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# Defense Intelligence DIGEST (U)

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October 1967 • Volume 5 • Number 10






DEFENSE INTELLIGENCE AGENCY

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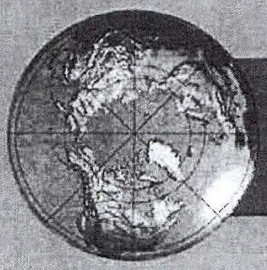

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SOVIET ASU-85 assault gun now is with Polish forces. See article on Exercise Autumn, Page 40. [S]


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## FOREWORD

MISSION: The mission of the monthly *Defense Intelligence Digest* is to provide all components of the Department of Defense and other United States agencies with timely intelligence of wide professional interest on significant developments and trends in the military capabilities and vulnerabilities of foreign nations. Emphasis is placed primarily on nations and forces within the Communist World.

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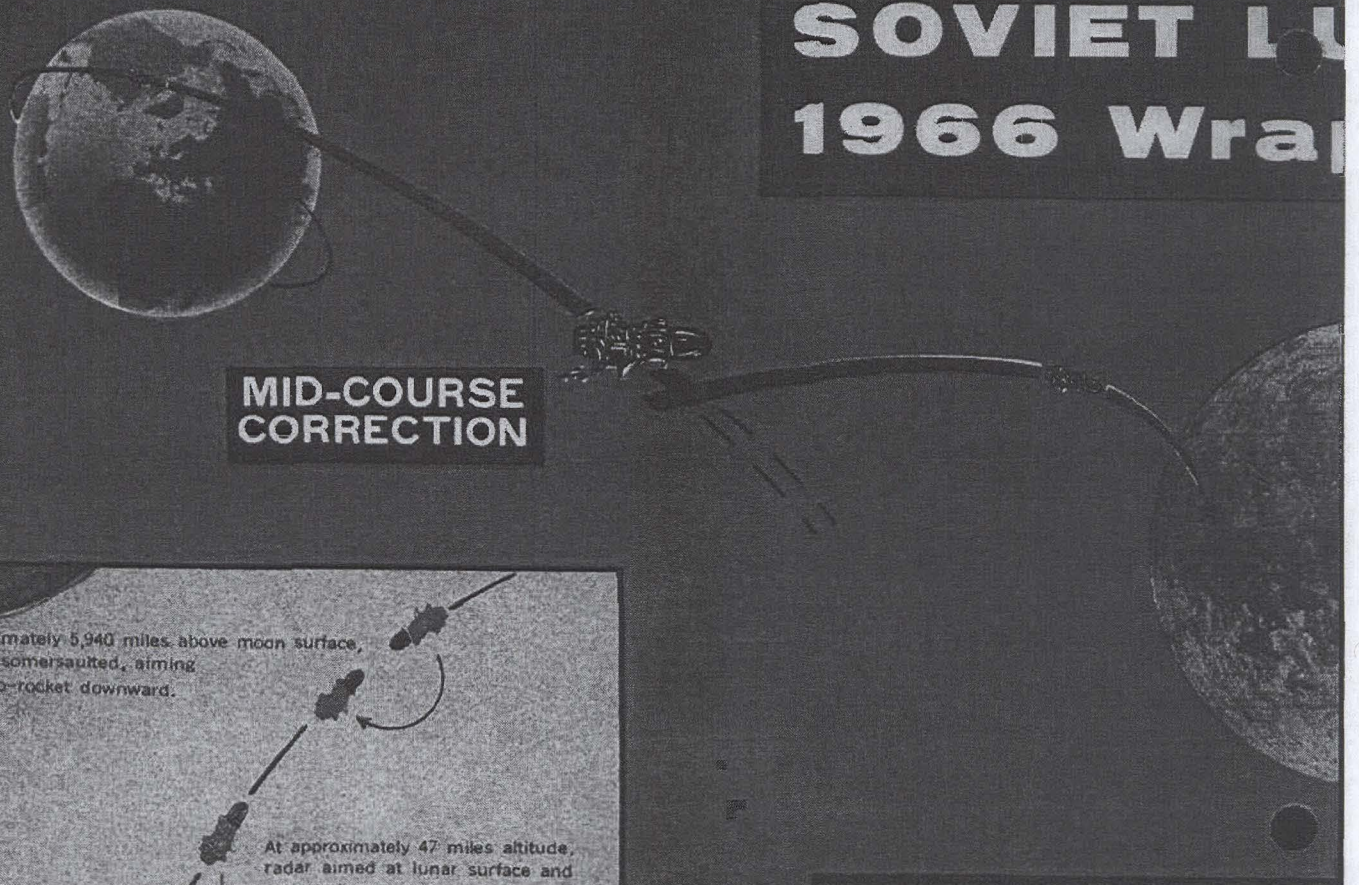
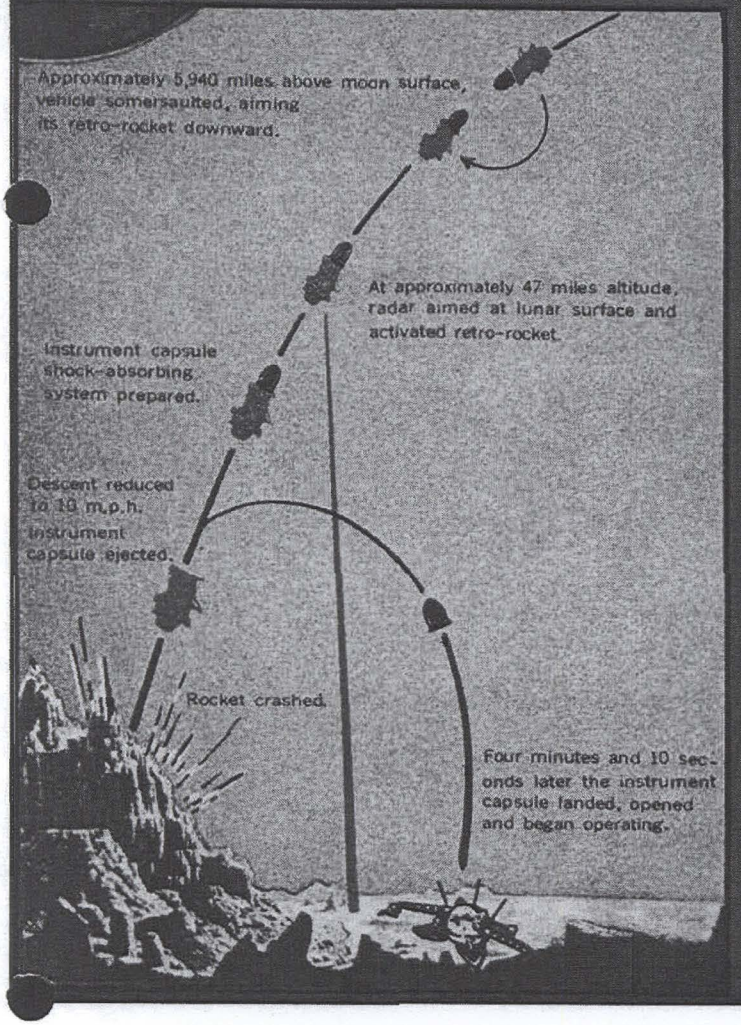
Joseph F. Carroll

JOSEPH F. CARROLL
Lt General, USAF
Director

# SOVIET L
# 1966 Wra



MID-COURSE CORRECTION




1. Astro-orientation system components;
   - 1a. Propellant supply.
   - 1b. Optical-mechanical.
   - 1c. Electronic.
2. Photo-TV device. 3. Radiator for heat
4. Radiometer. 5. Instrument compartme
6. Chemical battery. 7. Antenna. 8. Con
9. Braking engine for course correction.

# NAR PROGRAM:
# -up

*THE Soviet Union achieved notable successes in unmanned lunar explorations during 1966. Five "Luna" vehicles were launched and, considering the flight missions, they also represent a phase of development sequence leading to a manned lunar exploration.*

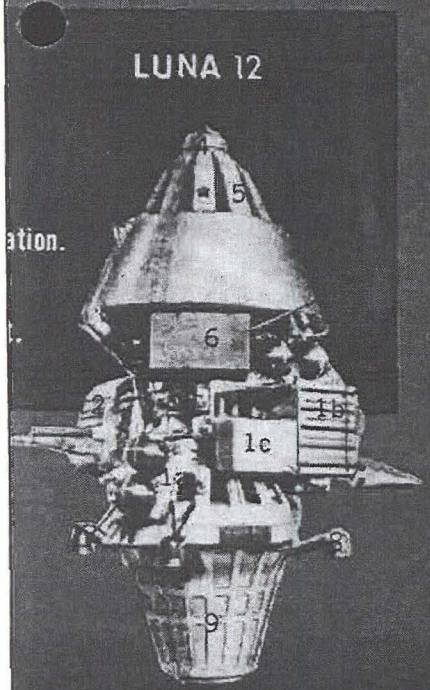
The first phase of the operation was accomplished during 1958–60. At least three of six direct-ascent lunar probes—using a three-stage launch system—probably were partially successful:

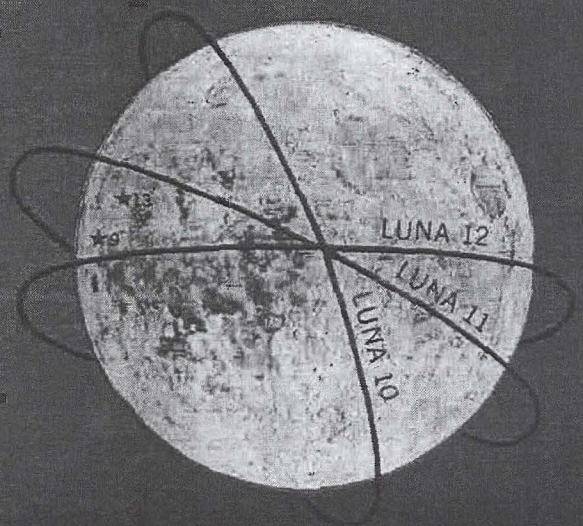
- The first successful flight of a spacecraft to the vicinity of the moon was made by Luna 1.
- Luna 2 impacted the lunar surface.
- Luna 3 photographed the backside of the moon.

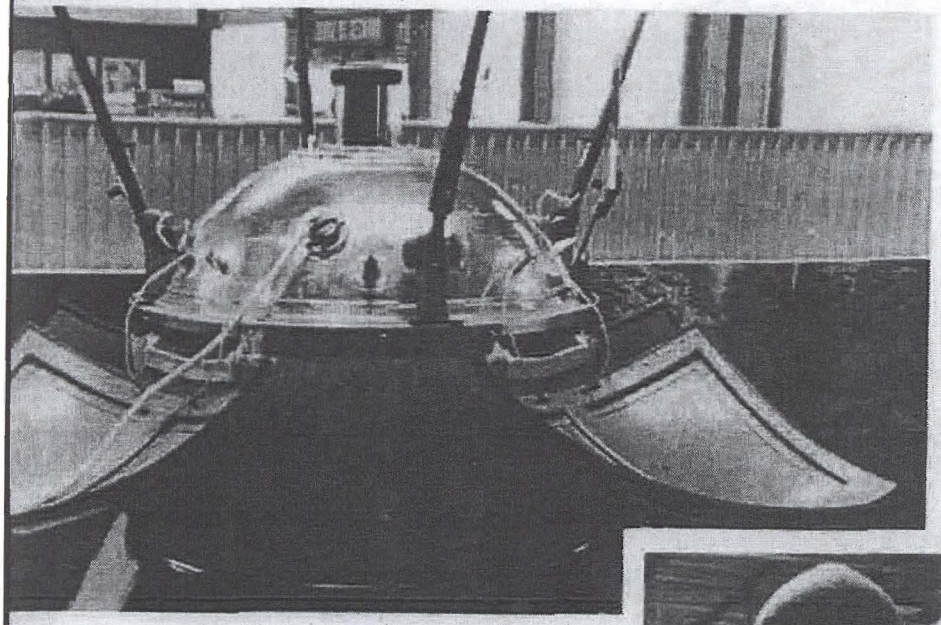
After a 32-month lull, the Soviets initiated the second phase of the lunar program with a four-stage launch system using a parking orbit instead of the three-stage direct-ascent method. Eleven lunar probes were attempted between January 1963 and December 1965. Of these, only five vehicles—Lunas 4 through 8—reached the vicinity of the moon, but none met its mission objectives completely. Not until 1966 did the Soviet Union attain any degree of success in the second phase of the lunar program—the soft landing and lunar orbiting of instrumented payloads.

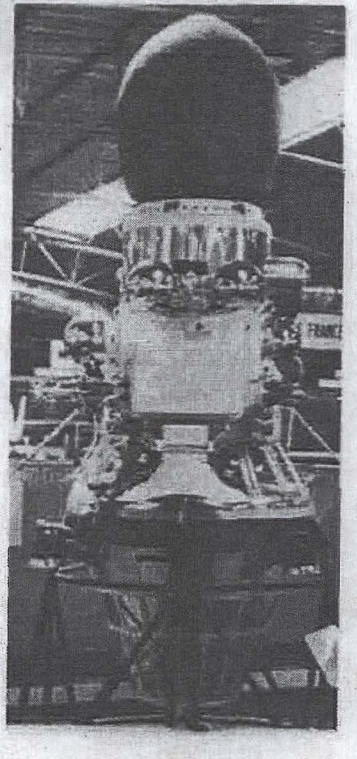
### Luna 9—first soft landing

The Soviets made the first soft landing of an instrumented probe on the moon with the Luna 9 on 3 February 1966. The landing was accomplished after a successful midcourse correction on 1 February and a braking maneuver on 3 February. After the braking maneuver—and just before touchdown—the Luna 9 payload was separated from the carrier rocket. Its physical shape roughly resembled a teardrop. It had a diameter of approximately 24 inches, a height of about 28 inches, and a weight of about 220 pounds. An onboard photographic system provided the Soviets with three pano-







LUNA 9 payload (above) and vehicle (right). The first soft landing of an instrumented probe was made by Luna 9 on 3 February 1966.

ramic, closeup views of the lunar surface. Soviet scientists have drawn the following conclusions about the lunar surface:

- There is no noticeable layer of dust in the landing area.
- The surface is hard enough to bear the weight of a station.
- The surface in the landing area is strewn with rocks and rock debris. Many of the rocks have dimensions exceeding two centimeters. Some of the rocks appear to be "sitting" on pedestals.

The latter anomaly, according to the scientists, apparently is caused by the action of solar wind and micrometerorite bombardment of the "softer" surface material beneath the rocks.

Also obtained were radiation intensity measurements along the Luna 9 earth-moon trajectory and on the lunar surface. Detected radiation on the moon surface exceeded by about 26 percent that in "free" space along the trajectory. Excess radiation according to the Soviets is caused by two factors:

- The radioactivity of the lunar surface.
- The secondary radiation produced by the bombardment of the primary cosmic radiation.

Luna 9 reportedly transmitted signals for a total of eight hours and five minutes from the moon; it completely exhausted its power supply on 7 February 1966.

## Luna 10

Luna 10 spacecraft, weighing 3,530 pounds, was launched from the Soviet Union two months later. It was the first man-made satellite to orbit the moon. The Luna 10 payload was separated from the spacecraft after a terminal maneuver slowed the vehicle sufficiently to permit its achieving lunar orbit. The payload weighed 540 pounds, according to the Soviets, and carried instruments for studying:

- The radiation, micrometeorite, and solar-plasma environment in near-luna space.
- The gamma and infrared emissions of the lunar surface.
- The magnetic field of the moon.
- Meteorite streams in cislunar space.

An additional task of Luna 10—during its remaining useful lifetime—was to study the lunar gravitational field on the basis of changes in the orbital parameters.

Some of the results of these investigations released by the Soviets indicate that:

- The moon has a weak magnetic field.
- The intensity of the moon's radiation belt is 100,000 times less than that of the earth's.
- There are nearly 100 times as many micrometeorites in the vicinity of the moon as in interplanetary space.
- The total intensity of gamma radiation from the lunar surface exceeds by 1.5 to 2 times that of the earth's crust.
- About 90 percent of the detected gamma radiation of the lunar rocks can be attributed to the response of the surface to bombardment by primary cosmic radiation, while not more than 10 percent of the detected gamma radiation can be attributed to the natural decay of radioactive elements in the lunar surface. The Soviets have not published any results of the infrared investigations of the lunar surface.

M. V. Keldysh, president of the USSR Academy of Science, stated that Luna 10 did not have a photographic capability. The lunar probe transmitted signals for 58 days, after which the power from its chemical batteries was exhausted.

## Luna 11

The Luna 11 probe was launched on 24 August 1966 and entered lunar orbit on 27 August. The space vehicl

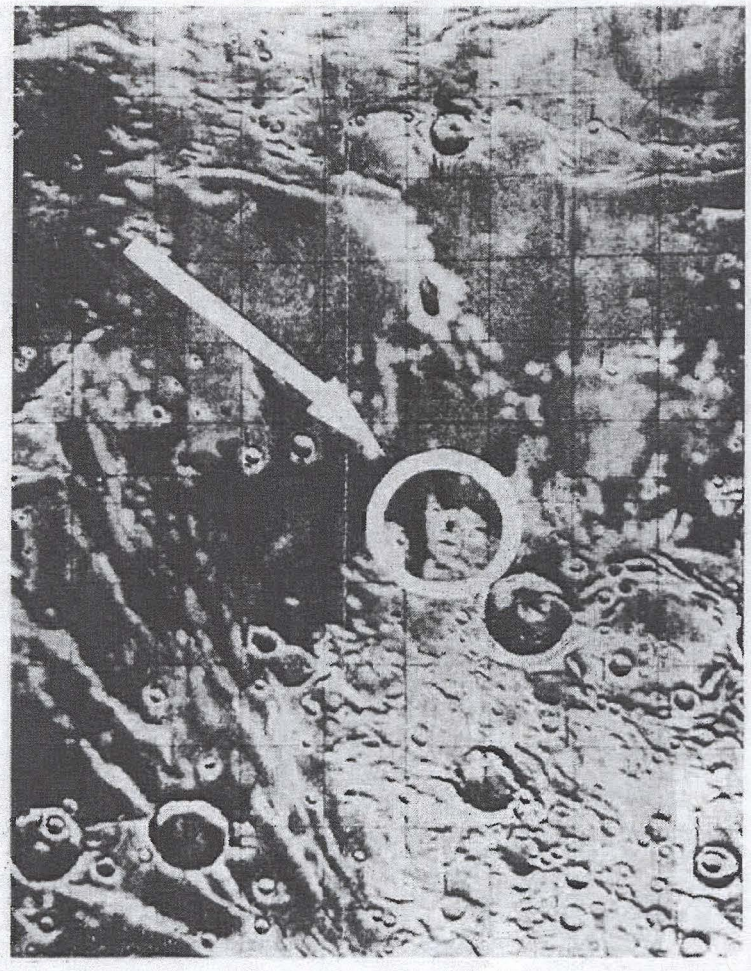
weighed 3,616 pounds including a payload of approximately 625 pounds. [redacted] however, this was not confirmed by the Soviets. They stated that the probe had a "main purpose of testing the systems of an artificial moon Sputnik and scientific explorations in near-lunar space." The degree of success of the mission has not been determined, but it is evident from the weight of the payload that it contained additional data-collection equipment. This has been substantiated by a TASS announcement that the Luna 11 contained instruments:

- For the study of gamma and X-rays emitted by the lunar surface for determining more exactly the chemical composition of the surface.
- To measure the moon's gravitational field by studying the vehicles' orbital evolution.
- To record the concentration of meteoric streams and the intensity of hard corpuscular radiation near the moon.

### Luna 12

The third successful probe was achieved by Luna 12. It was launched on 22 October 1966 and entered a lunar orbit on 25 October. Based on the subsequent success of Luna 12, it may have been the first Soviet attempt to establish a lunar probe with a photographic mission. Luna 12 reportedly also conducted basically the same type of investigations as Luna 11.

According to Pravda, "One of the tasks of this station was the procurement and transmission to the earth of photographs of separate sections of the lunar surface, made from a comparatively close distance. It should be noted that details hundreds of times smaller than those which can be seen on the best photos taken from earth are visible." Each picture is comprised of 1,100 lines—about twice the number used on conventional television. Pictures were taken with a special phototelevision device as the spacecraft orbited within 100 kilometers of the lunar surface. If the Luna 12 photos are of good quality, they may provide the Soviets with sufficient detail for choosing landing sites for a manned lunar landing.



LUNA 9 payload shown on moon surface. S/RT

### Luna 13

Luna 13, equipped with a variety of apparatus, including a phototelevision device similar to that on Luna 9 was launched on 21 December 1966. It soft landed on the moon on 24 December. The estimated weight of the Luna 13 payload is about 300 pounds. It transmitted results of its investigations for about 5 days and apparently was completely successful in its mission. A mirror in the photosystem of the Lunar craft was rotated 300 degrees about a vertical axis for a panoramic view of the surface. Luna 13 pictures confirmed Luna 9 data—that there is no thick dust layer on the moon.

Luna 13 also carried equipment to determine the firmness and density of the surface. A measured explosive charge drove a probe into the lunar crust, and the depth it penetrated measured the load-bearing capability of the surface. A radiation densitometer was used for an accurate determination of the density of the lunar surface in the area of the landing. These two devices, installed on long telescoping booms, were deployed after the capsule landed on the surface. Another device, which the Soviets called a "dynamograph," was installed in the Luna 13 capsule for measuring the impact deceleration during landing.

### Design philosophy

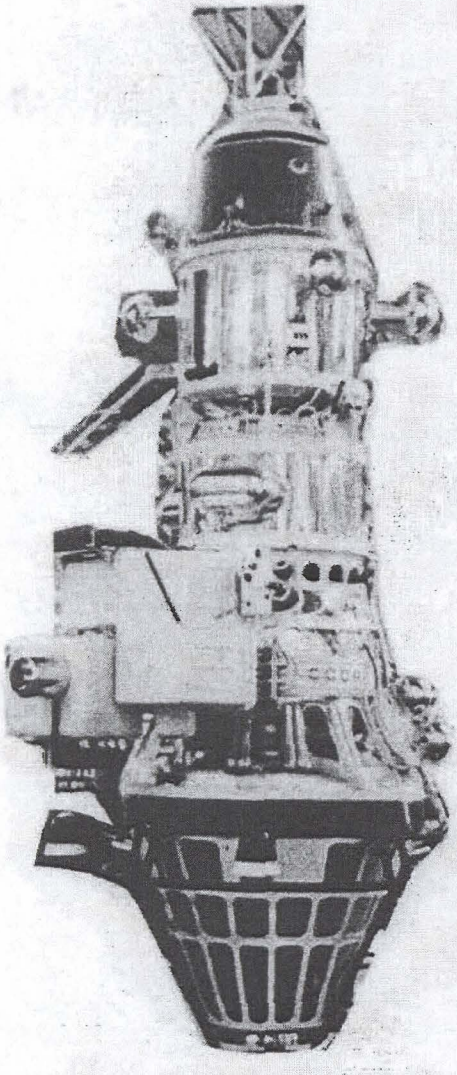
Analysis of available data yields an insight into the overall Soviet design philosophy of lunar vehicles. Two factors are apparent:

- The Soviets establish one basic design for a variety of missions. Therefore, only minor modifications are required from one mission to the next. This provides the flexibility required to use the same spacecraft hardware on different missions, and permits similar mission profiles to be used for soft landing or orbiting.
- The first successful payload of a given series (either soft landing or orbiting) had a less sophisticated mission than its successors. This has

been evident from the Luna 9 and 13 payloads and from the Luna 10, 11, and 12. The Soviets appear to emphasize the operational aspects of early missions, with only a minor scientific data return. Once the feasibility of the operation is proved on the early missions, subsequent missions are modified to permit sophisticated scientific investigations.

The systems used for the current phase of unmanned lunar exploration are probably adequate for a variety of future missions. Lunar surface analytical, seismographic, and micrometeorite detection equipment may replace or supplement the photofacsimile equipment on future soft-landing craft, as has been evidenced by the inclusion of lunar surface studies on Luna 13; however, weight limitations (maximum estimated to be about 300 pounds) probably prevent the inclusion of all these experiments on the same spacecraft.

Weight analysis of the Luna 10 spacecraft indicates that the payload growth potential is about 500 to 600 pounds. How much of this potential was used on the Luna 11 and 12 orbiting vehicles is not known. However, there are indications that the payload was not separated from the spacecraft on those two missions as it was on Luna 10. The total weight on each of the last two missions is estimated to be about 2,500 pounds. Data obtained by the lunar orbiters and soft-landing craft would support both future manned circumlunar and manned lunar landing missions. [END]



LUNA 10 was first manmade satellite to orbit the moon. The spacecraft weighed 3,530 lb

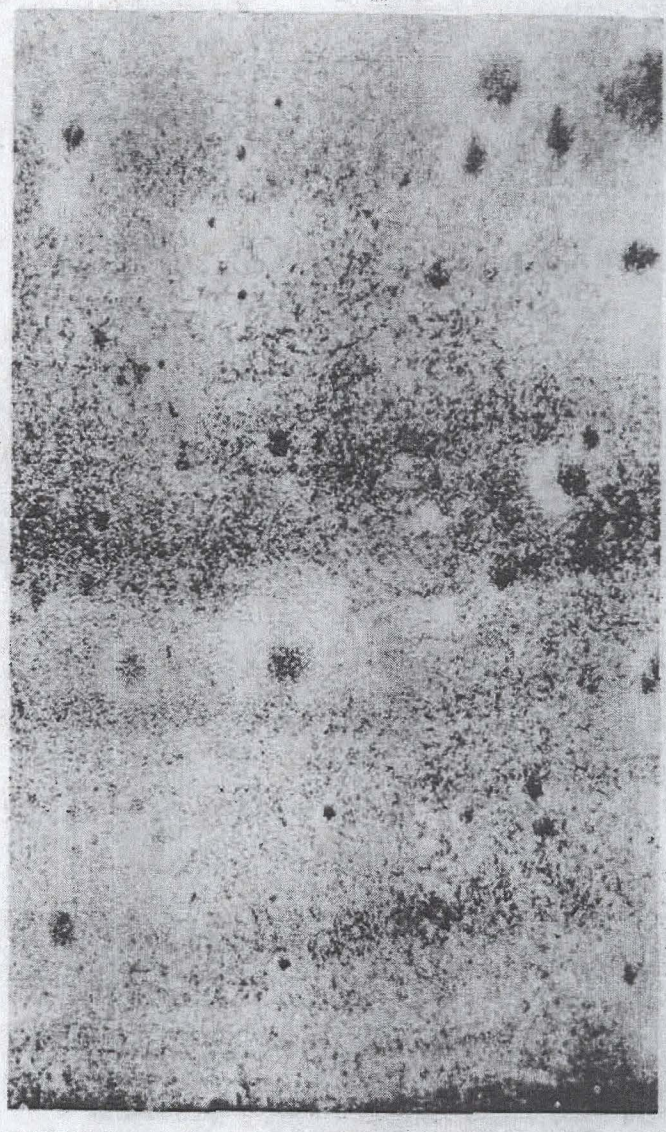


PHOTO of lunar surface by Luna 12 during orbit in October 1966.