Biography of an Influential Software Engineer: Margaret Hamilton

Introduction:

Margaret Hamilton is an American Software Engineer and Computer Scientist. She is most famous for leading the team that developed the software for the Apollo program, and is often credited with creating the term “Software Engineering”.

The Apollo missions were an inspirational moment for mankind, made possible in no small part by Hamilton’s work in the field of software Engineering

Early Life:

Margaret Hamilton was born in Paoli, Indiana, US, in August 1936. She studied Mathematics at the University of Michigan, but transferred to Earlham College where she earned her Bachelors Degree in Mathematics in 1958.

She had planned to do graduate work at Brandeis University, but instead took a short-term position at the meteorology department at MIT, under Edward Norton Lorenz. There, she developed weather predicting software, working with the Librascope LGP-30 and PDP-1 computers.

SAGE Project:

In 1961, Hamilton moved on from meteorology to work on the Semi-Automatic Ground Environment (SAGE) Project at MIT’s Lincoln Lab. There, she helped program the prototype AN/FSQ-7 computer; which was the largest discrete computer system ever built, which was used to calculate interception points for missiles and aircraft against airborne threats.

It was here that she began to find her interest in what causes errors and how they can be avoided and prevented.

Her efforts on this project are a large part of what made her eligible to lead the development of the Apollo software.

Draper Laboratory and the Apollo Program:

Hamilton later moved from the Lincoln Lab to the Draper Lab, which worked on the Apollo missions. She ended up leading the team that developed the software for Apollo and later the Skylab space station.

Her team worked on in-flight software for the Apollo command module and lunar lander. They also developed the systems software, including error detection and recovery software. There were a million things that could go wrong on the Apollo craft, and good error management was essential to making sure that nothing went wrong.

Hamilton herself worked on much of the software to gain hands on experience, as, at the time, that was the only way to really learn to develop software, as courses in software engineering did not yet exist. She developed a system of priority displays, which communicated important information to the astronauts should anything go wrong.

Apollo 11:

In the moments before the Apollo 11 lander was about to make it's landing, the software system overrode the normal systems to alert the astronauts that something had gone wrong. The computer was being overloaded by the landing system and radar, which needed more processing than the computer could provide.

Fortunately, Hamilton's system allowed the computer to prioritise tasks based on importance over sequence. The priority displays posed a decision to the astronauts: to abort the mission, or to continue with the landing. The astronauts chose the latter, and the rest is history.

Business:

Hamilton remained working on NASA projects for a few more years, before moving on to found two companies. In 1976, she co-founded Higher Order Software (HOS); there, she further worked on fault tolerance and error prevention techniques.

In 1986, she founded Hamilton Technologies Inc, which developed a language called the Universal Systems Language. USL is designed to prevent the most common forms of error, instead of accounting for them after they happen.

Impact on Software Engineering:

Hamilton has been credited with giving the field of software engineering it's name. In the early days of the Apollo missions, the development of software was not taken seriously as other fields of engineering. Hamilton sought to legitimise the software as a field of engineering. Her influential work on the Apollo program led to more hardware engineers to respect the discipline, and, over time software engineering came to share the respect given to other technical fields.

Her work in the field also deserves credit for helping inspire more women to enter the discipline, as well as other areas of STEM.

She has received many Awards for her work and impact on the discipline, including the Ada Lovelace Award, the Presidential Medal of Freedom, and a number of honorary doctorates. She was also memorialised in a 2017 "Women of NASA" Lego set.

Sources:

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