Grace Hopper was born in New York City on December 9th, 1906. In her family of Scottish and Dutch descent, she was the eldest of three children. A history of familial naval accomplishment pre-existed her birth; her great-grandfather having served as an Admiral in the Civil War. A childhood of tearing apart clocks to determine her inner-workings was the beginnings of a lifelong trait of intense curiosity.

She graduated from Vassar in 1928 with a bachelor’s degree in mathematics and physics and earned her master’s degree at Yale University in 1930. By 1934 she had earned her Ph.D in mathematics from Yale, and her dissertation entitled ‘New Types of Irreducibility Criteria’ was published in the same year. She had begun teaching mathematics in Vassar in 1931, and was promoted to associate professor in 1941.

The ‘Hopper’ surname was a remnant of her only marriage to New York University professor Vincent Foster Hopper, which lasted from 1930-1945.

Hopper attempted to enlist in the Navy in WWII but was rejected due to her being considered too old at the age of 34, her weight to height ratio being too low, and her career in mathematics being valuable to the war effort. She eventually succeeded in joining the Navy in 1943 having acquired both a leave of absence from her university and a medical exemption in order to enlist.

Having graduated first in her class from Naval Reserve Midshipmen’s School in 1944, she served on the Mark I computer programming staff, a project to create a general purpose electromechanical computer to address the increasingly laborious calculations previously required to be performed by human ‘computers’ (largely made up of women who studied mathematics since men were chiefly employed elsewhere in the war effort). The Mark I was of the comically massive generation of supercomputers, containing over 500 miles of wiring inside, and it was while working on this project that the term ‘debugging’ was coined by Hopper, after a moth was discovered to be stuck in a relay and impeding operation.

Hopper continued to request to join, and be rejected for due to her advanced age, the regular navy, and chose to turn down a full professorship at Vassar in favour of working as a research fellow under a Navy contract at Harvard.

In 1949 Hopper joined the team developing the UNIVAC I as a senior mathematician. The UNIVAC was the first fully electronic computer on the market in 1950, and as such offered a far more competitive processing speed than the Mark I. It is estimated that in the first 10 years of UNIVAC’s life it performed more calculations than had been done in the totality of human existence prior. The first programmers of UNIVAC were six women, emphasising the importance of women, especially icons such as Hopper and Lovelace, in the formation of computer science. An important emphasis to emphasise I feel, given the modern male domination of the field.

Hopper recommended the development of a new programming language that would use entirely English words, increasing accessibility. The current system required a knowledge of mathematics to the level of a college professor, ensuring high costs and ‘accidental difficulty’. She was quickly informed that she “couldn’t do this because computers didn’t understand English”. By 1952 Hopper had created a working compiler, allowing for a higher level description of code that the compiler would then translate to machine-code. However, much to Hopper’s frustration “...nobody would touch it. They told me computers only do arithmetic”.

Hopper was named the company’s first director of automatic programming in 1954, and her department produced some of the first compiler-based programming language such as MATH-MATIC and FLOW-MATIC.

From this came COBOL (COmmon Business-Oriented Language), which extended Hopper’s FLOW-MATIC language with some ideas from the IBM equivalent, COMTRAN. In COBOL the world had a language that could be run on many machines by reducing high-level language to each machine’s often different machine code. This unifying feature of COBOL received great backing from the US government and military as they were one of few organisations to have faced the problem of code running on one machine, but not on another, as in order to have such a problem you must first own multiple machines and programming teams, which took gargantuan amounts of money.

In the 1970s Hopper advocated for the Defence Department to replace large, centralised systems with networks of small distributed computer. Any user on any computer node could access common databases stored on the network. She developed the implementation of standards for testing computer systems and components, most significantly for FORTRAN and COBOL. The Navy tests for conformance to these standards led to a significant convergence among programming languages of computer vendors. Leading to an increasingly unified programming effort and the emergence of COBOL as the most ubiquitous business language to date.

Hopper’s work innovated the field of Computer Science from machine code and low-level languages like Short Code to the higher-level ‘English’ appearing code she had envisioned, such as FORTRAN and COBOL. In the resulting unification of programming efforts, Hopper continued working to standardise the field and enable greater accessibility. No longer was a programmer necessarily a maths graduate, and no longer was a client of IBM required to continue purchasing IBM machines and products because of language restrictions. Hopper’s work led to a greater fluidity in the world of Computer Science, without which it would not be flourishing as it is today.