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JET PROPULSION LABORATORY, CALIFCRNIA INSTITUTE OF TECHNOLOGY
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
PASADENA, CALIFORNIA. TELEPHONE 354-5011

SURVEYOR III PRESS CONFERENCE

JPL AUDITORIUM, APRIL 22, 1967

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FLOYD ROBERSON, Cognizant Scientist for the Soil Mechanics Experiment.

COLELLA: Good morning, we're late so very quickly from left to right, Dr. William Pickering, the Director of the Jet Propulsion Laboratory, Mr. Howard Haglund, the Surveyor Project Director here at the JPL, Dr. Ronald Scott, Associate Professor from Civil Engineering at Caltech and also the principle investigator for the Soil Mechanics Experiment on Surveyor on the far right, Floyd Roberson of JPL and Floyd is the cognizant scientist for the Soil Mechanics Experiment. Dr. Pickering.

PICKERING: Well, I don't want to take time away from the people who are going to describe to you what we've been doing last night. I would just like to mention, however, that in a mission of this sort, it always well to remember that the success of the mission is the result of the work of many people and many organizations. In particular, of course, the Hughes Aircraft Corporation, who built the Surveyor should be given credit for their contribution to the mission. The people who worked at tracking stations here and around the world. The people who have been connected with the launching operation and everyone concerned has done their bit to make this a success. I would like to at least take the opportunity to introduce a couple of the men actually from JPL who are concerned with the engineering of the engineering operations of the Surveyor. First, Bob Forney, who is the Surveyor spacecraft system manager, and Kermit Watkins, who is the assistant manager for operations. Well, as we all know, of course, Surveyor continues to operate on the moon now for well into the second day, almost beginning the third day and we're certainly very pleased with the way things have been going. Thank you.

Surveyor III has now taken over 1600 pictures, to be precise, 1610 600-line pictures and 53 200-line pictures. Because it landed in a crater and because of the bounce it took, it is probably suffering from some degradation of the thermal surfaces and because of landing in the crater, probably being shaded improperly, so that the camera and soil mechanics device now must be

operated on a duty cycle. However, we have been getting some spectacular information out of it. The rest of the spacecraft continues to work fine, We're charging properly. The compartment temperatures housing the electronic equipment other than the surface sampler and the television equipment seems to be working within limits and we have been able to work around all of our difficulties so far. About a year ago, when Ron Scott was looking at the early Surveyor pictures,I remember him saying, "I wish I scratch the surface." Well, I think we've provided him the mechanics for doing this job. I'd like to turn this over to first Floyd Roberson, who will talk about this and then Dr. Scott.

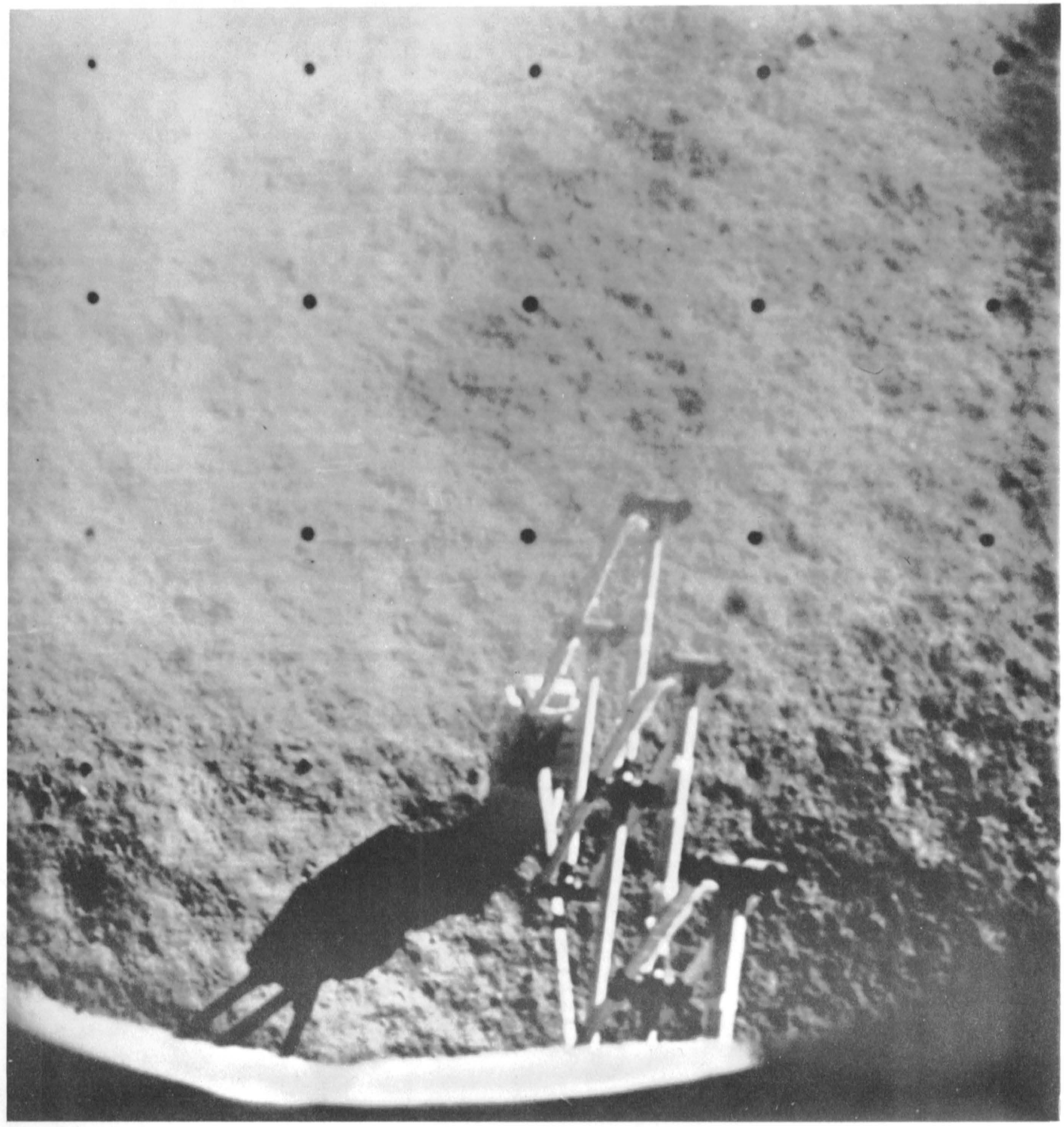
ROBERSON: Our first operations of the surface sampler were performed two Goldstone passes ago, that is day before yesterday. Up to that time we had been watching our temperatures carefully in the electronics unit with some concern. When we reached the time we were ready to turn on, all our indications from the telemetry we were getting seemed to be that the device was working very well. Our initial deployment and check out of the motors showed that each of the motors was moving almost exactly as expected in terms of the distance per command. The difference, the one exception, was in the extension retraction motor. This motor appeared to be moving roughly half what we expected from our test data. Our best estimate of the cause of this at this time is a temperature, This particular motor being on the underneath lower side of the mechanism, having very little access to radiate to space, so that it would heat up much more than the other motors. However, we're able to calibrate this from the moon just through video information and correct our sequences and plan where we want to go very accurately. We now know quite well how far it will go for any command we give and in mode of operation we're in, we're able to position it where we expect the next picture and we were able to do this well last night and I think Ron has some things to say about the results.

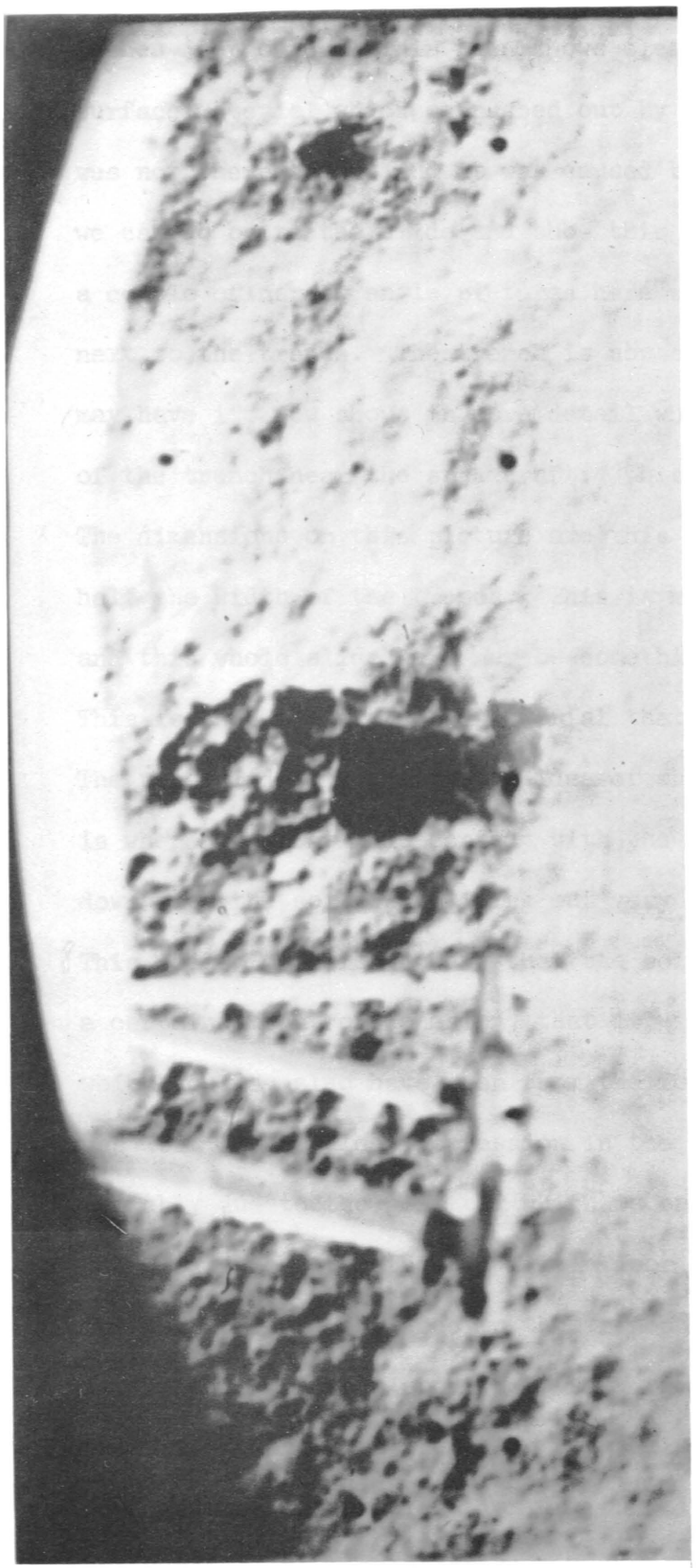
SCOTT: We had, of course, prior to the mission prepared the standard plan of operations which we would go through, but we're working with non-standard spacecraft at the moment, and so we began last night pass with the camera survey of the area in which we intended to operate based on our previous information. When the camera stopped stepping in azimuth during this survey, we decided that we would leave the standard sequence that we had planned at that time and get the camera, get the surface sampler which seemed to operating okay, in the place where the camera was looking and I think if any of you were here last night, you might understand the delay we had getting around to this position instead of having the camera look where we were. And so, we decided, first of all, to do what we do a bearing test in the center of the camera position. That is, to place the surface sampler on the lunar surface in the center of the camera frame as near as we can, near as we could, and push the surface sampler into the ground relatively slowly, that is just drive it into the ground using the downward elevation drive motor. We did do this. We followed this out . . we then brought the surface sampler out of the ground and followed this up by moving slightly to one side and slightly further away from the spacecraft, opening the scoop door on the surface sampler driving it into the ground again slowly, not dropping it, but just driving it into the ground slowly, with the scoop door open and then dragging it back, towards the spacecraft in the beginning stages of a trenching operation. We followed this up by moving to another location which is desirable for a number of reasons after it had been determined that the camera would probably be able to go over to another location. We operated under some assumptions of limiting the number of camera motions that we would require, and so we moved to another location and began the first couple of stages of a trenching operation. I think we have some five or six slides which show the results of doing this, and if I can I'd like to show the slides after this brief summary I've given and then I can say a little about what we see on the slides.

The first slide shows the first place we were . . . . .

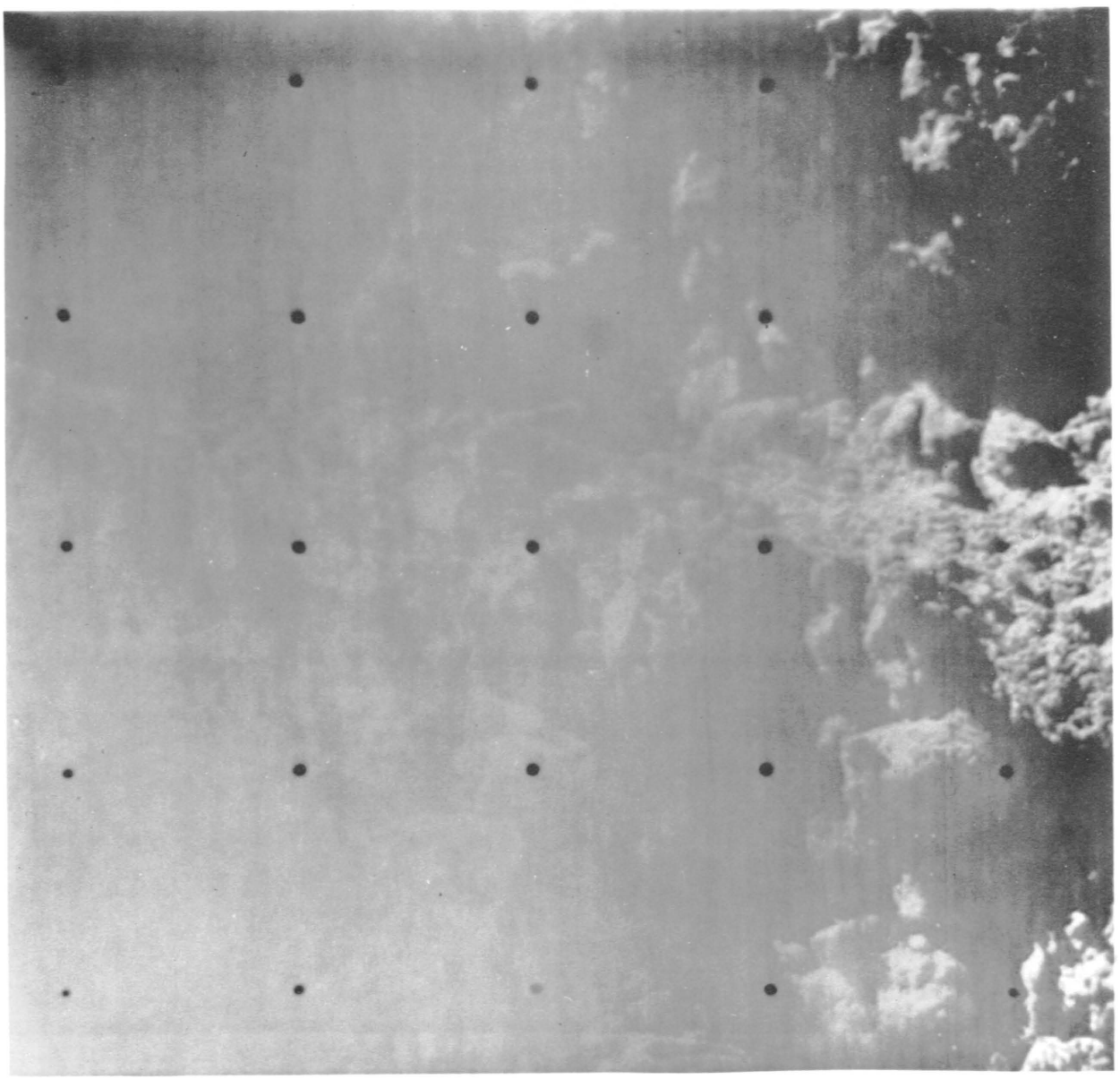
COLELLA: Pull that back a minute please.

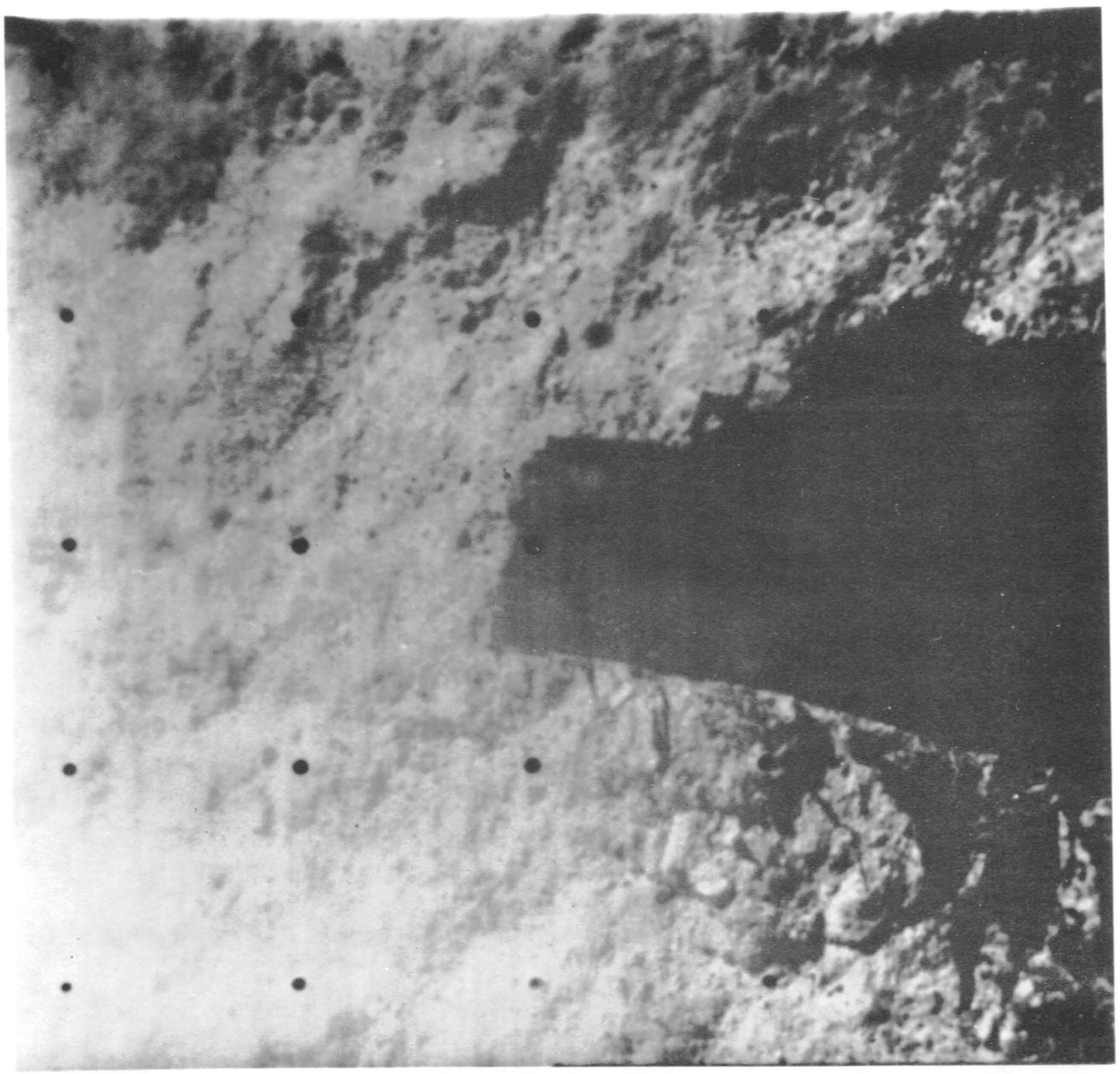
SCOTT: The first slide shows the first location at which we came down to the lunar surface. We brought the sampler over to this point and lowered it to the surface the sequence dictated by Mr. Roberson blind, without taking any pictures and the first picture we had after moving from the aux battery position which is a picture you may have seen from moving from the aux battery position over to here and lowering to the surface on the basis of Mr. Roberson's extimates of the sampler performance showed this picture. We just barely touched the surface. Just got down to the surface and we were just barely touching it here, indicates very good performance of the sampler. The next picture I had two of these superimposed so you could get a clear indication of what we actually did that first time. We're resting on the right hand edge of a small crater or depression here. The surface sampler is pushed into the soil in this picture and this section of soil here has all been pushed out and toward the spacecraft by the surface sampler in pushing it downwards. I think you may already have seen some pictures of the spacecraft that we have the model here and you realize, I think, that when the surface sampler is in contact with the surface, and is commanded down, it does not go vertically downward, but does actually move slightly toward the spacecraft. And so, the area soil is pushed up toward the spacecraft. The surface sampler has gone in a couple of inches this time. It looks as if we're in the ground a couple of inches. This is very much like what we would expect on the basis of Surveyor I results. It looks as if this is a reasonable thing to expect, for this kind of soil. In other words, the soil looks like the Surveyor I soil. When we remove the surface sampler, we drove it up out of the way here so that we could get a photograph of the trench. Here is the depression made by the surface sampler. This region here is something like 4 or 5 inches long, it's 2 inches wide,

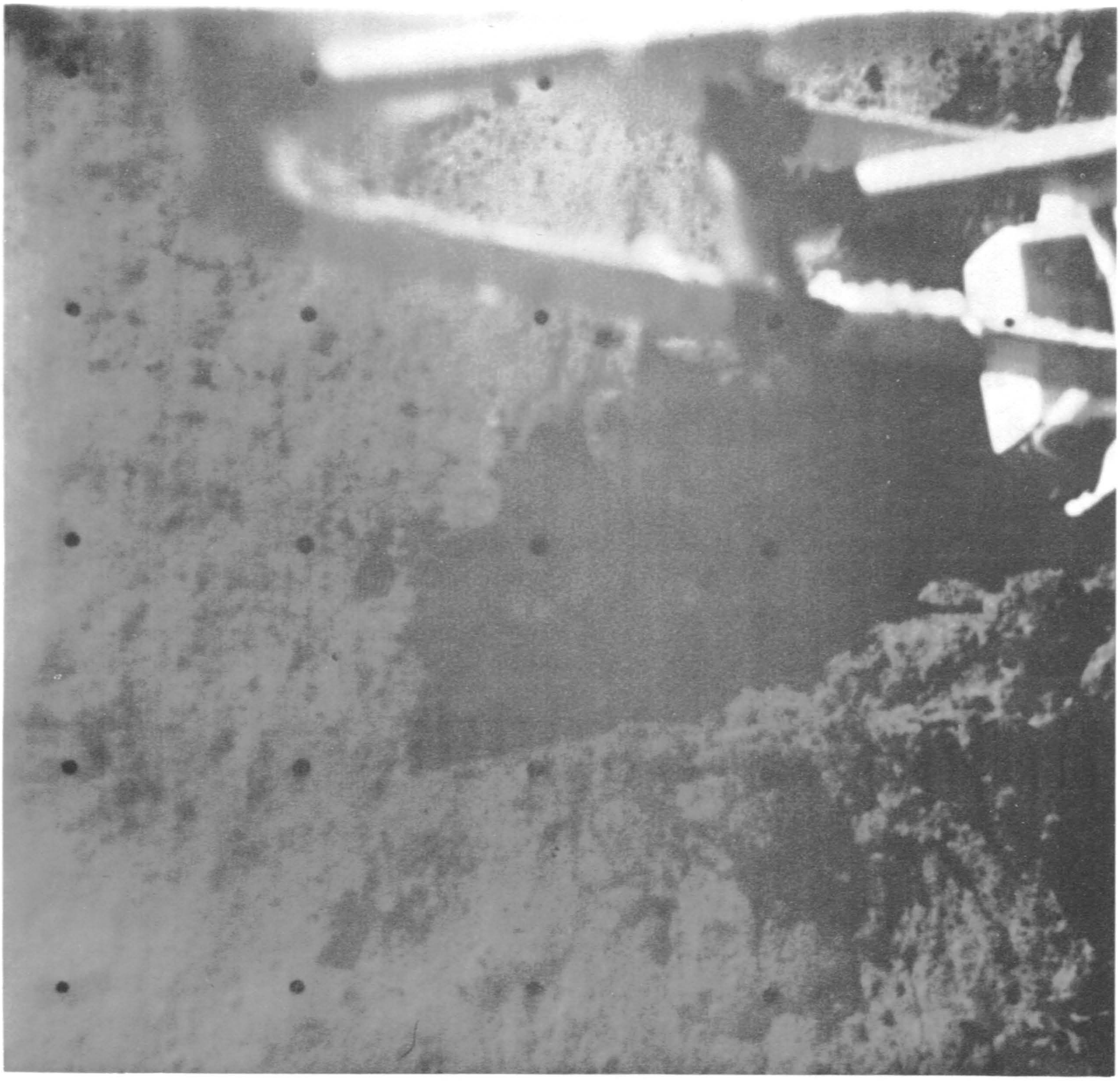


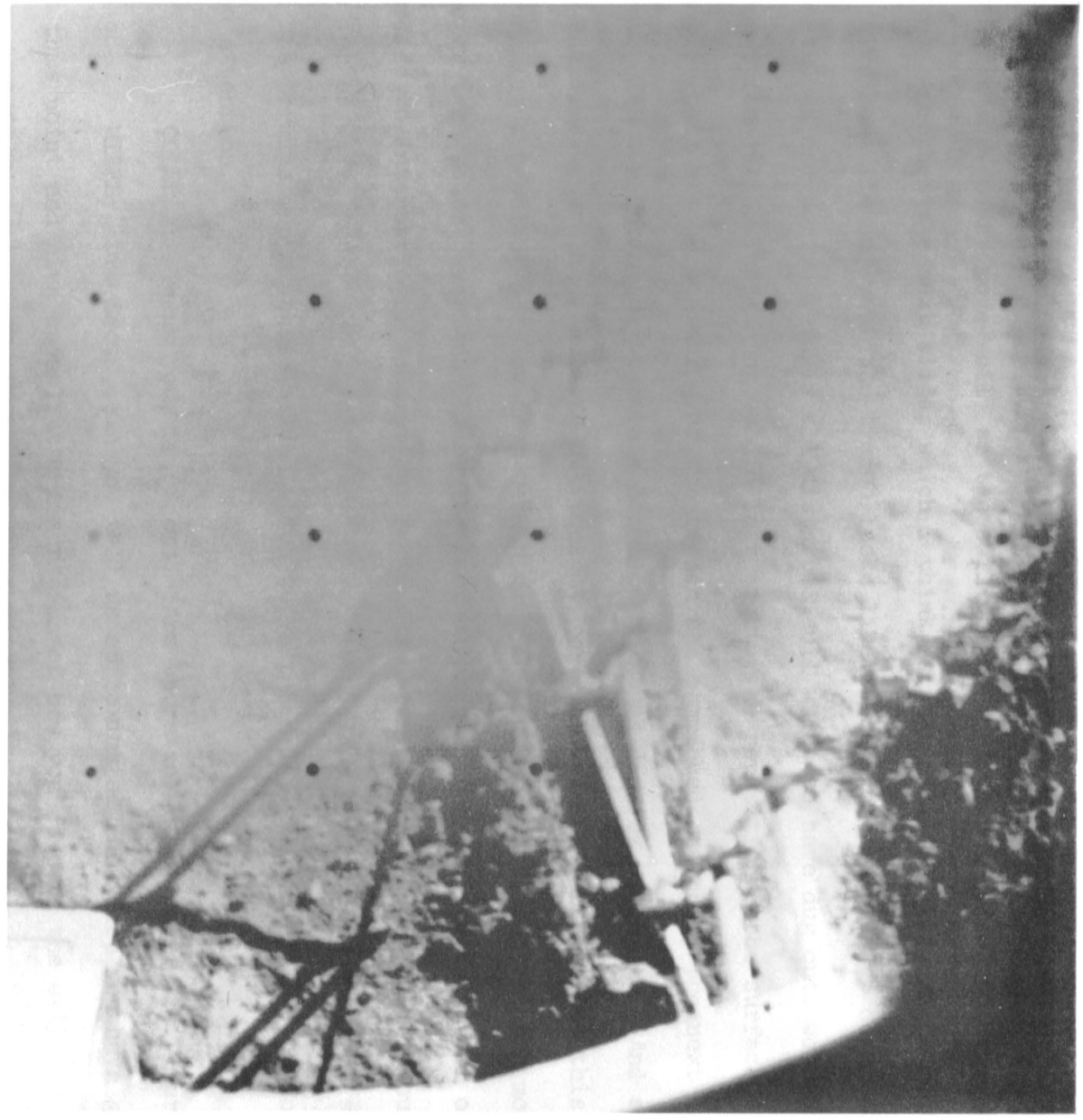


and from the estimates in this picture up here, it's something like a couple of inches deep or so. This then shows clearly the disturbed region of the lunar surface material which we pushed out by pushing the sampler into the soil. This was not there before and it was caused by us. A very gratifying event. I think we can go on to the slide and show this is now a narrow angle picture. There is a couple of narrow angle pictures here which shows the region of disturbed soil next to the trench. The trench is now over here. The following picture, if I may have if, now shows in more detail what the trench has done. This is the section of the trench near the spacecraft. This is the left hand boundry of the trench. The dimensions on this picture are this from here to here is a little more than half the width of the trench. This is maybe a inch and a half or so in dimension and this whole slide here may be something like 5 or 6 inches of the lunar surface. This is then the disturbed material that we caused by pushing the sampler in. The next slide gives a better idea of what the top of the trench looks like. This is where we first made contact with the surface and then the soil sampler pushed down into the soil and slicing out very neatly a section of the lunar surface. This seems to indicate here that the soil as expected from Surveyor I does possess a certain amount of cohesion, that is, it has an ability to retain an impression which you may also have seen from the footpad mark near number 2 and as the sampler has left a very clear impression in the surface. This little bit over here is probably due to the gear box which is on that side of the surface sampler. The gear box which operates the little door of the little trap door of the scoop. The next picture now goes to the trench which is the last thing we did last night . . . this morning, about 2:00 a.m. or so, PST, this morning. We are now in the process of digging a trench in a position where the surface sampler motion up and down and the camera elevation motion only, not any azimuth motion of the camera are parallel to each other so we can go up and down this trench and the camera can follow up by merely stepping in elevation only. And so, we started here,







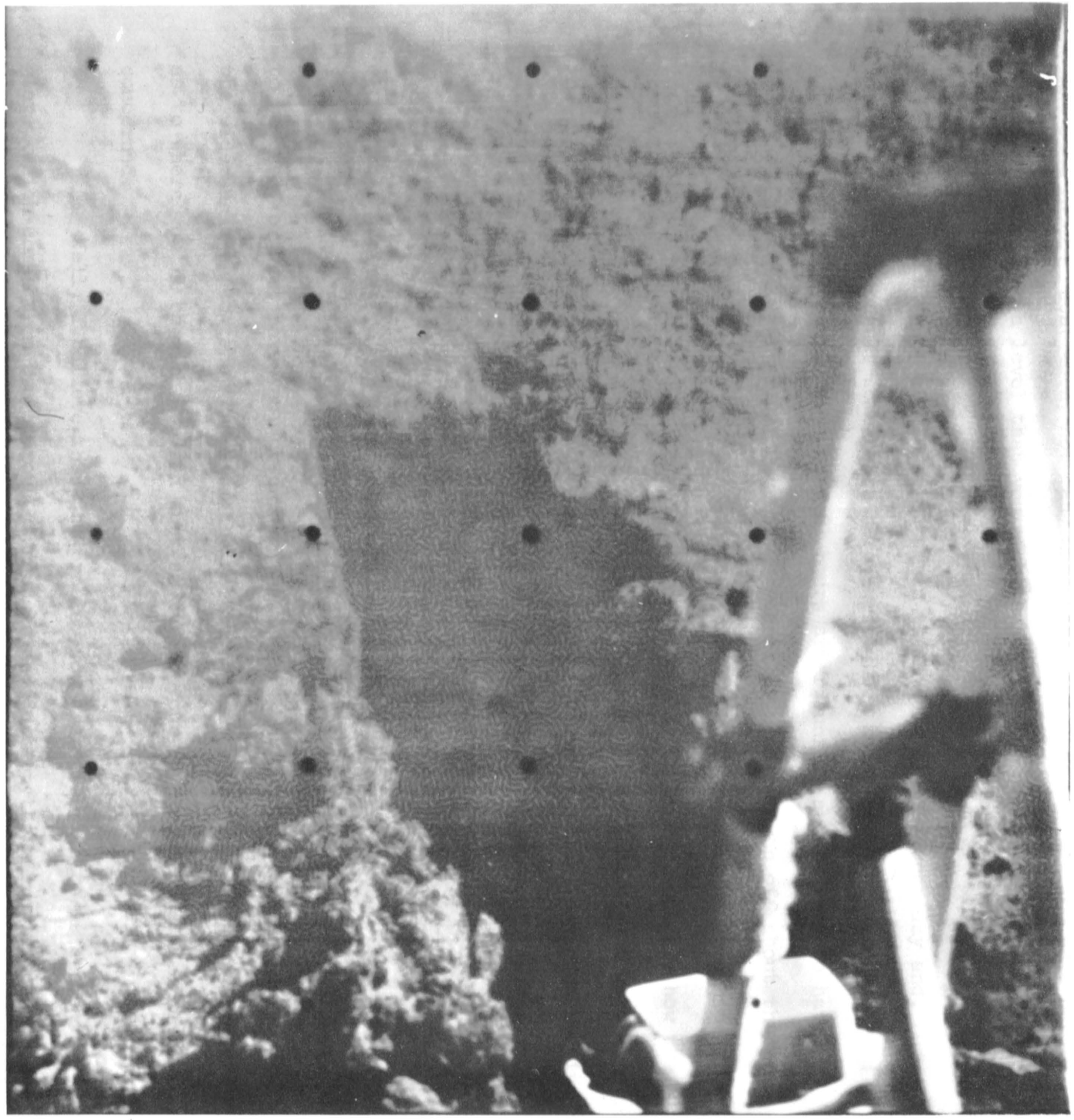


with the bucket open again, pushed it into the dirt, dragged it right down toward the spacecraft, a distance of the order of 12 or 15 inches, took a narrow angle picture which shows the trench very nicely again a clean cut edge up here, some disturbed material here which is pushing, being pushed out of the way because the bucket is now full up. After the first inch or two of motion the buckets full up it can't accept any more soil, so the soil has to go somewhere else, so its outside here. And then the next slide, which I think is the last, is a wide angle picture to give some idea of what the trench looks like. The trench starts up here and comes down and here. This is all disturbed soil which we have dug out, we then reposition is the last thing we did last night. We repositioned the surface sampler back at the beginning of the trench and commenced one next, the next drag test. Its our intention that this location to go as deep as we can go. And so, we shall. . . our luck, holding out tonight, we shall attempt to continue this trenching operation, see how deep we can go. I think we are already at the moment deeper than we've ever gone below the surface of the moon. I don't know if one applies to International Federations for lunar depth records but, this is about as far as we've gone. Now, voluntarily, we exclude Rangers. (laughter) This is the termination of these slides which we've taken last night. Thank you for you attention.

COLELLA: Thank you, Dr. Scott. Are there any questions? . . . Marvin first.

MILES: Dr. Scott, can you tell us approximately how deep you have gone at this point and give us a little discussion of how you compare the soil you are encountering here with that on Earth.

SCOTT: I think if as a visual indication you can see over there with the model sampler we're in the second pass down this last trench which we're engaged in at the moment. We're over the gear box, we're in the vicinity of that gear box and the tape, the retraction tape is very close to the surface of the ground, so



it looks very much as if we're down around 4 inches-4½ inches. The penetration of the footpads on Surveyor I was around a couple of inches, for example.

MILES: Gentlemen, how many more days of operation will you have before the lunar sun is at a level that you might have to turn off for a period of time if indeed you will.

A: We always plan to turn off in the middle of the lunar day and, let's see better consult some notes here, we've been going now since Wednesday afternoon--seems longer. We landed 21 hours after sunrise and we were to have 13 days and 22 hours after landing and we generally plan to drop off about the middle four or five days. I would imagine that it would probably be somewhat longer this time. We really are going to have to play it by ear, and see how the duty cycles could be worked monitoring the temperatures. As I have said before the electronic compartments seem to be all right, but we're being very conservative with the operation of the television camera to make sure that we don't in our zealousness try and get too much out of it at the expense of keeping it from lasting because if we can wait till the sun angles change we'll get even clearer pictures of the area that we've scratched already.

MILES: Could you pursue that last just a bit? We noticed what seems to be dust, or what have you, obscuring the top of the pictures, particularly in the wide-angle photography and from the sun values now, what is your projection as to where you'll be with sun and dust as far as your future pictures taking is concerned.

A: Well, I believe that the problem you are referring to is caused by glare, which comes from two sources, sun angle and dust on the mirror filter system. We have no way of separating them, quantatively, we know that the pictures we took this morning had less glare than the pictures we took the day before. But there is no way of putting a number on how much comes from sun angle, we're about

about the same spot or a little farther from where we were, relative to the sun when Surveyor I landed. We started out with the sun down more so we never saw these glare conditions on Surveyor I so we will have to proceed cautiously again today see how much improvement we get in the glare from the fact that the sun is higher in the sky. 'Course as we get higher we will wash out as we get to the other side of the zenith then the spacecraft will provide some shading to this area and we hope to get clearer pictures at that time. So we will work cycle ourselves to stretch as much as possible. I realize this is tough on deadlines and program spots but we're going to continue to play it conservatively.

HIMMEL: Dr. Scott, knowing what we do about the weight of the LEM and also about the astronauts what do you suppose the chances are of the LEM landing safely if it were to hit such an area as this at an angle and straight down. And, what do you suppose an astronaut might do to this seeming soft soil.

SCOTT: I think all of the calculations were made at the time of Surveyor I--so it doesn't look from a bearing capacity point that you, if you through in roughness and slope angles and so on, doesn't look like there'll be a problem for LEM from a penetration point of view providing it lands on soil similar to this.

HIMMEL: Do you have any idea what the weight of the LEM is and what

SCOTT: I'm not in the position to talk about the LEM design.

Q: Dr. Scott, on the basis of what you have seen, how would you describe the lunar soil in earth soil terms. Is it like what.

SCOTT: Again the same as Surveyor I, it looks and behaves very much to me, as a personal opinion, that it looks and behaves very like a damp, fine grain soil, slightly damp beach sand, very fine grains, behaves in a perhaps disappointingly ordinary way. (Laughter)

Q: You're not saying that it is damp, it just acts like it.

SCOTT: It has a slight stickiness which obviously must be for other reasons than dampness I'm using the term "damp" just to give the an impression of when you push into lunar soil you leave an impression behind. It retains the impression that you pushed in, and when you dig a trench in it you get, at least to the depth we've gone, get a little vertical wall at it so it's got a little stickiness or cohesion to it. And the nearest thing, the easiest way of simulating it or thinking about it would be a dampish soil.

Q: Like a beach soil, beach sand after the tide has gone out a little bit.

SCOTT: Yes, I guess so. (Laughter) It's rather hard to find similies for these things which don't confuse somebody or it don't arouse some other such desire.

Q: Have you determined the health of the telemetry or decided anything about it or

A: Yes, we've decided something about it we miss it. There are quite a few measurements that we are getting at the low bit rates in terms of power and compartment temperatures. We're obviously getting camera temperatures, because that's what's causing you the problems we're cycling to keep the temperature in the region of 140° F and so the latest cycling has been for about a half hour on and half hour off. So we are getting data we wish we were getting more.

Q: Is that duty cycle half hour on half hour off, then.

A: (not audible)duty cycle this morning at 3:35. This afternoon when the sun is up some more we'll plot the curves again and see how bold we can become. We continually plot the curves and plot the rise time and plot the cool off time and from that determine what the duty cycle is. We're just treating it very carefully.

Q: Dr. Scott, I wonder if you could comment on the bearing strength.

Have you any idea of what the bearing strength in this location might be? Somebody said four to five psi last night.

SCOTT: Yea, I hope you'll forgive me for continually referring to Surveyor I, because I rather doubt that point. From Surveyor I the most recent analysis of the dynamics indicate something like 6 psi, little higher than was indicated at the time. From a couple of experiments last night in the first bearing test the distance the sampler was extended it would exert about six or seven pounds of force on the lunar surface. With the scoop closed the bottom of the scoop if flat and has an area of 2 square inches, its proportions are 2 inches by 1 inch, so we would have exerted about 3 to $3\frac{1}{2}$ psi on the surface. We gave the thing a couple of down commands and presumably came fairly close to stall which would give the six or seven pounds and so we penetrated the lunar surface something like an inch and a half or so with a pressure of $3\frac{1}{2}$ pounds psi.

Q: Is that true of the other tests you took too, did it all seem to be about the same?

SCOTT: When we began the trenching operation, we opened the scoop door, which cuts down the amount of area in contact with the lunar surface. And so it's considerably less than two square inches which might be several tenths of an inch and on commanding that down we did not attempt many commands to see how far it would go. We will try this but it went further in than the first time, it definately went further in at the slightly higher pressure.

Q: I wonder if you would comment on one more thing. Yesterday, Rueter's quoted a Russian astronomer his name is Trotsky, of all names, he said that their measurement
it indicated a thirteen foot thick layer of tiny porous particles only 8 thousandths of an inch across with very little contact between particles indicating a very

little cohesiveness.

SCOTT: What do you want me to say? (Laughter) There is obviously a gramular layer present on the surface of the moon. People have or lots of people have estimated it's of the order of several meters deep on the average but with radio measurements you can only get average values or tens of kilometers. So, this looks like a reasonable figure. As far as the density is concerened, I don't we have no measurements as to the density. As I say the stuff behaves like an ordinary soil as far as we can tell. With some evidence it seems to get stronger with depth.

Q: Dr. Scott, do you have any idea what force relative to the capacity of the motor was necessary to pull the digger in?

SCOTT: No, we have no telemetry measurement which are interpretable at the moment. Normally, we make measurements of the motor current and we have calibrated the surface sampler in terms of force at the bucket and various directions versus the motor current necessary to attain that force. So normally we monitor the motor currents, we did so but the results are not interpretable on the basis of our calibrations for telemetry reasons.

Q: I wanted to ask you what you hope to accomplish this afternoon with what limitations you are working with. Are you going to try to find out how soft the surface is down below where you've gone already? Is that the idea?

SCOTT: The trenching, yes. Since we can't make the force measurements--all the force measurements--we'd hoped for we will keep trenching as far down as we can. If we get significant information from seeing what the side wall of the trench looks like, the more scientifically inclined people will be able to determine layers or possibly differences in shading or grain texture which would be of interest to them. I will find out if it gets harder with depth, and if at some depth the side of the trench collapses, we get a distinct measurement, absolute measurement, of the strength of the soil that way. If we go down so far and the

side wall of the trench collapses, it's possible to analyze that event and get an idea of the strength.

Q: Dr. Scott, if these soil sampling experiments are successful on future Surveyors do you hope to have a more sophisticated mechanism, what would you like to do potentially that you're not doing with this now.

SCOTT: There are no plans for a more sophisticated soil mechanics experiment on later Surveyor.

Q: But there are plans to have this type of experiment on later Surveyors are there not?

SCOTT: There will be another sampler of this type on Surveyor IV, on the next Surveyor, Mission D.

Q: Is there still a problem in unscrambling some of the telemetering data? I understand that interogation business is still going on.

A: We will examine the digital data point by point in effort to try and gain a key to it. As I say we already have been able to get some very significant engineering measurements out in terms of ampere hours of charging, in terms of the temperature in the other parts of the spacecraft and it remains to be seen what can be determined by detailed analysis. We're sure going to try.

Q: (not audible)

A: We can't say at this point. We're still trying to get a key to it.

Q: Dr. Scott, how much more can we add to our information with the alpha analyzer on 5 and 6 Surveyors, if we were to perform the same experiments with the alpha analyzer. And again, could you see any hazard to an astronaut walking himself in trouble on the surface?

SCOTT: I will take your last question first. There doesn't seem to any hazard in walking along the surface near where Surveyor III is one wouldn't

sink too far, it wouldn't be hazardous to walk on. It might be rather soft to fall on. One wouldn't penetrate too far, half an inch an inch maybe. Dr. Turkovich of the University of Chicago is the principal investigator for the alpha scattering experiment which is intended to give some analysis of the composition of the surface material. I'm not in a position to tell more than that.

Q: Dr. Scott, can you tell us if there are any lunar rocks in your reachable area. How, what size they might be if there are, and what you plan to with them.

SCOTT: There are one or two small objects around, not very many. If we get the time and if we have the TV camera, we will try to do something to them. We also intend, you may have noticed on the trenching operation, that we've pulled out some lumps where the surface is broken up into lumpy like material. We will attempt to find if some, or at least some of these lumps, are rocks or just aggregates of particles.

Q: Will you be using the sampler to pick at these rocks or pound on them in any way? How do you intend working?

SCOTT: There is a proposed mode of operation, to strike something. There is nothing in our area that's work striking at the moment, unless footpad #2. There is no nice big rock. Say, twelve inches or so across, which we could take a whack at. The ones, the small bits and peices that are there may be rocks or may be clumps. We might try to pick them up to see if we crush them in the trap door and see if we can squash them down first before trying any dropping or impact experiments.

Q: Exactly what experimentation, if any, will be done during the eclipse tommorrow night?

A: Again depending upon the state of the health, we had planned to run some cool down experiments. If we have the proper sensors available and can interpret the data, this will be one possibility. There would be pictures of the horizon

and corona that we might want to look at. But, again, the standard operation for Surveyor III has been non-standard, and we'll play it by ear.

Q: Mr. Haglund, you talk of turning on the strain gauges while the shovel is working. Were you able to do that during the night? Or will you try it tonight.

HAGLUND: The data was noisy when they were turned on last night, I imagine we will attempt to do it again to see what we can do.

Q: How will this help you? What more accurate measurement can we get?

SCOTT: If we operate the surface sampler and the trenching operation and we get involved with forces that are near the stall capability of the motor, which is something like 20 pounds at normal temperatures it may be less than that with the higher tempratures we seem to be at. This 20 pound force is of such a magnitude that the strain gauges on the legs of the spacecraft, that is the strain gauges intended for landing, might record something. In fact, they should record a signal. And so because we have no motor telemetry that seems to be reliable at present, we concluded that we might get some worthwhile force indications by reading the forces in the legs while we conducted the sampler operations.

Q: I would like to ask one facetious question. I guess the astronauts will not have to wear snow shoes up there, will they?

A: No.

Q: Do you have any idea about albedo?

A: No.

Q: Is it too soon to exact that, to get albedo?

A: We've been concentrating on these other things. I don't know. Leonard Jaffe, have we looked at anything in the albedo measurements yet at all? Or have we just been looking at terrain?

A: We don't have any numbers yet. Until today the photometric charts, which are on the antenna out there and on the leg down on the bottom, have been in

shadow. The sun is coming from this way, so the side that can be seen from the camera is dark. If we had not been able to get any calibrations photometrically to get any quantative albedo measurements, the only casual observation we've made of this kind is that the footprint of pad #2. That shows the honeycomb, is obviously brighter than the nearby surface and seems to have higher albedo. Clearly there have been some changes around the surface sampler area, too, in the detail of the surface. We have not locked the landing gear legs yet. In case there is any bleed from the shock absorbers to give us a slight sink. So that if this does occur, we might be able to get some stereo pictures.

Q: Any idea about lunar temperatures as we go into the lunar day, so far.

A: They're hot, as the television camera indicates. This is a different attitude for us to be. We're in a crater, as you know, and we have again concentrated on getting as much data out as possible in the way of the soil mechanics experiment pictures. The temperatures will have to be searched out bit by bit in the telemetry record to see what we can get out.

Q: Mr. Haglund or Dr. Scott, is there one way you could sum up how much ahead we are of Surveyor I or how much we're learning or have learned because of the sampler on then we did on Surveyor I.

A: A great deal. Surveyor I was an uncontrolled experiment.

COLELLA: Any further questions? Thank you very much gentlemen.