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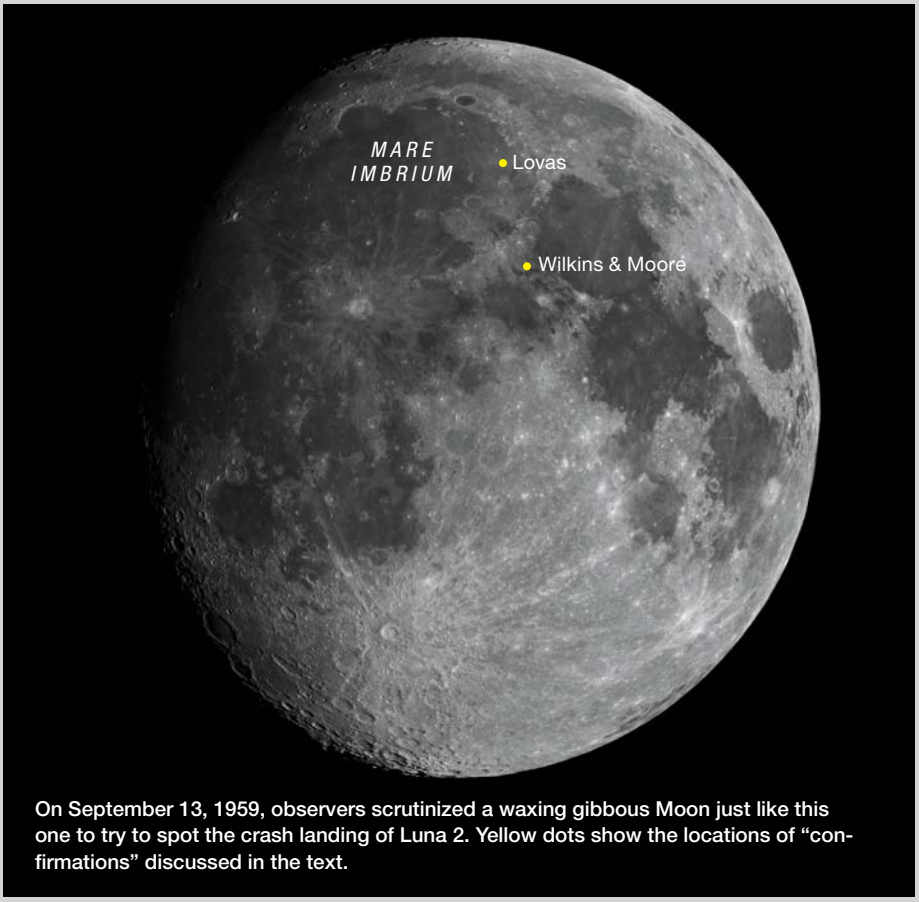
The Enduring Mystery of Luna 2

Amateur observers claimed to see its impact — but no trace of the crash site has ever been found.

Fifty-eight years ago this month, the first spacecraft reached the Moon. On September 12, 1959, the Soviet Union launched Luna 2 on a collision course with the Moon. Weighing 170 kilograms (375 pounds), the probe consisted of an 81-cm (32-inch) spherical pod festooned with protruding antennas. Crammed aboard were a magnetometer, radiation counters, micrometeorite detectors, and many stainless steel pennants bearing the nation's hammer-and-sickle coat of arms that were to be scattered around the impact site.

Soviet authorities announced that Luna 2 would crash into the lunar surface at a velocity of 3.3 kilometers per second at 21:01 Universal Time on September 13th, about 38½ hours after launch. The announced target was **Mare Imbrium**, though there was considerable uncertainty in that. An error of only 1 meter per second in the rocket's final velocity would displace the point of impact on the Moon by a whopping 250 km, while a deviation of just 1 arcminute in its trajectory would introduce a further offset of 200 km.



On September 13, 1959, observers scrutinized a waxing gibbous Moon just like this one to try to spot the crash landing of Luna 2. Yellow dots show the locations of "confirmations" discussed in the text.

The uppermost stage of the rocket, which carried the probe toward the Moon, broadcast a series of pulses so that the vehicle's trajectory could be monitored. The world's most powerful radio telescope at the time, the 250-foot-diameter steerable dish at Jodrell Bank in England, tracked Luna 2 throughout its mission. Frequent updates on the spacecraft's progress dominated news reports — reaching the Moon was a feat of considerable technological prowess in 1959.

As the hour of predicted impact drew near, hundreds of observers trained their telescopes on the Moon in the hope that some trace of the event might be visible. The Moon was at a waxing gibbous phase, less than four days from full, so any effect would have to be glimpsed against a brilliant sunlit surface.

While most saw nothing, seven observers reported seemingly credible sightings. Hugh Percy Wilkins, a leading British lunar observer who'd recently published a 300-inch-wide map of the Moon, reported to the prestigious journal *Nature* that he had swept Mare Tranquilitatis, Mare Serenitatis, and Mare Vaporum using his 15-inch reflector at a power of 300×:

> *The stated time for the impact arrived and nothing was seen. I decided to continue for a short while and 1½ minutes after the stated time at 21h02m23s I was looking at the Mare Vaporum, the nearest part to the center [of the lunar disk]. At this point, north of the Hyginus Cleft and close to Schneckenberg, I observed a pinpoint of light and a kind of dark ring, just as though dust had been disturbed and heated. This lasted a few seconds.*

DMITRY MAKOLKIN; BANNER IMAGE: NASA

Fifty miles from Wilkins' observatory in Kent, his close collaborator Patrick Moore, host of the BBC's popular television program *The Sky at Night*, kept a vigil with a 12½-inch reflector. In a seemingly striking corroboration of Wilkins' observation, Moore reported seeing a "minute pinpoint of light" at 21:02:23 UT. "It appeared suddenly and faded out within half a second . . . in the Hyginus area, close to **Schneckenberg**." Moore cautioned that "the phenomenon was so uncertain and so close to the limit of visibility that it seemed unwise to trust it."

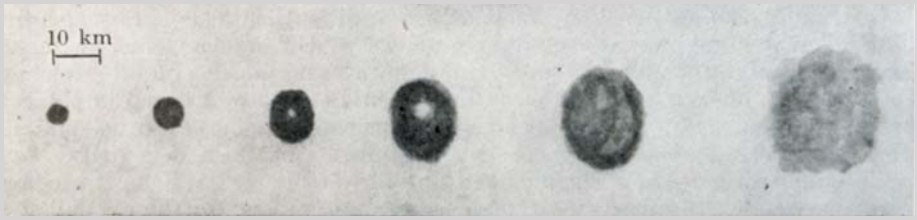
Meanwhile, at Konkoly Observatory in Budapest, a young assistant observer named Miklós Lovas turned a 7-inch refractor on the Moon. Recounting the events of that night a half century later, he recalled:

> *The Soviets had only provided the time, so I had to fit an eyepiece that allowed one to see the whole face of the Moon. I think they didn't even know where it would hit . . . All of a sudden, a dark speck appeared. The phenomenon lasted twenty minutes. It expanded and faded slowly. At first it was quite dark, but it turned to gray and was much fainter toward the end . . . The first detection of the speck (21h 02m 30s) agreed well with the termination of the radio signal of the probe (21h 02m 24s).*

Lovas' slowly fading dusky cloud was located in **Palus Putredinus**, on the southeastern edge of the Mare Imbrium, not far from the outer ramparts of the crater Archimedes but hundreds of kilometers from the bright flashes reported by Wilkins and Moore.

Damningly, a series of photographs taken that night through the 24-inch refractor at Pic du Midi Observatory in France failed to record anything out of the ordinary. In time, Patrick Moore would recant:

> *Eleven months later, when I was in Moscow, I discussed the optical observations with authorities at the U.S.S.R. Academy of Sciences and studied the other reports. They were, to put it mildly, in violent disagreement with my observation and with each other; there were flashes, luminous glows, and dark expanding spots dotted over a huge area of the Moon! This confirmed a view that none of us had in fact seen the true impact. When straining to catch a glimpse of an excessively faint phenomenon, without even knowing its position in advance, it is only too easy to be deceived.*



According to Hungarian observer Miklós Lovas, Luna 2's impact created a dark cloud of debris that enlarged and dimmed for about 20 minutes. Modern impact simulations suggest such an obvious splash would not have occurred.

Modern-day consensus, based on the observations of the impacts of other spacecraft on the Moon, holds that the crash of Luna 2 would not have been visible against a sunlit background. The sightings of Moore and his contemporaries are classic cases of the phenomenon that psychologists call *expectation bias*, the proclivity of observers or experimenters to allow their expectations to affect the outcome — and the tendency to distort recalled events to make them fit expectations.

It's worth noting that the impact sites reported by Wilkins, Moore, and Lovas are all consistent with the rocket's initial ballistic trajectory, Jodrell Bank's determination of its acceleration, and radio interferometry measurements of its course by Soviet tracking stations. Although impact specialists have grave doubts about Lovas' observation, Palus Putredinis is nonetheless listed as the impact site of Luna 2 in most databases.

Painstaking examination of Lunar Reconnaissance Orbiter images has turned up traces of 32 spacecraft or components that have crashed into or landed on the Moon — but the tiny crater and ejecta blanket created by the impact of Luna 2 remain an elusive needle in a vast haystack.

More recently, telescopic observers have indeed witnessed chunks of interplanetary debris crashing into the Moon. But those impacts are much faster, and the observed strikes have all occurred at locations darkened by lunar night.

In three months you'll have a golden opportunity to watch for impacts on the unilluminated portion of the crescent Moon. In the predawn hours of December 14th, Earth and Moon will sweep through the stream of particles shed by the near-Earth asteroid 3200 Phaethon during the annual Geminid meteor shower. Cosmic shrapnel will strike the lunar surface at roughly 36 km (22 miles) per second, an order of magnitude faster than Luna 2 did. At such speeds, a meteoroid with a mass of only 5 kg can excavate a crater more than 9 meters across and hurl 75 metric tons of lunar soil and rock on ballistic trajectories above the lunar surface.

The Moon will be a narrow waning crescent only 14% illuminated. Keep a vigil on the dim, earthlit portion of the lunar disk, where Geminid impacts will appear as flashes of light as bright as 6th to 9th magnitude.

The Meteoroid Environment Office at NASA's Marshall Space Flight Center monitors meteoroid impacts on the Moon in collaboration with the Association of Lunar and Planetary Observers. Their websites are noted below.

■ Contributing Editor **TOM DOBBINS** has observed most reported phenomena on the planets, both real and illusory.

• Learn more at https://is.gd/NASA_lunar_impacts & https://is.gd/ALPO_lunar_impacts.

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