

KOKH'S QUESTION

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In the middle of the last century, not yet three fourths complete, human beings did an amazing thing. They built several large chemical rockets and made a few trips to the Moon and back. The rocket type was the “Saturn V”, which had nothing to do with Saturn; it was a monster of a rocket, of which the preceding rockets were small by comparison. Yet this 360-foot-tall rocket and its associated technology was the *minimum* needed to accomplish the task with one rocket flight.



Photo courtesy Tom Huff of the Pitt YMCA.

Some day, centuries from now, some Thor Heyerdahl will try to prove the ancient Americans could have reached the Moon on such contraptions.

But since then, there have been no manned flights to the Moon. There have been no lunar settlements. To the bafflement of 1950's science fiction writers, humans went to the Moon, and then stopped going there, or even anywhere else except Earth orbit. Prior to the 1960's, except in the circles of such science fiction writers, talk of going to the Moon was crazy. So it was again in the 1990's.

Which brings us to Kokh's Question, named after Peter Kokh, an ardent lunar exploration activist, and founder of the Artemis Society. The question is:

"If lunar exploration Began in the 1960s, why aren't there lunar settlements now?"

In answering this, one can refer to the loss of funding by the U.S. Government, recalling the pink slips handed out to the launch crew after Apollo 17 cleared the pad in 1972. Apollo was to last until Apollo 20 and beyond, with a program of post-Apollo exploration called Apollo-X, which used modified Apollo hardware and more Saturn Vs. All that was cancelled; one Saturn V was used to launch an experimental space station called Skylab, and four Saturn IBs—a smaller version of the Saturn using Jupiter-type engines in cluster—to launch three crews to Skylab and one crew to join a Russian Soyuz in orbit in 1975. The remaining Saturns became museum pieces.

But why did the Apollo missions fail to inspire people in political power to continue the process of manned space exploration beyond Earth orbit? Kokh's Question has a "meta" component that goes far beyond the transcripts of the Congressional Record. It asks why humans retreated from this new horizon.

Some argue that robotic probes can explore just as well, or better, than humans, and there is no concern in most cases (except for sample return machines like Hayabusa) to bring them back. Still, sixteen nations have independently made machines that orbit the Earth, but only six —The United States, the Soviet Union, China, Japan, India and Israel—have made machines that went to the Moon.

One compelling argument was that the United States for geopolitical reasons had to *beat* the Soviet Union to the Moon, a so called "Moon Race", and once it was accomplished, there was no longer any reason for going to the Moon. There is considerable documents to show this was a matter of grave concern. Newly independent nations from British, French and Dutch de-colonialization might send their best and brightest to Soviet institutions of higher learning, and they might return as Marxists, some feared, and this would be more the case if it were perceived that the Soviet Union were technologically superior. There is no direct military advantage to a Moon colony; by the time missiles arrived from the Moon to their Earthly targets, World War III would have been "over." But if the Soviets were in outer space and the U.S. was not, some might think that the Communist system was vastly superior.

Not that there was much difference; both the U.S. and U.S.S.R. space programs were vast government organized enterprises. The only difference is that in the U.S.S.R. the companies that made the hardware were state-owned; in the U.S.A. they were privately or corporately owned. But both were *state-directed* and *state-funded*. Early prophetic science-fiction movies such as *Frau im Mond* and *Destination Moon*

had private investors organizing and building the rockets to get to the Moon. That did not happen in the USA or USSR.

While one might analyze the local political reasons why the USA lacked a will to continue manned lunar exploration, the other country that was capable of lunar travel, the USSR, also gave up. The primary reason seems to be that their rough equivalent of the Saturn V, the N-1, kept malfunctioning and could never be man-rated. While continued development might have resulted in a man-rated vehicle, by that time, the Apollo program was on track and would have landed. But the USSR could have landed on the Moon another way. They had a rocket that was the rough equivalent to the Saturn IB, the Proton, which could loft a Soyuz into a circumlunar orbit. In fact, these were used to launch Soyuz spacecraft with animals around the Moon and back. A manned Proton-Soyuz was on the pad in December, 1968, ready to go, but the launch of Apollo 8 pre-empted it. The Apollo 8 mission was moved up to be a 1968 circumlunar flight precisely because the Soviets were about to have a circumlunar flight of this nature, and close to executing it, but the USA wanted to be the first to do it.

Yet there was a plan for the USA to get to the Moon in the event the Saturn V, or its drawing board predecessor, the Nova, could not be built successfully. This was to use Saturn IBs to assemble a Moon landing craft in Earth orbit and fly it to a lunar landing. This was called *Project Horizon*. The Soviets might well have used Protons to mount a very similar operation; but they made the wrong choice with the N-1, and did not want to be the second nation on the Moon. The N-1 development was not continued nor was the Proton-Soyuz launched around the Moon with a human.

So we see a great yawning gap of almost half a century in which manned spaceflight beyond Earth orbit did not happen. No nation had the will to organize an effort to do it, nor—so far—have private investors. Almost every U.S. Administration promised a return to Moon, but none yet delivered in the intervening five decades. The present administration, through Vice-President Pence, has scheduled a return to the Moon by 2024. In the Obama administration we saw the test of the lunar-capable Orion spacecraft aboard an Aries 1X Shuttle-derived rocket. The Orion was crewable. But as the Aries-1X test happened in 2009 (a decade ago) the Constellation program—which included later manned lunar return -- was cancelled.



Mockup of the Orion Capsule. Photo by F. Graham.

So what is it that stopped the continuous human emergence from the cave? Was this environment, outer space, too much to allow human adaptation? Keep in mind humans did not colonize Antarctica until quite recently in history. Antarctica had no indigenous humans before the Age of Exploration. Perhaps that is the answer: we did not return to the Moon because it is too hard. Mark Barlow has suggested a tie to per capita energy of projects like the Apollo Program or the Manhattan Project.

There is a popular answer to Kokh's Question that is erroneous: that the Moon is worthless. The Moon's chief mineral is ilmenite, a titanium silicate, not so common on Earth. The late Girard K. O'Neill and T.A. Heppenheimer have shown that recovery of lunar resources is possible if capitalized. But that infrastructure required to bring it to full utilization is the part that is "hard", that is, vastly expensive. Not only the Moon, but Mars; its subsurface water and volcanism hint of gold and silver hydrothermal deposits; on Titan, the amount of hydrocarbons vastly exceed terrestrial oil deposits. The Moon also has fusionable Helium-3 in its regolith. But all this has not motivated efforts.

In addition, because it has been almost five decades since people were on the Moon, a cottage industry has grown up denying that the Moon landings even happened. While there are denialists for almost anything, this particularly nasty type of pseudohistorical revisionism is only going to get worse as lunar absence continues. It would be an unprecedented irony if one of the greatest achievements of humans in the 20th century—besides avoiding nuclear war—was believed by most people in the late 21st century as having never occurred.

I do not know the full answer to Kokh's Question. It seems to have many paths, social, psychological, sociological, financial, geopolitical and perhaps even biological. The expansion of the Oecumeni—the Greek term for the community of humans, emphasized by historian Arnold Toynbee, has happened for 30,000 years and now extends to Earth orbit. It would be nice to know if humans will return to the Moon before the last one that was there passes.