

70 Years Ago, January 2016!

Bill Norris was one of the founders of Engineering Research Associates. The VIP Club recognizes that event with Mr. Norris' experiences before that date.



William C. Norris



World War II Experiences



Advisory

This electronic file was created in August 2015 by scanning a paper document donated to the VIP Club's IT Legacy Committee in 2006. The committee was in its' infancy at that time thus did not record the paper's donor. The paper is now archived at the Charles Babbage Institute at the University of Minnesota.

Other IT Legacy information is available at <http://vipclubmn.org>. Scanning and formatting for the web was by Lowell A. Benson, webmaster and 2014/15 VIP Club President.

The Great Depression of the

early '30s was a major factor in determining the role I would have in World War II. Because of its adverse consequences, neither I nor any of my classmates graduating from the University of Nebraska in 1932 with degrees in electrical engineering could find positions to practice our newly acquired profession. The member with the highest grades, Laverne Ruth, enlisted in the Marine Corps. Another high ranking member and a class friend who had worked his way through college as a barber was able to find a job in a barber shop in Omaha. Due to my father's untimely death a month before graduation, I returned to the farm to help my mother avoid the fate of many Midwest farmers, which was the loss of their farms because of extremely low crop prices due to the depression and low to zero yields as a result of the worst drought in memory.

WESTINGHOUSE

After two years on the farm, I was offered a job as a sales engineer with the Westinghouse Corporation. Although I much preferred an engineering position, crop prices were still low and the drought had only partially subsided, so I accepted the offer. Soon I was able to make badly needed cash available to the farm operation.

Although I never enjoyed the Westinghouse sales job, I was successful. By 1940, I was being considered for a promotion to a district manager position with responsibility for several midwestern states. At that same time, war clouds were on the horizon, and the U.S. had commenced to build up its military capability. This activity created demand for engineers, which had been virtually nonexistent since my graduation. I learned from a notice in a U.S. Post Office that the U.S. Navy Bureau of Ordinance was hiring engineers in Washington, D.C. I applied and was quickly notified of acceptance.

Making the decision to abandon the investment of six years of my life with Westinghouse was not an easy one, but I believed that I would be unlikely to get a better opportunity any time soon to do engineering work. There was also the draft to con-

sider. I had a 1-A classification and a low registration number.

At the time I resigned from Westinghouse, I lived in Waterloo, Iowa. I left Waterloo by car in early April, 1940, around 9:00 P.M. My friend, Dr. S.A. Barrett, was with me. We had roomed at the same private home in Waterloo. His objective was sightseeing in Washington, D.C. Along the way, we stopped for several hours in East Dubuque, IL, so he could play the slot machines. Meanwhile, I napped, and then we drove on to Chicago. I spent an hour the next morning saying good-bye to Al Koch, my boss, and my associates in the Westinghouse Chicago office. We then drove, stopping only for gas and food, to Washington, D.C.

BUREAU OF ORDINANCE

I immediately reported for work at the Bureau of Ordinance (BUORD) Navy Department on Constitution Avenue and was relegated to a "bull pen" of engineers (approximately 50) engaged primarily in checking and revising blueprints for anti-aircraft gun installations on Naval ships.

The first task assigned by my supervisor (I don't recall his name) was to study the drafting instruction manual. After about an hour of perusing the manual, I reported to my supervisor that I was ready to go to work. He said that he would have something for me soon. After waiting the rest of the day and part of the next day, I observed to one of the engineers at a drafting table next to mine that the organization appeared to be awfully inefficient. He shrugged his shoulders and noted that if I didn't keep quiet, I'd be given work. His advice was to be quiet and enjoy not having an assignment. Almost a week passed before I finally received the next task, which was to check a blueprint. By that time, I was thoroughly dismayed.

I never had a sense of accomplishing anything worthwhile during my ten months at the Bureau of Ordinance. Once the horrible inefficiency of the organization became clear, I decided to get out as soon as possible. Fortunately, an alternative appeared by way of expansion of commissioned officers in the U.S. Naval Reserve. I applied and was accepted as a Lieutenant, Junior Grade.

In addition to my vivid recollection of the inef-

iciency of the organization, three others are still clear in my mind. One is the red-haired secretary. She was a source of great frustration to her boss (my supervisor). The cause was often failing to follow instructions (according to him) and, when challenged, she would remind her boss that she was being mistreated according to civil service rules. These incidents occurred frequently. They were loud and each always threatened the other with a filing of a formal complaint of inappropriate conduct. These scenes were a source of entertainment for the engineers. We always stopped work to listen and watch.

A second clear memory is of one of the engineers, Morton Sobol, more because of subsequent events than what occurred between us at the BUORD. His drafting table was close to mine, and he often stopped by to chat. In fact, during the first few months, he made a greater effort to be friendly than most of the other engineers. However, early in our relationship I sensed that he had an agenda outside of work that seemed to be very important to him, as on several occasions he invited me to attend a meeting at his place to enlarge my circle of friends in Washington. Because I sensed another agenda, Sobol didn't interest me as an associate outside of work, so I didn't accept his invitations. Later, as I became better acquainted with other engineers, one labelled Sobol as a "parlor pink," the then current term for someone with a leaning toward communism.

That information proved to be accurate. Years later, Sobol was convicted as a spy accomplice of Julius and Ethel Rosenberg. The Rosenbergs were executed for the crime of passing information to Russia regarding the atomic bomb. Sobol's punishment was a term in prison.

The third clear recollection, even after more than 50 years, is of the heated arguments I had with the U.S. Navy captain who was the commanding officer with overall jurisdiction over the section of the BUORD to which I was assigned. Under the rules, as a civil service employee in the Navy I had to have permission of the commanding officer to apply for a commission in the U.S. Naval Reserve.

I made an appointment with the captain (can't recall his name) to request written permission to apply for a commission. He refused to grant it on the basis that I wasn't in a position to know how I

could best serve my country. It was his opinion that I could serve best by staying in the BUORD as a civil service engineer. While I was willing to agree that I didn't necessarily know where I could best serve, I also couldn't see where he had all that much relevant information either, so I returned to his office the next day to revisit the subject. At first he ignored me; however, after sitting in the ante-room of his office for about an hour, he finally spoke briefly to the effect that the answer was still the same. I responded by saying that the bullpen I was in was grossly inefficient and that my talents were being wasted. Hence, I believed that I was entitled to a chance to contribute somewhere else. At that point, he became angry and said all right, you can apply; however, I will see to it that you are assigned to dangerous duty as a radar air defense officer in London. I said that would be all right with me. As it turned out, he didn't have influence as to my duty. After I received my commission, I was assigned to the Chief of Naval Operations Communications Intelligence Section (COM INT).

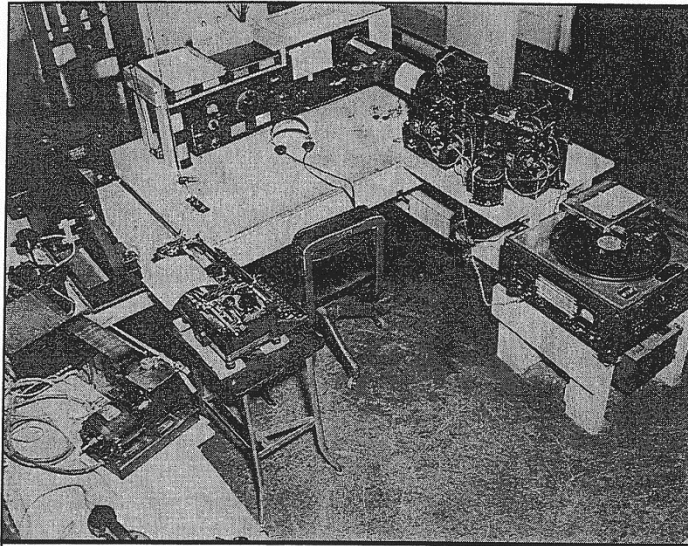
In addition to ending my time at the BUORD, another and related activity came to an end, which was riding the bus to work and back. I lived in Arlington, VA, and the bus crossed the Potomac River at Georgetown on its way to Constitution Avenue. The trips to work were uneventful; however, the trips home were often delayed at the Georgetown Bridge. Under Virginia law, at that time black people were restricted to the rear of the bus. Upon arriving at the bridge, the driver would stop the bus and request that any black riders in the front part move to the rear. Often, there were black people in front, and some would refuse to move. In response, the bus driver wouldn't cross the bridge. Since the place where I roomed was about three miles from the bridge, I would get out and walk rather than wait to see the outcome of the contest between the driver and the black folks.

**NAVAL
COMMUNICATIONS
INTELLIGENCE
(COM INT)
WASHINGTON
1941-1943**

My orders (February 1941) to active duty as a Lieutenant JG in the U.S. Naval Reserve instructed me to report to Commander George Welker. He was in charge of Navy radio direction finding and radio intercept stations. His was one of two major activities in communications intelligence; the other was cryptanalysis (breaking enemy encoded messages). His unit was located in the Communications Annex on Massachusetts Avenue, and quite some distance from the Navy Department on Constitution Avenue. Since the Annex was not readily accessible from Virginia by bus, I was able to get an increase in my gasoline ration sufficient to drive my car to work and back.

Commander Welker, after a warm greeting, said that he had selected me from among a number of candidates because of my education and experience, and my assignment was to head up Atlantic Radio Fingerprinting (RFP). Its mission was to identify German U-boats by the unique characteristics of their radio transmissions. At that time, there were differing views within the Navy about the accuracy of the RFP process. The number one priority was to address the issue of accuracy, hopefully verifying that the process produced reliable results. Chief Warrant Officer Ritchie was one of the members of the project staff. He had been involved with RFP from its inception and knew more about it than anyone else in the Navy. Ritchie also was in charge of the round-the-clock German U-boat radio transmission monitoring station located at the U.S. Naval Research Laboratory, Anacostia, MD, across the Potomac from Washington, D.C.

Radiomen (enlisted men) operated the RFP equipment; which included a sensitive radio re-



Radio Fingerprinting (RFP) equipment used to identify German U-boats by their radio transmissions.

ceiver, an oscilloscope and a high-speed camera. Once a U-boat transmission was identified and tuned in, an image of the signal appeared on the oscilloscope and was photographed. The image on the film was quickly analyzed to identify the particular U-boat which originated it.

Since U-boat transmissions occurred over a wide range of high radio frequencies, it was necessary to continuously search for signals. Enemy transmissions were kept relatively short to help avoid detection by the U.S. radio direction finder network, which had stations along the Atlantic coast and in the Caribbean. Direction finder station operators were connected by a radio network (RFP operators included), so that when one station operator identified a U-boat signal, the other stations were given the frequency so that they could all take bearings (direction). The bearings for a transmission were plotted on a map of the Atlantic Ocean, and the intersection of the bearing lines defined the approximate location of the U-boat. Navy bombers were immediately dispatched to the area; however, they weren't often successful because the fix (position) might be in error by several hundred miles.

As the direction finder stations were taking bear-

ings, radio intercept operators simultaneously copied the transmissions and immediately relayed them to cryptanalysts for decoding as quickly as possible. It was standard procedure for each German U-boat commander to include his name and the position of his boat in the message. The transmissions were made while the U-boats were on the surface to recharge their batteries. Early in the war of the Atlantic, the U.S. Navy Intelligence, with the help of its counterpart in Britain, had broken the enigma code used by the U-boats. Unfortunately, by the time the message was decoded, the U-boat had submerged. Consequently, a large-scale effort was underway in the Navy to speed up the decoding process through the use of electronic devices (forerunners of the electronic digital computer), which were under development. Being able to quickly and accurately identify specific U-boats was critical to this effort, because each captain's name was encoded in his message. The names of U-Boat captains had been obtained from previously decoded messages. Hence, the commander's name was a reliable reference point to facilitate decoding.

There was great urgency for accelerating the decoding process due to heavy losses of allied ships early in the war. They were so severe that if they had continued indefinitely the outcome of the war would have been quite different. Although I can recall seeing daily charts which showed the location of allied ships sunk during the previous 24 hours, I am unable to recall the number except it was usually more than one or two.

Initially, I worked alone in analyzing identification accuracy. Not having access to a U-boat transmitter, I spent most of my time at the Naval Research Laboratory library searching for relevant information. While Ritchie was a nice person and I enjoyed the association, he was strictly a hands-on type with little theoretical knowledge of the identification process. In fact, he never indicated having the slightest doubt about its accuracy and was never even willing to acknowledge that it should be questioned.

After three months of effort, I was able to assemble information about radio transmitters and characteristics of their signals which indicated that identification could be accurately made in many cases of individual transmitters and hence U-boats. However, radio transmission conditions could on

occasion make identification inaccurate or impossible.

At about the same time that I reported this information, I was transferred to a newly created research section under the direction of Captain Howard T. Engstrom. Unlike Welker, who was a "regular," Engstrom was a reservist who had been an associate professor of mathematics at Yale University. Because of the urgency for gaining more information on enemy operations, his research unit was provided with all the funding needed to rapidly build up a large research group. This group eventually contained an unparalleled assemblage of talent consisting of some 1,000 mathematicians, physicists, engineers and social scientists, a number of whom had achieved national and/or international recognition in their fields.

In addition to the large and highly talented internal technical staff, the technical resources of other organizations were obtained under contracts. Included were contracts with The National Cash Register Company (NCR), IBM, Bell Laboratories, The Massachusetts Institute of Technology, and Princeton and Cambridge (England) Universities. By far the largest and most important contract was with NCR for the design and production of electromechanical and electronic equipment to speed up the decoding processor. In fact, virtually all research and engineering work related to NCR's commercial products ceased and the personnel and facilities were devoted to the Navy contract.

Because of the dire consequences if my analysis was incorrect in any substantive way, I requested that it be checked. This resulted in Captain Engstrom assigning Lt. Charles B. Tompkins (Tommy) to work with me. Prior to the war, Tommy was a professor of mathematics at Princeton University. Tommy verified my analysis.

NAVAL COMMUNICATIONS INTELLIGENCE (COM INT) PACIFIC 1943

Soon after this verification (early in 1943), Admiral Wenger (head of COM INT) decided that RFP should be applied in the war with Japan and placed me in charge of a group to achieve that mission. Included in the group was Tommy Tompkins, Warrent Officer Ritchie and several radiomen (operators skilled in copying radio messages). The RFP Center was to be located at the Naval Radio Intercept Station in Hawaii on the island of Oahu.

My means of transportation was by railroad to San Diego and then the seaplane tender "Chandeleur" to Pearl Harbor. The departure of the U.S.S. Chandeleur was delayed for about a week in order to repair a noisy propeller drive shaft to reduce the danger of detection by Japanese submarines. Each day during the delay (as well as the entire voyage) I along with other naval officers, mostly ensigns, would assemble in the ship's mess hall before breakfast to receive orders for the day, which during the time in port included permission to go ashore if desired.

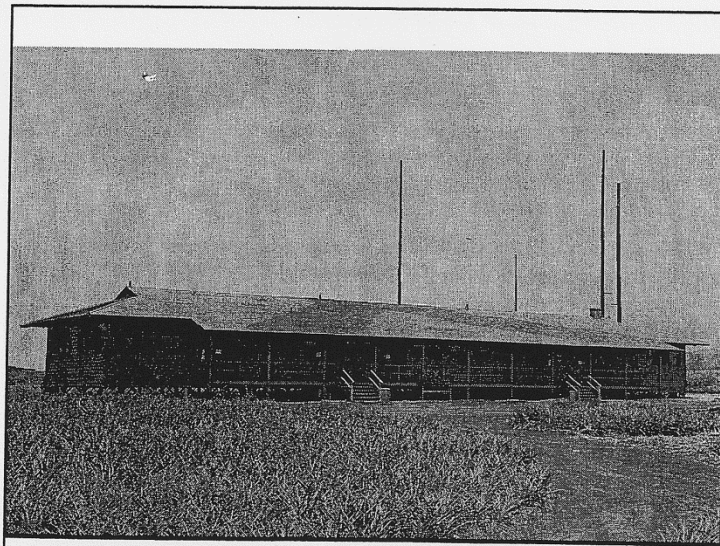
The day finally arrived when the ship got underway. At the end of the morning briefing (mostly safety precautions, etc.) the commanding officer asked if there were any questions. One ensign held up his hand and said "Sir, do we have permission for shore leave again today?" The commander was speechless for a moment, then looking out a porthole said, "It's okay by me if you can swim to port and back to the ship by 4:00 P.M." An outburst of laughter followed.

I was met at Pearl Harbor by Lt. Cmdr. Underwood, who was in charge of the Intercept Station located near the small town of Wahiwa, about in the center of the island of Oahu. During my time riding with Cmdr. Underwood to the radio station in his jeep, he told me

about his experience during the Japanese attack on Pearl Harbor. On that day of the week, as was the custom, he attended a meeting at Pearl Harbor with his superior officer. During the trip back, low flying planes shot several holes in the top of his jeep. His reaction was one of dismay that U.S. Navy pilots were so careless about training practices. Later, to his great surprise, he learned that Pearl Harbor had been attacked and the holes in the top of his jeep were from Japanese bullets.

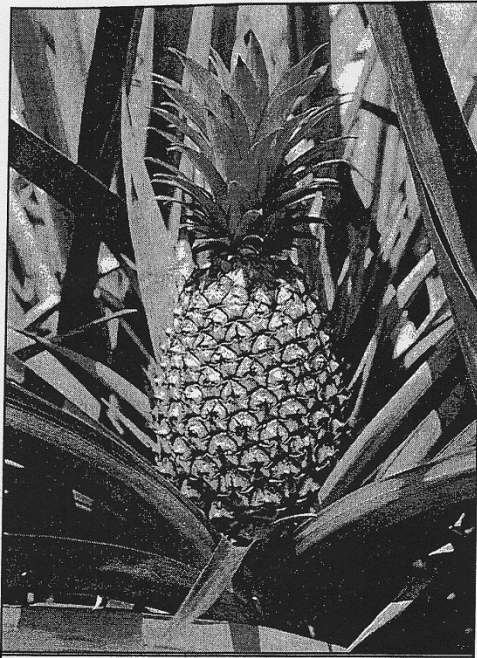
Because of security requirements and lack of suitable radio receiving antennas, it was necessary to erect a new building along with antennas. The site was in the middle of a large pineapple field. Although the land was owned by the U.S. government, a private company had the right to grow pineapples on it. Lack of Navy ownership of the pineapples didn't deter the RFP staff from keeping a supply of fresh pineapple on hand, mostly in desk drawers. This wasn't an ideal storage place because if not eaten in a few days the pineapple attracted a swarm of fruit flies.

About 6 months were required to complete construction of the radio building. Soon thereafter the RFP Center was fully operational, and at that point I no longer felt challenged. Even though the climate was as close to ideal as one could find, the



The RFP Center constructed at the Naval Radio Intercept Station, Oahu.

THE NEW YORK TIMES, WEDNESDAY, FEBRUARY 21, 1945.



A ripe pineapple about to be picked by RFP staff.

food reasonably good, the living quarters pleasant, and an occasional social event in Pearl Harbor, I was glad to receive orders to return to the Naval Communications Annex in Washington, D.C.

RADIO TELEPHOTO SYSTEM

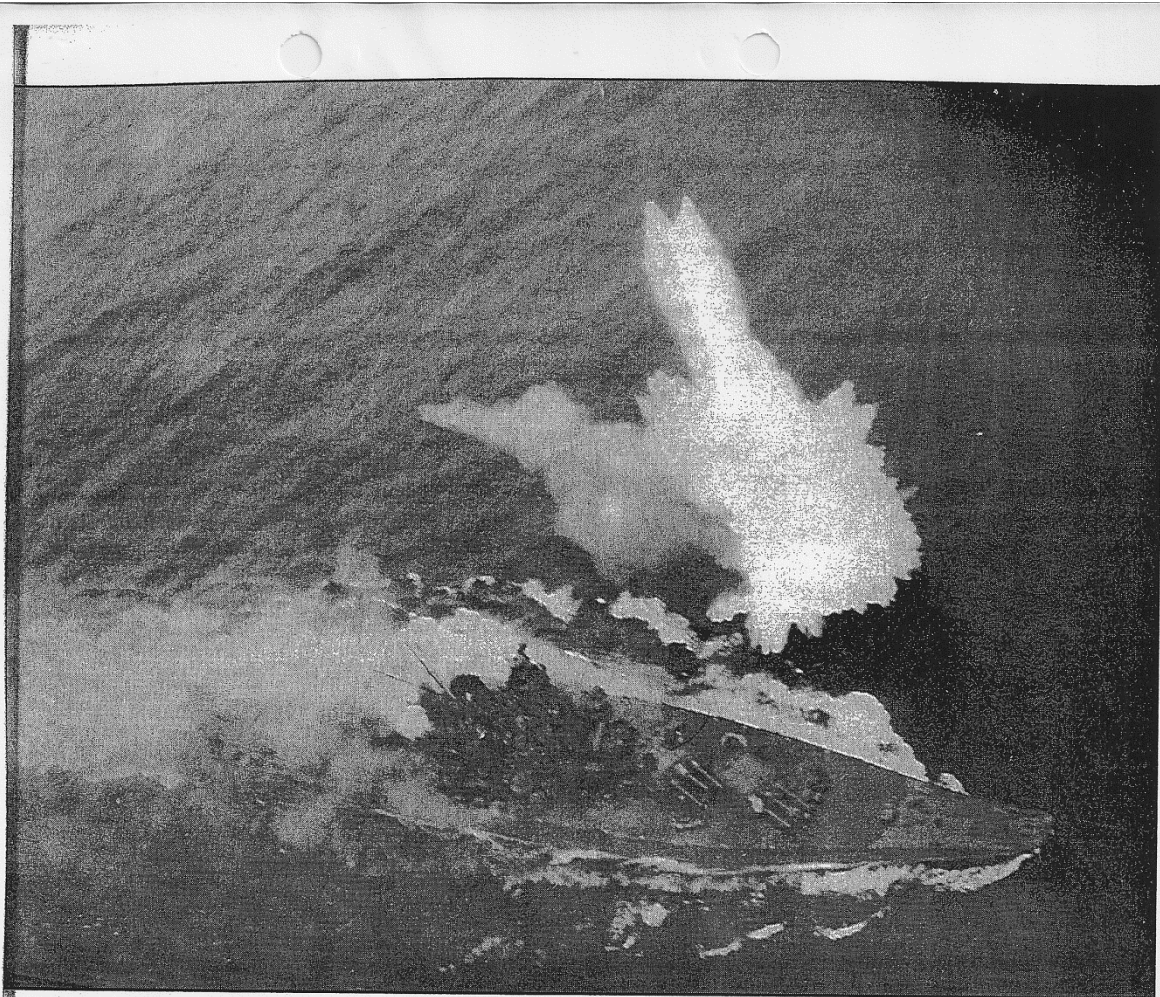
My next project after I returned was to implement a radio telephoto system. The Navy was anxious to speed up the reporting of information on the course of the war in the Pacific. My section had the equipment and personnel to get the system in operation quickly. The telephoto service was well received by the press, especially the *New York Times*, which published an article extolling its capabilities. A copy of the article was transmitted to all the radio stations in the network. Many dramatic scenes were transmitted, including those from the battle of Midway Island, the flag raising at Iwo Jima, and the sinking of Admiral Yamamoto's flagship, the battleship Yamato.

PICTURE MIRACLE

Even in these days of swift communication it seems almost incredible that newspapers reporting the first landing of Marines on Iwo Jima could simultaneously publish pictures of the landing itself. Wireless has taught us to regard Puck as rather slow in putting his girdle round the earth in forty minutes. But to watch a battle fought in midocean halfway across the world almost from the moment it begins ranks still among the miracles of modern transmission.

The pictures themselves are not less remarkable than the speed of their delivery. They move panoramically from the gathering of the fleet to the storming of the beaches. First we view the broad bosom of the ocean filled to the horizon with warcraft small and great. Next a pillar of smoke from the bombardment whirls across the hump of rock like a black tornado. Then comes the landing seen from the sky. Though not a single human figure can be distinguished no picture of the war has surpassed this in dynamic power. It suggests an upheaval of nature, something that might have happened when the world was in its birth-throes. Against dark water and sky the volcano Suribachi wraps itself in a fiery veil as though shrinking from the hundreds of broad white arrows flashing toward the shore. These are the wakes of our landing barges. In an instant the conquerors of the island will be pouring by the thousand up the beach. Goya or Doré might have composed this terrifying picture of mechanized fury.

These photographs were taken from a Navy plane and flown 750 miles to Guam. There they were sent to San Francisco by Navy radio. In this country they were being distributed over The Associated Press wire-photo service within exactly seventeen and a half hours of the landing. Television may accomplish something like this in the future but it cannot do so now. Such prompt service to the public shows that the United States Navy is at last fully news-conscious.



Battleship Yamato, smoking amidship, tries to escape bombs and torpedoes of attacking U.S. Pacific Fleet aircraft carrier planes, on April 7, 1945, in the East China Sea. Fires can be observed amidship from previous attacks, and a fresh miss explodes off the port bow. (Navy radio photo, Guam)

COM INT WASHINGTON 1943-1946

Personal Affairs

Soon after my return from the Pacific, the most fortuitous event in my life occurred, which was making the acquaintance of Betty Jane Malley. She was a Wave officer assigned to the section responsible for radio intercept and direction finding—the section to which I first reported. Meanwhile, Cmdr. Welker was gone, having been assigned to sea duty. His replacement was Cmdr. Cross, a

reservist. Since all radio intercept stations were under the direction of Cross (including the RFP station in Hawaii once it was operational), I often met with him about problems. He was an ex-government civil servant, a typical bureaucrat, who was given to question technical decisions despite being technically ignorant. As a consequence, we got into arguments. Invariably, he would push a button and in would come this attractive Lt. J.G. Malley to bring him additional information.

During the meetings, I noticed she had on an engagement ring, so I asked an enlisted man who

worked in the same room if he knew what the situation was. He didn't, but said he would find out. The report back was that there was some uncertainty, so I asked Lt. Malley for a date, which led to our being married in September 1944.

TRIP TO GERMANY

A few months after the war ended in Europe, word was received that the Allied occupation forces had discovered a German laboratory in the Bavarian Alps, camouflaged as a hospital, which had housed a major research effort in cryptography (encoding) and cryptanalysis (decoding). I was asked to head up a British-American group to visit the laboratory and collect information on the research. Tommy Tompkins was also assigned to the group.

The trip to Germany included a stopover at Bletchly Park, England, which was the headquarters for British intelligence. Our travel was by a U.S. Airforce DC-4 to Paris and then a DC-3 to London, and London to Bletchly Park by train. I stayed in a quaint little inn where guests were awakened in the morning by a maid coming into the room

unannounced with hot tea.

After a few days in Bletchly we flew back to Paris to make connection with the U.S. Army, which would provide transportation by jeep into Germany. We stayed at the Royal Monceau Hotel in Paris to await word that transportation was available. The hotel was an elegant place less than a half block from the Arc de Triumphe. I didn't enjoy the stay there because I had contracted a bad case of stomach flu and felt miserable. However, two events occurred which are still vivid in my memory. One was a large parade on the Champs-Elysees which ended at the Arc de Triumphe and was led by a band playing the French National Anthem. The occasion was the celebration of Bastille Day and my birthday, both July 14. The other event was a telegram from the Navy office in Washington with the information that Bill, Jr. had been born the previous day.

The U.S. Army flew us to Frankfurt, Germany by DC-3, where a jeep with a driver was waiting to take us to the laboratory in the Bavarian Alps, near Berchtesgaden, a village about 60 miles north of Nuremberg. The building had huge white crosses painted on the roof to make it appear to be a hospital, which presumably would not be targeted by Allied bombers.

Several British officers were already at the laboratory when we arrived. With the group complete, actions to find out what had been going on could proceed, except for one obstacle. All of the equipment and documents had been removed from the laboratory.

A meeting with the head of the laboratory, Oscar Vierling, revealed that the staff had buried them in the woods. The British members of the group were incensed and wanted to immediately arrest all staff members. Instead, I believed that it would be better if we suggested that they might ultimately be dealt with less severely if they cooperated.



A German military laboratory in the Bavarian Alps, disguised as a hospital to deter bombing.

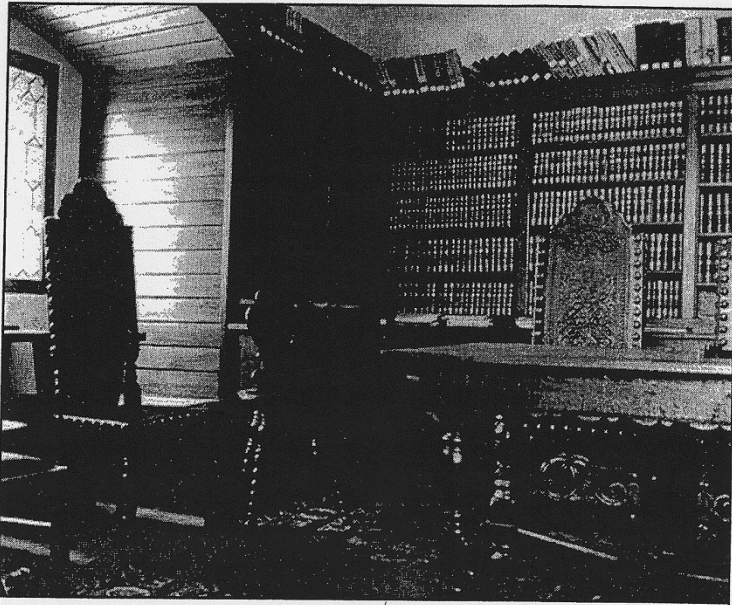
Since I was in charge, I prevailed (however, unbeknownst to me at the time, a British member radioed Bletchly Park in an unsuccessful effort to get me replaced).

Meanwhile, the German staff agreed to cooperate. They dug up everything and brought it all back into the laboratory and provided detailed information.

Other than the initial hassle with the British members, the rest of the mission was conducted peacefully with plenty of free time, which provided the opportunity to take long walks in the surrounding area, much of which was forest. Often there were elderly women gathering bundles of fallen twigs and branches for fuel. One day I walked to Berchtesgaden (about 3 miles) to get a haircut in the little barbershop. I was greatly surprised when the barber greeted me with "Hi! How is everything in the good ole' USA?" During our conversation, he said that he once lived in Schenectady, N.Y., and the dumbest decision he had ever made was to return to Germany.

Particularly interesting was the time I spent in the library, which contained a priceless collection of old books. Many had been confiscated by the German army from university libraries in Poland and Czechoslovakia. There was also Vierling's personal mementos such as a photograph of him shaking hands with Herman Goering (reported to be No. 2 in the Nazi regime).

One of the most intriguing devices at the laboratory was located at the place where all personnel checked in and out. It was alleged to have the capability to detect anything being smuggled out by an employee. According to Vierling, there had been serious losses from theft by personnel, which ceased once the "detector" was placed in operation. The only visible evidence of the device was a red light which flashed on when an



Library in the Bavarian Alps military laboratory. Books shown are part of a collection of German Physics journals going back over 100 years.

employee had a concealed object.

We asked Vierling to let us inspect the device, but he refused, saying that if we obtained information on it, there might be a leak to laboratory personnel and thus they would be able to figure out how to avoid being caught with concealed articles.

We had several meetings among our group to brainstorm how the device worked. The more we thought about it, the more puzzling it became. Finally, when I decided to be more insistent with Vierling, he smiled and said it is very simple. There is a concealed footswitch connected to the red light. The guard at the entry gate activates the switch only when there is evidence from other sources that a particular person is stealing. When that person passes through the gate, the guard steps on the switch. After two suspects were caught, the stealing ended.

When the process of interrogating the laboratory staff was nearing completion, I returned to Washington via Frankfurt and Paris. The trip back was uneventful except in crossing the Atlantic, the DC-4, which had stopped to refuel in the Azores,

had a problem on take off—one of the engines caught fire. Fortunately, the plane was able to quickly return to the airfield where the flames were extinguished, with no apparent damage, because we took off again in a short time.

U-BOAT SURRENDER

Soon after my return to Washington, a German U-Boat captain notified the U.S. Navy that he wanted to surrender his ship to the U.S., and he was ordered to sail into the Portsmouth Naval Base. At the end of hostilities with the Axis, German U-Boat captains who were at sea selected different ports in which to surrender. Some chose to go into French, some to British, and one chose a U.S. port, Portsmouth, Massachusetts. (I've forgotten the reason for the delay between the end of the war and the surrender of the U-Boat.)

The U-Boat in Portsmouth was of the latest design and was equipped with a high speed message sending device to make it more difficult to use radio direction finding or radio fingerprinting. Consequently U.S. Navy Intelligence was extremely interested in learning about it and was concerned that the crew might destroy the equipment before leaving the ship.

I was ordered to go to Portsmouth and be part of a party to immediately board the ship upon arrival. One of the other members of the party was a civilian engineer employed by the Naval Base. It was his responsibility to remove the transmitting equipment and send it to the Naval Research Laboratory in Washington, D.C.

At the last minute, the civilian engineer refused to join the boarding party. He said that being married with one child precluded his taking the risk that the equipment might be wired to an explosive which would detonate if it were removed.

While I was aware of such a possibility, it occurred to me that a German crew member should be the one to remove the equipment, so I requested that the ship's commander have the chief radioman brief me on the radio transmitting equipment. As it turned out, this person spoke English fairly well. During our meeting I managed to inject a personal note in the discussion by asking about his family. He eagerly responded by saying he was married and had one son, but

he had not had any communication with his wife for more than six months, and he was very worried. This information caused me to relax because I knew he wouldn't be likely to want to be close to the radio transmitter if it was wired to explode. However, I suggested that because of his familiarity with the high-speed device, he should remove it. He readily complied and since it was about the size of a small travelling bag, I carried it off the boat to give to the civilian engineer waiting on the dock. I didn't bother to tell him that I hadn't removed the device from the transmitter.

While the task of removing the high-speed message device is my most vivid recollection of boarding the U-Boat, I haven't forgotten the awful stench that staggered me when I went below the main deck. One source of it was a countless number of sausage rings hanging from the upper beams. Apparently they were a major source of food.

POST-WAR PLANNING

In the summer of 1945, with the U.S.-Japan war rapidly drawing to a close, Engstrom and I started to discuss our return to civilian life. He didn't want to return to Yale, and I had no desire to go back to Westinghouse. Both of us wanted to continue working in the communications intelligence field, especially because of the potential of the then primitive electronic computer-like equipment, which with further development could become powerful and versatile electronic digital computers.

One option was to continue to work for Navy COM INT as part of civil service. This wasn't appealing to me because of my earlier BUORD experience. Engstrom also wasn't interested in a civil service job.

Another possibility was to start a company which would hire COM INT staff members to develop and build equipment for the Navy. The latter approach was reviewed with other COM INT staff members and it was received favorably. Admiral Wenger was then approached with the concept. He was receptive and gave us permission to develop a business plan and look for financing for such a company. The admiral supported the proposed plan because it offered a way of keeping together a sizable

nucleus of the unique expertise which had been acquired by the research group and, under contract, continue to further help develop the U.S. military cryptanalysis capability. Further, it offered some insurance against fluctuation in the years ahead in the military budget, in that the company would have other sources of income to assure retention of staff if military appropriations were drastically reduced.

After receiving the go-ahead from Admiral Wenger, Engstrom and I spent virtually full time planning the new company and contacting potential sources of financing.

Initially, the most likely source of financing appeared to be large companies for which our enterprise would be complementary. The National Cash Register Company was an obvious fit and our first contact. Surprisingly, there was no interest. The company was anxious to terminate its relationship with the Navy. Years later, as the computer industry began to emerge, National Cash Register regretted that decision.

A second likely prospect was Raytheon, Inc., which was a large military electronics equipment contractor and a major supplier of radar systems. We met with the president. He wasn't interested because Raytheon already had more attractive new developments than it could afford to pursue.

We met next with the president of American Airlines. We thought he would be interested because of the commercial potential of our electronic technology, such as the ability to establish an automated reservation system, but he wasn't. I've forgotten the reason.

Another prospect, and for a time it appeared to be a serious one, was the Automatic Electric Company in Chicago. Automatic Electric was part of a larger organization which owned several telephone companies. The chairman and CEO of the holding company was Mr. Adams. He had a posh office in a Miami Beach, Florida, hotel. We met in his hotel suite over lunch. Mr. Adams was very interested and said the next step was to review our plan with the

head of Automatic Electric, which would be the appropriate part of the organization for a relationship. After several meetings, the president of Automatic Electric decided that it should concentrate on telephone equipment manufacturing.

After our fourth strikeout, Admiral Wenger suggested we contact Admiral Louis Strauss, an assistant to the Secretary of the Navy, James Forrestal. Admiral Strauss was a reserve officer who was on leave as a partner in Kuhn Loeb, at that time a major New York investment banking firm.

Since Strauss had top secret clearance, we could

provide him much more information than the other prospects on what the group had accomplished during the war, the importance to military intelligence of preserving and building on the wartime experience, and the commercial potential of the technology. After several meetings, Strauss said that he viewed our proposal favorably

Bringing to reality the visionary idea of starting a company to carry out research and development to advance U.S. military cryptanalysis was the best possible way to bring to a close my period of duty in the U.S. Navy.

and would provide the financing. As the next step, he would like to have a Commander Paget on his staff review it.

Needless to say, we were elated. However, it was short-lived. Paget's analysis questioned the feasibility of the plan, so Strauss backed out. That experience proved wrong what I had heard and believed for many years, that a hand shake on a deal with an investment banker was as good as his signature.

Meanwhile, during our search, demobilization was well underway and members of our group were anxious to know if the plan for a company was going to be implemented. As we were trying to figure out what to do next, a rumor surfaced that another investment banker, John E. Parker, was looking for a way to keep the Northwestern Aeronautical Corporation, St. Paul, in business. He founded the company during the war to make troop-carrying gliders. With no further demand for gliders by

the military, and a payroll to meet, Parker was in a tight spot. So when we contacted him, he was immediately interested, but he had difficulty in understanding our plan. To help convince Parker of the merits of our proposal, Admiral Wenger arranged for him to meet with Secretary Forrestal, who urged Parker to support the new company. Parker agreed.

Bringing to reality the visionary idea of starting a company to carry out research and development to advance U.S. military cryptanalysis was the best possible way to bring to a close my period of duty in the U.S. Navy. In retrospect, it was rewarding in many ways: the assignments were interesting and challenging, which in turn led to my participation in a major way in the development of the computer industry; the three promotions in rank from J.G. to Lieutenant to Lt. Commander to Commander were much appreciated; and, most important of all, was the opportunity to meet Betty Jane Malley, which otherwise would never have occurred.

ENGINEERING RESEARCH ASSOCIATES

The new company, Engineering Research Associates, Inc., commenced operation in January 1946. Twenty-five scientists and engineers from the COM-INT group joined the company. The agreement with Parker stipulated that ownership of ERA be divided equally between him and the technical staff. The price per share was one dollar. The company made a loan to any technical person unable to immediately pay for his allocated shares.

Since the history of ERA has been well publicized, I won't repeat it here, except for three aspects. One is the name, which initially was Research and Development Associates. We hoped it projected an image of a technically oriented company where there was extensive employee ownership. After using the name for a time, it finally dawned on us that an abbreviation by competitors would likely be RED ASS. Needless to say, we didn't want to take that risk, so we changed it to Engineering Research Associates.

Second, ERA was one of two companies that

launched the computer industry. The other was Eckert-Mauchly in Philadelphia, which was established during June 1946, six months after ERA. Interestingly, Engstrom and I met with J.P. Eckert during our search for funding. He and John Mauchly were also having difficulty arranging for financing. We offered to join forces, but Eckert declined. Ironically, we came together later when Remington Rand acquired EMC in 1950, and in 1952 acquired ERA. These two companies constituted the Univac Division of Remington Rand. In 1955 Remington Rand was acquired by the Sperry Corporation to form Sperry Rand. I was given the job as general manager of the Univac Division of Sperry Rand.

My time with ERA was highly rewarding. It was a great pleasure to be associated with highly competent, dedicated technical people working in a highly cooperative mode in one of the two major pioneering efforts of the computer industry. This feeling was widely shared, as evidenced by the gloom in the technical staff when word was received that ERA had been sold to Remington Rand.