The the fundamental operating principles of computing

The new discipline of computing and the sciences that depend upon it have led the way in making space for women’s participation on an equal basis. That was in some ways true for Grace Murray Hopper, and it is all the more true for women today because of Hopper’s work. Grace Brewster Murray graduated from Vassar with a B. A. in mathematics in 1928 and worked under algebraist Oystein Ore at Yale for her M. A. (1930) and Ph.

D. (1934). She married Vincent Foster Hopper, an educator, in 1930 and began teaching mathematics at Vassar in 1931. She had achieved the rank of associate professor in 1941 when she won a faculty fellowship for study at New York University’s Courant Institute for Mathematics.

Hopper had come from a family with military traditions, thus it was not surprising to anyone when she resigned her Vassar post to join the Navy WAVES (Women Accepted for Voluntary Emergency Service) in December 1943. She was commissioned a lieutenant in July 1944 and reported to the Bureau of Ordnance Computation Project at Harvard University, where she was the third person to join the research team of professor (and Naval Reserve lieutenant) Howard H. Aiken. She recalled that he greeted her with the words, “ Where the hell have you been?” and pointed to his electromechanical Mark I computing machine, saying “ Here, compute the coefficients of the arc tangent series by next Thursday.” Hopper plunged in and learned to program the machine, putting together a 500-page Manual of Operations for the Automatic Sequence-Controlled Calculator in which she outlined the fundamental operating principles of computing machines. By the end of World War II in 1945, Hopper was working on the Mark II version of the machine. Although her marriage was dissolved at this point, and though

she had no children, she did not resume her maiden name. Hopper was appointed to the Harvard faculty as a research fellow, and in 1949 she joined the newly formed Eckert-Mauchly Corporation.

Hopper never again held only one job at a time. She remained associated with Eckert-Mauchly and its successors (Remington-Rand, Sperry-Rand, and Univac) until her official “ retirement” in 1971. Her work took her back and forth among institutions in the military, private industry, business, and academe. In December 1983 she was promoted to commodore in a ceremony at the White House. When the post of commodore was merged with that of rear admiral, two years later, she became Admiral Hopper. She was one of the first software engineers and, indeed, one of the most incisive strategic “ futurists” in the world of computing.

Perhaps her best-known contribution to computing was the invention of the compiler, the intermediate program that translates English language instructions into the language of the target computer. She did this, she said, because she was lazy and hoped that “ the programmer may return to being a mathematician.” Her work embodied or foreshadowed enormous numbers of developments that are now the bones of digital computing: subroutines, formula translation, relative addressing, the linking loader, code optimization, and even symbolic manipulation of the kind embodied in Mathematica and Maple. Throughout her life, it was her service to her country of which she was most proud. Appropriately, Admiral Hopper was buried with full Naval honors at Arlington National Cemetery on January 7, 1992.

Pursuing her belief that computer programs could be written in English, Admiral hopper moved forward with the development for Univac of the B-O compiler, later known as FLOW-MATIC. It was designed to translate a language that could be used for typical business tasks like automatic billing and payroll calculation. Using FLOW-MATIC, Admiral Hopper and her staff were able to make the UNIVAC I and II “ understand” twenty statements in English. When she recommended that an entire programming language be developed using English words, however, she “ was told very quickly that she couldn’t do this because computers didn’t understand English.” It was three years before her idea was finally accepted; she published her first compiler paper in 1952.

Admiral Hopper actively participated in the first meetings to formulate specifications for a common business language. She was one of the two technical advisers to the resulting CODASYL Executive Committee, and several of her staff was members