Grace Brewster Murray Hopper

Grace Brewster Murray Hopper (December 9, 1906 – January 1, 1992), affectionately known as the Grandmother of the Computer Age, was born in New York City to Walter Fletcher Murray and Mary Campbell Horne Murray. Grace's mother shared her love of mathematics with her daughter. As a youth, Grace was something of a tomboy but her parents did not attempt to curb her activities and interests that others might have believed unsuitable for girls. She developed a fascination with mechanical things, always anxious to understand how they worked. At age seven, curious about what made an alarm clock work, she took one apart, but was unable to put it back together so it would run. Undaunted, she searched through the house, found six more alarm clocks that she took apart one after another in her quest for understanding. Throughout her life Grace maintained an intense interest in how things worked, especially mechanical and electrical things.

At school, despite a small frame, Grace was active in sports, including basketball, field hockey, and water polo. At sixteen she applied to Vassar College, but somehow managed to fail a Latin exam, and was forced to wait a year before she was allowed to enroll. She graduated Phi Beta Kappa from Vassar in 1927 with a Bachelor of Arts degree in mathematics and physics. She continued her studies at Yale University, earning an M.A. in 1930 and a Ph.D. in mathematics in 1934. Algebraist Øystein Ore directed her thesis, "New Types of Irreducibility Criteria." Grace married Vincent Foster Hopper, an English instructor at New York University's School of Commerce, in 1930. They separated in the early 1940s and divorced in 1945, the same year he was killed in WWII. Grace continued to use the name Hopper throughout her life.

Hopper taught mathematics at Vassar College from 1930 to 1943, employing teaching methods that were rather unusual for the times. She attempted to show the role mathematics played in real life by offering concrete examples. In her probability course, she required her students to play bridge and dice games, and predict the results. In another course, she had them plan a city; figure the expense of running it and where to get the funds to cover those expenses. She sometimes gave out her final exams at the beginning of the course, so that her students would know what was expected of them.

When the Japanese attacked Pearl Harbor, Hopper was eager to serve her country's war efforts. Her great-grandfather Alexander Russell had been a Rear Admiral in the U.S. Navy. This prompted her to volunteer, but the Navy wasn't interested. She was not only considered too old at 36, and at 105 pounds too frail, but additionally it was believed she could better serve her country by continuing her work as a mathematics professor. Hopper was persistent, and in 1943 convinced the U.S. Navy to allow her to enlist in the WAVES (Women Accepted for Volunteer Emergency Service). After graduating from Midshipman's school, she was assigned to the Bureau of Ordnance Computation Project at Harvard University to work with the first U.S. computer, the Mark I, the brainchild of the project's director Howard Aiken.

If those who cut Hopper's orders more clearly understood the work to be done at the Cruft Laboratory, they might have sent someone with an engineering background rather than a theoretical mathematician like her. Fortunately for the Navy and the computer era to come, her great curiosity about how things worked and her supreme confidence in her ability to learn new things, led her to throw herself into a crash course in the complexities of computers and how to program them to crunch numbers in the service of the war effort. Upon reporting to the Computation Lab, Hopper recalled Howard Aiken's first words to her: "Where the hell have you been? Here, compute the coefficients of the arctangent series by next Thursday." Thus she designed her first computer program, becoming only the third person to program the Mark I.

The team of scientists used the Mark I to figure ordnance calculations. One of the first problems the lab received from the Navy was to compute firing tables for antiaircraft guns. Grace obtained mathematical formulas for firing tables, and then wrote a series of instructions, which were instructions translated into a binary code that the computer understood. The completed solution accommodated input variables, including target bearing, elevation and range, the ship's angle of pitch and roll, drift angle, time of flight, and residual projectile velocity. Hopper won the Naval Ordnance Award for her work on the Mark I, Mark II, and Mark III. While working with the Mark II computer, Hopper was credited with coining the term "bug" in reference to a glitch in the machinery. The first bug was actually a moth that flew through an open window and into one of the Mark II's relays, temporarily shutting down the system. It was removed and pasted into the logbook. From then on, if Hopper's team was not producing numbers, they claimed to be 'debugging' the system. This is not an "urban legend;" the remains of the moth can be seen in the logbook that is kept at the Naval Surface Weapons Center.

After the war, Hopper joined the Eckert-Mauchly Computer Corporation as a Senior Mathematician. The company's new product was UNIVAC, a computer that recorded information on high-speed magnetic tape, an improvement over the standard punch cards of the day. Remington Rand purchased the Eckert-Mauchly Company in 1950, which in turn merged

into the Sperry Corporation in 1955. Hopper stayed on at Sperry, becoming systems engineer and director of automatic programming from 1952 to 1954. From this beginning "Amazing Grace" became a leader in the development of modern computing systems, creating a program [a compiler] to translate programmer's code to machine language, and contributed to the invention of the COBOL programming language. A true visionary, Hopper conceptualized that a much wider audience could use the computer if there were tools that were both programmer-friendly and application-friendly. Hopper wanted to write computer programs that would allow other scientists, and ultimately non-scientists, to use computers directly, instead of having to depend on computer specialists to do this for them.

In 1966, Hopper's age forced her to retire from the Naval Reserves. But, in less than seven months, the Navy recalled her from retirement in order to help standardize high-level naval computer languages. Her original reappointment was for six months, but it was later extended indefinitely. Hopper remained an active-duty officer or a reservist for 43 years and in 1983 received a special Presidential appointment to the rank of Rear Admiral. At the time of her retirement in 1986, she was the oldest officer ever to serve on active duty.

Grace Hopper always sought ways to make ideas and procedures more accessible to greater numbers. She was innovative, because innovation was what was necessary at the birth of the computer age. Her curiosity as to what made things work and how they could be made to work better, an attribute from childhood, was probably her greatest strength. If not that, then it was her determination to see her visions become realities. She didn't believe in taking the safe way or of being satisfied with previous accomplishments. Hopper believed in pushing ahead to wherever this would take her, certain that it would be where she belonged. She preached this to young people, who she believed could and should change the world. She had a maxim, which she taught to youngsters: "A ship in port is safe, but that's not what ships are built for."

Grace Hopper was an inspiration to women and scientists everywhere. She was not only a remarkable woman; she was a remarkable person. Her outstanding contributions to computer science benefited academia, industry, and the military. Her early recognition of the potential for commercial applications of computers, and her leadership and perseverance in making this vision a reality, paved the way for modern data processing. In her 40 years in computing, Hopper made major contributions to the field that developed "the machine that assisted the power of the brain rather than the muscle." Hopper felt her greatest contribution was "all the young people I've trained." Grace hoped to live to the age of 94 because she

wanted to be around for New Year's Eve on December 31, 1999, but she miscalculated, dying in her sleep on January 1, 1992 in Arlington, Virginia. She was buried with full military honors at Arlington National Cemetery.

Quotation of the Day: "Humans are allergic to change. They love to say, 'We've always done it this way.' I try to fight that. That's why I have a clock on my wall that runs counterclockwise." - Grace Hopper