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APOLLO 16 SURFACE SAMPLER

DATA PACKAGE

May 1972

by

Lisimaco H. Carrasco

Lockheed Electronics Company, Inc.




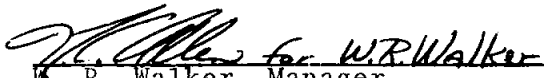
MANNED SPACECRAFT CENTER
HOUSTON, TEXAS

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PREFACE

This report was prepared by the Houston Aerospace Systems Division, Lockheed Electronics Company, Inc., in support of the Planetary and Earth Sciences Division at the Manned Spacecraft Center, Houston, Texas. The work was performed under Contract No. NAS 9-12200 for the National Aeronautics and Space Administration in compliance with Job Order No. 63-0115-4404. The report was prepared by Lisimaco H. Carrasco of the Geophysics Section, Planetary and Earth Sciences Department, Lockheed Electronics Company, Inc.

ABSTRACT

Two surface samplers, one with velvet cloth and another with beta-cloth, were used to collect the outer few hundredths of an inch of moon surface. The beta-cloth, as predicted, returned with an extremely small sample. The entire sampling surface of the beta-cloth was carefully photographed and a mosaic of the entire surface has been prepared from the set of NASA photographs. A map of the mosaic has been prepared indicating which photograph corresponds to each section on the mosaic. This map will aid in locating any trace of lunar soil on the surface of the soil sampler.

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1. INTRODUCTION

In order to make studies of solar radiation, cosmic rays, etc., of the moon the outer few hundredths of an inch of it's surface is needed. To collect such a thin layer as a "surface sampler" a Contact Soil Sampling Device (CSSD) was designed and carried to the moon on the Apollo 16 mission.

Two surface sampling devices were used, one with velvet cloth and a second with beta-cloth. They were laid gently on the surface of the moon and the grains were trapped in the fabric pile. The beta-cloth surface sampler takes a minimum depth layer sample which is extremely small.

Prior to the mission the surface of the sampler retainer was carefully photographed as part of the premission documentation. A series of photographs was taken of the entire surface of the sampler and processed in the NASA photographic laboratory. A mosaic was prepared of the photographs and a map was made indicating which photograph numbers correspond to each section of the mosaic. This will aid the prime investigators in recognizing and locating any trace of soil on the surface sampler retainer. Some photographs of the sampler are included in this report, and an appendix listing the pertinent photographs is included. These photographs are on file in the Geophysics Section of Lockheed Electronics Company, Inc. at the Gemini building.

2. CONTACT SOIL SAMPLING DEVICE (CSSD)

The CSSD is used to obtain two adjacent top layer soil samples of the undisturbed lunar surface. The minimum-depth layer sample (obtained with beta-cloth) was taken first to

avoid contamination. To insure minimum contamination it is highly desirable that the samples be taken at least one kilometer distance from the landing/ALSEP but not on a ray or near a fresh young crater.

The specific site selected for these two top-layer soil samples must not have been exposed to throwout caused by Descent Propulsion System (DPS) exhaust impingement. Extreme care must be exercised by the astronauts to avoid kicking up dust or otherwise disturbing the sample area prior to sampling. Photographs of the area were taken after sampling.

A. Test description

The Universal Handling Tool (UHT), widely used to carry sample returning bags, is attached to the UHT adapter (see Figure 1) to enable the astronaut to easily lower the CSSD onto the lunar surface. Opening the lid of the container allows the sample retainer to protrude, exposing the sample collection material. The CSSD is lowered until the referenced surface on the container contacts the lunar surface. The soil particles adhere to the sample collection material on the sample retainer. The lid is then closed to provide a dust-proof container for the soil particles during earth return.

B. Apollo 16 surface sample experiment

As the beta-cloth recovers from the moon surface only the outer few millimeters, perhaps a sample of only 0.1 mm thick, are present. This is an extremely small sample. This was the reason the surface of the soil sampler (Figure 2) was carefully photographed as part of the premission documentation. Fifty-five closeup photographs

were taken of the surface and were processed in the NASA photographic laboratory during premission documentation.

C. Equipment

The photographs were taken with:

Spotmatic Honeywell Pentax with built-in light meter and associated equipment, 50 mm lens (Super-Macro-Takumar Type)

Aperture Range: f 1.4 to f 22

Shutter Speeds: 1 sec to 1/1000 sec. with click stop at each valve

Focus Range: 0.77 ft. to ∞ .

D. Procedure for taking photographs

The photographs were taken in a clean room of building 10 at NASA. The distance between the camera lens and the surface of the sampler was 9 inches. Film used was Kodak Plus-X ASA #125. The first photos were taken at shutter speed of 15 sec., aperture of lens f 10. About 10 photos were taken with this aperture; then it was changed to f 8. (see Figure 3)

E. Mosaic

A mosaic of the photographs of the retainer surface has been carefully prepared. The photographs have about 40 percent overlapping; so in most instances the center of the photograph was used. Two mosaics were made by two different people; both of them coincide, and it is the feeling of the author that they are truly representations of the surface sampler. One of the mosaics has been mounted and leveled. It is on display in the

Geophysics Section of Lockheed Electronics Company, Inc.
in the Gemini building.

F. Map

A map (Figure 4) was prepared indicating each section
of the mosaic with its respective NASA photo number.
Several copies of these photos are on file in the
Gemini building.

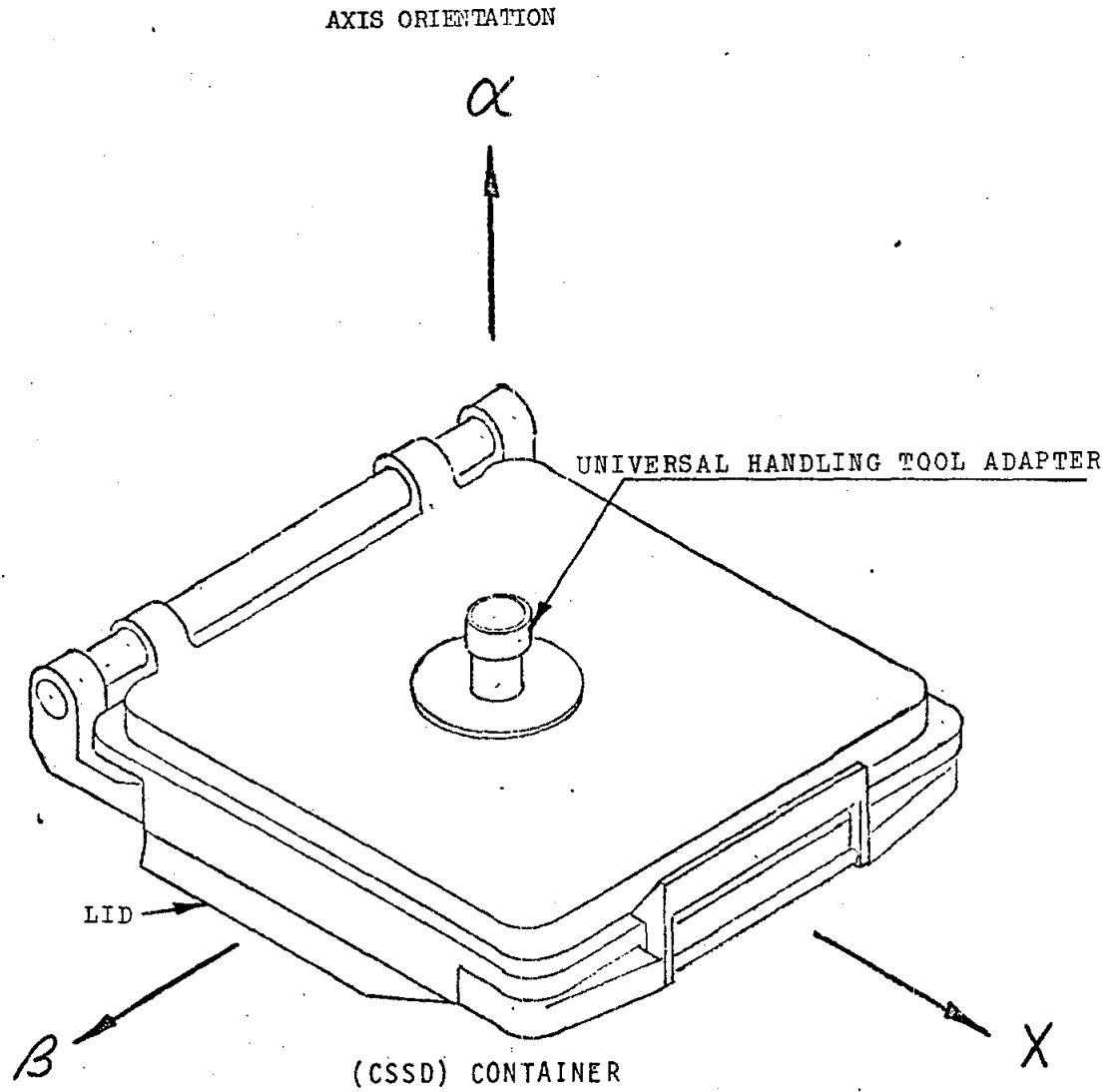


Figure 1 - Contact soil sampling device (CSSD)

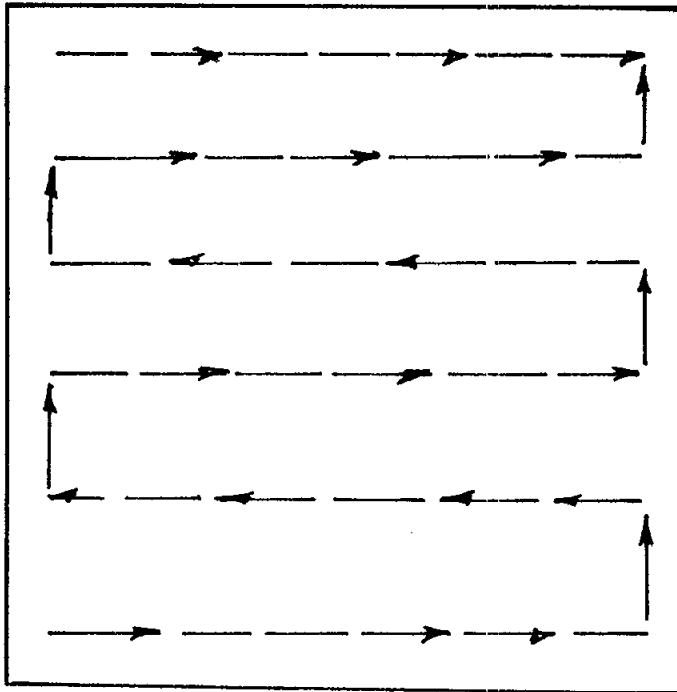


Figure 3 -- Lines indicate the pattern followed in taking the photographs

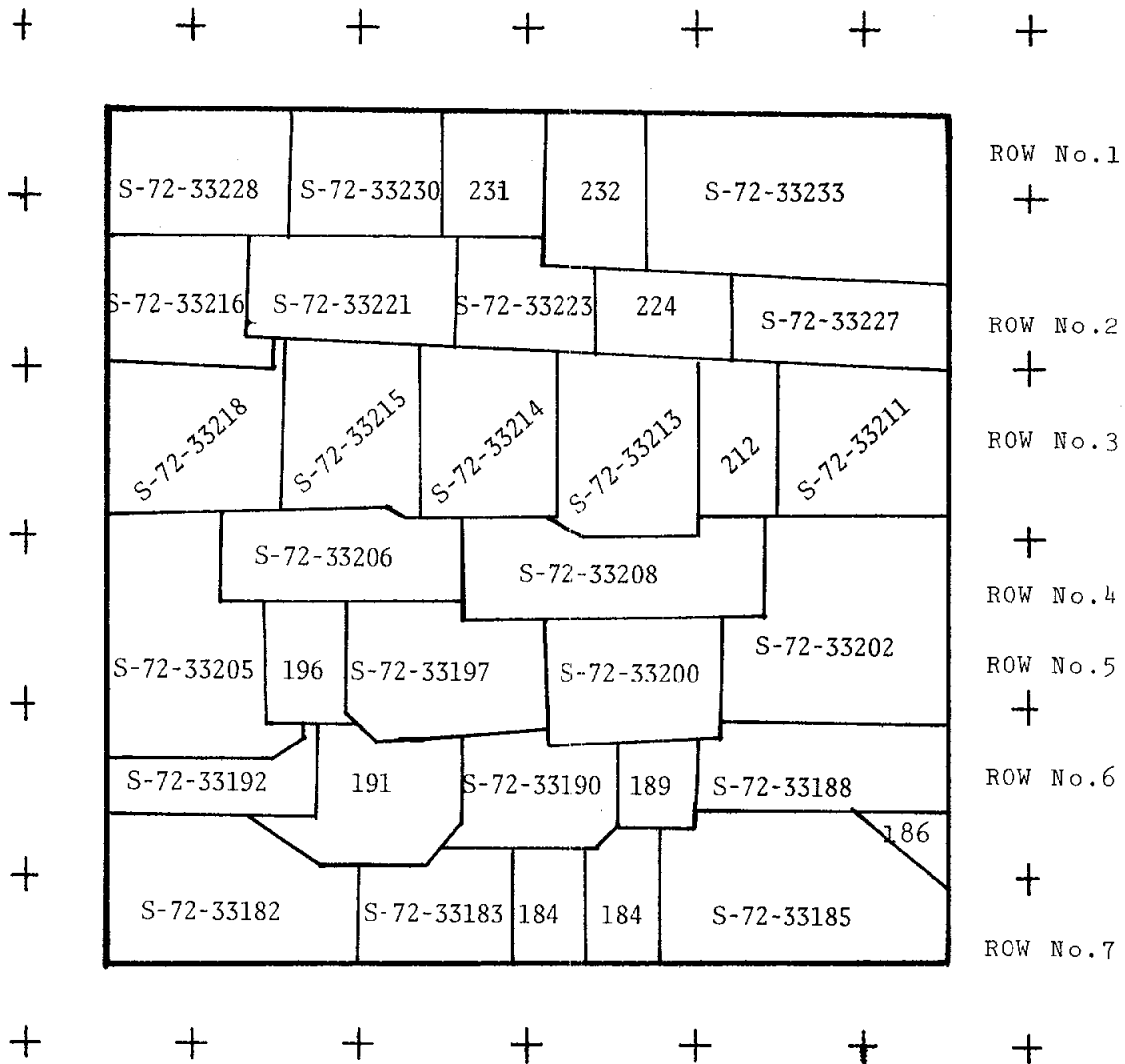


Figure 4 -- Map of the mosaic of Apollo 16 surface sampler experiment

NABA
S-72-33241

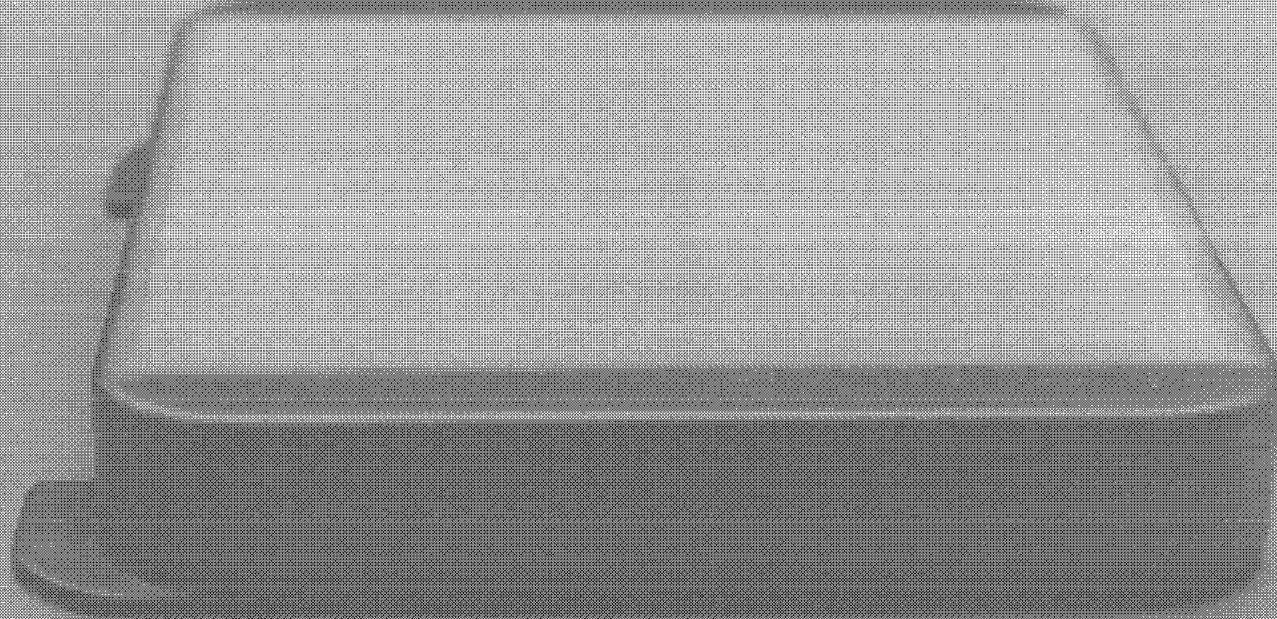


Figure 5 - Closeup beta-cloth surface sampler retainer

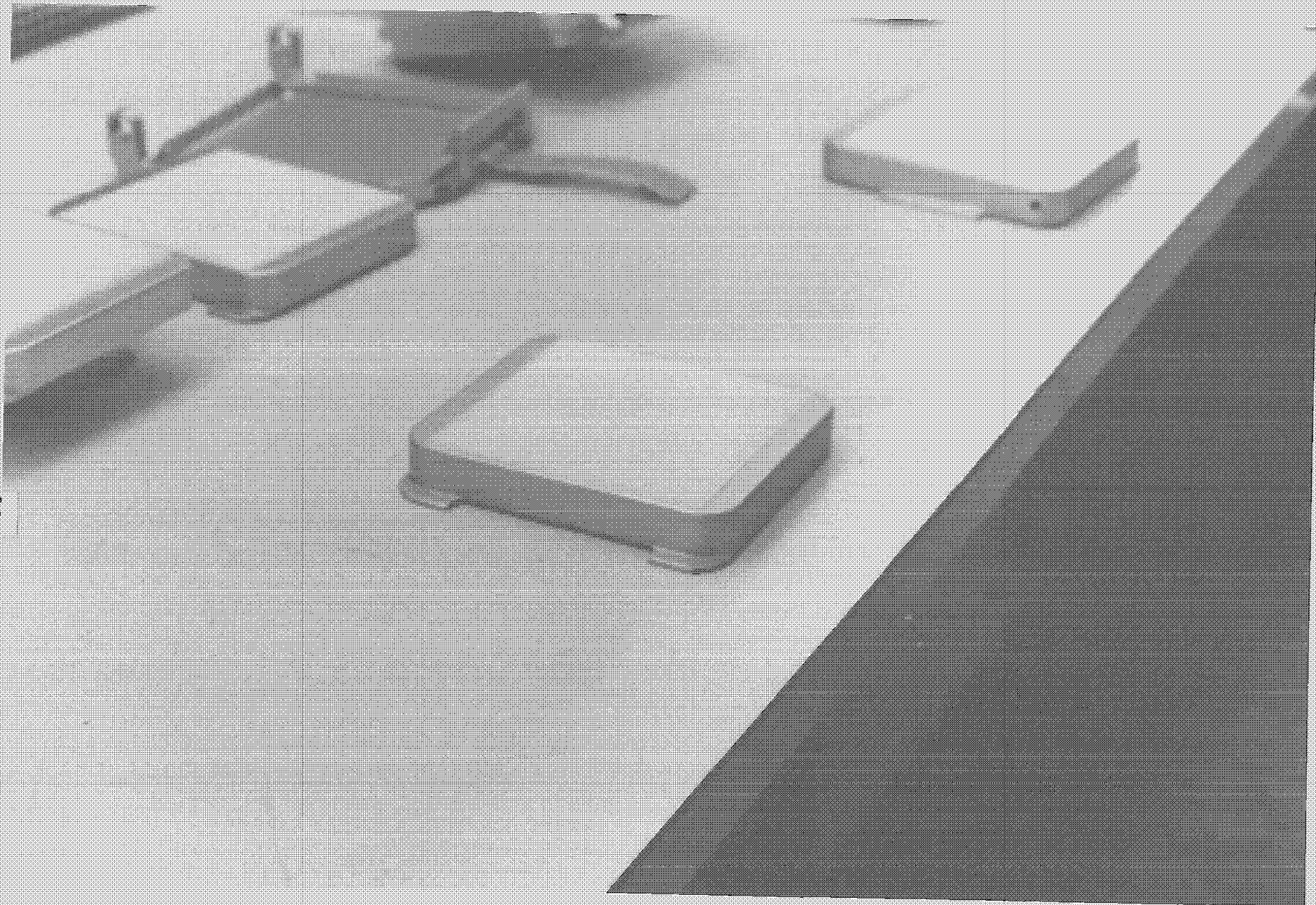


Figure 6 - Beta-cloth surface sampler retainer

NASA
S-72-33253

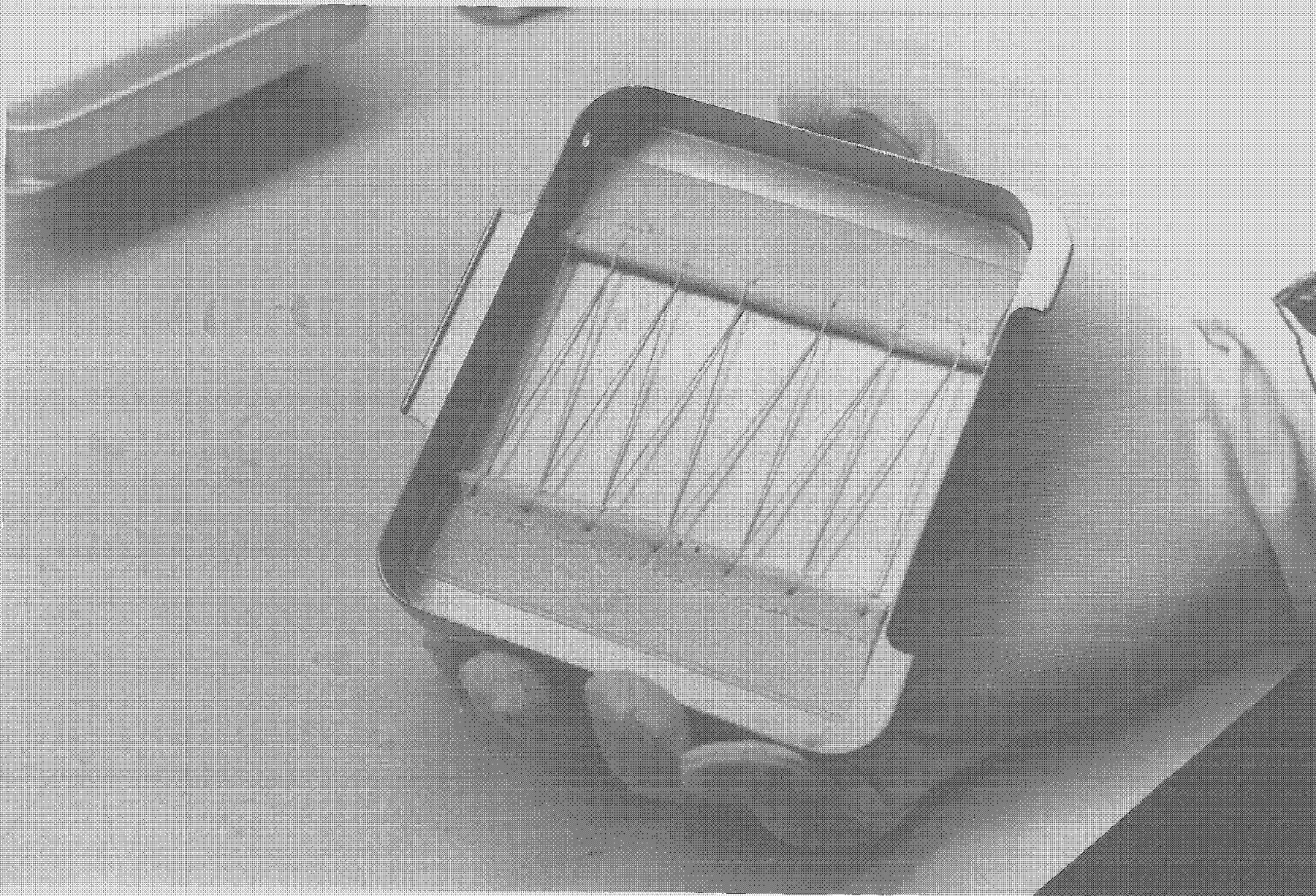
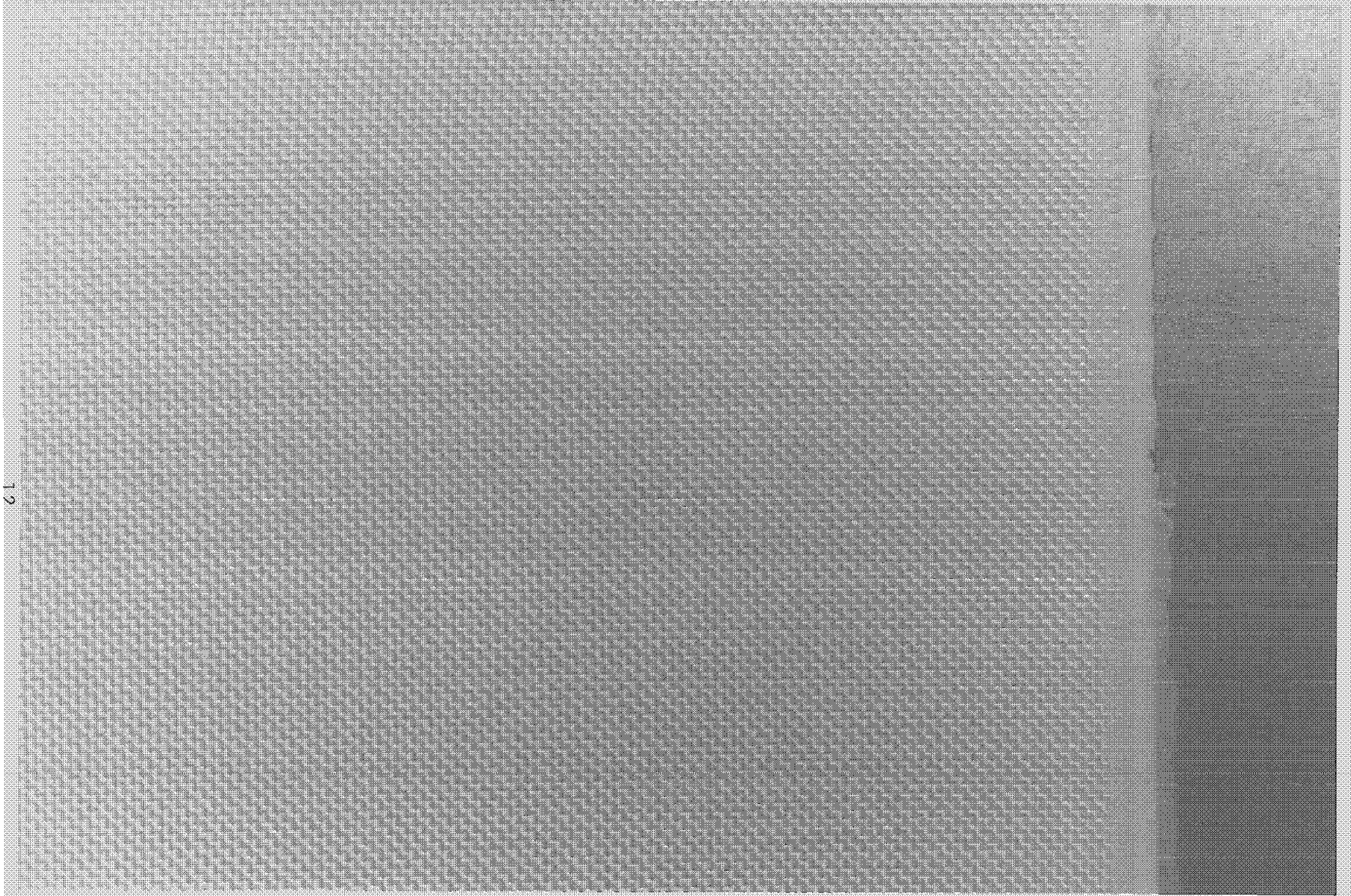


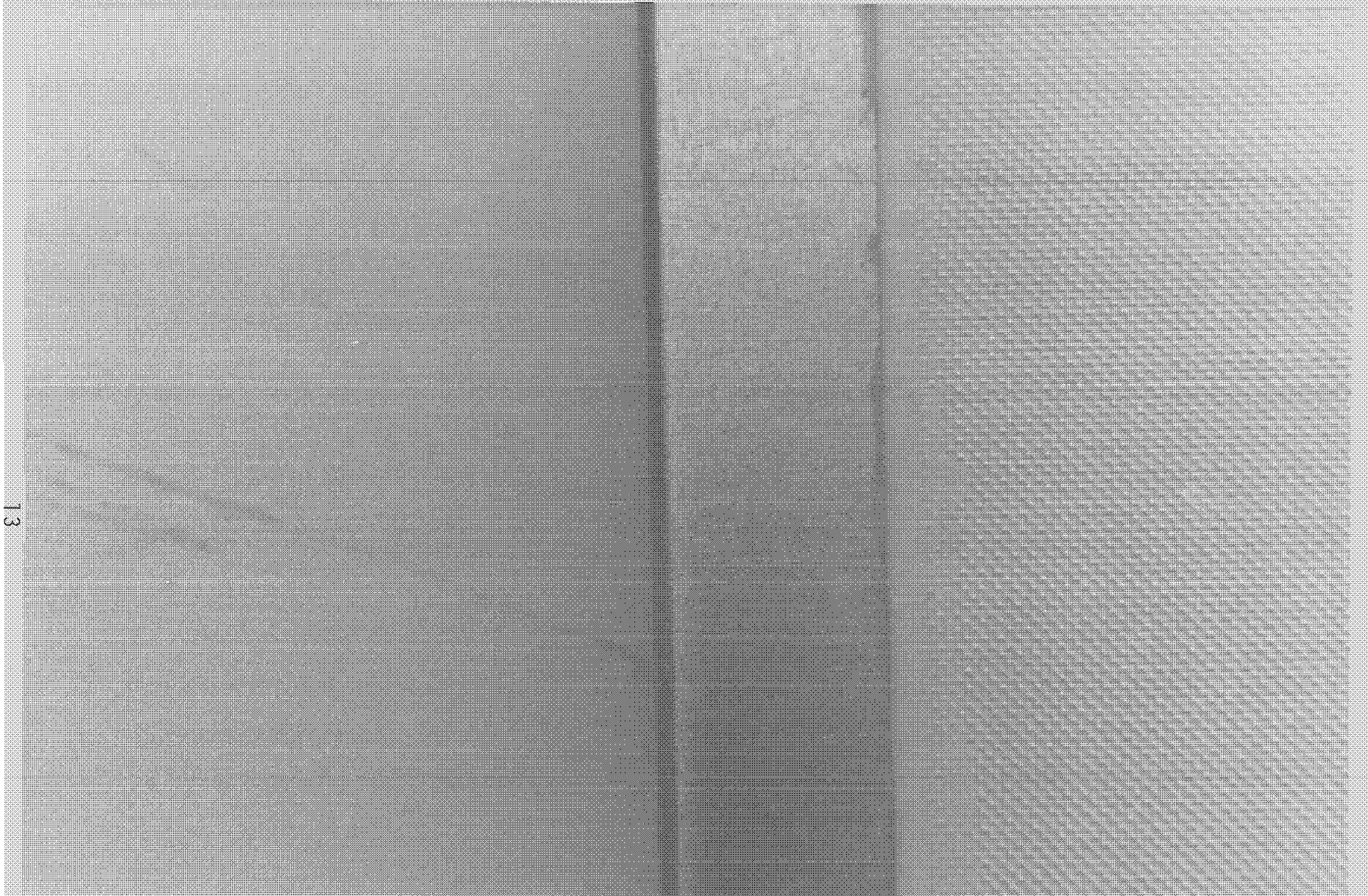
Figure 7 - Back of beta-cloth surface sampler retainer

NASA
S-72-33225



12

Figure 8 - Center surface used in mosaic



13

Figure 9 - Outer edge surface used in mosaic

APPENDIX A

Blueprint numbers of the Contact Soil Sampling Device (CSSD) parts are as follows:

Plug	SDB 39107679
Pin	SDB 39107677 - 002
Spacer	SDB 39107677 - 001
Retainer	SDB 39107675
Lid	SDB 39107674
Container	SDB 39107673

APPENDIX B

The NASA photographs of the surface sampler were carefully selected for the mosaic. Fifty-five photos were taken of the surface and developed by the NASA Photography Laboratory. Thirty-three photos were used on the mosaic. Some of these were duplicated and others had too much overlap so they were not used. The ones selected are as follows along with NASA numbers:

Row No. 1	S-72-33228
	S-72-33230
	S-72-33231
	S-72-33232
	S-72-33233
Row No. 2	S-72-33216
	S-72-33221
	S-72-33223
	S-72-33224
	S-72-33227
Row No. 3	S-72-33218
	S-72-33215
	S-72-33214
	S-72-33213
	S-72-33212
	S-72-33211
Row No. 4	S-72-33206
	S-72-33208
Row No. 5	S-72-33205
	S-72-33196
	S-72-33197

Row No. 5	S-72-33200
	S-72-33202
Row No. 6	S-72-33192
	S-72-33191
	S-72-33190
	S-72-33189
	S-72-33188
Row No. 7	S-72-33182
	S-72-33183
	S-72-33184
	S-72-33185
	S-72-33186

Some photos of the entire surface sampler were taken and the NASA numbers are as follows:

from S-72-33237 to S-72-33251

The back of the surface sampler from S-72-33252 to S-72-33256

Candid shots S-72-33257 to S-72-33259

The above photographs are on file with the Geophysics Section of Lockheed Electronics Company, Inc., located at the Gemini building.

APPENDIX C

Source of Information

Photographs were taken by Dr. Dave W. Carrier, III, Ext. 5891.

Contact Soil Sampling Device (CSSD) blueprints by
Billy Campbell, Ext. 2488.