

Space

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INTELLIGENCE NOTES

SPACE SYSTEMS INFORMATION BRANCH, GEORGE C. MARSHALL SPACE FLIGHT CENTER

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FEATURED ARTICLES

- ✓◆ THE HIDDEN SIDE OF THE MOON
- ✓◆ THE SOVIET VENUS PROBE

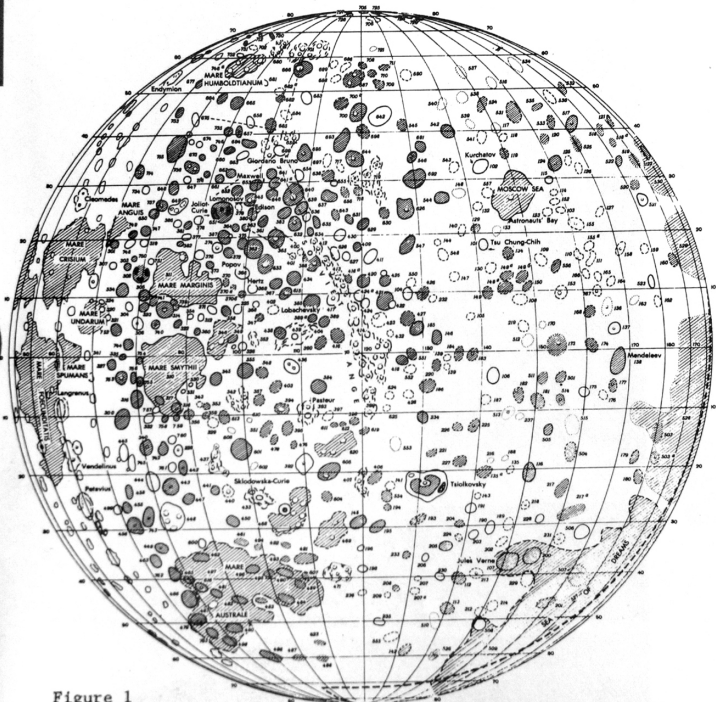


Figure 1

This map of the moon's far side was compiled from Lunik III photographs. Solid, dashed, and dotted outlines denote formations in the three categories: most, less, and least reliable, respectively. Features darker than their surroundings are shaded; if brighter, unshaded. Light dashed lines represent bright rays; the heavy broken line at lower right is the boundary of the still unobserved part of the moon. North is upward, and west longitude increases from the left. The region east of longitude 70° is from existing maps of the near side. From the "Astronomical Journal," U. S. S. R. Academy of Sciences.

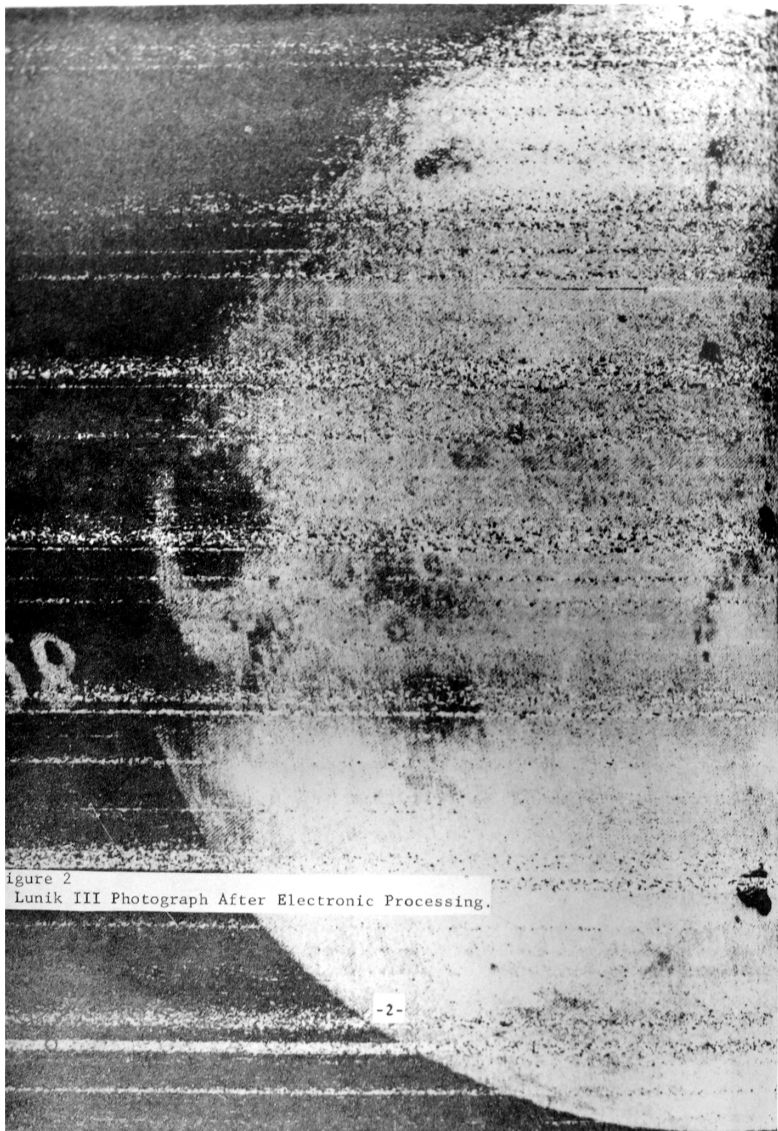


Figure 2
Lunik III Photograph After Electronic Processing.

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THE HIDDEN SIDE OF THE MOON. At 3:30 Universal time on October 7, 1960 a radio command from Earth was received by an automatic planetary station and photographing the surface of the other side of the Moon was begun. Thus one of the great riddles of the universe was solved. The procedure by which the photographs were taken has been described previously, (SIN, Vol. 1 No. 1, November 1, 1960, "The Use of Television In Soviet Space Research") but the actual photographing was only a part of this tremendous achievement. After the photographs were received the Soviet scientists were faced with the difficult task of reconstructing the lunar surface from the many blurred and distorted negatives.

The task of analyzing and interpreting the details of the photographs was accomplished by the Sternberg Astronomical Institute in Moscow together with the Central Scientific Institute of Geodesy, Aerial Photography, and Cartography. These organizations developed methods for interpreting the details of the lunar photographs, compiled a catalogue describing all recognizable formations, measured their coordinates, calculated the cartographic projections and drew up the final map (Fig 1). The photographs were studied simultaneously and independently at the Pulkovo Observatory near Leningrad and at the Kharkov State University Observatory.

Major Difficulties: The two major difficulties encountered in interpreting the photographs were the Moon was full as seen by the planetary station resulting in a lack of shadows and consequent loss of contrast, and without exception all of the photographs had varying amounts of imperfections. Since the location of the defects relative to the lunar surface's image varied on different exposures, it was possible to test their reality by comparing the details on several negatives.

Superposition of Negatives: The recognition of imperfections was greatly simplified by superposing several negatives and aligning them in the following manner. Three film projectors were set up, each containing a different negative, and were used to project superimposed images. By turning the projectors properly, the edges of the lunar images could be made to coincide, thus producing the best possible coincidence of those features that were clearly visible on all three negatives, such as Mare Humboldtianum, Mare Marginis, Mare Australe, the Moscow Sea, the crater Tsiolkovsky, and others.

The method of superposition made it possible to trace individual formations on a semi-transparent screen. It was possible to outline a reliable part of the boundary of Mare Smythii, discover an apparently elevated light spot within the Moscow Sea and detect several formations to the northeast of the Soviet range. The method of superposition was somewhat limited due to the presence of interference bands which were random in direction due to the slow rotation of the planetary station. In regions where the bands intersected interpretation became entirely impossible.

Photographic Masking: When the maximum contrast between the individual regions of a negative greatly exceed the photographic latitude of the printing paper, weak contrasts between neighboring regions on a negative can be intensified by the use of a photographic mask. This method reduces extreme contrast between different regions of the negative without weakening the slight contrasts of features within these regions.

Results: The program of electronic reproduction was based on the photometric peculiarities of the regions to be interpreted. Study of all the material revealed 499 objects. Of these about 100 formations are visible from the Earth, but many of their outlines and coordinates were obtained more precisely than given on existing maps of the Moon.

All the formations recorded have been divided into three reliability categories. In class I are objects identified in photometric cross sections of three or more of the original negatives which have distinct outlines. Their positions and shapes have been reliably established. This category includes the 100 formations observable from the Earth. Class II is made up of objects identified on at least two original negatives, but with outlines which are not completely clear, and Class III is composed of formations appearing on the photometric cross sections of one original negative, or on several negatives but with very indistinct contours.

Of the objects charted on the map, 252 belong to category I, 190 to category II, and 57 to category III.

Hidden Side Different: The two hemispheres of the Moon are unlike in that there are no extensive depressions on the far side such as Oceanus Procellarum and Mare Imbrium on the near side, both of which appear to be more than 2000 meters lower than the general level. There are no such large basins on the far side. The Moscow Sea and the Sea of Dreams are probably quite shallow although their combined area is close to that of Mare Imbrium. The assumption that there is an extensive lowland on the Moon's opposite side near the western limb, continuing the belt of the seas, was not verified.

Formations on both sides of the Moon are similar in nature and the presence of crater images in the photographs of the hidden side is beyond any doubt.

A large area located beyond the eastern limb as seen from the Earth was left uncharted by the Lunik cameras thus leaving something for future investigation. (Sky & Telescope, March 1961)

THE SOVIET VENUS PROBE. On February 4, 1961 the Soviet Union launched Kosmicheskij Korabl-Sputnik 4 (Sputnik 7), a 14,292-lb satellite with a perigee of 124 miles and an apogee of 196 miles. An official Soviet release stated that this satellite "contained no special equipment for

outer space, nor were there any experimental animals" aboard. The announced purpose of flight was to put a large satellite in orbit and to "study (the) parameters which characterize the operation of its design."

Then, a week later (on February 12) Kosmicheskij Korabl-Sputnik 5 (Sputnik 8) was orbited with an estimated weight of 14,000 lb. To the surprise of the astronomical community of the West this was not simply another sputnik but rather an orbital launching station for a Venus probe. Called the *Automaticeskaya Mezplanetnaya Stantsiya 2* (Automatic Interplanetary Station 2), the probe weighed 1,418.9 lb and entered into a trajectory designed to bring it close to the planet Venus. The feasibility of the parking orbit and the orbital launch technique were proven in this single, epoch-making experiment. It is speculated that the February 4 firing failed to accomplish the mission successfully carried out on the 12th, meaning that Kosmicheskij Korabl-Sputnik 5 was a back-up vehicle for Kosmicheskij Korabl-Sputnik 4, which suffered some sort of malfunction after it entered into orbit.

The Carrier Vehicle: While the configurations of Soviet space carrier vehicles are unknown, it is speculated that at least the more recent satellites have been launched by modified T3A vehicles. It has been estimated that T3A is a three-stage, liquid-propelled carrier using liquid oxygen and kerosene in all three stages, thrust levels estimated to be 650,000, 268,000, and 78,100 lb, respectively. The total vehicle weight at lift off is placed somewhat in excess of 400,000 lb. The following table lists firing histories of the T3A vehicle based on the best available open-source information.

T3A FIRING HISTORY

Satellite Missions

<u>No.</u>	<u>Date</u>	<u>Remarks</u>
1	15 May 60	Launched <u>Kosmicheskij Korabl-Sputnik 1</u> (Sputnik 4). Weight, lb: 10,008; perigee and apogee, miles: 188 and 228*. No recovery due to breakdown in satellite's orientation system (retro-rockets fired 180° out of phase).
2	19 Aug 60	Launched <u>Kosmicheskij Korabl-Sputnik 2</u> (Sputnik 5). Weight, lb: 10,120; perigee and apogee, miles: 190 and 210. Reentry capsule recovered with animals, including two dogs.
3	1 Dec 60	Launched <u>Kosmicheskij Korabl-Sputnik 3</u> (Sputnik 6). Weight, lb: 10,060; perigee and apogee, miles: 116 and 164. No recovery. (two dogs and animals aboard).

T3A FIRING HISTORY (continued)

Satellite Missions

No.	Date	Remarks
4	4 Feb 61	Launched <u>Kosmicheskij Korabl-Sputnik 4</u> (Sputnik 7). Weight, lb: 14,292; perigee and apogee, miles: 124 and 196. "Contained no special equipment for outer space nor were there any experimental animals." Purpose of flight to put large satellite in orbit and the "study of the parameters which characterize the operation of its design."
5	12 Feb 61	Launched <u>Kosmicheskij Korabl-Sputnik 5</u> (Sputnik 8). Weight, lb: ~14,000?; perigee and apogee, miles: 125, and 201. Venus probe fired from satellite which split in two, each part subsequently revolving in slightly different orbits.
6	9 Mar 61	Launched <u>Kosmicheskij Korabl-Sputnik 6</u> (Sputnik 9). Weight, lb: 10,363.5; perigee and apogee, miles: 105 and 155.5. Payload contained a dog that was recovered successfully from the reentry capsule.

Probe Missions

1	2 Jun 59	Launched <u>Mechta</u> ** lunar by-pass probe which entered into heliocentric orbit. Weight, lb in trajectory: 3,245 (payload: 793); perihelion and aphelion, miles: 91,100, and 120,000,000.
2	12 Sep 59	Launched <u>Lunnaya Raketa</u> *** (Raketa dostigla Luni). Weight, lb in trajectory: 3,332 (payload: 860.4). Impacted on Moon when at 236,875 miles distance from Earth. Traversing time: 35 hr, 2 min, 24 sec.
3	4 Oct 59	Launched <u>Automaticheskaya Mezplanetnaya Stantsiya 1</u> .**** Weight, lb in trajectory: 3,247 (payload: 614.1) Circumnavigated Moon; maximum distance from Earth: 292,000 mi. Approached to 3,828 mi from Moon. Entered Earth satellite orbit, 15.8 day period.
4	12 Feb 61	Launched <u>Automaticheskaya Mezplanetnaya Stantsiya 2</u> . Weight, lb in trajectory: 1,418.9. Launched from orbiting Earth satellite from which it entered into a Venus trajectory.

* Increased to 430 after retrorockets fired.

** Popularly: "Lunik 1"

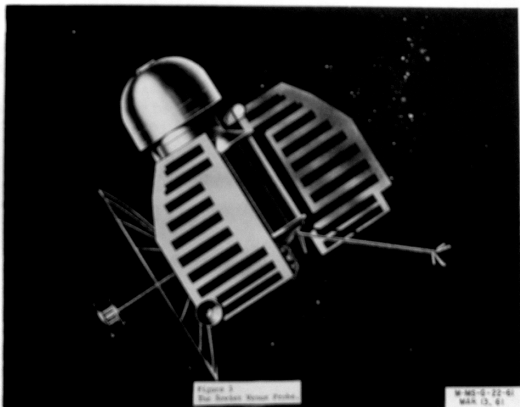
*** Lunar Rocket, or "Lunik 2"

****Automatic Interplanetary Station, or "Lunik 3"

Contact Lost: The Soviet news agency Tass announced on March 2 that contact with the Venus probe was lost on February 27, fifteen days after it was launched from the orbiting space vehicle. Tass said, "As long as the station remains in the zone of direct visibility from the territory of the Soviet Union, efforts will be made to establish radio contact with the automatic interplanetary station."

Slightly Off Course: The probe was scheduled to pass within 62,100 miles of the planet Venus but later reports indicate it will miss the surface by some 105,000 miles. Data released one week after launch placed the probe 1,566,500 mi from the Earth and moving with a velocity of 64,164 mph. Cabin temperature was maintained between 82-88°F, and pressure at 900 mm of mercury.

Probe Configuration: The Automatischekaya Mezplanetnaya Stantsiya 2, shown in Figure 3, was described by Pravda, the Communist Party newspaper, as an airtight body consisting of a cylindrical part with two major protrusions containing scientific equipment and chemical battery clocks. Other scientific equipment is attached to the outside of the body together with two solar battery panels, the shutters of the heat regulating system and part of the orienting system. The probe's measurements were stated to be 80 inches long and 41 inches in diameter, exclusive of aeriels and solar batteries. The vehicle weight was 1,418.9 lb. The Pravda report added that the vehicle carried equipment that would stabilize it and revolve it in the neighborhood of Venus to insure that the desired readings of the cloud-shrouded planet were obtained.



✓ SOVIET ROCKETS STUDY ECLIPSE. During the total eclipse of the sun on February 15, a number of geophysical rockets were launched simultaneously by Soviet scientists. The rockets ejected radio sondes which took photographs, radiation intensity measurements, and spectrographic measurements of the solar corona. Results were telemetered to Earth and parachute-recovery allowed scientists to retrieve spectrograms. In addition to these rockets, others were launched before, during, and after the eclipse to make quantitative measurements in the stratosphere. (Flight, March 3, 1961)

INTELLIGENCE BRIEFS:

The Soviet Venus probe contained, in addition to scientific equipment, a medal with hammer and sickle and date of launch as well as a hollow titanium globe (replica of the earth) 70 mm in diameter. The medal has engraved orbits of Mercury, Venus, Earth and Mars around the sun. This is an indication that the Soviets had hoped for a Venus impact. (Pravda, February 26, 1961)

Soviet scientist Alexander Topchiev, vice chairman of the Soviet Academy of Science labeled as "a complete fabrication" Western reports that some Soviet astronauts had perished in futile attempts to put man into space. He also declared that the Soviet Union has never concealed any space failure in the past and wouldn't do so in the future. (Baltimore Sun, March 29, 1961)

Top Russian scientists announced that they are in the final stages before sending a man on a space flight with "no unsolved fundamental problems" blocking the path. The usually tight-lipped Russians expressed confidence that they are ready to put an astronaut into orbit, however, they declined to predict a date. (Washington Post, March 29, 1961)