

**The World War Two Experiences  
Of Roger Wallace  
BS in Physics, Caltech 1941  
PhD in Nuclear Physics,  
UC, Berkeley 1952**

**March 30, 2010**

**roger94563@hotmail.com  
250-216-2406**

**My 1941 class of 16 physics majors did not get a single job interview from any company before graduation. We were told that Lockheed would hire all of us without interviews. All but one of us went to Lockheed.**

**At Lockheed we were put into their engineering training program. I worked in many departments in the shop for four months to get direct shop experience building the two planes then being produced. The model 14 (Super Electra) was a passenger plane which had been intended to compete with the Douglas DC-3. It had been converted into a bomber and sold to the British who called it the Hudson. They used it for coastal reconnaissance. The Hudson had an upper gun turret and a belly gun and a nose with many windows and a drift sight window in the floor and a navigation window in the roof. One Hudson was produced about every other day. I spent almost a month riveting inside of the wings of the model 14.**

**Near the end of my shop training I was finally promoted to rivet on Lockheed's pride and joy, the P-38. This plane was the first twin engine, pressurized, air conditioned, super charged, tricycle landing geared, flush riveted, heated wing, long range fighter in the world. After a few months of this hands-on shop training I was moved to the engineering department and given a group of 30 draftsmen. Our first job was to redraw the drawings of the control cables of the P-38 incorporating the many engineering changes which had been made in the course of several model improvements. Aircraft drawings had been on tracing paper but in 1941 Lockheed was beginning to use dural sheets for the pencil drawings. These were then photographically transferred to the actual dural used in the prototype new planes.**

**I was then put in charge of the electrical conduit drawings of the cockpit and under the floor, but not out into the wings, of the model 49 which became the Constellation with the iconic triple tail. The electric circuits' drawings were done by another group. The model 49 design was to be the first pressurized passenger transport plane. It was being changed from the Howard Hughes TWA and Pan Am specifications to a troop transport for 100 men. Howard Hughes was very much in charge of the project and apparently was still paying for it. I never saw Howard. He sent his orders to Kelly Johnson (future head of the Lockheed Skunk Works) who was our boss. The 49 first flew in 1943. It originally weighed 40 tons and was faster than the Japanese Zero fighter.**

**In the fall of 1942 I went back to graduate school in the Chemical Engineering Department at Caltech and also worked on the Navy rocket project in Eaton Canyon in Altadena. Professors William Lacey and Bruce Sage were in**

charge of the project. My direct boss was Norman Wimpres. Three other Caltech graduate students worked there. Hugh Baird was in charge of static testing. Edward Price, Quinten Elliott, William Corcoran and I worked on propellant design. Eaton Canyon had rocket propellant extrusion presses. We designed the shape of the resulting propellant "grains". Since they were soft enough to be extruded they were not very strong. As they burned (deflagrated) they had to resist large accelerations, high temperatures and pressures and not collapse into the rocket nozzle. Premature collapse of the grain sealing the nozzle made the pressure and temperature rise rapidly which would cause the rocket's steel container to rip longitudinally. The containers were 2 1/4" seamless steel pipes.

I also designed a salt water proof igniter for the 2 1/4" rocket motors that propelled the Mousetrap (an improvement on the Hedgehog) ahead-throwing anti-submarine and beach bombardment rockets. The igniter contained an electric squib which set off the black powder which filled the igniter and in turn started the deflagration of the propellant grain. The squib had two wires attached which were threaded past the propellant grain and out the nozzle. These rockets were carried on the bows of small ships and landing craft and were drenched with every bow wave. I also made and tested a complex static firing device that could stop the deflagration of a rocket propellant grain at any fraction of its one 1 second burning (deflagration) time. The actual partially burned shape was needed to improve the performance of rockets.

Larger rockets were made in Eaton canyon which used 5" seamless steel oil well casing pipes. These were the fin stabilized 5" forward firing aircraft rockets. They were carried under the wings of fighter planes. The Navy called them the 5" HVAR (high velocity aircraft rocket or Holy Moses). They proved to be very accurate and deadly since the airflow speed of the plane over their fins before firing was added to the airflow speed of the rocket itself after firing giving a total air speed of about 950 mph. The Navy told us that when these rockets were fired from a plane into the water on the near side of a ship they would level off under water and then could go clear through a ship doing enormous damage.

When I was doing an experiment extruding a new grain shape with our small test press the powder deflagrated destroying the press and sending a shock wave down a corridor and around two 90 degree turns into the safe control room where I was watching the extrusion. The shock wave blew me backward through a window. I had been at the beach the day before and had bad sunburn on the right side of my face. The doctors at the Huntington Hospital decided my face had been burned in the explosion. The explosion wave had hit the left side of my face but the doctors said I was lying and had an industrial injury.

At Eaton Canyon we could only do static firing tests. To check on the response of the propellants to acceleration forces we field tested our rockets at Gold Stone Lake in the Mojave Desert. We also field tested some Russian rockets. The Russian rockets worked well. Professor George Kistiakowsky from Harvard University came to Pasadena and brought with him a new ammonium perchlorate composite propellant made by Monsanto to be tested dynamically at Goldstone. The Monsanto rockets all blew up on ignition. I designed and built a rocket propelled 11 3/4" in torpedo which was intended to avoid the shock to the drive machinery of airplane launched propeller driven torpedoes. This rocket torpedo was successfully tested in the Morris Dam Reservoir. I also served as the Chem. Eng. representative on Linus Pauling's artificial blood committee. Artificial blood

was not produced successfully. I was also a member of the selection committee to pick a site to move the Eaton Canyon explosive production and rocket design project to from Altadena. A residential site was inappropriate for a producing explosives factory. By the end of the war Eaton canyon had produced over 1 million rockets. As the war wound down other explosive companies were beginning large scale production of rocket propellants. After considering many sites in the entire US and comparing their individual pros and cons we chose the present day Inyokern-China Lake site.

As a physicist I wanted to work on the then new and rapidly developing radar technology. The Navy gave me an Ensign's Reserve commission as a line officer and said they would send me to the radar lab at MIT. In November of 1943 I got orders to the Naval Officers Indoctrination School at Fort Schuyler on Throggs Neck, New York (Bronx). The Navy school shared Throggs Neck with the New York Merchant Marine Academy. The students were Ensigns and Lieutenant Jgs. The course ran for two months and was focused on Morse code, naval history, naval regulations and our heritage from Queen Elizabeth I's navy. We were told that most of us would get orders to armed guard duty on merchant ships going in convoys to Murmansk Russia and should subscribe to several magazines since we would have long periods of inaction.

After finishing the indoctrination I got orders to the anti submarine blimp base at Lakehurst New Jersey. The executive officer of the Throggs Neck indoctrination school called me in and said he did not believe in blimps. As a result of my Eaton Canyon Navy Rocket experience he offered to call Washington to get my orders changed. So I was ordered to the Navy Rocket office in Washington, DC, which was Caltech's connection to the Navy Ordinance Department and thus controlled the Eaton Canyon Altadena, California project. They seconded me to the Naval Powder Factory at Indian Head, Maryland where I worked on the small chaff dispensing rockets which gave a large false radar image when fired to the rear of a plane.

In addition to daytime rocket design work I was also given a night shift running the Naval Powder Factory rocket grain propellant extrusion plant. The enlisted crew was mostly made up of drafted, married farmers from Pennsylvania where there was an overly enthusiastic draft board. These draftees had wives and children who were having difficulty running their farms. I had to write many letters asking for hardship discharges. One extrusion press blew up which is a frequent problem with extrusion presses. Since I had I had been a member of the committee investigating a press blow up in Eaton Canyon I had to chair another accident investigation which as usual could not pinpoint the cause of the explosion.

Late in 1944 since I had a modest reading knowledge of German and French from courses at Caltech, I got orders to go to Europe in the Navy Combined Advanced Field Team (CAFT) as an intelligence officer. This unit was attached to the Office of Strategic Services (OSS (1941-1945) Major General Wild Bill Donovan). When the war ended Harry Truman split the OSS between the State and War departments. He changed his mind in 1947 and resurrected it with the new name of CIA.

We expected a desperate house to house defense of the more defensible mountainous regions of southern Germany and Austria similar to the furious

Japanese defense of the Pacific islands. A radio intercept from Germany was interpreted to indicate that the Germans were making southern Germany and Austria into a "National Redoubt" for a last man defense. It turned out, after the war, that this was a mistaken decoding of the radio intercept. So we expected street to street guerilla fighting. We were sent to the Burning Tree Country Club in Maryland for guerilla training in knife fighting, high explosive demolition and night fighting with a Thompson sub machine gun. We were even instructed on how to convert the Navy 45 caliber Colt pistol to sound like a Tommy gun. I have not found a use for this specialized training so far. It turned out that the Germans were so war weary, and central control from Berlin was so disrupted, that their only policy was "each man for himself."

The Navy decided that we intelligence officers were important enough to fly to Europe. They told us that we must fly as civilians with passports in case the plane had to land in Portugal or Spain where the US Embosses could smuggle us back to England. None of us had passports so we were sent to the State Department in Washington where we were all given a civilian dark blue coat and white shirt and conservative tie for our passport picture. Two days later we all got out passports. We did not personally have civilian clothes to fly in but we did have to show these civilian passports when we landed in Scotland.

In January of 1945 I flew from Washington National Airport to the Patuxent River Naval base where I picked up 30 enlisted men that I was to escort to Paris. From Washington National Airport we flew to Stephenville, Newfoundland where we ate and refueled. Then we flew over the ice berg filled North Atlantic to Lagens airfield on Terceira Island in the Azores. The DC-4 Navy transport (C-54 Skymaster) had no seats and the clear floor area was jammed with military cargo. The enlisted men slept on the single row bench seats along each side and I slept on the cargo. The unpressurized low altitude DC-4 gave a much better view of the ground than you see from modern high altitude jets.

At Lagens there were several hundred German prisoners eating breakfast in the Navy mess. They were eating large helpings and seemed to be extremely happy to be out of the war. We refueled again and took off after dawn and flew northwest low over many small farm and garden plots with walls around them next to Portuguese style farm houses. The DC-4s' limited range and heavy load made this circuitous route necessary. Several hours after we left Lagens, south of England, we were intercepted by two English Spitfires which checked on us about every ten minutes all the way across Cornwall and up the Irish sea to Prestwick, Scotland.

We landed there well after dark. Much to my surprise we were all ushered into a customs and immigration hanger. There were five or six lines of sleepy American solders in each line up to the British officials who were behind bank teller type windows. After a moment there was an announcement on the loudspeaker that Ensign Wallace was to come up to the front of the line.

The Scottish lady in the teller's window told me to go to the office door on my left. When I went in to the office all the customs and immigration inspectors shut their respective windows and came together and said that we would now all have tea. I asked if this was their regular tea time and what about the hundreds of soldiers waiting outside. The customs inspectors said that we were having tea at this unusual hour because I had a famous Scottish name. I was very

uncomfortable about leaving my 30 enlisted men standing in line. In spite of my protests the Scottish customs officials had a fine English tea served while we waited for the car they had called to take me to a hotel. We had a little tea time talk about flying over the Atlantic in the winter. They were very proud of the fact that there were about ten golf courses that touched the enormous Prestwick aerodrome. The closest town is Ayr to the south on the Irish Sea and to the northeast is Glasgow. The suburb east of Ayr is Wallacetown. But the most important fact about Ayr is that Robert Burns was born near there. His house is a shrine and in those days only cost 6 pence to visit. Also Ayr is a beach resort filled with golf and beach stores. We finally finished our tea and the Scots opened up the customs windows to the waiting crowd and I took off in the car they had called. It was very dark in the winter so far north. I checked into the hotel and walked around town looking in the sporting goods stores in the no lights darkness. I went to a movie but the only thing that I can remember is that there was a short subject, now called a documentary, on washing babies. The UK health department said that you should wash a baby about once a week. So much for the state of personal hygiene in 1945 Britain. I guess the infrequent washing kept a lot of babies from freezing to death.

We took off about ten the next morning in a Navy DC-3 (R4D) and flew south down the center of England directly toward London. We were not intercepted very often by English fighter planes as we had been on the way north. In spite of the February date the weather was clear and sunny and the beautiful English countryside was just as advertised. We flew low over London's east end where the German bomb and fire damage was very widespread. Most roofs were gone leaving only walls standing showing basements filled with rain water. This is typical of bombing. Artillery damage brings down both roofs and walls. South of London we turned east and went over the English Channel from farmland to farmland without flying over any ports. The French coast showed lots of shell or bomb craters.

The French countryside is different from the English countryside. The little English villages have very artistically designed houses and elegant churches and manor houses and always a commons surrounded by a few hotels and pubs. The little French villages seem to be more grey and the houses less varied. The French have been less prosperous over the long haul than the English.

The French 2nd armored division was the first of the allies to enter Paris on August 23, 1944. We sighted the Eifel Tower and circled it at a respectful distance and then landed at Villa Coublert a military airfield in Paris. The airfield had been fought over and none of its buildings were more than waist high except for one small garage sized shack which was being used as the control tower. We got a ride to the Navy hotel. The day after I arrived was a Sunday and the Navy offices were closed, so I walked around on the magnificent boulevards that make Paris so famous. On one boulevard there was an endless US Army convoy of trucks. There was a dense crowd of cheering French citizens on each side of the boulevard. And it is really true that French women and girls climb up on army trucks, even though the truck is moving, to kiss each soldier just like you see in movies. The US Navy had taken over the Royal Monceau Hotel which had been the German Navy's hotel. It was said to be the only hotel in Paris with hot water. A US Navy truck frequently delivered French coal for heat.

I was assigned to a double room with a Yale physics professor who specialized in radar. At the time the German V-2 high altitude rockets were bombarding London. He said he had an idea of how to eliminate them. The Navy had made an appointment for him to talk to Winston Churchill the next day so he could explain his proposal. He flew to London and returned the same day a little disappointed. He said Churchill was very charming and offered him champagne, caviar and cigars and discussed his proposal in detail. Then Churchill said that since the war was almost over that it would be unwise to reveal the possibility that the allies could stop these long range rockets. The defense method should be kept as an allied secret to be used in the next war.

I was reassigned to another room which I found was filled with large wood shipping containers which had obviously been made by a Navy carpenter. Soon a Navy captain (4 stripes) came in. He was furious that an ensign roommate had been put in his room. He introduced himself as the director of the Harvard College Observatory. I realized he was the author of a book I had read on telescope design. This was a popular topic among students at Caltech in the 30s since at the time the 200 inch mirror was being ground in the building next to my student house (Dabney). I asked what was in the wood chests. He said they contained optical equipment including a Zeiss photo theodolite, a much desired instrument. He said he had liberated them from the Carl Zeiss factory in Jena. The allies had captured Jena but had agreed to turn it over to the Russians. He said that he had brought them to Paris to keep them out of the hands of the Russians. So I was moved to another room. The next day I noticed an armed Navy shore patrol guard on my former double room with the captain and his shipping boxes. The guard told me that the captain had been arrested for trying to ship valuable astronomical instruments to himself in the States.

My next room mate was a Navy Lieutenant a neurosurgeon at the National Navy Hospital in Bethesda Maryland. He was a graduate of Magill University Medical school in Montreal, Canada. He spoke Quebec French but he would not use it in France since it sounded to the Parisians like he was from the 16 Th century. His specialty was hydrocephalus in children. His patients were the dependent children of naval personnel. He had been sent by the Bethesda Naval Hospital to Europe with two suitcases of dull surgical scalpels which he was to take to the Henckels factory, in southern Germany, where they had been made to have them sharpened. He was planning to spend one week at the factory.

The Navy Intelligence office where I was assigned a desk was on the south west side of the second ring of the Etoile (now Place de Gaulle). The office had a good view of Napoleon's Arc de Triomphe which is in the center of the Etoile. From late in January through February into early March we were stationed in Paris studying what intelligence the army already had on the Germans, and assembling our travel equipment and preparing to find out what military equipment the Germans had developed. We were to concentrate on four areas of special interest. To do this we were to visit every town and factory and school and laboratory in our assigned area of southern Germany and Austria. Our mission was as follows:

1. Look for German nuclear weapons. Since hearing of the discovery of Uranium Fission by Lise Meitner (Austrian) and Otto Hahn (German) in 1939 physicists had known that Nuclear Bombs were theoretically possible. They were not yet misnamed as Atomic Bombs. That happened in late 1945.

2. Find out about the construction of the fuselage of the V2 rockets. The Germans were thought to have superior aluminum welding techniques. The question of fuselage design was somewhat eliminated in February when a V-2 that was aimed at London did not turn down to follow its ballistic trajectory when it reentered the atmosphere but went into a flat spin. The fins may have been damaged when the rocket was launched. So instead of a nose first landing the V-2 landed on its side and the fuse failed and the war head did not detonate and the entire fuselage and fuel tanks and rocket motor and nozzle design could be analyzed.

3. Discover the method the Germans used to produce 100% hydrogen peroxide. At several chemical plants that we visited the chemists told us that they were using a method patented by the Buffalo Electrochemical Co. of Niagara Falls, NY. They were apparently paying royalties through Swiss banks for the use of this process. When I got back to the Navy office in Washington, D.C. I went to the Buffalo Electro Chemical plant in Niagara Falls and found that this was true.

4. We should try to find out what information or equipment had been sent to Japan by submarine. In Germany we never learned anything about this question.

[After the war it was learned that German submarine U-234 was loaded with 240 tons of cargo intended for Japan. She was one of the large mine laying and cargo U boats which had been used to resupply and refuel patrol submarines any where in the world. On her last voyage from Kiel headed for Japan she was loaded with sufficient diesel fuel and food for six to nine months. She was in mid Atlantic headed for Japan when she noticed that the highly coded U boat control transmissions from Germany had gone silent. Then after a delay she received a radio signal from German Naval headquarters in Kiel to surface and surrender. The captain of U-234 conferred with two other nearby U boat commanders about whether this was an allied trick radio signal. Finally after surfacing and listening to civilian radio broadcasts they decided the war was really over. U-234 surrendered to the American destroyer Sutton (DE-771) south of the Grand Banks. Members of the Sutton's crew sailed the U-234 to the Portsmouth Naval Shipyard. She had German Army passengers aboard. Two Japanese passengers had committed suicide and been buried at sea. In Portsmouth an inventory of her cargo was taken. She carried half a ton of uranium oxide, aircraft drawings, arms, medical supplies, instruments, lead, mercury, caffeine, steel, optical glass, brass and two dismantled Me-262 jet fighters.]

We were to report on any other developments that we might find. The Rules of Engagement, which were explained by our admiral during our final briefing, were to "not risk our personal safety using force to capture any prominent Nazis alive." We did not realize at the time that the Germans had an extreme fear of being captured by the Russians. All the Germans that we met had apparently decided to cooperate with the Americans who were known to treat prisoners very well. Many of them asked to be sent to the US to get jobs to continue their war work. They assumed that the Americans would continue their fight against the Russians.

There were about thirty CAFT Naval Officers assigned to each of the three allied Army Group areas. We seldom saw any of the US Navy officers from the two army groups to the north. In Paris we were each to be issued a Jeep and appropriate equipment and an enlisted driver. Later in the Rhineland we would each be paired up with a British officer. This would make three men in each Jeep. We were to write a one page or less report on each place that we inspected and send our reports and any interesting German papers back to Paris via the Army G4 field intelligence units that were in each army unit.

If we wanted to send civilians of interest back to the States there was a convenient way to do this provided by the British. Under British law the king of England could detain any one for up to six months at the king's pleasure. Apparently he could also turn them over to the Americans at his pleasure. I actually used this arrangement twice. This is the way that captured German scientists and engineers who were usually civilians were sent to the States without legal complications.

Spreading about 200 men over all of western Germany means that we seldom saw each other. The only casualties we had were two officers killed in North Germany who had been careless in picking a place to sleep. Several got dysentery in North Germany. One of our teams eventually did go to every factory and school and laboratory in the entire allied captured area of Germany. This meant that most targets were visited several times by different members of our CAFT Navy team. Our first need was to find a portable typewriter since the Navy did not have any. This turned out to be easy since the Germans had many Olivetti Italian portables as well as German portables. The Olivetti's were most prized for light weight and small size and they did not have the Z and X keys reversed as the German keyboards did. In the five months that we spent in Germany we wrote hundreds of reports. We took flimsy paper and carbon paper with us since paper was rare in the war zones. Recently I have found that my grandchildren do not know what carbon paper was used for.

We spent a few days in February looking at records of spy reports from the area which we planned to investigate. These records were on 5 X 7 cards then located at Supreme Allied Headquarters (SHEAF) in Luis XIV's Versailles Royal Palace located in a suburb west of Paris. The files were actually in Luis XIV's Petite Ecurie (little stable). This an enormous building built by Mansart in 1679-1683 located next to the main parade grounds in front of the palace. The Petite Ecurie and its twin the Grand Ecurie built next to each other had housed 1000 horses and their equerries. They have wide spiral ramps that horses could climb to the second and third floors. The Army Intelligence (G4) card files were arranged geographically. They were mainly reports from civilians who gave names and addresses of factories.

It is interesting that the named managers of these German factories were all listed as being between 16 and 18 meters tall. So the WWII US Army intelligence division was still uninformed about the metric system after 200 years. We never saw any of these Super Men. These reports usually were correct about the location of factories, but few of them correctly identified the products from these factories.

My favorite target was described on one of the 5X7 cards from an aerial photo taken near the Czech border as a square kilometer of forest with a large pile



of dirt under each tree. I thought that this must be the German Nuclear Bomb factory. I eventually got to the Czech Border and found the forest with a pile of dirt under each tree. Instead of the nuclear bomb laboratory, which would have made me famous, it turned out to be an empty underground storage tank for aviation gasoline. The Germans had very little aviation gasoline.

The Battle of the Bulge around Bastogne and in the Ardennes Mountains and forest was winding down in January, but the Rhine River was not crossed until early March. The Battle of the Bulge with 90,000 Americans involved and 19,000 killed was the largest American battle of WWII. The Remagen Bridge fell to the First Army (Bradley) on March 7. Our Navy team was to be assigned to the American Sixth Army which with the French First Army was a part of the Seventh Army Group which was assigned to invade southern Germany below the Frankfurt to Nuremberg line.

During February we watched from Paris the daily advances toward Germany on the three major fronts in eastern France. The first was the elimination in January of the German Bulge in the Ardennes Forest and around Bastogne by Bradley and Patton. This brought the allies to the Rhine. We also spent February getting ready to go into Germany. I was issued a jeep with a trailer and a Navy enlisted auto mechanic who fortunately, in my case, turned out to be a professional race car driver. I was issued a 45 caliber Thompson sub machine gun (the Tommy gun preferred by Chicago gangsters) and three 30 round straight magazines for the Tommy gun. The gun used 45 ACP ammunition (Automatic Colt Pistol). I filled the magazines and got 500 extra rounds, which we stored under the right front seat of the jeep. We were all issued Colt Automatic Pistols which conveniently used the same ammunition as the Tommy gun.

Ensigns carried the Thompsons and when they were promoted to Lt JG they carried .30 M1 carbines and gave their Thompsons to the nearest ensign. The nearest Ensign to me was Aden Meinel a Caltech Research Associate. The carbines with smaller ammunition and less steel were much lighter and more accurate than the Tommy guns. Since it was winter we were issued triple artificial fur lined jackets that had two enormous pockets each of which could take a 30 round magazine.

I got a tapered, down lined, sleeping bag which was just large enough to also hold the loaded and cocked sub machine gun by my legs when I slept. We always slept with our legs pointing toward the bedroom door. We got large black hunting knives which several Germans told me were not what an officer should carry. Officers they said should only carry ceremonial daggers. These Navy knives were great for opening K rations which were designed to be able to float in the sea for years without any damage. We only once managed to get the much tastier C rations. We packed the trailer with several boxes of fruit and our sleeping gear. The fruit was eventually stolen from our trailer one night in Germany while it was parked in a "guarded" area.

I decided to not have the foot and leg problems of WWI and WWII army field soldiers from walking in freezing mud. I checked on what the Russians wore in the frightful winter weather in Russia. They wore waterproof soft leather boots that went up the knees. So I bought some black waterproof soft leather tall engineers boots from Sears and a large number of sox. I found that my feet were

comfortable even though the winter of 1945 was one of the coldest Europe had had in years.

At the end of February my driver and I left for Germany in our open jeep with only the skimpy canvas top. Paris is a very large city and the French driving rules in the 40s were unfamiliar to us. There were no traffic control signs or electric stop signals, only the French Rule. The French Rule is simply that the car on the right has the right-of-way. While this rule is reasonable and usually works, it is unnerving to someone who is used to a few traffic control signs. There were no STOP signs or electric signs at any intersection. Outside of Paris most of the traffic was military.

This traffic was mainly the day and night military Red Ball Express. The many allied armies were mainly supplied by 6000 X 2 1/2 ton ten wheeled US Army trucks. They were usually driven by African Americans who were glad to be behind the front. The Red Ball Express was critical to keeping the allied armies moving forward.

We only outran the Red Ball supply chain when we got to Bavaria and the Czech border. When supplies ran low we had to pay cash to the US Army supply depots for gas and parts for our jeep. In Bavaria we had a flat tire from a small hole in a tire tube. I had to pay one of my last US \$20 bills to an Army supply depot for a single little 1 inch diameter rubber inner tube patch. In 2010 dollars this 1945 \$20 would be well over \$2500. We had a flat tire and we needed the patch.

The only Jeep problem we had, aside from occasional carburetor adjustments which were quickly fixed by my expert mechanic driver, were tire casing damage. All cities except Heidelberg were severely damaged. The Army Engineers bulldozed the broken bricks and concrete and stones from the bombed buildings into paths through the cities. These paths rapidly damaged the synthetic rubber tires on the Jeep. We had a spare tire when we left Paris. We shredded one tire driving over the rubble from bombed out cities in Bavaria and ran on the spare to Munich. The spare tire, our last casing, shredded in the Munich rubble. The Munich Army supply depots had no jeep sized tire casings. My driver found a three wheeled German truck that had the same tire size as the jeep. We requisitioned one of the three tires and ran on it to the end.

We were paid a small war zone allowance once a week in German marks. These were worth 10 cents American. There was nothing to buy except hair cuts. We got the usual war zone daily rations of a razor blade, a stick of gum, a K ration and a pack of cigarettes. Most of us used these things for trading. Our real pay was deposited in our banks back in the States. A military person is assumed to live where his wife lives and his pay is sent to her. There are similar arrangements for unmarried personnel.

We drove east from Paris to Metz, the turning point of the war of 1870 which was won by Germany. Bismarck used this victory to unite all the little German city States into the First Reich by crowning the first Kaiser in the French Versailles palace where Bismarck had his headquarters. Then we drove a short distance to Verdun the turning point of World War I where we saw a few dead horses. WWI dethroned the Kaiser and produced the democratic Second Reich which was replaced by Hitler's Third Reich.

At one intersection in eastern France the British military police asked us to not cross their line of traffic. We were stopped for two hours while a British Army drove north from the Rhone river area to the British front in Northern France. An entire army of several divisions and regiments and support staff uses a very large number of trucks and many armored cars when it moves. Usually the tanks are on large flat bed multi tired trailers. Military police are usually stationed at each intersection to control traffic. We got to the German border at Saarbrucken a quaint town in a deep valley. At the Saar River there was a sign saying that the bridge over the Saar River into Germany proper was provided by curtesy of the Engineers of the Third Army (George Patton). We soon learned that all bridges, no matter how small, had been blown by the retreating Germans. East of Saarbrucken we came to the first Autobahn which went north and south in the beautiful Rhineland.

We got to Kaiserslautern which is in the Rhineland on the west side of the Rhine River and found the undamaged high school where the Navy had its HQ. Finding a building in a town was always difficult since we did not have any city maps. The US Army was so short of paper that all of our larger maps were printed on the backs of captured Rommel's Africa Corps maps. In Kaiserslautern each officer in our group was assigned an English officer to travel with us (generally they did not have a driver's license). My English officer was Col George Galley whose specialty was artillery fuses. He could have stepped right out of an English movie. It turned out that he, as with many other high ranking civilians, had an equivalent military colonel's rank. This practice allows armies to use civilians without complications of privilege when they are assigned to the military for special operations.

One of my fellow CAFT ensigns was assigned a real Scottish army colonel who wore a dark tan kilt (strictly forbidden by SHAEF). He had his own personal English army batman. The Scottish colonel was apparently a cousin of the queen. He spoke Gaelic most of the time and we could hardly understand his English, so his batman translated for us. The batman helped all of us especially by bringing buckets of water to flush the usually waterless German toilets. He also kept us supplied with firewood to heat bath water in the geyser that was over most German bath tubs. Unfortunately he did not bring us bed tea.

We had to quickly learn some simple facts about army organization. From the bottom up the classic chain of US Army command with the number of soldiers and rank of command is:

Squad 10 sergeant  
 Platoon 16-44 lieutenant  
 Company 60-190 captain  
 Battalion 300-1000 lieutenant colonel  
 Brigade 3000-5000 colonel  
 Division 10,000-15,000 major general  
 Corps 20,000-45,000 lieutenant general  
 Army Group several armies commanded by a full general or field marshal

It was useful to know the succession of command since we drove around anywhere we wanted to go. The food was different in these different commands. The important facts about food were that only corps and above had ice-cream and

tank companies had steak. The best average menu was in MASH units that had nurses. We had to depend on a different unit for lunch each day since our Navy base units did not serve lunch.

The Remagen Bridge which had been badly damaged by German attempts to blow it was overrun by Bradley's army on March 7. After a week it finally collapsed from German artillery fire, but only after two American divisions had crossed it into Germany proper. North of Remagen just south of Mainz the first pontoon bridge was opened on March 24. The Seventh Army Group which contained the Sixth Army (Patch) of which we were Navy guests captured Ludwigshafen on March 1. After several days the Sixth Army under heavy German artillery fire forced a "tread way" pontoon bridge across the Rhine from Ludwigshafen to Mannheim. Tread way means there is nothing in the center, only two narrow steel mesh tracks on the sides. The parts of the bridge can be carried on trucks and when assembled are strong enough to carry tanks.

Ludwigshafen with its BASF and IG FARBEN plants and the Oppau Ammonium Nitrate plants was a critical military target and had been hit by 13,000 B-17's in 121 separate raids. The fact that ammonium nitrate could detonate was discovered at Oppau in 1921 when 4500 tons of it detonated with its shock wave doing great damage.

We had been told by the Navy back in Paris to be sure to have our health immunization shots records to show when we crossed the Rhine. This proved to be a bureaucratic misunderstanding of the Fog of War in a war zone and the source of much laughter. I happened to be driving when we got to Ludwigshafen. As a result of the 121 bombing raids and US artillery fire when the town was taken there was nothing left of the buildings that stood more than waist high.

Along the road through what was left of Ludwigshafen to the Rhine River there were encouraging US Army signs which said DROP OUT OF LINE IF YOU CANNOT KEEP 30 MILES PER HOUR. Another sign that was even more assuring said IF YOU ARE FOLLOWING A TANK KEEP YOUR BRAKES ON SINCE YOU WILL BE GOING DOWN HILL ON THE PONTOON BRIDGE. I was following a tank. The Rhine was covered by waves being blown north by one of the Alpine winds. The waves were breaking over the tread way and pontoons and all the vehicles. The tank ahead of us pushed the bridge down so far that the tank treads were in several inches of water. The waves were breaking over the pontoons and all the vehicles and drenching everything. On the Manheim side of the river there were thousands of abandoned shaped charge anti-tank rockets neatly stacked up. Apparently the Germans were in a hurry to leave. The German rear guard artillery had bombarded the pontoon bridge for several days before moving on east.

A real war moves much slower than it does in the movies. We once saw more than a thousand B-17 planes go over Bavaria on a raid to the oil refineries in Ploesti Rumania. It took more than an hour for the whole formation to go over us. We saw another example of the slow pace of a real war when we drove along a road in southern Germany. To our side there was forest. A group of tanks was going in our direction in the forest. The tanks were dodging from tree to tree trying to stay out of sight. We were driving at about 30 mph while they were going less than 5 mph. A friend of mine in the 8th Air Force in England told me about an example of how slow a real war can be. When the weather over the Bulge cleared on Christmas Eve in 1944 he and his B-17 crew was sent on a 1000

plane raid to cut one rail junction behind the Bulge to interrupt the German rail supply to their troops surrounding Bastogne. It took 4 hours for 1000 planes to take off from several English airfields and to assemble over England before the entire flight headed to this single rail junction. This time consuming assembly burned up a lot of gas but it allowed a large number of planes to arrive almost simultaneously over the target which would overwhelm the anti-aircraft and fighter plane defense. Remember that in WWII there was no US Airforce as such. All army aviation was in the United States Army Air Force (USAAF) sometimes called the Air Corps. The United States Air Force was not formed until 1947.

We later learned that the main reason for the slowness of German Army movement was due to the fact that a majority of German Army transport was by horse drawn wagons. Even the magnificent Autobahns were largely used by horses. Some very high ranking Germans had gasoline but we saw very few German Army vehicles that had gasoline. After the war ended we saw thousands of horses.

Heidelberg, which had not yet fallen, is south of Manheim on the Necker River. The town is a short distance east of where the Necker flows in to the east side of the Rhine. We bypassed Heidelberg and drove further south to Karlsruhe which had been occupied by the French First Army under General de Gaulle. We spent three days and nights there. The only target we found in Karlsruhe was a large factory right on the Rhine River that made brakes for trucks. We were sniped at while we were in the factory. The sniper fire apparently came from an apartment across the street from the wide park that surrounded the factory. This sniping delayed us but we never caught site of the sniper. There was artillery firing in the woods around the town. We saw one German body. Each morning we watched the parade which was held for General Charles de Gaulle along the main street of downtown Karlsruhe. On the third day of our visit the town center of Karlsruhe caught fire and we drove out between burning buildings through a lot of smoke.

We drove north to Heidelberg which had fallen on March 29. Heidelberg, Tubingen, Gottingen, and Rothenberg were only slightly bombed. The first three because of their universities and the last because of its quaintness. The army was ordered by the Secretary of War to not use artillery on Rothenberg since it was declared to be the most German of all German towns by both the Nazis and the Americans.

Since the Germans had been ordered to blow all bridges the first day we arrived in Heidelberg the US Army Engineers had to work all night under flood lights replacing the just blown beautiful old medieval bridge over the Neckar river with a heavy wood bridge that could carry tanks. The army lifted the usual civilian night time curfew so that the German civilians could watch the army engineers at work. The German army had also set fire to the Heidelberg cathedral and to the university library. The civilians could also watch the army put out these two fires. We were billeted in a comfortable dentist's office and apartment on the north side of the Neckar River.

We started checking targets to the north and east of Heidelberg. We found the usual scenario was that at each factory, after our tanks had gone by, the still present former managers had put on white laboratory coats and assembled all of their detailed reports about their war work and were waiting for us in the

manager's office. We would tell them to unlock all the usual German roll top desks and put toilet paper and a bucket of flush water in the bathroom in the manager's office. The managers answered all of our questions in their rusty high school English. Most of them asked how they could come to the States and get jobs to continue their important war work for the US. They assumed that the US would take over and continue their fight against the Russians. They were very worried that we would turn them over to the Russians who were at the time nearing Vienna, which fell on April 13.

The Army G4 came to me to ask a favor. They had a very irate professor of medicine at the university medical school whose house had been destroyed by an accidentally dropped bomb. He wanted to be paid for the damage. The G4 man said maybe a Navy officer not part of the army could cool the professor down. So I talked to the professor and pointed out that I was not in charge of anything but would try to help. I asked him about his specialty. He had spent 15 years doing research on the physiology of airplane crews breathing oxygen in unpressurized planes at high altitudes. I guess that now he would be called a Flight Surgeon in the Navy. This was a subject I knew nothing about but thought the Air Corps would like to hear about so I sent him to England to be guest of the king at the king's pleasure and suggested he might get a job in the States. He was not happy but he did go to England.

Word came that the sixth army had taken Nuremberg. We drove there as fast as we could through a long, narrow salient the sixth army had driven south into Nuremberg. We went directly to the enormous Nazi stadium where Hitler had held his big speech rallies. We began taking pictures of each other in front of the colossal swastika above the speaker's podium. Immediately our military police drove in to tell us that we must leave as fast as we could since SHAEF had turned Nuremberg over to Patton's Third army so that for historic purposes Patton could take Nuremberg the Nazi's emotional center. There was only one road out of Nuremberg to the north in the salient that the Sixth Army had driven south into the city. The Sixth army withdrew into the flanks of the salient to protect the flanks of the rapidly moving Third Army. We spent about 12 hours driving against Patton's usual one way two lane traffic. We dodged endless Third Army tanks and trucks by driving off of the road into the forest or farm land on the side to wait for a rare space in the very heavy oncoming southbound traffic. Patton usually made roads one way in whatever direction he was moving. We eventually got back to Heidelberg in the less hectic Sixth Army area.

We drove from Heidelberg to one or two towns behind the front lines each day. Then we would type up a report on each place we had visited. These reports were sent to our Paris office by the Army G-4 field units. The G-4 units always had working telephones. I never found a non working phone anywhere in the war zone. Phone wires were strung along fences where the phone poles had been damaged. Serious signs warned that the phone wires were not to be cut. It was often said that it was easier to put a call through to Washington from anywhere in the war zone than it was to call across the street in Paris.

We never saw any moving engines or rolling stock on the German railroads. Several times to bypass blown highway bridges we had to drive on the ties of railroad tracks straddling one rail and bumping along on the ties (sleepers). The rails on the main line German tracks were very high. When the rails were wet it was hard to get the jeep over the straddled to get off of the track even while using

the Jeep's four-wheel drive. We were required to keep our windshield folded down when on the railroads since windshield reflections were often used by snipers as aiming points.

We found a stalled train of several flat cars each loaded with hundreds of 5" diameter fin stabilized unsteered anti-aircraft rockets. They were each fueled with a pair of hypergolic liquids (liquids that ignite on contact). The igniter containing an electric squib and black powder was located in the reaction chamber above the nozzle. When the igniter fired it broke the seals on the two liquid tanks. The liquids would then ignite further increasing the pressure in the reaction chamber and as the burning gas left the nozzle there was enough set back acceleration to inject the two liquid fuels from the two large storage tanks into the reaction chamber against the reaction chamber pressure. These inexpensive no moving parts rockets apparently could reach bomber altitudes and then detonate. We did not find out what type of fuse they used in their war heads. These rockets were called Typhoons which was the name of several fighter planes of WWII and by coincidence is the present day name of the European Union's newest fighter plane.

We visited several Brown Boveri plants (a Swiss company making heavy electrical machinery). We were told that we should contact their American branch for information. This was true but the American branch was actually a very small fraction of this large international company. When we visited several Linde plants we got the same story. The Linde plants were supplying the same gasses as Linde plants supplied in the States. These well known plants had all been heavily damaged. Some of the large machine tools in the Brown Boveri shops were massive enough to survive bomb hits and still be in working order.

We toured two large almost undamaged Dynamit AG plants. This is the company founded by Alfred Nobel. We did not find any new unknown developments in any of these large well known plants. At one Dynamit AG plant the director's house was unusually large and very luxurious. There was a concert grand piano in the music room. It was being played by a Russian female slave laborer in the standard blue and white striped slave suit. She obviously had had years of classic Russian music conservatory training. She and her fellow freed slaves did not seem to be house broken.

We did not run across a 100% hydrogen peroxide production plant. They were located further north since the hydrogen peroxide was used in submarines. Hydrogen peroxide in the presence of manganese acting as a catalyst is converted to oxygen and steam. This can run a piston engine or a turbine.

On one of our trips south of Heidelberg I was eating a K ration when I suddenly felt hot and soon developed a high fever. We drove back to Heidelberg and my driver and the colonel took me to the Army Hospital. I told the colonel and my driver to go back to our comfortable quarters in the dentist's office and enjoy Heidelberg until I got out of the hospital. Heidelberg was off limits from bombing and was designated as a hospital town. There were large "H"s painted on the roofs of major buildings. All heated suitable buildings, even the zoo, were used as hospital wards. The Army doctor did not think that the K ration had caused the high fever but that bronchitis had. I was assigned to a bed in the University English Department library. There were a few German POWs in the same ward. There was a library shelf next to my bed which contained all of Jack London's

books. Jack London, being a communist, was banned by the Nazis and his books burned in public demonstrations. The English Department of the University had secreted away a large number of English banned books in this room. The bronchitis was cured in a few days by the newly available sulfa. I spent ten days reading Jack London.

A dozen US soldiers with malaria were in the same room. They had all caught malaria while being pinned down by the Germans for several months on the Arno River in Florence Italy. They had a three day malaria cycle with coldness, rigor, fever, and sweating and semi recovery for a day and then the cycle was repeated. Malaria is a disease you do not want to get.

Out of the hospital we went back to our investigations. We drove to Kohlhof (market garden) a small resort in the hills south east of Heidelberg which was at the end of a railroad spur that had been used before the war to bring tourists up from Heidelberg. On the railroad spur there were several flat cars each with a full sized section of a real submarine on it. Anti-radar 1/4 wavelength coatings had been sprayed on to the above water surfaces of the sub sections. There were radars used to test the reflection and absorption of these coatings to try to produce a stealth submarine that was more difficult for allied radar to detect. This was the only radar work that we saw in Germany.

We finally went to Rothenberg since we remembered that the army had been ordered to not use artillery on Rothenberg. Its reputation of being most German of all German small towns was justified. We had assumed that the Germans would move important war work there to take advantage of the lack of bombing. The town was largely made of picturesque residential half timbered old houses. We checked out many houses. All of their attics were filled with parachutes. We each took a parachute and a Nazi flag but found nothing else of interest. We cut up the flags to make red scarves which we wore to keep our collars cleaner. We only found one army laundry which washed and dried anything we needed in a few minutes while we waited in line.

[We got as far as the Czech border where we met a CAFT team of two astronomers. One of them was Aden Meinel a Caltech Research Associate. I asked how he became an Ensign before graduating from college. He had set up an optics laboratory at Caltech to make very special telescopes for Navy submarines. At the time he was barely out of high school. The Navy gives an Ensign's commission to men with a bachelor's degree. He explained Olber's Paradox (1823) about why sky is dark at night which is related to the subject of his PhD thesis. He had already done the experimental work for his doctor's thesis in Astronomy while he was still in high school. He measured the spectrum of the light from the night sky. When we got back to Paris he took me to the Paris Meudon Observatory where he seemed to know everyone. Apparently he had grown up at the Mount Wilson Observatory. After the war he got his AB from UC Berkeley in two years, 1947, and his Ph D in two more years, 1949. He visited me in Berkeley when he was starting work on the Hubble telescope to see how the Berkeley accelerators designed moving parts that had to work in a vacuum. He got the Kitt Peak observatory started, has designed several large telescopes, been a professor at the University of Arizona which has named their Optical Sciences building after him and is now working at JPL.]



We spent some time in the French First Army area in south western Germany. At the French officer's mess the food and wine were very good but they did not get to petite dejuner (breakfast) until about 10:00 AM. The University of Tubingen in another lightly bombed town did not have interesting war work. In the French area there were hundreds of US supplied 2 1/2 ton trucks which the French were filling with household items that they could use back in France. Most trucks had two or more women camp followers riding in the back. These women cooked and washed for the French soldiers. On the narrow one lane roads a truck and a jeep could not pass. When we met an oncoming truck we had to get off the road since they never slowed down. We were side swiped by a French truck which tore off the left side support bracket of our canvas roof and unbent the steel roof support pipe. We had no tools and found we could not remove the right support bracket. For two days we trailed this long pipe scraping on the road. Then when I was driving another careless French truck coming toward us in the middle of a one lane road forced me into a drainage ditch. The right side of the jeep scraped along the right the side of the ditch which tore off the remaining right side support bracket for the roof. The two passengers held on miraculously since seat belts had not yet showed up on any vehicles. So we were completely topless until we turned in our jeep in Wiesbaden.

In southern Bavaria driving along a one lane farm road that crossed a large swamp we saw in the middle of the swamp that there were at least 100 land mines piled up on each side of the road. We could not go back so we stopped for a little conference. Our decision was to fire half of our 500 rounds of machine gun ammunition in to the mines. None of the mines detonated and as we drove slowly by we could see dozens of holes in their round pressure sensitive containers. Munitions are usually designed to be insensitive to rifle and machine gun fire.

The war in Europe ended on May 8, 1945 while we were still in the western part of the Black Forest area. The Black Forest bordering on the Rhine in Baden-Wurttemberg west of Bavaria is not as dense as the Ardennes forest further north. Munich was now open. We headed to Munich the second most important city in Germany. Before we got to Stuttgart, which is on the way to Munich, we heard that Werner Heisenberg the director of the German Nuclear Bomb project had been located in Urfeld on May 3 and had been taken to Hechingen west of Stuttgart. Heisenberg and his staff of would be nuclear bomb physicists were of great interest to us. So we drove to Hechingen. Colonel Pash of the OSS, who was in charge of the Heisenberg physicists, told me that a Navy ensign, even a physicist, was not high enough in rank to talk to any of the German physicists. Ten of the best German physicists including Heisenberg were sent by the OSS operation Alsos to England. They were held at the king's pleasure in Farm Hall, a large country home for several months after May 1945. Secret recordings were made of their conversations and interrogations under the code name of Operation Epsilon and are now available as the Farm Hall Transcripts.

So turned back at Hechingen we decided to investigate Stuttgart. The center of town was entirely destroyed so we went to the only slightly damaged airport where there was a laboratory. The laboratory contained a large vertical wind tunnel which was used to develop parachutes. We thought that the parachutes were being designed to be more steerable. We were shown around by a German speaking Russian slave laborer who insisted on giving us one of the millions of leather bound personally signed copies of Hitler's book Mein Kampf which he wrote while in prison in 1923. We declined the gift and told him to save

the book to sell after the war. Then German 88 mm artillery began hitting the air field so we left.

The autobahn east of Stuttgart is fairly level with a few tunnels. These tunnels were all blocked with machine tools moved from factories further north that had been bombed out. Detouring the tunnels was a slow process over small farm roads. Some of the straight sections of the autobahn had been converted to aircraft landing runways by pouring green concrete in the middle. There were many fighter planes on the sides with their tails in the surrounding woods. We checked a few planes and found some were booby trapped so we drove on to Ulm. In Ulm we inspected a Schuco toy factory but did not find anything interesting.

We drove on east to Augsburg where there was one surviving concrete pedestrian foot bridge. The engineers had cut the railings off of the two flights of stairs leading up to the bridge. We drove up the stairs. The jeep 4 wheel drive worked fine climbing the stairs and making a U turn on each landing between the flights of stairs until it rained. Then the tires were set afire as they skidded on the steel edges of the stairs. After crossing, the steady rain put the fires out. We only had to cross this bridge three times. From Augsburg we went on to Munich.

The center of Munich was badly damaged except for the large science museum on an island in the Isar River. The island had been captured by Polish American troops who, though very friendly, spoke no English. We did not find that any secret war work was going on there. A few parts of the Graff Zeppelin were on display. I had seen the Graff Zeppelin in 1929 over Chicago on it's only around the world trip.

We were billeted in a new walled subdivision south west of Munich. We were assigned to a large house with many bedrooms which we shared with about six newspaper war correspondents. They sat around the dining room table in the daytime and typed their war dispatches which they sent to their respective newspapers through G4. They never seemed to go out to see for themselves what the army was doing but used G4 mimeographed hand outs as the basis for their stories. They had a nice car and liquor and were interesting to watch.

Everyone in the subdivision ate in the Navy mess. This was in one large comfortable community dining hall which had previously served all of the lucky Nazis who had houses in this gated guarded community. Of course they were all gone by now. The colonel and I were assigned to a large oval table with about ten men. Two of them were noteworthy. One was Kenneth Mees the then Vice President of Research of Eastman Kodak. Kodak had bought the English Wratten photographic filter company just to get their best scientist Mees. George Eastman president of Kodak had rapidly promoted Mees. George Eastman had a firm policy of hiring MIT graduates for research jobs so Mees was a rare exception at Kodak. Fortunately I had read his very important photographic book *The Theory of the Photographic Process Macmillan Co., New York, 1942*. The main subject in the book is the behavior of silver crystals in emulsion. So we talked at great length about photography. At the time Kodachrome was just ten years old. Kodachrome in 35 mm cartridges was in such short supply in 1945 that each of us was only allowed to purchase 2 rolls for our entire intelligence mission.

The other important person at the mess table was Charles Lindberg. Many of us tried to talk to him with little result. He would pass various dishes along the

table but he had no small talk even for a vice president of Eastman Kodak. In another part of the dining room there was an area set aside for Theodor Von Karman's own very special staff. He had decked himself and his staff out in his personally designed comic opera style uniforms. Wearing anything but standard Army or Navy uniforms in a war zone was strictly forbidden by SHAEF and is dangerous if captured. Professor Theodore Von Karman was not easily denied his wishes. He had written an excellent paper for the Eaton Canyon Rocket project showing that evaluating the enthalpy in a rocket nozzle was easier to follow by using temperature instead of pressure as one of the independent variables. After 65 years my memory of the details is poor. But Von Karman put on a fine show in Munich.

The army announced that all German cameras, binoculars, guns, pistols, swords and daggers whether civilian or military were to be surrendered at the nearest police station. We also found that US military personnel could take the cameras. We visited one police station that was actually knee deep in cameras. Most had been stepped on but a few were ancient or useable. We left them all since we had our own 35 mm cameras.

Our first target in Munich was the BMW factory. At the time BMW only made motorcycles. We did not find any interesting war work. We did find more than a thousand crudely made rifles with soft wood stocks intended for the Volksturm (people's assault troops) of old men and underage boys. Since guns were to be turned in at police stations we loaded our jeep with more than 500 of these guns displacing two passengers. We dumped them at a police station and decided that this was not what we were in Germany to do and never collected guns again. The US Army slowly made a door to door search in all of Germany for guns and explosives in contrast to the situation in Iraq where the US did the opposite.

We went to the Oberpfaffenhofen airport south west of Munich located on the north shore of the Ammersee (lake). It had many large hangers. A German Air Force general came out to see what we were up to. He said he did not talk to Navy Ensigns. I said that now that the war was over that he should tell us what work was being done at the airport. He quickly changed his mind and showed us through all of the hangers. It appeared that only routine aircraft maintenance was going on. As we were leaving the general called us back and said we might want to see something special as we drove out. If we drove down the east side of the Ammersee Lake we would come to a village where there was one of Heinrich Himmler's enlisted men's breeding camps (Lebensborn). He said that when an enlisted German soldier with blond hair and blue eyes came up for leave that he was given the choice of going home or to one of the breeding camps. So we found the village on the lake and there were several blond ladies wheeling baby carriages around. We did not know at the time that we would see an officer's breeding camp later near Wiesbaden.

One dark raining night we drove our topless jeep in to a small town east of Munich. We were all soaking wet. I was driving as we entered the large center of town open plaza or commons (zentrum) paved with rain slick cobble stones. There was an Army welcome sign DON'T SLOW DOWN TYPHUS. As we were discussing what to do about TYPHUS the half track I had been following hit a mine that had been buried under the cobble stone pavement. The violent explosion cut the half track's left steel caterpillar tread. The free end of the caterpillar tread chain shot up in the air toward us and hit the top of our windshield frame and all

of the successive steel tread links clattered over the windshield frame and over the jeep just missing the rear seat frame and on to the pavement behind us. We three leaned out as far as we could on either side. The half track skidded around 180 degrees since its left side had no caterpillar tread and was sitting on the left drive cogs. I skidded around too and just missed the half track. This was our worst experience in the whole expedition.

Driving south from Munich in the first foothills of the Alps we came across a factory that made developing tanks for 35 mm professional movie film. They were not developing any new equipment that was worth a report to Paris. We drove on south into the Alps along the road to Innsbruck which goes on to the Brenner Pass and into Italy. A few weeks earlier we had visited Garmisch-Partenkirchen, where the 1936 Winter Olympics had been held. Garmisch is in the next valley west of the main valley from Munich to Innsbruck. There was a cog railroad from Garmisch to the top of a mountain. We felt that the top of this mountain with its easy access would be a good place for secret war work. The Army would not let us go up the cog railroad from Garmisch, their excuse was that I was too low in rank and Colonel Galle was an English foreigner. When we got as far south on the Munich to Innsbruck road that Garmisch was in the next valley to the west we found a cable car which went up to the top of the same mountain that the Army in Garmisch had refused to let us visit.

So we rounded up some of the lift operators and left our driver at the bottom with the Thompson sub machine gun to impress the natives, whom we still did not trust. At the top we found a large laboratory which was apparently entirely staffed by former members of the same fraternity at Heidelberg. They had been on the Russian Front and had gotten a grant from the government in Berlin to run some fiendish experiments here in Bavaria. This had saved them from the Russian Front but was fatal to many Russian slaves which they had acquired to use as guinea pigs. There were about 100 Russian slaves standing around wearing the regulation blue and white striped slave suits which we saw everywhere in Germany. This jolly group of mad scientists had cast a concave concrete "mirror" about 20 feet in diameter with a horizontal axis. The German fraternity brothers would put a high explosive charge at one of the foci of the concrete reflector and then place a Russian slave at the other foci and detonate the high explosive charge and see if the converging shock waves killed or wounded the Russian slave.

The colonel and I listened to all this for a while and then began to realize that the Russian slaves who were standing around watching and listening did not know that the War was over. English is such a universal language that it is never certain who understands what you are saying. So we went to the cable car and signaled the operators at the bottom to be ready to start us down and then we told the Russians that the War was over. Some of the Russians apparently understood English and let out a shout, so did the Germans who let out a scream. The Germans tried to get in to the cable gondola. We slammed and locked the gondola door and signaled the operator to start down. We left for the Russians to deal with the German fraternity brothers. We wrote this all up when we got back to Munich and sent our report to Paris. I do not know what the Russian former guinea pig slaves did to the Germans.

Just before we got to Innsbruck we passed the local airfield where there were several ME-262 jet fighters parked. We had heard reports from Wurzburg

that when the ME-262s flew low along the river they were so fast that the allied radar controlled air defense guns could not follow them. They were the world's first operational jet-powered fighter aircraft. They entered active service in the German air force in April 1944. If they had entered service two years earlier they might have made it possible for the Germans to regain air superiority since they were about 100 mph faster than our fastest fighters.

We drove all the way to the Italian border at Brenner. We were told by the American MPs at the border that only a General officer could cross. Field grade officers like my colonel and company grade like myself were neither high enough in rank to cross the border in to Italy. I had listed a large factory seen on an aerial photograph in the mountains above Brenner from the files in Versailles. We went to the Brenner rathouse (city hall). The mayor was now a German speaking GI from Pennsylvania. The former German mayor was still there to answer questions. He said there was a large molybdenum processing plant in the mountains above Brenner. He said it was embarrassing to him for us to go up to it. He said that the people in the mountains had been inbreeding since Roman times and that they were defective. The German former mayor supplied us with a guide and we drove to the molybdenum mill. We didn't see any of these defective people and the molybdenum mill was not doing secret war work.

We stayed in Innsbruck for several days checking east and west along the Inn River. We found another development factory also staffed by fellow Heidelberg fraternity brothers who had rescued themselves from duty on the Russian front. They had converted truck tire vulcanizing molds to centrifuges. The high speed rotating steam heated molds made the rubber in the treads much denser. The remainder of the tire was filled with a dense rubber sponge. No high pressure air was needed to keep the tire inflated. This seemed like a very interesting improvement. In 1945 the tubeless tire had not been introduced and all passenger and truck tires had an inner tube. Various solid tire designs have been introduced for more than a century but unfortunately none has been widely adapted.

We drove west in the Inn valley hoping to get to the Arlberg pass at the Swiss border. The road was blocked by snow several feet deep. An army bulldozer was trying to clear it. Retracing our route to the east of Innsbruck we met a large open topped eight passenger Mercedes which you see in WWII movies transporting German officers. The passengers in this Mercedes were German civilians with their beautiful female secretaries. The males said they were the managing directors of the Heinkel-Hirth aircraft factory. So I arranged to have the males sent to England to be guests of the king. I do not know if the secretaries also became guests of the king.

Back in Innsbruck we decided to take just one day off - a Sunday. We developed our pictures in the morning and went skiing in the afternoon. In June we got to Kitzbuhel, Austria, which is a luxurious ski resort east of Innsbruck. The ski lodge hotel was magnificent with a sitz bath in our en-suite bath room. The hotel dining room served a four star meal. There was a very talented pianist in a US Army enlisted men's uniform who played for us during dinner. After we finished I asked the pianist who he was. He said he was a grandson of Franz List.

Then a courier interrupted my talk with the pianist with a dispatch from Paris that said we were ordered to drive to Wiesbaden to fly back to Paris. We

drove back to Wiesbaden which is north of Heidleberg and Manheim on the east side of the Rhine. At last the weather was warm so driving in our roofless jeep was pleasant. The Autobahn still had many detours and repairs under way. All of the side roads had crossed the Autobahn on elevated steel bridges. These had all been dropped across the Autobahn by the German army demolition engineers. Some of the steel bridges could be towed off the road by tanks. Others had to be cut up to clear the main road.

We did not have any city road maps of Wiesbaden so finding the Navy HQ office was slow. We finally found the Navy office and they sent us on to the Navy officer's billet at Villa Lilly about 40 miles north of Wiesbaden. Villa Lilly is a luxurious chateau located high on a promontory on the east side of the Rhine. The river flows around the promontory on three sides. Villa Lilly was the German summer home of the Saint Louis USA Anhauser Bush family. The main house was a large rustic hunting lodge. It was very comfortable as you would expect.

Then we were told that the several enormous buildings located behind the villa were originally built as quarters for the Anhauser Bush guests. These guest quarters were now occupied by another of Heinrich Himmler's German officer's breeding camps (Lebensborn). We could see the usual blond and, I guess, blue eyed ladies and their blond blue eyed babies strolling around in the extensive grounds. The Navy had occupied the main chateau at Villa Lilly after the army crossed the Rhine back in March but had not yet found a place to send the breeding camp ladies to. The Lebensborn (Fount of Life in old German) eugenics program (1935-1945) was established by Heinrich Himmler who himself had two illegitimate children. About 7,500 babies were born in Germany and 10,000 in Norway. There were about 12 breeding camps from France to Poland and 10 in Norway. The rules for officers were about the same as for enlisted men. When leave came up an officer could choose to spend it at home or in a breeding camp. Officers in the SS could volunteer to go to a breeding camp even if they were not eligible for leave at the time.

We were taken to a new army airstrip that was entirely made of interlocking steel plates. I reluctantly turned in our jeep. We had driven over 6000 miles since leaving Paris. My driver and I flew back to Paris in an Army DC-3. The colonel flew to London on an RAF passenger plane. We could see that in Germany there were hundreds of 1 km square replanted forests scattered between farms. We had been told back in Heidleberg that on Sundays families could gather a week's free fire wood from these reforestation plots. In Paris we organized our captured reports and papers. One item that I sent back was a complete set of issues of the Swiss Snow engineering journal.

In July I got orders back to Washington. Now that the European war was over there were so many Americans being sent home that only higher ranks could go by air. I was able to get a reservation on a ship. The ship turned out to be the Queen Mary which was scheduled to sail three weeks from Greenock, Scotland. I took the train from Paris to Dieppe, the port on the English Channel where the ill-fated great Canadian raid had struck in August 1942. The Canadians suffered very heavy casualties. There was no station left in Dieppe so the train stopped out in open farm land. We had to walk to what was left of the Dieppe port. The boat sailed to New Haven on the south coast of England. We took a train up to London where I was billeted in the Navy quarters on Berkeley square. I had two weeks to

see some of England. I did this by train from London to Windsor, Oxford, Cambridge and Edinburgh.

In July of 1945 it was not yet certain that all of the German submarines had surrendered. The British Admiralty did not yet risk the Queen Mary going to Southampton on the south coast of England. She was still landing in Scotland and was routinely anchored in the Firth of Clyde offshore from Greenock Scotland, much further from the indestructible bomb proof German submarine pens at St Lazare in France. On the day before we were to sail we took the night train from London to Greenock, Scotland. The US Navy was scheduled to load the last day. Our train arrived in the late morning and we lined up to be checked in by an army sergeant with the usual clip board. The army had leased the ship from the Cunard shipping company and was in charge of loading.

The man ahead of me in line was a Navy Chief Petty Officer (CPO). He had a large English hunting dog on a leash. I asked him how he was going to get the dog on the ship. He showed me the Navy orders for the dog's transportation back to the States. Navy CPOs know how to arrange these things. But when we got to the army sergeant he looked at the dog's orders and checked his clipboard and said the dog's orders were OK but all of the kennels were full and there was no kennel reserved for the CPO's dog. There are many kennels on the top outer deck of the Queen Mary which you can see in a Fred Astaire movie. Fred borrows a dog and is trying to pick up Ginger Rogers who is walking her dog. The Navy in London had forgotten to reserve one of the kennels for the CPO's dog. So I whispered to the CPO 'let's drop out of line and come back later when this sergeant may be at lunch.' We walked in to Greenock and found a veterinary hospital. The veterinary told us to go have lunch and he would solve our problem.

After lunch back at the veterinary hospital there was a beat up official Navy wood sea chest with a false bottom and concealed air slots around the sides of the bottom. The petty officer's name was stenciled on the outside. The vet gave the dog a sleeping drug, put him in the bottom of the chest, put in the false bottom on top of the dog and we emptied our two sea bags on top of the false bottom and padlocked the Navy sea chest. We paid the vet, thanked him and asked how he had gotten the very authentic US Navy chest in an hour. The vet said that residents of Greenock had been smuggling for hundreds of years and had done this many times before. So we carried the sea chest by its two rope handles, one on each end, back to our favorite sergeant. The Queen Mary (80,000 tons, quad screwed, 29 knots) was anchored in middle of the Firth of Clyde about a mile from Greenock far to the west of Glasgow. It took 3 or 4 days to load the 16,000 troops and the Cunard crew on to the Queen Mary. The US Navy loaded on the last day. The chief petty officer and I with the sea chest were ferried out to the Queen Mary.

As soon as we were aboard, to my surprise, I was put on the Navy duty list. My watch was to be from midnight to 4:00 AM every night as the deck officer for the 1000 Navy enlisted men on board. Most of them slept in the drained swimming pool which was filled with stacked bunks. We put the sea chest in the middle of the third class cabin which we shared with ten other Navy officers. We unpacked the chest into our sea bags, woke the dog up, and asked our room mates and our Cunard steward to not let the dog out the door and went to dinner.

Since there were 16,000 passengers plus several thousand crew aboard the Queen could only serve two meals a day, breakfast and dinner. As soon as the last of the Navy were aboard the Queen up anchored and sailed west out of the Firth of Clyde and south between Ireland and England and then west for New York all at 28 knots (32.2 mph = 51.9 kmph). It was not necessary to sail north of Ireland on this crossing. When we got back to the cabin after dinner the dog was gone. Our happy home bound roommates had carelessly let the dog out. We searched the enormous ship for a long time and finally found the dog being made over by a crowd of celebrating army nurses. We found our steward and he said he had one, three bunk unoccupied state room. Due to the limited amount of sea water that could be desalinated, the fresh water was limited to the dining rooms and bars, etc. Cabin sinks, bath tubs, and toilets had salt water. Our steward said the fresh water could not be turned off in the unoccupied state room, but if we promised to not use too much fresh water we could have the state room. We gave the steward a big tip. The dog slept in the lower bunk, I slept in the middle bunk and the CPO in the top.

My duty desk was located on the small deck between the two foremost cargo doors about 100 feet aft of the bow. By my desk there were enormous diagonal wrinkles in the 3" steel plate siding of the Queen. I found that these were the residual damage from a collision north of Ireland in October 1942 with the fast cruiser Curacao. The Queen was so fast she could not sail in a freighter convoy. The Curacao and several destroyers were on anti-aircraft duty protecting the Queen from land based German planes from Norway. The Queen had 15,000 American troops plus its own crew on board headed for England. The Curacao got out of phase with the Queen in the anti-submarine zigzagging course. The Queen sailing at 28 knots struck the Curacao amid ship and went clear through the cruiser. The 3" sheathing of the Queen was strong enough due to the small angle relative to the Queen's keel to cut through the two layers of 6" armor on the Curacao cutting the cruiser in two. The Queen's bow was folded back 40 ft. The bow had been partially repaired before I was on board and the wrinkles in the siding next to my duty desk were not repaired to shorten the time the Queen was in dry dock for the major bow repair. Both halves of the Curacao sank in a few minutes. Escort destroyers picked up 108 men, 338 went down with the two parts of the Curacao. The Admiralty eventually assigned 1/3 of the blame to the Queen Mary and 2/3 of the blame to the Curacao. The House of Lords upheld this decision.

The Queen Mary did not have any entertainment. The Army personnel were given the freedom of the entire ship at all times. The navy personnel were allowed on deck once in the entire crossing for only long enough to get their picture taken. In mid Atlantic my turn to go on deck came up. It was sunny and warm and the ship was very stable. While on deck I saw a small American escort aircraft carrier headed east in the opposite direction from ours close to our starboard side. The Queen was very steady and the waves did not seem high but the sea was actually so rough that the escort carrier was taking water over its bow on to the flight deck. The sea water on the flight deck ran the full length of the deck about a foot deep and drained over the carrier's stern in a waterfall. The Queen has a very deep draft to keep it stable in the rough North Atlantic. It has no stabilizers. As an example of the Queen's stability in December 1942, with 16,000 England bound US troops plus her own Cunard crew aboard, during a gale 700 miles west of Scotland she was broadsided by a 92-foot rogue wave. She listed 52 degrees and only recovered slowly.



**In less than 5 days in the morning of Saturday July 28, 1945 as we were abreast of the Statue of Liberty in New York harbor the public address system on the Queen announced that a US Army bomber had hit the Empire State building. We docked at pier 90 in the Hudson River which is at 51st street. We gave the dog the knock out pills and put him in the false bottom with all our gear on top. We practiced our statements for the customs and immigration inspectors we expected to meet on the pier.**

**When we disembarked about 11 AM the pier was deserted. Every one, even the immigration and customs officials, had gone to see the damage to the Empire State building. We took a cab to the Empire State building, waking the dog on the way. The B-25 had hit the 79th floor at 9:49 AM going clear through the building from north to south. One engine and part of the landing gear went clear through the building and landed on the roof of the 12-story building, across 33rd street on the south of the Empire State building, setting the roof pent house on fire. The burning aviation gasoline from the plane drained down the stair wells and elevator shafts setting fires down to the 75th floor and still on fire drained down outside of the south side of the building. The other engine landed on the roof of one of the Empire State's elevator cars cutting its cables. The engine and elevator car with two women inside fell 79 floors. Slowed by the car brakes the two women survived. When we arrived from the pier there was still smoke coming from the 79th down to the 75th floor. There was debris in 33rd street.**

**There was no major structural damage to the building and it did not occur to me that the building might collapse. The Empire State Building was built with riveted steel construction and had none of the design errors that showed up in the World Trade Center Towers. The next Monday I reported to the Navy rocket office in Washington DC in the old WWI buildings on Constitution Avenue on the north side of the Mall. Professor CC Lauritsen from Caltech was there to hear about what we had found in Germany and to review the state of the Eaton Canyon project.**

**The Japanese surrendered on August 14. That night I was in downtown Washington where the crowds were so dense and all the busses were so full of celebrating people coming in to the center of town that I had to hike about a mile north from the center of town to get on a bus that would go down town and then go back north to the suburbs. The gasoline ration was lifted immediately so I bought an old used Studebaker. I was soon ordered to the Naval Ordnance Test Station (NOTS) at China Lake, California near the little town of Inyokern in the Owens Valley east of the southern end of the Sierra and north of the Mojave desert. It had now been almost two years since the committee I had served on had chosen the China Lake site. The initial construction of NOTS including propellant extrusion presses and laboratory buildings and extensive housing for the entire staff was about 90% completed. In 1945 construction was very fast since there were few legal barriers to overcome.**

**I again took up rocket design. Fin stabilized Rockets are notoriously inaccurate since the fins do not become effective until the rocket velocity has increased to a few hundred feet per second. The jet out of the nozzle is not stable in direction and small variations in flow set the rocket off of its aimed course. Much more accurate artillery shells and gun bullets are spin stabilized. They also are fired from a barrel that contains the hot propellant gases for a short time and**

to a large extent prevents the hot gasses from offsetting the aim. Spin stabilized projectiles for gyroscopic stability must have their center of mass behind their center of form. Fin stabilized projectiles like arrows, on the other hand, must have their center of mass forward of their center of form. Much thought has been given to increase the accuracy of airplane to airplane firing. Rockets are not useful since they turn into the air stream and go parallel to the firing plane. Spin stabilized projectiles have a complex motion which is only accurate at close range.

My first job was to work on the design the 5" diameter spin stabilized rockets which the Navy had been using in combat. The first ones I was to test had six canted nozzles in a heavy steel plate at the rear of the rocket. The spin of about 300 revolutions per second puts a large radial strain on the propellant grain which had to have a different shape from the propellant used in fin stabilized rockets. I made up 100 of these spinners to test a new propellant shape. This test was budgeted at \$200,000 for the hardware which was to be made by Aerojet Engineering in Pasadena. So late in 1945 I went to AeroJet where I was told that AeroJet was getting out of the rocket business and going in to the kitchen plumbing business to make the "Swing Spout". When I told them that I had \$200,000 for them they agreed to make the rocket casings and nozzle plates more or less as a good will gesture. Aerojet is still not in the kitchen plumbing business and has changed it's name several times to Aerojet Electronics, Aerojet Ordnance and now to Aerojet-Gen Corp (NYSE GY).

Travel across the country was still almost entirely by rail. There were a few small airlines but cross country flights were very expensive and slow and inconvenient just after the war. The Naval Ordnance Test Station had a DC-3 (C-47) passenger plane for staff use. The DC-3 cruise speed of 160 mph and range of 1600 miles made us overnight in Nebraska each way when we flew from China Lake to Washington DC. I got my first cross country flight to Washington DC to report to the naval ordnance office on spinner rocket progress. I made a more interesting trip to White Sands New Mexico, where there was an Army test range, to see the Army Air Corps test fire one of the many captured German V2 rockets. The Air Corps spent two days trying to fire the rocket with no success. On the third day they sent a plane to El Paso Texas, which is close to White Sands, to pick up Wernher von Braun who was being held there. He arrived in about an hour and climbed a ladder to the place on the V2 where the umbilical cord was attached. He opened a panel and made a quick adjustment, climbed down the ladder and as he got into the waiting jeep I asked him what he had done but he ignored me and was driven off. The V2 made an impressive and noisy take off and some interesting atmospheric effects. We all went to a Mexican restaurant in nearby Las Cruces, New Mexico to celebrate.

In the spring of 1946 my Navy discharge number came up. I worked for a few more months at NOTS as a civilian. I even started to try to design a way of steering a rocket by moving its fins. In September of 1946 I went to Graduate school in Nuclear Physics in Berkeley.

Roger Wallace      April 4, 2010