DATA SET CATALOG #31

PEGASUS I, II, III Micrometeorite

65-009A-01A	1 tape
65-039A-01A	1 tape
65-060A-01A	1 tape

Condensed Pegasus I, II, III

65-009A-01B	1 tape
65-039A-01B	1 tape
65-060A-01B	1 tape

Table of Contents

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1. INTRODUCTION:

The documentation for this data set was originally on paper, kept in NSSDC's Data Set Catalogs (DSCs). The paper documentation in the Data Set Catalogs have been made into digital images, and then collected into a single PDF file for each Data Set Catalog. The inventory information in these DSCs is current as of July 1, 2004. This inventory information is now no longer maintained in the DSCs, but is now managed in the inventory part of the NSSDC information system. The information existing in the DSCs is now not needed for locating the data files, but we did not remove that inventory information.

The offline tape datasets have now been migrated from the original magnetic tape to Archival Information Packages (AIP’s).

A prior restoration may have been done on data sets, if a requestor of this data set has questions; they should send an inquiry to the request office to see if additional information exists.

2. ERRATA/CHANGE LOG:

NOTE: Changes are made in a text box, and will show up that way when displayed on screen with a PDF reader.

When printing, special settings may be required to make the text box appear on the printed output.

Version	Date	Person	Page	Description of Change
01				
02				

3 LINKS TO RELEVANT INFORMATION IN THE ONLINE NSSDC INFORMATION SYSTEM:

http://nssdc.gsfc.nasa.gov/nmc/

[NOTE: This link will take you to the main page of the NSSDC Master Catalog. There you will be able to perform searches to find additional information]

4. CATALOG MATERIALS:

a. Associated Documents — To find associated documents you will need to know the document ID number and then click here. http://nssdcftp.gsfc.nasa.gov/miscellaneous/documents/

b. Core Catalog Materials

PEGASUS 1, 2, 3

CARDS AND TAPE IMAGES OF CARDS

65-009A-01A

65-039A-01A

65-060A-01A

THESE DATA SETS HAVE BEEN RESTORED. THERE WAS ORIGINALLY ONE 7-TRACK, 556 BPI TAPE WRITTEN IN BCD. THERE IS ONE RESTORED TAPE, WRITTEN IN ASCII. THE DR TAPE IS A 3480 CARTRIDGE AND THE DS TAPE IS 9-TRACK, 6250 BPI. THE ORIGINAL TAPE WAS CREATED ON AN IBM 7094 COMPUTER AND WAS RESTORED ON AN IBM 9021 COMPUTER. THE DR AND DS NUMBERS ALONG WITH THE CORRESPONDING D NUMBER AND TIME SPAN IS AS FOLLOWS:

DR#	DS#	D#	FILES	TIME SPAN	ID#
DR004082	DS004082	D000208	1-2	02/17/65 - 03/29/66	65-009A-01A
			3-5	05/25/65 - 10/31/67	65-039A-01A
			6-8	07/30/65 - 08/15/67	65-060A-01A

D-05566
C-03913

CONDENSED PEGASUS 1, 2, 3 FORMAT

COLUMN	
1	Satellite Penetrated
2- 3	Year of Penetration
4- 6	Day of Penetration
7-10	Hour and Minute of Penetration
12-15	Local Time of Penetration
17-20	Satellite Clock Time when Penetrated
22-26	Latitude of Penetration
28-32	Longitude of Penetration
34-38	Ecliptic Latitude when Penetrated
40-44	Ecliptic Longitude when Penetrated
46-49	Right Ascension when Penetrated
51-55	Declination when Penetrated
57	Z Side of Penetration
58-60	Panel Penetrated (Assigned #)
61	Y Side of Penetration
62	Thickness Penetrated
64-68	Pulse Verify (Duration in MSEC)
70-74	Temperature Probe on +Z Side when Penetrated (°C)
76-80	Temperature Probe on -Z Side when Penetrated (°C)

FILE 1: PEGASUS I C
Feb. 17, 1965 to March 29, 1966

FILE 2: PEGASUS II A, B, C
May 25, 1965 to October 31, 1967

FILE 3: PEGASUS III A, B, C
July 30, 1965 to August 15, 1967

D-00208 #31
C-00092

File One	Key
File Two	PEGASUS I "C" Thickness Feb. 17, 1965 to Mar. 29, 1966
File Three	PEGASUS II "A" Thickness May 27, 1965 to Oct. 18, 1967
File Four	PEGASUS II "B" Thickness May 26, 1965 to April 13, 1966
File Five	PEGASUS II "C" Thickness May 25, 1965 to Oct. 31. 1967
File Six	PEGASUS III "A" Thickness Aug. 1, 1965 to Aug. 15, 1967
File Seven	PEGASUS III "B" Thickness July 31, 1965 to Nov. 23, 1965
File Eight	PEGASUS III "C" Thickness July 30, 1965 to Aug. 15, 1967

OHIO UNIVERSITY
ATHENS, OHIO 45701

COMPUTER CENTER
GRADUATE RESEARCH BUILDING
SCIENCE [illegible]

April 1, 1970

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

Dear Ken:

In response to our telephone conversation of March 31, I am sending five boxes of cards containing Pegasus Satellite Micrometeoroid Data. Three of these boxes contain data in the original NASA format with the unreadable events removed and with card sequence errors and mispunches corrected. The other two boxes contain the identical data, but in condensed form.

The listings accompanying these cards should explain fairly well what I have done with the data.

I feel our Computer Center may be of further use to you in this area. Perhaps we could arrange to receive from you various types of machine readable data for examination and possible correction.

If there is anything we can do, or if you have questions about the attached data, please let me know. Thank you very much.

Yours truly,

Robert W. Lilley
Director

RWL/hmo

Enc.

APR 8 1970
Rec'd damaged

DATA USERS' NOTE
NSSDC 69-15

PEGASUS 1 (1965 09A), 2 (1965 39A), AND 3 (1965 60A) METEOROID PENETRATION DETECTORS

INVESTIGATORS:

R. J. Naumann
K. S. Clifton

PREPARED BY:

G. Fuller, Acquisition Scientist
M. Beeler, Technical Writer

OCTOBER 1969

FOREWORD

This *Data Users' Note* is specifically designed to help potential data users decide if they can make use of the data obtained in the Pegasus 1 (1965 09A), 2 (1965 39A), and 3 (1965 60A) meteoroid penetration detectors experiment. Once a data user decides that he requires the data, it will serve as the unifying element – the key – in the actual use of the data available at the National Space Science Data Center (NSSDC). To achieve these goals, the *Note* briefly describes the experiment, including the instrumentation and measurements, the telemetry, and the operational experience. All available details are then provided on the actual reduction techniques and format of recorded data. For those desiring more details, the names and addresses of the experimenters are provided to facilitate direct contact. As a further aid, detailed references (and bibliography) are also included. When available, NASA accession numbers* are given. The primary purpose of these references is to identify the sources containing complete information concerning the subject under discussion. Most of these references are physically available at NSSDC – those that are not are readily obtainable.

Inquiries concerning the availability of data should be directed to:

National Space Science Data Center
Code 601
Goddard Space Flight Center
Greenbelt, Maryland 20771

Area Code 301 982-6695

*For example, N64-2243 is an accession number for an article reported in the *Scientific and Technical Aerospace Reports* (STAR), and A63-5921 refers to an entry in the *International Aerospace Abstracts* (IAA).

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LIST OF FIGURES

PEGASUS 1 (1965 09A), 2 (1965 39A), AND 3 (1965 60A)

METEOROID PENETRATION DETECTORS

BACKGROUND

The primary mission of the Pegasus project was to measure the frequency of meteoroid penetration of a satellite in the near-earth orbit in order to ascertain the probable meteoroid collision hazard to manned space flights. Thus, the main objective was to obtain measurements of the meteoroid abundance over the mass range 10^{-7} to 10^{-4} gm with greater accuracy than those of past methods. Measurements of the number-mass distribution of meteoroids in the mass range 10^{-11} to 10^{-7} gm have been conducted by impact sensors on other space vehicles, specifically Explorers 13, 16, and 23. Data points for the mass range of 10^{-4} gm to several grams have been determined with optical and radar systems from the ground.

The aluminum selected for meteoroid penetration detectors was intended to simulate materials used in a manned spacecraft, and thicknesses of aluminum were varied down to foil thickness to provide comparison with similar thicknesses on Explorer 16 and 23 impact detectors.[1,2]

The Pegasus project was directed by the Office of Advanced Research and Technology at NASA Headquarters. Scientists at the Marshall Space Flight Center had the responsibility for carrying out the development and operation of the project.[3]

The mission plans for all three spacecraft called for orbits ranging from 500 to 700 km, orbital inclinations of ~30° and periods of ~100 min. The orbital parameters of the spacecraft were as follows:[2]

	Pegasus 1	Pegasus 2	Pegasus 3
Launch date	2-16-65	5-25-65	7-30-65
Apogee (km)	737.7	742.1	540.0
Perigee (km)	501.6	511.7	521.9
Period (min)	97.0	97.0	95.3
Inclination (deg)	31.8	31.8	28.9
Eccentricity	.0169	.0164	.0013

INVESTIGATORS

R. J. Naumann – Marshall Space Flight Center, Huntsville, Alabama
K. S. Clifton – Marshall Space Flight Center, Huntsville, Alabama

EXPERIMENT

Instrumentation and Measurements

The Pegasus satellites used parallel plate capacitors as meteoroid detectors. A penetration through the capacitor created a discharge which was processed by the electronics as a "hit" indication. An exploded view of the capacitor detector assembly is shown in figure 1. The alodine thermal control coating was chosen because it added only a negligible thickness to the target sheet. The 0.04-mm target sheet was of 1100-0 aluminum while the two thicker targets were of 2024 T-3 aluminum. The 12-micron dielectric was approximately half mylar and half adhesive since it was composed of three individual layers of mylar bonded together. The foam core served both as a structural member and as a barrier to prevent the meteoroids and debris from passing through one capacitor and then striking the capacitor on the opposite side of the wing. The foam core for the 0.04-mm target sheet capacitors was 2.54-cm-thick rigid closed cell foam to provide additional structural stiffness. There were 416 individual capacitors forming 208 detector assemblies on each spacecraft.

The meteoroid detector assemblies were mounted on the two wings of the satellite so that both capacitors were exposed. The wings unfolded to dimensions of 29.3 m × 4.1 m. The separate wings were identified as the +Y and -Y wings; reverse sides were designated +Z and -Z; and the forward direction of the satellite structure was called +X. The orientation of the wing configuration is indicated in figure 2.

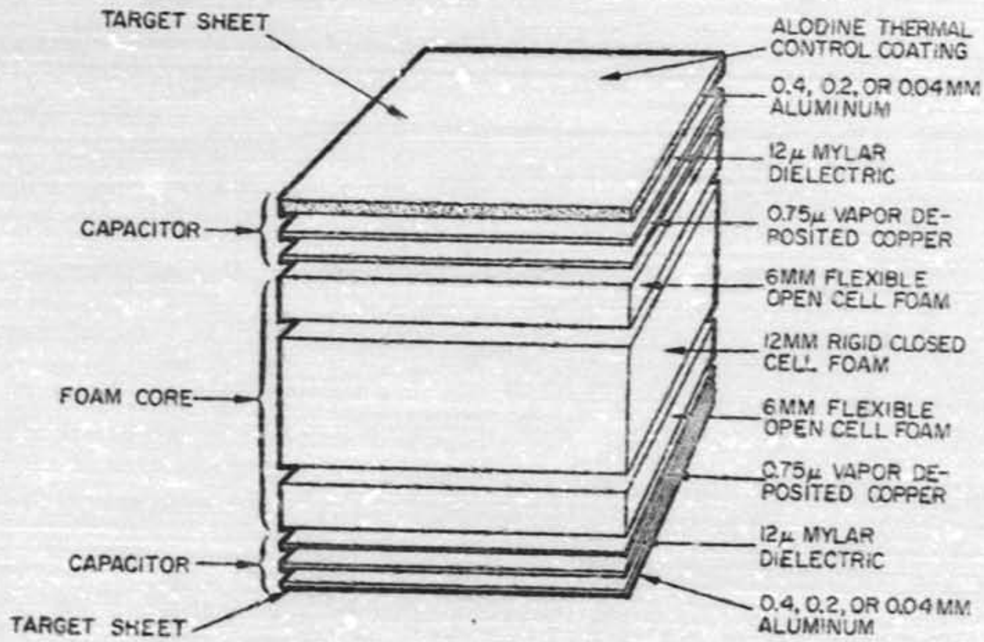

Figure 1–Meteoroid Sensor Panel

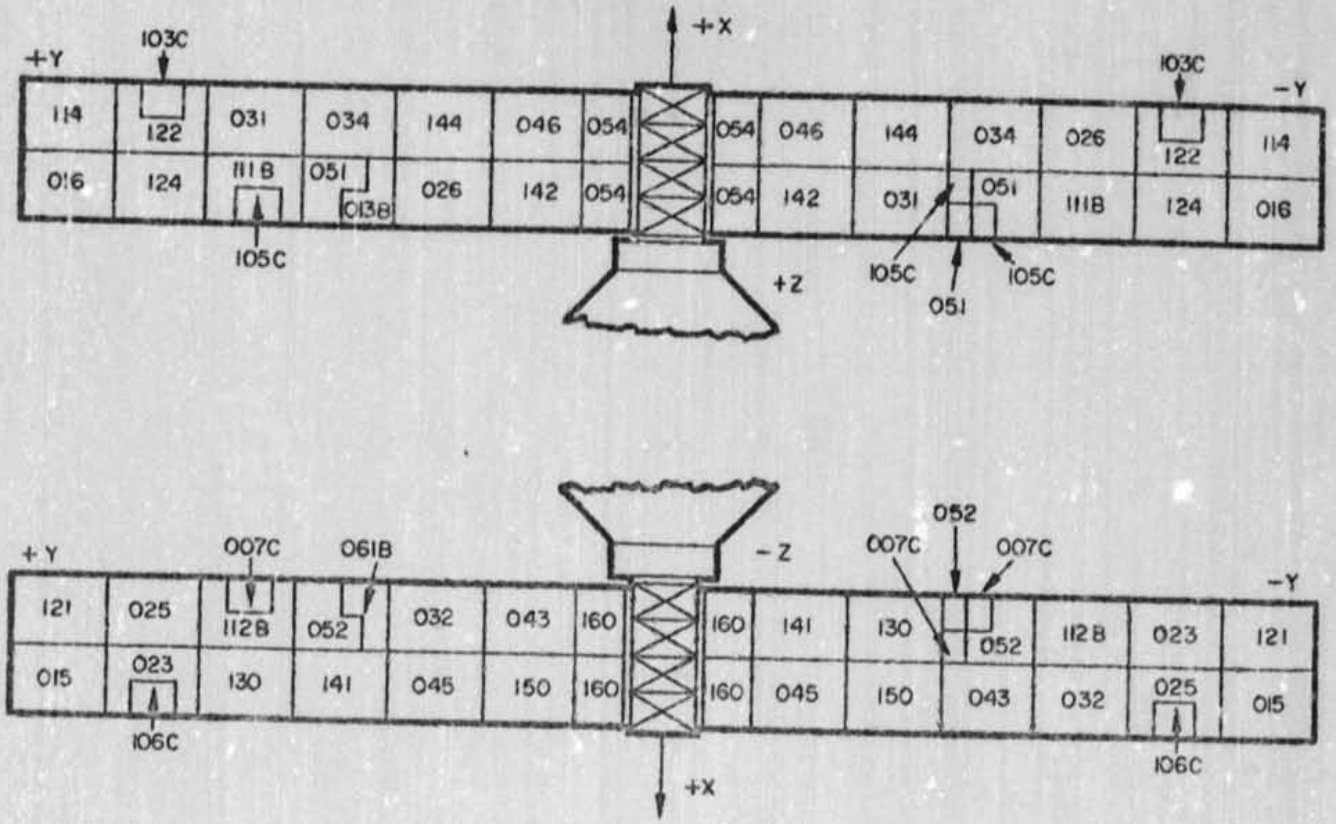

Figure 2—Pegasus Detector Panels. Schematic wings showing locations of various logic groups. The letter C after the logic group identification indicates 0.04-mm target sheets; B denotes 0.2-mm target sheets; no letter indicates 0.4-mm target sheets.

The total sensitive area on each satellite was approximately 200 m^2, which was divided among the three target sheet thicknesses as shown below, (figure 3).

Target Sheet Thickness	Area on Respective Satellite		
	Pegasus 1	Pegasus 2	Pegasus 3
0.04 mm	6.47 m^2	6.52 m^2	6.52 m^2
0.2 mm	15.84 m^2	14.45 m^2	14.45 m^2
0.4 mm	166.14 m^2	167.80 m^2	162.87 m^2
Total*	188.46 m^2	188.76 m^2	183.83 m^2

*Totals are rounded off.

Figure 3—Pegasus Target Sheet Thicknesses.

The individual capacitors were electrically connected in parallel to form 62 logic groups. The 0.4-mm area was subdivided into 48 logic groups of five to eight capacitors each, the 0.2-mm area into six logic groups of three to eight capacitors each, and the 0.04-mm area into eight logic groups of two capacitors each. The origin of each penetration event could be assigned to one of these logic groups by the electronics. The -Y wing had 30 logic groups and the +Y wing had 32. Apart from these minor differences the circuitry for each wing was identical. The numbers on the wings in figure 2 refer to the logic groups.

At the time of meteoroid penetration a temporary electrical short appeared in the capacitor which immediately cleared and allowed for recharge of the detector. The initial negative going voltage drop across the capacitor started an integrator in the hit detector which integrated the voltage drop across the detector panel for 250 μsec. If the integrated voltage-time product was greater than a predetermined value (the equivalent of a discharge with normal recharge of 5 volts for the 0.2- and 0.4-mm capacitors and 3 volts for the 0.04-mm capacitors on Pegasus 1, and 4 volts for all thicknesses on Pegasus 2 and 3), a "hit" pulse was generated. This pulse was used to initiate all follow-on circuitry. There were six hit detectors on each spacecraft. Three detectors served each wing with each detector monitoring all of the capacitors of the same thickness on one wing.

The current to recharge the capacitors to their normal 40-volt operating potential came from a network of 14 current recharge amplifiers (CRA's). Three of these identical CRA's supplied current to each logic group with no two groups connected to the same three CRA's. The identity of the detector group impacted could therefore be established by determining which three CRA's were supplying current immediately after impact. The length of time that recharge current was drawn above a threshold level was also measured. This time could be directly related to the depth of discharge of the capacitor. In order to prevent the unaffected capacitors in a logic group from contributing to the recharge of the impacted capacitor and thus preventing proper identification of the group, each capacitor was isolated from the others with a resistor-diode circuit placed between the capacitor and its signal lead. This kept the threshold level of the logic-group-identification circuitry at the same threshold level as that of the hit amplifier.

Since it was possible for capacitors to become electrically noisy or permanently shorted, switches were provided so that any logic group could be individually connected or disconnected from the satellite electronics. This procedure could also be used to test the electronics in orbit because the reconnection of a logic group would look like a meteoroid penetration to the electronics. On Pegasus 2 and 3 fuses were installed to each individual capacitor. If a noisy or shorted logic group was detected, the logic group would be switched to a special high current source which would blow the fuse of the affected panel. The logic group would then be reconnected to the normal satellite electronics. This procedure changed the sensitive area of the logic group. The change could be determined by measuring the recharge time of the logic group from a full 40-volt discharge since this was proportional to the number of capacitors in the group.

To prevent high frequency noise bursts from registering as impacts, it was necessary to clip the level of high frequency negative signals. This was accomplished by passing the signal from the capacitor through a low-pass filter consisting of a series resistor, a zener diode, and series capacitor to ground. The hit amplifier was not sensitive to positive signals. The design of the hit amplifier, which was especially insensitive to noise, was dictated by a problem which arose with the storage and subsequent release of high energy electrons from the mylar dielectric. The integration circuitry of the hit amplifier rejected the high frequency bursts when they were followed by a low-voltage normal discharge that was characteristic of the electrons. A radiation sensor was installed in the spacecraft to measure the omnidirectional flux of electrons as a function of position in orbit as a further protection against these spurious signals.*

Temperature measurements were made on two detector assembly sections so that any malfunction of the capacitors associated with their operating temperatures could be detected. There was also an attitude detection system consisting of solar aspect and earth sensors to supply data which could be used to determine the directionality of the impinging meteoroids.[1,4]

Telemetry

The attitude, temperature, and radiation data from the Pegasus satellites were secondary data intended to provide additional input to the meteoroid analysis. The data were recorded in the memory at 5-min intervals as controlled by an on-board clock. If the motion of the satellite was in question it was possible to command a rapid-attitude mode that recorded attitude data every 1.25 sec so that the ambiguity could be resolved. In addition to the capacitor temperatures, there were other temperature measurements on board. Some of these were recorded at intervals and some were broadcast real time.

The meteoroid data took precedence over all other data and were processed upon occurrence. The hit pulse generated by the hit amplifier served to initiate the processing by activating the word control logic circuitry. This, in turn, gated the word select which established the word identification code and initiated the flow of data to the input data shaper and parity generator. Simultaneously, it gated the output of the current recharge amplifiers to permit flow of panel (or group) identification information and pulse length information into the respective storage buffers. It activated a hit channel register encoded to identify the wing (+Y or -Y) and the thickness of material penetrated. The hit word, fed in parallel to memory

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*No correlation between electron flux and actual meteoroid pulses has been noted.

for storage and to the pulse-code-modulated (PCM) transmitter for real-time transmission, was highly redundant in information. It contained identification of the panel impacted, thickness identification, wing identification, verification of pulse (recharge time), and time of occurrence of impact to 1-min accuracy. A schematic of all of the word formats is given in figure 4.

The memory data were transmitted upon ground command. At each readout the memory was automatically cycled six times to assure correct data. After readout the memory could be cleared by a separate command. In addition to the PCM memory data, there were real-time pulse-amplitude-modulated (PAM) housekeeping data which were transmitted continuously over one of two beacon transmitters. The beacon carried not only the normal housekeeping measurements such as currents, voltages, and temperatures, but also transmitted each word as it was placed into the memory. The beacon data could therefore provide a cross-check on the memory data. Another beacon cross-check was the cumulative hit counter which was updated by the hit pulse from the hit amplifier. There was one counter for each capacitor thickness, and the total number of events on each thickness was broadcast continually over the beacon.

Operational Experience

The three Pegasus spacecraft began transmitting data on their respective launch dates and were still operating at the time of publication of this *Data Users' Note*, although meteoroid

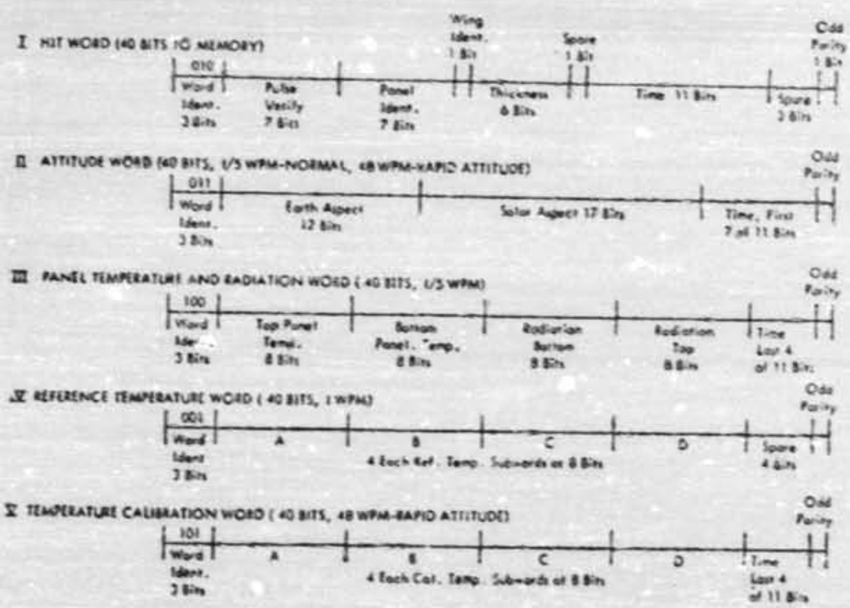

Figure 4—A Schematic of Word Formats.

analyses ended August 1969. The operational aspects of the three satellites are discussed in this section.

Pegasus 1

The major problem occurring in the operation of Pegasus 1 was higher than expected permanent electrical short rate in the 0.2-mm and 0.4-mm detectors. Furthermore, it was impossible to identify a panel group where five to eight detectors were connected. Some spurious discharges were also registered. The most usable data from Pegasus 1 were obtained from the 0.04-mm panels and the least usable data were from 0.4-mm detectors. No correlation was found between measured electron flux and recorded pulse rates of the meteoroid detectors.

Errors were found in the attitude system but the data were still usable. The detector plane was normal to the satellite's rotational axis which precesses slowly in space under the influence of gravity gradient torques.[1]

Pegasus 2

Minor changes were made in the electronic system of Pegasus 2. As previously stated, the threshold adjustment was changed from 5 volts on Pegasus 1 to 4 volts on Pegasus 2 and 3. The current recharge amplifiers were also modified to increase the sensitivity. Isolation between the detectors was increased by setting resistance to 1 megohm and installing fuses between each detector.

Intermittent failures occurred in the PAM and PCM channels but stable transmission in the PCM channel was re-established.[1]

Pegasus 3

Pegasus 3 was essentially the same as Pegasus 2 except for some reworking of the attitude system. The only problem was the failure of one FM transmitter after 3 months, but this did not result in a loss of data.

The orbit of Pegasus 3 was adjusted to a nearly circular orbit of approximately 530 km. Removable panels were installed on the wings of Pegasus 3 for possible recovery by an astronaut on a Gemini flight. (This mission, however, was not accomplished.) This feature slightly decreased the effective detection area on the wings.[1]

DATA

Reduction Techniques

In reducing the meteoroid data, the first task was to reconstruct the contents of the satellite memory for each readout. The memory was therefore read out six times before it was recycled. A computer searched for the synchronization pattern for each of the six repetitions and formed as many complete files of the memory as possible. A composite memory was then constructed word-by-word by taking each 40-bit word and comparing it with the corresponding 40-bit word in every file. The word that had at least one duplication in another file was taken for the composite memory. (See figure 4.)[5]

The total count for each thickness obtained from the beacon transmitter served as a check for the total number of hit words that should be found in the satellite memory. An attempt was made to find a hit word corresponding to each count registered by the cumulative counters.[5]

The next task in the data reduction was to separate natural events from those which resulted from commands. A large number of "test hits" were commanded by subsequently disconnecting and reconnecting a selected detector panel group. Since there was no way to distinguish between a "test hit" and a valid penetration, the command log maintained by the Satellite Control (SATCON) facility had to be used. A hit word indicating the penetration of more than one thickness and a simultaneous incrementing of two or more counters could be attributed to transients in the system and were therefore disregarded.[5]

At least 1 msec was considered necessary for recharging a capacitor. Any events occurring in which the recharge time was less than this value were considered invalid counts. Other events that may have resulted from the thermal cycling or intermittent operation had to be eliminated from the usable data. Most intermittent events were eliminated by disregarding more than one event per orbit from a single logic group. Events resulting from random shorts could be detected if the observed number of events greatly exceeded the expected number for a given group. The probability of rejecting valid data was calculated to be quite small.[5]

Groups which were observed to short several times without writing a hit word were disregarded. Also excluded were groups which required excessive time between events. It was concluded that this was caused by reduced voltage which greatly lowered the detection probability.

Hits that produced an improper bit pattern in the panel (or group) identification were considered valid and an estimate was made as to the actual panel identity.[5]

The area-time contribution for any group was considered only during the time when the hits on that group were considered valid. In deriving the perforation frequency for each thickness, each panel may be considered a separate experiment.[5]

Timespan of Data

NSSDC has penetration data on the number of valid hits for the time period February 17, 1965, to October 31, 1967.

Format of Available Data

The data are currently available on one tape written in even-parity with 80 BCD characters per record at a density of 556 bpi. The data are also available on approximately 4000 punched cards or 68 data tabulation sheets of computer printout.

The following is a key to the interpretation of the punched cards and computer printouts of the Pegasus data. Note that two lines are required for a single listing.

Key for format of all punched cards with a 1 in Column 80:

Columns 1-3	Day of penetration (UT)
Columns 5-8	Hour and minute of penetration (UT)
Column 10	Z side of penetration (+, −, or ",", meaning not determined)
Columns 11-13	Panel penetrated (assigned number)
Column 14	Y side penetrated
Column 15	Thickness penetrated (1 = 16 mils or 0.4 mm, 2 = 8 mils or 0.2 mm, and 3 = 1.5 mils or 0.04 mm)
Columns 17-21	Pulse verify (duration in msec)
Columns 23-27	Temperature probe on the +Z side when penetrated (°C)
Columns 29-33	Temperature probe on the −Z side when penetrated (°C)
Columns 35-38	Satellite clock time when penetrated (1−2048 clock cycle from which UT was determined)
Columns 40-43	Local time when penetrated
Columns 45-49	Latitude of penetration
Columns 52-56	Longitude of penetration
Columns 58-59	Year of penetration
Column 61	Satellite penetrated

Key for format of all punched cards with a 2 in Column 80:

Columns 1-3	Day of penetration (UT)
Columns 5-8	Hour and minute of penetration (UT)
Column 10	Z side of penetration
Columns 11-13	Panel penetrated (assigned number)
Column 14	Y side penetrated
Column 15	Thickness penetrated (mils)
Columns 17-21	Ecliptic longitude when penetrated
Columns 23-27	Ecliptic latitude when penetrated
Columns 29-32	Right ascension when penetrated
Columns 34-38	Declination when penetrated
Columns 40-43	Local time when penetrated
Columns 45-49	Latitude of penetration
Columns 52-56	Longitude of penetration
Columns 58-59	Year of penetration
Column 61	Satellite penetrated

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2. Clifton, S., and R. Naumann, "Pegasus Satellite Measurements of Meteoroid Penetration (Feb. 16–Dec. 31, 1965)," NASA TM X-1316, Dec. 1966.

3. "Scientific Results of Project Pegasus, Interim Report," NASA TM X-53629, July 3, 1967.

4. d'Aiutolo, C. T., W. H. Kinard, and R. J. Naumann, "Recent NASA Meteoroid Penetration Results from Satellites," *Smithsonian Contributions to Astrophysics, Vol. II*, proceedings of a symposium on Meteor Orbits and Dust, Cambridge, Mass., Aug. 9–13, 1965. NASA SP-135, 1967.

5. Naumann, R., "Procedure for Processing Pegasus II and III Meteoroid Data," George C. Marshall Space Flight Center, Working Paper, July 26, 1966.

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"Scientific Results of Project Pegasus, Interim Report," NASA TM X-53629, July 3, 1967.

"The Meteoroid Satellite Project Pegasus, First Summary Report," NASA TN D-3505, George C. Marshall Space Flight Center, Nov. 1966.

KEY

KEY FOR ALL CARDS WITH A 1 IN COLUMN 80

COLUMNS 1'3 DAY OF PENETRATION

COLUMNS 5'8 HOUR AND MINUTE OF PENETRATION

COLUMN 10 Z SIDE OF PENETRATION

COLUMNS 11'13 PANEL PENETRATED

COLUMN 14 Y SIDE PENETRATED

COLUMN 15 THICKNESS PENETRATED

COLUMNS 17'21 PULSE VERIFY

COLUMNS 23'27 TEMPERATURE PROBE ON THE + Z SIDE WHEN PENETRATED

COLUMNS 29'33 TEMPERATURE PROBE ON THE - Z SIDE WHEN PENETRATED

COLUMNS 35'38 SATELLITE CLOCK TIME WHEN PENETRATED

COLUMNS 40'43 LOCAL TIME WHEN PENETRATED

COLUMNS 45'49 LATITUDE OF PENETRATION

COLUMNS 52'56 LONGITUDE OF PENETRATION

COLUMNS 58'59 YEAR OF PENETRATION

COLUMN 61 SATELLITE PENETRATED

KEY FOR ALL CARDS WITH A 2 IN COLUMN 80

COLUMNS 1'3 DAY OF PENETRATION

COLUMNS 5'8 HOUR AND MINUTE OF PENETRATION

COLUMN 10 Z SIDE OF PENETRATION

COLUMNS 11'13 PANEL PENETRATED

COLUMN 14 Y SIDE PENETRATED

COLUMN 15 THICKNESS PENETRATED

COLUMNS 17'21 ECLIPTIC LONGITUDE WHEN PENETRATED

COLUMNS 23'27 ECLIPTIC LATITUDE WHEN PENETRATED

COLUMNS 29'32 RIGHT ASCENSION WHEN PENETRATED

COLUMNS 34'38 DECLINATION WHEN PENETRATED

COLUMNS 40'43 LOCAL TIME WHEN PENETRATED

COLUMNS 45'49 LATITUDE OF PENETRATION

COLUMNS 52'56 LONGITUDE OF PENETRATION

COLUMNS 58'59 YEAR OF PENETRATION

REC 1, LENGTH 84 ONE

REC 2, LENGTH 84

REC 3, LENGTH 84

REC 4, LENGTH 84

REC 5, LENGTH 84

REC 6, LENGTH 84

REC 7, LENGTH 84

REC 8, LENGTH 84

REC 9, LENGTH 84

TRATED REC 10, LENGTH 84

TRATED REC 11, LENGTH 84

REC 12, LENGTH 84

REC 13, LENGTH 84

REC 14, LENGTH 84

REC 15, LENGTH 84

REC 16, LENGTH 84

REC 17, LENGTH 84

REC 18, LENGTH 84

REC 19, LENGTH 84

REC 20, LENGTH 84

REC 21, LENGTH 84

REC 22, LENGTH 84

REC 23, LENGTH 84

REC 24, LENGTH 84

REC 25, LENGTH 84

REC 26, LENGTH 84

REC 27, LENGTH 84

REC 28, LENGTH 84

REC 29, LENGTH 84

REC 30, LENGTH 84

REC 31, LENGTH 84

REC 32, LENGTH 84

COLUMN 61 SATELLITE PENETRATED

REC 33, LENGTH 84

1650480226	1459	0735	-16.1	188.5	-16.0	11.8	1.	-19.8	+105+3	1.9
1650482117	0657	1866	31.9	145.2	31.7	252.1	238.	60.8	-007-3	1.9
1650492153	1221	1295	-0.6	217.1	-0.6	334.0	337.	12.8	*000+3	0.0
1650511105	1234	1480	-9.3	22.4	-9.3	338.8	337.	2.9	*000-3	0.0
1650520511	1738	0519	-31.8	186.9	-31.6	53.6	34.	-54.6	-007-3	0.9
1650531150	1643	0311	-31.9	73.3	-31.7	43.0	19.	-48.8	+105-3	0.9
1650552201	1651	1755	-30.1	282.7	-30.0	47.5	26.	-49.5	-007+3	0.9
1650580805	1457	1145	-31.5	103.1	-31.4	21.4	359.	-37.3	-007+3	0.9
1650582331	0406	0024	27.9	68.9	27.7	219.3	199.	43.7	+103+3	0.0
1650590913	0409	0606	26.9	284.?	26.7	220.5	201.	43.4	+103+3	3.9
1650592047	0736	1300	-0.5	162.4	-0.5	272.6	273.	31.2	*000+3	0.0
1650592158	0114	1371	31.9	49.0	31.7	177.0	160.	25.0	-106+3	0.0
1650601314	1145	0240	-30.0	337.9	-29.9	335.6	324.	-13.5	*000-3	0.0
1650622230	2209	1628	28.6	355.0	28.4	134.0	128.	4.1	*000+3	0.0
1650642201	0730	0386	-19.8	142.3	-19.6	276.0	276.	12.0	*000+3	61.5
1650651809	1843	1593	17.1	8.7	17.0	85.2	85.	-14.7	-106+3	0.9
1650660357	2014	0134	27.1	244.4	27.0	108.3	106.	-3.4	*000-3	0.0
1650661447	1334	0785	-22.5	341.8	-22.4	8.7	355.	-23.4	*000+3	0.0
1650690320	0043	0000	20.3	320.8	20.2	178.4	168.	16.2	*000-3	61.5
1650710218	0151	1095	3.3	353.4	3.3	197.4	193.	11.9	-106+3	61.5
1650711051	0843	1608	-31.5	328.0	-31.3	300.7	296.	-3.2	-007+3	1.9
1650711310	1908	1747	31.3	89.7	31.1	97.1	96.	-0.5	*000+3	61.5
1650742131	1213	0427	-1.7	220.7	-1.7	356.8	356.	0.3	+105-3	0.9
1650750657	0830	0993	-27.2	23.4	-27.1	301.3	298.	0.7	*000+3	0.0
1650761518	0854	0887	-21.9	264.1	-21.7	308.6	306.	3.8	+103-3	0.0
1650770157	2303	1526	2.9	316.6	2.9	161.3	163.	-7.2	*000-3	0.0
1650790315	1046	0390	3.6	112.8	3.5	339.0	344.	13.9	-106+3	2.9
1650800501	0930	1936	-3.4	67.4	-3.4	321.2	324.	16.2	*000+3	0.9
1650820110	1730	0490	26.3	245.2	26.1	83.0	84.	-5.4	+105-3	0.0
1650860508	1337	0347	31.6	127.4	31.4	28.8	40.	13.1	+105-3	0.0
1650861420	0616	0899	-5.2	239.2	-5.2	279.0	280.	26.2	-007+3	4.8
1650871915	0358	0588	-19.4	130.8	-19.3	245.6	247.	9.9	*000-3	0.0

File 1
Pegasus 1
A
Feb. 17, 1965
to
March 29, 1966

5.8 +10.7	REC	1.	LENGTH	84
16.9 - 5.5	REC	2.	LENGTH	84
14.5 +21.4	REC	3.	LENGTH	84
30.1 +34.1	REC	4.	LENGTH	84
30.5 +31.9	REC	5.	LENGTH	84
28.6 +28.4	REC	6.	LENGTH	84
20.6 +18.5	REC	7.	LENGTH	84
21.0 +17.3	REC	8.	LENGTH	84
46.3 -41.2	REC	9.	LENGTH	84
44.5 -36.7	REC	10.	LENGTH	84
15.0 +19.5	REC	11.	LENGTH	84
42.1 -30.8	REC	12.	LENGTH	84
99.9 -03.6	REC	13.	LENGTH	84
5.3 -23.9	REC	14.	LENGTH	84
60.2 -24.1	REC	15.	LENGTH	84
82.6 + 1.0	REC	16.	LENGTH	84
54.0 - 4.3	REC	17.	LENGTH	84
69.1 +19.5	REC	18.	LENGTH	84
0.0 0.0	REC	19.	LENGTH	84
17.7 -36.9	REC	20.	LENGTH	84
55.4 -27.7	REC	21.	LENGTH	84
58.0 + 9.2	REC	22.	LENGTH	84
75.9 +20.0	REC	23.	LENGTH	84
54.0 - 7.4	REC	24.	LENGTH	84
0.9 - 6.4	REC	25.	LENGTH	84
12.3 -46.9	REC	26.	LENGTH	84
5.6 +71.5	REC	27.	LENGTH	84
0.1 +70.1	REC	28.	LENGTH	84
2.1 +45.2	REC	29.	LENGTH	84
5.9 + 2.2	REC	30.	LENGTH	84
7.9 -24.5	REC	31.	LENGTH	84
1.2 -29.9	REC	32.	LENGTH	84

3652111929	0829	0418	26.7	195.2	26.5	75.6	77.	-1.6	+103-3	9.77	+22.6	+27.
3652120338	1147	0907	6.9	122.4	6.9	125.5	127.	-16.6	+111+2	49.80	+36.9	+39
3652121127	1015	1376	16.9	342.1	16.8	102.8	102.	-11.4	+105-3	4.39	+30.3	+36
3652130517	1545	0399	-24.4	157.1	-24.3	185.9	197.	-18.3	+046+1	12.21	+36.3	+44
3652130729	0109	0531	9.1	265.2	9.0	327.2	335.	23.3	+046+1	9.77	-35.2	-29
3652140048	2329	1570	-1.6	340.3	-1.6	302.8	306.	22.4	-106+3	9.28	-26.4	-20
3652140504	1550	1826	-26.5	161.7	-26.3	188.3	200.	-19.0	+105-3	12.70	+35.3	+44
3652140910	0612	0025	28.6	315.7	28.5	44.0	50.	7.0	-007-3	8.79	+16.5	+19
3652161038	1055	0946	-3.8	4.4	-3.8	116.7	121.	-29.3	-106-3	9.28	+32.9	+41
3652170015	0053	1763	19.9	9.5	19.8	326.6	340.	33.1	-007-3	7.81	-34.9	-28
3652170412	1240	2000	-19.2	127.1	-19.1	143.6	156.	-33.8	+103+3	4.88	+30.3	+39
3652170551	1340	0052	-24.2	117.3	-24.1	158.6	174.	-31.2	-130-1	62.01	+35.9	+39
3652181926	0707	0260	16.4	175.4	16.3	62.0	63.	-9.4	+105+3	7.32	+11.9	+19
3652182226	0427	0440	27.7	90.3	27.6	22.1	32.	14.1	-015+1	6.84	-18.2	-07
3652191136	1122	1230	-18.5	356.7	-18.3	126.5	138.	-40.1	+103-3	8.79	+33.3	+40
3652191620	1102	1514	-17.0	280.7	-16.9	121.7	131.	-40.4	+103-3	9.77	+33.1	+41
3652191827	1929	1641	-10.4	15.6	-10.3	248.4	248.	16.6	-025+1	62.01	+23.4	+32
3652201122	1110	0609	-20.2	357.2	-20.1	124.5	136.	-42.4	+103+3	10.25	+29.4	+36
3652210050	2303	1417	21.0	333.3	20.9	303.1	315.	43.7	+105-3	6.84	-23.7	-18
3652210101	0204	1428	29.1	16.0	28.9	348.6	5.	30.5	+034+1	11.23	-34.9	-29
3652210916	0706	1923	7.0	327.6	6.9	64.2	63.	-19.0	-106-3	9.28	+15.2	+20
3652211147	2056	0027	8.4	137.3	8.4	271.8	272.	37.3	+103+3	3.42	-06.4	-00
3652211152	2205	0032	16.8	153.5	16.7	289.3	296.	43.5	+054-1	12.70	-18.8	-1
3652221628	2305	1748	25.0	99.4	24.8	305.3	320.	46.5	-007-3	5.37	-25.0	-20
3652221945	0059	1945	29.0	78.7	28.8	334.1	353.	37.4	-112+2	62.01	-31.3	-25
3652230118	1302	0231	-29.1	176.1	-28.9	154.9	173.	-37.1	-106+3	7.81	+34.3	+3
3652231755	0035	1228	29.0	100.1	28.9	328.8	348.	39.9	-106+3	6.35	-30.9	-2
3652240633	2346	1986	28.6	258.4	28.5	317.2	336.	44.9	-007-3	8.79	-24.6	-1
3652241701	1433	0567	-24.7	323.0	-24.5	179.2	192.	-21.7	-112+2	9.77	+29.9	+3
3652241714	1740	0580	-4.9	6.7	-4.8	226.1	224.	15.8	-106-3	11.72	+29.8	+3
3652241807	0653	0633	-5.4	191.7	-5.3	64.4	60.	-31.0	-130-1	8.79	+06.9	+1
3652241933	0451	0719	10.9	139.6	10.9	33.9	35.	-5.7	-106+3	7.32	-21.1	-1

File 3
Pegasus 3
A, B + C
July 30, 1965
TO
August 15, 1967

+22.6	+27.6	REC	1.	LENGTH	84
+36.9	+39.9	REC	2.	LENGTH	84
+30.3	+36.3	REC	3.	LENGTH	84
+36.3	+44.2	REC	4.	LENGTH	84
-35.2	-29.9	REC	5.	LENGTH	84
-26.4	-20.7	REC	6.	LENGTH	84
+35.3	+44.2	REC	7.	LENGTH	84
+16.5	+19.5	REC	8.	LENGTH	84
+32.9	+41.4	REC	9.	LENGTH	84
-34.9	-28.3	REC	10.	LENGTH	84
+30.3	+39.3	REC	11.	LENGTH	84
+35.9	+39.1	REC	12.	LENGTH	84
+11.9	+19.8	REC	13.	LENGTH	84
-18.2	-07.2	REC	14.	LENGTH	84
+33.3	+40.2	REC	15.	LENGTH	84
+33.1	+41.0	REC	16.	LENGTH	84
+23.4	+32.3	REC	17.	LENGTH	84
+29.4	+36.3	REC	18.	LENGTH	84
-23.7	-18.6	REC	19.	LENGTH	84
-34.9	-29.4	REC	20.	LENGTH	84
+15.2	+20.4	REC	21.	LENGTH	84
-06.4	-00.7	REC	22.	LENGTH	84
-18.8	-13.1	REC	23.	LENGTH	84
-25.0	-20.1	REC	24.	LENGTH	84
-31.3	-25.0	REC	25.	LENGTH	84
+34.3	+37.3	REC	26.	LENGTH	84
-30.9	-24.7	REC	27.	LENGTH	84
-24.6	-18.4	REC	28.	LENGTH	84
+29.9	+36.1	REC	29.	LENGTH	84
+29.8	+36.1	REC	30.	LENGTH	84
+06.9	+17.5	REC	31.	LENGTH	84
-21.1	-11.9	REC	32.	LENGTH	84

3652252346	2352	0365	29.0	1.7	28.8	320.5	339.	43.8	+034-1	10.25	-21.1	-16.7
3652260003	0418	0382	10.5	63.9	10.5	26.9	29.	-3.2	+103-3	8.30	-33.7	-26.0

5 -21.1 -16.7 REC 33, LENGTH 84
0 -33.7 -26.0 REC 34, LENGTH 84