

# Dayton Codebreakers

*A story so important it was secret for 50 years*



US Navy Cryptanalytic Bombe, National Cryptologic Museum, Ft. Meade, MD

## An important story

### ***Dedicated to those who worked in Building 26, 1942-1946***

The mission of this site is to tell the story of hundreds of people who worked at the United States Naval Computing Machine Laboratory, a top secret project in Dayton during World War Two. These people kept their secret for over fifty years. They produced machines which were crucial to the war effort and helped to save the lives of tens of thousands of troops, on land and sea, around the world.

Please take a look—there are hundreds of pages of declassified documents, rosters of personnel, photographs and more. (An easy way to check this out is to visit the [Sitemap](#) page.) I have added a new bibliography page brought up to date to include burgeoning information about cryptography on the web.

This site originates with and is maintained by Debbie Anderson in Dayton, Ohio. My father was Joseph Desch, Research Director for the NCML. This site is an outgrowth of my own efforts to learn more about the story behind my father's secret work and a desire to share what I have learned. It also is a resource for the facts behind the documentary **Dayton Codebreakers**.

I am grateful to the [Archive Center](#) at [Dayton History](#), the [Wenger Command Display](#) in Pensacola, Florida, friends at the NSA [Center for Cryptologic History](#) and the [National Cryptologic Museum](#), and the many veterans—WAVES and sailors— who have been so generous over the years for a share of the photographs presented here.

Thanks for learning about a part of Dayton's, and the nation's, history.

***Launched 2001***

---

The National Cryptologic Museum has been increasing its presence on the web by offering new ways to appreciate cryptology. Puzzles and intriguing factoids are posted several times a week at their Facebook page, [National Cryptologic Museum](#). Join in the fun and get a workout for your brain.

The National Cryptologic Museum has been increasing its presence on the web by offering new ways to appreciate cryptology. Puzzles and intriguing factoids are posted several times a week at their Facebook page, [National Cryptologic Museum](#). Join in the fun and get a workout for your brain.

---

A popular page on my site, [The US Navy Cryptanalytic Bombe](#), now with new photos and a link to a bombe simulator.

Excellent update of a [page at Virmuze](#) [network of Virtual Museums] about the US Bombe with information about some components.

Watch a [YouTube video from the NCM](#) about the US Navy Cryptanalytic Bombe from the Nat'l Crypto Museum

My favorite page: The incredible amount of production at the US NCML reflected in the [By the Numbers](#) page.

Redone page of [Cryptanalytic Equipment](#) in operation at Nebraska Avenue, linked to full-size photos

## Joseph R. Desch



Joseph Desch  
1907-1987

### written by Debbie Anderson

Joseph Desch came into the world at the right place and time to become an inventor—he was born in Dayton, Ohio in 1907, just 4 years after the Wright Brothers historic flight, and about a mile from their Cycle Shop. He grew up at a time when Dayton was teeming with tinkers and craftsmen. His grandfather, father, and uncles were wagon makers who were not only wood workers and blacksmiths but precision tool-makers and problem-solvers. On all his free days from school he accompanied his father to the family wagonworks and was fascinated watching him forge tools. Once Joe discovered radio, at the age of eleven, it was natural for him to assume that he would build his own equipment. He taught himself the necessary skills, and when he began experimenting with various components, he used tools which he would design and his father fabricate.

He attended Emmanuel elementary school, attached to his neighborhood Catholic parish, then won a scholarship to the preparatory (high) school of the University of Dayton. Later, while attending college at U.D., Joe worked evenings as an inspector at Day-Fan Electric in Dayton, supervising radio testing and production. After graduation he went to General Motors Radio where he again supervised radio testing, and there he met two people who were to play large roles in his life—his future wife, Dorothy, whom he married in 1935, and Robert Mumma, who continued to be his colleague and friend for the next 50 years.



Joe, 2nd row, 3rd from left

After he supervised the liquidation of General Motors Radio in 1933, he conducted teletype communications research for Telecom Laboratories, which was financed by Charles Kettering. Two years later he was hired by Harry Williams as foreman for the Process Laboratory at the Frigidaire Division of General Motors, again in Dayton. He then followed Williams to the National Cash Register Company in 1938 to form the innovative Electrical Research Laboratory at the direction of Colonel Edward Deeds, then President of the Company. This was the opportunity Joe needed to establish himself in electronics research. At Deed's direction he conducted research to implement pioneering ideas regarding the use of tubes and circuitry in counting devices, with the idea of developing high speed mathematical computing machines to augment or replace the Company's mechanical machines. The idea of applying electronic counting to calculating mechanisms occurred to him when reading of a thyatron (gas-filled tube) counting ring of five places (5 digits, not five orders) developed by English scientist Wynn Williams. (This particular counting ring was used to scale down impulses from the Geiger-Mueller tube used in radioactive emanation research). He wrote:



Teletype for Charles Kettering

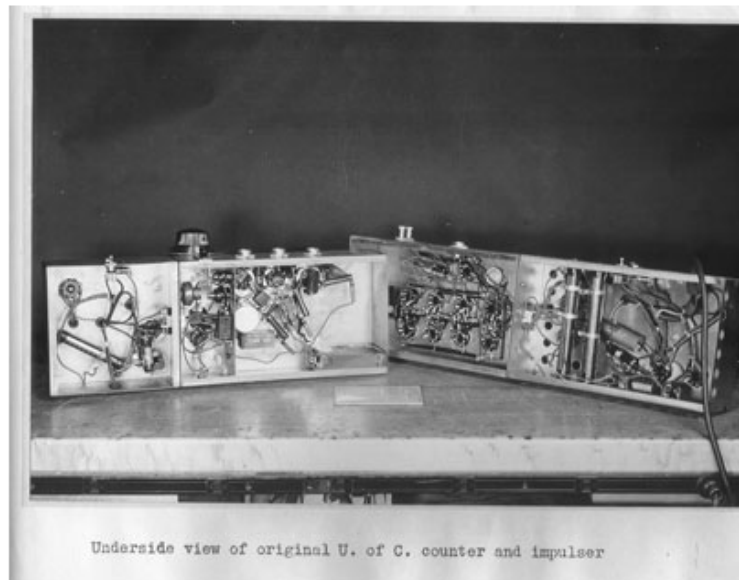
*Two kinds of counters were used: high vacuum counters using "trigger tubes" and gas tube counters using thyatrons. The idea of using counters arranged in groups of ten, for division by ten, that is decimal counting, or scale of 10 counting, became evident to me in my search for ways and means to effect electrical arithmetical computings. . . .since gas tube counters required fewer tubes, could probably be made smaller, and were completely reliable, we decided to begin our research work on this type of counter. . . . A miniature gas tube or thyatron was developed which has proven completely satisfactory, enabling us to attain much higher operating speeds than the most optimistic contemporary investigators.*

Of the thyatron, he further wrote "This tube, later used in quantity in Navy equipment for purposes other than counting , was developed for production from our laboratory type by the Hygrade Sylvania Tube Co., . . . Considerable time and effort were expended in perfecting this gas tube (thyatron) for counting use." Col. Deeds of NCR was known in the national scientific community and had formed a relationship, both personal and professional, with Vannevar Bush of MIT (the Massachusetts Institute of Technology). This relationship had an irrevocable influence on the direction of the Electrical Research Lab . Drs. Vannevar Bush and Samuel Caldwell of MIT conducted research at MIT under NCR sponsorship, concurrent with the counter work at NCR, working towards a "Rapid Arithmetical Machine". This long-standing professional exchange of ideas contributed to a critical turn in the goals of the lab's research in 1940, away from research to applied technology:



*In the later summer of 1940 we were approached by Dr. George Harrison, Chairman of Section D3, Instruments, of the NDRC (National Defense Research Council) and requested to aid in the development of electronic counters for war, capable for very high speed counting. The research objective was the development of a counter capable for accurately counting impulses at the rate of one million or more per second. Presumably we became known to Dr. Harrison through Dr. Caldwell and Dr. Bush . . .*

The Lab's initial work on the problem brought the top speed from 1,500 impulses per second (ips) to about 150,000 ips. When Dr. Coleman, assistant to Dr. Harrison of the NDRC, saw the new proposal Desch made involving a resetting-type binary counter was identical to a system that the University of Chicago had already developed, he asked him to visit the U. of C. A second six-month contract was received and during this period the work was moved to NCR, where the best reliable speed of this counter progressed from about 400,000 counts per second to a reliable in-field speed, at the time of the report, of 1,000,000 ips. The counter was to be used, unknown to Desch and the Lab, in the Manhattan Project. Their success gave them entry into the electronic research community that included MIT, the University of Chicago, RCA, General Electric and Eastman Kodak. The Navy ultimately would pick the NCR lab to develop and build an American version of the British "Bombe," a machine used to analyze the German Naval code Enigma. But first, the successes of the lab and the leadership of Joe Desch made him a prime candidate to evaluate the design for a totally electronic deciphering device created by a group of MIT academicians. While not an expert in cryptanalysis, he gave the opinion that the implementation of the design was not possible, primarily because of the large number of tubes necessary. Believing that the American version of the Bombe could be built using mechanical and electronic components, and recognizing NCR's past accomplishments, the Navy moved ahead.



Underside view of original U. of C. counter and impulsor

"They took us over" Desch said in 1973. Cmdr. Ralph Meader became head of the Naval Computing Machine Laboratory, housed in Building 26 on NCR's large campus. Desch, serving as Research Director, moved his lab and staff from Building 10 to this isolated building, located conveniently next to railroad tracks—ideal for nighttime shipments of equipment. Surrounding Building 26 with armed Marine Guards, and taking over NCR's summertime educational barracks, Sugar Camp, to house incoming WAVES, the Navy set upon the facilities to build the machines that would regain Allied control of the Atlantic Ocean. Lacking complete information on how the British devices worked, and not having received the promised prototype, Desch and his group had to complete their own design under tremendous pressure. This was the period when the Battle of the Atlantic was at its height, and the losses in shipping were mounting rapidly. The U-boat war was concentrated in the western part of the Atlantic, close to home and embarrassing for the US Navy which had taken over the protection of the Europe-bound convoys. The British had believed that they could solve the problem of breaking the codes of the U-boat fleet, but their lack of progress encouraged the US Navy to undertake their own decryption activity. After several false starts and redesigns, the first American Bombes were delivered to the Navy in 1943 and for the next two years Desch and Mumma continued to improve the devices and deliver machines on a regular schedule to the Naval Communication Annex on Nebraska Avenue in Washington, D.C.

The Navy also used the Desch home, because it was secure, to house guests visiting the project. Having only two bedrooms, and the "spare" being used by Cmdr. Meader, everyone from "Admirals in the Navy to Lords of Parliament" slept on the living room floor. Photos that Joe took show guests as varied as Adm. Joseph Redman, Capt. Joseph Wenger, and Cmdr. Travis of Bletchley Park; years later Joe also mentioned that Alan Turing was among those who "all had to sleep on the floor!" The Desch household was also a home-away-from-home for the WAVES, whose visits were later described not only by Dorothy but by her sister, her brother and their families. As the work on the design of the Bombes came to fruition in 1943, hundreds of people began arriving at NCR. While the original Laboratory staff was ten to twenty people, the complement grew to over one thousand by 1944. Enlisted Navy personnel came as early as February 1943 followed by train loads of WAVES in April. At its height the Laboratory included 100 officers and enlisted personnel and 600 WAVES, and a large civilian contingent. Living at Sugar Camp the WAVES marched to and from Building 26. Few of these people, however, knew of the purpose of the equipment they were building. Only a handful of NCR engineers, and Naval officers, had full knowledge of the project.

In 1946 Joe filed an application for a patent on an electronic calculator designed by him and Bob Mumma, as part of an application initiated in March of 1940. This brought about three interferences filed in the US Patent Office between their application and one by Arthur Dickinson of IBM. Eventually these were settled in favor of Desch, in part because he proved Dickinson's design unworkable, and gave Desch and Mumma the first patent on the modern digital computer. His career after this point was noteworthy, and he was especially proud in later years of his work with Bob Mumma in the development of the NCR 304, the first completely solid state computer. It was of course an immense relief just to have projects which he could actually talk about openly once again. In the next 20 years his contracts included the NEAM class computer, the Post-Tronic class calculator, check-sorting equipment, magnetic character printing equipment, computer peripherals including magnetic tape units, high speed printers, and numerous types of equipment for the government while directing the Military Division: command and control aircraft equipment, thermal printers (including equipment on the Apollo space flights), radio rescue beacons for downed pilots, Facer-Canceller machines, zip code readers and parcel post routing systems for the Post office. Joe retired from NCR in January 1972, shortly after the death of his wife Dorothy.

A source of pride for him, despite the fact he couldn't discuss it, was the Medal of Merit he received from President Harry Truman in 1947. It recognized "civilians of the nations prosecuting the war . . . as have distinguished themselves by exceptionally meritorious conduct in the performance of outstanding services in the furtherance of the prosecution of the war." He died at the age of 80, August 3, 1987.

Posthumous honors include *National Security Agency Hall of Honor, 2011*; The George R. Stibitz Computer & Communications Pioneer Award, American Computer and Robotics Museum (Bozeman MT) 2016; in 2017 he was awarded the University of Dayton Distinguished Alumnus Award.

Education: B.S.E.E., University of Dayton, 1929;  
Professional Experience: Radio Inspector, Day-Fan Electric while attending U.D., 1925-29;  
Military experience: Lieutenant, U. S. Army Reserve  
Supervisor of test Dev't and construction, General Motors Radio, Dayton, Ohio, 1929-1933;  
Engineer/researcher, Telecom Laboratories, Dayton, Ohio [purchased by IBM], 1933-1935;  
Foreman of Process Laboratory, Frigidaire Corporation, Dayton, Ohio, 1935-38;  
National Cash Register Company, Dayton, Ohio: Director of Electrical Research Laboratory, 1938-1941; Research Director, U.S. Naval Computing Machine Laboratory (Navy title), 1941-1946;  
Manager of Electrical Research, 1946-1952;  
Supervisor Electrical Engineering, 1952-1959;  
Director, Advanced Development, 1959-1960;  
Established Military Development Division, Director Military Division, 1960-1972.  
Awards and Honors: U.S. Medal of Merit awarded by President Harry Truman, 3 October 1945.  
Professional Organizations: Nat'l Society and Ohio Society of Professional Engineers, both A. I. E. E. and I.R.E., later I.E.E.E.,  
Army Ordnance Association (President, 1967-68)  
lifetime member A.R.R.L.

[Written by Deborah Desch Anderson, 2005. This piece builds upon material originally published in "The US Bombes, NCR, Joseph Desch and 600 WAVES: The First Reunion of the US Naval Computing Machine Laboratory" in the Spring 2000 issue of the IEEE Journal [Annals of the History of Computing](#), John A. N. Lee, Colin Burke and Deborah Anderson. This article can be read [here - The US Bombes, NCR, Joseph Desch, and 600 WAVES: The First Reunion of the US Naval Computing Machine Laboratory](#).



**National Cryptologic Museum** ★ Favorites · August 3 at 6:09 PM · 🌐

Joseph Desch was an innovative engineer for the National Cash Register Company (NCR). The U.S. Navy contracted NCR in March 1942 to design and build its Bombes, which were machines used for processing the German navy's four-rotor Enigma-based messages. NCR selected Joseph Desch, head of its electrical research laboratory, to be the principal engineer on the project. The Bombes Mr. Desch designed at the NCR became a vital cryptanalytic tool in the war against Germany's U-bo... [See more](#)



35 18 shares

**THIS POST, PASTED ABOVE, RAN ON THE NCM'S FACEBOOK PAGE, AUG. 3**

**THIS DATE IN WW2**

May 2

1945 - The Battle of Berlin ends when German General Helmuth Weidling, commander of the Berlin Defense Area, unconditionally surrenders the city of Berlin to Soviet General Vasily Chuikov

Sources

[Timelines of WWII at wikipedia](#)

[Cryptologic History Calendar](#)

[This Date in Naval History](#) (hosted by the US Navy)

**RECENT UPDATES**

[3801 Nebraska Avenue](#)

There is a detailed plain text...

[Links to more information](#)

9 April 2024: Many of these...

**STRAY THOUGHTS IN THE**

**INFORMATION AGE**

The farther backwards you can look, the farther forward you are likely to see.

Winston Churchill