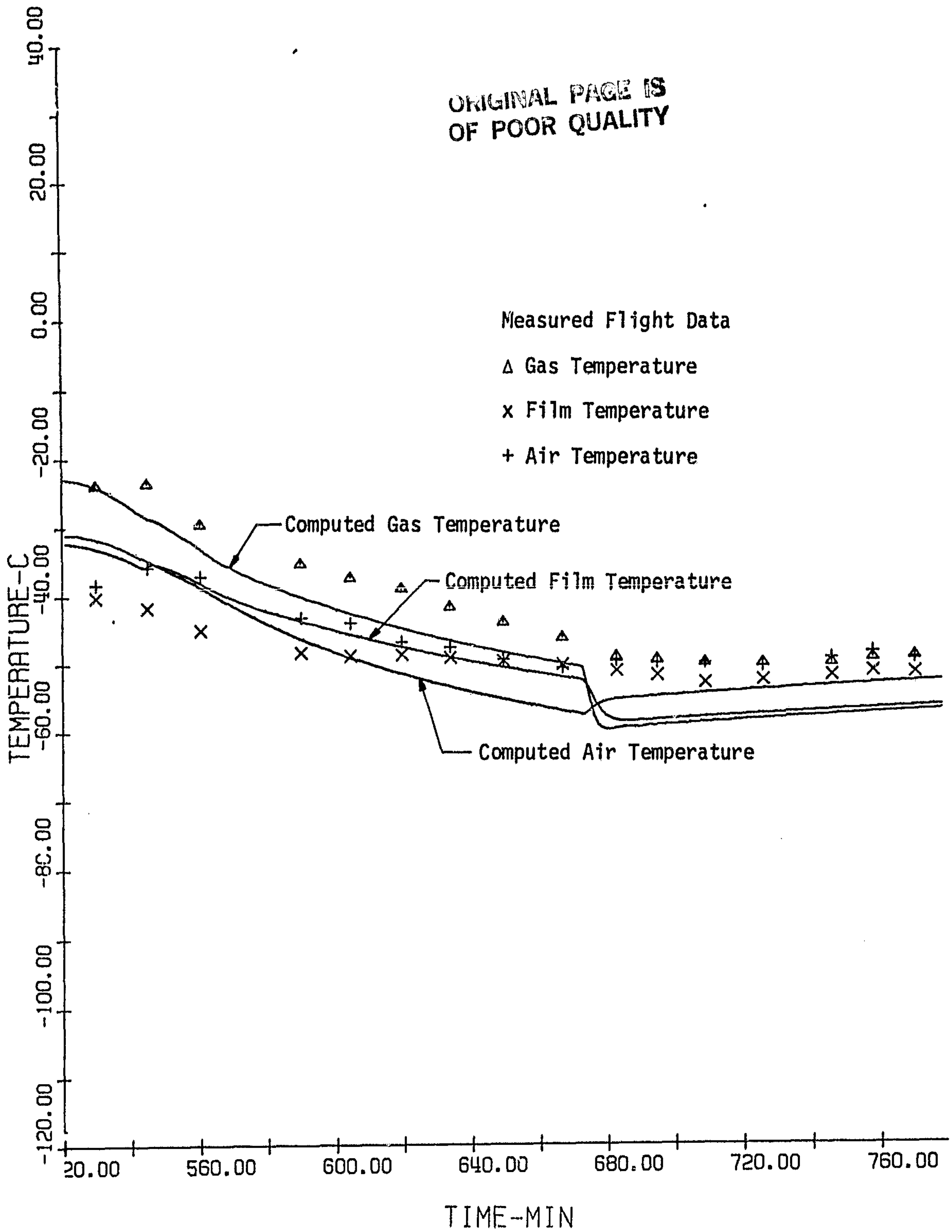

Figure 2.B. (continued) Temperature Profile for Flight 167N (66375 m^3 balloon launched 1135 CDT, 24 July, 1980)

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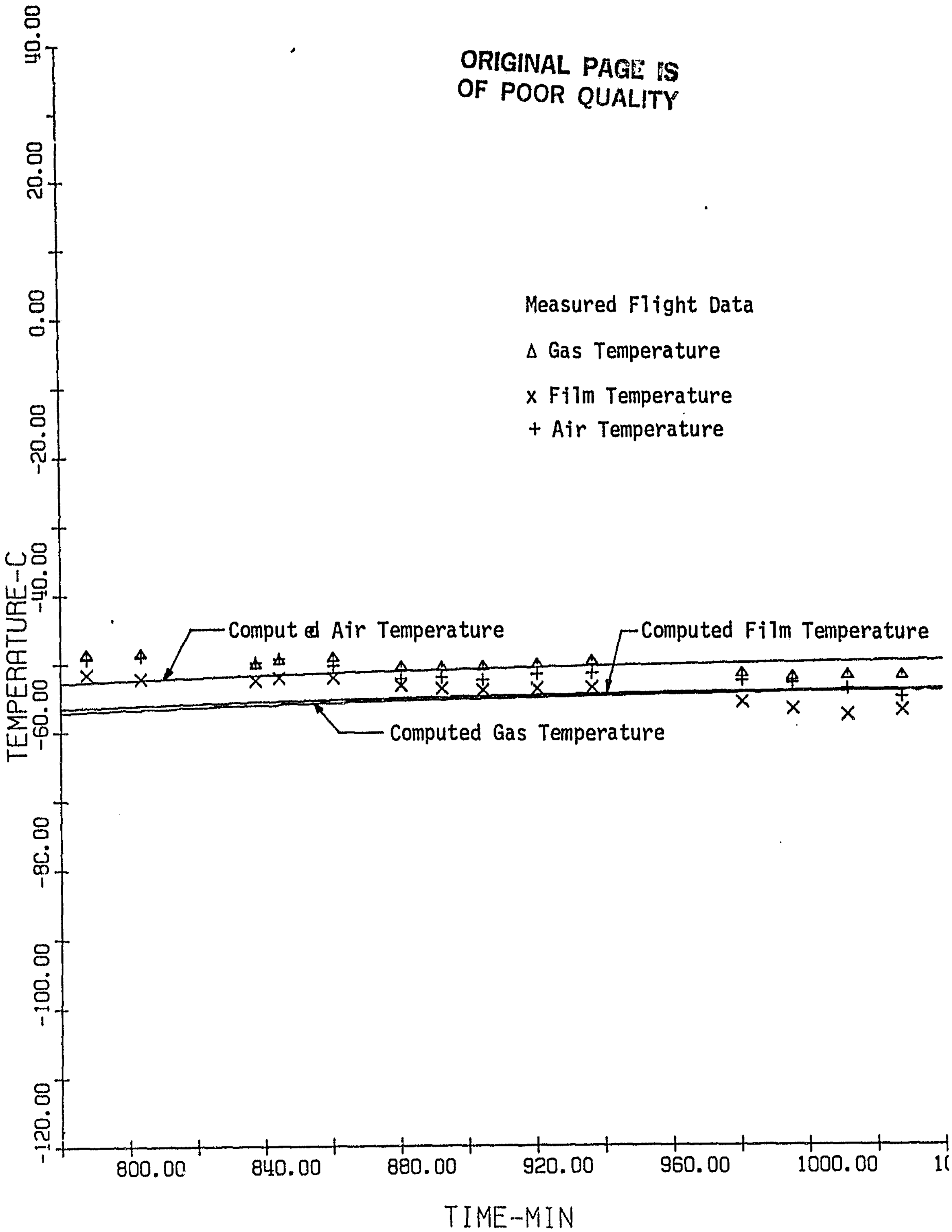

Figure 2.B. (continued) Temperature Profile for Flight 167N (66375 m^3

balloon launched 1135 CDT, 24 July, 1980

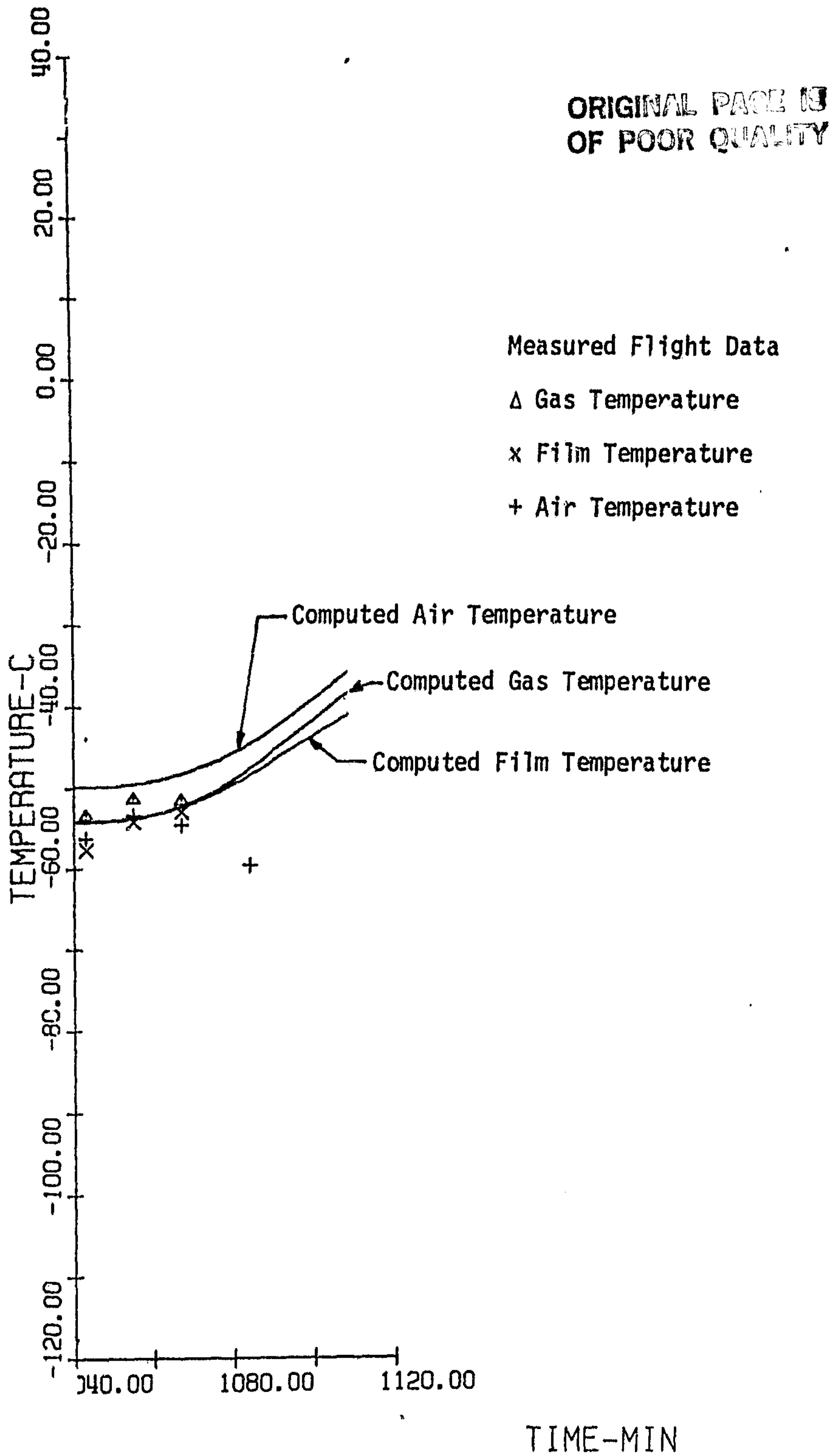

Figure 2.B. (continued) Temperature Profile for Flight 167N (66375 m^3 balloon launched 1135 CDT, 24 July 1980)

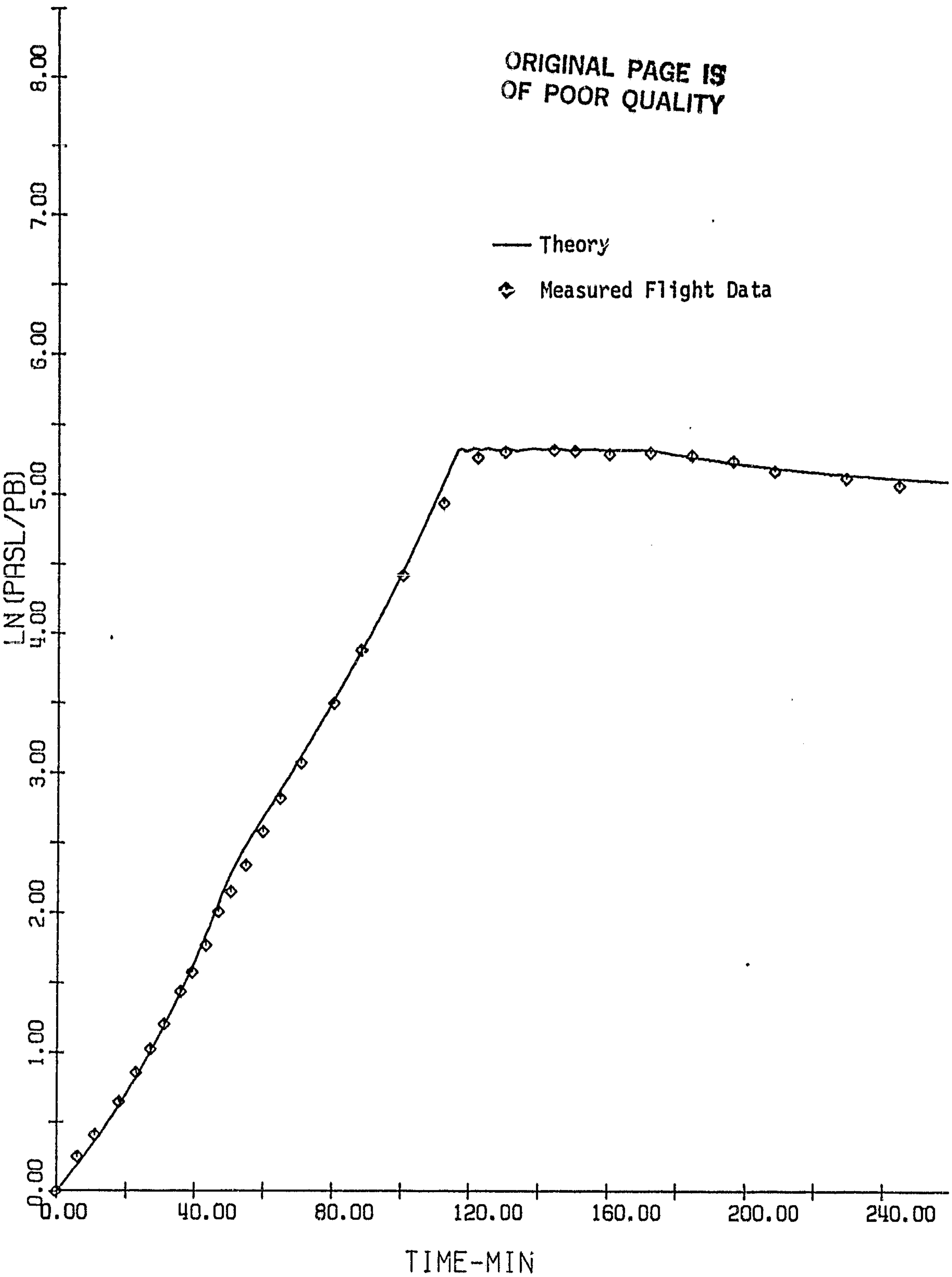

Figure 3.B. Pressure Trajectory for Flight 167N(66375 m^3 balloon launched 1135 CDT, 24 July, 1980)

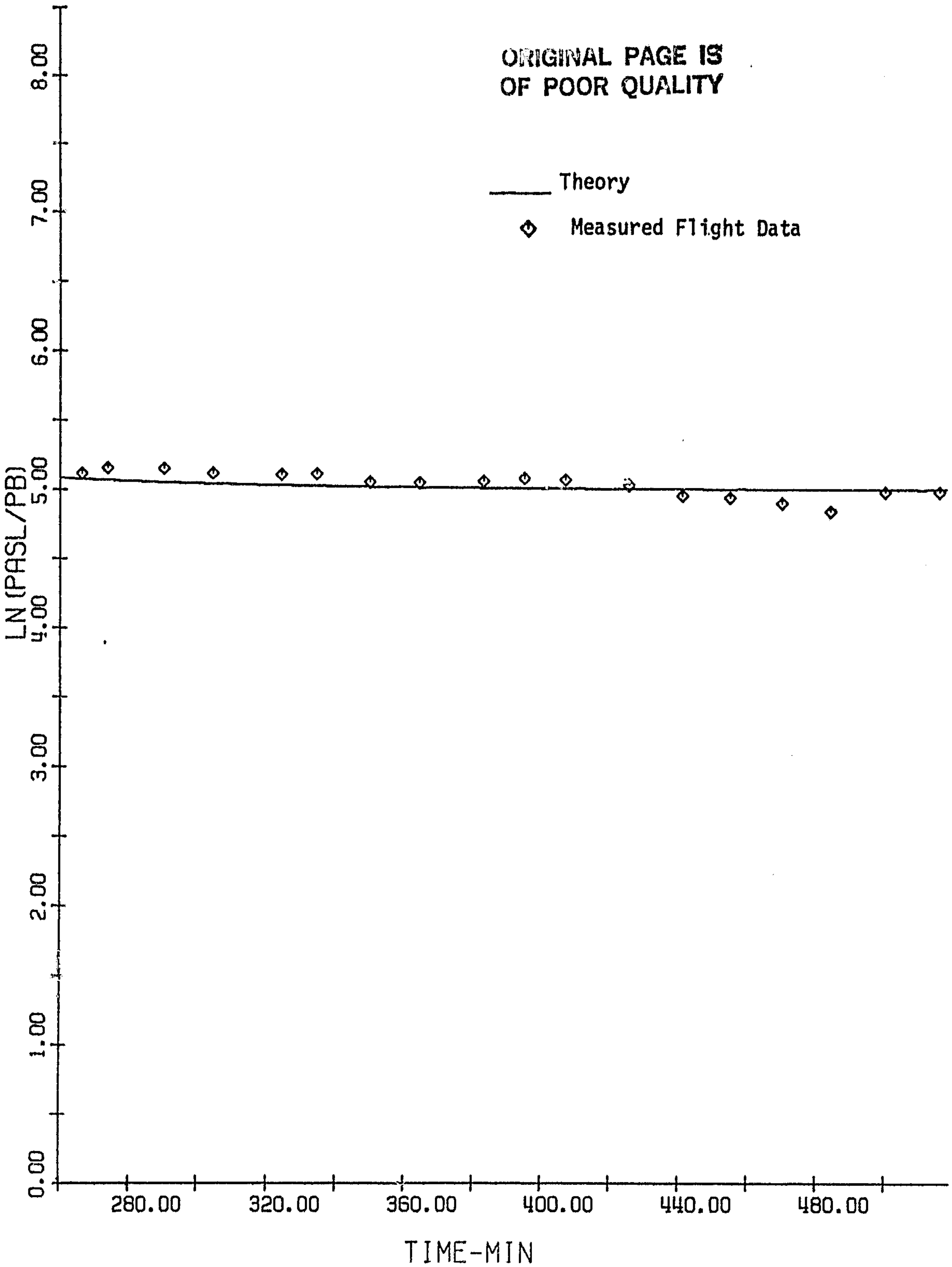

Figure 3.B. (continued) Pressure Trajectory for Flight 167N (66375 m^3 balloon launched 1135 CDT, 24 July, 1980)

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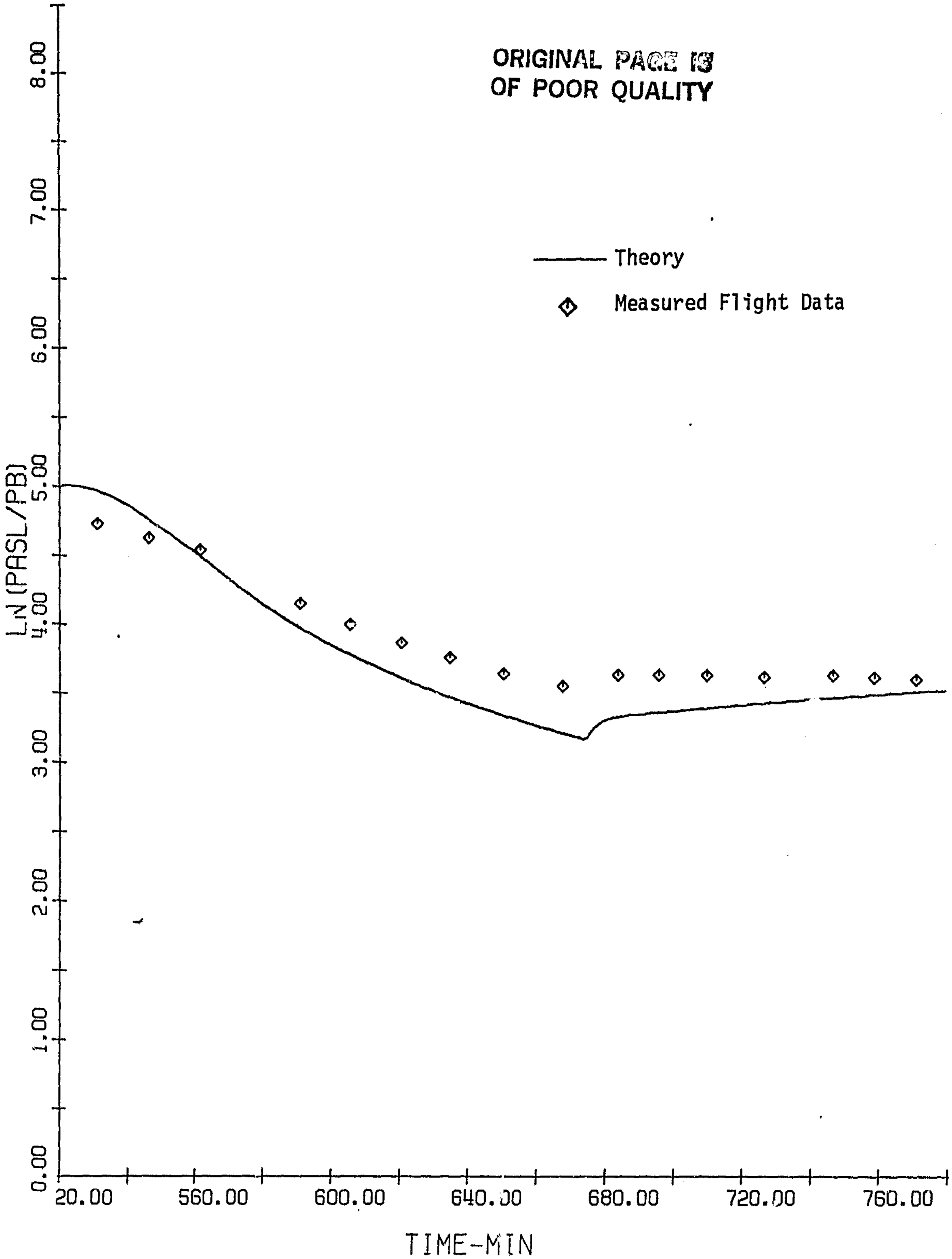

Figure 3.B. (continued) Pressure Trajectory for Flight 167N(66375 m^3 balloon launched 1135 CDT, 24 July, 1980)

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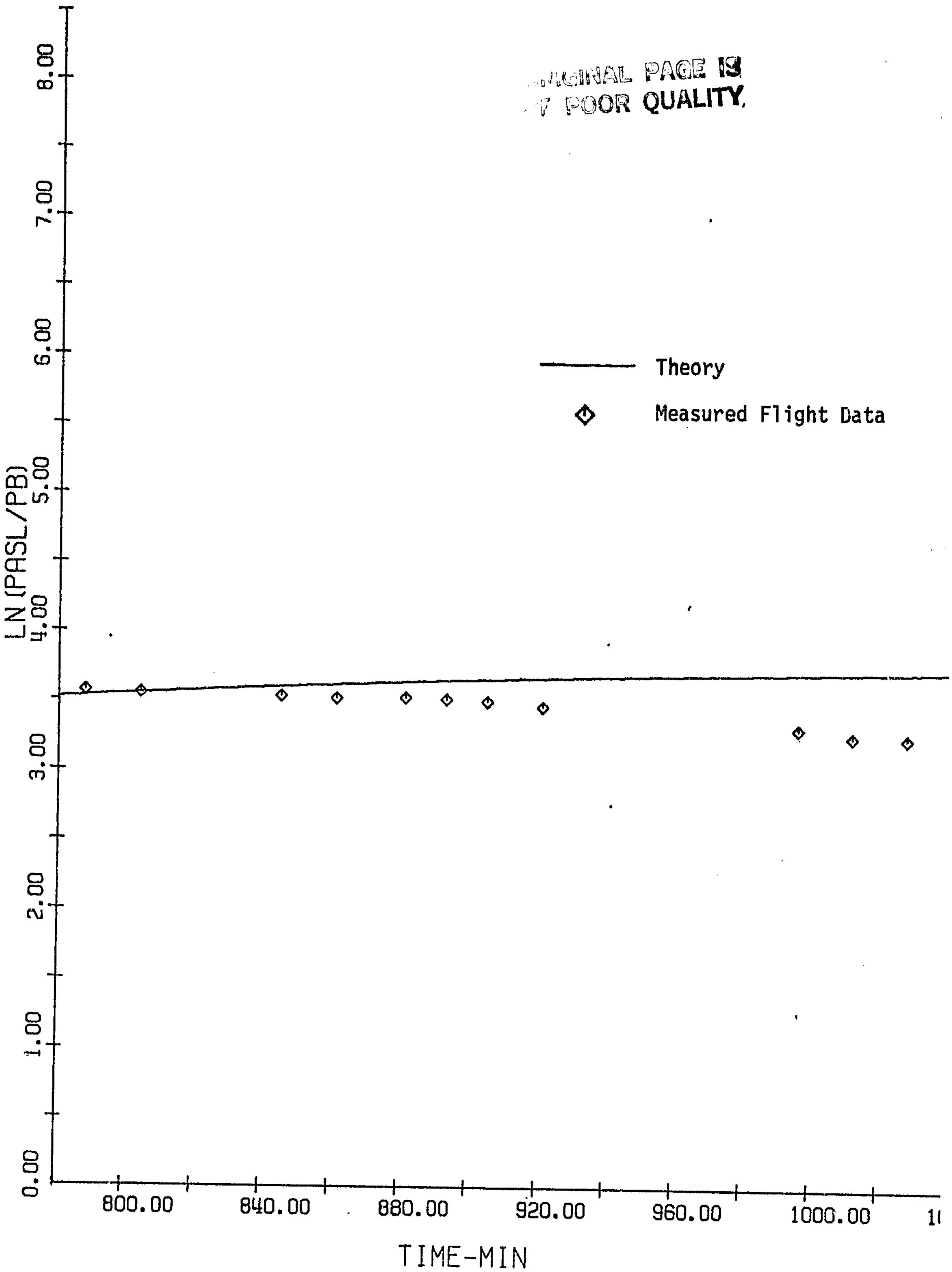

Figure 3.B. (continued) Pressure Trajectory for Flight 167N(66375 m^3 balloon launched 1135 CDT, 24 July, 1980)

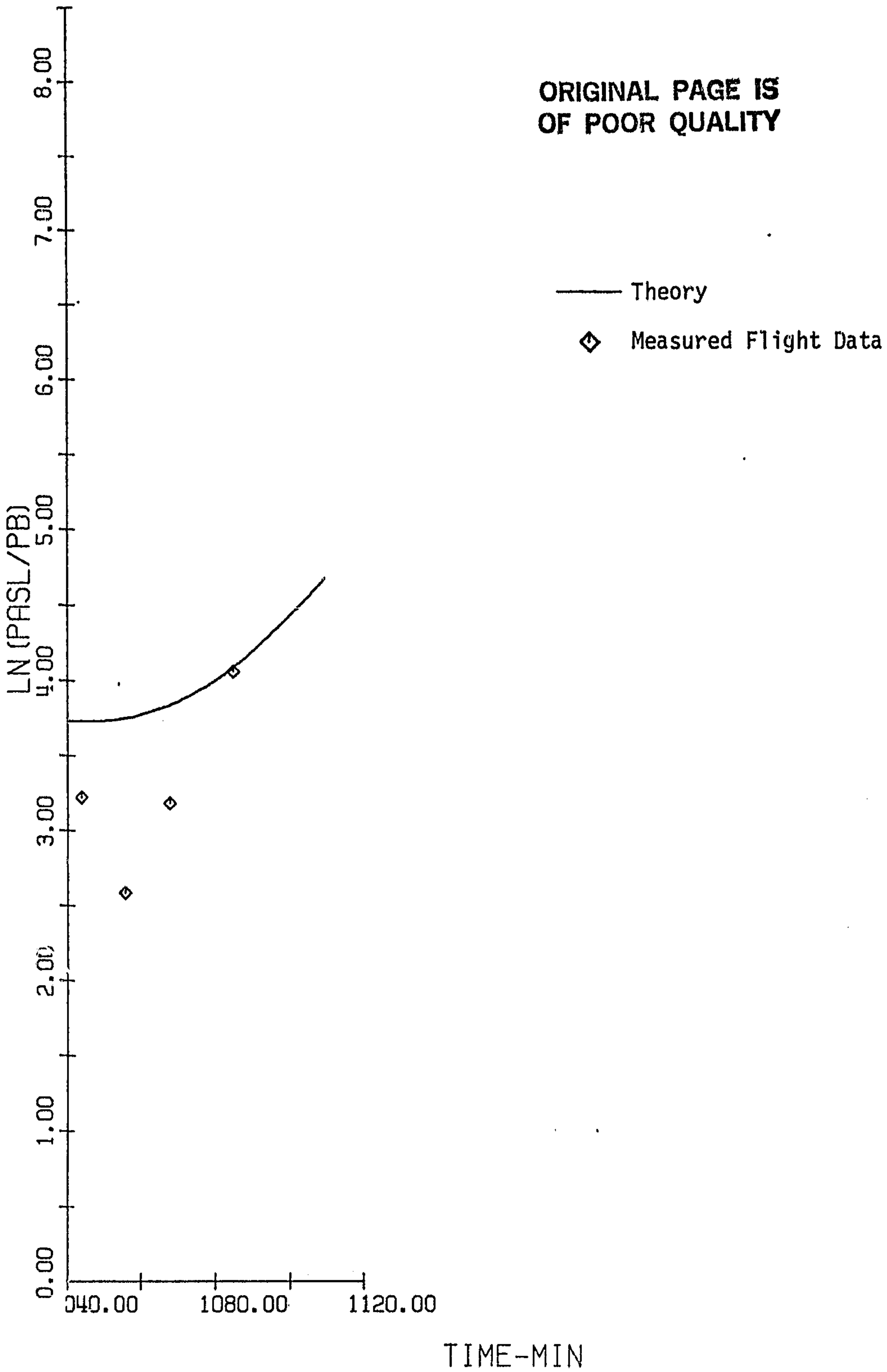

Figure 3.B. (continued) Pressure Trajectory for Flight 167N (66375 m^3 balloon launched 1135 CDT, 24 July, 1980)