Data Set Catalog #119

64-077A-09A 2 tapes

Mariner 4, Celestial Mechanics

64-077A-09A

MARINER IV

CELESTIAL MECHANICS

556 BPI, BINARY, ODD, 7 TRACK, 1 FILE, IBM 7094

D#	C#	START	STOP
D-01529	C-00101	11/28/64	12/05/64
D-01528	C-02556	12/05/64	12/08/67

JET PROPULSION LABORATORY *California Institute of Technology • 4800 Oak Grove Drive, Pasadena, California 91103*

Refer to: 311:GWN:po

18 November 1968

Mr. Ken Michlovitz
Code 601
National Space Science Data Center
Goddard Space Flight Center
Greenbelt, Maryland 20771

Dear Mr. Michlovitz:

This is to notify you that I have mailed, under separate cover, Mariner IV tracking data for the National Space Science Data Center (NSSDC). The detailed description of the transmitted information is as follows:

(1) Two magnetic tapes received from NSSDC on October 30, 1968. These tapes now contain compressed, edited Mariner IV tracking data at 556 bits/inch and are suitable for orbit determination. The contents of the tapes are:

TAPE A85823 - contains data from 15^h November 28, 1964 (launch) to December 5, 1964 15^h15^m (First Midcourse Maneuver).

TAPE A85822 - contains data from 16^h33^m December 5, 1964 until December 8, 1967 (end of MA IV mission).

These tapes were written on an IBM 7094.

(2)Three copies of TM GTD900-1 describing the data tape format

(3)One copy of TR32-1106 describing the orbit determination and data computation for MA IV. This reference also lists the data on the above tapes for the interval November 28, 1964 to October 1, 1965

(4)Three copies of an Astronomical Journal article on a solution for the mass of Mars

(5)One copy of a computer listing of the data from May 8, 1967 to December 8, 1967 (no tracking data was taken from October 1, 1965 until May 8, 1967)

(6)One copy of Technical Report 32-1306, "Constants and Related Information for Astrodynamic Calculations, 1968", July 15, 1968

Telephone 354-4321 *Twx 213-449-2142*

Since the data taken after October 1, 1965 has not been discussed in any publication a brief description of the more important features of the trajecory and data will be given here. Tracking data was taken from May 8, 1967 until December 8, 1967. This two-way coherent Doppler data was of the same form as described in TR 32-1108 and was generally of good quality although somewhat noisy at first because of low signal strength. All tracking stations during this period were tracking in an S-band configuration.

There was a second midcourse maneuver on October 26, 1967 6^h6^mU.T. and on October 27 the attitude control system went into a completely uncoupled mode when one half system of the cold nitrogen gas attitude control system depleted. Uncoupled is used here to indicate that small translational forces were created by the attitude control system. Between November 20, 1967 and December 7, 1967 the second half system depleted and the spacecraft was spun up by solar radiation pressure. It is recommended that for Celestial Mechanics purposes no MA TV data be used after October 26, 1967 at 06^h.

During most of the May-December 1967 period it could not be determined on which star the attitude control star tracker was locked. For this reason the small variations in positioning of the attitude control solar vanes can not be exactly transformed into solar radiation disturbance forces. Since there is such a large uncertainty in computing these forces, no detailed record of the 1967 vane positions will be given here. The solar vanes in 1966-67 remained within ten degrees (typically closer) to the positions recorded on October 1, 1965.

This concludes the trajectory and data description. If there are any important questions not answered in the enclosed documentation, I will be happy to provide the required information. A table of tracking station numbers is appended.

Sincerely yours,

George W. Null

George W. Null
Mariner IV Celestial
Mechanics Investigation

Enclosure -under separate cover

JET PROPULSION LABORATORY California Institute of Technology • 4800 Oak Grove Drive, Pasadena, California 91103

Mr. Ken Michlovitz 3 18 November 1968

TABLE OF TRACKING STATION NUMBERS

EXTERNAL VS INTERNAL

EXTERNAL = DEEP SPACE INSTRUMENTATION FACILITY TWO DIGIT CODE

INTERNAL = NUMBER USED ON THE MAGNETIC TAPES CONTAINING THE TRACKING DATA

LOCATION	EXTERNAL DSIF NUMBER	INTERNAL DATA TAPE NUMBER
Robledo, Spain (Madrid)	62	1
Canberra, Australia	42	2
Woomera, Australia	41	4
Johannesburg, South Africa	51	5
Goldstone, California (Echo Station)	12	12
Robledo, Spain (Madrid)	61	13
Goldstone, California (Mars Station)	14	14

MARINER 4 64-077A-
CELESTIAL MECH. 09A

SECTION II

DATA FILE FROM THE ORBIT DATA GENERATOR

The Data File produced by the Orbit Data Generator (ODG) consists of a record labeling the data file, a series of station summary records, and a series of data records. The following describes each of these records.

The first record contains an Data File label in 9 words of BCD and a check sum word. The label includes the date, time and computer on which the Data File was written.

Each station summary record contains 201 words with the last word being a check sum word. The first record of the series of station summary records contains the following.

Word 0-8. Word 0 equals the mission number. Words 1 to 3 should be ignored. Words 4 through 8 are used by the ODG DISCBU subroutine.

Word 9. Unused.

Words 10-39. Words 10 through 39 contain the last time of the last point for each station in seconds elapsed since the TDP Master File epoch in double precision, floating point. Internal station 15 is first, with internal station 1 listed last.

Words 40-199. Words 40 through 199 contain station summary information. There are 17 words for each station, in which up to 15 data types and station start times may be indicated. Internal station 15 is listed first.

Example:

Word

40 = Number of data type 1 observables for station 15.
41 = Number of data type 2 observables for station 15.
42 = Number of data type 3 observables for station 15.
.
.
.

Word

55-56 = Start time of station 15 in seconds elapsed since the TDP Master File epoch.

57 = Number of data type 1 observables for station 14.

Word 200. Word 200 is a check sum word.

Record 3. Record three continues with the station summaries from word 0 through 94.

Example:

Word

0 = Number of data type 8 observables for station 6.

.
.
.

92 = Number of data type 15 observables for station 1.

93-94 = Start time of station 1 in seconds elapsed since the TDP Master File epoch

Word 95 is unused and word 96 is a check sum word.

The following are data types in the ODG:

		Units
Data type 1	Range (R)	Kilometers
Data type 2	Range Rate (DR)	
Data type 3	Elevation (EL)	Degrees
Data type 4	Azimuth (AZ)	Degrees
Data type 5	Declination (DEC)	Degrees
Data type 6	Hour Angle (HA) or Right Ascension (RA)	Degrees
Data type 7	One-way Doppler (C1)	CPS
Data type 8	Two-way Doppler (CC3 or C2)	CPS
Data type 9	Three-way Doppler (C3)	CPS
Data type 10	Time Resolver (TR)	Microseconds
Data type 11	Range Units (RU)	
Data type 12	Planetary Range Units (PRU)	Nonoseconds
Data type 13-15	Not used	

Data Records

Following the station summary records are a series of data records: each contain 201 words. Word 201 is a check sum word. The format of the logical record, which is variable in length, is described in Table 3. The intermediate structure of the Data File is shown in Fig. 2.

APPENDIX I

FORMAT OF THE ODP FILE

I.1. ODP File Logical Record Format

The ODP File is written on disc starting at JPLODP+1001

Word	Contents
0	D = Number of words in logical record
1-2	Floating point double precision Seconds past 1950.0 MSP of time in Word 1 LSP of time in Word 2
3	Frequency increment (floating point)
4	Pass ID (BCD)
5	Code word
6	Observable No. 1 (floating point)
7	Weight code word

I.1.1. Format of Code Word

Bit: S 1 15 16 17 18 21 22 25 26 35

b c d d d d d d d d d n n n n n o a x x x x yyyy ttttttttt

a) If bits S and 16 are 0, doppler is L-band.
If bits S and 16 are 1, doppler is L/S-band;
If bit S is 0 and 16 is 1, doppler is S-band.

b) If bit n_i = 1, then data type i appears in the logical record.

Bit Number	Data Type
1	Range (R)
2	Range Rate (DR)
3	Elevation (EL)
4	Azimuth (AZ)

Bit Number	Data Type
5	Declination (DEC)
6	Hour Angle (HA) or Right Ascension (RA)
7	One-Way Doppler (C1)
8	Two-way Doppler (CC3 or C2)
9	Three-Way Doppler (C3)
10	Not Used
11	Range Units (RU)

c) Bits 12 through 15 are not used

d) If a = 0, Bit 5 corresponds to hour angle
If a = 1, Bit 5 corresponds to right ascension

e) xxxx is the transmitter ID (internal)

f) rrrr is the receiver ID (internal)

g) tttttttttt is the doppler averaging time (must be less than 1024 seconds).

Format of Weight Code Word

Bit:	S-2	3-5	6-8	9-11	12-14	15-17	18-20	21-35
	D_1	D_2	D_3	D_4	D_5	D_6		t_s

a. The D_i are indices for a priori weighting by table look-up.

b. Bits 18-20 are not used

c. t_s is the data type sample interval

The ODP File summaries are stored in JPLTDP. They are written after each ODP File update. The summaries are listed by data type and station

Number of words written:

$$(437)_8 = (287)_{10}$$

Two records are written on disc in reverse order by DCP (200-word records are used):

Record No. 1 = JPLTDP + 7899
Record No. 2 = JPLTDP + 7898

Information is stored forward within each record. When the records are reversed in core, information is:

Words 1-30: Double precision last time for each station (stored backward)

Words 31-287: ODP File summaries stored backwards as BSS type storage

The File summaries are (starting backwards from "SUM" = Word 287):

SUM-17 = No. of data type 1 observables for Station 1

SUM-16 = No. of data type 2 observables for Station 1

.

.

.

SUM-3 = No. of data type 15 observables for Station 1

SUM-2 = First data point time for Station 1

SUM-1 = Last data point time for Station 1

SUM-2 x 17 = No. of data type 1 observables for Station 2.

.

Continue similarly for 15 stations.

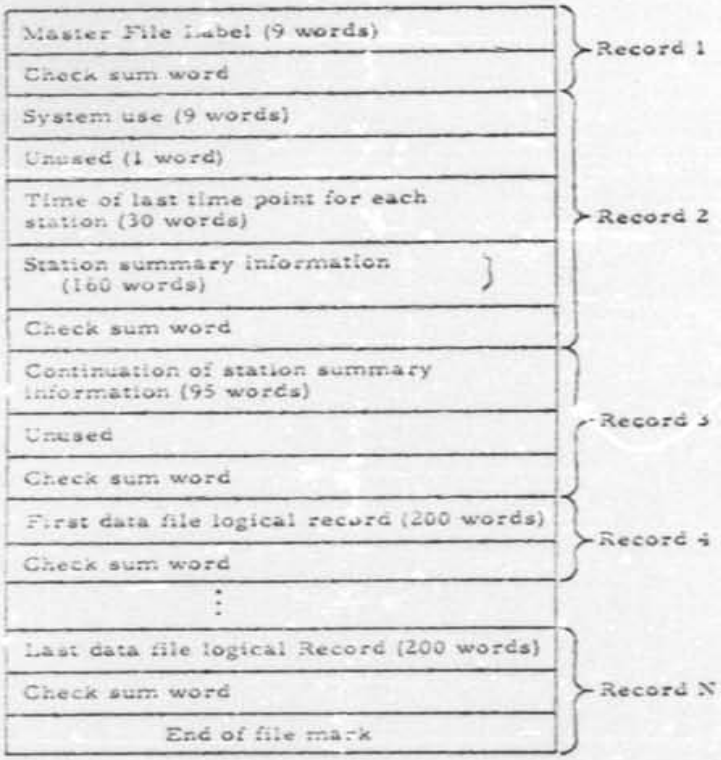

Fig. 2. Data File

Copy – Two tapes received 12/4/68 with documentation Km

DEC 4 1968

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DEC 4 1962

jpl

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