71-063C-06A
72-096C-01A

DESCRIPTION OF APOLLO HEAT FLOW EXPERIMENT DATA TAPES

I. Tape Specifications.

These tapes were written on an IBM 1130 Model 2415 tape unit at a density of 800 BPI with odd parity, data convert on and translate off. They are 7-track tapes. There are standard IBM inter-record gaps and a standard IBM end of file (2 consecutive inter-record gaps) at the end of the data.

II. Data Organization.

For each heat Flow experiment (Apollo 15 and 17) there are two data tapes, one for probe 1 and one for probe 2. On each tape there are five groups (files) of data in the indicated order:

File #	Record Content	Logical Record size	Physical Record Size
1	Time, T, ΔT for upper section gradient bridge	3 real words	100 logical records
2	Time, T, ΔT for lower section gradient bridge	"	"
4	Time, T, ΔT for upper section ring bridge	"	"
5	Time, T, ΔT for lower section ring bridge	"	"
3	Time, HTR, TREF, TC1, TC2, TC3, TC4	7 real words	"

Time is measured in milliseconds, since the beginning of the year in which the experiment was activated.
T is the average temperature for a given bridge
ΔT is the temperature difference between the upper and lower ends of a bridge.
HTR is the heater state - an integer between 1 and 16 converted to real mode.
TREF is the reference bridge temperature.
TCL, TC2, TC3, and TC4 are the thermocouple temperatures for each probe cable.

All temperatures and temperature differences are in degrees absolute and the order of the logical records in each file is chronological.

Note: This description applies to the data array for a physical record in core before it is written on tape. When the data are written on tape, the order is reversed; that is, for each physical record, the first word, in core (a time) becomes the last word on the tape record, and the last word in core (either a ΔT or TC4) becomes the first word on tape.

Each tape contains all the data for a particular probe since the experiment was activated until the end of 1974. The first time on the Apollo 15 tapes is 1971/212/19/48/00. The first time on the Apollo 17 tapes is 1972/347/3/5/40. The nominal data density is one point (Logical record) per hour.

The number of physical records for files 1 through 5 for these tapes are:

Tape	Experiment		Probe #		Sequence #				Number of Physical Records for				
Designation	A15	A17	1	2	1	2	3	4	File #1	2	4	5	3
A15P1#3	X		X				X		291	291	7	7	299
A15P2#3	X			X			X		281	281	6	7	289
A17P1#2		X	X			X			207	207	4	4	210
A17P2#2		X		X		X			206	206	4	4	210

Apollo 15 Heat Flow Thermaldata (71-063C-06A) is written in IBM 1130 Floating point. 1130 Floating point uses two words in storage, and is oriented as follows:

1st WORD	0: S	1–15: MANTISSA	most significant bits
2nd WORD	0–7: MANTISSA	8–15: CHARACTERISTIC	equals exponent plus 128

The number can contain up to 23 significant bits of mantissa, with a binary exponent ranging from —128 to plus 127. The sign of the mantissa is in bit zero of the first word. The next 23 bits represent the mantissa, and the remaining 8 bits represent the characteristic. The mantissa is normalized to fractional form, i.e., the implied binary point is between bits zero and one. The characteristic is derived by adding 128 to the exponent, thereby representing all exponents as positive numbers in core. This eliminates the problem of having to allow for a sign bit for the exponent. All characteristics between 0 and 127 represent negative exponents, and characteristics from 128 to 255 represent exponents from 0 to 127 (positive). The exponent is, in actuality, the number of places that the binary bit should be moved either to the left or right or its original position.

The following is an example of how to convert eight hex characters into a decimal equivalent:

sign bit and
mantissa
448081 A3 ----characteristic

1) Break the mantissa down into bits.

implied binary point — sign bit
0.100 0100 1000 0000 1000 0001

2) Then calculate the characteristic, and from that, the exponent.

A3 = 163   163
        -128
        35-----exponent

3) Now extend the mantissa out 35 places to the right to locate the correct position of the binary point (padding with zeros if necessary).

sign bit
0.100/0100/1000/0000/1000/0001/0000/0000/0000/. relocation of binary point
padding

4) Then convert to hex characters, starting from right to left.

4 4 8 0 8 1 0 0 0

This is your hex number. In this case, converting to decimal, we obtain a value in milliseconds of the year, which is 18,388,357,120---or 212.828 days.