

National Native American Hall of Fame  
2019 Inductee

**MARY ROSS**  
**CHEROKEE NATION**



**SCIENCE**  
**MATHEMATICIAN AND ENGINEER**

1 - 2 50-minute class periods

## **SELECTED COMMON CORE STATE STANDARDS**

### **CCSS Literacy SL 10-1**

Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 9-10 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.

### **CCSS Literacy SL 10-1d**

Respond thoughtfully to diverse perspectives, summarize points of agreement and disagreement, and, when warranted, qualify or justify their own views and understanding and make new connections in light of the evidence and reasoning presented.

### **CCSS.ELA-Literacy.RH.9-10.1**

Cite specific textual evidence to support analysis of primary and secondary sources, attending to such features as the date and origin of the information.

### **CCSS.ELA-Literacy.RH.9-10.2**

Determine the central ideas or information of a primary or secondary source; provide an accurate summary of how key events or ideas develop over the course of the text.

### **CCSS.ELA-Literacy.RH.9-10.3**

Analyze in detail a series of events described in a text; determine whether earlier events caused later ones or simply preceded them.

## **GOALS FOR UNDERSTANDING**

### **Students will understand**

- Mary Golda Ross was a brilliant mathematician and scientist
- What is Lockheed Martin?
- Mary Golda Ross achieved many notable firsts as a Native American and as a woman; including being the first woman ever hired as an engineer by Lockheed Martin

- Mary Golda Ross was a member of the Cherokee Nation
- Mary Golda Ross was the great-granddaughter of the famous 19<sup>th</sup> century Cherokee Chief John Ross

## ESSENTIAL QUESTIONS

How did Mary Golda Ross contribute as a scientist to the 1969 moon landing?

Why was Mary Golda Ross's appointment to Lockheed Martin a breakthrough for many people other than just Native Americans?

What types of historical challenges did Mary Golda Ross inherit and overcome?



*The theme of the 2019 Native American \$1 Coin design is American Indians in the Space Program. Native Americans have been on the modern frontier of space flight since the beginning of NASA. Their contributions to the U.S. space program culminated in the space walks of John Herrington (Chickasaw Nation) on the International Space Station in 2002. This and other pioneering achievements date back to the work of Mary Golda Ross (Cherokee Nation). Considered the first Native American engineer in the U.S. space program, Ross helped develop the Agena spacecraft for the Gemini and Apollo space programs.*

## **ASSESSMENT EVIDENCE**

### **Suggested Formative Assessment of Learning Outcomes**

Active listening through note taking

Small group discussion

Class discussion

### **Culminating Performance Assessment of Learning Outcomes**

- Students will finish their own small group K/W/H/L charts
- Participate in a small group discussion
- Answer the essential questions when reporting out as a group to the class

## **ENTRY QUESTIONS**

Who is Mary Golda Ross?

What achievements did Mary Golda Ross accumulate during her career to be inducted into the National Native American Hall of Fame?

Of which Native American Nation is Mary Golda Ross a member?

## **MATERIALS**

Computer and internet access for the following videos is required. Additional written materials for printing are at the end of this lesson.

1-minute biography from the Cherokee Times about Mary G Ross

[https://www.youtube.com/watch?time\\_continue=8&v=kWZPVgdLQ\\_E&feature=emb\\_logo](https://www.youtube.com/watch?time_continue=8&v=kWZPVgdLQ_E&feature=emb_logo)

3-minute video biography about Mary G Ross

[Hidden Figuras: Mary Golda Ross - YouTube](#)

4-minute video describing Mary G Ross's achievements

<https://www.youtube.com/watch?v=eh2vhhQar40>

75-minute video about Mary's great-grandfather, John Ross, and the Trail of Tears

[https://www.youtube.com/watch?time\\_continue=24&v=Sdlx2bT7c6I&feature=emb\\_logo](https://www.youtube.com/watch?time_continue=24&v=Sdlx2bT7c6I&feature=emb_logo)

## LEARNING MODALITIES

Audio/Visual: Students will watch videos that describe the astounding life and achievements of Mary Golda Ross. These short videos are available online and provide key facts and details about her incredible career and wonderfully long life.

Writing/Recording: Students will take notes while observing the films, which will be used to complete the K/W/H/L chart in the small groups.

## OVERT INSTRUCTION

- 1) The instructor divides the class into groups of four and asks each person and each group to begin making a “K/W/H/L” Chart, which stands roughly for “What they Know/What they Want to Know/How to Research this topic/What they Learned”  
The teacher can introduce Mary Golda Ross by playing the first short video which is linked here for streaming access: [Hidden Figuras: Mary Golda Ross - YouTube](#)
- 2) After showing the video, the instructor can distribute the biography of Mary Golda Ross and students can begin completing the K/W/H/L graphic organizer.
- 3) After about 15 minutes of reading, discussion and chart work, the teacher will show the class one of the longer video interviews that have been pasted above. *The Trail of Tears* video profiles Mary’s great-grandfather John Ross, and is over an hour long, so it would require two class periods to watch this video. The 75-minute video can also be edited down to show only key segments of the film, this is up to the instructor’s discretion.
- 4) Students will watch the PBS, *We Shall Remain: Trail of Tears* video, which provides historical background to Mary Golda Ross’s life and achievements. Each team member will contribute with one person recording the information on a separate sheet. This information can also be utilized for the group K/W/H/L chart.

### Questions

- a. How did Mary Golda Ross distinguish herself as a Native American, as a woman and as a citizen of the Cherokee Nation?
- b. What devastating legacy did Mary Golda Ross inherit?
- c. Why is Mary Golda Ross considered to be a legendary scientist?
- d. What types of challenges did Mary Golda Ross overcome as a professional, and how did she succeed?

- 5) Following the small group discussions, each group will report out on their answers, and the answers will be included into a class K/W/H/L chart organized by the instructor on a smartboard or projector.
- 6) The instructor will open the discussion to include any final thoughts, questions or insights about Mary Golda Ross and her career and legacy.

### **This concludes the first 50 minutes of the Lesson**

#### **Extension Exercises**

Students who wish to continue their study of Mary Golda Ross can research online and write an essay that attempts to answer the following questions:

What are the unique qualities and background that gave Mary Golda Ross the foundation to achieve great things?

How is Mary Golda Ross's story an inspiration to all people around the world?

What makes Mary Golda Ross's career and legacy so special and inspirational?

### **CRITICAL FRAMING**

Mary Golda Ross was a descendant of Cherokee people who survived the Trail of Tears, a forced march removal of the Cherokee and several other nations who had formerly inhabited the southeastern area of the continental United States since time immemorial. These nations were all forcibly removed to Oklahoma, and the overwhelming loss of life, severe poverty, and extreme geographic change all caused significant trauma to surviving generations. Mary Golda Ross's great-grandfather John Ross was a notably successful Cherokee Chief, yet he still suffered the same fate of relocation. Mary's success came before any congressional legislation to support Native American people or culture, she was truly a forerunner in many ways.

### **BIBLIOGRAPHY AND ADDITIONAL RESOURCES**

#### **Remembering Mary Golda Ross**

*by Ariel Sandberg*

*Aerospace Engineering*

*June 14, 2017*

**She was a brilliant mathematician, Space Race trailblazer, first female and only Native American engineer at Lockheed Aircraft Corporation.**



*IMAGE: Celebrating Mary Golda Ross*

Brilliant mathematician, Space Race trailblazer, first female and only Native American engineer at Lockheed Aircraft Corporation: Mary Golda Ross was a pioneer of America's early quest for the stars.

Ross was born on August 9, 1908, in Park Hill, Oklahoma, a year after the founding of the state. Her great-great grandfather, John Ross, served as Chief of the Cherokee Nation during the Trail of Tears, the 1838 forced Cherokee relocation from Georgia to Indian Territory in Oklahoma. Later in life, Ross reflected on the importance of the Cherokee tradition of equal education for both girls and boys in her life path.

From a young age, Ross possessed a keen aptitude for mathematics and the sciences:

"Math was more fun than anything else. It was always a game to me... I was the only female in my class. I sat on one side of the room and the guys on the other side of the room. I guess they didn't want to associate with me. But I could hold my own with them and sometimes did better."

By 20 years old, Ross had graduated from Northeastern State Teacher's College with a degree in mathematics. For the next nine years, Ross taught math and science in rural Oklahoma amid the Great Depression. In 1937, she applied her skills as a statistical clerk for the Bureau of Indian Affairs in Washington, D.C., earning a mathematics degree from Colorado State Teachers College one year later. During this time, Ross developed a deep interest in astronomy, and she pursued a rigorous campaign of self-teaching and supplementary coursework.

With the onset of World War II, Ross's passions evolved towards aviation. In 1942, she was hired as an assistant to a consulting mathematician for Lockheed Aircraft Corporation in Burbank, California. In this role, she worked on the development of fighter planes, making especial contributions to the P-38 Lightning fighter. With the support of Lockheed, Ross attended additional aeronautical and mechanical courses at UCLA and received her California Professional Engineering (PE) certification in 1949.

In 1952, Ross was selected to serve as one of the founding 40 members of the top-secret Skunk Works team. She was the sole female engineer and only employee of Native American heritage. She noted: "With such a small group, you had to do everything. Aerodynamics. Structures... I was on the ground floor at Lockheed Missiles and Space, and I couldn't think of a more ideal situation."

Insight into her achievements at Lockheed can be gained through her 1969 SWE senior membership recommendation letter, submitted by P.B. Weiser, Systems Evaluation Manager at Lockheed Missiles and Space Company:

"[Ross] was a Research Engineer and participated in feasibility, performance, and evaluation studies of low-altitude defense missile systems, intermediate-range ballistic missile systems, near-Earth satellite systems and underwater-launched IRBM systems. I would unhesitatingly place her in the top 10% of engineers of my acquaintance and professional knowledge. I would therefore be privileged to recommend her for status as a senior member of SWE."



*IMAGE: Ad Astra per Astra by America Meredith  
(National Museum of the American Indian)*

In addition to her aviation innovations, Ross contributed critically to the nation’s space exploration endeavors. She was an author of the *NASA Planetary Flight Handbook*, analyzed trajectory data for Mars fly-by missions and worked on development of the Agena rockets.

In 1973, Ross retired from Lockheed as a senior engineer. For the next three decades, she continued advocating strongly for improved opportunities for American Indians, serving on the Council of Energy Resource Tribes and the American Indian and Science and Engineering Society. In 2008, Ross passed away a few months shy of her 100<sup>th</sup> birthday.

Mary Golda Ross’s contributions have been immortalized in art. As explained [by the Smithsonian](#):

“[Ross’s] face graces [a sculpture at Buffalo State College](#) and [a painting by Cherokee artist America Meredith](#) that shows her against a starry, rocket-filled sky is now in the collections of the Smithsonian’s National Museum of the American Indian. Entitled *Ad Astra per Astra*, meaning to the stars from the stars (a play on the Latin phrase “*per aspera ad astra*”), references a Cherokee origin story of how humans arrived on Earth from the Pleiades. Packed with symbolism—a seven-pointed star references the Seven Sisters constellation, the seven clans of the Cherokee and the seven directions in Cherokee cosmology—the portrait also includes a depiction of the Agena spacecraft. “

## Mary G. Ross: 5 Fast Facts You Need to Know

- By Jessica McBride
- Updated Aug 9, 2018 at 9:42am



Google Doodle Mary G. Ross

Mary G. Ross, the first American Indian female engineer, and a highly regarded pioneer in her industry, is the subject of a Google Doodle honoring her 110th birthday.

The contributions of Mary G. Ross to the aerospace industry “include the development of concepts for interplanetary space travel, manned and unmanned earth-orbiting flights, and orbiting satellites,” Google noted.

Google called Mary G. Ross “a pioneer who reached for the stars and whose legacy continues to inspire others to do the same.” Mary Golda Ross was born on August 9, 1908 and is regarded as the first American Indian woman engineer.

Here’s what you need to know:

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## **1. Mary G. Ross Was the Great-Great Granddaughter of a Cherokee Nation Chief**

Mary G. Ross is of Native American heritage as she is descended from a Cherokee Nation chief.

Ross was the “great-great granddaughter to Chief John Ross of the Cherokee Nation,” Google wrote on August 9, 2018.

Chief John Ross, according to The Smithsonian, “fought to preserve his nation from white settlers’ incursions—and later was forced to lead his people along the march that became known as the Trail of Tears.”

His great-great-granddaughter became her own force to be reckoned with.

According to The Smithsonian, in 1958, Ross – whose full name was Mary Golda Ross – “stumped the panelists on ‘What’s My Line?’ It took the actors Arlene Francis and Jack Lemmon, journalist Dorothy Kilgallen and publisher Bennet Cerf, celebrity panelists of the popular television game show, quite a while to figure out her M.O.”

According to The Smithsonian, Ross reconnected with her Native American roots only later in her life, but when she did she was known for “mentoring and supporting others in her field and calling attention to her heritage.”

When the Smithsonian opened the National Museum of the American Indian in 2004, Ross attended in ancestral dress and “left a bequest of more than \$400,000 to the museum upon her death in 2008,” The Smithsonian Magazine reported.

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## **2. She Had a Love for Rocket Science & Astronomy**

According to Google, Mary G. Ross had math skills that “were surpassed only by her passion for aviation and the sciences. After teaching in Oklahoma for 9 years, she attended the University of Northern Colorado to pursue her master’s degree and love for astronomy and rocket science.”

During World War II, Ross “was hired by Lockheed Aircraft Corporation as a mathematician. It was there that she was encouraged to earn her professional certification in aeronautical engineering from UCLA in 1949, after which she broke new ground as one of the 40 founding members of the top-secret Skunk Works team,” Google wrote.

Her work on the team “included developing initial design concepts for interplanetary space travel (including flyby missions to Venus and Mars) and satellites including the Agena rocket (depicted in today’s Doodle),” wrote Google.

“Often at night there were four of us working until 11 p.m.,” she later recounted, Google noted.

“I was the pencil pusher, doing a lot of research. My state-of-the-art tools were a slide rule and a Frieden computer. We were taking the theoretical and making it real.”

According to a biography of Ross, “Ross was later to remark that she had been brought up in the Cherokee tradition of equal education for both boys and girls. She was, however, the only girl in her math class, which did not seem to bother her. Indeed, her early interests were math, physics, and science.”

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### **3. Mary G. Ross Was a Pioneer for Women & American Indians Hoping to Pursue Careers in STEM Fields**

Mary G. Ross is considered a pioneer both for women and for American Indians interested in STEM fields.

“Leading by example, Ross also opened doors for future generations of women and American Indians by participating in efforts to encourage their pursuits in STEM fields, including being a member and Fellow of the Society of Women Engineers (SWE),” wrote Google.

According to Cherokee.org, Mary Golda Ross had “a lifetime of success in aerospace technology as the first woman engineer for Lockheed Missiles and Space Company.”

“The accomplishments of Mary Golda Ross epitomize the Cherokee spirit,” said Chad Smith, Principal Chief of the Cherokee Nation, to Cherokee.org. “This exceptional woman was and will continue to be a great example to each of us. Her ambition and successes exemplify the importance of education and are evidence of the doors that can be opened through higher learning.”

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## **4. A Scholarship Was Established in the Name of Mary G. Ross**

According to Google, there is a scholarship in the name of Mary G. Ross that aims to encourage other women to become engineers.

“In 1992 the SWE established a scholarship in Ross’s name, which aims to support future female engineers and technologists, including Aditi Jain, a current Google Maps engineer,” wrote Google, quoting Jain as saying, “More than money, it gave me confidence. I don’t think I considered myself an engineer until I received the scholarship.”

Cherokee.org reports that Ross “taught school in Oklahoma for nine years. Ross then went on to work for the Bureau of Indian Affairs (BIA) in Washington D.C.”

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## **5. The Family of Mary G. Ross Helped Create the Google Doodle**

Google gave “special thanks to both the family of Mary G. Ross and the Society of Women Engineers for their partnerships on this project.”

According to Google, Jeff Ross, nephew of Mary G. Ross, shares his thoughts on his aunt’s legacy:

The Ross family is excited that Google has chosen Mary G. Ross for a Doodle on her 110th birthday. A proud Cherokee woman and the great-great granddaughter of Chief John Ross, Mary is an excellent role model for young women and American Indians everywhere. Her accomplishments are a testament to her determination and love for education. Our hope as a family is that her story inspires young people to pursue a technical career and better the world through science.

Mary G. Ross died in 2008 at the age of 99.