Making History: Margaret Hamilton

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Description of the event, artifact depicted, and its historical context and significance:


The photo we decided to recreate was taken in 1969 in NASA, depicting Margaret Hamilton standing next to the vital programming codes needed for the Apollo 11's successful landing on the moon. The year 1969 historically was not only during the Cold War but also during the Space Race between the USSR and the USA, causing the drive and motivation for the successful moon landing. During this time period the United States and USSR were at a standoff and in a race to see who could land on the moon first. Most memorably, the USSR had already launched Sputnik 1, an Earth orbiting satellite and Sputnik 2, which carried the first dog, Laika, to space. Among other successful projects by the USSR, the US was falling behind. Margaret Hamilton stated, "There was no second chance. We all knew that." on the development of the software. All major research developments were vital. Margaret Hamilton and her team made a breakthrough in the programming technology and the results are what Hamilton is standing next to, the programming for the Apollo Guidance Computer.

The Apollo Guidance Computer had two main jobs. According to *The Atlantic*, "First, it computed the necessary course to the moon… Second, it controlled the many physical components of the spacecraft. The AGC could communicate with 150 different devices within the spacecraft—an enormously complicated task." Hamilton's team designed the "Interpreter" which allowed 5-7 virtual machines to be run simultaneously in the existing hardware."

Margaret Hamilton is a computer programmer who wound up leading the Software Engineering Division of MIT which was in contract for the Apollo program. The software Hamilton and her team created allowed the computer to recognize error messages and ignore low-priority tasks which guided astronauts Neil Armstrong and Buzz Aldrin for a successful and safe travel to the moon. Margaret and her teams software acted as an alarm and a guidance system, "It quickly became clear," she later said, "that [the] software was not only informing everyone that there was a hardware-related problem, but that the software was compensating for it." Hamilton was confident in the software and Mission Control trusted her.

Margaret Hamilton coined the term "software engineering" and developed the building blocks for its foundation. When the Apollo missions were planned, the process of writing code began on large sheets of paper. A keypunch operator would create holes in paper cards, keying the codes into what were called punch cards. The Smithsonian Museum holds the Apollo Flight Guidance Computer Software Collection Hamilton and her team created today. The archival includes the printout sheets known as "The Listings." The Listings show the results of guidance equations and errors. The software that Hamilton and her team produced contained no errors.
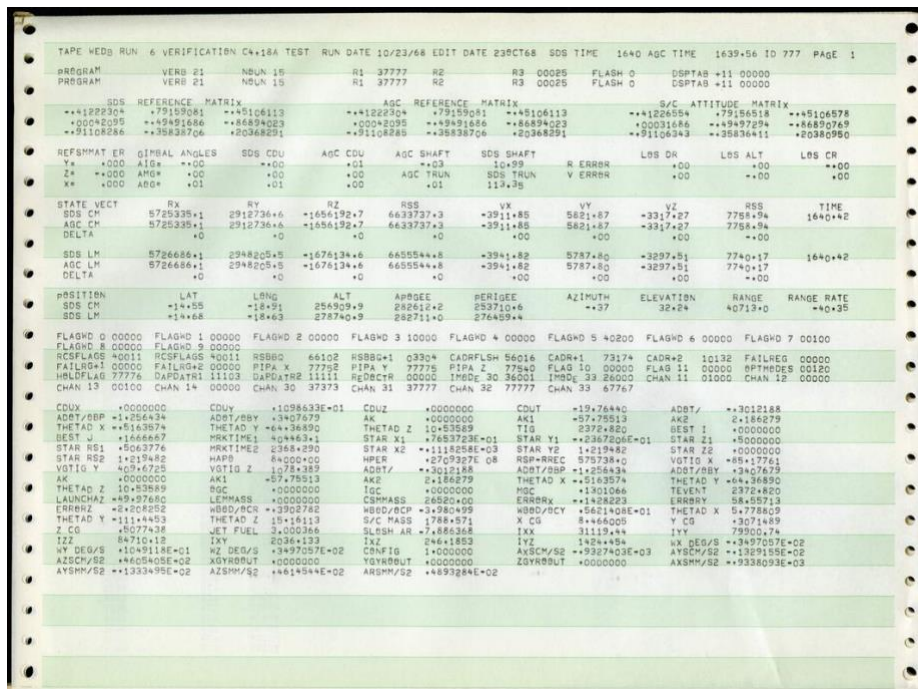
The Smithsonian's National Air and Space Museum holds in its collections the Apollo Flight Guidance Computer Software Collection (above, page number 45506-A) created by Hamilton and her team. (National Air and Space Museum)

To conclude, Margaret Hamilton and her team were not the sole developers and cause of the success of the Apollo 11 mission. In fact, her and over 400,000 others were involved in this triumph; collaboration is needed for success. The software Hamilton is standing next to in the photo is monumental and was one of the first and most influential pieces of software engineering. Thus, creating the way for more development. Recently Hamilton received the Presidential Medal of Freedom for her discoveries and contributions by President Obama at the White House. According to the White House website, "this prestigious award is the Nation's highest civilian honor." Some others who were awarded with this medal were Rosa Parks and Martin Luther King Jr.

Image Recreation Process:

To recreate Margaret Hamilton's iconic picture at NASA, our group chose to pick the SBU library as the best location. We chose our team member, Nicole Fezza, to model as Hamilton because they share similar features. Nicole oversaw props and she obtained a dress and wireframe glasses that are very similar to what Hamilton wore. The wireframe glasses that

Nicole bought were actually sunglasses, so we spent a surprisingly long amount of time trying to take the dark lenses out to make them look like normal glasses.

Next, we were able to find a quiet room in the library so that if we talked loudly, it would not disturb people. We started stacking books by getting the thickest books we could find. We stacked about 19 books to make sure they reach up to Nicole's head. It was quite a struggle to keep 19 heavy books from toppling over. While Nicole posed, Matthew took the pictures, and Olivia and Tasmima helped guide Nicole to imitate Hamilton more. Afterwards, we had to remember where we got all the books from. This was a challenge but we were able to put away all of the books in their original locations.

Our team member, Matthew edited the images because some alterations were needed. The location we chose was near identical in terms of layout but some things needed to be added and removed. Matt started by cropping out the images to fit the scale of the original photos. This helped get rid of the fire alarm with ease. Matt then removed the posters that were behind Nicole. He was able to do so using the clone stamp tool and blending the color with the healing tool. Then he cropped out the chalkboard from behind Margaret Hamilton and copied it over to our pictures. This proved to be difficult because he needed to make a layer using Nicole's arm so that he can paste the chalkboard underneath. He used the same technique of cropping to add the original outlet as well. In the left photo Matt also added in the coat hanger from the original photo. This was an easier task compared to the chalkboard because he was able to fit it in frame lining up the corner of the library room we chose. Then he blended the floor around the hanger to match the library room's floor. Once he finished all of this, the last thing he had to do was apply a black and white filter.

The process of stacking books by Olivia, Matthew, Tasmima and Nicole

Before and After Editing

Citations:

- https://www.nasa.gov/feature/margaret-hamilton-apollo-software-engineer-awarded-presidential-medal-of-freedom, Margaret Hamilton, Apollo Software Engineer, Awarded the Presidential Medal of Freedom, Nicholas P. Russo, Aug 6, 2017
- https://www.smithsonianmag.com/smithsonian-institution/margaret-hamilton-led-nasa-software-team-landed-astronauts-moon-180971575/ Margaret Hamilton Led the NASA Software Team That Landed Astronauts on the Moon, Alice George, March 14, 2019
- https://www.theatlantic.com/science/archive/2019/07/underappreciated-power-apollo-computer/594121/ Your Smart Toaster Can't Hold a Candle to the Apollo Computer, Alexis C. Madrigal, July 16, 2019

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Link to Presentation:

https://drive.google.com/file/d/1NfXwhyKjFhD1pjr0Z8A3xxwjG8tfpq5G/view?usp=sharing