

Of course we went to the Moon

A defense of the Lunar Landings...

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The Question...

Did NASA land people on the moon? To many, the answer is an obvious "yes". But to an increasing number of people the answer is either "probably not" or "no". The Internet is full of sites that suggest the existence of an intricate conspiracy that has been going on since the 1960's. Proponents of the conspiracy theory believe that NASA did not have the technology or the resources to send people to the moon, so in order to keep an anxious public happy, they staged the entire event. This is a pretty big claim. Imagine the entire human population being taken in by a hoax that has persisted since 1969. It seems almost unbelievable, and yet conspiracy theorists say they have evidence to support their claims. The evidence they point to seem to show inconsistencies that can only be explained by suggesting that the Lunar landings were faked—perhaps produced in a studio. These inconsistencies involve such things as the lighting on the Lunar surface, unrealistic behavior of dust, supposed flag movements caused by drafts (there is no air on the moon), and the impossibility of humans surviving in the unfiltered radiation produced by the sun.

The purpose of this article is to look at some of the evidence provided by the conspiracy theorist and decide whether or not the evidence should lead us to

conclude that the Lunar landings were hoaxes. For each piece of evidence I will offer an explanation that is in keeping with the idea that humans went to the moon. If the counter explanations are more convincing than the conspiracy theorist's explanations, we will be justified in continuing to believe that NASA sent people to the moon.

1. Flags that wave in the non-existent wind

One of the first pieces of evidence that the conspiracy theorist puts forward involves the American flag. When you watch the footage of the flag, it seems to be moving as if it is being blown by the wind. Now, since there is no wind on the moon—in fact the moon has no atmosphere—it should be *impossible* for the flag to be waving in a breeze. So how can it be moving? Is it possible that the Lunar missions were part of a hoax and the producers of the hoax made a mistake this big? Or is there another explanation? Well, nothing's impossible, but given the importance of the Lunar landings it is hard to believe that such a big mistake was made. As rational people, we should not be so quick to accept the waving flag as evidence for Lunar landing fraud.



Let's look at the problem carefully. Hoax theorists claim that the moving flag is evidence that the lunar mission was shot in a studio. Now if the footage was shot in a studio we have to again ask ourselves "why is the flag moving?" It takes a lot of wind to move a flag, and there is usually not much wind in a studio. They would need to bring in large fans to make the flag move as shown in the lunar landing footage, and it is unlikely that they would do this because they know that there is no wind on the moon. Furthermore, how could it be that the case that the dust on the ground is not moving if there is so much wind blowing through the studio? Perhaps the fact that the flag is moving can be explained in a better way. Perhaps it can be explained by looking at how objects move in an environment with no atmosphere.



In order to spread the flag in an environment with no wind, it was necessary to attach it to a thin wire frame. In the picture above you can see that the top of the flag is perfectly straight. That's because it is attached to a horizontal wire frame. Now think about how you put a stick into the ground. You push the stick down while twisting it back and forward. This is exactly what the astronauts did. They twisted the pole into the Lunar dust and in doing so they caused the flag to 'wobble'. Since there is no atmospheric friction on the moon, and since there is a low gravitational field, the wobble of the flag persisted for much

longer than it would on Earth. It appears *as if* it is blowing in the wind but in reality it has retained movement momentum from the action of twisting it into the ground.

This explanation does not, on its own, provide enough reason to shelve the conspiracy theorist's claims. There are several other pieces of evidence that could be used to support the hoax theory.

2. The dust blows

One of the most interesting pieces of evidence that the conspiracy theorist offers concerns the motion of dust in the videos. When you look at the footage carefully, you notice that dust (when moved into the air) falls very quickly to the ground. This is especially noticeable when the module takes off. The dust is blown into the sky by the rocket's downward force, and then it falls quickly to the ground. Surely, says the conspiracy theorist, the dust should stay in the sky for much longer on the moon. There is, after all, very little gravity on the moon. And dust is very light.

This line of reasoning betrays a mistake that is frequently made. On Earth, dust falls to the ground more slowly than (say) a brick. Many people assume this is because the dust is lighter. But this is misguided. Dust falls to Earth slower than a brick because of the movement of air, which can push it up and around in many different directions. In reality, weight has nothing to do with how fast objects fall. All objects fall at the same rate when dropped in the same gravitational field. You can establish this for yourself with a little thought experiment. Imagine that it's true that bricks fall faster than coins because they are heavier. Now ask yourself what would happen if you tied a brick to a coin with a piece of string, and then dropped them from a tall building. Would the brick drag the coin down faster than it would normally fall? Or would the

coin pull up on the brick thus slowing its descent? If it is true that these objects fall at different rates, there is no way to decide whether the brick will speed up the coin's fall, or if the coin will slow the brick's fall. This is a paradoxical situation that highlights the mistake in thinking that objects fall at different rates depending on their weight.

So, if there happened to be no atmosphere on Earth we would expect a speck of dust to fall to the ground at the same speed as a brick. This is the effect we see in the Lunar video footage. The dust falls to the ground quite quickly because there is no atmosphere to hold it up. It falls to the Lunar surface at the same speed as anything else that was dropped on the moon. The rate at which the dust falls is, of course, a little slower than the rate at which objects fall on Earth. This is because the moon's gravitational field is weaker than Earth's. The speed of the falling dust in the Lunar video clips actually gives us reason to believe that the footage *must* have been taken on the moon. We know that dust can't fall at that rate on Earth because of the atmosphere. And even if the engineers of a Lunar hoax managed to create a vacuum in a studio, we would expect the dust to fall much faster than it did in the actual footage. Dust in a vacuum falls as fast as a brick.

So, the movement of dust in the Lunar footage can't be used to support the conspiracy theorist's claims. If the conspiracy theorist continues to assert that the footage is fraudulent, the following question arises: *If the footage is fraudulent, how could the special effects producers of the 1960's create footage of dust falling to the ground in a vacuum slower than it would on Earth?* The burden is on the conspiracy theorist to answer this question.

3. Shady shadows

Many photographs were taken on the moon and most of them have been scrutinized very carefully by conspiracy theorists. Their hope is that they might find some discrepancies in the lighting, shadows, or scenery. Interesting evidence has subsequently emerged that could give us reason to doubt the authenticity of a few of the photos. This evidence centers primarily around *inconsistencies* in the shadows cast by objects.

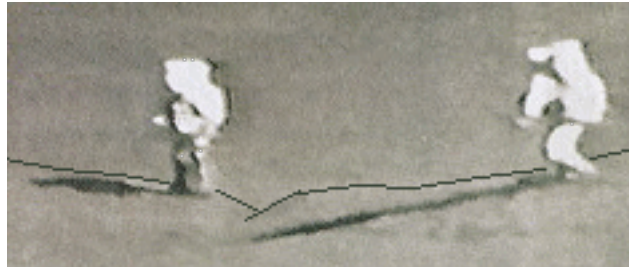


Look at the above photograph. It shows two astronauts very close to each other on the Lunar surface. But look at their shadows. Not only are they different sizes, they are cast in different directions. This seems to indicate the existence of two separate sources of light. But we all know that the primary source of light on the moon is the sun (the Earth's brightness provides some light, but that is small in relation to the sun). How can these shadows be explained except by supposing that someone made a mistake when setting up the lighting for the production of hoax footage?

This is a good question, the answer to which might lie in the blurry nature of the photograph. Since it is not a clear picture, we cannot make out the contours of the Lunar surface. Even in the clear photographs it is hard to make out the shapes of small slopes on the moon because everything is so bright and uniformly white. But imagine if the photograph was clear and in focus. We might notice that the astronaut on the right was heading *down a slope*, while the astronaut on the left was at the foot of an *upward slope*. If the sun was

behind them (to the far right of the picture) then their shadows would be correct.

Consider the same picture again with the slopes highlighted.



You see; it starts to make more sense when you view the picture like this. Similar explanations can be offered to explain lighting discrepancies other photographs.

Another lighting problem that is often pointed to concerns the fact that objects remain brightly lit when hidden by shadows. Consider this picture of an astronaut leaving the landing craft.



Conspiracy theorists make their objection by asking: *How is it possible for us to see the astronaut so clearly?* The sun is obviously on the other side of the

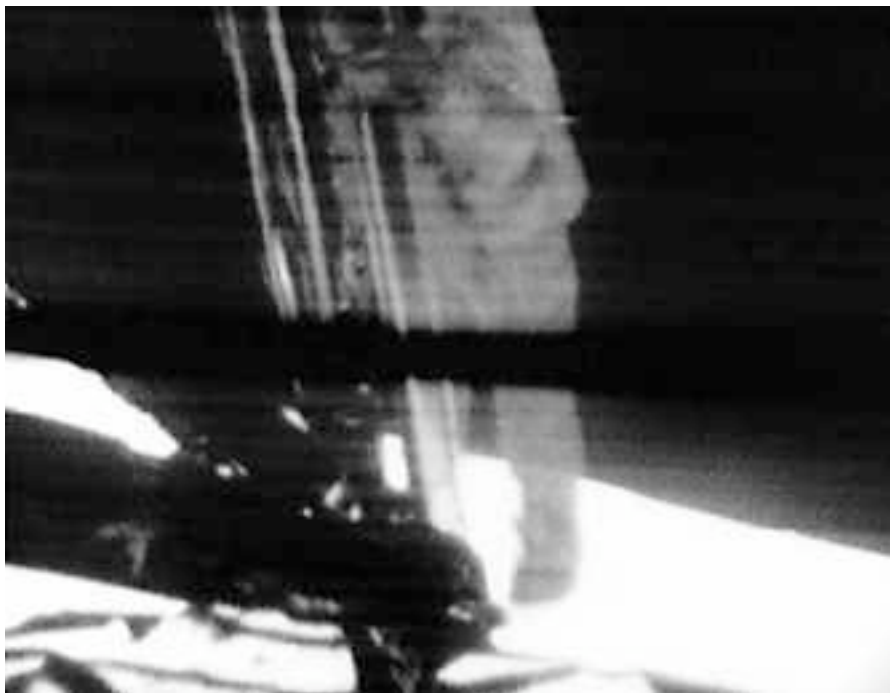
landing craft because it seems to be in shadow. Yet we see the astronaut clearly and brightly *as if* there is another source of light. Furthermore, the top of the astronaut's oxygen pack is shaded *as if* there is a source of light on the ground.

This is an important objection, but unfortunately for the conspiracy theorist it rests on the simple oversight that there *is* another source of light on the moon, namely the moon itself. The moon is a very bright whitish object, which reflects the light from the sun as brightly as snow. Since the astronauts were constantly surrounded by the bright reflecting surface of the moon, they were always brightly lit.

Like much of the evidence presented by the Lunar conspiracy theorist, the evidence from shadows can be put aside when illuminated by a better understanding of the Lunar environment.

4. Camera evidence

When I was young, I remember watching archived footage of Neil Armstrong climbing out of the landing craft to take his first step on the moon. Because I was so used to watching television scenes portrayed as real events, it never occurred to me that there must have been a camera-person shooting the footage. As time went by, however, I found myself wondering: *if these are Armstrong's first steps on the moon, who's holding the camera?* This question has also been asked by the Lunar conspiracy theorist. The low quality picture below is a frame captured from the footage of Armstrong's departure from the landing craft.



A few years ago I had never heard of the Lunar conspiracy debate, so it didn't occur to me that the footage might have been faked. But I needed an answer to the question, so I came up with one of my own. I reasoned that since the world would want to see Armstrong's first step on the moon, he probably left the craft and set up a camera before the live feed took place. Once in place, the camera could be operated remotely and could be used to film Armstrong's "first step". This is a reasonable explanation, but it is not correct. I was right in thinking that NASA would come up with a plan to film Armstrong's first step, but I was wrong in thinking that he set up the camera himself. What NASA actually did was attach a camera to an extended arm on the landing craft. This camera was lined up with the exit port and was operated from within the craft. Hence, Neil Armstrong's famous first step onto the Lunar surface was watched LIVE as it happened.

Another problem that is sometimes put forward concerns a supposed anomaly in the photographs. Take a look at the cross-hairs (the targeting '+' shapes) in the photo below.



You will notice a problem with the cross hair on the left side of the picture. It appears to be behind part of the image in the photograph, when in fact it should be superimposed over the picture. Some people have put this forward as evidence to show that the photographs are fakes (and BAD fakes at that).

The cross-hair anomaly in this picture can be explained by looking at how images from the moon were transmitted to Earth. Pictures taken on the moon were split into data-blocks, which were sent to Earth separately. The cross-hairs contained in the images are reference points, which Nasa used to reassemble the pieces of the photograph. In the above example, one of the image slices was obviously pasted on top of one of the cross-hairs.

There are much more interesting images that the conspiracy theorist can focus on. One of those is the footage of the space-craft leaving the moon. The question they ask here is: *who filmed the astronauts' departure?* The camera pans up to follow the ascent of the craft, which means it must have been operated by someone. Did NASA leave a camera person on the moon, or was the whole thing done in a special effects studio?

This question presupposes the need for a camera operator. But remember that by 1969 NASA had developed the ability to send remote controlled craft into space, and some of those craft had automatic cameras on board. It would have been no problem to set up a timer controlled camera on the surface of the moon and have it designed to pan upwards as the Lunar craft ascended. Everything else about the mission was timed to the second, and NASA knew exactly how fast the Lunar craft would travel off the surface. So the question is

better posed as: *did NASA arrange for a timer operated camera to be taken to the moon, or was the whole mission fabricated in a studio?* Both options are possible, and as such the conspiracy theorist cannot use the film of the space-craft leaving the moon as strong evidence that the entire mission was a hoax.

5. The problem of Radiation

One of the more serious problems with the authenticity of the Lunar missions involves the level of radiation produced by the sun. Here on Earth, we are protected from most of the sun's radiation by our atmosphere and the Earth's magnetic field. However, out in space there is no such protection. Some theorists have estimated that a space-craft moving beyond Earth's protective magnetic field (much further than the International Space Station) would need several inches of lead shielding to protect the astronauts on board. Since the missions to the moon had no such shielding, theorists conclude that the astronauts on board should have perished; and since they obviously survived, the whole thing was faked.

The problem with this type of reasoning is that these theorists are *estimating* what will happen when people aboard space-craft are exposed to such intense radiation. When they conclude that astronauts could not possibly survive, they seem to be closing their theory to the possibility of falsification. When presented with the possibility that the astronauts *did* survive, these theorists do not reassess their theories—rather, they denounce the evidence as fake. This isn't the way science should work. The idea that nobody can survive the radiation in space is a theory that can only be confirmed or falsified by sending someone up there. Now, since supporters of this theory do not believe that anyone *has* been that far into space, they have no grounds upon which to assert the truth of their claim and the falsity of the Lunar missions. For all they know, they could be wrong and people *did* go to the moon and survive.

The thought that radiation would kill the astronauts on their way to the moon rests on a misunderstanding of radiation in space. It is true that the sun can release intense bursts of radiation, but not *all* radiation is harmful. Radiation from the sun can be measured in terms of *solar particle energies*. These range in intensity. The low energy particles, which measure in the thousands of electron volts, can easily be stopped by a space-craft's hull or a space suit. At the other end of the scale, the very high energy particles (over 1000 million electron volts) can pass right through a space-craft and the people on board without actually interacting with their body cells. The most dangerous particle energy level sits somewhere in the middle (in the millions of electron volts). During a solar flare, particles at all energy levels are produced and this can be very dangerous for astronauts. Fortunately, solar flares do not occur everyday and they do not send particles out in all directions.

An understanding of radiation in space shows us that an astronaut on a trip to the moon will not *necessarily* be exposed to dangerous levels of radiation. Of course, this is not to say that there are no risks. A solar flare in the wrong direction could do serious harm to an astronaut. But such flares are not everyday occurrences. Furthermore, being exposed to a high dose of radiation does not guarantee illness, cancer, or death. It merely raises the *probability*. It is possible for an astronaut to live a long healthy life after being exposed to radiation levels produced during a solar flare.

6. Common sense

Imagine the difficulty in fabricating the Lunar missions of the 1960's and then trying to keep the truth a secret. There were thousands of people involved in the missions and millions watched the events live on television. How could so many people be taken in? How could NASA ensure the silence of all those involved? Surely someone would have leaked the secret. It would only take

one disgruntled NASA employee to go to the press and the whole thing would have been exposed. And given the amount of planning involved, such a leak could have happened months or years before the missions were supposed to take place. Yet there were no leaks and the missions were carried out as planned. The U.S.S.R (who watched *everything* in the U.S.) did not cry "FRAUD"—and they would most certainly have said something if they thought the missions were faked. It seems difficult to believe that the entire Lunar program was produced in the studio.

There are many different types of conspiracy theories, ranging from the Lunar hoax theory to the government cover up of UFO's. Such theories offer evidence that looks, on the surface, to be reasonable. However, a little digging can usually reveal holes in the theory and inadequacies in the evidence. It is quite revealing that conspiracy theorists never take an unbiased approach in presenting their theories. They never consider alternatives or entertain objections to their claims. They speak in an authoritative fashion and present their views as accepted scientific research. But as rational human beings, we should not let ourselves be convinced so easily. We should always look for alternative explanations and then weigh the probabilities. If the conspiracy claim is supported well by the evidence, then we have reason to take it seriously. If, on the other hand, it turns out to be more likely that the conspiracy claim is false, we can enjoy strengthened confidence in our current view.

Of course we went to the Moon

The conspiracy theorist has put forward evidence to show that the Lunar missions were part of an elaborate hoax. This evidence has included photographic anomalies, and physical phenomena such as radiation levels in space and the movement of objects on the moon. Much of the conspiracy

theorist's evidence is compelling when first looked at. However, a little research shows that the evidence relies on a misunderstanding of the Lunar environment. For each piece of evidence presented in this article, I have offered an alternative explanation that is in keeping with what we know about the Lunar environment. These alternatives do not show that the conspiracy theory is false, but they do show that the evidence is far from convincing.

Considering the fact that the conspiracy theorist's evidence is not convincing, and considering the immense difficulty in staging such an elaborate hoax and keeping it a secret, we are justified in holding the belief that NASA sent people to the moon.

References and Further Reading

Bakel, Rogier van, 1993-1997, "The Wrong Stuff", <http://members.tripod.co.uk/W3/MoonLandHoax.htm>

Bpoppe@sec.noaa.gov (Name not available), 2001, "A Primer on Space Whether", <http://www.sel.noaa.gov/primer/primer.html>

Dotto, Lydia, 2000, "Radiation in Space: Assessing the risks", <http://schools.tdsb.on.ca/spacenet/newstories/rad/radiation.htm>

Ludwig, Bob, & Oneil, Megan, 2001, "Radiation and the International Space Station", National Academy of Sciences, <http://www4.nationalacademies.org/news.nsf/isbn/0309068851?OpenDocument>

Phillips, T., 2001, "The Great Moon Hoax", http://science.nasa.gov/headlines/y2001/ast23feb_2.htm

Science Net, "How did people go to the Moon without being harmed by the radiation coming from the sun?", <http://www.sciencenet.org.uk/database/Physics/9812/p01335d.html>

Author unknown, 1998-2001, "Moon Hoax?", <http://www.redzero.demon.co.uk/moonhoax/>