NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

APOLLO 17

TRAVERSE PLANNING DATA

(3RD EDITION)

NOVEMBER 1, 1972

MANNED SPACECRAFT CENTER
HOUSTON, TEXAS

August 2008 Publication Note

The third edition of the Apollo 17 Traverse Planning Data book was prepared by the Manned Spacecraft Center for use during the EVA's on Taurus-Littrow, the landing area for the mission. The original document was provided by Ed Fendell, Apollo Flight Controller.

This PDF version was produced by Bill Wood. The original pages were scanned with an Epson Expression 10000XL, using Silverfast AI Studio, to produce high quality 480 pixel per inch, 48-bit images, for further processing. The printed halftone images were carefully converted to continuous tone replicas. Each page image was straightened and cleaned up in Photoshop CS3 prior to producing 300 pixel-per-inch EPS page images. Adobe Acrobat 9 Professional was used to prepare the final PDF edition. The document is made searchable by using Adobe ClearScan.

Bill Wood was a Unified S-Band Lead Engineer at the Goldstone Apollo MSFN station during the lunar missions. Ed Fendell was the Head, Apollo Communications Sections, Flight Control Operations Branch at JSC during most of the Apollo missions. Both are now retired in Barstow, California and Houston, Texas, USA.

PREFACE TO THE 3RD EDITION

Since publication of the 2nd edition, minor changes have been made to the nominal LRV traverses, a better definition of the station tasks has been developed, and contingency guidelines for the traverses have been firmed up. Although much of the material from the 2nd edition is unchanged, it is reprinted here so that this document replaces the 2nd edition in its entirety. This new material will also be reflected in the final edition of the Lunar Surface Procedures Document.

The changes to the lunar surface activity which affect the traverses are summarized below:

a. Landing Point: Deployment of the heat flow experiment closer than about 300 m (one crater radius) from the rim of Camelot crater (station 5) would likely result in locally anomalous heat flow readings due to the presence of the crater. Estimates can be made for correction factors to the heat flow data, however, the validity of the corrections depends upon the accuracy of ones assumptions and models, so that overall an additional uncertainty is introduced in the final heat flow result due to the presence of the large crater.

Although the nominal target point just meets the criterion for heat flow deployment one crater radius from the Camelot rim, the absence of any identifiable crater patterns in the vicinity of the target point will make it difficult for the crew to confirm that they have indeed landed at the desired point. However, slightly east of the target point (about 200 m) such crater patterns do exist. Therefore, it is planned to manually redesignate uprange to this area provided the automatic guidance is indeed on the pre-mission target point. The final touchdown point will, of course, be subject to continuing assessment by the crew for landability. Dispersions could still result in landing elsewhere in the 1.5 km radius circle (Figure 7) and the mission support elements must be prepared to replan the traverses from any landing point. For pre-mission planning, however, the traverses will originate from this new landing point 200 m east of the target point. This is reflected in the calculated traverse parameters in this document and results in only minor changes. It will also be reflected in the on-board traverse maps.

b. New equipment: The 500 mm camera system has recently been approved for Apollo 17 and will be used on the traverses to photograph targets of opportunity selected by the crew. No specific timeline allocation is made for 500 mm photography since it is understood that this activity will be accomplished within the framework of existing photographic tasks and "observation" time.

c. EVA 1: The surface electrical properties transmitter deployment has been moved to the end of EVA 1 after the return from station 1. Thus, the EVA 1 traverse begins a few minutes earlier and ends earlier; the time at station 1 remains the same. The bar-chart timeline for EVA 1 is shown on page 43.

d. EVA 2: No changes have been made to the EVA 2 traverses with the exception of the relocation of one of the LRV samples stops and minor changes to the traverse parameters resulting from the new landing point origin.

e. EVA 3: Station 10 has been eliminated in favor of station 10b (Figure 17b). This possibility was discussed in the previous edition as a real time alternate, but subsequent discussions have led to select 10b as the prime station.

INTRODUCTION

The purpose of this document is to provide a consolidated source of information on the various aspects of Apollo 17 lunar surface activities to the many program elements involved in planning the Apollo 17 EVA's. It is recognized that the material contained herein will change as the Apollo 17 planning evolves; further, additional material will be added as it is developed. Revisions will be issued to recipients of the document periodically until such time as the official Lunar Surface Procedures document is published. Thereafter, this information will appear in the Lunar Surface Procedures document and its revisions.

The present material has been developed by a number of sources: notably, the Field Geology Experiment Team, various individuals in the Science and Applications Directorate, the EVA Planning Branch of the Crew Procedures Division, the Operations Analysis Branch of ASPO, and the Experiments Branch of Flight Control Division. Special acknowledgement is made to Drs. V. L. Freeman, J. W. Head, W. R. Muehlberger, and E. W. Wolfe who prepared the material on the geologic objectives of the mission, and the discussion of the Taurus-Littrow geologic setting, the Presentation and Data Management Group from the Apollo Spacecraft Program Office who prepared the figures and handled the publication, to Mr. Stanley M. Blackmer, the Apollo 17 Mission Staff Engineer, who provided many of the photographs as well as valuable criticism, and to Mrs. Carol Goree whose cooperation in assemblying and typing the report and whose patience and understanding in making the many revisions are greatly appreciated by the author.

LANDING SITE

Geographic setting - The Taurus-Littrow region is located in the northeast quadrant of the moon (Figure 1), in the mountainous region of the southeastern rim of the Serenitatis basin, approximately 750 km east of the Apollo 15 site (Figure 2). The site name is derived from the Taurus Mountains, which lie to the north and northeast of the site forming a mountainous plateau at the eastern edge of Serenitatis between Posidonius and Macrobius, and from Littrow, an old 30 km highland crater which lies approximately 35 km north of the landing site. This area is well illustrated in Figure 3, an Apollo 15 metric camera oblique, a view of the Taurus-Littrow area from south of the landing site. Posidonius is the large crater in the upper left near the horizon, Mare Serenitatis is the dark region along the left margin, and the crater Littrow lies in the left-center, just north of the landing site. Macrobius is off the picture to the west and the relatively fresh large crater in the upper right is Romer. Figure 4 shows the map location of this region.

Approach and Landing - The approach to the landing point is from due east over a set of the sculptured hills which rise about 1 1/2 km above the plains. At the point where the descent trajectory passes over the hills, the terrain is about 750 meters above the landing site, and the spacecraft clears the local terrain by about 3000 meters.

Figures 5 and 6 show two oblique views of the landing area and approach path. In Figure 6, South Massif is just out of view on the left margin but the light mantle material of the debris slide can be seen just downrange from the landing point.

Figure 7 shows a closer view of the landing area with the landing dispersion ellipse superimposed. Coordinates of the target point are as follows: longitude 30° 44' 58.3" E, latitude 20° 09' 50.5" N, radius 1,734,484 meters based on analytical triangulation of Apollo 15 photography. Figure 7A shows the detailed view of the landing area.

Sun elevation at landing is 13.3° and sun azimuth is 95.5°. Figure 7B shows the variation of these parameters during the lunar stay period and extends through the post-ascent period.

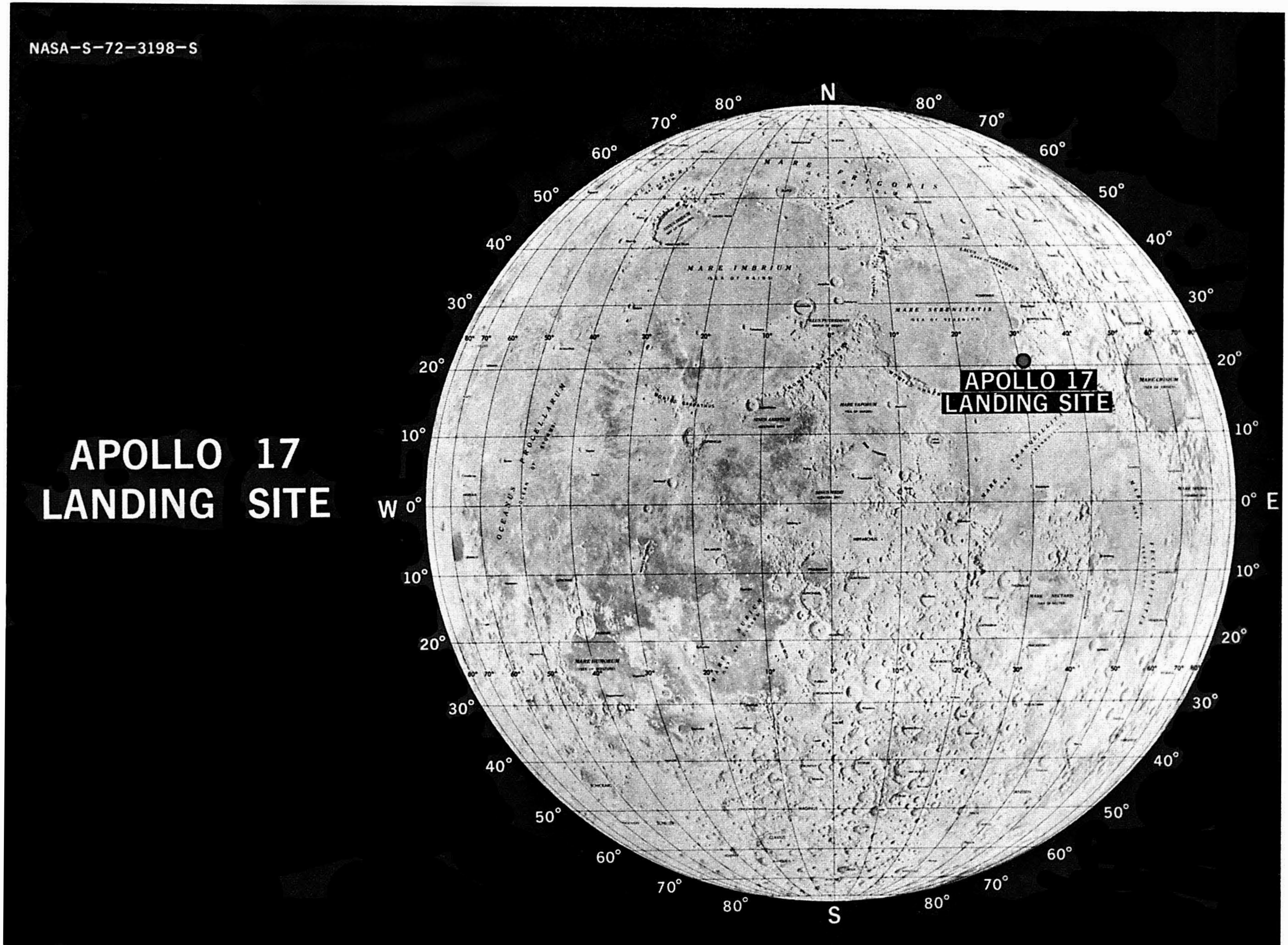


Fig. 1 - Whole moon view showing Apollo 17 landing site: 20 09'50"N, 30 44'58"E.

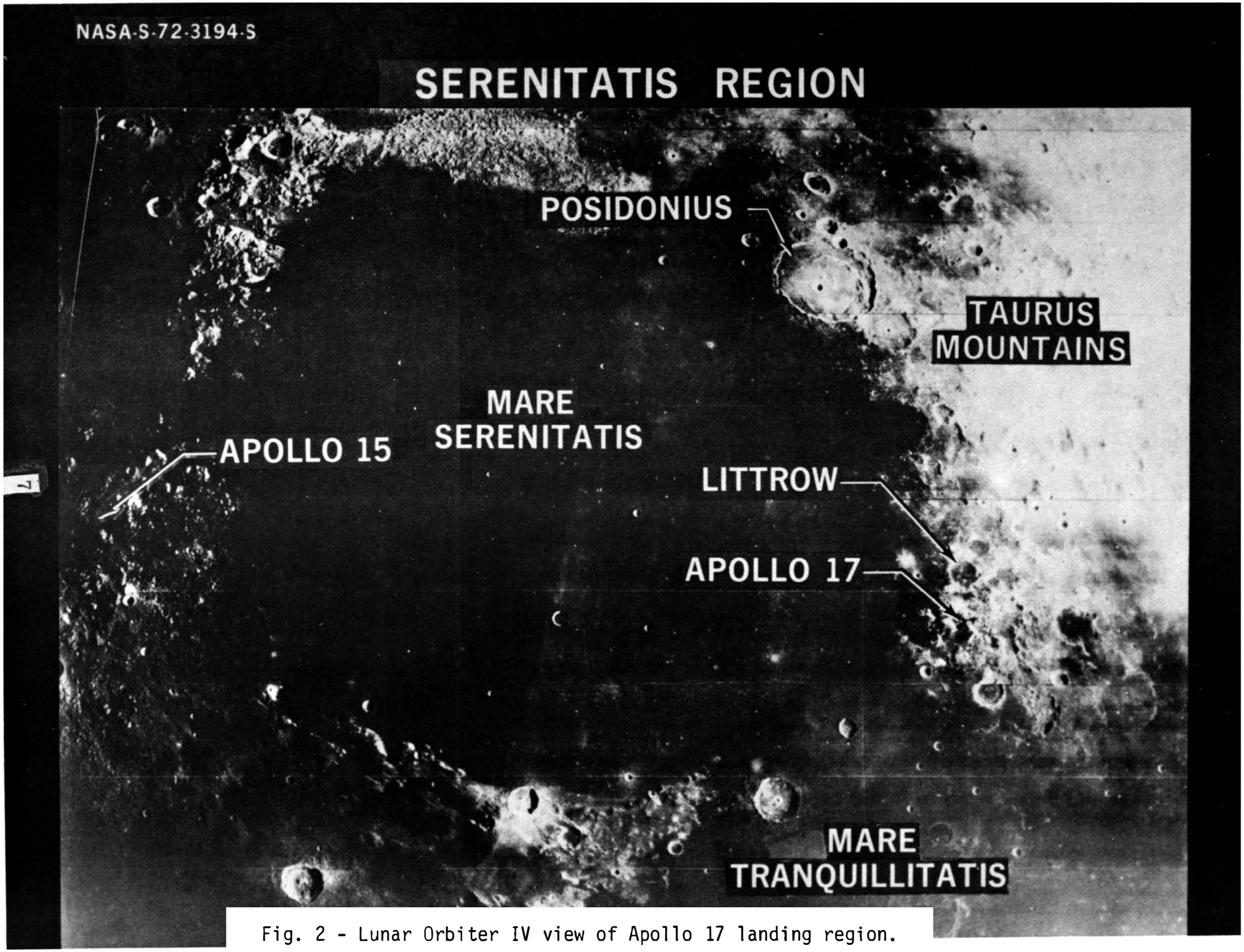


Fig. 2 - Lunar Orbiter IV view of Apollo 17 landing region.

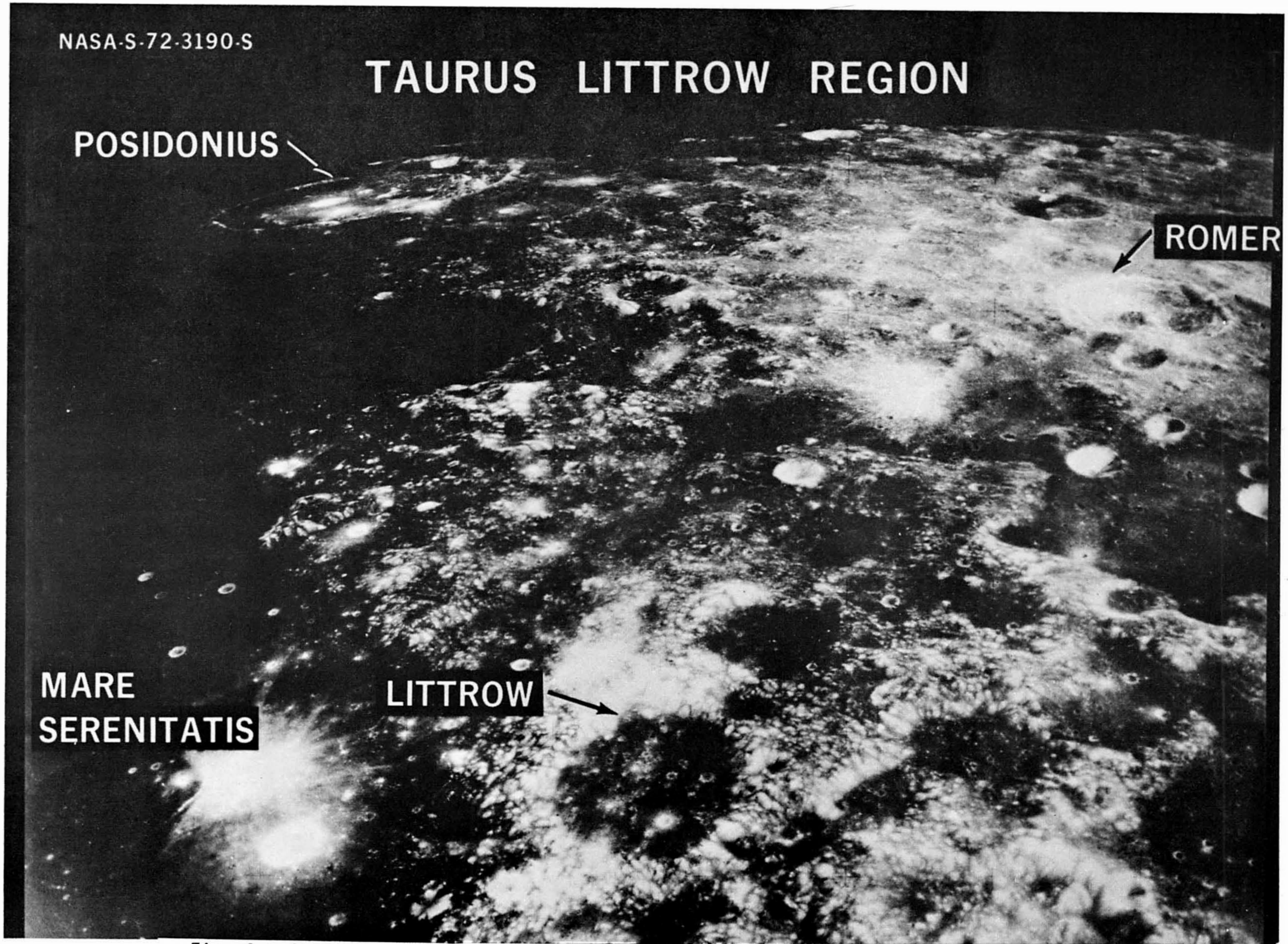


Fig. 3 - Oblique view of Apollo 17 landing region as seen by Apollo 15 mapping camera. The landing site itself is off the picture just below the center margin.

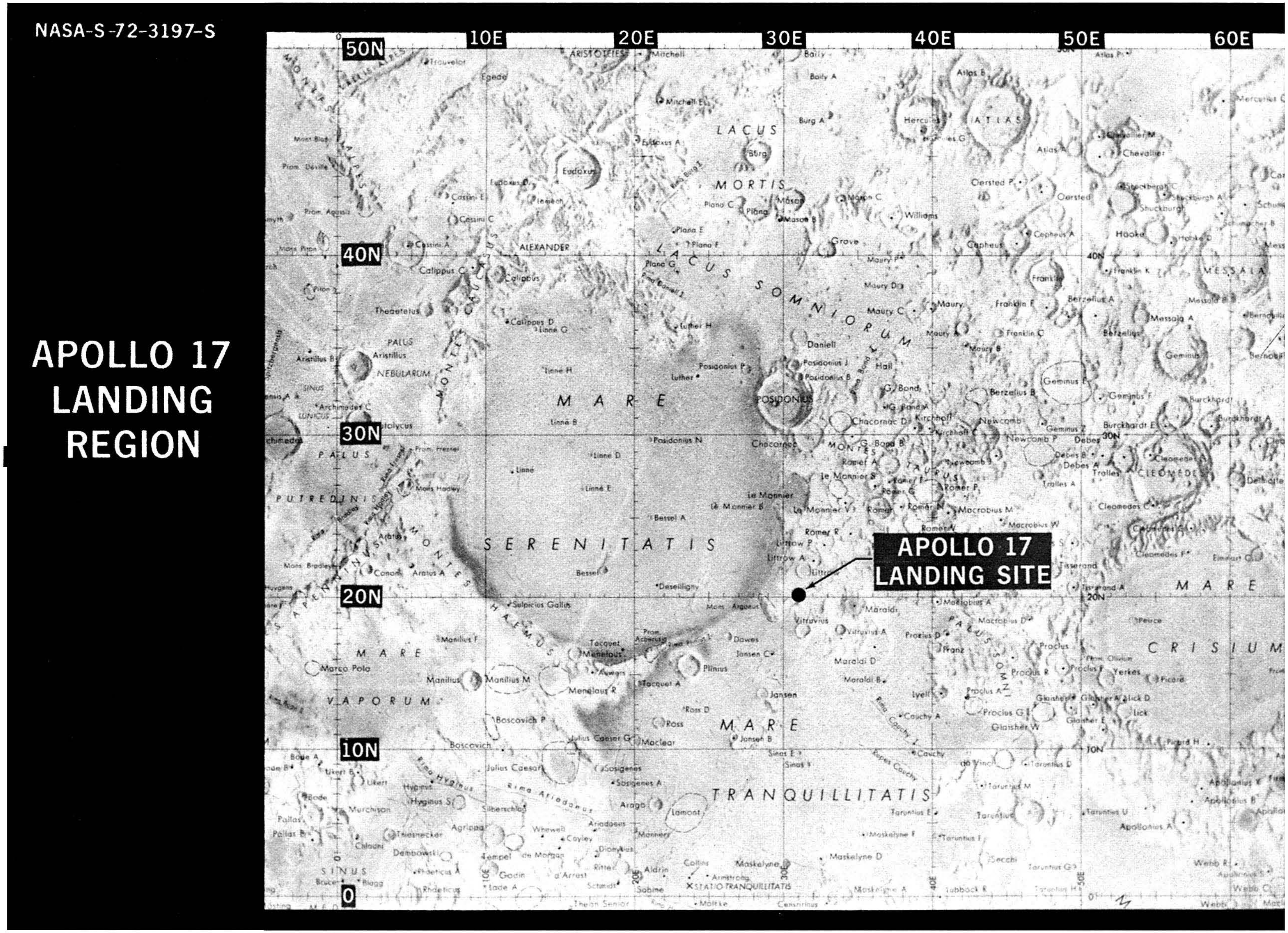


Fig. 4 - Map view of Apollo 17 landing region.

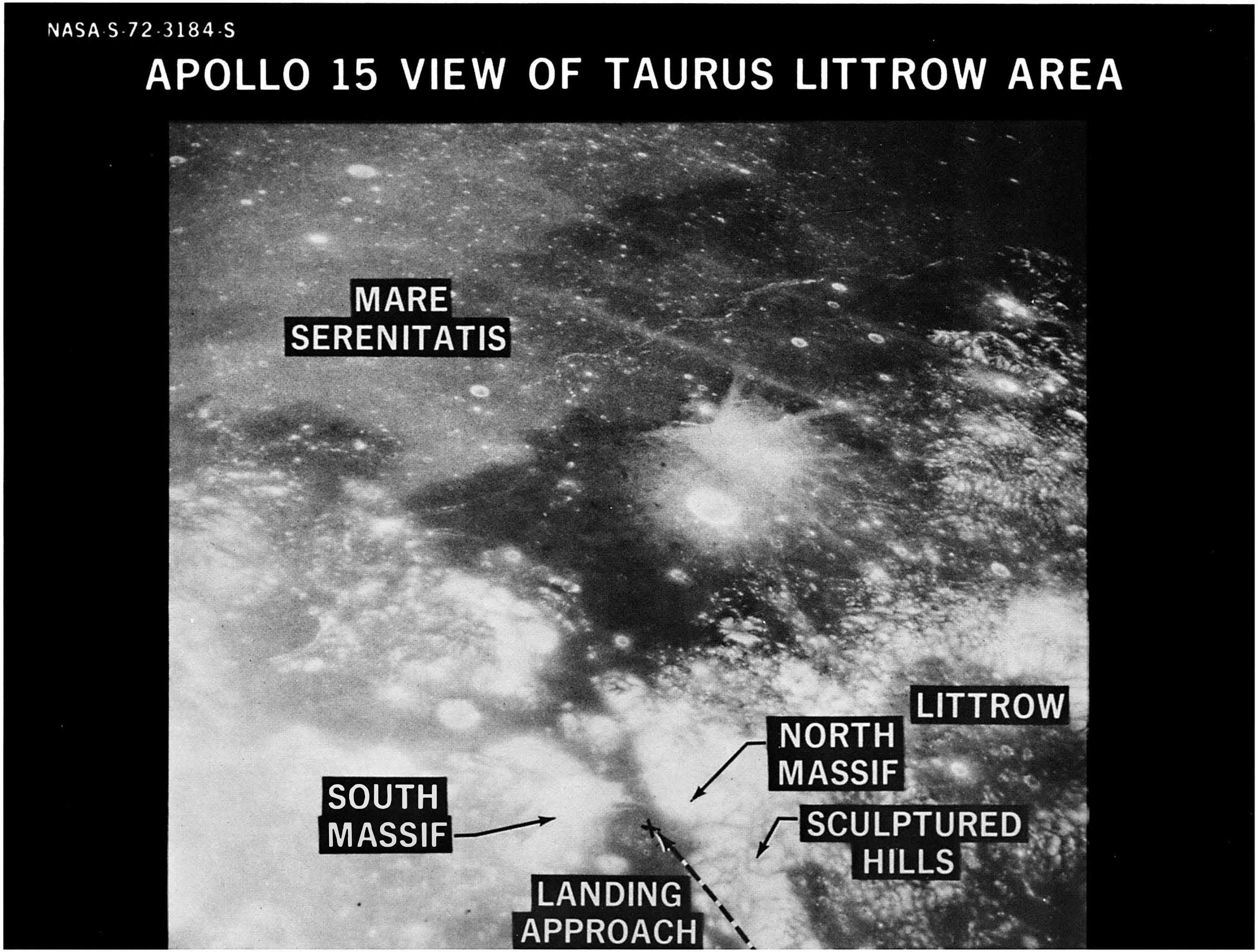


Fig. 5 - Apollo 15 oblique view of Taurus-Littrow area.

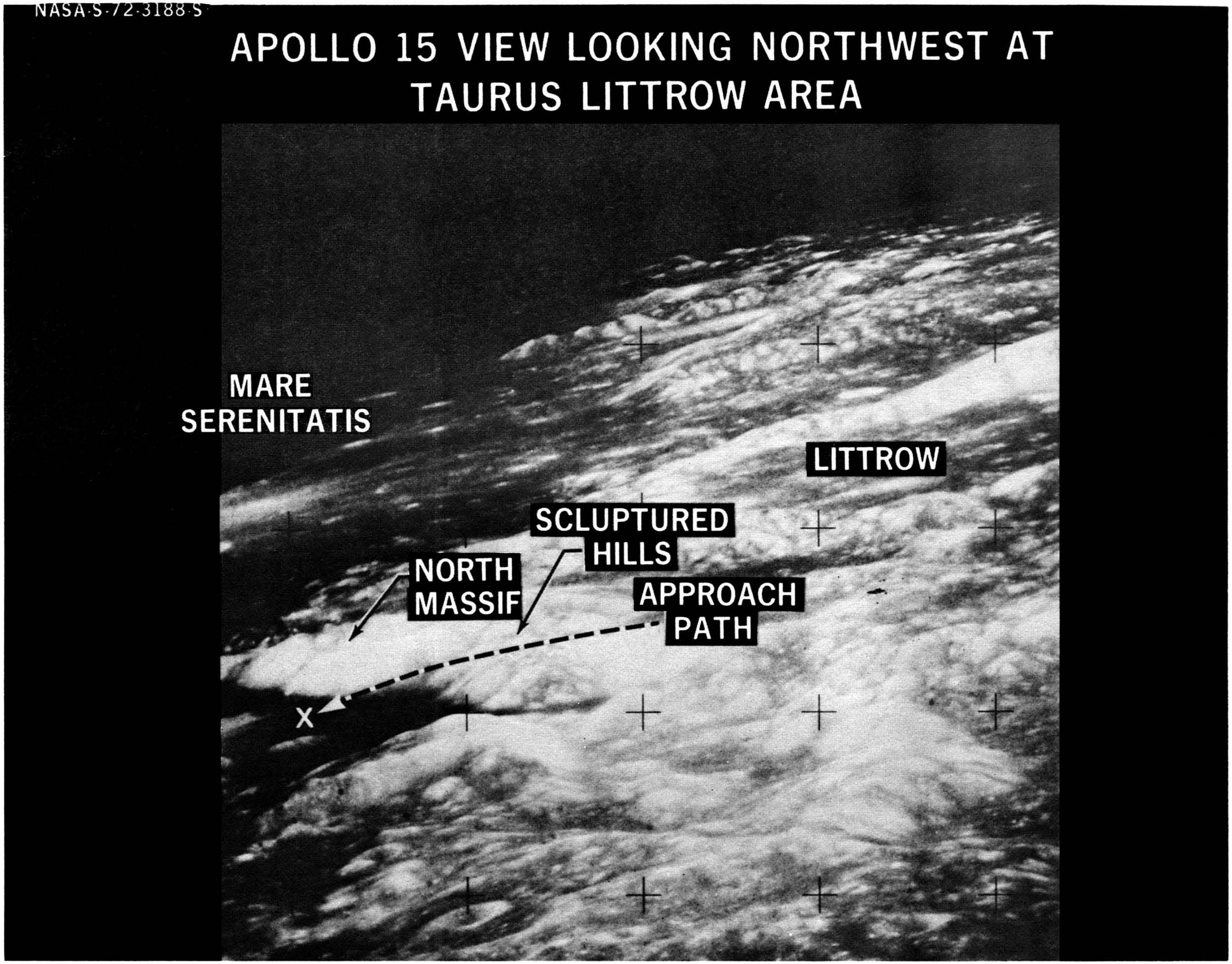


Fig. 6 - Apollo 15 oblique view looking northwest at the Taurus-Littrow area.

Fig. 7 - Landing approach and landing dispersion ellipse.

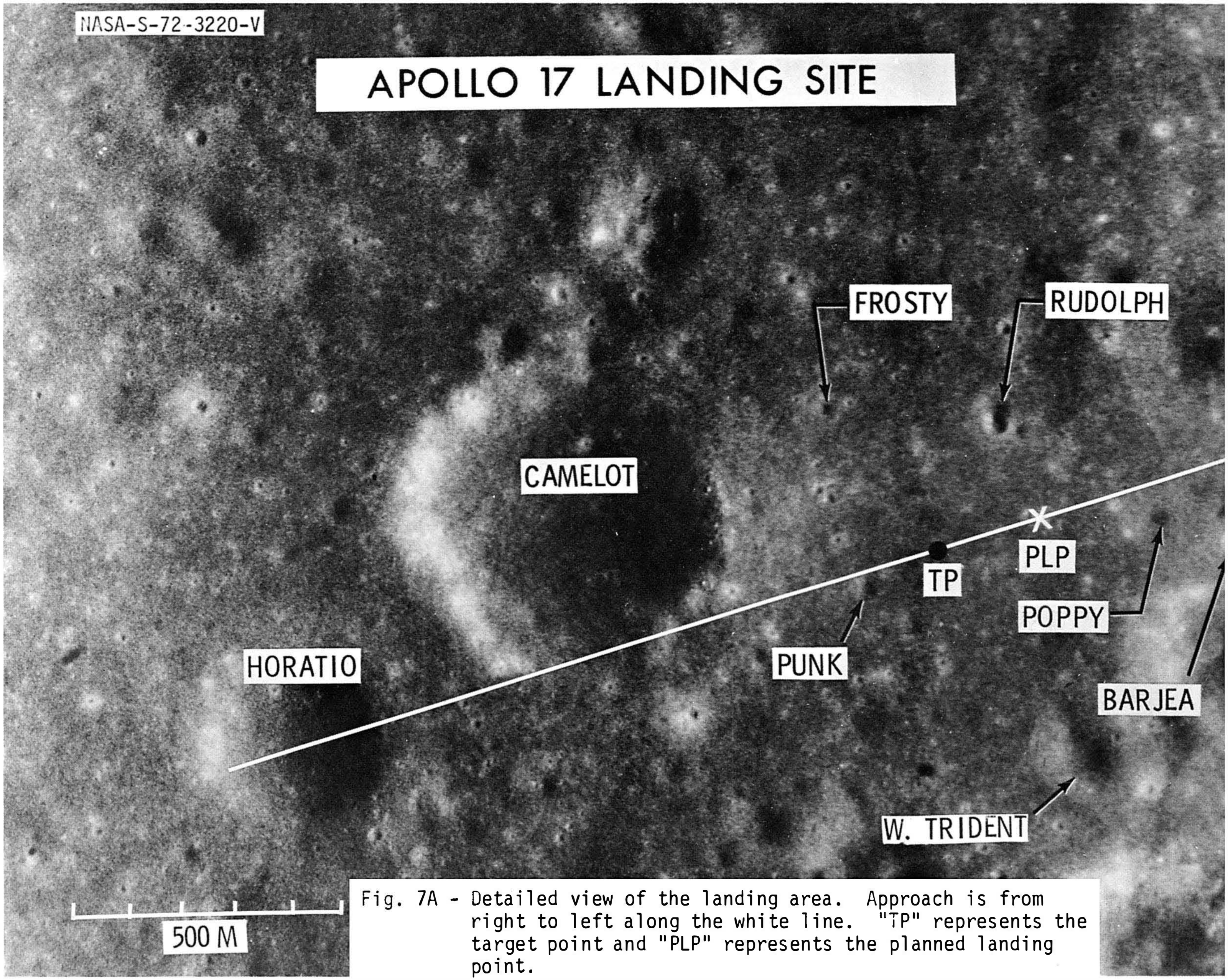


Fig. 7A - Detailed view of the landing area. Approach is from right to left along the white line. "TP" represents the target point and "PLP" represents the planned landing point.

20 July 1972

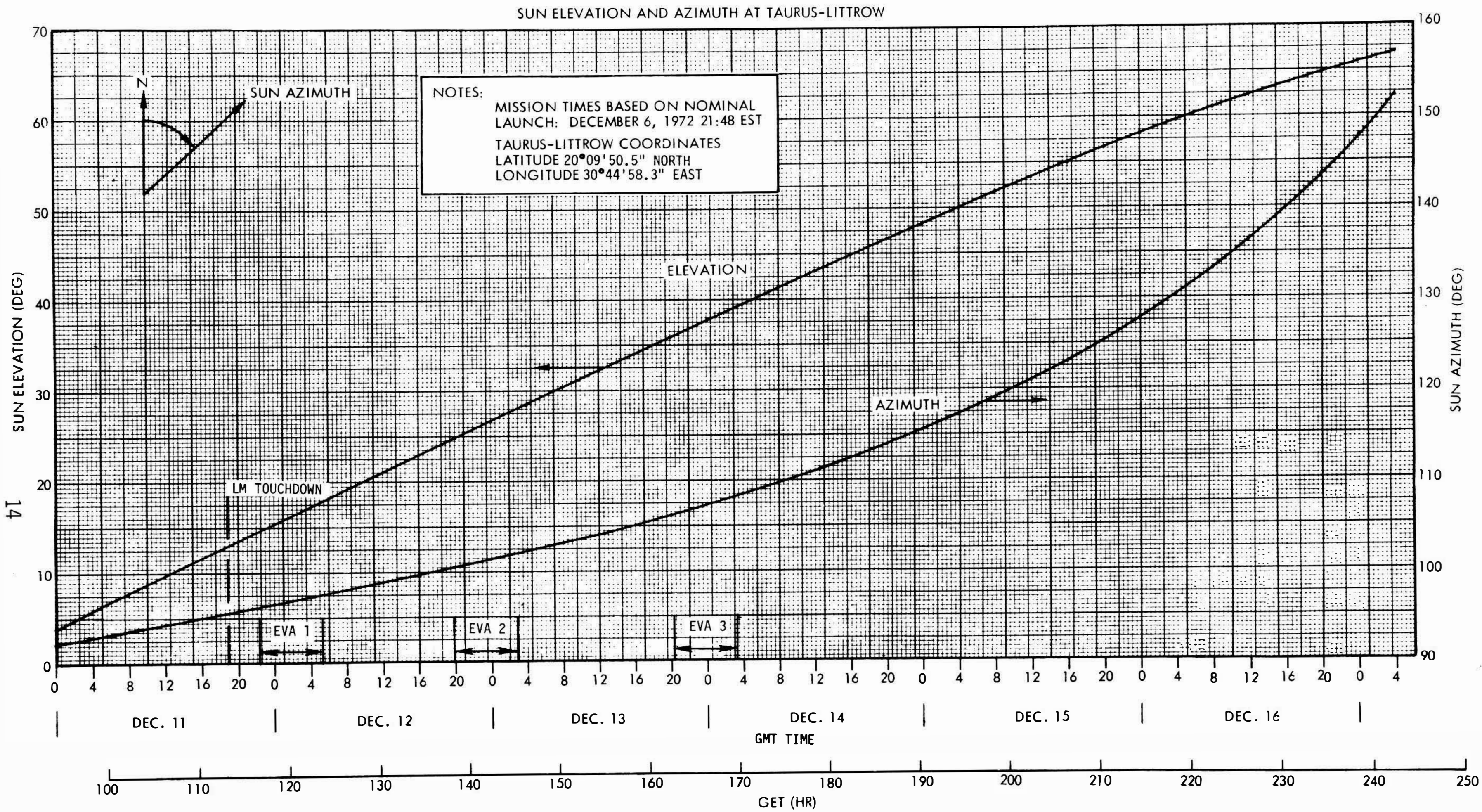


Fig. 7B - Variation of sun azimuth and elevation with time for the period December 11-16.

GEOLOGIC SETTING

General - The Taurus Mountains and associated highlands form the eastern mountainous edge of the Serenitatis basin, one of the moon's large multi-ringed basins. The bulk of this region probably consists of lunar crustal material uplifted to its present position at the time of formation of the Serenitatis basin. The landing point itself is on the floor of a flat-floored valley (Figure 8) whose subsurface is thought to consist of highlands material down-dropped by graben formation and partially buried by younger basin-filling plains materials. The valley floor, as well as portions of the upland area, is covered by a fine dark mantle that may be composed of volcanic fragments. The regional distribution of the dark mantle material, roughly circumferential to Serenitatis, is illustrated in Figures 9A and 9B, earth-based telescopic views of the Serenitatis and Taurus-Littrow region.

Figure 10 is an Apollo 15 photograph looking south toward the Apollo 17 landing site at the edge of Mare Serenitatis (on the right). Several of the linear graben-like rilles so characteristic of the margins of large basins are seen in the center of the figure. The large crater in the center is Littrow B. The South Massif appears just at the upper tip of the engine nozzle, and the top of the North Massif is just below that. The dark mantle is visible south of Littrow and around the massifs. Plains units and low highlands are seen in the foreground.

Geology of the landing area - The local setting of the landing site is shown in Figures 11 and 12, and the distribution of major geologic units is shown on Figure 13, a geologic map which covers approximately the same area as Figure 12.

Massif Material - Massif material forms the high, steep, relatively blocky mountain face immediately north and southwest of the landing point. The distinctive nature of the massifs is illustrated in Figure 14, which shows them grouped on the horizon in a view looking south. South Massif is indicated by the arrow. The materials of the massifs probably consist of breccia (broken rock) and recrystallized breccia formed during impacts that created some of the large basins. Significant contributions of ejected breccia may have come from Serenitatis, Nectaris, Crisium, and Imbrium (listed in order of decreasing age of basin formation). These ejecta deposits probably overlie still older ejecta from earlier less well defined impact basins such as Tranquillitatis. Accordingly, the age of the massif material is regarded as Imbrian and pre-Imbrian (3.9 billion years and older).

Faults bounding the massifs may have been caused by the Serenitatis event. However, the sharp definition of the massif boundaries suggests that more recent structural adjustments have occurred. Otherwise, erosion would have smoothed and obscured these boundaries.

A possible alternative interpretation is that the North and South Massifs are volcanic in origin. Their very steep faces and arcuate convex-outward shapes (Figure 12) are similar to shapes common in terrestrial volcanic domes rich in silica and thus they could be extrusive volcanic materials.

Sculptured Hills Material - The sculptured hills unit, characterized by the occurrence of closely spaced domical hills (Figure 11) is widespread in the highlands between Serenitatis and Crisium. It is within traverse range northeast of the landing point (Figure 12, 13). Because of its occurrence in the walls and rims of old craters (e.g., Littrow),

(Figure 11) the sculpturing may be interpreted as an erosional degradation of highlands material controlled by pre-existing sets of fractures. Accordingly, the sculptured hills unit may be similar in composition and different in structural history from the massifs or it may differ in composition so as to have responded differently to deformational stresses. The lack of resolvable blocks at the bases of slopes in the sculptured hills compared with their relative abundance at the bases of massif slopes supports the hypothesis of compositional difference. The sculptured hills probably consist of ejecta of Imbrian and pre-Imbrian ages, but, again, they have some characteristics suggestive of volcanic origin.

Low Hills Material - Low hills material occurs in discontinuous patches adjacent to massif and sculptured hills materials where they border the plains (Figure 11). The low hills are most likely the tops of downfaulted blocks of massif or sculptured hills materials that protrude slightly above the general plains surface (Figures 8, 12). In addition, they may include materials derived from the adjacent uplands by mass wasting.

Sub-Floor Material*- The relative evenness of the valley floor at the landing site suggests that a basin-filling unit (sub-floor material) was emplaced after formation of the trough (Figure 8). This material apparently submerged all but the highest projections of hill-forming material. Such fill might consist of volcanic flows, colluvium derived from the adjacent uplands, or sheets of breccia. Similar materials may fill nearby upland basins (e.g., Littrow) or may underlie the topographic bench around the east edge of the Serenitatis basin.

* In previous discussions, the term "plains material" was used. The nomenclature has been changed to "sub-floor material" to avoid confusion with the more familiar usage of "plains" meaning the valley floor independent of any stratigraphic connotation.

Sub-floor material is presumably exposed in the bright walls of the craters on the plains. The abundance of blocks in the walls of these craters and on their rims indicates that the sub-floor material is either indurated or contains large indurated blocks. The large craters may penetrate through the sub-floor material into the underlying massif or hills units, which may be represented in their ejecta. Sub-floor material appears to be younger than the bulk of the massif and hill materials and is probably older than youngest mare fill of the Serenitatis basin. Hence an age of Imbrian or pre-Imbrian is inferred for the sub-floor material.

Dark Mantle Material - Dark, presumably unconsolidated material with no resolvable large blocks (i.e., no blocks larger than 2 meters in diameter) occurs as a blanket a few meters to tens of meters thick on the plains surface and on the floors of nearby upland basins (Figure 9). It is discontinuous on sloping upland surfaces and on the steep walls of pre-existing craters (Figure 15). Low reflectivity in 3.8 and 70 cm radar images implies relative scarcity of cobbles and boulders in near-surface materials. The dark mantle is most readily interpreted as a pyroclastic deposit and is probably unconsolidated. A few small dark halo craters that could be vents for volcanic ash can be recognized in areas of massif and hills materials. No undoubted vents have been identified on the plains in the landing area. If vents are present in the landing area, they may be too small to resolve in the orbital photographs, or we may misinterpret them as impact craters.

The dark mantle is interpreted to be younger than all of the large craters on the plains. Its relatively smooth uncratered surface and the sharpness of some of the underlying craters suggest a fairly young, probably Copernican, age.

Light Mantle Material - A bright ray-like feature with linear ridges and finger-like projections onto the dark mantle extends north from the

South Massif (Figures 12, 16). No source crater for such a ray of ejecta can be identified. Hence this light mantle material may have been deposited by an avalanche of unconsolidated debris from the slopes of the South Massif. It seemingly overlies the dark mantle because craters with dark ejecta dot the surface of the deposit. Large craters and a prominent scarp are visible through the mantle and attest to the thinness of the deposit. Resolvable blocks (>2 m) are absent except near the south end of the slide and on the adjacent south massif slope. The light mantle shows greater reflectivity than the dark mantle in 3.8 cm radar imagery, which indicates a greater frequency of cobbles in the near surface materials of the light mantle. The absence of all but small scattered impact craters, apparent position of the light mantle over the dark mantle, and the relative absence of mixing near the thin edges of the light mantle imply a young, probably Copernican, age.

Surface Features - Major surface features of special geologic interest include craters and the prominent east-facing fault scarp.

The larger craters (generally >100 m) on the plains surface (Figure 15) are of three types:

(1) large (.5-1 km) steep-sided craters that occur in a cluster near the landing point,

(2) large subdued craters with barely perceptible rims,

(3) scattered clusters of smaller (<.5 km) craters.

All three types are inferred to be older than the dark mantle although some could be contemporary volcanic sources. Exposures of wall and rim material are light colored and discontinuous. Most such exposures occur on the inner wall below the rim crest. Elsewhere the ejecta are mantled except for scattered blocks large enough to project through the thin dark mantle. Although the larger craters are probably of impact origin, a volcanic origin for some should be considered.

The dark mantle is excavated only by relatively small craters that are generally much less than 100 m in diameter. The most likely vents for dark mantle material in the nearby uplands are small craters with related very dark deposits of local extent. Vents in the plains area may be represented by similar small craters closely enough spaced so that the ejecta blankets overlap.

An apparently young, east-facing scarp, with local height of as much as 80 m, crosses the floor of the trough about 5 km west of the landing point and continues into the North Massif (Figure 16). The scarp, which probably represents the surface trace of a complex fault, consists of alternating north and northwest-striking segments, each on the order of 5 km long. Some segments occur as single, continuous, approximately straight scarps, others as zones of discontinuous en echelon scarps. Between the light mantle unit and the North Massif the scarp may be covered by the dark mantle unit, which it therefore appears to antedate. However, distinctness of some segments of the scarp in the area of the light mantle and absence of dark mantle on some segments of the scarp on the North Massif suggest that younger movement may have occurred.

Regolith - An unusually small thickness of regolith is expected on the surfaces of the dark and light mantle units. In Apollo 15 orbital photographs with resolution of a few meters, these surfaces are not saturated by resolvable craters. An albedo boundary that may represent the edge of a local dark mantle unit crossing a .5 km crater about 2 km south of the landing point (Figure 15) shows no evidence of mixing at the same high resolution. Extrapolation from crater counts in the dark mantle suggests that crater diameters at the upper limit of the steady state distribution are most probably .3 m but may be as large as 3 m.

Hence the mean thickness of completely mixed regolith may lie within the range of 3 to 30 cm.

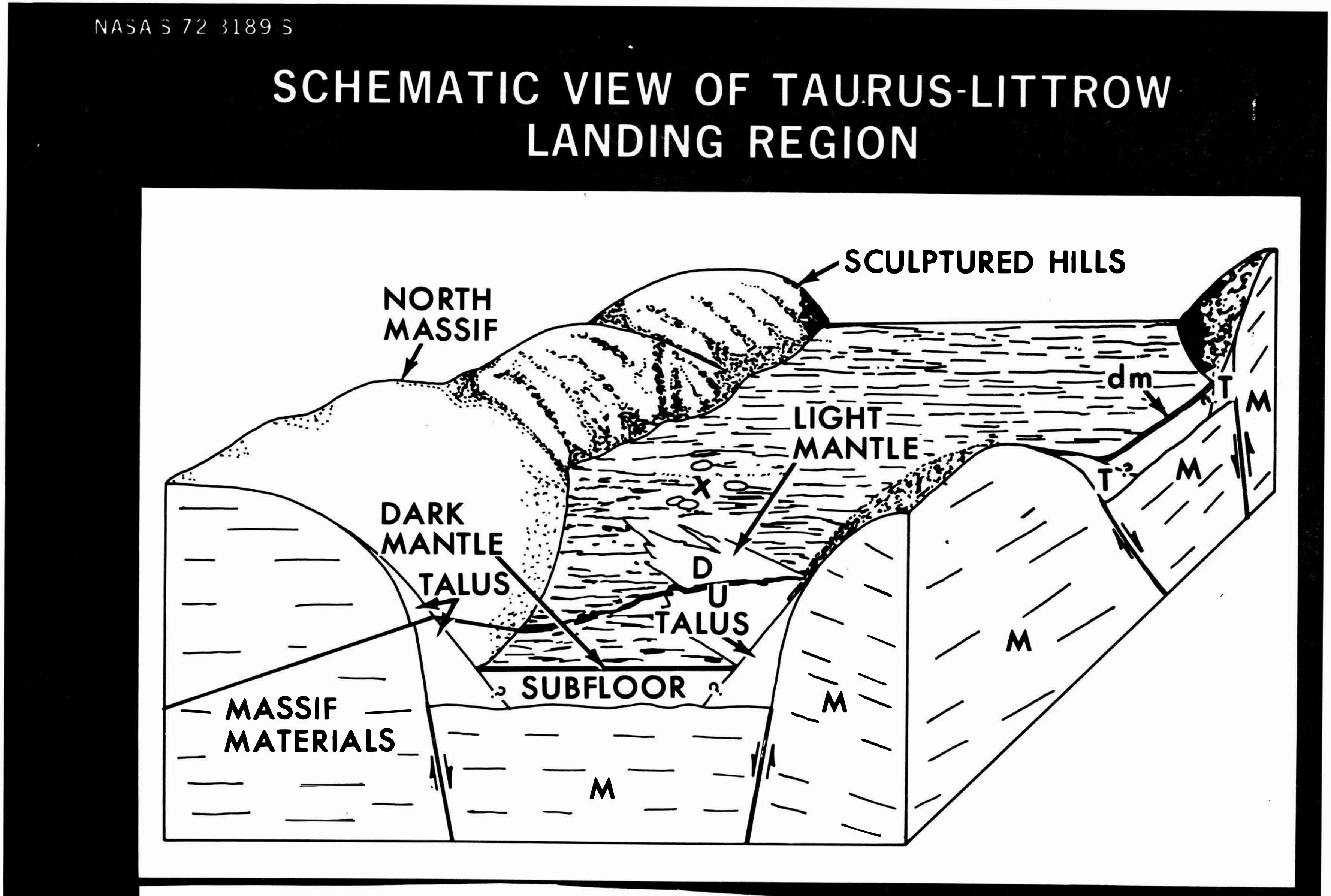


Fig. 8 - Schematic view of Taurus-Littrow landing and traverse region looking east-southeast. X is nominal landing site. Vertical exaggeration about 2.5.

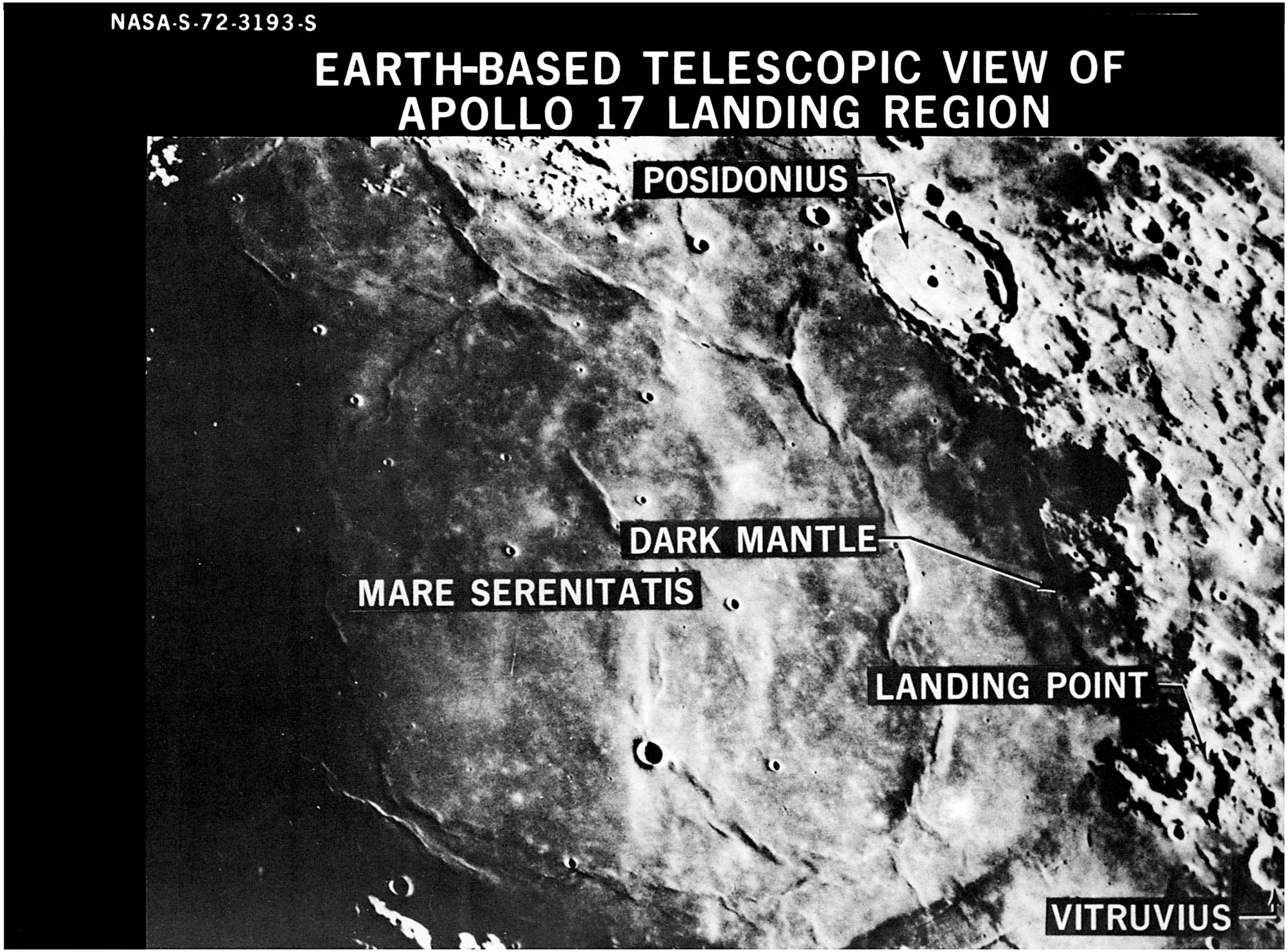


Fig. 9A - Earth-based telescopic view of Apollo 17 landing region.

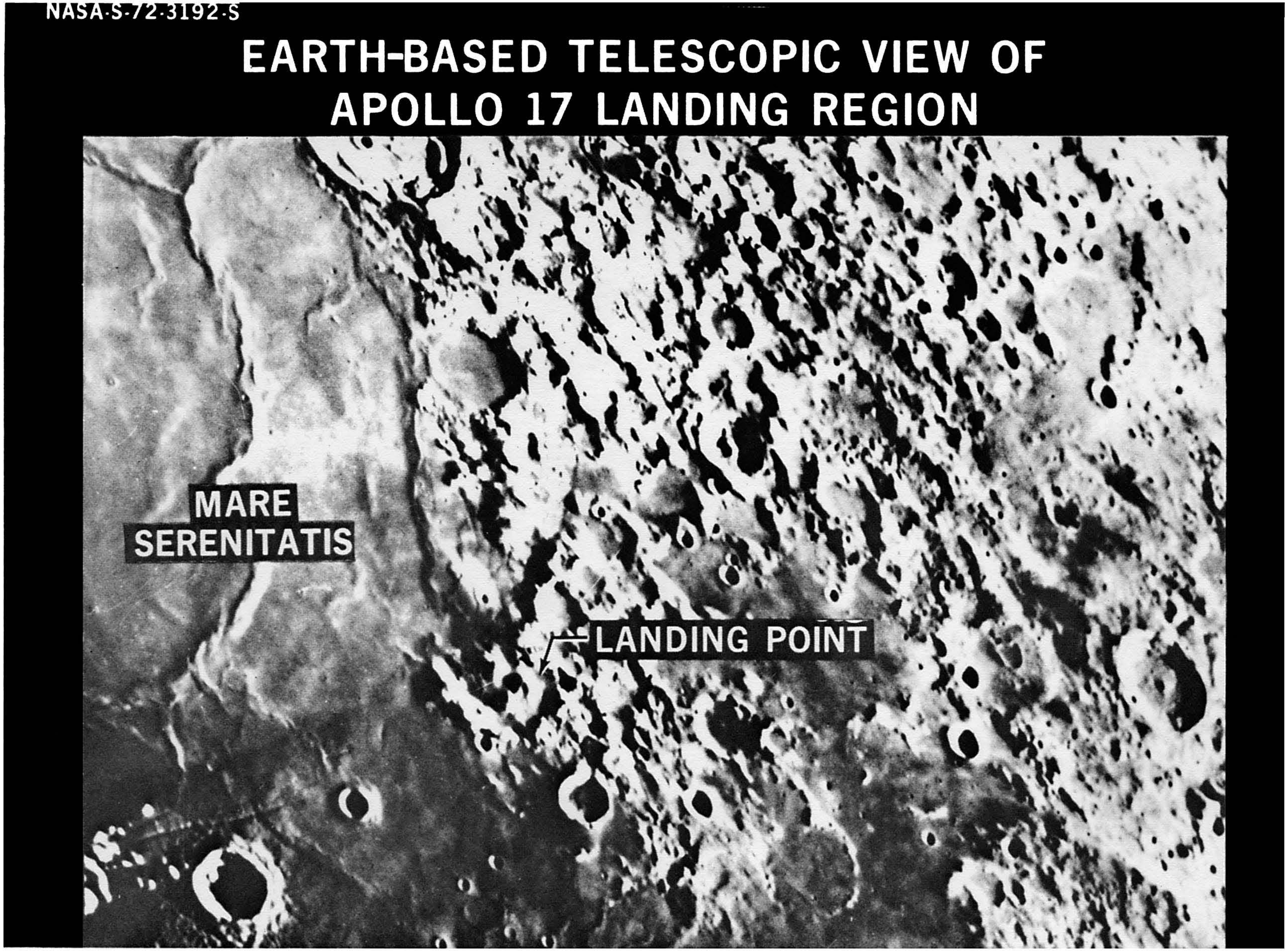


Fig. 9B - Earth-based telescopic view of Apollo 17 landing region.

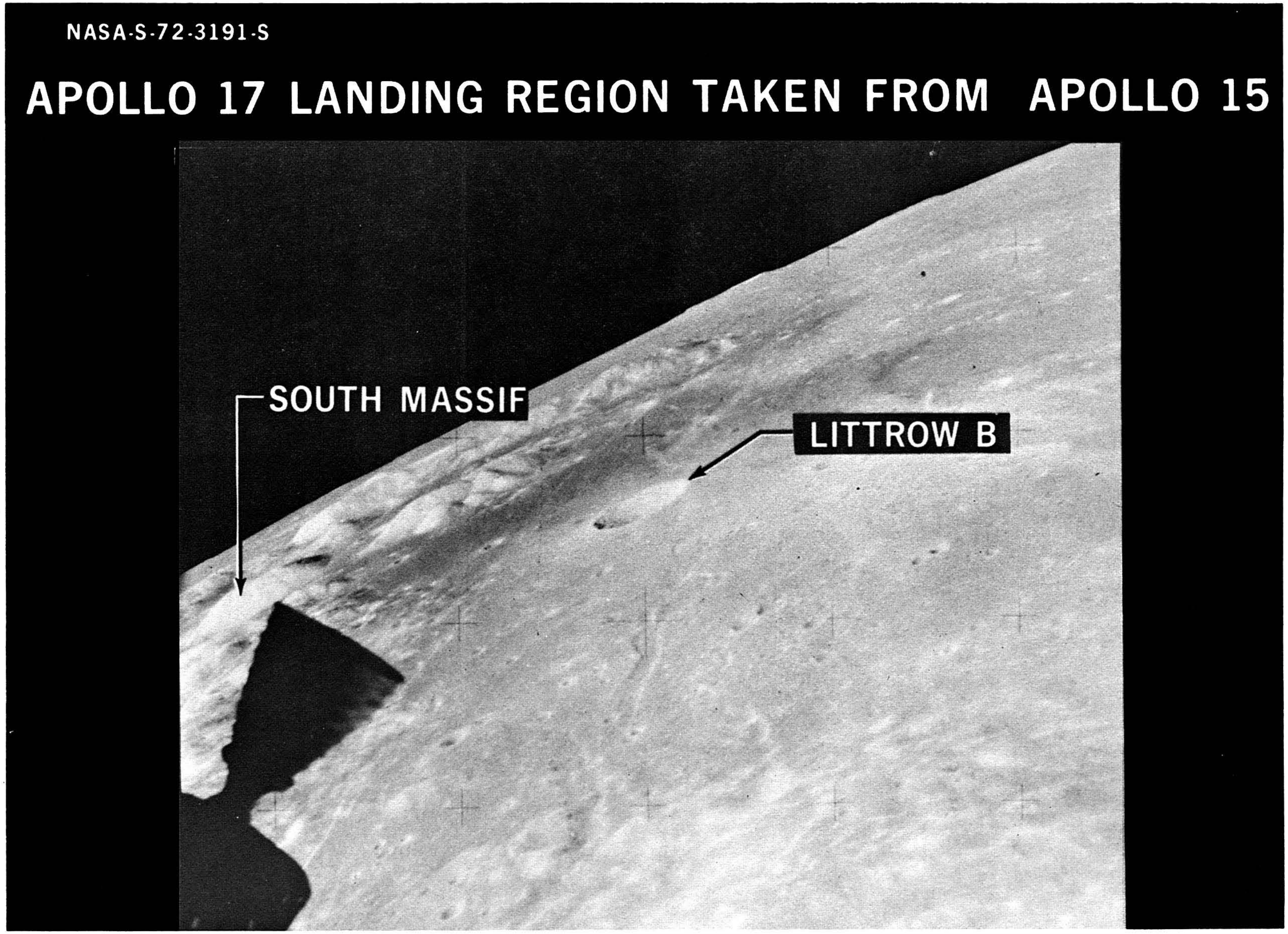


Fig. 10 - Southerly-looking oblique view of of Apollo 17 landing region taken from Apollo 15.

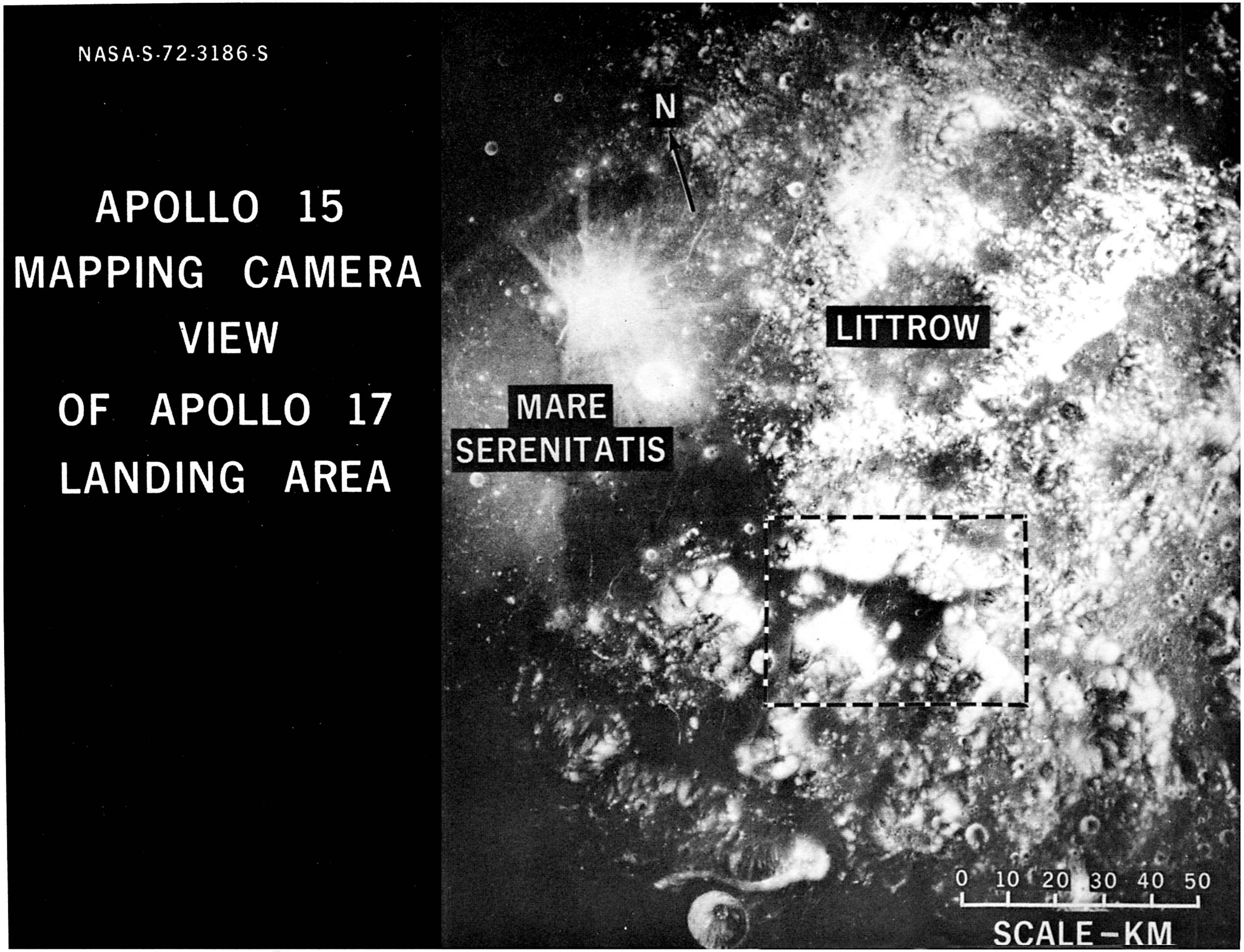


Fig. 11 - Apollo 15 mapping camera view of Apollo 17 landing area.

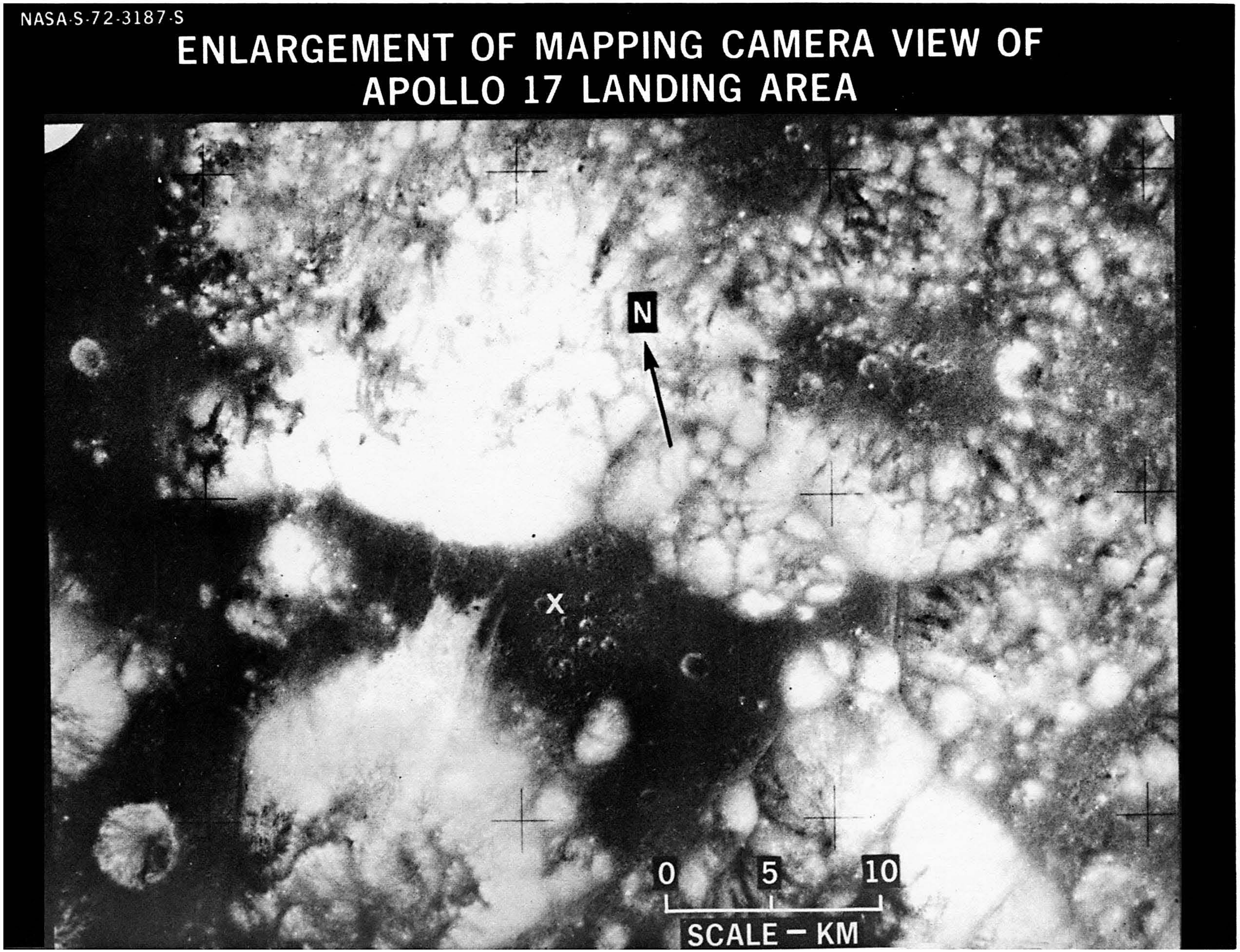


Fig. 12 - Enlargement of mapping camera view of Apollo 17 landing area and traverse area from Figure 11.

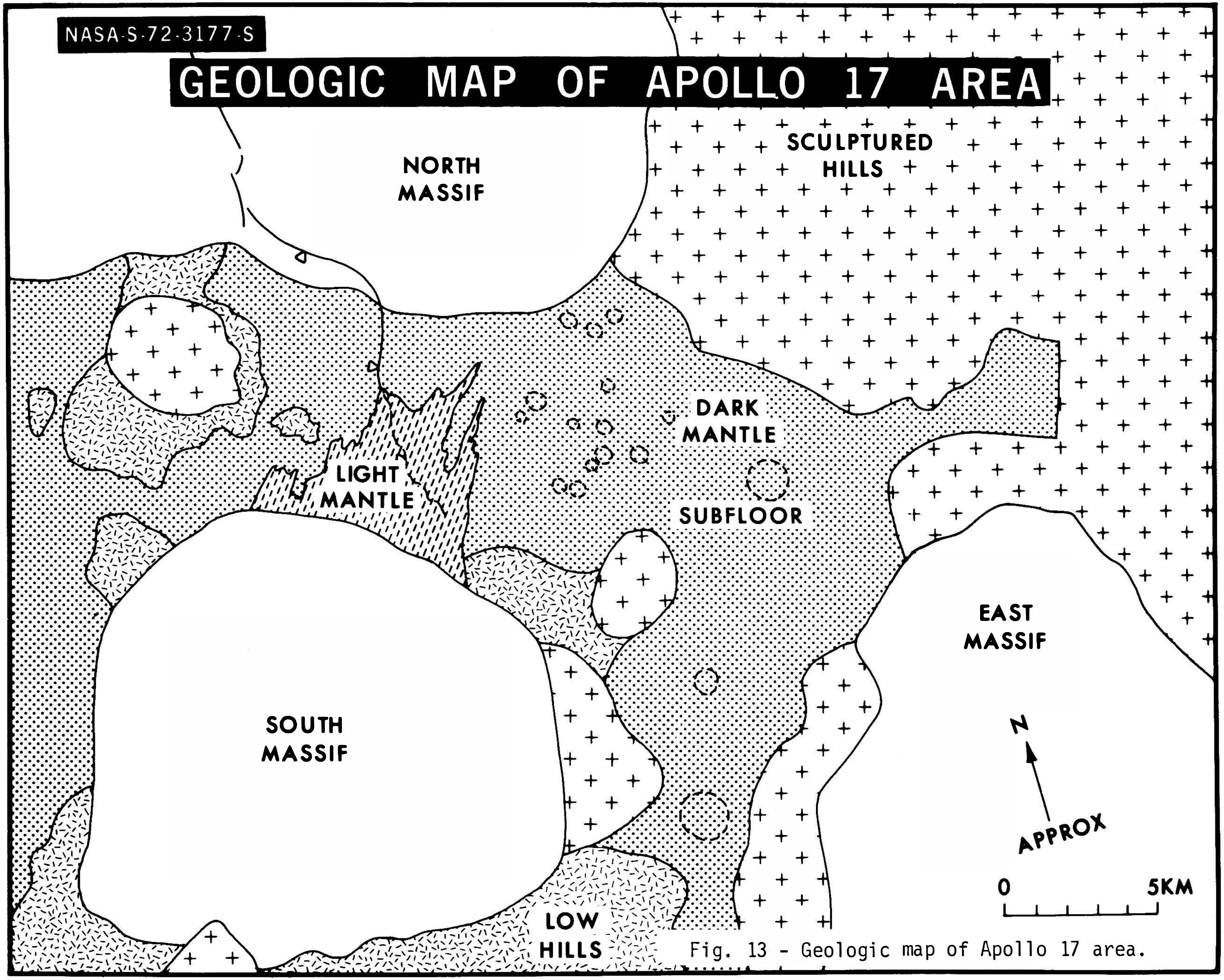


Fig. 13 - Geologic map of Apollo 17 area.

NASA-S-72-1710-V

GENERALIZED GEOLOGIC MAP OF THE TAURUS-LITTROW AREA

E. W. Wolfe, J. W. Head, V. L. Freeman, and H. H. Schmitt

EXPLANATION

COPERNICAN		*Light mantle material*
COPERNICAN AND ERATOSTHENIAN		*Dark mantle material*

IMBRIAN AND PRE-IMBRIAN

(Sub-floor)

Sub-floor *material (mantled except in crater walls)*	*Massif material*	*Sculptured Hills material*	*Low Hills material*

Contact (includes fault contacts)

Rim of larger pre-mantle crater on plains *
(sub-floor material exposed in walls and rims)

Scarp; barbs point downhill

Adapted in part from Lucchitta, B. K., 1972, Preliminary Geologic Map of the Littrow Region of the Moon: U.S. Geological Survey, unpublished map.

Source and explanation of symbols in geologic map.

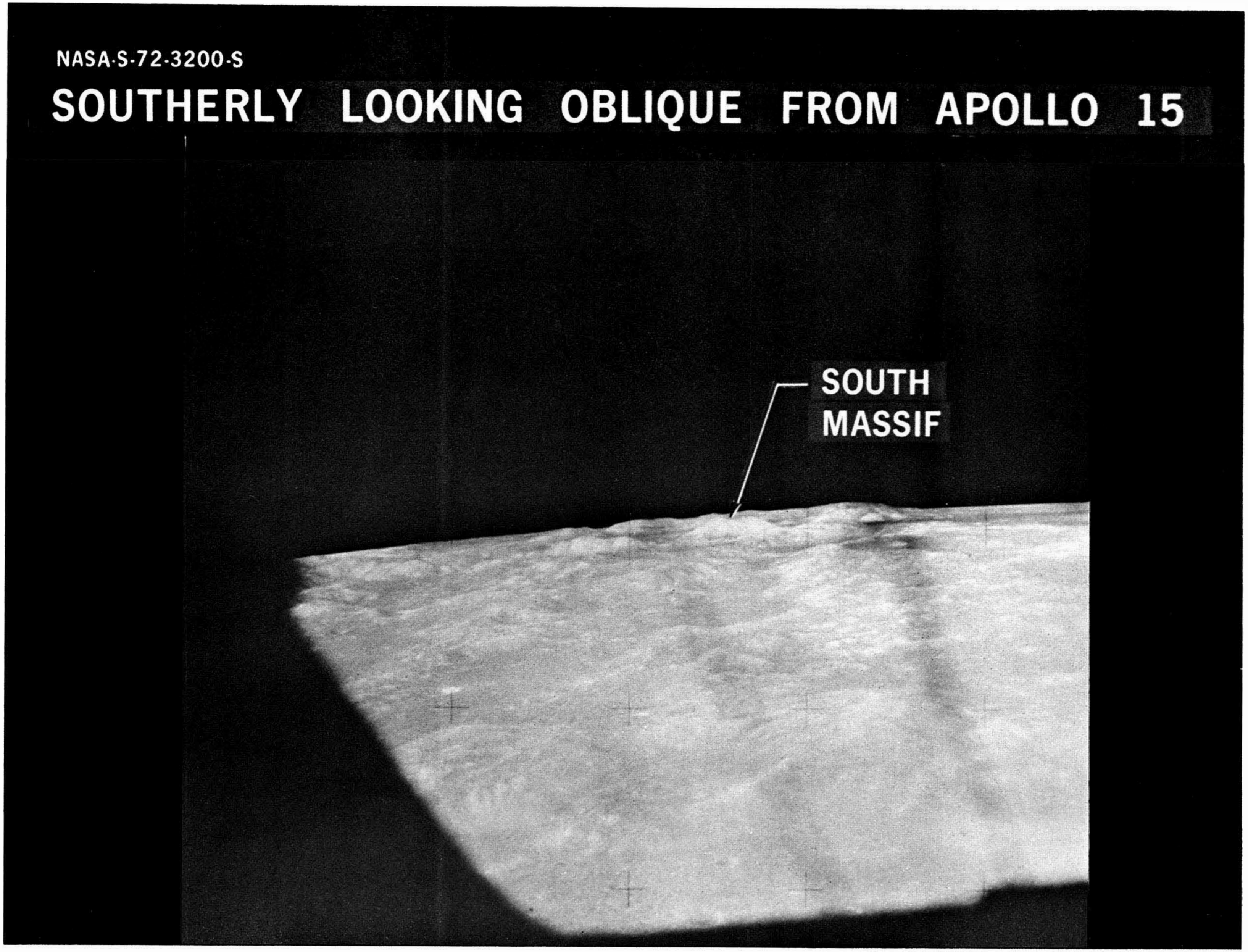


Fig. 14 - Southerly-looking oblique from Apollo 15.

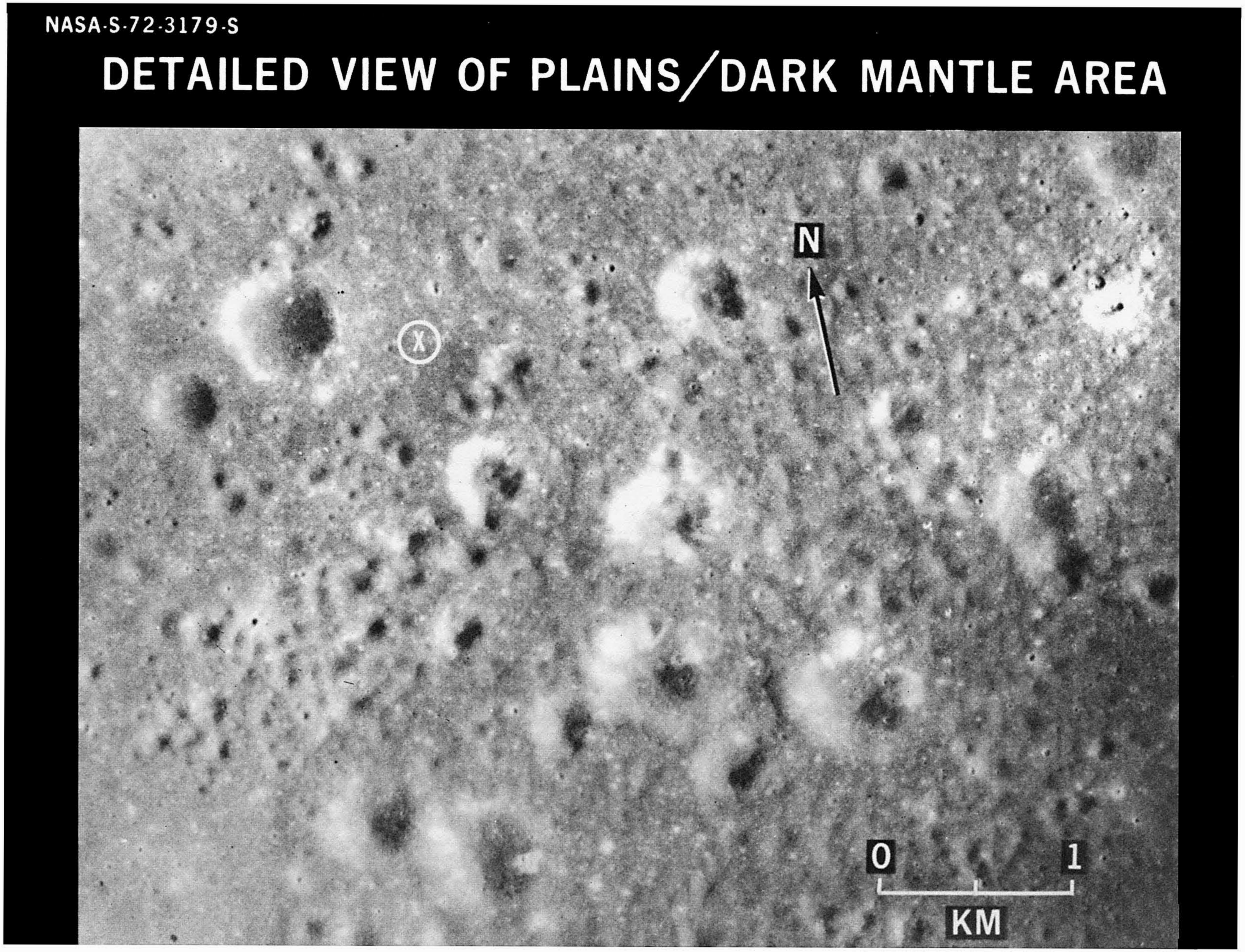


Fig. 15 - Detailed view of plains/dark mantle area.

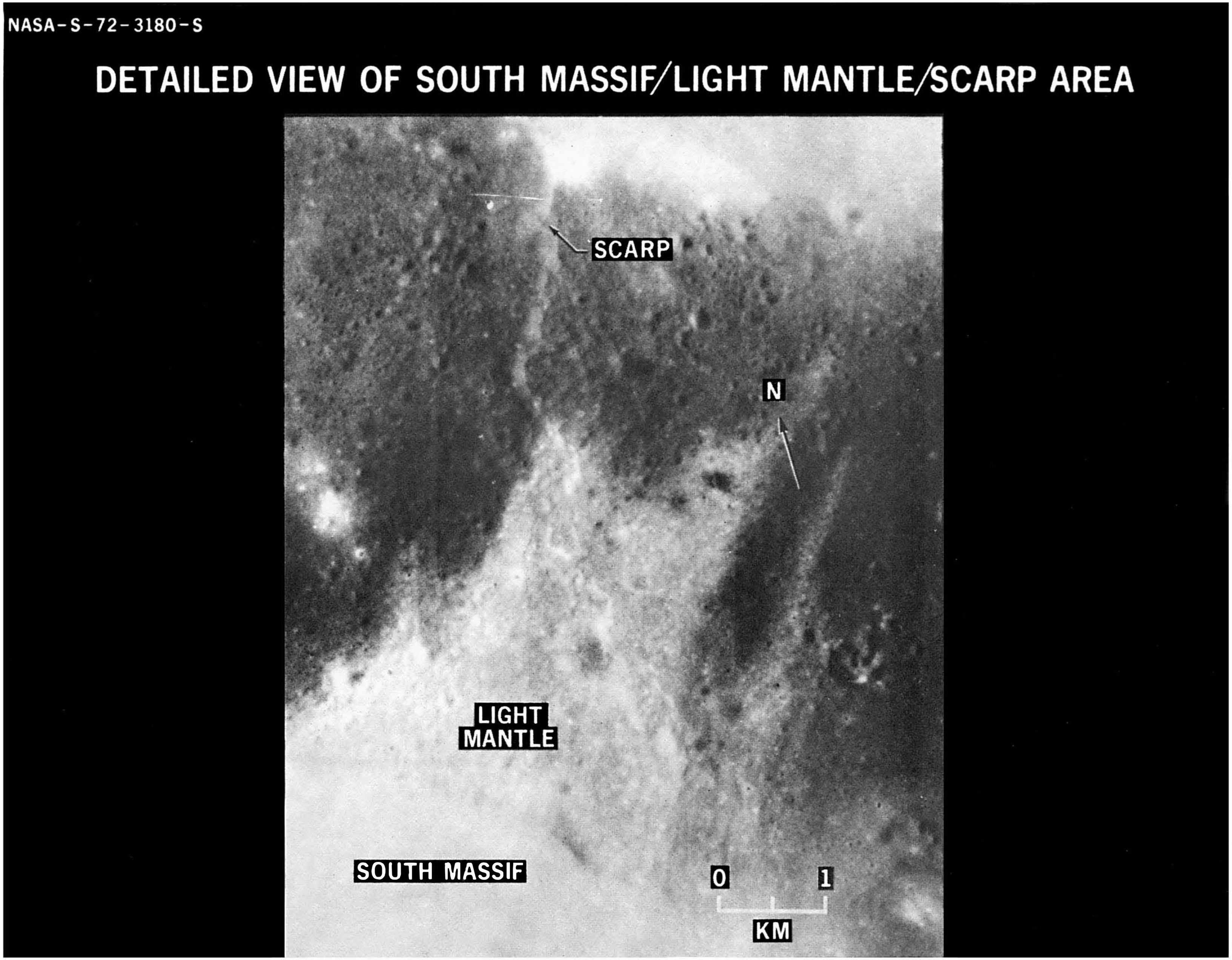


Fig. 16 - Detailed view of South Massif/Light Mantle/Scarp area.

LUNAR SURFACE OBJECTIVES

The lunar surface science objectives are described in the Mission Science Planning Document These objectives are enumerated below:

1. Apollo Lunar Surface Experiments Package
   - a. Heat Flow Experiment
   - b. Seismic Profiling Experiment
   - c. Lunar Ejecta and Meteroid Experiment
   - d. Lunar Atmospheric Composition Experiment
   - e. Lunar Surface Gravimeter
2. Field Geology, includes
   sampling objectives and deep drill core
3. Traverse Gravimeter
4. Surface Electrical Properties
5. Neutron Flux Monitor
6. Cosmic Ray Detector

A detailed discussion of these objectives and their priorities can be found in the aforementioned documents. It is the purpose of the present document to discuss in detail only those which bear on the traverses; principally the field geology observations and sampling, and, to the extent that traverses are affected, the traverse geophysics experiments (Surface Electrical Properties, Traverse Gravimeter, and Seismic Profiling). These discussions follow: The reader is referred to Figures 17 to 20 for identification of the traverse stations and to Appendix 2 for the onboard version of the traverse maps.

Geologic Objectives and Exploration Rationale -

1. Massif and related units - Observations, characterization, and sampling

a. Mode of origin and emplacement - the massif and related units are probably composed of breccia from various ejecta blankets, most likely arranged in subhorizontal layers with the youngest deposits lying at higher elevations. Observational and photographic data bearing on this problem will be gathered.

b. Vertical variation - the light mantle unit appears to be some type of debris flow or avalanche which may contain massif material derived from the South Massif. Sampling stations (2, 3, and 4) are scheduled in the light mantle in a direction normal to the mountain front in the hope that a maximum variety of South Massif rock types will be collected. Sampling at the base of the massifs is also designed to collect the widest possible variety of samples of massif material through sampling of boulders derived from the mountain slopes and collection of rake, soil, and other documented samples (stations 2, 6, and 7). Investigation of boulders should provide the opportunity to examine and document internal structures indicative of the mode of origin of the massif materials.

c. Areal variation - sampling at and within the North and South Massifs and comparison with the sculptured hills is designed to provide data on areal variation of highlands material. The distinct morphology of the sculptured hills suggests that they may be of different composition from the massifs. Station 8 is designed to investigate this possibility.

Relationships of the massif and massif-related units to the dark mantle unit are being investigated at stations 6-7, and 8; to the light mantle at station 2.

2. Dark mantle material - observations, characterization, and sampling

a. Mode of origin and emplacement - the dark mantle may be a volcanic pyroclastic deposit. Sources of the widespread dark mantle on the plains have not been specifically identified, but a variety of crater types (stations 1, 4, 5, 9, 10B), among which sources might be included, will be investigated. In addition, investigation of a possible exposure of the edge of a local young dark mantle unit (station 1) may provide important data on the mechanism of emplacement.

b. Internal stratigraphy - both the vertical compositional variation in the dark mantle and the time span during which it accumulated are of scientific interest. Radial sampling of craters at stations 4 and 9 as well as numerous core tubes are designed to provide data on these questions.

c. External stratigraphy - observations and photographs of the relationships of the dark mantle to other units will also help to establish its historical significance. Relationships to the sub-floor unit will be studies at stations 1, 5, and 10B and with the massifs at stations 6, 7, and 8. Observations of the relations of the dark and light mantles will be made as the crew drives across the contact and at station 4 where they will investigate a dark halo crater in the light mantle.

d. Areal variation - possible areal variations will be investigated at widespread sampling points in the dark mantle (stations 1, 4, 5, 8, 9, 10B, and several LRV sample sites); these stations will provide samples over an area of about 30 square km. If sources are local, a variety of sources will be sampled.

3. Sub-floor material - observations, characterization, and sampling

a. Mode of origin and emplacement - the sub-floor materials may be volcanic in origin or they may be impact breccias. Early characterization of rock types at station 1 should bear on this question.

b. Areal variation - separation of stations 1, 5, and 10B by several kilometers provides the opportunity to investigate areal variation. The relationship of the sub-floor material to the dark mantle and possibly to other underlying units will also be investigated.

LRV TRAVERSES

During the 75-hour lunar surface staytime three 7-hour EVA's are planned. EVA 1 is largely occupied with the deployment of the LRV, ALSEP, and other experiments, with about 2 hours available for a traverse. EVA's 2 and 3 are largely devoted to the traverses. This section presents the details of the LRV traverses as currently planned.

EVA 1 - A summary timeline of EVA 1 activities is shown on page 43. Approximately the first 1 3/4 hours are spent in the LM area off-loading the LRV, configuring the LRV for the traverse and off-loading the ALSEP and fueling the RTG. The crew then moves to the ALSEP deployment site about 100 m west of the LM where they spend the next 2 1/4 hours. During this period, the ALSEP experiments are deployed, the deep drill core is obtained, and the neutron flux monitor emplaced in the deep drill core hole, from which it will be recovered at the end of EVA 3.* A geophone array is deployed as part of ALSEP Seismic Profiling Experiment and will be employed later to detect the seismic waves from eight separate explosive charges to be deployed at various points on the LRV traverses.

Following the activities at the ALSEP site, the crew configures for the traverse, off-loads the SEP transmitter from the LM and emplaces it at a site about 100 m east of the LM where it will be deployed at the end of EVA 1 and then departs on the EVA 1 traverse, a little more than 4 hours into the EVA.

Objectives for the EVA 1 traverse are to investigate and sample the sub-floor material and the dark mantle, emplace seismic profiling charges, and obtain traverse gravimeter measurements. Figure 18 shows the route of the traverse across the dark mantle material southeastward to station 1. En-route to station 1, a short stop is made (noted by the X) to emplace the

* Limited sampling may also be done in the ALSEP area if time permits.

1 pound explosive charge for the Seismic Profiling Experiment. Station 1 duration is 1 hour 06 minutes and details of the station objectives and activities are shown in the pages following Figure 18. Included in the station activities is the deployment of the 3 pound seismic profiling charge. Leaving station 1, the crew return to the LM via their outbound path with a short stop enroute to emplace the 1/2 pound seismic profiling charge. The final hour of EVA 1 is spent in SEP antenna deployment and closeout activities at the LM.* Details of the traverse parameters including consumables margins for traverse contingency cases appear in the tables following the station activity discussion.

EVA 2 - Objectives of the EVA 2 traverse are to investigate and sample the base of the South Massif and the light mantle material of the debris slide, further investigation and sampling of the dark mantle and sub-floor material, emplacement of seismic profiling charges, obtaining traverse gravimeter measurements, and obtaining data for the Surface Electrical Properties Experiment.

The initial 52 minutes of the EVA is spent in configuring for the traverse. Equipment is loaded on the LRV, base measurements are made with the traverse gravimeter, the SEP transmitter and receiver are turned on and the traverse begins from the SEP site. A short stop is made about 500 feet west of the ALSEP area where a 1/8 pound seismic profiling charge is deployed. Enroute to station 2 (Figure 19), two short stops are scheduled (2 minutes each) where samples are taken from the LRV using the LRV sampling device. Approximately 2 1/2 hours of station time are spent on the light mantle material at three major stations (2, 3, and 4) and three short LRV sampling stops.

---

* The Fuel Products Contamination Sample will probably be obtained during this period, also.

Proceeding eastward from station 4, there is a short stop at the depression about 1 km east of station 4 where the 6 pound seismic profiling charge is deployed, an LRV sample is collected, and observations and photographs of the depression are made. Depending upon the crews' assessment, additional time could be invested here at the expense of station 5. An additional LRV sample is collected enroute to station 5. Station 5, where approximately 1/2 hour is available, provides a further opportunity for investigating the sub-floor material and dark mantle. The traverse then returns to the LM with an intermediate stop about 250 m west of the ALSEP where a 1/4 pound seismic profiling charge is deployed. The final 44 minutes of EVA 2 are spent in closeout activities in the LM area.

Details of the station objectives and activities appear in the pages following Figure 19. Tables of detailed traverse parameters follow the station activity discussion.

EVA 3 - Objectives of the EVA 3 traverse are to investigate and sample the North Massif and sculptured hills material to the north and northeast of the landing site, further investigation and sampling of the dark mantle and sub-floor material, emplacement of seismic profiling charges, obtaining traverse gravimeter measurements, and obtaining data for the Surface Electrical Properties Experiment.

The initial 45 minutes of the EVA is spent in configuring for the traverse. Leaving the LM area, the traverse proceeds in a northerly direction to station 6 with a single LRV sampling stop enroute. Approximately 2 1/4 hours station time is spent in the North Massif/ sculptured hills area at three major stations (stations 6, 7, 8; see Figure 20). Proceeding westerly from station 8, the traverse continues to station 9 where a fresh 80 m crater provides an opportunity to investigate the dark mantle and possibly learn something about its stratigraphy. Leaving station 9, the traverse route goes in a southerly direction to station 10B. A single LRV sampling stop is made enroute to station 10B. Sampling and observations of the dark mantle and plains material occupy the 47 minutes available at station 10B.

The traverse then returns to the LM area. Two seismic profiling charges (1/4 pounds and 1/8 pounds) are emplaced in the vicinity of the SEP station at the conclusion of the traverse. The final 55 minutes of EVA 3 are spent in closeout activities, including the retrieval of the neutron flux monitor probe at the ALSEP site.

Details of the station objectives and activities appear in the pages following Figure 20. Tables of detailed traverse parameters follow the station activity discussion.

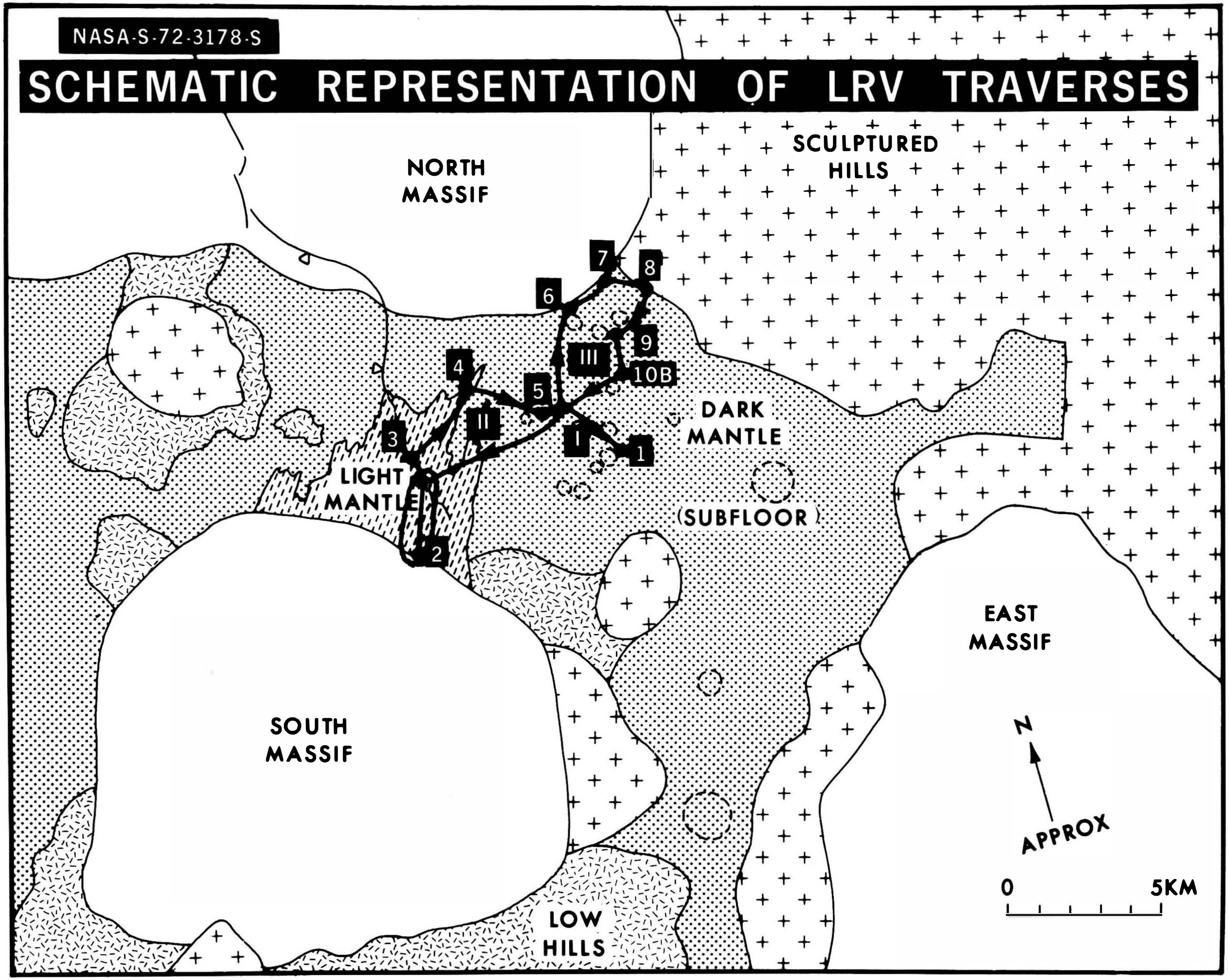


Fig. 17A. - Schematic representation of LRV traverses

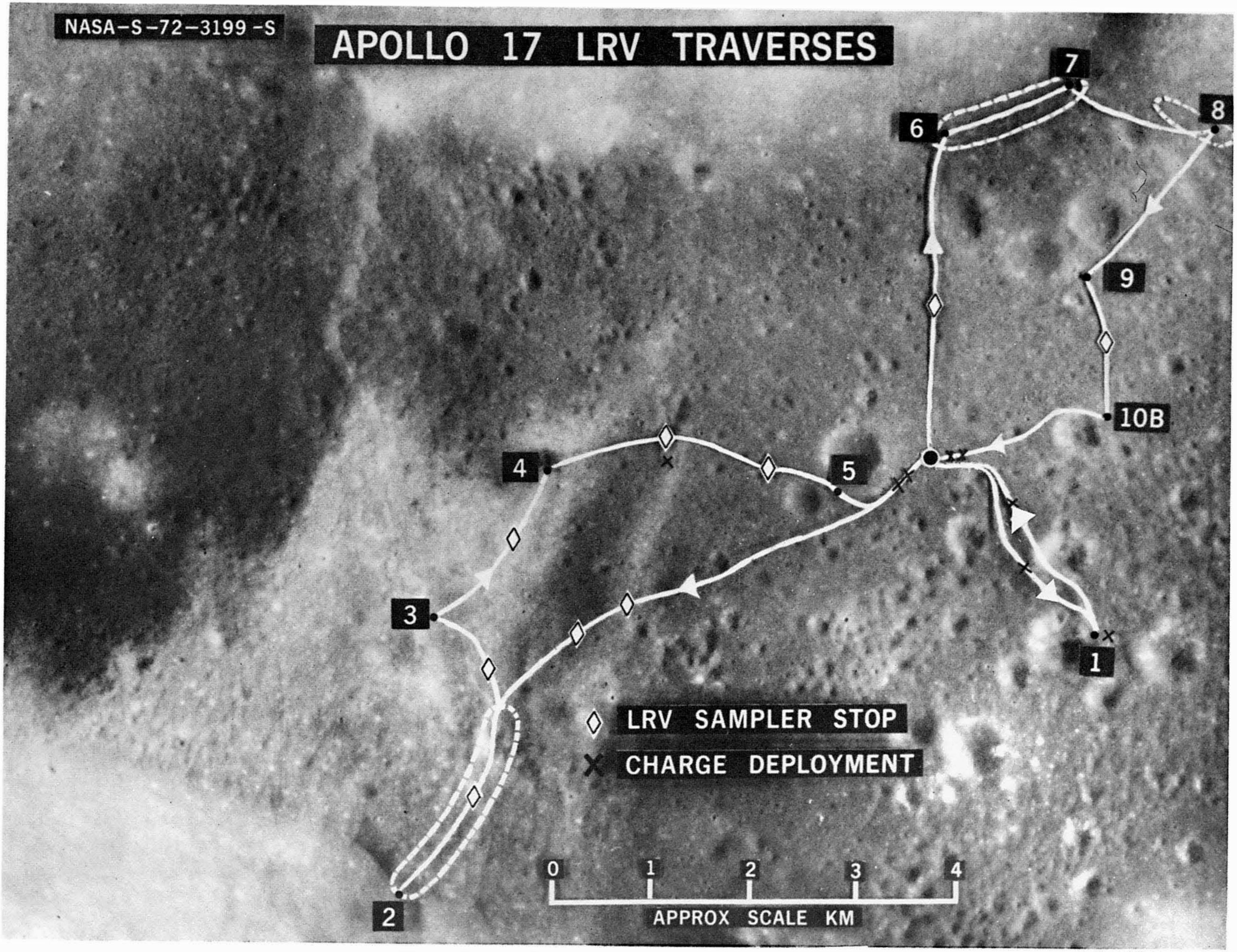
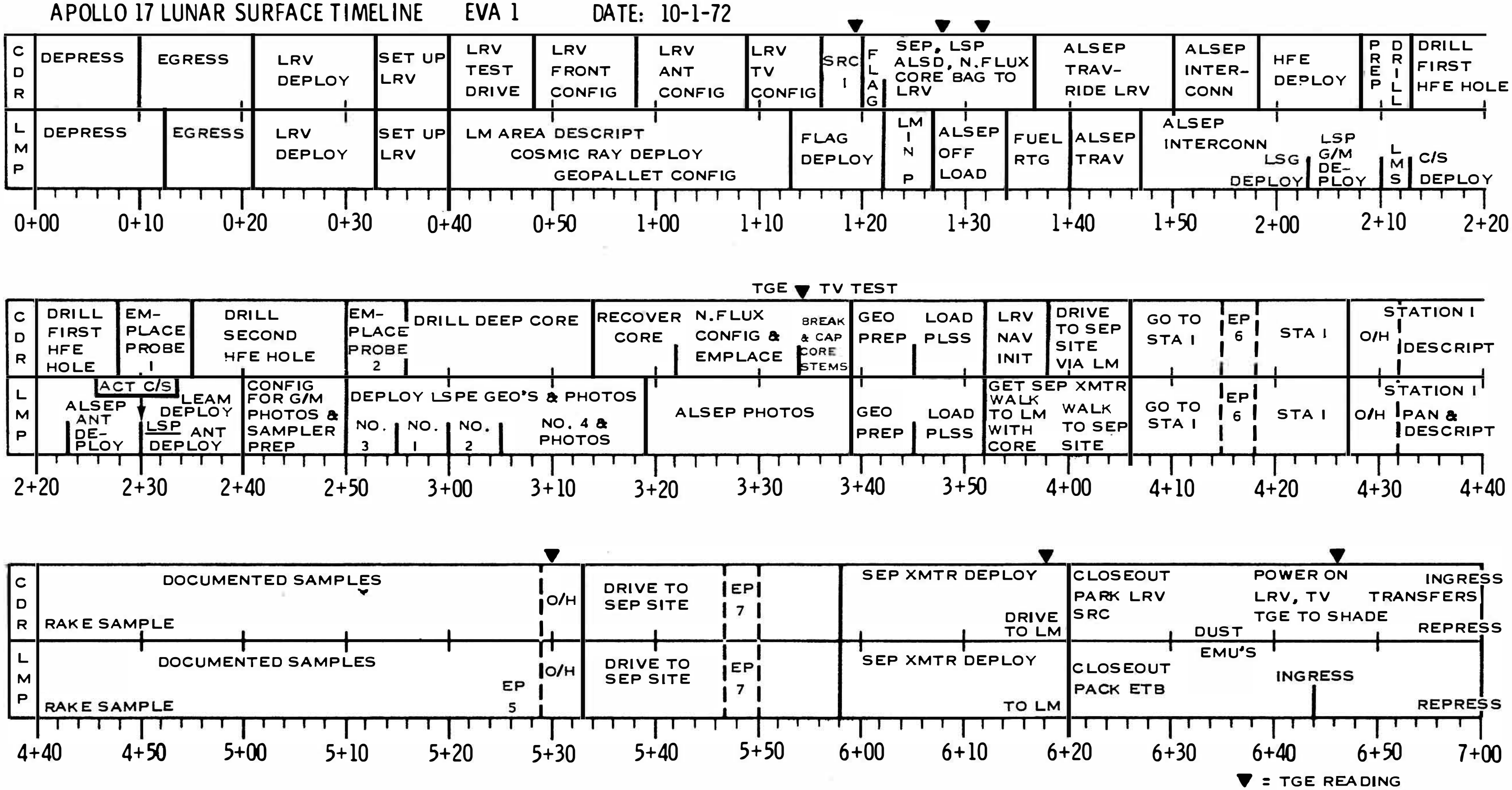


Fig. 17B - Pictorial view of the LRV traverses

APOLLO 17 LUNAR SURFACE TIMELINE EVA 1 DATE: 10-1-72



43

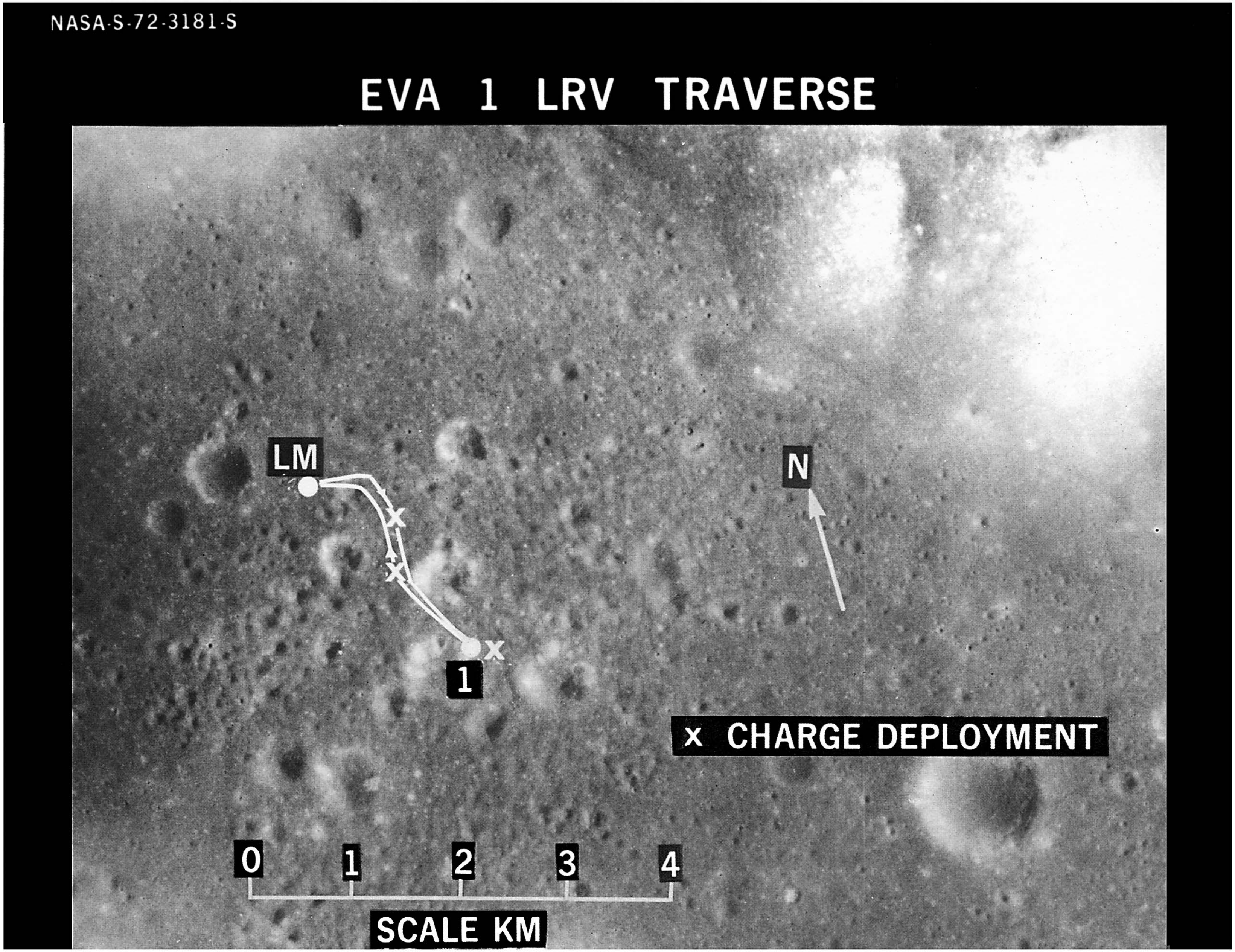


Fig. 18 - EVA 1 LRV traverse.

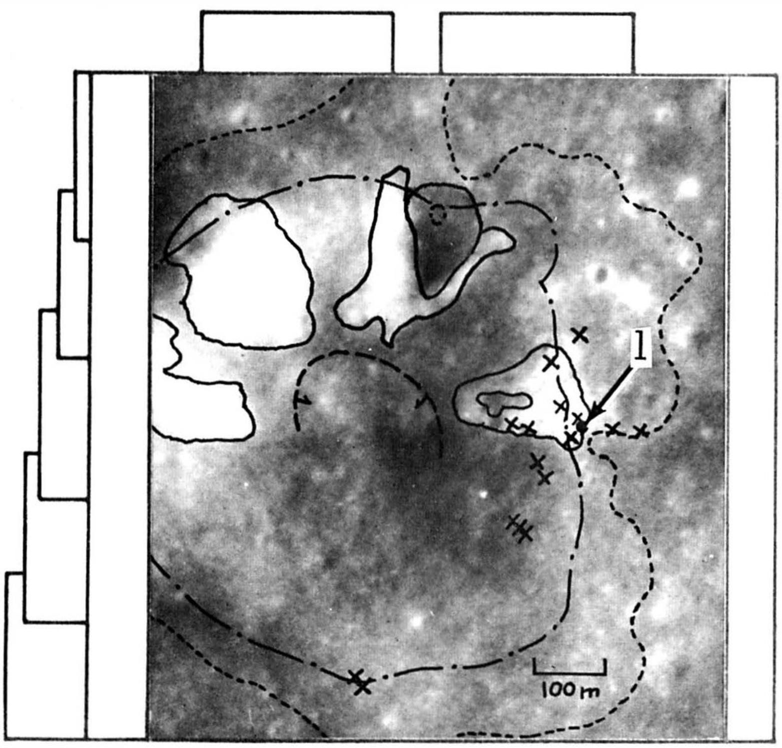
Location: East rim of 650 m crater at boundary between dark mantle and blocky subfloor material.

Geologic setting: Subfloor material is exposed in parts of the crater wall and rim as ejecta, talus, and perhaps outcrop. The subfloor unit is interpreted as basin-filling material such as lava flows, impact breccias, impact melts, or colluvial deposits emplaced after formation of the landing site valley. The original valley floor upon which the subfloor unit was deposited may have consisted of the upper part of the massif or sculptured hills units, and these materials may have been included in the ejecta at station 1.

Dark mantle covers the floor and parts of the crater wall and rim. Unusually dark mantle that could represent a younger or thicker (and hence less mixed) mantle deposit covers the southern half of the crater. Its northern boundary crosses the crater floor and wall as a distinct nearly straight line. An additional small patch of very dark mantle occurs on the north wall and rim of the crater. The dark mantle may be young, fine grained pyroclastic material derived from abundant, small vents that are generally unidentifiable in the orbital photographs.

Objectives:

- Characterize subfloor material
- Investigate historical sequence and mode of origin of dark mantle



Tasks *	Rationale
•Observe/photograph crater walls, rims, ejecta	•Origin of crater
Subfloor:	
•Blocks •Observe/photograph structures and textures in several blocks in both bright and dark portions of crater rim •Documented samples	•Block structure and lithology as recorded in photographs and samples provide data on variety and interrelations of rock types and on origin and history of subfloor unit; lithologic distinction across albedo boundary would suggest high angle contact between distinct subfloor units.
•Rocks and soils •Documented samples •Rake	•Supplemental to block sampling; increases probability of comprehensively sampling subfloor materials.
•Pan	•Location; setting; crater wall structures; plains--dark mantle relationships
Dark mantle:	
•Observe/photograph dark mantle--very dark mantle-subfloor contacts	•Geometry and origin of mantle
•Documented samples - dark mantle and very dark mantle	•Composition; age; mixing
•Rake-very dark mantle	•Texture of mantle permitting, rake might optimize collection of scattered lithic fragments
•Trench - dark mantle--very dark mantle contact; very dark mantle--subfloor contact	•Geometry and origin of mantle units; relative amounts of regolith development
•Double core in very dark mantle near contact with dark mantle	•Stratigraphy; contact attitude; regolith history; sampling undisturbed mantle material
•Observe/photograph mantle--block relationships	•Chronology of blocks and mantle; origin of mantle
•Observe/photograph contrasting light and dark areas elsewhere on crater rim (especially dark patch on north rim)	•Possible clues to origin of mantle
•Pan	•Stereoscopic view (with earlier pan) of crater wall, very dark mantle contact crossing crater

* Considered to be an all inclusive shopping list of tasks if time were available. The station timeline which follows presents the particular tasks (and time allocations) which were selected as the nominal station activities.

Station 1 Timeline

EVA-1	1+06	
	CDR	LMP
Initial overhead	5	5
Observation	10	10
•Crater, rim, ejecta, wall		
•Blocks, characterize and compare		
•relate to subfloor		
•Subfloor and mantle contacts		
•Block-mantle relationships		
•Regolith development		
Subfloor	21	21
•Documented sampling-emphasis on blocks		
•Rake/soil (kg)		
•Pan		
Subfloor and mantle contacts	14	14
•Exploratory trench and photographs		
•Double core in youngest unit		
Very dark mantle	7	7
•Documented sample		
•Rake/soil (kg)		
•Pan		
Dark mantle	3	5
•Documented sample		
Seismic charge deploy	2	
Final overhead	4	4
	66	66

APOLLO 17 TAURUS LITTROW TRAVERSES

EVA 1 | CALCULATED DATA | OCT 25 1972

EVA START 116:40 HR:MIN GET

STATION	SEGMENT DISTANCE (KM)	LRV MOBILITY RATE (KM/HR)	RIDE TIME (MIN)	TOTAL TRAVEL DISTANCE (KM)	ARRIVE STATION EVA TIME (HR+MIN)	STOP TIME (HR+MIN)	DEPART STATION EVA TIME (HR+MIN)
LM				0.00	0+ 0	1+45	1+45
ALSEP				0.00	1+45	2+21	4+ 6
SEP							
RIDE	1.43	7.30	12				
1#CHG R=1.3				1.43	4+18	0+ 3	4+21
RIDE	0.98	7.30	8				
1 3#CH R=2.3				2.41	4+29	1+ 6	5+35
RIDE	1.65	7.30	14				
1/2#CH R=0.8				4.06	5+48	0+ 3	5+51
RIDE	0.76	7.30	6				
SEP				4.82	5+58	0+22	6+20
LM				4.82	6+20	0+40	7+ 0
TOTALS			40			6+20	7+ 0

--------------- TRAVERSE CONTINGENCIES ---------------

STAT NO	RETURN DISTANCE TO LM (KM)	LRV FAILURE: WALKBACK TIME TO LM (HR+MIN)	LRV FAILURE: STATION MARGIN ABOVE WALKBACK REQUIREMENTS FW (HR+MIN)	O2 (HR+MIN)	AMP HRS (HR+MIN)	PLSS FAILURE: MIN LRV RIDEBACK SPEED REQUIRED 0 MIN (KM/HR)	10 MIN (KM/HR)	AVG EVA MET RATE (BTU/HR)
LM	0.00	0+ 0	****	****	****	0.00	0.00	1050.00
ALSEP	0.10	0+ 2	3+26	3+ 8	3+14	0.10	0.12	1050.00
SEP	0.10	0+ 2	3+26	3+ 8	3+14	0.10	0.12	1050.00
1#CHG R=1.3	1.51	0+25	2+39	2+21	2+36	1.47	1.75	1026.31
1 3#CH R=2.3	2.49	0+41	1+ 3	0+44	1+ 6	2.42	2.88	999.81
1/2#CH R=0.8	0.84	0+14	1+34	1+16	1+17	0.82	0.97	982.02
SEP	0.10	0+ 2	1+26	1+ 7	1+ 1	0.10	0.12	978.85
LM	0.00	0+ 0	1+ 7	0+49	0+45	0.00	0.00	985.64

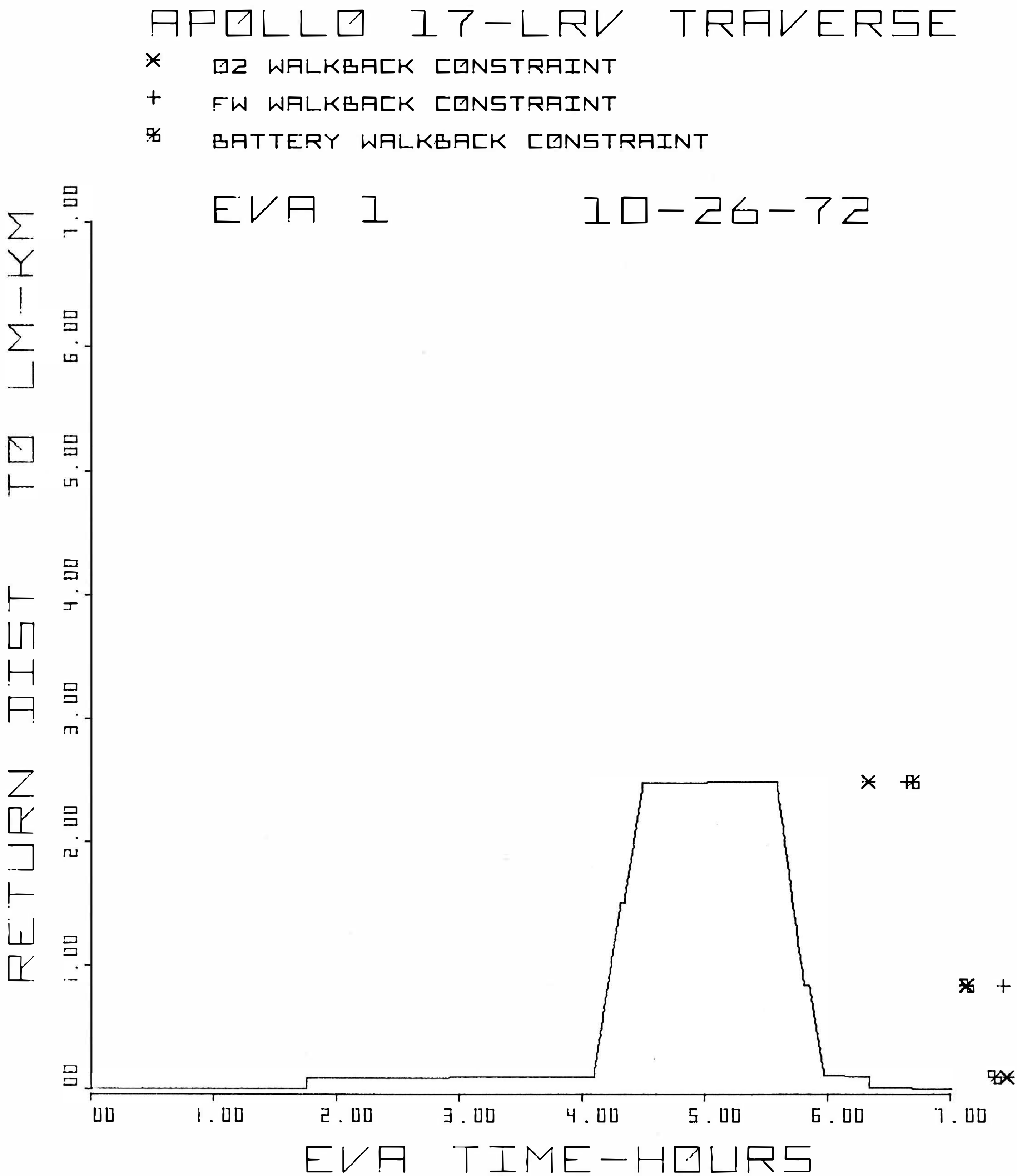
APOLLO 17 TAURUS LITTROW TRAVERSES

EVA 1 INPUT DATA OCT 25 1972

EVA START 116:40 HR:MIN GET

STATION NO	STOP TIME (HR+MIN)	SEGMENT DISTANCE (KM)	RETURN DISTANCE (KM)	HEAT LEAK (BTU/HR)	-MOBILITY RATES- WALK (KM/HR)	RIDE (KM/HR)	MET RATE WALK (BTU/HR)
LM	1+45	0.00	0.00	0.00	◆◆◆◆	◆◆◆◆	◆◆◆◆◆◆
ALSEP	2+21	0.00	0.10	0.00	3.60	7.30	1560.0
SEP 1#CHG R=1.3	0+ 3	1.43	1.51	0.00	3.60	7.30	1560.0
1 3#CH R=2.3	1+ 6	0.98	2.49	0.00	3.60	7.30	1560.0
1/2#CH R=0.8	0+ 3	1.65	0.84	0.00	3.60	7.30	1560.0
SEP	0+22	0.76	0.10	0.00	3.60	7.30	1560.0
LM	0+40	0.00	0.00	0.00	3.60	7.30	1560.0

MET RATE ALSEP (BTU/HR)	MET RATE RIDING (BTU/HR)	MET RATE STATION (BTU/HR)	MET RATE LM O/H (BTU/HR)	LEAK RATE O2 (LB/HR)	EVA START (F/W-LB)	EVA START (O2-LB)	OPS TIME (MIN)
1050.00	550.00	950.00	1050.00	0.020	10.86	1.403	61.8



APOLLO 17-LRV TRAVERSE
O2 WALKBACK CONSTRAINT
FW WALKBACK CONSTRAINT
BATTERY WALKBACK CONSTRAINT
EVA 1
10-26-72
RETURN DIST TO LM-KM
EVA TIME-HOURS

LRV TRAVERSE ASSUMPTIONS

1. 30 MINUTES RESERVES MAINTAINED ON ALL PLSS CONSUMABLES AT STATION METABOLIC RATE

2. ALL DISTANCES AND SPEEDS ARE MAP DISTANCES AND MAP SPEEDS (MOBILITY RATES)

3. REQUIRED RATE = RETURN DISTANCE/AVAILABLE OPS RIDING TIME
   AVAILABLE OPS RIDING TIME = TOTAL OPS TIME LESS ALLOWANCES
   ALLOWANCES $\begin{cases}\text{5 MIN BSLSS HOOKUP}\\ \text{13 MIN LM INGRESS}\end{cases}$

4. TIME MARGIN AT STATION METABOLIC RATE
   STATION MARGIN = TIME REMAINING AFTER ALLOWANCE FOR 10 MINUTES AT LRV, WALKBACK, AND 13 MINUTES INGRESS

5. FINAL LM O/H MARGIN = TIME REMAINING WITH NO ALLOWANCES

6. RESPIRATORY EXCHANGE QUOTIENT = 0.9

7. FEEDWATER HEAT OF VAPORIZATION 1038 $\frac{\text{BTU}}{\text{LB}}$

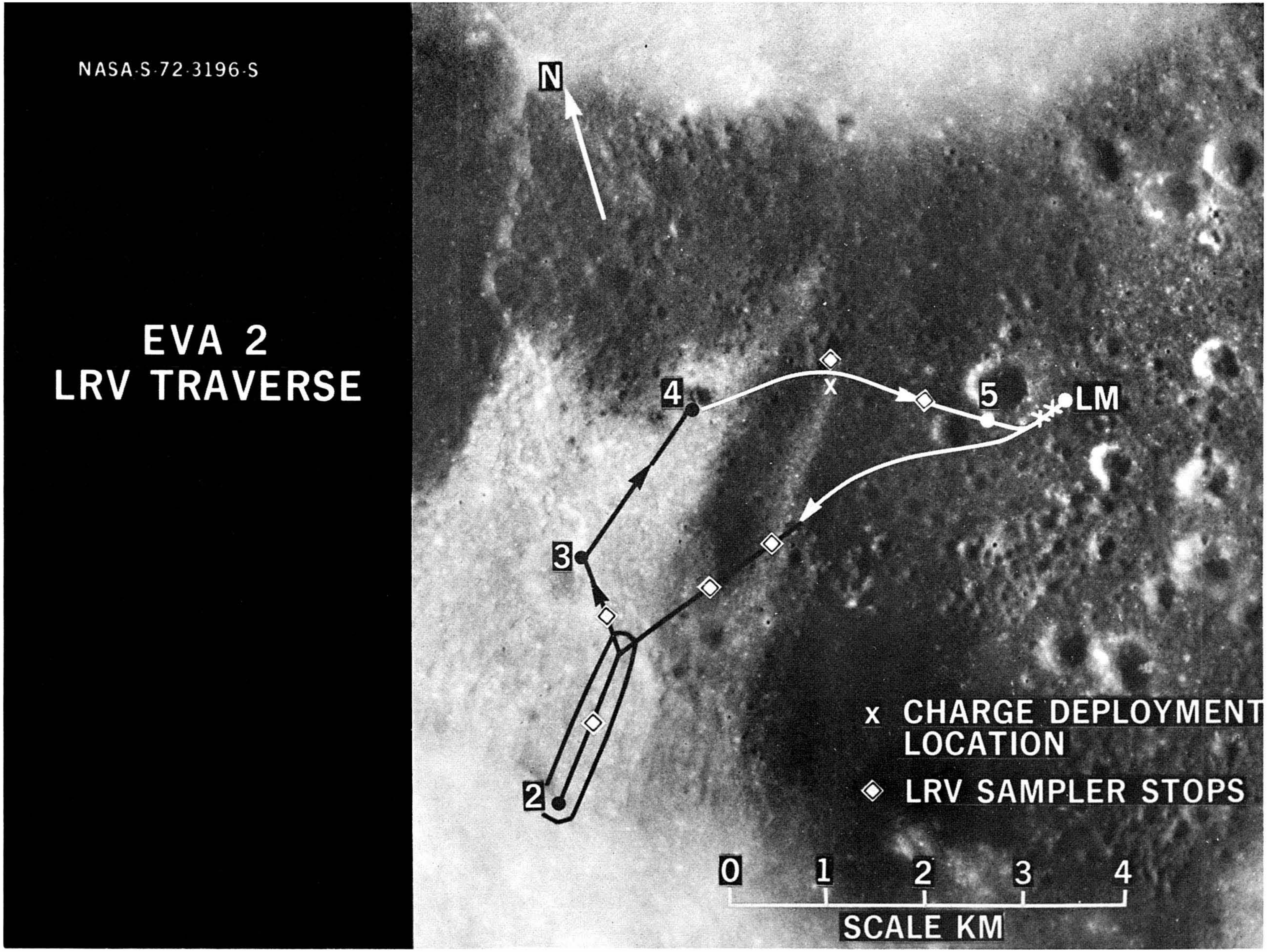


Fig. 19 - EVA 2 LRV traverse

Location: Base of South Massif at contact between South Massif and light mantle

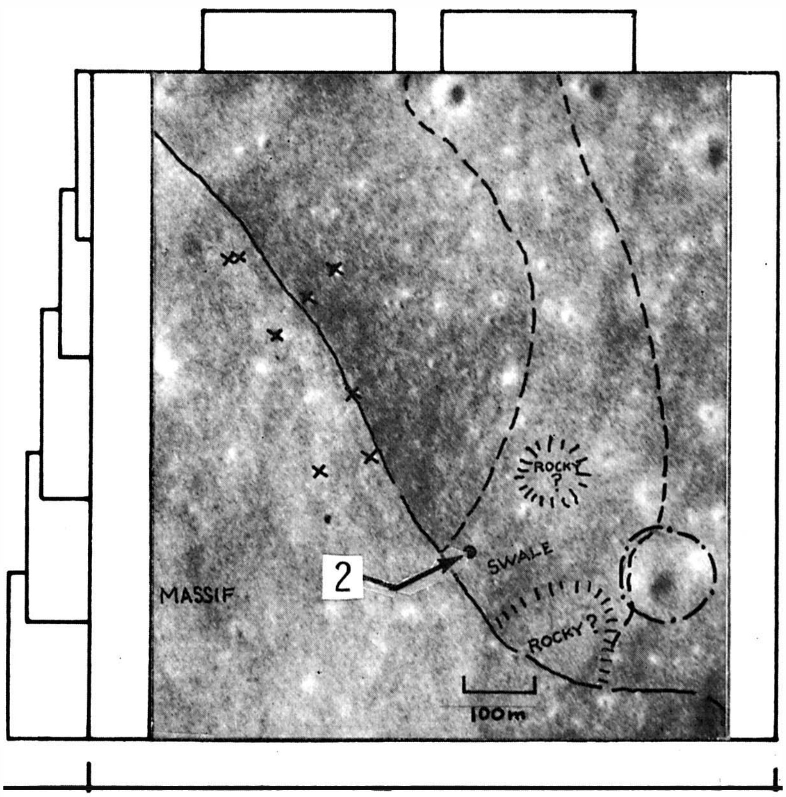
Geologic setting: Massif material underlies the steep mountain face at station 2. Most probably it consists of sheets of breccia ejected from the moon's large basins as they were formed. Faulting related to the Serenitatis event is thought to have uplifted the massif relative to the valley floor. Subsequent movement may also have occurred. However, the lower part of the mountain face is probably covered by talus that buries the bounding fault zone.

Light mantle occurs as a relatively thin ray-like sheet that extends onto the valley floor from the base of the massif. Absence of a likely source crater suggests that the light mantle is not a ray of ejecta. It may be debris from the mountain face deposited by an avalanche fairly late in the history of the landing area.

Objectives:

- Characterize South Massif bedrock as represented by materials at base of slope.

- Characterize light mantle and investigate features indicative of its origin.



TASKS *	RATIONALE
Massif:	
•Documented samples of rocks and soil with special emphasis on blocks with tracks.	•Collect representative sample of massif rock types as represented in talus at base; blocks with tracks most probably derived from massif
•Observe/photograph tracks and block sources	•Documentation of block sources may permit stratigraphic analysis of massif
•Observe/photograph block structures--textures	•Block structures and textures record history of emplacement and deformation of massif materials
•Rake sample	•Statistical sample of lithologic variety in pebble-size fragments in massif talus
•Observe/photograph proximal edge of light mantle	•Documents discrimination between talus and light mantle materials; may show light mantle features indicative of mantle origin
•Relate sample locations to proximal edge of light mantle; collect from above light mantle if possible	•Light mantle, if derived from massif, may represent source distinct from major sources of talus; hence discriminate sampling may permit stratigraphic interpretation of massif materials
•Pan-southeast crest of rim of Nansen crater near base of massif	•Massif-light mantle structures, contact; trough at massif base; blocks near massif base
Light mantle:	
•Documented samples of rocks and soil	•Characterize lithology of light mantle materials (which presumably were derived from south massif); exposure age of light mantle surface; possible sample of Nansen ejecta (could include subfloor or massif materials)
•Rake sample (intercrater area)	•Statistical sample of lithologic varieties in pebble-size fragments for comparison with rake samples from massif and from stations 3 and 4
•Observe/photograph surface structures such as riges and troughs	•Surface structures may be indicative of emplacement mechanism
•Trench	•Internal structures may provide evidence of mode of emplacement of light mantle
•Observe/photograph layering or other structure in trench walls	
•Pan from rim of Nansen crater 50(?) m away from intersection of rim with massif	•Stereoscopic view (with pan 1) of lower massif, trough and boulders near massif base; surface structures on light mantle.

* Considered to be an all inclusive shopping list of tasks if time were available. The station timeline which follows presents the particular tasks (and time allocations) which were selected as the nominal station activities.

EVA 2	Station 2 timeline	0 + 50	
		CDR	LMP
Initial overhead		5	5
Observation		10	10
•Blocks, tracks and sources			
•Blocks, structures and textures			
•Massif/light mantle contact			
•Light mantle, surficial and internal structure			
•Regolith			
Massif		21	21
•Documented sampling-emphasis on blocks with tracks			
•Rake/soil (kg)			
•Pan			
Light mantle		10	10
•Documented sampling-rocks			
•Rake/soil (intercrater area)			
•Pan			
Final overhead		4	4
		50	50

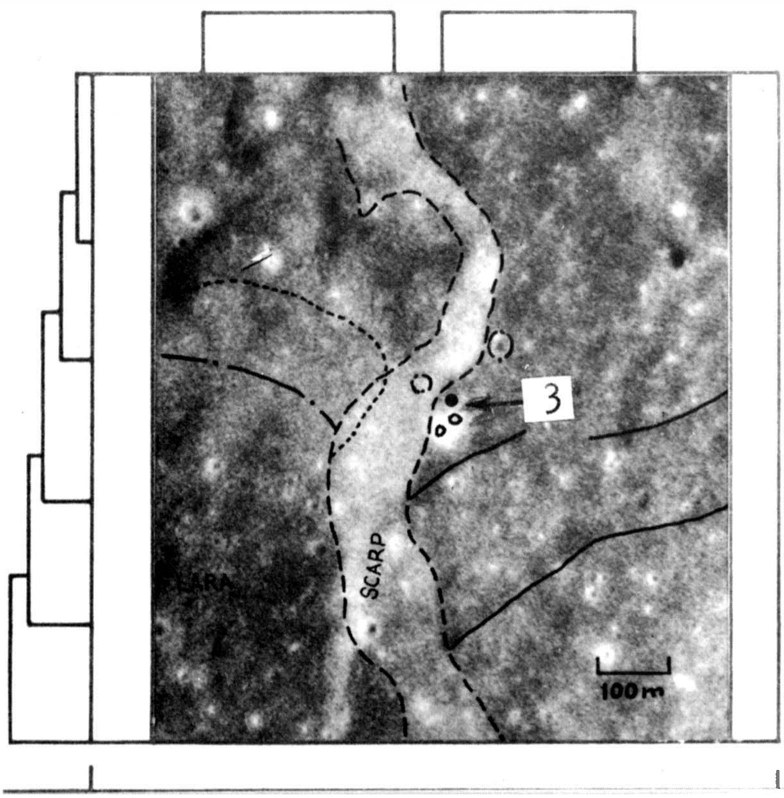
EVA 2 Station 3 Station time 0 + 45

Location: Base of scarp approximately halfway from station 2 to station 4.

Geologic setting: Light mantle apparently veneers the scarp, which may be the topographic expression of a fault, upthrown on the west. Presence of the scarp when the light mantle was emplaced may have produced depositional structures in the light mantle that can be used to interpret its origin. Ledges or blocks representing the bedrock underlying the scarp face may be accessible although none are recognized in pre-mission photographs. Two fresh craters, 15 and 20 m in diameter penetrate the surface of the light mantle near the base of the scarp.

Objectives:

- Sample central part of light mantle near base of scarp.
- Examine and sample scarp to determine interrelations and chronology of scarp and mantle materials.



EVA 2 Station 3 (continued)

TASKS *	RATIONALE
Light mantle:	
•Documented samples of rocks and soil	•Characterize lithology of light mantle materials (presumably these were derived from South Massif); exposure age of light mantle surface.
•Rake sample (inter-crater area)	•Statistical sample of lithologic varieties in pebble-size fragments for comparison with samples from stations 2 and 4.
•Double core in undisturbed surface near base of scarp (lower section goes in CSVC)	•Regolith development; detailed stratigraphy of upper meter of light mantle; possible volatiles in fault zone.
•Radial sample 15-20 m fresh crater	•Stratigraphy of upper 3 to 4 m of light mantle.
•Pan near 15-20 m fresh crater	•Location; character of scarp, light mantle surface, and sampled crater.
•Observe/photograph surface structures, textures, and fragment distribution; note apparent relations to scarp	•May indicate mode of emplacement of light mantle.
•Trench in undisturbed surface of light mantle	•Internal structures may indicate emplacement mechanism for light mantle; regolith thickness--relative age by comparison with regolith on dark mantle.
•Observe/photograph layering or other structure in trench walls	

Scarp:

•Observe/photograph (flight-line surveys) surface structures, textures, and fragment distribution.	•Characterize scarp and forming its surface; chronology of scarp and mantle units; origin of mantle units.
•Documented samples of scarp materials--may be desirable to observe and sample at small fresh crater.	•Scarp (or small fresh crater in scarp face) may expose (or excavate) materials older than the light mantle (e.g. dark mantle or sub-floor). Occurrence of such materials at or near scarp face bears on chronology of scarp and mantle units and on mechanisms of scarp and mantle origins.
•Trench - Observe/photograph layering or other structures in trench walls	•Stratigraphy; origin of scarp face; origin of light mantle.
•Pan near scarp base	•Scarp and light mantle features;stereoscopic view with previous pan.

---

* Considered to be an all inclusive shopping list of tasks if time were available. The station timeline which follows presents the particular tasks (and time allocations) which were selected as the nominal station activities.

EVA 2 Station 3 timeline 0 + 45

	CDR	LMP
<u>Initial overhead</u>	5	5
<u>Observation</u>	5	5
•Distinguish light mantle and scarp materials		
•Chronology of scarp and light mantle (light mantle draping?, faulted?)		
•Depositional features of mantle on surface and in exploratory trenches; regolith development		
<u>Light mantle</u>	29	14
•Documented sampling (possible radial sampling) - rim of 20 m bright crater		
•Rake/soil (inter-crater area)		
•Pan		
•Double core by CDR near scarp base; lower section goes in CSVC		
<u>Scarp</u>	2	17
•Exploratory trench; documented sampling (by LMP)		
•Flight-line survey		
•Pan		
Final overhead	4	4
	45	45

Location: Dark halo crater at distal end of light mantle.

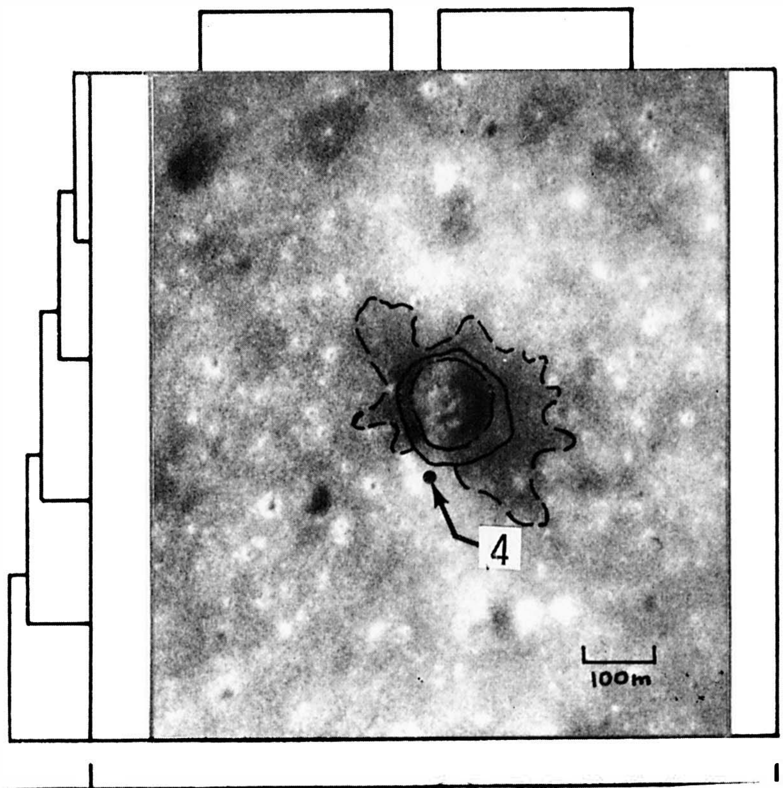
Geologic setting: A rayed, 110 m, dark halo crater is superimposed on the distal end of the light mantle. It seems likely that the crater was formed by impact and excavated thick dark mantle from below the light mantle. The crater floor is flat, benched, very rough, and is apparently covered by dark mantle material. This floor may represent a resistant layer, perhaps the top of the subfloor unit, about 10 m below the general level of the valley floor. No light colored materials or blocks are visible on the crater walls or rim, but subfloor fragments could be present.

Alternatively, the crater could be a vent that produced a small amount of dark mantle material after emplacement of the light mantle.

Several small bright craters occur in the light mantle south of the dark halo crater. They suggest that the light mantle may be as much as 4 m thick in this area. Two small craters nearest the dark halo crater could be in light colored ejecta (overturned light mantle) of the dark crater.

Objectives:

- Examine dark halo crater to determine its origin and sample its ejecta.
- Examine distal end of light mantle and sample its variety of rock types.



TASKS *	RATIONALE
Dark halo crater:	
•Observe/photograph ejecta, rim, crater interior	•Crater origin; sampling rationale
•Radial sample (dixie cup) 5 sample minimum	•Stratigraphy of dark mantle
•Documented samples - rocks and soil at crater rim (possible rake sample)	•Characterize lithology of dark mantle; possible sample of subfloor material; exposure age of crater
•Double core near edge of dark halo (if impact, core just within dark ejecta; if volcanic, try for one drive tube full of dark ejecta)	•Stratigraphy of ejecta and underlying light mantle
•Pan - crater rim	•Crater structures; scarp
•Polarimetry - crater rim	•Polarimetry of north and south massifs and sculptured hills to provide data on their similarities and differences
•Exploratory trench	•Compare regolith development with regolith on light mantle
Light mantle:	
•Observe/photograph surface structures, textures, fragment distribution, internal structure, regolith	•Mode of emplacement; compare with stations 2 and 3; relative age based on regolith thickness
•Rake sample (intercrater area)	•Statistical sample of lithologic varieties in pebble-size fragments for comparison with samples from stations 2 and 3
•Documented samples of rocks and soil from rim and ejecta blanket of small (approx. 10 m) fresh crater	•Characterize lithology of light mantle materials
•Pan	•Location, sampling context

* Considered to be an all inclusive shopping list of tasks if time were available. The station timeline which follows presents the particular tasks (and time allocations) which were selected as the nominal station activities.

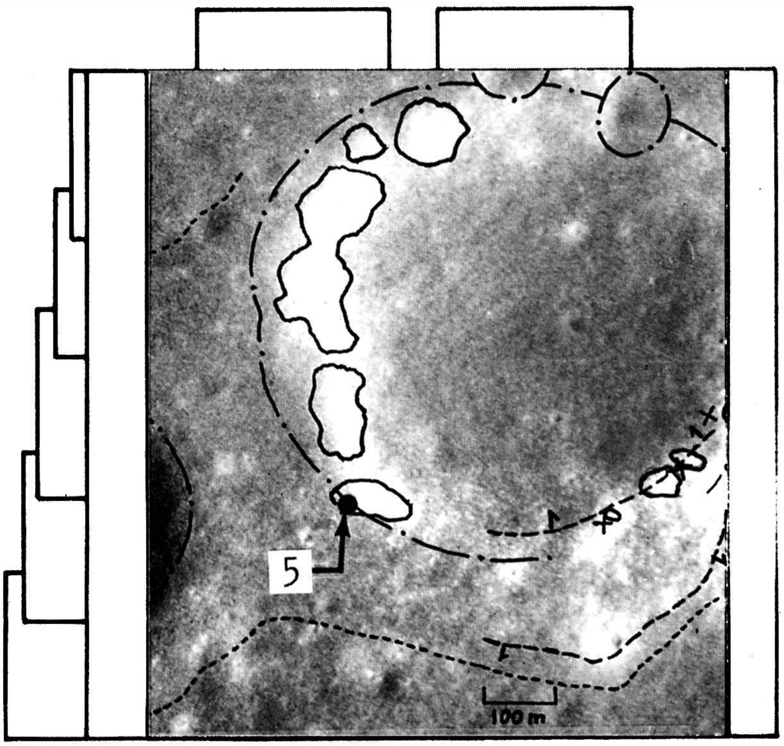
	CDR	LMP
Initial overhead	5	5
Observation	5	5
•Dark halo crater interior, deposits (origin), regolith •Light mantle lithology, structures, regolith •Uplands and scarp (500 mm)		
Dark halo crater	12	15
•Documented sampling (rim) possible rake soil •Pan (rim) •Polarimetry (rim) •Radial sample (dixie cup) (at least 5 samples)		
Light mantle	14	11
•Documented sampling (bright crater) •Rake/soil (inter-crater) •Pan		
Final overhead	4	4
	40	40

Location: Southwest side of low-rimmed 700 m crater west of landing point.

Geologic setting: As at station 1, subfloor material is exposed in parts of the crater rim and wall. Accessible exposures, however, are few and small, and no blocks are resolvable in the station area. Dark mantle covers the floor and much of the rim and wall of the crater.

Objectives:

- Observe and sample subfloor and dark mantle materials for comparison with other stations.



TASKS*	RATIONALE
•Observe/photograph crater walls, rims	•Crater origin
Dark mantle:	
•Double core through dark mantle/ subfloor interface	•Lateral variation in dark mantle (compare with deep drill core); character, age of pre-mantle surface
•Trench; observe/photograph regolith	•Comparison with light mantle for relative age; with other dark mantle areas for cause of thinning on crater rim
Subfloor:	
•Documented samples •Rake/soil	•Representative sampling of subfloor materials for comparison with samples from stations 1 and 10

* Considered to be an all inclusive shopping list of tasks if time were available. The station timeline which follows presents the particular tasks (and time allocations) which were selected as the nominal station activities.

EVA 2 — Station 5 Timeline — 0 + 30

	CDR	LMP
Initial overhead	5	5
Observation	3	3
•Crater wall/rim (origin) •Subfloor - compare with station 1 •Subfloor/dark mantle contact •Regolith		
Subfloor	9	9
•Documented sampling •Rake/soil		
Dark mantle	9	9
•Double core (including top of subfloor unit) •Pans (stereo-camelot)		
Final overhead	4	4
	30	30

APOLLO 17 TAURUS LITTROW TRAVERSES

EVA 2 CALCULATED DATA NOV 6 1972

EVA START 139:10 HR:MIN GET

STATION	SEGMENT DISTANCE (KM)	LRV MOBILITY RATE (KM/HR)	RIDE TIME (MIN)	TOTAL TRAVEL DISTANCE (KM)	ARRIVE STATION EVA TIME (HR+MIN)	STOP TIME (HR+MIN)	DEPART STATION EVA TIME (HR+MIN)
LM				0.00	0+ 0	0+52	0+52
RIDE	0.40	7.30	3				
1/8#CH R=.20				0.40	0+55	0+ 3	0+58
RIDE	3.43	7.30	28				
LRV-SA				3.83	1+26	0+ 2	1+28
RIDE	0.39	7.30	3				
LRV-SA				4.22	1+32	0+ 2	1+34
RIDE	3.40	7.30	28				
2				7.62	2+ 2	0+50	2+52
RIDE	1.00	7.30	8				
LRV-SA				8.62	3+ 0	0+ 2	3+ 2
RIDE	1.08	7.30	9				
LRV-SA				9.70	3+11	0+ 2	3+13
RIDE	0.73	7.30	6				
3				10.43	3+19	0+45	4+ 4
RIDE	1.09	7.30	9				
LRV-SA				11.52	4+13	0+ 2	4+15
RIDE	0.79	7.30	6				
4				12.31	4+21	0+40	5+ 1
RIDE	1.39	7.30	11				
PHOTO LRV-SA 6#CH R=2.4				13.70	5+13	0+ 5	5+18
RIDE	0.93	7.30	8				
LRV-SA				14.63	5+25	0+ 2	5+27
RIDE	0.79	7.30	6				
5				15.42	5+34	0+30	6+ 4
RIDE	0.72	7.30	6				
1/4#CH R=.25				16.14	6+10	0+ 3	6+13
RIDE	0.40	7.30	3				
LM				16.54	6+16	0+44	7+ 0
TOTALS			136			4+44	7+ 0

		TRAVERSE CONTINGENCIES						
		LRV FAILURE				PLSS FAILURE		
	RETURN DISTANCE	WALKBACK TIME	STATION MARGIN ABOVE WALKBACK REQUIREMENTS			MIN LRV RIDEBACK SPEED REQUIRED		AVG EVA
STAT NO	TO LM (KM)	TO LM (HR+MIN)	FW (HR+MIN)	O2 (HR+MIN)	AMP HRS (HR+MIN)	0 MIN (KM/HR)	10 MIN (KM/HR)	MET RATE (BTU/HR)
LM	0.00	0+ 0	◆◆◆◆	◆◆◆◆	◆◆◆◆	0.00	0.00	1050.00
1/8#CH	0.30	0+ 5	6+21	5+52	6+19	0.29	0.35	1016.65
R=.20								
LRV-SA	3.73	1+23	4+21	3+52	4+31	3.62	4.32	866.46
LRV-SA	4.12	1+32	4+ 6	3+37	4+17	4.00	4.77	857.41
2	7.50	2+47	1+21	0+51	1+44	7.28	8.69	834.33
LRV-SA	6.50	2+24	1+42	1+12	1+56	6.31	7.53	822.75
LRV-SA	5.41	2+ 0	2+ 6	1+36	2+ 9	5.25	6.27	811.51
3	5.50	2+ 2	1+14	0+45	1+16	5.34	6.37	830.64
LRV-SA								
4	4.13	1+32	1+ 1	0+33	0+49	4.01	4.78	833.28
PHOTO	2.84	0+47	1+35	1+ 7	1+17	2.76	3.29	824.56
LRV-SA								
6#CH								
R=2.4								
LRV-SA	1.91	0+32	1+51	1+24	1+23	1.85	2.21	818.91
5	1.12	0+19	1+37	1+10	1+ 0	1.09	1.30	824.92
1/4#CH	0.40	0+ 7	1+48	1+22	1+ 3	0.39	0.46	821.56
R=.25								
LM	0.00	0+ 0	1+32	1+ 5	0+45	0.00	0.00	843.37

APOLLO 17   TAURUS LITTROW TRAVERSES

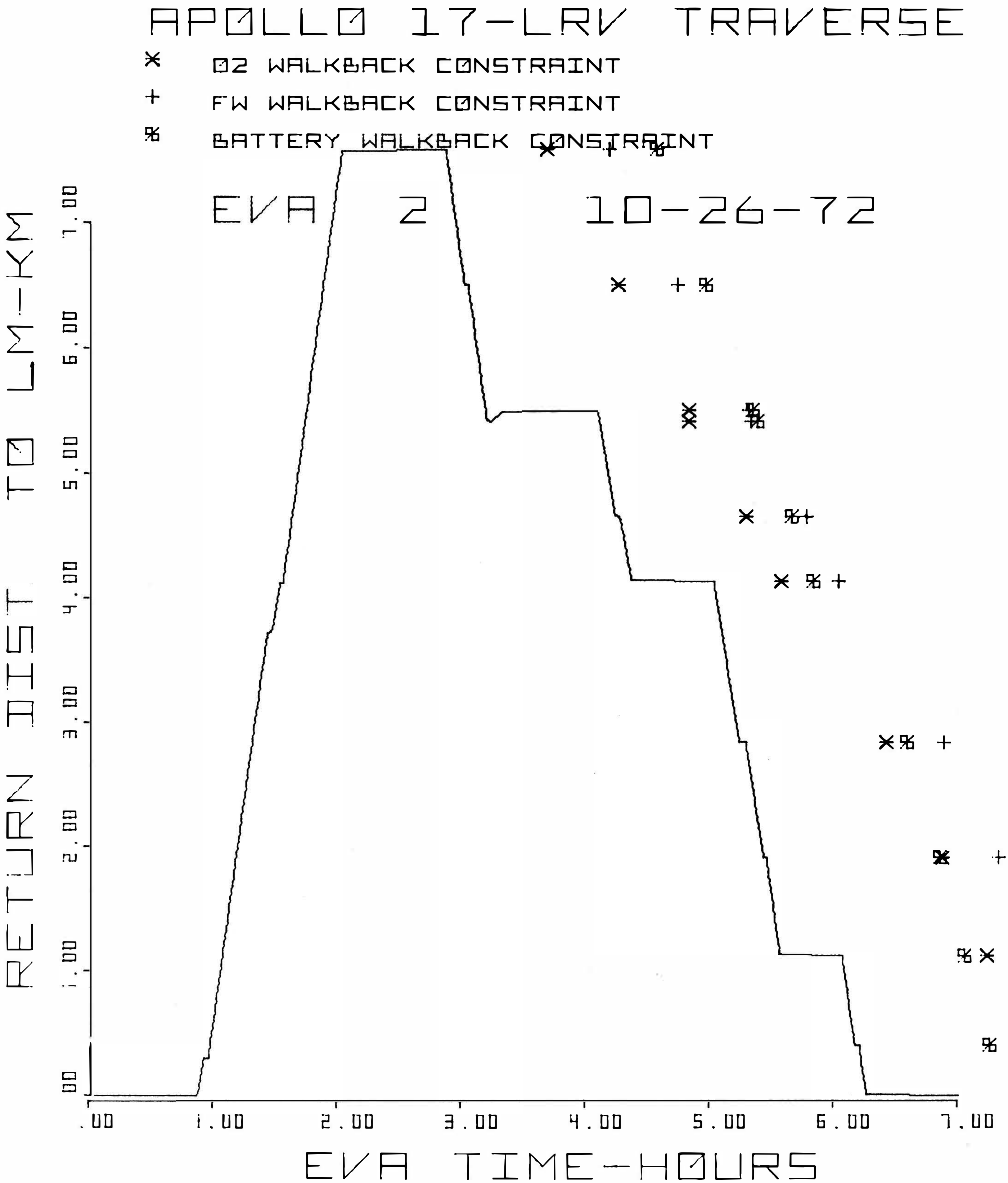
EVA 2   INPUT DATA   NOV 6 1972

EVA START 139:10 HR:MIN GET

STATION NO	STOP TIME (HR+MIN)	SEGMENT DISTANCE (KM)	RETURN DISTANCE (KM)	HEAT LEAK (BTU/HR)	-MOBILITY RATES- WALK (KM/HR)	RIDE (KM/HR)	MET RATE WALK (BTU/HR)
LM	0+52	0.00	0.00	135.00	****	****	******
1/8#CH R=.20	0+ 3	0.40	0.30	135.00	3.60	7.30	1560.0
LRV-SA	0+ 2	3.43	3.73	135.00	2.70	7.30	1290.0
LRV-SA	0+ 2	0.39	4.12	135.00	2.70	7.30	1290.0
2	0+50	3.40	7.50	135.00	2.70	7.30	1290.0
LRV-SA	0+ 2	1.00	6.50	135.00	2.70	7.30	1290.0
LRV-SA	0+ 2	1.08	5.41	135.00	2.70	7.30	1290.0
3	0+45	0.73	5.50	135.00	2.70	7.30	1290.0
LRV-SA	0+ 2	1.09	4.65	135.00	2.70	7.30	1290.0
4	0+40	0.79	4.13	135.00	2.70	7.30	1290.0
PHOTO LRV-SA 6#CH R=2.4	0+ 5	1.39	2.84	135.00	3.60	7.30	1560.0
LRV-SA	0+ 2	0.93	1.91	135.00	3.60	7.30	1560.0
5	0+30	0.79	1.12	135.00	3.60	7.30	1560.0
1/4#CH R=.25	0+ 3	0.72	0.40	135.00	3.60	7.30	1560.0
LM	0+44	0.40	0.00	135.00	3.60	7.30	1560.0

MET RATE ALSEP (BTU/HR)	MET RATE RIDING (BTU/HR)	MET RATE STATION (BTU/HR)	MET RATE LM O/H (BTU/HR)	LEAK RATE O2 (LB/HR)	EVA START (F/W-LB)	EVA START (O2-LB)	OPS TIME (MIN)
1050.00	550.00	950.00	1050.00	0.028	11.29	1.353	61.8

NOTE: OPS TIME IS TOTAL DRIVING TIME AVAILABLE!


APOLLO 17-LRV TRAVERSE
O2 WALKBACK CONSTRAINT
FW WALKBACK CONSTRAINT
BATTERY WALKBACK CONSTRAINT
EVA 2 10-26-72
RETURN DIST TO LM-KM
.00
1.00
2.00
3.00
4.00
5.00
6.00
7.00
EVA TIME-HOURS

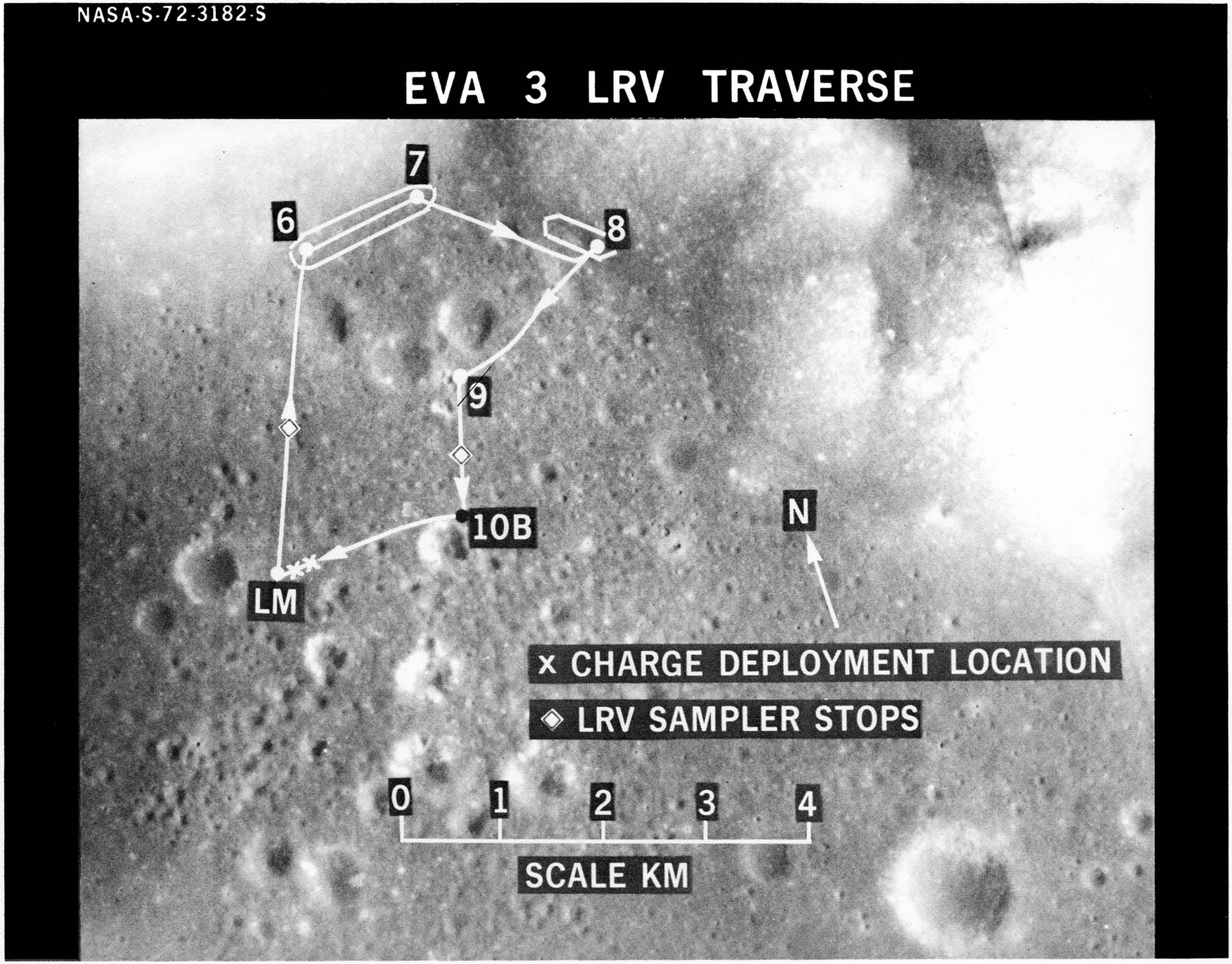

NASA-S-72-3182-S
EVA 3 LRV TRAVERSE
7
6
8
9
10B
LM
N
x CHARGE DEPLOYMENT LOCATION
◇ LRV SAMPLER STOPS
0
1
2
3
4
SCALE KM

Fig. 20

Location: Field of large blocks near base of north massif. West end (Station 6) defined as 8x16m block near 20m fresh crater.

Geologic setting: As at Station 2, the north massif materials, most probably ejecta from the moon's large basins, are thought to be buried by talus on the lower mountain slopes. In contrast to the sharp mountain foot at Station 2, the lower slope of the north massif grades through a gentle curve into the subhorizontal surface of the valley floor. Presumably the boundary has been subdued by accumulation of materials, including dark mantle, that have been transported down slope by mass wasting. The valley floor is covered by dark mantle, which extends upward locally onto the lower massif slopes.

Several large blocks, thought to be derived from the north massif are present near the mountain foot. Particularly notable is a large (8x16m) block lying at the end of a trail more than 1km long on the mountain face. A sharp crater near the block may contain reworked massif materials in its ejecta.

Objectives:

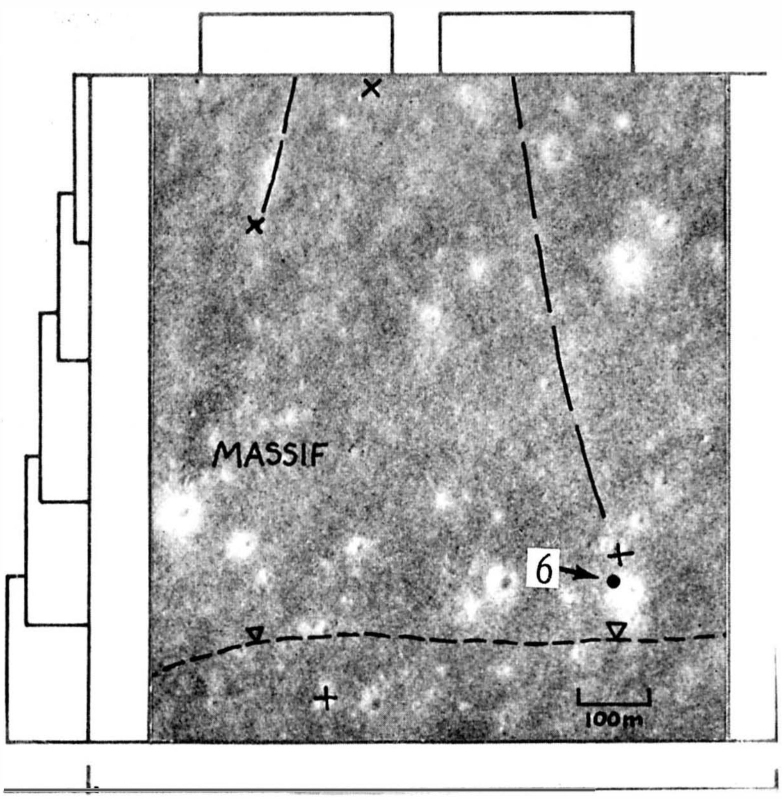
Characterize and sample materials representing the north massif.
Sample dark mantle.

EVA-3 - Station 6 and 7 continued

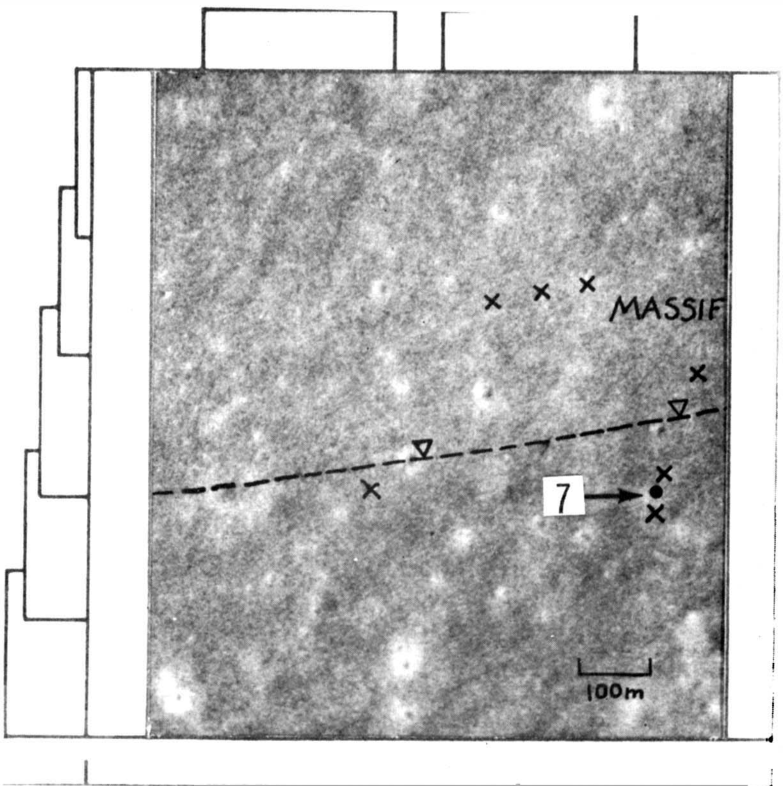
Tasks *	Rationale
North Massif:	
Documented samples from large blocks with special emphasis on blocks with tracks	Large blocks provide variety of clasts in their matrix - thus most detailed characterization of massif materials; blocks with tracks most probably derived from massif
Observe/photograph tracks and block sources	Identification of sources may permit stratigraphic analysis of massif
Observe/photograph block structures and textures	History of emplacement and subsequent modification of massif materials
Rake/soil and documented samples of rocks on rim of bright 20 m crater	Sample representative colluvium at massif base; may include both massif debris and dark mantle from massif surface.
Rake/soil and documented samples of massif materials on top of or mixed with dark mantle (especially if bright 20 m crater does not excavate massif colluvium)	Attempt to collect fragments of massif colluvium
Dark mantle:	
Documented sample from plains surface near massif base	Lateral variation in dark mantle composition; compare with other stations
Observe/photograph relations between blocks and dark mantle	Timing, mechanism of emplacement of blocks or dark mantle.
Single core	Lateral and vertical variation in dark mantle

* Considered to be an all inclusive shopping list of tasks if time were available. The station timeline which follows presents the particular tasks (and time allocations) which were selected as the nominal station activities.

	CDR	LMP
Initial overhead (includes TGE, TV pan)	5	5
Observation	5	5
•Block tracks and sources (500 mm)		
•Block structures and textures		
•Block/mantle relationships		
•Slope/mantle relationships		
•Stations 7, 8		
•Compare lithologies of blocks, crater rims, talus		
Blocks		
•Documented sampling	15	15
Talus	8	8
•Documented sampling		
•Single core		
Crater (20 m, fresh)	9	9
•Documented sampling		
•Rake/soil (Kg)		
Pans	1	1
Final overhead	4	4
	47	47



	CDR	LMP
Initial overhead (includes TGE, TV pan)	5	5
Observation	5	5
•Block tracks and sources (500 mm)		
•Block structures, textures		
•Block/mantle relationships		
Blocks	21	18
•Documented sampling		
Dark Mantle	11	11
•Documented sampling		
•SESC - permanently shadowed soil (east-west split)		
Pans	1	1
Polarimetry - Sculptured Hills		3
Final overhead	4	4
	47	47



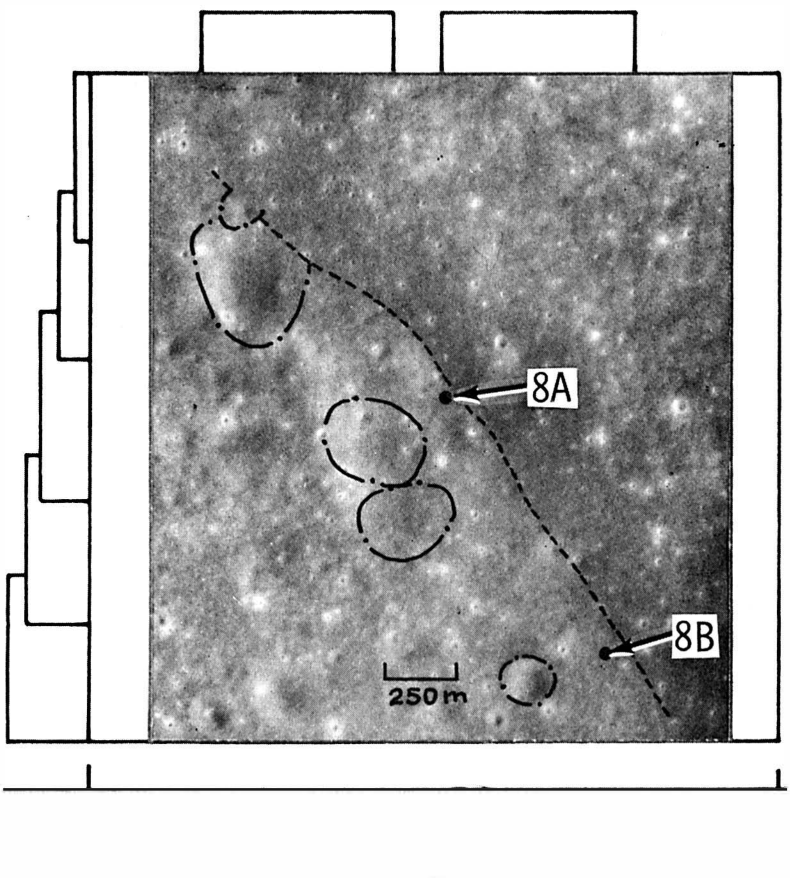
Location: Base of sculptured hills.

Geologic setting: Sculptured hills material underlies much of the highland area between the Serenitatis and Crisium basins. The base of the hills grades gently into the subhorizontal valley floor; apparently a thick accumulation of mass wasted materials has subdued the topographic break at the base of the slope.

Dark mantle covers the valley floor and extends well up onto the slope at the station. Craters that excavate materials from beneath the dark mantle have not been positively identified on the accessible part of the slope.

Objectives:

Characterize sculptured hills unit
Compare with massif and subfloor materials
Sample dark mantle



Sampling criteria:

1) area in which debris from hillside (other than dark mantle) is visible on surface of lower slope, or
2) crater on lower slope that excavates materials distinct from dark mantle, or
3) largest, freshest crater as high on lower slope as possible

Tasks*	Rationale
Sculptured hills:	
Observe/photograph lithology of blocks, rocks from sculptured hills	Characterization, comparison with massif and plains materials; sampling rationale; history of emplacement and deformation
Trench, observe soil	Colluvium from sculptured hills may be mixed with dark mantle - hence, may be sampled in soil
Block area	
Documented samples - blocks, rocks	Characterization of sculptured hills materials
Rake/soil (interblock area)	Attempt to concentrate fragments of sculptured hills material from soil
Crater area	
Documented samples - rocks from crater rim	Crater may excavate colluvium including sculptured hills material from beneath dark mantle
Rake/soil at crater rim	Attempt to concentrate fragments of sculptured hills material from soil excavated in small cratering event
Dark mantle:	
Documented samples	Comparison with other stations (i.e. lateral variation)
Pans	Location, sampling context

* Considered to be an all inclusive shopping list of tasks if time were available. The station timeline which follows presents the particular tasks (and time allocations) which were selected as the nominal station activities.

EVA 3	Station 8 Timeline	0 + 47*	
		CDR	LMP
Initial overhead		5	5
Observation		10	10
•Rock tracks and sources •Rock lithology - compare with massifs •Hills debris in soil (trench) •Dark mantle occurrence			
Sculptured Hills material			
Rock debris (on surface)		24	24
•Documented sampling •Rake/soil (interblock area) (Kg)			
	OR		
Crater		24	24
•Documented sampling (ejecta) •Rake/soil (ejecta) (Kg.) •Rake/soil (inter-crater area)			
Dark mantle		3	3
•Documented sampling			
Pans		1	1
Final overhead		4	4
		47	47

* 47 minutes is available for station 8 provided an appropriate sampling site is found at the first encounter with the sculptured hills region (station 8A). If it is necessary to range along the base for some distance (approximately 1 km is allowed), the increased driving time to station 8 (and subsequently back to station 9) is about 10-12 minutes and will be done at the expense of station 8 time; the observation time will be reduced to a minimum on the premise that observations from the LRV (while driving) will suffice; thereafter, reduction in sampling time will be necessary.

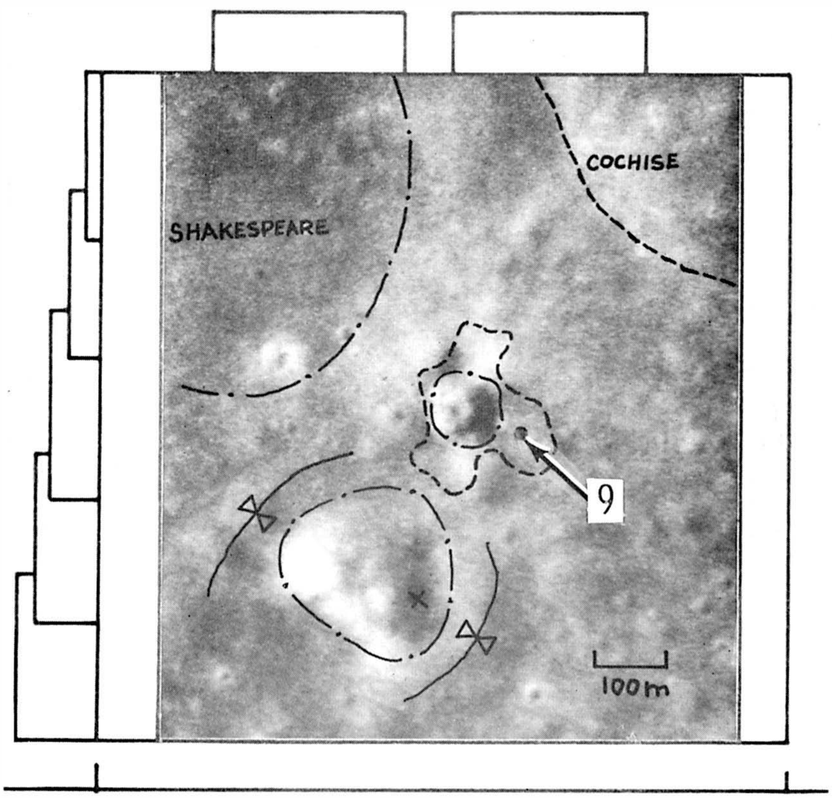
Location: Sharp-rimmed 80m crater on valley floor about 2km northeast of the landing point.

Geologic setting: The 80m crater has a lumpy floor and a sharp raised rim. It occurs on the valley floor in an area extensively covered by dark mantle. No blocks are visible in its ejecta, and its walls, floor, and rim are indistinguishable in albedo from the surrounding dark mantle.

Most probably the crater was formed by impact, but volcanic origin is a viable alternate hypothesis. The freshness of the crater suggests that fresh ejecta can be sampled at the surface. However, the uniformity of albedo across the ejecta and onto the surface of the surrounding valley floor causes worry that a young thin deposit of dark mantle material could coat the crater ejecta.

Objectives:

Determine historical sequence and lateral continuity of dark mantle at young 80m crater.



Tasks*	Rationale
Observe/photograph ejecta, rim, crater interior	Crater origin; sampling rationale
Radial sample (dixie cup) 5 sample minimum	Stratigraphy of dark mantle
Documented samples-rocks and soils at crater rim (possible rake sample)	Characterize lithology of dark mantle; possible sample of subfloor material; exposure age of crater
Stereo-pan at crater rim	Vantage point for crater structure and regional setting

* Considered to be an all inclusive shopping list of tasks if time were available. The station timeline which follows presents the particular tasks (and time allocations) which were selected as the nominal station activities.

EVA 3 Station 9 Timeline 0 + 30

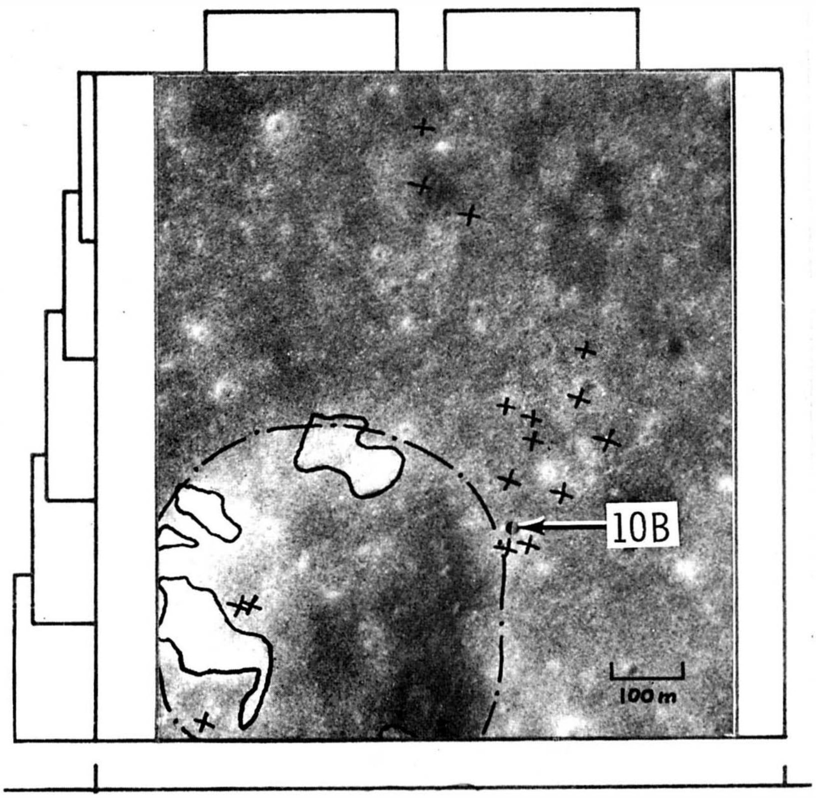
	CDR	LMP
Initial overhead	5	5
Observation	5	5
•Relation of dark mantle to crater •Crater interior, deposits (origin)		
Crater	11	16
•Documented sampling (rim) possible rake/soil •Pan (rim) (stereo of crater interior) •Radial sampling (dixie cup) - by LMP (at least 5 samples)		
Dark mantle	5	0
•Documented sampling •Pan		
Final overhead	4	4
	30	30

Location: Block field just northeast of Sherlock crater.

Geologic setting: Subfloor material is exposed in the west and north walls of Sherlock crater. The northeast part of the crater is extensively covered by dark mantle. However, a number of large blocks apparently protrude through the dark mantle on and beyond the northeast crater rim. Their occurrance near the crater rim suggests that they are ejecta from Sherlock. If so, they are most probably derived from the subfloor.

Objectives:

Compare, contrast numerous blocks with subfloor materials at Stations 1 and 5.
Sample dark mantle.



Tasks*	Rationale
Blocks:	
Observe/photograph block textures and structures	Characterization, origin, history of subfloor materials
Documented samples of blocks	Extend subfloor sampling begun at Stations 1 and 5
Dark mantle:	
Observe/photograph relation of dark mantle to blocks	Mechanics of dark mantle emplacement
Documented sample	Comparison with dark mantle of other localities
Double core	Depositional and weathering history

* Considered to be an all inclusive shopping list of tasks if time were available. The station timeline which follows presents the particular tasks (and time allocations) which were selected as the nominal station activities.

EVA 3 | Station 10B Timeline | 0 + 47

	CDR	LMP
Initial overhead	5	5
Observations	5	5
•Block textures and structures compare with stations 1, 5		
•Relation between dark mantle and blocks		
Blocks	21	21
•Documented sampling		
Dark mantle	11	11
•Documented sampling		
•Double core		
Pans	1	1
Final overhead	4	4
	47	47

APOLLO 17 TAURUS LITTROW TRAVERSES

EVA 3A CALCULATED DATA OCT 25 1972

EVA START 162:40 HR:MIN GET

STATION	SEGMENT DISTANCE (KM)	LRV MOBILITY RATE (KM/HR)	RIDE TIME (MIN)	TOTAL TRAVEL DISTANCE (KM)	ARRIVE STATION EVA TIME (HR+MIN)	STOP TIME (HR+MIN)	DEPART STATION EVA TIME (HR+MIN)
LM				0.00	0+ 0	0+45	0+45
RIDE	1.63	7.30	13				
LRV-SA				1.63	0+58	0+ 2	1+ 0
RIDE	1.75	7.30	14				
6				3.38	1+15	0+47	2+ 2
RIDE	0.75	7.30	6				
7				4.13	2+ 8	0+47	2+55
RIDE	2.08	7.30	17				
8A				6.21	3+12	0+47	3+59
RIDE	1.94	7.30	16				
9				8.15	4+15	0+30	4+45
RIDE	0.64	7.30	5				
LRV-SA				8.79	4+50	0+ 2	4+52
RIDE	0.73	7.30	6				
10B				9.52	4+58	0+46	5+44
RIDE	1.60	7.30	13				
1/4#CH				11.12	5+57	0+ 3	6+ 0
R=.25							
RIDE	0.05	7.30	0				
1/8#CH				11.17	6+ 1	0+ 3	6+ 4
R=.20							
RIDE	0.15	7.30	1				
LM				11.32	6+ 5	0+55	7+ 0
TOTALS			93			5+27	7+ 0

---------------- TRAVERSE CONTINGENCIES ---------------

		-----------LRV FAILURE---------------				--PLSS FAILURE--		
	RETURN	WALKBACK	STATION MARGIN ABOVE			MIN LRV RIDEBACK		
	DISTANCE	TIME	WALKBACK REQUIREMENTS			SPEED REQUIRED		AVG EVA
STAT	TO LM	TO LM	FW	O2	AMP HRS	0 MIN	10 MIN	MET RATE
NO	(KM)	(HR+MIN)	(HR+MIN)	(HR+MIN)	(HR+MIN)	(KM/HR)	(KM/HR)	(BTU/HR)
LM	0.00	0+ 0	****	****	****	0.00	0.00	1050.00
LRV-SA	1.65	0+27	5+30	5+ 4	5+54	1.60	1.91	935.78
6	3.40	0+57	3+49	3+23	4+24	3.30	3.94	895.70
7	3.56	0+59	2+54	2+28	3+28	3.46	4.12	898.11
8A	4.33	1+36	1+22	0+56	1+47	4.20	5.02	883.42
9	2.39	0+40	1+44	1+19	1+57	2.32	2.77	871.77
LRV-SA	1.98	0+33	1+49	1+24	1+57	1.92	2.29	866.51
10B	1.80	0+30	1+ 3	0+39	1+ 8	1.75	2.08	872.15
1/4#CH	0.20	0+ 3	1+31	1+ 7	1+18	0.19	0.23	861.05
R=.25								
1/8#CH	0.15	0+ 2	1+29	1+ 5	1+16	0.15	0.17	861.43
R=.20								
LM	0.00	0+ 0	0+56	0+32	0+45	0.00	0.00	885.21

APOLLO 17 TAURUS LITTROW TRAVERSES

EVA 3A INPUT DATA OCT 25 1972

EVA START 162:40 HR:MIN GET

STATION NO	STOP TIME (HR+MIN)	SEGMENT DISTANCE (KM)	RETURN DISTANCE (KM)	HEAT LEAK (BTU/HR)	-MOBILITY RATES- WALK (KM/HR)	RIDE (KM/HR)	MET RATE WALK (BTU/HR)
LM	0+45	0.00	0.00	200.00	****	****	******
LRV-SA	0+ 2	1.63	1.65	200.00	3.60	7.30	1560.0
6	0+47	1.75	3.40	200.00	3.60	7.30	1560.0
7	0+47	0.75	3.56	200.00	3.60	7.30	1560.0
8A	0+47	2.08	4.33	200.00	2.70	7.30	1290.0
9	0+30	1.94	2.39	200.00	3.60	7.30	1560.0
LRV-SA	0+ 2	0.64	1.98	200.00	3.60	7.30	1560.0
10B	0+46	0.73	1.80	200.00	3.60	7.30	1560.0
1/4#CH R=.25	0+ 3	1.60	0.20	200.00	3.60	7.30	1560.0
1/8#CH R=.20	0+ 3	0.05	0.15	200.00	3.60	7.30	1560.0
LM	0+55	0.15	0.00	200.00	3.60	7.30	1560.0

MET RATE ALSEP (BTU/HR)	MET RATE RIDING (BTU/HR)	MET RATE STATION (BTU/HR)	MET RATE LM O/H (BTU/HR)	LEAK RATE 02 (LB/HR)	EVA START (F/W-LB)	EVA START (02-LB)	OPS TIME (MIN)
1050.00	550.00	950.00	1050.00	0.035	11.29	1.353	61.8

EVA 3B is identical with EVA 3A except that station 8 is located further east along sculptured hills (station 8B) with attendant reduction in station 8 duration.

APOLLO 17 TAURUS LITTROW TRAVERSES

EVA 3B — CALCULATED DATA — OCT 30 1972

EVA START 162:40 HR:MIN GET

STATION	SEGMENT DISTANCE (KM)	LRV MOBILITY RATE (KM/HR)	RIDE TIME (MIN)	TOTAL TRAVEL DISTANCE (KM)	ARRIVE STATION EVA TIME (HR+MIN)	STOP TIME (HR+MIN)	DEPART STATION EVA TIME (HR+MIN)
LM				0.00	0+ 0	0+45	0+45
RIDE	1.63	7.30	13				
LRV-SA				1.63	0+58	0+ 2	1+ 0
RIDE	1.75	7.30	14				
6				3.38	1+15	0+47	2+ 2
RIDE	0.75	7.30	6				
7				4.13	2+ 8	0+47	2+55
RIDE	3.03	7.30	25				
8B				7.16	3+20	0+35	3+55
RIDE	2.30	7.30	19				
9				9.46	4+14	0+30	4+44
RIDE	0.64	7.30	5				
LRV-SA				10.10	4+49	0+ 2	4+51
RIDE	0.73	7.30	6				
10B				10.83	4+57	0+47	5+44
RIDE	1.60	7.30	13				
1/4#CH R=.25				12.43	5+57	0+ 3	6+ 0
RIDE	0.05	7.30	0				
1/8#CH R=.20				12.48	6+ 1	0+ 3	6+ 4
RIDE	0.15	7.30	1				
LM				12.63	6+ 5	0+55	7+ 0
TOTALS			104			5+16	7+ 0

TRAVERSE CONTINGENCIES

		LRV FAILURE				PLSS FAILURE		
			STATION MARGIN ABOVE WALKBACK REQUIREMENTS			MIN LRV RIDEBACK SPEED REQUIRED		
STAT NO	RETURN DISTANCE TO LM (KM)	WALKBACK TIME TO LM (HR+MIN)	FW (HR+MIN)	O2 (HR+MIN)	AMP HRS (HR+MIN)	0 MIN (KM/HR)	10 MIN (KM/HR)	AVG EVA MET RATE (BTU/HR)
LM	0.00	0+ 0	◆◆◆◆	◆◆◆◆	◆◆◆◆	0.00	0.00	1050.00
LRV-SA	1.65	0+27	5+30	5+ 4	5+54	1.60	1.91	935.78
6	3.40	0+57	3+49	3+23	4+24	3.30	3.94	895.70
7	3.56	0+59	2+54	2+28	3+28	3.46	4.12	898.11
8B	4.51	1+40	1+23	0+57	1+47	4.39	5.22	868.93
9	2.39	0+40	1+49	1+24	1+58	2.32	2.77	856.25
LRV-SA	1.98	0+33	1+54	1+29	1+58	1.92	2.29	851.36
10B	1.80	0+30	1+ 7	0+42	1+ 8	1.75	2.08	859.58
1/4#CH R=.25	0.20	0+ 3	1+35	1+11	1+19	0.19	0.23	849.03
1/8#CH R=.20	0.15	0+ 2	1+33	1+ 9	1+16	0.15	0.17	849.53
LM	0.00	0+ 0	0+59	0+36	0+45	0.00	0.00	874.91

APOLLO 17   TAURUS LITTROW TRAVERSES

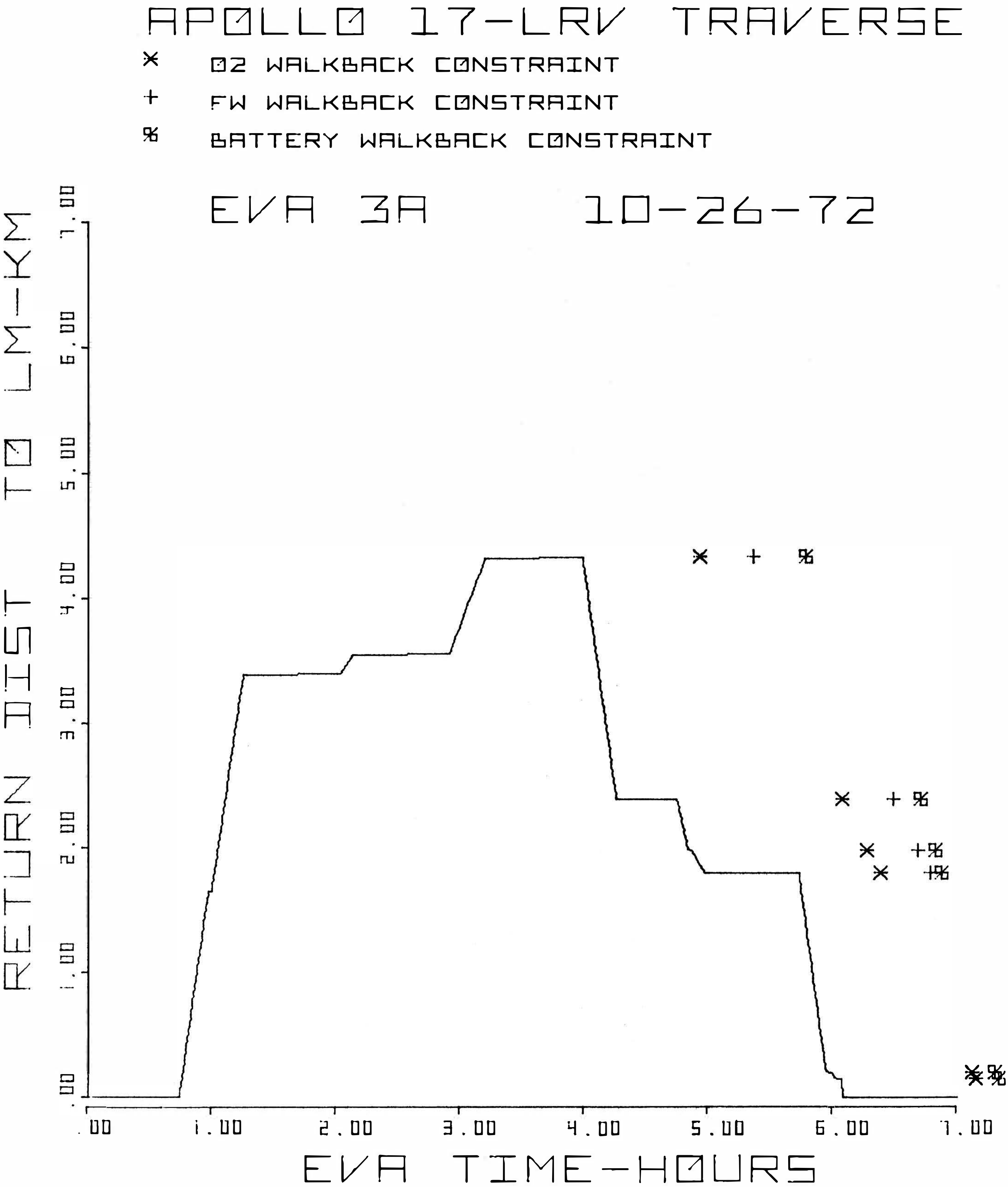
EVA 3B   INPUT DATA   OCT 30 1972

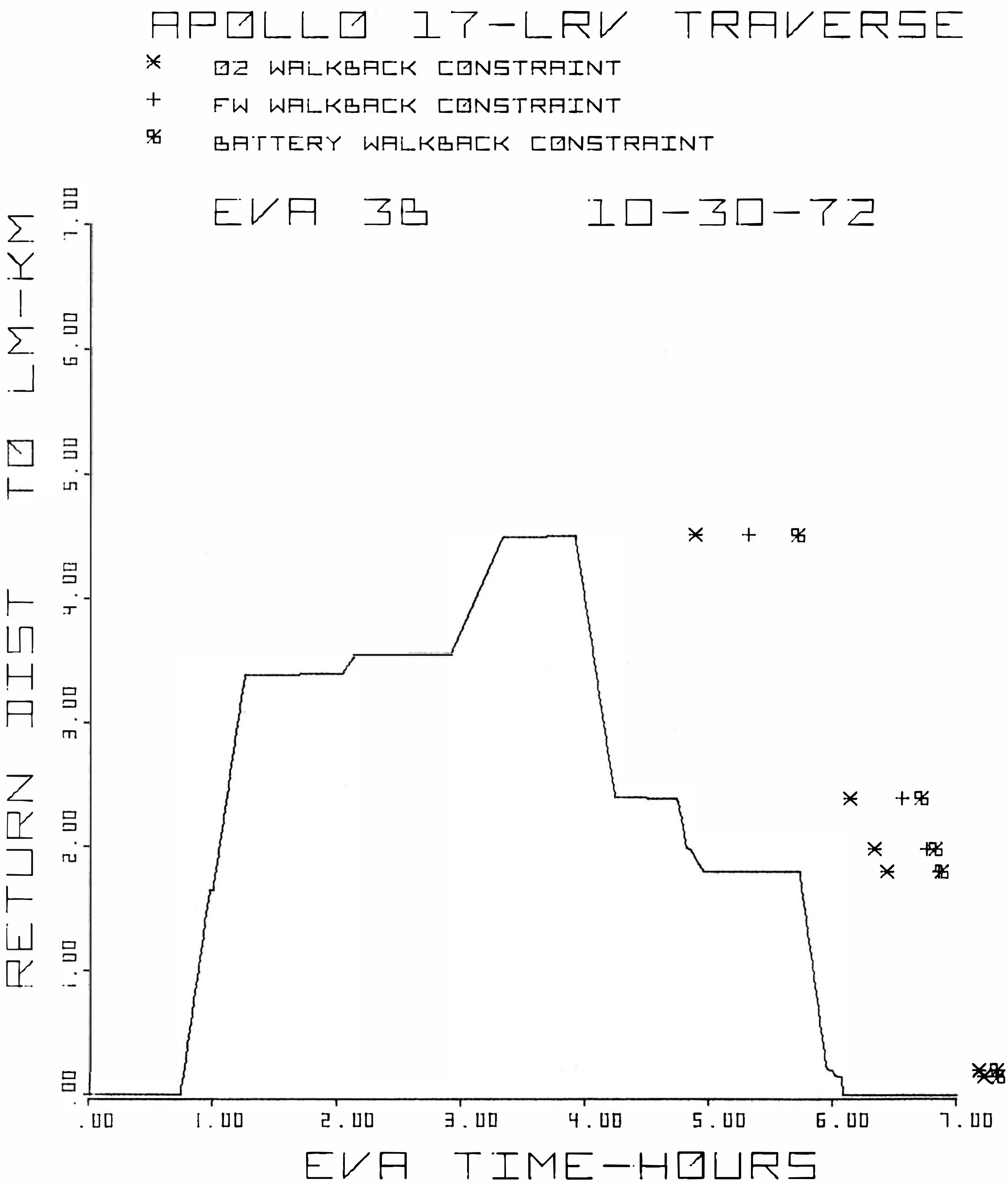
EVA START 162:40 HR:MIN GET

STATION NO	STOP TIME (HR+MIN)	SEGMENT DISTANCE (KM)	RETURN DISTANCE (KM)	HEAT LEAK (BTU/HR)	-MOBILITY RATES- WALK (KM/HR)	RIDE (KM/HR)	MET RATE WALK (BTU/HR)
LM	0+45	0.00	0.00	200.00	****	****	******
LRV-SA	0+ 2	1.63	1.65	200.00	3.60	7.30	1560.0
6	0+47	1.75	3.40	200.00	3.60	7.30	1560.0
7	0+47	0.75	3.56	200.00	3.60	7.30	1560.0
8B	0+35	3.03	4.51	200.00	2.70	7.30	1290.0
9	0+30	2.30	2.39	200.00	3.60	7.30	1560.0
LRV-SA	0+ 2	0.64	1.98	200.00	3.60	7.30	1560.0
10B	0+47	0.73	1.80	200.00	3.60	7.30	1560.0
1/4#CH R=.25	0+ 3	1.60	0.20	200.00	3.60	7.30	1560.0
1/8#CH R=.20	0+ 3	0.05	0.15	200.00	3.60	7.30	1560.0
LM	0+55	0.15	0.00	200.00	3.60	7.30	1560.0

MET RATE ALSEP (BTU/HR)	MET RATE RIDING (BTU/HR)	MET RATE STATION (BTU/HR)	MET RATE LM O/H (BTU/HR)	LEAK RATE O2 (LB/HR)	EVA START (F/W-LB)	EVA START (O2-LB)	OPS TIME (MIN)
1050.00	550.00	950.00	1050.00	0.035	11.29	1.353	61.8

NOTE: OPS TIME IS TOTAL DRIVING TIME AVAILABLE!


APOLLO 17-LRV TRAVERSE
O2 WALKBACK CONSTRAINT
FW WALKBACK CONSTRAINT
BATTERY WALKBACK CONSTRAINT
EVA 3A
10-26-72
RETURN DIST TO LM-KM
EVA TIME-HOURS
.00
1.00
2.00
3.00
4.00
5.00
6.00
7.00


APOLLO 17-LRV TRAVERSE
* O2 WALKBACK CONSTRAINT
+ FW WALKBACK CONSTRAINT
% BATTERY WALKBACK CONSTRAINT
EVA 3B 10-30-72
RETURN DIST TO LM-KM
.00
1.00
2.00
3.00
4.00
5.00
6.00
7.00
EVA TIME-HOURS

SUMMARY OF TRAVERSE OPERATIONS
WITH THE
TRAVERSE GEOPHYSICS EXPERIMENTS

This section discusses only those operations of the traverse geophysics experiments which affect the traverses. Details of deployment procedures and the like are discussed in the Lunar Surface Procedures document. Details of the experiment descriptions and objectives are contained in the Mission Science Planning Document.

Surface Electrical Properties - Data are obtained continuously throughout the traverse portions of EVA 2 and 3 (see figure 17B). The experiment is not operated during EVA 1 because of frequency conflicts with the Lunar Sounder Experiment.

At the beginning of EVA 2, the crew drives as close as practicable to the SEP transmitter (at least within 25 m of it) and begins the traverse by driving westward along the east-west leg of the antenna (within 5 m of that element). It is highly desirable that the first 300 m of the traverse should continue in as near a straight line as possible. At the conclusion of the traverse it is highly desirable that the crew retrace this path for the last 300 m ending up at the same point from which the traverse started.

Similarly, at the beginning of EVA 3, the traverse should originate near the transmitter and proceed northward along the north-south leg of the antenna and continue in as straight a line as possible for the first 300 m. At the conclusion of EVA 3 it is highly desirable that the LRV be driven along any one of the antenna elements into a point near the transmitter.

During the traverse, some thermal management of the receiver may be required to prevent overheating. This will be determined in real time based on temperature readouts by the crew, and will be accomplished by operation of the radiator covers. In addition, it will be necessary to turn off the tape recorder at some of the traverse stations to insure recorder coverage through the end of EVA 3; total coverage available is approximately $9\frac{1}{2}$ hours wehreas the total traverse time on EVA's 2 and 3 is about 10 3/4 hours.

Lunar Seismic Profiling Experiment - Eight seismic charges ranging in explosive size from 1/8 pounds to 6 pounds are deployed during the three traverses. The charges are arranged 4 each on two pallets, only one of which can be carried at a time on the LRV. Each charge has an internal timer which is activated at deployment and counts down over a period from 91 to 94 hours at which time the charge is activated and capable of receiving a command to detonate. Figure 21 shows the location of the charges on the two pallets and their assocated timers.

The eight charges are deployed at different distances from the geophone line (which has been deployed in EVA 1 as part of the ALSEP). Figure 22 shows the nominal location for the deployed charges and figure 23 shows the detailed view of the charge locations in the LM/ALSEP/SEP vicinity. In general, the deployment locations do not coincide with planned traverse stations; the exception is the 3 pound charge on EVA 1 which is deployed at station 1. For the other charges, the plan will be for the LMP to remove the next charge to be deployed from the pallet upon leaving a station, carry the charge in the seat until the planned deployment location is reached and then deploy the charge from the seat without dismounting from the LRV. An allowance of 3 minutes for each such deployment stop is made in the timeline which includes a LRV navigation readout and partial photographic panoramas both of which are requirements for post mission reconstruction of the actual charge location.

The table following figure 23 summarizes the charge deployment plan including the expected time of charge detonation. It is expected that television coverage of the explosions will be available from the camera mounted on the LRV.

Traverse Gravimeter Experiment - Current plans call for a gravity measurement at each of the numbered traverse stations. In addition, gravity measurement will be made at the LM site, the ALSEP area, and in the area of the SEP transmitter. Bias measurements will also be made at the LM site at the beginning and end of each traverse. Early in the first EVA, a determination will be made of the effect of the LRV (if any) on the measurements and the effect of TV camera motion (if any). Based on these results, a final determination will be made as to whether or not to inhibit the TV operation during the readout phase (maximum of 3 minutes 20 seconds) and whether or not the instrument should be removed from its location on the rear pallet and placed on the lunar surface for readings. Plans and procedures will be developed for both options.

Figure 24 shows the location of the traverse gravimeter measurements.

PALLET NO. 2

CHARGE NO.	7	CHARGE NO.	4
CHARGE SIZE	1/2 LB	CHARGE SIZE	1/8 LB
TIMER*	93 HR	TIMER*	91 HR
CHARGE NO.	5	CHARGE NO.	6
CHARGE SIZE	3 LB	CHARGE SIZE	1 LB
TIMER*	92 HR	TIMER	91 HR

PALLET NO. 1

CHARGE NO.	3	CHARGE NO.	8
CHARGE SIZE	1/8 LB	CHARGE SIZE	1/4 LB
TIMER	94 HR	TIMER	94 HR
CHARGE NO.	1	CHARGE NO.	2
CHARGE SIZE	6 LB	CHARGE SIZE	1/4 LB
TIMER	92 HR	TIMER	93 HR

*THESE TIMES ARE THE TIME AT WHICH THE CHARGE BECOMES CAPABLE OF BEING DETONATED. THERE IS A SECOND TIMER ASSOCIATED WITH EACH CHARGE WHICH TIMES-OUT 1 HR EARLIER. THIS SECOND TIMER IS ASSOCIATED WITH THE RE-SAFING MECHANISM IN THE EVENT THE CHARGE IS NOT DETONATED.

Fig. 21 - LSPE Charge/Pallet/Timer Assignments.

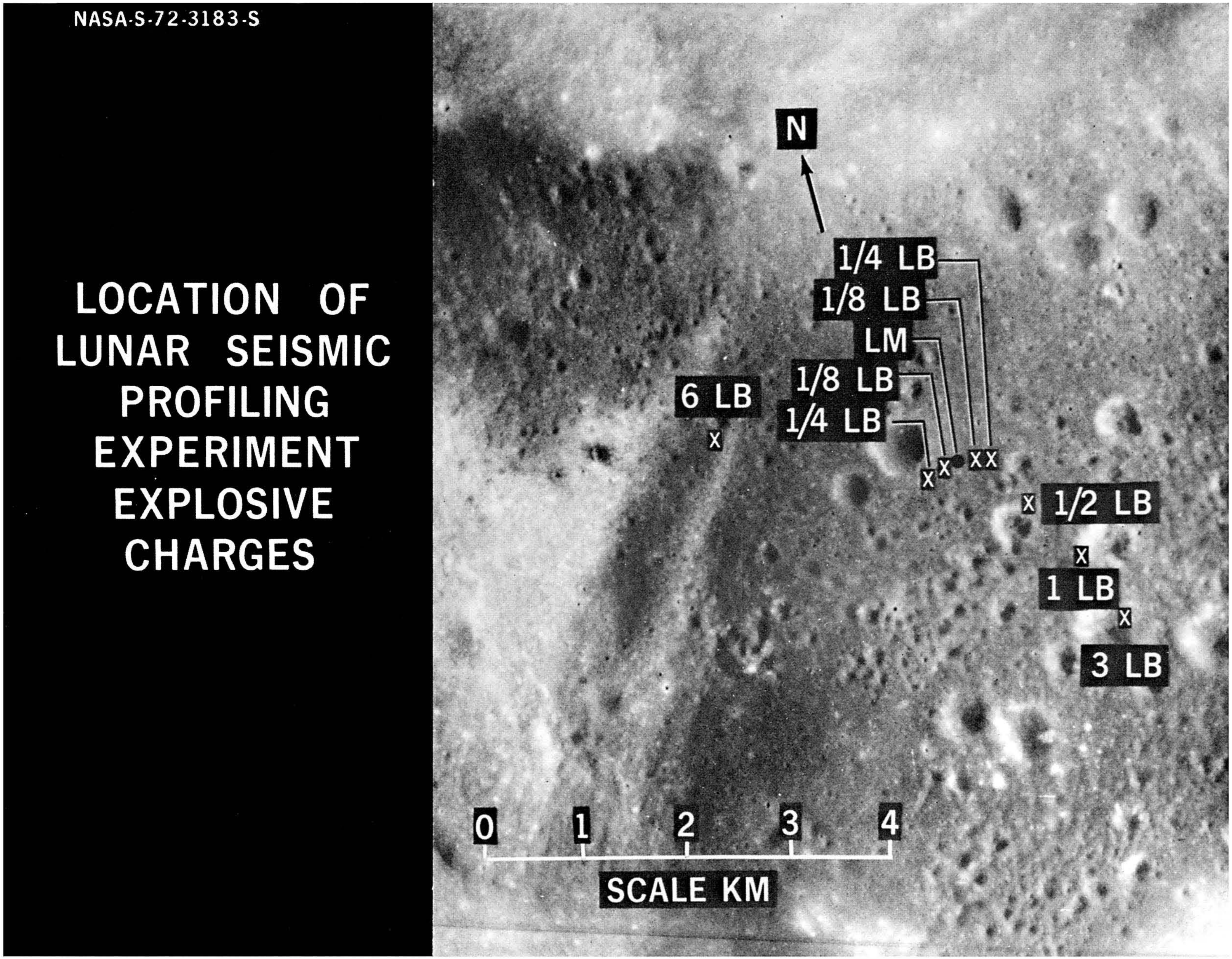

NASA-S-72-3183-S
LOCATION OF LUNAR SEISMIC PROFILING EXPERIMENT EXPLOSIVE CHARGES
N
1/4 LB
1/8 LB
LM
1/8 LB
1/4 LB
6 LB
1/2 LB
1 LB
3 LB
0
1
2
3
4
SCALE KM

Fig. 22 -

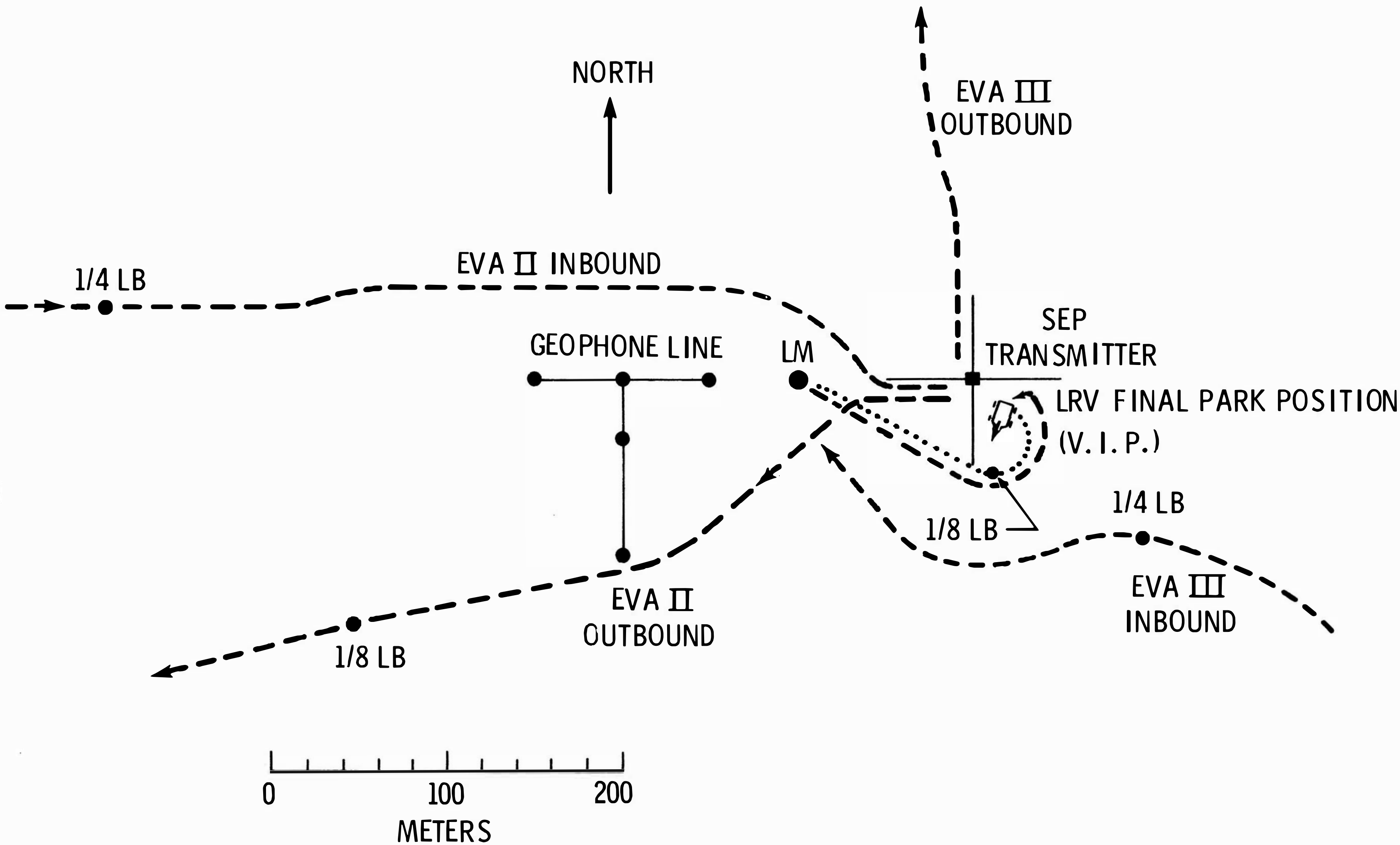


Fig. 23 - Detail of LSPE Charge Deployment Plan in LM Area. The positions indicated for ALSEP geophone line, S.E.P. transmitter, and LRV final park position are minimum distance from LM (~100 m); the separation may be greater. Depending upon this determination in real time, the relative locations of the LRV and S.E.P. transmitter may be somewhat different than pictured.

LSPE EP DETONATION PLAN

EP NUMBER	TRANSPORT MODULE NO.	EP CHARGE SIZE-POUNDS	DEPLOYMENT DISTANCE - KILOMETERS FROM NEAREST GEOPHONES			NOMINAL DEPLOYMENT TIME - HR: MIN		DETONATION TIME*	
			MAX.	MIN.	PLAN.	EVA	EVA TIME	AFTER DEPLOYMENT - HOURS: MIN.	AFTER LM LIFTOFF - HOURS: MIN.
6	2	1	1.3	0.9	1.3	1	4:20	90:45	23:42
5	2	3	2.4	2.0	2.3	1	5:31	91:45	25:53
7	2	1/2	0.9	0.7	.8	1	5:50	92:45	27:12
4	2	1/8	0.2	TBD	.2	2	:57	90:45	42:49
1	1	6	2.7	2.1	2.4	2	5:17	91:45	48:09
8	1	1/4	.38	.20	.25	2	6:12	93:45	51:04
2	1	1/4	.38	.20	.25	3	5:59	92:45	73:21
3	1	1/8	0.2	TBD	.2	3 (after LRV park at V.I.P.)	6:40	93:45	75:02

Note: The times given above are based on the following planned Mission Event GET times:

Landing	113:02
Start EVA 1	116:40
Start EVA 2	139:10
Start EVA 3	162:40
LM Liftoff	188:03
TEI	236:40

*Based on nominal timer; specification allows ± 27 minutes tolerance.

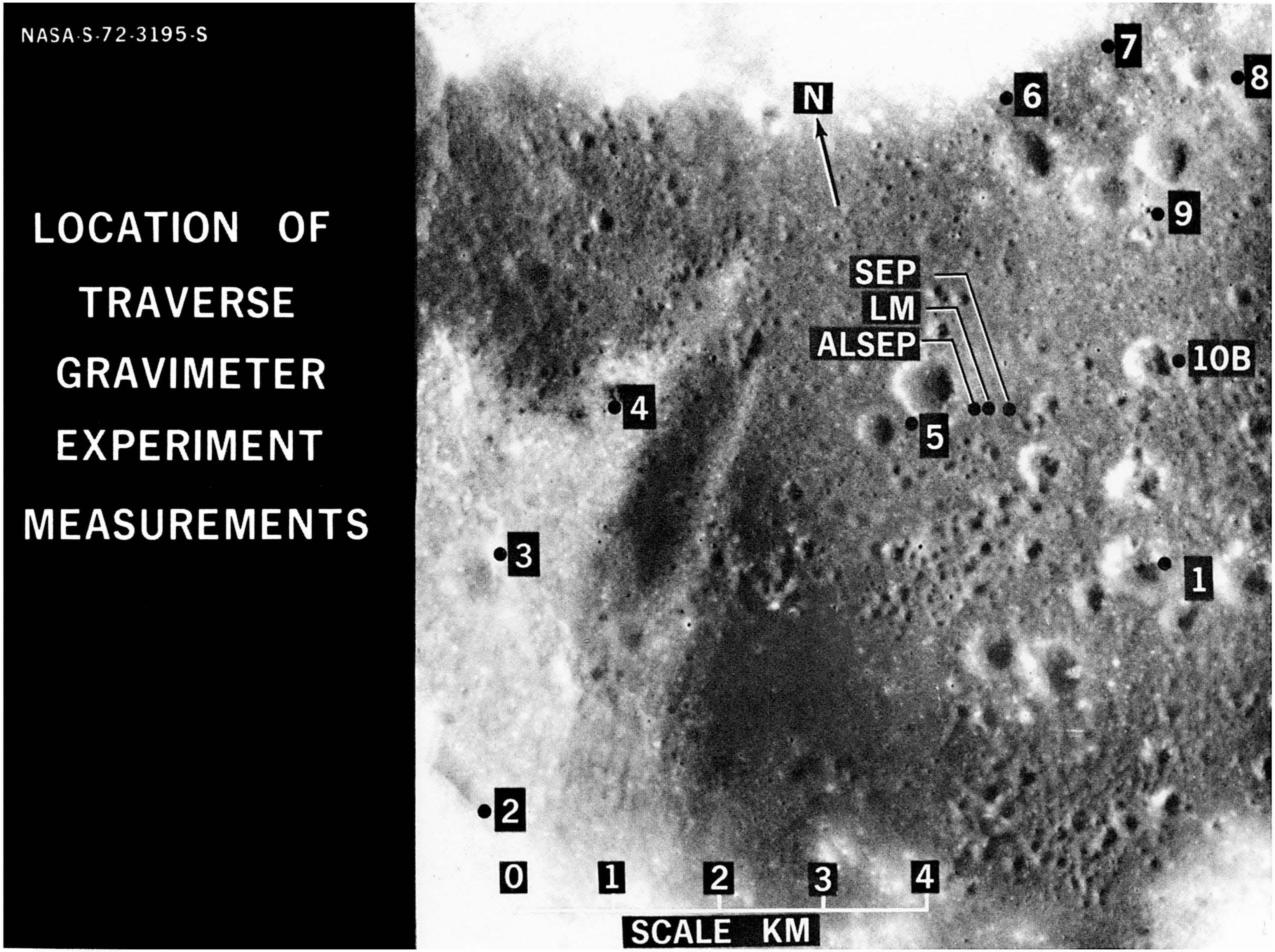

NASA-S-72-3195-S
LOCATION OF TRAVERSE GRAVIMETER EXPERIMENT MEASUREMENTS
N
SEP
LM
ALSEP
1
2
3
4
5
6
7
8
9
10B
0
1
2
3
4
SCALE KM

Fig. 24

CONTINGENCY PLANNING

In order to expedite publication of the changes to the nominal traverses, the contingency planning summary will be issued in a special supplement.

APPENDIX 1

APOLLO 17

TRAVERSE PLANNING PARAMETERS

NOVEMBER 1972

(NO CHANGE FROM 2ND EDITION)

JUNE 1972

EVA TRAVERSE PLANNING PARAMETERS

The purpose of this appendix is to provide a summary reference source for primary data used in lunar surface traverse planning. These data are those that have been generally concurred with for use in current lunar surface operations planning and study. Officially approved data for each mission ultimately appear in the Apollo Spacecraft Operational Data Books, Flight Mission Rules and the Flight Plan. Prior to that time, these EVA traverse planning parameters will be updated periodically through the Lunar Surface Operations Planning Meetings.

Primary lunar surface traverse planning data presented herein are categorized for each reference with the organization and person responsible for the data indicated at the bottom of each page, along with the official data source reference.

APOLLO 17 PLANNING PARAMETERS

1. Crewmen Parameters

1.1 Metabolic Rates[1], $\dot{Q}_M$

a. Riding on LRV 550 Btu/Hr

b. Working

(1) Overhead and ALSEP Activities 1050 Btu/Hr

(2) Geological Station Activities 950 Btu/Hr

c. Contingency Walking

Duration	Walking Speed[2] (Average) Over Uncorrected Map Distance	Metabolic Rate Including 20-Percent Uncertainty
Up to 1 Hour Total Return Time	3.6 Km/Hr	1560 Btu/Hr
Return Requiring Over 1 Hour	2.7 Km/Hr	1290 Btu/Hr

d. Normal Walking (Average)

2.5 Km/Hr, Uncorrected Map Distance, 1000 Btu/Hr

1.2 Respiratory Quotient 0.90

1.3 Time in Pressurized PGA[3]

Uninterrupted time in a pressurized PGA should be limited to 7 hours of nominal EVA.

Responsible Organization: Medical Operations Division/DD

Point of Contact: J. F. Zieglschmid, MD; Ext. 42
[2]R. G. Zedekar/CG3; Ext. 3091

Official Data Sources: [1]SODB, Vol. II, LM Data Book, Part 1, Table 4.3-2, page 4.3-13

[3]SODB, Vol. IV, EMU Data Book, Operational Constraints and Limitations, page 3.2-3, EPG-11

2. PLSS Parameters

2.1 PLSS Battery

a.	Battery Capability		25.4 Amp-Hours
b.	Battery Voltage		16.8 Volts dc
c.	TM Usable		20.92 Amp-Hours
	(1) Pre-EVA Checkout	1.2 Amp-Hours	
	(2) Post-EVA Reserve	1.43 Amp-Hours	
	(3) TM Inaccuracy	1.85 Amp-Hours at 7.6 Hours	
d.	Usage Rate		2.7 Amps

Responsible Organization: Crew Systems Division/EC

Point of Contact: J. L. Gibson; Ext. 2352

Official Data Sources: SODB, Vol. IV, EMU Data Book, EMU Consumables Tables 4.0-3A and 4.0-3B

2. PLSS Parameters (Continued)

2.2 Primary Oxygen Supply

		(EVA 1)	(EVA 2 or 3)
a.	POS Bottle Volume	378 Cu In.	
b.	Full Charge	1432 Psia @ 70°F 1.860 Lb (Z = 0.9485)	1395 Psia @ 70°F 1.810 Lb (Z = 0.950)
c.	EMU Pressurization	70 Psia 0.091 Lb	
d.	LM Repress	25 Psia 0.031 Lb	
e.	TM Inaccuracy	48 Psia 0.060 Lb	
f.	Minimum Regulation Pressure	145 Psia 0.180 Lb	
g.	O_2 Reserve at Normal Working Rate	76 Psia 0.095 Lb	
h.	Total Usable O_2	1.403 Lb	1.353 Lb

2.3 EMU O_2 Leak Rates

a. EVA 1 0.020 Lb/Hr

b. EVA 2 0.028 Lb/Hr

c. EVA 3 0.035 Lb/Hr

Responsible Organization: Crew Systems Division/EC

Point of Contact: J. L. Gibson; Ext. 2352

Official Data Sources: SODB, Vol. IV, EMU Data Book, EMU Consumables Tables 4.0-3A and 4.0-3B, and Mission Appendix

2. PLSS Consumables (Continued)

2.4 O_2 Usage Rate — $1.627 \times 10^{-4} (\dot{Q}_M)$ + EMU Leak Rate

2.5 PLSS Feedwater

a. Feedwater Loading			11.90 Lb
(1) Main Tank	8.50 Lb		
(2) Aux. Tank	3.40 Lb		
b. Transport Loop Makeup (EVA 1 only if PLSS launched with feedwater)			0.13 Lb
c. Non-Expellable			0.09 Lb
d. Slave Water			0.63 Lb
e. Usable Leftover Slave Water (EVA 2 or 3)			0.30 Lb
f. Reserve at Normal Working Rate			Provided by slave water and thermal inertia
g. Heat of Sublimation			1038 Btu/Lb
h. Usable Feedwater		(EVA 1)	(EVA 2 or 3)
		10.86 Lb 11,273 Btu	11.29 Lb 11,719 Btu

Responsible Organization: Crew Systems Division/EC

Point of Contact: J. L. Gibson; Ext. 2352

Official Data Sources: SODB, Vol. IV, EMU Data Book, EMU Consumables Tables 4.0-3A and 4.0-3B, and Mission Appendix

2. PLSS Parameters (Continued)

2.6 EMU Heat Leak, $\dot{Q}_{hl}$[1]

EVA	I	II	III
T=0 Launch	0 RLP*	+135 RLP*	+200 RLP*
T+24 Launch	TBD	TBD	TBD

*RLP - Rough Lunar Plain

2.7 Feedwater Usage Rate[2]

a. Cooling Rate, $\dot{Q}_T = 1.26\ \dot{Q}_M + 153\ \text{Btu/Hr} + \dot{Q}_{hl}$

b. Feedwater, $\dot{W}_{H_2O} = \dfrac{\dot{Q}_T}{1038\ \text{Btu/Lb}\ H_2O}$

2.8 PLSS LiOH Capability[3]

a. Nominal Loading

(1) Total CO_2 Absorption, No Thermal Soak — 10,900 Btu

(2) Total CO_2 Absorption, Thermal Soak — 8,400 Btu

b. Usage Rate — Crew Metabolic Rate

Responsible Organization: Crew Systems Division/EC

Point of Contact: J. L. Gibson, Ext. 2352

Official Data Sources:

[1]SODB, Vol. IV, EMU Data Book, EMU Heat Leaks, Figure 4.0-1 and Mission Appendix

[2]SODB, Vol. IV, EMU Data Book, page 4.5-66, Figure 4.5-44

[3]SODB, Vol. IV, EMU Data Book, EMU Consumables, Tables 4.0-3A and 4.0-3B

3. BSLSS/OPS

3.1 OPS[1]

a.	OPS Bottle Volume	322 Cu In.
b.	Full Charge	5.75 Lb at 5880 Psia
c.	Residual	
	(1) High Purge	0.706 Lb at 500 Psia -40°F
	(2) Low Purge	0.411 Lb at 300 Psia -40°F
	(3) Makeup	0.106 Lb at 100 Psia 64°F
d.	Usable	
	(1) High Purge	5.04 Lb
	(2) Low Purge	5.34 Lb
	(3) Makeup	5.64 Lb
e.	Lifetime	
	(1) High Purge	39 Minutes
	(2) Low Purge	79.5 Minutes

3.2 BSLSS[2]

a.	BSLSS Hookup Time Required[3]	5 Minutes
b.	Emergency LM Ingress Time[3]	13 Minutes
c.	Time Limit for Walk-back to LRV (Ops Low Purge) for BSLSS Hookup	10 Minutes

---

Responsible Organization: Crew Systems Division/EC

Point of Contact: J. L. Gibson; Ext. 2352
[3]R. G. Zedekar/CG3; Ext. 3091

Official Data Sources: [1]SODB, Vol. IV, EMU Data Book, EMU Consumables Tables 4.0-3A and 4.0-3B, Figure 4.6-5

[2]SODB, Vol. IV, EMU Data Book, Section 4.7, page 4.7-1

4. Lunar Roving Vehicle

4.1 LRV Mobility Rate for Premission Planning	7.3 Km/Hr
4.2 LRV Emergency Return Speed	Not to exceed 9.2 Km/Hr for premission planning; actual value to be assessed in real time over outgoing leg of traverse.

Responsible Organization: MSFC

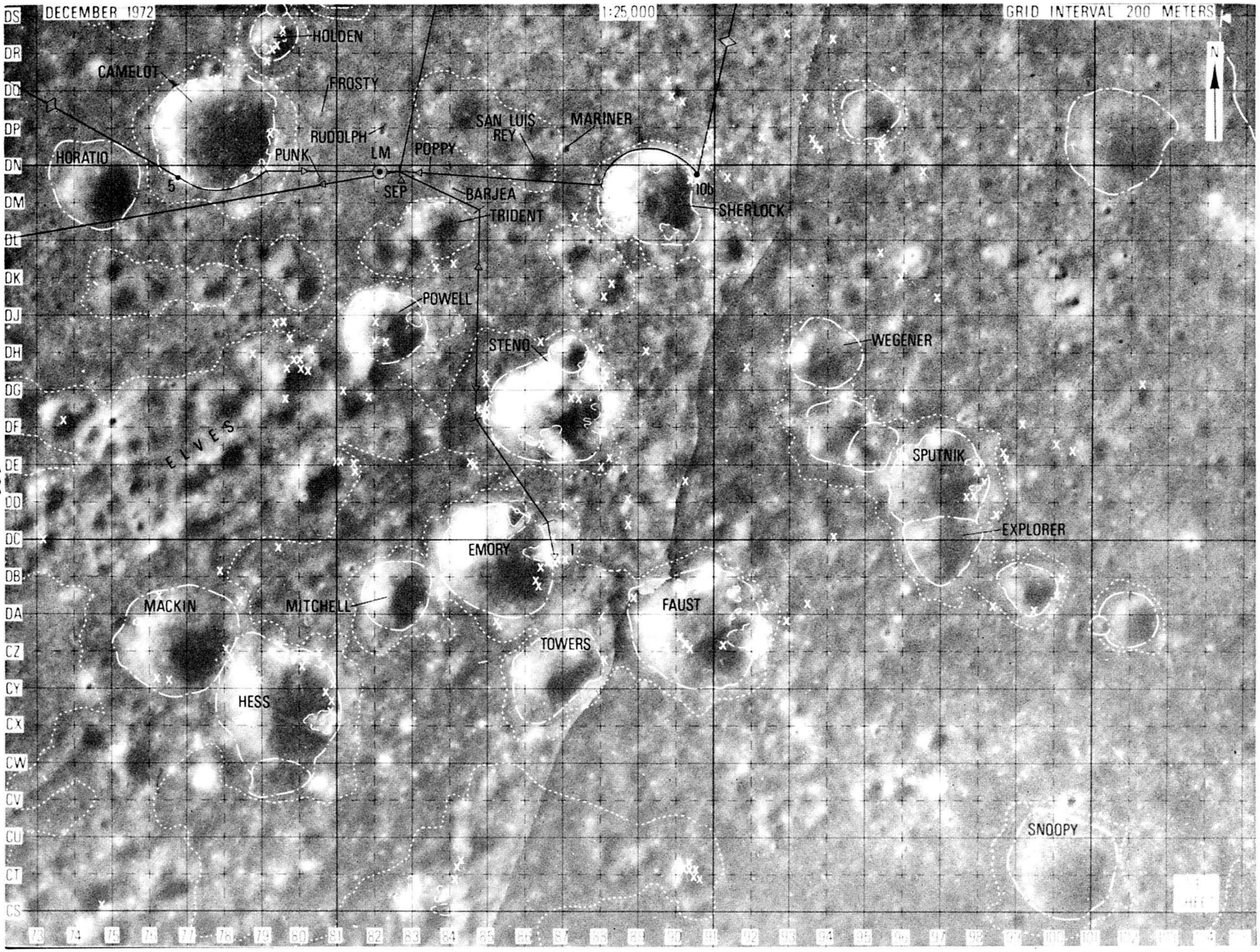
Point of Contact: D. Arnett

Official Data Sources: LRV Operations Data Book

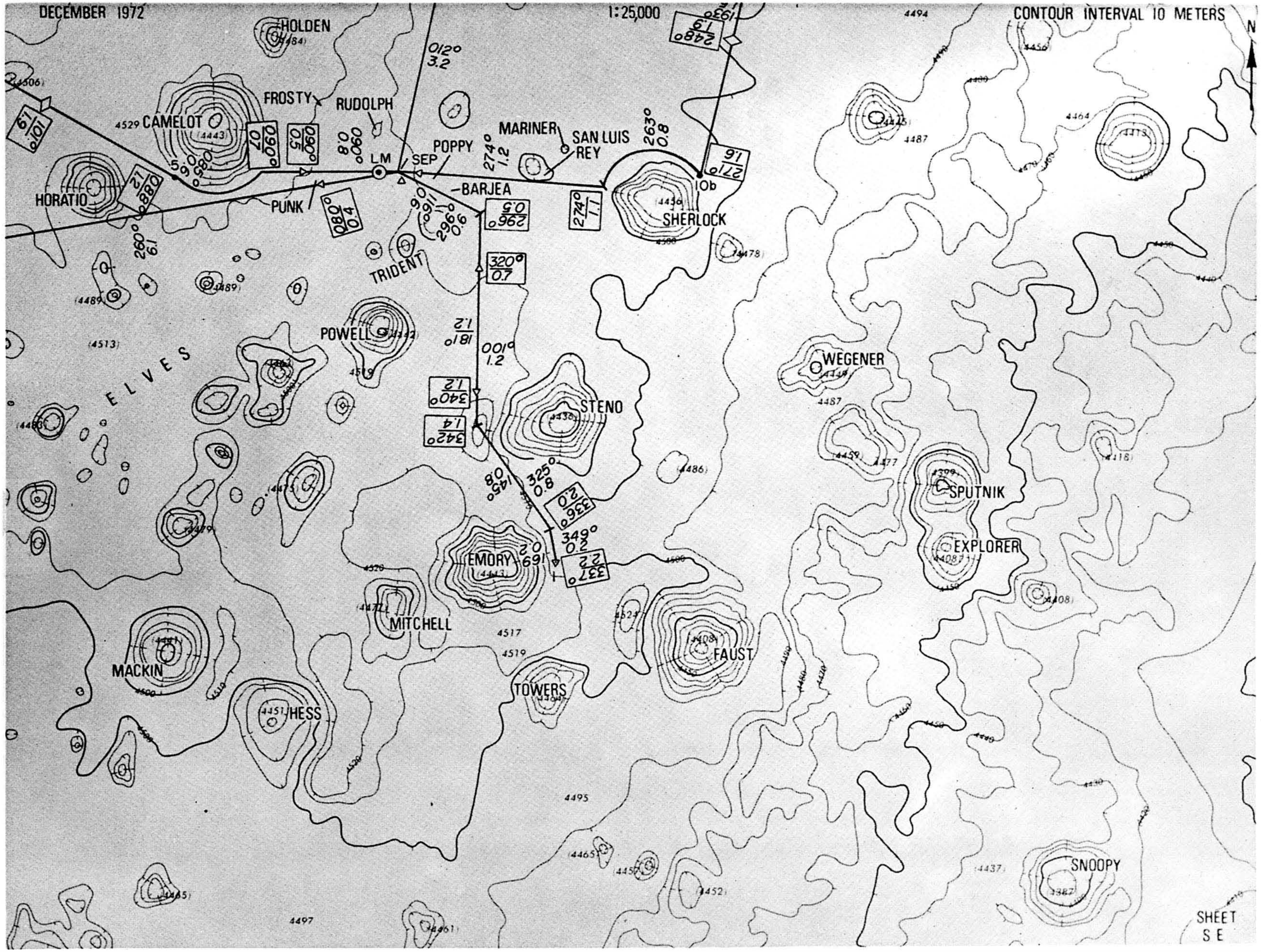
APPENDIX 2

ONBOARD TRAVERSE MAPS

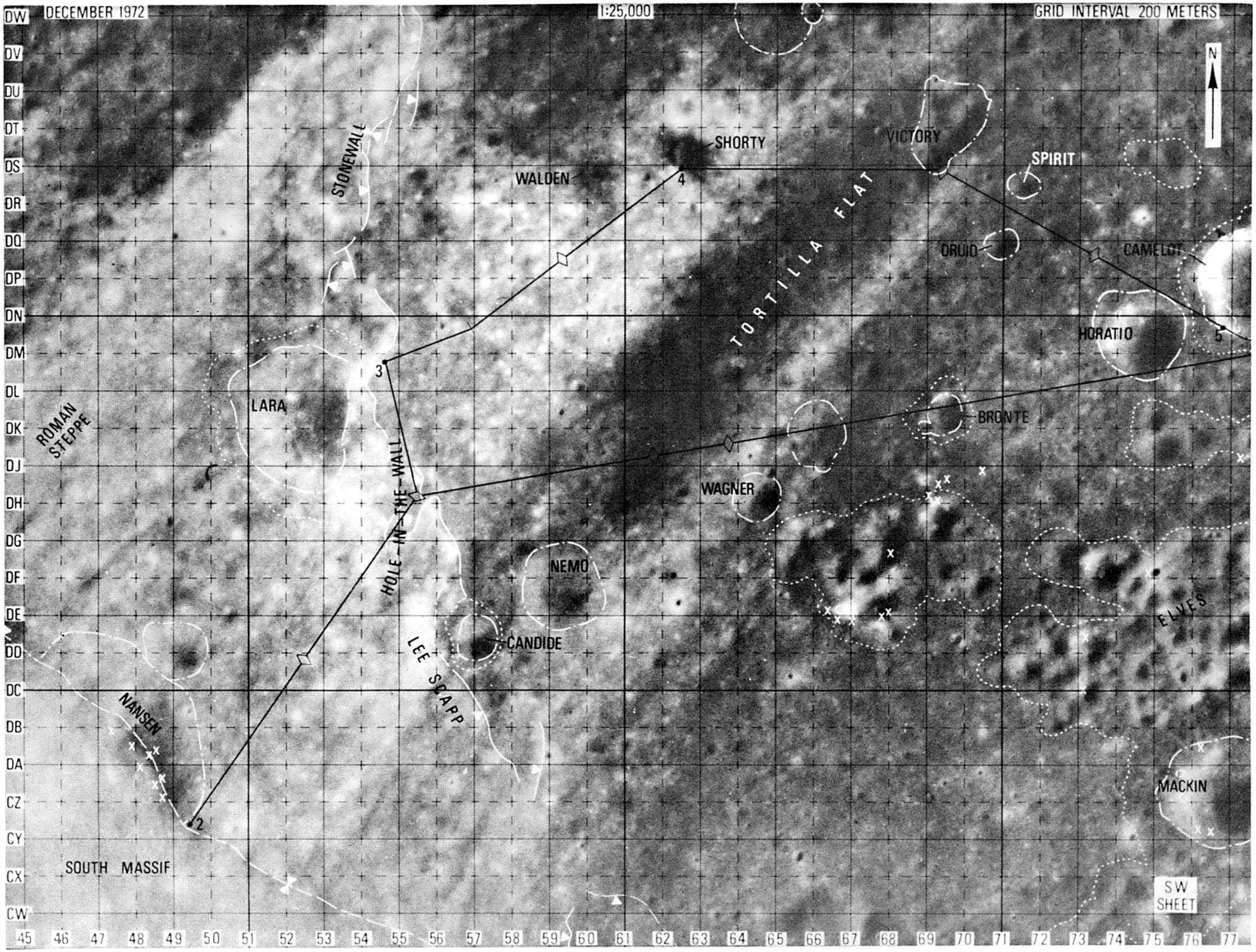
NASA
S-72-52081



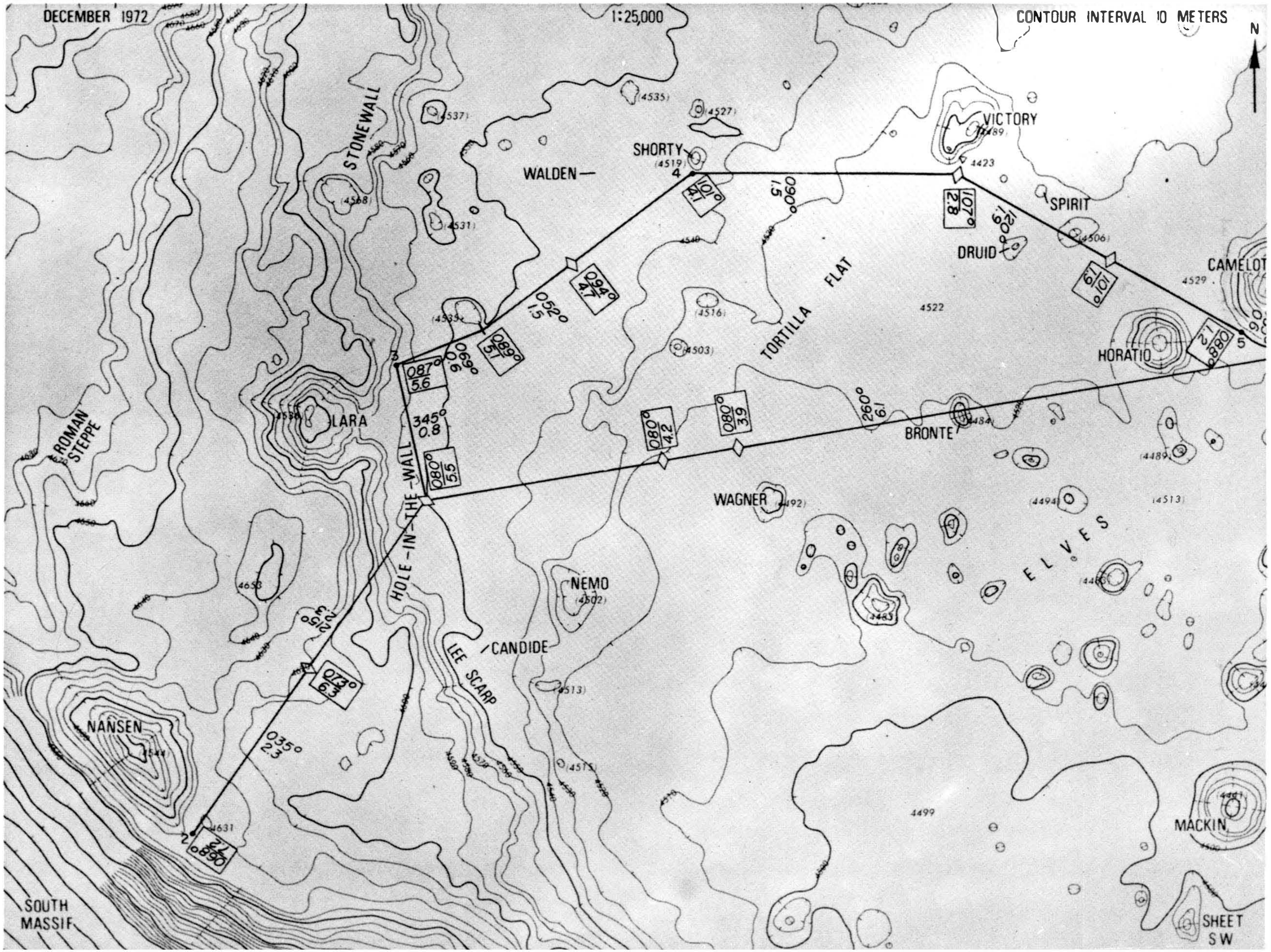
NASA
S-72-52085



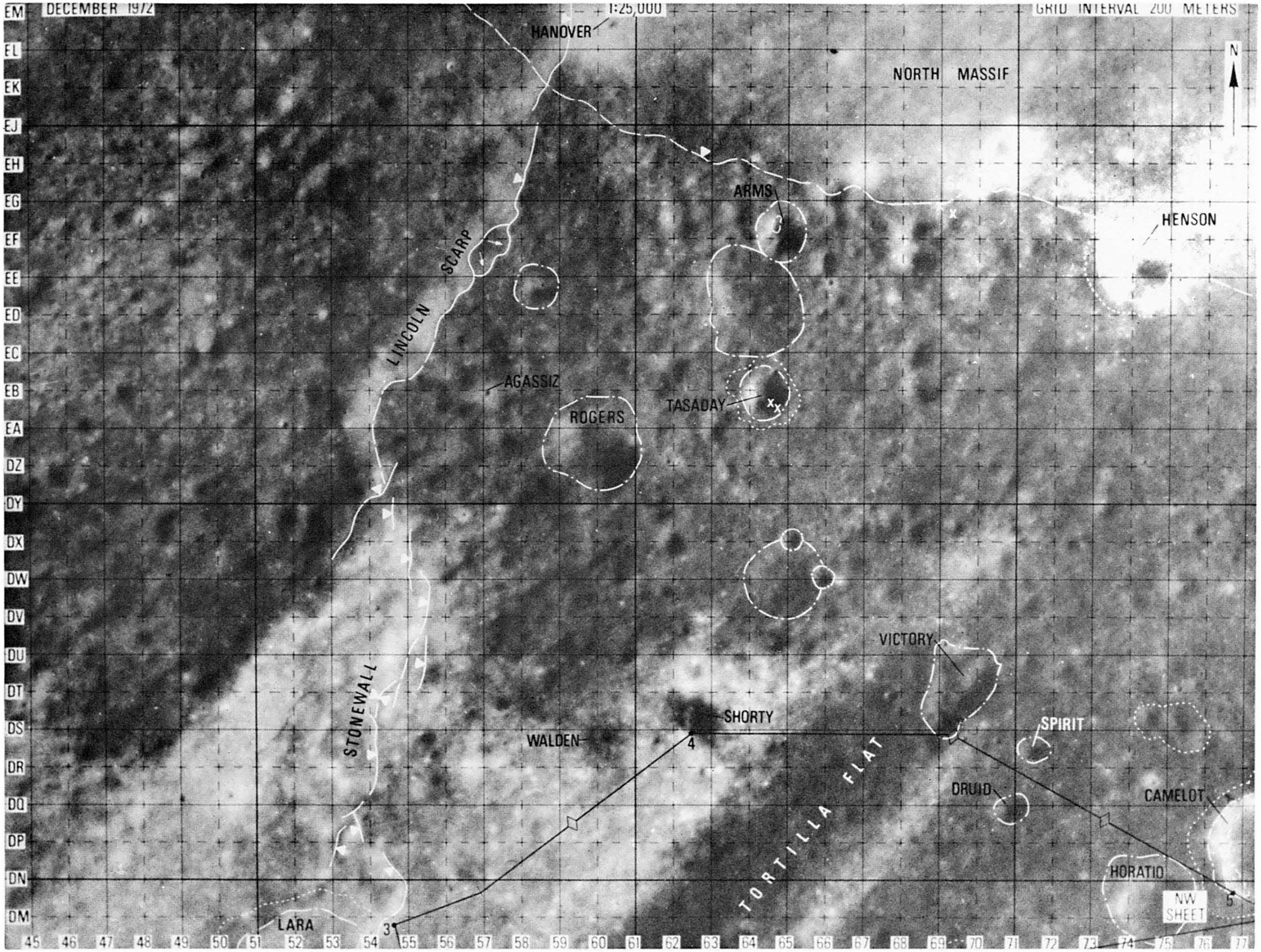
NASA
S-72-52084



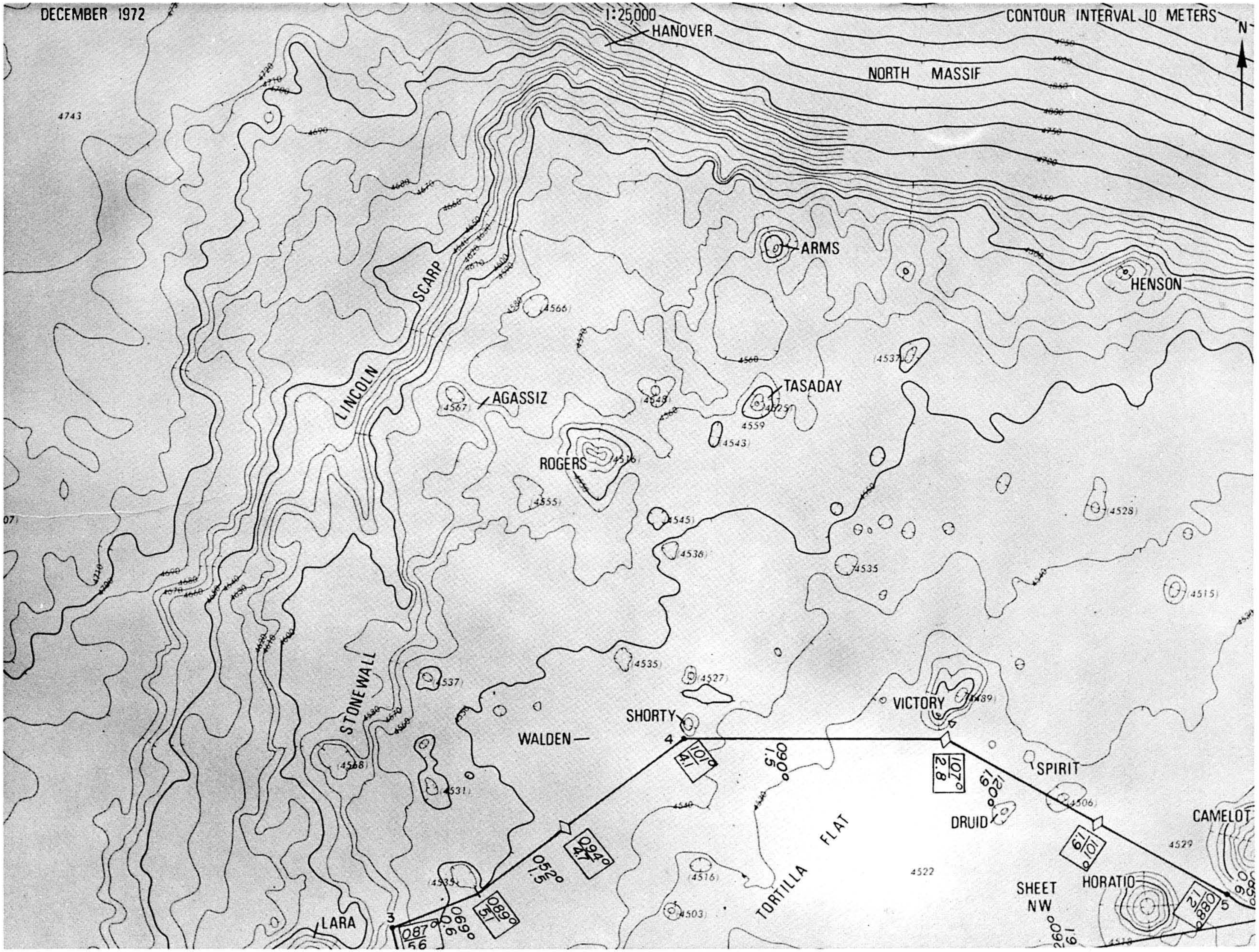
NASA
S-72-52082



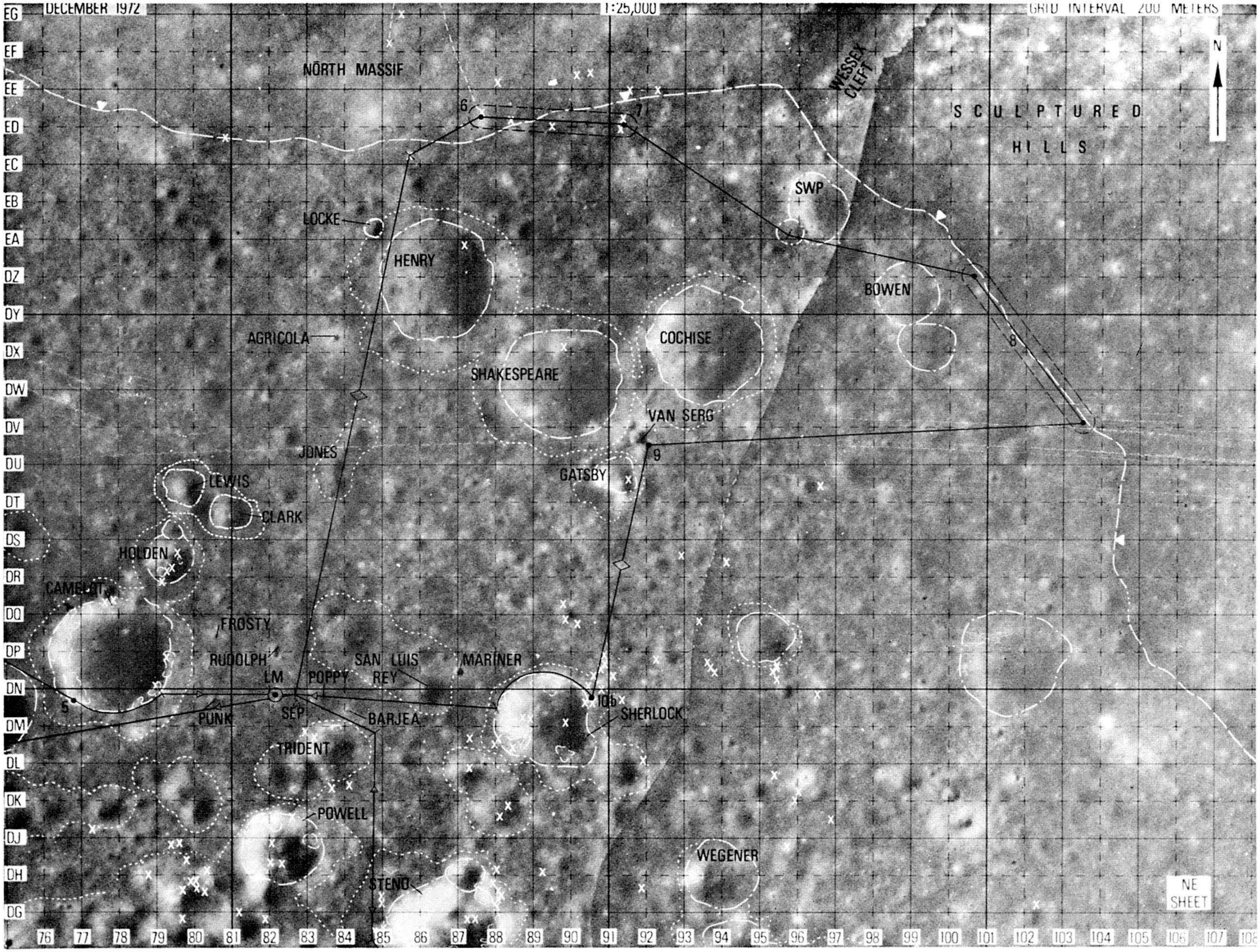
NASA
S-72-52078



NASA
S-72-52079



NASA
S-72-52083



NASA
S-72-52080