ARCHIVIST'S NOTES #3:

LUNAR SAMPLES PRESENTLY CURATED UNDER HELIUM

March 24, 1994
J. H. Allton

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Judy Allton, March 24 1994

A large bolt top container connected to a gas cylinder supply of helium is maintained in the Returned Sample Vault. This container, known as the "bean pot," contains samples from two Special Environmental Sample Containers (SESC) collected during Apollo 15 [Apollo 15 returned from the Moon in August, 1971]. The SESCs were sealed via an indium/knife-edge seal on the Moon. 15012 and 15013 were taken to University of California Berkeley to be opened in the UCB organic clean room under helium March 31, 1972. At Berkeley the SESCs were opened and from each 5 allocations for nitrogen analysis and several reserve aliquots to be stored by the Curator were prepared.

Prior to the opening at UCB, the Curator had already prepared a small glove box which could be helium-filled. [This small glove cabinet presently resides in B. 31N, room 1107] A complete inventory of the bean pot was ordered on 8/5/74 and allocations were made 11/15/74. [This suggests that the samples may have been exposed to organic contamination levels typical of an RSPL cabinet at the time of this inventory.] There are 21 samples of 15012 and 16 samples of 15013 presently stored in the bean pot.

RATIONALE for collecting samples in SESC: No precise documentation is yet found. However, the Geochemistry Group Report of the NASA 1965 Summer Conference on Lunar Exploration and Science (NASA SP-88, p. 255) expressed a desire to see a number of smaller metal containers suitable for high vacuum used to return samples under conditions approximating the lunar environment. They desired containers capable of holding 10^{-12} torr.

RATIONALE for opening samples under nitrogen: As early as 1965, the Geochemistry Group Report [cited above] also specifies nitrogen as the most desirable non-reactive gaseous atmosphere in which to open samples because nitrogen would not interfere with noble gas analyses on lunar samples. Subsequently when the LRL was constructed, vacuum was determined to be more preferred by influential individuals because of the unknown nature of lunar samples. When it became evident that 1) vacuum sample handling was not practical, and indeed risky to samples when the vacuum was suddenly degraded, and 2) lunar samples did not react violently with nitrogen, sample handling was then conducted under nitrogen [interviews with Wasserburg, Haskin]. This switch from the vacuum system processing to nitrogen processing occurred just prior to Apollo 14 in December 1970 [LSAPT minutes].

RATIONALE for opening samples at University of California Berkeley: UCB demonstrated a capability to open samples in an organically clean manner [LSAPT correspondence 6/4/71]. Apollo 14 [14240] and Apollo 17 [70011] SESC samples were opened in the UCB facility under nitrogen [Apollo 14 implied nitrogen in UCB report, Apollo 17 stated nitrogen in LSAPT correspondence]. Apollo 12 SESC [12023] was opened at JSC in the organic cabinet under nitrogen [implied]. No information about Apollo 11 SESC sample. Bill Phinney's Apollo 16 planning notes indicate that an SESC sample of permanently shadowed soil was to be taken at station 9, but no SESC samples were noted on the returned sample lists. Phinney recalls that the astronauts ran short of time at station 9 so the permanently shadowed sample may have been placed into a sample bag instead of an SESC because it was quicker. SESC containers were flown on all missions. Thus, it is believed that only 15012 and 15013 were opened under helium.

RATIONALE for opening SESC samples in helium: "... so that some lunar samples uncontaminated by terrestrial nitrogen will be available for analysis.." Helium was preferred among gases other than nitrogen due to price and easy availability. By the time of Apollo 17, LSAPT decided to open the SESCs in nitrogen since there was no demand for samples opened in helium. [notes on LSAPT minutes attached].

5 ATTACHMENTS

REFERENCES:

Burlingame A.L., et al (1971) *UCB Space Sciences Laboratory Organic Clean Room and Lunar Material Transfer Facilities.* This publication is in the Data Center.

Burlingame, A. L., et al. (1971) *UCB Space Sciences Laboratory Simulation 3 Sand Transfer and Transfer of Apollo 14 SESC Lunar Material.* This publication is included in the 14240 data pack.

LISTING FOR SAMPLE TRANSFER

CO NUMBER:
DATE: 16-Mar-1994
LIST GENERATED BY:

NOTEPAD codes: NS = notes about specific; NG = notes about generic

SAMPLE IN HELIUM BEING SENT

GENERIC	SPECIFIC	PARENT	LOCATION	GROUP CONTAINER	CONTAINER	WEIGHT G	DESCRIPTION	NOTEPAD	FLAG
15012	10	0	RSV-BP	1 0034	275 101	3.221		NG	
15012	20	0	RSV-BP	1 0034	275 103	3.162		NG	
15012	21	0	RSV-BP	1 0034	275 105	3.027		NG	
15012	22	0	RSV-BP	1 0034	275 108	1.820		NG	
15012	23	0	RSV-BP		83 2542	1.640		NG	
15012	24	0	RSV-BP		83 2334	2.038	SESC	NG	
15012	25	0	RSV-BP		83 2526	9.434	RESERVE	NG	
15012	26	0	RSV-BP		83 2495	5.977	SESC	NG	
15012	27	0	RSV-BP		275 185	58.100	SESC	NG	
15012	28	0	RSV-BP		275 92	60.500	SESC	NG	
15012	29	0	RSV-BP		275 186	58.800	SESC	NG	
15012	30	0	RSV-BP		83 2487	0.195	SWEEPINGS	NG	
15012	56	0	RSV-BP		87 2214	0.400	GRAY CLOD	NG	
15012	58	56	RSV-BP		275 98	1.700	GRAY CLOD	NG	
15012	59	56	RSV-BP		87 2082	0.900	GL BRECCIA	NG	
15012	60	56	RSV-BP		87 2888	0.020	FI	NG	
15012	61	56	RSV-BP		87 1283	0.200	GL BRECCIA	NG	
15012	62	56	RSV-BP		87 2841	0.200	GRAY CLOB	NG	
15012	64	56	RSV-BP		87 2774	0.100	BRECCIA CLOD	NG	
15012	65	56	RSV-BP		87 1181	0.200	BRECCIA	NG	
15012	66	56	RSV-BP		87 2199	0.100	GREY CLOD	NG	
15013	12	0	RSV-BP		86 1231	2.107	SESC		
15013	17	0	RSV-BP	1 0042	86 1518	2.241	SESC		
15013	18	0	RSV-BP	1 0042	86 1164	3.188	SESC		
15013	19	0	RSV-BP	1 0042	86 1193	2.600	SESC		
15013	20	0	RSV-BP	1 0042	86 1547	0.998	SESC		
15013	21	0	RSV-BP	1 0042	86 1479	1.213	SESC		
15013	22	0	RSV-BP	1 0042	86 1025	1.080	SESC		
15013	23	0	RSV-BP		275 188	57.600	SESC		
15013	24	0	RSV-BP		275 184	9.300	SESC		
15013	25	0	RSV-BP		275 189	60.800	SESC		
15013	26	0	RSV-BP		275 187	54.400	SESC		
15013	27	0	RSV-BP		83 2308	0.067	BEAD		
15013	28	0	RSV-BP		83 2472	0.432	PEBBLES		
15013	29	0	RSV-BP		83 2416	0.015	PEBBLES		
15013	30	0	RSV-BP		83 2473	0.062	SWEEPINGS		
15013	31	0	RSV-BP		83 2342	2.105	FINE		

SPECIAL ENVIRONMENTAL SAMPLE CONTAINER

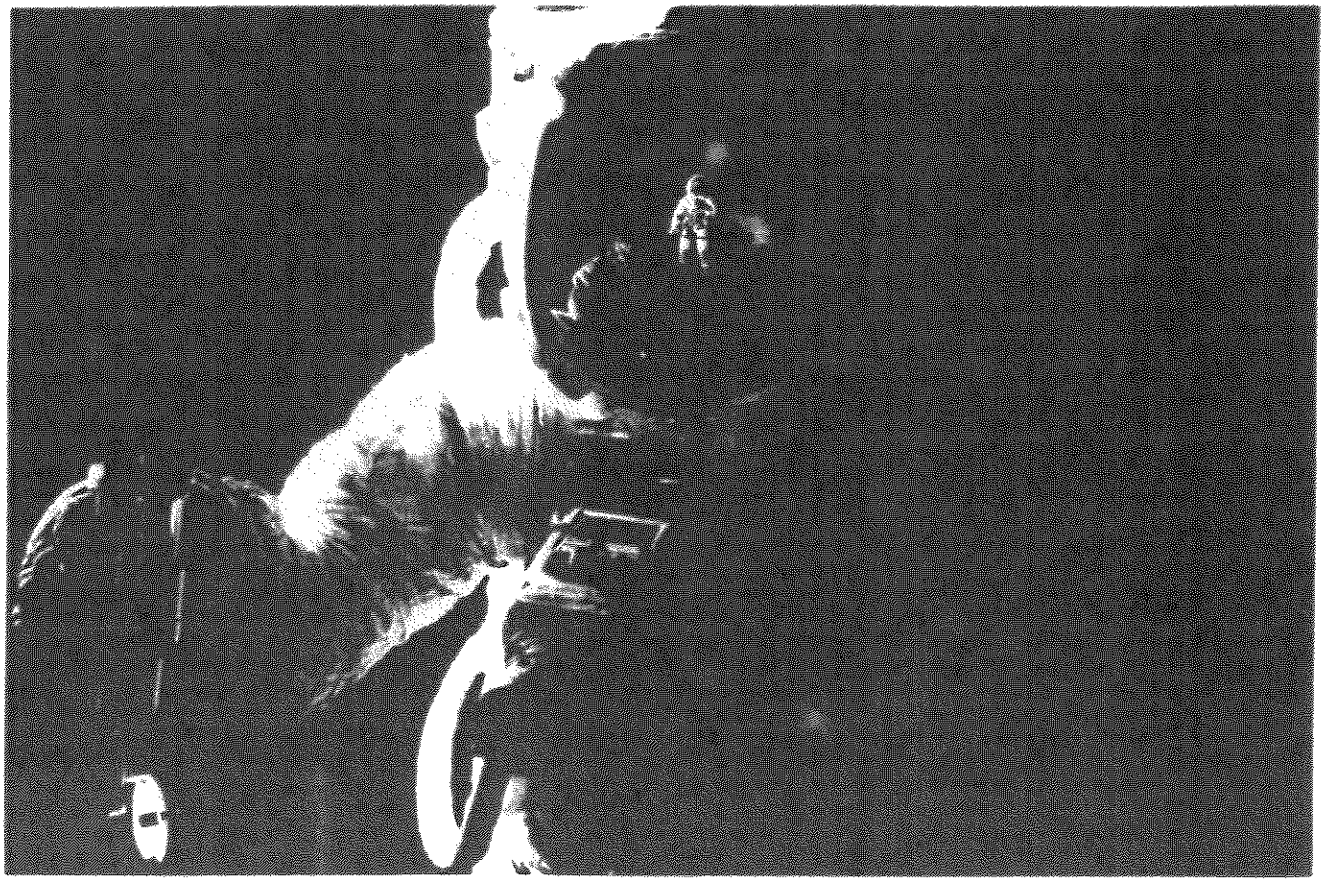

Fig. 91. Apollo 12 astronaut holds Special Environmental Sample Container (SESC) full of soil. The seal protectors have been removed and the container is ready to be closed (NASA photo AS12-49-7278).

WEIGHT:	**360 g**
DIMENSIONS:	**21 cm overall height**
	6.1 cm outer diameter

SYNONYMNS: SESC

DIMENSIONS: The overall height, from top of the handle to the bottom of the grip was 21 cm, and the outer diameter of the can was 6.1 cm. The can, without the lid, was 12.7 cm tall with an inside diameter of 6 cm and a wall thickness of 0.5 mm.

CAPACITY: 360 cm^3

MANUFACTURER: Union Carbide, Nuclear Division, Oak Ridge, TN

USE: The SESC (Figs. 91-94) provided a knife-edge seal into metal to insure that the sample inside was not exposed to terrestrial atmosphere or spacecraft cabin gases.

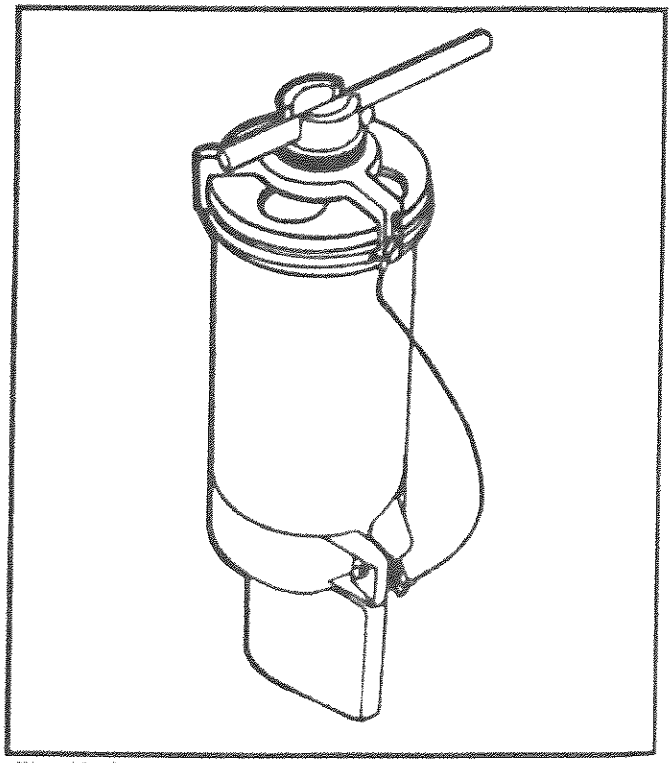

Fig. 92. Special Environmental Sample Container (drawing from [35]).

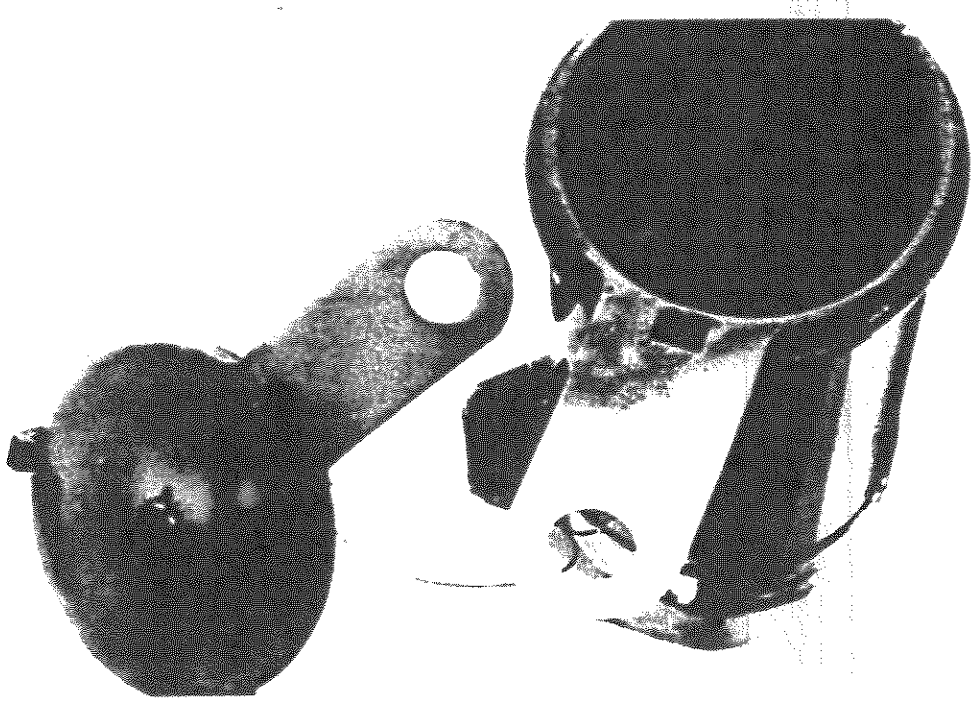

Fig. 93. SESC, with seal protectors in place, after being filled with simulated lunar dust in an experiment to test the ability of the seal protectors to keep the sealing surfaces clean (NASA photo S88-52667, taken from Union Carbide photo no. 137775).

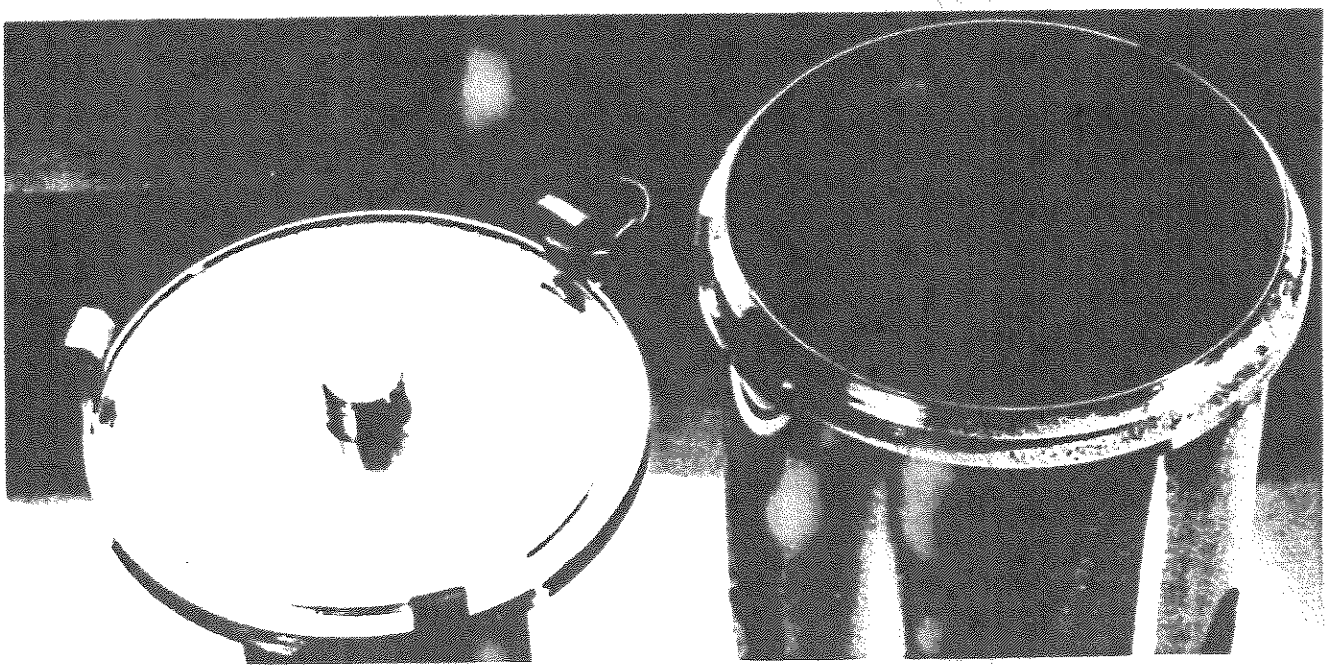

Fig. 94. SESC with seal protectors removed after test (see Fig. 92). Simulated lunar dirt got onto the sealing surfaces in this test (NASA photo S88-52666 taken from Union Carbide photo no. 137774).

OPERATION: Both the knife-edge on the can and the indium alloy on the lid were packed for flight with teflon sheets covering the sealing surfaces to prevent dust from interfering with the seal. After the astronaut filled the container with soil or rocks, he removed these seal protectors and closed the can. A torque handle allowed the lid to be pressed onto the knife-edge of the can lip.

APOLLO MISSIONS: Special Environmental Sample Containers were used on all Apollo missions.

MATERIALS: The SESC can and lid were made from 304L stainless steel. The indium alloy seal in the lid was indium with 10% silver, and the seal protectors were sheet teflon.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
MANNED SPACECRAFT CENTER
Houston, Texas 77058

December 15, 1971

REPLY TO ATTN OF: TL4

MEMORANDUM

TO: TA/Chairman, LSAPT

FROM: Vice-Chairman, LSAPT

SUBJECT: Processing of Apollo 15 SESC Samples at Berkeley Facility

1. LSAPT recommends that SESC's 15012 and 15013 (contaminated and uncontaminated soil samples) be opened at the Berkeley Space Sciences Laboratory Organic Clean Room and Lunar Material Transfer Facility in an atmosphere of helium rather than nitrogen, so that some lunar samples uncontaminated by terrestrial N_2 will be available for nitrogen analysis. The He cabinet system is to be approved by the Lunar Sample Curator and by the LSAPT SESC subcommittee before lunar samples are processed in it.

2. The five allocations (Kaplan, Gool, Moore, Hintenberger, Kirsten) of SESC material that will be used for nitrogen analysis shall be packaged in McKinney containers (primary containers). These are to be placed in 250 ml bolt-top cans fitted with Viton gaskets (secondary containers). Primary and secondary containers are to be filled and sealed in the He cabinet.

3. Three additional 1 gram and three 2 gram samples from each SESC, are to be packaged in McKinney containers, to serve as a readily accessible Curator's reserve. These are to be placed in one or more large bolt-top cans and sent to the Lunar Sample Curator. McKinney containers and bolt-top cans are to be filled and sealed in the He cabinet.

4. Remaining soil samples shall be left in the SESC's in which they were collected; these are to be sealed with new gaskets in the He cabinet and returned to the Curator.

5. Pebbles of >5 mm diameter encountered during processing shall be inventoried and stored in McKinney containers (one or more for pebbles from each SESC) which are to be included in the bolt-top cans containing the Curator's reserve samples.

John A. Wood

cc:
TL4/Lunar Sample Curator
TA/Capt. James A. Lovell
TN/Dr. Paul W. Gast
LSAPT Members

JAW:lhr

LSAPT Mtg 12/15/71

Members:

Wood, Vice Chairman
Burnett
Haskin
Heymann
Schmoss
Tilling

Invited:

Duke
Annexstad
Butler
Heiken
Laughon
Townsend
Villarreal

1. The question of Group C representation was discussed at some length. Add additional member? Combine Group B and Group C? Switch Burnett to full-time Group C?

   - Discussion touched on general question of full-time vs. part-time LSAPT membership.

   - No reaction as yet from LSAPT Chairman to November 15 memo re desirability of new member in Group C.

2. Vice Chairman reported that the editor of Science stated that a review article on the results presented at the "rock festival" would be suitable. The idea is to aim at a "short" paper (approximately 3 printed pages).

   - Question of coverage of session by members deferred until detailed program was available.

3. The question of a gas environment other than dry nitrogen for handling SESC samples was discussed. Schmoss briefed the meeting on his discussions with the Berkeley group and with P. I.'s. Helium seems preferred because of price and easy availability of supply, delivery, etc.

MOTION:

(to use He, etc; see memorandum)

CARRIED UNANIMOUSLY

- Distribution of the Apollo 15 SESC to be implemented after the Lunar Science Conference.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
MANNED SPACECRAFT CENTER
HOUSTON, TEXAS 77058

REPLY TO ATTN OF: TL4

December 15, 1971

MEMORANDUM

TO: TL4/Lunar Sample Curator

FROM: Vice Chairman, LSAPT

SUBJECT: Long-term storage of SESC samples opened in helium

LSAPT requests that the Curator obtain design information on a small storage cabinet, with minimum manipulative capacity, to hold a He atmosphere, which would be installed permanently at the MSC Curatorial Facility to store and process lunar samples opened in a He atmosphere.

We suggest that flowing He, analogous to the flowing N_2 systems in ordinary processing cabinets, is not necessary: primary sample containers, filled with He, could be stored in secondary bolt-top containers, also filled with He, and left inside a cabinet which maintained 1" (water) He over-pressure to replenish leakage losses. This cabinet would merely be flushed for a day with He before any samples were transferred in it.

In order to receive the Apollo 15 samples being opened in He at the Berkeley facility, this cabinet would be needed by March

John A. Wood

cc:
TA/Chairman, LSAPT
TA/Capt. James A. Lovell
TN/Dr. Paul W. Gast
LSAPT Members

JAW:lhr

LUNAR 03/21/73 **LSAPT MINUTES. Meeting of Lunar Sample Analysis Planning Team.**

For March 4-23, 1973 meeting.
Discussion: What atmosphere in which to open Apollo 17 SESC container and package samples?
MOTION PASSED: Since there is insufficient demand for samples from the Apollo 17 SESC container in helium, it is therefore moved that the container be opened in nitrogen.
On 3/22/73: MOTION PASSED: That transfer of the Apollo 17 SESC sample be handled at the Space Science Laboratory at Berkeley using a nitrogen atmosphere instead of helium.

Suggested LSAPT look into matter of improving the facilities at JSC for opening SESC type samples.