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Coordinated Science Laboratory

UNIVERSITY OF ILLINOIS – URBANA, ILLINOIS

RESULTS OF SIXTEEN DIFFERENTIAL ABSORPTION AND FARADAY ROTATION MEASUREMENTS WITH NIKE-APACHE ROCKETS

J.Gooch, H.Krone & D.Skaperdas

REPORT R-324

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I. Introduction

During the years 1964-1965 the Coordinated Science Laboratory conducted a series of radio-propagation experiments employing rocket probes to determine electron density and collision frequency from measurements of differential absorption and Faraday rotation in the D-region of the ionosphere in connection with a synoptic IQSY program, headed by Dr. Sidney Bowhill. A total of 17 rocket experiments were conducted, 16 of which were considered operationally successful. This report presents a general description of the automatic data processing equipment and compilation of all the differential absorption and Faraday rotation data extracted from thirteen experiments conducted by the Coordinated Science Laboratory and three experiment conducted by the Aeronomy Group of the University of Illinois Electrical Engineering Department, using the equipment developed by CSL. A complete description of CSL's radio propagation experiment is given in reference 1. A description of early data analysis before completely automatic data reduction methods were used is given in the same reference. All of the data presented here was obtained by the automatic data processing techniques.

II. Differential Absorption and Faraday Rotation Data

The rocket designation number, location of launch, launch time, nominal transmission frequency, and miscellaneous notes for the seventeen experiments are listed in Chart I. No Faraday rotation and questionable differential absorption data were observed for the equatorial firing 14.228 from the aircraft carrier. One reason for this is that it was extremely difficult to set the required linear polarizations aboard the aircraft carrier.

Experiment 14.147 was fired from Wallops Island in a low trajectory over the aircraft carrier USNS Croatan. During the rocket ascent, signals were transmitted from the Wallops Island, Virginia, site. During the descent, signals were transmitted from the Croatan about 60 miles east of Wallops Island. Data obtained from the descending portion of the rocket trajectory has always been inferior for all these experiments because the rocket has moved out of the main vertical lobe of the transmitting antenna array pattern.

Experiment 14.248 was only partially satisfactory because poor telemetry operation resulted in very low signal-to-noise ratios. The presented data for this experiment is therefore, incomplete.

III. Automatic Reduction of Differential Absorption Data

Differential ionospheric absorption is represented by the excess of extraordinary (S) wave transmitted power required to maintain a constant amplitude ratio (about 3:1) between the ordinary (O-wave) and the X-wave as seen at the output of the rocket-borne receiver. A return path from the rocket to ground, via telemetry provides for servo controlling the X-wave transmitted power to a level which maintains the desired ratio during D-region penetration.

Tape records of both X-and O-wave power levels are obtained from potentiometers ganged to the corresponding logarithmic rf attenuators. Attenuator position is recorded, as an amplitude modulated, 145 Hz signal. The modulation represents transmitted power on a decibel scale. The system for transferring the attenuator data from the analog magnetic tape recorder to punched paper tape, which serves as an input to a digital computer, is described below. The digital computer is programmed to give a tabulated print out and a graphical plot of X-wave power in dB vs time after launch. Figure 1 is a block diagram of the data reduction system. During rocket flight the 145 Hz, X-wave power level signal is recorded on a Minneapolis-Honeywell type 8100 magnetic tape recorder at 30 inches per second tape velocity. The O-wave is also recorded as a 95 Hz signal. In the data reduction process these tapes are played back at 1-7/8 inches per second, or 1/16 record velocity. This stretches the data in time and allows more sampling points per second to be punched on the paper tape at its maximum punch rate of 10 words per second. The Honeywell recorder output is coupled to a full wave rectifier where the 145 Hz signal is converted to dc representing the X-wave power level. Figure 2 is a schematic of the rectifier-filter. A precision rectifier circuit is used that incorporates rectifying diodes in the feedback loop of a Burr-Brown 1503 operational amplifier. Non-linearity of the diodes is reduced to a very small value. The rectifier balanced output is followed by an RC ripple filter with a compromise time constant smaller than the data sampling rate and larger than the 145 Hz carrier ripple period.

The dc representing X-wave power level is fed to an analog-to-digital converter and to the paper tape punch. A launch range time decoding system feeds commands to the converter. The units involved in these functions are a Vidar type 510 integrating digital voltmeter, a Vidar type 651-1 coupler, and a Tally type 420 tape punch. An Offner RS pen recorder provides a low resolution analog plot of the data during processing. Since the transmitted O-wave power level was kept constant during a flight, the differential absorption is represented in the data presented in this report by a change in the transmitted X-wave power level.

IV. Automatic Reduction of Faraday Rotation Data

Faraday rotation is represented by the relative polarization angle between the transmitted O- and X-waves. Since the transmitted O- and X-waves are in the amplitude ratio 3:1 and have a frequency difference of 500 Hz, the resultant transmitted wave appears in space as an ellipse whose axis rotates at 250 rps. Faraday rotation, f_F, causes a change in the rotation of the axis of this ellipse. The detected output of the rocket receiver in the absence of the rocket roll thus consists of a signal whose fundamental frequency is $2(250 \pm f_F)$ Hz. In addition, the rocket roll rate, f_r, adds its component to the fundamental frequency to give the result $2(250 \pm f_F \pm f_r)$. There is also a small phase correction due to time delay of the transmitted signal in reaching the rocket. This amounts to -0.3°/km.

The Faraday rotation data processor automatically extracts the accumulated Faraday rotation, $\theta_F = 2\pi \int f_F dt$ by removing the accumulated roll phase component θ_r and the accumulated phase due to the X- and O-wave difference frequency θ_{500} from the composite rocket receiver signal.

In equation form, this may be stated as

$$2\theta_F(t) = \theta_{rr} - 2\theta_r - \theta_{500}$$

$$= 2\pi \int (2f_F \pm 2f_r \pm 500)\, dt \mp 2\pi \int 2f_r dt \mp 2\pi \int 500\, dt, \qquad (1)$$

integrated over the interval from rocket launch to time t.

The Faraday rotation data processor block diagram is shown in Figure 3 and in more detail in Figure 4. During rocket flight, the rocket receiver output, rocket roll (magnetic aspect) signal and difference frequency signal between the X- and O-waves are recorded on magnetic tape at 30 inches/sec. During the data reduction these tapes are played back at 1/16 of the record velocity. Faraday rotation angle is extracted from three sinusoidal inputs, whose phases specify angles. The X- and O-wave difference frequency signal is fed to a mechanical phase shifter which has a servo-driven shaft input corresponding to Faraday rotation angle. This shaft angle is generated by a servo feedback loop described below.

The mechanical phase shifter output phase is added to the rocket roll signal phase in an image-free frequency mixer to form a "synthesized reference." In the absence of servo motion, the reference phase differs from the rocket receiver telemetered signal phase only by the amount of Faraday rotation. For the initial zero Faraday rotation, and for a suitable initial servo position, the phase difference of the rocket receiver output and synthesized reference differ by a constant 90^{o} and no output is obtained from the correlation phase detector. No servo driving signal is then present. In the event of Faraday rotation, the rocket receiver signal phase changes with respect to the reference phase producing a polarized output from the correlation phase detector. This output is a servo error signal which causes the servo to turn the mechanical phase shifter an amount necessary to bring the rocket receiver and reference phases again to 90^{o} difference. The servo shaft position indicates Faraday rotation and is read out by a helipot. Since the analog calculations are performed on double angle indications, the servo shaft indicates double Faraday rotation angle.

The servo shaft position is picked off by a multi turn-potentiometer set to give 1.80 volts per shaft revolution. Analog output is then 0.01 volts per degree of Faraday rotation. This output is fed to an integrating digital voltmeter which performs an analog-to-digital conversion and actuates the Tally tape punch. Paper tape punches are commanded by repetitive pulses derived from, and synchronized with the launching range time signals.

A detailed description of the Faraday rotation data processor is being prepared in a Coordinated Science Laboratory internal report.

V. Description of Digital Computer Program

The purpose of the computer is to:

1. Determine non-linear corrections from calibration data and apply these to all differential absorption data.
2. Use the factors obtained in 1. to translate and convert this data to differential absorption in dB versus time after launch.
3. Plot all differential absorption values versus seconds after launch.
4. Average the differential absorption values for each one second interval and print these versus time after launch.
5. Obtain the median values for each one second interval and print these versus seconds after launch.
6. Plot the median values versus seconds after launch.

The computer tasks for obtaining Faraday rotation are identical except that a calibration procedure is not employed.

The computer program, called Program Median, accomplishes the required tasks for both differential absorption and Faraday rotation as follows:

1. The paper tape from the analog-to-digital converter is translated to Fortran E10.0 format and stored on magnetic tape.
2. For the differential absorption data only, the X-attenuator calibration signals are also translated and stored on magnetic tape. This calibration data is printed out, the conversion

factor is manually extracted for each attenuator step and the data is returned to the computer in the form of a parameter tape. The conversion factor for the largest attenuator setting in dB is fed in first. Step number 2 is omitted for Faraday rotation since there is only one constant factor, labeled CNVFCT, fixed at 100 degrees/volt.

3. The data stored on the magnetic tape is fed to the computer. The program can handle a maximum of 100 seconds of data at 100 data points per second.

4. The computer examines the main parameter tape to ascertain
   a) if the data is three or four significant figures,
   b) if the data is differential absorption (D.A.), Faraday rotation (F.R.) or D.A. calibration data,
   c) the talley punch decimal control mode (In the case where three significant figures are called for, this parameter specifies which three of the five decimal figures on the digital voltmeter output are being used.),
   d) the number of data points per second,
   e) the rocket designation number,
   f) the data starting time in Greenwich mean time,
   g) the launch time in Greenwich mean time (seconds only),
   h) the desired starting time after launch for calculating and plotting data points,
   i) the desired stopping time after launch for calculating and plotting data points, and
   j) the last second's worth of data put on magnetic tape.

5. The parameter tape is stored on the magnetic tape preceding the translated data of step 1.

6. The data tape is examined to ascertain whether it is in the form of 3 or 4 significant digits. The first second's worth of data is then read in, printed out, and data errors rejected and indicated. The good data points, including the end points, are then averaged over one second and the average printed out for each second after launch. The median for each second's worth of data is then obtained by going through the list of data points and successively selecting the smallest value until half plus one of the total number of points in one second have been ordered. This point is designated the median value and printed out versus time after launch. If a data error occurs within a second, the median is not calculated for that particular interval of time.

7. If it is desired to automatically plot the above results, a plotting parameter tape is examined for the following information:

   a) Start and stop plotting times after launch.

   b) Whether an ordinate scale factor is desired. If not, the computer calculates an optimum scale factor.

   c) Ordinate scale factor.

   d) Height of maximum ordinate in inches, with a maximum of 29 inches.

   e) Number of seconds per inch (time after launch scale).

8. Type of plot desired. The routine can plot

   a) all data points versus seconds after launch,

   b) two data points per second versus seconds after launch,

   c) median values versus seconds after launch.

A more detailed description of Program Median is given in reference 2.

REFERENCES

1. CSL Report R-273 "High Resolution Radio Frequency Measurements of Faraday Rotation and Differential Absorption with Rocket Probes" by H. Knoebel, D. Skaperdas, J. Gooch, B. Kirkwood, and V. Krone. Edited by D. Skaperdas, Univ. of Illinois, Coordinated Science Laboratory, Dec. 1965.

2. CSL Internal Report I-134, "Program Median," by H. C. Morrision, Coordinated Science Laboratory, Sept. 1966.

Chart I

ROCKET LAUNCHES WITH DATA PROCESSED

Rocket Number	Launch Date	Launch Time G.M.T.	Launch Location	Propagation Frequency MHz	Apogee Altitude km	Time of Last Valid F. R. Data
14.143	4-16-64	2105:00	Wallops Isl., Va. 37° 50' N 75° 29' W	3.385	167.8	

Comments: This first experiment established the validity of the servo loop mode of operation.

Rocket Number	Launch Date	Launch Time G.M.T.	Launch Location	Propagation Frequency MHz	Apogee Altitude km	Time of Last Valid F. R. Data
14.144	7-15-64	0800:00	Wallops Isl., Va.	2.225	154.3	83.1

Comments: First of series of three launches for photo detachment study. Launch prior to D-region sunrise. Sayres R.F. probe arms deployed at 49 sec. cause roll rate change, and require F.R. correction using Figure RR-128.

Rocket Number	Launch Date	Launch Time G.M.T.	Launch Location	Propagation Frequency MHz	Apogee Altitude km	Time of Last Valid F. R. Data
14.145	7-15-64	0920:00	Wallops Isl., Va.	2.225	160.8	91.5

Comments: Second of series of three. Launch after layer sunrise, but prior to ground sunrise.

Rocket Number	Launch Date	Launch Time G.M.T.	Launch Location	Propagation Frequency MHz	Apogee Altitude km	Time of Last Valid F. R. Data
14.146	7-15-64	1025:00	Wallops Isl., Va.	2.225	171.2	90.6

Comments: Third of series of three. Launch shortly after ground sunrise.

Rocket Number	Launch Date	Launch Time G.M.T.	Launch Location	Propagation Frequency MHz	Apogee Altitude km	Time of Last Valid F. R. Data
14.147 (Up)	11-10-64	1107:00	Wallops Isl., Va.	3.385	118.8	102.9
14.147 (Down)					251.0	

Comments: Launch time choosen for no C-layer during ascent, but present during descent. Low trajectory passed over USNS Croatan on shakedown cruise lying 60 miles east off Wallops Isl., Va.

Chart I (continued)

Rocket Number	Launch Date	Launch Time G M.T.	Launch Location	Propagation Frequency MHz	Apogee Altitude km	Time of Last Valid F. R. Data
14.148	11-19-64	2202:06	USNS Croatan lying off Wallops Isl., Va.	2.225	169.7	

Comments: Second launch of 14.148, 14.149 series. (5:20 p.m. EST) After sunset launch. C-layer present during ascent, no C-layer during descent. F.R. measures erratic, negative.

14.149	11-19-64	2020:00	Wallops Isl., Va.	2.225	167.0	76.7

Comments: First launch of 14.148, 14.149 series. (3:20 p.m. EST) Abrupt change in roll rate at 50.1 seconds from 6.7 rps to 3.5 rps due to r.f. probe arms extension. Figure RR-128 shows correction to F.R. of -68° for this roll change.

14.228	3-20-65	1320:09	USNS Croatan on Magnetic Equator 100 miles W. Lima, Peru	3.385	174.0	

Comments: Circularly polarized rocket receiving antenna. Linearly polarized, E.-W. and N.-S. waves transmitted. Broadcast interference audible on final part of flight. Heavy filtering used to process.

14.229	3-27-65	0931:09	USNS Croatan on Magnetic Equator 100 miles W. Lima, Peru	2.225	164.7	

Comments: No data obtained due to telemetry failure.

14.230	4-5-65	1345:53	USNS Croatan 29° 34' S 75° 13' W	3.385	177.0	

Comments: Latitude survey series. Magnetic latitude 17° S. Solar Zenith angle 60°.

Chart I (continued)

Rocket Number	Launch Date	Launch Time G.M.T.	Launch Location	Propagation Frequency MHz	Apogee Altitude km	Time of Last Valid F. R. Data
14.231	4-9-65	1918:15	USNS Croatan 44^{o} 15' S 77^{o} 40' W	3.385	191.0	81.4

Comments: Lattitude survey series. Magnetic latitude 31^{o} S. Solar Zenith angle 60^{o}.

14.232	4-12-65	1714:02	USNS Croatan 58^{o} 19' S 78^{o} 00' W	3.385	186.7	80.7

Comments: Latitude survey final launch. Magnetic latitude 47^{o} S. Solar Zenity angle minimal value.

14.244	9-15-65	2028:00	Wallops Isl., Va. 37^{o} 50' N 75^{o} 29' W	3.385	180.0	84

Comments: Third IQSY Rocket. Solar Zenith angle 60^{o}.

14.245	6-14-65	0913:30	Wallops Isl., Va.	3.385	175.0	

Comments: Included cross modulation experiment in co-operation with radio station WTOP, Washington, D.C.

14.246	6-17-65	2141:00	Wallops Isl., Va.	3.385	176.0	85.8

Comments: Second IQSY Rocket solar Zenith angle 60^{o}.

14.247	12-15-65	1700:00	Wallops Isl., Va.	3.385	182.9	

Comments: Very heavy radio teletype or C.W. interference. Filters used in rocket receiver channel to process data.

14.248	1-10-66	1714:00	Wallops Isl., Va.	3.385		

Comments: No data after 49 seconds due to telemetry failure.

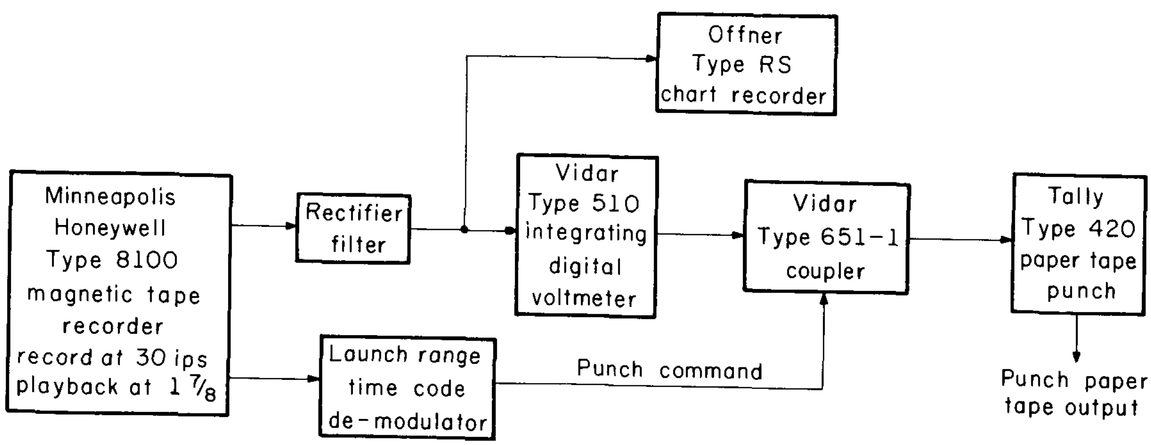


Figure 1. Block diagram of differential absorption data processor.

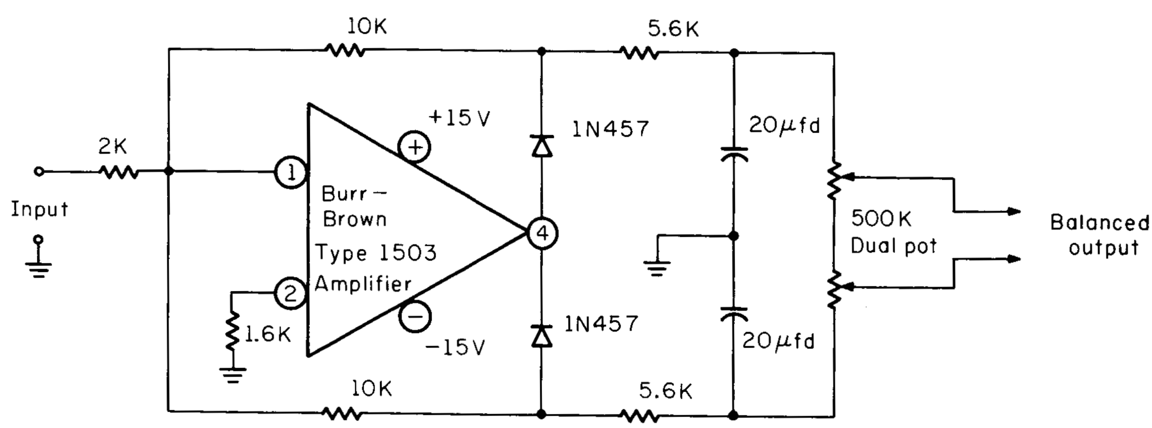


Figure 2. Rectifier filter schematic diagram.

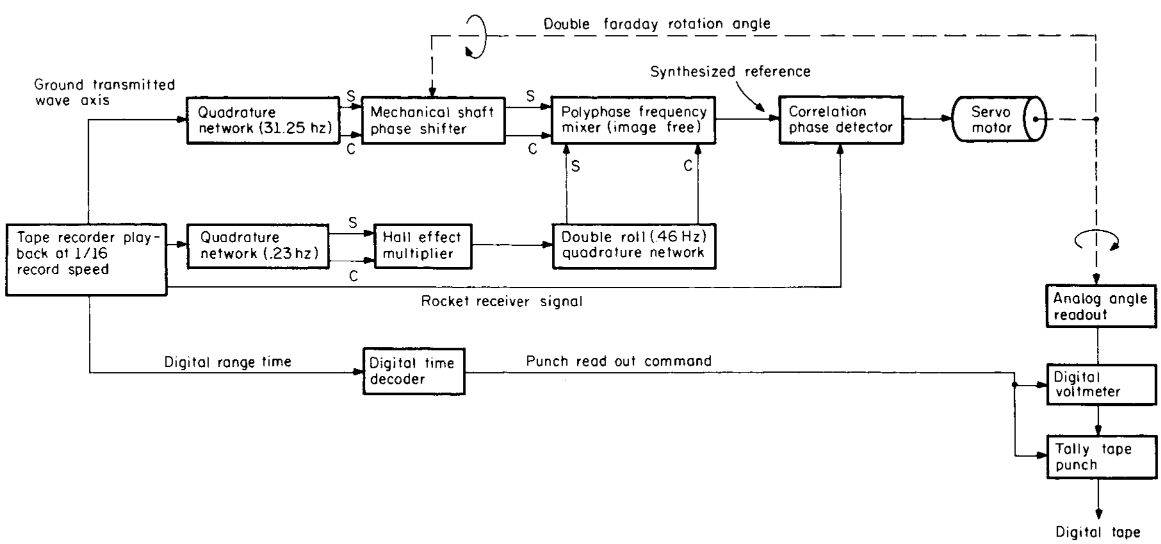


Figure 3. Block diagram of Faraday Rotation Data Processor.

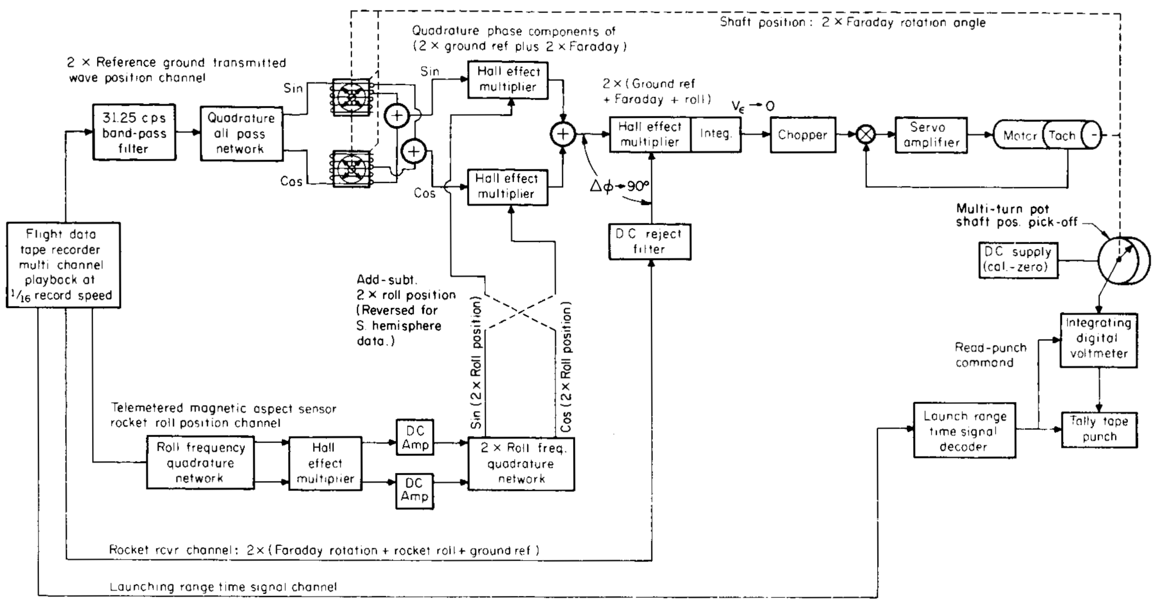
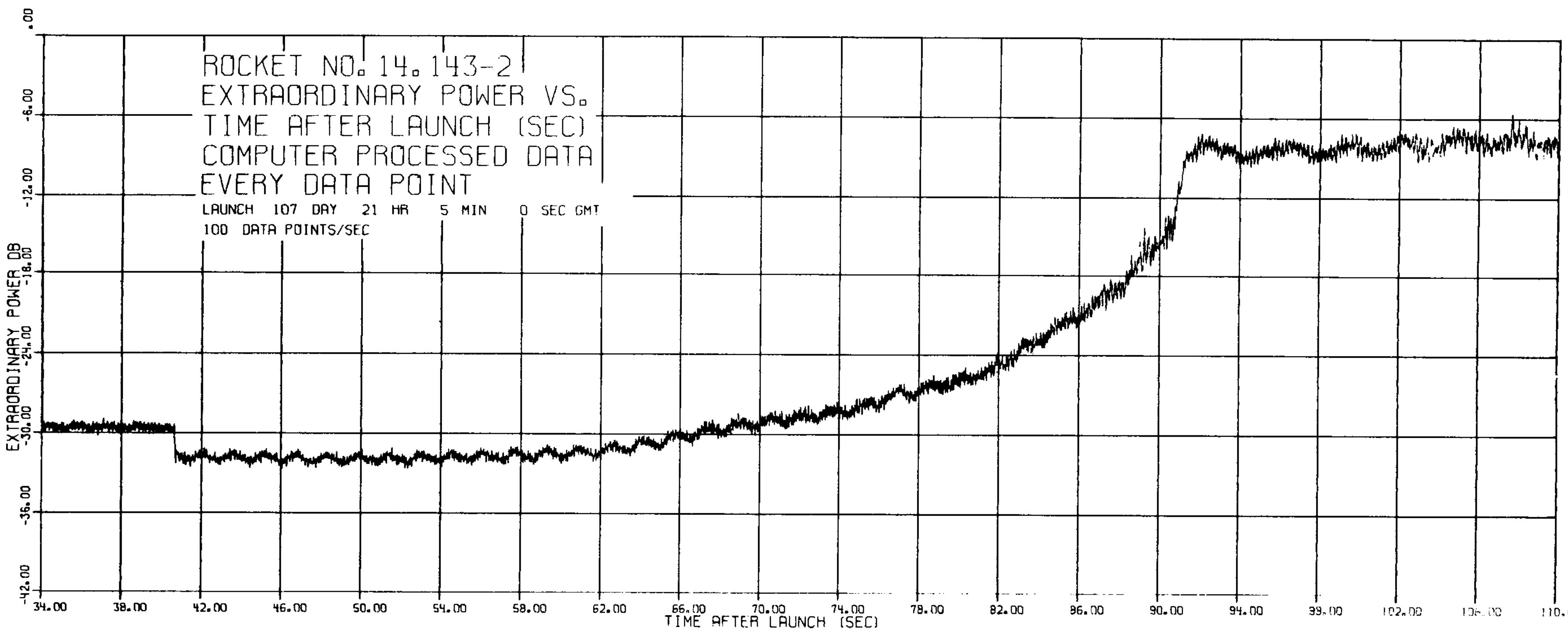


Figure 4. Block diagram of Faraday Rotation Data Processor - more detailed.



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TIME AFTER LAUNCH (SEC)
COMPUTER PROCESSED DATA
EVERY DATA POINT
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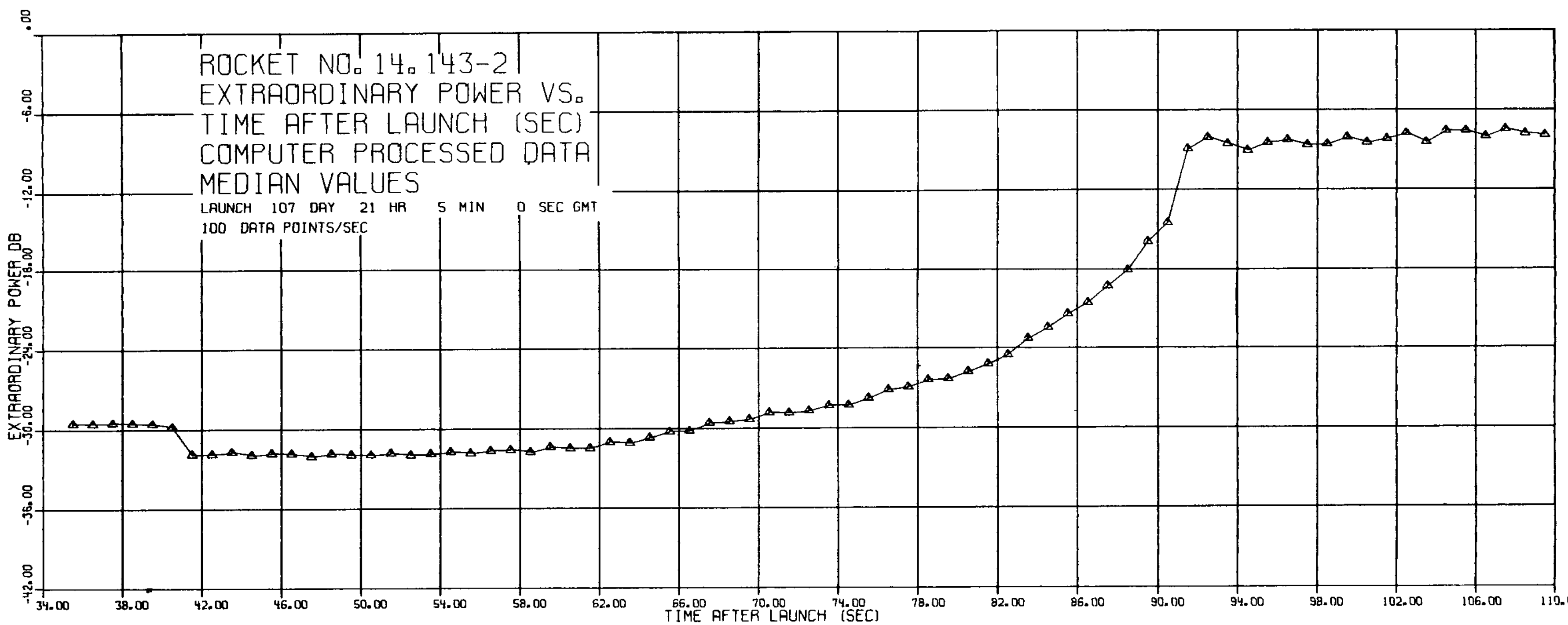
100 DATA POINTS/SEC
EXTRAORDINARY POWER DB
.00
-6.00
-12.00
-18.00
-24.00
-30.00
-36.00
-42.00
34.00
38.00
42.00
46.00
50.00
54.00
58.00
62.00
66.00
70.00
74.00
78.00
82.00
86.00
90.00
94.00
102.00
110.00
TIME AFTER LAUNCH (SEC)



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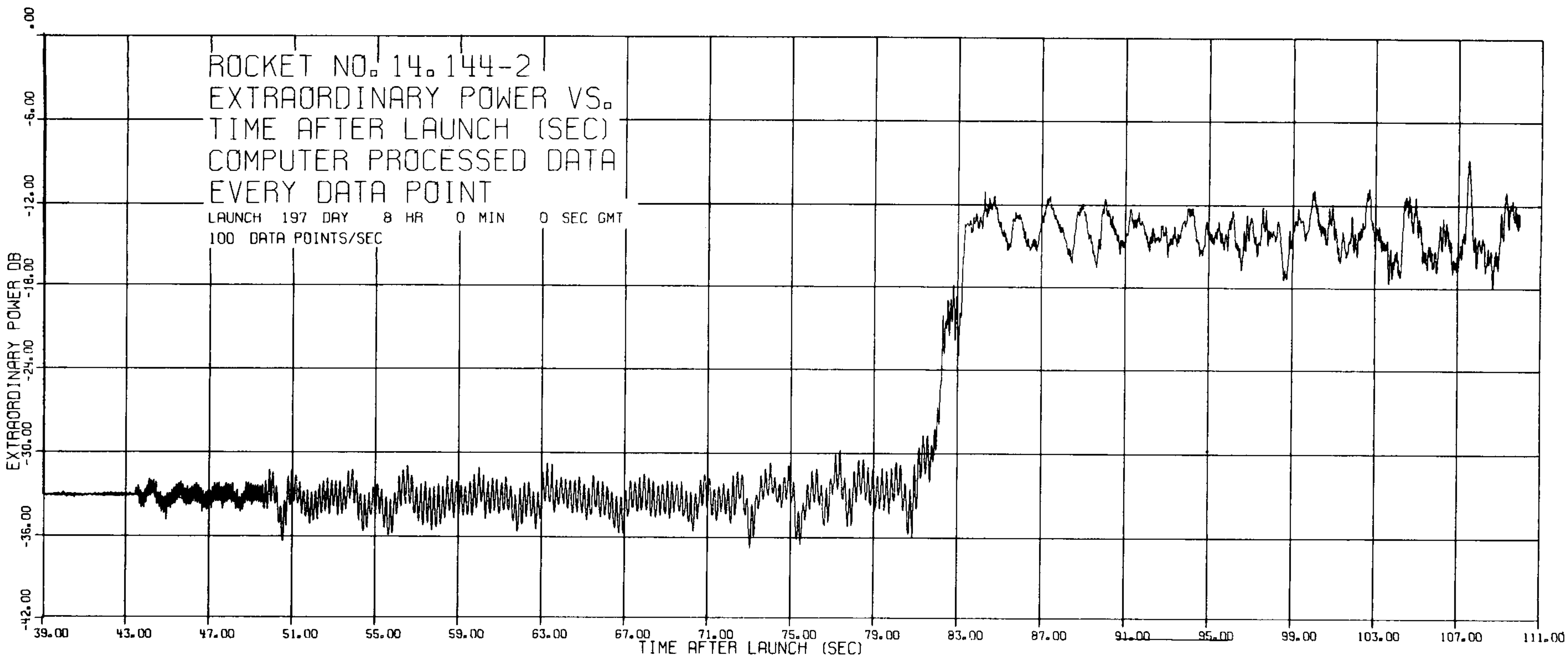
100 DATA POINTS/SEC
EXTRAORDINARY POWER DB
TIME AFTER LAUNCH (SEC)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TIME AFTER LAUNCH (SEC)
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100 DATA POINTS/SEC
EXTRAORDINARY POWER DB
.00
-6.00
-12.00
-18.00
-24.00
-30.00
-36.00
-42.00
39.00
43.00
47.00
51.00
55.00
59.00
63.00
67.00
71.00
75.00
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83.00
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91.00
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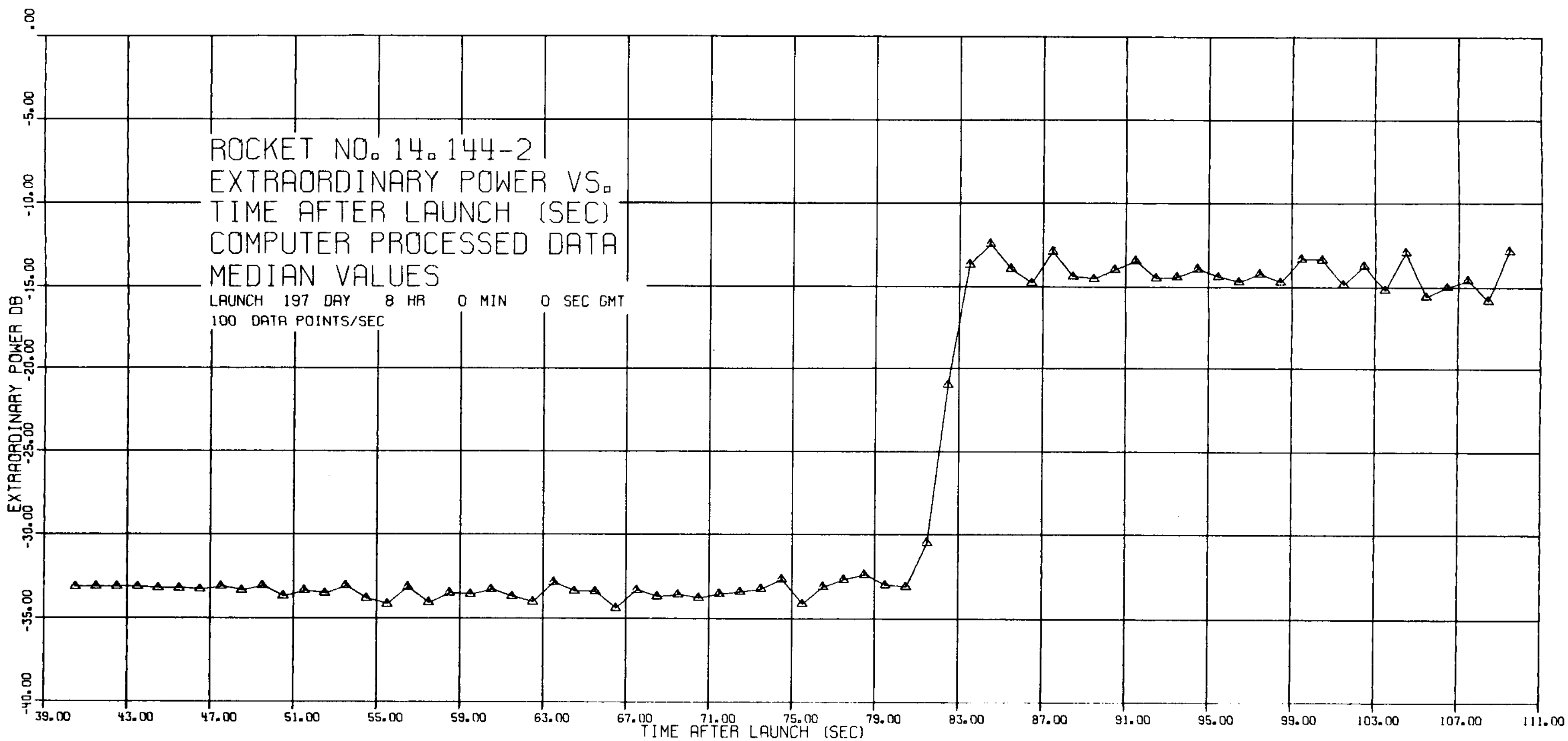
103.00
107.00
111.00
TIME AFTER LAUNCH (SEC)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TIME AFTER LAUNCH (SEC)
COMPUTER PROCESSED DATA
MEDIAN VALUES
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EXTRAORDINARY POWER DB
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-10.00
-15.00
-20.00
-25.00
-30.00
-35.00
-40.00
39.00
43.00
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63.00
67.00
71.00
75.00
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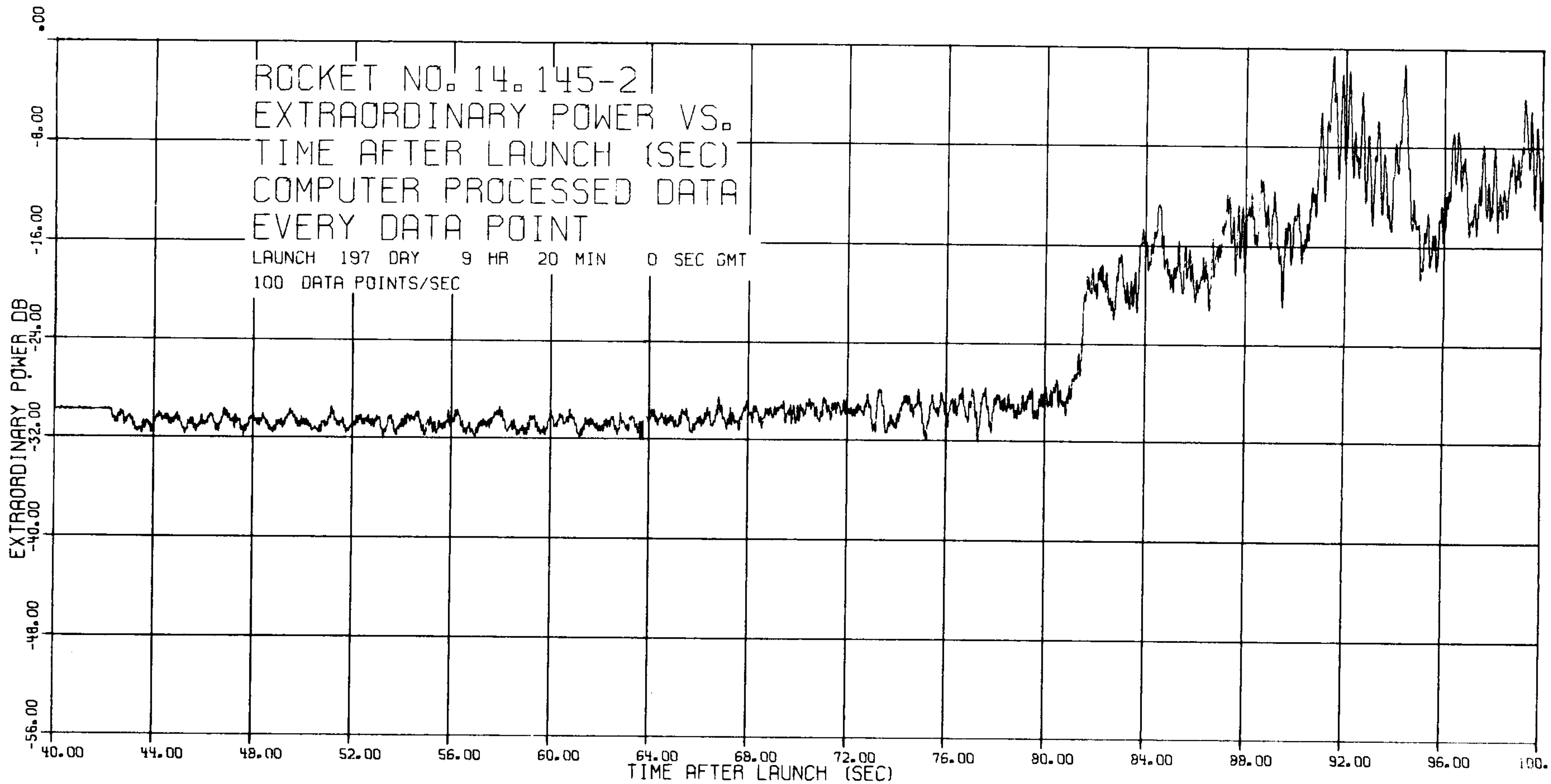
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100 DATA POINTS/SEC
EXTRAORDINARY POWER DB
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-16.00
-24.00
-32.00
-40.00
-48.00
-56.00
40.00
44.00
48.00
52.00
56.00
60.00
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88.00
92.00
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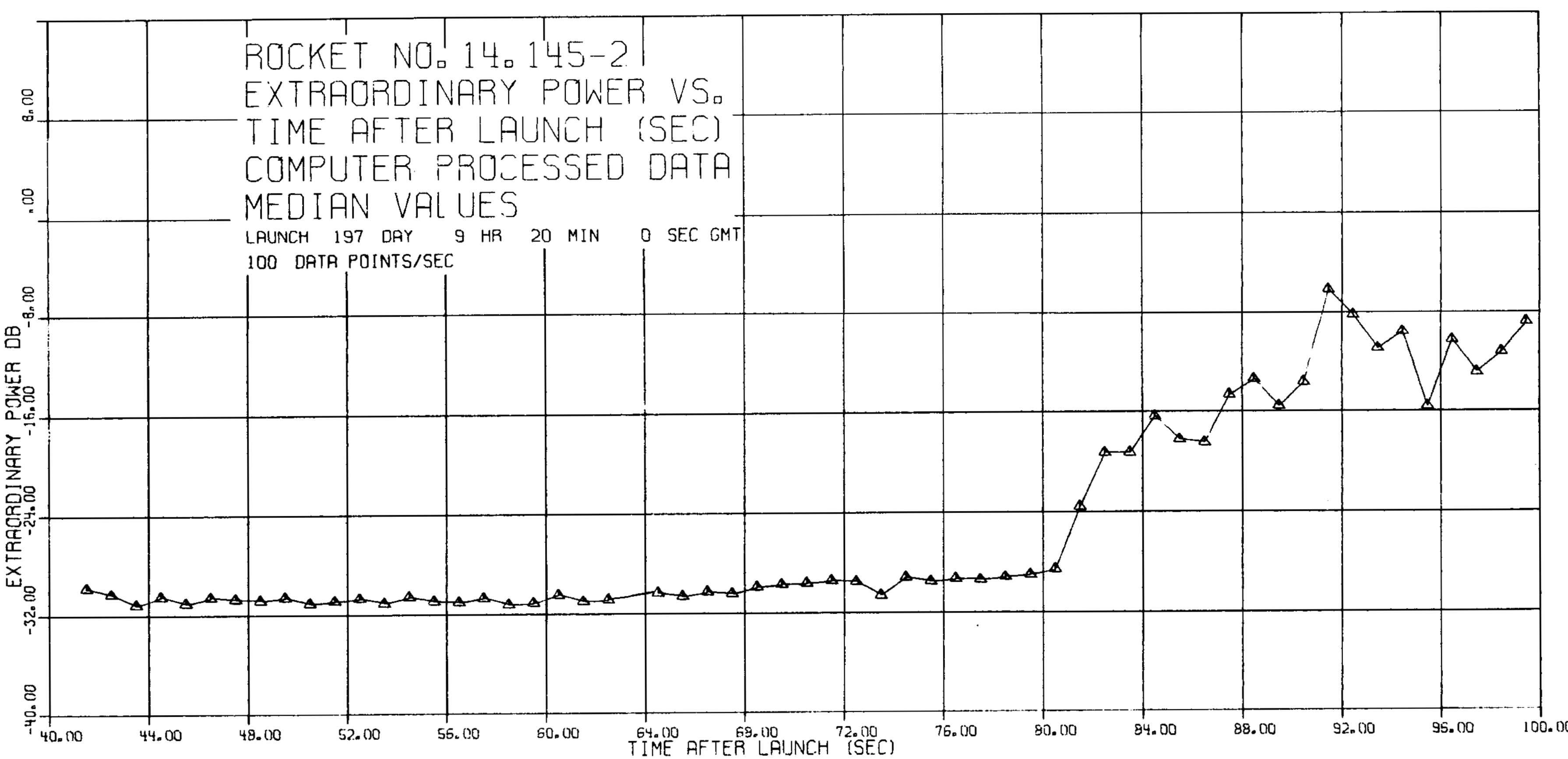
TIME AFTER LAUNCH (SEC)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COMPUTER PROCESSED DATA
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100 DATA POINTS/SEC
EXTRAORDINARY POWER DB
8.00
.00
-8.00
-16.00
-24.00
-32.00
-40.00
40.00
44.00
48.00
52.00
56.00
60.00
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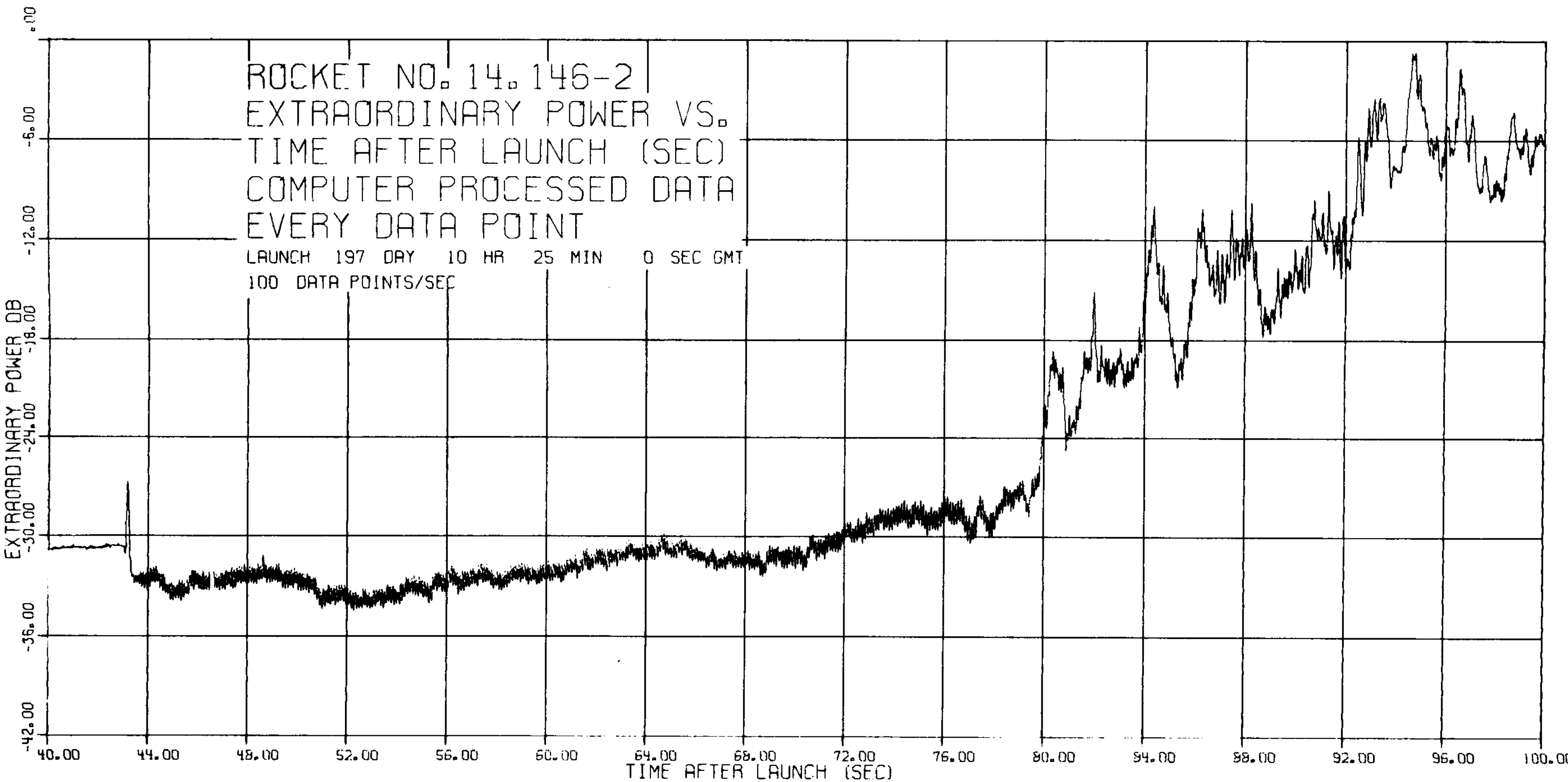

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100 DATA POINTS/SEC
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48.00
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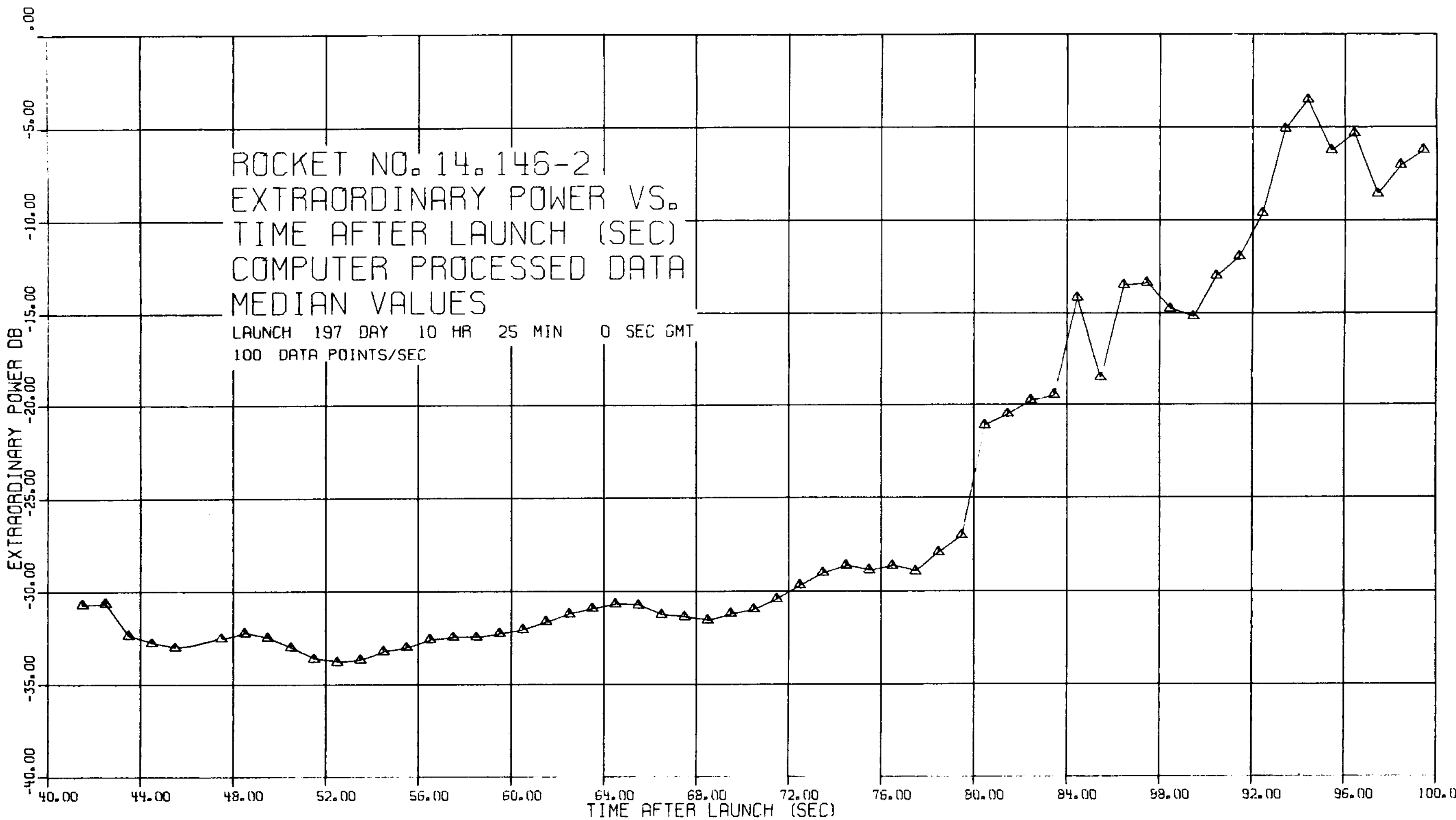
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52.00
56.00
60.00
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96.00
100.00
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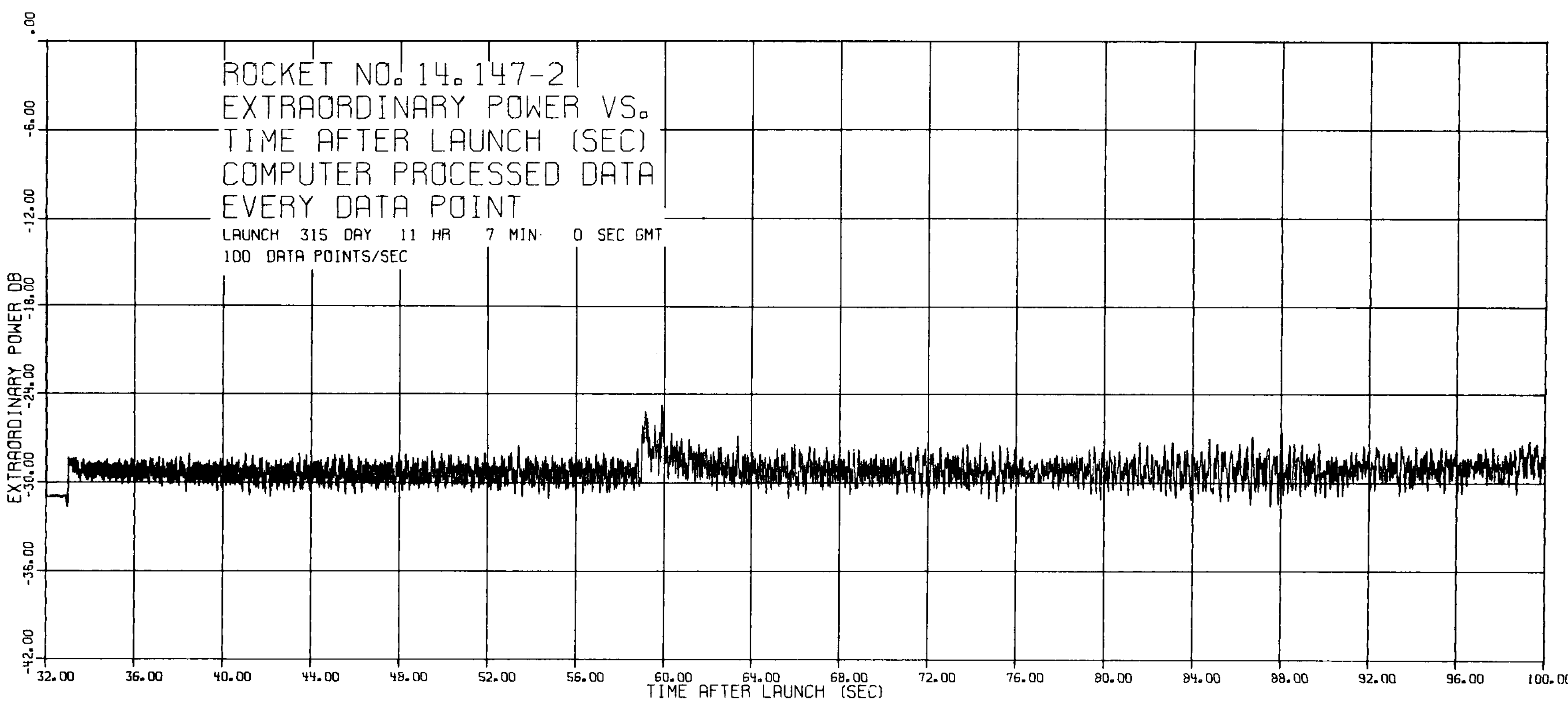
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COMPUTER PROCESSED DATA
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100 DATA POINTS/SEC
EXTRAORDINARY POWER DB
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-12.00
-18.00
-24.00
-30.00
-36.00
-42.00
32.00
36.00
40.00
44.00
48.00
52.00
56.00
60.00
64.00
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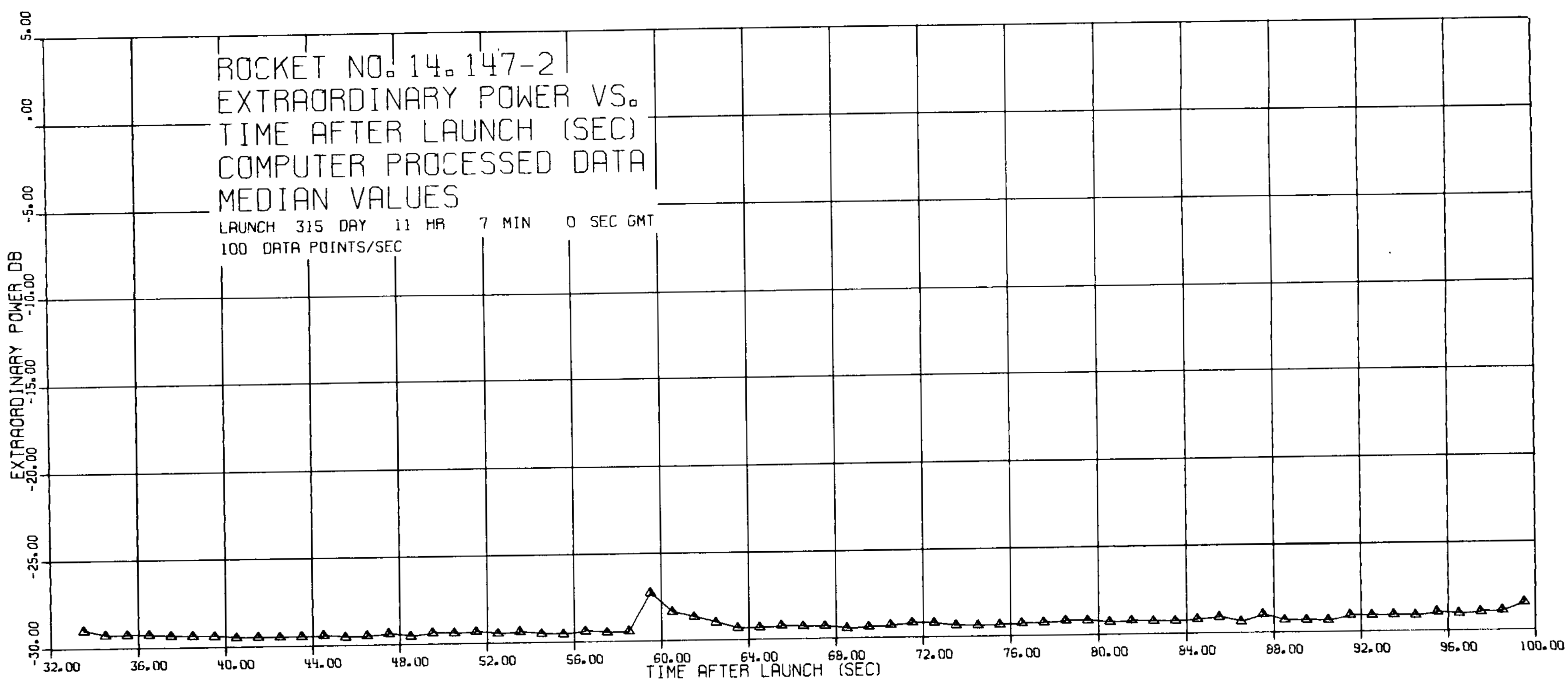
72.00
76.00
80.00
84.00
88.00
92.00
96.00
100.00
TIME AFTER LAUNCH (SEC)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TIME AFTER LAUNCH (SEC)
COMPUTER PROCESSED DATA
MEDIAN VALUES
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100 DATA POINTS/SEC
EXTRAORDINARY POWER DB
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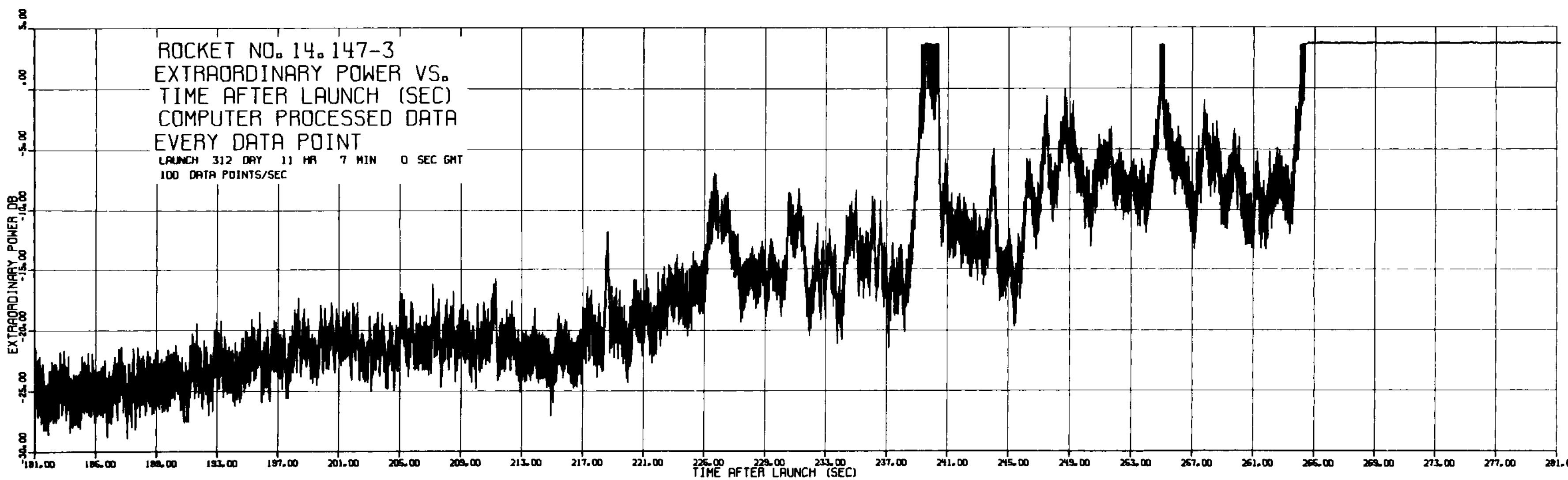
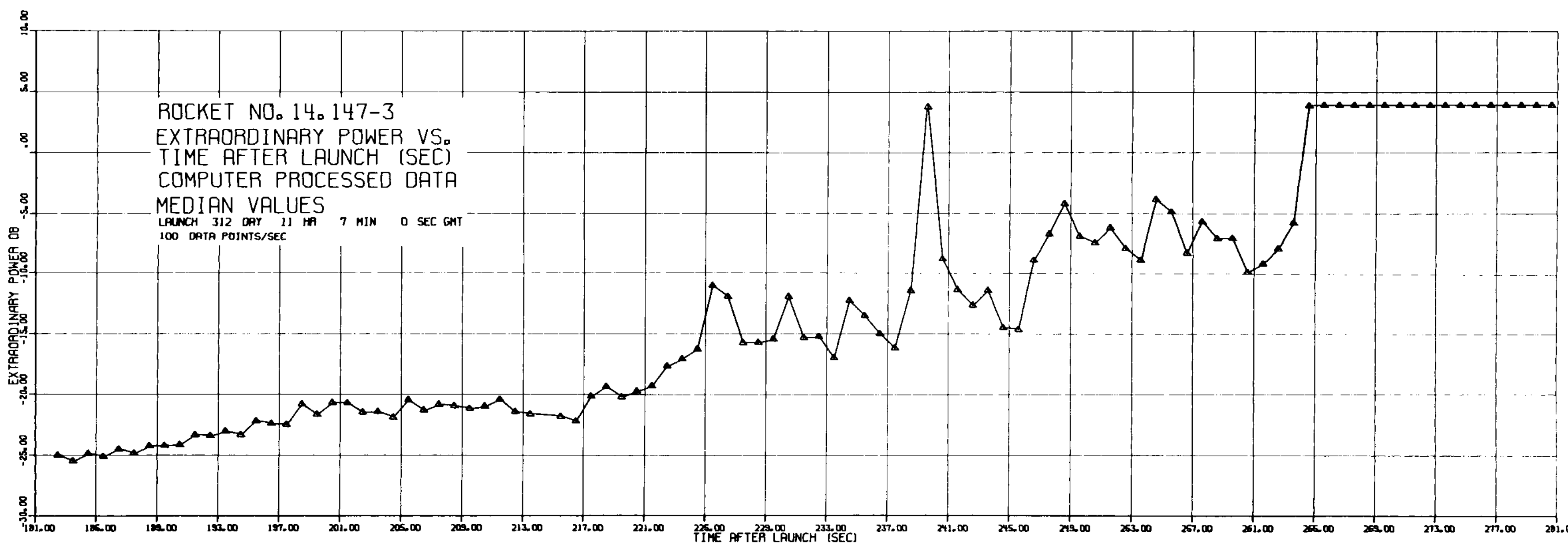
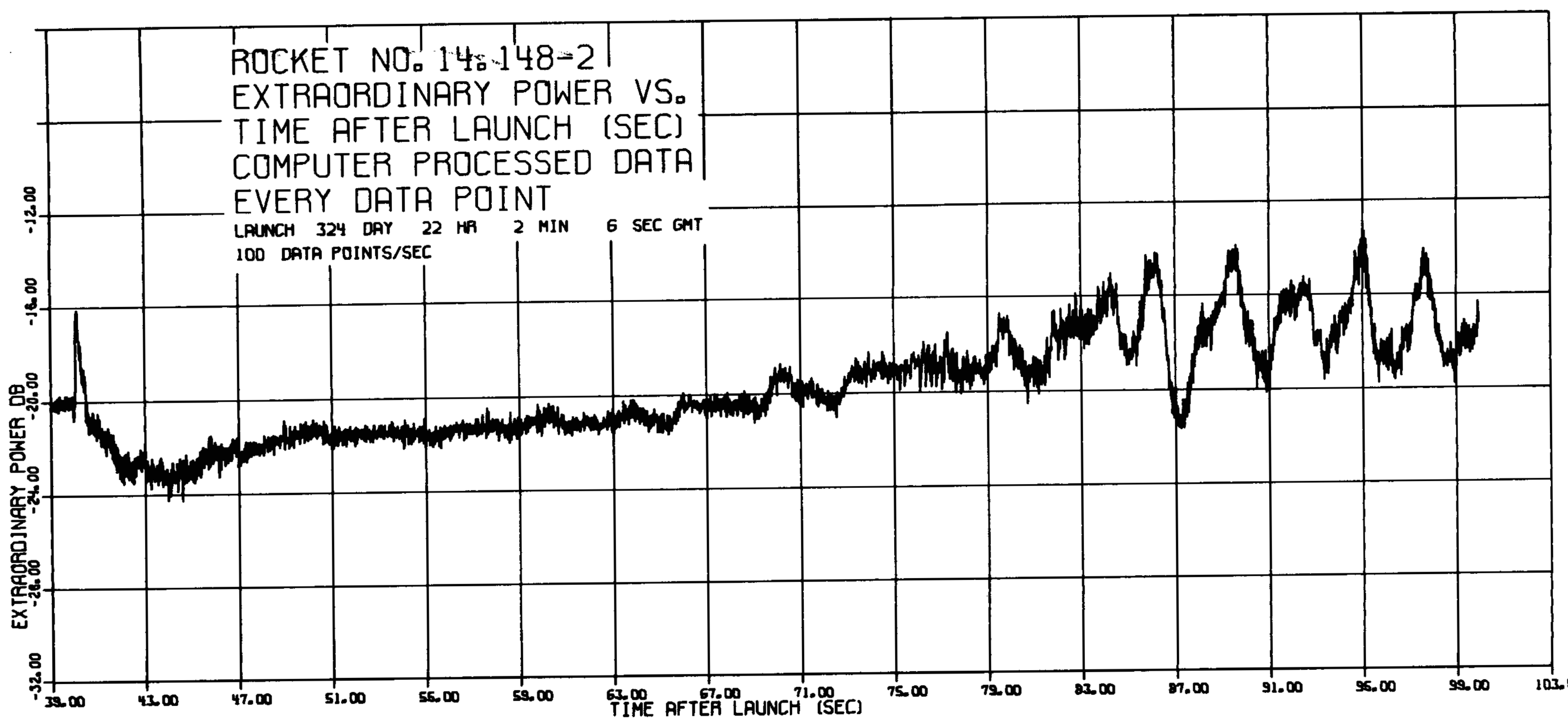
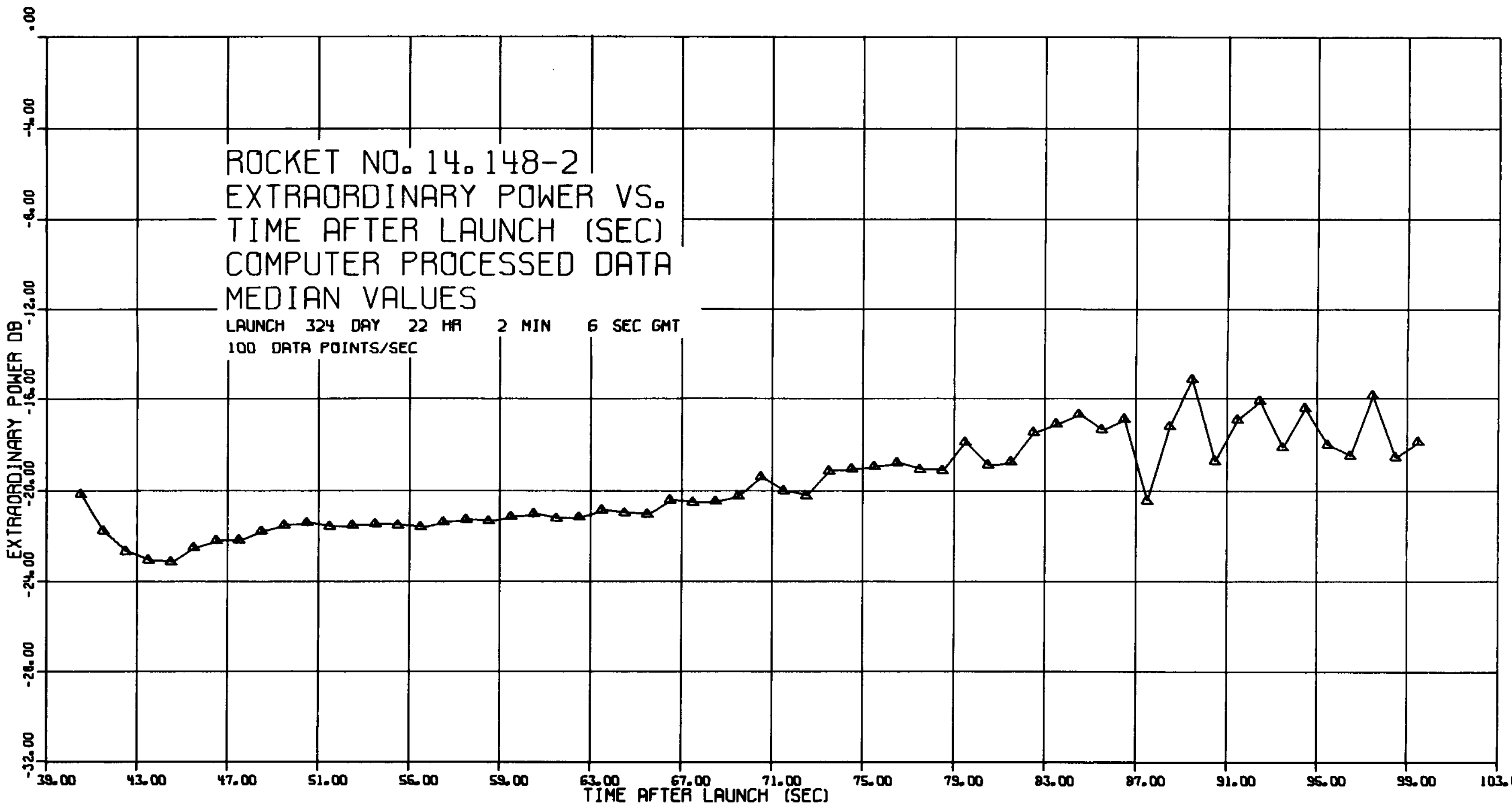
.00
-5.00
-10.00
-15.00
-20.00
-25.00
-30.00
32.00
36.00
40.00
44.00
48.00
52.00
56.00
60.00
64.00
68.00
72.00
76.00
80.00
84.00
88.00
92.00
96.00
100.00
TIME AFTER LAUNCH (SEC)

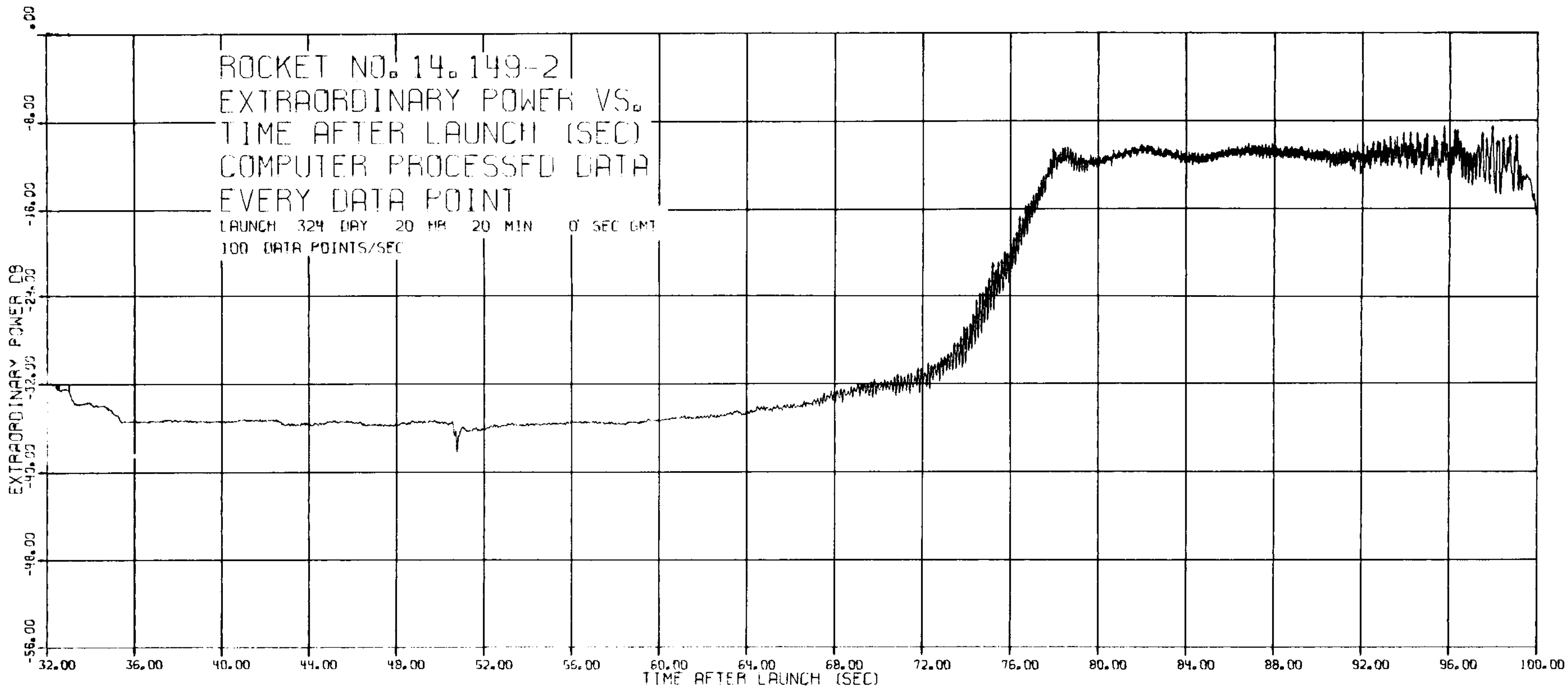

ROCKET NO. 14.147-3
EXTRAORDINARY POWER VS.
TIME AFTER LAUNCH (SEC)
COMPUTER PROCESSED DATA
EVERY DATA POINT
LAUNCH 312 DAY 11 HR 7 MIN 0 SEC GMT
100 DATA POINTS/SEC
EXTRAORDINARY POWER DB
TIME AFTER LAUNCH (SEC)


ROCKET NO. 14.147-3
EXTRAORDINARY POWER VS.
TIME AFTER LAUNCH (SEC)
COMPUTER PROCESSED DATA
MEDIAN VALUES
LAUNCH 312 DAY 11 HR 7 MIN 0 SEC GMT
100 DATA POINTS/SEC
EXTRAORDINARY POWER DB
TIME AFTER LAUNCH (SEC)

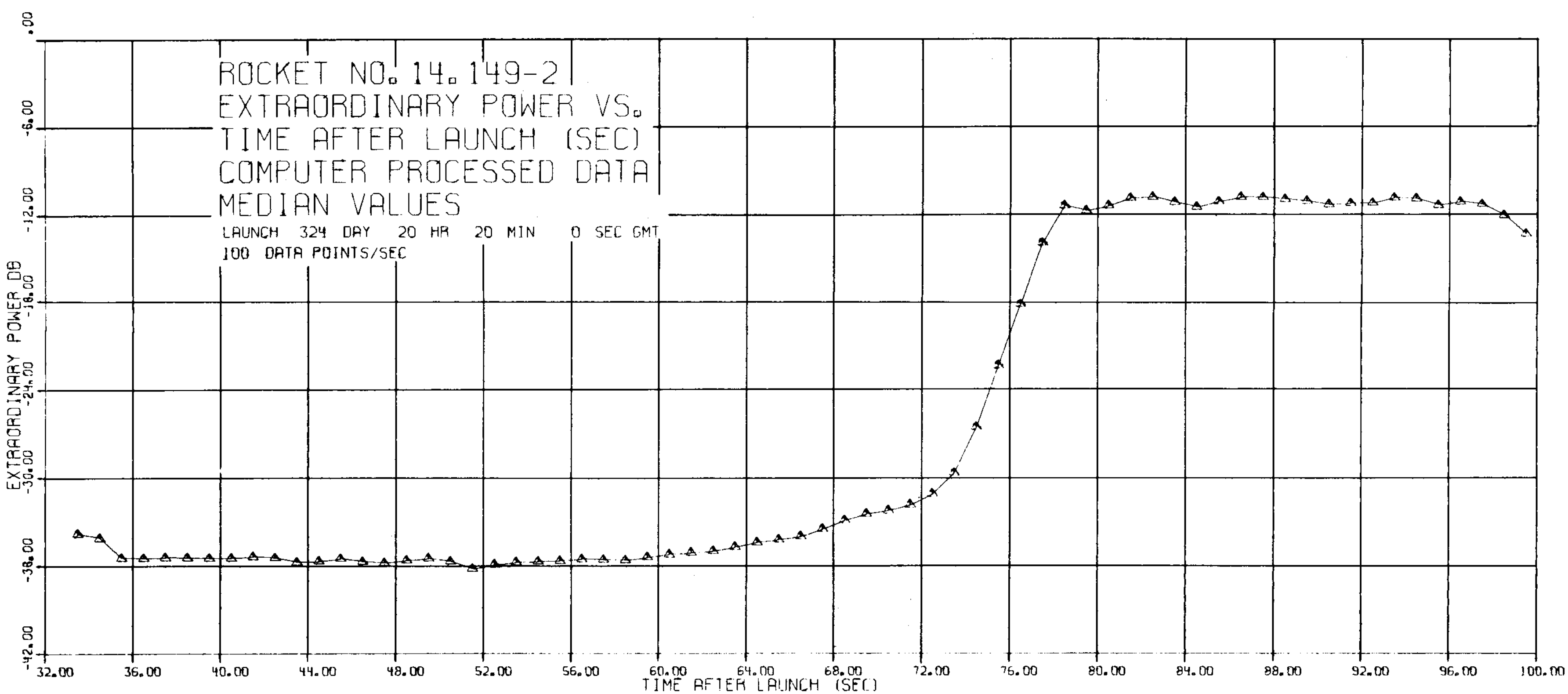

ROCKET NO. 14.148-2
EXTRAORDINARY POWER VS.
TIME AFTER LAUNCH (SEC)
COMPUTER PROCESSED DATA
EVERY DATA POINT
LAUNCH 324 DAY 22 HR 2 MIN 6 SEC GMT
100 DATA POINTS/SEC
EXTRAORDINARY POWER DB
-12.00
-16.00
-20.00
-24.00
-28.00
-32.00
39.00
43.00
47.00
51.00
56.00
59.00
63.00
67.00
71.00
75.00
79.00
83.00
87.00
91.00
96.00
99.00
103.00
TIME AFTER LAUNCH (SEC)



ROCKET NO. 14.148-2
EXTRAORDINARY POWER VS.
TIME AFTER LAUNCH (SEC)
COMPUTER PROCESSED DATA
MEDIAN VALUES
LAUNCH 324 DAY 22 HR 2 MIN 6 SEC GMT
100 DATA POINTS/SEC
EXTRAORDINARY POWER DB
.00
-4.00
-8.00
-12.00
-16.00
-20.00
-24.00
-28.00
-32.00
TIME AFTER LAUNCH (SEC)
39.00
43.00
47.00
51.00
55.00
59.00
63.00
67.00
71.00
75.00
79.00
83.00
87.00
91.00
95.00
99.00
103.00



ROCKET NO. 14.149-2
EXTRAORDINARY POWER VS.
TIME AFTER LAUNCH (SEC)
COMPUTER PROCESSED DATA
EVERY DATA POINT
LAUNCH 324 DAY 20 HR 20 MIN 0 SEC GMT
100 DATA POINTS/SEC
EXTRAORDINARY POWER DB
.00
-8.00
-16.00
-24.00
-32.00
-40.00
-48.00
-56.00
32.00
36.00
40.00
44.00
48.00
52.00
56.00
60.00
64.00
68.00
72.00
76.00
80.00
84.00
88.00
92.00
96.00
100.00
TIME AFTER LAUNCH (SEC)


ROCKET NO. 14.149-2
EXTRAORDINARY POWER VS.
TIME AFTER LAUNCH (SEC)
COMPUTER PROCESSED DATA
MEDIAN VALUES
LAUNCH 324 DAY 20 HR 20 MIN 0 SEC GMT
100 DATA POINTS/SEC
EXTRAORDINARY POWER DB
.00
-6.00
-12.00
-18.00
-24.00
-30.00
-36.00
-42.00
TIME AFTER LAUNCH (SEC)
32.00
36.00
40.00
44.00
48.00
52.00
56.00
60.00
64.00
68.00
72.00
76.00
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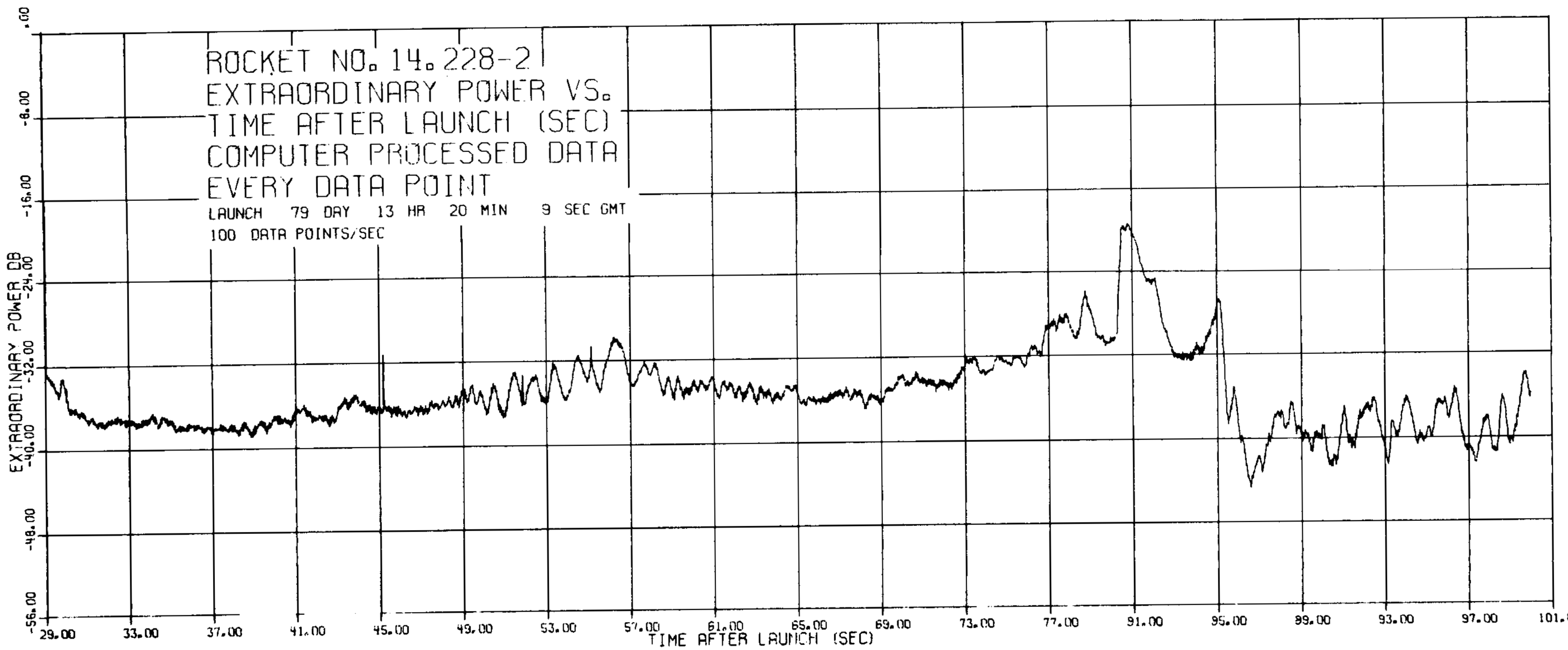
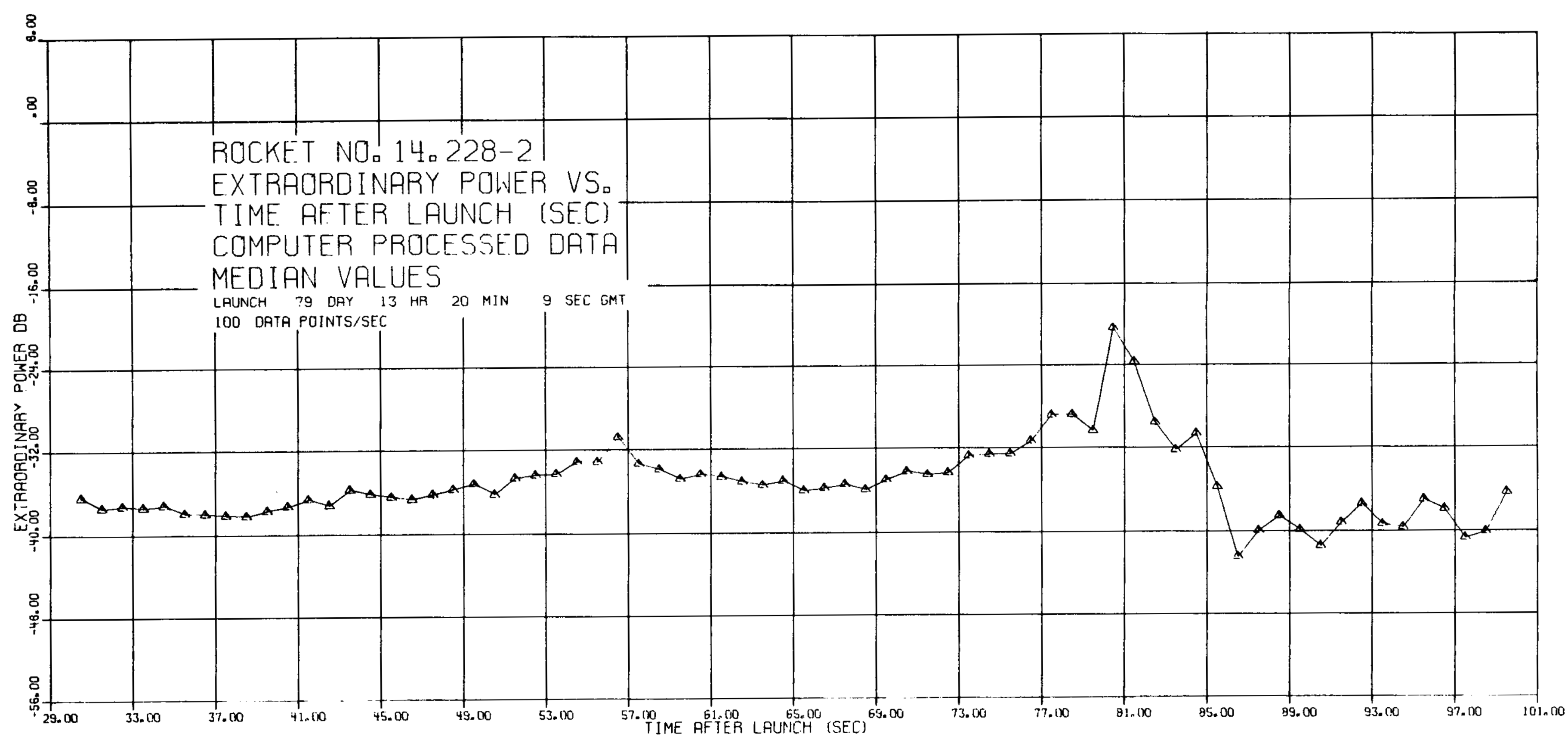
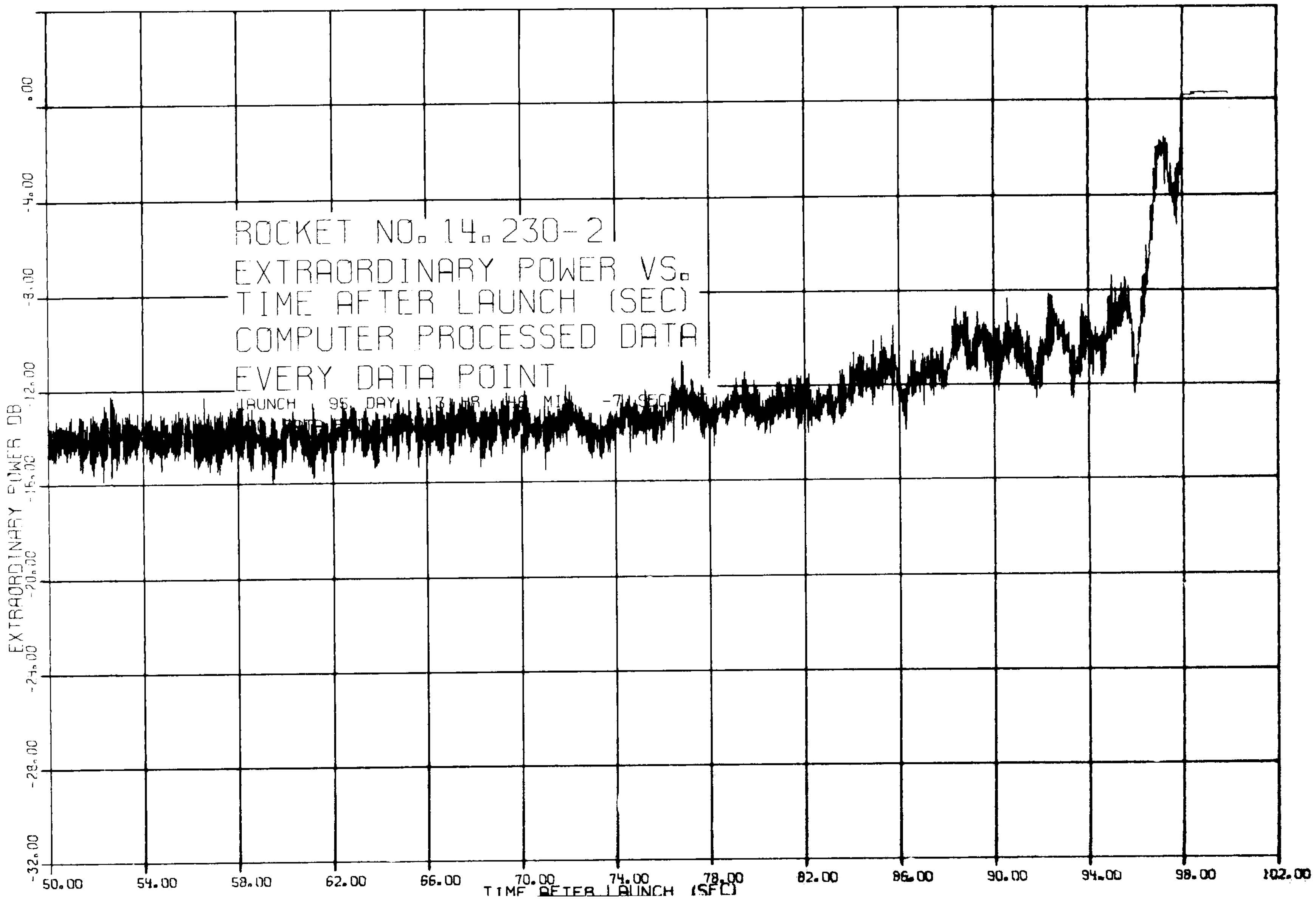
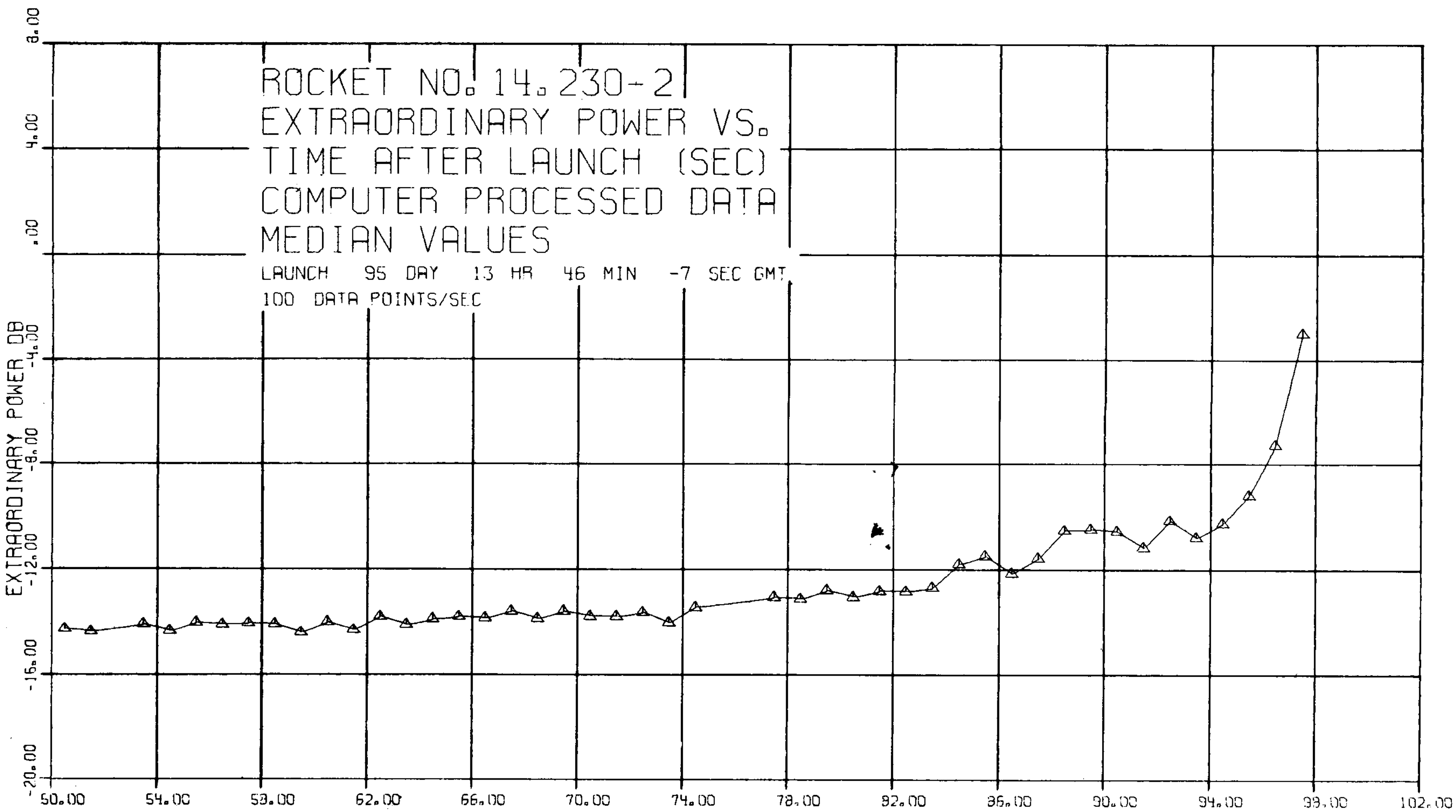
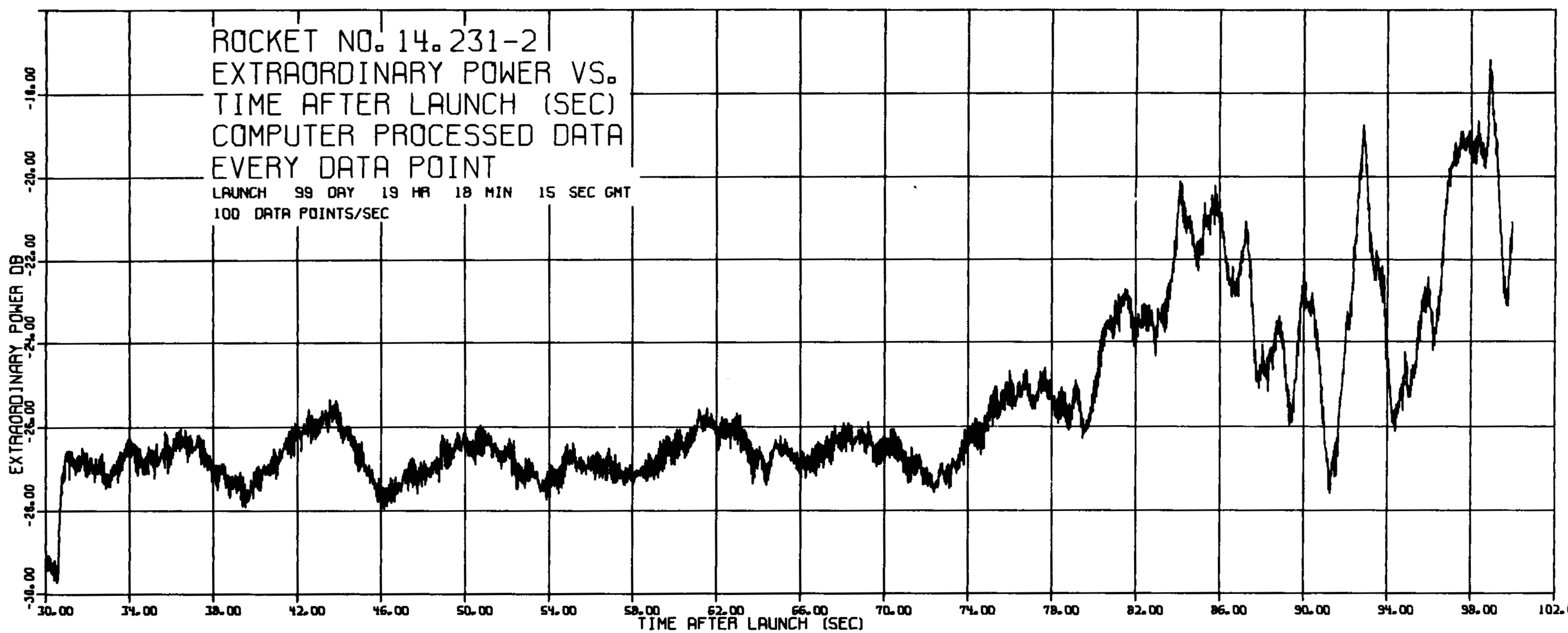
92.00
96.00
100.00

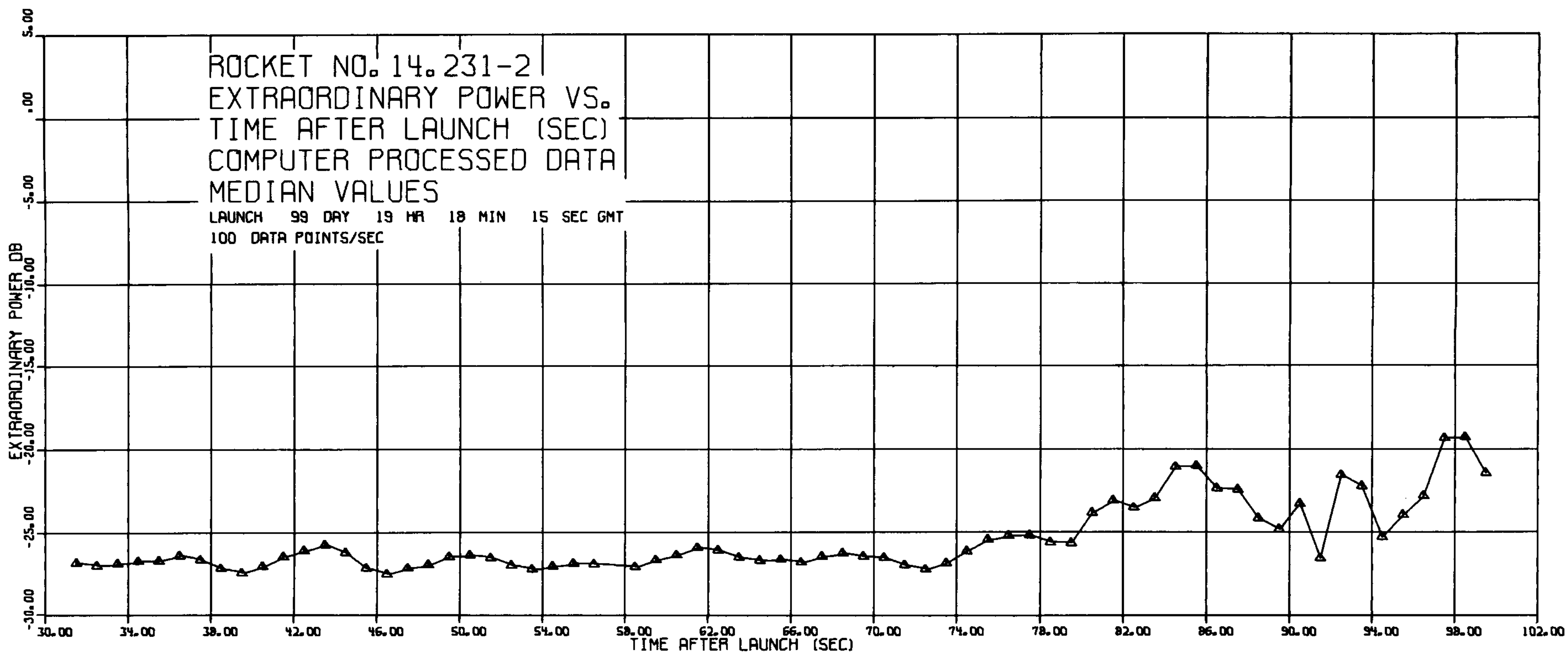

ROCKET NO. 14.228-2
EXTRAORDINARY POWER VS.
TIME AFTER LAUNCH (SEC)
COMPUTER PROCESSED DATA
EVERY DATA POINT
LAUNCH 79 DAY 13 HR 20 MIN 9 SEC GMT
100 DATA POINTS/SEC
EXTRAORDINARY POWER DB
.00
-8.00
-16.00
-24.00
-32.00
-40.00
-48.00
-56.00
29.00
33.00
37.00
41.00
45.00
49.00
53.00
57.00
61.00
65.00
69.00
73.00
77.00
91.00
95.00
99.00
93.00
97.00
101.00
TIME AFTER LAUNCH (SEC)


ROCKET NO. 14.228-2
EXTRAORDINARY POWER VS.
TIME AFTER LAUNCH (SEC)
COMPUTER PROCESSED DATA
MEDIAN VALUES
LAUNCH 79 DAY 13 HR 20 MIN 9 SEC GMT
100 DATA POINTS/SEC
EXTRAORDINARY POWER DB
8.00
.00
-8.00
-16.00
-24.00
-32.00
-40.00
-48.00
-56.00
29.00
33.00
37.00
41.00
45.00
49.00
53.00
57.00
61.00
65.00
69.00
73.00
77.00
81.00
85.00
89.00
93.00
97.00
101.00
TIME AFTER LAUNCH (SEC)

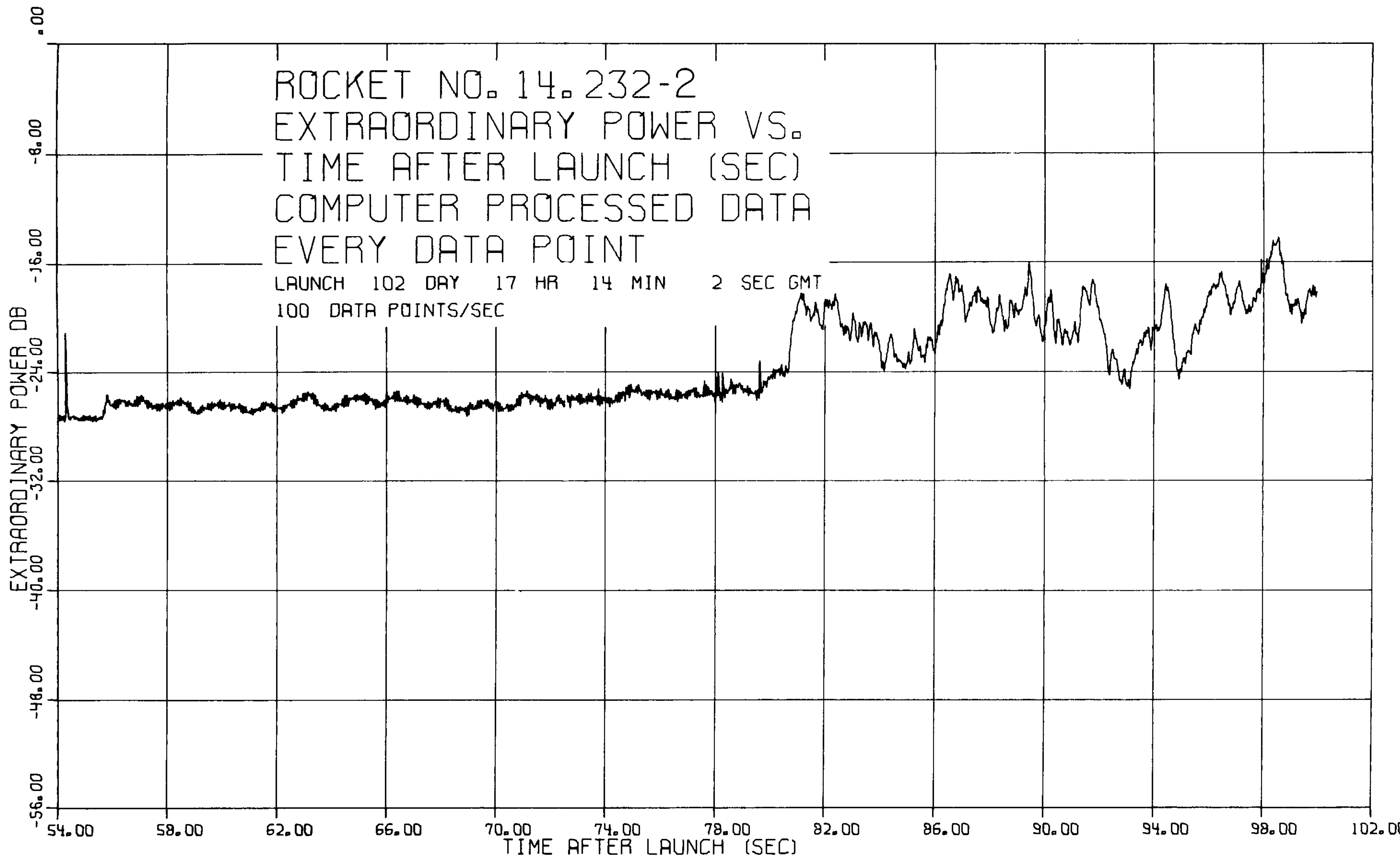

ROCKET NO. 14.230-2
EXTRAORDINARY POWER VS.
TIME AFTER LAUNCH (SEC)
COMPUTER PROCESSED DATA
EVERY DATA POINT
LAUNCH 95 DAY 13 HR 49 MI -7 SEC
EXTRAORDINARY POWER DB
TIME AFTER LAUNCH (SEC)
.00
-4.00
-8.00
-12.00
-16.00
-20.00
-24.00
-28.00
-32.00
50.00
54.00
58.00
62.00
66.00
70.00
74.00
78.00
82.00
86.00
90.00
94.00
98.00
102.00

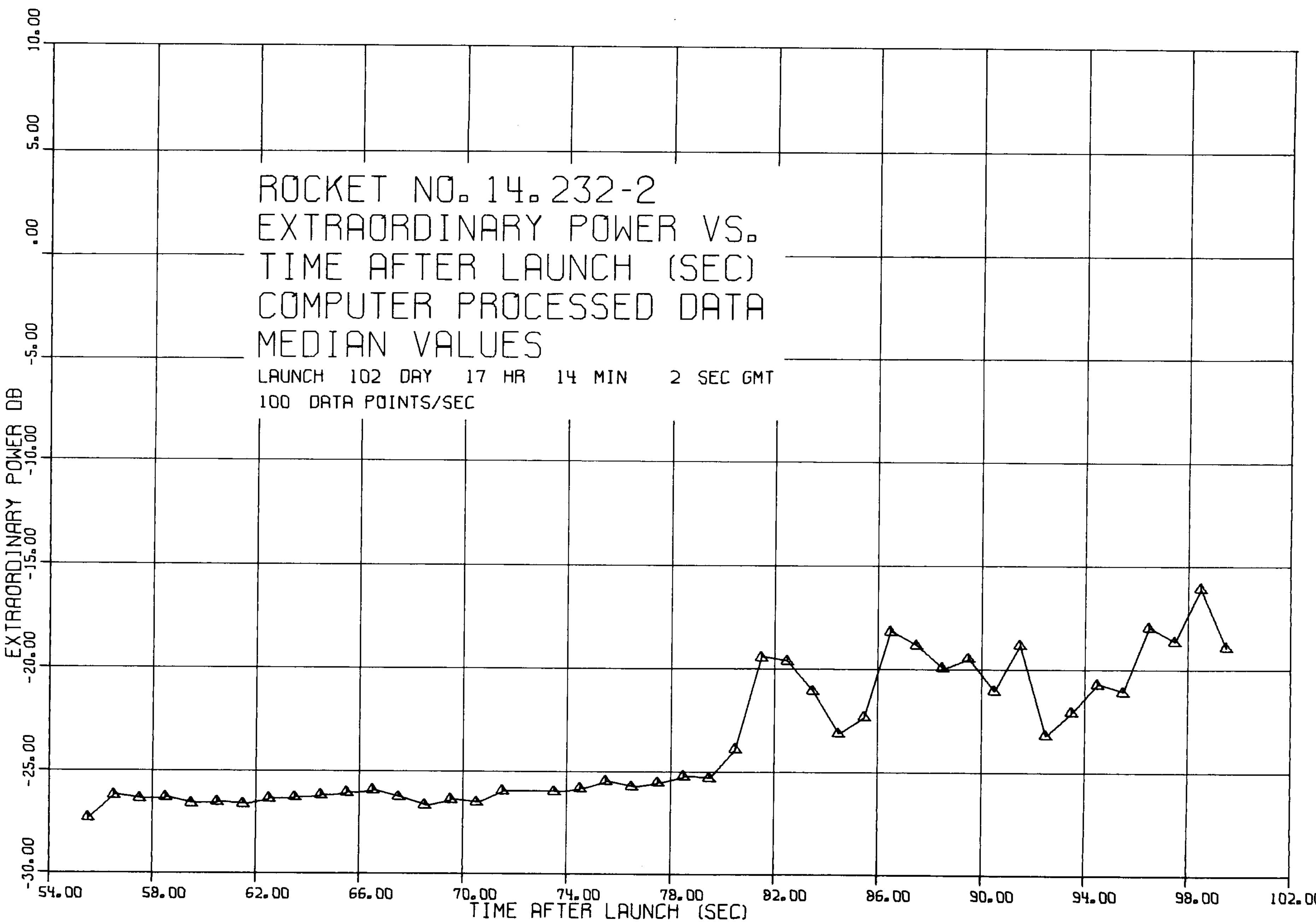

ROCKET NO. 14.230-2
EXTRAORDINARY POWER VS.
TIME AFTER LAUNCH (SEC)
COMPUTER PROCESSED DATA
MEDIAN VALUES
LAUNCH 95 DAY 13 HR 46 MIN -7 SEC GMT
100 DATA POINTS/SEC
EXTRAORDINARY POWER DB
8.00
4.00
.00
-4.00
-8.00
-12.00
-16.00
-20.00
50.00
54.00
58.00
62.00
66.00
70.00
74.00
78.00
82.00
86.00
90.00
94.00
98.00
102.00


ROCKET NO. 14.231-2
EXTRAORDINARY POWER VS.
TIME AFTER LAUNCH (SEC)
COMPUTER PROCESSED DATA
EVERY DATA POINT
LAUNCH 99 DAY 19 HR 18 MIN 15 SEC GMT
100 DATA POINTS/SEC
EXTRAORDINARY POWER DB
-18.00
-20.00
-22.00
-24.00
-26.00
-28.00
-30.00
30.00
34.00
38.00
42.00
46.00
50.00
54.00
58.00
62.00
66.00
70.00
74.00
78.00
82.00
86.00
90.00
94.00
98.00
TIME AFTER LAUNCH (SEC)

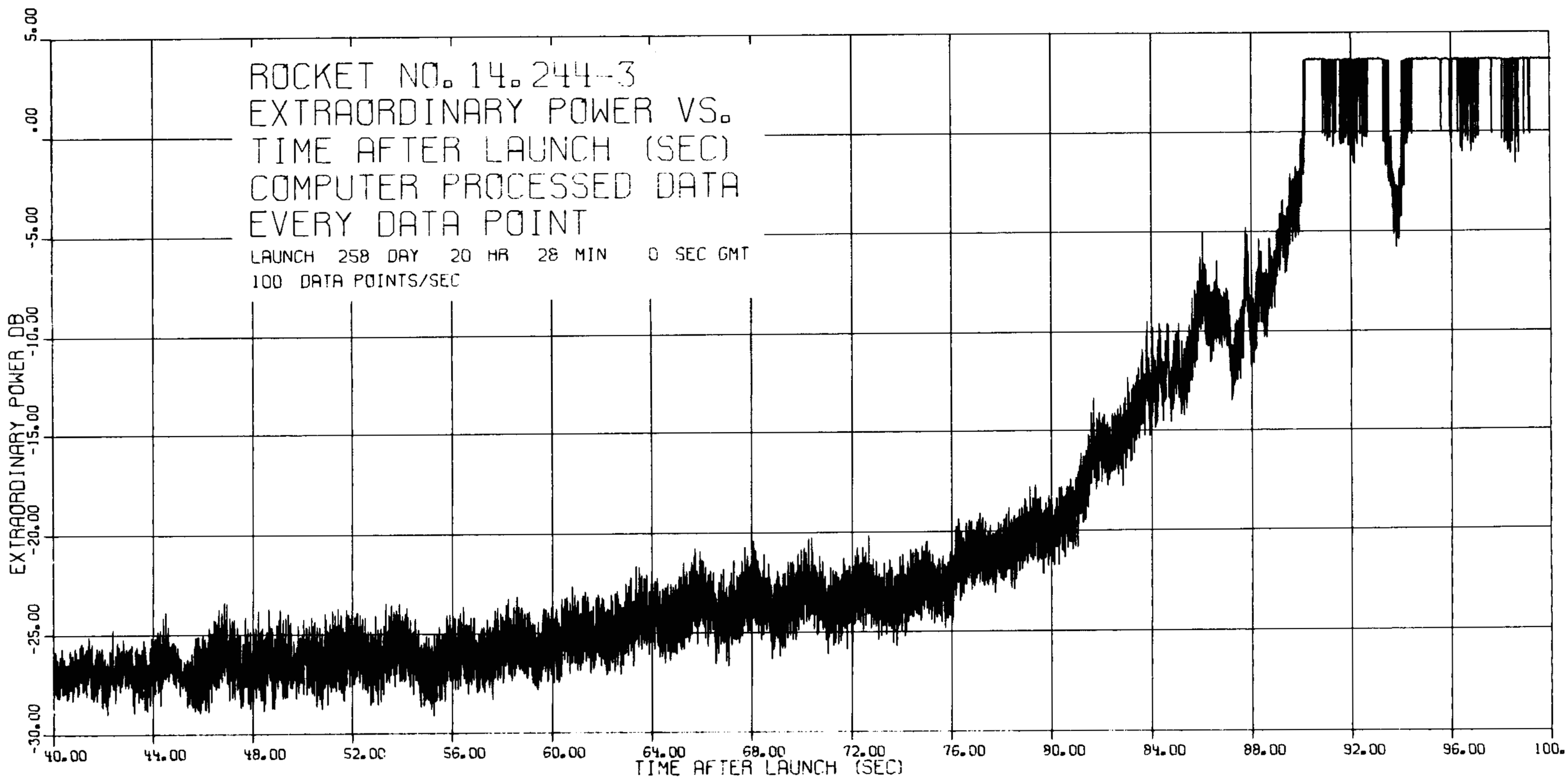


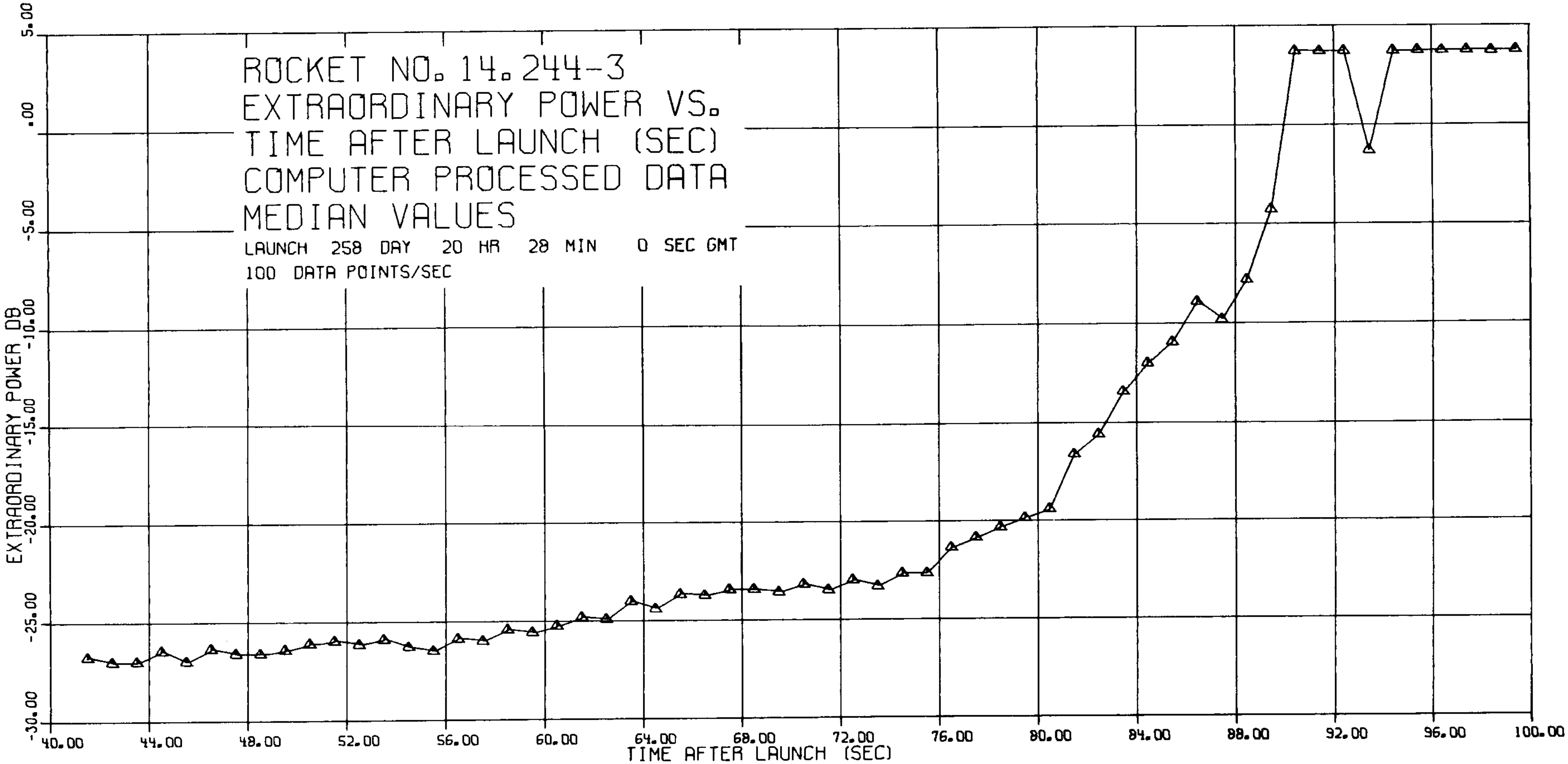
ROCKET NO. 14.231-2
EXTRAORDINARY POWER VS.
TIME AFTER LAUNCH (SEC)
COMPUTER PROCESSED DATA
MEDIAN VALUES
LAUNCH 99 DAY 19 HR 18 MIN 15 SEC GMT
100 DATA POINTS/SEC
EXTRAORDINARY POWER DB
5.00
.00
-5.00
-10.00
-15.00
-20.00
-25.00
-30.00
30.00
34.00
38.00
42.00
46.00
50.00
54.00
58.00
62.00
66.00
70.00
74.00
78.00
82.00
86.00
90.00
94.00
98.00
102.00
TIME AFTER LAUNCH (SEC)

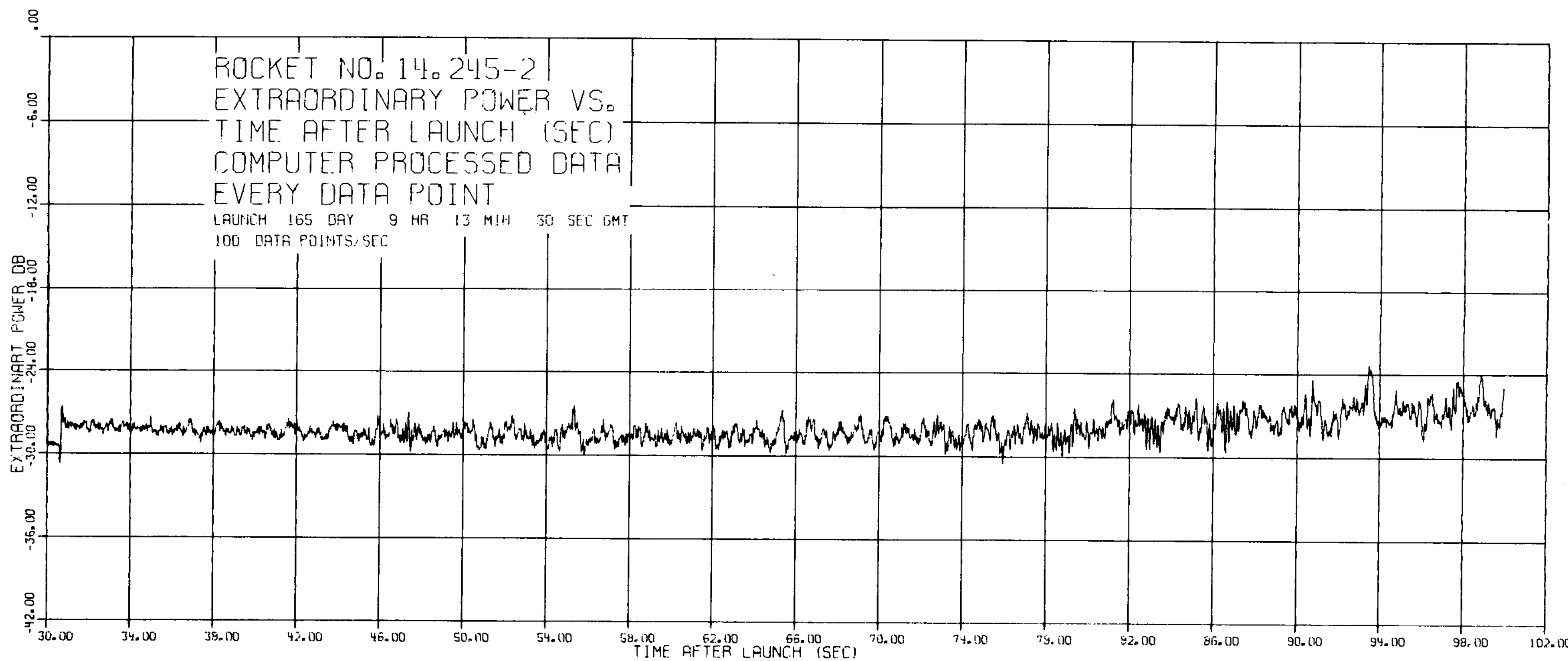

ROCKET NO. 14.232-2
EXTRAORDINARY POWER VS.
TIME AFTER LAUNCH (SEC)
COMPUTER PROCESSED DATA
EVERY DATA POINT
LAUNCH 102 DAY 17 HR 14 MIN 2 SEC GMT
100 DATA POINTS/SEC
EXTRAORDINARY POWER DB
.00
-8.00
-16.00
-24.00
-32.00
-40.00
-48.00
-56.00
54.00
58.00
62.00
66.00
70.00
74.00
78.00
82.00
86.00
90.00
94.00
98.00
102.00
TIME AFTER LAUNCH (SEC)



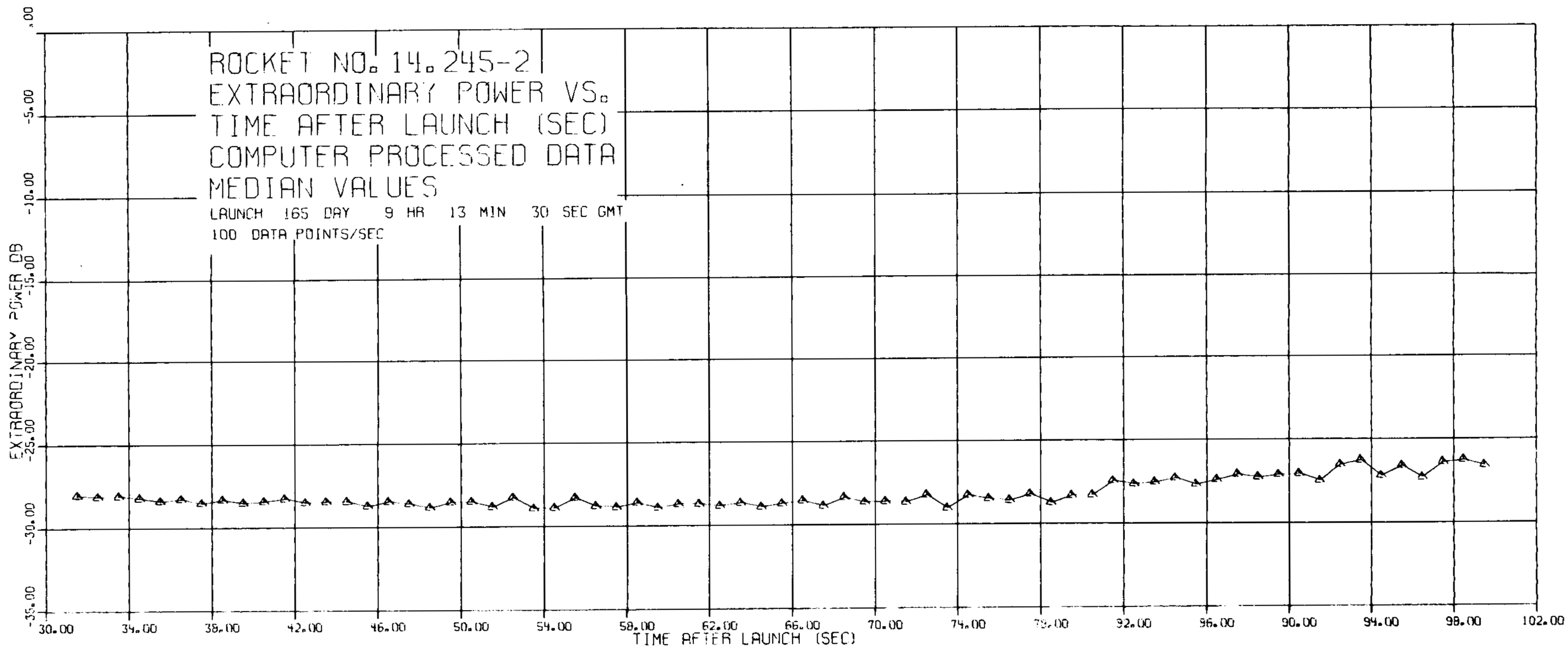
ROCKET NO. 14.232-2
EXTRAORDINARY POWER VS.
TIME AFTER LAUNCH (SEC)
COMPUTER PROCESSED DATA
MEDIAN VALUES
LAUNCH 102 DAY 17 HR 14 MIN 2 SEC GMT
100 DATA POINTS/SEC
EXTRAORDINARY POWER DB
10.00
5.00
.00
-5.00
-10.00
-15.00
-20.00
-25.00
-30.00
54.00
58.00
62.00
66.00
70.00
74.00
78.00
82.00
86.00
90.00
94.00
98.00
102.00
TIME AFTER LAUNCH (SEC)

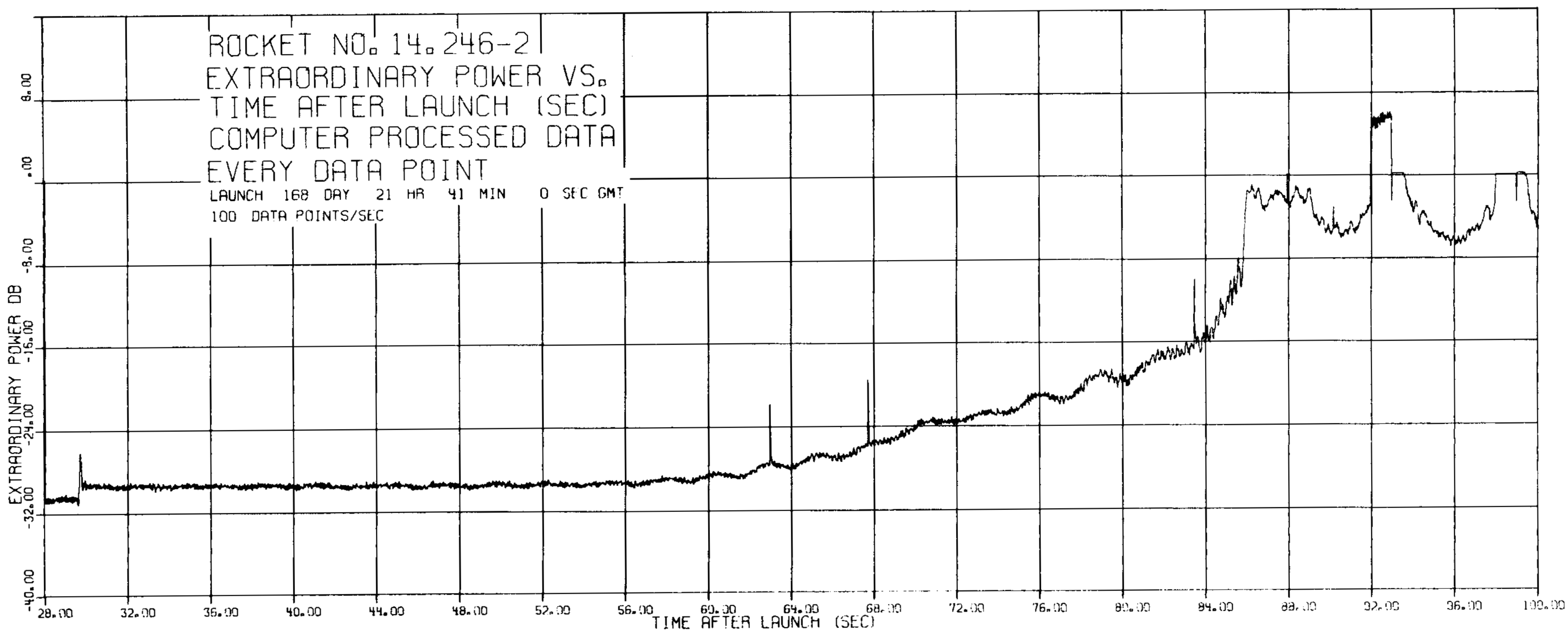

ROCKET NO. 14.244-3
EXTRAORDINARY POWER VS.
TIME AFTER LAUNCH (SEC)
COMPUTER PROCESSED DATA
EVERY DATA POINT
LAUNCH 258 DAY 20 HR 28 MIN 0 SEC GMT
100 DATA POINTS/SEC
EXTRAORDINARY POWER DB
5.00
.00
-5.00
-10.00
-15.00
-20.00
-25.00
-30.00
40.00
44.00
48.00
52.00
56.00
60.00
64.00
68.00
72.00
76.00
80.00
84.00
88.00
92.00
96.00
100.00
TIME AFTER LAUNCH (SEC)


ROCKET NO. 14.244-3
EXTRAORDINARY POWER VS.
TIME AFTER LAUNCH (SEC)
COMPUTER PROCESSED DATA
MEDIAN VALUES
LAUNCH 258 DAY 20 HR 28 MIN 0 SEC GMT
100 DATA POINTS/SEC
EXTRAORDINARY POWER DB
5.00
.00
-5.00
-10.00
-15.00
-20.00
-25.00
-30.00
TIME AFTER LAUNCH (SEC)
40.00
44.00
48.00
52.00
56.00
60.00
64.00
68.00
72.00
76.00
80.00
84.00
88.00
92.00
96.00
100.00



ROCKET NO. 14.245-2
EXTRAORDINARY POWER VS.
TIME AFTER LAUNCH (SEC)
COMPUTER PROCESSED DATA
EVERY DATA POINT
LAUNCH 165 DAY 9 HR 13 MIN 30 SEC GMT
100 DATA POINTS/SEC
EXTRAORDINART POWER DB
.00
-6.00
-12.00
-18.00
-24.00
-30.00
-36.00
-42.00
30.00
34.00
38.00
42.00
46.00
50.00
54.00
58.00
62.00
66.00
70.00
74.00
78.00
82.00
86.00
90.00
94.00
98.00
102.00
TIME AFTER LAUNCH (SEC)


ROCKET NO. 14.245-2
EXTRAORDINARY POWER VS.
TIME AFTER LAUNCH (SEC)
COMPUTER PROCESSED DATA
MEDIAN VALUES
LAUNCH 165 DAY 9 HR 13 MIN 30 SEC GMT
100 DATA POINTS/SEC
EXTRAORDINARY POWER DB
TIME AFTER LAUNCH (SEC)


ROCKET NO. 14.246-2
EXTRAORDINARY POWER VS.
TIME AFTER LAUNCH (SEC)
COMPUTER PROCESSED DATA
EVERY DATA POINT
LAUNCH 168 DAY 21 HR 41 MIN 0 SEC GMT
100 DATA POINTS/SEC
EXTRAORDINARY POWER DB
8.00
.00
-8.00
-16.00
-24.00
-32.00
-40.00
TIME AFTER LAUNCH (SEC)
28.00
32.00
36.00
40.00
44.00
48.00
52.00
56.00
60.00
64.00
68.00
72.00
76.00
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84.00
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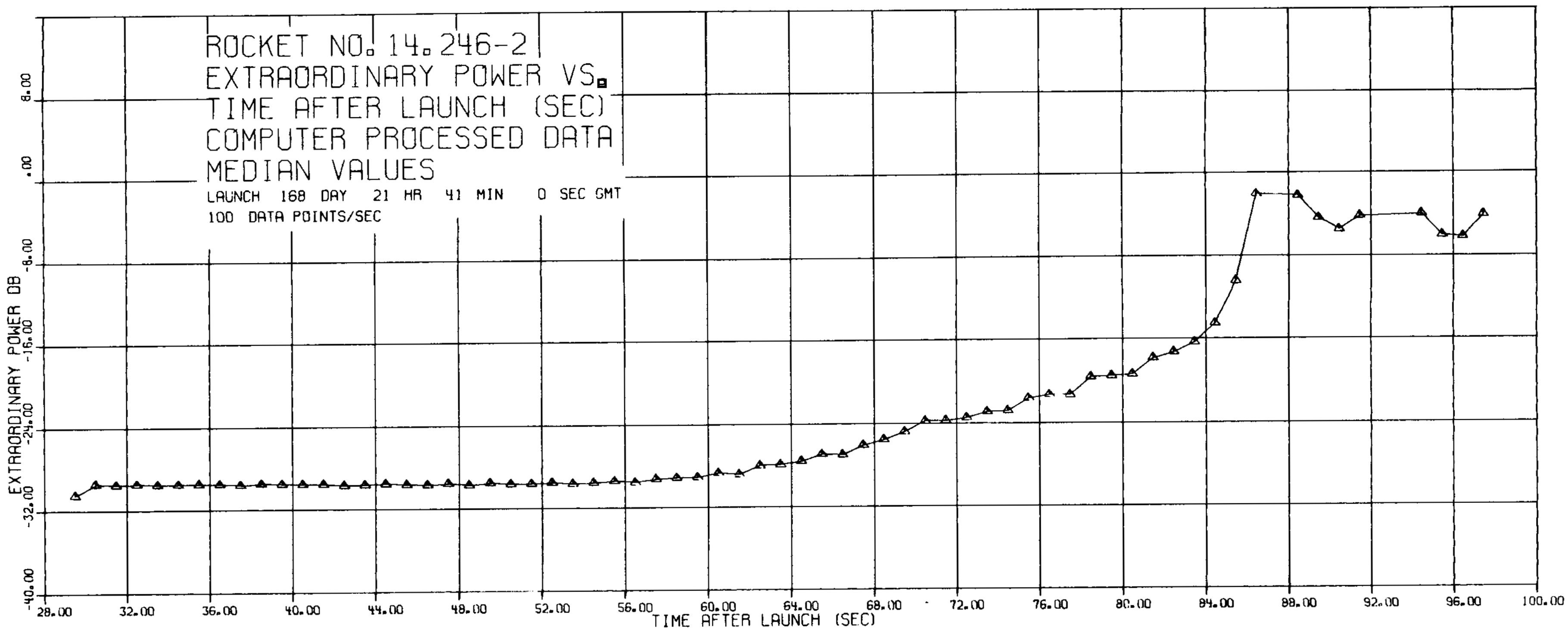
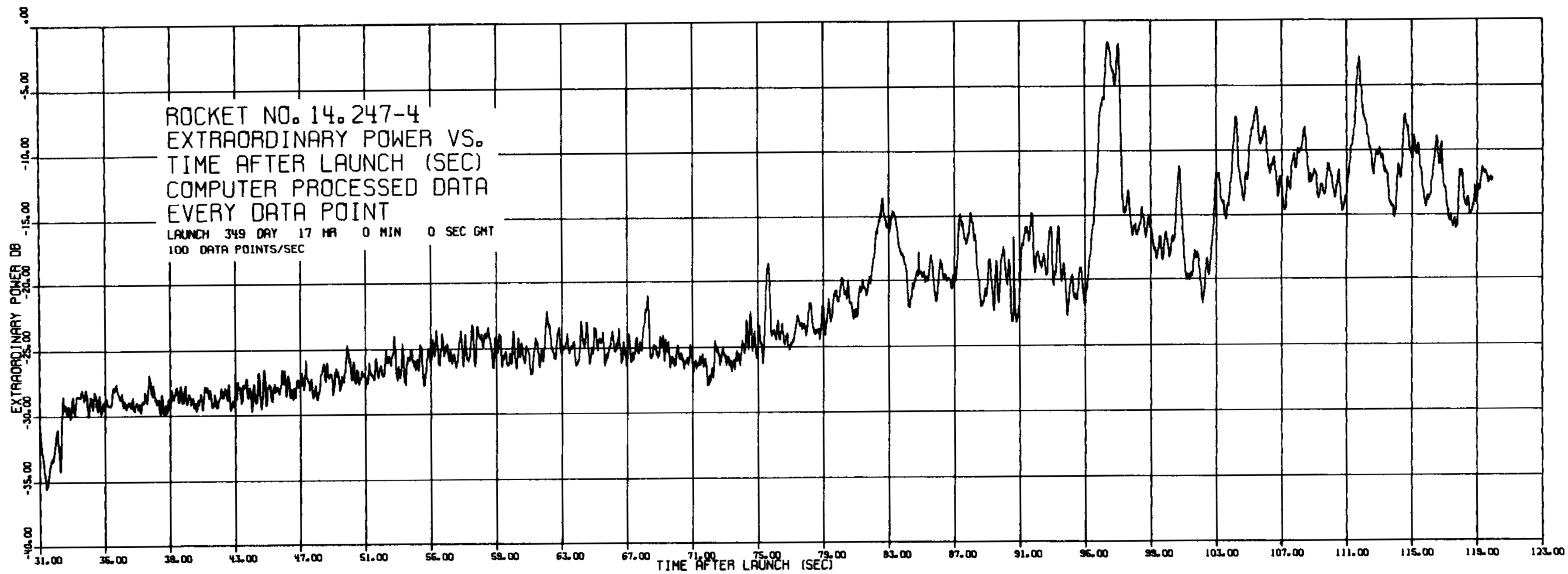
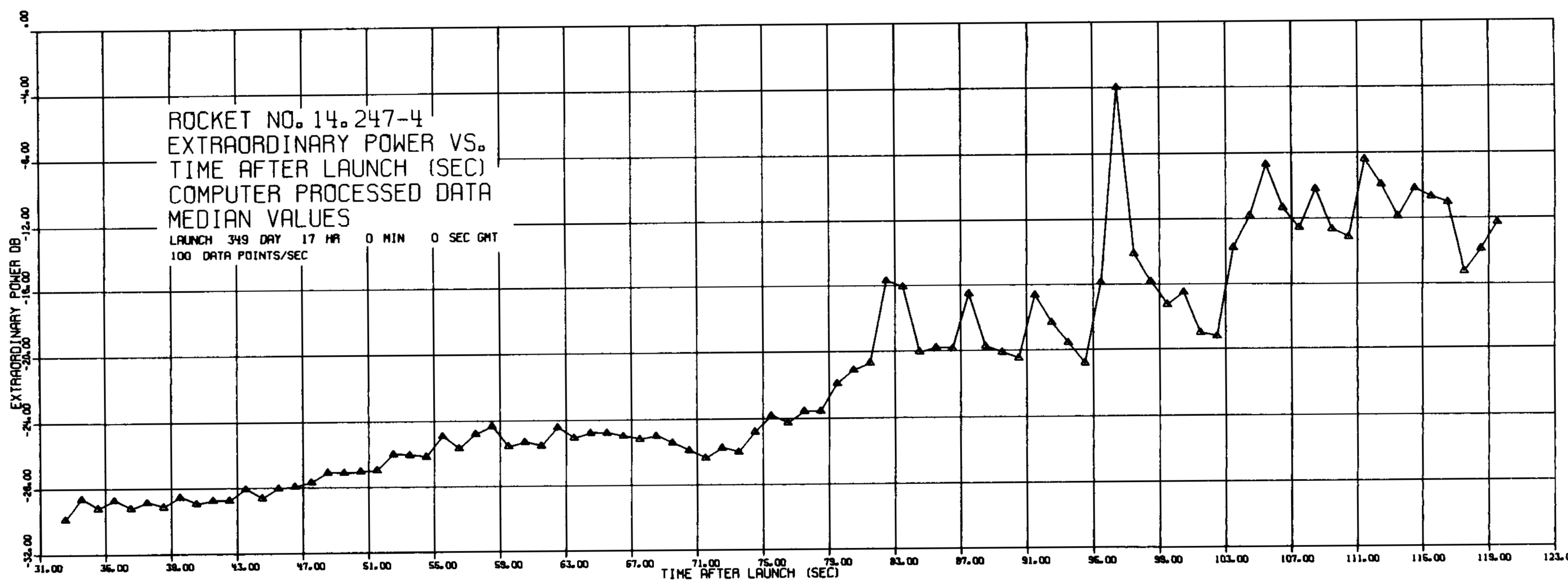
92.00
96.00
100.00

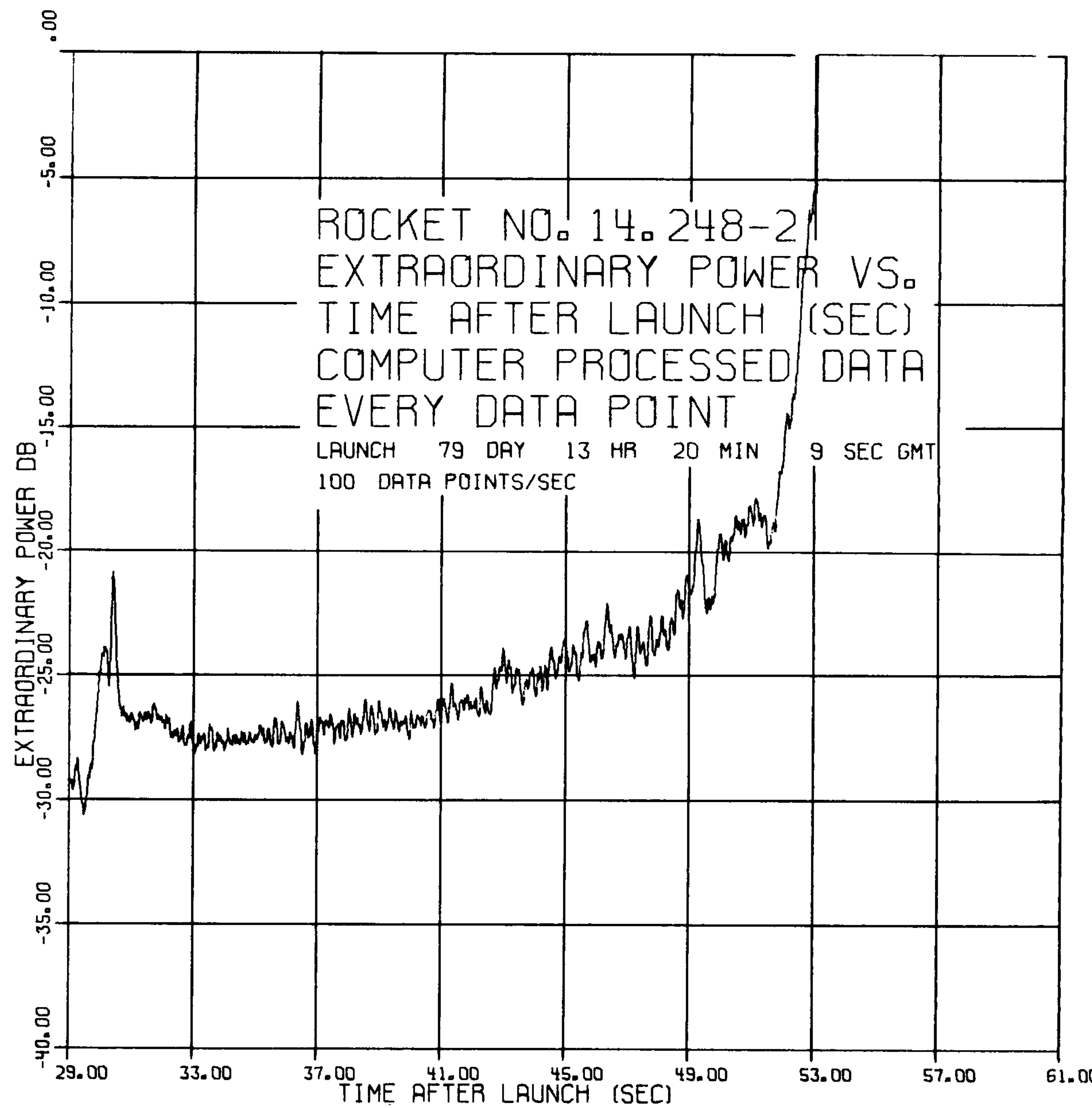


ROCKET NO. 14.246-2
EXTRAORDINARY POWER VS.
TIME AFTER LAUNCH (SEC)
COMPUTER PROCESSED DATA
MEDIAN VALUES
LAUNCH 168 DAY 21 HR 41 MIN 0 SEC GMT
100 DATA POINTS/SEC
EXTRAORDINARY POWER DB
8.00
.00
-8.00
-16.00
-24.00
-32.00
-40.00
TIME AFTER LAUNCH (SEC)
28.00
32.00
36.00
40.00
44.00
48.00
52.00
56.00
60.00
64.00
68.00
72.00
76.00
80.00
84.00
88.00
92.00
96.00
100.00

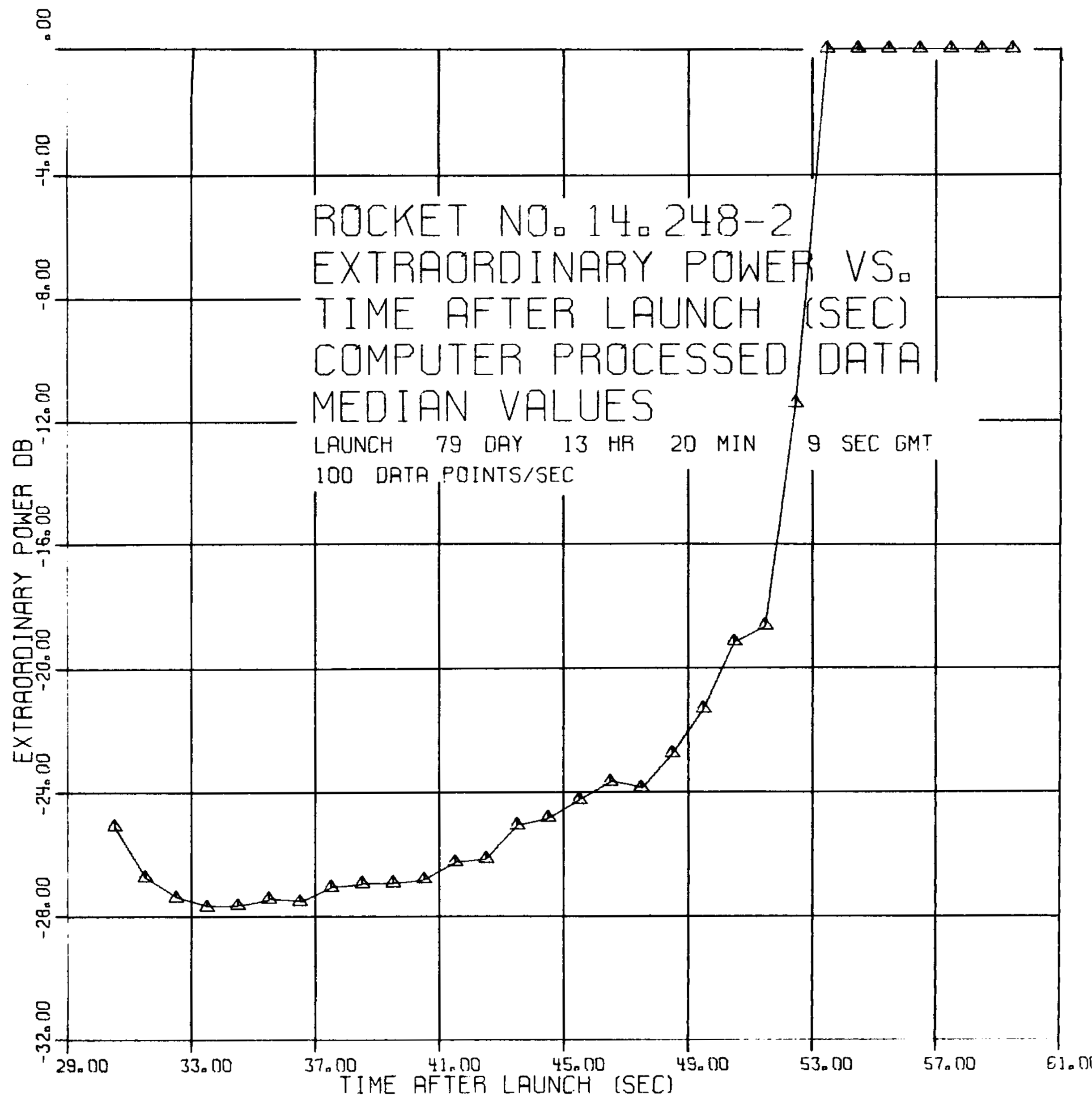

ROCKET NO. 14.247-4
EXTRAORDINARY POWER VS.
TIME AFTER LAUNCH (SEC)
COMPUTER PROCESSED DATA
EVERY DATA POINT
LAUNCH 349 DAY 17 HR 0 MIN 0 SEC GMT
100 DATA POINTS/SEC
EXTRAORDINARY POWER DB
TIME AFTER LAUNCH (SEC)

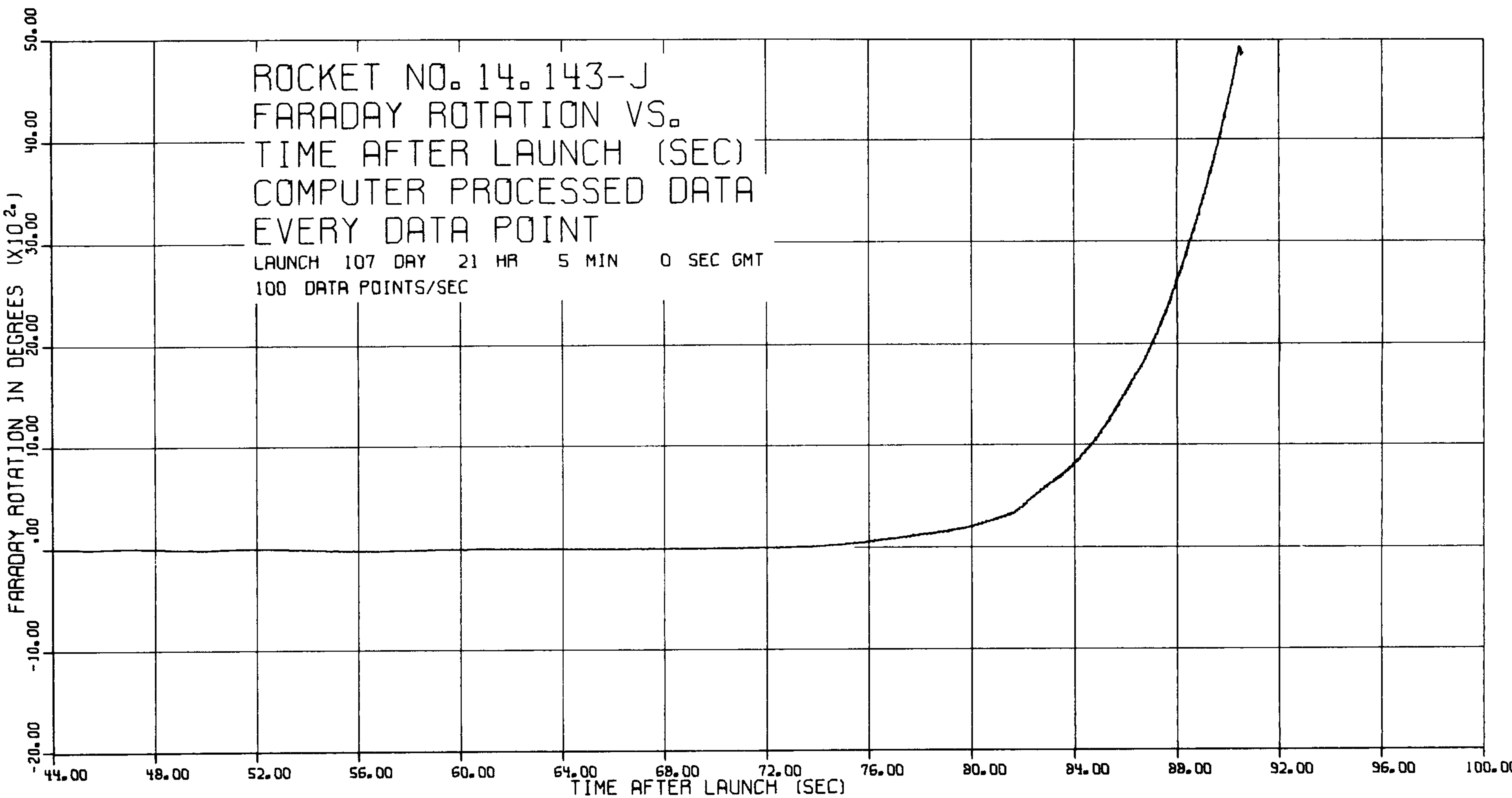


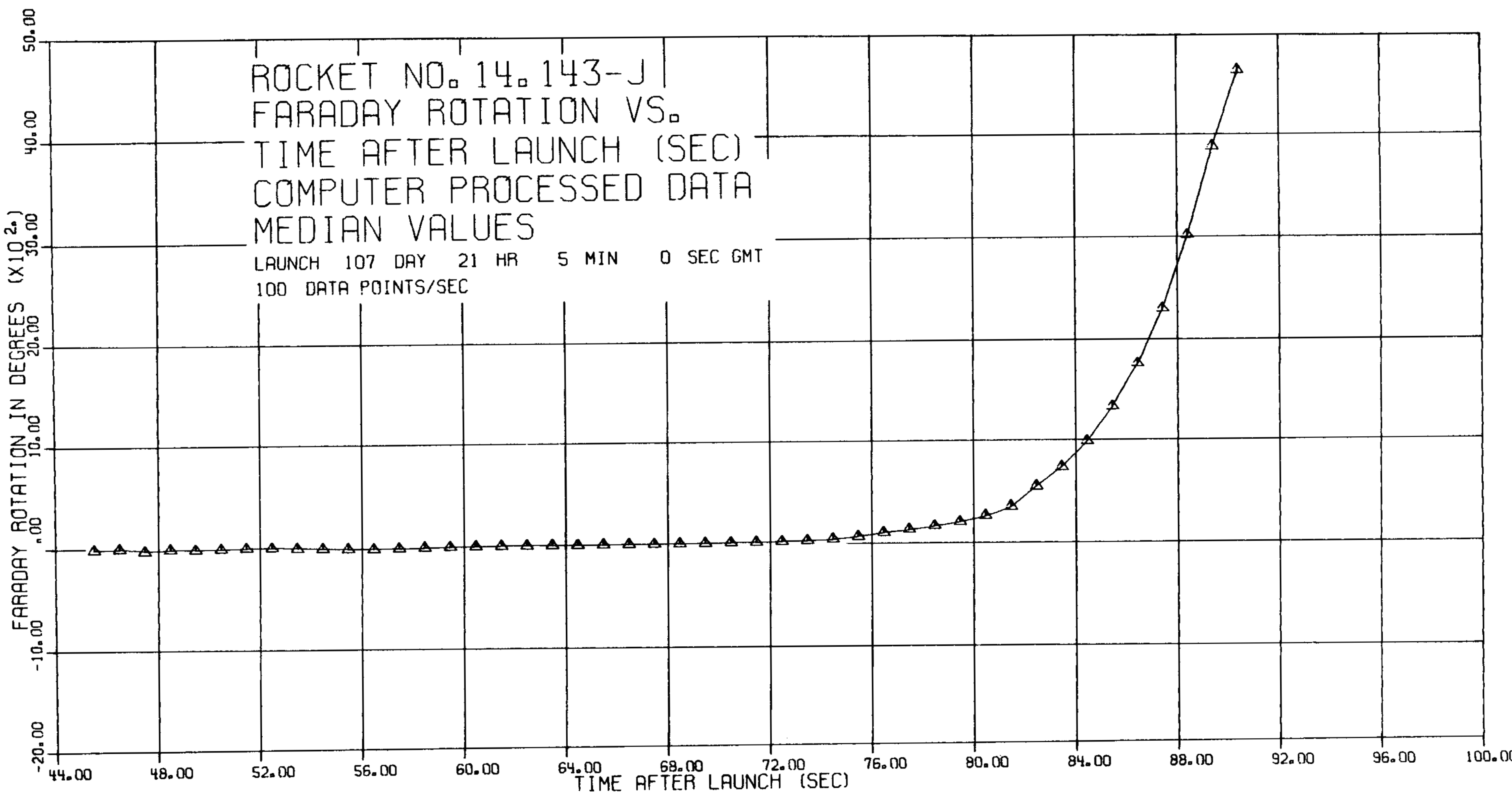
ROCKET NO. 14.247-4
EXTRAORDINARY POWER VS.
TIME AFTER LAUNCH (SEC)
COMPUTER PROCESSED DATA
MEDIAN VALUES
LAUNCH 349 DAY 17 HR 0 MIN 0 SEC GMT
100 DATA POINTS/SEC
EXTRAORDINARY POWER DB
TIME AFTER LAUNCH (SEC)

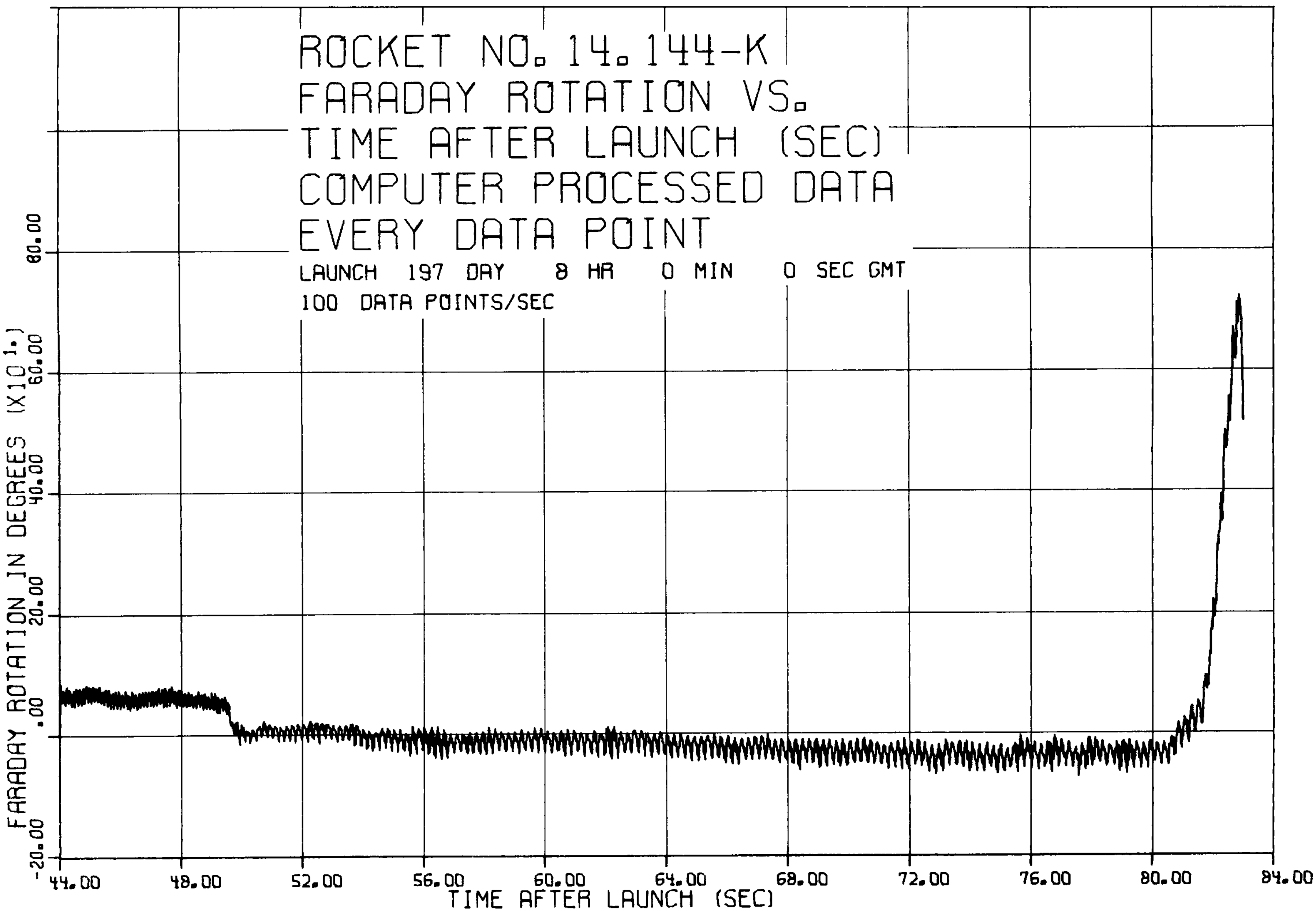


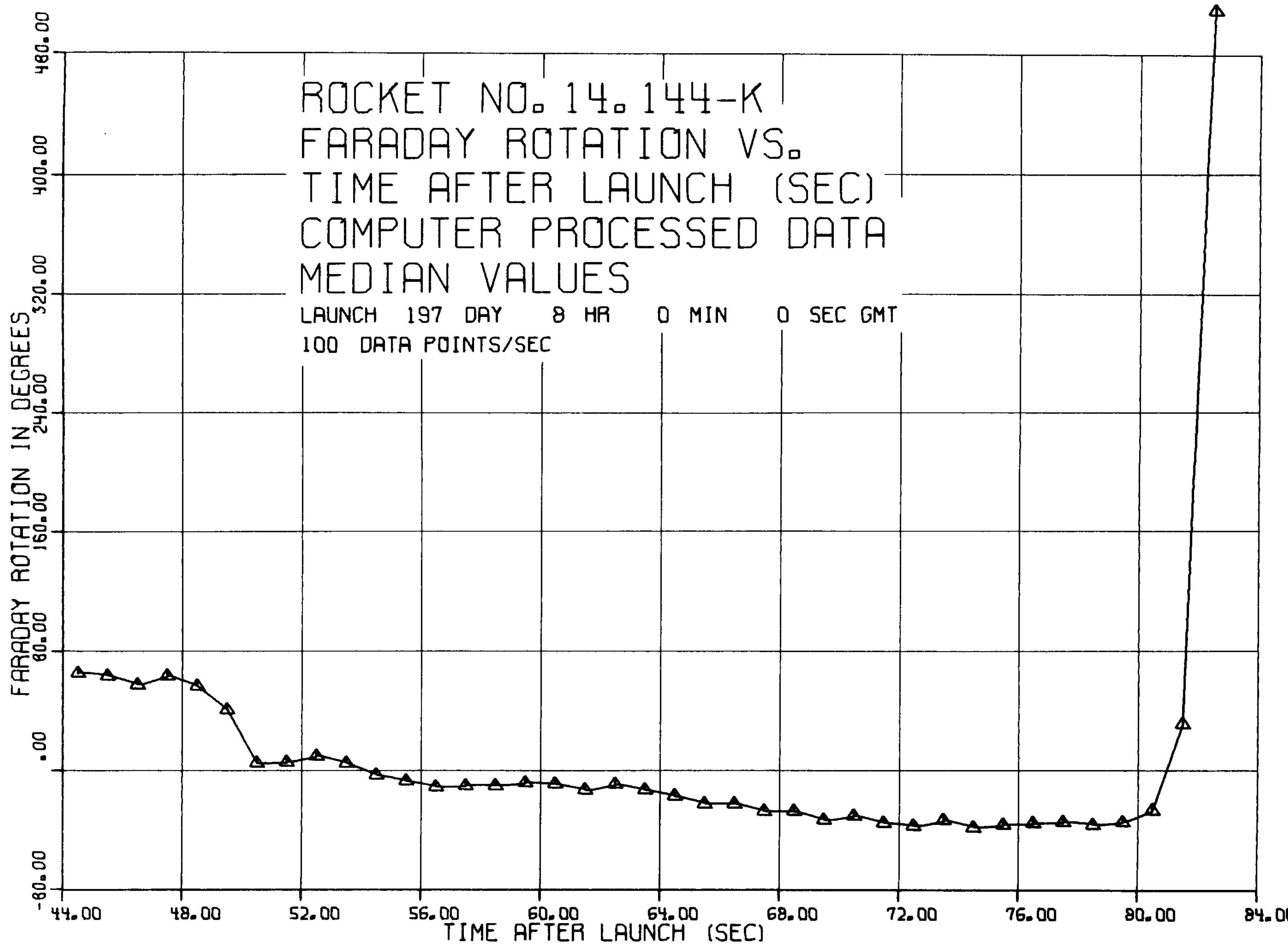
ROCKET NO. 14.248-2
EXTRAORDINARY POWER VS.
TIME AFTER LAUNCH (SEC)
COMPUTER PROCESSED DATA
EVERY DATA POINT
LAUNCH 79 DAY 13 HR 20 MIN 9 SEC GMT
100 DATA POINTS/SEC
EXTRAORDINARY POWER DB
.00
-5.00
-10.00
-15.00
-20.00
-25.00
-30.00
-35.00
-40.00
29.00
33.00
37.00
41.00
45.00
49.00
53.00
57.00
61.00
TIME AFTER LAUNCH (SEC)

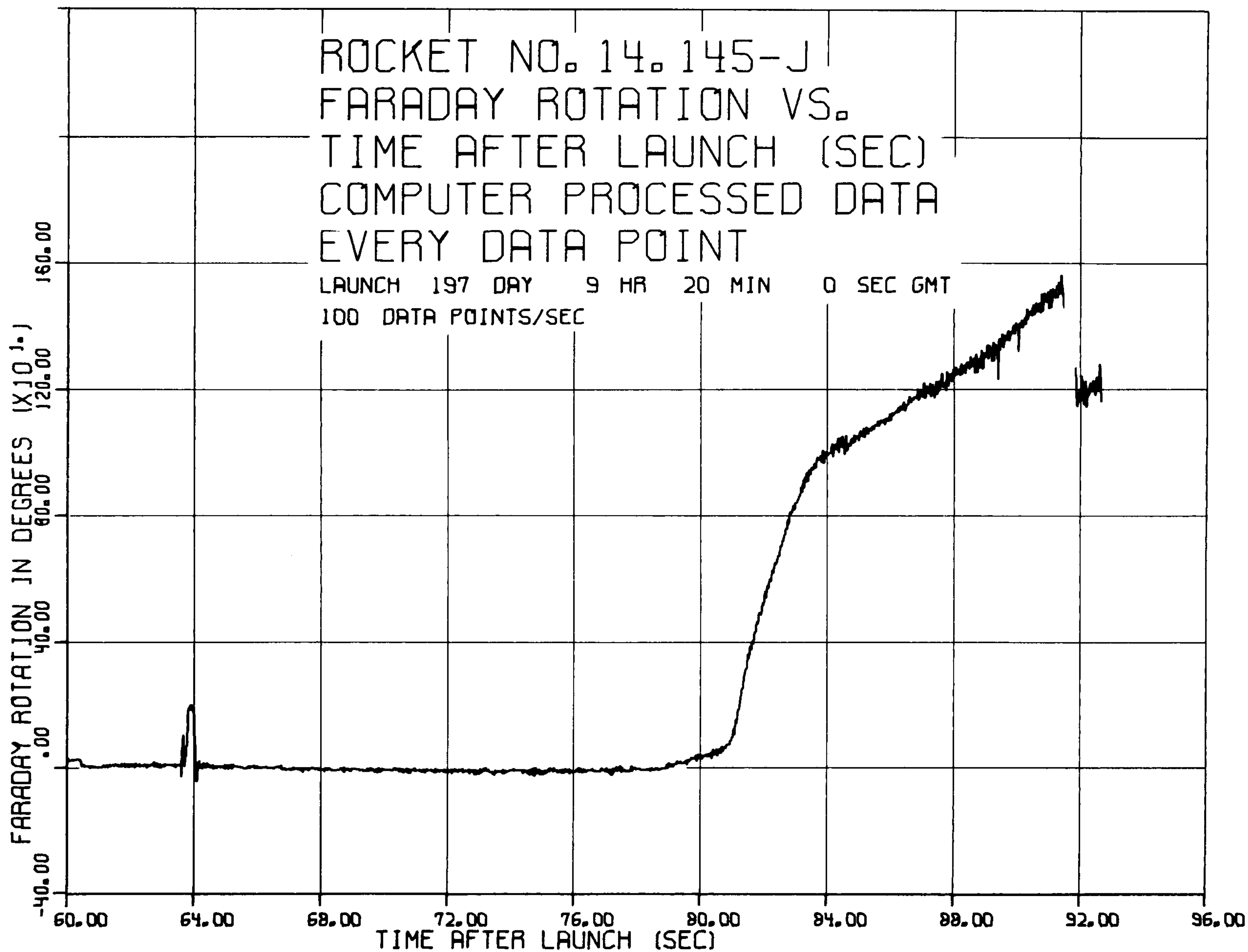

ROCKET NO. 14.248-2
EXTRAORDINARY POWER VS.
TIME AFTER LAUNCH (SEC)
COMPUTER PROCESSED DATA
MEDIAN VALUES
LAUNCH 79 DAY 13 HR 20 MIN 9 SEC GMT
100 DATA POINTS/SEC
EXTRAORDINARY POWER DB
.00
-4.00
-8.00
-12.00
-16.00
-20.00
-24.00
-28.00
-32.00
TIME AFTER LAUNCH (SEC)
29.00
33.00
37.00
41.00
45.00
49.00
53.00
57.00
61.00

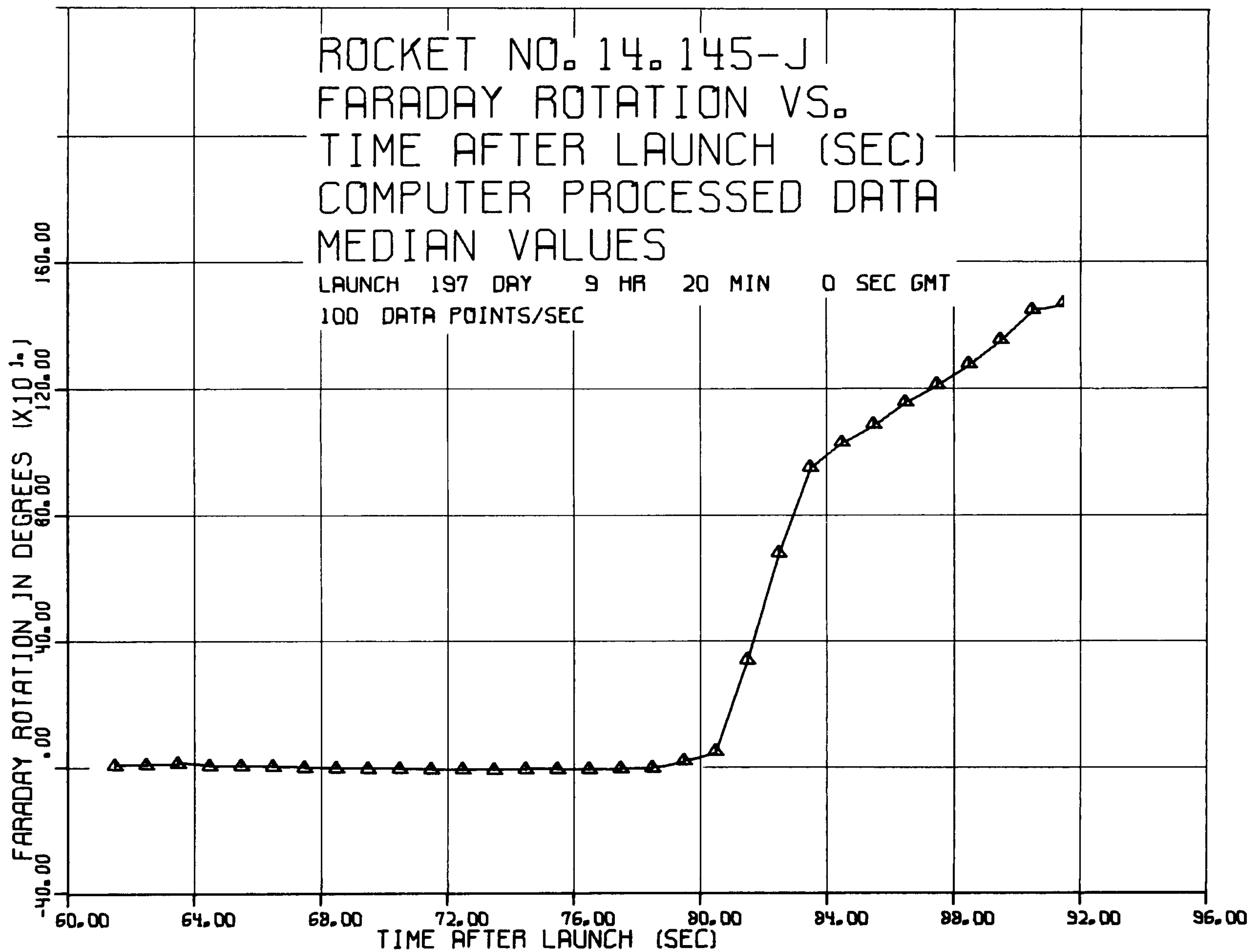

ROCKET NO. 14.143-J
FARADAY ROTATION VS.
TIME AFTER LAUNCH (SEC)
COMPUTER PROCESSED DATA
EVERY DATA POINT
LAUNCH 107 DAY 21 HR 5 MIN 0 SEC GMT
100 DATA POINTS/SEC
FARADAY ROTATION IN DEGREES (X10 2.)
50.00
40.00
30.00
20.00
10.00
.00
-10.00
-20.00
44.00
48.00
52.00
56.00
60.00
64.00
68.00
72.00
76.00
80.00
84.00
88.00
92.00
96.00
100.00
TIME AFTER LAUNCH (SEC)

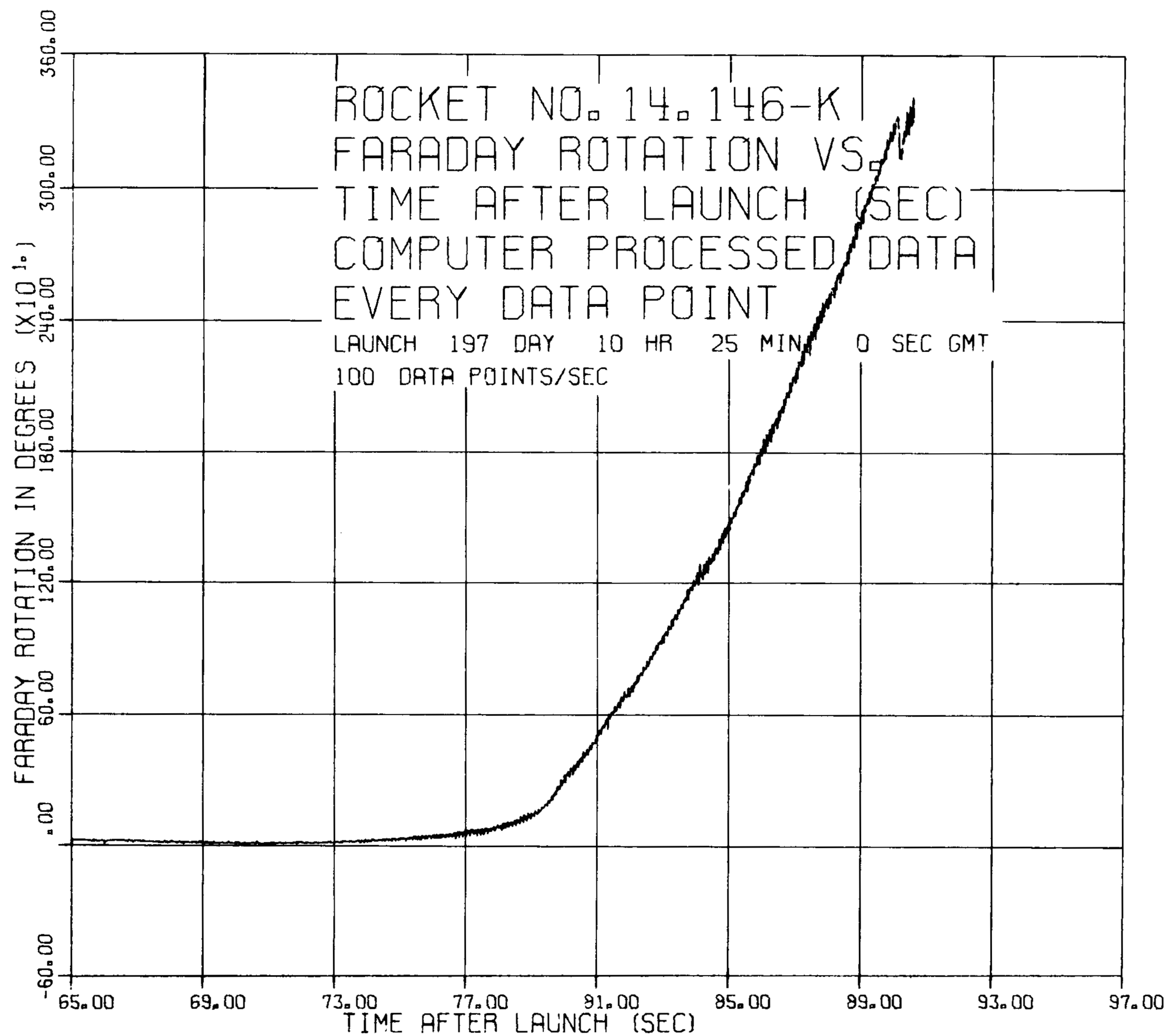

ROCKET NO. 14.143-J
FARADAY ROTATION VS.
TIME AFTER LAUNCH (SEC)
COMPUTER PROCESSED DATA
MEDIAN VALUES
LAUNCH 107 DAY 21 HR 5 MIN 0 SEC GMT
100 DATA POINTS/SEC
FARADAY ROTATION IN DEGREES (X10 2.)
50.00
40.00
30.00
20.00
10.00
.00
-10.00
-20.00
44.00
48.00
52.00
56.00
60.00
64.00
68.00
72.00
76.00
80.00
84.00
88.00
92.00
96.00
100.00
TIME AFTER LAUNCH (SEC)

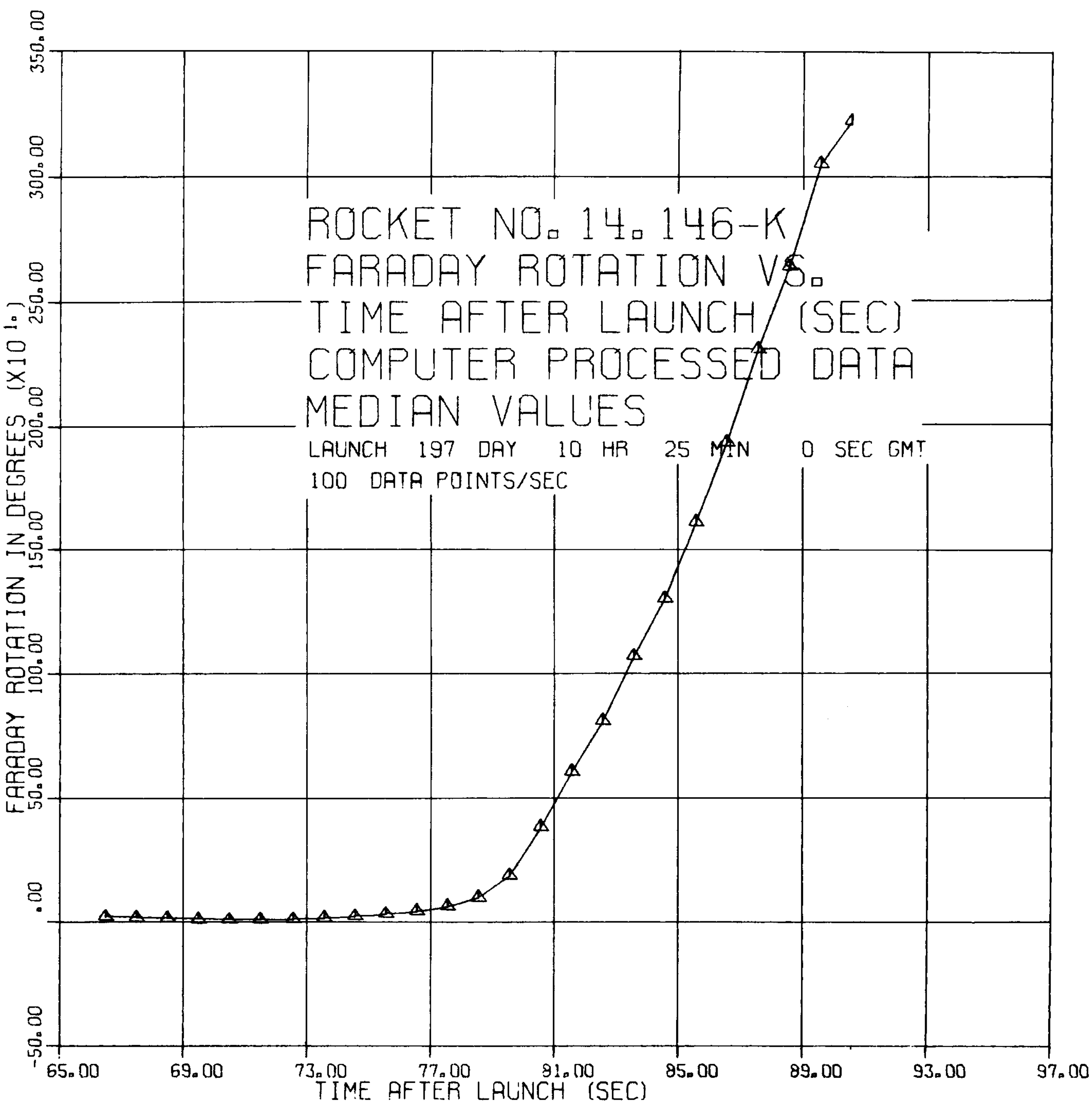

ROCKET NO. 14.144-K
FARADAY ROTATION VS.
TIME AFTER LAUNCH (SEC)
COMPUTER PROCESSED DATA
EVERY DATA POINT
LAUNCH 197 DAY 8 HR 0 MIN 0 SEC GMT
100 DATA POINTS/SEC
FARADAY ROTATION IN DEGREES (X10 1.)
-20.00
.00
20.00
40.00
60.00
80.00
44.00
48.00
52.00
56.00
60.00
64.00
68.00
72.00
76.00
80.00
84.00
TIME AFTER LAUNCH (SEC)

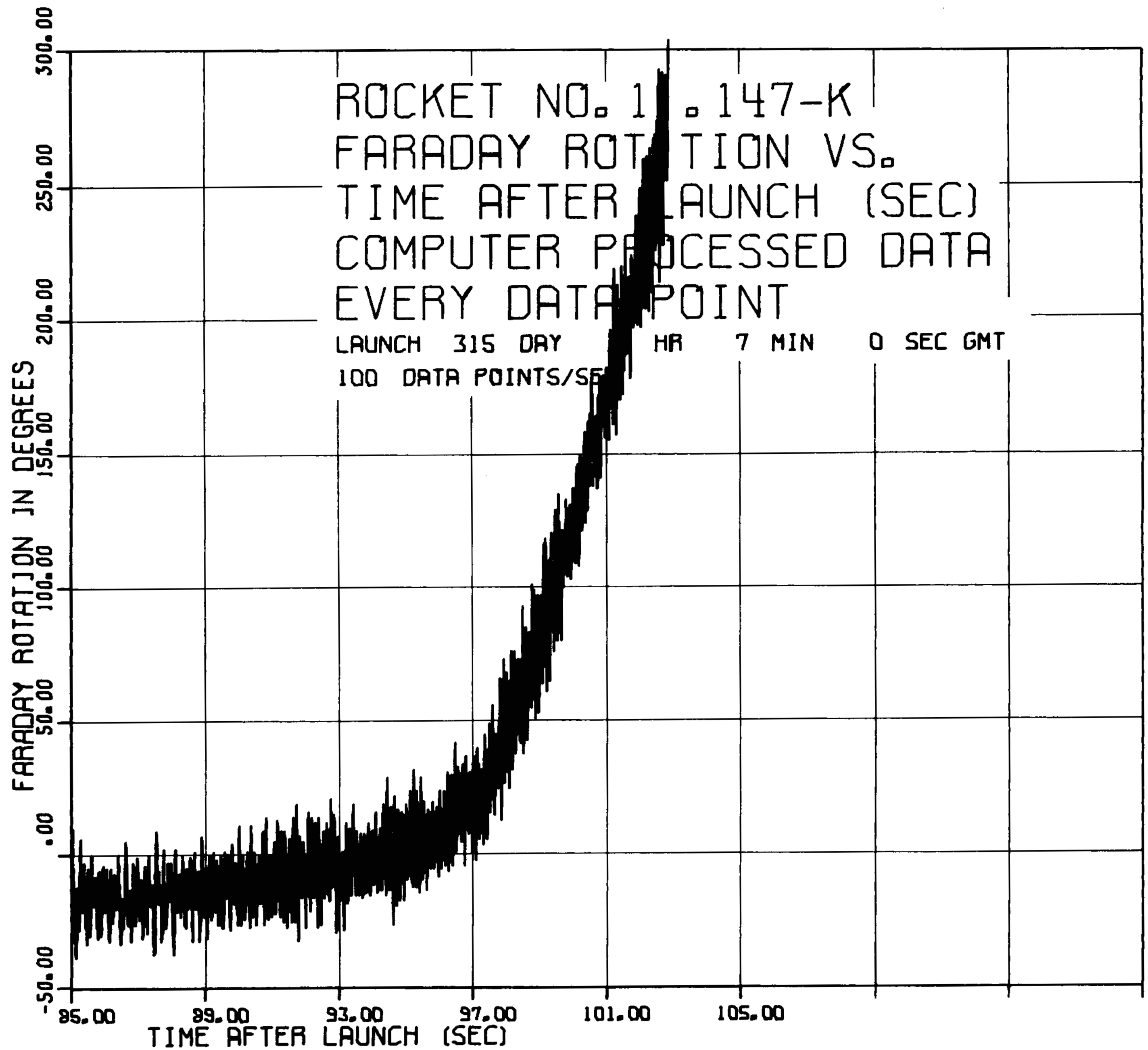

ROCKET NO. 14.144-K
FARADAY ROTATION VS.
TIME AFTER LAUNCH (SEC)
COMPUTER PROCESSED DATA
MEDIAN VALUES
LAUNCH 197 DAY 8 HR 0 MIN 0 SEC GMT
100 DATA POINTS/SEC
FARADAY ROTATION IN DEGREES
480.00
400.00
320.00
240.00
160.00
80.00
.00
-80.00
44.00
48.00
52.00
56.00
60.00
64.00
68.00
72.00
76.00
80.00
84.00
TIME AFTER LAUNCH (SEC)

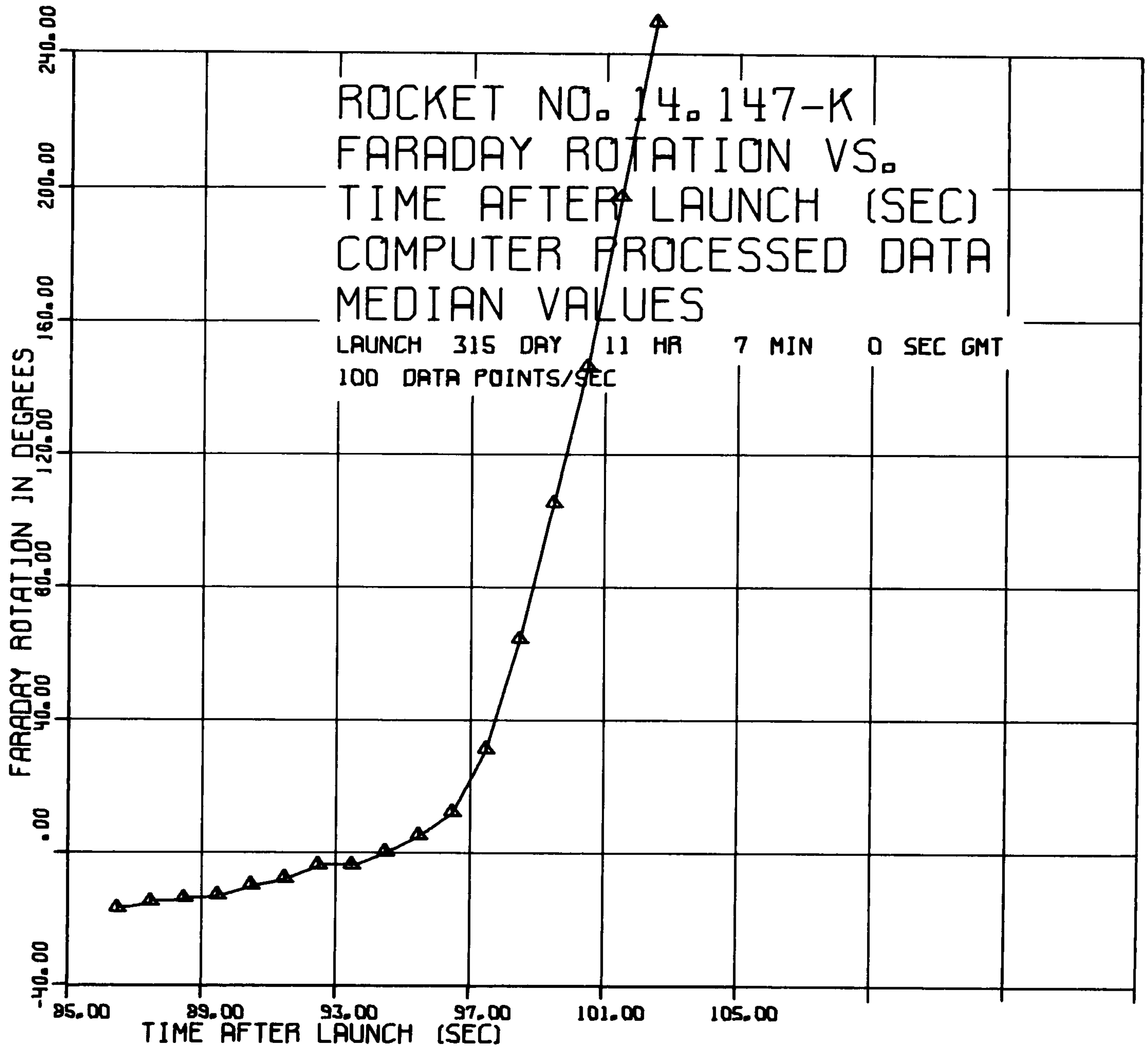

ROCKET NO. 14.145-J
FARADAY ROTATION VS.
TIME AFTER LAUNCH (SEC)
COMPUTER PROCESSED DATA
EVERY DATA POINT
LAUNCH 197 DAY 9 HR 20 MIN 0 SEC GMT
100 DATA POINTS/SEC
FARADAY ROTATION IN DEGREES (X10 1.)
160.00
120.00
80.00
40.00
.00
-40.00
60.00
64.00
68.00
72.00
76.00
80.00
84.00
88.00
92.00
96.00
TIME AFTER LAUNCH (SEC)

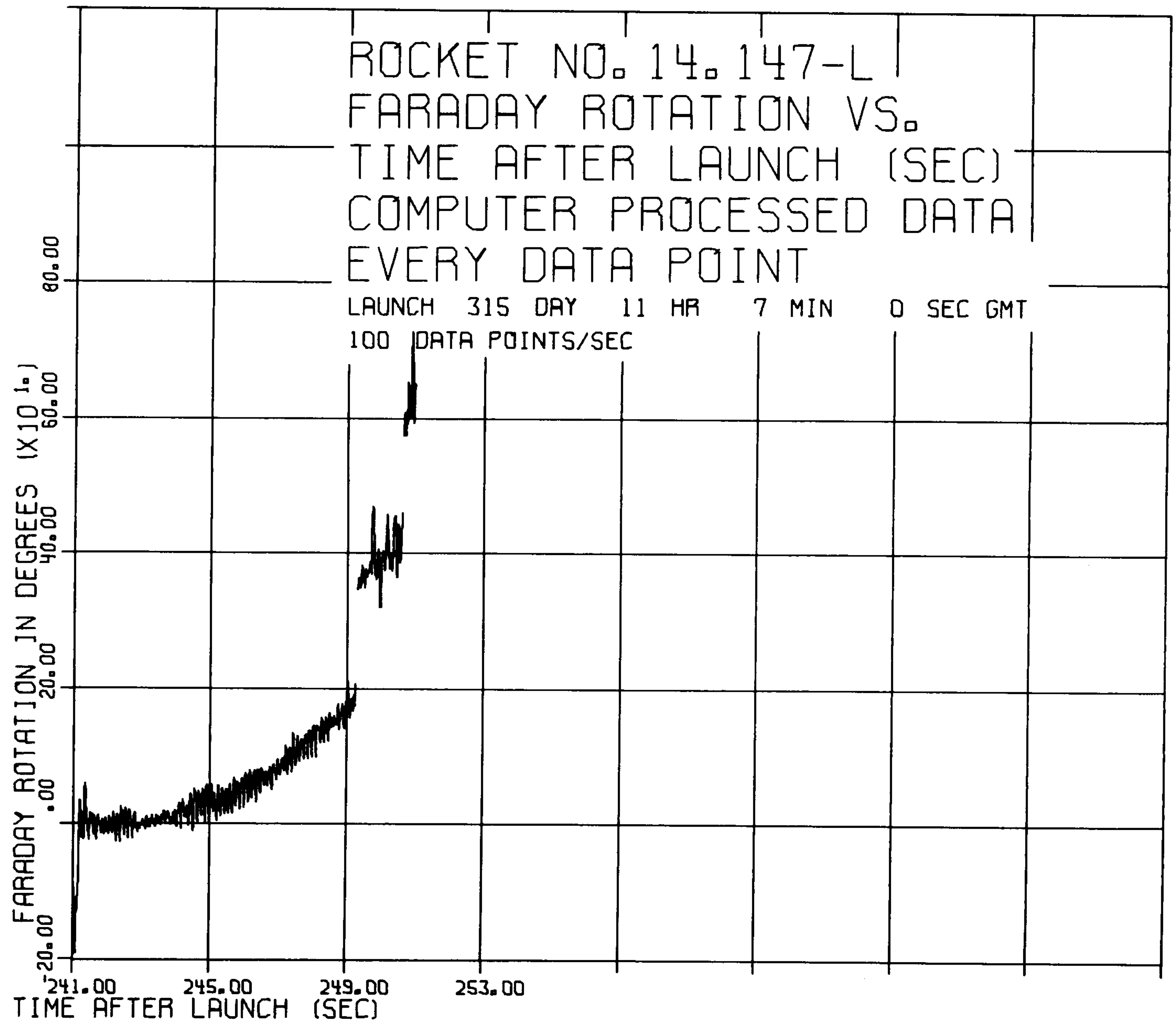

ROCKET NO. 14.145-J
FARADAY ROTATION VS.
TIME AFTER LAUNCH (SEC)
COMPUTER PROCESSED DATA
MEDIAN VALUES
LAUNCH 197 DAY 9 HR 20 MIN 0 SEC GMT
100 DATA POINTS/SEC
FARADAY ROTATION IN DEGREES (X10 1.)
160.00
120.00
80.00
40.00
.00
-40.00
60.00
64.00
68.00
72.00
76.00
80.00
84.00
88.00
92.00
96.00
TIME AFTER LAUNCH (SEC)

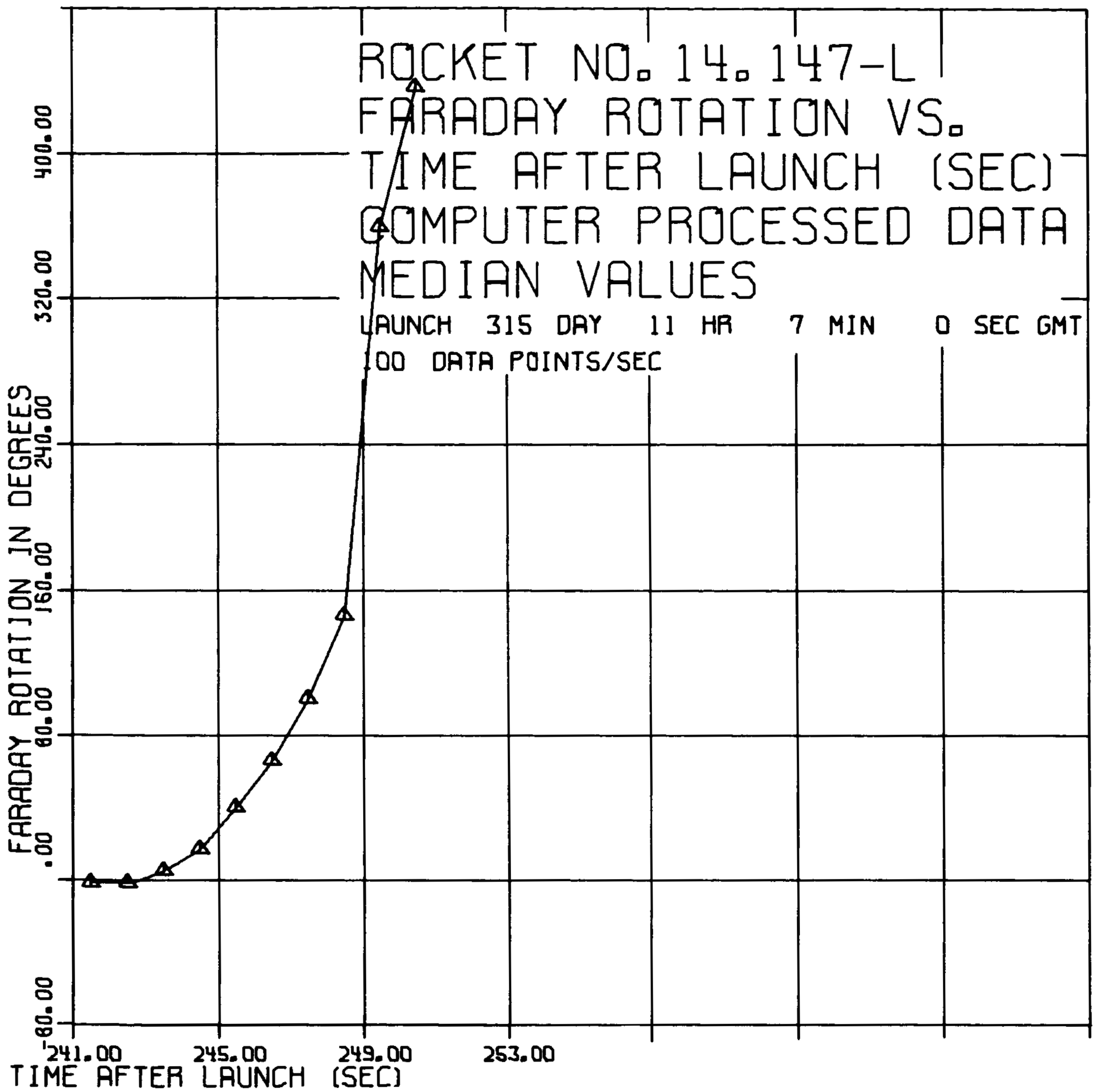

ROCKET NO. 14.146-K
FARADAY ROTATION VS.
TIME AFTER LAUNCH (SEC)
COMPUTER PROCESSED DATA
EVERY DATA POINT
LAUNCH 197 DAY 10 HR 25 MIN 0 SEC GMT
100 DATA POINTS/SEC
FARADAY ROTATION IN DEGREES (X10 1.)
360.00
300.00
240.00
180.00
120.00
60.00
.00
-60.00
65.00
69.00
73.00
77.00
91.00
85.00
89.00
93.00
97.00
TIME AFTER LAUNCH (SEC)

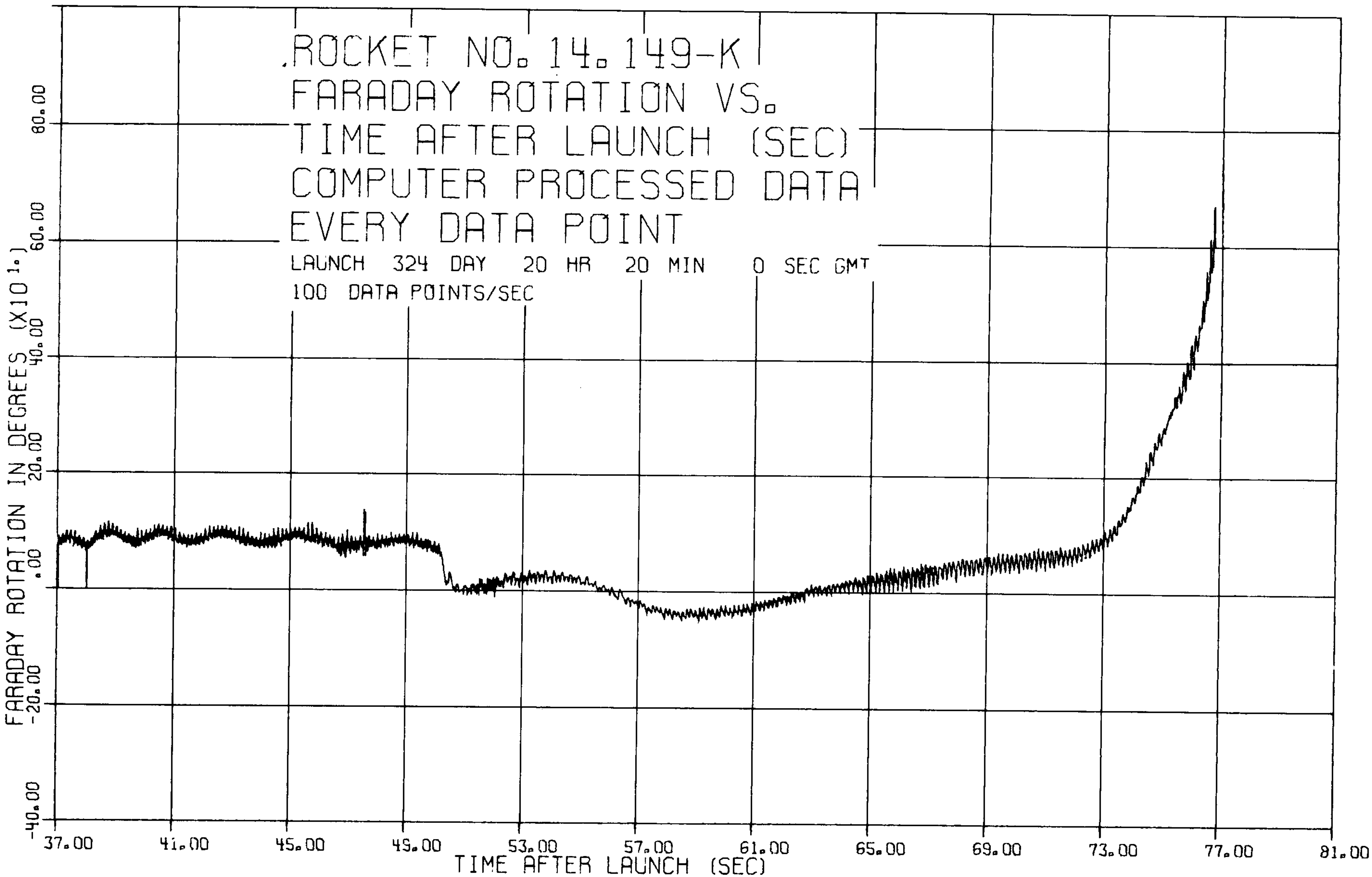

ROCKET NO. 14.146-K
FARADAY ROTATION VS.
TIME AFTER LAUNCH (SEC)
COMPUTER PROCESSED DATA
MEDIAN VALUES
LAUNCH 197 DAY 10 HR 25 MIN 0 SEC GMT
100 DATA POINTS/SEC
FARADAY ROTATION IN DEGREES (X10 1.)
350.00
300.00
250.00
200.00
150.00
100.00
50.00
.00
-50.00
65.00
69.00
73.00
77.00
81.00
85.00
89.00
93.00
97.00
TIME AFTER LAUNCH (SEC)

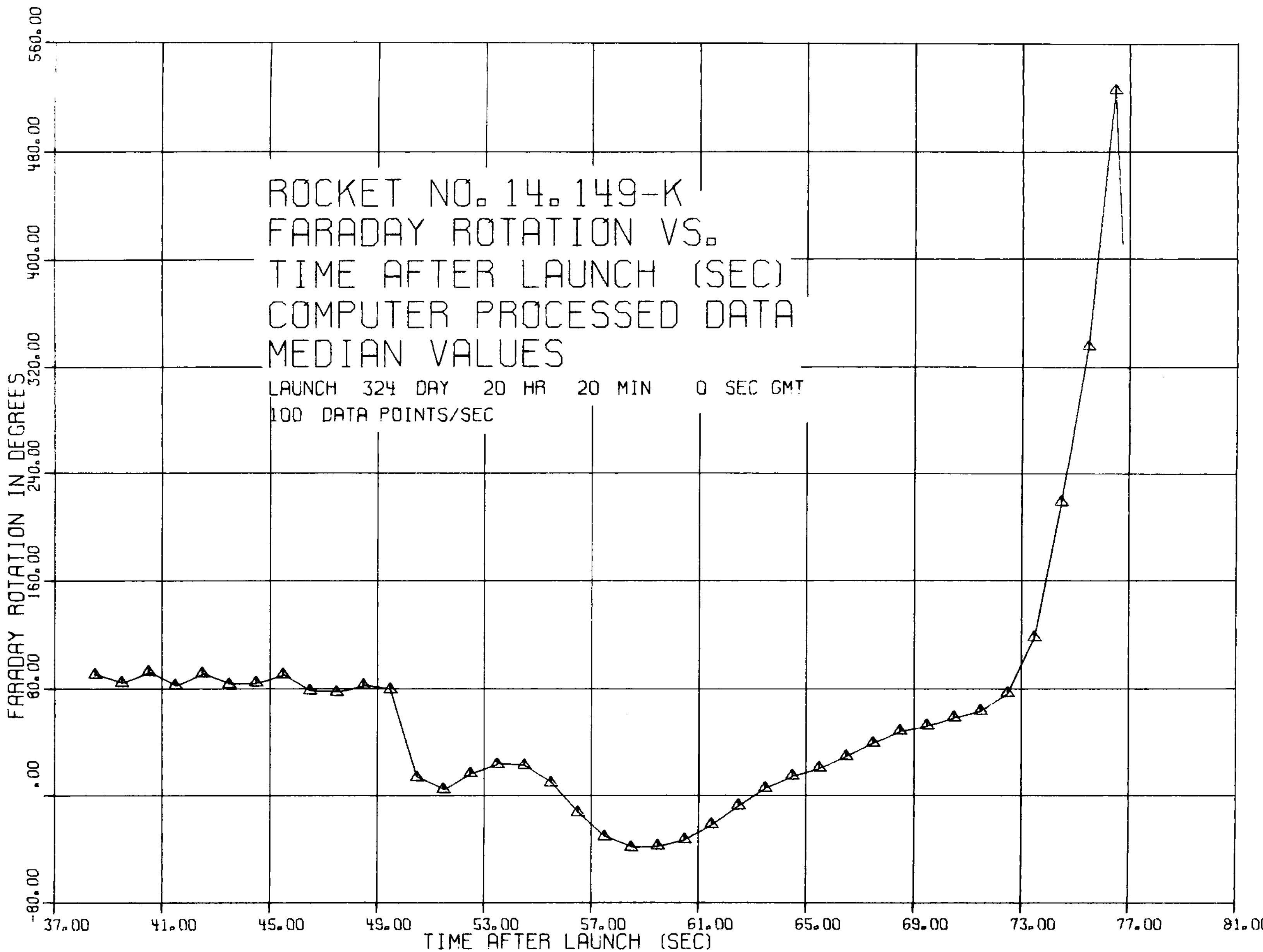

ROCKET NO. 1 .147-K
FARADAY ROT TION VS.
TIME AFTER LAUNCH (SEC)
COMPUTER P OCESSED DATA
EVERY DATA POINT
LAUNCH 315 DAY HR 7 MIN 0 SEC GMT
100 DATA POINTS/SE
FARADAY ROTATION IN DEGREES
300.00
250.00
200.00
150.00
100.00
50.00
.00
-50.00
85.00
89.00
93.00
97.00
101.00
105.00
TIME AFTER LAUNCH (SEC)

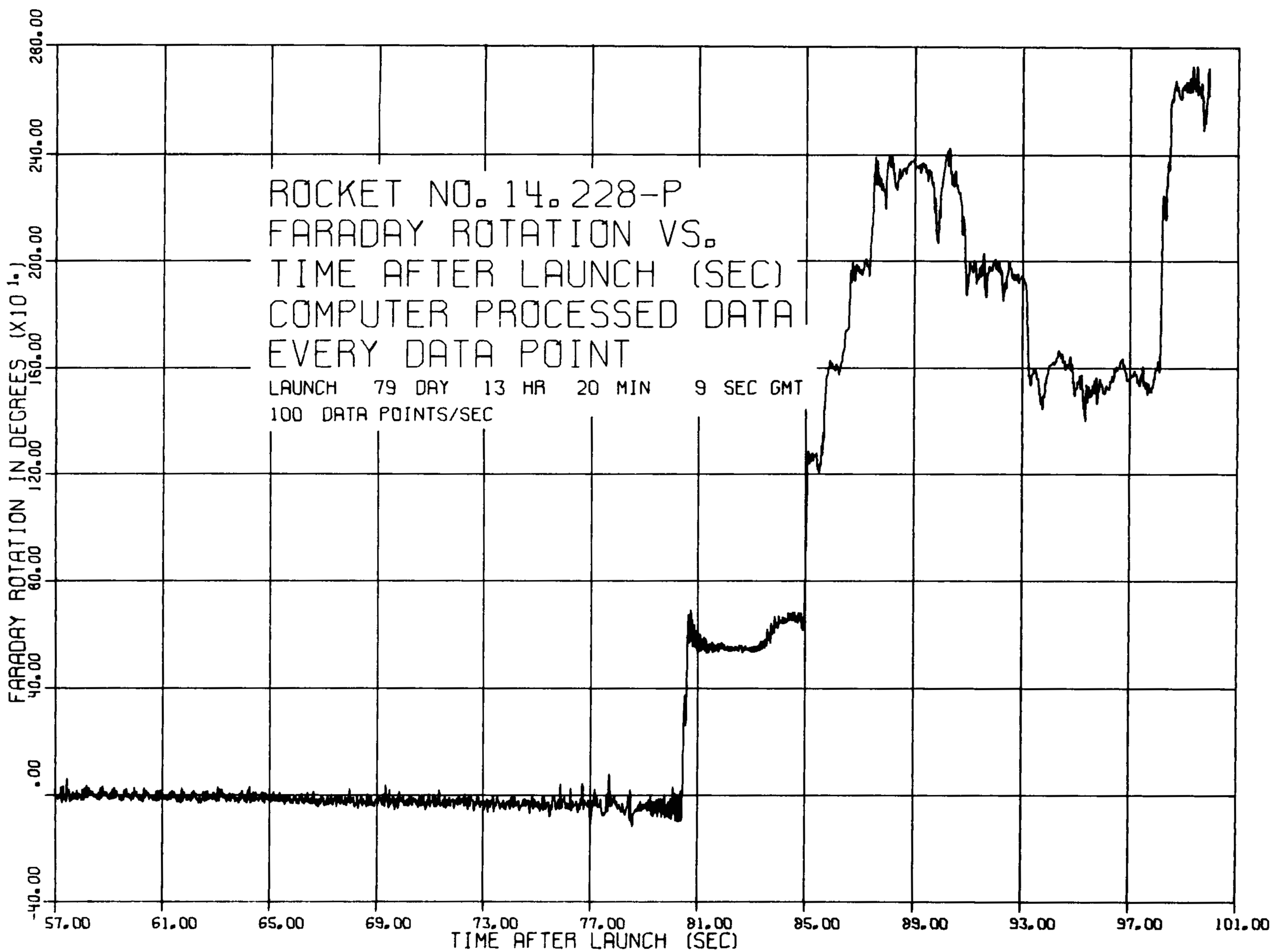

ROCKET NO. 14.147-K
FARADAY ROTATION VS.
TIME AFTER LAUNCH (SEC)
COMPUTER PROCESSED DATA
MEDIAN VALUES
LAUNCH 315 DAY 11 HR 7 MIN 0 SEC GMT
100 DATA POINTS/SEC
FARADAY ROTATION IN DEGREES
240.00
200.00
160.00
120.00
80.00
40.00
.00
-40.00
85.00
89.00
93.00
97.00
101.00
105.00
TIME AFTER LAUNCH (SEC)


ROCKET NO. 14.147-L
FARADAY ROTATION VS.
TIME AFTER LAUNCH (SEC)
COMPUTER PROCESSED DATA
EVERY DATA POINT
LAUNCH 315 DAY 11 HR 7 MIN 0 SEC GMT
100 DATA POINTS/SEC
FARADAY ROTATION IN DEGREES (X10 1.)
80.00
60.00
40.00
20.00
.00
-20.00
241.00
245.00
249.00
253.00
TIME AFTER LAUNCH (SEC)

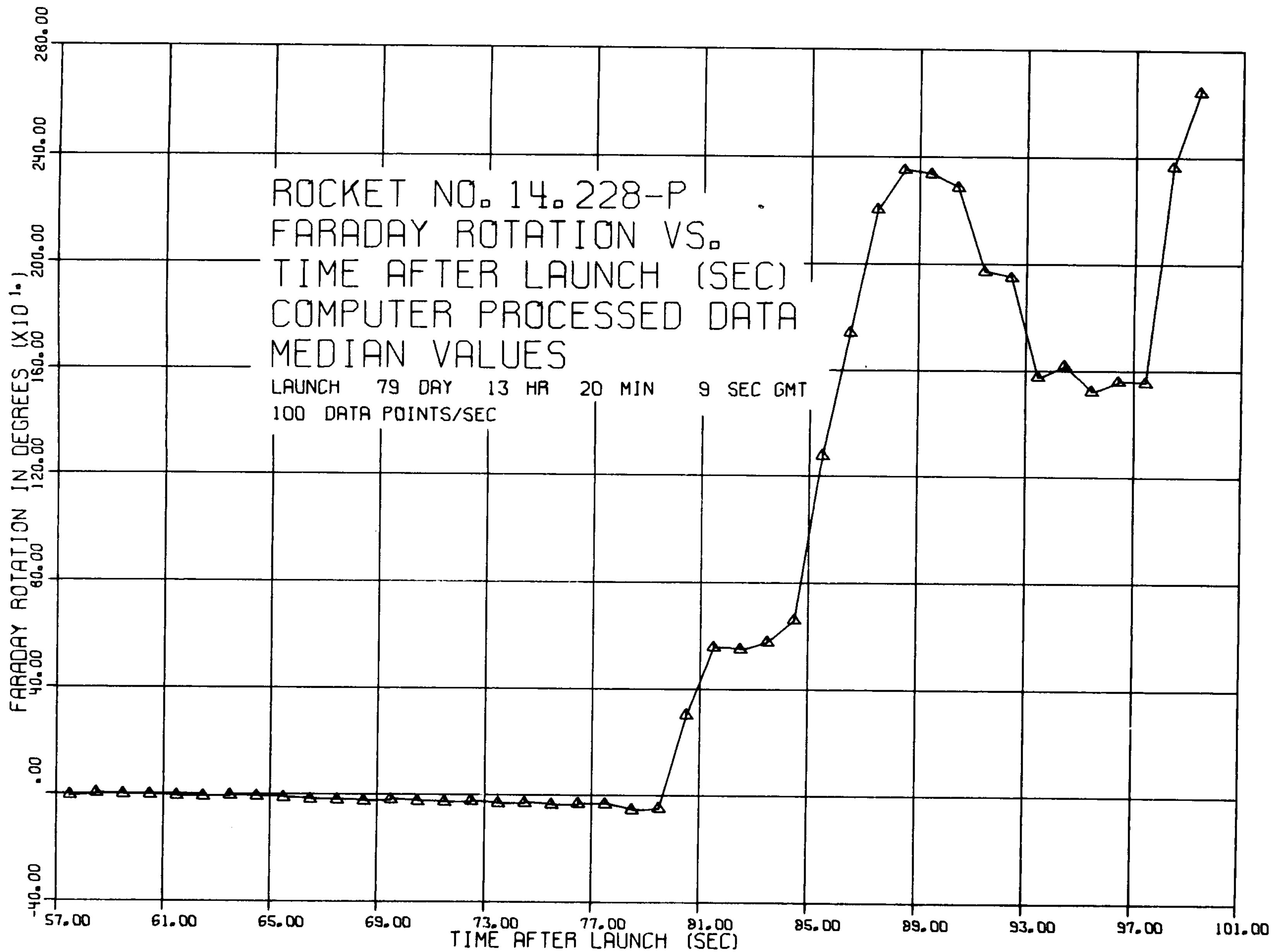

ROCKET NO. 14.147-L
FARADAY ROTATION VS.
TIME AFTER LAUNCH (SEC)
COMPUTER PROCESSED DATA
MEDIAN VALUES
LAUNCH 315 DAY 11 HR 7 MIN 0 SEC GMT
100 DATA POINTS/SEC
FARADAY ROTATION IN DEGREES
400.00
320.00
240.00
160.00
80.00
.00
-80.00
241.00
245.00
249.00
253.00
TIME AFTER LAUNCH (SEC)

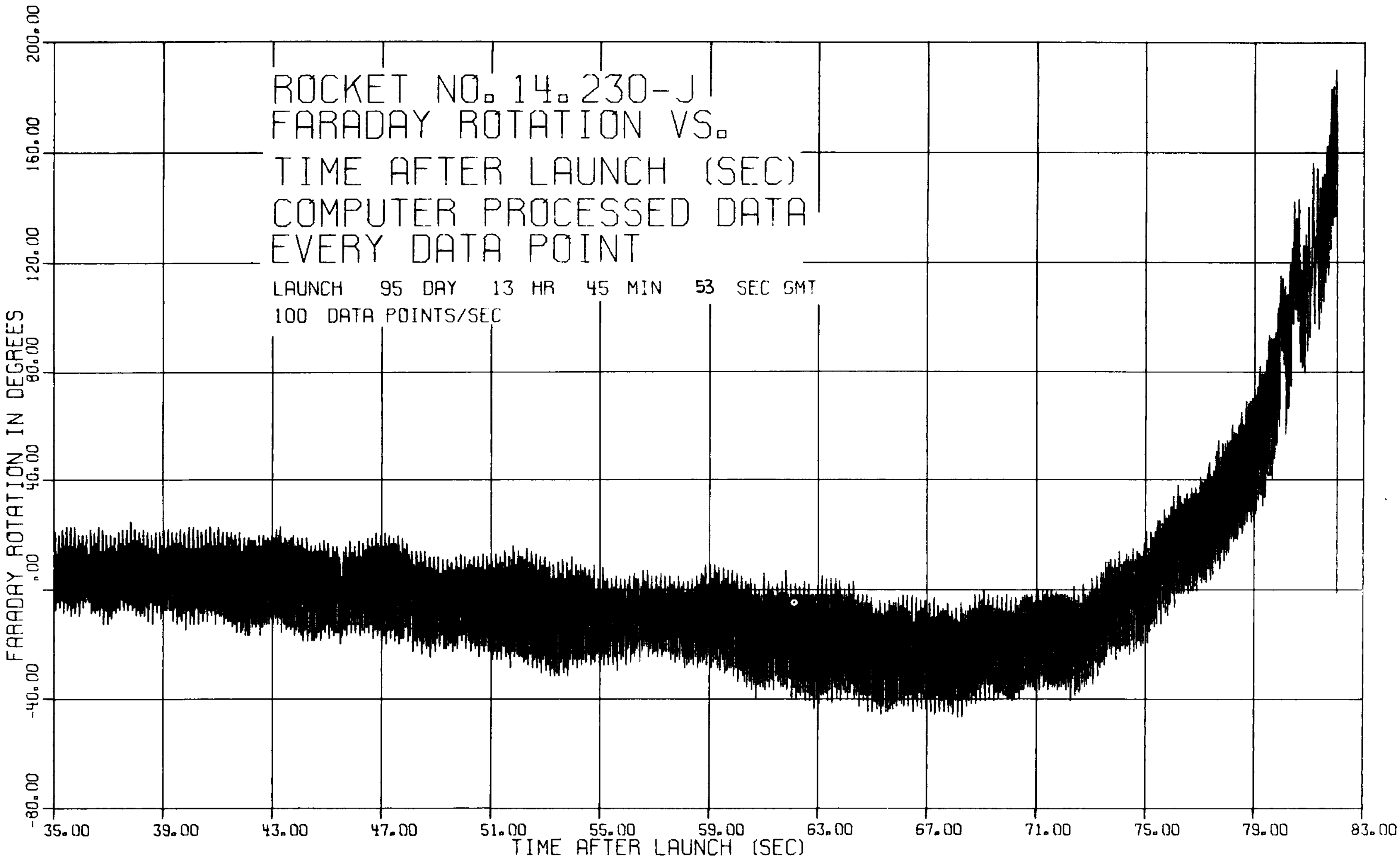

ROCKET NO. 14.149-K
FARADAY ROTATION VS.
TIME AFTER LAUNCH (SEC)
COMPUTER PROCESSED DATA
EVERY DATA POINT
LAUNCH 324 DAY 20 HR 20 MIN 0 SEC GMT
100 DATA POINTS/SEC
FARADAY ROTATION IN DEGREES (X10 1.)
80.00
60.00
40.00
20.00
.00
-20.00
-40.00
37.00
41.00
45.00
49.00
53.00
57.00
61.00
65.00
69.00
73.00
77.00
81.00
TIME AFTER LAUNCH (SEC)

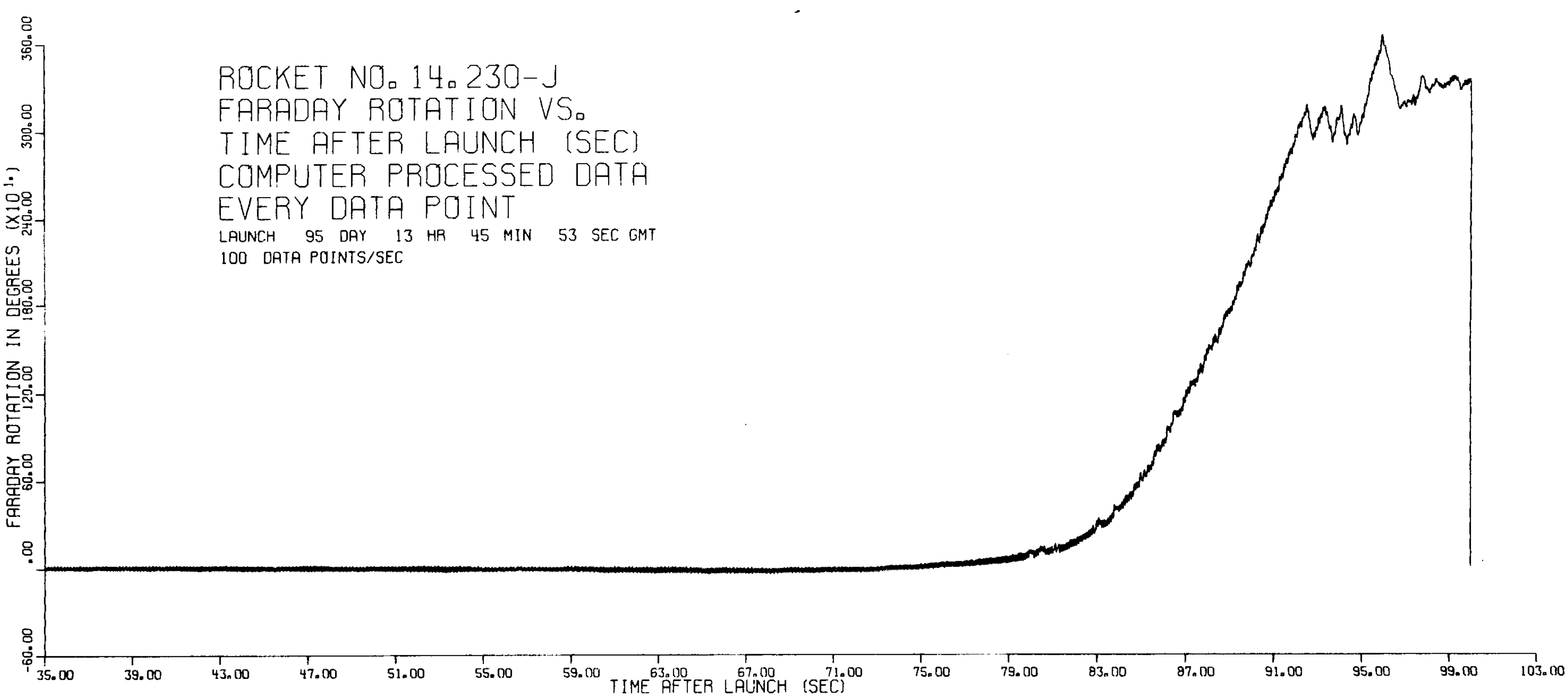

ROCKET NO. 14.149-K
FARADAY ROTATION VS.
TIME AFTER LAUNCH (SEC)
COMPUTER PROCESSED DATA
MEDIAN VALUES
LAUNCH 324 DAY 20 HR 20 MIN 0 SEC GMT
100 DATA POINTS/SEC
FARADAY ROTATION IN DEGREES
560.00
480.00
400.00
320.00
240.00
160.00
80.00
.00
-80.00
37.00
41.00
45.00
49.00
53.00
57.00
61.00
65.00
69.00
73.00
77.00
81.00
TIME AFTER LAUNCH (SEC)

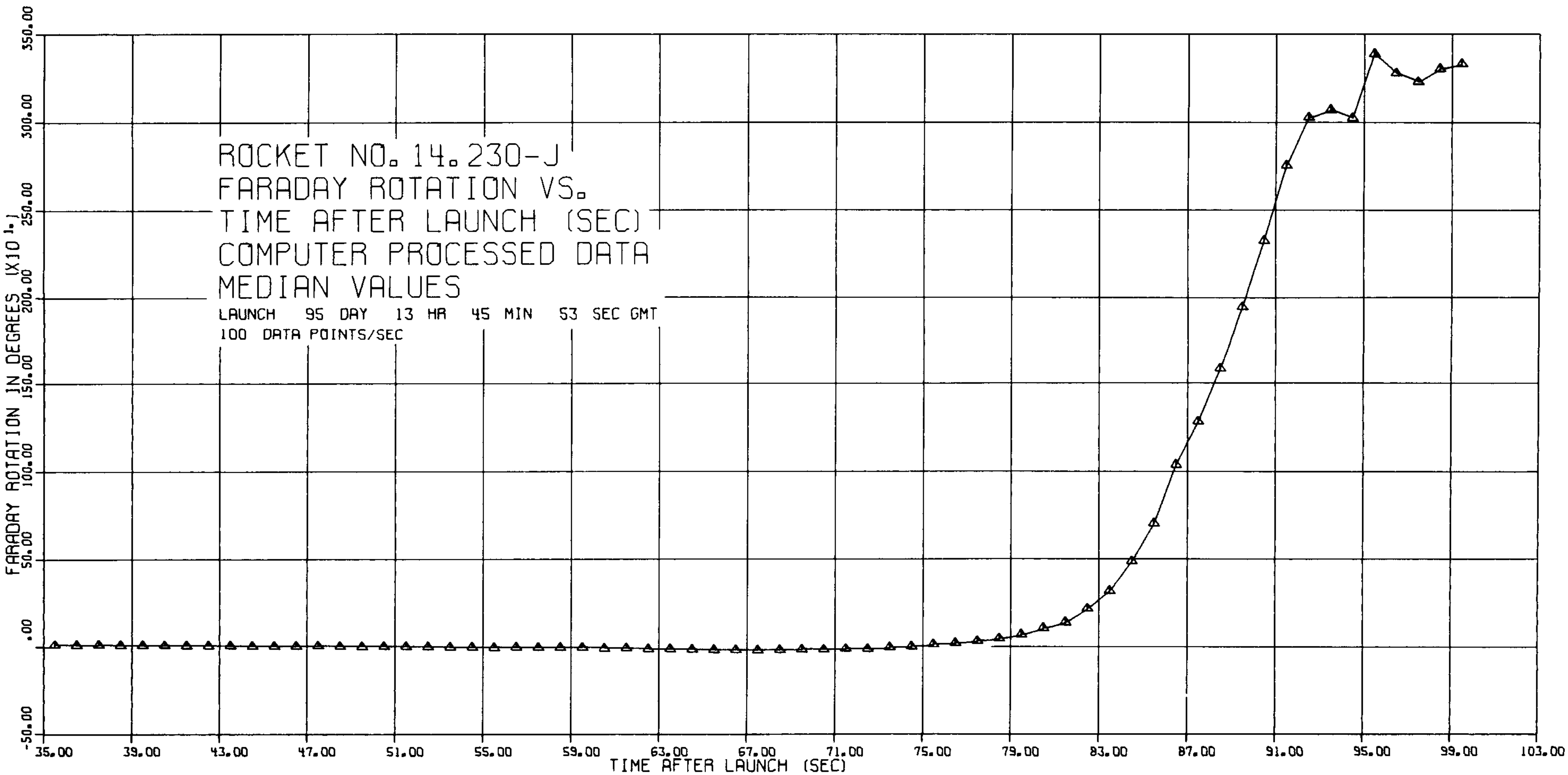


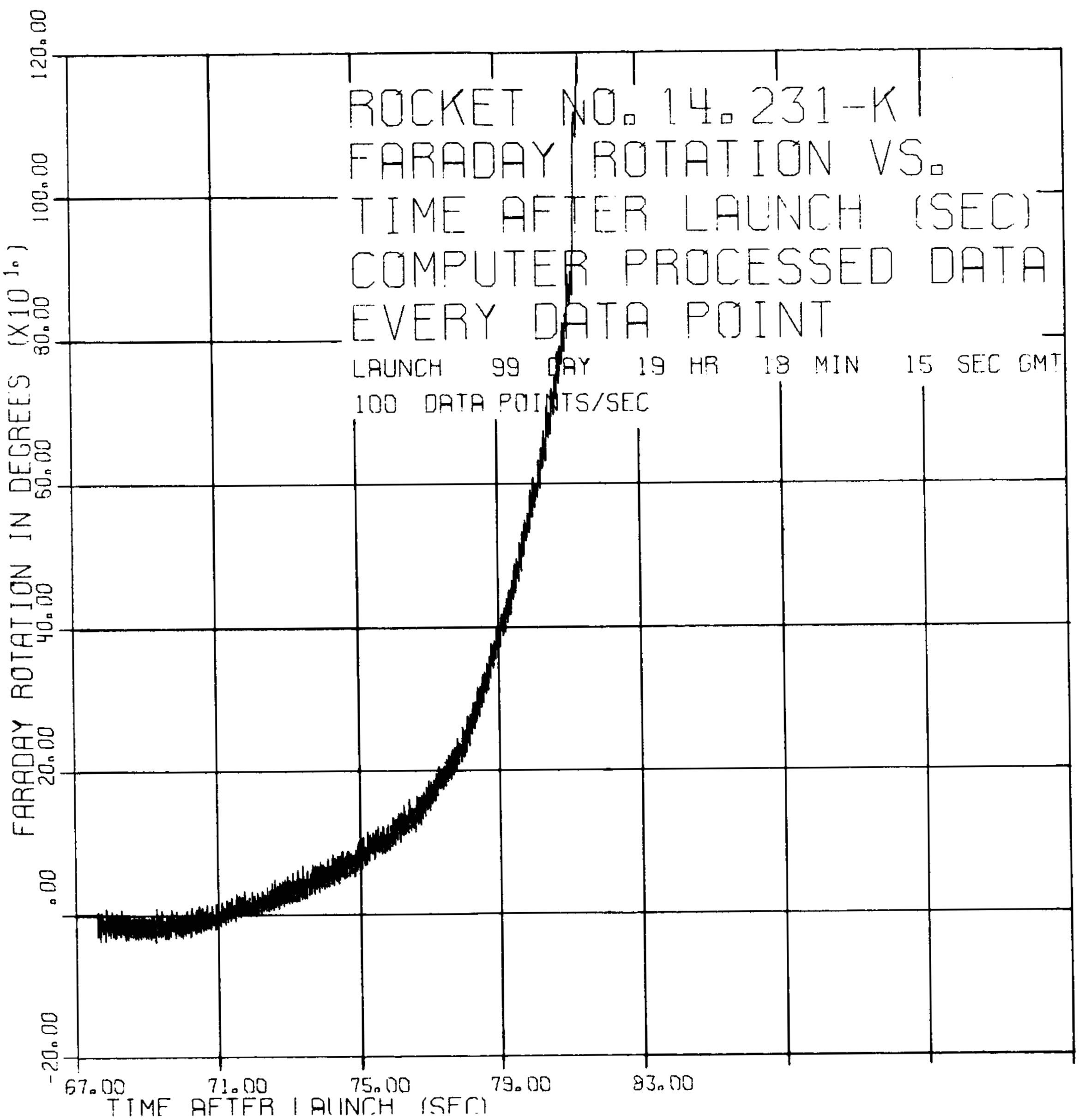
ROCKET NO. 14.228-P
FARADAY ROTATION VS.
TIME AFTER LAUNCH (SEC)
COMPUTER PROCESSED DATA
EVERY DATA POINT
LAUNCH 79 DAY 13 HR 20 MIN 9 SEC GMT
100 DATA POINTS/SEC
FARADAY ROTATION IN DEGREES (X10 1.)
280.00
240.00
200.00
160.00
120.00
80.00
40.00
.00
-40.00
57.00
61.00
65.00
69.00
73.00
77.00
81.00
85.00
89.00
93.00
97.00
101.00
TIME AFTER LAUNCH (SEC)

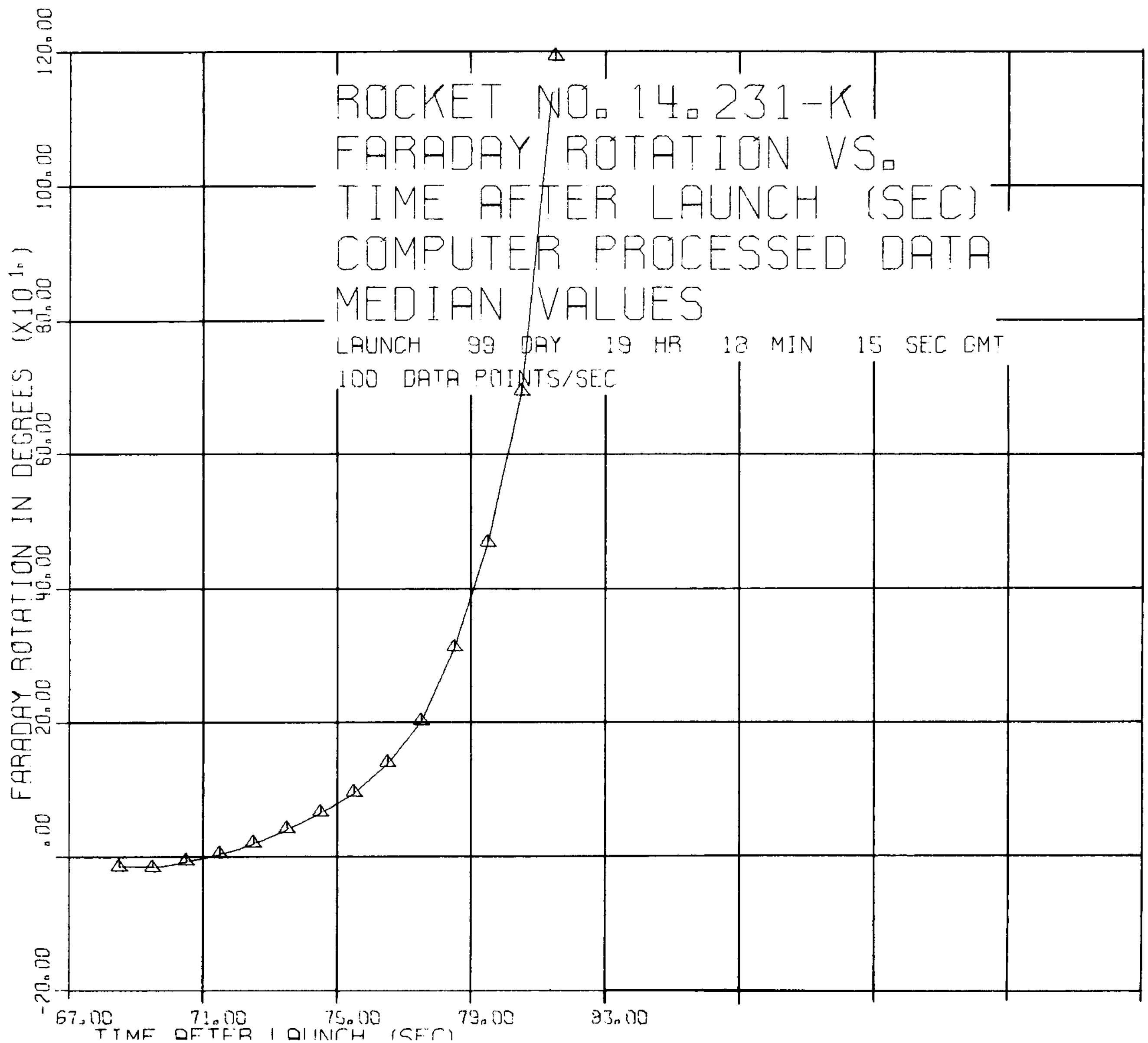

ROCKET NO. 14.228-P
FARADAY ROTATION VS.
TIME AFTER LAUNCH (SEC)
COMPUTER PROCESSED DATA
MEDIAN VALUES
LAUNCH 79 DAY 13 HR 20 MIN 9 SEC GMT
100 DATA POINTS/SEC
FARADAY ROTATION IN DEGREES (X10 1.)
280.00
240.00
200.00
160.00
120.00
80.00
40.00
.00
-40.00
57.00
61.00
65.00
69.00
73.00
77.00
81.00
85.00
89.00
93.00
97.00
101.00
TIME AFTER LAUNCH (SEC)

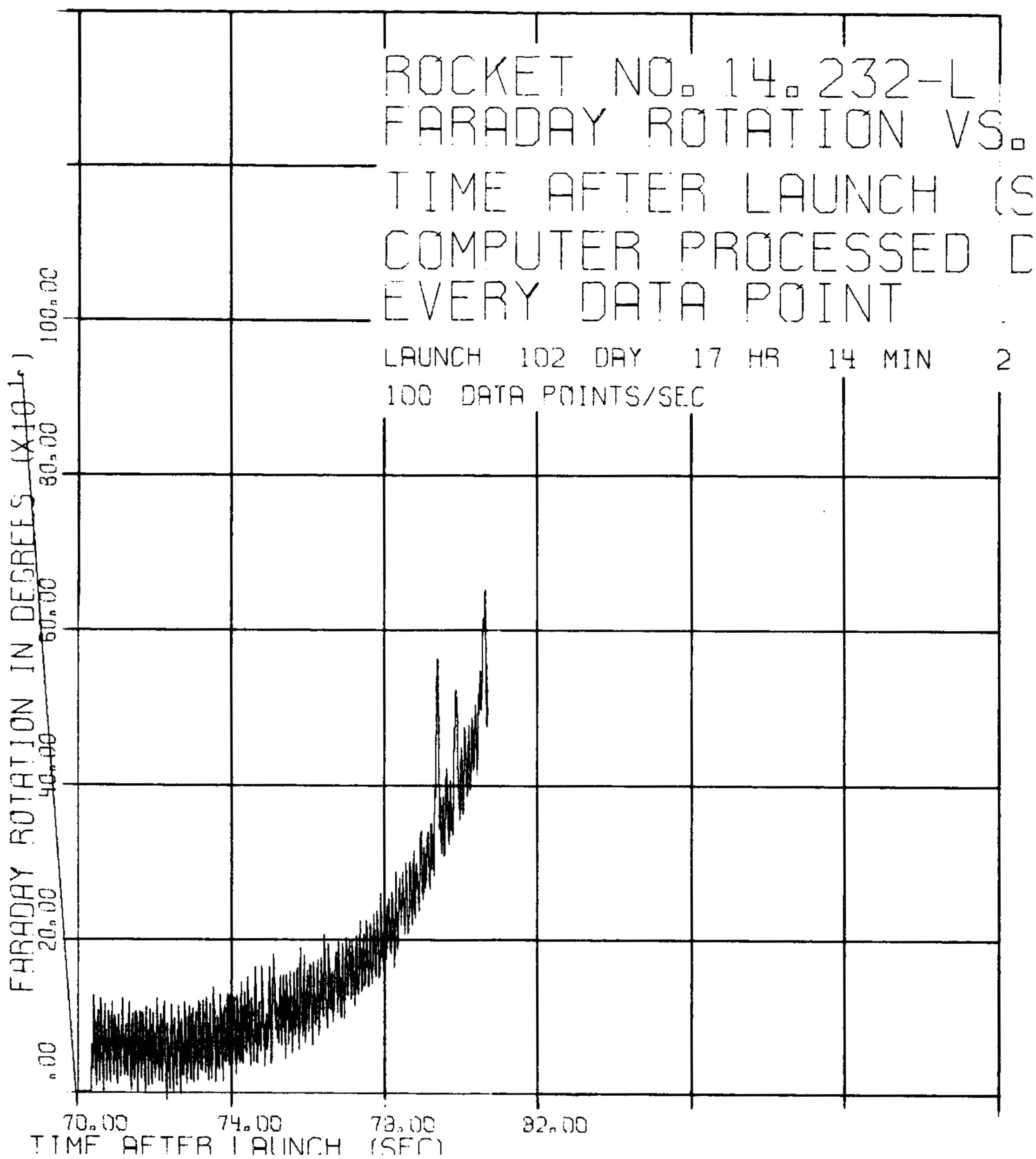

ROCKET NO. 14.230-J
FARADAY ROTATION VS.
TIME AFTER LAUNCH (SEC)
COMPUTER PROCESSED DATA
EVERY DATA POINT
LAUNCH 95 DAY 13 HR 45 MIN 53 SEC GMT
100 DATA POINTS/SEC
FARADAY ROTATION IN DEGREES
200.00
160.00
120.00
80.00
40.00
.00
-40.00
-80.00
35.00
39.00
43.00
47.00
51.00
55.00
59.00
63.00
67.00
71.00
75.00
79.00
83.00
TIME AFTER LAUNCH (SEC)

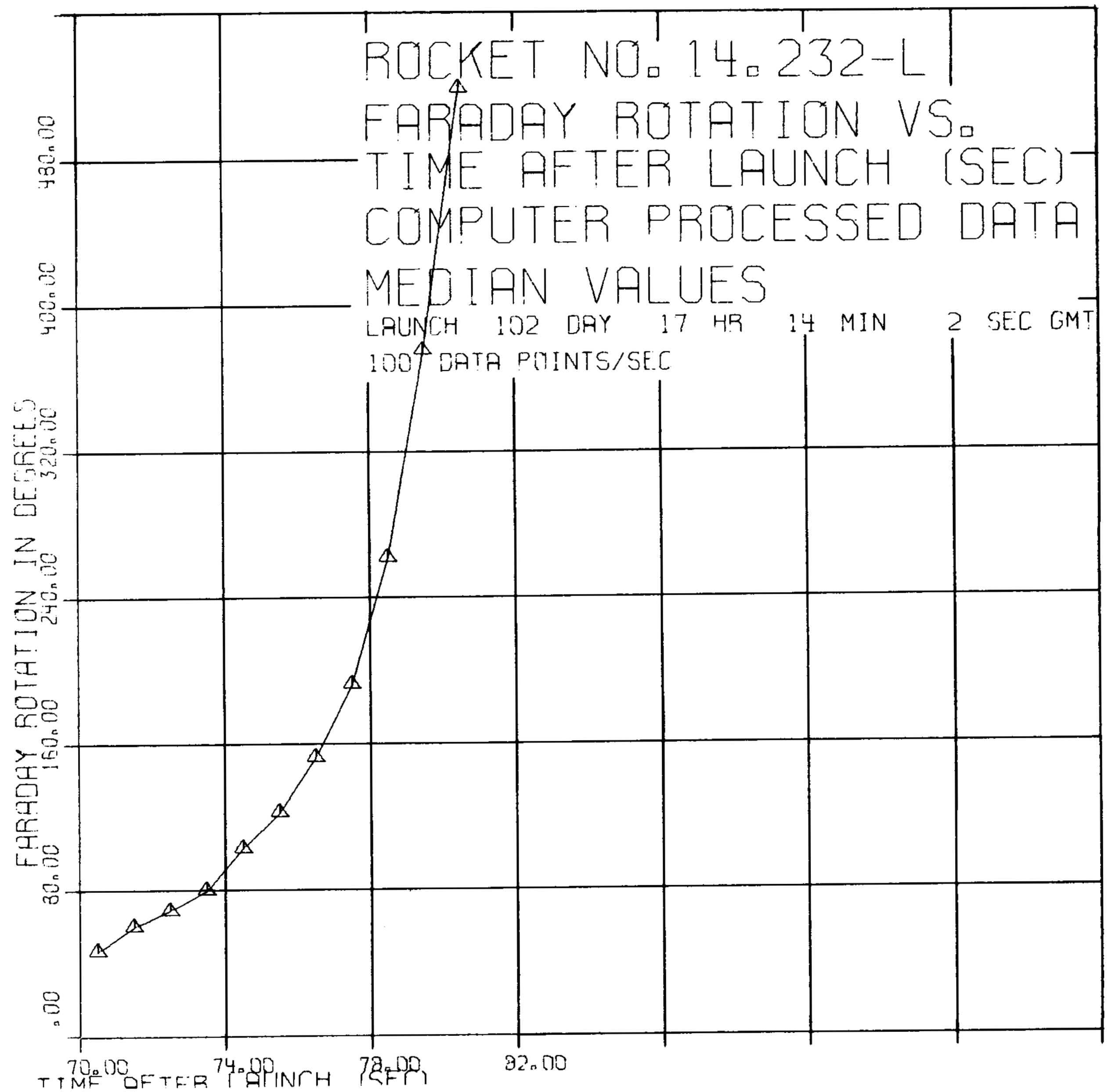

ROCKET NO. 14.230-J
FARADAY ROTATION VS.
TIME AFTER LAUNCH (SEC)
COMPUTER PROCESSED DATA
EVERY DATA POINT
LAUNCH 95 DAY 13 HR 45 MIN 53 SEC GMT
100 DATA POINTS/SEC
FARADAY ROTATION IN DEGREES (X10 1.)
360.00
300.00
240.00
180.00
120.00
60.00
.00
-60.00
35.00
39.00
43.00
47.00
51.00
55.00
59.00
63.00
67.00
71.00
75.00
79.00
83.00
87.00
91.00
95.00
99.00
103.00
TIME AFTER LAUNCH (SEC)

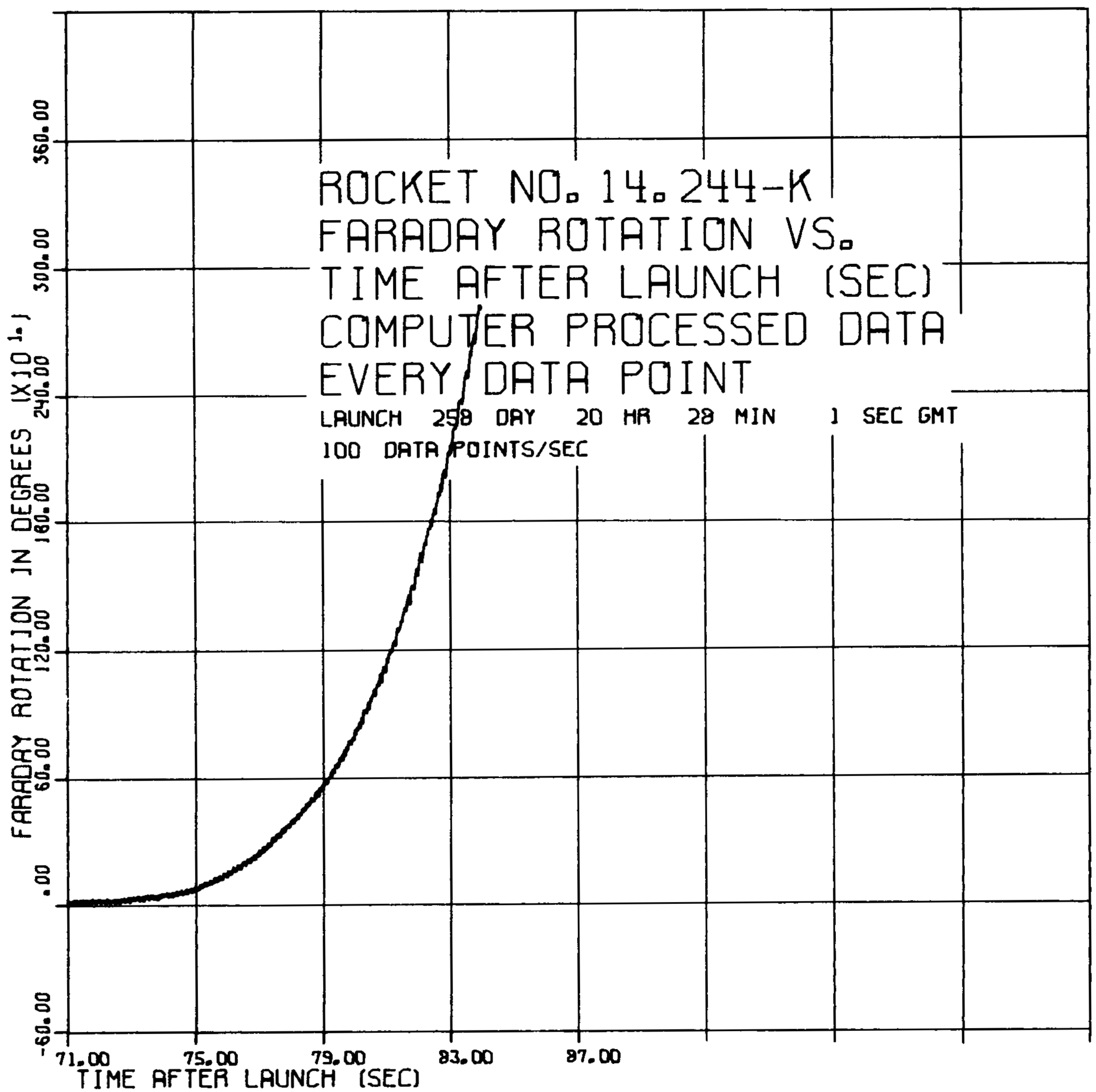

ROCKET NO. 14.230-J
FARADAY ROTATION VS.
TIME AFTER LAUNCH (SEC)
COMPUTER PROCESSED DATA
MEDIAN VALUES
LAUNCH 95 DAY 13 HR 45 MIN 53 SEC GMT
100 DATA POINTS/SEC
FARADAY ROTATION IN DEGREES (X10 1.)
350.00
300.00
250.00
200.00
150.00
100.00
50.00
.00
-50.00
35.00
39.00
43.00
47.00
51.00
55.00
59.00
63.00
67.00
71.00
75.00
79.00
83.00
87.00
91.00
95.00
99.00
103.00
TIME AFTER LAUNCH (SEC)

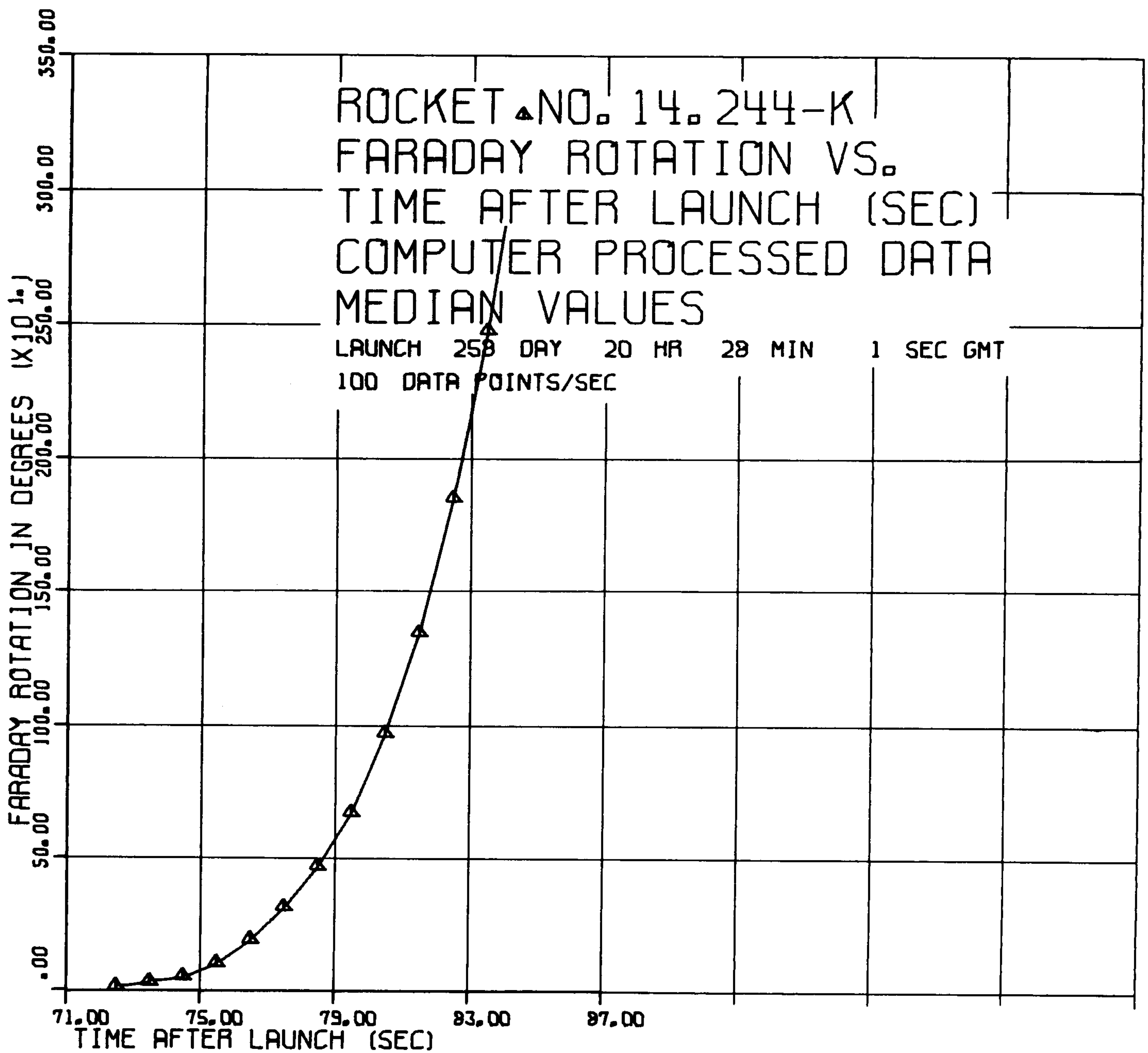

ROCKET NO. 14.231-K
FARADAY ROTATION VS.
TIME AFTER LAUNCH (SEC)
COMPUTER PROCESSED DATA
EVERY DATA POINT
LAUNCH 99 DAY 19 HR 18 MIN 15 SEC GMT
100 DATA POINTS/SEC
FARADAY ROTATION IN DEGREES (X10 1.)
120.00
100.00
80.00
60.00
40.00
20.00
.00
-20.00
67.00
71.00
75.00
79.00
83.00
TIME AFTER LAUNCH (SEC)


ROCKET NO. 14.231-K
FARADAY ROTATION VS.
TIME AFTER LAUNCH (SEC)
COMPUTER PROCESSED DATA
MEDIAN VALUES
LAUNCH 99 DAY 19 HR 18 MIN 15 SEC GMT
100 DATA POINTS/SEC
FARADAY ROTATION IN DEGREES (X10 1.)
120.00
100.00
80.00
60.00
40.00
20.00
.00
-20.00
67.00
71.00
75.00
79.00
83.00
TIME AFTER LAUNCH (SEC)

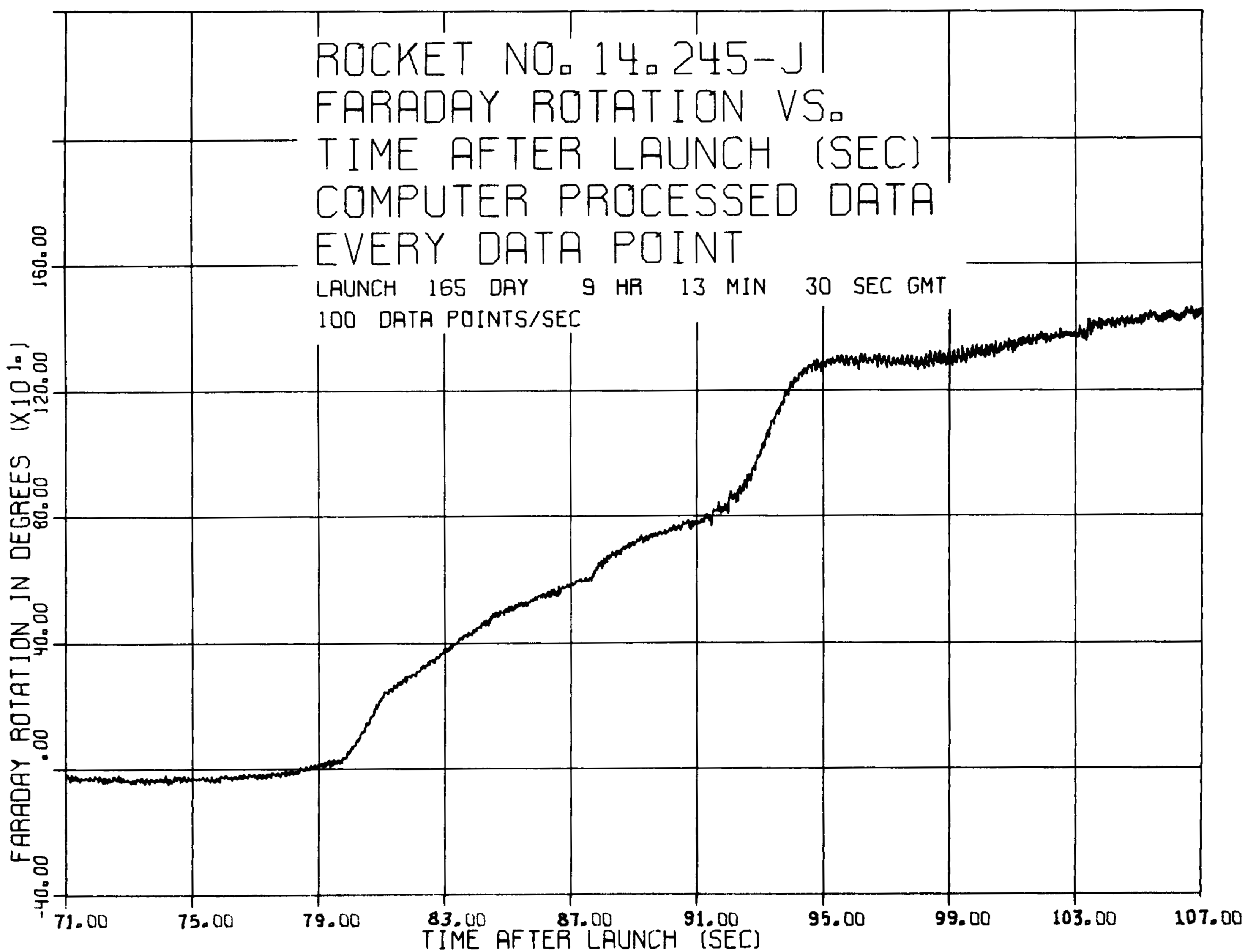

ROCKET NO. 14.232-L
FARADAY ROTATION VS.
TIME AFTER LAUNCH (S
COMPUTER PROCESSED D
EVERY DATA POINT
LAUNCH 102 DAY 17 HR 14 MIN 2
100 DATA POINTS/SEC
FARADAY ROTATION IN DEGREES (X10 1)
.00
20.00
40.00
60.00
80.00
100.00
70.00
74.00
78.00
82.00
TIME AFTER LAUNCH (SEC)


ROCKET NO. 14.232-L
FARADAY ROTATION VS.
TIME AFTER LAUNCH (SEC)
COMPUTER PROCESSED DATA
MEDIAN VALUES
LAUNCH 102 DAY 17 HR 14 MIN 2 SEC GMT
100 DATA POINTS/SEC
FARADAY ROTATION IN DEGREES
.00
80.00
160.00
240.00
320.00
400.00
480.00
70.00
74.00
78.00
82.00
TIME AFTER LAUNCH (SEC)

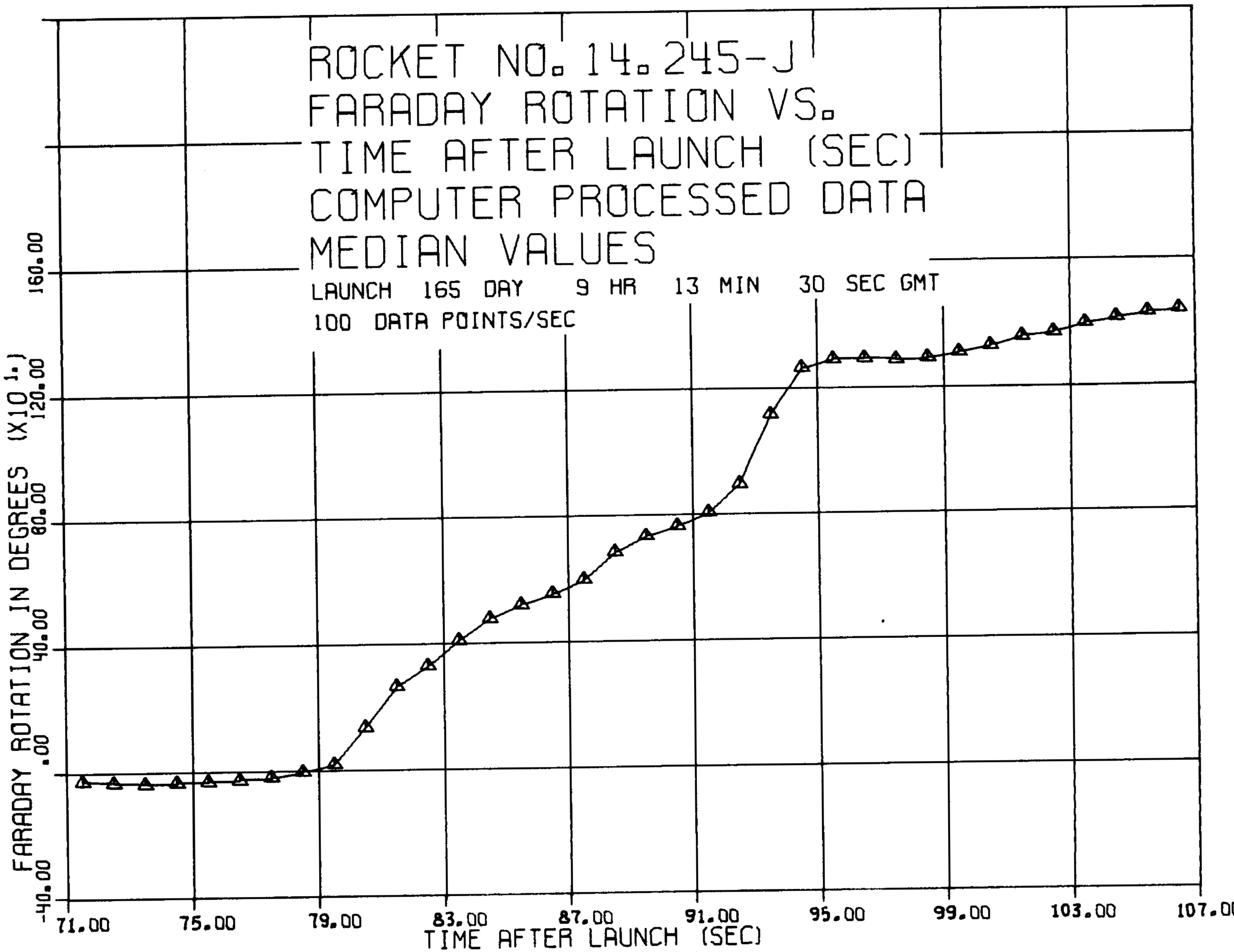

ROCKET NO. 14.244-K
FARADAY ROTATION VS.
TIME AFTER LAUNCH (SEC)
COMPUTER PROCESSED DATA
EVERY DATA POINT
LAUNCH 258 DAY 20 HR 28 MIN 1 SEC GMT
100 DATA POINTS/SEC
FARADAY ROTATION IN DEGREES (X10 1.)
360.00
300.00
240.00
180.00
120.00
60.00
.00
-60.00
71.00
75.00
79.00
83.00
87.00
TIME AFTER LAUNCH (SEC)

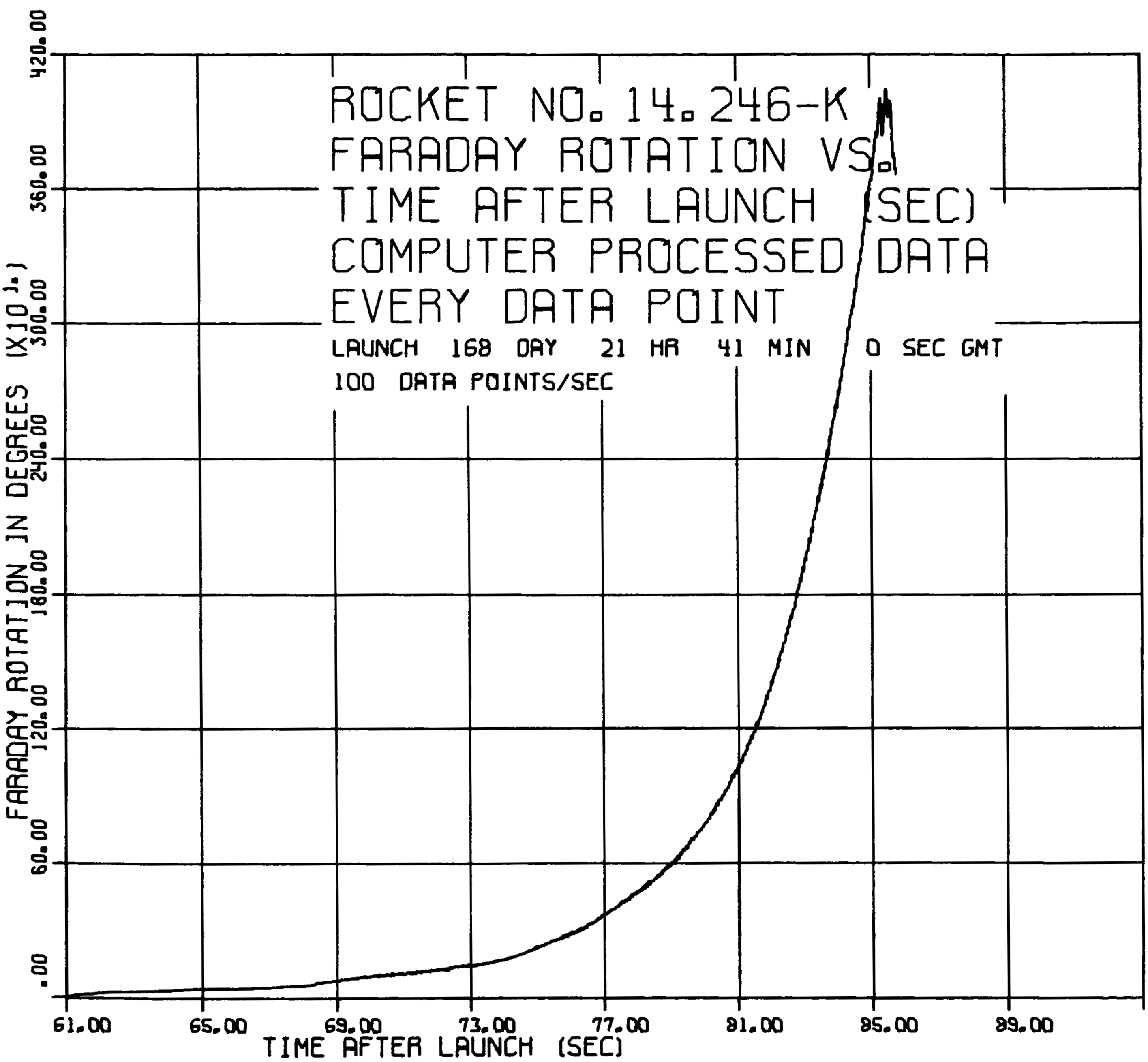


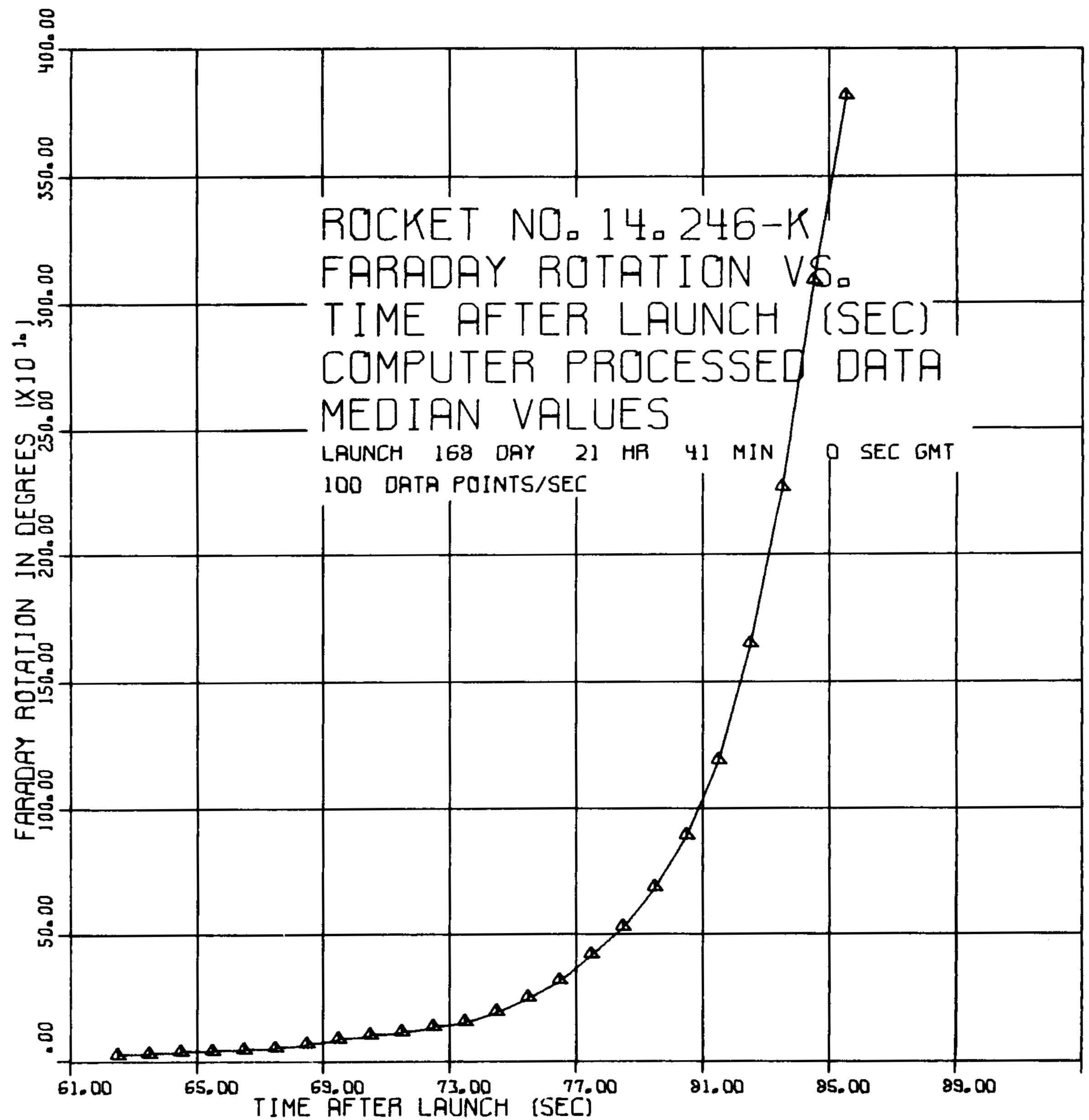
ROCKET ▲NO. 14.244-K
FARADAY ROTATION VS.
TIME AFTER LAUNCH (SEC)
COMPUTER PROCESSED DATA
MEDIAN VALUES
LAUNCH 258 DAY 20 HR 28 MIN 1 SEC GMT
100 DATA POINTS/SEC
FARADAY ROTATION IN DEGREES (X10 1.)
.00
50.00
100.00
150.00
200.00
250.00
300.00
350.00
71.00
75.00
79.00
83.00
87.00
TIME AFTER LAUNCH (SEC)

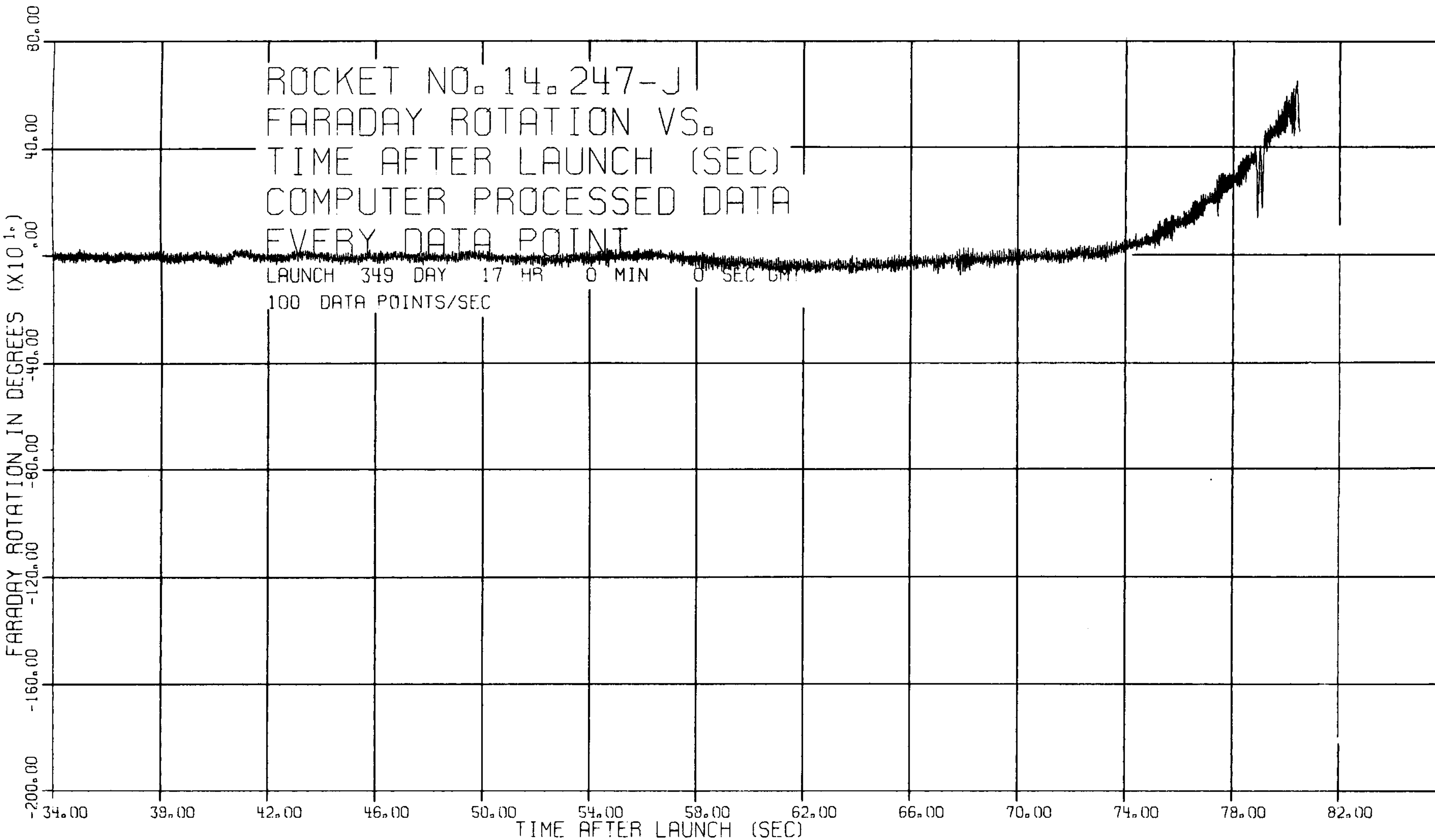


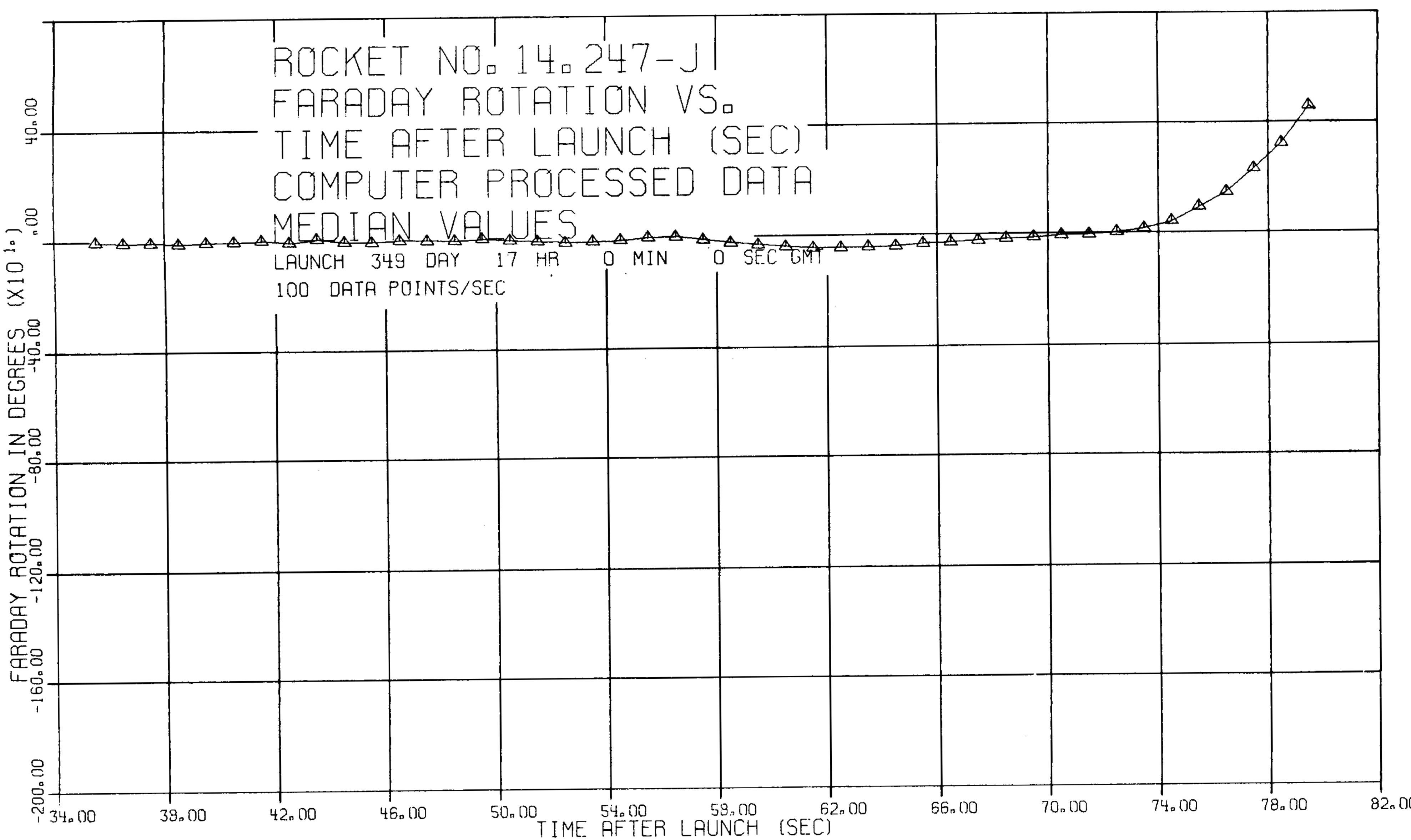
ROCKET NO. 14.245-J
FARADAY ROTATION VS.
TIME AFTER LAUNCH (SEC)
COMPUTER PROCESSED DATA
EVERY DATA POINT
LAUNCH 165 DAY 9 HR 13 MIN 30 SEC GMT
100 DATA POINTS/SEC
FARADAY ROTATION IN DEGREES (X10 1.)
160.00
120.00
80.00
40.00
.00
-40.00
71.00
75.00
79.00
83.00
87.00
91.00
95.00
99.00
103.00
107.00
TIME AFTER LAUNCH (SEC)


ROCKET NO. 14.245-J
FARADAY ROTATION VS.
TIME AFTER LAUNCH (SEC)
COMPUTER PROCESSED DATA
MEDIAN VALUES
LAUNCH 165 DAY 9 HR 13 MIN 30 SEC GMT
100 DATA POINTS/SEC
FARADAY ROTATION IN DEGREES (X10 1.)
-40.00
.00
40.00
80.00
120.00
160.00
71.00
75.00
79.00
83.00
87.00
91.00
95.00
99.00
103.00
107.00
TIME AFTER LAUNCH (SEC)


ROCKET NO. 14.246-K
FARADAY ROTATION VS.
TIME AFTER LAUNCH (SEC)
COMPUTER PROCESSED DATA
EVERY DATA POINT
LAUNCH 168 DAY 21 HR 41 MIN 0 SEC GMT
100 DATA POINTS/SEC
FARADAY ROTATION IN DEGREES (X10 1.)
420.00
360.00
300.00
240.00
180.00
120.00
60.00
.00
61.00
65.00
69.00
73.00
77.00
81.00
85.00
89.00
TIME AFTER LAUNCH (SEC)


ROCKET NO. 14.246-K
FARADAY ROTATION VS.
TIME AFTER LAUNCH (SEC)
COMPUTER PROCESSED DATA
MEDIAN VALUES
LAUNCH 168 DAY 21 HR 41 MIN 0 SEC GMT
100 DATA POINTS/SEC
FARADAY ROTATION IN DEGREES (X10 1.)
TIME AFTER LAUNCH (SEC)
.00
50.00
100.00
150.00
200.00
250.00
300.00
350.00
400.00
61.00
65.00
69.00
73.00
77.00
81.00
85.00
89.00


ROCKET NO. 14.247-J
FARADAY ROTATION VS.
TIME AFTER LAUNCH (SEC)
COMPUTER PROCESSED DATA
EVERY DATA POINT
LAUNCH 349 DAY 17 HR 0 MIN 0 SEC GMT
100 DATA POINTS/SEC
FARADAY ROTATION IN DEGREES (X10 1.)
80.00
40.00
.00
-40.00
-80.00
-120.00
-160.00
-200.00
34.00
38.00
42.00
46.00
50.00
54.00
58.00
62.00
66.00
70.00
74.00
78.00
82.00
TIME AFTER LAUNCH (SEC)


ROCKET NO. 14.247-J
FARADAY ROTATION VS.
TIME AFTER LAUNCH (SEC)
COMPUTER PROCESSED DATA
MEDIAN VALUES
LAUNCH 349 DAY 17 HR 0 MIN 0 SEC GMT
100 DATA POINTS/SEC
FARADAY ROTATION IN DEGREES (X10 1.)
40.00
.00
-40.00
-80.00
-120.00
-160.00
-200.00
34.00
38.00
42.00
46.00
50.00
54.00
58.00
62.00
66.00
70.00
74.00
78.00
82.00
TIME AFTER LAUNCH (SEC)

Distribution list as of May 1, 1966

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