

**THE MOON IS NOT POOL-TABLE FLAT! REALITY VS. OUR VISUALIZATIONS OF THE LUNAR SURFACE.** D. T. Britt. University of Central Florida, Center for Lunar and Asteroid Surface Science (CLASS), Department of Physics, 4111 Libra Drive Room 430, Orlando, FL 32816. [dbritt@ucf.edu](mailto:dbritt@ucf.edu).

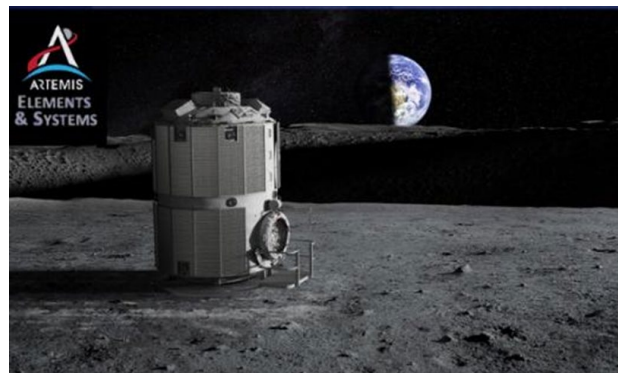
**Introduction:** A common thread in NASA, ESA, other space agencies, and commercial company's depictions of the Lunar surface is their highly unrealistic view of a flat, benign, level, and easily landable Lunar surface. Missing are the craters, boulders, and dust that are the fundamental challenges to safe landings. The three images to the right illustrate the problem. Craters at all scales are a feature of the Lunar surface, but these images display an almost complete lack of craters. The pervasive Lunar dust seems to be pervasively missing. The astronauts in the top image are amazingly clean. Dust does not seem to be a problem for their spacesuits. Their surface operations do not seem to disturb any dust. The second image is of a habitat on a flat, dustless plain. There is a big crater in the distance, but no smaller craters, no dust, no boulders. The third image of a Lunar rover continues the delusion of a featureless, flat plain over which operations will be simple and easy. Again, no craters, no dust, no boulders, no obstacles of any kind.

**The Apollo Experience:** All the Apollo landings had varying degrees of trouble with dust-obscuration on landing, landing in and near craters, avoiding boulders, and accumulating dust during surface operations. Three out of the six Apollo landings had issues with lander tilt. Apollo 15 was the worst, ending up on the edge of a six-meter crater at an 11-degree tilt with one of the lander footpads completely off the surface. The problem was dust-obscuration on landing from the descent rocket plume.

From Pet Conrad's Apollo 12 debrief: *"The dust went as far as I could see in any direction and completely obliterated craters and anything else... I couldn't tell what was underneath me. I knew I was in a generally good area and I was just going to have to bite the bullet and land, because I couldn't tell whether there was a crater down there or not."*

Ed Scott Apollo 15: *"...at the altitudes looking down as we approached the landing, it was very difficult to pick out depressions... as far as the shallow depressions there and the one in which the rear footpad finally rested, I couldn't see that they were really there. It looked like a relatively smooth surface."*

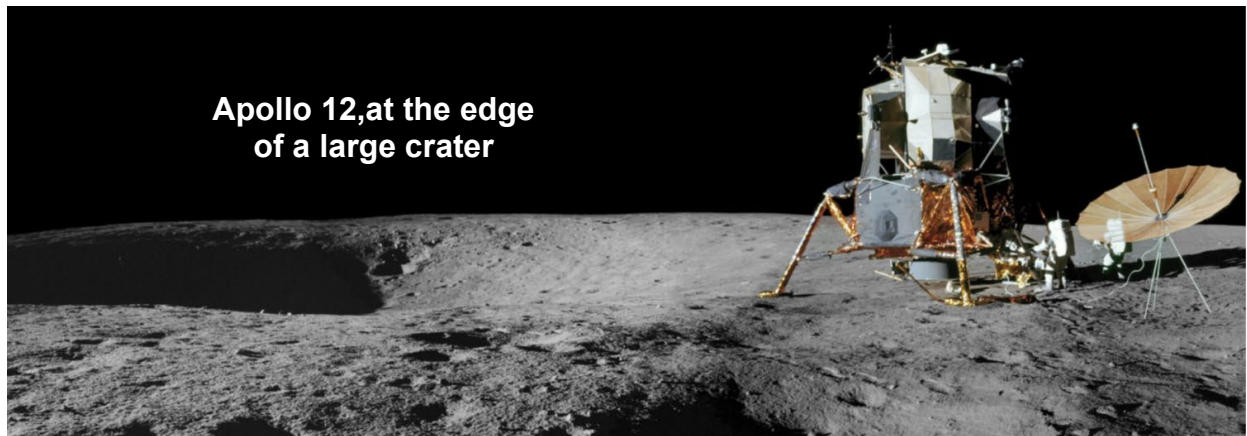
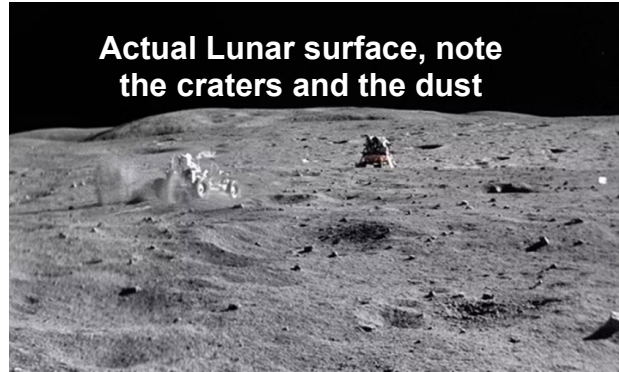
Along with the dust, part of the problem was the lighting conditions which tended to wash out the smaller terrain features. John Young Apollo 16: *"I couldn't judge slope out the window worth a hoot, and that's the truth. Even down low. The ground looks flat, but I'm sure it would look flat if it had been a 6 -8-*



*degree slope too. I don't see any way around that."*

Aside from the dust issues on landing, dust during Lunar surface operations was (and will be) a constant feature. It coated the space suits, the equipment, and came into the Lunar Module with the astronauts. A glance at the space suit in the bottom picture is a stark reminder.

**What to do?** For a start, let's stop fooling ourselves. Insist that artist depictions include realistic Lunar terrain. That means craters, dust, and boulders. I will have more suggestions during my talk.



Apollo 12, Ocean of Storms, EVA 1, 19 November 1969, frames A12-46-6746 to A12-46-6751 : Apollo 12 landing site showing the deep shadow on the eastern wall of Surveyor C

