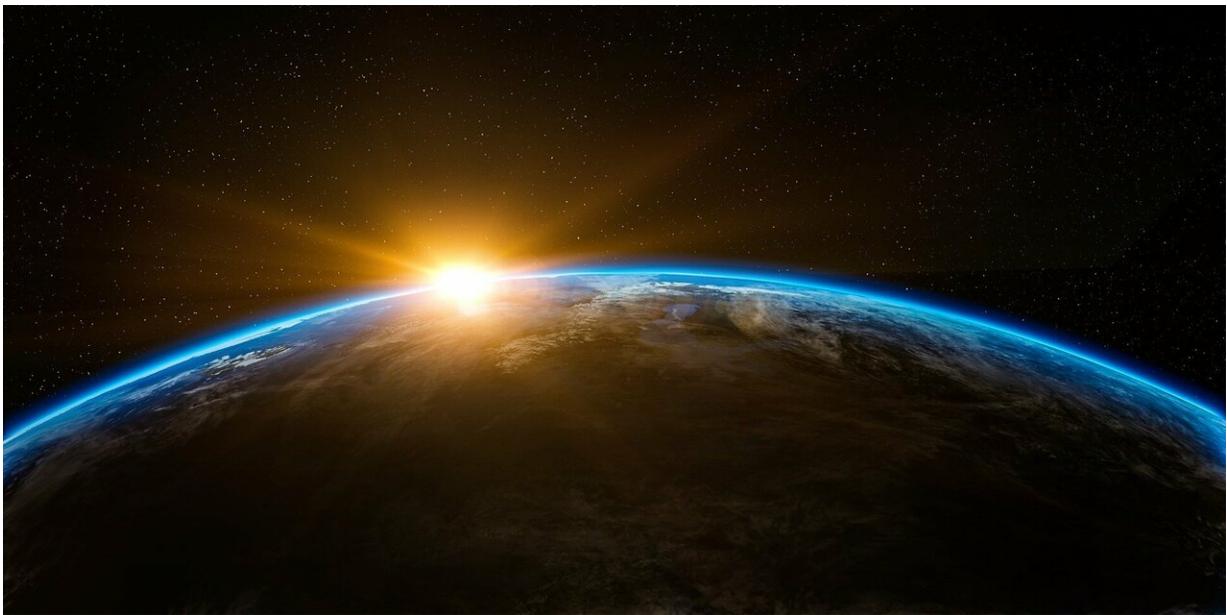


Women played crucial roles in the space program, yet we don't know much about them. Why?

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Edith Gustan's name appears in the fourth paragraph of a Seattle Times article from 1970, a skinny strip of text above a nearly full-page ad for Sears' Mother's Day sale that advertises, among other things, "incontestably female ... cardigans!"

Gustan was a biologist and longtime Boeing employee who conducted

research on subjects at the nexus of biology and [space](#) travel. But while many stories from NASA's Apollo program are common knowledge, hers is nearly nonexistent. Do some digging and you'll find a 1985 Associated Press article describing her research on the viability of a space-station greenhouse under the headline "And Now, Vegetables in Space." You might read her name in aerospace and engineering industry journals, on papers examining subjects like closed ecological life-support systems. Addresses place her in Shelton and East Wenatchee. But a Google search turns up only a two-sentence obituary from 2017. We know she worked on collaborations between Boeing and NASA, but we don't know much about her.

This is an all too common outcome for many of the [women](#) who played crucial roles in the success of the Apollo 11 mission and, more broadly, the American manned spaceflight program. They wrote code, made complex calculations, and—in Gustan's case—envisioned a future where astronauts might even grow their own food during space travel. But in many cases, we're only uncovering their contributions now, half a century after humans first walked on the moon.

It's a pattern of "fits and starts" throughout the history of women in America, and it's one Margaret Weitekamp knows well. She's the author of "Right Stuff, Wrong Sex: America's First Women in Space Program," which explores the rise and disappearance of an early program that envisioned sending women to space. She also curates the National Air and Space Museum's social and cultural dimensions of spaceflight collection in Washington, D.C. "When we look at the history," she says, "what we find is that many of what we would now call STEM fields—science, technology, engineering and math—were overwhelmingly male, but they were not exclusively male and much of that perception has been shaped in the years since."

Undoing that perception takes work and careful research into the women

who were, as Weitekamp puts it, "in some of these rooms." "Famously, we now have paid more attention to the women computers who had for years been working for NASA," she says. This group included Mary Jackson, Katherine Johnson and Dorothy Vaughan, mathematicians who worked at NASA during the space race, who faced the dual barriers of racism and sexism, and whose story was told in Margot Lee Shetterly's 2016 book "Hidden Figures," and the film of the same name.

In contrast to today's male-dominated world of computer programming, some technical roles at NASA were considered women's work. Human computers such as Jackson, Johnson and Vaughn had "a job that was a woman's job the way being a secretary was a woman's job," says Weitekamp. They did the calculations that made spaceflight possible. Women who held these positions at NASA were among the nation's earliest computer programmers. Though it's difficult to find exact figures on how many women worked as human computers, thousands of women were involved in the Apollo program, and given that human computers were primarily women, it's likely they made up a large part of that workforce.

One of the best-known women to work on the Apollo 11 mission was also a programmer, Massachusetts Institute of Technology computer scientist Margaret Hamilton, who in 2016 was awarded a Presidential Medal of Freedom by President Barack Obama for her work on Apollo. Hamilton led the team behind the code that took the spacecraft to the moon, and even if you don't know who she is, it's possible you've seen an iconic photograph of her taken from her time with the Apollo program. She stands smiling next to the piled volumes of her code; the stack is as tall as she is. (You may even have seen this image on Twitter last April, when many users paired it with the image of Katie Bouman, also an MIT computer scientist, posing with hard drives containing data that made it possible to photograph a black hole.)

There were also women like one of NASA's first women engineers, JoAnn Morgan, who worked in launch control for Apollo 11, and appears in a famous image from that time. She's the only woman in a sea of men in white dress shirts and ties, and one of the only people in the shot still sitting at a console while the others stand up to watch the launch.

But one place in the Apollo program where women were conspicuously absent was in the spacecraft themselves. That wasn't because women didn't aspire to be astronauts. (It's an impulse so relatable it made it into a well-trod campaign anecdote for Hillary Clinton in 2016.) It also wasn't because no one had thought about sending women to space.

Well before Apollo, William Randolph Lovelace II, the New Mexico physician who oversaw psychological and physical testing for the first corps of would-be astronauts, suspected that women might be good candidates for space travel. But Lovelace's interest in sending women to space wasn't rooted in lofty ideas of equity or feminism before its time, but in traditional notions of male and female labor. When Lovelace imagined human societies on space stations, he did it in accordance with the strict gender striations of the '50s and '60s: He thought that space stations would need workers like "telephone operators and laboratory assistants and nurses and things that were traditionally pink-collar jobs," says Weitekamp. And that would mean sending women to space. "He is in some ways incredibly visionary and in some ways very much a product of his time," she says.

Thirteen women pilots did undergo Lovelace's testing for potential astronauts, including Jerrie Cobb, an accomplished pilot who held world records for flying and who would go on to testify before Congress, arguing that women should be allowed into the astronaut corps.

She never got her wish. In 1961, when President John F. Kennedy

announced an ambitious timeline for getting a man onto the moon, NASA's resources were funneled to that goal. The quick turn precluded any slower, more deliberate focus on human spaceflight that might have included women, says Weitekamp. Women were nowhere near the astronaut corps in 1961, and the speed required to reach the moon would mean NASA had to work with the pilots they had—all of them men. "Women didn't get to participate in large part because NASA by the end of May 1961 is already focused on 'what do we need to do to get to the moon and back?' " Weitekamp says.

A lot has changed since then. From the 1970s onward, desegregation and laws like Title IX brought women into medicine, engineering, law and other fields that had been historically male-dominated. "It's a result of any number of lawsuits to allow women into these professional roles, to get them into the schools that then give them the credentials that allow you to have a story like a Ruth Bader Ginsburg, who's one of the first women in her law class and who was told repeatedly that she's taking some man's spot," says Weitekamp.

This new openness extended to the astronaut corps as well. In 1983, Sally Ride became the first American woman in space, emerging from a class of astronauts who were living proof that NASA had recognized the need for a corps that more closely mirrored the nation. The 35-member group included three African American men, an Asian American man and six women. Ride was followed by other women, including Bonnie Dunbar, of Sunnyside, Yakima County, and Mae Jemison, who in 1992 became the first African American woman to go to space. To date, 45 women have entered the American astronaut corps.

"Those women are not necessarily women like the Lovelace women who identified first as pilots and who are interested in flying the spacecraft," says Weitekamp. "These are people who have Ph. Ds in physics or oceanography or other kinds of research subjects who are going to be

doing experiments in the payload bay of the space shuttle."

But the Lovelace women might've seen more of themselves in Eileen Collins, who in 1995 became the first woman space-shuttle pilot, decades after the Lovelace tests, or Spokane's Lt. Col. Anne McClain, a military test pilot who returned to Earth on June 25 after more than six months in space.

It's unlikely that NASA would have made this connection. "Part of what's frustrating is when they were greeting the women in the 1970s they did not look back at any of this data from the 1950s and 1960s. They just kind of started over," says Weitekamp.

It's an omission that reflects the circuitous churn of documenting women's history: one step forward, two steps back. Even though we know more about women's contributions to [space travel](#) than perhaps ever before, we still must reckon with blind spots, and the stories of lives and scientific achievements—like those of Edith Gustan—that we have yet to fully understand.

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