

Biography of a Software Engineer: Margaret Hamilton

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When starting this essay, I was at a loss as to what software engineer, I wanted to write about. Some of the infamous names at the top of the industry currently came to mind such as Mark Zuckerberg and Paul Buchheit but they were stories that everyone had become so familiar with; I wanted to take this opportunity to learn about somebody new. As I was researching different people, I came across so many fascinating and impressive individuals, however, my mind drifted back to one of my favourite movies Hidden Figures. I recalled how in awe I was at these amazing mathematicians and their stories. As I was reading up further on these women, a thought spurred in my head about the software behind such a feat as the Apollo 11 mission; By following that path it wasn't long until I happened across Margaret Hamilton.

Born August 17th 1936, in Paoli Indiana, Margaret Hamilton had what one would consider an ordinary childhood and upbringing. After graduating high school, she continued onto the University of Michigan pursuing a mathematics degree. Hamilton then transferred to Earlham college continuing her major in mathematics but taking up a minor in philosophy. She credits Florence Long, the head of the mathematics department at Earlham College as the catalyst for her passion to pursue abstract mathematics. As I was looking into Margaret Hamilton's educational background, I was very surprised that one of the most ground-breaking figures in the world of software engineering didn't come from a direct computer science background or degree.

During this module, one of the main realisations for me was what software engineering consisted of, and that studying computer science does not result in you being a software engineer. Margaret Hamilton was a real-life example of how individuals from different backgrounds, not always pure STEM courses can make a mark in the world of software engineering. In Hamilton's case, she is the person who coined the infamous term "software engineering".

In the summer of 1959, Margaret Hamilton took up a job in the meteorology department in MIT, in the laboratory of Professor Edward Lorenz, the father of chaos theory in mathematics, to create a system to predict the weather. In 1959, computer science and software engineering were not yet established, or independent disciplines, they were learnt on the job with a “hands-on” approach. With this initial introduction to programming, Margaret Hamilton continued to program software for the MIT Lincoln Lab on the Semi-Automatic Ground Environment (SAGE) project. It is as a result of Hamilton’s extensive efforts on the SAGE project, that she was considered a prime candidate for the position within NASA as the lead developer for the Apollo flight software, where her name went down in history.

There are very few people that are not familiar with the Apollo 11 mission, however, many are not with the Apollo Guidance Computer that was created to assist in the landing and general warning protocols onboard the spacecraft. Hamilton and her team were responsible for the priority alarm display that interrupted and warned astronauts of emergencies as they appeared. The asynchronous execution priority of emergencies was based on J. Halcombe Laning’s design.

This onboard computer and specific software were critical to the Apollo 11 flight as it averted an abort of the landing on the moon. The scale of how impressive Margaret Hamilton’s work did not truly set in for me until I saw the photo of her standing beside her code. Now I was not naïve to the scale of the project but what I found awe-inspiring and very telling of her diligence was that no bug was ever found within the in-flight software of any Apollo mission. She is credited with popularising and naming the discipline of “software engineering” as Hamilton was fed up that software development was not taken seriously in comparison to the other engineering disciplines.

Margaret Hamilton went on to co-found a company called Higher Order Software, to further delve into the world of error prevention and fault tolerance following from her previous experience and speciality in MIT and the Apollo program. Hamilton is now a highly regarded individual in the world of software engineering and is heavily decorated, with awards ranging from the Computer History Museum Fellow Award (awarded 28/4/2017) to the Presidential Medal of Freedom (awarded by

President Obama in 2016). There is also a special edition Lego Minifigure made of her which is part of the “Woman of NASA” set released in 2017.

There is little that can't be said about Margaret Hamilton. Hamilton is an exceptional individual, a pioneer in the world of software engineering and she never let her gender be a question regarding her leadership abilities. I am quite fortunate to be able to have such a role model in the software engineering field, she truly paved the way for so many others before me. When I was researching previous interviews of Hamilton, one lesson I learned that I want to incorporate into my studies and career is her “What If?” mindset. Looking at a project from this perspective is crucial in changing the thinking and logic from the developer's point of view to the user's perspective instead. I learned quite a lot by writing this essay on Margaret Hamilton, from the history and beginning of the discipline of software engineering to approaching a project from all perspectives.