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LUNA - 10

IN ORBIT AROUD THE MOON

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L U N A — 10

IN ORBIT AROUND THE MOON

Official Tass Communique and
The PRAVDA Editorial
No. 95 (17412)
MOSCOW, 5 April 1966.

25545

SUMMARY

This report consists in the official Tass communique on the achievement by LUNA-10 of orbit around the Moon, and the PRAVDA editorial of the same date, providing details relative to the way the lunar orbiting was achieved, and giving the various flight parameters. The column ends with general comments on the performance. It is illustrated by sketches and a later view of the automatic station.

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THE TASS COMMUNIQUE:

ONE STEP FURTHER INTO SPACE

On 3 April 1966 at 2144 hours Moscow time the automatic station LUNA-10 was placed into a selenocentrical orbit (near-lunar) and thus became the first Moon's artificial satellite.

The successful bringing of the station into a selenocentrical orbit was assured by the correction of trajectory successfully performed on 1 April of the current year, and by accurately materializing the necessary maneuver on command from Earth as the station approached the Moon.

The orbit parameters of the first Moon's artificial satellite are :

— minimum distance from the Moon's surface — about 350 km

— maximum distance from the Moon's surface — about 1000 km

— revolution period around the Moon — about 3 hours.

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* LUNA-10 NA ORBITE VOKRUG LUNY.

** YESHCHE ODIN SHAG V KOSMOS

Scientific apparatus for the investigation of the near-lunar space have been installed on board Luna-10. The observation data will be telemetered to Earth.

The flight observation and the measurements of orbit parameters are being carried out by the center of remote radio communications.

The bringing of Luna-10 into orbit around the Moon is a new outstanding victory of Soviet scientists, engineers, and workers. Having created the first artificial satellite satellite of the Earth in 1957, our country is now first to put a satellite in orbit around the Moon which is an important stage for its investigation.

"INTERNATIONAL" RESOUNDS IN THE UNIVERSE

LUNA-10 IN ORBIT AROUND THE MOON

(Editorial)

Only two months elapsed from the day of the grandiose experiment—the soft landing of Luna-9. And again attention of all mankind is forged to the Moon. On 3 April at 21 44 hours Moscow time, the Soviet automatic station Luna-10 emerged into orbit around the Moon. A man-made spacecraft moves around the Moon for the first time in history!

The realization of artificial satellites of the Moon constitutes one of the indispensable stages of mastering outer space. AES helped to lift the curtain over many a mystery of nature. Nowadays hundreds of satellites are in near-terrestrial orbits helping people to achieve radio communications and telemetry through outer space, correctly to forecast the weather and conduct broad meteorological investigations. The AES allowed to obtain a series of Earth's radiation belts, to investigate our planet's magnetic field and ionosphere, the corpuscular radiation of the Sun and cosmic rays.

Numerous scientific problems, linked with the heavenly body nearest to the Earth—the Moon, may be resolved by direct study with the aid of artificial satellites of the Moon (AMS). A program conducted with their aid will allow a substantial broadening of our knowledge of the Moon and the near-lunar space.

The launching of AMS will permit the solution of a series of scientific and technical problems linked with the working out of guiding methods for a spacecraft designed to be put in orbit around the Moon, the study of the operation of radio-engineering devices near the Moon for the determination of apparatus' orbit parameters and also conduct broad investigations of the physical properties of the Moon and of the near-lunar space.

One of the interesting problems is the investigation of the meteoric conditions in space near the Moon. Measurements conducted by AES have shown that at various heights of the near-Earth space there is a nonuniformity in the distribution of meteoric matter. Thus far, it is not known how meteoric particles are distributed near the Moon.

Meteor streams may constitute a great hasard for spacecraft. Moving with a velocity reaching tens of kilometers per second, meteoric particles are capable of effecting great destruction. Though the probability of encounter even with insignificantly tiny meteorites is small, for the assurance of total safety of space flights our knowledge on the composition and variations of meteor streams must be widened.

Another important problem is the determination of the thermal characteristic of the Moon. The Earth's atmosphere has in the infrared part of the spectrum a small "transparency window" through which 8 to 12 radiation can penetrate. Thus, fluxes of thermal radiation of bodies situated outside the Earth's atmosphere can be measured only in that window. However, its width is insufficient for the study of the total thermal spectrum of the Moon.

It is well known that the temperature of the Moon's surface varies within a broad range. As the Sun rises above the lunar horizon, the surface temperature begins to increase rapidly. By noon the Moon's surface in the equatorial region is heated to 100 - 130° C. After sunset the surface of the Moon cools off rapidly and its temperature drops to —120° C.

A more detailed study of thermal characteristics of the Moon from close distance, when measurements are no longer distorted by the Earth's atmosphere, will allow to solve one of the most important problems linked with the study of the Moon.

The magnetic field of the Moon was already investigated with the aid of Luna-2 launched in September 1959. These investigations have shown that the Moon has an unsubstantial magnetic field of which the intensity does not exceed one thousandth of the Earth's magnetic field to say the least. A further refinement of the value of the Moon's magnetic field with the help of a more sensitive magnetometer will have a great perceptive significance for ascertaining the nature of magnetism of different heavenly bodies.

One of the most interesting scientific problems is the determination of the characteristics of the Moon's gravitational field. Astronomical methods allowed to determine the mass of the Moon, but the more delicate characteristics of its gravitational field are known at present only tentatively, because for their determination one must involve various, still unconfirmed hypotheses. Measurements of AMS motion parameters during a prolonged time will allow to track the orbit evolution. Inasmuch as the character of orbit evolution is directly dependent upon the nonuniformity of the gravitational field, the distinctive character of the Moon's gravitational field from the symmetrical type may be estimated with the help of direct methods. The conducting of such an experimental study of the Moon's gravitational field has a very important scientific value.

All of these problems offer great interest for science.

The complex investigations of the near-lunar space and of the Moon's surface with the aid of satellites and automatic stations of Luna-9 type will supply a great amount of information on the various scientific aspects of the Earth's nearest neighbor.

The beginning of the Luna-10 flight is similar to that of other lunar probes. It was first put into a near-terrestrial orbit from which it was blasted off to the Moon. However, the flight trajectory was aimed at a point 1000 km from the Moon and not at a point of its surface.

Over the flight trajectory of a craft toward the Moon, two parts may be separated:

- the sector of motion in the sphere of action of the Earth where the gravitational attraction of the Earth prevails over that of the Moon,
- the sector, where, to the contrary, the latter prevails.

The mass of the Moon is substantially less than that of the Earth; this is why the sphere of action of the former is smaller than that of the latter. The sphere of action of the Moon spreads to a distance of the order of 60 - 70 thousand kilometers from its center and is inside the sphere of action of the Earth. At blast off, the intermediate orbit of the AES, the acceleration block assured the automatic station a velocity of 10.87 km/sec. At such an initial velocity, the flight to the Moon constituted a little less than three and one-half days. At entering into the sphere of action of the Moon, the automatic station had relative to the Moon a velocity of ~ 1 km per second.

A trajectory correction was performed according to the results of radiomeasurements in order to assure the bringing of the station into a pre-assigned orbit. As a result, the station entered a flight trajectory passing at the pre-assigned distance from the Moon.

Moving according to the laws of celestial mechanics, the station acquires in the region of the Moon a velocity of 2.1 km/sec, and, as this velocity is decreased, the station will abandon the Moon and become an AES. Therefore, in order to bring it into a near-lunar orbit, thus transforming the station into an artificial satellite of the Moon (AMS), it is necessary to lower the speed to about 1.25 km/sec at a specific point of the near-lunar space.

The fulfullment of these conditions is assured by a special system of radiomeasurements and a corresponding motion guidance system.

In previous launchings of lunar probes, the trajectory control system, the airborne radioapparatus, the astroorientation system, and the autonomous guidance devices were all worked out in natural conditions.

The automatic station Luna-10 (see Fig. 1) consists of two fundamental parts: the AMS, which is brought into a lunar orbit and the motive installation with its instrument compartments. After putting the station into the near-lunar orbit with the help of a special device, the AMS is separated from the motive installation and begins the conducting of scientific investigations.

The AMS constitutes a hermetic container weighing 245 kg. The following equipment is installed in it:

- radioapparatus, telemetry, program-time devices,
- scientific apparatus for the study of the Moon and of the near-lunar space
- thermoregulation system
- antenna arrays
- feeding source.

The motive installation of the automatic station consists of a liquid-fuel engine, fuel tanks, fuel feed system, guidance instruments required for the stabilization of the apparatus in flight during engine operation.

The trajectory correction and the deceleration for the transfer into the near-lunar orbit are performed with the aid of the motive installation. The guidance system apparatus complex for the flight guidance and the orientation system consists of gyroscopic, electron-optical and program-temporal devices. Here also is located the fuel feed source, the telemetry control apparatus and the microengines of the orientation system.

The guidance system assures the stabilization of the automatic station around the center of gravity, the conveying of commands on engine switch on and off. The stabilization is assured with the help of microengines.

After its putting into the trajectory toward the Moon, the weight of the automatic station Luna-10 constituted 1600 kg. The scheme of its flight is shown in Fig. 2.

At first the automatic station and the acceleration block were put in the orbit of an AES. This orbit had the following parameters:

- distance in perigee 200 km;
- distance in apogee 250 km;
- orbit inclination to equatorial plane about 52^{o}.

Then the station was transferred to flight trajectory to the Moon. The factual motion of Luna-10 differed somewhat from the computed in accord with the prognosis received. This is why the initial data for the correction of its motion were prepared by the measurement-command complex. The command was given from the Earth at the time of one of the radiocommunication sessions. The subsequent operation of all systems took place automatically.

As a result of the correction performed on 1 April, the motion velocity of Luna-10 changed in the required direction by the necessary quantity. The parameters of the corrected trajectory were measured by the ground complex. Calculations have shown that upon correction the trajectory, the initial data for braking with the view of transferring the station to the lunar orbit, were obtained by the trajectory parameters computed after correction. These were transmitted on board.

Beforehand, at the time the distance from the surface of the Moon was about 8000 km, the station was so oriented that at deceleration time near the Moon, the engine nozzle be directed against the motion (see Fig. 3).

At about 21 44 hours, a signal was emitted by the guidance system to switch on the motive installation. After engine switch off, the velocity of the station decreased from 2.1 to 1.25 km/sec, and this decrease assured its transfer to the orbit of AMS with the following parameters:

- distance in aposelion-maximum distance from the Moon's surface near 1000 km;
- distance in periselion-minimum distance from the Moon's surface near 350 km;
- revolution period near three hours.

Twenty seconds after deceleration engine switch off, the guidance system admitted a signal for separating the AMS from the motive installation and the guidance system's compartments. The separation system operated normally. Then began the first radio communication session with the AMS. This session has shown that the apparatus was functioning normally, that the system of thermoregulation assures the required regime and that the radio communication is steady.

The creation of an artificial satellite of the Moon (AMS) is a prominent event in the history of outer space mastering; it is yet another stage in the development of human knowledge. And most rejoiceable and agreeable of all is the fact that the way to outer space is paved the Soviet men who step by step lead in the world along the difficult path to the knowledge of the Universe.

THE END

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Translated by DR. ANDRE L. BRICHANT
on 8 April 1966 (dac)

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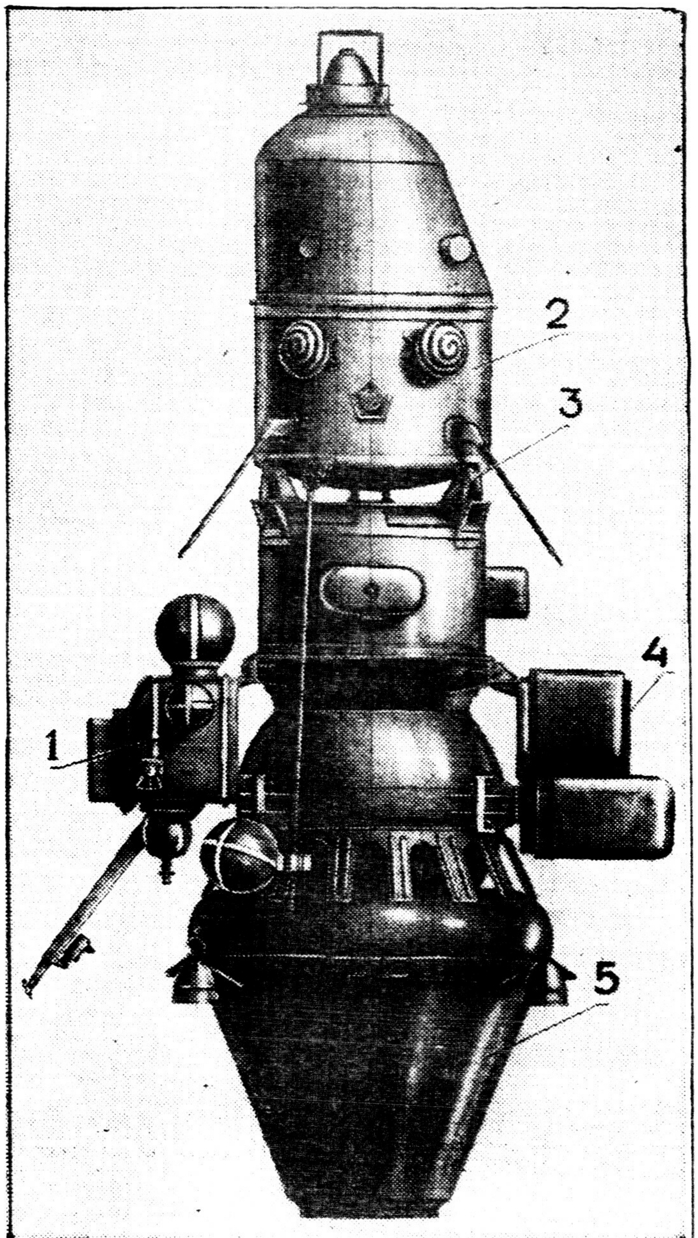

Рисунок 1. АВТОМАТИЧЕСКАЯ СТАНЦИЯ «ЛУНА-10»

1. Аппаратура радиосистемы измерений. 2. Искусственный спутник Луны. 3. Система отделения искусственного спутника Луны. 4. Аппаратура системы астроориентации. 5. Двигательная установка.

Fig. 1. - AUTOMATIC STATION "LUNA-10"

1. Radiosystem measurement apparatus;
2. - AMS; 3 - System for AMS separation;
4. - Astroorientation system apparatus;
5 - Motive installation.

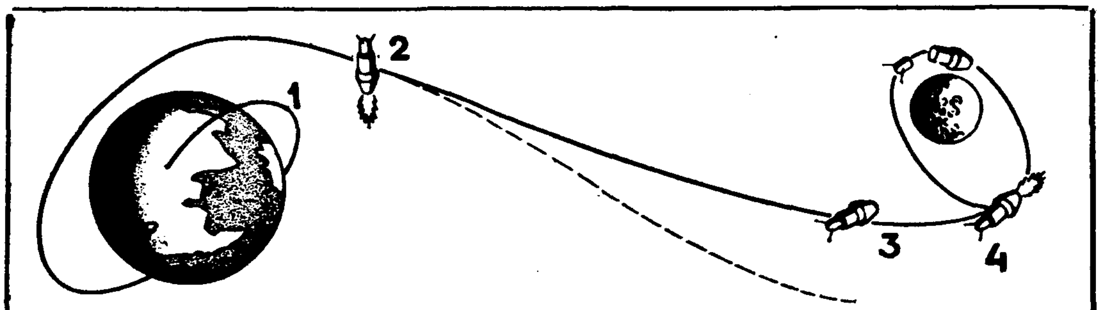

Рисунок 2. СХЕМА ПОЛЕТА АВТОМАТИЧЕСКОЙ СТАНЦИИ «ЛУНА-10».

1. Промежуточная околоземная орбита. 2. Коррекция траектории полета к Луне. 3. Ориентация автоматической станции «Луна-10» перед торможением. 4. Торможение и выход на орбиту искусственного спутника Луны.

Fig. 2. - FLIGHT SCHEME OF "LUNA-10"

1. - Intermediate near-Earth orbit; 2 - Flight trajectory correction toward the Moon; 3 - Orientation of the automatic station Luna-10 before deceleration; 4 - Deceleration and emergence into the orbit of AMS.

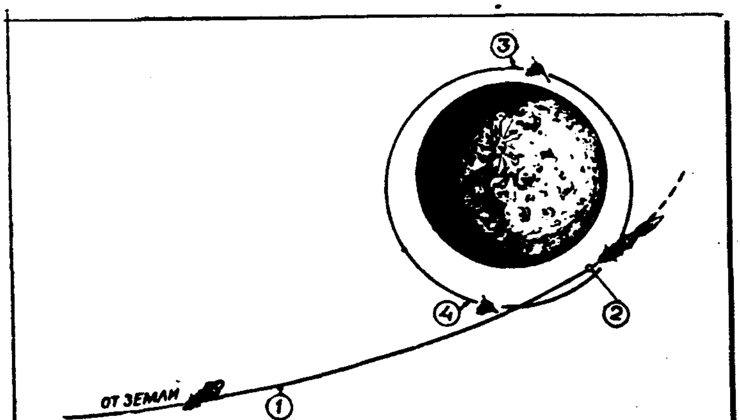

Рисунок 3. ВЫХОД ИСКУССТВЕННОГО СПУТНИКА ЛУНЫ НА ОРБИТУ

1. Пролетная траектория. 2. Точка включения тормозной двигательной установки. 3. Периселений орбиты. 4. Апоселений орбиты.

Fig. 3. - EMERGENCE OF THE AMS INTO ORBIT.

1. Flight trajectory; 2 - Point at which the decelerating motive installation is switched on; 3 - Orbit periselenion; 4 - Orbit aposelenion.