NUKING THE MOON

AND OTHER INTELLIGENCE SCHEMES AND MILITARY PLOTS LEFT ON THE DRAWING BOARD

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The incessant beeping chirped away in the key of A-flat.

Beep. Beep. Beep.

The sound lasted three-tenths of a second. Then came three-tenths of a second of silence. Then the sound again. Over and over.

It was a sound that changed history. The NBC radio announcer on that night, October 4, 1957, understood the ramification of that beeping.

"Listen now," he said, "for the sound that forevermore separates the old from the new."

The object making that incessant sound was not very big—about the size of a beach ball. It only weighed 184 pounds. But it spurred on a revolution in science and technology that prompted the United States to put a new national priority on beating the Soviets at their own game. Through a radical reorganization of how we operated in science, technology, and engineering—from the laboratories of universities, to the factory floors of private industry, to the corridors of power in Washington—American innovation would never be the same. We would eventually put our own satellites into space (first, Explorer 1, and then later, the Corona reconnaissance satellite), reorganize defense research into a powerful organization (the Advanced Research Projects Agency, now the Defense Advanced Research Projects Agency), and create a civilian space agency (NASA) to fly America into the great beyond.

Eventually.

But at that moment, something needed to be done sooner rather than later. We needed to prove to the world that we hadn't lost the space race before it had even begun. The American people needed a sign to reassure them that the Soviets did not have a permanent upper hand—that Sputnik wouldn't soon be replaced by Soviet ICBMs raining down on the United States. *We* were supposed to be the world's innovators. We invented potato chips, condensed milk, electric light bulbs, photographic film, the phonograph, cotton candy, the mousetrap, the airplane, ice pops, and chocolate chip cookies. We invented sunglasses, nylon, and the microwave.

We invented the atomic bomb.

America needed to show the world we were back in the game.

And we needed something big.

. . .

Leonard Reiffel had no desire to leave Chicago. He was a native of the Windy City, and greatly enjoyed his exciting and rewarding job working alongside physics legend Enrico Fermi at the University of Chicago's Institute for Nuclear Studies following the conclusion of World War II. But in 1949 he was given a chance to manage all of the cutting-edge physics research at another Chicago-based institution, the Armour Research Foundation (ARF—now known as the Illinois Institute of Technology). From that year through 1962, Reiffel and his team pushed physics to its limit, working on projects that studied the global environmental effects of nuclear explosions.

Sometime before May 1958 (Reiffel isn't quite sure of the exact date), the U.S. Air Force asked the ARF team to investigate something truly out of the ordinary: "the visibility and effects of a hypothetical nuclear explosion on the Moon." The Air Force wanted to surprise the Soviets and the world. Hey, look at what we can do. We can blow the hell out of the moon.

Reiffel, to his credit, knew that he didn't have the necessary expertise in-house to do this kind of a study. To supplement his ARF researchers, he brought on Gerard Kuiper, the expert on planetary physics whose name you might recognize from the Kuiper belt, a disk-shaped region beyond Neptune that contains hundreds of thousands of icy bodies and a trillion or more comets. To round out the group, Kuiper suggested that Reiffel bring in a young graduate student from the University of Chicago whose name you'll likely also recognize: Carl Sagan.

Wait . . . *that* Carl Sagan?! The lovable, affable, and eminently huggable guy who was on TV when I was growing up, and who made me love science as a kid? "Billllllions and billllllllions" guy? *He* wanted to nuke the moon?

Yes. That Carl Sagan.

Sagan's job was to do math. Lots of math. It was important to the project that someone like Sagan could accurately model the expansion of the dust cloud that would be caused by a nuclear explosion on the moon. We needed to know how the moon would react so that we could know if the explosion could be seen from Earth. After all, that was the whole point of the program.

And this brings up two important questions:

1. Why would self-respecting scientists agree to a project to detonate a nuclear weapon on the moon?
2. Would this thing work in the first place? What would a nuclear explosion on the moon look like?

To answer the first question, we need to put ourselves in the shoes of American scientists in the late 1950s/early 1960s. This was a time when American science was (unfortunately) inextricably linked to American Cold War policy. Although the age of McCarthyism had ended, scientists still vividly remembered when Robert Oppenheimer was publicly flogged for taking a position considered antithetical to U.S. national security—opposing the creation of the hydrogen bomb.

But it wasn't just fear that inspired physicists, chemists, biologists, astrophysicists, and others to join university laboratories, private industries, or government institutions that were working on defense research. Most of these scientists were patriots. They believed in what they were doing. This was a fight to the death, or at least for the future of the free world. These men and women (but mostly men because of the times) had a skill set that was integral for the security of their nation. Sometimes it's a simple as that.

But what about this program in particular? Surely nuking the moon just for the public relations win would stretch the limits of what even the most patriotic scientists would willingly accept.

You'd be surprised.

Whether these were serious considerations, or just ways to justify their actions, many of those involved in Project A119 cited the potential for *real and important scientific discovery* that could come out of detonating a nuclear weapon on the surface of the moon. These were exciting times, with the potential to explore new frontiers of science. Carl Sagan, the man who would dedicate his life to searching for evidence of life on other worlds, thought this could be a great way to try and identify the presence of microbes or organic molecules on the moon (this is when we still thought there might be something up there besides dust). Others envisioned experiments centered on lunar chemistry, or the thermal conductivity of the lunar surface. Reiffel's team also wondered if the nuclear blast would produce enough seismic activity to evaluate the makeup of the moon's immediate subsurface structure. According to Reiffel, "A central theme, which runs through many of the projected experimental situations, envisions placing of a maximum of three identical instrument packages at arbitrary locations on the visible face of the moon prior to any possible nuclear detonation. These instrument packages would be equipped to make a variety of measurements."

There were also serious fears that the Soviets would blow up a part of the moon before we got the chance to do it ourselves. On November 1, 1957, United Press International sent out a wire report that claimed that the Soviets planned to detonate a hydrogen bomb on the moon on or about November 7. Headlined "Latest Red Rumor: They'll Bomb Moon," the article states that a "fellow" told UPI he talked to "a guy 'high in U.S. intelligence'" who said that the Soviets were timing the launch to coincide with the November 7 fortieth anniversary of the Bolshevik Revolution. Although the article exclaimed, "If that's

true—look out!" it also warned that the rocket carrying the nuke was just as likely to miss the moon entirely and boomerang back to Earth. "If the rocket contained an H-bomb," the article surmised, "the best hope of earth would be that the whole thing would burn up harmlessly in the atmosphere before it impacted, as the missile men say."

No one is really sure where this rumor started, but it is indicative of the kind of panic in the United States in the wake of the launch of Sputnik.

Now to the most important question: Would this work?

First, let's get the basics out of the way. By 1959, the Soviet Union had already crashed a probe into the moon. The United States followed this less than three years later with a kamikaze probe of their own. So, in a general sense, the world knew that launching something on a rocket and sending it to the surface of the moon was feasible. We still don't know some of the specific technical details of early American ballistic missile technology (some things are still classified), but during an interview Reiffel gave later in life, he insisted we had the capability to hit a target on the moon with an accuracy of within two miles. That's pretty good, given that the Moon has a diameter of 2,159 miles.

So we've got that going for us, which is nice.

So that leaves us with the most important question: How insanely cool would the mushroom cloud on the moon look? You'd want to detonate the bomb on the edge (known as the terminator) of the dark side of the Moon, so that the sun's light would silhouette the trademark mushroom cloud from behind. It would be totally rad.

Except . . . that wouldn't happen.

Mushroom clouds from a nuclear explosion are caused by the movement of dust and debris kicked up in a *dense* atmosphere. The explosion also releases a massive amount of heat very rapidly, which

interacts with the cooler surrounding air and makes it *less dense.* (You don't need a nuclear explosion to make a mushroom cloud. Really anything that causes a rapid release of heat, like a volcano or even a major forest fire, can cause a mushroom cloud to form.) The hot air in the center of the blast rises, creating a vacuum that is immediately filled by the surrounding air (which also expands and starts to rise). Eventually the rising air runs smack into the air on top of it, which had been just hanging around in the atmosphere—like on any normal day—helping birds and planes fly. The atmospheric air pushes down on the rising column of smoke, dust, debris, superheated and not-so-superheated air and flattens out the top. Smush, a mushroom cloud.

Then we have to factor back into the equation the atmospheric air. A lot of it is busy applying pressure to the top of the cloud, but some of it doesn't have much choice and gets blown out of the way by the rapidly rising heat. This air, which is at much lower temperature than the air in the center column, does what cooler air does: It descends. But it doesn't get far. The cooler air gets sucked back into the vacuum created by the explosion, and back up again it goes. This is why you see that swirly pattern at the edges of a mushroom cloud.

The moon, however, is essentially a vacuum already. It has *some* gases hanging around on its surface, but it really doesn't have an atmosphere like we do on Earth. Without the weight of a dense atmosphere, there would be no resistance to the expansion of the nuclear-produced dust and debris. They would just keep on going and going, instead of curling back to the surface. No big plume, no sound or shock wave, no smush, and no mushroom cloud. Just a lot of dust.

This doesn't mean there wouldn't be a hell of a show. The people of Earth would see a visible flash from the detonation. And maybe the

sun would shine through the dust and debris in such a way as to give the world a pretty view.

But it's really not the same.

AND THEN WHAT?

You might have noticed I skipped over the when, how, and why this program was ultimately scrapped. It's not because we don't know the when; we do: January 1959. It's not because we don't know the how; we also do: The U.S. Air Force decided it was time to mothball Project A119.

The reason I waited until now to discuss the cancellation of the program—and part of what makes it so fascinating—is I've yet to see anyone provide a convincing reason for *why* it was canceled. Multiple sources have weighed in. All are operating on speculation. There's a lot of using words like "apparently" and "seemingly" in references to the end of the project. *Apparently* the Air Force canceled the program because of the potential danger to people on Earth (in case the mission catastrophically failed the way so many of the early U.S. attempts at spaceflight sadly—and sometimes humorously—failed). *Apparently* the scientists were concerned about contaminating the moon with radioactive material, preventing any future mission to land a man on the surface (or even lunar colonization). The mission was scrapped *seemingly* out of a worry that the best-laid PR plans of the Air Force would be thwarted when the public saw this as an abhorrent defacement of the moon's beauty instead of a demonstration of American scientific prowess. *Maybe* we realized landing a man on the moon was possible, and more impressive?

Who the hell knows? If Reiffel did, he wasn't telling.

When Reiffel went public and acknowledged his role on the project in 2000, he also claimed he didn't know the precise reason for the cancellation of the project. But that didn't stop him from providing his own speculation:

> As these things go, this was small. It was less than a year and never got to the point of operational planning. We showed what some of the effects might be. But the real argument we made, and others made behind closed doors, was that there was no point in ruining the pristine environment of the moon. There were other ways to impress the public that we were not about to be overwhelmed by the Russians.

Are you convinced the U.S. Air Force, at the height of the Cold War, in the wake of the shocking launch of Sputnik and the fear left in its wake, scrapped A119 because it might muss up the moon a little bit?

Neither am I.

One of the most interesting components to this whole story is why Leonard Reiffel, after all those years maintaining his silence, decided to go public. He did it because of Carl Sagan, and a conviction that Sagan broke the law.

Many of us remember Carl Sagan as the man who authored, coauthored, or edited more than twenty books, like the extraordinary *Pale Blue Dot,* or the much-better-than-the-movie *Contact.* Others might remember him as the popular television personality, who brought the universe into American households through the 1980 series *Cosmos.*

But if Leonard Reiffel is correct, Carl Sagan should have been known more for his unauthorized disclosure of classified nuclear secrets. Sagan seems to have included his role in the project on his application for an academic scholarship at the University of California, Berkeley, in 1959—just after the cancellation of the program. On his application forms, Sagan listed his qualifications and accomplishments . . . which happened to include two classified papers from A119: *Possible Contribution of Lunar Nuclear Weapons Detonations to the Solution of Some Problems in Planetary Astronomy* and *Radiological Contamination of the Moon by Nuclear Weapons Detonations.*

It didn't take a rocket scientist to ferret out what those papers were talking about. (Although it's likely several actual rocket scientists were evaluating his application . . .)

So what did Sagan have to say about all of this security breach hubbub? He died three years before it became public, and would never get a chance to clear his name.

But what about the rumors of a Soviet plan to nuke the moon that surfaced just after Sputnik? Those rumors were totally unfounded, and based on God only knows what information, likely someone's vivid imagination. The crazy part is, they were right. Sort of. There was no Soviet plan to nuke the moon in November 1957. Yet that doesn't mean the Soviets *never* intended to do just that. In fact, not long after the rumored November launch, the Soviets actually decided to begin planning for their quest to conquer the moon. It was called the "E-series" of programs. E-1 had the mission to hit the moon, and accomplished this on September 14, 1959, when the spacecraft Luna 2 became the first man-made object to reach the moon. E-2, launched on October 4, 1959, as Luna 3, sent back the first pictures of the far side of the moon. E-3 had a similar "fly-around" mission, but failed to achieve orbit.

E-4 was the doppelgänger of Project A119: Explode a nuclear device on the moon's surface. Fortunately, this idea was dismissed along with its American counterpart. The Soviets were afraid of a failure to launch, which could drop the nuclear warhead back onto Soviet soil. Or even worse, a partial launch failure, which might drop the warhead on *someone else's* soil, causing (in wonderful Russian understatement) "a highly undesirable international incident."

Hard to argue with that.