Written Statement of Dr. Peter L. Jakab
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before the
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Chairwoman Johnson, Ranking Member Lucas, and Members of the Committee, thank you for the opportunity share reflections and lessons of Apollo.

As we reflect on the Apollo era and the extraordinary achievement of the lunar landings a half century ago, it is very easy, and quite appropriate, to see them through the lens of awe, amazement, pride, inspiration, and perhaps humanity's greatest moment of unity. For those of us who can remember the bulky-spacesuited figures bounce-stepping on the lunar surface first hand, retelling the story still never fails to bring us right back to those exciting moments. For those who only know of it through those stories, Apollo stands as a historical lesson and powerful cultural milestone for what we can achieve looking forward. Simply stated, Apollo allows us to focus on who we are as a nation and what humanity can achieve. But those first steps on the Moon also are a window onto to the complexity of history and how historical events have many threads and interconnections. I'd like to share two brief examples, one about technology, and one about politics and diplomacy.

It is often suggested that all sorts of new technologies emerged from Apollo and the space age in general, and in some ways that is true. In broad strokes we can talk about how space based technologies have shaped our current lives. One need look no further than the satellites orbiting our planet that connect us and provide information we rely on every day. But this reality, I believe, does tend to give the impression that everything about Apollo technology was cutting edge and completely innovative. An interesting aspect of getting to the Moon was how much off-the-shelf technology was used and adapted. This was driven by one very powerful requirement: If you have people in a spacecraft traveling hundreds of thousand miles away from Earth, everything *has* to work. There was little margin for trouble shooting new technology on your way to the Moon. The safety of the astronauts was at the forefront of everyone's thinking. Engineers working on Apollo tried to take advantage of proven technologies as much as possible to achieve the best chance of reliability. This context gives special significance to one technological choice that was critical to Apollo's

success. That was the decision to use the then new integrated circuit technology for the vital Apollo guidance computer.

Using the integrated circuit, or "chip" as we often call it today, would seem in retrospect an obvious choice. Size and weight was everything in spacecraft design, and these tiny wonders would seem perfect for this application. But in the early 1960s, integrated circuits were largely untested and their reliability unknown. Using integrated circuits in the vital guidance system was a bold decision, and illustrates that the path to success, especially a success as momentous as landing on the Moon, is never straight forward. In the end, the decision to go with the integrated circuit proved to be the right one. None of the Apollo missions ever experienced a hardware failure in the guidance computer.

But the story doesn't end there. Spurred, in part, by the use of integrated circuits in the initial Apollo spacecraft design, the industry took off and engineers quickly were cramming more and more components onto integrated circuits. Remarkably, the advancing technology moved so quickly there was no way to adequately test it for the computers on the later Apollo missions because of the concern for reliability I talked about earlier. But the breadth of other applications quickly spread and by the end of the 1960s an industry was in full swing, particularly in an area of California that soon came to be known as "Silicon Valley." The Apollo program was not the sole reason for the transformation of Silicon Valley, but it was a major factor. As we enjoy the many electronic devices that enhance our lives today, we should recall the courage of Apollo engineers who were bold enough to choose a circuit made of a sliver of silicon to guide our astronauts to a safe landing on the Moon.

Let me now turn to a very different part of the Apollo story. With the safe return of the Apollo 11 astronauts the world embraced the achievement not just as an American accomplishment, but one the entire world could take pride in. In the persons of Armstrong and Aldrin, with Collins orbiting close by, humans stepped on another world for the first time. Symbolically, as Armstrong so famously proclaimed, it was a "giant leap" for us all. President Kennedy's famous commitment to land humans on the surface of the Moon by the end of the decade had been fulfilled, and across the globe people felt a part of it. Yet, as stunning a technical achievement as Apollo was, it is also important to understand the political dimension of the program as well. Made at the height of the Cold War, Kennedy's call to action had a significant political context.

Landing on the Moon, and doing so first, was as much about making a political statement as it was about science and engineering.

After the Apollo 11 crew returned safely to Earth, President Nixon instinctively grasped the value of Apollo beyond the science, and quickly sought to leverage the diplomatic opportunities presented by the success of Apollo 11. After greeting and congratulating the astronauts on board the USS *Hornet*, Nixon began a 12-day, eight-nation diplomatic tour of Asia and Europe, called "Moonglow," to promote the "spirit of Apollo" and foster goodwill and international cooperation. This was followed shortly thereafter by a goodwill tour by the astronauts themselves, visiting 30 cities around the world in two months. The launch of Apollo was rooted in competition. The success of Apollo provided an impetus to focus on cooperation. Among other diplomatic overtures, the afterglow of Apollo was a factor in Nixon's efforts to open China and advance détente with the Soviet Union. This foray into "space diplomacy" was not without consequence. That period of unity surrounding the success of Apollo had impact on Earth in ways unanticipated when the Saturn V rocket launched Apollo 11 toward the Moon 50 years ago today. This is another example of how history illustrates the many complex threads of human endeavor. As we celebrate the thrill and inspiration of Apollo on this anniversary, let us also recognize the value of history to understand and illuminate the many layers of the past.

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Dr. Peter L. Jakab is Chief Curator of the Smithsonian National Air and Space Museum, (NASM). Formerly he served as the museum's Associate Director for Collections and Curatorial Affairs. He has been with NASM since 1983. He holds a BA, MA, and Ph.D. in American history from Rutgers University. Areas of specialization include the history of technology, aerospace history, and American social and cultural history. Prior museum work includes stays at the Edison National Historic Site, West Orange, N.J., and the New Jersey Historical Commission. He also spent a year with the Thomas A. Edison Papers Project and two years teaching American history at Rutgers University during his graduate study. During his stay at the NASM, he has curated numerous exhibitions and frequently lectured on the history of technology, the history of invention, the Wright brothers and pioneer aviation, and First World War aviation. His most recent exhibition is *Artist Soldiers: Artistic Expression in the First World War,* at the National Air and Space Museum. Major exhibitions also at the National Air and Space Museum include *Leonardo da Vinci's Codex on the Flight of Birds,* featuring the original da Vinci Codex, and *The Wright Brothers & the Invention of the Aerial Age.* His publications include the books *Visions of a Flying Machine: The Wright Brothers and the Process of Invention* (Smithsonian Institution Press, 1990); *Icare: revue de l'aviation française, #147, Les Frères Wright*, 1994; *The Published Writings of Wilbur and Orville Wright* (Smithsonian Institution Press, 2000), and *The Wright Brothers and the Invention of the Aerial Age* (National Geographic Society, 2003), the companion book to the exhibition.