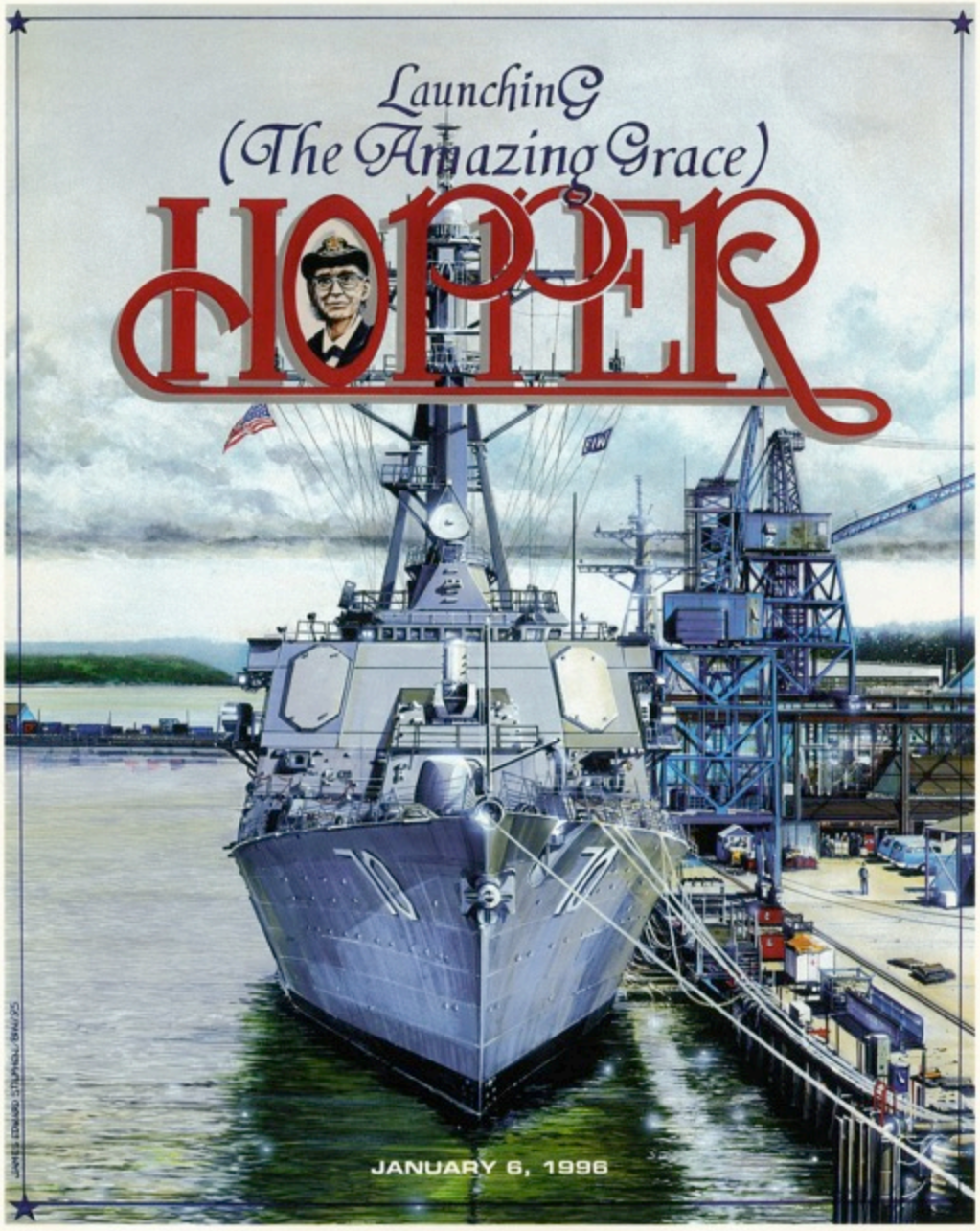
Grace Murray Hopper

Admiral of the Cyber Sea


Launching
(The Amazing Grace)
HOPPER
JANUARY 6, 1996

WORLD'S GREATEST CALCULATOR—A front view of the automatic sequence controlled calculator, the greatest mathematical calculating machine, to be presented to Harvard today.

HarvardGetsHugeCalculator

51-Foot Machine Costs $250,000, Took Six Years

By DOROTHY G. WAYMAN

A gray-eyed six-foot blond Viking from Wisconsin, Com Howard H. Aiken, USNR, says that the 51-foot "Automatic Sequence Control Calculator" which he invented and International Business Machine Corporation spent $250,000 and six years to build, and Harvard now has fallen heir to, was only "a lazy man's idea."

The calculator will be presented to Harvard University today at University Hall in a formal ceremony by Thomas J. Watson, president of the International Business Machines, Inc., and will be accepted for the university by President James B. Conant.

"Eight years ago, as a graduate student, I picked as a thesis for my doctorate at Harvard a paper on the Theory of Space-Charge. I spent a year working out the calculation necessary to the paper, and decided there was a field for a machine that would do calculations for scientists. I worked two years on the theory of such a machine. It was going to cost a lot of money and need a lot of technicians to build it. I told Mr. Thomas J. Watson, president of the IBC, about my idea and the credit for the rest of it belongs to Mr. Watson and his company and the men who worked on it with me," explained Com Watson, who before the war came to Harvard as instructor in physics and communication engineering. He is at present "on leave" as associate professor of applied

COM HOWARD AIKEN

mathematics in the Harvard Graduate School of Engineering.

Machine 51 Feet Long

The A. S. C. Calculator is a neat little gadget, longer than a Deisel locomotive, set up behind dust-proof glass panels in the basement of the Harvard Computation Laboratory, with four Navy mechanics to run it. The machine can "think" in terms of mathematics, but it cannot oil itself or dust itself or push its own buttons to start it working.

It is 51 feet long, 8 feet high, and about as thick as a row of Postoffice mail boxes, and looks roughly like a huge telephone switchboard. Its interlocking panel contains 500 miles of wire, 3,000,000 wire connections, 3500 multiple relays with 35,000 contracts, 2235 counters, 1464 10-pole switches and 72 adding machines in tiers.

Speaking unscientifically, a scientist "states his problem" by punching keys or feeding in punched cards at one end; a mechanic pushes the right buttons, and the big billboard begins clattering and clicking behind its glass panels until the answer comes out at the far end, on either a punched ticket or a typewritten slip. You can have the answer in whichever form you choose by punching the right button in the beginning.

For the duration, the Navy gets the benefit of this lightning calculator. It can give you the answer to a mathematical problem 50 times faster than the best mathematician, with all his desk-computators and logarithmic tables, could work it out.

The average citizen steers clear of mathematics, but here's an example. A certain mathematical calculation that used to take four expert mathematicians three weeks to figure out was answered by the machine in 19 hours. The reason, as Com Aiken points out with dry terseness, is, "The average man cannot carry on abstruse mathematical calculations for more than six hours at a stretch without fatigue; the machine never gets tired."

Will Reduce Errors

In civilian usage, this machine will greatly speed the labors and reduce the errors of scientists using applied mathematics, astronomy, chemistry, physics, engineering, pure mathematics. If that sounds technical, just remember that research and calculations in such fields are basic to making better radios, better synthetic silk stockings, automobiles, bridges, etc. The researchmen have to find basic formulae and they find them by applied mathematics in many cases.

Any amateur mathematician who wants to check his own speed against the machine can try figuring "log 10 x" to 23 places. The machine can do it in one minute, 28 seconds. Folks who do not think in logarithms can try by dividing any 23-number figure by another 23-number figure. The machine answers that one in 14 seconds. It takes this reporter about 14 seconds just to write "divide 26, 789, 574, 392, 057, 847, 732, 965" and the 23-number divisor is not yet written!

High naval officials interested in science will be guests at the ceremony, including Rear Adm Edward L. Cochrane, U. S. N., chief of the Bureau of Ships; Rear Adm A. H. Van Keuren, director of the Naval Research laboratory; Rear Adm J. A. Furer, coordinator of research and development, and others. Rear Adm Robert A. Theobald, U. S. N., commandant of the 1st Naval District, and his staff. Capt. John S. Barleon, U. S. N., will also participate.

Assigned to Take Charge

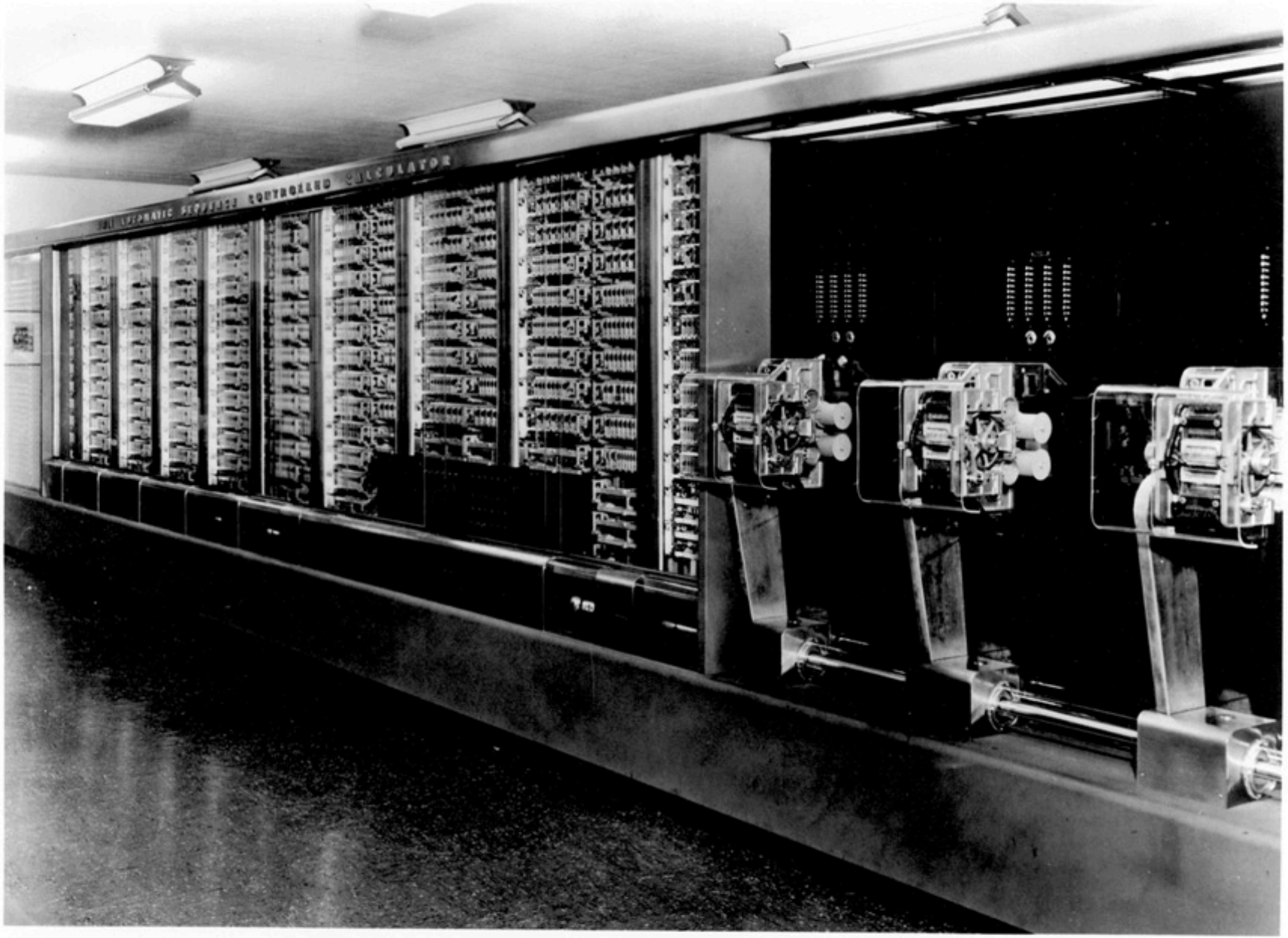
Com Aiken has been assigned by the Navy to be in charge of the Calculator, since its installation at Harvard. He has just finished three years active duty in charge of a Navy school.

Associated with Com Aiken, in the development of the machine and in the patent issued for it, are Clair D. Lake, Frank E. Hamilton and Benjamin M. Durfee, who worked with him on it at the IBC engineering laboratory in Endicott, N. Y. Ens Robert V. D. Campbell, USNR, was also closely associated in the design and now in the operation of the Calculator.

"This is not a mechanical brain" warns Com Aiken. "A good mathematician is needed to set the problem which the machine is asked to calculate and answer. If the problem is wrongly stated, the answer will be erroneous. Even if the problem is rightly stated, it is possible for a mechanical error to occur. However, mathematicians who can state a problem, can also state a check on the answer, which the machine will calculate."

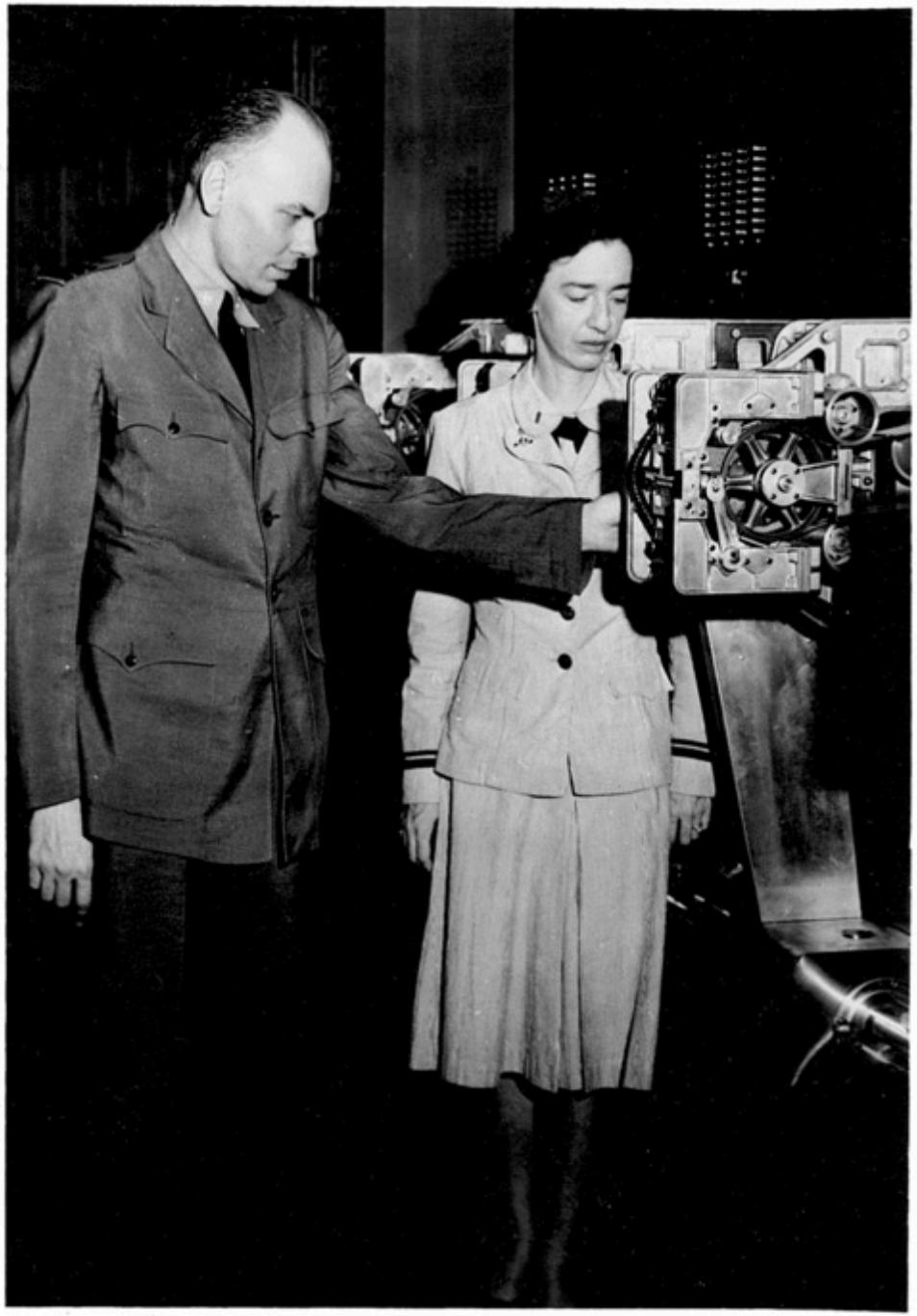
Aiken is very factual and critical of his brain-child; but Harvard mathematicians wax lyrical, describing it as "an algebraic super-brain that will solve practically any known problem in mathematics." Among the functions it performs are (1) computation and tabulation (2) evaluation of integrals (3) solution of differential equations (4) solution of simultaneous linear algebraic equations (5) harmonic analysis (6) statistical analysis.

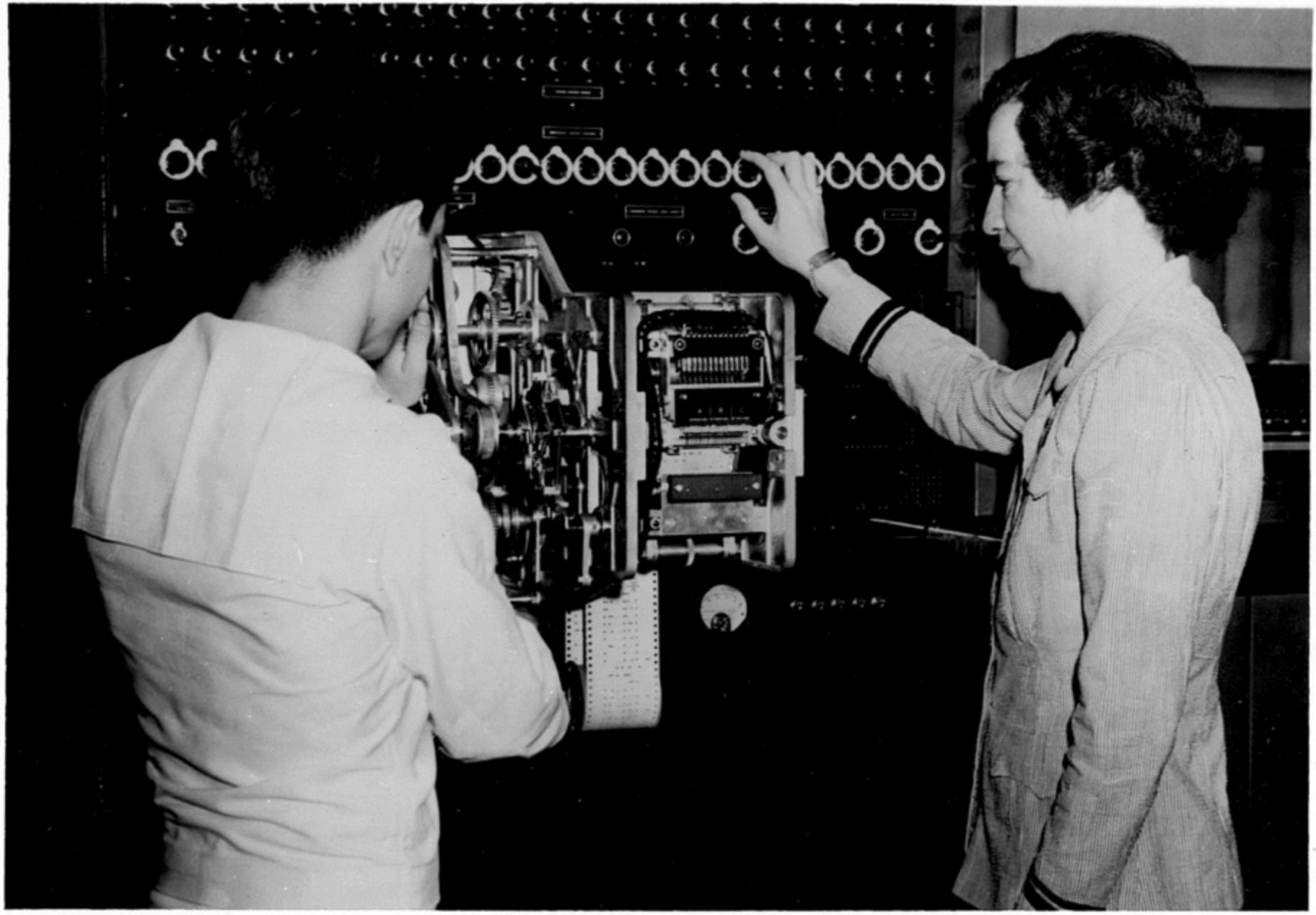
Today the Harvard and Navy mathematicians are going to have a field-day of wallowing in higher mathematics. Com Aiken has posed a little problem that covers one wall of a room on a blackboard, and the experts are going to watch the machine digest the figures fed in at one end, and spit out at the other end on a neat typewritten slip to 23 decimal places!



IBM Automatic Sequence Controller Calculator


IBM AUTOMATIC SEQUENCE CONTROLLED CALCULATOR





Japs Squeezed Into Tiny Trap At Guam's Tip

U. S. Pacific Fleet Headquarters, Pearl Harbor—(AP)—American Marines and soldiers on Guam have compressed several thousand squirming Japanese into the northern one-tenth of the island, bringing complete reconquest of the former U. S. naval base very near today.

More Bad News

Other bad tidings for the enemy:

Apparent neutralization of Yap Island, once-mighty Japanese airbase in the Carolines 600 miles southwest of Guam.

Slicing of the Japanese supply line between Aitape and Wewak in British New Guinea.

Reports — Tokyo-originated—of American airplanes over the Philippines on Monday (U. S. time).

The Tokyo raido said a large plane dropped "three small bombs harmlessly into the sea" near Davao, Mindanao, at 1 a. m. An hour later another plane "fled before reaching Davao."

No Verification

There were no substantiating reports from Lieut. Gen. George C. Kenney's Far Eastern Air Force, which patrols from the Australian-New Guinea area toward the Philippines. There has been no Allied air attack upon the Philippines since mid-April, 1942, before the fall of Corregidor.

The Japanese belatedly acknowledged a two-day raid by an American carrier task force upon the Bonin and Kazan islands, 1,000 miles north of Guam and only about 600 miles from Tokyo, but said 41 U. S. planes were shot down and an American cruiser damaged.

11 Vessels Sunk

Admiral Chester W. Nimitz previously announced that 11 Japanese vessels were sunk and 30 other surface craft damaged, and 13 enemy planes were destroyed, for the loss of 16 American planes, last Thursday and Friday.

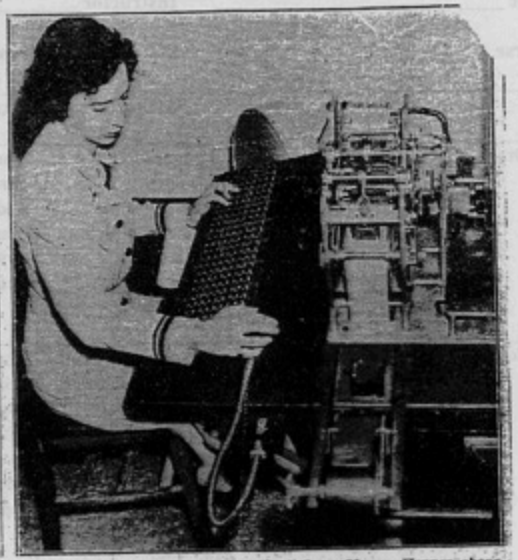
Gen. Douglas MacArthur reported a 30-ton mid-day bombing raid Sunday upon Yap, 800 miles east of Mindanao, and added:

"There was no attempt at interception. The enemy's air base appears to have been neutralized by our continuous attacks."

MacArthur also announced that an American counter-envelopment force east of Aitape had inflicted heavy casualties upon trapped Japanese units, severed the enemy supply line from Wewak, and was advancing westward on Afua village.

Resort Association Asks Early Order

Presti ... Math Made Easy With New 'Gad



IT TAKES AN EXPERT—WAVE Lieut. Grace Murray Hopper, above, manipulates a "manual tape punch," accessory instrument to the Navy's new 35-ton electric calculator, reportedly able to solve almost any known problem in applied mathematics. Costing $250,000; the giant machine, which took eight years to develop, was presented yesterday to Harvard University, but will remain for the duration a Navy project. Lieutenant Hopper, daughter of former Plainfielder, Walter Murray of New York City, is the niece of Roger F. Murray of 901 Madison Ave.

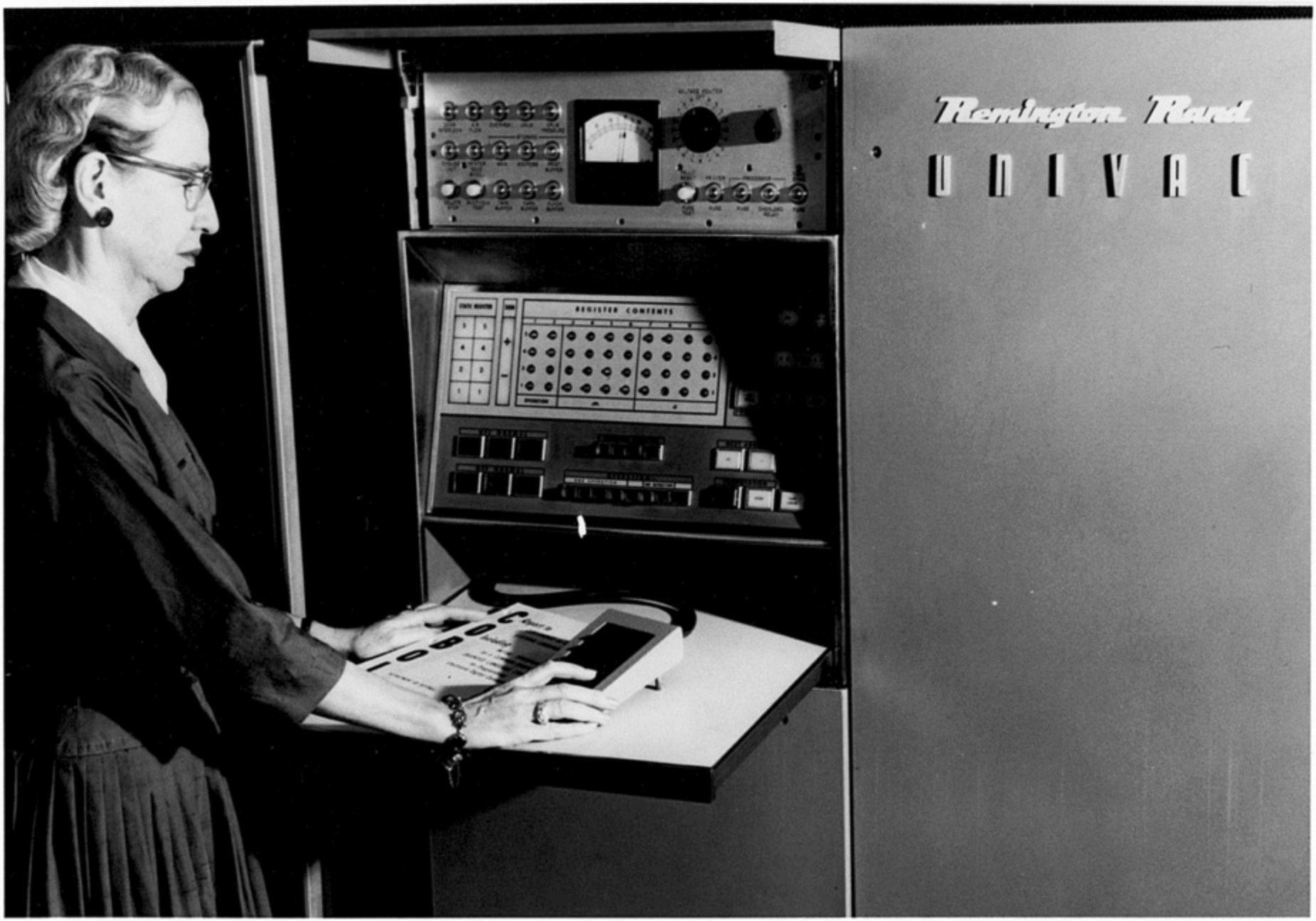
Plainfielder's Niece Is Operator of Robot 'Einstein'

Former Vassar instructor and a Yale Ph.D., Lieut. Grace Murray Hopper, who was graduated in June at the head of her class of 800 WAVE officer candidates, is one of the expert personnel assigned to the Navy's formidable new electric calculating machine, a 35-ton instrument reported capable of reaching the solution to almost any known problem in applied mathematics.

Niece of Plainfielder

[illegible] of Roger F. Murray of 901 Madison [illegible] daughter of Mr. and Mrs.

1,000 American Bombers Back


Remington Rand
UNIVAC
REGISTER CONTENTS

first to receive

dpma's

computer sciences man-of-year award

THE First DPMA Computer Sciences Man-of-the-Year Award, recognizing, internationally, individuals who have made outstanding contributions through distinguished service to the field of computer sciences, will be presented during the General Assembly on June 17.

Recipients of this new annual award are selected from a list of eligible candidates submitted by DPMA Chapters without regard for membership affiliation. Nominations are open to all men and women without restriction so long as the nature of their service or contributions directly relates to the advancement of the computer sciences.

CDR. Grace Murray Hopper, USNR, Ret. (presently on active duty) has been selected to become the first recipient of this distinguished award. She is eminently qualified.

Career in Computer Sciences

A graduate of Vassar College, where she was Phi Beta Kappa, she holds an MA and PhD from Yale University. CDR. Hopper is presently serving as Director, Navy Programming Languages Group, Office of Information Systems Planning and Development, U.S. Navy. Although she retired in 1966, CDR. Hopper was recalled to active duty in 1967. Currently she is on special military leave from UNIVAC, Division of Sperry Rand Corporation, where she is Staff Scientist, Systems Programming.

Dr. Hopper's experience with computer sciences spans most of her career life. Upon graduation from the United States Naval Reserve Midshipman's School-W at Northhampton, Massachusetts in 1943, she was commissioned Lieutenant (JG) and ordered to the Bureau of Ordnance Computation Project at Harvard. There, in 1944, she learned to program the first large-scale computer, Mark I. Subsequently she contributed to the development of Mark II and Mark III. Later she was instrumental in the development of UNIVAC I, the first commercial electronic large scale computer.

Dr. Hopper's career has been marked by outstanding achievement. Her knowledge of computer sciences is extensive, and she has shared that knowledge through a vast number of papers and articles on various aspects of computer related subjects. In addition, CDR. Hopper serves as Visiting Associate Professor at the Moore School of Electrical Engineering, University of Pennsylvania, where she has taught since 1959.

Active in Standards Development

Among awards she has already received are the 1964 Achievement Award by the Society of Women Engineers, and the Naval Ordnance Development Award, received in 1946. She was elected Fellow of the Institute of Electrical and Electronic Engineers, and has also been honored by the Philadelphia Chapter of that organization. She is also a Fellow of the American Association for the Advancement of Science.

Dr. Hopper served on the ASA X3.4 Committee on the standardization of computer languages, and was instrumental in the first meeting of CODASYL. CDR. Hopper is an active member of the Association for Computing Machinery and a member of the Franklin Institute.

CDR. Hopper assumed her present Navy assignment in August of 1967 reporting to the Special Assistant to the Secretary of the Navy in the Pentagon.

CDR. Grace Murray Hopper, USNR

MARY WESTATE MURRAY COLLECTION 10/99

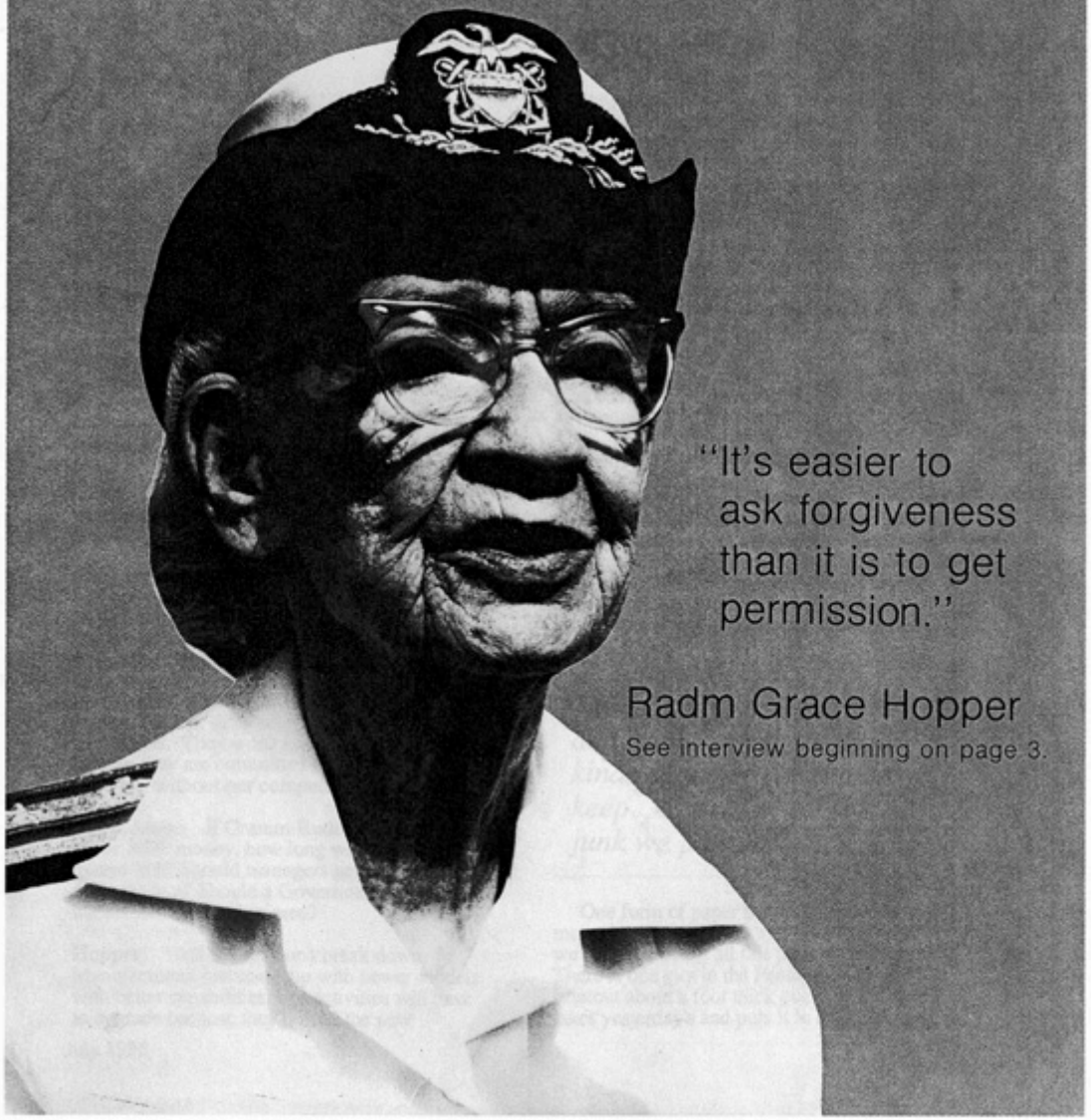
"DATA MANAGEMENT"


GRACE MURRAY HOPPER
SERVICE CENTER

CHIPS AHOY

A Navy Microcomputer Periodical

July 1986



"It's easier to ask forgiveness than it is to get permission."

Radm Grace Hopper

See interview beginning on page 3.

New York Times
1/3/92

Rear Adm. Grace M. Hopper Dies; Innovator in Computers Was 85

By JOHN MARKOFF

Rear Adm. Grace Murray Hopper, retired, a mathematician and pioneer in data processing who was a legendary figure among both computer scientists and industry executives, died New Year's Day at her home in Arlington, Va.

Admiral Hopper, who was 85 years old, had been in ill health recently, family members said, and died in her sleep, apparently of natural causes.

She had been in the Navy, as an active-duty officer or a reservist, since World War II, and received a special Presidential appointment to the rank of rear admiral in 1983. In 1982, with the retirement of Adm. Hyman J. Rickover, Admiral Hopper became the oldest officer on active duty in the armed service, which she remained until retiring herself in 1986.

Admiral Hopper made several vital contributions to the development of modern computing systems, including helping invent the Cobol programming language, which is still in widespread use in business.

Award from President

In September, President George Bush awarded her 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 woman to receive the award individually.

At the time of her death she was a senior consultant to the Digital Equipment Corporation. She joined Digital in 1986, shortly after her retirement from the Navy.

"Grace took every opportunity to challenge people young and old to consider the infinite possibilities of technology," said Kenneth H. Olsen, Digital Equipment's president.

Admiral Hopper was born Grace Brewster Murray on Dec. 9, 1906, in New York City. After receiving a Ph.D. in mathematics from Yale, she taught math at Vassar College, her alma mater, where she later became an associate professor. She was divorced in 1945 but kept her married name.

In 1949 she worked as a mathematician at the Eckert-Mauchly Corporation. The company was formed by Dr. John W. Mauchly and J. Presper Eckert, who in 1946 had developed one of the world's first electronic computers, ENIAC, at the University of Pennsylvania. Eckert-Mauchly was then building the Univac I, the first commercial electronic computer. The company was later bought by the Remington Rand Corporation.

U.S. Navy, 1985

Rear Adm. Grace M. Hopper

Earlier, in 1943, Dr. Hopper had joined the Navy. As a lieutenant assigned to the Bureau of Ordnance Computation Project at Harvard University, she worked as a programmer on a calculating device called the Mark I, a precursor electronic computers.

Recalled by the Navy

Leaving the Navy in 1946, she remained at Harvard as a faculty member in the computation laboratory. She continued to work on early Navy computers and maintained her Naval career as a reservist. Although retired from the Navy reserve in 1966, then-Commander Hopper was recalled within a year to active duty to oversee a program to standardize the Navy's computer programs and languages.

In 1962, she was elected a fellow of the Institute of Electrical and Electronic Engineers. In 1969, the Data Processing Management Association selected her as its first computer sciences "Man of the Year."

Her work led to the first practical compiler for modern computers. A compiler is a program that translates instructions written by a human programmer into more specific codes that can be directly read by a computer.

Among her many contributions, Admiral Hopper is known for coining the term "bug," which is widely used to refer to mysterious computer failures.

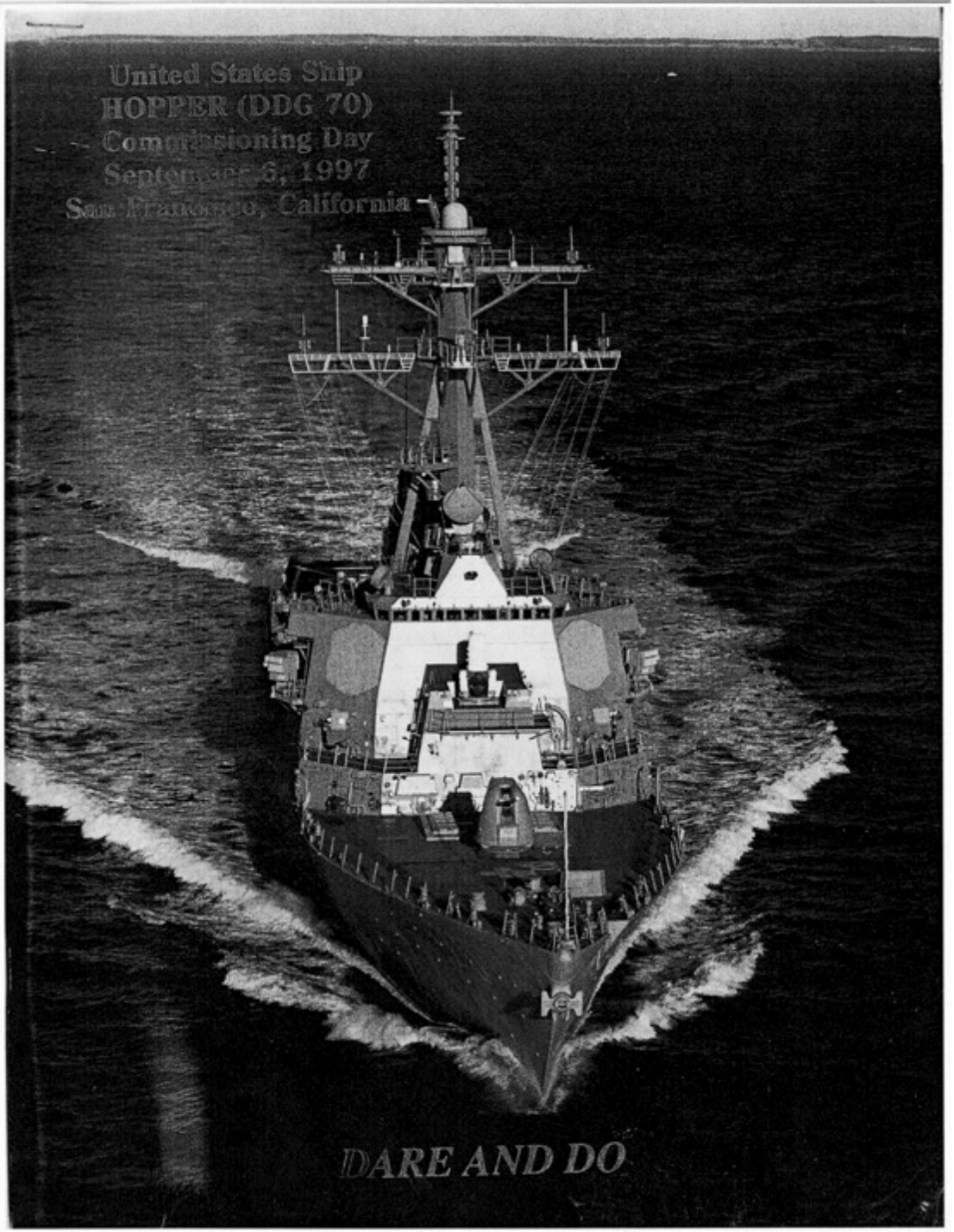
The first bug actually was — a moth, as Admiral Hopper told the story. It was discovered one August night at Harvard in 1945 inside the Mark I.

"Things were going badly, there was something wrong in one of the circuits of the long, glass-enclosed computer," she is quoted as saying. "Finally, someone located the trouble spot and, using ordinary tweezers, removed the problem, a two-inch moth. From then on, when anything went wrong with a computer, we said it had bugs in it."

Like another Navy figure, Admiral Rickover, Admiral Hopper was known for her combative personality and her unorthodox approach.

A self-described "boat rocker," she once said in a speech that she hoped to live until the year 2000. "I have two reasons," she said. "The first is that the party on Dec. 31, 1999, will be a New Year's Eve party to end all New Year's Eve parties. The second is that I want to 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 is survived by a brother, Dr. Roger F. Murray II of New Hampshire, and a sister, Mary Murray Westcott of New Jersey.


United States Ship
HOPPER (DDG 70)
Commissioning Day
September 6, 1997
San Francisco, California
DARE AND DO