

Pioneering the Moon, Part 2

by Robert Reeves

Background from Part 2: In the early winter of 1959, both the US and USSR had lofted probes toward the moon. The Russian Luna 1 reached space two months before the American Pioneer 4, but neither probe returned significant lunar data. Now the Space Race intensified as NASA, with help from the Air Force, mounted its next scientific assault on the moon.

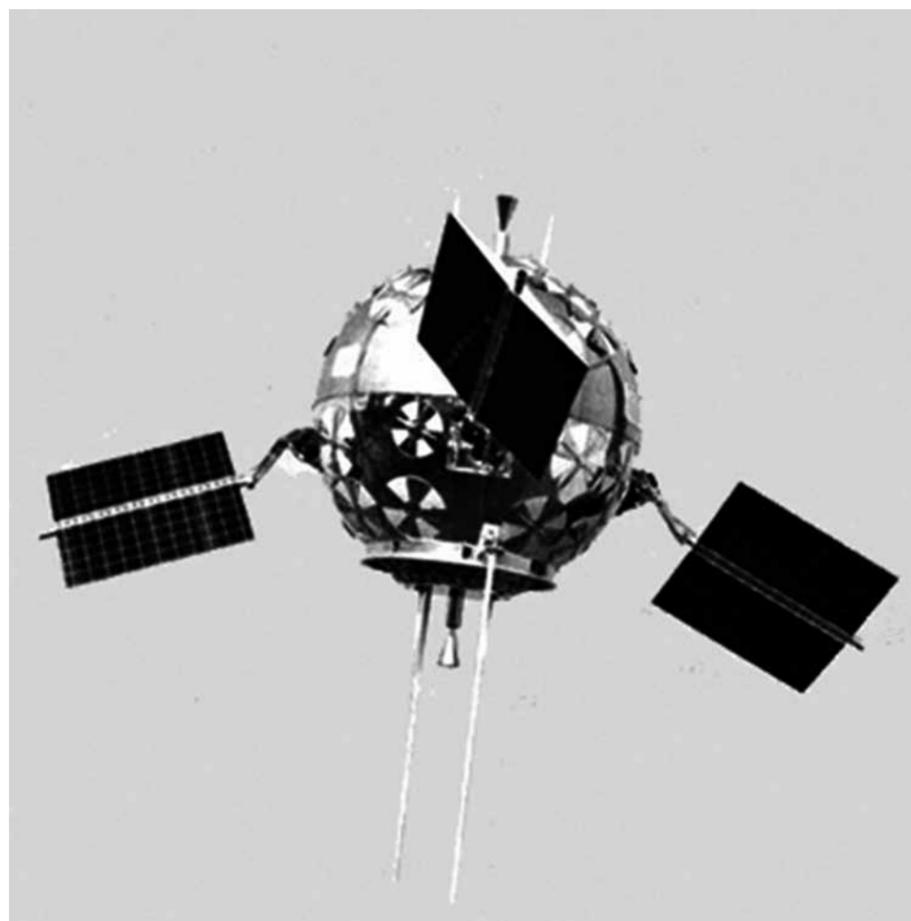
Part 3: NASA's Growing Pains and the Moon's Political Legacy

As the first American lunar efforts with Operation Mona concluded in the spring of 1959, the next phase of U.S. lunar exploration began out of political expedience. The Air Force substituted the larger Atlas ICBM for the Thor IRBM under the Vanguard second and third stages and created the more powerful Atlas-Able booster. The initial use for the new booster was to send a 122-kilogram probe toward Venus in June, 1959, followed later by two lunar orbiters. The January 1959 success of Mechta created such a political sensation that the Venus probe was dropped and all the Atlas-Able probes were retargeted toward lunar orbit out of political expediency. Because Mechta had missed the moon, America still had a chance to claim the moon prize.

Operating under the same name of Pioneer, the new spin-stabilized probes were giants compared to the previous tiny American lunar craft that could be cradled in one's arms. Measuring one-

meter in diameter, the new spherical aluminum-skinned craft had grown to 169 kilograms. Four solar panels, each a half meter square, extending from the spacecraft's equator gave the craft the nickname of the "paddle-wheel satellite".

Scientific instruments included a television scanner to image the far side of the moon, radiation detectors, a magnetometer and micrometeor detectors. Data was to be sent to Earth over twin 1.5-watt transmitters. Protruding from the spacecraft's poles were twin hydrazine-fueled thrusters. The one at the base could fire 4 times to increase the probe's velocity if needed while the



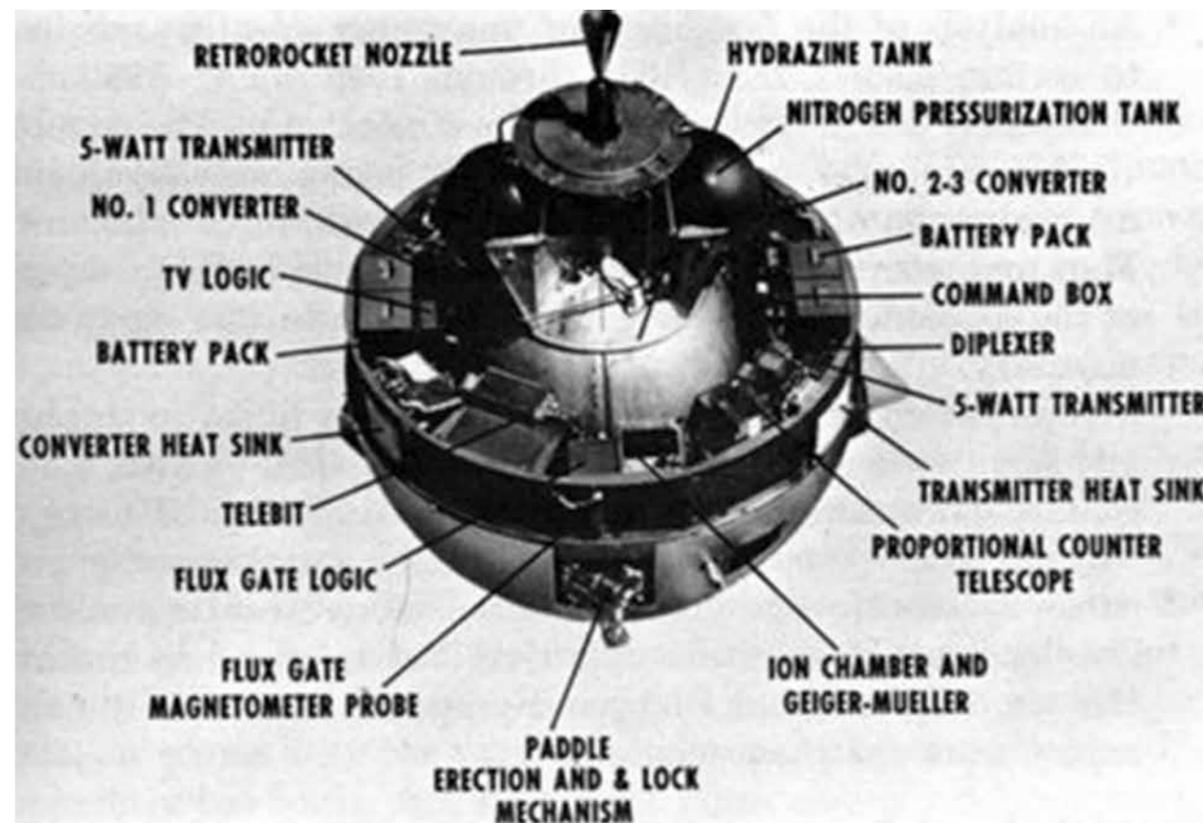
The second-generation Air Force/NASA Pioneer probes were ambitiously complex: solar powered robotic explorers that contained an on-board liquid-fuel propulsion system to place them into lunar orbit. Photo courtesy of NASA



one on top could fire twice to slow it down to enter lunar orbit. The new Pioneers were the first lunar probes with a self-contained liquid-fueled propulsion system.

Just 10 days after the Russian Luna 2 became the first man made object to strike the moon, the Atlas-Able booster underwent a crucial pre-launch test at Cape Canaveral. On September 24, 1959, the vehicle's main engines were static-fired on the launch pad to validate their reliability. The test had disastrous results. The Atlas engines unexpectedly shut down and a ruptured fuel line fed a fierce fire at the base of the rocket. After about 10 seconds, the flames weakened the Atlas' structure and the rocket collapsed on the launch pad. When the liquid oxygen tank ruptured, a violent explosion produced a huge fireball symbolic of American space efforts to date. Any hope of quickly following Luna 2 and imaging the moon with a more advanced American spacecraft faded with the flames.

The Air Force Atlas-Able booster was technically capable of lofting 180 kilograms to the moon, but suffered from reliability problems that prevented all three second generation Pioneer probes from leaving Earth. Photo courtesy of the US Air Force



A cutaway view shows the advanced complexity of the second generation Pioneers relative to their existence early in the Space Age. Photo courtesy of NASA

On October 4, 1959, exactly two years after the USSR shocked the world with Sputnik, Luna 3 was launched with a photographic payload to image the far side of the moon for the first time. The probe flew a precision trajectory that looped around the moon then returned to Earth so the images could be transmitted. The lunar farside images were a public sensation. Luna 2 and 3 completed a lunar one-two punch that deflated American space prestige.

Two months after the Luna 3 spectacular, another Atlas-Able was ready for flight. This booster was fitted with the same probe intended to be launched by the previous Atlas-Able that had exploded during a test firing. The probe was now designated Pioneer P-3. Liftoff from Pad 14 at Cape Canaveral came at 2:26 A.M., November 26, 1959. Forty seconds after launch, the lunar effort came to a sad end as the booster broke up and exploded.

Analysis of the failure showed that the Atlas-Able's payload shroud had failed. To house the one-meter diameter spacecraft and its folded solar panels atop the Able stages, the shroud had a bulbous hammer-head shape. As the booster accelerated, the rush of air past the enlarged tip caused a partial vacuum on the outside of the shroud. The buildup of air pressure inside the shroud blew it apart and tore off the Pioneer spacecraft and its third stage.

The next Atlas-Able Pioneer moon probe would not fly for 10 more months. During the lengthy stand-down, the spacecraft evolved into a heavier, more science oriented craft. Now weighing 176 kilograms, the television imaging experiment was dropped in favor of more science instruments. The Russians had beaten the United States in exploring the hidden side of the moon and the imaging effort had lost the element of the spectacular. Instead of the camera, four separate radiation detectors were

to measure a range of energy levels, three different magnetometer instruments would study magnetism and a plasma detector would examine solar emissions. The spacecraft was targeted to enter a 2,400-by-4,000 kilometer orbit after a 62-hour flight from Earth.

Liftoff came at 11:13 A.M., September 25, 1960. This time, the Atlas reached space and the Able stages took over. However, a fault in the oxidizer system prematurely shut down the second stage. The Pioneer and its third stage soared over the Atlantic and fell to Earth. Some rocket debris survived the plunge through the atmosphere and crashed 40 minutes after launch on farm near Zoekmekeer, in the Transvaal in what was then the Union of South Africa. A 71-centimeter long metal object and a 91-centimeter diameter metal sphere were recovered.

Two months later, the final Atlas-Able lunar attempt lifted off on December 14. This time, the Pioneer did not reach space. The Atlas booster pitched over and exploded 68 seconds after liftoff. A salvage effort was mounted off the coast of Cape Canaveral to find out why the last shot of the \$40 million Pioneer lunar orbiter project had also failed.

At this point in the lunar exploration effort, three Air Force and two Army Pioneer launches had resulted in two partial successes (Pioneers 1 and 3) that gathered valuable radiation data about the space environment, and one probe that escaped the Earth forever, but missed its lunar target (Pioneer 4). NASA's attempts to orbit the moon with the heavier Atlas-Able Pioneers had only placed the USA in a position perceived as second place following the Russian space effort.

What the public did not see was the mind-numbing series of lunar launch failures also experienced by the USSR. By carrying out their space launches in absolute secrecy, then highly publicizing the occasional success, the Russian propaganda machine left the world with the impression of Soviet dominance in space.

Because of the ongoing Cold War political rivalry between the Western and Eastern governments, the initial lunar attempts by the

American Pioneers and the Russian Luna probes embroiled the moon in the politics of democracy vs communism. With each lunar success, Soviet propagandists wasted no effort in using the lunar spectacular to equate space success with the superiority of communism over democracy. The moon thus became as much a symbolic Cold War battleground as Korea had been an actual battleground. The shotgun wedding between lunar exploration and earthly politics would continue for another decade until the Apollo 11 landing forever settled the issue of who was best in space.

As 1960 came to an end, the painful trials of the Pioneer lunar efforts became a past memory for NASA. The civilian space agency now had its own Ranger lunar program under development that was independent of the Army or Air Force's early space ambitions. Now chartered by the government as the lead agency in space exploration, NASA set its sights on landing a Ranger instrument capsule on the moon within the next year.

As the decades have passed since the Pioneer moon shots, those early efforts have been pushed deeper into the dustbin of history. Historians anxious to forget the early lunar heartbreak and too willing to concentrate on later more successful explorations of our neighboring world have allowed the lunar Pioneers to slip from public memory. The Pioneer 4, the most successful of the series, barely garners several short paragraphs on JPL's history website.

Instead of ignoring these early lunar missions, we should remember them for what they were.... the first bold voyages into a new ocean when no vessel had yet sailed. Those of us who lived at the birth of the space age also remember the Pioneer probes as elevating the moon from the topic of B-grade science fiction movies to a destination now within our grasp. The Pioneers brought America hope and optimism that perseverance and technical innovation could allow us to master the new space frontier. Thus the Pioneers should be remembered as much as Columbus' voyages of discovery because they were the first steps that eventually led Apollo to the moon.



When the three year effort to launch Pioneer lunar probes ended in 1960, the moon remained as enigmatic as it was before the Space Age began. Not one scrap of lunar information had been gathered by any of the eight Pioneer launches. Photo by Robert Reeves