

HOPPER, Grace (Murray). December 9, 1906–January 1, 1992.

VASSAR COLLEGE (BA 1928), YALE UNIVERSITY (MA 1930, PhD 1934).

Grace Brewster Murray was the daughter of Mary Campbell (Van Horne) (1883–1960) and Walter Fletcher Murray (1873–1947). Her parents were both born in New Jersey and married in 1903. Her mother had attended a private girls' school in New York, and her father graduated from Yale University in 1894 and became an insurance broker. She had two younger siblings, Mary (b. 1909) and Roger Franklin II (1911–1998); all the children were born in New York City. Her maternal grandfather, John Van Horne, was a civil engineer for the City of New York, and she accompanied him on surveying trips as had her mother when she was young. Her paternal grandfather had emigrated from Scotland to New York City when he was eleven years old.

Grace Murray attended the Graham School 1911–13 and the Schoonmaker School 1913–23, both private schools in New York City. She spent the year 1923–24 at, and graduated from, an all-girls boarding school, Hartridge School, in Plainfield, New Jersey. She enrolled at Vassar College in Poughkeepsie, New York, in 1924 and was elected to Phi Beta Kappa in her senior year. She graduated in 1928 with a degree in mathematics and physics, having attended beginning courses in all the sciences offered, as well as business and economics courses. She attended Yale University on a Vassar College fellowship 1928–29 and on a Sterling scholarship 1929–30 and received her MA in 1930.

During her childhood, Murray spent her summers at a family house on Lake Wentworth, near Lake Winnepesaukee, in Wolfeboro, New Hampshire. She met her future husband, Vincent Foster Hopper (1906–1976), in Wolfeboro during the summer of 1923. Their marriage took place on June 15, 1930, at the West End Collegiate Church in New York City, the same church in which her parents had been married. Vincent Hopper had graduated from Princeton in 1927 and received his MA there in 1928. That year he began his long association with New York University as an instructor of English in the School of Commerce, Accounts, and Finance (now the Leonard N. Stern School of Business).

Grace Hopper studied at Yale 1930–31, again on a Sterling scholarship. In 1931 she joined the faculty at Vassar as an assistant in mathematics. In 1934 she received her PhD from Yale and was promoted to instructor at Vassar. In 1932 Vincent Hopper was promoted to assistant professor, and in 1938 he received his PhD in English and comparative literature from Columbia University with a dissertation on medieval number symbolism. Grace Hopper apparently became interested in number symbolism, since in 1936 she published an article in the *Monthly* that begins “of all the fanciful and philosophical attributes said to have been assigned to numbers by the Pythagorean theorists, the most enigmatic is the apotheosis of the number 7 as Athena, sprung full-armed from the head of Zeus” (1936, 409).

In 1939 Grace Hopper was promoted to assistant professor, and she and Vincent Hopper built a home in Poughkeepsie. In 1940 she and members of a mathematics class made a movie animating a plane curve; she reported on the project in a note in the *Monthly*. Vincent Hopper remained at NYU, commuting to Poughkeepsie on weekends, and was promoted to associate professor in 1941. During 1941–42, Grace Hopper was absent on leave half-time from Vassar and studied at NYU's Center

for Research and Graduate Education in Mathematics (later Courant Institute of Mathematical Sciences) on a Vassar Faculty Fellowship.

After the bombing of Pearl Harbor in December 1941, Grace Hopper's husband and brother both enlisted in the Air Force, and her parents and sister worked in war-related jobs. A maternal great-grandfather, Alexander Wilson Russell, had been a rear admiral in the navy, and Grace Hopper wanted to join that branch of the military even though women were not accepted into the regular navy. Because she was over-age for enlistment in the WAVES (Women Accepted for Volunteer Emergency Service), and she worked in a profession (mathematics teaching) that was considered crucial, Hopper asked for a waiver to join the WAVES. During the summer of 1943 she taught an accelerated wartime calculus course as an assistant professor at Barnard College and joined the US Naval Reserve in December 1943. Hopper began a leave for military service in 1944 and from May 4 to June 27 of that year she served as an apprentice seaman and midshipman at the United States Naval Reserve Midshipman's School for Women in Northampton, Massachusetts. When she graduated she was commissioned a lieutenant (jg). By this time she and Vincent Hopper had separated; they were divorced in 1945 and had no children.

Immediately after graduation, Grace Hopper was assigned to work at Harvard University. On July 2, 1944, she reported for duty at the Bureau of Ships Computation Project housed in the Cruft Research Laboratory and began work on the Mark I computer, formally known as the Automatic Sequence Controlled Calculator. She worked as a mathematical officer under the direction of Howard Aiken, a commander in the Naval Reserve, writing code for the Mark I and, later, for the Mark II, the first multiprocessor. She was also given the job of compiling notes written about the Mark I into a book. She both edited and contributed to the volume that appeared in 1946. Although she continued to work at Harvard, Hopper's official assignment changed in October 1945 to the Boston branch of the Office of Research and Inventions. Hopper's transfer came shortly before the January 1, 1946, transfer of the Computation Laboratory from the sponsorship of the Bureau of Ships to that of the Bureau of Ordnance.

On June 1, 1946, Hopper was promoted to lieutenant and on August 7, 1946, she was released from active duty. She was thirty-nine and too old to transfer to the regular navy, which by then was admitting women. She decided to remain in the naval reserve and stay at the Harvard Computation Laboratory as a research fellow in engineering science and applied physics rather than return to her position at Vassar, where she had been promoted to associate professor in 1944. In 1947, while Hopper was still writing code for the Mark II at Harvard, a moth caused a failure in one of that machine's relays. The actual moth was saved in a [logbook](#). In 1979, in the first issue of the IEEE's *Annals of the History of Computing*, James J. Horning wrote that "Capt. Grace Hopper turned up the original 'bug' in going back to the MARK I log books—the bug for whom debugging was named" (p. 70). In 1981 Hopper repeated that claim when she related the anecdote, "The First Bug," in the same journal (3, no. 3: 285–86); she correctly identified the computer as the Mark II but mistakenly put the year as 1945 instead of 1947. Since then several articles have appeared that document that both the terms "bug" and "debug" preceded the discovery of the now famous moth.

In 1949 Hopper left Harvard to become senior mathematician at the Eckert-Mauchly Computer Corporation. During World War II, J. Presper Eckert and John

Mauchly had built a computer, the ENIAC (Electrical Numerical Integrator and Calculator), at the University of Pennsylvania. In 1946 they formed their own company and built the BINAC (Binary Automatic Computer), which was completed at about the time that Hopper joined them in Philadelphia and for which Hopper was to write code.

In 1950 the Eckert-Mauchly Computer Corporation was bought by Remington Rand, and Hopper's title changed to Senior Programmer. She worked on the UNIVAC (Universal Automatic Computer) and in 1952 developed its first compiler. She was made Systems Engineer, Director of Automatic Programming Development. In 1955 Remington Rand merged with the Sperry Corporation and became the Remington Rand UNIVAC Division of Sperry Rand. Hopper remained with Sperry Rand, which later merged with Burroughs and is now known as UNISYS, until her retirement in 1971.

Starting in 1955, Hopper developed the first English-language data processing language, FLOW-MATIC. Computer languages, including the business oriented FLOW-MATIC, were machine specific and by 1959 it was clear that there had to be some sort of standardization in computer languages so that the same language could be used in the growing number of computers that were being developed. Grace Hopper was one of the leaders in the movement to develop a standardized business language for computers. The result was COBOL, Common Business Oriented Language. Although Hopper is often credited with developing COBOL, she was not among those who worked on the design of the language. However, she was a technical advisor to the executive committee overseeing the development of the language, and her work on FLOW-MATIC greatly influenced the actual developers of COBOL.

In 1959 Hopper was made Chief Engineer, Automatic Programming, of the UNIVAC division of Sperry Rand. In 1961 she became Director, Research - Systems and Programming, and in 1964 was made Staff Scientist, Systems Programming. During this period Hopper also taught at the University of Pennsylvania's Moore School of Electrical Engineering, starting as a visiting lecturer in 1959 and ending as a visiting associate professor in 1963. When she retired in 1971, Hopper was made professorial lecturer in management science at George Washington University in Washington, D.C., and held that position until 1978. In 1973 the Moore School made her an adjunct professor of engineering.

During her years in the naval reserve, Hopper was promoted to lieutenant commander on April 1, 1952, and then to commander on July 1, 1957. She was involuntarily retired at the end of 1966. However, on August 1, 1967, she was returned to active duty having been asked to standardize COBOL for the navy. She was to have served only six months but did not retire again until 1986. From August 1967 until September 1968 she served in the office of the Special Assistant to the Secretary of the Navy as director of the navy programming languages group. For the next nine years, until September 1976, she was assigned to the office of the Chief of Naval Operations as the head of the programming languages section. Her last ten years in the naval reserve were spent with the Naval Data Automation Command as head of the training and technology directorate and special advisor to the commander. She was promoted to captain on August 2, 1973, and to commodore on November 8, 1983; two years later the rank was raised to rear admiral (lower half). She was on military leave from Sperry during her final four years of official employment there

and was a senior consultant for Digital Equipment Corporation after her final, again involuntary, retirement from the naval reserve in 1986.

Hopper's retirement ceremony took place on August 14, 1986, aboard the USS *Constitution*, the navy's oldest commissioned warship. Hopper had requested that site for the occasion since at seventy-nine she was the oldest officer on duty in all of the armed services; she was also the last WAVE to remain on active duty. During the retirement ceremony she received the Navy Distinguished Service Medal and was named the First Fellow of the Boston Computer Museum.

Hopper was a member of a very large number of scientific and professional organizations, including the following that are not listed below: the Data Processing Management Association, the Association of Computer Programmers and Analysts, the Franklin Institute, the International Oceanographic Foundation, the Armed Forces Communications and Electronics Association, the Planetary Society, the New York Academy of Sciences, the Oceanic Society, the American Institute of Industrial Engineers, the US Naval Institute, the Association for Women in Computing, the Charles Babbage Institute, the Navy Women's Association, the World Future Society, and the Ordnance Association. She was also a member of the Mary Murray chapter of the DAR, the Dames of the Loyal Legion, and many historical and genealogical societies, as well as the Clan Campbell Society, the Clan MacPhearson Association, the Retired Officers Association, and the American Rose Society. She served on various committees of the Association for Computing Machinery: the committee on nomenclature 1953–56, the council 1957–58, and the *Communications* editorial board 1957–58. When SIAM was formed in 1952 she was elected vice president and later served as chairman of the planning committee 1953–54 and trustee 1957–59. In 1975 she served on the *IEEE Spectrum* editorial board.

Among the many honors and awards bestowed on her are nearly fifty honorary doctorates and seven military medals. Among her awards and nonmilitary medals are the Naval Ordnance Development Award (1946), the Society of Women Engineers SWE Achievement Award (1964), the first Data Processing Management Association Computer Science "Man-of-the-Year" Award (1969), the American Federation of Information Processing Societies Harry Goode Memorial Award (1970), Yale University Wilbur Lucius Cross Medal (1972), the Legion of Merit (1973), IEEE W. Wallace McDowell Award (1979), the IEEE Computer Pioneer Medal (1983), the AAUW Achievement Award (1983), the Federally Employed Women Achievement Award (1983), the ACM Distinguished Service Award (1983), the Association of Women in Computing Ada August Lovelace Award (1983), the Federation of Government Information Processing Council Lifetime Achievement Award (1986), the National Medal of Technology (1991), and the DAR medal to women "worthy of honor" (posthumously). She was elected a Fellow of IEEE in 1962, of AAAS in 1963, of the Association of Computer Programmers and Analysts in 1972, and of the Institute for the Certification of Computer Professionals in 1981. In 1973 she was elected to membership in the National Academy of Engineering and was made a Distinguished Fellow of the British Computer Society, the first American and the first woman so honored. In 1974 she was inducted into the Engineering and Science Hall of Fame. Twenty years later she was inducted into the National Women's Hall of Fame in Seneca Falls, New York.

Captain Grace Murray Hopper Day was declared in New Hampshire on November 7, 1983, the day the Grace Murray Hopper Center for Computer Learning was

opened at the Brewster Academy, a private school in Wolfeboro. The Grace Murray Hopper Service Center of the Navy Regional Data Automation Center in San Diego, California, was dedicated on July 28, 1987. Hopper's awards and honors are displayed at the Center in San Diego. In 1996 a guided missile destroyer was christened the USS *Hopper*. She was seen by many on a segment of *60 Minutes* in 1983, the David Letterman Show in 1986, and as grand marshal of the Orange Bowl Parade in 1987. Her interview as one of eight American women of achievement was published by the Voice of America, US Information Agency, in 1984. The Grace Murray Hopper Award was established by the UNIVAC division of the Sperry Rand Corporation in 1971 and is now supported by UNISYS; it is presented annually by the ACM to the outstanding young computer professional of the year. In 1994 the first Grace Hopper Celebration of Women in Computing Conference was held. It is now held every two years and is sponsored by the Anita Borg Institute for Women and Technology and the ACM.

Grace Hopper died in her sleep at her home in Arlington, Virginia, on New Year's Day 1992. She was eighty-five at the time of her death and was buried at Arlington National Cemetery on January 7, 1992, with full military honors.

Organizational affiliations: AMS, MAA, SIAM, AWM, IMS, ACM, IEEE, SWE, AAAS, Phi Beta Kappa, Sigma Xi.

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