National Aeronautics and Space Administration
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SOVIET PRESS COMMUNIQUES AND THE PRAVDA EDITORIAL ON "LUNA-9" SOFT LANDING ON THE MOON

10 FEBRUARY 1966

SOVIET NEWSPAPER HEADLINES 4 FEBRUARY 1966

"PRAVDA"

SOVIET STATION "LUNA-9" ON THE MOON !

Communiqué "TASS" :

NEW PROMINENT ACHIEVEMENT OF SOVIET SCIENCE AND TECHNOLOGY

On 3 February 1966 at 21 45 hours 30" Moscow time, the automatic station "LUNA-9", launched on 31 January, effected a softlanding on the Moon surface in the region of the Ocean of Storms (Oceanus Procellarum) to the west of Reiner and Mariy craters.

The radio communication with the station located on the Moon's surface is steady. The transmission is conducted at 183.539 Mc/s. The onboard apparatus of the station operates normally. The next radio communication session will take place from 00 00 hours to 00 15 hours Moscow time on 4 February 1966.

5 FEBRUARY 1966

Communiqué "TASS" : LUNA-9 CONDUCTS THE REPORTING

After a successful completion of soft landing on the Moon's surface a reliable radio communication has been established with the station Luna-9. On 4 February four sessions of radio communications were held, with a total duration of 3 hours 20 minutes.

During these sessions telemetry information was obtained, which confirmed the normal functioning of its apparatus. On command from Earth on February 4 at 04 50 hours Moscow time, the station Luna-9 began the scanning of the lunar landscape and the transmission of its image to Earth. The information thus obtained is processed and studied.

The successful completion of the program of the station Luna-9 is the result of sequential fulfillment of the plan of Moon investigation, as projected.

The alternate radio communication sessions with the station Luna-9 will take place on 4 February from 18 40 hours and on 5 February from 04 00 hours Moscow time.

Translated from "PRAVDA" and "KOMSOMOL'SKAYA PRAVDA", of 4 and 5 February 1966.

A. L. Brichant - Contract No.NAS-5-3760
(Limited release)

"PRAVDA" 6 FEBRUARY 1966

"TASS" Communiqué

LUNA-9 PURSUES THE SCANNING OF THE LUNAR SURFACE

The station "LUNA-9", located at the point of lunar surface with coordinates 7 degrees 8 minutes N.L. and 64 degrees 22 minutes W.longitude, continues to fulfill the projected program of Moon investigation.

The radio communication session, having taken place on 4 February at 18 30 to 19 55 hours Moscow time, the station transmitted to Earth a circular panorama of lunar landscape. Moreover, on radiocommand transmitted from the ground center of space communications, a detailed examination of separate portions of Moon's surface was conducted at scientists' choice.

The quality of images received on Earth is good. The information received is being analyzed by scientists and will be published in the nearest future.

On 5 February at 04 00 hours a communication session took place, which consisted in the reception of telemetered information from the probe. It has shown that the station's parameters (pressure, temperature, voltage of feeding sources and so forth) stand within preassigned limits. The next session is marked for 5 February at 19 00 hours Moscow time.

This session will mark the completion of the projected program of Moon investigation with the help of the automatic station "LUNA-9".

FROM "PRAVDA" EDITORIAL OF 6 FEBRUARY 1966

GREAT ACIEVEMENT OF MANKIND

(EXCERPTS)

A soft landing on the Moon — celestial body devoid of atmosphere, is one of the most difficult problems of astronautics. Because of absence of atmosphere on the Moon the space probe's decelaration prior to landing may be performed only by a retrorocket and is linked with the requirement of considerable fuel reserve on board, constituting about one half of the weight of the probe prior to deceleration.

At soft landing, the guidance and braking must be so regulated that the velocity of its motion be lowered to zero immediately prior contact with the Moon's surface. This requires a special soft-landing radiosystem and a corresponding high-precision motion guidance system.

The processing of the soft landing of automatic lunar stations will allow the solution of numerous problems of obtaining data on the physical conditions on the Moon, the properties of its surface and relief, which are not attainable by optical and radioastronomical methods. In particular the latter do not provide the possibility of determining the mechanical properties of the lunar soil and of establishing the presence of dust cover.

These data, required prior to manned flights to the Moon, can only be obtained by landing on the Moon unmanned automatic scientific stations.

The station "LUNA-9" consists of three basic parts: the automatic lunar station proper, having to achieve a landing sufficiently soft to allow all its instrument package preserving its operational capability; a system of engines designed to effect trajectory corrections and braking prior to landing; instrument compartments. Part of the apparatus, of no use during deceleration, is placed in two suspended compartments, separating directly prior to blast off the retrorocket.

The automatic station proper constitutes a hermetically-sealed container where the airborne radiosystem is placed, and also the temporal-programming device, the thermoregulating system, the scientific apparatus etc. The station is provided with a television system allowing circular scanning with transmission of lunar landscape image to the ground.

The body of the station includes: antennas, automatically opening after the lunar station has touched the ground, an amortization system, designed to soften the impact at time of contact with the lunar surface and metallic petals, preserving the television system from possible shocks at landing and rendering the position of the station on the Moon's surface steadier (see drawing).

The motive installation consists of a rocket engine with a pumping system of fuel feed, required for flight stabilization during engine operation, and fuel tanks.

The guidance compartments include a complex of gyroscopic and guiding devices, electron-optical installations for in-flight orientation of the probe, a system of orbit radio-control, a temporal-programming device, a soft-landing radiosystem, feed sources and microengines of the orientation system .

From the standpoint of construction, the connection of the automatic station with the motive installation and guidance compartments is conceived in such a fashion that at the instant preceding touchdown, the lunar station separates and descends on the side of the point at which the motive installation has landed.

The weight of the station after its bringing to Moon flight trajectory constituted 1 583 kg.

The flight of Luna-9 is schematized in Figs. 1 and 2. The following peculiarities are characteristic of that scheme :

- first stage : Luna-9 is placed into orbit of an AES with the aid of the carrier rocket; it includes the rocket block designed for the subsequent acceleration from the orbit;

- second stage: firing of the acceleration rocket block so as to bring Luna-9 into the flight trajectory to the Moon;

- third stage: trajectory correction assuring the encounter of Luna-9 with the Moon surface in the region of the earlier-marked planar part of the Oceanus Procellarum;

— fourth stage : deceleration and soft landing on the Moon.

The choice of the date — January 31,1966 was timed to onset of lunar morning in the region of Oceanus Procellarum. The temperature and the conditions of operation of the radiotechnical apparatus are most favorable during the lunar morning. At time of landing the Sun was at 3° over the horizon.

The coincidence of the lunar morning onset in the Oceanus Procellarum region with a relatively high position of the Moon above the terrestrial equatorial plane had a fairly great significance. The latter condition assures sufficiently long intervals of Moon's radiovisibility from the territory of the Soviet Union.

The orbit to which Luna-9 was brought is characterized by the following parameters : perigee at 173 km, apogee at 225 km and the orbit inclination to the equatorial plane near 52°.

Starting from the guarantee of probe's maximum weight, the flight duration was chosen near 3.5 days

The aggregate fuel consumption, and consequently the weight of the station's payload, depend on energy consumption on acceleration from the orbit, on motion trajectory correction and on consumptions on the deceleration at Moon's surface.

As the flight duration from Earth to Moon decreases, the consumption for the acceleration at the Earth and deceleration at the Moon increases Thus, for example, for a flight duration of 3.5 days, it is necessary to amortize a velocity of 2 600 meters/sec, while for a flight duration of 2.5 days, the velocity to amortize is 2 800 m/sec. On the other hand, when fuel consumption is curtailed at accelaration near the Earth and deceleration near the Moon, its consumption for trajectory correction is increased, for the influence of errors of bringing the lunar trajectory to deflection.

The putting into orbit of Luna-9 and then into the trajectory to the Moon took place on 31 January. Subsequent trajectory measurements from the ground during the following night revealed that it would carry the probe approximately 10 000 kilometers away from the center of the Moon. Accordingly, initial data were computed by ground command for the correction; these were coded for tranfer on board on 1 February and applied on command from the ground, all subsequent operation of the various systems being carried out automatically, according to the foreseen on-board automation program.

At the beginning the correction was performed with the aid of an optical system and micro-engines and directed at the Sun. Subsequently, while still oriented at the Sun an optical search for the Moon took place in such a way that the axis of the motive installation be in a plane perpendicular to the direction at the Moon. The position of the optical telescope of the astro-orientation system relative to probe's body was assigned by command from the ground and so chosen that the axis of the engine occupy the required posture.

Upon the end of orientation the motive installation was switched on on 1 February 1966 at 22 29 hours. The engine cutoff was performed by the guiding system after communicating to the station the preassigned correction velocity.

As a result of correction the motion velocity of Luna-9 changed in the direction required by 71.2 m/sec, while the corrected trajectory began passing practically through the computed landing point in the region of Oceanus Procellarum.

In order to ensure the preassigned landing precisions, high accuracies were required in the performance of correction. Thus, the deflection in the magnitude of the correction velocity by 0.1 m/sec would entail a deflection of 10 — 15 km on the Moon's surface. The velocity vector deflection in a plane perpendicular to the direction at the Moon by 1 angular minute would lead to about the same deflections of the landing point.

After completion of correction from ground measurement points, new measurements' session were performed, which corroborated the high precision of the correction.

Data for soft landing were computed by the results of trajectory measurements in the coordination-computation center, that is the value of the braking impulse, the tuning of the astroorientation system and the correction for the initial time of retrorocket operation. The initial data for conducting the deceleration session were transmitted on board on 3 February by 16 00 hours.

Alongside with this the information on the readiness for operation and the functioning of airborne systems, temperature regime of the station and pressure in its various compartments was telemetered. The orientation of the station required for materializing the deceleration was done in advance about one hour prior to landing, by way of construction of the lunar vertical by optical means.

Properties of a hyperbolic trajectory pencil were then utilized: if the height of engine switching on is preassigned, there must exist for that height a distance from the center of the Moon (about 8 500 km), over which thedirection at the center of the Moon coincides with the required thrust direction at the beginning of deceleration. It should be noted that this distance does not practically depend on the value of the deflection of the real from the computed trajectory.

At a specific moment of time, corresponding to the height of about 8 300 km, both, the station and the motive installation were oriented strictly along the lunar vertical. Then this direction was preserved for about one hour with the help of optical tracking devices of the Sun and the Earth, until the wear of the decelerating motive installation.

It is essential that the orientation method applied on Luna-9 prior to deceleration assures the autonomous initial orientation of the engine axis along the velocity vector.

At the height of about 75 km above the Moon, and 48 seconds prior to landing, the braking motive installation was switched on at command of the radar altimeter. Before that 2 compartments with instruments not used over the landing portion were separated. During engine operation the amortization system was readied for landing. The system allowed velocity deceleration from 2 600 m.sec to a few meters/s at small altitude above the lunar surface.

At time of reaching the lunar surface the automatic station was separated from the motive installation with its amortization system and landed nearby. The lunar station descended on the surface of the Moon on 3 February 1966 at 21 45 hours and 30 seconds.

Antennas opened up 4 minutes and 10 seconds after the landing, and thus began the first radio transmission from the Moon. The scanning of the Moon began on 4 February at 04 50 hours on command from Earth, transmitting the images back.

[The Tass communiqués related the sequences of the various sessions of radio communication].

The point of landing near the Oceanus Procellarum (Ocean of Storms) has the coordinates 7° 08' N.lat. and 64° 22' W. long.

The Oceanus Procellarum is the largest of "maria" formations on the surface of the Moon. It lies on the western borderline zone of the visible hemisphere (see Fig. 3).

The fundamental types of superficial structures of the Moon are two : - clear, crater-carved continental massifs, and dark, comparatively uniform and smooth "maria" areas. But if we speak in terms of craters with diameters of less than 500 meters, their number in "maria" and "continents" is practically identical.

The landing of "Luna-9" took place to the west of craters Marius (diameter 41 km) amd Reiner (diameter 30 km). Situated also near the place of landing are the Cavalieri and Galilee craters, respectively of 64 and 16 km in diameter. The greatest crater in the landing area is Hevel, with its 118 km diameter.

The selected, typically "marine" landing area, is in many respects characteristic and offers unquestionable interest for a detailed research, of which the results may be widely used in subsequent space experiments.

[Follow all sorts of considerations concerning the impact of the Soviet achievement on the future of manned investigations of the Moon].

It is well known that certain terrestrial atmosphere components, such as ozone, water vapor, carbon dioxide, absorb a great part of the radiation originating from other heavenly bodies. The most important information that would allow the study of physical processes on other heavenly bodies, does not reach the Earth. Even in the radioband where the component of the terrestrial atmosphere are sufficiently transparent, there is a comparatively narrow "transparency" window" beyond which the terrestrial ionosphere reflects the radiation originating from outer space.

From the astronomical viewpoint an observatory on the Moon would be in exceptionally favorable conditions. The absence of atmosphere would not only eliminate the absorption, but would also prevent the images from flickering and trembling. Much greater magnifications could be used on the Moon than they can on Earth, and moreover, the conditions of observations would be quite different. Indeed, the time of complete revolution of the Moon around its axis is 650 hours, so that more than 300 hours would be available for the study of heavenly bodies above the horizon during the lunar night.

The absence of atmosphere would also eliminate the bright background and render possible the study of stars and planets during the lunar day.

Space security services for subsequent manned flights could be installed on the Moon observatory and, at the same time, studies of solar X-ray, UV and corpuscular emissions could be carried out.

Every branch of astronomy would find interest in the observations from such a space observatory: the radioastronomy for the cosmic and galactic radio emissions and supernova outbursts, while the investigations of the Milky Way and other objects would be of great importance to stellar astronomy. No less important for astronautics would be the astrometric work in refining the basic astronomical constants, in constituting catalogues, charts, and so forth.

The scientific bases on the Moon would allow the initiation of an entirely new method of studying the Earth. We might, in the first place, state the problem of investigation of our planet's radio emission regime, the seasonal variations of its brightness, the system photographing of the Earth. The meteorological services would obtain information on the entire terrestrial hemisphere at once, and this would include such difficult regions as the oceans and the polar basins. The data relayed by the Earth's artificial satellites could not provide such a global picture. The lunar observatory would greatly contribute to weather forecasting on Earth.

It is interesting to note that objects of a few meters' dimensions, that is, hundreds and thousands times tinier than those that could be observed on the Moon by the very same instruments from Earth, will be observable on the Moon. At the same time, the quality of the image seen in a telescope installed on the Moon will be very high, inasmuch as the terrestrial atmosphere, constantly moving and full of dust, is in direct proximity to the object of observation — the terrestrial surface.

A very particular spot would be occupied by the study of the Moon itself, that is, of the physical conditions of its surface, of the structure of its soil, by conducting seismical, gravitational and magnetic prospecting searching for useful minerals, and a large-scale mapping.

The study of the development of lunar formations would be of great importance for the theory of origin of the solar system. The absence of atmosphere and of free water resulted in the preservation in their original form of the oldest, multimillion years' formations.

The conditions on the Moon, particularly on its surface, are very favorable for vacuum and electronic techniques. Indeed, vacuum exists there boundlessly.

Attractive possibilities open up also in the fields of biology and medecine. What would be the behavior of animals and plants under the conditions of small gravitational pull?

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The realization of soft landing on the Moon is an outstanding victory for the Soviet science and technology, which, after the launching of Sputnik I the first manned space flight, and the first emergence of an astronaut from a spacecraft, constitutes the most important stage in the mastering of space.

**** THE END ****

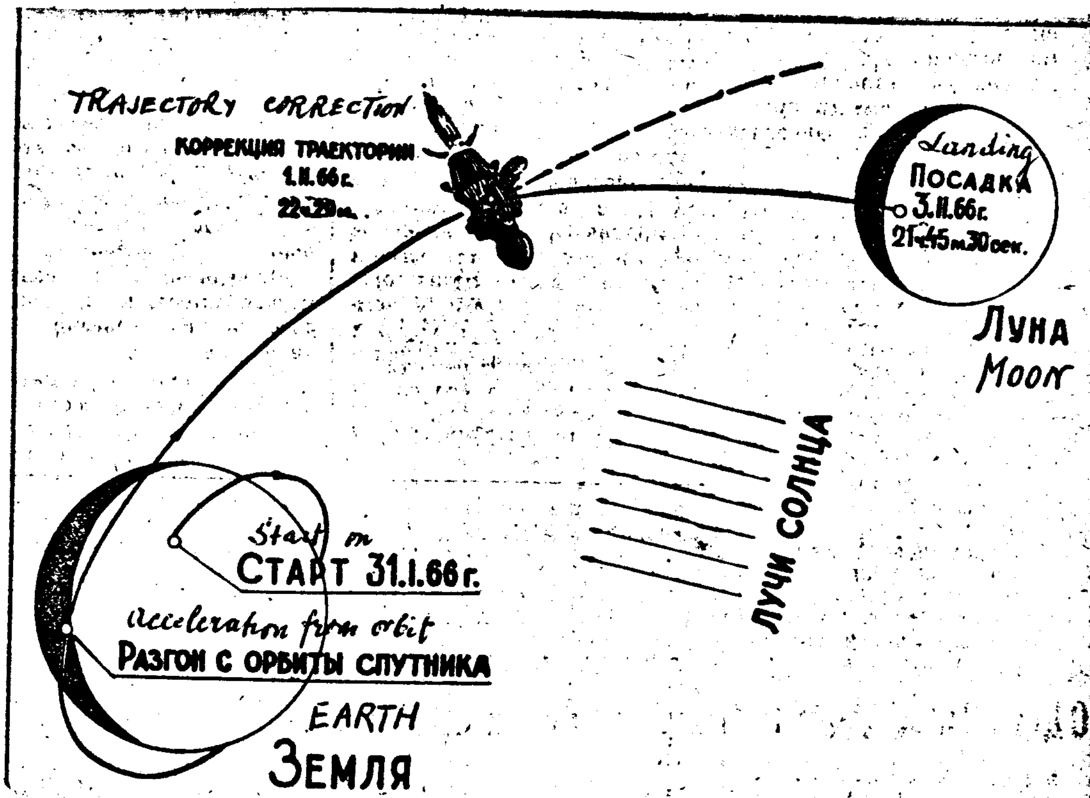


Рис. 1. Схема полета автоматической станции «Луна-9».

Fig. 1.- Sketch of the flight of LUNA-9. -

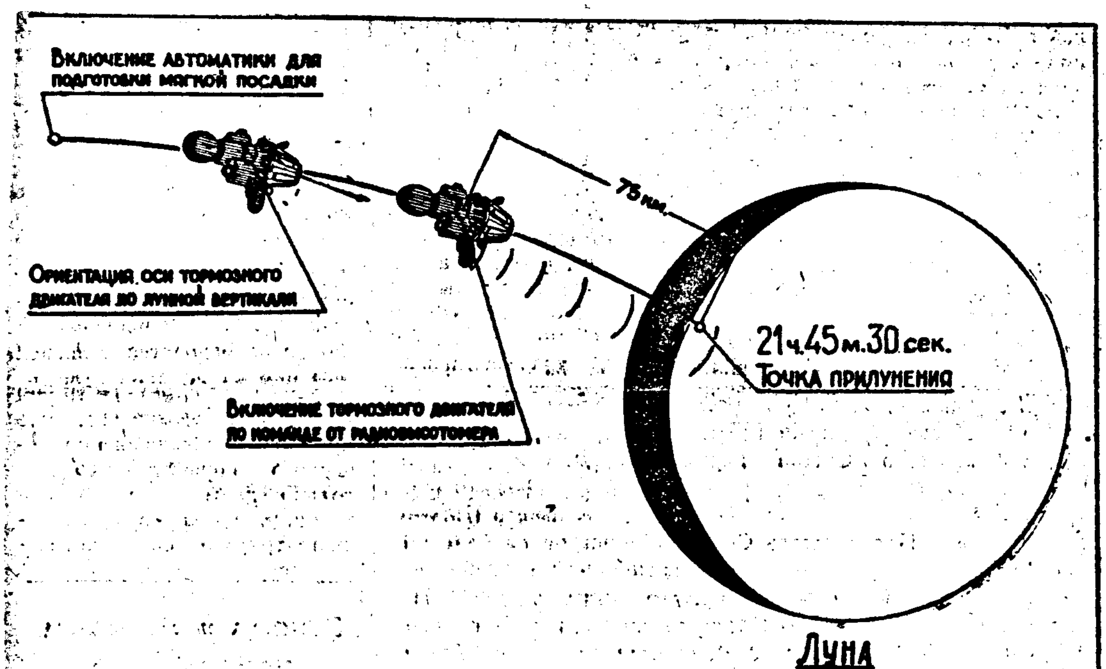


Рис. 2. Схема полета автоматической станции «Луна-9» на участке торможения 3.II.1966 г.

Fig. 2 - Sketch of the deceleration portion of the flight of LUNA-9.

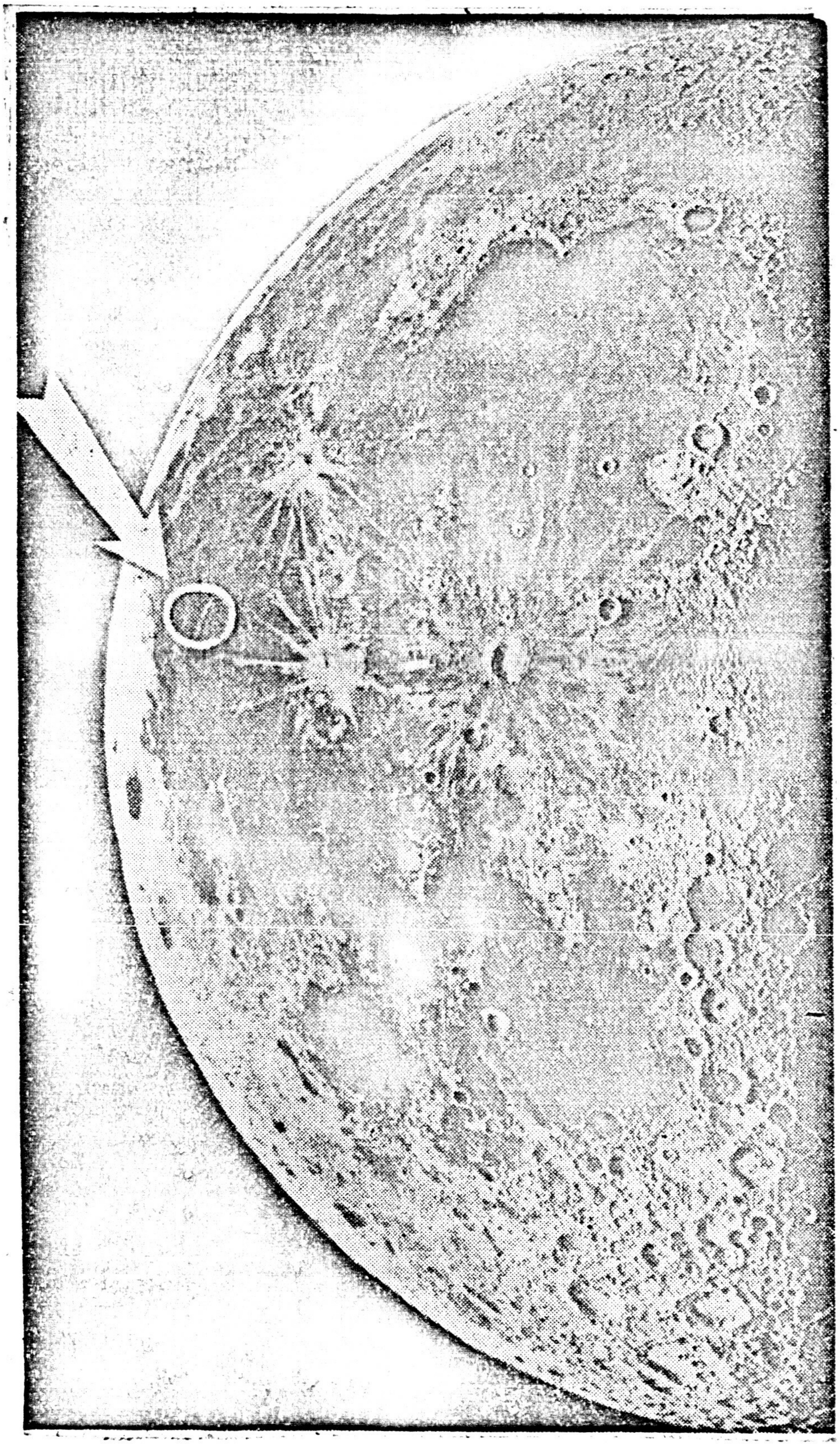


Fig. 3

Point of impact of Luna-9 at soft landing on Feb, 3, 1966

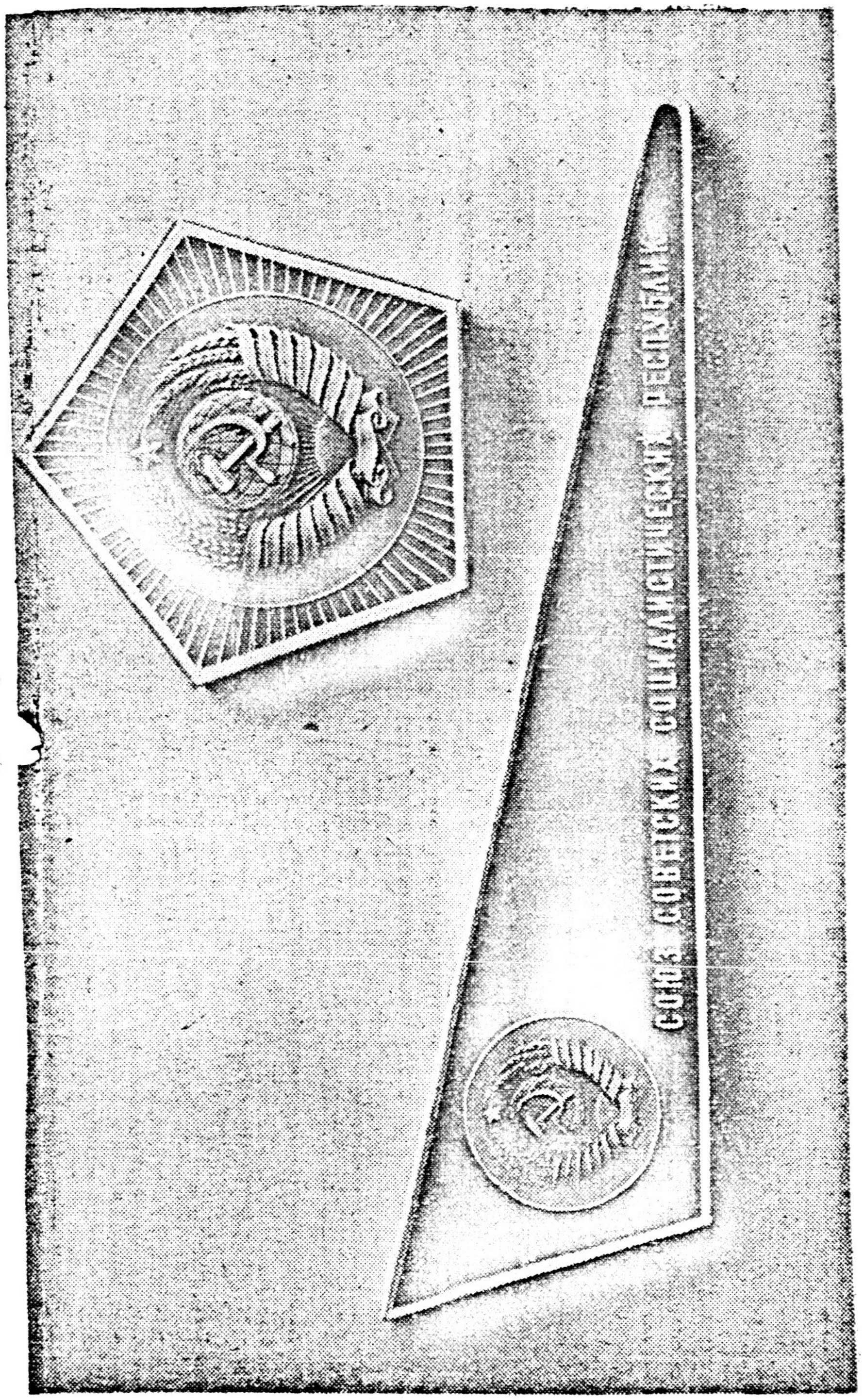


Fig. 4

Pennant with Soviet insignia soft-landed on the Moon by LUNA-9

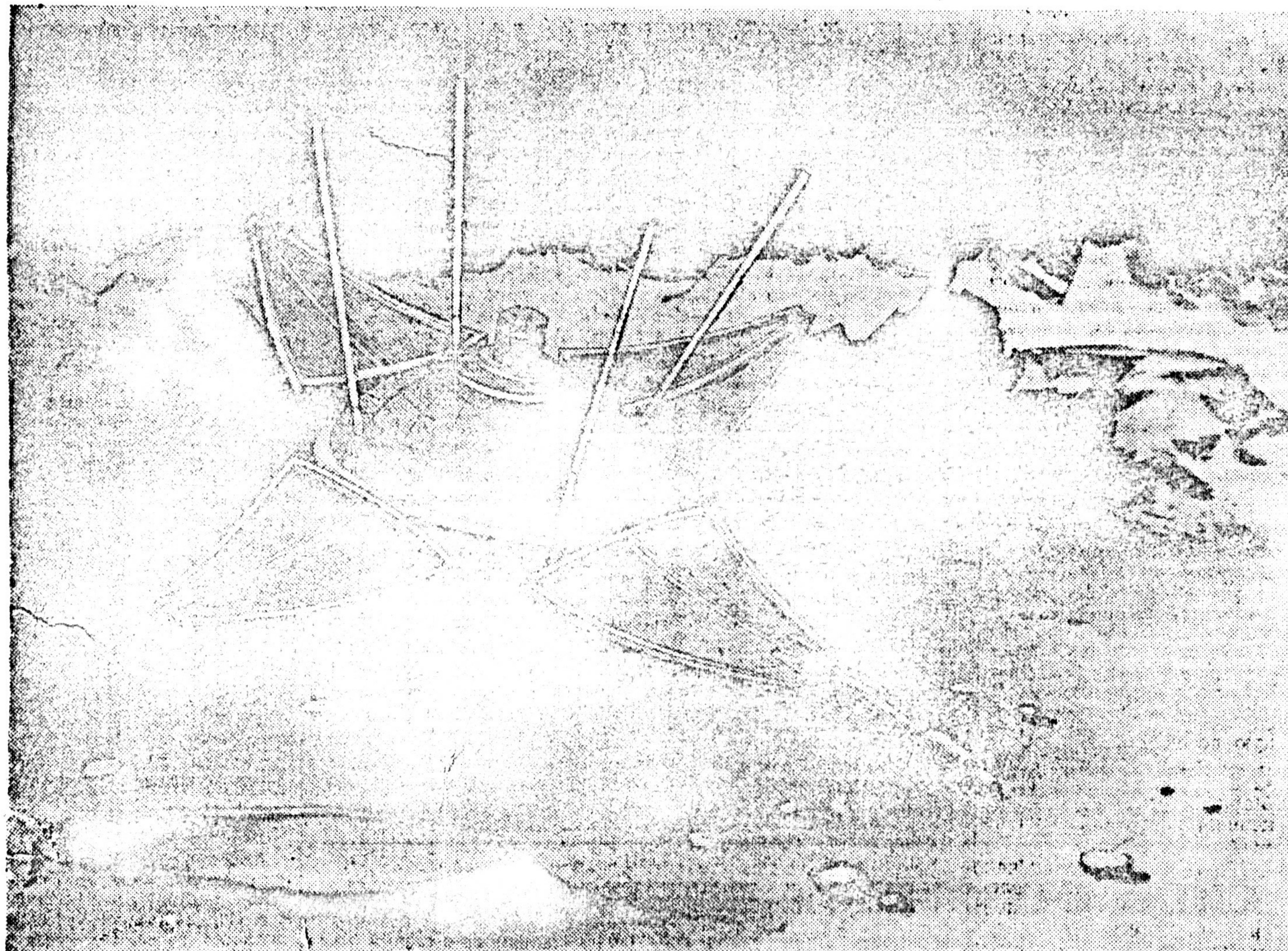
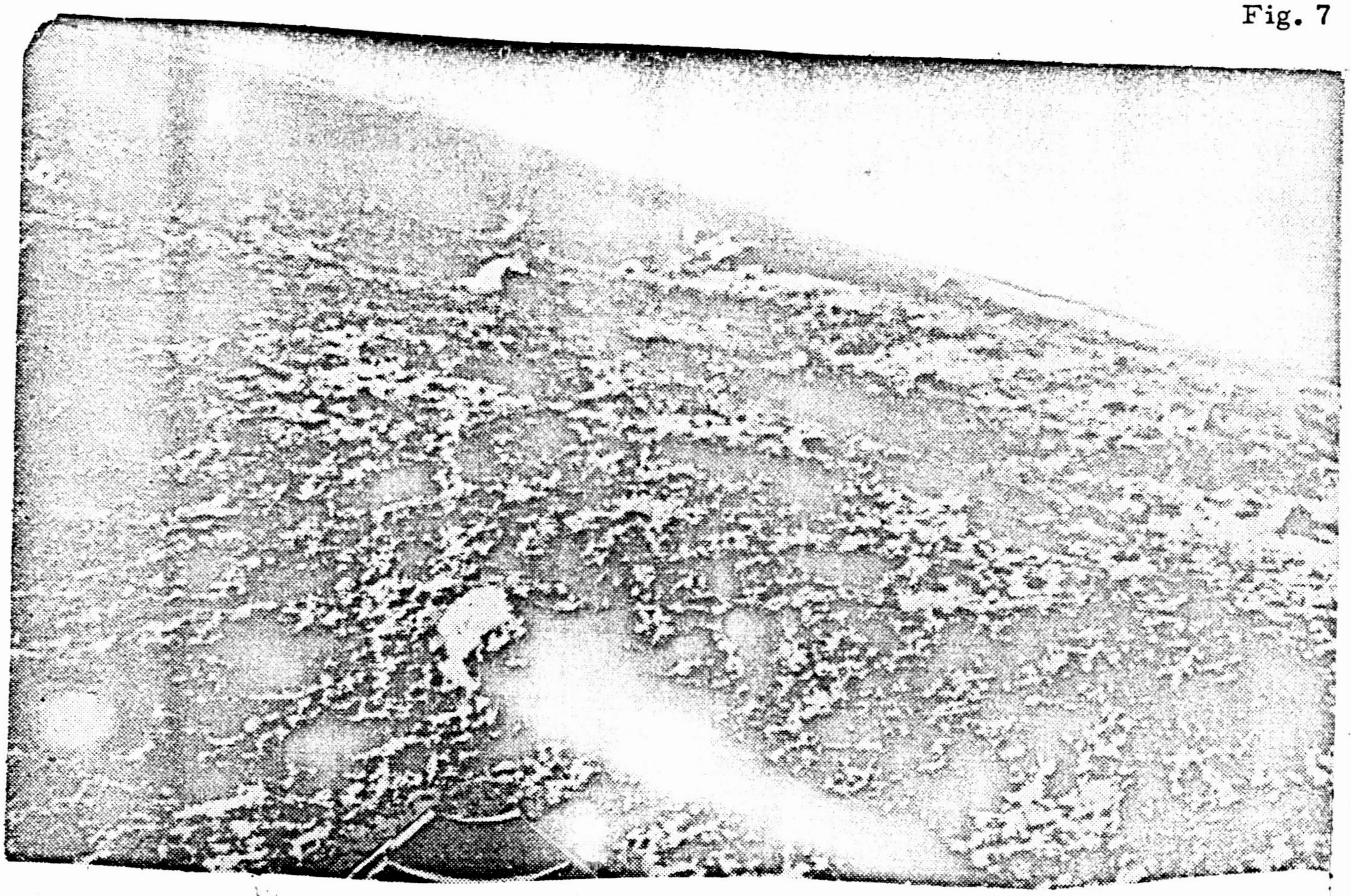


Fig. 5
Drawing representing the probe
LUNA-9

Fig. 6.- On this photograph we may see against the lunar surface backgoound two elements of the probe: the dimension of the upper round part of the element to the left is near 8 cm, the one to the right is more blurred, being at shorter distance from the objective of the etelevision system

Fig. 7



Seen in this double photograph are two parcel
These pictures were taken in the morning of 4 Febru
Oceanus Procellarum, near the lunar equator. Here
visible from the station, was at about 7 degrees abov

During the transmission the camera was incli
left. The vertical line on the left of the right-hand p
mirror in which the lunar surface is reflected. Ve
the scale near the station is given by the distance b
(left photograph), which is equal to 4 cm.

Detailsof one to two millimeters in size coulc

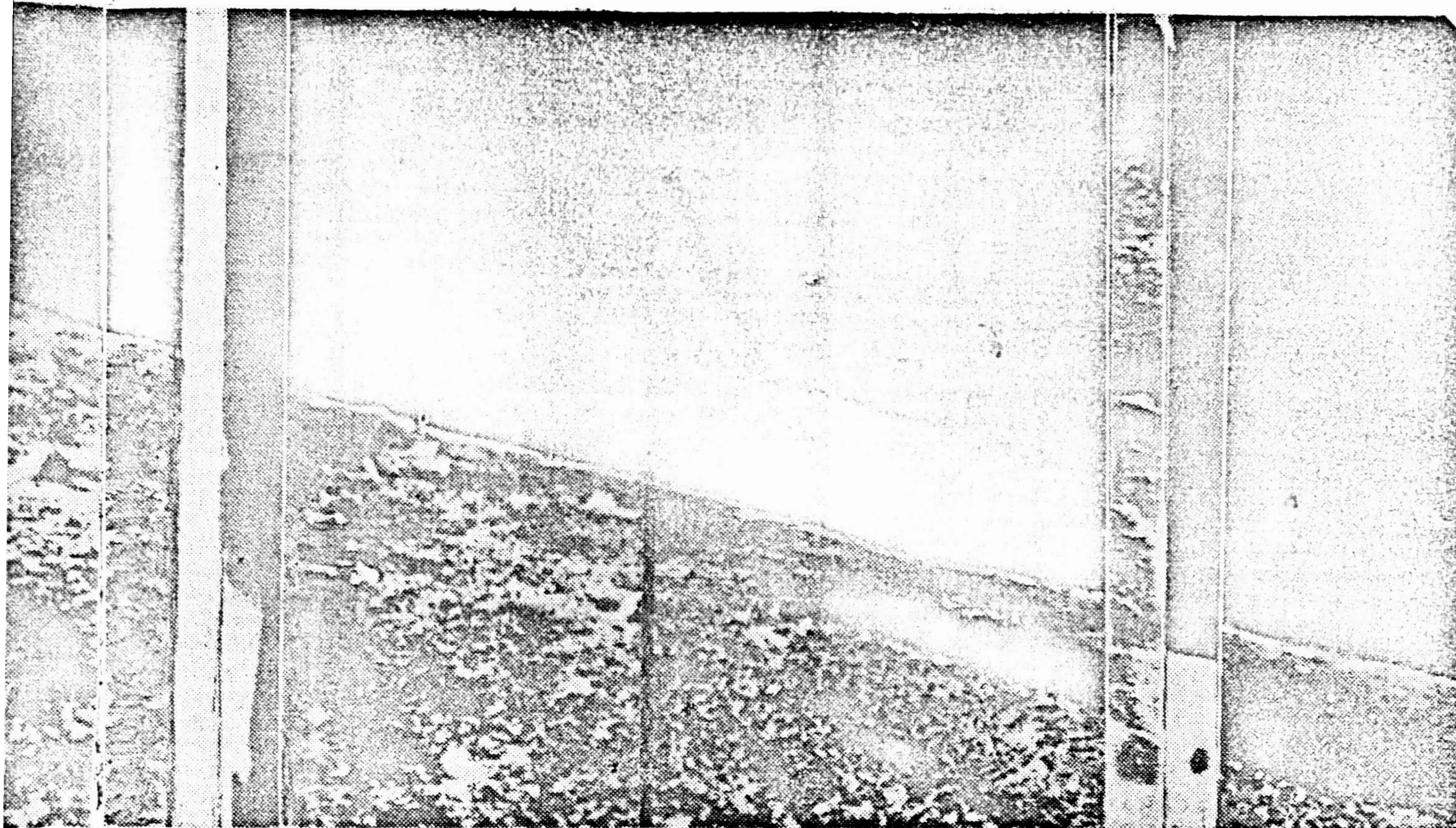
The surface of the Moon near the station (prc
ficant sinking of the station exists; nor are any no

The Moon's surface is very rough and shows

Formations of types of stones are scattered
shadow, has a dimension near 15 cm and is at a dis
Substantially coarser stones are visible at a distar
The large dark spots constitute hollows. A particul
verse dimensions constitute a few meters. A grou
the top of the picture.

Because of absenceof atmosphere we see a c
also heavier contrasts.

'ig. 7



parcels of the lunar panorama on the southeastern side of Luna-9.
February 1966. The probe's position is at the eastern end of the
Here the surface of the Moon is comparatively smooth. The Sun,
s above the horizon of the Moon.
s inclined to the horizon. Part of the probe can be seen on the
nand part is the antenna; in the right-hand part also is a dihedral
d. Very tiny details are distinguished near the station. The idea of
ance between the upper angles of the visible details of the station

e could be distinguished on the photographs.
on (probe) is sufficiently hard, for the picture shows that no signi-
any notable traces of dust visible on the lunar surface.
shows numerous hollows or cavities and tubercles.
ttered around. The one lying in front of the station, giving a long
t a distance of the order of two meters from the station.
distance, of which the dimensions are hidden by the perspective.
articularly large one may be seen to the extreme right. Its trans-
A group of major hollows and hills can be seen to the left and from

see a completely black sky. The absence of scattered light gives

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CIRCULA

CENTRAL PART OF

884-/

Fig. 8

LAR PANORAMA

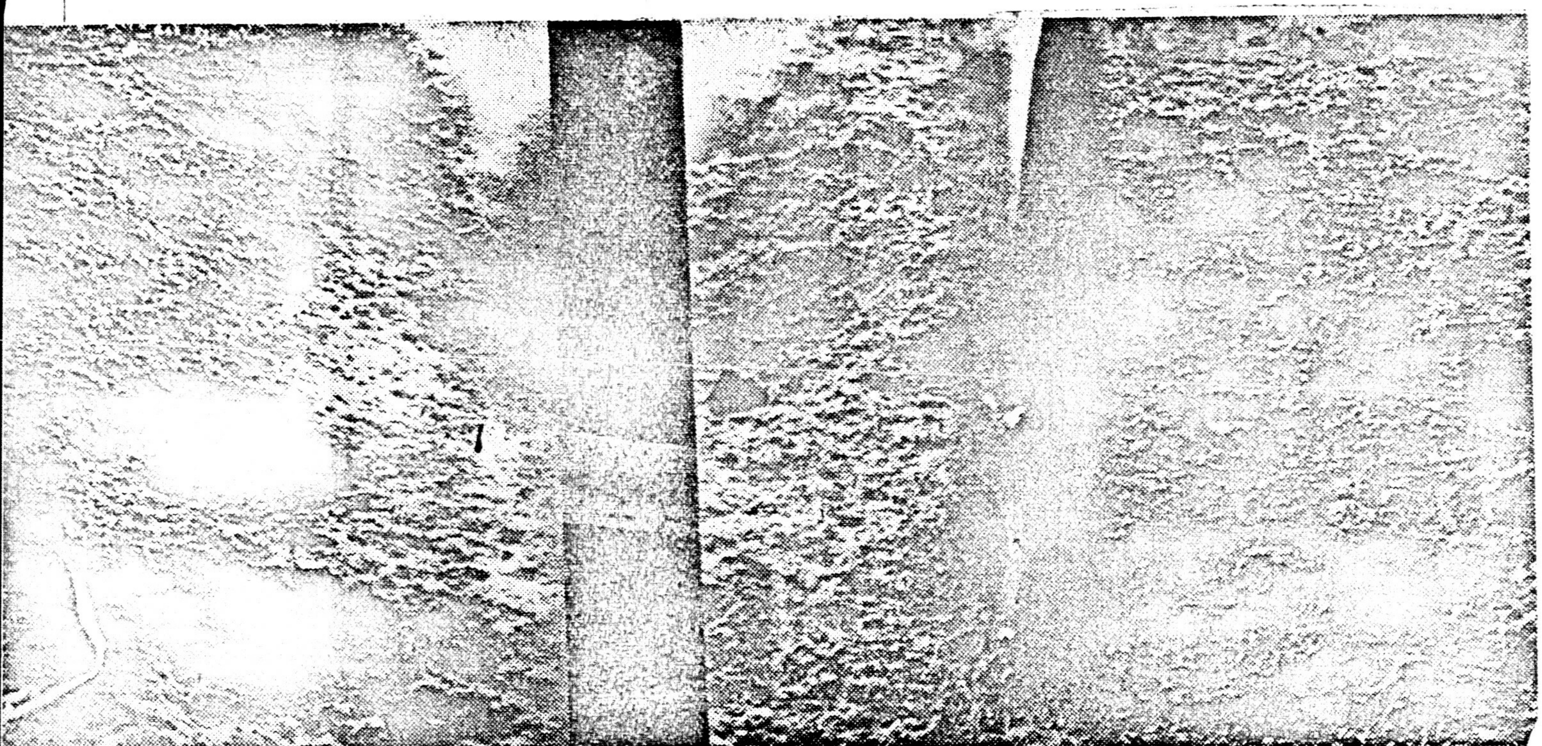

Fig. 9

OF THE CIRCULAR PANORAMA

8+9-2