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NATIVE AMERICAN HERITAGE MONTH

Mary Golda Ross

Designing for Interplanetary Travel

From the Classroom to the Skunk Works

Mary Golda Ross was born on August 9, 1908, in Park Hill, Oklahoma. A citizen of the **Cherokee Nation** and great-granddaughter of Principal Chief John Ross, she grew up in a family that valued education. She earned a bachelor's degree in mathematics from Northeastern State Teachers' College in 1928, then spent roughly a decade teaching math and science in rural Oklahoma schools. She later worked for the Bureau of Indian Affairs as a statistician and as an advisor at the Santa Fe Indian School, and completed a master's degree in mathematics in 1938.

Lockheed hired her as a mathematician in 1942. Her early assignments included analysis of the problems the P-38 Lightning encountered in high-speed dives, when aircraft of that era began meeting the aerodynamic effects of air compressing near the speed of sound. Recognizing her ability, Lockheed supported her as she earned a professional engineering certification through UCLA coursework, moving her from calculation into design.

In 1952 Ross became the only woman in the original group of about 40 engineers at the **Skunk Works**, Lockheed's classified advanced-development unit. Her focus shifted to **orbital mechanics** and mission planning. She contributed to the operational requirements for the Agena rocket stage, later used as a docking target in NASA's Gemini program, and helped author sections of NASA's Planetary Flight Handbook dealing with flights to Mars and Venus — early work on the **trajectories** that interplanetary missions would require.

Much of her work remained **classified**, which has made her career difficult to document fully. After retiring in 1973 she mentored young women and Native students, as a charter member of the Society of Women Engineers and a supporter of the American Indian Science and Engineering Society. She attended the 2004 opening of the Smithsonian's National Museum of the American Indian and left the museum a bequest when she died in 2008. In 2019 the U.S. Mint featured her on its Native American \$1 coin.

Part 1 • Comprehension & Analysis

1. Trace Ross's path from teacher to aerospace engineer. Identify two points where her mathematical background was the deciding factor.

2. What problem was the P-38 Lightning facing, and why would a mathematician be useful in solving it?

3. What is the connection between the Agena rocket and NASA's later human spaceflight program?

4. The passage says Ross's career is 'difficult to document fully.' What causes this, and how should a historian handle claims about her work?

Part 2 • Quantitative Challenge

Kepler's Third Law and the Road to Mars

For objects orbiting the Sun, Kepler's third law says $T^2 = a^3$, where T is the orbital period in years and a is the average distance from the Sun in astronomical units (AU). Earth is at 1.00 AU; Mars is at about 1.52 AU. A Hohmann transfer orbit — the most fuel-efficient path between two planets — is an ellipse that touches Earth's orbit at one end and Mars's orbit at the other. Show your work and round to three significant figures.

- 1 Use $T^2 = a^3$ to calculate the orbital period of Mars in years.

- 2 The transfer orbit's semi-major axis is the average of the two distances. Find a for the Earth-to-Mars transfer orbit.

- 3 Find the period of that full transfer ellipse, then the one-way trip time (half the period). Convert the trip time to days.

- 4 A spacecraft cannot launch toward Mars on just any day. Using your answers, explain why interplanetary missions depend on launch windows.

Part 3 • Discussion & Extension

Ross spent decades on classified projects, and much of what she did may never be publicly known. At the same time, she is now honored on a national coin. How should society weigh the need for secrecy in defense and space research against the right of engineers — especially women and Native engineers who were already underrepresented — to be recognized for their work?
