

## REAR ADMIRAL GRACE HOPPER

*"I've always been more interested in the future than in the past." – Hopper*

Commonly referred to as the Grandma of COBOL, or the Queen of Software, Rear Admiral Grace Hopper was born in 1906 in New York City. A pioneer in the software engineering field, she is responsible for the invention of the first ever compiler as well as the creation of the Common Business-Orientated Language (COBOL).



### EARLY LIFE & EDUCATION

Hopper grew up in New Jersey and went to Vassar College to study maths and physics graduating with a bachelor's degree in 1928. She then went on to pursue a masters (1930) and Ph.D. (1934) in mathematics at Yale University. She was one of the first women to achieve this honour.

### CAREER

In 1931, she returned to Vassar College to begin her teaching career. She remained there until 1943 when the American involvement in World War II encouraged her to join the US Navy. She joined WAVES (Woman Accepted for Voluntary Emergency Service) in 1943 and was commissioned as a Lieutenant in 1944.

Hopper was assigned to the Bureau of Ordnance Computation Project at Harvard University. She was part of Howard Aiken's team where she worked as a programmer on the Harvard Mark I, an early prototype of the electronic computer. This was her first jump into the world of computing and she was responsible for writing up the 500-page Manual of Operations for the Automatic Sequence-Controlled Calculator in which she outlined the fundamental operating principles of computing.

After the war, Hopper remained as a Navy reserve officer and became a research fellow at Harvard to continue her work on the Harvard Mark I, and the later versions, Mark II and III. It was during her work in Harvard that she coined the term “bug” with reference to computer glitches. In August 1945, the circuit in the Mark I was malfunctioning due to a moth getting stuck in the computer. *“From then on, when anything went wrong with a computer, we said it had bugs in it.”*

In 1949, Hopper moved into private industry working with Eckert-Mauchly Computer Corporation and then Remington Rand where she worked on programming UNIVAC, the first all-electronic digital computer.

It was around this time that Hopper began to challenge the current methods of programming computers. At this time, computers were programmed in binary, series of 0s and 1s. Hopper believed that computers could be programmed in code more similar to the English language and that this could then be translated into a language the machine understood. It was this belief that led to Hopper inventing the world’s first compiler, the A-0 System, in 1952.

In 1957, her work on the compiler led to the development of Flow-Matic, the first English-language data-processing compiler. This compiler was aimed at business applications, such as calculating payroll and automatic billing. Flow-Matic was the basis for the language COBOL which she helped to co-develop in 1959. COBOL was one of the world’s first standardized computer languages and opened up computer programming to a much wider audience.

In 1966, Hopper retired from the Naval Reserve with the rank of commander. However, due to her pioneering work in computing she was called to active duty at the age of 60. She was assigned with the task of standardizing the Navy’s computers languages. She remained at the Navy for 19 years eventually being promoted to Rear Admiral in 1985. When she retired in 1986, she was the oldest serving officer in the service.

## LATER LIFE

After retiring from the Navy, Hopper continued to teach and lecture. She believed that one day computers would be small enough to fit on a desk and that people who weren’t professional programmers would be able to use them. She wished to live until the year 2000 so she could “point back to the early days of computers and say to all the doubters, ‘See? We told you the computer could do all that.’”

She died of natural causes at the age of 85 in 1992 and was laid to rest in Arlington National Cemetery.

## IMPACT

Hopper's belief that programming could be based on the English-language opened up computers to a much wider audience. Her work on developing the compiler was a revolutionary moment in computing. Any high-level programming language, such as Java, C++ or Python, use a compiler today. Her work made computer programming more accessible and helped to change the way people thought about computers.

COBOL was the realization of her wish to have a programming language based on the English-language. Hopper worked hard to make computer programming a more inclusive industry and widen its appeal. Hopper championed the creation of COBOL, a language that is still in use more than 50 years after its creation. According to a survey done by ComputerWorld in 2012, 53% of organisations surveyed use COBOL to develop new business applications. While it isn't the cutting edge of technology, the fact that it is still in use after 50 years is a remarkable feat and is a testament to Hopper herself.

One of Hopper's greatest joys in life was teaching. Her legacy includes encouraging young people to code and championing women in a male dominated industry. Every year 'The Grace Hopper Celebration of Women in Computing' takes place. It is a series of conferences designed to celebrate and encourage the achievements of women in computing. With nearly 20000 attendees in 2018, and speakers such as Sheryl Sandberg, Melinda Gates and Frances Allen, the first female Turing award winner, the conference has carried on Hopper's legacy and opened up the world of computing to a more diverse audience.

## AWARDS & HONOURS

Hopper's incredible achievements in computing did not go unnoticed during her lifetime. She remains to be an incredible female role model for women in STEM and her long list of accolades show why.

In 1973, Hopper was named a distinguished fellow of the British Computer Society. At the time, she was the first and only woman to hold this position.

In 1991, George Bush awarded her with the National Medal of Technology, "For her pioneering accomplishments in the development of computer programming languages that simplified computer technology and opened the door to a significantly larger universe of users." She was the first female individual recipient of this honour.

In 2016, Hopper was posthumously awarded with the Presidential Medal of Freedom by Barack Obama for her accomplishments in the field of computer science. This is the highest civilian award in the United States and demonstrates the importance of Hopper's work and how it has continued to impact those in the industry today.

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