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50 years after Apollo 17

Our future in space in the words of Jack Schmitt and some of those who helped carry out the last moon landing

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AIAA SHAPING THE FUTURE OF AEROSPACE

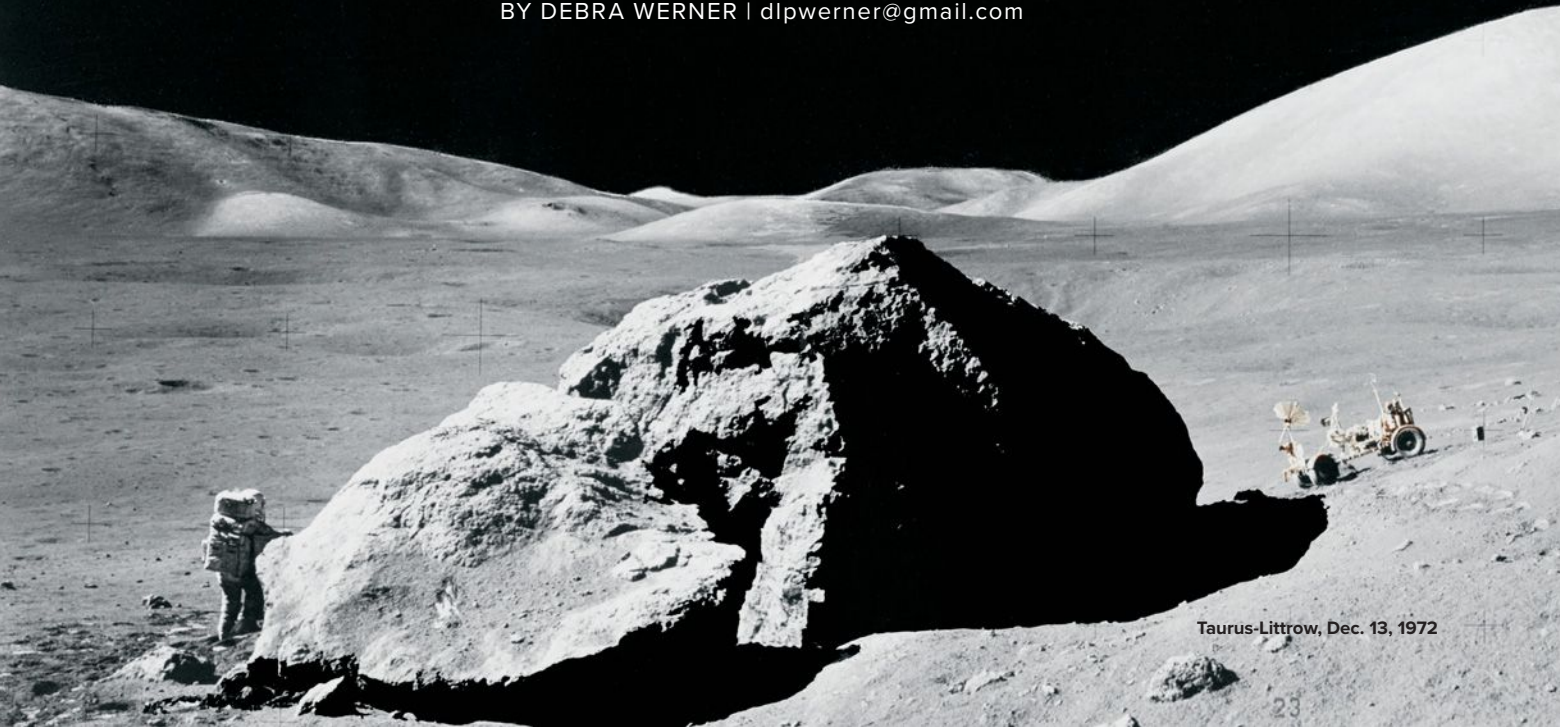
APOLLO 17 | 50TH

In their words: Veterans of the last moon landing share their views

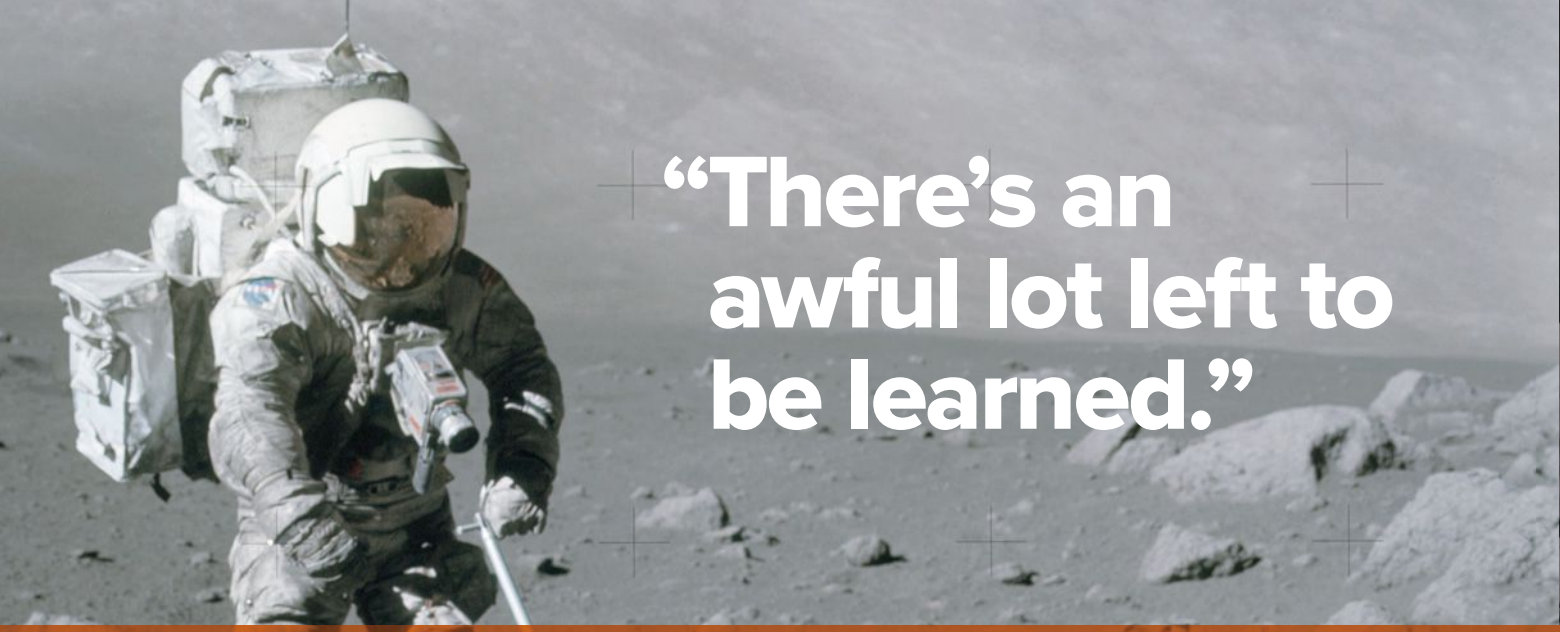
When Gene Cernan and Jack Schmitt rode their rover back to the Lunar Module on Dec. 14, 1972, they knew they would be the last humans on the moon for a while. The Nixon administration had removed the final three missions from the Apollo plan. Now, after what has grown into a half-century hiatus, the moon is back in play under the Artemis program. As the 50th anniversary of Apollo 17 approaches, **Debra Werner** posed this question to four of those involved:

"It's been 50 years since Apollo 17, and no one has been back to the moon. Are you disappointed?"

BY DEBRA WERNER | dlpwerner@gmail.com



Taurus-Littrow, Dec. 13, 1972



"There's an awful lot left to be learned."

Astronaut Harrison "Jack" Schmitt | APOLLO 17 LUNAR MODULE PILOT

On the surface of the moon, Schmitt, a geologist with a Ph.D. from Harvard, spent 22 hours over three days traveling in a rover driven by Apollo 17 Commander Eugene Cernan, stopping to take photographs and, together with Cernan, filling sample bags with rocks and regolith. When Schmitt was done, he famously threw their geology hammer into the distance and climbed into the Lunar Module, followed by Cernan. After leaving NASA, Schmitt served a term as a Republican senator from New Mexico before his defeat in 1982.

▲ Astronaut Harrison Schmitt scoops lunar regolith during his second moonwalk with Apollo 17 Commander Eugene Cernan. During their three moonwalks, the astronauts collected about 740 rock and soil samples, a total of 110.5 kilograms.

NASA/Eugene A. Cernan

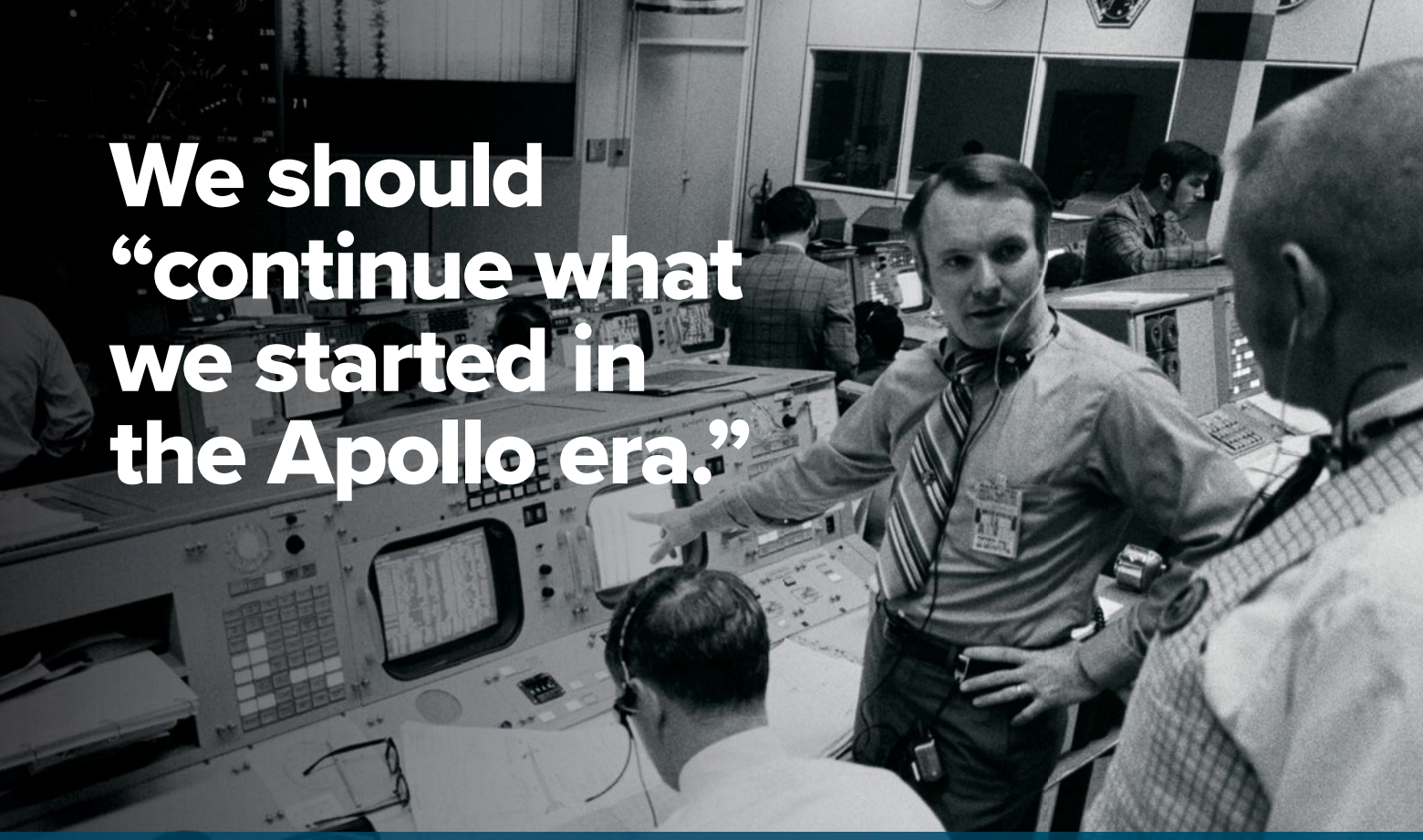
ON THE OPENING SPREAD
A mosaic of Apollo 17 Lunar Module Pilot Harrison Schmitt was taken by Commander Eugene Cernan during their third and final moonwalk. Cernan and Schmitt spent a total of 22 hours exploring the lunar surface during their 75-hour stay, traveling from their lunar module in the Lunar Roving Vehicle, at right.

NASA/Eugene A. Cernan

The answer is yes, particularly that Americans have not been back. It's a geopolitical priority to be dominant in lunar exploration as well as space exploration in general. The Chinese clearly are very interested in dominating the world here on Earth, and part of that plan is to dominate space. We are basically in another Cold War with China. That is the bottom line again, as it was for Apollo. Apollo was a geopolitical effort, initially. Fortunately, we also had the capability to gather a great deal of exploration information from the surface of the moon based on the six Apollo landings.

From a scientific point of view, there's an awful lot left to be learned. We know very little about the far side of the moon, which is significantly different than the near side, probably because of the effect of two very large basin formations. On the far side, there's the South Pole-Aitken basin, which is about 2,500 kilometers in diameter. My lunar science colleagues and I believe that is a very large impact basin. On the near side, there's the Procellarum basin, which is much larger, about 3,200 kilometers in diameter. The Procellarum basin is the location of the thinnest crust of the moon. We know that from the GRAIL [Gravity Recovery and Interior Laboratory] orbital mission. There are many indications that the Procellarum basin was formed early in lunar history, probably about 4.35 billion years ago. That was a time when the interior of the moon was still quite warm, relatively solid but warm, and the release of pressure from that impact did cause some significant overturn of that warm upper mantle, at least the upper 500 kilometers, and also probably some partial melting, which produced a suite of rocks that we like to call the Mg-suite. [Mg stands for magnesium and refers to rocks produced during the earliest periods of lunar magmatic activity.]

Scientifically, understanding the moon gives us an understanding of what the early solar system was like and, in particular, what was happening here on Earth in about the first 800 million years of Earth's history. That is the part of Earth's history that we know the least about. Because the Earth is such a dynamic geological body, that part of Earth's history has been largely erased. The moon, though, ceased to evolve as a small planet at the end of that 800 million years. So, it tells us what the environment of the solar system was like, particularly the impact environment, during that period of time in which life was getting started here on this planet. The oldest fossils that we have identified here on Earth, that there's general agreement are indeed fossils, are about 3.5 billion years old. We have no information about that early history except what we have learned from the moon, and again, that is the environment in which life began. It was extremely violent, and here on Earth, it was also wet. In that kind of environment, life somehow or other got its start.



We should "continue what we started in the Apollo era."

Gerald D. Griffin | APOLLO 17 LEAD FLIGHT DIRECTOR

Griffin's role on this mission, as on Apollo 12 and 15, was to imagine every possible problem and envision potential solutions. This is how he ensured that the astronauts and the ground crew were ready. An aeronautical engineer and former U.S. Air Force officer, Griffin began working at NASA's Mission Control Center in Houston in 1964 and led Johnson Space Center from 1982 to 1986. Being flight director was "the best job I ever had," he says.

I'm not so disappointed as I am surprised and somewhat frustrated. We had a great situation in Apollo. We had three presidents: Kennedy, Johnson and Nixon. Two Democrats, one Republican. They supported us through the whole thing. We had a fire. [Virgil "Gus" Grissom, Edward White and Roger Chaffee died during a 1967 Apollo 1 ground test. The capsule was pressurized and filled with oxygen when a fire swept through the cockpit.] We had Apollo 13. We had other kinds of setbacks. Congress, on both sides of the aisle, Democrat and Republican, supported us through the hard times and the good times. The American public was behind us too. There was a Cold War raging at the time with the Soviet Union, and the whole idea of technological dominance was very important, particularly after Sputnik and Yuri Gagarin were launched into orbit. And the U.S. responded. Neil Armstrong talked about that with me after the program had ended. Neil's point was that the nation had always responded well to a threat, particularly from another nation. However, since Apollo ended, the U.S. has never really come back together to consistently support deep space exploration by humans. My frustration is that I wish the country, especially its leaders, could understand and embrace the importance of continuing what we started in the Apollo era. Perhaps 1,000, 5,000 or 10,000 years or more from now, we may have reason to get off this planet if the human species is to survive. I'm not talking about global warming. I'm talking about humans simply using up the resources on Earth. Then, we would need another place to inhabit very much like this planet. What we accomplished in Apollo was a teeny step in human space exploration. What we're going to do in Artemis is a small next step. Even when we get to Mars, that's still a small-to-moderate step in deep space travel and its exploration by humans. Humans need to learn how to move around in really deep space and, ultimately, go to places much farther away than Mars.

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▲ Gerald Griffin (center) worked in mission control as a flight director for all the crewed Apollo missions.

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“You rarely establish a foothold and then take the next logical steps.”

James W. Head | APOLLO LUNAR EXPLORATION MISSIONS PROGRAM GEOLOGIST

Head, a geologist with a Ph.D. from Brown University, analyzed potential Apollo 17 landing sites, planned mission operations, trained astronauts to collect samples, debriefed astronauts after flights and analyzed samples. After Apollo, Head served as the Lunar Science Institute interim director before returning to Brown’s Department of Geological Sciences. He continues to study planetary evolution and serve as an investigator on NASA and European Space Agency planetary missions, including ESA’s Mars Express and NASA’s Lunar Orbiter Laser Altimeter.

The solar system is a big place with a lot of destinations to go to. The moon is a critically important one because it has such close relationships to the Earth, both in terms of distance as well as, of course, origins. It is literally a sibling of the Earth, or some kind of progeny. We continue to study it. We have the Lunar Reconnaissance Orbiter in orbit around the moon. We’re learning a huge amount from the orbital remote sensing and utilizing all the data from Apollo to connect the dots. We’re still exploring.

My sense of history is that you rarely establish a foothold and then take the next logical steps. There are voyages of discovery and scientific expeditions, but then it takes awhile. Yes, I’m disappointed. I would love to see humans, particularly NASA astronauts that I work with to this day, exploring the moon. But there are lots of destinations. We’re learning a lot about the moon. We’re formulating even better questions for when we go back.

We collected a huge amount of information through the Apollo missions. When Apollo 17 ended, I was thinking about what we would do with all these data to enhance our knowledge, because that knowledge is the legacy of Apollo. Each Apollo mission, we worked shoulder to shoulder with the engineers to engage in what we call science and engineering synergism. Engineers make our scientific dreams a reality. Once we knew we could land humans safely on the moon and return them safely, we focused on the science. We need more samples. We need to go to a specific place. Apollo 12 accomplished that. There was a big problem with Apollo 13. We rebounded from that for Apollo 14. We went to a very rough place in the highlands. Then, we need to get around more. We need a car on the moon. We can do that. Apollo 15, 16 and 17 had rovers that went 30 kilometers or so. We need to bring back more samples. We got more samples. We need to stay longer. We did all that. The whole idea of science and engineering synergism was really important because it showed how the combination of the two — not just scientists going up, you know, scratching their head about problems, or not just engineers going up and building the next bridge — working together enhanced the scientific legacy.

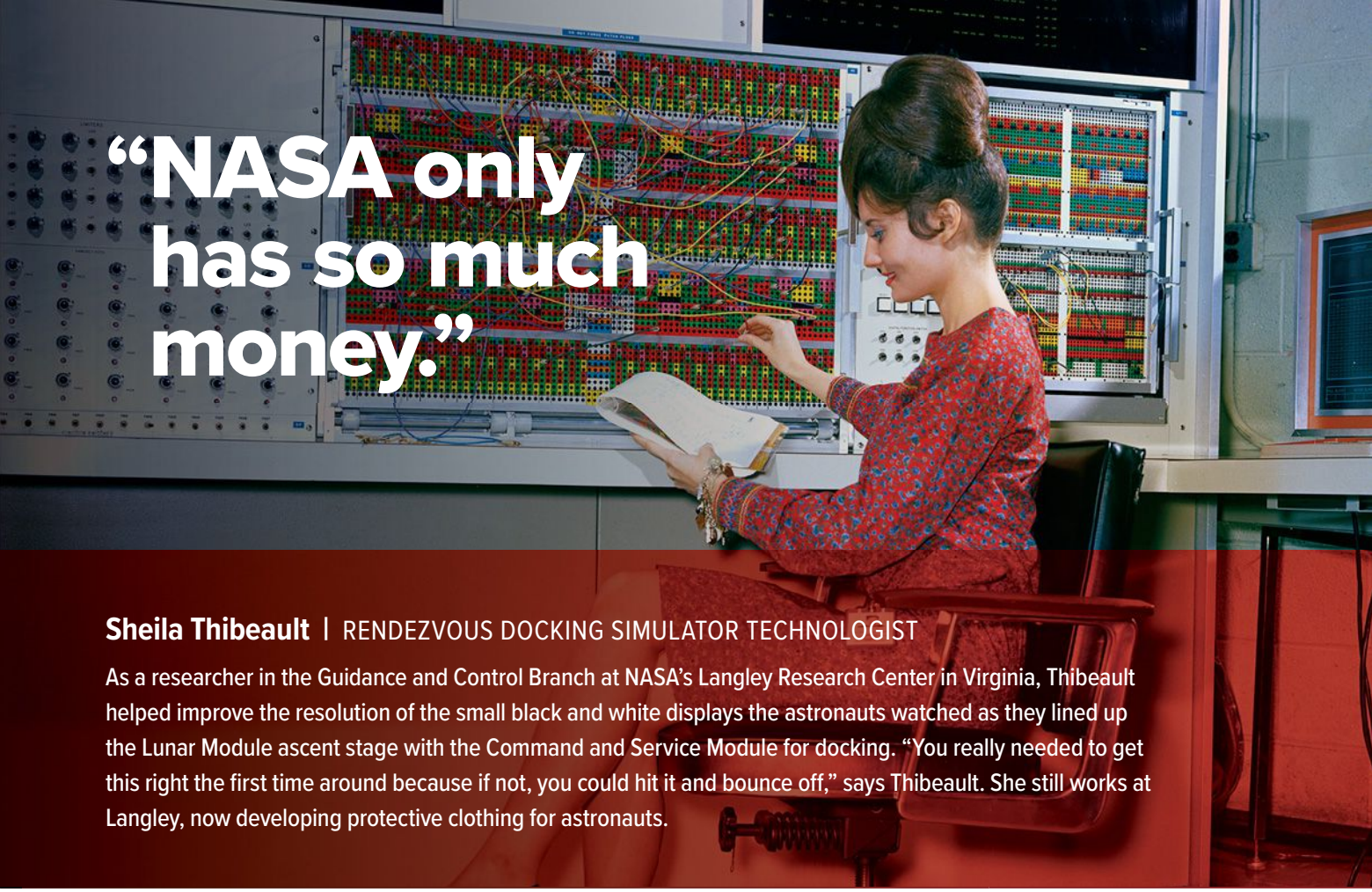
FACT

HEAD IS AMONG THE MANY SCIENTISTS who believe that “moon” should be treated as the proper name for Earth’s natural satellite. Aerospace America does not capitalize moon.

▲ Geologist James Head continued to work with NASA after Apollo 17 but also kept up his Earthly research. He’s pictured here at Mount St. Helens after the May 18, 1980, eruption in which the volcano’s northern face broke apart and created the largest landslide yet recorded.

Lionel Wilson

“NASA only has so much money.”



Sheila Thibeault | RENDEZVOUS DOCKING SIMULATOR TECHNOLOGIST

As a researcher in the Guidance and Control Branch at NASA’s Langley Research Center in Virginia, Thibeault helped improve the resolution of the small black and white displays the astronauts watched as they lined up the Lunar Module ascent stage with the Command and Service Module for docking. “You really needed to get this right the first time around because if not, you could hit it and bounce off,” says Thibeault. She still works at Langley, now developing protective clothing for astronauts.

▲ Sheila Thibeault at NASA’s Langley Research Center circa 1967, plugging numbers into a computer.

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In a way, I am. I knew Apollo 17 was the last Apollo mission. I was young. I was a researcher, not in Washington making decisions. I thought, “There will be another program.” We had the Mercury program, and we had the Gemini program, and we had the Apollo program. These things all had a beginning and a middle and an end. I thought there’d be another program with another name. And there is. It’s called Artemis. I just thought the Artemis program would be earlier.

I understand why we haven’t been back. NASA is a small agency with a limited budget. In order to have done more, we would have either needed to have more money, or we would have had to give up something else. One thing we have been doing is looking at Mars. The problems with Mars are so challenging that you have to start early working on them. It’s so far away. It takes a long time to get there and a long time to get back. In order to line up the trajectories to minimize the time spent getting there and coming back, you need to stay awhile. It is a long mission, which means if anything goes wrong, it’s hard to rescue people. There is a radiation problem. The longer the mission, the more you’re exposed to the radiation, and the radiation dose is cumulative.

There’s so much basic research that needs to be done to solve these problems in order to eventually have a mission. All these things take money. And then, of course, there’s the International Space Station. We have been sending astronauts up there to live for long periods of time in microgravity and studying the effects on their bodies and trying to figure out how to overcome the effects. You need to do that if you’re going to be living in space for a long period of time, which is what you’d be doing if you went to Mars.

When we did Apollo, mission success was bringing the astronauts back alive. They knew that, and they had to volunteer for the mission. Well, now that’s not good enough. Mission success is now bringing them back healthy. That is harder to do. We’ve obviously learned from ISS, and we’ve learned a lot from Mars. All of this feeds back to make Artemis a bigger, better mission.

With Apollo, there was this feeling of “Let’s hurry up and do this,” because of Sputnik. Now it’s more, “Let’s take our time and make sure we do everything as safely as possible.” The equipment has to be the latest technology, and it has to last longer.

I look through all of this and understand it. NASA only has so much money. We’ve always wanted to go back to the moon. Finally, we’re getting to do this, and we’re going to do it better. In the meanwhile, we still have ISS, we get the lunar Gateway, and we have vehicles on Mars. I am disappointed, but I’m also not disappointed, because I look at all the things we’ve done. ★