

# One Small Controversy About Neil Armstrong's Giant Leap

<https://www.theatlantic.com/science/archive/2019/07/tiny-imprecision-heart-apollo-11/594556/>  
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When, exactly, did the astronaut set foot on the moon? No one knows.

*Jacob Stern*



NASA

The Apollo 11 mission was, in most respects, a feat of extraordinary precision.

Traveling at a maximum velocity of about seven miles a second, the Saturn V rocket would have launched the crew far off course in the event of even a slight navigational error. From nearly 240,000 miles away, Houston's Mission Control could track the spacecraft's position to within 30 feet. The command module's guidance computer kept time to the millisecond.

And yet for all that precision, no one can say with absolute certainty when, *exactly*, Neil Armstrong first set foot on the moon.

Most of the details of the moment are canonical: Armstrong took his one small step on July 20, 1969—50 years ago this past Saturday. The step took place just after 10:56 eastern time that night. And Armstrong bookended the step with the lines “Okay, I’m going to step off the [lunar module] now” and “That’s one small step for man, one giant leap for mankind.” (Or was it “one small step for a man,” as Armstrong insisted?) At some point during the roughly eight-second interval between those

two lines, he became the first human being to walk on the moon. But when exactly he did so is unclear.

The night of the moon landing, NASA told the press that Armstrong had stepped onto the lunar surface at 10:56:20 p.m., and *The New York Times* reported that same time stamp on its front page the next morning. The real-time transcription of the mission's air-to-ground voice transmission suggests that Armstrong took the step sometime between 10:56:43 and 10:56:48. And when NASA's official Apollo 11 mission report went public in November 1969, it pinpointed first contact five seconds earlier, at 10:56:15.

Experts agree that the time NASA fed reporters is probably the least reliable of the bunch. They also don't put much stock in the air-to-ground transcript, a document rife with human error. Some even question the mission report, which incorporated months of data analysis and debriefings with the crew.

Heiko Küffen, a German software engineer and space enthusiast, first came across this discrepancy in 2009, while trying to design a homemade real-time tracker that he could use to relive the moon landing for its 40th anniversary. (When I called Küffen a decade later, on the morning of the 50th anniversary, he told me that he couldn't talk long, because he was closely following an online replay of the 195-hour Apollo 11 mission.) When he tried to match the air-to-ground transcript to an audiovisual recording, he found that the transcript was behind—and that one of the records had to be wrong about the time of Armstrong's first step.

Küffen sees the moon landing as perhaps “the greatest achievement of mankind,” and he was disappointed that NASA had not recorded so great a milestone with greater precision. In 2011, he began analyzing transcripts and footage in an effort to establish a definitive time stamp.

The obstacles to absolute precision, Küffen soon discovered, are many. For starters, the moon is very far away, and even light takes more than one second to travel the 238,900 miles between here and there. So, too, did the audiovisual data beamed back down into the analog television sets of the roughly 500 million people watching as Armstrong descended the ladder of the lunar module. Add the time to process those data, and the delay between the moment Armstrong took the step and the moment viewers on Earth saw it extends to as long as a few seconds, by some accounts.

Even accounting for lag, synchronizing the audio with the video still poses a problem, mainly because hardly any of what's audible in the recordings is visible in the footage. Had Armstrong taken out a bass drum and given it a thump just before stepping off the ladder, that moment would have anchored the sights to the sounds. But when the astronauts spoke, their reflective visors concealed their lips.

“In the end,” Küffen acknowledged, “we can never know if video and audio are really in sync.”

The one thing tying the audio recordings back to time stamps is the real-time air-to-ground transcript, which, of course, loops right back to the original problem: human error.

“You have to remember that it wasn't like an Olympic swim race where touching the wall stops the timer,” Bill Barry, NASA's chief historian, said in an email, when I asked him about the discrepancy. “The exact time of Neil's first boot contact with the lunar surface is necessarily subject to interpretation because it was measured from a distance with ‘tools’ that were never meant to produce precision down to the second.”

To synchronize the transcripts and the recordings, Küffen made what he calls “reasonable assumptions,” which nearly a decade later he has yet to see contradicted. Armstrong, he found, first set foot on the moon at 10:56:25—closer, in other words, to the almost universally dismissed time given to the press that night than to the time produced by the mission report's months-long analysis.

Eric Jones, a former Los Alamos National Laboratory researcher who founded the Apollo Lunar Surface Journal, concluded after conducting an investigation modeled on Küffen's that first contact occurred at 10:56:17. NASA's sticking with its November 1969 mission report: If there's an official time, Barry said, it's 10:56:15.

A half century of scrutiny may not have produced a solution, but it has fairly well established the insolubility of the problem. Barry, for one, is not especially concerned. "This," he said, "is what happens when space geeks and engineers have 50 years to analyze and re-analyze data." But listening to Küffen effuse in imperfect English, it's hard to believe that geekery is all there is to this.

"The adventure of going where nobody ever has been before, into the unknown, driven by our natural given curiosity, is deeply soul-touching, and so I dived into the matter a bit deeper," he told me. "Knowing when walking on another celestial body happened for the very first time ... has a meaning to me, because it is important it happened, and I believe we should know all about it the best possible and most detailed way, and that includes the exact time."

Even if we don't assign the moment of the step the kind of transcendental significance that Küffen does, our lingering uncertainty has a poignancy to it. Watching the Saturn V rocket rise "out of its incarnation of flame" at Kennedy Space Center, Norman Mailer wondered whether the Apollo 11 mission wasn't one massive act of hubris, so vulgar as to verge on sacrilege. "The notion that man voyaged out to fulfill the desire of God," Mailer wrote, "was either the heart of the vision, or anathema to that true angel in Heaven they would violate by the fires of their ascent."

Contained within that moment of hubris, though, is a moment of humility. Even as we were surpassing the limits of human exploration, we were bumping up against the limits of human knowledge, though we didn't realize it at the time. We may have slipped the surly bonds of Earth and touched the face of God, but we were not infallible.

When I asked Küffen why he's devoted so many hours to analyzing a single second, he answered with his favorite quote from the Apollo program. The quote doesn't come from Apollo 11, but from Apollo 15. Standing on the lunar surface, looking out over the plains of Hadley, Commander David Scott understood "a fundamental truth to our nature." "Man," he said, "must explore. And this is exploration at its greatest." Inconsequential as it seems, Küffen's quest to answer an unanswerable question expresses that same fundamental nature, perhaps even in terms more universal than Scott's: Few of us have walked the moon, but almost all of us have sought to know what cannot be known.

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