

#265

APOLLO 12, 14, 15 + 16

ARTIFICIAL IMPACTS TAPES

69-099C-03F

71-008C-04F

71-063C-01E

72-031C-01E

5 TAPES

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## Table of Contents

1. Introduction
2. Errata/Change Log
3. LINKS TO RELEVANT INFORMATION IN THE ONLINE NSSDC  
INFORMATION SYSTEM
4. Catalog Materials
  - a. Associated Documents
  - b. Core Catalog Materials

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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 This inventory information is now no longer maintained in the DSCs, but is now managed in the inventory part of the NSSDC information system.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

APOLLO 15 LM/ASLEP

TAPES OF ARTIFICIAL IMPACTS

71-063C-01E

PSPG-00416

This data set has been restored. There was originally one 7-track, 800 BPI tape written in Binary. There is one restored tape. The DR tape is a 3480 cartridge and the DS tape is 9-track, 6250 BPI. The original tape was created on a 1130 computer and the restored tape was created on an IBM 9021 computer. The DR and DS numbers along with the corresponding D number are as follows:

| DR#      | DS#      | D#      | FILES | TIME SPAN           |
|----------|----------|---------|-------|---------------------|
| -----    | -----    | -----   | ----- | -----               |
| DR005904 | DS005904 | D014072 | 1     | 08/03/71 - 12/16/71 |

See 69-099C-03F

APOLLO 14 LM/ASLEP

TAPES OF ARTIFICIAL IMPACTS

71-008C-04F

PSPG-00358

This data set has been restored. There was originally one 7-track, 800 BPI tape written in Binary. There is one restored tape. The DR tape is a 3480 cartridge and the DS tape is 9-track, 6250 BPI. The original tape was created on a 1130 computer and the restored tape was created on an IBM 9021 computer. The DR and DS numbers along with the corresponding D number are as follows:

| DR#      | DS#      | D#      | FILES | TIME SPAN           |
|----------|----------|---------|-------|---------------------|
| -----    | -----    | -----   | ----- | -----               |
| DR005902 | DS005902 | D014071 | 1     | 02/07/71 - 12/16/71 |

See 69-099C-03F

APOLLO 16 LM/ALSEP

TAPES OF ARTIFICIAL IMPACTS

72-031C-01E

PSPG-00339

This data set has been restored. There was originally one 7-track, 800 BPI tape written in Binary. There is one restored tape. The DR tape is a 3480 cartridge and the DS tape is 9-track, 6250 BPI. The original tape was created on a 1130 computer and the restored tape was created on an IBM 9021 computer. The DR and DS numbers along with the corresponding D number are as follows:

| DR#      | DS#      | D#      | FILES | TIME SPAN           |
|----------|----------|---------|-------|---------------------|
| -----    | -----    | -----   | ----- | -----               |
| DR005689 | DS005689 | D014073 | 1     | 12/10/72 - 12/15/72 |

*See 69-099C-03F*

APOLLO 12 LM/ALSEP

TAPES OF ARTIFICIAL IMPACTS

69-099C-03F

PSPG-00600

This data set has been restored. There were originally two 7-track, 800 BPI tapes written in Binary. There is one restored tape. The DR tape is a 3480 cartridge and the DS tape is 9-track, 6250 BPI. The original tapes were created on a 1130 computer and the restored tapes were created on an IBM 9021 computer. The DR and DS numbers along with the corresponding D numbers are as follows:

| DR#      | DS#      | D#      | FILES | TIME SPAN           |
|----------|----------|---------|-------|---------------------|
| -----    | -----    | -----   | ----- | -----               |
| DR005627 | DS005627 | D014069 | 1     | 11/20/69 - 12/15/69 |
|          |          | D014070 | 2     | 11/20/69 - 08/03/70 |

REQ. AGENT

MAW

RAND NO.

RB5594

ACQ. AGENT

RWV

APOLLO 12, 14, 15, &amp; 16

## TAPES OF ARTIFICIAL IMPACTS

69-099C-03F

71-008C-04F

71-063C-01E

72-031C-01E

This data set consists of 5 Apollo Artificial Impacts tapes. They are 800 BPI. binary, 7-track, 1 file made on an IBM 7090 computer using a program that writes the tapes in IBM 1130 format.

The time spans for these tapes are as follows:

APOLLO 12                      69-099C-03F

| <u>D#</u> | <u>C#</u> | <u>TIME SPANS</u>                |
|-----------|-----------|----------------------------------|
| D-14069   | C-11257   | 11/20/69 - 12/15/69 (NEW FORMAT) |
| D-14070   | C-11258   | 11/20/69 - 08/03/70 (OLD FORMAT) |

APOLLO 14                      71-008C-04F

| <u>D#</u> | <u>C#</u> | <u>TIME SPANS</u>   |
|-----------|-----------|---------------------|
| D-14071   | C-11259   | 02/07/71 - 12/16/71 |

APOLLO 15                      71-063C-01E

| <u>D#</u> | <u>C#</u> | <u>TIME SPANS</u>   |
|-----------|-----------|---------------------|
| D-14072   | C-11260   | 08/03/71 - 12/16/71 |

APOLLO 16                      72-031C-01E

| <u>D#</u> | <u>C#</u> | <u>TIME SPANS</u>   |
|-----------|-----------|---------------------|
| D-14073   | C-11261   | 12/10/72 - 12/15/72 |

Event tapes are numbered serially and are in chronological order.

All tapes are labeled with the event tape number, station number, tape number, and total time interval covered by the tape. Listings of the time intervals covered on each tape are supplied with the tapes and can also be found using the next data set (#3). The format with which event tapes are read is described in the section on tape formats.

### 3. Event Compressed Scale Playouts

Each event tape (data sets #2 and #4) has been plotted in compressed scale to provide a visual display of the contents of each event tape. These playouts have the same format as data set #1 with the exceptions that time is not continuous and an amplitude scale twice that of data set #1 is used.

### 4. Artificial Impact Event Tapes

Each impact of man-made origin (artificial impacts) has been recorded on a special set of event tapes. These tapes are identical in format to the event tapes (data set #2). Table 3 shows data pertinent to each of the impacts. The reader is directed to the brief station history for information concerning the status of each station at times of impacts. Compressed scale playouts of these events are supplied as part of data set #3.

### 5. Expanded Playouts

A. Method of Selection: Expanded time scale playouts (usually ten minutes in length) have been generated for the following long-period seismic events.

1. All events observed at station 12 (data set #6) during the period November 20, 1969 to February 5, 1971 with peak-to-peak signal amplitudes of two or more digital units.

Table 3: ARTIFICIAL IMPACT DATA

| EVENT          | Year, day | hr min sec  | Lat.                       | Long.   | Distances (km) and Azimuth from stations |              |               | Impact Angle from Horizontal | Impact Heading | Impact Energy, ergs     |
|----------------|-----------|-------------|----------------------------|---------|------------------------------------------|--------------|---------------|------------------------------|----------------|-------------------------|
|                |           |             |                            |         | 12                                       | 14           | 15            |                              |                |                         |
| Apollo 12 LM   | 1969, 324 | 22 17 17.7  | 3.94°S                     | 21.21°W | 73°<br>112°                              | -            | -             | 3.7°                         | 306°           | 3.36 X 10 <sup>16</sup> |
| Apollo 13 SIVB | 1970, 105 | 01 09 41.0  | 2.75°S                     | 27.86°W | 135°<br>274°                             | -            | -             | 76°                          | 78°            | 4.63 X 10 <sup>17</sup> |
| Apollo 14 SIVB | 1971, 035 | 07 40 55.4  | 8.09°S                     | 26.02°W | 172°<br>207°                             | -            | -             | 69°                          | 103°           | 5.54 X 10 <sup>17</sup> |
| Apollo 14 LM   | 1971, 038 | 00 45 25.7  | 3.42°S                     | 19.67°W | 114°<br>96°                              | 67°<br>276°  | -             | 3.6°                         | 282°           | 3.25 X 10 <sup>16</sup> |
| Apollo 15 SIVB | 1971, 210 | 20 58 42.9  | 1.51°S                     | 11.81°W | 355°<br>83°                              | 184°<br>69°  | -             | 62°                          | 97°            | 4.61 X 10 <sup>17</sup> |
| Apollo 15 LM   | 1971, 215 | 03 03 37.0  | 26.36°N                    | 0.25°N  | 1130°<br>36°                             | 1048°<br>29° | 93°<br>276°   | 3.2°                         | 284°           | 3.43 X 10 <sup>16</sup> |
| Apollo 16 SIVB | 1972, 110 | 21 02 04±4* | 2.24±.33°N<br>24.49±.33°W* |         |                                          |              |               | 79° (?)                      | 78°            | 4.59 X 10 <sup>17</sup> |
| Apollo 17 SIVB | 1972, 345 | 20 32 42.3  | 4.21°S                     | 12.31°W | 338°<br>96°                              | 157°<br>96°  | 1032°<br>209° | 55°                          | 97°            | 4.71 X 10 <sup>17</sup> |
| Apollo 17 LM   | 1972, 350 | 06 50 20.8  | 19.96°N                    | 30.50°E | 1750°<br>64°                             | 1598°<br>61° | 770°<br>98°   | 4.9°                         | 283°           | 3.14 X 10 <sup>16</sup> |

\* tracking signal lost before impact. The origin time was obtained by interpretation of seismic data, and the location was extrapolated from the early trajectory.

2. Most of the events observed at two or three stations during the period February 5, 1971 to April 21, 1972.

#### B. Annotation Formats

1. Events occurring during the years of 1969 and 1970 were detected by station 12 only. The long-period components (X,Y,Z) have been played out for each event. The annotation is as follows:

YEAR

SKIP X MAG (C)

DAY HR MN SECOND

YEAR = year in which the playout begins

SKIP = tape identification numbers which can be ignored

MAG = multiplicative factor which adjusts the signal amplitude of an event for plotting; this number can be ignored.

C = long-period component, e.g. X = long period X component (LPX)

Y = long period Y component (LPY)

Z = long period Z component (LPZ)

DAY = Julian day of the year on which the playout begins

HR, MN, SECOND = universal time at which the playout begins

Time marks are placed at one minute intervals. The first tick mark indicates the time DAY:HR:MIN+1.

2. Playouts of events occurring during the years of 1971 and 1972 are annotated as follows:

YEAR DAY HR MIN

YEAR = year in which the playout begins

DAY = Julian day of the year on which playout begins

HR MIN = time at which the first minute mark is placed; minute marks are indicated by the vertical tick marks superposed upon the seismic traces.

#### Section 4: Tape Formats and Irregularities

##### FORMATS

Data sets #2 (event tapes), #4 (artificial impact tapes) and #7 (PSE-tapes, one-year of data) formats are described below. All tapes are 7 track, 1/2 inch binary, 800 bpi, odd parity, with standard IBM EOF on 2400 foot reels.

Data is transmitted from the Moon in 64 word frames, one frame every 0.60375 seconds. The ALSEP words are assigned to meet the needs of the scientific instruments in the Apollo Lunar Surface Experiment Package. Those assigned to the Passive Seismic Experiment are given in Table 4. Each ALSEP word is ten bits, or a range from 0 to 1023 digital units. Sensor equilibrium data values are near 500 digital units. Missing ALSEP words in the short period data (2,46, etc.) should be replaced to obtain equal spacing of data points.

Each frame of data is recorded on tape in a logical record consisting of eighteen 36 bit words for format A and nine 36 bit words for format B. The first three of these words contain timing, synchronization, and error information as described below. The remaining words containing the data are described in Table 5 A and B.

Word 1 contains time at the start of the frame in milliseconds from the beginning of the year starting in bit 1 and ending in bit 35 right justified in binary.

The time on January 01 at 00 hours 00 minutes 00 seconds is reset to  $8.64 \times 10^7$  msec so that the year starts on day 1 rather than day 0.

Word 2 contains a range station I. D. code in bits 0-3, a bit error

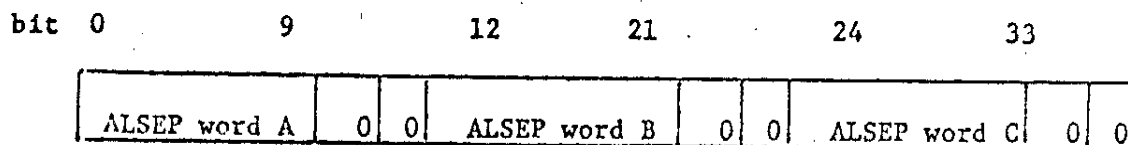
rate in bits 4-9, and, starting on day 183, 1973, a time source indicator in bit 35 (last bit); if this bit is set, then computer clock time rather than G. M. T. was used for updating the time code. Several tens of seconds of error in time codes have been noted when the computer clock is used.

Word 3 contains synchronization codes and a frame counter. This word should contain the following in bits 0-9, 12-21 and 24-25.

|        |   |   |   |   |   |   |   |   |   |   |    |    |    |    |    |    |    |    |    |    |    |    |
|--------|---|---|---|---|---|---|---|---|---|---|----|----|----|----|----|----|----|----|----|----|----|----|
| bit:   | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 24 | 25 |
| value: | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0  | 0  | 0  | 0  | 1  | 1  | 1  | 0  | 1  | 1  | 0  | 1  |

If this is not the case, then sync has been lost with the data and errors may be present. Bits 26-32 contain a frame counter which steps once per frame resetting to zero after 89 frames. A break in the sequence may indicate timing errors.

ALSEP words arranged as shown in Table 5 are packed in the 36 bit words as shown below:



Note that in FORMAT B (Table 5-B) the data is compressed by a factor of 2 as all SP ALSEP words are missing. This was done as a cost-saving procedure since the station 12 short period component is not operating.

Each tape begins with two identical label records written in BCD. These records contain four words each as described below:

| Word | Parameter                          |
|------|------------------------------------|
| 1    | experiment I.D. (PS EXP or PSEXPB) |
| 2    | ALSEP I. D.                        |
|      | Sta. 12 = A                        |
|      | Sta. 14 = B                        |
|      | Sta. 15 = C                        |
|      | Sta. 16 = D                        |

TABLE 4  
P.S.E. ALSEP Words

| ALSEP Word(s)                         | Description                     |
|---------------------------------------|---------------------------------|
| even words (except<br>2, 24*, 46, 56) | short period (SP) vertical data |
| 9, 25, 41, 57                         | long period X component (LPX)   |
| 11, 27, 43, 59                        | long period Y component (LPY)   |
| 13, 29, 45, 61                        | long period Z component (LPZ)   |
| 35 (even frames)                      | X axis tidal                    |
| 35 (odd frames)                       | Z axis tidal                    |
| 37 (even frames)                      | Y axis tidal                    |
| 37 (odd frames)                       | instrument temperature          |

\*Apollo 15 only

TABLE 5-A

## ALSEP WORD LOCATIONS

FORMAT A<sup>1</sup>

| 36 bit word | ALSEP word | USE               |
|-------------|------------|-------------------|
| 4           | 4, 6, 8    | SP, SP, SP        |
| 5           | 9, 10, 11  | LPX, SP, LPY      |
| 6           | 12, 13, 14 | SP, LPZ, SP       |
| 7           | 16, 18, 20 | SP, SP, SP        |
| 8           | 22, 24, 25 | SP, SP*, LPX      |
| 9           | 26, 27, 28 | SP, LPY, SP       |
| 10          | 29, 30, 32 | LPZ, SP, SP       |
| 11          | 33, 34, 35 | -, SP, TDLX/Z     |
| 12          | 36, 37, 38 | SP, TEMP/TDLY, SP |
| 13          | 40, 41, 42 | SP, LPX, SP       |
| 14          | 43, 44, 45 | LPY, SP, LPZ      |
| 15          | 46, 48, 50 | -, SP, SP         |
| 16          | 52, 54, 57 | SP, SP, LPX       |
| 17          | 58, 59, 60 | SP, LPY, SP       |
| 18          | 61, 62, 64 | LPZ, SP, SP       |

\* not for Apollo 15

<sup>1</sup>  
used for all tapes (except station 12 tapes after day 288, 1971)

TABLE 5-B  
ALSEP WORD LOCATIONS  
FORMAT B\*

| 36 bit word | ALSEP WORD | USE                  |
|-------------|------------|----------------------|
| 4           | 9, 11, 13  | LPX, LPY, LPZ        |
| 5           | 25, 27, 29 | LPX, LPY, LPZ        |
| 6           | 33, 35, 37 | -, TDLX/Z, TEMP/TDLY |
| 7           | 41, 43, 45 | LPX, LPY, LPZ        |
| 8           | 46, 57, 59 | -, LPX, LPY          |
| 9           | 61, -, -   | LPZ                  |

\*used only for station 12 starting on day 289, 1971

## PSE Tape Irregularities

The following is a list of types of irregularities, other than tape reading errors and data glitches, found in PSE tapes. The user of PSE tapes is urged to be aware of their existence.

### 1. Data gap

A normal data gap is represented by a time increment from one logical record to the next by an amount that is an exact multiple of the normal frame rate ( $603.75 \pm 0.05$  ms) and an increment of the frame count corresponding to the time increment. Small data gaps, a few seconds in duration, are quite common, occurring at a rate of several to a few tens of times per day.

### 2. Data overlap

A normal data overlap is represented by a time decrement from one logical record to the next by an amount that is an exact multiple of the normal frame rate and a decrement of the frame count corresponding to the time decrement. Data overlaps are rare, but they do occur in earlier tapes.

### 3. Clock offset due to range station switch

When the range station receiving data from the Moon is switched from one to another, a slight offset in time is observed, which is normally less than 20 milliseconds.

### 4. Sync error

When data from the Moon are not correctly translated onto PSE tapes because of errors in synchronization, it is reflected on the Barker code which is included in each logical record. A data gap of a few frames normally follows a sync error.

5. Zero record

Some logical records are filled with all zeroes. A data gap may or may not occur at the same time.

6. Clock rate error

This occurs when time information based on a computer internal clock is substituted. It can be identified by an abnormal time increment from one frame to the next. The normal time increment per frame is 603 or 604 milliseconds, with 90-frame average in the range of 603.70 to 603.80 milliseconds. The abnormal clock rate is usually less than 0.5% off normal, but larger anomalies are found. The duration of this error is from a few minutes to as much as 6 to 8 hours. An anomalous period usually starts with a small offset in frame count and ends with a large offset in frame count, representing a large clock adjustment. Multiple clock adjustments are found in some cases. The amount of clock adjustment ranges from a fraction of a second to several tens of seconds. The time information on tapes are nearly continuous, thus generating a data gap or a data overlap without clear indication of their existence when the clock is adjusted.

7. Time/frame count error

Simultaneous discontinuities in time and frame count which do not agree with each other occur rather frequently without abnormal clock rate. They occur in pairs or multiples so that the net offset in time and/or frame count is always zero. The offset in time at a discontinuity is often either an exact multiple of the normal frame rate or even seconds. When it is an exact multiple of the normal frame rate, whether the error is in time or in frame count cannot be determined. When it

is not an exact multiple of the normal frame rate, including offsets of even seconds, a time error is indicated.

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| DAY | HOURS | MINUTES | SECONDS | D NUMBER |
|-----|-------|---------|---------|----------|
|-----|-------|---------|---------|----------|

Apollo 12

APOLLO TAPES OF ARTIFICIAL  
IMPACTS

|                         |
|-------------------------|
| ART TIME=<br>STOP TIME= |
|-------------------------|

|            |
|------------|
| 110<br>350 |
|------------|

|          |
|----------|
| 20<br>11 |
|----------|

|         |
|---------|
| 49<br>4 |
|---------|

|                  |
|------------------|
| 21.444<br>24.733 |
|------------------|

|                  |
|------------------|
| D14069<br>D14069 |
|------------------|

|                           |
|---------------------------|
| START TIME=<br>STOP TIME= |
|---------------------------|

|            |
|------------|
| 324<br>215 |
|------------|

|         |
|---------|
| 22<br>6 |
|---------|

|        |
|--------|
| 6<br>8 |
|--------|

|                  |
|------------------|
| 49.302<br>42.451 |
|------------------|

|                  |
|------------------|
| D14070<br>D14070 |
|------------------|

" 12

|                           |
|---------------------------|
| START TIME=<br>STOP TIME= |
|---------------------------|

|           |
|-----------|
| 36<br>350 |
|-----------|

|         |
|---------|
| 0<br>11 |
|---------|

|         |
|---------|
| 34<br>5 |
|---------|

|                  |
|------------------|
| 56.815<br>51.062 |
|------------------|

|                  |
|------------------|
| D14071<br>D14071 |
|------------------|

" 14

|                           |
|---------------------------|
| START TIME=<br>STOP TIME= |
|---------------------------|

|            |
|------------|
| 215<br>350 |
|------------|

|         |
|---------|
| 2<br>11 |
|---------|

|         |
|---------|
| 52<br>5 |
|---------|

|                  |
|------------------|
| 54.606<br>34.585 |
|------------------|

|                  |
|------------------|
| D14072<br>D14072 |
|------------------|

" 15

|                           |
|---------------------------|
| START TIME=<br>STOP TIME= |
|---------------------------|

|            |
|------------|
| 345<br>350 |
|------------|

|          |
|----------|
| 20<br>11 |
|----------|

|         |
|---------|
| 19<br>5 |
|---------|

|                  |
|------------------|
| 22.011<br>49.046 |
|------------------|

|                  |
|------------------|
| D14073<br>D14073 |
|------------------|

" 16

|     |           |    |
|-----|-----------|----|
| REC | 1, LENGTH | 18 |
| REC | 2, LENGTH | 18 |

REC 3, LENGTH 3645

Dupe of D-14069  
C-112-57

4/19/88 - 12/15/88

Apollo 12

artificial impacts

[illegible]

47B47C00000023AF40E50B0200000E240EC5D0B8347B87C012B954E548347B87C40008347B87C40000023AF40B07B0200000E240EC5  
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REC 4. LENGTH 3645



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REC 6. LENGTH 3645

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