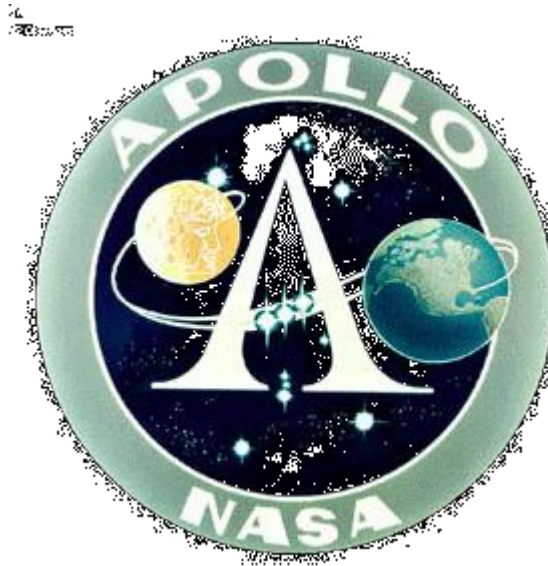


Who Mourns For Apollo?

-- Or --

Was It *Really* Only a Paper Moon?

by
Mike Bara
With
Steve Troy and Richard C. Hoagland



In the last few years, we have become increasingly alarmed as a particularly silly and damaging "urban myth" has begun to take hold. Promoted by a few well known authors such as David Percy and the late James Collier, this latest twist on the current "conspiracy nation" fad is based on a simple, if unbelievably naive and absurd notion -- that the Apollo Missions and subsequent Moon landings were faked. Admittedly, we thought this whole issue was put quite nicely to rest in August 1997, when Enterprise Mission principal investigator Richard C. Hoagland "debated" Collier on Art Bell's "Coast to Coast AM" radio program. The results of that debate can only be described as an unmitigated humiliation for Collier, who turned out to be totally out of his element and misinformed on the general subjects of space travel, physics, engineering, NASA, and Apollo itself.

Yet still, it rears its ugly head today. Even after Percy's Fortean Times article was pretty much taken apart by readers, references to the "fake" landings began to creep into popular culture, springing up in such diverse places as Jay Leno's "Tonight Show" monologue and commercials featuring ESPN's Chris Berman. Usually, the references were tongue-in-cheek, but when we heard that the Fox

network was planning a full scale special on the issue, we decided the time had come to say something.

Let us be clear; we are all uniformly, unabashedly, "conspiracy theorists" here. We are 100-percent convinced that there has been a cover up by NASA of some extraordinary discoveries made in the course of the agency's 40-year year history. That said, one thing they did **not** do, unquestionably, was fake the Moon landings. In fact, most of the charges made, not just by Collier and Percy, but by others who have picked up the mantle of their assertions, are so absurd, so easily discredited, so lacking in any kind of scientific analysis and just plain common sense that they give legitimate conspiracy theories -- like ours -- a bad name. Frankly, we suspect **that** may ultimately be the point of this whole thing after all.

Almost from the moment that Neil Armstrong and Buzz Aldrin set foot upon the Moon at Tranquility Base, the rumors began that the whole thing was faked. We have always felt that there was something a little more to this than simple stupidity or naïveté. Something a bit insidious about the whole thing. We assumed that as time went by, the notion would weaken and falter, rather than gain momentum as it has recently. We have come to wonder, given our own stance on the whole question of what the Moon program was really about and what the astronauts really found, if there wasn't perhaps something a bit "conspiratorial" about the promotion of this patently absurd and demonstrably false conspiracy theory.

As you will see, some of these charges can actually be more easily explained not just by a complete rejection of the Moon Hoax theory, but a combination of conventional explanations and our own "glass ruins" model of the Moon. The way light scatters on the Lunar surface; the size of solar reflections in the visors of the astronauts (which are way out of proportion to their counterparts on modern day Space Shuttle missions); the sometimes secretive stance taken by the astronauts and the Agency; the very peculiar qualities of the film in the cameras taken to the Moon by the astronauts, all point to something bigger and more interesting than we have been led to believe by NASA itself. But, we suspect that the promotion of this particular idea -- that the Apollo astronauts never went there at all! -- which is so easily discredited (as we will do below), is designed to lessen the blow when revelations regarding what NASA has **really** found across the Solar System begin to happen ... later this very year.

If NASA is eventually forced to admit that there was more to the Face on Mars than meets the Eye, that maybe they missed something "the first three times around," or that there is truly something "ancient and extraordinary on the Moon" ... then it will be crucial to have thoroughly discredited the "conspiracy theorists" out there (read: us). Remember, it is our position (and has been for some time), that this millennium cycle, the 2000-2001 period, is the beginning of an ongoing pattern of disclosure. Up to now, we had assumed that this would come in a

series of significant revelations; of outright announcements that things are not quite what we had been led to believe. But now, we suspect that there will simply be a series of much smaller releases -- like simply taking a new image of the Face on Mars and releasing it without comment -- and pretending that the "Eye" isn't there staring back at them. If enough people can be convinced by this deliberate disinformation campaign that "there are no NASA conspiracies" -- by the deliberate promotion and then effective debunking of obviously bad conspiracy theories like "We Never Went To The Moon" -- then it will be much easier to sell the idea that NASA "just missed a couple of things" on those Mars pics all those years ago. And certain people, deeply implicated in the cover-up, will neatly escape the consequences for their theft over more than forty years of our entire space program!

So this then appears to be the political agenda. We plan to "scotch this thing once and for all" -- as a JPL spokesman was heard to say about the "Catbox" image of the Face on Mars -- in order that we might make clear the differences between what we have alleged, and the way that the powers-that-be would like you think about all things conspiratorial.

In this article, we will try to sort out the most common claims being made, highlight the rebuttal evidence, and show that the Moon landings were something quite extraordinary after all. Some of the details concerning these issues are beyond the scope of this article, however, and we plan to follow up with more specifics at a later date.

There are three major thrusts used by the fake landing advocates to bolster their claim: first, that the radiation exposure suffered by the astronauts was not survivable; second, that the photographic evidence "proves" that the landings were staged in a Disney movie studio somewhere; and third, that the mechanical aspects of the mission -- the pure mechanics and physics of the journey -- are not as claimed and therefore must be faked. As you will see, each of these is based on misinterpretations, misrepresentations, or just plain ignorance of the realities of space travel. It is not a coincidence that many of the "believers" in this myth are too young to literally remember the Moon landings. If they had been old enough to watch the actual missions, especially on live TV, they would have known that most of these claims are poppycock. For this article, we will deal with each of these claims in separate sections, and try to directly address the key sub-claims being made.

SECTION ONE - THE PHOTOGRAPHIC EVIDENCE

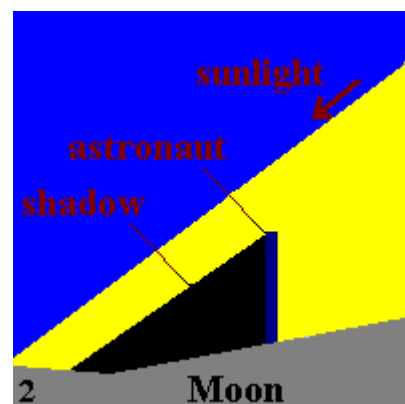
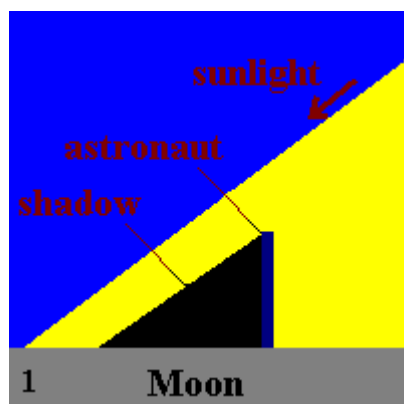
Percy is one of the primary drivers of this particular set of claims, but Collier and others have added to it. Let's list a few of the claims one-by-one and address them.

ISSUE 1 - The shadows don't fall right in images taken on the Lunar surface, proving that there are multiple light sources, like professional stage lighting using high-powered lamps. Since the Moon has only one light source, the Sun, these images (these people claim) "have to have been shot on a sound stage somewhere."



This one is usually based on images like the one above (taken from an Apollo 17 TV transmission), that seem to show the shadows of the astronauts coming from **different** lighting sources. However, a logical approach to this problem reveals that there is nothing at all mysterious about either the shadows or the light sources. If, in fact, the shadows were cast by different light sources, wouldn't each astronaut have **two** shadows, instead of just the one each we see here? Of course they would. Yet, in the images that the "Moon Hoaxers" cite, there is consistently only one shadow being cast, indicating that the Sun is (as it should be) the dominant light source.

So, how to explain the seemingly divergent shadows in this image? If you look closely, you will see that the astronaut on the right is on a slight rise above the astronaut on the left. This has not only the effect of lengthening his shadow, but also if the slope is greater in one direction, say to the left of the astronaut on the right, it will tend to flow and elongate in that direction.



It's important to keep in mind that the Moon has a very rough and uneven surface, with lots of slopes, rises and potholes. As a result, many of the shadows will appear to be non-parallel. Invariably, the Moon Hoax advocates will compare

these lunar images to flat, smooth terrestrial landscapes, like this one below from David Percy.



In a sense, the Moon Hoax advocates are correct here; there is no comparison to be made from Lunar landscapes and terrestrial ones. But, it is because the surface of the Moon is so uneven, not because there are multiple light sources, i.e. lamps, casting the "wrong" shadows.

Also at issue is the photographic equipment used by the astronauts on the lunar surface. Shortened wide-angle lenses, like the ones on the hand-held Hasselblad 70mm cameras used by the astronauts, will distort otherwise parallel shadows. Simply pull some outdoor photos from your own personal collection and see for yourself.



Apollo 12 astronaut Alan Bean with Hasselblad camera on the surface of the Moon.

ISSUE 2 - The foreground of many images of the astronauts on the Moon are filled in with light, while the shadows remain absolutely black, again proving that there are multiple light sources.



In this one, the argument is that with his back to the sun, the astronaut's suit should be as dark as his own shadow stretching out in front of him (see Apollo 16 image, above). Since there is no light diffusion in an absolute vacuum, NASA "must" have used reflectors or "fill-in lamps" to illuminate the astronaut for this photograph. The truth is, there *is* evidence of a "reflector" in this image -- but it is the **lunar surface** itself! Obviously, the lunar surface is a fairly bright gray color. It is known, from the Apollo samples brought back and analyzed in Houston, to contain a LOT of glass beads, with a lot of reflective and refractive minerals in it. All of these materials tend to kick light directly back toward the source of illumination with very high efficiency, in this case the sun. This is one reason why the Full Moon is so much brighter (than other phases) in the night sky; the sun is "behind" the Earth. The effect of the sunlight hitting the lunar surface and being reflected back toward the sun itself creates a "backscatter" that fills in the astronaut's bright white shadowed suit with excellent "fill-light." And the fact that the shadow is so dark on the ground in front of him is proof of exactly the opposite of the claim being made by the "Moon Hoaxer" crowd. It shows that indeed, the astronaut is standing **upright** in a harsh vacuum, where his suit can "see" the illumination from the surrounding lunar landscape. By stark contrast (pun intended ...), almost no light at all has seeped into the shadow -- because it's lying flat on the ground and cannot "see" anything but black space overhead! It is, as it should be, extremely dark and sharp.

Interestingly, as to the question of multiple light sources, some of the leading debunkers of the Moon Hoax theory have also made a very significant mistake. It

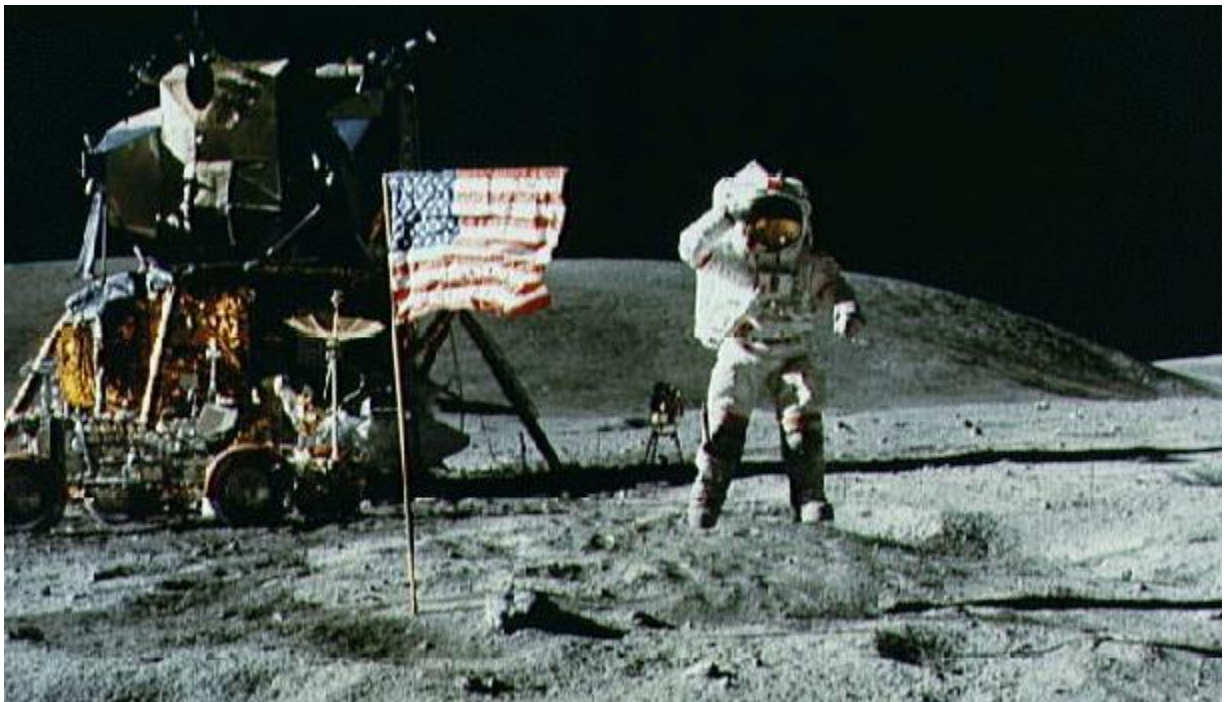
is flat wrong, ,as many of them have stated, that the Earth is a "very significant" light source on the Moon. When full, the Earth is on the order of 68.4 times brighter than a full Moon as seen from Earth. It also takes up something like 13.5 times as much sky. But, that's not the whole story.

The Earth is -- maximum -- 100 times the brightness of a Full Moon (we're going to overestimate a bit to prove the point). The apparent magnitude (brightness) of a Full Moon is about -13. The equivalent magnitude of the Sun is about -27. Subtracting, that's a difference of 14 magnitudes. Since each 5 magnitudes corresponds to a factor of 100 in brightness, a difference of 14 magnitudes corresponds to almost $100 \times 100 \times 100$, or a factor of a million! Allowing for the ~100 times greater reflected brightness of the Earth (at "Full Earth"), the direct lunar sunlight is still **~100,000 times brighter** than the Earth's illumination.

There is **NO WAY** that the slide films used by the crews (even the "super film" developed by EG&G, see below) could have detected that feeble "Earthlight" on the lunar surface, even in the shadows, with exposures set for the sunlit view.

Of course, we have our own thoughts on this. Some of the debunkers must be realizing that backscatter is insufficient to account for some of what we are seeing on the lunar surface photography. To come up with an explanation, they have resorted to the (obviously incorrect) "Earth light" angle; but it is of course, more interesting than that. Read on.

ISSUE 3 - There are no stars in the background from pictures taken on the Moon.



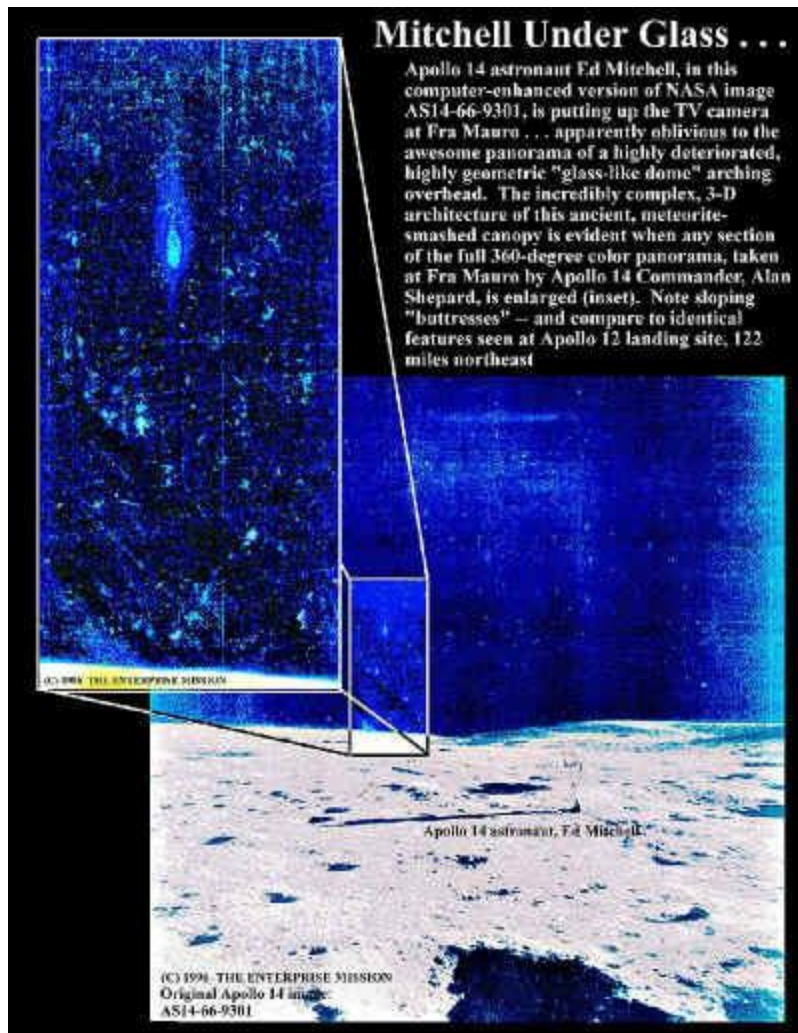
This one keeps coming up, but the answer, while obvious, is somewhat complicated by our own lunar conspiracy theory. Usually, Moon Hoax advocates cite any number of pictures of the lunar surface showing an absolute black background, but this one above of John Young saluting the flag in front of the LM "Orion" is quite prevalent. Anyone with the slightest knowledge of photography can easily put this one to rest. Any brightly lit foreground object must be photographed with a very short exposure time. Otherwise, the image will be badly overexposed. Any background pinpoint light sources -- like, say, stars that are literally trillions of miles further away -- will not show up at all. Likewise, if the photographer wants to capture the background stars, he is going to have to use a very long exposure time, which means that the foreground will be totally washed out in one blob of overexposed light. Obviously, there would be no real benefit to taking such an image, since the point of the lunar surface photography was to document the activities of the EVA's **on the lunar surface** -- not to stargaze.

This whole process is complicated by the fact that in a vacuum, the problem is made even worse, the light far more intense, and the exposure must be even shorter. The Moon Hoax advocates also seem to have forgotten that they are basing most of their "analysis" on press release photos, which are invariably cleaned up before release to the press. So of course, these sanitized press kit images would reflect what we all would expect to see, an absolute black background.

Which brings us to our own thoughts on the Moon and lunar photography.

Contrary to what the Moon Hoax advocates have been saying, the sky above the astronauts **should** be absolutely black. And in fact, on most of the prints that they have been looking at, web based images, press release photos, and even new prints from the archives, it is. The problem is that while the sky **should** be absolute black, and **does** appear that way in images presented by the Moon Hoax advocates, it most demonstrably is **not** absolute black in the images examined by Enterprise Mission investigators.

As you know, a few years ago *Enterprise* principal investigator Richard C. Hoagland was approached by former NASA flight instructor Ken Johnston, Jr., and supplied with a set of extraordinary first generation prints of Apollo lunar photography which had remained untouched for nearly thirty years since he obtained them from inside NASA. What these prints showed was quite another story -- that the sky above the astronauts was far from blank -- it was in fact filled with a strange, bluish, **geometric** set of ruins.

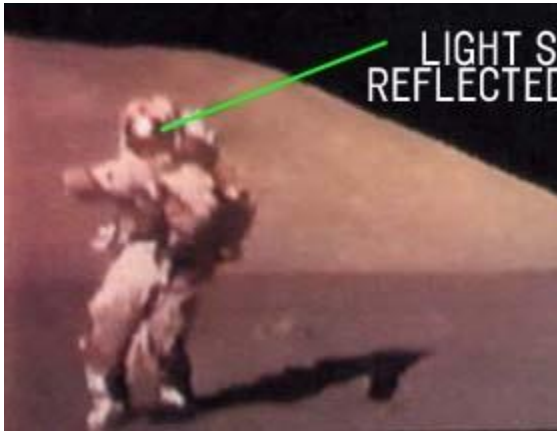


So the problem is exactly the opposite of how it is stated by the Moon Hoax advocates. The sky **should** be black, but it **isn't**.

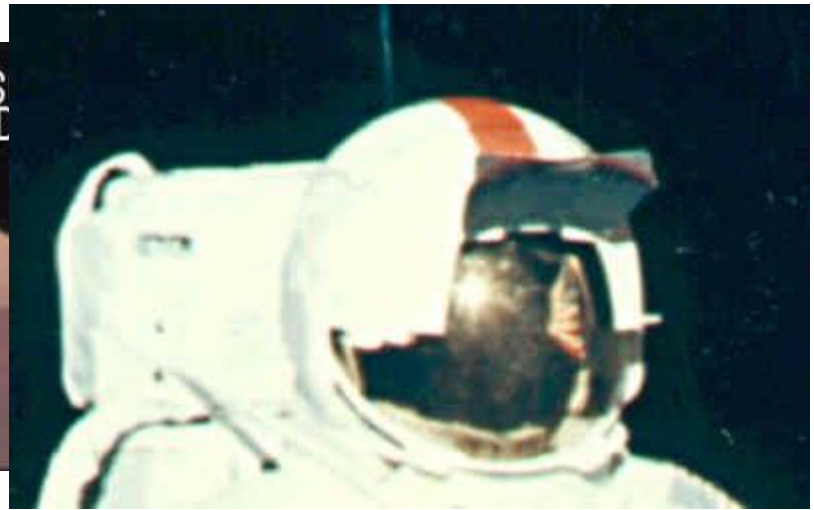
One amusing sidelight of this Apollo 16 photograph is that it is used on several web sites as "proof" that many of the pictures taken on the Moon are fake, since John Young "... is casting no shadow at all!" on the lunar surface. In fact, all it really shows is how dumb most of the Moon Hoax advocates really are. If you actually look at the picture, you will see that Young is casting a shadow to the right side of the picture a few feet away. How can this be? Why is the shadow not "attached" to young's feet?! Well, because in this famous sequence, John Young is leaping into the air as he is saluting, while Charley Duke snaps the photo. Many Moon Hoax advocates, too young to have actually watched this all on live television, look at this picture and mistakenly believe that Young is standing on the slight dome shaped rise in the background, when in fact he is in midair (well, OK, mid-**vacuum**). This famous sequence is also a good way to show that the astronauts are indeed in the one-sixth gravity of the Moon, since in order to get this kind of elevation on Earth (especially with the bulky, several-hundred-pound

spacesuit and backpack on), Young would have to have the leaping ability of Michael Jordan! For those interested, I can highly recommend the excellent NASA video series "[Apollo - Mission to the Moon](#)" which shows film of this famous live TV sequence.

ISSUE 4 - In some images, a huge light source can be seen reflected in the astronaut's visors. This has to be a very bright, nearby source.



Apollo 17



Apollo 14

This argument is essentially a variation of the first argument. Occasional images, like the ones above (taken from the Apollo 17 EVA TV transmissions and Apollo 14), seem to show a very bright, huge light source taking up almost 25% of the astronaut's visor. Moon Hoax advocates argue that this is proof of a large light source (a stage flood or a spot, again) positioned very close to the astronauts. What they are missing here is essentially the same geometric problem they missed with the "bent shadows" argument. As you can see from the previous image of Alan Bean (above), the gold-covered helmet visors that the astronauts wore were very convex shapes -- similar to automotive wide-angle side mirrors included on many current models ("Warning: objects may be closer than they appear ..."). Like the surface shadows in the earlier images above, this curved helmet has the effect of severely distorting the reflections, making them appear much smaller (and thus farther away) than they actually are.

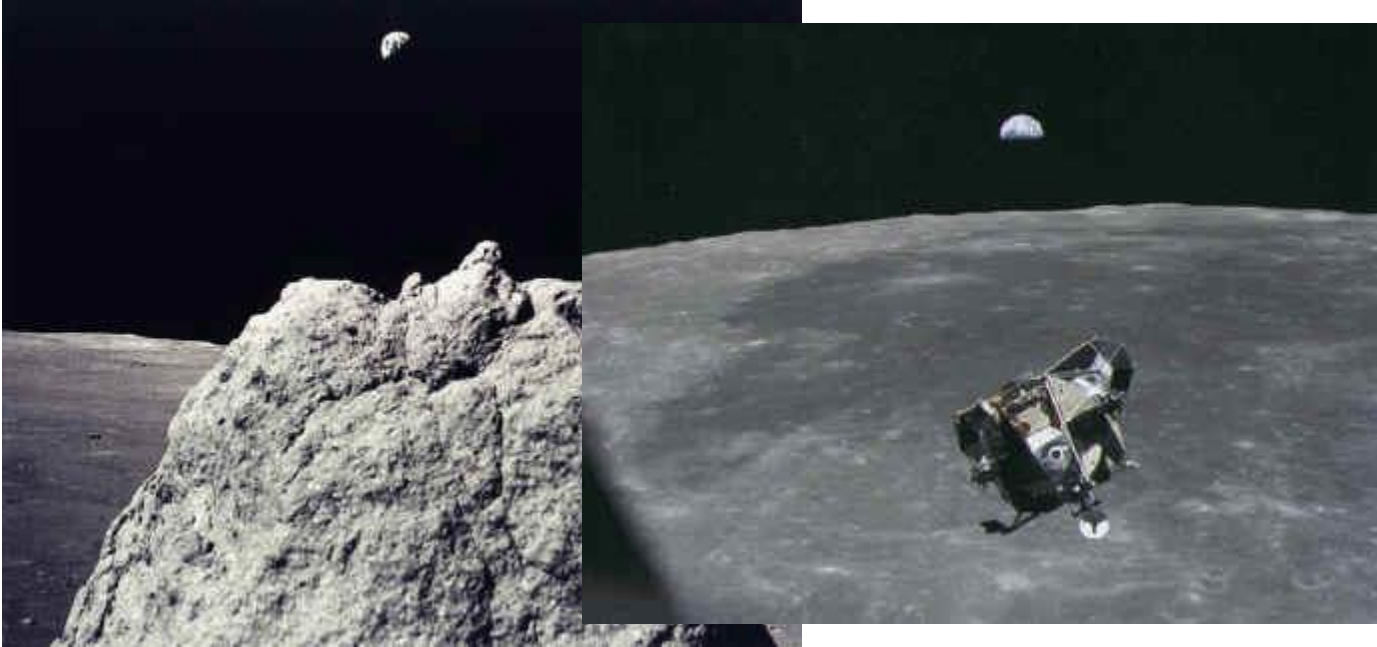
The problem: the sun, in the lunar helmet reflection pictured here, appears much larger (and therefore closer!) than it possibly could. Our explanation for this remarkable observation is firmly grounded in our investigation of the **REAL** conspiracy that NASA has worked so hard, for over 40 years, to cover-up: the presence of **ancient, glass-like ruins on the Moon**. It is these ruins, sticking up above the lunar horizon and physically intervening between the low-angle sun and the Apollo astronauts roaming across the surface, which create the magnified halo of scattered light seen in the gold visors. Since this area of

"forward scattering" is much larger than the optical size of the sun itself, it makes the "reflection" appear disproportionately larger -- even in the curved gold visors - - than the view of a similar reflection of the sun from Ed White's helmet, photographed in Earth orbit on the Gemini 4 mission in 1965 (photographic comparison, below).



ISSUE 5 - There are no views of the Earth in pictures taken from the Moon.

This one also is just plain wrong. Collier was among the most enthusiastic promoters of this mistaken notion, based on studying only a few press release photographs from NASA. Below is an Apollo 17 picture (on the left) of a large boulder, with the Earth in the background, taken by an astronaut with a hand held Hasselblad 70mm camera (the same camera which took the photograph of Gene Cernan, with the flag and Earth, above). Below right is a hand-held 70mm Hasselblad picture taken by Apollo 11 astronaut Michael Collins, as the Eagle approached the CSM for the return trip home. Since all the non hand-held pictures taken on or at the Moon were using something other than 70mm transparency film, these photos had to have been taken by a human being -- an Apollo astronaut -- physically present either on the Lunar surface or in space around the Moon.



ISSUE 6 - How could NASA take TV images of the LM ascending on Apollo 15, 16, and 17 if there was no one on the Lunar surface to man the camera?



Now, most of these charges are pretty dumb, but this one really has to take the cake. As you can see from the collection of images above (from two different missions) on the later Apollo missions (15-17) the astronauts left the TV camera pointed at the LM so that viewers on Earth could watch the liftoff. Initially, the camera was unable to track the ascent stage as it rose into space, but by Apollo 17, NASA had figured a way to get the camera to track upward and follow the spacecraft. So the answer to this one is also simple and obvious -- the camera was remotely controlled from Earth.

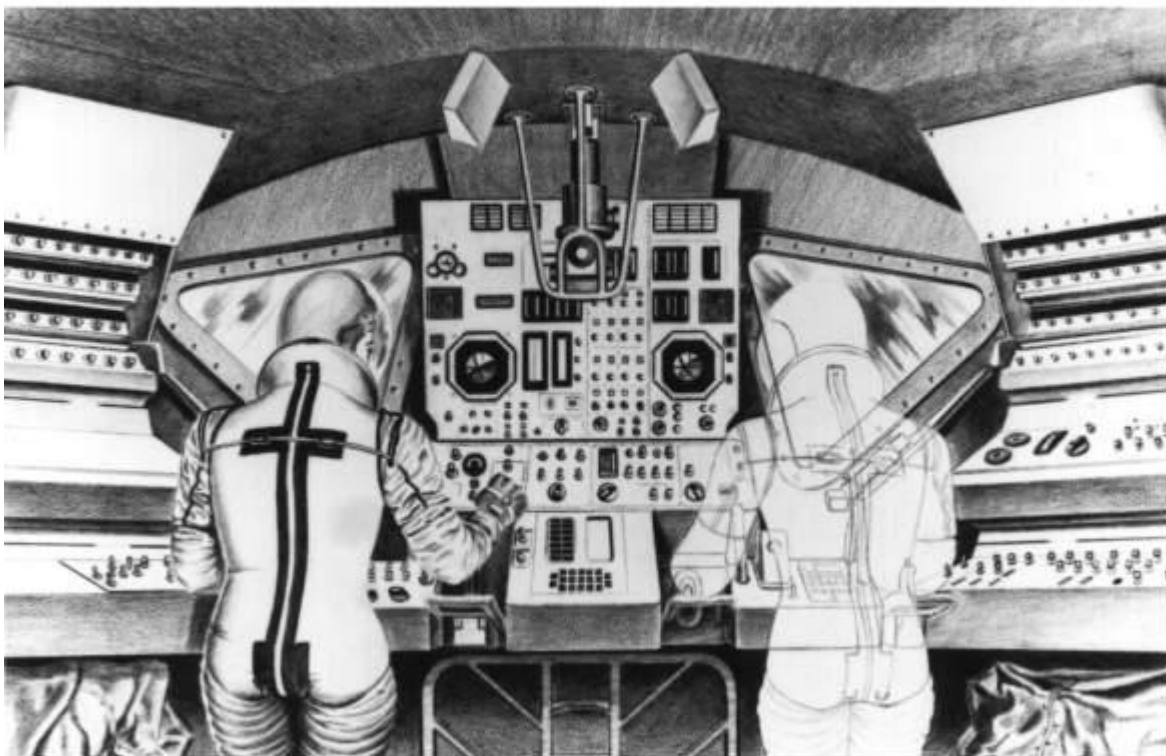
SECTION TWO - THE MECHANICAL ARGUMENTS

Most of these claims come from James Collier's "Was it only a paper Moon?"

ISSUE 1 - The astronauts could not have egressed and ingressed the LM because they could not fit through the hatch and there was no room to even open the hatch in the LM.

It's hard to know just how to respond to this one beyond simply stating that it is wrong. As you can see from the artist's concept below, the astronauts were positioned on either side of the central cockpit panel, with the main EVA door between them. There was in fact plenty of room to open the hatch. On Apollo 11, Armstrong would have been manning the left position in this view and Aldrin the right. The door was latched to Aldrin's side, necessitating that the door be swung open inward, and effectively "trapping" Aldrin momentarily on his side of the LM. In fact, this is the main reason that Armstrong egressed first. Once he was out, Aldrin was able to close the hatch, move over to Armstrong's position, and exit himself.

LEM COCKPIT INTERIOR



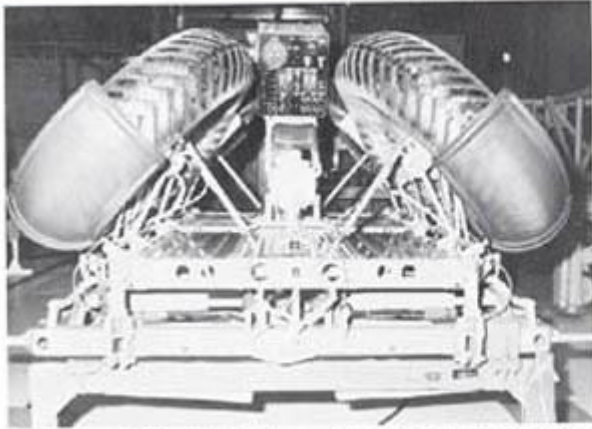
As to the issue of whether the astronauts could fit through the hatch, as you can see below, they must have. This is an image taken from a film shot by Armstrong of Aldrin egressing the Lunar Module. The entire sequence is available from the NASA archives, and shows the whole procedure from start to finish, including Aldrin opening the hatch and crawling through it.



Furthermore, if it turns out that the astronauts could not fit through the hatch, this will come as quite a shock to our friend and contributor Ken Johnston, Jr. He spent many hours in the vacuum chamber at Houston, fully suited up including the backpack, crawling in and out of the full scale mockup of the LM, to test exactly that. He'll be very upset to learn that he wasted all that sweat for nothing.

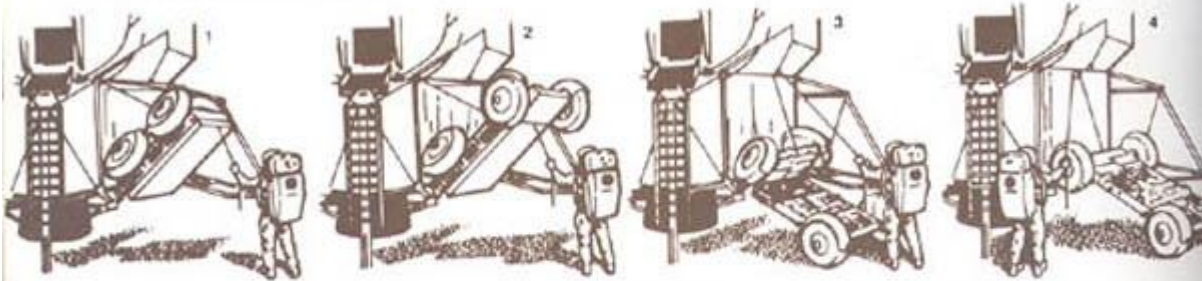
ISSUE 2 - The Lunar Rover was too big to fit in the LM.

Well, this is strictly true if you take the measurements of the Rover when it was fully deployed and assembled. However, the Rover came packed into a very tight little package which fit neatly into the space provided in the LM.



Folded up to fit within its storage bay in the LM descent stage, the little car was designed so that it almost assembled itself.

Deploying the Lunar Rover



Carried to the Moon in a nose-down, floorpan-out position, the Rover could be deployed by an astronaut paying out two nylon tapes. In the first stage the car swings out from its storage bay. Then the rear part of the chassis unfolds and locks, and the rear wheels unfold. In the third stage the front chassis and wheels snap out.

Finally, the astronaut lowers it to the surface, and unfolds the seats and footrests. Torsion-bar springs and latches made assembly semiautomatic. Power for the Rover came from two 36-volt silver-zinc batteries driving an independent $\frac{1}{4}$ -hp motor in each wheel. A navigation system kept track of the bearing and range to the LM.

Touring the Moon

Encumbered by a spacesuit, an astronaut on foot could not venture very far from the LM; carrying tools and samples made his forays more difficult. On the last three lunar missions a lightweight electric car greatly increased the productivity of the scientific traverses. Mission rules restricted us from going more than 6 miles from the LM—the distance we could walk back in a pinch—but even so the area that could be investigated was ten times greater than before. The Rover's mobility was quite high; it could climb and descend slopes above 25° . Crossing a steep slope was uneasy for the man on the downhill side, but there were no rollovers. On the level we averaged close to our top speed of 7 mph. Once, going down the Lee-Lincoln scarp, we set an informal lunar speed record for four-wheeled vehicles of 11 mph.

When the astronauts got the Rover out, all they had to do was pull on two nylon cords and the Rover popped right out of its berth and down to the lunar surface. As it did so, the wheels, which were folded over (as you can see in the photograph above) deployed outward and were then locked into position. The main purveyor of this claim that the Rover was too big to fit into the LM is Collier, who took his measurements by going to the Johnson Space Center (where there is a full scale mockup of the Rover in it's deployed configuration) and then compared those numbers to the containment bay on the LM. Anybody with a rudimentary knowledge of engineering could have figured this one out -- simply by looking at the hinges which allowed the wheels to fold out when deployed (there are no "tires" -- they are very cool wire mesh construction). This whole aspect of the controversy could have been avoided by a trip to the film archives or viewing the video series mentioned before, Apollo - Mission to the Moon. Both have footage from the Apollo missions showing the astronauts actually deploying the unfolding Rover on the Moon.

ISSUE 3 - The astronauts could not get from the Command module to the Lunar module with their space suits and pack on.

Again, strictly true. They never did go from the CSM to the LM and back with their packs on for one very good reason -- they didn't have to. The packs were stored in the LM the whole time. Beyond that, they did not wear their packs at all until they actually went out on their EVA's. As you can see from the LM cockpit interior concept above, this was always the intention. In fact, an image taken by Armstrong of Aldrin right after touchdown shows this was indeed the case.



ISSUE 4 - There can't be any pictures taken on the Moon because the film would melt in the 250° temperatures.

Any normal film exposed to 250° would indeed melt at that temperature. There are only two problems with this Moon Hoax claim -- this was no ordinary "Ektachrome" film, and it was never exposed to those kind of temperatures in the cameras.

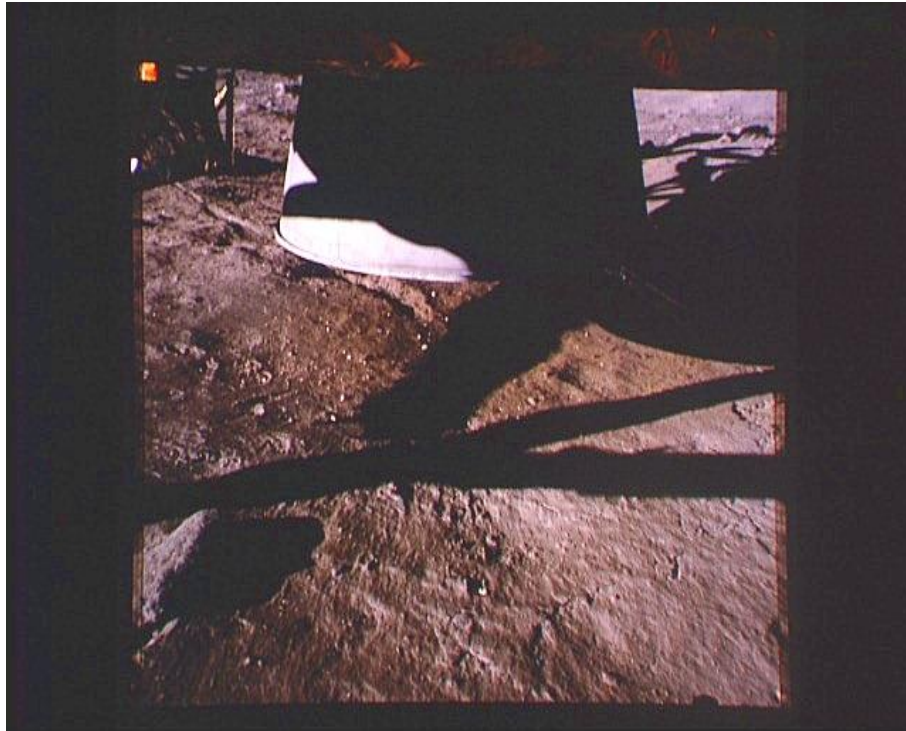
The 70mm film used in the Hasselblad cameras the astronauts carried was a very special transparency film designed specifically (under a NASA contract) for hostile environments like the Moon. According to Peter Vimislik at Kodak, the film would at worst begin to **soften** at 200° F, and would not **melt** until it reached at least 500° F. So, a worst case scenario of 250-280° F for a totally uninsulated, non-reflective camera would still be well within the film's operational parameters.

The film itself, in terms of its light-gathering abilities, was also quite amazing (in striking contrast to the uninformed claims of the debunkers). It was a special "extended range color slide film" called "XRC," that allowed the astronauts to take perfect "National Geographic" quality pictures on the lunar surface, even though they were hardly experienced photographers. This has truly opened up whole web pages of controversy -- with the Moon Hoaxers claiming that such a film simply doesn't exist! In fact, **Enterprise** Principal investigator Richard C. Hoagland actually used many rolls of this "super lunar film," back when he was advising Walter Cronkite at CBS. His personal story of the film's development, its inventor, and how NASA cleverly hid its very development from everyone, will be detailed in a future segment of this series. Suffice it to say that more than thirty years after the first manned lunar mission, many of the features of this amazing film are only now finding their way into the commercially-available color emulsions used in today's modern day 35mm and 70mm non-digital cameras

As you can see from the image of Alan Bean above, the cameras were also protected inside a special case designed to keep them cool. Although it is true that in the direct, airless sunlight the temperature can reach upwards of 250° - 280° Fahrenheit, precisely because there is no air, it's fairly easy to keep cool. The situation is a lot different than in your oven, for instance. With no convection or conduction, the only type of heat that is of concern is radiative. The best way to reflect radiative heat is to wrap the object (like a camera or person) in layers designed to reflect as much heat as possible, usually by simply being white. As you can see from the images above, most all of the astronaut's clothing and the camera casing were indeed white, which very efficiently directed heat away from the both the astronauts and camera film.

ISSUE 5 - The LM engine was very powerful. How come it did not leave a crater below the spacecraft? Why didn't it kick up any dust when it landed?

The truth here is once again very straightforward. At all of the landing sites, the astronauts found that the Lunar surface had about a two inch layer of dust. Below that was pretty much hard pan. As you can see from the image below from Apollo 11, not only is the upper layer of dust blown away in a radial pattern (as if from a thruster?) there is also a small depression below the nozzle. Since the LM descent engine only made about 3,000 pounds of thrust (compared to a modern jet fighter which makes between 18,000 and 22,000 pounds of thrust), this is pretty much as any engineer or geologist would expect things to look.



And, as this picture from Apollo 12 shows (below), the LM did leave a strikingly clear, "discolored" ground track (when photographed at right angles to the sun) as it descended to it's final resting place across the Lunar surface.



And what of the charge that no dust was kicked up by the LM as it descended? Again, we'd recommend any of the fine NASA videos on the Apollo program. They show that in each and every case, the LM did indeed create a literally blinding swirl of dust blown radially outward from under the descending LM, as it groped its way down, balanced on its 3000-lb thrust engine, to its final lunar resting place. You simply have to be willing to find the films and watch them.

SECTION THREE - THE RADIATION ARGUMENTS

ISSUE 1 - The astronauts could not have survived the trip because of exposure to radiation from the Van Allen belts and other sources.

Actually, of all the issues put forth by the Moon Hoax advocates, this is the one that requires the most digging into. The Van Allen radiation belts are a pair of toroidal-shaped belts of high-energy electrons and ions trapped in the Earth's magnetic field. The inner region is centered at about 3000 km above Earth and has a thickness of about 5000 km. The outer region is centered at about 15,000 - 20,000 km above the surface of the Earth and has a thickness of 6,000 -- 10,000 km. As you can see from the extract below, the radiation in the belts was of some concern to the scientists working on the problem. However, they actually considered a rogue solar flare to be a much bigger problem.

RADIATION PLAN FOR THE APOLLO LUNAR MISSION

Jerry L. Modisette, Manuel D. Lopez, and Joseph W. Snyder
Space Physics Division
NASA Manned Spacecraft Center

Abstract

The radiation protection plan for the Apollo Program is based on real-time monitoring of solar activity and radiation in the spacecraft to provide data on which to base estimates of the radiation to be expected. The major radiation hazard is from solar flare particle events, which are unlikely to occur during any given mission. The monitoring system, consisting of onboard dosimeters and the Solar Particle Alert Network, provides early warning through observation of solar flares and the associated radio bursts and a continual updating of the radiation picture as particles arrive at the spacecraft. Prediction criteria have been developed which are progressively revised as more data are received, with a corresponding reduction in the error limits on the prediction of radiation dose.

The criteria are initially based on the energy in the radio burst, with flare classification, location on the sun, delay time between the flare and particle arrival at the spacecraft, and particle flux measurements factored in as data become available.

Introduction

Space radiation was brought to public attention as one of the unique problems of manned space flight when the Van Allen belts were discovered in 1958. At approximately the same time, researchers began to recognize that various ionospheric and solar disturbances which had been observed for many years were aspects of a greater phenomenon, the solar flare particle event. Although early conservative estimates indicated that radiation would be a major problem, observations from the ground and from spacecraft have demonstrated that the space radiation hazard is one of the lesser engineering problems to be overcome in spacecraft design and mission planning. Flux maps of the Van Allen belts have become available, solar flare particle events have been subjected to intensive statistical analyses, and techniques have been developed to calculate radiation doses behind complex spacecraft structures. Van Allen belt radiation doses can be kept small by use of low-altitude orbits or by rapid movement through the belts. Only the very large (and consequently very rare) solar flare particle events constitute a hazard for moderately shielded spacecraft. Also, secondary radiation is not significant for such spacecraft.

(See p. 3 of previous paper)

The radiation plan for the Apollo lunar mission calls for low-altitude earth orbits and rapid transit to the moon to keep the Van Allen belt radiation dose below 1 rad. Most of the radiation protection activity is directed towards providing protection against major solar flare particle events which might occur while astronauts are in the lunar module or on the lunar surface. The events, which start at the sun, are detected by ground-based instrumentation and are measured at the spacecraft by dosimeters and particle spectrometers. A prognosis of the radiation dose is prepared and continually updated by radiation environment specialists manning

a console in the Mission Control Center. Dose estimates are then provided for the use of the medical officer, who advises the Flight Director of the radiation effects to be expected.

Real-Time Data Systems

Onboard Radiation Monitors

The onboard radiation monitors measure both dose and particle flux and spectra. Each astronaut carries a personal dosimeter which measures the accumulated skin dose by integrating the current from a thinly shielded 10-cubic-centimeter ion chamber. The read-out is made by the astronaut from a digital register on the dosimeter (Fig. 1). Two additional ion chambers in the Apollo command module provide readings which are telemetered to the ground and fed into the data system at the Mission Control Center where the data are available for video display. One ion chamber measures skin dose; the other is shielded so that it measures the dose that would be received at a body depth of 5 centimeters. The depth dose is significant only for the relatively hard spectrum of Van Allen belt particles; therefore, this dosimeter is called the Van Allen belt dosimeter (VABD) (Fig. 2). A portable dose rate meter (Fig. 3) is to be carried into the lunar module and onto the lunar surface.

Comparison of the dose behind the two different shield thicknesses of the VABD gives an indication of the particle spectrum. More detailed spectral information and discrimination between protons and alpha particles are provided by a solid-state spectrometer mounted on the Apollo service module. Data from the particle spectrometer (Fig. 4) are also telemetered to the Mission Control Center where the data are used for the calculation of doses in the command module, lunar module, and space suits. The dose calculations are made automatically and are read out on the video data display (Table I). The relative biological effectiveness (RBE) of the protons and alpha particles as functions of energy is introduced into the dose calculations so that the doses are given in rem.

Solar Particle Alert Network

The Solar Particle Alert Network (SPAN) (Fig. 5) monitors solar flares and associated radio emissions on a 24-hour basis. The solar flares are observed with optical telescopes equipped with filters that transmit a 1/2-angstrom band about the H α line. Time of occurrence, area, and location of the flare are determined by SPAN observers and are teletyped to the Mission Control Center where the data are incorporated into the estimate of the particle event size. Radio emissions associated with the flares are observed at 1420, 2695, and 4995 megahertz. The radio burst profile for each frequency is also teletyped to the Mission Control Center. In approximately 2 years of operation, SPAN has observed several hundred flares and radio bursts. Data from SPAN are augmented by data from the solar and ionospheric monitoring systems operated by the Environmental Science Services Administration and the Air Weather Service.

In fact, as stated in this official government report, the scientists working on the problem of Van Allen radiation considered it to be minor compared to other design hurdles to be conquered. Their solution was simple -- avoid exposure by keeping the spacecraft at low Earth orbit altitudes while in parking orbits and then send it through the belts at high speed. The eventual escape speed, some 25,000 miles per hour, would have passed them through the belts in less than an hour, keeping their dose well below 1 rad. There was a modicum of shielding from the equipment, but in the end this was not necessary as the extraordinary transition speed kept the dose below harmful limits -- both going to and returning from the Moon.

As to the issue of solar flares and the danger they presented, there simply weren't any major ones during any of the Apollo missions. So the biggest reason that none of the astronauts died from their radiation exposure was that they simply did not get a bad dose to speak of. Readers wanting more information on this issue should read NASA Technical Notes - NASA TN D-7080, Apollo Experience Report - Protection Against Radiation by Robt. English, Richard E. Benson, J. Bailey, and C. Brown, --Manned Spacecraft Center, Houston, March, 1973.

Ultimately, all of the claims made by the Moon Hoax advocates are easily explainable with a little research, common sense or just a plain good memory of what happened back during the Apollo program. While we remain fiercely critical of the NASA hierarchy in general and certain members of the Apollo team in particular, we should not let that get in the way of our undying admiration for the rank and file men and women, scientists and engineers, who pulled off the most amazing feat in human history -- the Apollo program. To give these silly claims attention, as Fox is now doing, is an insult to those who sacrificed, some with their lives, to get man to the Moon.

And what's worse is that regardless of the stance that Fox takes on this issue, by focusing attention on a silly and unsupportable series of claims like these, they are painting all "conspiracy theories" with the same brush. We find the timing of this, just as NASA is beginning to lift the veil of secrecy around the Face and other artifacts on Mars to be a bit "convenient." What better way to put forth the "honest but dumb" model ("gee, it does look like a Face after all!") than to convince everyone that there are no conspiracies, or at least no serious and sober conspiracy theorists. For this reason, we will continue to focus on the worst of the conspiracy theories when we are forced to do so. We plan to follow up this report with a bit more detail at later date, and hopefully, that will be the last time we will have to address this entire silly issue.

[CLICK HERE FOR PART II](#)

CONTACT INFORMATION:

MICHAEL BARA LunarAnomalies@mn.rr.com

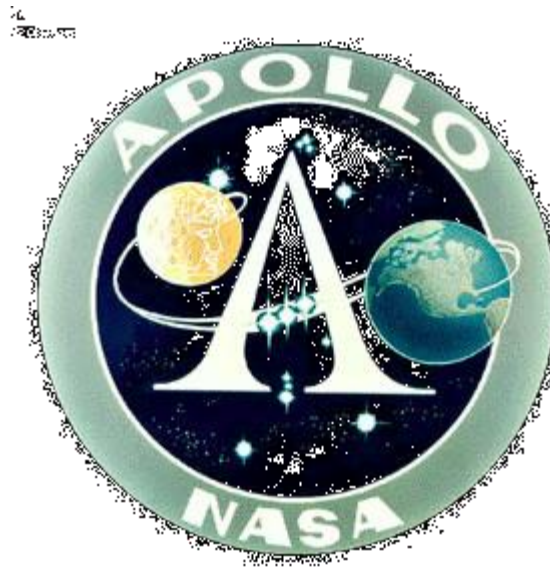
STEVE TROY malibu57350@yahoo.com

Note - we are not able to respond to all e-mails, but we *will* read them

Who Mourns For Apollo?

Part II

by
Mike Bara



Since the publication of our [initial report](#) debunking the accusation that the Apollo Moon landings were hoaxed, the Fox television network has broadcast a special called "Conspiracy Theory -- Did we Land on the Moon?" Because this Special raised some additional issues we did not specifically cover in our previous article, in the interest of closure I have decided to address them here. Make no mistake, I was so unimpressed with this laughably stupid presentation initially that I was quite willing to let the previous piece be our final statement on the matter. I felt that we easily showed that a good 90% of the claims are totally without scientific or rational merit. Further, I felt we made it quite clear that the issues raised were so unutterably stupid and easily explained that the individuals making them had absolutely zero intellectual credibility left concerning the "un-addressed" claims in the program. With Richard Hoagland and Steve Troy working on follow-ups, I was ready to move on to other, more substantive issues. Still, the idea that some of these idiotic claims had not been specifically refuted was eating at me. I kept thinking that there are a sizable number of people in the United States who

believe that the Holocaust never really happened, or that Church's Fried Chicken truly has a "secret ingredient" in it to make Black men sterile.

So I guess I just can't resist. Hopefully, these next few articles will put all these claims to rest. Let's address the additional issues brought up on the Fox special as we did before, one by one.

1. There are cross hairs on pictures taken on the Moon that appear to be ***behind*** objects, rather than in front of them, where they should be.

The crosshairs, called reseau marks, were geometric indicators specifically put in the Apollo cameras by the vacuum deposition of a set of whisker-thin aluminum "crosses" on an optical glass plate, subsequently placed just in front of the film plane. The purpose of this (according to NASA) was to enable the NASA-Houston developers of the film to align multiple image panoramas vertically and horizontally, so that they might appear geometrically correct when printed.

The Fox special showed four examples of the crosshairs appearing ***behind*** objects in the pictures. One example each from Apollo 11 and 16, and two from the same frame on Apollo 12. In addition, I found another example on the [Project Apollo image archive](#), [AS16-117-18818](#). The four that were presented on the show are the same ones that seem to make the rounds of all the Moon Hoax sites, and I have not seen any other examples although, as I just demonstrated, it seems fairly easy to do so.



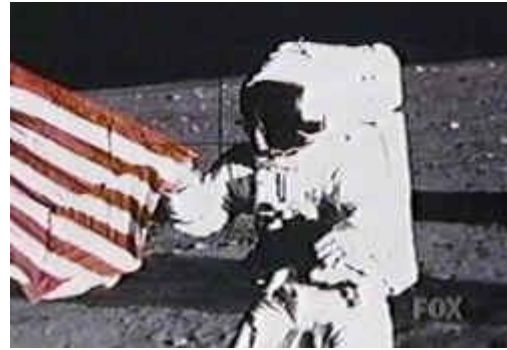
From [AS16-107-17446](#)



From [AS11-40-5931](#)



From [AS12-47-6897](#)



From [AS12-47-6897](#)

The argument made by the Moon Hoax advocates (primarily, [James Collier](#), [David Percy](#), [Bill Kaysing](#), "brilliant lay physicist" [Ralph Rene](#), and SPSR's [Dr. Brian O'Leary](#)) is that these obscured reseau marks "prove" that the photos taken on the Moon are "faked." They imply that the marks were added **after** the photos were taken to make it appear that they were taken on the moon but that NASA "screwed up" some of these "fake" marks.

It's hard to follow this "logic" at all. If NASA were faking these pictures in a movie studio at Area 51, as Fox and Kaysing allege, why wouldn't they simply have used cameras with the same aluminized, pre-marked plates in them that were used on the "real" Apollo cameras? Wouldn't that be easier than painstakingly adding the marks one by one **by hand** to every single Apollo hand held photograph? And if the pictures were all faked, why add the marks at all? Wouldn't it be easier to just avoid the whole hassle by skipping the reseau marks completely?

Of course it would. So if these pictures are not faked, what gives with the obscured reseau marks? Actually, there are a couple of very good, very logical explanations.

For one thing, in all the pictures presented, the marks are obscured by white areas of the pictures. Be they the white stripes of the American flag, the white covering of a scientific instrument, or an astronaut's spacesuit. Anyone who has ever developed color film will tell you that white tends to bleed a bit into other colors, and given that the crosshairs are only a few thousandths of an inch across, it's easy to assume that this is the explanation. As far as I know, none of the Moon Hoax advocates has ever actually examined the negatives of these frames, either. Certainly, if the blotting out of the crosshairs is an anomaly of the printing process, then the negatives should probably have the full reseau marks visible and we will have our explanation.

But, failing in that, there is another, even better explanation. The pictures were deliberately altered.

Wait a minute, doesn't that imply just what the Moon Hoax advocates are saying? That the photos are faked?

No. Of course it doesn't.

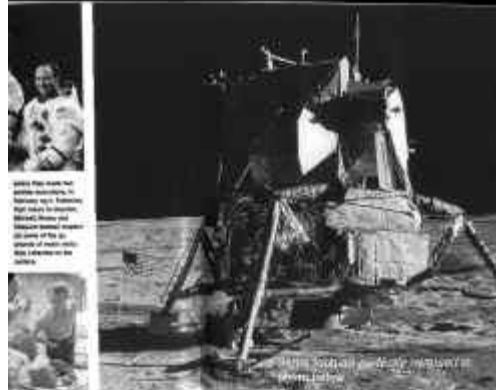
There is a huge, huge difference between "altered" and "faked." It's a fairly safe bet that numerous Apollo pictures were altered, and there is nothing sinister at all about it.

In each case that I have seen, including the one that I personally found, the altered crosshairs (if that's what they are) are from the NASA press release collection for the Apollo Program. It is an entirely common practice for press release photos to be "cleaned up" before publication, and there is no reason at all to think that the Apollo Missions to the Moon were excluded from this practice. It is difficult for us, in this digital age, to appreciate the importance of print media in the days of the Apollo Program. Most Americans got their view of Apollo not from TV, but from newspapers and magazines like Look, Life, and National Geographic. A potential press release quality photo (say, of an astronaut standing next to the American Flag) would of course be cropped, blots and flaws would be "airbrushed" out, and perhaps an offending reseau mark would be kept from crossing in front of the Flag itself.

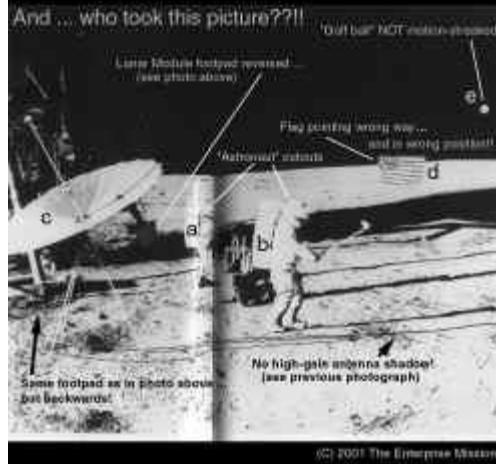
Contrast these harmless alterations to an outright, overt fake which recently appeared in Alan Shepard's chronicle of his life and journey to the Moon: "[Moon Shot.](#)"

Fake "Golfshot" in Alan Shepard's "Moonshot!"

The Apollo 14 photograph (below) depicts Lunar Module "Antares" at Fra Mauro. View is from the southeast and is authentic. The second image on this page is a reverse print of *this same photo*, with the addition of several fake objects!!



Fake objects inserted into this reversed photograph (below) include: a) astronaut Mitchell, b) astronaut Shepard, c) high-gain antenna (with fake shadow), d) fake American flag, and e) fake "golf ball" Shepard hit for "miles and miles" across the Moon. Why is this fake image the centerpiece of Shepard's book??!

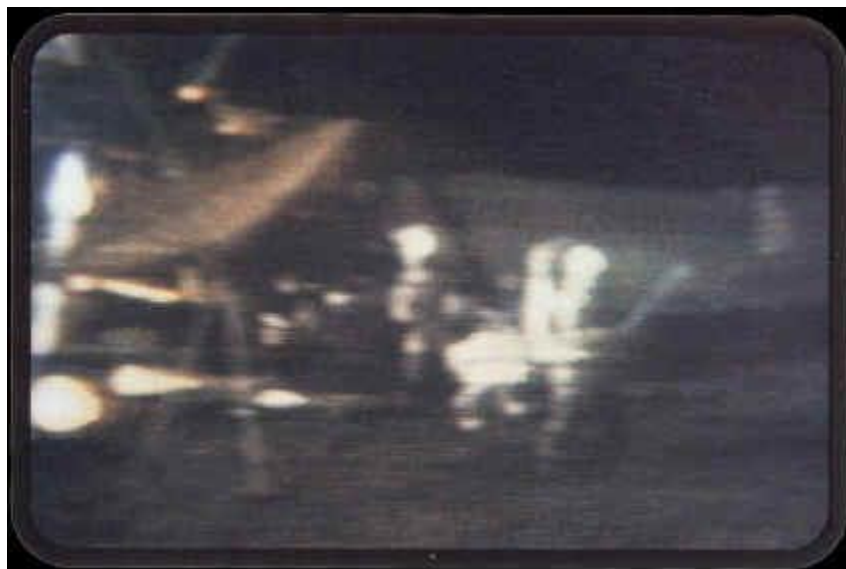


In the middle of the book -- literally the centerpiece of his memoir -- Shepard has placed an image of his famous "golf shots at Fra Mauro" that is an easily-determined **fake**. (Video showing the real A-14 TV shots of this event can be found [here](#).) The picture in "Moonshot," on the other hand, is spliced together from a number of other, actual Hasselblad frames taken on the Apollo 14 Mission. The LM is taken from another view of Fra Mauro printed one page earlier in the book (but flipped!); astronaut Edgar Mitchell is spliced (and also flipped) -- though somewhat imperfectly -- from the famous "[Mitchell under glass](#)" frame AS14-66-9391 (see below). There is even the "final touch" of a fake golf ball "caught in flight" off Shepard's club. Obviously, since both astronauts are in the picture, apart from the individual, easily proven fake elements, there is NO

possibility that this composite itself is a legitimate Apollo 14 photograph; for, *who* possibly could have been with Shepard and Mitchell on the lunar surface ... to take this *particular* "historic" frame??!!



What Shepard was apparently trying to do in "Moonshot" was to recreate the scene from the famous NASA-TV footage of his two golf shots (below). However, as you can see from this screen capture, the quality of the TV footage was probably deemed (by unnamed persons) "far below that required for an historical document," like Shepard's memoir.



So apparently, in violation of all journalistic ethics, he provided (or, certainly approved) a genuine fake for publication in his book (the ethics violation lies in the fact that the caption attempts to pass the photo off as the *real thing*! Inquiries to his publisher (Turner Publishing, Inc.) resulted in an explanation that the picture "came from NASA," although this is impossible to confirm. The difference

between this overt (and very bad) fake, and simply "cleaning up a few crosshair marks" is obviously substantial. But does it prove that the Moon landings themselves were also faked?

No, in fact we think it points to a much bigger picture, one which fits exactly our own model of the true mysteries of the Apollo Program. We do not, for instance, think that Shepard's choice of the "Mitchell Under Glass" frame, from which he (or someone) took the cutout of Mitchell, is a mere "coincidence." Shepard was the one who took that extraordinary photograph, and he would certainly be better equipped to know what was on it -- in the background and above the horizon -- than anyone else. By putting a deliberately bad fake of his infamous "golf shot" in his own book (his one claim to unique "lunar fame"), Shepard was telling us that "all is not as it seems with Apollo ... And these are the pictures you should carefully examine to prove it!" The problem is that the Moon Hoax advocates have latched onto these kinds of discrepancies and clues -- and divined exactly the ***wrong Apollo Message!***

If you want to see the NASA press release collection for the Apollo program online, the images can be found [here](#). However, the NASA versions are highly compressed. Generally better versions can be found at the [Project Apollo image archive](#).

One final point. Over the last ten years, Richard Hoagland, Steve Troy and myself have examined literally thousands of Apollo pictures taken on the lunar surface. The only ones which have had this issue with the crosshairs have come from the press release collection exclusively. We have simply not seen this phenomena on any of the non-press pictures.

2. Perfect framing of pictures. According to Kaysing, "All" of the Apollo pictures are perfectly centered and framed. This is supposedly "impossible" given the problems associated with lunar photography.

There are three points to be made here. First the majority of Apollo surface photography is very good for one reason -- the astronauts practiced it incessantly. By the time they made it to the Moon, each of them had taken thousands of photographs with the same equipment they used on the Moon and knew how to get good results.



Edwin Aldrin practicing lunar photography

The second point is that once again, the Moon Hoax advocates are looking at the press release collection. Every image shown in the Fox special was from the press release collection. Obviously, these images are cleaned up, as I pointed out before. The crosshairs on the photos are all the same size, except for the one at the exact center of the photo which is twice as large. There are many examples of photos from the press release collection which show this double size crosshair off-center. These are pictures have been cropped in order to correct the framing. Again, there is no mystery to the "perfect framing" question. It's due to plenty of practice and cropping of photos for press kits. And as with the crosshairs non-mystery, there are plenty of pictures not in the press release collection that are hardly "perfectly" framed.

Finally -- and this cannot be overstated -- NASA and the astronauts had a "secret photographic advantage" that has not been publicly known, let alone adequately discussed, for more than thirty years: the "super color film" NASA quietly developed and took to the Moon. In his planned section of this series, Richard Hoagland will reveal some extraordinary details about this amazing color film, how it was developed, how he actually got to test it **before** it went to the Moon, and how it was cleverly used by NASA darkroom technicians when the astronauts got home to not only eliminate almost all traces of the lunar ruins we now know are there ... but also to enable the astronauts to publish "all too perfect pictures" taken on the Moon.

3.The footprints left by the astronauts are proof that the Moon landings are fake.

This one is also essentially a two pronged argument. First, the Fox show charged that the LM engine was so powerful that the upper layer of dust should have been blown away around the LM, so there should not be any footprints. Others have charged that the footprints should not be there since in the absence of water as a bonding agent, they should not maintain coherent shapes and sharp outlines.



While we addressed the power of the LM descent engine in our [first installment](#), we did not address the issue of the footprints. In essence, the critics' argument is that footprints like those seen on the Apollo photographs can **only** occur if the ground has moisture in it; they then compare the "lunar footprints" to those that appear on Earth in wet sand. At first, this may seem like a logical argument. However, it is dependent -- as so many of the Moon Hoax arguments -- on an assumption that the Moon and Earth are essentially the **same place**. Critics wrongly assume (since they obviously haven't been there!) that since there is no moisture on the Moon, footprints must fill-in -- like they do in bone dry, sandy deserts here on Earth.

But, of course, in this area too their poor understanding of space physics is glaringly apparent; there are other well-known bonding agents that can create coherent, stable footprints in a vacuum, like those seen in the Apollo photographs taken on the lunar surface.

The lunar surface is pretty much made up of a variety of materials that fall under the general category of "silicates." Silica has a natural tendency/ability to bond with other silica, making large "chains" of atoms and molecules. When a meteorite impacts a body (or, in our model, a massive glass-based protective

lunar structure), a lot of the energy released goes into fracturing the surrounding structure, if not its rock foundation. These fractures are, in fact, breaks in molecular bonds in the artificial and naturally-occurring minerals. These fractures, in turn, leave many "exposed" bonds. On Earth, these fractures are quickly filled by oxygen in the atmosphere (a process called "oxidation" or "weathering"). With a total lack of oxygen (such as on the lunar surface), these molecules with bonding potential simply have nothing to attach to ... until something changes (an impact event) and places two molecules or atoms side-by-side. This is how, in the absence of a "wetting agent" (like water), this dust (the lunar soil) can form not only "large clumps" -- but stick to itself like a mold, forming "mirror images" of any outside "deforming structures" (like spacecraft landing pads, or the cleats of astronaut boots). The consistency of this pulverized dust, incessantly battered over literally eons, is finer than talcum powder or cement dust. This incidentally is exactly how the astronauts described the lunar surface dust ... like "talcum powder or wet sand ..."



[Click on image for full size version](#)

Of course, all of this was pretty well known concerning the lunar surface before the astronauts ever set foot on it. The earlier Surveyor series of unmanned probes was designed to land on the airless lunar surface and take soil samples. When they did so, the trenches scooped out did not fill in as they would in dry desert sand, but rather held their shape and walls more like they would in "wet" sand. In one case, (below) you can even see the grooves cut in the side of the trench by the serrated edges of the scoop!



[Click on image for full size version](#)

Clearly, the Apollo footprints are consistent not only with the theoretical concepts outlined above, but (far more important!) with the actual, earlier experiential and surface photographic results from the Surveyor Missions themselves. Of course, the Moon Hoax advocates can always argue that Surveyor never made it to the Moon either, but this is problematic since, paradoxically, they need unmanned spacecraft to take certain equipment to the lunar surface ... to successfully "fake" Apollo! At least one of the Moon Hoax advocates (Percy) argues that the unmanned missions had to have made it to the Moon, as this is the only way he can account for the presence of the laser reflectors at all the Apollo landing sites (which were actually carefully placed there by the astronauts, Dave).

4. There is no dust on LM footpads. -- According to Kaysing and Fox, this is the strongest evidence that the Moon landings are faked. They allege that with the swirling dust from LM descent engine, the foot pads should be covered with dust.

As with all the other Moon Hoax charges, this one is flat wrong on several counts. First, the allegation that there is no Moon dust on the landing pads is wrong. Second, it is far from accurate that there **should** be dust on the pads. Finally, contrary to the claims made by Fox, an absence of dust would actually **prove**, rather than discount, that the LM had put down in an alien environment.

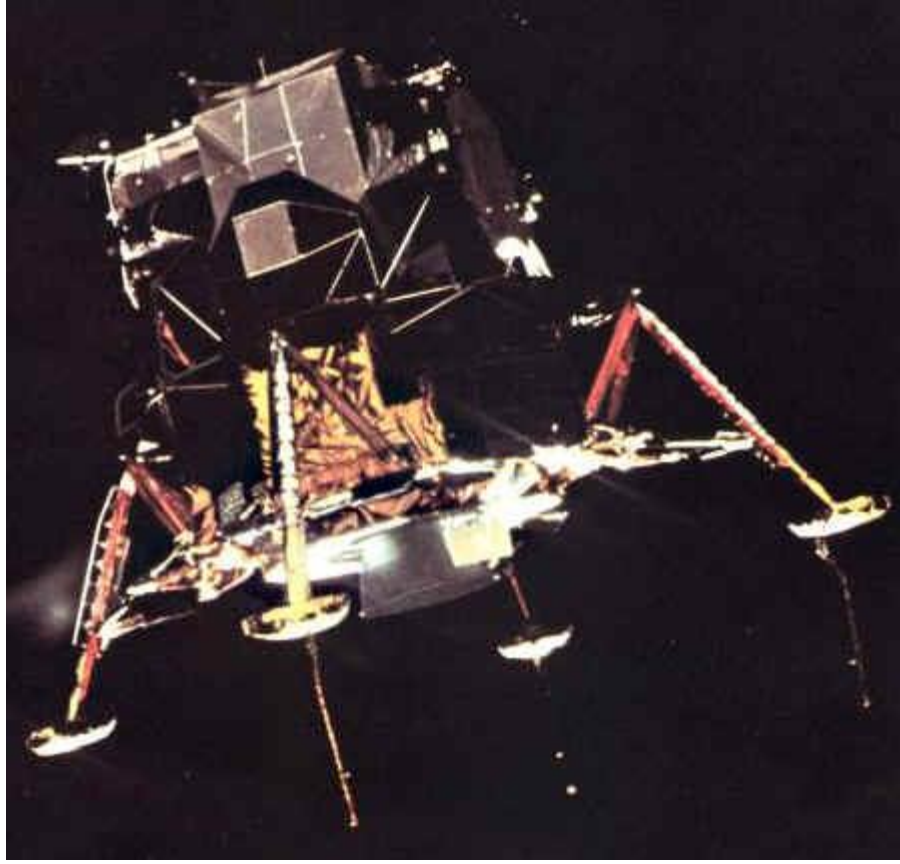
It was fairly easy to disprove Kaysing's claim that there was "no dust" on any of the Lunar footpads.



Here is an Apollo 16 picture, NASA frame [AS16-107-17442](#). Obviously, the moon dust can be plainly seen on the footpad. Now, it is remotely possible that the dust got there by being kicked onto it by one of the astronauts, but since this is not the pad below the ladder, that's unlikely. Still, the fact that there is dust there at all is really a matter of luck as it does not necessarily follow, as Fox and Kaysing wrongly assume, that the "swirling dust" should settle on the footpad.

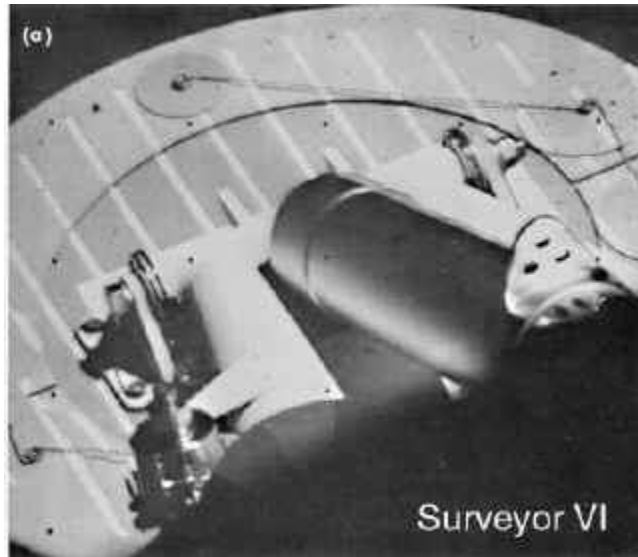
As we have already shown, the descent engine of the LM is not nearly as powerful as Kaysing and the Moon Hoax advocates assume it is. Beyond that, the thrust does not behave in the airless vacuum the same way it does on Earth. As an example, the thrust in a vacuum is spherically shaped, as opposed to a tight, coherent tube on Earth. Further, without the air to help push around the dust particles of the Lunar surface, there is very little distribution of the particles. So Kaysing's expectation of the dust swirling around the LM is just wrong, only a small amount of dust in the direct path of the thruster blast would be affected.

There is also the issue of the height of the LM off the Lunar surface.

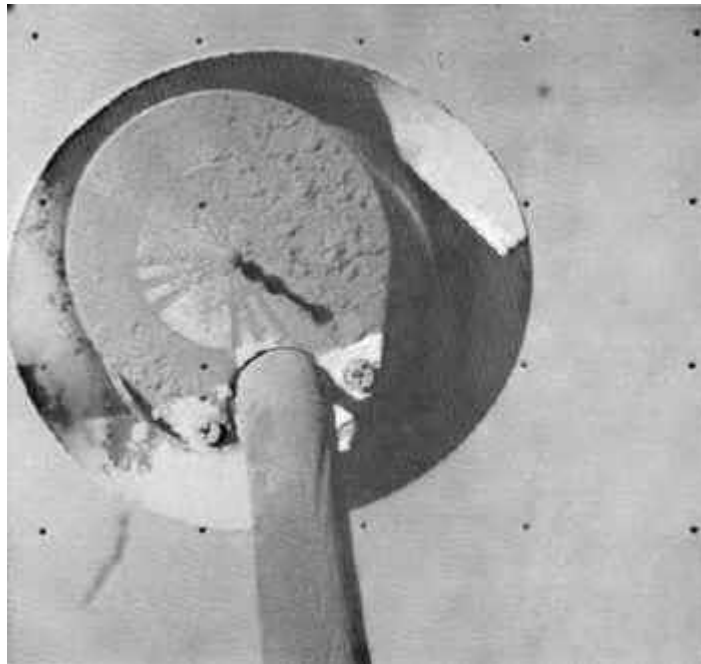


The LM had landing sensors built into three of the four footpads. When one of the six-foot-long sensors scraped the Lunar surface, a light went off in the cabin and the LM pilot cut the descent engine. Without air to circulate the dust particles, the swirling of the Lunar dust essentially ceased within seconds of the engine cutoff. As a result, it is not at all unexpected that there would be little or no build up of dust on the footpads -- there simply wasn't much to settle on them in the first place.

Additional proof of this can once again be obtained from the earlier Surveyor unmanned landers.



Pictures transmitted from the Lunar surface of the Surveyor foot pads show that - just as in the Apollo case -- there is little or dust build up on the footpads. In fact, only when the Surveyors were commanded to "hop" on the Lunar surface by briefly firing their main thrusters did any significant amount of dust build up on the footpads.



What these images prove is that it is entirely reasonable -- if not normal -- for there to be little or no dust build up on the footpads. Assumptions to the contrary are based on ignorance of not only the physics of landing in an airless alien environment, but the previous experience of the Surveyor program.

5. The LM was so unstable that it could not have possibly maneuvered in the vacuum and landed on the Moon.

This one is primarily the domain of "brilliant lay physicist" (Collier's term) [Ralph Rene](#). Essentially, he argues that LM was so delicately balanced on its single descent engine that in the vacuum of the Lunar surface, the slightest shift of the center of gravity would send it tumbling out of control. While he acknowledges that the LM had thrusters to control the attitude of the LM, he argues that were insufficient to right the spacecraft if one of the astronauts shifted his weight "even a tenth of an inch."

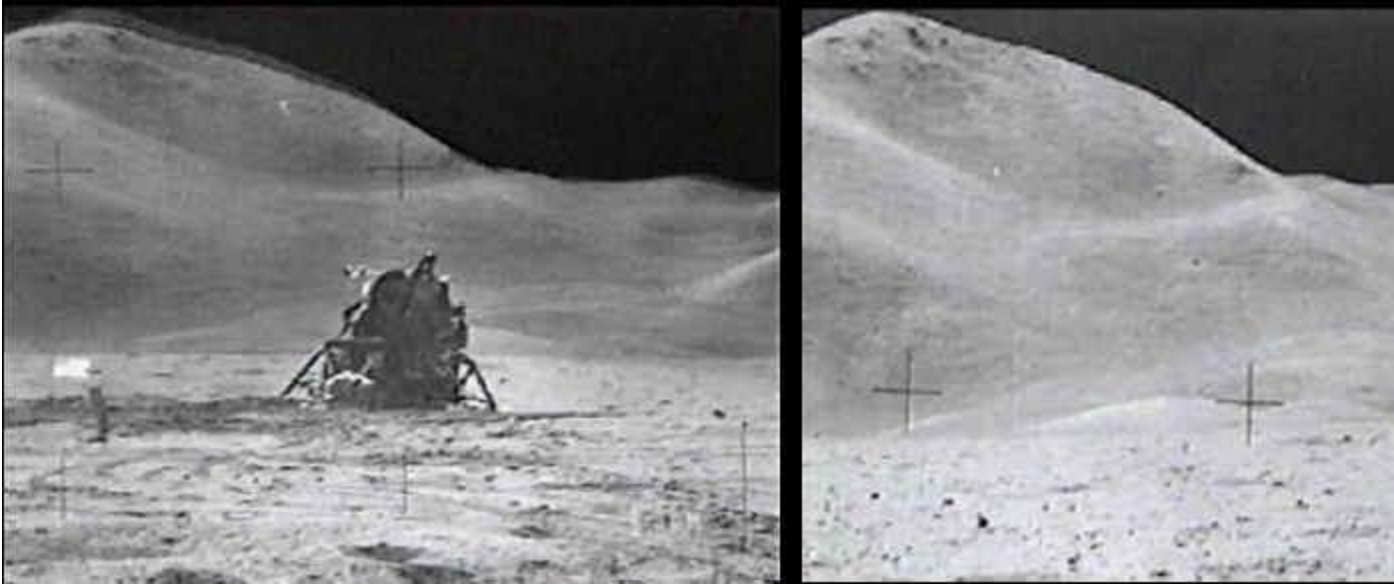
To put it bluntly, "brilliant lay physicist" Ralph Rene is a complete idiot. He has evidently never heard of gyroscopes, computers, or weightlessness.

As [this NASA page states emphatically](#), the LM had an automatic computer control guidance and inertial control system. This system was designed to measure the attitude of the LM several times per second using a system of gyroscopes measured against a "stable member" mounted in the LM structure. If it found that the LM was out of proper attitude, it automatically rotated (gimbaled) the main descent engine, and/or throttled it back, and fired the Reaction Control Subsystem (RCS) thrusters as needed to stabilize the spacecraft. The LM pilot could, if he chose, manually control all of this, but usually left it to the computers because they could react much more rapidly than he could manually. In the weightless environment of space or the one-sixth gravity of the near Lunar surface, the RCS thrusters had plenty of force to push the spacecraft around as necessary to keep it stable.

This issue is prime example of not only the lack of basic scientific knowledge on the part of the Moon Hoax advocates, but on the shoddiness of their research skills. If Rene had bothered to examine the NASA documents on the subject, he would have known how wrong his assumptions about the performance characteristics were. That is, assuming he was capable of understanding them.

Some of the Apollo pictures have identical backgrounds, but the LM is only visible in one of them.

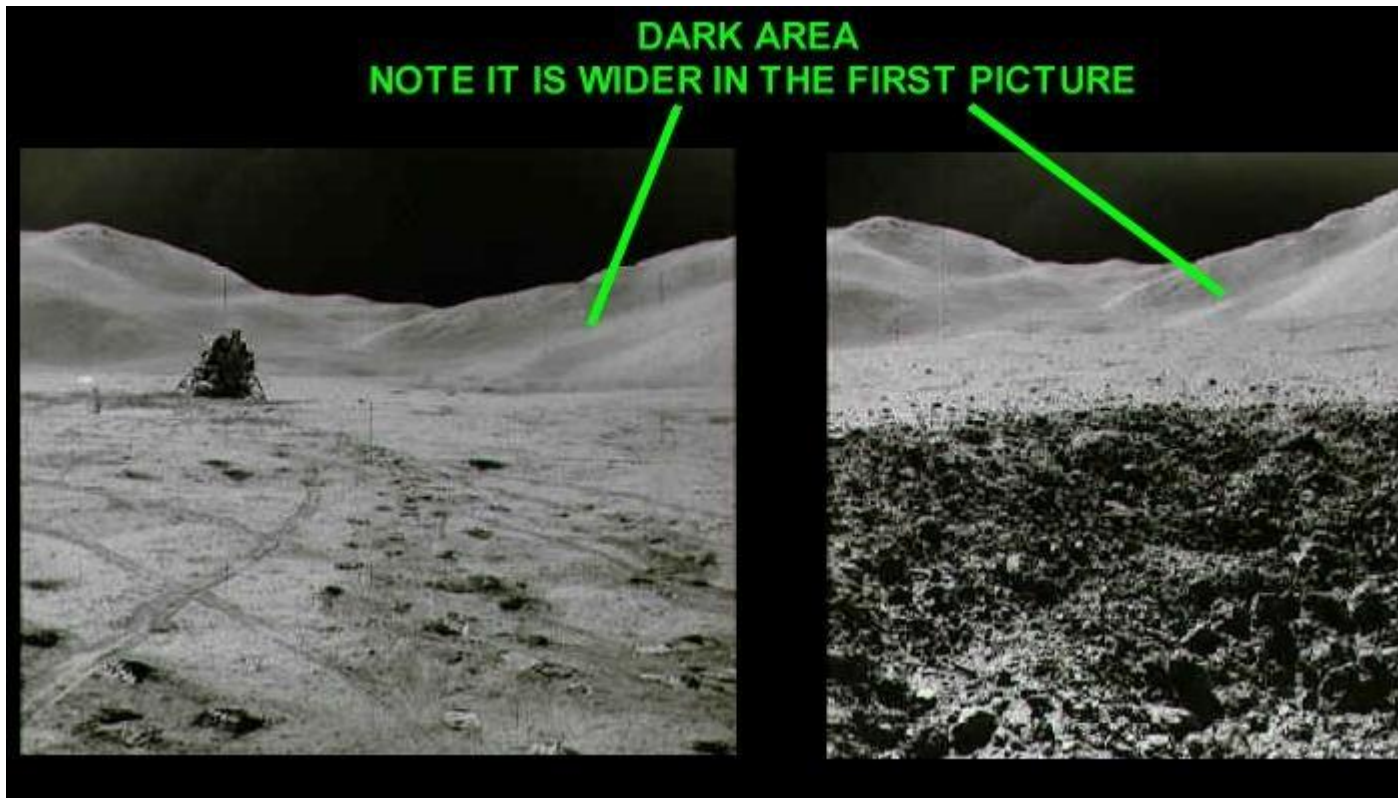
Once again, this is one of the dumber and most easily explained "mysteries" found by the Moon Hoax advocates. While the claim is made in the Fox special that there are "several" pictures supposedly taken from the same spot with identical backgrounds but different foregrounds, the show covers only one case. Still, this case is easily cast aside.



The Fox special shows two shots from Apollo 15, supposedly taken from the "same spot." In one, the LM is visible in the near field in the foreground. In the other, it is not. Fox argues that this is proof that the mountains are merely an identical backdrop used by mistake on that mythical Area 51 soundstage. The truth is that the pictures have been cropped from the two frames below to make it look like the location is the same. However, it's clear when you look at the uncropped version of the pictures that they were not taken in the same spot. The second picture without the LM in it was probably taken several hundred feet to the right of the first one, which is why the LM does not appear in the second frame.



But how then can the background mountains look the same? The simple truth is they don't. If you look closely, you can see a number of differences between the two frames consistent with the notion that the second picture was taken some distance to the right of the first one. For instance, note how in the version below the dark area (marked up) has become skinnier in the second photo. This is because the photographer has moved to his right, and the lighter colored hillside to the right has obscured more of the darker area.



Beyond that, we would **expect** the background to be pretty much the same, since the mountains are some distance -- perhaps several miles -- from the spacecraft. Untrained observers, like the Moon Hoax advocates, are once again expecting the Moon to be exactly like the Earth. Without the standard visual queues to go by, like haze, they are assuming that the mountains are right on top of the spacecraft. In truth, they aren't. As you can see from this [EVA map](#) for Apollo 15, the Apennine mountains (which are the ones in the pictures) are about 4 km away.

When you take this all into account, it's obvious that the supposed "identical backgrounds" are a non-issue.

In some Apollo video, the American flag can be seen to be waving in the wind.

I've saved the stupidest charge for last. In the Fox special, the claim was made that American flag could be seen to "wave," which according to Bill Kaysing, was caused by a sudden gust of wind on the "soundstage." In reality, it is plainly obvious that the flag is being moved around by the astronauts as they twist the pole into the hard Lunar surface.



From the first Apollo landing, astronauts commented on how difficult it was to insert the flag into the ground. They encountered very hard ground at about 9-11 inches, and had to twist the metal pole repeatedly to get it to seat in the surface properly. It is this motion which Kaysing is seeing and attributing to wind. Despite his attempt to discount the actions of the astronauts, the Fox special did not show any video of the flag "waving" without an astronaut tugging on it. Not one frame.

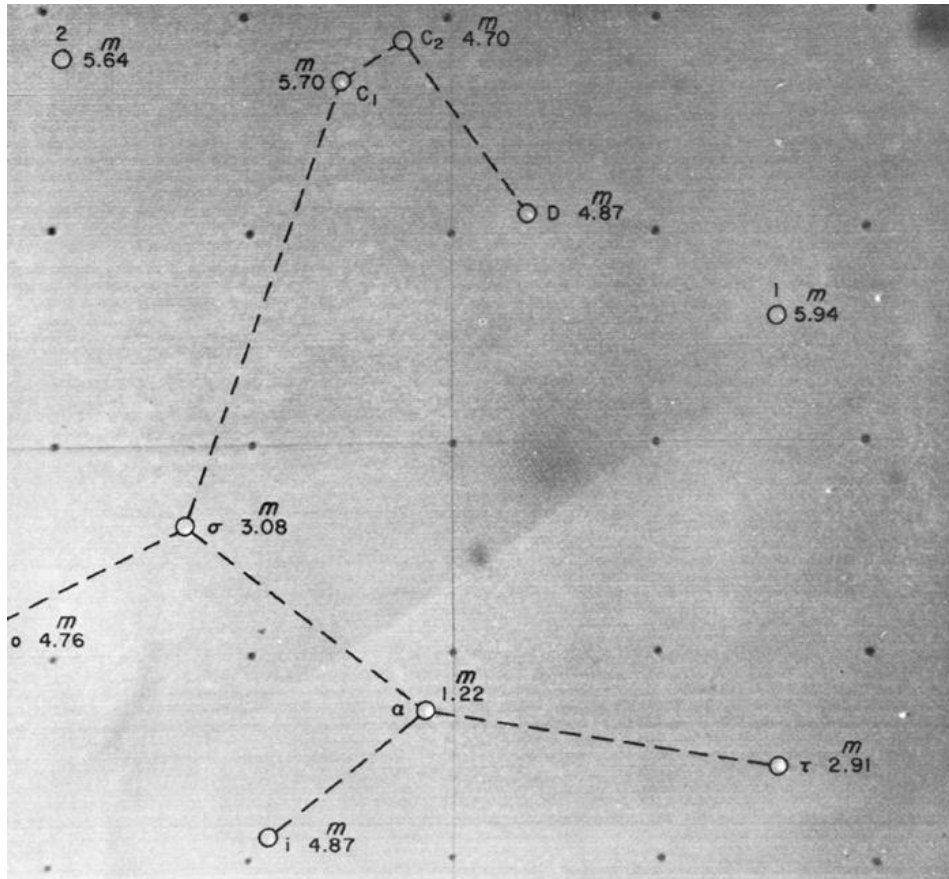
And they never will. Because it never happened. The flag was on the airless Moon, just as we all knew all along.

For a full history of the American flags taken to the Moon, please read "Where No Flag Has Gone Before" [here](#). I personally wish Kaysing or Fox had. Maybe they wouldn't have made such fools of themselves on national TV.

ADDITIONAL DATA ON ISSUES ADDRESSED IN PART 1

Since the publication of my first article in this series (assisted by Richard C. Hoagland and Steve Troy) some new information has come to light on several issues which were previously discussed.

Why aren't there any stars in the background of pictures taken from the Lunar surface?



Surveyor 6 picture of constellation Scorpius taken from the Lunar surface

In the first article, we discussed the allegation that stars "should" have been visible in the background of the Apollo photographs. The true explanation was that in the harsh light of the sunlit lunar surface, very short exposure times were needed to keep the film from overexposing foreground objects -- like the surface and the astronauts themselves. As a result, faint, distant objects (like stars) are simply NOT visible in any of the photographs taken of foreground action on the Moon -- nor should they!

We have since found other pictures, taken by several unmanned Surveyor spacecraft from the lunar surface, that overwhelmingly demonstrate our point. In order to get the stars even to show up (for navigation and location purposes), the

Surveyor cameras had to use (in one example) a **three-minute** time exposure to record them. By contrast, the average exposure time of the hand-held, film photographs taken on the lunar surface by Apollo astronauts is about **one 250th** of a second -- or an average of **forty-five thousand times shorter** than the exposure required (three full minutes) to actually record stars in the airless lunar sky. Clearly, if these "disbelievers" believe at least in the reality of the unmanned lunar landings (which at least some say they do), this simple example should satisfy even the densest Moon Hoax advocates as to the nagging question of "why stars aren't visible" in the background of any Apollo surface photographs. Because they're simply too damn dim!

Why isn't there any flame visible when the LM ascent engine fires?



In the Fox show, it was charged that there "should" have been visible flame coming from the LM ascent stage engine when it was filmed taking off from the surface. As "evidence," the Fox program pointed to "NASA's own illustrations" as "proof" that there should have been a visible flame. Again, this assumption is based on a complete misunderstanding of the physics in a vacuum. Exhaust flame is made visible by the interaction of the hot gas expelled from the engine with *atmosphere*, something the Moon doesn't have. Without oxygen to interact with, there is nothing for the exhaust flame to ignite, and nothing can be seen from the engine. How then does the engine work? Oxygen is pumped into the mix chamber to facilitate ignition, but once the hot gasses have escaped, there is nothing more for them to consume so you don't see a flame.

And illustrations are intended to "illustrate" a point in an exciting and dramatic way. Not to be a literal physics lesson. It's doubtful the artist who painted this ever cracked a physics book.

With the possible exception of the "Rooster tail" kicked up by the Lunar Rover (because some dust particles are moving faster than others, after being caught up in the mesh "tires," and subsequently collide with each other ... and thus deflect from a perfect ballistic arc), as far as I know this pretty much covers the litany of "evidence" that "we didn't go to the Moon," as presented on the Fox show. As I have repeatedly demonstrated, all of these charges are simply without merit, either from a scientific or simple common sense perspective. Although Steve and Richard are proceeding with their follow-ups, this is the last time (I promise) I will visit this "non-issue."

The simple truth is that the people presenting this nonsense (primarily [James Collier](#), [David Percy](#), [Bill Kaysing](#), "brilliant lay physicist" [Ralph Rene](#), and SPSR's [Dr. Brian O'Leary](#)) are just plain stupid. They either lack the scientific/engineering expertise to separate fact from fantasy, the diligence to properly research their claims before they make them, or ... they have a decided "political" agenda. All they have done is to muddy the waters around what is a very significant and ongoing *real* "honesty problem" at NASA -- as illustrated by Shepard's outright photographic fraud, presented here (above). I suspect that some of these people were well-meaning in the beginning, and simply latched on to the wrong explanation ("We didn't go to the Moon!") as the only rational means (to their knowledge) of understanding the actual "inexplicable" lunar problems they stumbled across.

Yes, the video from the Moon should have been better. Yes, it is bizarre that the FBI destroyed all the blueprints of the Saturn rockets and Apollo spacecraft. Yes, it is unbelievable that NASA ordered Ken Johnston to destroy all the duplicate sets of Apollo photography, essentially trying to confine the control of the visual record to one set of prints that NASA could manipulate. But it wasn't to cover up that we never went! It was to cover up what we found when we got there!

I hope, with this series of articles, we have proven one key point -- that the real "NASA problem" lies before us, still waiting to be solved. -- MB.

Who Mourns For Apollo? Part III

Management of Apollo Radiation

By
Steve Troy

In our first two pieces in this series "Who Mourns for Apollo," ([Part I](#) and [Part II](#)) we dealt with a series of silly and irresponsible assertions by the "Moon Hoax Advocates" who say that we never went to the Moon. One of the centerpiece claims is that the Apollo astronauts never could have passed through the Van Allen radiation Belts on their way to the Moon and survived. Although we addressed this issue briefly in our first article, since [they](#) use this argument as a 'big-gun' in attacking the validity and credibility of Apollo, we decided a more complete deconstruction of the issue was appropriate.

Included in their [disinformation campaign](#) are seemingly logical but blatantly mistaken prevarications about the "fatal" dangers the astronauts faced from various types of radiation exposure. According to them, cosmic rays going through the spacecraft's thin skin, and "massive" doses of solar radiation would have resulted in the astronauts being transformed into hairless crispy critters.

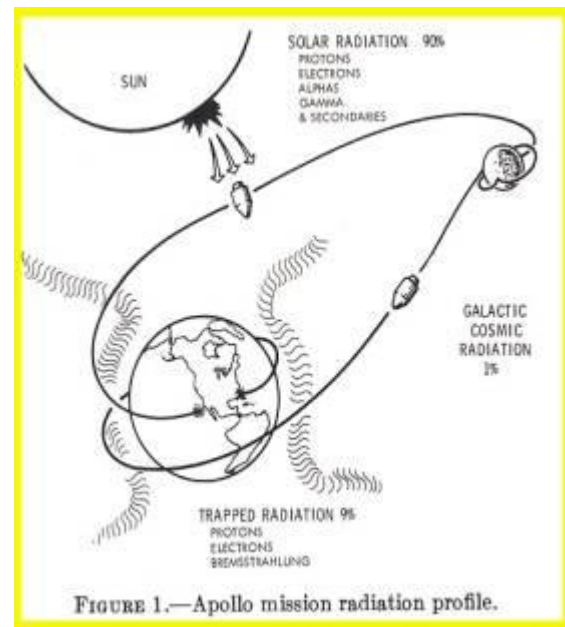
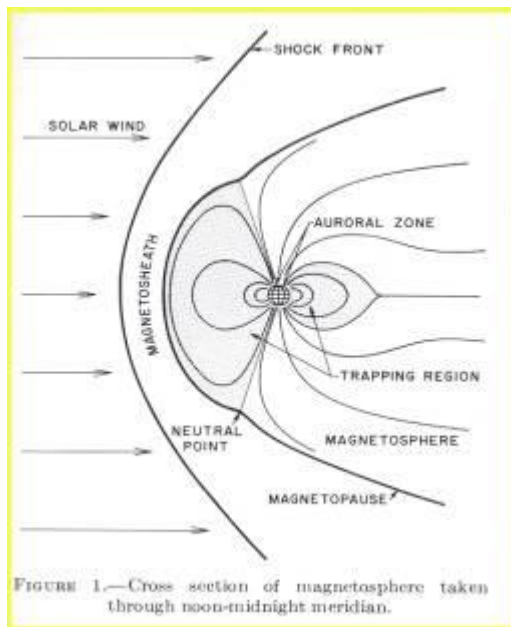
If for any reason you are one of the unfortunate souls who have bought into this nonsense, you may want to know that the key irrefutable fact is that no matter how much the debunkers try to pull the wool over the eyes of the American public, the Apollo astronauts only received a harmless 1 rem ([Roentgen Equivalent Man](#) – a unit of measurement for biological radiation exposure) and that came from quick transfer through the Van Allen belts and not from the Sun or galactic cosmic rays. Extensive radiation research prior to any Apollo launch as well as statistics from real-time Apollo instrumentation both on the ground and in space proved this to be true. The potential dangers encountered in other aspects of the mission would have greatly overshadowed anything encountered regarding this problem. The danger of death from an engine failure was far greater than anything encountered in the radiation belts, as Apollo 13 proved.

This article should serve to responsibly inform the Moon Hoax Advocates about NASA's extensive involvement and preparation to deal with Apollo's radiation threat. It is a story of a well managed and successfully resolved issue. For the ones who are closed to knowledge or who are heavily invested in the idea that we didn't go; don't bother reading this. Truth can be a bitter pill to swallow.

Background - The Van Allen Belts

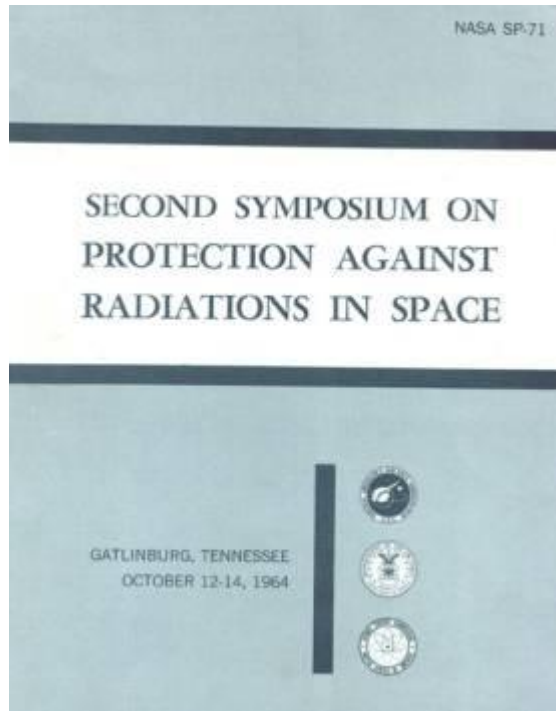
Protection against natural radiations of the Van Allen belts was a complex problem recognized long before Apollo or even before the advent of manned space flight. Prior to 1958, scientists knew that ions and electrons could be trapped within Earth's magnetic field. 1957 and 1958 were designated as the "[International Geophysical Year](#)" -- a time in which the first artificial satellites were launched by both America and the Soviet Union (Russia) for the first overall surveys of the Earth from space.

The Soviet's [Sputnik](#) and America's Explorer I (the latter instrumented by [James Van Allen](#)) were both launched in 1957, and 1958, respectively. [Explorer I](#) carried Van Allen's Geiger counters to observe cosmic rays, but the instruments mysteriously appeared only to work at the lower altitudes of its elliptical orbit. [Explorer III](#) followed two months later with more sophisticated instruments, and detected very high levels of radiation; vast numbers of energetic particles were seen to hit the counters at higher altitudes, and in specific regions. These "belts" (which had literally saturated Explorer I's more limited detectors, accounting for their apparent failure to "detect" the belts at higher altitudes) were eventually recognized as toroidal- (doughnut) shaped regions where both protons and electrons are trapped within Earth's toroidal magnetic field. Particles within the belts were seen to spiral around the Earth's magnetic lines of force, therefore changing orientation continuously in relation to a moving spacecraft.



These two radiation belts have different origins. The one discovered by Van Allen occupies a region above the equator, is a byproduct of high-energy cosmic radiation, and is populated by protons of energies in the 10-100Mev (million electron volt) range. These can penetrate spacecraft and on prolonged exposure, damage instruments and astronauts. NASA made sure that Apollo trajectories to and from the Moon always steered clear of this belt. The outer belt is seen as plasma trapped in the magnetosphere (from the Sun's expanding solar wind), where "radiation belt" is the term applied only to the more energetic parts of that plasma population of about 1 Mev of energy. It is also a documented fact that all the Apollo's passed through this area of radiation quickly and therefore avoided the danger.

As early as 1962, six years before the first circumlunar flight of Apollo 8, several symposia were called: to address the issue of protection against radiations in space, including specific planning for the Apollo Missions. Both NASA and the Atomic Energy Commission held two symposia, the first in Gatlinburg, Tennessee in 1962 -- sponsored by NASA, Oak Ridge National Laboratory, and the American Nuclear Society.



By 1964, more information on the radiation hazard had been gathered and analyzed. Meeting again at Gatlinburg, those concerned with the upcoming manned missions defined radiation problems encountered in deeper space, the radiobiological effects, and radiation effects on materials and components including shielding requirements. To refrain from writing a book on what was covered as a result of this extensive study, refer to the October 1964, NASA SP-71 Publication, Second Symposium on Protection Against Radiations in Space. By examining the contents of the '64 Symposium, you will see the laboriously considered and investigated areas early in our space program's history that are directly relevant to Apollo and the radiation issue. The fact that it was studied six years prior to any Apollo Moon launch indicates that it had been the primary concern on their agenda. And from looking at contents of the 1964 Symposium, it's blatantly obvious that the Apollo-hoaxers never even thought to address any of the specific early radiation topics that are seen there. Why? Because they would rather browse through uninformative websites or hear opinions from uninformed sources to arrive at their general silly opinions. Why would such extensive studies have been done if there were no contemplated preparations to avoid such hazards during the upcoming manned space missions being planned ... namely Apollo?

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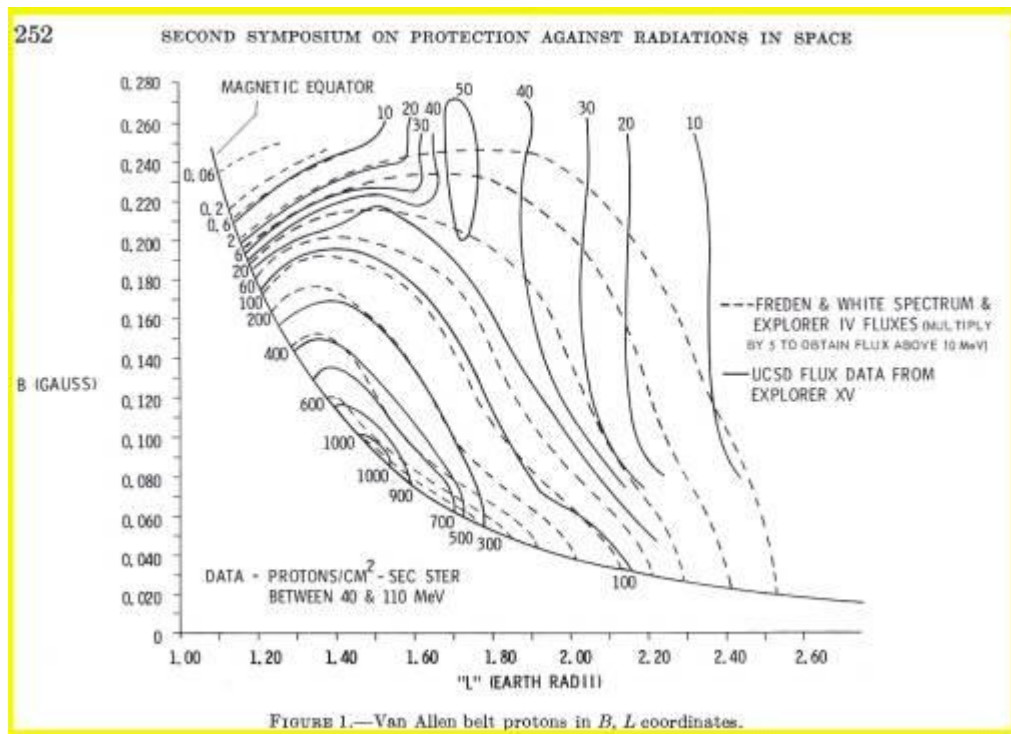
A quick perusal of just the table of contents of this report shows that NASA had very carefully and completely considered all the problems relating to radiation exposure. The report itself is over 550 pages, and the table of contents alone is seven pages long.

From these extensive, early radiation sessions dealing with specific effects on materials and components, it was concluded that -- with the exception of the effects on a few particular types of materials -- very long exposure times in the space environment would be required to produce significant damage. During these symposia, problems for 3-types of deep space missions missions (including Apollo) were examined. These included study of integrated proton flux numbers and shielding analysis of the LM and the Command module, as well as the interactions and transport of radiations through these spacecraft. A straight-ahead method of spacecraft design to handle the proton secondaries was created. It included refinements of complicated vehicle geometry (to be discussed), the exchange of a massive amount of electron data, and passive and active shielding information.

It is a fact that during the Apollo years, experience in radiation protection included the two distinct areas of both space and earth: space, where the critical radiation sources were uncontrollable; and Earth, where most sources of any strength are controllable and manmade. And it's also a fact that for Apollo, the goal was to avoid harmful effects by limiting the radiation dose to the lowest level judged consistent with the achievement of beneficial goals in both areas. This goal was achieved.

Before Apollo, insitu measurements were taken in regard to (lower belt) geomagnetically trapped protons. These were based on "radiation spectral data" developed by visually inspecting photographic emulsions recovered directly from Air

Force missile nose cones which had flown up and down through the lower belt and, as a result, defined the flux of particles therein. Van Allen belt protons were studied extensively at several different energy levels in this manner. (Refer again to the 1964 Second Symposium Report.)

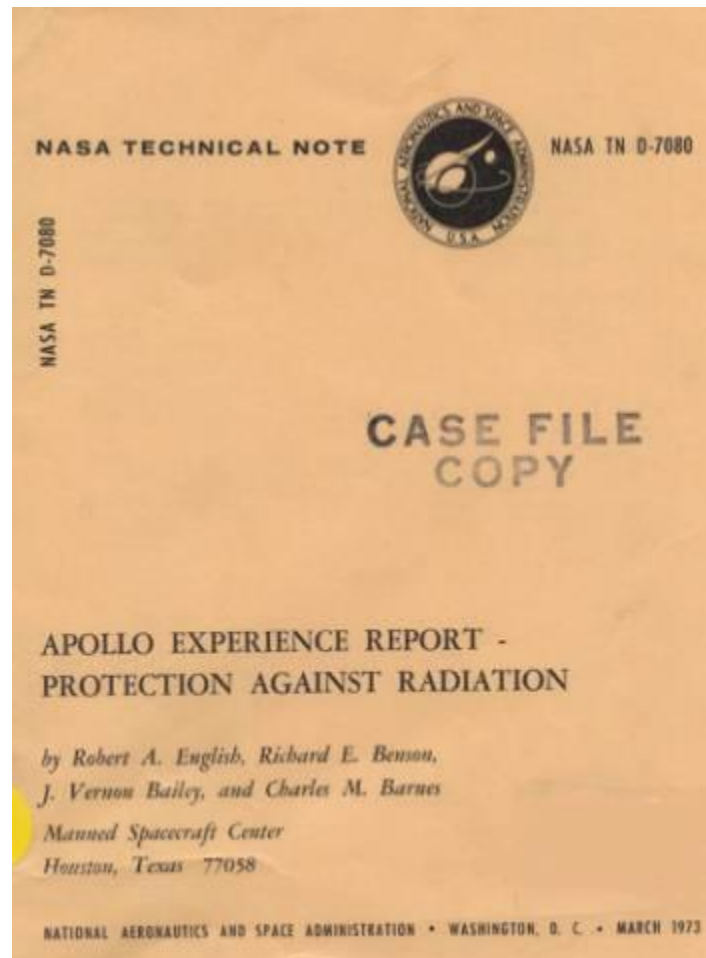


The number of protons encountered at each trajectory point of these ballistic missiles' test flights was determined from the flux and time interval to the next trajectory point of the missile's flight path; and the total dose calculations for belt exposure were made from the resulting total residual energy spectrum from those flights. This research was invaluable in developing the later Apollo era technology.

This chart reproduced here (above -- along with other mathematical calculations and figures seen in the scientific papers) may be difficult for some readers to interpret, but the bottom line is that when correctly translated, it demonstrates unequivocally that we knew *precisely* what the Van Allen belt profiles were, well *before* Apollo ever left the ground. The notion that the people who had done these studies would have deliberately placed the Apollo astronauts in mortal danger is absurd. And as you will see, the solution to the "Van Allen Belt Problem" was not to "fake" the Moon missions ... but to properly manage the threat.

Apollo indeed placed men outside the protective geomagnetic shielding where radiation could have been a serious problem. But again, in fact, doses to crews were minimal. The transfer from low earth orbit to translunar coast similar to the translunar injection burn of Apollo 8 (which incidentally was witnessed by many in Hawaii,) meant that they had to traverse the regions of geomagnetically trapped

electrons and protons in the Van Allen belts. When beyond them, they were subjected to cosmic rays and particle Sun bursts. So how much did they get?



Before we proceed, it is necessary to define a few terms. A RAD or Radiation Absorbed Dose, is a unit of measurement that determines the actual absorbed amount of radiation by any given material. The material can be plastic, metal, or biological, or anything else for that matter. It does not define the degree of biological damage that can occur to the absorbing individual, since different types of radiation can cause differing levels of damage to human tissues. Rather, it is a blanket number defining total radiation exposure of all types.

The REM, as we mentioned above, is a unit used to derive a quantity called equivalent dose. This relates the absorbed dose in human tissue to the effective biological damage of the radiation. Not all radiation has the same biological effect, even for the same amount of absorbed dose. To determine equivalent dose (rem), you multiply absorbed dose (rad) by a quality factor (Q) that is unique to the type of incident radiation.

There are several mitigating factors that can effect the amount of damage done to human tissue by radiation exposure. Even if a specific type of radiation is very damaging to humans, if you limit the time that a person is bombarded by that radiation, you can reduce the effect on the persons cells. This is why fair skinned

people will not get a sunburn if they are only outside without a sunblock for a few minutes. If they are outside for a few hours, they can get a very painful radiation burn. Continuous exposure of this type over years can lead to skin cancers.

This time element, or exposure, must always be considered alongside the intensity and quality of the radiation a person is exposed to.

As a rule, acceptable doses for high risk individuals like astronauts are expressed in rads. For example, 100 rads will induce vomiting, over 150 rads are fatal if untreated, and a 500-rad dose is fatal even with medical treatment. Delayed effects include cancer and other genetic changes. These long-term effects can occur even when the dose rates are far below the thresholds for any prompt effects.

The actual doses, in rads, that the astronauts received were quite small. From NASA Technical Note, TN D-7080- Apollo Experience Report- Protection Against Radiation, by English, Benson, Bailey and Barnes, March 1973 (where many of the figures and diagrams displayed here were taken), the tabulated radiation dose average from the thermoluminescent dosimeters carried by Apollo astronauts for their respective missions is given. (In comparison to the doses actually received, the report states that the original maximum operational dose (MOD) limit for each of the Apollo missions was set at 400 rads (x-ray equivalent) to the skin and 50 rads to blood forming organs.) Bottom-line actual doses received by the astronauts were:

TABLE I. - AVERAGE RADIATION DOSES OF THE FLIGHT CREWS FOR THE APOLLO MISSIONS	
Apollo mission	Skin dose, rads
7	0.16
8	.16
9	.20
10	.48
11	.18
12	.58
13	.24
14	1.14
15	.30

While this table does not include the results from Apollo's 16 or 17, there is enough data to conclude that the actual radiation exposure that the astronauts endured was very small. It never came close to being lethal or even damaging.

Specific Astronaut Protection

There were many qualitative precautions taken regarding Apollo instrumentation to detect radiation proton and electron flux.

The dosimetry instrumentation that was used in the belts during flight utilized omni-directional radiation sensors so that the flux could be measured accurately. The Van Allen belt dosimeter (VABD) was designed for Apollo dosimetry within these radiation belts and was proved satisfactory because dose values derived from its greater than 180 degree radiation acceptance angle correlated well with the doses indicated by Apollo post flight analyses of passive dosimeters worn by the astronauts.

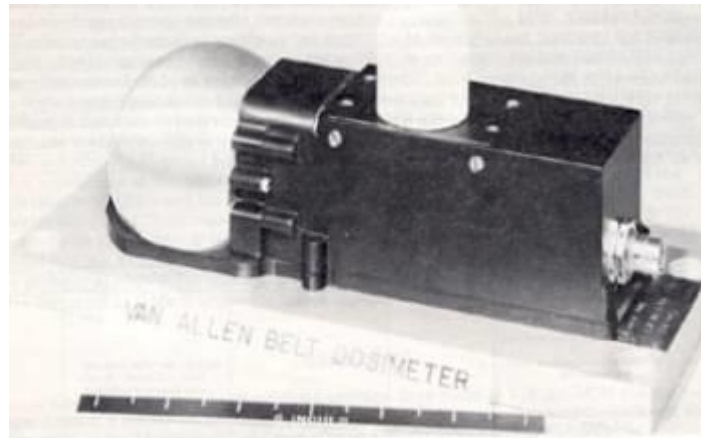
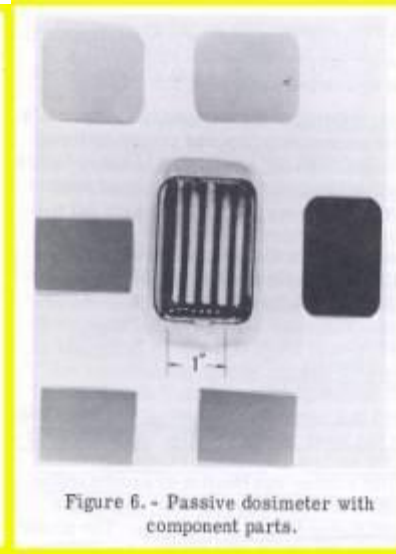
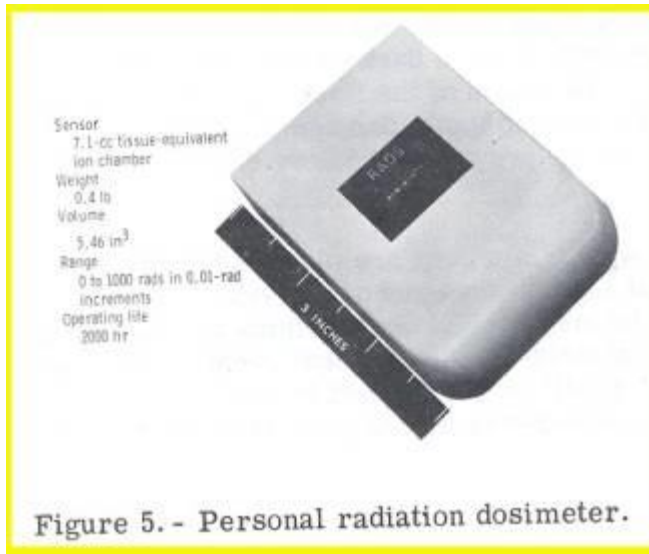


Figure 3. - Van Allen belt dosimeter.

A compromise in the final version of the VABD design was required for Apollo flammability considerations, and aluminum was used as a replacement for tissue equivalent plastic in the ionization-chamber walls.

Neutrons created by cosmic rays in collision with lunar materials were said to be a potential hazard. Whole body counting and neutron-resonant foil techniques were initiated on the Apollo 11 mission and results showed that the neutron doses were lower than anticipated. To allow accurate determination of the radiation exposure to the crewmen as far as cosmic rays, neutrons, and the diverse fractions of radiations from the Van Allen belts, each astronaut carried a personal radiation dosimeter (PRD) and three passive dosimeters. The PRD provided visual readout of accumulated radiation dose to each crewman during missions. It was small and was placed in the suits of the astronauts. They contained a lithium fluoride thermo luminescent powder, nuclear emulsions, and neutron-dosimetry foils as well as foils for specific detection of high atomic weight cosmic particles. Detector materials were analyzed after every mission and were able to accurately determine radiation dose to practically every part of the body.



In addition to these instruments, the radiation-survey meter (RSM) was utilized on each mission. This was a direct reading dose rate instrument that allowed the astronauts to determine radiation levels inside any location within any compartment of the spacecraft.

Alpha (helium nuclei) and isotropic proton particle (hydrogen nuclei) flux levels, from potential solar particle events (solar flares) were measured by the nuclear particle detection system (NPDS). There was a solar proton event between the Apollo 16 and 17 missions but it did not threaten the missions because NASA was able to make appropriate decisions not to launch when it occurred. It was one of the largest solar proton events ever recorded and produced radiation levels of sufficient energy for the astronauts outside of the Earth's magnetosphere to absorb lethal doses within 10 hours after the start of the event.

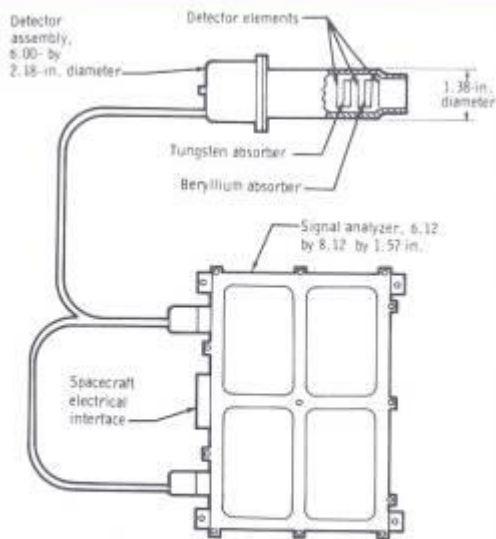


Figure 4. - Nuclear-particle-detection system.

Sensor	Range- linear	
10-cc tissue-equivalent ion chamber	0 to 100	} rads/hr
Weight	0 to 10	
1.60 lb	0 to 1	
Volume	0 to 0.1	
23 in ³	Operating life	1200 hr

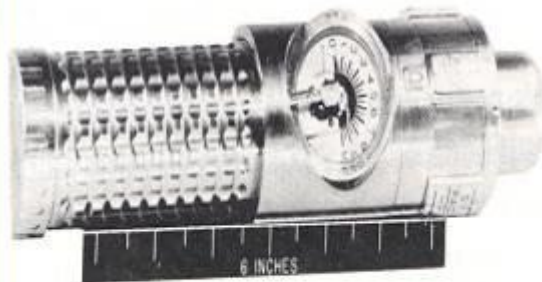


Figure 7. - Radiation-survey meter.

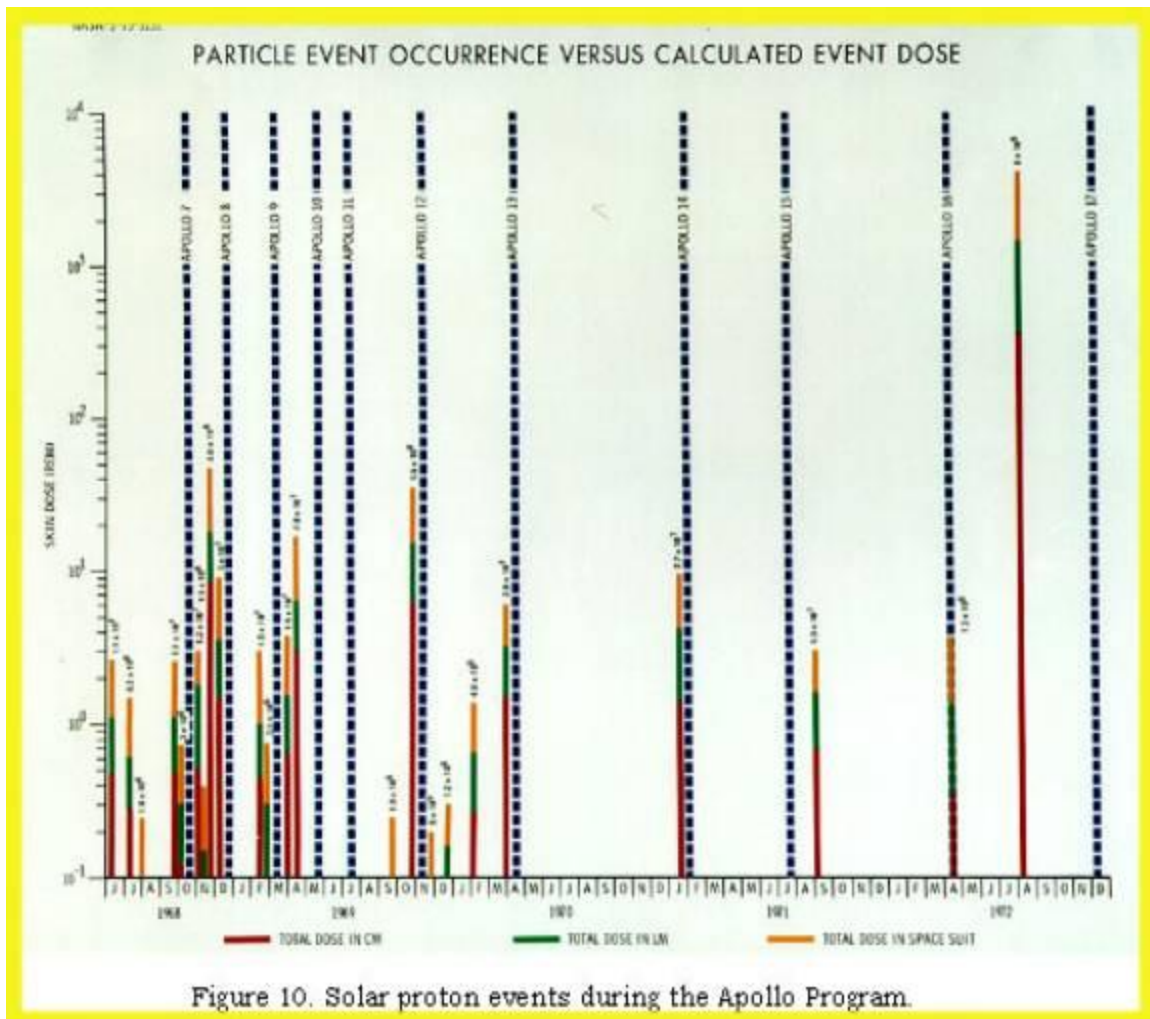


Figure 10. Solar proton events during the Apollo Program.

It is critically important to realize that NO "solar particle events" occurred during any Apollo Mission. Even so, a number of different protective contingency systems against solar activity were in place before any lunar launch. During the early stages of these deliberations, the scientists agreed -- considering the difficult nature of forecasting such events -- that the best that could be provided was an estimate of particle dose by giving visual or radio frequency (RF) confirmation that a solar event had indeed occurred. A system of terrestrial solar monitoring stations, the Solar Particle Alert Network (SPAN) -- consisting of three multiple frequency radio telescopes and seven optical telescopes -- was utilized under contract to NASA. These provided NASA with continuous data on the severity of solar flare activity. Because only about 20% of solar flares result in particle events reaching the Earth/Moon system, it was considered premature to change normal Apollo mission procedures based solely on RF or visual observations. Radiation sensors located onboard Apollo spacecrafts, as well as Earth orbit satellites, were used to confirm actual particle events reaching the astronauts. Only after particles were confirmed, would subsequent (but pre-planned) actions be taken to protect the astronauts.

TABLE II. - SOLAR-FLARE RULES FOR APOLLO MISSIONS

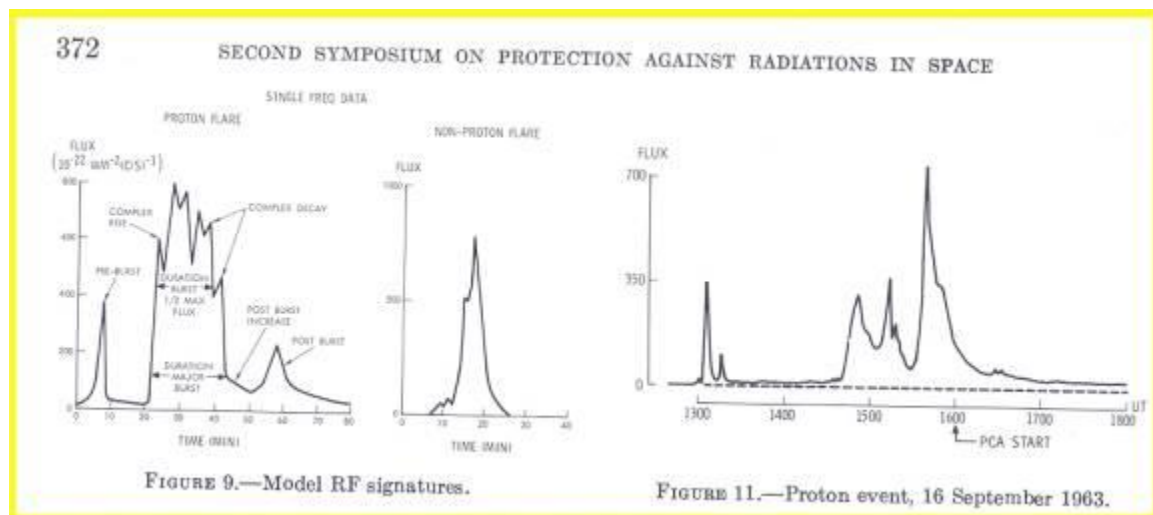
Condition	Mission phase	Rule	Comments
Major solar flare has been predicted.	All	Continue mission.	
Major solar flare has occurred.			
Unconfirmed particle event has occurred.	All	Continue mission.	Report: particles have not been confirmed. No mission impact is indicated.
Confirmed particle event and SPAN or real-time analyses indicate the MOD will be exceeded during the mission.	Prelaunch	Hold until data analysis indicates that the MOD will not be exceeded.	
	Earth parking	Continue mission. If data analysis indicates that the MOD will be exceeded by a significant amount before mission completion, translunar injection is no-go.	Translunar injection is no-go only if firm computation before go/no-go indicates more than the MOD.
	All other phases	Continue mission. Consideration will be given to early (or extended) transearth injection and inhibiting crew transfer to the lunar module.	
	Translunar coast	Continue mission. Consideration should be given to entering in next best preferred target point if the total dose can be reduced significantly without increasing total risk to the crew.	Crew should begin personal dosimeter and radiation survey meter read-outs. A projection of greater than the MOD is not required for crew read-outs.
	Lunar orbit	Continue mission. Consider extending lunar orbit stay time if the total dose to the crew would be reduced significantly by lunar shielding.	Hatch-down attitude may be used to reduce the total dose. If a particle event is confirmed, the crew will transfer from the lunar module to the command and service module.
Confirmed particle event and spacecraft telemetry or personal radiation dosimeter read-out projections indicate the MOD will be exceeded during the mission.	Lunar stay	Consider reducing the lunar stay time or extravehicular activities if the total dose to the crew can be reduced significantly without increasing the total risk to the crew.	Comparison of command and service module and lunar surface personal radiation dosimeters is advised.
	All other phases	Continue mission.	

Once detected by SPAN, the relevant solar data was then sent by teletype straight to the Space Environment Console (SEC) at Mission Control, in Houston. There it was evaluated and the vigil of Earth-based satellite sensors would be monitored for early signs of increased particle flux in the Earth-Moon system.

In addition to SPAN, the Solar Forecast Center (SFC -- located at the North American Air Defense Command in Colorado Springs, Colorado) provided to NASA a worldwide network of solar surveillance centers that were located at points all over the globe, some as far away as Iran. Personnel within this network sent 24-hour-a-day real time solar data to the SFC and four forecasts were publicly released daily. The Space Disturbance Forecast Center (SDFC), located at Boulder, Colorado operated one of

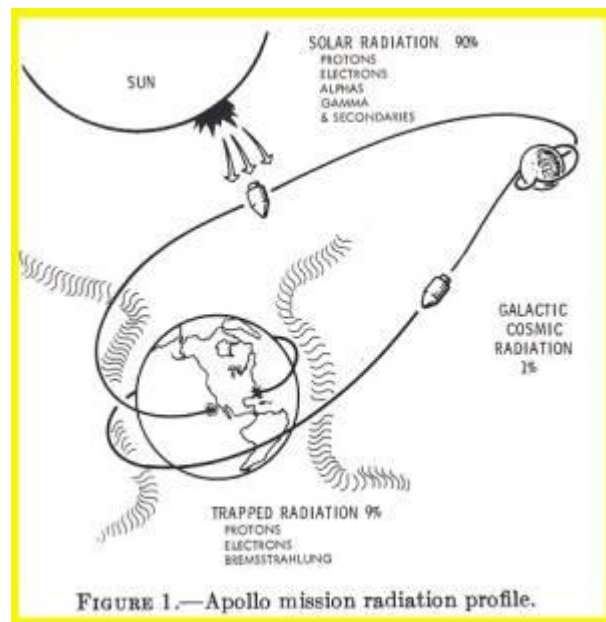
the seven SPAN optical telescopes and served as a collection for data from a number of other solar monitoring stations located near Boulder.

The riometer system (relative ionospheric opacity meter) was a highly sensitive system that measured the intensity of electromagnetic fields. It measured the changes in absorption of cosmic radio noise as it traversed the ionosphere. When it was used at different frequencies the proton flux and spectra could then be accurately determined. On September 16, 1963, a very active series of solar events took place during which RF signals were noted. Through the courtesy of Dr. Covington of the National Research Council of Ottawa, Canada, the RF signature was received. This was analyzed to determine: (1) if it represented a proton event; and (2) the size of the event. It was concluded that this RF signal did represent a proton event in the low $107p+/cm^2 > 30$ MeV size. Several months later it was determined from the Douglas Aircraft Company, which had a riometer located on the South Pole, that their calculations indicated that this event was on the order of 106 to $107p+/cm^2 > 30$ MeV. This check in methods gave confidence that the RF method of proton detection even for short warning periods could be a useful tool and important for the upcoming LM and lunar surface operations.



Radiation and the Spacecraft

It is often misstated by the Moon Hoax advocates that the Apollo spacecraft contained "no" radiation shielding. The truth is that the LM contained very little, but the CSM contained quite a bit.

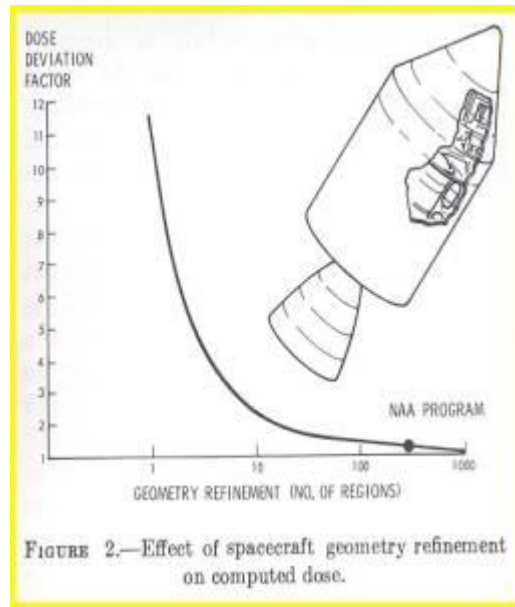
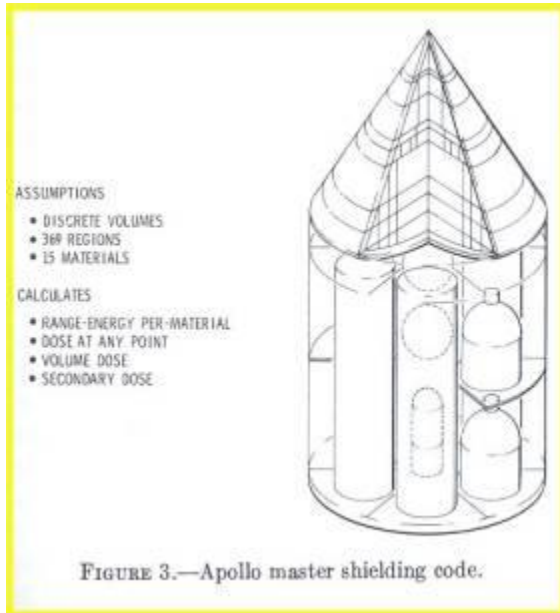


It's a fact that both high and low energy radiation flux particles affected the lunar spacecraft. The number of protons encountered (total flux) depended on the energy of the particles. For example, the flux of high energy particles is less and the flux of low energy particles is more, meaning that lower fluxes did not and could not penetrate the skin of an astronaut or the spacecraft. The CSM sliced through the more intense areas of radiation (high flux) in a short period of time. Thus, the Van Allen belts (because of this brevity of exposure) ultimately, literally presented no problem.

But, in order to deal specifically with these issues, shielding parameters had to be designed for the CSM and LM combination. Calculations regarding various radiation dosages during various mission modes -- like CSM-LM docking -- narrowed down specific dangers. One maneuver that was worked out beforehand, with the Van Allen Belts specifically in mind, was the the docking procedure of the CSM-LM combination, after "translunar injection" (final rocket firing) toward the Moon. The entering of the LM by the crew wasn't permitted in the flight plan until 10-20 minutes *after* this translunar injection (when the accelerated spacecraft had safely cleared the highest dosage in the Van Allen belts); concurrently, the astronauts weren't allowed to leave the CSM for at least that same amount of time into translunar trajectory, and for the same reason. These historic NASA documents effectively *prove* that careful, serious consideration was given to the radiation dangers that might be encountered during all Apollo missions -- effectively giving lie to the "Moon Hoaxers" wild assertions.

Shielding studies that sought reasonable protection of the spacecraft and the astronauts were intensive. A computer program was utilized to calculate astronaut dose in relation to the shielding effectiveness of the actual CSM structural geometry: geometry defined by the description of the dimensions and material construction of the spacecraft. Detailed construction parameters for Apollo were finalized only after

these exhaustive preliminary studies on and testing of the geometric configuration of the spacecraft was completed. NASA and the NAA (North American Aviation -- the builder of the Apollo spacecraft) selected a program that divided the spacecraft into 370 regions, permitting critical measuring of shielding codes to be implemented in the final design.



The computer program calculated the dose and secondary dose values at any point in the CSM, as well as dose effects that would be received by different parts of the astronauts bodies in different positions within the CSM. Many materials were studied for purposes of dose reduction (see the Symposia reports.) A warning system was installed on Earth that was ready to alert astronauts of impending solar events (which never occurred). A complete radiation protection system was implemented for Apollo, as a result of these studies. This included technology (the manually activated attitude control system) to permit the astronauts to reorient the spacecraft, by interposing the heavily shielded Service Module between them and the incoming particle and x-ray radiation. Solar RF emission, solar x-rays, ultraviolet rays, solar flares, magnetic field and ionospheric disturbances ALL were considered in these equations.

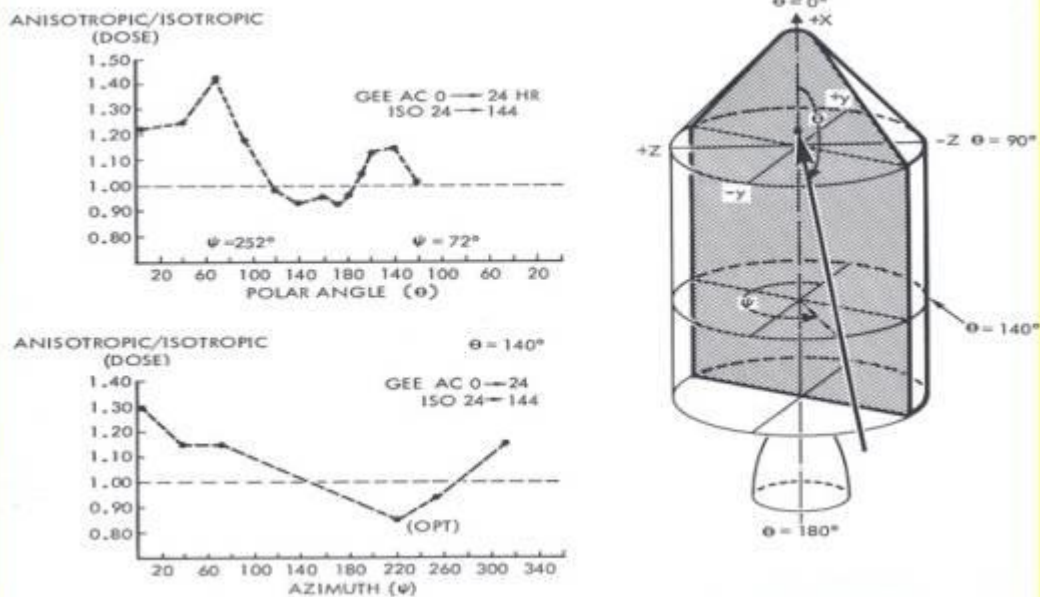
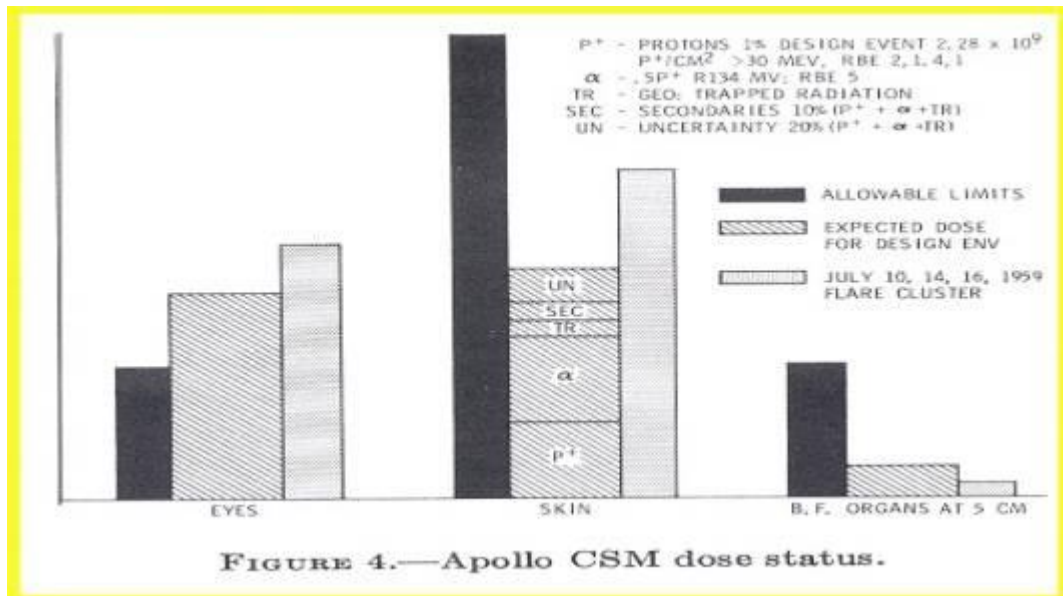


FIGURE 14.—Effect of spacecraft orientation on dose.



It was a ground support function to protect the crew against manmade sources of radiation, and potential problems involving such sources in the spacecraft. Radio-luminescent sources were applied directly to some of the Apollo equipment, in case cabin lighting failed during the mission. With these strict radiation limits in mind, the Lunar Module was equipped with radio-luminescent switch tips (in case of emergency), but ones that shielded out the original ionizing radiations by allowing only the passage of light.

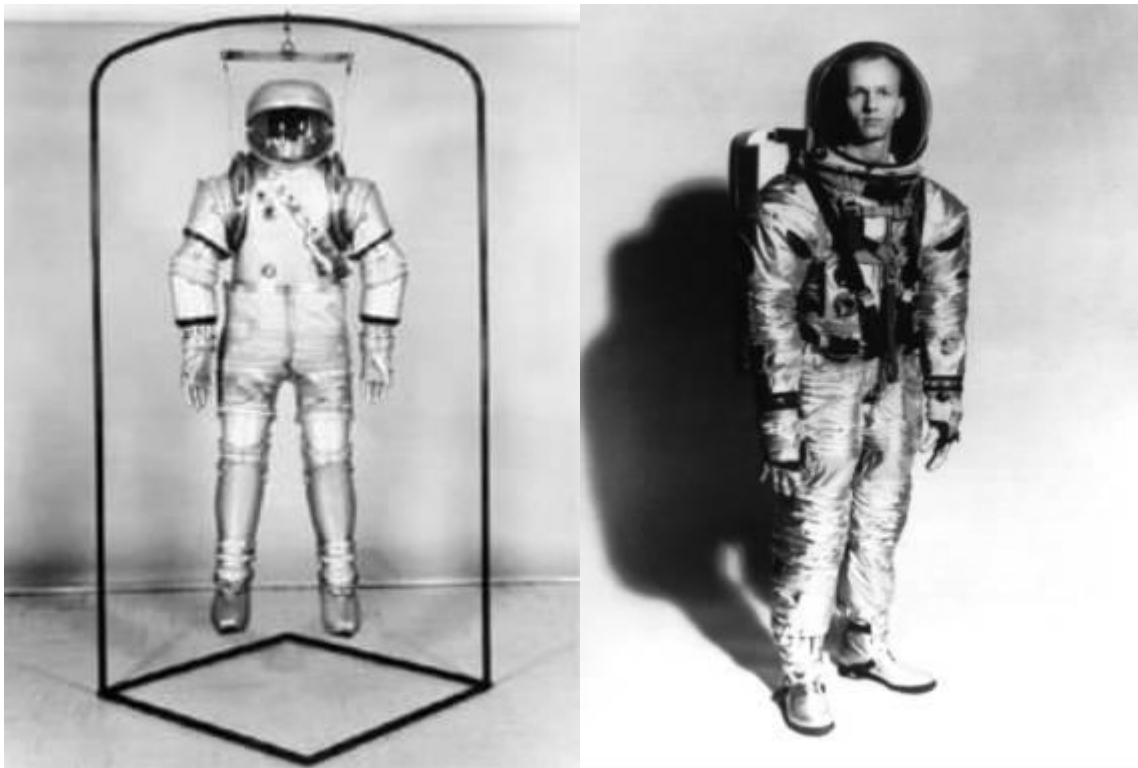
In addition, critical LM panels had a coating of special radio-luminescent paint and a thin coating of acrylic plastic was applied over the paint as a "radiation sealer." This

reduced the soft x-ray dose from an initial value of 13 rads/hr at a distance of 2 inches from the panel, to an acceptable value of less than 0.3 rad/hr. It wasn't hazardous to the astronauts during missions because their suits (worn while in the LM) provided more than enough additional shielding to protect them.

Radio-luminescent lighting was also integrated into the portable life support system (PLSS-or suit) worn by astronauts on the lunar surface. It had a remote control unit (RCU) that contained the controls and quantity gauges. Beta lights eliminated external radiation problems.

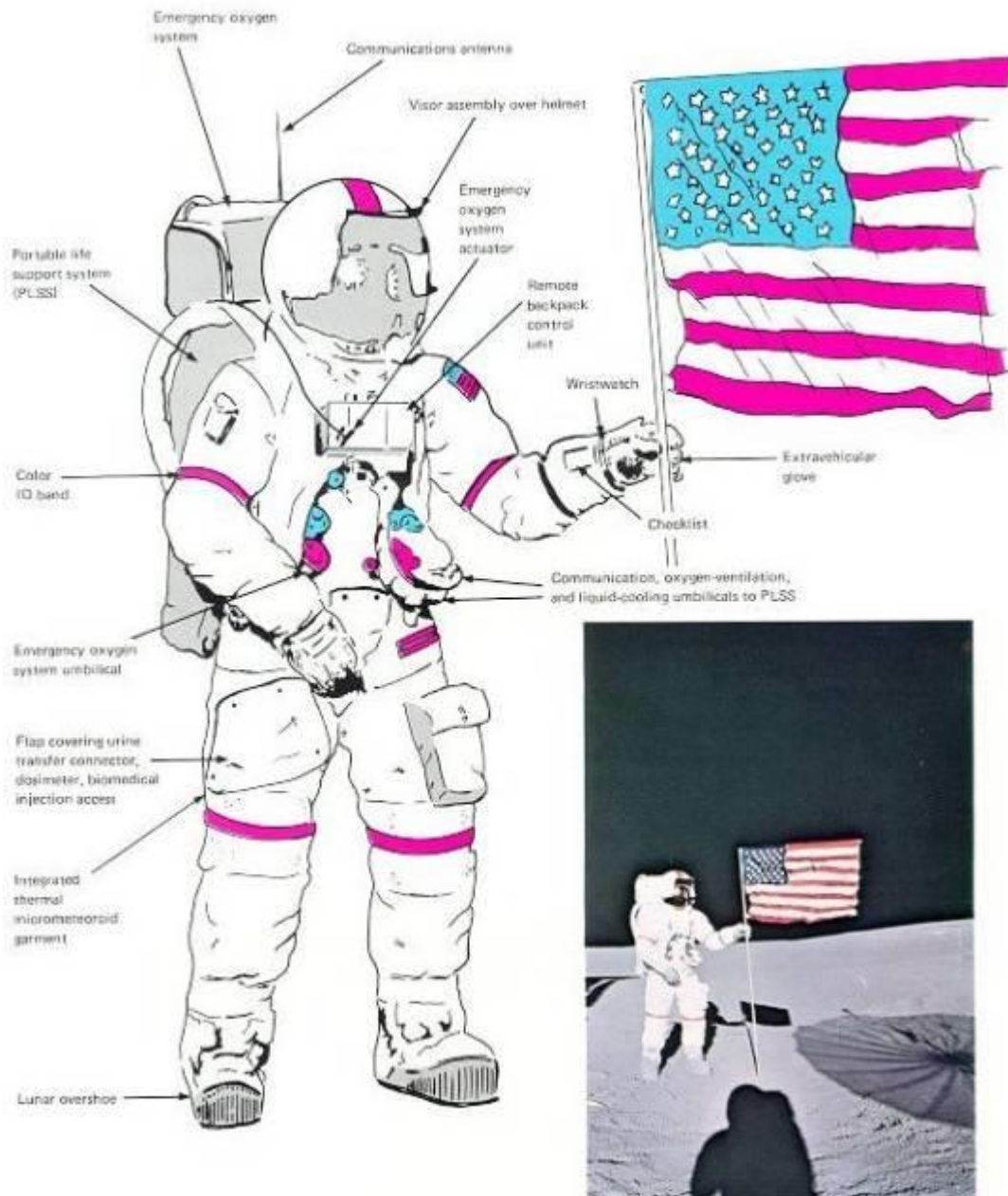
The Spacesuits

While some organizations struggled with spacecraft developmental phases, others focused on spacesuit design. For 30 years the suit went through numerous modifications adjusting to the needs and demands of space including radiation. Early pressure garments went through primitive evolution and included non- stretch fabrics, laced up corsets and special movable joints and cables.



With the upcoming flights of Mercury and Gemini, new "spacesuit problems" were anticipated: we would be going farther out into space, eventually to the Moon. Eventually, during Apollo, twelve astronauts spent a total of 161 hours of EVA in the vacuum of the lunar environment. And additional hours were spent in micro-gravity while coming back to Earth, when one CMP (command module pilot) retrieved photographic film from outside the Command Module half way between the earth and Moon. The Apollo suits not only served as virtual life support systems and

backup pressure systems inside and [italicize] outside the spacecraft, but each was literally an 80-lb independent spacecraft [italicize "independent spacecraft" (minus the engine). Along with the boots and gloves, the suit protected the astronauts from the lunar vacuum, carbon dioxide, micrometeorite impact, heat, and radiation. The helmet was a high strength polycarbonate "bubble" attached to the suit with a pressure seal, and movable visors over that bubble were made of UV blocking Mylar which protected the astronauts eyes and epidermis (skin) from the Sun's raw ultraviolet radiation. On the Moon, background particle radiation from the Sun was non-existent. As can be seen, contrary to the accusation that NASA ignored the "radiation problem," every potential problem that the astronauts might encounter on the lunar voyages was addressed at some point in the process of spacecraft and spacesuit development



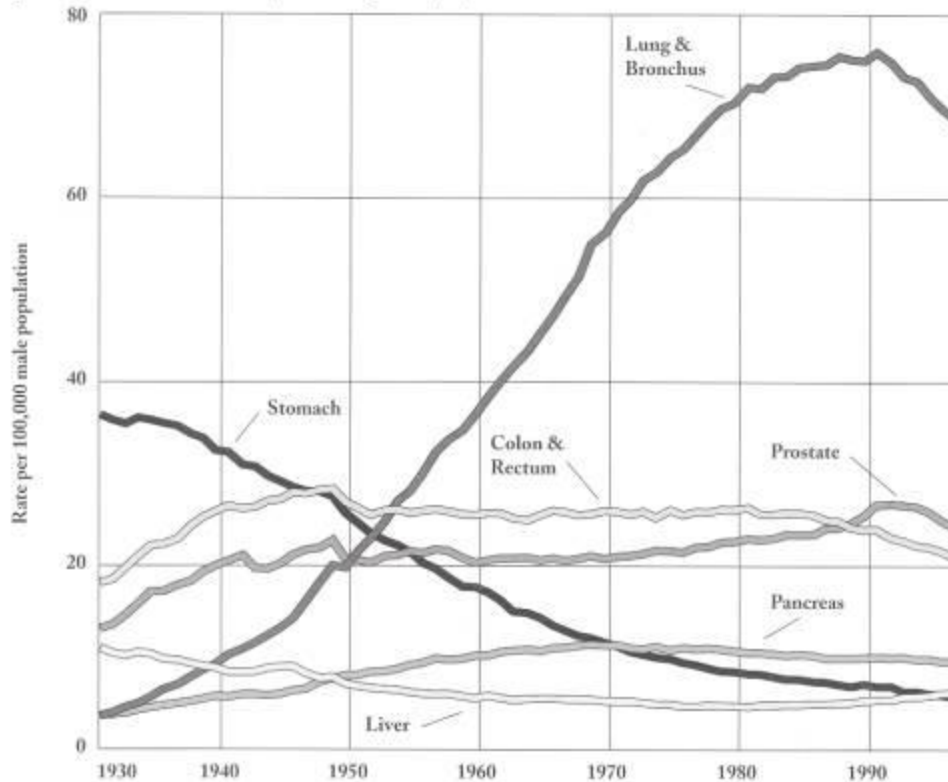
Ultimately, the Apollo spacesuits were "three suits in one," consisting of three independent layers, each having its own hardware and specific purpose for survival. The inside layer was connected to the backpack portable life support system (PLSS) where water and oxygen were stored. The pressure garment was linked to this layer and the PLSS. The outer armor-layer consisted of 13 separate fabrics and materials (like beta cloth) designed to protect the two inner garments from the lunar elements (micrometeorites and radiation) and space itself (the vacuum). There were systems with backup systems for about every application. On top of this, each astronaut had a literal wardrobe of suits designed for the different phases of Apollo ... training, lunar EVA, and flight. They all (obviously!) worked -- but only after literally decades of development, with the radiation and other space hazards firmly in the minds of the designers.

No One Got It

How about radiation and the cancer risk? The Moon Hoax advocates say "the Apollo astronauts never went to the Moon." The fact is (from other overwhelming evidence presented in this series) 21 American astronauts passed safely through the belts to and from the Moon, and *none* died as a direct result of cancer incurred during Apollo. Jack Swigert (of Apollo 13) died in 1982 of cancer, ten years after his Apollo flight, just after being elected to the Congress. Alan Shepard (of Apollo 14) died decades after his own flight, of leukemia. Both cases were diagnosed as "unrelated to their lunar mission experiences."

Cancer statistics today from the American Cancer Society, show that one out of two Earthbound adult males (American) will develop "some type of cancer" in their lifetime; out of 18 randomly picked American men, half will develop a related lifetime risk. The specific probability of developing an invasive cancer for men up to age 39 is 1 in 62; for ages 40-59, 1 in 12; and ages 60-79, 1 in 3.

Age-Adjusted Cancer Death Rates,* Males by Site, US, 1930–1996



*Per 100,000, age-adjusted to the 1970 US standard population. **Note:** Due to changes in ICD coding, numerator information has changed over time. Rates for cancers of the liver, lung & bronchus, and colon & rectum are affected by these coding changes.

Source: US Mortality Public Use Data Tapes 1960–1996, US Mortality Volumes 1930–1959, National Center for Health Statistics, Centers for Disease Control and Prevention, 1999.

American Cancer Society, Surveillance Research

Even if the Swigert and Shepard deaths had been a direct result of cancers developed from their missions (which, as has been stated, wasn't the case), cancer statistics for the Apollo Mission years themselves indicate a higher rate of mortality for *all* different cancer types for the population as a whole for those years ... astronauts not included. And again, according to the American Cancer Society, only high-frequency x-ray, ultraviolet light (UV), or ionizing particle radiation has been proven to cause human cancers. The Apollo astronauts, as we have seen, were specifically protected from all these sources. There is more danger on Earth from high-dose radiation from x-rays and radon, if not exposure to sunlight that causes basal and squamous cell skin cancer and melanoma, than there was for the Apollo astronauts going to the Moon.

In Daniel Drasin's perceptive satire *Zen and the Art of Debunkery*, he published "indispensable guidelines for the zealous skeptic." It satirically lays out precisely what the Moon debunkers and promoters of anti-scientific attitudes have tried to do.

Substitute 'scientific propaganda for scientific method.'

However, in this case they foolishly stepped over the line and tried to bite off more than they could chew -- by trying to debunk a clearly proven era of science: the sojourns of Apollo. They have failed. Because their miserable attempts have now been recognized for what they are (ignorant and temporary "distractions"), perhaps we can finally move on to more significant issues ... about what NASA really doesn't want us to know. As Mike Bara said in his second piece in this series, maybe it's a case of ignorance obviating the rational mind. Perhaps their agenda (the "Moon Hoaxer" crowd) is political, and they're hooked up with other "higher-level distracters." They have desperately and deliberately attempted to take the focus off of what is really important about our Moon, by making the mistake of challenging the validity of Apollo and the integrity of scientific fact. Like thieves, they have chosen to make their dollars off of the impressionable American public, and they'll have to live with that when all is said and done.

NASA spent millions to insure that the astronauts that went to the Moon were protected from the physical threats of deep space. We now know (from literally hundreds of thousands of pages of official documents) that the Space Agency literally spent billions doing the necessary research and developing the necessary technologies to get them there and back safely. These are not really the issues.

The underlying reasons for NASA's deception and duplicitousness regarding what is really on other planets in our solar system -- including the 30+ year pattern of withholding crucial Lunar information from the people who paid for Apollo in the first place, and what we now *know* from NASA's own photography is on the Moon -- are the REAL issues here.

It is TIME to get the focus back on track where it belongs.

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The Apollo "C-Rock" Revealed

By Steve Troy

In past installments of Who Mourns For Apollo, we definitively explained and resolved many of the discrepancies and absurdities put forth by the moon hoax crowd who claim we never went to the moon. Included in this group are many who profess to have done "arduous research" to try to prove that the Apollo legacy was a fraud and have subsequently tried to push this fallacy to a large portion of the public, many of whom still remain uninformed and susceptible to such drivel.

In any scientific quest for truth, it essential for anyone or any group endeavoring to challenge accepted and conventional scientific information to first properly investigate said information before reporting on or releasing any new data that may challenge it. In the case of the moon hoax conclave that keeps declaring

they have found information that is suspiciously in error (regarding Apollo), the tack that they've chosen to follow is now blatantly predictable.

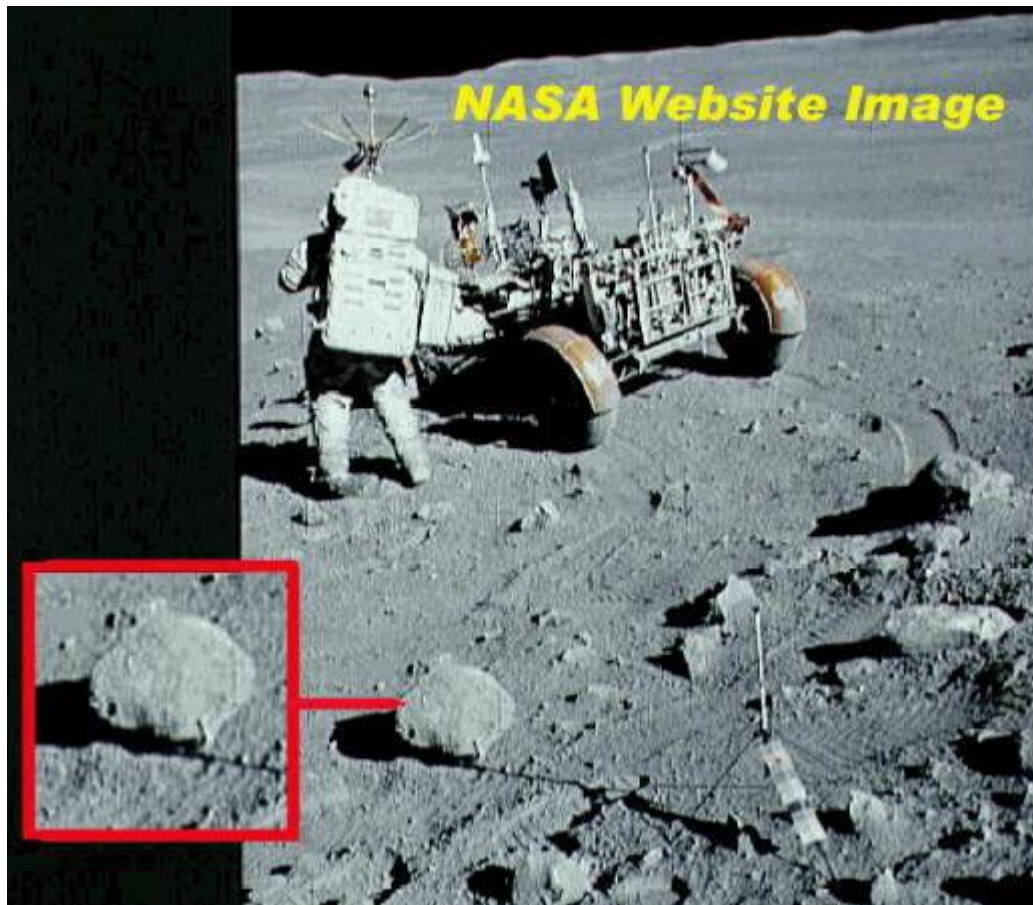
They have repeatedly donned the disguise of legitimate scientific inquiry to fatuously dare the facts, yet haven't done the investigative research necessary to find out that the information they disagree with so vehemently is indeed, irrefutably valid. They don't want to know the truth and not one has done the homework to find it. They instead irresponsibly accept the shared tidbits of data they've seen at a glance to generally discredit and debunk the validity of Apollo as a whole. As a result of their unexplained lapses of judgment (as reflected in their web postings), there is confusion among the impressionable masses as to what is true or not.

French amateur astronomer Phillipe Lheureux is the latest to jump on the moon hoax-bandwagon. In his book, Lights on the Moon, his twist reflects the errant notion that NASA, in order not to give out the real Apollo photos containing scientific information about the moon which could be exploited by the Russians (?), released faked photos taken during training stages that reflected the Apollo cover-up. He lays out several of the familiar Apollo photographs in an attempt to substantiate his accusations. These are among the same tired photographs used by other moon hoaxers in their arguments. These people are simply oblivious to the certainty that there is a scientific explanation for all of them.

A classic example of unexamined data, which is included in Lheureux's gallery and other hoax-sites, involves a controversial lunar rock: a Type 4, complex gray and white breccia seen at Station #4 during the Apollo 16 mission. It can be seen on NASA photographs AS16-107-17445 and 17446. We refer to it as the "**C-rock**" because of the mark on it resembling the letter "C." Hoaxers claim that this rock that was a deliberately labeled special theatrical property used as part of a desert sound-stage of the Station #4 scene. According to them it was inadvertently leaked out in this picture.

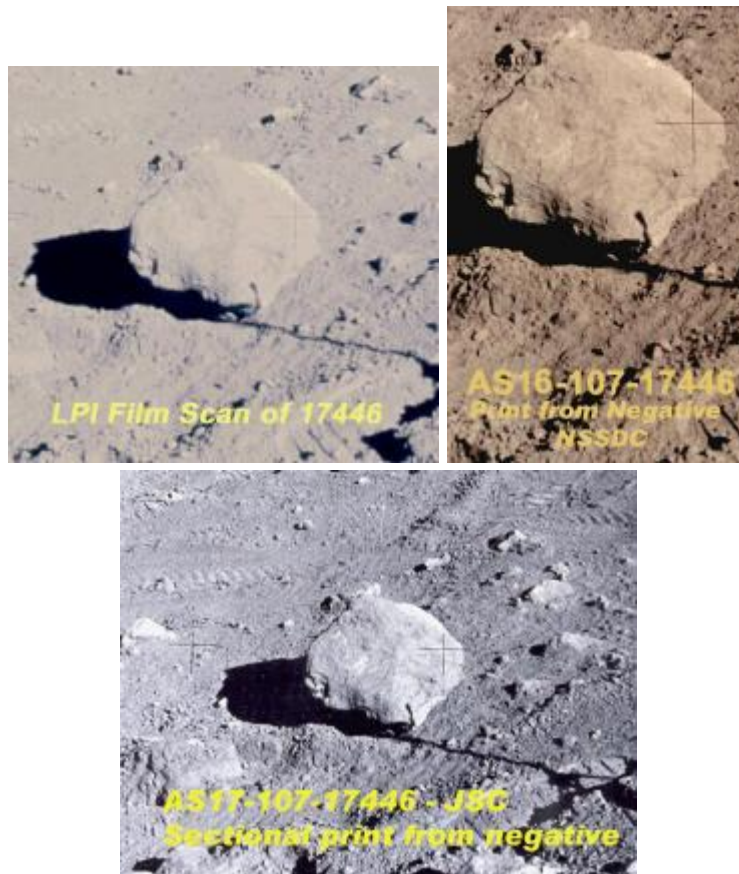


What may seem more convincing to their case is that the 'C-rock' is also seen in an archived shot on a NASA website. It follows that they would jump on this one full force and say that this rock is a proverbial smoking gun.



Now we strongly suspect that most of the 'moon hoax crowd' has neither had the time nor desire to even find the frame numbers so that they could check the veracity of their claim. Those who were tempted to do this and could have – **DIDN'T**. If they had gone to just one of the many NASA photographic archives to investigate the negatives, they would have discovered that in reality, the 'C'-rock is just an ordinary lunar breccia absent of any alphabetical embellishment whatsoever. Since we've been able to find an easy explanation for everything erroneously claimed by the hoaxers to date, we decided to investigate this issue to once again set the record straight.

We first ordered 8X10 negatives of these frames from three Apollo archives including NSSDC, Greenbelt, MD, The Lunar and Planetary Institute (LPI)-Houston, and Johnson Space Center (JSC)- Houston. We discovered from examining all three sets from all three archives along with developed print sectionals from each, that the "C" did **not** appear on the rock on any of the photographic negatives.



Yet the "C" was still evident on the print on the NASA website. We knew that this print had to have been made from a negative yet we knew now that the negatives from all the archives were 'clean.' We therefore had some questions regarding the printing procedure. We spent some time with photographic and research people at JSC and LPI to dig a little deeper about how it could have gotten there.

Initially, the personnel at both at LPI and JSC agreed that the close-up 'C'-rock photo shown in the first photo in this piece is indeed a hoaxed, embellished version of the NASA website photo. They assumed someone took the liberty to deliberately enhance the "C" seen on this photo. There isn't, of course, a feasible way that they could have taken the NASA web version and blown up the image to the resolution seen in the debunkers-close-up photo due to pixelation distortion. But what if someone had somehow obtained a duplicate print of the version seen on the NASA website?

With more detective work from LPI photographic personnel, things began to get interesting, and some revelatory information came to light. First, LPI examined the transparencies of AS16-17445-46 from their collection and they discovered what we had found: that neither showed the "C" or any other questionable suspicious marking. They then checked their prints. They have two prints of both 17445 and 17446, and on one of the 17446 prints, they found the "C." They noticed that when the "C" on the rock was seen through a magnifying loupe, it

looked like a piece of hair or string resting on the print. It definitely does **not** appear to be imprinted on or engraved into the rock itself. In fact they noted that there was a shadow under part of it suggesting that whatever it was, was not lying completely flat. Their conclusion was that it was indeed a hair or fiber more likely on the paper when the print was made.



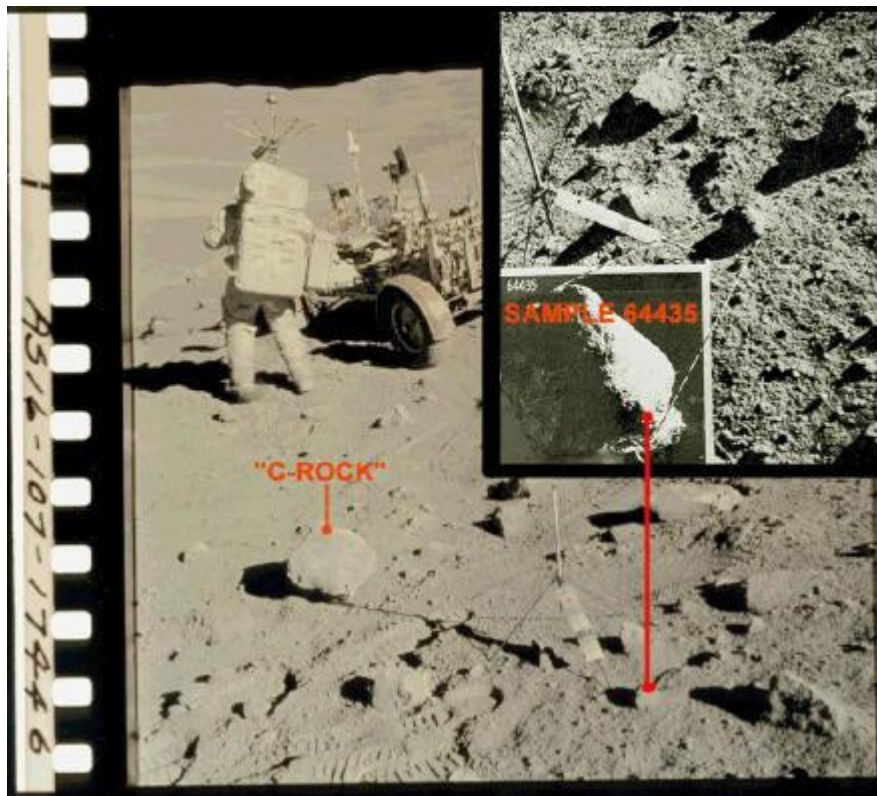
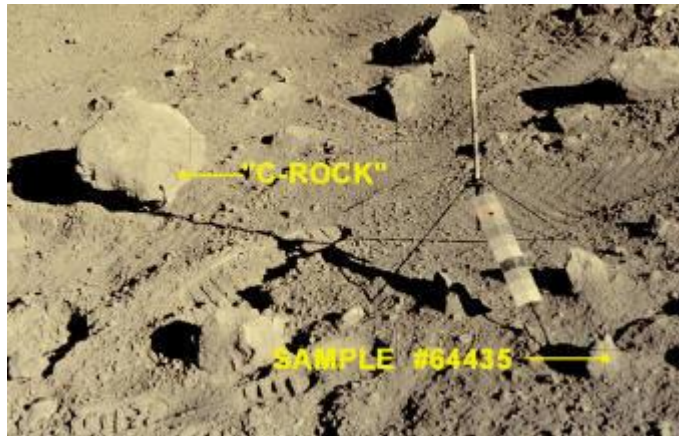
The problem with a hair or fiber on the film or paper is that normally, an object such as this on photo paper or film would produce a **white mark** on the print. They discussed this with their LPI staff photographer and she accurately explained that Apollo prints were produced from positive film (like slide film) and not from negative film (the originals being color reversal ektachromes.) This meant that an object like a "C" shaped fiber on the film or paper would produce a **dark mark** on the print, which it did. If the hair or fiber was on the film, they thought that all copies of 17446 made in that print run would have the "C" on them. If the "C" was on the paper, they say it is likely that the 17446 'C'-rock print in their collection is the only one. We were told that this particular print had been from a NASA produced set. Since our investigation, LPI says they have found a special place for it in their archive.

LPI then scanned the rock from the anomalous 17446 print at highest resolution available with their equipment. A 14MB file was compressed to 1.5MB and a maximum jpg was saved and sent to us. The image is a 4X enlargement of the highest resolution scan of the rock. Although somewhat blurry, it clearly represents what the infamous "C" really is as seen under magnification: **a hair or fiber!** It is even a different color from the lunar color seen on the developed prints. This represents a classic bit of crucial information the hoaxers haven't known about, because they failed to do the homework to verify it!

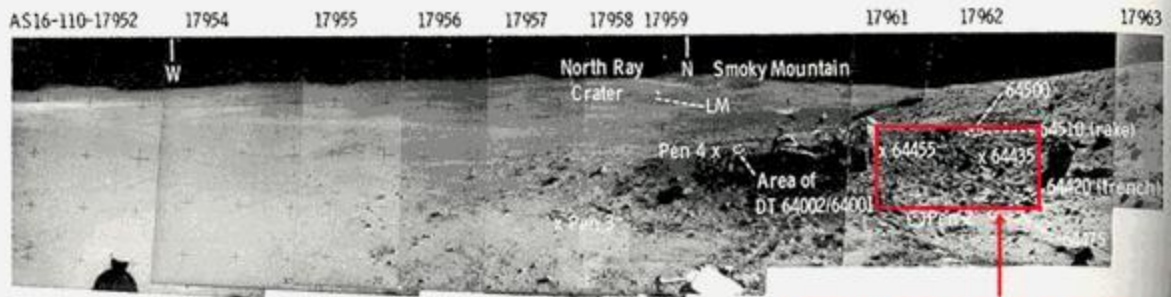


JSC concurred with LPI's analysis and found the NASA website print intriguing. Like LPI, they determined that the negative of 17446 in their repository was 'clean.' They believe somewhere at sometime, something got onto an enlarger lens and a print came out with the "C" on it. They said one of these prints was then scanned for the NASA website in the late 1980's or early 90's. The person we talked to at JSC told us he had no control over getting the image replaced by a clean one or removed, but he assured us that their prints didn't bear this mark.

If this information weren't enough to nail the hoaxers' coffin shut on this issue, we found other pertinent data about Station #4 including the classification, composition and geology of the rocks at this EVA site. From examining the Apollo 16 Preliminary Science Report, NASA SP-315, we know in all probability that the 'C'-rock is a Type 4 lunar breccia because we have a returned breccia sample (#64335) that was taken from the surface **not 7 feet away from it**. We also have other surface photography taken from different angles that shows the #64335 sample as well as the arrangement and distribution of other rocks including the 'C'-rock, as seen on 17445 and 17446.



Researchers who have explored the Apollo program know that there continues to be, as there always has been, meticulous cataloging and report on every detail about every lunar sample returned from the moon. Some relevant information for Station #4 is presented below for perusal. Those (including the hoaxers) who wish to learn about more about detailed geologic reports of the area that include the rocks at Station #4 as well as the scientific reports on any aspect of any Apollo mission, are encouraged to contact the Lunar and Planetary Institute, Houston.



(Symbols same as in fig. 6-13)

AREA OF "C-ROCK"

TABLE 6-IV. - Classification of Samples

Crystalline		Glass ^c (G)	Breccia ^d					
Igneous ^a (C ₁)	Metaclastic ^b (C ₂)		Light-matrix light-clast (B ₁)	Light-matrix dark-clast (B ₂)	Medium-gray matrix		Dark-matrix light-clast (B ₄)	Dark-matrix dark-clast (B ₅)
					Friable (B _{3a})	Coherent (B _{3b})		
60015	60135	60095	60025	60016	62247	61175	60017	63331
61016	60235	61195	60035	60075	62248	61295	60018	68111
67956	60315	65016	60055	60215	62249	66035	60019	68811
68415,1	60335	67095	60056	61015	63507	66036	60115	
68415,2	61156	67486	60057	61135		66037	60255	
68416	62235		60058	61157		66075	60275	
69955	62295		61226	61158			61155	
	64455		62236	62255			61225	
	65015		62237	64425			62245	
	65055		62246	64475			63355	
	65905		62275	64476			63505	
	65906		67075	65035			63506	
	66095		67415	65075			63508	
	67025		67705	65095			63509	
	67935		67948	65315			63515	
	67936		67955	65907	Station 4 sample: 64435		64435	
	67937			66055			64477	
	67945			66085			64478	
				66086			65056	
				67015			67435	
				67016			67475	



A type 4 rock recovered from station 4

FIGURE 7-8. -Complex gray and white breccia. Sample 61015 shows the complex arrangements that in some areas show white clasts in a gray matrix but in others show gray clasts in a white matrix (S-72-37758).

The opportunity is always there for anyone to challenge science with integrity. Unfortunately, there hasn't been much of it shown by the moon-hoax crowd. Hey guys, the information is out there. You can't keep your cogent outward appearance by merely saying you have proof we never went to the moon with data like your 'C'-rock, and then cast your disinformation about Apollo to the public. One would think these purveyors of disinformation would at least have common sense enough to police their own ranks. It only serves to demonstrate

one thing: They cannot and never will be recognized as a part of the legitimate scientific community.

In solving the "C"-rock issue, NASA was most cordial and helpful in helping us get to the truth. When they heard we were trying to find answers to debunk the debunkers, they were right there to assist us in every way they could. There are however, some questions involving our specific area of lunar investigation that to date, have remained unanswered. We therefore ask the cogent question relating to the real issue:

Now guys, will you help us get to what's REALLY waiting for us on our moon?"

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