

Katherine Johnson Dies at 101; Mathematician Broke Barriers at NASA

She was one of a group of black women mathematicians at NASA and its predecessor who were celebrated in the 2016 movie “Hidden Figures.”



Katherine Johnson, part of a small group of African-American women mathematicians who did crucial work at NASA, in 1966.

Credit...

NASA/Donaldson Collection, via Getty Images



By **Margalit Fox**

- Feb. 24, 2020 Updated 1:04 p.m. ET

They asked Katherine Johnson for the moon, and she gave it to them.

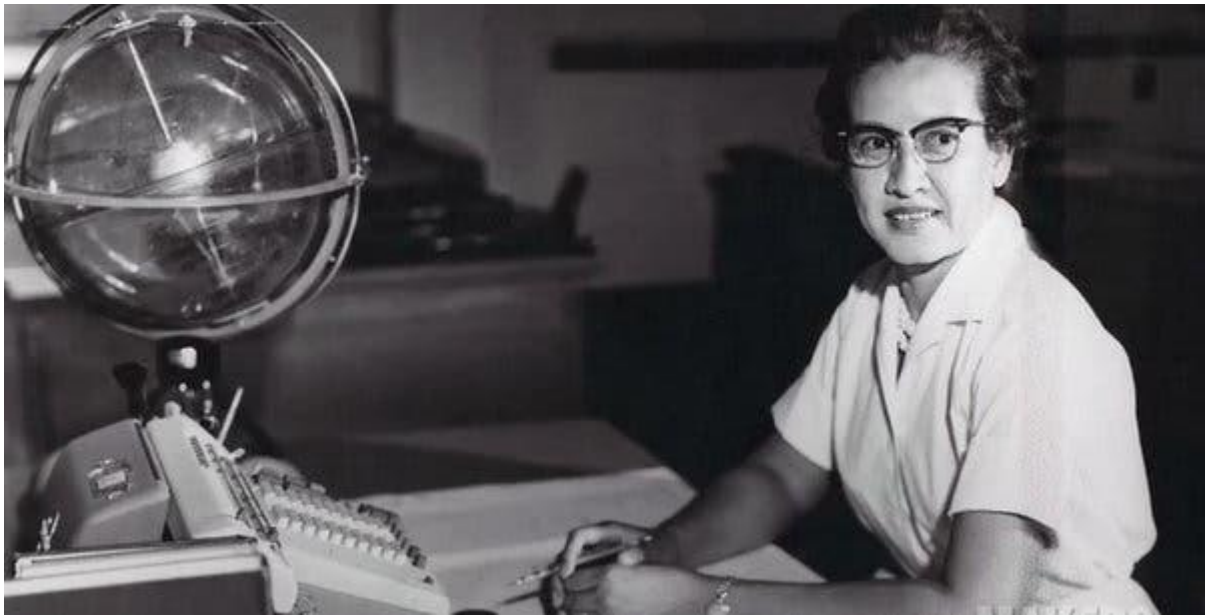
Wielding little more than a pencil, a slide rule and one of the finest mathematical minds in the country, Mrs. Johnson, who died at 101 on Monday at a retirement home in Newport News, Va., calculated the precise trajectories that would let Apollo 11 land on the moon in 1969 and, after Neil Armstrong's history-making moonwalk, let it return to Earth.

A single error, she well knew, could have dire consequences for craft and crew. Her impeccable calculations had already helped plot the successful flight of Alan B. Shepard Jr., who became the first American in space when his Mercury spacecraft went aloft in 1961.

The next year, she likewise helped make it possible for John Glenn, in the Mercury vessel Friendship 7, to become the first American to orbit the Earth.

Yet throughout Mrs. Johnson's 33 years in NASA's Flight Research Division — the office from which the American space program sprang — and for decades afterward, almost no one knew her name.

Mrs. Johnson was one of several hundred rigorously educated, supremely capable yet largely unheralded women who, well before the modern feminist movement, worked as NASA mathematicians.



Mrs. Johnson at her desk at Langley in an undated photo.

Credit...

NASA

But it was not only her sex that kept her long marginalized and long unsung: Katherine Coleman Goble Johnson, a West Virginia native who began her scientific career in the age of Jim Crow, was also African-American.

In old age, Mrs. Johnson became the most celebrated of the small cadre of black women — perhaps three dozen — who at midcentury served as mathematicians for the space agency and its predecessor, the National Advisory Committee for Aeronautics.

Their story was told in the 2016 Hollywood film “Hidden Figures,” based on Margot Lee Shetterly’s nonfiction book of the same title, published that year. The movie starred Taraji P. Henson as Mrs. Johnson, the film’s central figure. It also starred Octavia Spencer and Janelle Monáe as her real-life colleagues Dorothy Vaughan and Mary Jackson.

In January 2017 “Hidden Figures” received the Screen Actors Guild Award for outstanding performance by a cast in a motion picture.

The film was nominated for three Oscars, including best picture. Though it won none, the 98½-year-old Mrs. Johnson received a sustained standing ovation when she appeared onstage with the cast at the Academy Awards ceremony that February.

Of the black women at the center of the film, Mrs. Johnson was the only one still living at the time of its release. By then, she had become the best-known member of her formerly unknown cohort.

In 2015, President Barack Obama awarded her the Presidential Medal of Freedom, proclaiming, “Katherine G. Johnson refused to be limited by society’s expectations of her gender and race while expanding the boundaries of humanity’s reach.”

In 2017, NASA dedicated a building in her honor, the [Katherine G. Johnson Computational Research Facility](#), at its Langley Research Center in Hampton, Va.

That year, The Washington Post described her as “the most high-profile of the computers” — “computers” being the term originally used to designate Mrs. Johnson and her colleagues, much as “typewriters” was used in the 19th century to denote professional typists.

Editors’ Picks

She “helped our nation enlarge the frontiers of space,” NASA’s administrator, Jim Bridenstine, said in a statement on Monday, “even as she made huge strides that also opened doors for women and people of color in the universal human quest to explore space.”



Taraji P. Henson portraying Mrs. Johnson in a scene from the 2016 movie “Hidden Figures.”

Credit...

Twentieth Century Fox, via Associated Press

As Mrs. Johnson herself was fond of saying, her tenure at Langley — from 1953 until her retirement in 1986 — was “a time when computers wore skirts.”

For some years at midcentury, the black women who worked as “computers” were subjected to a double segregation: Consigned to separate office, dining and bathroom facilities, they were kept separate from the much larger group of white women who also worked as NASA mathematicians. The white women in turn were segregated from the agency’s male mathematicians and engineers.

“As Good as Anybody”

But over time, the work of Mrs. Johnson and her colleagues — myriad calculations done mainly by hand, using slide rules, graph paper and clattering desktop calculating machines — won them a level of acceptance that for the most part transcended race.

“NASA was a very professional organization,” Mrs. Johnson told *The Observer* of Fayetteville, N.C., in 2010. “They didn’t have time to be concerned about what color I was.”

Nor, she said, did she.

“I don’t have a feeling of inferiority,” Mrs. Johnson said on at least one occasion. “Never had. I’m as good as anybody, but no better.”

To the end of her life, Mrs. Johnson deflected praise for her role in sending astronauts into space, keeping them on course and bringing them safely home. “I was just doing my job,” Ms. Shetterly heard her say repeatedly in the course of researching her book.

But what a job it was — done, no less, by a woman born at a time, Ms. Shetterly wrote, “when the odds were more likely that she would die before age 35 than even finish high school.”

Creola Katherine Coleman was born on Aug. 26, 1918, in White Sulphur Springs, W.Va., the youngest of four children of Joshua and Joylette (Lowe) Coleman. Her mother was a schoolteacher, her father a farmer.

From her earliest childhood Katherine counted things: the number of dishes in the cupboard, the number of steps on the way to church and, as insurmountable a task as it might pose for one old enough to be daunted, the number of stars in the sky.

“I couldn’t wait to get to high school to take algebra and geometry,” Mrs. Johnson told *The Associated Press* in 1999.

But for black children, the town's segregated educational system went as far as only sixth grade. Thus, every fall, Joshua Coleman moved his family 125 miles away to Institute, W.Va.

In Institute, Katherine's older siblings, and then Katherine, attended the high school associated with the West Virginia Collegiate Institute, a historically black institution that became West Virginia State College and is now West Virginia State University.



Mrs. Johnson at NASA's Langley Research Center in 1980.

Credit...

NASA

Mr. Coleman remained in White Sulphur Springs to farm, and, when the Depression made farming untenable, to work as a bellman at the Greenbrier, a world-renowned resort there.

Katherine entered high school at 10 and graduated at 14. The next year she entered West Virginia State. By her junior year, she had taken all the math courses the college had to offer.

Her mentor there, [William Waldron Schieffelin Claytor](#), only the third black person to earn a doctorate in mathematics from an American university, conceived special classes just for her.

“You would make a good research mathematician,” he told his 17-year-old charge. “And I am going to prepare you for this career.”

“Where will I find a job?” Katherine asked.

“That,” he replied, “will be your problem.”

After graduating summa cum laude in 1937 with a double major in mathematics and French, she found, unsurprisingly, that research opportunities for black female teenage mathematicians were negligible. She took a job as a schoolteacher in Marion, Va.

In 1940, she was chosen by the president of West Virginia State to be one of three black graduate students to integrate West Virginia University, the all-white institution in Morgantown.

Two years earlier, ruling in the civil-rights case [Missouri ex rel. Gaines v. Canada](#), the United States Supreme Court held that where comparable graduate programs did not exist at black universities in Missouri, the state was obliged to admit black graduate students to its white state universities. In the wake of that decision, West Virginia’s governor, Homer Holt, chose to desegregate public graduate schools in his state.

Now married to James Francis Goble, a chemistry teacher, she entered West Virginia University in the summer of 1940, studying advanced mathematics.

“The greatest challenge she faced,” Ms. Shetterly wrote, “was finding a course that didn’t duplicate Dr. Claytor’s meticulous tutelage.”

But after that summer session, on discovering she was pregnant with her first child, she withdrew from the university. She returned with her husband to Marion and was occupied with marriage, motherhood and teaching for more than a decade.

NASA Opens to Women

Then, in 1952, Katherine Goble heard that Langley was hiring black women as mathematicians.

The oldest of NASA’s field centers, Langley had been established by the National Advisory Committee for Aeronautics in 1917. In 1935, it began hiring white women with mathematics degrees to relieve its male engineers of the tedious work of crunching numbers by hand.

Within a decade, several hundred white women had been employed as computers there. Most, unlike the male scientists at the agency, were classified as subprofessionals, paid less than their male counterparts.

In June 1941, as the nation prepared for war, President Franklin D. Roosevelt signed [Executive Order 8802](#), barring racial discrimination in the defense industry. In 1943, with the wartime need for human computers greater than ever, the Langley Memorial Aeronautical Laboratory, as the research facility was then known, began advertising for black women trained in mathematics.

Among the first hired was [Dorothy Vaughan](#), who began work that year. In 1951, Mrs. Vaughan became the first black section head at NACA, as the advisory committee was known, when she was officially placed in charge of Langley's West Area Computing Unit, the segregated office to which the black women were relegated.

It was in this unit that Katherine Goble began work in June 1953, tabulating sheets of data for the agency's engineers.

By the time she arrived, the company cafeteria had already undergone de facto desegregation: Its "Colored Computers" sign, designating a table in the back for the women, had been a salubrious casualty of the war years. But the separate bathrooms remained.

Quite by accident, Katherine Goble broke that color line herself. While the agency's bathrooms for black employees were marked as such, many bathrooms for whites were unmarked.

Without realizing it, she had been using a white women's restroom since her arrival. By the time she became aware of her error, she was set in her routine and disinclined to change. No one took her to task, and she used the white bathrooms from then on.

Two weeks into her new job, she was borrowed by the Flight Research Division, which occupied an immense hangar on the Langley grounds.

There, the only black member of the staff, she helped calculate the aerodynamic forces on airplanes. For that task, as she quickly demonstrated, she came armed with an invaluable asset.

"The guys all had graduate degrees in mathematics; they had forgotten all the geometry they ever knew," Mrs. Johnson said in the Fayetteville Observer interview. "I still remembered mine."

She remained in the division for the rest of her career.



Image



Mrs. Johnson did the trajectory analysis for the launch of Freedom 7 in 1961, the Mercury program mission on which Alan B. Shepard became the first American in space.

Credit...
NASA

By the early 1960s, with the United States provoked by Soviet prowess in space, NASA was under great pressure to launch an astronaut. It fell to the Flight Research Division to do many of the associated calculations.

“Our assignment was the trajectory,” Mrs. Johnson explained to The Associated Press. “As NASA got ready to put someone in space, they needed to know what the launch conditions were. It was our assignment to develop the launch window and determine where it was going to land.”

Clandestine Calculations

Their work was secret — at times even from the mathematicians themselves.

“We were the pioneers of the space era,” Mrs. Johnson told The Daily Press, a Virginia newspaper, in 1990. “You had to read Aviation Week to find out what you’d done.”

She routinely logged 16-hour days, once falling asleep at the wheel of her car and waking up — safe, providentially — at the side of the road.

But the work engaged her deeply.

“I loved every single day of it,” she told Ms. Shetterly. “There wasn’t one day when I didn’t wake up excited to go to work.”

It helped sustain her through the death of her first husband from brain cancer in 1956, leaving her, at 38, a widow with three adolescent daughters. She married James A. Johnson, a United States Army captain, in 1959.

Over the years, Mrs. Johnson published more than two dozen technical papers. She was among the first women at NASA to be a named author or co-author on an agency report.

Ceaselessly curious about the aerospace technology that underpinned her work, she made it possible for women to attend the agency’s scientific briefings, formerly closed-door affairs reserved for male staff members. (“Is there a law against it?” Mrs. Johnson asked, and when her male colleagues, after some head-scratching, concluded that, no, there was no law, they let her in.)

After retiring from NASA, Mrs. Johnson became a public advocate for mathematics education, speaking widely and visiting schools.

Her death was announced by NASA. She is survived by two daughters, Joylette Hylick and Katherine Moore; six grandchildren; and 11 great-grandchildren. Another

daughter, Connie Garcia, died in 2010; her second husband, James Johnson, died in 2019.



Image



Mrs. Johnson, left, and her fellow former NASA scientist Christine Darden in 2016 at the Hampton History Museum in Virginia.

Credit...

Chet Strange for The New York Times

Mrs. Johnson's colleague Mary Jackson died in 2005; Dorothy Vaughan died in 2008.

In 2016, Mrs. Johnson, self-effacing as ever at 98, seemed somewhat indifferent to the fuss surrounding the feature film about her life.

"I shudder," she told The New York Times that September, some three months before the film's release, having heard that the screenwriters might have made her character seem a tiny bit aggressive. "I was never aggressive." (As things transpired, Mrs. Johnson liked the finished film very much, Ms. Shetterly said in an interview for this obituary in 2017.)

Mrs. Johnson may not have been aggressive, but she was assuredly esteemed. An index of just how esteemed she was came from Mr. Glenn, Mercury astronaut and future United States senator, who died in 2016.

In early 1962, a few days before he prepared to orbit the Earth in Friendship 7, Mr. Glenn made a final check of his planned orbital trajectory. The trajectory had been generated by a computer — not the flesh-and-blood kind, but the electronic sort, which were starting to supplant the agency's human calculators.

Electronic computation was still something of a novelty at NASA, and Mr. Glenn was unsettled by the use of a soulless mass of metal to divine something on which his life depended.

He asked that Mrs. Johnson double-check the machine's figures by hand.

"If she says the numbers are good," he declared, "I'm ready to go."

Margalit Fox is a former senior writer on the obituaries desk at The Times. She was previously an editor at the Book Review. She has written the send-offs of some of the best-known cultural figures of our era, including Betty Friedan, Maya Angelou and Seamus Heaney.