5.0 Army Ordnance or War is Hell

A. Preliminary Training

During my undergraduate work at the University of Michigan from September 1925 through June 1929, I took Military Training. Since I was a Chemical Engineering student, I was assigned to Army Ordnance.

The training, which I received at the University, was very elementary except for a minimum discussion of ammunition and artillery design and manufacture. The training should have been more advanced and more technical. Too, the Officers presenting the work were not all experts in the specialized work; and they lacked teacher training and teaching experience. They should have had specialized training before being assigned to university education work -- as all university professors should have. How to teach is important in university work; but less so than what to teach -- one is bad, the other impossible.

As noted on page , during the summer of 1928, I was assigned to a six weeks training course at Aberdeen Proving Ground, Maryland. While part of the training was under the direction of Captain Bricker, then assigned at the University of Michigan, I was assigned to the company under the direction of an officer from Cornell University, whose name I have forgotten.

The training at Aberdeen consisted of lectures and actual firing tests of weapons from rifles up to and including the French 155 mm Gun of World War 1 vintage, and observation of repairs and maintenance of all types of weapons and ammunition. Of great interest to me, was the Museum with its limited samples of tanks, guns, mortars, and armor. "Museum" lectures should have been presented to explain the good and bad features of each weapon; and what should be done to improve it. Also, the "Field Use" of the various weapons should have been discussed. Again, the instructors should have had specialized training in the subjects which they were to teach. (2)

On completing my undergraduate work in Chemical Engineering, in June 1929, I was commissioned a Second Lieutenant in Army Ordnance. I completed my work for the Doctor's Degree in Chemical Engineering in December of 1938. Winifred and I moved to Detroit in March of 1933. During the next few years I completed enough class and correspondence courses to be promoted to First Lieutenant, probably in 1935.

1. Rock Island Arsenal

In the summer of 1936, I think, I was ordered to Rock Island Arsenal for a two weeks' training course. Winnie and Neal were left with her parents, Dr. and Mrs. Robert Denman, in Helmer, Indiana and I went to Rock Island, Illinois, by train. We were then living in Detroit. I was working on Tire Test Report Writing at the United States Rubber Products plant on East Jefferson Avenue, near the Belle Isle Bridge.

The experience at Rock Island was of interest as the Arsenal was actually manufacturing recoil mechanisms and assembling components. The instructors had had no special training in what was important, or what to teach. Apparently, they knew nothing of our average backgrounds. The whole course was poorly planned and executed.

As an aside story, our whole group went for a boat ride on the Saturday night that we were at the Arsenal. This consisted of a trip of a few miles up and down the Mississippi River on an excursion boat of some ancient sort. There was also a group of nurses on the boat. We soon got acquainted and spent the evening dancing.

2. Savannah River Ordnance Depot

In the summer of 1938, I think it was, I was ordered to Savannah Ordnance Depot in Illinois for two weeks training. At the time we were living in Fayetteville, Arkansas, where I was teaching Chemical Engineering. Again, Winnie and our boys stayed in Helmer, Indiana, with her parents.

At Savannah, the dozen or so reserve officers were on their own. Colonel John C. Brier, who was a Professor of Chemical Engineering at the University of Michigan at Ann Arbor, and a former professor of mine, was Commander of the Reserves; and I was Assistant commander. This meant that I was supposed to give about half the lectures. Professor Brier was a very lazy man; so I gave most of the lectures which I should have done. How he became a professor, I never knew.

The work consisted of about one-half lectures and one-half actual plant work. We were expected, in the two weeks, to have conducted personally all the ammunition loading operations, and to have written a critique regarding the plant and its operations. This we did. The work included melting and loading Shell with TNT (trinitrotoluene), or with ammunol (ammonium nitrate). We loaded split Shell, destroyed TNT by burning, etc. In small amounts up to 100 pounds or so, TNT burns nicely! Safely and rapidly. Well, quite rapidly!

The split Shell were regular Shell casings, which had been sawed lengthwise, and lugs and bolts attached; thus the "Shell" could be opened to inspect the loaded TNT for cavitation. Cavitation can lead to troubles in firing as the TNT could move in a Shell when it is fired, and explode in the gun; thus blowing up the gun and probably killing the gun crew. War is Hell!

One thing of note was that we corrected some of the poor installation of the TNT melter used in regular operations. While the melter had been used for years, we found that it did not work properly due to lack of proper air vents. This was the result of poor design. I remember that the first time we used the melter, we began to ask questions. We soon realized why it took so long to heat up. I think the second day, we 'fixed it' by installation of proper vents. Why had not the regular army officers corrected this? Did they ever look at it; or was it beneath their dignity to consider such problems? An employee had been coming to work two hours early for years in order to get the melter heated to its working level. After proper vents were installed, this occurred in about three minutes -- while an employee hung up his hat and picked up his tools. West Point? In the fall of 1938, I believe, I was promoted to Captain.

3. Picatinny Arsenal

In the summer of 1939, I was ordered to Pictatinny Arsenal for two weeks. Again, Winnie and Neal and Douglas were left at Winnie's parents' home in Helmer, Indiana, and I went to Picatinny, New Jersey, by train. And again, I was the instructor in charge of the sessions of "training". The course was unique. It resulted in my learning more than ever before or since in any two weeks.

We lived in tents on the shore of Picatinny Lake near Dover, New Jersey. This was a beautiful setting even though we could only swim. No fishing was allowed. As a result, bass, trout, and other fish were very commonly seen near shore; and sometimes, at night, by being more careful, one could actually touch them. They appeared to be sleeping. Also, living was of interest as it was easy to go swimming and to go for long walks in the Pocono Mountains. We ate at a barracks near the tents. The "soldier cooks" were excellent.

My tentmate, whose name I have forgotten, was a Federal Internal Revenue investigator assigned to check the income of the Mayor and the rackets in Atlantic City. (3) So we spent one weekend there. The stories that he told of the rackets were not only interesting; they were also very instructive. Women and men! Which are to blame? Both? Or the wives?

At the "Camp", there were fifteen officers present, including me. All were highly educated and, I believe, all except me, held very responsible positions. (4) I remember one was Director of Research of Hercules Powder Company and two were Federal Tax Experts assigned to evaluation of railroads and dams for tax purposes. I was the youngest officer: and, I believe, the only Captain. All the others were Majors, Lieutenant Colonels, and Colonels, mostly Colonels. I believe there was one Brigadier General. I think that I was the only Chemical Engineer. I never knew who wrote the instructional program. It was poorly done -- it was High School, not University level.

We ran the classes by sitting around a large table with four men on each side, with the sixteenth place occupied by a civilian expert from Picatinny Arsenal in the subject being discussed. We spent four hours in discussion and three hours in the laboratory and on inspections daily. The topics covered were Shell loading, components of ammunition, long discussions regarding purity of materials, difficulties encountered, probability of fires and explosions, etc., etc. It was a most interesting two weeks of sessions! There was very little joking or extraneous discussion -- rather continuous reading and technical discussion-- normally morning until bedtime -- even during meals. Everyone except me, was an expert in some area. In fact, there appeared to be an expert in every area. I usually started the "day" off with a half-hour lecture, and then the rest took over in long discussions. I was just the catalyst.

As customary, we were invited to the Commanding Officer's home for cocktails the first evening on the Post. The Commanding Officer was the same man that had been at Savannah Ordnance Depot when I was there. When we arrived at his home, he and his wife received us cordially as we remembered one another. His wife offered us the usual drinks, starting with whiskey, cocktails, beer, etc When I said, "I'm sorry, I don't drink," she asked, "How about hot chocolate?" And when I said, "Fine", she grabbed me by the arm and said, "A man after my own heart. Let's go to the kitchen." Of course, half of the others who preferred not to drink went along. And we had hot chocolate while we sat around her kitchen for two hours, or so and just visited. The heart of a home is the kitchen. The easiest way to avoid cocktails is just say, "I'm sorry, I don't drink." Hot chocolate tastes much better! I am not a prohibitionist. I just don't care or understand. I regard alcohol as a mild drug or almost a poison.
I believe many people drink cocktails as they think it is the smart thing to do. It is not good sense. Are we all daredevils? I believe that the use of alcohol is weakly habit forming. I just do not understand its use. I do drink a bit of wine when pressed. I prefer orange juice. Since I have presented many, many lectures, perhaps I think as an individual. Thus, I do not regard drinking alcoholic beverages as a social need. I never thought of what others may have thought of me, nor cared.

B. Aberdeen Proving Ground

In the summer of 1940, I was ordered to Aberdeen Proving Ground, Maryland, along with Professor, or Major, John C. Brier of the Department of Chemical Engineering of the University of Michigan. I had had a course in Organic Technology under Professor Brier at Ann Arbor, and Professor, or Captain, Charles Selheimer, for three months to revise and update Army Ordnance Reserve Training Manuals. Professor Selheimer had received his Doctor's Degree a couple of years before me at Ann Arbor. He was teaching Chemical Engineering at Wayne State University in Detroit. So, we were all acquainted and all had had four or more years of Chemical Engineering teaching experience. Apparently, it appeared logical to order us as a group to Aberdeen for the assigned purpose.

Winnie, our boys, our dog, and I left Fayetteville, Arkansas, about one week before my duty began because we planned to drive leisurely to Aberdeen, Maryland, "as a vacation". On arrival we rented an apartment in Havre de Grace about eight miles from my assumed office, and got settled over the weekend. This apartment was of interest in its shabbiness, small size, etc. It was light and airy. We believed that it was an old slave quarters, since it was in the loft of an old horse barn -- long since converted to apartments. Winnie took me to the depot as I usually commuted by Pennsylvania Railroad Train from Havre de Grace to

Aberdeen and by the local Government train from Aberdeen to the Post -- a total distance of eight miles and two trains. Then Winnie and the boys would meet me at the Post in the evening for a swim before dinner at home or hamburgers at a restaurant. So we had an enjoyable summer.

On Monday morning, as ordered, I reported to Aberdeen Proving Ground Headquarters. I was told that our assignments had been cancelled since it appeared war was imminent; and the revised courses could not be printed before they would be of little use. Professors Brier and Selheimer had received their revised orders before leaving their homes. As we had left earlier, I had not received the revised orders not to report for duty.

I never understood why my orders were not immediately cancelled. I believe that my wartime assignment was to be Aberdeen Proving Ground. I have always thought that General George Eddy (then Captain) simply stated that I should stay at Aberdeen Proving Ground for the summer. At any rate, I was ordered to report to Lieutenant John Cave at the Main Front, while Headquarters got my orders cancelled. At the end of the three-month assignment, the orders appeared to have been still in force as I was paid my regular salary as a captain for the full period. Why we did not plan and prepare for War earlier, I do not know. Perhaps general planning was done; and perhaps my "orders" were evidence of planning.

1. Organization

At the time under discussion, or mid-1940, Aberdeen Proving Ground consisted of Headquarters and, I think, four main branches; Antiaircraft, Mobile Artillery, Small Arms, and Ballistics Research Laboratory. The Ordnance School was just starting. The Mobile Artillery, Coast Artillery, and Trench Warfare Branches had been combined just before my arrival. While the combined Branch was officially called the Mobile Artillery Branch, our area was informally simply called the Main Front.

Headquarters Division was just that. It consisted of perhaps a half-dozen Officers plus quite a number of civilian employees who furnished all services and maintained the Museum. Services included the normal utilities, the carpenter and machine shops, drafting services, measurements laboratories such as projectile velocity measurements, observations of impacts, and maintenance of firing ranges. Most of the people, including the officers, were not very progressive. They knew little about development work--they did not think as engineers.

The Anti-aircraft Branch carried out the firing tests of ammunition and weapons and prepared the formal reports covering their weapons. The Small Arms Branch carried out development tests on their weapons, including the 37 mm Gun, and prepared the formal reports. All hand weapons, including pistols, rifles, and machine guns, are tested in closed ranges; so no production weapons' tests on those weapons were being performed at Aberdeen. Ballistics Research Laboratories carried out extensive research, prepared range tables, etc. They usually simply requested that the various firing ranges conduct their firing tests. They did operate the static bomb test range. Why, I never could guess.
The way Topsy grew? The tests did require considerable instrumentation.

The Main Front conducted the tests of the Trench Warfare weapons, all Field Artillery from the 75 mm Howitzer and larger, and Coast Artillery including the 16 inch Coast Defense Guns. This was a wide range of weapons and included Tank and Antitank Guns over 37 mm, all Field Guns and Howitzers, and many special weapons.

Main Front facilities in 1940 consisted of two warehouses each about 40 x 140 feet, a powder storage building, a firing line of perhaps a quarter mile and various weapons, tools, etc, and a small office. The types of tests being conducted consisted of tests of ammunition components, complete rounds, various guns, and limited weapon development tests. All reports were sent to Headquarters for review, typing, and distribution. No women were assigned to the Main Front.

The Main Front firing range faced southwest on the direct line from New York - Philadelphia to Baltimore - Washington, or near U.S. Route 40. The so-called ranges, or impact ranges, were equipped with concrete observation posts, telephones, etc. They were located about 1, 2, 3, 5, and 15 miles down range or down the line of fire. The land area was several miles across. It was cut diagonally some 10 miles down range by Bush River, a Branch of Chesapeake Bay, so that to reach the farthest range required a 30-mile drive. On the right were the main lines of the Pennsylvania and Baltimore and Ohio Railroads. On the left was Chesapeake Bay. Between the Main Front, Route 30, and the railroads was the airport with some low level bombing ranges.

Firings of long-range weapons were conducted by sending boats down the Bay and firing between ship passages directly into the Bay. As a result, firings were frequently interrupted and some troubles did arise during World War II. Luckily, no one got killed; no train got wrecked; no ship got sunk or even smacked and no automobile got hit.

There was also a Coast Artillery Division, which conducted the firing tests of Coast Defense weapons; and there was a Trench Warfare Branch. Ballistic Research Laboratories did the calculations and prepared the Range Tables (elevation versus range or distance; effects of wind, air density, rotation of the Earth, etc.)

2. Main Front Assignment

The Main Front personnel on my arrival consisted of Captain John Dave, three civilian Proof Officers, only one of whose name I remember, that of Louis Rhein, no secretaries, a civilian foreman and eight civilian laborers, or gun crew men. Trench Warfare included some five or six men. There were several service people such as powder handlers in the area. These were directed by Bernard Bass.

May I turn to the organization of the Ordnance Department and explain how our work assignments arrived? I had very little conception of the organization of the Ordnance Department other than that it was a division of the War Department responsible for the development, production, storage, issue, and maintenance of all Army weapons and ammunition. The actual organization was huge. It included the procurement of all Ordnance material, storage of the materiel, maintenance, field issue, recovery, and construction of non-commercial items. These included all guns, their recoil mechanisms, carriages, tanks, all weapons and ammunition, and a host of similar items needed by the Army. Picatinny Arsenal, Frankfort Arsenal, Rock Island Arsenal, Aberdeen Proving Ground, and other organizations, including several large storage depots, were components of the Department.

At that time and throughout World War II, the Development Division of the Ordnance Department that I was concerned with, operated on "Ordnance Minutes", or more truly, assignments agreed upon in meetings of the responsible officers and civilians of the Ordnance Development Board. Actually, proposals for development programs, or tests, were prepared by the responsible officers or civilians, and upon approval by a sort of Committee of the Whole, an "Ordnance Minute", would then become the legal document authorizing expenditures, development, construction, and test of new components, or weapons. Based on these Minutes, letters would be sent to the various organizations such as the loading plants and ammunition plants including Rock Island and Picatinny Arsenals and to Aberdeen Proving Ground authorizing construction of experimental weapons, ammunition, firing tests, road tests, etc. The system worked well. I think that the reason that the system worked at all was the frequent transfers of personnel between the various Ordnance establishments. We used the French word rather than the English word, material -- a remembrance of Officers of World War I.

Industry should consider this system. Most business executives are too autocratic, especially the top executive officers. Because they control the money, they insist that they make the decisions right or frequently wrong. Interchange the Chairman of the Board and a Production Superintendent for a few years and you might not recognize the Company! In two ways? Interchange the New York Advertising Department

Head and Shop Superintendent of the most remote plant for a year. Then have both men teach for a year, half time in a shop and half time in the headquarters office. For example, move the highest officer in the New York office to Texas for a couple of years and the Texas man to the New York office. Sales will boom. Anyway, why would anyone live in New York City or even in the New York City area? Life is too short. You only live once; so why spend it in New York City? I don't understand. Visit, yes, live, not me. But it is what you get used to. You forget the time lost to and from work. During my life I refused two jobs in New York City. Still I made enough to live.

Most people are too scared to make decisions; and they fail to make those decisions that may involve any risk to them-selves. The secretaries can run the offices during transfers -- many do it all the time. Don't stop there. Move your junior people to give them experience. Every person that has been in the same Administrative job for five years should quit. The Board of Directors of many corporations seem more concerned with their stock options than the business of the companies. Why Boards of Directors? Every Director should be fired at the age of 55. (5) Henry Ford was so successful because he ran the Company. He was a farmer near Britian, Michigan, who tried to make his own automobile -- and did so -- and hundreds of millions of dollars.

a. Case Tests

For the first several weeks that I was at Aberdeen, I acted as a Proof Officer, to help at first, and later to conduct routine firing tests. I believe the first was an "Acceptance Test of 75-mm Shell Cases". Each test consisted of "firing seven rounds", consisting of sample cases selected at random from each lot of several thousand production cases. These were loaded and tested with regular weight Shell and extra powder charges in a regular field 75-mm Gun.

To understand the above statement requires a consideration of the reasons for the firing tests. Each "round", as issued to the field for use in war in the small field artillery weapons consists of a brass or steel cartridge case, a primer or igniter, the necessary powder or propellant, and the projectile or "Shell". The projectile includes the fuze that starts the explosive train on impact of the Shell after firing, and the explosive, or "load" in the projectile. The projectile or "Shell", or thick-walled steel tubes were filled with TNT, or trinitrotoluene, or other explosive. The case for the 75-mm gun consists of a copper alloy or steel tube some 14 inches high and about four inches in diameter, with an open top and a closed bottom with a hole in the center of the bottom for the primer. The primer consists of an igniter such as silver oxide or lead oxide, a small charge of black powder in a paper lined brass tube perhaps two inches long by three-eighths inch diameter in which several holes are drilled and which is brazed to a small plug. The primer is pressed into the bottom of the case in a hole 5/8-inch diameter. The lead oxide or mercury fulminate is in the form of a pressed pellet about one-eighth of an inch in diameter and height, so placed that a thin copper shield may be compressed by the gun's firing pin, which in turn deforms or shatters the pellet, which in its turn, explodes or detonates. This ignites the black powder, which shoots flames throughout the regular pellets of 75-mm gunpowder in the case. The pressure rises rapidly due to the "burning" of the powder to perhaps 28,000 psi (pounds per square inch or 14 tons per square inch). Meanwhile the projectile is moving down the gun's barrel and increasing in velocity until it leaves the gun at perhaps 1500 feet per second. Exactly these same processes occur in all pistols and rifles from small "hand guns" to large Coast Artillery and Naval guns.

In respect to the test of "cases", these were chosen by the Ordnance Inspectors located at the manufacturer's plant. (6) I believe that five cases were chosen at random from each lot of 10,000 cases. Each case was tested at 115% of the maximum allowable normal firing pressure. To pass the test, all cases were required to be rejected freely from the test gun. Failure consisted of one or more cases expanding until it, or they, stuck in the gun breech. In the case tests, cast iron projectiles were used to save costs. Similar tests were made on other small gun and Howitzer' cases. While not carried out on the Main Front, case tests were also conducted on certain Small Arms and Anti-Aircraft weapons.

The maximum pressure during the burning of the powder was measured by the amount of change in height, or compression, of a short copper bar housed in a steel case with a small copper cup seal, or piston. Each of these pressure gauges was about three-fourths inch diameter by two inches in height. Normally, two gauges were placed in the powder charge of each test round fired.

b. Shell Tests

During this same period, I ran several acceptance tests of Shell, or projectiles of various sizes. These tests differed from the case tests in several respects. The Ordnance Manufacturing Plant Inspectors selected at random five Shell from each lot of 10,000 Shell. These were measured with a micrometer at several diameters. The Shell were inert loaded with paraffin to regular weight as normally fired. They were fired, I think, at 120% of the normal maximum allowable firing pressure. The impact area was observed and each Shell, as it landed, was marked by an observer and then dug up and later re-measured to make certain no deformation had occurred during the firing tests.

Since Shell are rotated in flight to give them stability, they continue to rotate in the ground. However, the density of the earth is too great for stability and the direction of the Shell changes. At an impact angle of about 15 degrees, a Shell will turn direction until it surfaces. If properly fired for the proper impact angle, most Shell will surface and may be picked up very close to the impact positions -- otherwise, someone must dig them up for inspection and measurement. Or they may locate them on the surface, possibly some distance from the impact positions.

Live Shell with inert fuzes are sometimes fired as are live Shell with live fuzes to test detonation, etc. Recovery of the Shell that do not detonate is, of course, a bit hazardous, particularly those fired with live fuzes which fail to detonate. Recovery is sometimes essential to determine causes of failures.

Recovery of fired loaded Shell requires a detailed knowledge of the Shell, the fuzes, and a proper respect for various explosives. (7) Remember explosives become more sensitive with age -- particularly under adverse weather conditions. Never, but never lose respect for explosives such as TNT or dynamite. They demand and expect your respect. It is safer for you if you see that they receive it. It's your body and life! As I keep repeating, you have only one; and you are allowed only one mistake. You will never make a second mistake. Just like an automobile accident!

c. Powder Tests

The test of the propellants for guns such as the 155-mm Gun is a very different matter. The powder for this gun consists of cellulose nitrate, which has been formed into pellets about one inch long by 0.25 inch diameter, with seven holes about 0.03 inch diameter, one in the center and six spaced half-way from the center hole to the outside. Different size pellets are used for different weapons.

In manufacturing, cotton, or other cellulose such as purified wood pulp, is reacted with nitric acid, washed, and the cellulose nitrate softened with solvents, the mix is extruded, cut into short lengths or powder pellets, and the solvent recovered by evaporation at slightly elevated temperatures. The pellets are mixed or blended by mixing for several cycles through large storage bins. Each lot is then packaged in steel cans holding about 200 pounds each. Samples of these cans are chosen at random and used to "establish" the powder charges for the field firings. A powder "lot" consists of about 100,000 pounds of blended powder, or about a carload of 50 tons.

The powder charge is determined by firing projectiles of the standard weight and measuring the velocities. Low charges are used for the first two rounds; higher charges are fired until about 120% of the maximum allowable gun pressure is measured at higher velocities. Then a seven-round group of charges is fired at the "established correct charge", and a slight correction is calculated for the "true powder weight" to

give the standard velocity. Using this weight, the entire lot can be weighed into charges for issue to the Field Forces.

Since powder varies considerably in rate of burning, the test powder is always stored in constant temperature rooms, weighed as accurately as possible--usually to the nearest pellet or powder "grain", and fired before it becomes appreciably heated or cooled.

At the time in question, velocities were measured by firing magnetized Shell through coils of wire placed perhaps 20 to 30 feet apart. Velocities of 2,000 feet per second could be measured to within one to two feet per second. The weight of the projectiles for the 155-mm gun was about 95 pounds.

During the summer of 1940, I ran 24 tests of powder firings in the 155-mm gun, M1. Each test consumed all of one day's work. A gun crew of five men and several other people were required to weigh powder, measure velocities, measure pressures, etc. Each powder lot consisted of about 100,000 pounds of powder which at that time cost about one dollar per pound -- twenty dollars per pound today, 1984, or $2,000,000. War costs money.

d. Other Work

While I was at Aberdeen Proving Ground in 1940, an attempt was made to have me visit the other "fronts" or "Firing Ranges", and to observe regular and special firings. Two programs may be of interest. These were the "Range Firings" of the 75-mm Howitzer and the 8-inch Howitzer, M1.

(1) Range Firings

During a good part of the summer, Louis Rhein was conducting the Range Firings of the 155-mm Gun, M1. This weapon and the companion 8-inch Howitzer, M1, had been recently designed and the prototypes manufactured; the guns by Watertown Arsenal, the recoil mechanisms by Rock Island Arsenal, and the carriages by someone else; I believe it was Watervleit Arsenal. Frankfort Arsenal had built the fire control instruments that were used for setting the elevation of the guns for firing. As noted, the Arsenals operate in Peacetime in this country to keep armament development alive. However, I am not up to date.

The 155-mm Gun Shell weigh about 95 pounds while the 8-inch Howitzer Shell weigh about 200 pounds. The Howitzer was slightly shorter; but it was heavier than the 155-mm Gun; and the powder was slightly smaller grain size.

The conduction of a Range Firing was rather elaborate procedure in that every Shell was weighed, measured, and inspected. Each powder charge, as all powder charges were, was check weighed by two persons, one of which was the Proof Officer -- you check weighed your own test powder.

On firing a round in Range Firing the powder was kept at as constant temperature as possible until just before loading, the projectile was loaded with as nearly equal force on ramming the Shell into the gun as practical, etc. When the weapon was elevated to give a longer range, the elevation was checked by the Gun Crew Foreman on the regular fire control instrument and by the Proof Officer on a second independent instrument. Again, you checked your own measurements.

(2) Firing Tables

On firing the projectile at a given elevation, velocity was measured, and the exact location of the impact was marked and measured both in range and deflection. Other data collected at the same time were

wind velocity and direction and meteorological data as noted previously. The above data were reduced to standard conditions by complex calculations. (8)

At the time I am discussing, these calculations were handmade by Ballistics Research personnel. Each round required about one person's time for a month. Then standard tables were prepared for field issue. Of course, computers are used today -- in fact, Aberdeen was one of the most important organizations in the development of computers. I was not involved except in data collection in actual firings. And of course, nuclear weapons have replaced heavy artillery. As noted elsewhere, the first computer was used to calculate the 8-inch Howitzer Range Tables. In 1940 I was the proof officer for part of the firings.

It should be noted that the probable error in range at say 8,000 yards (or about four miles) for the 8-inch Howitzer was only about six yards and only one yard in deflection. Thus, it probably was the most accurate weapon ever developed. As an example, while the Americans were advancing up the Italian Peninsula from the south in World War II, they were held up by a mountain ridge on which there is an Abbey known as Cassino. This was declared open by the Germans; and they claimed no Germans were using the Abbey. In flight, the Shell could be followed with binoculars. It was seen to enter the roof of the Abbey. With a delayed fuze setting, it probably detonated close to the center of the Abbey. Very soon, German officers and men were exiting in a hurry from every door. Repairs should have been charged to the Germans -- as the whole War should have been. Pity the poor Germans! As a result of the war, Germany became a second rate country and Russia became a major country. Both unjustified in some ways. All due to Hitler and his followers! Russia has enormous potential. (9)

e. Rifle, M1. A new automatic rifle was designed. This replaced the older hand operated bolt rifle. Otherwise, the two weapons were quite similar. We carried out only a few tests. But early in the tests one of the officers suggested that I fire a few rounds at a silhouette. I didn't do well as the rifle is not easy to hold an automatic fire at the start of a burst of several rounds. I did have a very black and blue shoulder for a couple of weeks. And I got razzed -- as usual.

While I had started the 8-inch Howitzer range firings, I had done very little work when I had to return to the University of Arkansas to teach in September 1940. In February 1941, I received orders to move to Aberdeen in June 1941 for "Permanent Assignment". This we did as discussed elsewhere. I have continued my Aberdeen story here as if it had not been interrupted by ten months of teaching Chemical Engineering. Note that our Secret Service must have known the "date" of "Pearl Harbor" before 1938 and my training assignments were 1937 -— Rock Island Arsenal; 1938 -- Savannah River Loading Plant; 1939 -- Picatinny Arsenal; 1940 -- Aberdeen Proving Ground. I believe the Rock Island assignment was a normal training assignment; but the 1938 and later assignments were training for my Wartime assignment; and the date of Pearl Harbor was known to our Secret Service and War Department early in 1938 at the latest. We fortified the right island and the Japanese by-passed it. Why the Japanese Government thought that Japan could win a War with the United States is unknown to me.

f. Fuzes. Fuzes are small devices which contain an easily detonated pellet of lead oxide, silver oxide, or some similar material. When wet, lead oxide may be shipped or handled safely; but when it is dry, it is easily detonated by friction, pressure, or simply violent vibrations. Many stories are circulated about detonators. I present only two that I was involved in indirectly at a distance.

First, at Picatinny Arsenal, one of the regular employees went from the "loading Plant" up a board walkway about 100 yards to a storage vault. He carried a regular chemistry drying flask that would hold perhaps two quarts. It was not covered at any time. On reaching the vault he filled the flask with wet lead or silver oxide. I do not know which metal had been used. He carelessly let a few small pieces of powdered oxide drop on the rim of the flask. On his way back to the loading plant, some of this lead or silver oxide on the rim of the flask dried a bit. About one mile away men fired a 155-mm Gun as I passed him on the walk. The concussion due to the firing of the weapon caused the dried oxide to detonate; obviously the wet material did not as you are reading this story. I still have a very vivid mental picture of the event.

Second, among the facilities at Aberdeen that I was responsible for was the examination of projectiles or fuzes that failed to detonate and the disassembly of foreign materiel. We had an isolated building, poorly equipped with safety devices, and poorly equipped with the most desirable equipment. It, and the storage of powder, were my greatest worries. While the man in charge of the disassembly building was very knowledgeable in what he was doing, he was a poor worker when it came to keeping the place clean. He had been a long time Sargeant; I had insisted that he be Commissioned. He was the "Expert" in the Army.

One day he pressed a detonator out of a brass holder used in a complete fuze. Without thinking, he picked it up. The added strain due to the heat and pressure from his thumb and finger caused it to detonate. It did very little harm due to its small size. It did demonstrate the sensitivity of the dry material. Of course, it had just been stressed and may have retained some residual heat due to its compression on being pushed out of the holder. Later, the Sargeant picked up a fuze that he "recognized"; It blew up near his chest and he was killed. A few days later he would have been discharged at the end of 40 years of Army Service. (I am not sure the number 40 is correct. But I know he was looking forward to the Discharge.)

Ordinarily fuzes were tested at Picatinny Arsenal or elsewhere due to their small charges. In addition to lead oxide pellets, perhaps one-eighth inch diameter by one-eighth inch high, they contained larger pellets of tetryl, which were easily detonated and provided the large detonation necessary to explode or detonate TNT loaded Shell.

(1) Air Burst. Early in the war we did carry out many burning tests of fuzes. They were used for airbursts of Shell. The test fuzes were assembled into complete rounds and fired at night with measurements made of time of flight with stopwatches. The time of burning was the time for a powder train to burn. Later, mechanical time fuzes were tested.

(2) Proximity. Some time early in the War someone suggested the development of a proximity fuze. This may have been developed in Europe; I believe in Germany or France. I do not know when or by whom the suggestion was made. Such a device should detonate a Shell when the Shell came within a preset distance of a solid target such as an airplane. The first that I was involved in was when John Hopkins University Chemists and Physicists wanted to test such devices. The group included Dr. Laurence Hafstad and Dr. Merlo Tuve, this I know. The Aberdeen Ballistics Research Laboratory had also co-operated in the development. At any rate, we fired the first rounds. We had no part in development other than that. I never understood why we were not brought in earlier, jealousy by Ballistic Research or "Never thought about that?" Which? Probably never thought about that.

When it came to test the large numbers of fuzes required in the Production Tests, a special group was set up on the Eastern Shore of Maryland for firing over water. I had only very nominal contact with that group. I visited it once. On that trip, I nearly got into trouble. I was riding in the front seat with my WAC driver when we got stopped by Military Police that were escorting troops. Anyway, my WAC went by some troops and got stopped and bawled out. He was a Private while she was a Sergeant. Afterwards we laughed. She also drove fast. An Officer is not supposed to ride in the front seat with his chauffeur, especially a WAC, with his left arm resting on the back of the seat and sitting close to her. I was reading a report aloud and I had no idea of what was taking place or even where we were. The WAC was also my Secretary. I was reading aloud so she could correct the English, etc, as she drove. She was also a very good-looking young lady -- and very intelligent.

g. Grenades. Ordinarily we did not test any hand grenades. These were routinely tested at Jefferson Proving Ground, Indiana. Professor John C. Brier, as Colonel Brier (12), was the Commanding Officer there. He told me of one of the men while setting up a test outside of a concrete barricade said, "There's something wrong with this grenade." Apparently, as he took it out of the shipping box, the fuze,

which had a five-second delay, came apart. Had he thrown the fuze instead of looking at it, he might not have been killed. Possibly poor inspection? Was the inspector drunk the evening before?

We fired numbers of unloaded, live fuzed hand grenades, in demonstrations. Always I removed each fuze and checked to make sure that I had an empty grenade before I threw the fuzed grenade to demonstrate its functioning. To repeat, never but never trust anyone -- it is your life! You have only one -- so you can make only one mistake.

The ordinary grenade was about two inches in diameter and three inches long and made of cast iron, or an alloy of some sort. The hollow space held enough explosive that the grenade was lethal for perhaps three feet. It was detonated by a small spring-set fuze that started a five-second delay train when thrown.

It was obvious that an improved grenade could be made by making a spherical device the size and weight of the conventional baseball with a thin metal cover. All kinds of devices were tried and tested. One of these included an impact detonated fuze that would arm when a small pin was withdrawn in the air by a very thin metal vane about 3/4 inch diameter. Before throwing, the person handling the grenade had to remove a very small safety pin. On paper, the device appeared excellent.

Several hundred of these grenades were made up for our test. Apparently, many had been tested previously; and the fuzes had worked as designed. The Proof Officer did not like the grenade. He simply didn't have faith in the simple fuze, perhaps due to the lack of complex safety devices. It did appear, however, to be safer than the fuze on the conventional grenade then used widely by our troops. And the fuze worked on impact.

We tested many of the grenades without any failures. Then the grenade was placed in production. We were supplied several hundred grenades for an extended test. The employee who was throwing the devices was throwing them from behind a low barricade. He was not completely protected, as this was a "production" test. After a few hundred fuzes had been thrown, one detonated as it left his hand. A piece of the outer Shell struck his eye and followed the nerve duct into his brain. Had the fragment been one-eighth inch away in any direction he probably would have lost an eye instead of his life. He was supposed to duck below the barricade as he threw each grenade -- this he failed to do. Always follow the rules. Later, the Proof Officer learned to throw the grenades so that frequent predetonations occurred. So the project was cancelled.

I continue to believe that I was to blame for the man's death. I did not inspect the test during the actual throwing of the production fuzes. I had inspected the area previously and considered it satisfactory. The Proof Officer was one of the most intelligent men in the group; and all of the men had been selected from many others. The man did fail to duck as ordered. I can only say that the work was hazardous. We could never predict when accidents or ammunition failures would occur. As I have mentioned, we drive automobiles, knowing they are dangerous devices; and that unknowingly through our own carelessness, we may cause accidents which will result in one or more deaths: possibly our own. And I was a bit busy most of the time.

h. 60 Caliber Machine Gun. During the last part of World War II, we were developing the 60 Caliber Machine Gun. Firings were being conducted by Small Arms at Aberdeen. Many troubles developed because of the high pressure and high rate of fire. My part was simply to see that the work progressed. What became of the program, I do not know.

i. Recoilless Rifles. During World War II the Germans carried out experiments with recoilless rifles of various sizes. I think that they were the inventors -- they have been an inventive people. Recoilless rifles are based on the principle of equal forward and rearward forces during the firing of the weapons. In an ordinary rifle the energy imparted to the rifle is equal to that imparted to the projectile. In

larger weapons this energy is absorbed by shoving the weapon to the rear as oil is forced through orifices -- thus converting a large part of the recoil energy into heating the oil. This principle was tested on movable bumpers on some automobiles. I do not know whether or not it is used on any presently made automobiles. I think not --passengers in automobiles are left to fend for themselves. Automobiles are designed to sell, not to save lives.

The German weapons were very crude and not very important in the field. The Germans were inventors and Chemical Engineers, not Mechanical Engineers.

(1) 57-mm. Two engineers at Frankfort Arsenal were assigned the design of a 57-mm Recoilless weapon. They produced a beautiful weapon. It was very soon placed in production and used extensively.

The weapon consisted of a tube about six feet long, light enough to be carried and fired by one man. The tube extended about two feet to the rear and four feet forward. The projectile was 57-mm diameter by about four inches long. When shaped charges were used, the projectile's explosion would penetrate about 2.0 inches of steel; so the Shell would stop a light tank when fired at the sidewalls or even bend or break one of the tank's tracks.

Our work with these weapons was surprisingly simple, as many firings had been made at Frankfort Arsenal using inert projectiles. We found essentially no suggested changes in design. We did proof test both weapons and ammunition. At one time there was a very great rush to get a large number of the weapons tested. We worked very long hours. It was my understanding that the first drop of American troops across the Rhine was equipped with the weapons as a "drop" of about 1000 weapons was made along with the troops. After the American troops landed, they started firing. The Germans mistook their sound for 155-mm Guns. Many thought they were surrounded by many American troops; so a whole Division surrendered. As a result the Americans were able to cross the Rhine River with very little trouble. I've often wondered if this crossing of the Rhine was not used as an excuse by the Germans to surrender.

After reading the above, Lugene Hungerford stated she knew and had talked to the Pilot that took the American Generals over to Germany. She stated that the Pilot once remarked that they did not understand why the Germans surrendered the Rhine River Bridge. We knew. They did not surrender it. We captured it by surprise before they could blow it up.

Again, there was a great rush to proof test many weapons. These tests were carried out by Proof Officers from the Ordnance School and not by experienced engineers who had handled strange weapons for years. The three or four test officers were warned against trying to correct even slight deficiencies or difficulties; and all were especially warned never to step behind a loaded weapon under test: and always to call for help at the least difficulty. The inevitable happened -- due to lack of proper training. In my own defense, I objected to bringing in untrained men from the Ordnance School for the extra help. I was overruled. The man was from the Officers Training Corps. "Nothin's gonna happen!" Watchout! All I could do was to send Major Johnson to the man's funeral! And try to forget, which I have not been too successful in doing.

The proof tests of firing the guns at normal and excess pressure were carried out with the guns suspended on chains in a reinforced concrete shelter with all firings carried out remotely from outside the shelter. Movements of the guns were observed through mirrors. All went well for several hours. Then, possibly due to a piece of dirt that became lodged in a firing mechanism, or some other minor malfunction, occurred during a test. This was on the night shift about 0400. The gun failed to fire. Apparently the Proof Officer went near the gun and may have started to remove the Shell. We never knew. At any rate, the gun fired.

To provide the rearward force, four holes were provided in the rear of the breechblock. On firing, burning gases at a white heat escaped under pressures as high as 10,000 psi. The man's right leg was struck by two of these streams of hot gas. The leg was cut completely through in two places. Of course, the muscles were torn. He died in the ambulance on the way to the Hospital, probably due to shock and loss of blood.

I have always believed that I was partly to blame for his death. Certainly he broke his instructions. Had I taken more time, his life might have been saved. The previous afternoon Lieutenant Potter had prepared the Safety Regulations for the tests; and I had approved them just before I left for home in the evening. I believe Lieutenant Potter also believed insufficient instruction had been given to the Test Officer.

(2) 105-mm Recoilless Gun. I had very little to do with the 105-mm Recoilless Gun since the first weapon was delivered for test just before I returned to civilian status and returned to teaching.

j. 75-mm Gun. In 1940 ten 75-mm Field Guns were built and thoroughly tested. Why, I never knew, as the 75-mm Gun was too light to be of much service. Perhaps the tests helped develop other weapons. I do not know.

k. 3-inch Gun. In 1940 an attempt was made to convert the 105-mm Howitzer to an anti-tank weapon by replacement of the Howitzer tube with a three inch Gun that used a lighter weight Shell, but the Shell had a much higher velocity than the 105-mm Howitzer Shell. The high velocity with armor piercing Shell would have been effective against the German tanks then in use; but they were not effective against the later German tanks; so no three-inch Guns were ever used in action in World War II. They were widely distributed about the United States and were frequently seen in Parks. I think all have been scrapped.

I was the Project Officer at Aberdeen, during the summer of 1940. The work consisted of assembling a three-inch Gun on the 105 mm Howitzer carriage - that was quite simple. Firing tests consisted of simply checking all components to make sure all worked satisfactorily.

l. 105-mm Howitzer, M1. I had very little to do with development tests of the 105 mm Howitzer, M1. We did have a long tube erosion program. This is discussed briefly under special programs below. We conducted acceptance tests on many weapons and many lots of ammunition components.

When we entered World War II, there was a great expansion of ammunition production. Several contractors began production of the 105-mm Shell. After a time it became obvious that occasionally short rounds were occurring. In actual fact, many rounds had muzzle velocities 30 ft per sec below normal. That was enough to result in these short round projectiles falling into our troops. I believe the actual invasion of Europe was held up for about six weeks while we looked for the source of trouble. A million men sat for six weeks while Joseph Sporazzo looked for a minor defect! And the Germans made more ammunition! Where was I? Men were being killed.

The first step we took was to test a large number of rounds of Shell lots supplied by the various manufacturers.

It was during the tests with these Shell that we ran short of powder; so we had to have a fast shipment from Kansas City. I requested a car of powder be attached to a passenger train. This was fused by the railroads. I then ordered the car by special freight -- a one-car freight "train" overnight Kansas City to Aberdeen. I didn't dare ask the cost; it could not have been very great. And I never asked about the train "orders". It probably followed a Passenger train. I assume that full crews were used. I assume that I was responsible for not checking on our powder requirements before we got into trouble - at least I was the responsible Officer. So? The Public paid the bill. I plead guilty. I also assume that the Special Train was a greater hazard than the powder.

m. 4.5-inch Gun, M1. A 4.5-inch Gun was developed along with a companion weapon, the 155-mm Howitzer. Both weapons used with the same carriage and nearly the same recoil mechanisms. The gun proved to be inaccurate and the projectile proved to be too small to be effective; so the weapon was never built in quantity or used in the field. Its development costs would have been avoided by a question of Aberdeen's peoples' opinions.

n. 155-mm Howitzer, M1. The 155-mm Howitzer, M1, was designed and the first weapon tested and range fired late in 1940, I believe. Great numbers of these were built and issued to the troops. In fact, they were still being used in Viet Nam. I believe other countries have followed very closely our design or we followed their design. I don't know who was first. I had little to do with the weapon except some powder tests, which were made at Aberdeen.

o. 155-mm Gun, M1. The 155-mm Gun, M1, was designed in the late 1930's. Production got under way only in 1940. I had nothing to do with the Gun, except as noted in my summer work in 1940, when I determined powder charges for some 24 lots of powder.

p. 8-inch Howitzer, M1. The companion weapon for the same carriage used for the 155 mm Gun was the 8-inch Howitzer. Rock Island Arsenal built the first 48 production recoil mechanisms for the 8-inch Howitzer in 1940. However, the first production carriage was not received until the summer of 1941. Previously a pilot carriage and weapon had been built and used in the range firings mentioned above.

(1) Carriage failure. In July 1941, the first production carriage was delivered for the 155-mm Gun and the 8-inch Howitzer. This carriage was immediately used for tests of the 8-inch Howitzer recoil mechanisms.

The carriage for an 8-inch Howitzer consists of a rotating section with a large U-shaped welded piece in which the recoil mechanism with trunnions on the side frames is fitted. The frame, or carriage, is mounted on eight wheels on a square frame about six feet by six feet. The weapon is elevated by a worm gear on the carriage, which works against a large gear section on the bottom of the recoil mechanism frame.

The large rotating section may be rotated by a large gear in the bottom section by some 25 degrees right or left. The bottom section and the top U-shaped section operate on a roller bearing some 2.5 feet diameter. The bottom section is in turn mounted on a heavy axle with large double dual tires on each side. Trails or long beams are attached to the sides of the lower section; and these may be rotated about 25 degrees from the center line to each side to give support and absorb the rotating forces due to firings at different elevations and angles. These trails are about 14 feet long and are supplied at the rear with spades that are set in the ground. Each spade, as used in the ground, is about 1.5 feet deep and 2.5 feet wide.

The recoil mechanism frame is about one foot deep and two feet wide. The main cylinder forces oil through orifices when the Howitzer is fired and moves to the rear about four feet. The orifices convert much of the energy of movement of the weapon into heat. A second cylinder with a piston under about 2200-psi nitrogen pressure returns the Howitzer tube to firing position.

The Howitzer tube is about 16 feet long with a wall thickness varying from about two inches at the muzzle to nearly eight inches at the rear. It is equipped with pins some six inches in diameter which fit into the movable section of the recoil mechanism. The breech ring is about 28 inches outer diameter.

Before tests, we went over the carriage and placed distance marks at various points in order to measure any deformations of the carriage components or trails.

After firing the first round, Lt. Richard Potter and Mr. Louis Rhein measured the carriage to check for deformations. It was seriously deformed. Mr. Rhein called me. When I put my hand on one of the trails to climb over it, I realized that my hand was on a curved area instead of a flat area. They had not noticed that the trails had buckled. As a result, the carriage had to be changed by specifying a steel with higher strength and all the carriages already built were used for 155 mm Guns only.

This was one of the few examples at Aberdeen that I remember in which the stress analyses of carriages, guns, etc. were incorrect. The 76-mm Tank Gun discussed below was also miscalculated or we used higher powder charges. I think that the latter was the cause of the trouble.

Later, a large number of carriages for the 8-inch Howitzer were manufactured by American Locomotive Company at Schenectady, New York. The first one to arrive was disassembled for an inspection of workmanship. Of course, they had been inspected and passed by the Manufacturer's People and Inspectors and by the Army Ordnance Inspector at the Plant -- apparently these Inspectors did their "inspections" with their feet on their desks while reading the latest scandal sheet - a convenient way to inspect production of large machined components - or locomotives. No wonder frequent train wrecks occurred.

On disassembly we found several places at which the machining had been done, and the rough edges had not been smoothed over. In addition, we found perhaps a large cup of machine metal chips in the bearing of the main rotation component. This was about a five-inch diameter pin that held the rotating part of the carriage and a roller bearing about 30 inches diameter. The chips could enter the bearing race, and indeed some were in the race.

When I called the President of American Locomotive Company, he denied that such workmanship could occur in his plant. So I invited him to come to Aberdeen. He did so with several of his staff. We then disassembled a carriage in their presence. We, of course, chose one that had just arrived and was still on the flat car. It was about the worst one of the lot. We had no more trouble. I never knew what he said to his Staff. I would have liked to have been present. Maybe I would have learned some new cuss words! Why he didn't check his own plant before his trip to Aberdeen was not explained to me.

It is interesting to note that several years later I inspected the American Locomotive plant as a part of a contract Selection Board. As usual, I thoroughly inspected the toilets first. They were dirty and ill kept, as was the whole plant. On inspections of this kind, don't look at the President's Office; rather inspect the most remote wash rooms, particularly the Negro wash rooms if there are separate rooms; and particularly inspect the women's wash rooms! And don't expect any worker to do good work with dirty dressing rooms and filthy wash rooms! If you are President, use the most distant wash room in the Plant part of the time, particularly that of the women's end and, if they have both, the "Colored Women's" room. Even the warning of an inspection will be very effective. To repeat, don't expect anyone to do good work when the toilets are filthy; and the smell is terrible.

(2) Breech Ring Failure. When we started routine tests of the 8-inch production Howitzers, we began to have failures of the breech rings. These breech rings, as noted above, are about 28 inches OD with threaded sections to thread or screw on the rear of the tubes. The length of the threaded section in respect to the gun’s tube's length is about 14 inches. There are about 10 inches of steel to the rear of the end of the tube. This rear section is machined with interrupted threads to hold the breechblock, which is about 10 inches diameter and opens to allow loading the Shell and powder charge into the Howitzer.

The acceptance firing tests for Guns and Howitzers consisted of firing a series of rounds at increasing maximum chamber pressures of something like 75, 90, 100, 105, 110, and 115% of the maximum allowable pressure for the weapon. The maximum pressure in each round was measured and checked.

Note that the "Factors of Safety" used for the weapons are a small percent of normal industrial "Factors". As I keep repeating, I have long advocated reduction in Industrial Factors of Safety as set by the American Society of Mechanical Engineers from 5 to 4 or even to 3, as mentioned elsewhere. I did gain a little once. Today, 1982, I think 2.5 for most machines and 3.5 to 4.0 for buildings would be reasonable. I still agree to 7.0 for mine and elevator cables as these are subject to wear. All elevators are automatically locked from moving in case of cable failure. Lower factors of safety would save money that could be used to prevent automobile accidents at a saving of many lives.

The 8-inch Howitzers were tested in concrete vaults built with two feet of reinforced concrete. On failure the breech rings broke at the rear of the Howitzer tubes and due to the high pressures of around 24,000 psi, traveled to the rear with sufficient energy to go through the two feet thick reinforced concrete walls. Luckily, no persons were injured or killed.

Analyses of the steel indicated that the ingots used in manufacturing of the breech rings were improperly worked. New breech rings manufactured of a different alloy and properly worked and heat-treated passed the tests satisfactorily.

(3) Coppering. All the Howitzers, including the 105-mm, 155-mm, 8-inch, and 240 mm, are used normally for high elevation, or plunging fire. Therefore various powder charges are used and the weapons are fired at different muzzle velocities, depending upon the targets. The 8-inch Howitzer was found to build up copper from the Shell rotating bands fired at high velocities. As the initial rounds after a change of zone firing varied in range, it was necessary to reject the first round's velocity when fired at a different velocity, or zone. Later, 8 inch Howitzers were mounted on tracked vehicles for rapid mobility. However, I was not involved in that project except to demonstrate the weapons once or twice.

The objectives of War are to kill people, destroy property, and win the War. War is Hell! Let's kill the idea of War! Why we can't live on this small Planet in continued Peace is a wonder to me! Life is short enough without shooting one another. Now with "nuclear" explosives, weapons need not be accurate!

q. 8-inch Gun, M1. Two other companion weapons were designed and pilot models tested early in World War II. These were the 8-inch Gun, M1, and the 240-mm Howitzer, M1. The weapons were designed to use the same carriages and similar recoil mechanisms. The 8-inch Gun had a very high velocity and hence a long range.

We tested the 8-inch Gun at great length, using different powders. The accuracy was poor. Finally, we tried different tubes with different angles of rotation. The accuracy always remained poor; so that finally I believe, the construction of the gun was abandoned. One memo that I dictated to outline some proposed tests required firing of over $2,000,000 ($40,000,000 today, 1984) of ammunition. Gun crews and all services cost about another $500,000 ($10,000,000 today); all to no avail. This is where some taxes go! War is Hell!

r. 240-mm Howitzer, M1. The 240-mm Howitzer, M1, fires a projectile that weighs about 340 pounds. It speaks with authority. We had only one difficulty with this weapon. That was coppering of the tube. This effect had been noted on the 8 inch Howitzer.

Later, I was embarrassed since I did not recognize the coppering effect. What happened was that we were firing "time of flight" tests in the evening. When we changed zones (Shell velocities, or zones of target impact), the woman who was computing the velocities asked me what the velocity in the new zone of fire would be. I gave her a number; however, the first round velocity was off about 30 feet per second. Why I didn't investigate, I don't know. Anyway, I forgot the incident until later.

A month or so later Louis Rhein carried out the range firings. The Ballistic Research Laboratory had arranged with International Business Machines in Philadelphia to carry out the calculations on punched cards. This they did. Actually, this was the first large-scale program ever carried out by computers. Why I didn't immediately buy all the IBM stock I could is another mystery.

Later, Firing Tables were prepared and the Field Artillery Board at Ft. Bragg conducted firing tests. Their results did not check the Tables prepared at Aberdeen. Aberdeen repeated the calculations and checked their previous results. This was Saturday. I suggested that I would spend Sunday going over the records, etc, to try and find the cause for the discrepancy. I was actually laughed at by Robert Kent and smiled at by others at Ballistic Research Laboratory. However, when I plotted the actual firing data Sunday morning, the answer was obvious; so the last laugh was on Bob and the Mathematicians. Always plot your raw data! Errors do show up -- especially gross errors. Computers do not evaluate data for accuracy.

s. 240 mm Gun. After World War II, a 240-mm Gun was built. The heavy carriage and the heavy weight of the Gun made this weapon top heavy and impractical; and so far as I know no production models were built. It did have one use because originally it was the only land transportable weapon that could fire a nuclear device. Since then, of course, nuclear devices have been built for various weapons. In fact guns, except for local wars, are out of date -- as I hope Wars are. Have we gained a bit in respect for Civilizations?

The 240-mm Gun was tested with a nuclear device at the Nevada Nuclear Test area. At least, I believe it was a 240-mm Gun, although I am not certain that my memory is correct.

At that time I was Chief of the Production Reactors Branch of the Atomic Energy Commission in Washington, D.C., and, as such I was sent to observe the test as an official observer. We were seven miles away from the air burst. On that test I represented the Navy and not the Army. Why, I never knew. It was spectacular!

My observations were that the weapon was impractical for field use. Later, nuclear devices for use in other weapons were developed. I have not followed those developments in detail.

The best parts of the above trip were: (a) I rode in the Pilot's seat much of the trip going west as the Copilot operated and the Pilot took a nap; (b) I spent two days hunting fossils while we waited for suitable weather for the test; and (c) I had my only "enforced" vacation on the public's money. Usually I carried lots of work (writing and reading reports) with me.

t. Mortars. We tested various components of both 60 and 81-mm Mortars. Bent base plates, etc were studied.

I was always amused by one of the "gun crews" at Trench Warfare. This crew consisted of five greatly overweight Negro women dressed in coveralls who moved slowly and continuously, and always with laughter. Every time I came near, I became the butt of all their jokes. Actually they worked very hard and the lack of comments regarding Trench Warfare herein is really a tribute to them and the Trench Warfare staff. And again, I always tried to create situations that led to jokes and laughter.

One item that is of interest is that Lt Allan Wilson heard that mortar crews were being killed because rounds hit limbs of trees over the men and the Shell detonated. He developed a safety device to build into the fuzes to prohibit this type of accident.

Just before I left Aberdeen, we received six-inch and ten-inch Mortars for test. I had nothing to do with these except that I did observe some firings. Accuracy must have been very poor.

u. Special Tests. In addition to the regular acceptance tests and development of our normal lines of artillery weapons discussed above, we conducted many programs of a special nature. Many of these were closely related to the regular development programs. But many differed widely from these. I have discussed these tests and my part of the work in this section. It appears to be quite a hodgepodge!

I think it will be obvious to the reader that most of my time was spent on these special programs. In fact, after the first year, I spent probably ninety per cent of my time on the special tests. By that time the younger Proof Officers were carrying out the routine testing and development work with very little instruction or supervision. I was responsible for approval of all the Formal Development Reports in my area. Once some visitors (two Major Generals and one Brigadier General) mentioned that the War was being fought around my desk. They were worried that I would have a nervous breakdown. My Secretary, Edith White, turned to them, poked her thumb at me, laughed, and said "He'll never get the Hibby-Geebees'; he gives 'em." What we should have done was to invite Adolph Hitler, his personal Staff and the Japanese Emperor and his General Staff to spend a month touring U.S. and Canadian Industries, Mines, and Research and Development Organizations including those of the War and Navy Departments. Fewer people might have been killed. Research and Development are effective.

v. Shaped Charges. Shaped Charges were used in various types of ammunition and for destruction of fortifications.

A shaped charge consists of a block of explosive such as trinitrotoluene (TNT), so shaped that a hollow cone is left at the business end within the explosive. For example, a round cylinder of TNT 10 inches diameter and 14 inches long may have a deep cone in the top. This is lined with perhaps one-eighth inch steel sheet. On detonation at the bottom, the cone collapses and the shattered steel and hot gases are blown forward at high velocity. Since pressures in such devices may approach 1,000,000 pounds per square inch, the hot gases and molten steel particles are accelerated in a small stream to velocities approaching 5,000 feet per second at perhaps 3,000 degrees F. As such, they are potent drills. In general, a shaped charge designed properly will develop a small hole about twice the depth of the charge's original diameter in armor plate, and about seven times its diameter in concrete. Thus, shaped charges should have many commercial uses.

w. Other Tests.

(1) Rifle Grenades. Rifle Grenades with shaped charges were under test when I arrived at Aberdeen in 1941. Other than routine tests, I had no part in the program. These weapons were fired from regular 30 caliber rifles, using blank cartridges. Their range was short. They would stop a German tank then in use if the tank was struck on the side since rifle shaped charges would penetrate some two inches of steel. They would not stop the later German tanks.

(2) 105-mm Howitzer, M1. Many tests were made on shaped charges as fired from the 105-mm Howitzer. These projectiles, when set up and fired statically against armor plate at the correct distance from the plate, would penetrate nearly ten inches of steel. However, when fired from a Howitzer, or Gun, the rotation of the projectile resulted in dispersion of the gas-metal jet and multi-penetrations to only about five inches of armor plate. Theoretical and experimental work carried out by Ballistics Research Laboratories were to no avail. Later, the problem was solved.

In conjunction with this work we carried out spark photography of Shell detonations. Actually, a Shell burst quite uniformly. The first flame is seen at the top and at the rotating band areas essentially simultaneously.

w. Destruction of Concrete Fortifications. Prior to World War II, the French built a series of thick walled fortifications, consisting of heavy steel reinforced concrete -- along the French-German border. This was known as the Maginot Line. After Germany conquered France, Germany added fortifications to the French and their own previous line of Forts known as the Westwall, or Seigfried Line. They also built Forts along the North Sea and elsewhere.

Several years after the War, Winnie and I personally inspected a reinforced concrete building used to assemble submarines a short distance from the Rhein River. This was located near Bremen. The walls and roof were eight feet thick of very heavily reinforced concrete. The British bombed the fortification after the war. It was a shambles, but still effective.

When the United States entered World War II, the development of means of destruction of these fortifications became a necessity and, it seemed to me, almost an obsession to some people. The problem was attacked on several fronts:

a. Shaped Charges
b. Machine Guns
c. Artillery
d. Mortars

Unfortunately, I was involved in all four programs. The first step was to decide how to proceed. The obvious thing was to build similar Forts as well as special targets, and test the ammunition we had; and then to develop improved weapon systems. We also set our goals as development of textbooks and training films. In all three types of work, we succeeded.

The first step was to build various types of fortifications. A little real thought here would have helped. The answers should have been obvious. We did not know how; so the Secret Service offered to get drawings of typical French Maganot Line and German Westwall or Seigfried Line. When we agreed, the drawings duly arrived a few days later. (24) The Corps of Engineers built five "Forts" using the imported drawings and drawings that the U.S. Army made. These Forts were located at the end of Plumb Point below Bush River, 30 miles by road from the office.

This program was typical. The fortifications were built before the test program was written. Whether the proper Forts were built and utilized in the tests was never asked and probably never considered - partly, or perhaps all, my fault. I believe larger Aberdeen staffs would have saved thousands of lives and shortened the War. This kind of work should be going on today. I should have set up a few-man Committee to think about the Program. My superior, Colonel John Cave, probably would have objected. He was of little help. I should have bypassed him and talked to Colonel George Eddy and done my own thinking and planning. I had no part in the design of the Forts. In fact, Colonel Cave did not ask for anyone's advice at any time. He "knew" the answers, "His opinions". Colonel Cave was very intelligent. (25) He did not understand development work -- and he was in command. Colonel Eddy, Mr. Rhein, and I should have spent a week at a Mountain Monastery each month. Every Director of Research and Development should spend a month each year with his top staff people at a Monastery where there are no telephones, telegraphs, or mail. Colonel Eddy and I should have visited the Navy Proving Ground one day each month and their top Officers should have visited Aberdeen each month for General discussions, no agenda, and no mail or telephones.

We also built a number of walls of various materials and various thicknesses to use for developing a better knowledge of Terminal Ballistics. Because of the importance of the program, I dictated the test program and outlined the work for the Proof Officers. Ballistics Research assigned people.

Special Reports were prepared weekly and sent by special messenger to Washington. Frequently we visited Washington to discuss the program. Several Wednesday evenings we were still writing and

typing the reports at 2200; and they were sent to Washington by Special messenger to be there the next morning at 0830.

The various weapons, which were developed, or attempts made to develop weapons, are discussed first and then the actual tests to destroy the Forts or bunkers are mentioned.

(1) Shaped Charges. Shaped charges consisting of an explosive with "cones" properly shaped were made, as noted on page ----. These were some ten inches diameter by about twenty inches long. The idea was that a man might crawl up to a Fort during darkness, set a shaped charge and detonate the charge after he had retreated an appropriate distance. Set properly and detonated, it was found that a hole a couple of inches diameter would be drilled through seven feet of concrete with steel reinforcement bars and enough hot gases would enter the hole to kill any person in the open in the Fort - or, at least stir his coffee, and probably scare every person present.

The reader should understand that to develop such a charge and technique requires weeks of theoretical work and months of tests to obtain the optimum design and methods of use.

(2) Machine Guns. Tests were made with both the 30 and 50 caliber machine guns. The 30-caliber gun was of little use except one way. If mounted near a Fort, its crew would appear to be an easy target. But if mounted unseen and fired, it could shoot into open ports and possibly do damage inside the Fort. It could, however, when armor piercing bullets were used, penetrate the porthole doors sufficiently that the doors frequently could not be opened without repair -- a bit embarrassing to those inside the Fort. The 50-caliber Machine Gun was more effective in this way. But neither were serious threats.

Machine guns might keep a single Fort closed up in order to permit the use of shaped charges. As far as I know this type of attack was not used by our troops in World War II in Europe. In fact, coordination between Aberdeen, and the troops was just about zero, when it should have been near 100 per cent. This was also true of Naval Ordnance development. I never understood the higher commands. Never thought about that? Scientists and Engineers always think of alternatives. West Point was out of date. As noted, Colonel Eddy and I should have visited the Naval Proving Ground one day each month and perhaps, West Point.

(3) Artillery. The series of weapons tests, including artillery required several months. We started with the smaller weapons, including machine guns, and increased caliber to be able to determine optimum weapons, their usefulness, and how to use them. Actually in warfare, the soldiers almost always have the least optimum weapons when and where they need them. So, we started with machine guns of various calibers and projectiles.

During all tests we took detailed data, still pictures, and motion pictures. Weekly, monthly, and final reports were prepared along with a training manual and films.

(a) Small Caliber Artillery. I do not remember the details of all the tests. In general the smaller artillery weapons up through the 155-mm Howitzer were effective only when brought up to within one-quarter mile or so of Forts. Except for the tank guns, armor-piercing Shell were not available for the smaller weapons. Weapons such as the 105-mm Howitzer were effective only against portholes, and the weapons had to be set up close enough to fire into the ports. Meanwhile interdiction fire would be expected to be quite serious.

Tests demonstrated that when close enough that direct impacts could be made on the gun and personnel ports, the small weapons such as the 105-mm Howitzer would damage or even penetrate the gun ports. Shaped charges did severely damage the gun ports and in some cases hot gases and metal

fragments entered the Forts. When detonated inside a Fort, a 105-mm Howitzer Shell would be expected to make life a bit uncomfortable -- especially if it ignited the propellants of the Forts' artillery ammunition.

In general these smaller weapons were found to be not overly effective.

(b) Special Fuzes. Ordinarily the weapons from the 105-mm Howitzer and higher were issued in the field with only one type of fuze. This could be set superquick, or delay. The delay permitted firing for ground ricochet and airburst a hundred yards or so further on. This type of fire stopped the Germans at the time of their attack at Anzio Beach. (26)

When this fuze is fired either superquick or delay against concrete, the fuze is crushed and the Shell detonates before it can penetrate concrete. To correct this, the Officer (27) in Charge of Design at Aberdeen suggested an armor piercing nosed fuze. We made some up and found on firing that indeed such fuzes would not break off or fire superquick provided that the Shell were fired at low velocities. This meant that the ordinary Howitzer rounds could be used with a special fuze and field assembled as needed. At low velocities the 155-mm Shell, for example, stops in the concrete before it detonates.

The advantage of the use of a detonating Shell in destruction of concrete fortifications is that the Shell carries enough explosive that on detonation, for example, of a 155-mm or 8-inch Shell, a wall several feet thick is cracked. A second round fired in the same area normally broke through the wall (as built by the French and Germans) and exploded on the inside. The hot fragments of the Shell body set fire to whatever ammunition was inside. The resulting fires killed personnel that escaped the fragments of the Shell produced by its explosion. (28) The object of War is to win the War! War is Hell! Soldiers and others get killed. Why start a War? Who gains? Apparently, the Russians do. It's the Politicians that are at fault, not the Soldiers. Use of War is silly.

The fuzes were used on Shell used against a fortification in one of the harbors in France. The Fort was, I believe, built of granite blocks. The first round cracked and broke the wall; and the second Shell detonated inside. Men ran out in all directions in anything they had; and the Fort surrendered.

These same fuzes were used extensively in an attack on a portion of Manila; but inspection after the fact indicated that they had been fired at high velocities and the armored fuzes broke off without detonating the Shell. Apparently, our Officers did not read, or did not believe, the instructions. The instructions differed from previous Training Manuals. Probably the Officers never read the instructions; or, if they did, they let their opinions override the instructions. West Point again? Or Colonel Caves? Both?

Mr. Bernard Bass, who was in charge of our Ammunition Loading Section, suggested that the fuze be redesigned to use a Navy booster since this was shorter and would have allowed more threads and a better concrete piercing fuze. We suggested this to Colonel John Cave, who informed us that he would make any recommendations for changes he thought should be made. I believe he should have been Court Marshaled. At least, I never spoke to him again whenever I could avoid it -- which I did rather well. (29) He was soon transferred from Aberdeen. War is Hell! And Aberdeen was a very exciting and comfortable place to be in Wartime. And I had to take his place. I should have been left on the Main Front.

Bulova Watch Company set up a line and manufactured the special fuzes.

(c) Large Caliber. The 155-mm Gun, M1, when firing armor-piercing Shell, could blast through the German Westwall Forts. This took several shots fired almost on top of one another. The reason was that the true armor piercing Shell carry relatively small explosive loads. But the main objection was that the large number of rounds that were required, permitted the Fort to return the fire, usually effectively before sufficient armor piercing rounds could be fired to break through the walls of the Fort. With the special fuze and regular Shell, the second round usually penetrated the fortification's walls. The regular Shell carried more explosive than the armor piercing Shell. Of course when possible, many guns were located forward of

the fortifications and were aimed at the Fort's gun ports. War is hell! Anyway, the Westwall was easily breeched and passed. Forts are out of date today (1981).

(d) Heavy Mortar. Someone, apparently at Ballistics Research at Aberdeen, suggested that if we built a heavy enough projectile that a single projectile landing on the top of a concrete bunker would breakthrough the roof and destroy the bunker. Such bunkers were used in the German Westwall. So the Ballistics Research people came up with the idea of a 36-inch mortar which was expected to fire a 36-inch Shell loaded with a soft explosive that was expected to be exploded after it had flattened a bit on the top of a Fort. (30) Think about this a bit -- even draw a couple of pictures and use your imagination!

A contract was entered into between the Ordnance Department and a steel equipment manufacturing company in Buffalo to design and build such a widget. I was very skeptical; our Design Officer was outspoken in a very negative manner. I should have been. I was too busy to think. We were not brought into the design discussions, or early manufacture meetings. If we had been, the Project would have been killed. Why we were not is still an Aberdeen and Washington mystery. Of course the necessary accuracy was impossible -- or at least very highly improbable.

The device, as it evolved, was something like the following. A very large steel frame was designed with plate sidewalls and bottom. Why I don't know. In this was fixed a heavy frame, which carried the base for the 36-inch mortar. Limited movement was allowed for small changes in aim of the weapon both in azimuth and elevation. A primitive type of plunger shock absorber was built in the bottom. It actually was a bit updated Roman Ballista, and about as effective. It could have hit a City if set up just outside the Walls. The damage inside a City would not have been great except that fires could have been started.

The whole case, or frame, was carried on double tractors, one fore and one aft. The device was set up by digging a ditch some 100 feet long, twelve feet wide and twelve feet deep. What an enemy Army would have done while this trench was being dug, I don't know. Perhaps wondered a bit? Or sat and laughed?

The projectile consisted of a steel case, quite spherical, which was expected to carry about 1,000 pounds of a plastic explosive. The rotating bands were precut. The projectiles were muzzle loaded.

A Company of soldiers was ordered in for labor. Why, I never knew. A detailed test program was prepared. I assigned responsibility to Louis Rhein. He never expressed his opinion of the --- thing.

The device was considered so important that General Barnes, Head of Research and Development of the Ordnance Department, and Colonel Gearhart, who was responsible for artillery development, came in from Washington frequently to witness tests. My opinion was never requested. I should have sent a telegram to the Chief of Ordnance, and by-passed everyone. It was either laughable or pathetic. I never decided which. Both?

The preliminary tests such as determination of powder charge were readily completed. Difficulties started when I began to suspect the projectiles were unstable. So I got off to the side a bit and observed the firings. The Shell were so large that no field glasses were needed. Sure enough, the projectiles developed large yaws, up to 29 degrees for a few turns. This, however, made the accuracy very questionable. It turned out that a simple redesign corrected that defect.

On completion of the preliminary tests we had found that the accuracy was only fair -- not at all as good as the eight inch Howitzer -- but possibly useful for destruction of fortifications. At least the explosion of a projectile near a Fort would scare the persons inside and not much else -- except to stir their tea and coffee a bit. It would have been an accident to have to hit a Fort. Interdiction fire could have been effective.

Then Mr. Rhein set up to fire live rounds. He took great care that every person in the area was behind heavy concrete barricades. Well, that he did. I suspect that he was suspicious. The first round detonated at the muzzle, 1,000 pounds of explosive. The weapon was completely destroyed. I called Colonel Gearhart, but found him and the other ranking officers in a conference in General Barnes' office regarding the device. I interrupted the Conference. I told Colonel Gearhart what had happened. He and General Barnes came to Aberdeen the next day.

The project was killed. I never liked the device, as it was too cumbersome and too heavy for field use. I also thought the design was primitive. I think I was prejudiced because I thought that the armor piercing shell fired from mobile mounts would be more effective. The set-up time for the mortar was just too great; and the time between rounds would have permitted interdiction fire.

The only accident we had was that one man was leaning on a crane as it turned and cut off the ends of three fingers. I think the medical people were able the replace the fingers. They were working on his fingers within a few minutes. How do you plan things better? In War or Peace?

(e) Conclusion. Of course, I had no part in the conclusion. The airdrop of the recoilless weapons, I am quite certain, made it possible for the Second Army's airdrop to capture one of the Rhein River Bridges and to erect the sign "Walk Across the Rhein, Courtesy of the Second Army". The sign should have read "Courtesy of Two Civilian Engineers of Frankfort Arsenal". These men, who were named Kroger and Musket, had designed the weapon; hence our name -- "Crow Musket".

After reading the above Lugene Hungerford stated that after the War she talked to the man who had been General Patton's pilot. He had told her that very large numbers of Germans had surrendered to "just a few Americans" who had been dropped across the Rhine. I heard that the Germans thought that they were surrounded by many American troops and that the 57-mm Recoilless Guns were actually 155-mm Guns; so they surrendered.

The destruction of the concrete fortification, when necessary, proved to be simple. Of course, with nuclear weapons fortifications are out of date. Fallout shelters are something else. (31)

(4) Destruction of South Seas Fortifications. I had no part in the special program and group set up to study the destruction of the South Seas' type of fortifications used by the Japanese. These were made from local coconut logs, dirt, and stones. The coconut logs were tough. When a Fort was struck by an explosive projectile, it simply rose up and settled down again; so their attack was very difficult.

Colonel Cave bypassed me. He set up a special group, mostly of my people, directly under his Command. Why? You can guess. I think he wanted a trip to the South Pacific -- which, unfortunately, he got. This was to the South Seas, Philippines, etc. Why Colonel Eddy let him do what he did, I never knew. Was it that both were "West Point Officers" -- and Buddy helps Buddy? Why West Point? It may have been reorganized by now. I doubt it. It was out of date in World War II. What will happen in World War III?

(5) Plate Tests. I have classed here as plate tests of concrete, stone, and armor plate. We built and tested various types of walls, including block granite. This proved to be most resistant other than steel. Actually, this was part of a large "Terminal Ballistics" program that we ran for a long time.

The Armor plate tests were run almost daily as routine checks of both plate and armor piercing Shell. One series of tests included armor plate for soldiers. This may sound 'silly' but it is not. In actual battle many soldiers are wounded or killed by ricochets, small pieces of armor picked up by bullets, and pieces of shrapnel, or even gravel. Many of these stray pieces of metal or stone can be stopped by very thin pieces of metal. So human armor plate was developed.

The most effective armor against the various types of shrapnel, etc. on a weight basis was found to be a mixed rayon-aluminum sheet. This has been used commonly since. Actually, we had no part in its development.

(6) Tank Test. Unfortunately the word "tank" is overworked as it means simply a container for water. By extension it means an armored, usually tracked, motor driven vehicle, equipped with a considerable list of lethal weapons. It is in this last meaning that I am discussing the subject here.

If a tank is struck by a projectile that penetrates the outer armor, particularly if the projectile is filled with high explosives and explodes inside the tank, hot steel particles will usually penetrate the powder cases of the loaded rounds in the tank. The powder in these will burst into flame and burn very rapidly. The crew, if alive, has only a few seconds to get out -- a maximum of nine seconds in the American World War II tanks. Obviously most men did not get out.

A long series of tests were run to determine how these loaded rounds could be protected. Use of armor plate and water tanks were tried. But as far as I know the problem remains unsolved. War is Hell!

x. Special Weapons. A number of tests were run using various weapons. These included tank, anti-tank, aircraft, and coast defense.

(1) 75-mm Tank Gun. In the summer of 1940, I did some firing of the 75-mm Tank Guns used in the General Sherman Tanks, I believe. This was the tank used in such numbers in North Africa in the early part of World War II. The tank was so designed that the gun could only be fired in a limited azimuth (horizontal angle). We always considered it a very poor design. The German design was far superior. Why we were not sent drawings of the tank for comment before manufacturing started is a War Department secret. Probably some General's opinion, as I keep repeating. As noted, we were never brought into the Ordnance Board Planning as we should have been. Colonel George Eddy and I should have been exofficio members of the Board.

(2) 76-mm Tank Gun. The 76-mm Pilot Tank Gun was sent to Aberdeen for test. This gun was tested at excess pressure in accordance with our regular procedures. It was then mounted in the open and a 2,000 round wear test was started. Periodically the wear at the front of the powder chamber, or forcing cone, was measured.

At about round 1,500 the gun failed. The whole rear half broke into fragments, some eight to ten inches on a side, and two to two and one-half inches thick. Now it has been known for a long time that when a gun fails in this way that the rear travels to the rear, the front of the tube travels forward, and the pieces left of the sides travel outward at various angles -- just as you would expect. There are 45 degree angle sections at the rear on either side (or in a "cone") that are reasonably safe.

In this gun failure there were, I think, three men standing in the so-called "safety angle" at the rear. The only injury consisted of a piece of wood being blown against the leg of one man and causing a superficial bruise. However, one piece of the gun flew between one man's body and his left arm, which he had swung outward as he fired the gun by pulling the lanyard with his right hand. The piece of steel was near enough his body to tear his shirt and one thread of his underwear. I always suspected that he was a wee bit scared! Had he not thrown his arm out as he pulled the lanyard, the arm would have been torn from his body and probably he would have died!

I assigned Captain Losco to investigate the gun's failure. He was a very bright metallurgist. He visited Watertown Arsenal, reviewed the design and concluded that, for the steel used, the safety factor was

just about 1.00. The steel specifications were changed to provide a factor of safety of at least 1.20. No further failures occurred. 1.20 compares with 4.0 and 5.0 for most pressure vessels, 5.0 for most bridges, and 7.0 for mine and elevator cables used in Peacetime. This experience has led me to recommend reduction in our Industrial Factors of Safety as mentioned elsewhere. I agree with 7.0 for mine and elevator cables as they are worn a bit in use. Three might be satisfactory for ordinary use. I have lost the argument.

Later the 76-mm Tank Gun was adopted and used very extensively. We proof tested great numbers of them. The only active part I had was that occasionally a gun would be bore-scoped (optically examined on the inside) and inclusions or defects in the metal would be noted. Then, I had to look at the tube and make the decision to accept or reject. Obviously, the girls who routinely bore-scoped the guns were the experts; so I always talked the situation over with the girl who examined the guns and, if she indicated any opinion, I safely agreed with her. It was always a judgement. Any inclusion over 0.5 inch, I rejected. Why? Somebody had to make an arbitrary decision; and I was the Sacrificial Goat. Men were being killed and Tanks blown up and lost. Further, it was necessary to end the War to save others from being killed. I was in the middle. There were no Historical background data that I knew about. I believe that our Industrial Factors of Safety are excessive, as given in the A.S.M.E. (32) codes. I always assumed that the inclusions and cracks that were located on the outside of the tubes were noted prior to painting. Why these cracked guns were not rejected at
the factories was a mystery to me. Perhaps the inspectors did not like to be Sacrificial Goats -- but there has to be one. Perhaps they inspected the guns with their feet on their desks and the external cracks had been painted over.

(3) 76-mm Tank Gun Mounts. The utilization of the 76-mm Tank Gun required development of a different tank gun recoil mechanism. This was designed and turned over to the Ford Motor Company for production. Even the pilot mechanism was beautifully and correctly machined.

This type of recoil mechanism simply forced oil through a large orifice and a spring returned the gun into battery or firing position. Captain Kolb ran a 2,000 round test on one of these units with no trouble.

Before we entered the War, one American Company had contracted with the British Government for a large number of Tank Gun Mounts. These mounts included the recoil mechanisms and steel supports As I heard the story, a group of men (possibly only one) in Wiles-Barre, Pennsylvania, had the idea that an old machine shop could be used to make weapons to be sold to the British Government. So they hired a high pressure salesman; and he promptly sold something like $200,000,000 of goods at, I understood, two per cent commission, or $4,000,000 -- for a few days trip and a two hour Conference -- probably on the group's expense account. It wasn't funny. Anyway, the salesman sued for his commission. I never heard how that suit came out.

About the time production started, the United States agreed to carry out the inspection of these components. The first mounts that came in were in very poor shape; and we rejected them. Later, they improved as the United States Plant Inspectors made their weight felt. Then a carload came in, all oversize in some of their outside dimensions. I called the President of the Company. We agreed that the future shipments would be checked and corrected. The next carload came in the same shape. The President apologized and said the shipment had just left when I called previously; so we ground them down. Then another carload came in. These we did not unload. We sealed the car and shipped it back. I then called the President and so informed him. He paid the freight both ways. We had no further trouble. And we needed the weapons! What is right? Men were being killed.

(4) 105-mm Gun. We tested a large tank gun which I believe was 105-mm. We had no trouble. I don't remember more.

(5) 16-inch Gun Test. In 1933 Japan and the United States signed a contract to limit construction of Naval vessels. The United States removed a number of 16-inch guns from ships and destroyed them while the Japanese proceeded to develop and build 18-inch guns. We also scrapped many of our 16-inch Coast Defense Guns. Others were stocked.

Just before World War II Aberdeen was called upon to test one of these 16-inch gun tubes. Apparently, in the nearly 20 years, it had been forgotten that this tube had not been properly heat-treated. At any rate, I had a gun crew set the tube up for test one day that I was not too busy. On test, the first projectile tore most of the lands loose (lands are the ridges left after the grooves are machined in the inside of the tube to rotate the projectile.) The "ridges," or lands, between the grooves were torn loose and hanging in shreds after the first round. So I had the men cut the $1,000,000 tube into sections and ship it out as scrap metal.

Then in 1942 one of my Ordnance friends, whose name I have forgotten, wrote an "Ordnance Minute", recommending dismantling all our Coast Defense facilities. This was approved. Now we must rely on aircraft.

(6) 75-mm Aircraft Gun Mount. The conventional fighter aircraft built before the War and during the War carried machine guns and 20-mm guns. These had a high rate of fire and a dozen of them on a plane can throw a lot of weight. Frequently heavier weapons have been suggested.

A 75-mm Gun Mount was designed to hold a short 75-mm Gun Tube and an automatic loader designed to fire, I think, 20 rounds at intermittent fire. We had all kinds of minor troubles getting the widget to work perfectly.

Finally, it was approved for construction. After great and lengthy discussions and objections, the Air Force finally mounted one on an old bomber. The part that I heard of the story of what took place, which was possibly near the truth, follows.

Two men took off in the old bomber from, I believe, the Philippines in daylight; flew across the China Sea; met an ocean freighter, sank it; shot up a truck convoy on the coast; near Burma caught a freight train entering a tunnel, wrecked the freight, and jammed the tunnel; and then flew back to their base; all in one sunny afternoon. Such is War and even without nuclear explosives.

I believe the subject was dropped. Of course, rockets were mounted on planes. Their accuracy was too poor to be effective. With nuclear heads, rockets need not be accurate. Why the Air Force rejected the gun, I could never even guess; probably some General's opinion. It was new! And unfamiliar to him. Technology had simply out classed the Admirals and Generals.

y. Gun Erosion. Gun erosion is due to the action of the hot flowing gases and the wear of the Shell on the forcing cone and lands during loading and firing. I believe that a good part of the erosion occurs due to the escape of gases past the rotating bands upon firing. At any rate, gun tubes wear out, particularly at the forcing cones (33) where the grooves start. The gun tubes must be replaced. The guns are sometimes lined with more heat resistant steel than the ordinary steels in use for the bulk of the tubes. I learned later that some work on heat transfer was done at Purdue University on this subject. We fired many rounds to measure the wear, or erosion, in the guns so that the men in the field could make measurements and correct their Range Tables for their gun elevations.

z. Fragmentation Tests. One test may be of general interest. We statically detonated large Shell in sand, screened the sand, and laid out the recovered pieces of the steel Shell (or projectiles) for study and pictures. Ballistics Research conducted many static bomb tests for the pressure waves.

aa. Bomb Disposal. The Ordnance School, which was located immediately west of the Proving Ground, had responsibility for training Bomb Disposal Officers. Note that disposing of bombs which have been dropped and which have not exploded on impact requires a very detailed knowledge of explosives, bomb fuzes, and their good and bad habits -- plus a bit of care, respect, and luck --especially luck. Don't ever lose your respect for high explosives! Unlike most things, they become a greater hazard with age especially when some decomposition has occurred. As I keep repeating, they expect your respect. They deserve it. Always see that they have it! When they talk, they speak with authority. You will never talk back!

The Ordnance School had asked the Proving Ground for a practice area. At that time early in 1942, I believe, I was not responsible for the Ranges. I do not know who issued the necessary permits. I suspect that it was done by someone in Headquarters, and done as a routine piece of paper without much consideration, or knowledge. At any rate, several students and one or more of their instructors were permitted to enter an old storage area and "dispose" of some ammunition. This ammunition was World War I vintage Shell which had been stored in the open in a damp area, probably 20 or more years. The steel had corroded; but of course, the explosives had all their youthful vim and vitality, probably even more vim -- due to partial decomposition.

At any rate, the people carried perhaps twenty 155-mm Shell from the pile and laid them in an area so the Shell could be detonated. Each Shell contained perhaps 20 pounds of trinitrotoluene or TNT. They apparently laid standard two-pound explosive packages next to each Shell, moved away, and electrically detonated the small charges.

Then they went back to look at the remains. Two of the Shell had not detonated. So all the soldiers gathered round. One Shell detonated. As luck would have it, I think only one man was killed instantly; one lost one arm and leg and refused hospitalization as he said he would die no matter what the surgeons did; and others might be saved as others were injured. The man died in a few minutes.

They violated two rules; (a) never but never move old rusty Shell or old explosives of any kind; and b) never return to a detonation area after a blow until the next day. This applies to the use of dynamite in Civilian use including mines.

I regretted that I did not call the Commanding General of the Proving Ground when I heard that the Bomb Disposal people were to try out their destructive procedures, and ask that their work be placed under my command. I still think that I was responsible for their deaths even though others bypassed me. (34) Colonel Eddy had approved the work. And I might have been killed.

I was in charge of the impact areas or ranges for two years. We had one accident in that period. One of the old civilian employees who had worked on the ranges for 20 years picked up a Shell which he "recognized" as an inert loaded 37-mm Test Shell. These Shell were simply fired with dead loads of paraffin in Shell case, powder, and tube, acceptance tests. The Shell he picked up actually was an Italian 41-mm armor-piercing Shell, I think, which had been fired for some reason by Small Arms. It had not exploded on impact. The Shell was lying at the men's rest area. The man was sitting on a low bank. After looking at it, he dropped it between his feet next to the bank. Due to the bank only one foot and part of one lower leg were injured. I believe he recovered total use of his foot and leg.

The other "rangemen" that worked all during the War on the ranges was a retired Sargeant who had been in the Army, I believe, until retirement age. At least he retired before the War. Soon after the War started he was working as a Civilian for a contractor who was "recovering" Shell from the impact areas for steel scrap. That is all I ever heard except that he was killed while picking up scrap. Had I known what was going on, I would have chased them out of that area.

On the other hand, we examined all kinds of foreign materiel, including various types of trick devices left by retreating troops. Always one is on the edge of catastrophe and must tread softly and follow the rules. Never but never touch an unknown Shell unless a two pound charge has been detonated next to it and at least twelve hours have elapsed between the detonation and the movement of the Shell. As I keep repeating explosives expect and demand your respect or even your life. Its safer for you to see that explosives have your respect.

bb. Foreign Materiel. One of our important functions was to study the foreign materiel sent to this country. Captain Allan Wilson worked on this program at length and Captain Harold Kolb spent a long time on study of the British 57 mm Antitank Gun. Others were also involved. In addition, we disassembled and examined devices like grenades, anti-personnel devices, etc. as noted above.

The disassembly of anti-personnel devices involved some hazard. The Germans in particular devised several widgits that would explode on touching and others on disassembly. The Germans were experts.

Most of the foreign materiel that we examined was British and German; we did have Russian weapons. The Russian weapons were excellent.

(1) Mortars. The German 81-mm Mortar and its ammunition were examined and test rounds fired. This weapon was so nearly like ours that the only item to note is that it had a somewhat heavier and stronger base plate. The British mortars were almost identical to those of the Germans.

(2) 57-mm Gun. The British manufactured a 57-mm Gun for anti-tank use. No other country did so. Because this gun had done yeoman service in North Africa, there was pressure for us to adopt the weapon. Accordingly, several were sent to Aberdeen for test. Captain Kolb carried out the tests and wrote the report. He concluded that the weapon was relatively ineffective.

The British 57-mm Gun fired, I believe, a seven pound solid steel projectile at 2,800 feet per second. This was a high velocity; but the Shell were too small to be effective -- at least against the German tanks built after the North African Campaign.

In addition, we concluded that the weapon was too complicated for high production. As I remember it, there were several pages of objections. Nevertheless, we did manufacture and test many of these weapons. I don't believe our troops ever used any of them. My opinion was that we should not have wasted any time on tests of the guns or ammunition. Why the guns were ever ordered is a mystery to me. Some General's opinion? Why we weren't asked about things, I never knew. We certainly said what we believed to be true.

Captain Kolb was the Proof Officer on tests of some of the German tanks. I don't remember the details but his report led to an argument between him and me. As he said, he spent days writing the report to make certain that it was nearly perfect. Then I tore it to pieces in about five minutes. He stated, "You make me so mad", as he got up to leave. "But I have to admit that tomorrow I'll say it's a better report." Harold is still a close friend. He is Director of Research of Caterpillar Tractor Company in Peoria, Illinois. Later, he came to visit me occasionally at Lafayette, Indiana. It's easy to criticize others. That's why so many "Bosses" get by -- they criticize others; but no one criticizes them.

(3) 105-mm Howitzer. The British and Germans as well as the United States built 105-mm (35) Howitzers in large numbers. We compared these weapons in respect to details of manufacture, ease of disassembly for repair, ease of loading, accuracy, etc.

It turned out that the ammunition for the three weapons was very much alike; and the weapons functioned quite alike. The manufacturing operations differed radically. My God, the man and machining hours!

A British breech-block was cut from a block of steel and machined on all surfaces. The German one was partially machined. The American one was cast almost to shape and finish machined on the working surfaces. The German wheel and axle assemblies were very involved and included many small parts. They did not follow the "Kiss Principle" - "Keep it simple, Stupid."

We did not disassemble the recoil mechanisms as this was done by Rock Island Arsenal. Presumably they were much alike in principle. The Americans used tubes and the British drilled holes through heavy forgings. I have forgotten what the Germans did; but I believe they used drilled forgings.

In resume, our weapons were very much cheaper to build and maintain as well as being lighter and more easily handled.

(4) Russian Tank. A Russian tank was sent in and tested by the Automotive Division. We simply looked at the general vehicle and armament. It was well built, simple design, and, had excellent operating characteristics.

cc. Demonstrations. We conducted many demonstrations for special persons and special groups. The demonstration for General Marshall was mentioned above. In addition we had many important visitors, including President Franklin D. Roosevelt, and separately Mrs. Roosevelt, and many others. Of course General Harris, Commander at Aberdeen, General Campbell, Chief of Ordnance, and General Eddy, Commander of the Proving Ground, acted as hosts for important people. I did the talking for less important people. President Roosevelt smoked cigarettes continuously with a foot long holder, and looked bored. I was quite amused. I never had any respect for him. I think that I was just introduced and shook hands with him.

Some demonstrations were of interest. The demonstration for Mrs. Roosevelt was one. We had Negroes and Caucasians working together. These included labor, gun crews, engineers, office people, etc. Since Aberdeen is located in Maryland, we had separate washrooms. Why? Habit I think. When it was announced that Mrs. Roosevelt was coming in, word was given out to make certain that these washrooms were all alike as she was "interested in the colored problem". I quote here -- I would have used, Negro. We did nothing as we had no need to do so. But once we did have trouble with one Negro girl. She demanded the privilege of use of the Caucasian Women's Room. She was invited to do so. But she never did. One other time of the Negro men raised the same problem. He failed to follow through when he was welcomed to use the "White Men's Room". I was amused as no man or woman wanted to use a wash room of the other sex. I thought that was a logical extension of the argument. (36) Negroes have made great advances during my life. Intermarriages?? Soon?

(1) Chicago Editor. Colonel Robert McCormack, Editor of the Chicago Tribune, was brought in one day by General Barnes. Colonel Eddy and I spent the day with them. We gave Colonel McCormack a full dress tour including firing the 240-mm Howitzer. I considered that a waste of money and time even though I had an enjoyable day.

(2) Women. A group of women was brought in for a partial demonstration which included the firing of the 240-mm Howitzer. These women were chosen by various groups of women employees who were helping out the War work in munitions factories. I never knew how, nor why.

Before firing the 240-mm Howitzer, I warned them where to stand, how to hold their ears, and what might happen. Even though they were all standing well behind the weapon and we used the lowest powder

charge, on firing the blast blew their clothing tightly against their bodies. Actually, the blast would not knock anyone down; but it was quite noticeable. Everyone of the women looked stunned, everyone dropped her handbag, and after about five seconds all started laughing at the others.

(3) Employees' Families. In May 1944 we arranged for a demonstration of most of the weapons for the employees and their families. Many of the employees in offices and shops had never been in the highly restricted firing areas. We permitted every employee to bring his or her immediate family -- about 5,000 in all. We did this on a Sunday, which turned out to be a beautiful nearly perfect May day. Then, if ever, came perfect days.

Each Proof Officer, both Civilian and Army, was asked to discuss and demonstrate "his particular weapon". Everything went off in fine shape. I'm sure the day was long remembered in the Aberdeen area. This was a moral booster program. And I believe the expense was justified. Even Winnie and our boys got to see the area where I worked.

dd. Odds and Ends.

(1) Powder Pressures. Of course there were many other things that were of interest. Each Thursday we had a one to two hour movie of action pictures. These were front line movies and showed the worst part of the War. War is Hell! Then there were many questions. One of these, I remember, dealt with several lots of 8-inch Gun powder. The maximum firing pressures were 2,000 psi too high. Rejection meant burning some two to four million pounds of powder. I recommended accepting the powder for issue. I never knew what was done. I suppose it was burned. The powder cost about $1 per pound, about $20 per pound today or $20 x 4,000,000 is 80,000,000. A bit of money.

(2) Invasion Plans. At the time that the nuclear devices were dropped on Hiroshima and Nagasaki, I had the Geologic maps of Tokyo Bay on my desk studying, along with many others, the optimum point for an amphibious landing. We expected 1,000,000 casualities in the fighting in Japan. Actually, the Japanese casualities would probably have been much higher than ours if the civilian casualities would have been included. After all, an estimated 155,000 people lost their lives in the Tokyo fire bomb raid and the resulting fires. (37) Again, "War is Hell!" In addition, we knew all the interned Americans were to be killed immediately following the landings. This would have included Eugene Hungerford and thousands of others. So ending the War with nuclear devices saved hundreds of thousands of lives. Nevertheless, I have always believed that some publicity about the nuclear explosives followed by a demonstration in Tokyo Harbor wuold have convinced the Japanese of the futility of further fighting. I realize how few nuclear weapons we had at the time. I believe that a demonstration, or request for a review by neutrals, would have ended the War without the deaths that occurred. On the other hand, Nagasaki and Hiroshima may have done more to end wars than anything else could have. If so, the dead in those Cities may not have died in vain. I am afraid that wars will continue. We must keep prepared to fight back and win, if attacked. To the Japanese "Face" is important. As noted, I don't have any. Most Americans don't know what it means -- they just don't give a damn!

(3) Powder Storage. I mentioned above that powder storage was one of my worries. The Main Front had a Loading Plant consisting of a brick building perhaps forty by sixty feet. About two-thirds of this building was open for general work while the other third was cut up by double brick walls into ammunition loading rooms. There were, I think, three smokeless powder rooms and one black powder room used for weighing charges, etc.

In each weighing room there was a table and racks for Shell cases, a scale table and scale, and other tools. Powder in steel drums which held 200 pounds would be brought in and charges weighed as

needed. The powder rooms were maintained at 70 F. While we used very little black powder, some was used. This room was always scrubbed immediately after each use.

The regular smokeless powder was stored in a constant temperature reinforced concrete building designed for a maximum of 10,000 pounds of powder. During most of the War we had from 50,000 to 110,000 pounds of powder in the building. Since some of this was rifle powder, a fire could have had rather serious consequences. Normally, while I was in charge of the Main Front, I tried to inspect the building daily. Mr. Bernard Bass, who was in charge of this area, inspected the building regularly. At no time did I ever find any spilt powder, or grit on the floor. The powder, except when being weighed, was always sealed in steel drums of 200 pounds of powder each. Once I found three "Coke" bottles on the floor. I kicked them against the opposite wall breaking them into many pieces and walked on. I never found a bottle on the floor again. If you see an empty bottle, just pick it up and drop it on the floor and walk on. Everything in a powder or explosive material's area must always be in its place. Never lose your respect for gun powder or explosives. As I stated above, "Explosives demand and expect your respect." Always see that they receive it. Its your life and you only have one. You can only make one mistake!

In respect to black powder, when I was at Savannah Ordnance Depot, one of the Officers had assigned a soldier to disassemble some old parachute flares containing small black powder charges. Apparently the soldier did not know the characteristics of black powder. When the Officer I was with and I found him, he had it all over the floor. We called him to the door and got him away. A spark could have caused a violent fire from which he probably would not have escaped. Since black powder is partially soluble, it can be washed into sewers. Just don't spill any.

There was some rifle powder at Aberdeen. We had only a negligible amount. But we got involved in tests of rifle powder due to fires elsewhere. The rifle powders contained nitroglycerin, which will detonate by heat or friction. Dissolved in smokeless powder, it increases the rate of burning. In large quantities under pressure, instead of burning with a flame, rifle powder will detonate.

Fires occasionally occur in rifle powder manufacture. These are expected. However, in one instance the powder fire spread into two railroad cars -- probably due to careless work by the men. The powder on board those cars detonated; the railroad cars and contents simply disappeared. It must have been quite a bang. As a result we ran several tests of piles of rifle powder. We would pile up powder, say two feet deep, over a squib which could be used to light the powder from a distance, and burn the powder to see what the critical mass was. These tests amused and entertained us several Sunday mornings.

(4) Locomotive Tests. At the time in question, most European locomotives were steam operated. Partisans frequently blew up a locomotive by placing explosives on the tracks. The Germans got around this by rapid repairs of the damage and by pushing one or two worn out cars ahead of the locomotives. So we had to develop counting devices that would count the wheels and then blow up the locomotives beyond repair. Telephone dial counters worked well for the wheel counters. All a Partisan had to do was to set his explosives and wait until a train got in sight, count the wheels to pass over the counters, set his timer and disappear. We never heard how they worked. Our test on a locomotive was an entertaining success. We also developed means to make repairs very difficult. How do you blow up a steam locomotive beyond repairs? We never learned how.

These tests occupied and entertained us for several Sunday mornings.

(5) Weird Results.

(a) Antiaircraft. Two things happened that may be of interest. The first of these is that a Proof Officer at the Antiaircraft Range was testing an 120-mm Antiaircraft Gun. During some of the firings at very high elevations of 75 degrees or so, the Shell simply disappeared.
Soon, however, we heard where they went. What goes up usually comes down.

All Shell are rotated on firing to give them stability. These Shell were over-stable, and when they reached their maximum elevation, they did not turn over but came down backwards. As a result they landed across Chesapeake Bay on farms on the Eastern Shore, miles away from the impact area. Luckily no one was killed.

(b) Bombs. I had nothing directly to do with the bomb ranges or tests; so I had no part in the following. (38)

The bomb ranges at Aberdeen were used for low elevation tests. With the advent of World War II, planes flew much higher; so high altitude bombs were developed. Samples of these were inert loaded for recovery tests; and one was dropped from a high altitude. The bomb did not strike the bomb range. It struck across Route 40 and the Pennsylvania Railroad near the Baltimore & Ohio Railroad. As a result the high bombing range near Death Valley was opened promptly.

(6) Museum. During the middle of World War II the Museum at Aberdeen was scrapped. It had been built up at great expense and included most of the U.S. and foreign weapons used in World War I. The excuse given was that the material was needed as scrap iron.

I opposed the scrapping as it was useful for old test pieces like muzzle blast deflectors. We had used it several times. Also, I believed that its educational value was too great to permit its use for scrap. And I still think so, in 1984. I lost the argument. I'm sure that the decision to scrap the materiel was made by a person that had no idea of its educational value or its use to us.

(7) Officer of the Day. Even with the work outlined above, I still had to take my turn as Officer of the Day. I considered it a waste of my time. A day's rest would have been a more important and greater value.

During the War Aberdeen Proving Ground consisted of the Proving Ground proper, or Arms and Ammunition Development and Test, the Ordnance School, Ordnance Training Camp, and Ordnance Field Supply Depot. I was attached to the Proving Ground. I had no part in the Training, or Field Supply programs. However, there were necessarily several Officers' of the Day and one Field Officer of the Day. This latter was either a Major or Lieutenant Colonel. So there being only a limited number of those Officers, I had to serve my turn, usually on Sundays as there wasn't supposed to be trouble on Sundays. I was too busy on weekdays to serve. I thought that it was a waste of my time -- I still think it was. I was busy reading reports most all day and I always had a Secretary part of the day. And I needed some rest and relief from duty. I had a family with young boys that needed me.

Several things happened which may be of interest. Some of them are listed; but not in the order in which they occurred, as I have forgotten the dates. Everything seems to happen to me!

One night it was cold and rainy. I was out most of the evening on inspections as we had to check all the Officers of the Day. Unfortunately, I had a bad cold; and I was very tired. I should have called in sick. Anyway the next day I went to the hospital for ten days with pneumonia. (39) When Winnie came to call on me at the Hospital and found me in the Ward with a high fever and pulse, she got me transferred to a private room. I had a good rest, which I very badly needed. Winnie acted as my Special Nurse for a few days.

One other time I got a minor skin infection and the Doctor wanted to give me a series of "shots"; so he put me in the Hospital. There were practically no patients. So my room was usually filled with nurses who had little to do but give me back rubs. This, of course, was not related to "Officer of the Day". I read reports most of the time.

One of the first times that I was Field Officer of the Day on a Sunday, I was called about 0900 from Bush River, south of Aberdeen. The Pennsylvania Railroad had a small depot there and local trains stopped. The ticket agent stated a worker had just come in and said that, "Dere are arms and legs all long track". So I was asked if we were missing one or more soldiers; and, if so, would I send out an ambulance for the arms and legs and presumably other parts.

What had happened was that a passenger train with a couple of cars of Draftees was going north from Baltimore to Aberdeen. It had slowed down at Bush River -- actually Bush River is a mile wide branch of Chesapeake Bay -- and one of the draftees had tried to get off. The train had probably slowed from 110 to 50 or so miles per hour. The man had been dragged or rolled -- probably Rolled -- under the train. Also there was a freight on the next track soon after at probably 70 miles per hour. His body was cut into several pieces. I suppose that he was scared of what would happen to him in the Army.

It was my duty to telegraph the man's parents, and tell them that their son had been killed accidentally. I got the Adjutant to write the message. Life goes on, unhappily at times.

Another time I was about asleep one Sunday afternoon in eadquarters when the phone rang. The man calling spoke about as follows: "This is the Sheriff in Elkton. One of your MP's just shot a man. Do you want to send an ambulance for the body, or shall I stick it in the morgue?"

What had happened was that one of the trainees had gone AWOL (absent without leave); and gone to Elkton to see his girl. They had a large pyrotectics plant there with lots of girls. An MP (40) had been sent to arrest the man who was in civilian clothes. When the MP found him, the man ran. The MP then started chasing him and fired a warning shot. But as the MP fired, he stumbled and the bullet struck the AWOL man in the back, killing him instantly. Women and men again! And to repeat, life goes on; but how and again, everything seems to happen to me. That time I got the Adjutant to handle the whole affair.

Not all things end in such tragedies. Others are different. One Sunday about 1000, I walked into the Mounted or Military Police Dormitory to inspect it. This requires explaining. While at Aberdeen I had a continual feud with the Mounted Police. Their Commandant was one of these here super efficiency guys. I did not like him. Anyway, his men were always arresting my men and women for speeding and minor traffic infractions. Since they had to go to the so-called court to explain these things, it took them from work. Finally, I refused to let them go. I would call the Court Clerk and explain what had happened. Then they started holding Court at night! They won that round!

The MP's were always driving around the area at high speeds. One night four of them were in Aberdeen; and I tried to catch them. If I had, they would have been in deep trouble. They turned into the Post Road; and the guard there waved them on and stopped me. They had been driving over 60 miles per hour in a 30 mile per hour zone.

One other Sunday, when I was "Officer of the Day", I was ordered to inspect the Military Police Dormitories. When I walked in, a girl that I recognized was lying on one of the beds. She had nothing on. She quickly covered herself. I had seen her out of the corner of one eye. So, I inspected the dorm and walked out without letting anyone know that I had seen her. I saw no reason to get men in trouble over a girl. She was a very good-looking girl. The tragedy was that, later, I found out from the Hospital that she had syphillis. One part of the story is that the feud between the Military Police and me ended with no further trouble to my people. The other part was that, when Headquarters found out the girl had syphillis, they fired her. I called the Adjutant and tried to get her sent to the Hospital. I lost that argument. Anyway, she very soon married a young man that lived in Havre de Grace. I lost all further knowledge of her. (41)

Each time I was Field Officer of the Day, the Commanding General sent me to a different place. He always read my reports to his staff; I understood that he never read anyone else's. I took the duty seriously. I think I amused him. Four of the things among others, that I inspected were as follows:

(a) Guard House. I was sent to inspect the Guard House and eat dinner with the prisoners. I enjoyed it. The food was good. The men I talked to were all in the Guard House for very minor infractions and short terms. In my opinion, their Guard House "duty" was too light. A couple of days at "Morgue Detail" would have been more effective. The Guard House seemed to be a Club. As all jails are!

(b) Churches. There were three or four churches. So one day I had to inspect them -- Sunday too. Major Gilbert Hyde, who lived in part of a duplex house with us, was one of the Chaplains; I believe Chief. So I enjoyed that too. I asked him to accompany me on my inspection of the Churches. I found many things wrong. Mostly they were dirty. Maintenance was very poor. I complained "loudly" in my written report. The Churches got cleaned up promptly. The Hydes were very good friends of ours.

(c) Stores. Once I was sent to inspect the Supply Depot. That was a mess also. The Colonel in charge was a good friend. I don't think he ever walked through the Warehouses until I called on him to accompany me. I wrote up a very damning report. Stuff was poorly catalogued; the warehouses and equipment were dirty; there were too many people involved; etc, etc. I think this applied to the whole Ordnance Supply system. As reported elsewhere I was asked to help in revision of the Accounting System.

(d) Officers' Club. The funniest job or experience that I ever had was inspection of the Officers Club. And on Saturday night! In the Army there is almost always a formal dance at the Officers' Club on Saturday evening. All Officers and their wives are supposed to attend. Most do. The purpose of the Officers' Clubs is to get the various officers acquainted on an informal basis so that they can work together. Also it gets the wives acquainted. As the families are moved frequently, this is very valuable. You don't mind moving when you know that you will be welcomed by so many former friends.

I think the General ordered my inspection for his amusement. I was in regular work uniform with cap -- it is not removed while under arms--and with ammunition belt and a pistol. There were loud guffaws from everyone. I proceeded to inspect the bar while a crowd of Officers and their wives in formal dresses gathered around. While I made a drink of a few cc of wine, I opened every drawer and moved most of the bottles. I drank my wine, said "Goodbye", and left. There were cockroaches and dirt everywhere. My report was a very damning one as I did not pull my punches that time.

Later that evening, I inspected the Non-Commissioned Officers' Club, I found nothing wrong. The Club was "spick and span". So my report was quite a contrast. It is very difficult to operate a kitchen or a Club and have a surprise inspection without something being out of place or dirty.

C. End Notes

1. This chapter is "out of date" due to the development of Nuclear Weapons.

2. War is out of date as is most artillery. Small wars have continued and may do so for years. Man is a vicious, warlike creature; so wars and slavery probably will continue. Where do I belong? Russia has sent troops to many of its Allies or surrogate bandits (1984). Are we doing nothing? Do our President and Congressmen understand or care? He who takes action gets there first. The Persian Gulf may lead to World War III; but Persia seems to be changing toward a democracy.

3. I believe the Mayor repaid some of his fees and spent a few years in prison. As noted elsewhere, prisons have become fulltime "Social Clubs".

4. Should I include teaching Chemical Engineering as "a very responsible position?" Since I was teaching Chemical Engineering, it must have been assumed that I could teach Army Ammunition loading, at least I was ordered to do so.

5. I believe that "most" financial people "have little idea of reality". I originally wrote "age of 65". Maybe it should be at 45? or 35?

6. I believe that five cases were chosen at random from each lot of 10,000 cases.

7. Firing and recovery of loaded Shell was very seldom used.

8. The Aberdeen area was so flat that elevation above Sea Level was only a few feet and very uniform.

9. World War I and World War II should be charged to the Germans -- probably the Pacific part of World War II should be charged to the Japanese. They were over confident. They did not consider the Midwest Manufacturing Facilities. (U.S. and Canada)

10. TNT is trinitrotoluene. Explosive D or Tetryl is ammonium nitrate.

11. We used five girls as observers or "timers". I was always the butt of their jokes.

12. He was a Professor of Chemical Engineering at the University of Michigan. I had a course that he taught.

13. I have forgotten which officer handled the different tests; so I cannot name the various officers assigned to all the different tests.

14. Had the Germans neared the end of their productivity of new ideas, and the lead passed to us (or Canada?). Will it -- or has it - passed to Russia (1984)? Next will it pass to India or China? Or is France or Spain in a new Renaisance?

15. The men were named Kroger and Musket; hence our Aberdeen name -- "Crowmusket".

16. Pounds per square inch.

17. Pounds per square inch.

18. This was one of the experiences that led me to recommend a lower factor of safety in the American Society of Mechanical Engineers' Codes.

19. Always start with the Negro Women's room -- if they are separate. Of course everyone will object; but don't pass the opportunity. Wash rooms in the order of "ill-keptness" were Negro Women's, White Women's, Negro Men's, and White Men's -- think about the meaning of this sentence! They may have improved.

20. Outside diameter.

21. Threads were cut out every other sixteenth of the circle of the breechblock or every other section of threads was machined out; as was that of the breechring. As a result, it was only necessary to turn one-sixteenth circle to release to open or to lock the breechblock for firing.

22. One of the cuputer people was a woman that I knew as we had eaten together a few weeks at a "Boarding House in the evenings after Winnie and the boys had gone to Helmer, Indiana, the first summer that I was at Aberdeen.

23. That was the only time that I ever knew her to interrupt my conversation with visitors. They laughed. Poor Edith, she died of cancer a few months later.

24. Think about this a bit?

25. He seemed to unwilling to admit that he did not know all the answers.

26. About 30 miles directly south of Rome, Italy.

27. If you enjoy destruction of fortifications with people inside! Or firing nuclear explosives at Cities?

28. I have forgotten his name.

29. He was a very close neighbor. My blood boils simple reading this. Men were being killed. Colonel Cave was a very knowledgeable person. He lacked common sense.

30. The idea may have been suggested b the Predient of Buffalo Machine Company. I don't know.

31. To repeat, I think war is out of date. I hope so. I'm afraid not.

32. American Society of Mechanical Engineers.

33. The forcing cone is near the rear of a rifle's barrel where the bullet's copper rotating band diameter is partially reduced by the lands of the guns; and the shell or bullets are rotated as they move forward. This gives them stability in the air.

34. To repeat, we live in a Carnivorous Society -- as all animals do.

35. 105-mm equals 4.13 inches.

36. The Women's washrooms were always dirtier than the Men's and the Negro's were dirtier than the White's. Why? Maybe this was true just at Aberdeen Proving Ground.

37. I believe this was the largest single number of persons killed in one act in the History of Mankind.

38. I never quite know where responsibility started and ended. I don't today. And we all drive dangerous devices.

39. My "lost time" could in no way have been justified by what I did as Officer of the Day. Crazy Army Rules! I had asked to be excused from Officer of the Day due to my work, which I considered more important.

40. Military Police

41. I'm still mad (1981). As I saw the situation, it was our duty to help the girl, not to fire her. There are such things as pity and care for your fellow men and women -- even in Wartime.

42.