8)
Cosmic Rocket / [Luna 1]
Nation: USSR (4)
Objective(s): lunar impact
Spacecraft: Ye-1 (no. 4)
Spacecraft Mass: 361.3 kg (with upper stage)
Mission Design and Management: OKB-1
Launch Vehicle: 8K72 (no. B1-6)
Launch Date and Time: 2 January 1959 / 16:41:21 UT
Launch Site: NIIP-5 / launch site 1
Scientific Instruments:

1) three-component magnetometer
2) two gas-discharge counters
3) piezoelectric detector
4) scintillation counter
5) ion traps

Results: Although this Soviet spacecraft was the first humanmade object to reach escape velocity, its trajectory was less than accurate due to a problem in the guidance system, and the probe missed its main target, the Moon. The spacecraft (which, with its launch vehicle, was referred to as "Cosmic Rocket" in the Soviet press) eventually passed by the Moon at a distance of 6,400 kilometers about 34 hours following launch. Before the flyby, at 00:57 UT on 3 January 1959, the attached upper stage released one kilogram of natrium at a distance of 113,000 kilometers from Earth and was photographed by astronomers on Earth.

The first robotic explorer to the Moon, Luna 1.

Ground controllers lost contact with Cosmic Rocket (retroactively named Luna 1 in 1963) approximately 62 hours after launch. The probe became the first spacecraft to enter orbit around the Sun.

The Luna 3 spacecraft returned the first views ever of the far side of the Moon. The first image was taken at 03:30 UT on 7 October at a distance of 65,200 kilometers, after Luna 3 had passed the Moon and looked back at the sunlit far side. The last image was taken 40 minutes later from 66,700 kilometers. Altogether, twenty-nine photographs were taken, covering 70 percent of the far side. The photographs were very noisy and of low resolution, but many features could be recognized. This was the first image returned by Luna 3; taken by the wide-angle lens, it showed that the far side of the Moon was very different from the near side, most noticeably in its lack of lunar maria (the dark areas). The right three-quarters of the disk are the far side. The dark spot at upper right is Mare Moscoviense; the dark area at lower left is Mare Smythii. The small dark circle at lower right with the white dot in the center is the crater Tsiolkovskiy and its central peak. The Moon is 3,475 kilometers in diameter, and north is up in this image.

9)
Pioneer 4
Nation: U.S. (5)
Objective(s): lunar flyby
Spacecraft: N/A
Spacecraft Mass: 6.1 kg
Mission Design and Management: NASA / ABMA / JPL
Launch Vehicle: Juno II (no. AM-14)
Launch Date and Time: 3 March 1959 / 05:10:45 UT
Launch Site: ETR / launch complex 5
Scientific Instruments:

1) photoelectric sensor trigger
2) two Geiger-Mueller counters

Results: Although it did not achieve its primary objective to photograph the Moon during a flyby, Pioneer 4 was the first U.S. spacecraft to reach escape velocity. During the launch, the Sergeants of the second stage did not cut off on time and caused the azimuths and elevation angles of the trajectory to change. The spacecraft thus passed by the Moon at a range of 59,545 kilometers (instead of the planned 32,000 kilometers)—not close enough for the imaging scanner to function. The closest approach was at 10:25 UT on 4 March 1959. The craft's tiny radio transmitted information for 82 hours before contact was lost at a distance of 655,000 kilometers from Earth, the greatest tracking distance for a humanmade object to date. The probe eventually entered heliocentric orbit and became the first American spacecraft to do so. Scientists received excellent data on radiation in space.

10)
no name / [Luna]
Nation: USSR (5)
Objective(s): lunar impact
Spacecraft: Ye-1A (no. 5)
Spacecraft Mass: c. 390 kg (with upper stage)
Mission Design and Management: OKB-1
Launch Vehicle: 8K72 (no. I1-7)
Launch Date and Time: 18 June 1959 / 08:08 UT
Launch Site: NIIP-5 / launch site 1
Scientific Instruments:

1) three-component magnetometer
2) two gas-discharge counters
3) piezoelectric detector
4) scintillation counter
5) ion traps

Results: The Soviet Ye-1A probe, like the Ye-1, was designed for lunar impact. Engineers had incorporated some minor modifications to the scientific instruments (a modified antenna housing for the magnetometer, six instead of four gas-discharge counters, and an improved piezoelectric detector) as a result of information received from the first Cosmic Rocket (Luna 1) and the American Pioneer 4. The launch was originally scheduled for 16 June but was postponed for two days as a result of the negligence of a young lieutenant who inadvertently permitted fuelling of the upper stage with the wrong propellant. During the actual launch, one of the gyroscopes of the inertial guidance system failed at T+153 seconds, and the wayward booster was subsequently destroyed by command from the ground.

11)

Second Cosmic Rocket / Luna 2

Nation: USSR (6)
Objective(s): lunar impact
Spacecraft: Ye-1A (no. 7)
Spacecraft Mass: 390.2 kg (with upper stage)
Mission Design and Management: OKB-1
Launch Vehicle: 8K72 (no. I1-7b)
Launch Date and Time: 12 September 1959 / 06:39:42 UT
Launch Site: NIIP-5 / launch site 1
Scientific Instruments:

1) three-component magnetometer
2) six gas-discharge counters
3) piezoelectric detector
4) scintillation counter
5) ion traps

Results: After an aborted launch on 9 September, the Ye-1A probe successfully lifted off and reached escape velocity three days later. Officially named the "Second Soviet Cosmic Rocket," the spacecraft released its one kilogram of natrium on 12 September at a distance of 156,000 kilometers from Earth in a cloud that expanded out to 650 kilometers in diameter and was clearly visible from the ground. Fortunately, this sixth attempt at lunar impact was much more accurate than its predecessors. The spacecraft successfully reached the surface of the Moon at 23:02:23 UT on 14 September 1959, thus becoming the first object of human origin to make contact with another celestial body. The probe's impact point was approximately at 30° north latitude and 0° longitude on the slope of the Autolycus crater, east of Mare Serenitatis. Luna 2 (as it was called after 1963) deposited Soviet emblems on the lunar surface carried in 9 x 15-centimeter metallic spheres. The spacecraft's magnetometer measured no significant lunar magnetic field as close as 55 kilometers to the lunar surface. The radiation detectors also found no hint of a radiation belt.

12)

Automatic Interplanetary Station / Luna 3

Nation: USSR (7)
Objective(s): lunar flyby
Spacecraft: Ye-2A (no. 1)
Spacecraft Mass: 278.5 kg
Mission Design and Management: OKB-1
Launch Vehicle: 8K72 (no. I1-8)
Launch Date and Time: 4 October 1959 / 00:43:40 UT
Launch Site: NIIP-5 / launch site 1
Scientific Instruments:

1) Yenisey-2 photographic-TV imaging system
2) micrometeoroid detector
3) cosmic-ray detector

Results: This spacecraft, of the Ye-2A class, was the first Soviet probe designed to take pictures of the far side of the Moon using the Yenisey-2 imaging system (replacing the Yenisey-1 used on the abandoned Ye-2 probe). The TV system consisted of a 35-mm camera with two lenses of 200-mm (wide-angle) and 500-mm (high-resolution) focal lengths and a capacity to read up to 40 images. Strictly speaking, the probe was not meant to reach escape velocity; instead, the launch vehicle inserted the spacecraft, called the Automatic Interplanetary Station (AMS) in the Soviet press, into a highly elliptical orbit around the Earth at 48,280 x 468,300 kilometers, sufficient to reach lunar distance. During the coast to the Moon, the AMS suffered overheating problems and poor communications, but the vehicle eventually passed over the Moon's southern polar cap at a range of 7,900 kilometers on 6 October before climbing up over the Earth-Moon plane. At a distance of 65,200 kilometers from the Moon, on 7 October, cameras began taking the first of 29 pictures of the far side of the Moon. The exposed film was then developed, fixed, and dried automatically, after which a special light beam of up to 1,000 lines per image scanned the film for transmission to Earth. Images were finally received the next day (after a few aborted attempts). Seventeen of the images were of usable quality and showed parts of the Moon never before seen by human eyes. The spacecraft, named Luna 3 after 1963, photographed about 70 percent of the far side and found fewer mare areas on the far side, prompting scientists to revise their theories of lunar evolution.

13)

Able IVB / "Pioneer"

Nation: U.S. (6)
Objective(s): lunar orbit
Spacecraft: P-3 / Able IVB
Spacecraft Mass: 169 kg

Mission Design and Management: AFBMD / NASA
Launch Vehicle: Atlas-Able (no. 1 / Atlas D no. 20)
Launch Date and Time: 26 November 1959 / 07:26 UT
Launch Site: ETR / launch complex 14
Scientific Instruments:

1) high-energy radiation counter
2) ionization chamber
3) Geiger-Mueller tube
4) low-energy radiation counter
5) two magnetometers
6) photo-scanning device
7) micrometeoroid detector
8) aspect indicator
9) radio receiver to detect natural radio waves
10) transponder to measure electron densities

Results: This mission used the first of four spacecraft designed by Space Technology Laboratories for a lunar assault in 1959 and 1960; two of them had originally been slated for Venus orbit (in June 1959), but mission planners had redirected their missions after the success of the Soviet Luna 3 mission. All the scientific experiments and internal instrumentation were powered by nickel-cadmium batteries charged from 1,100 solar cells on 4 paddles. Each probe also carried an internal hydrazine monopropellant motor for lunar orbit insertion at a range of 8,000 kilometers from the Moon. Ideal lunar orbital parameters were planned as 6,400 x 4,800 kilometers. The missions also inaugurated the first use of the Atlas-with-an-upper-stage combination, affording increased payload weight. During this first launch, the nose fairing began to break away just 45 seconds after liftoff. Aerodynamic forces then caused the third stage and payload to break away and explode. The ground lost contact with the tumbling booster at T+104 seconds. Investigation showed that the 3-meter fiberglass shroud failed because there had been no measures to compensate for pressure differentials as the rocket gained altitude.