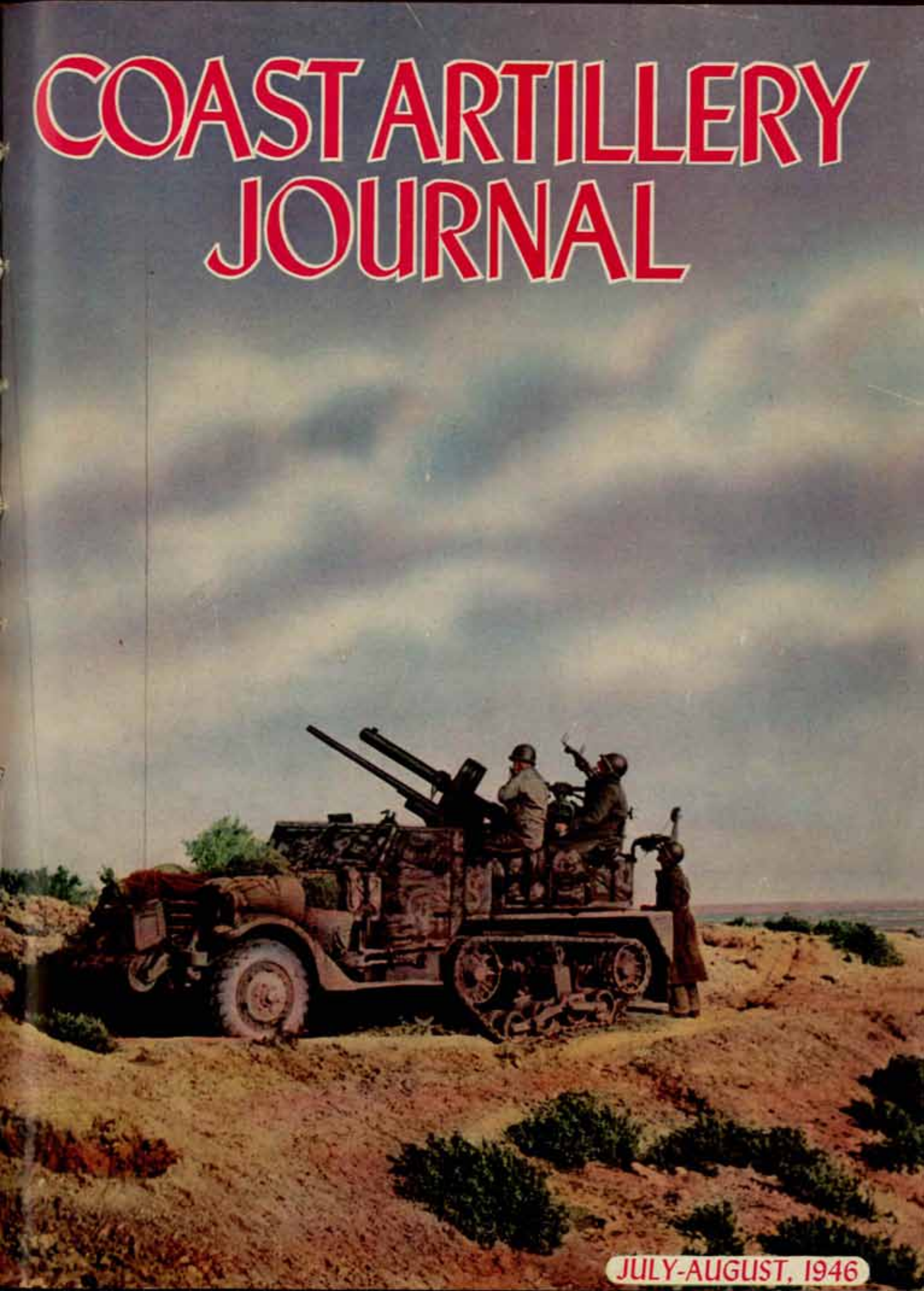
COAST ARTILLERY JOURNAL



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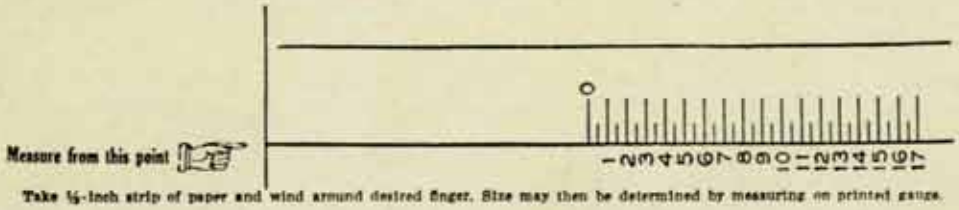

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THE COAST ARTILLERY JOURNAL

COAST ARTILLERY JOURNAL

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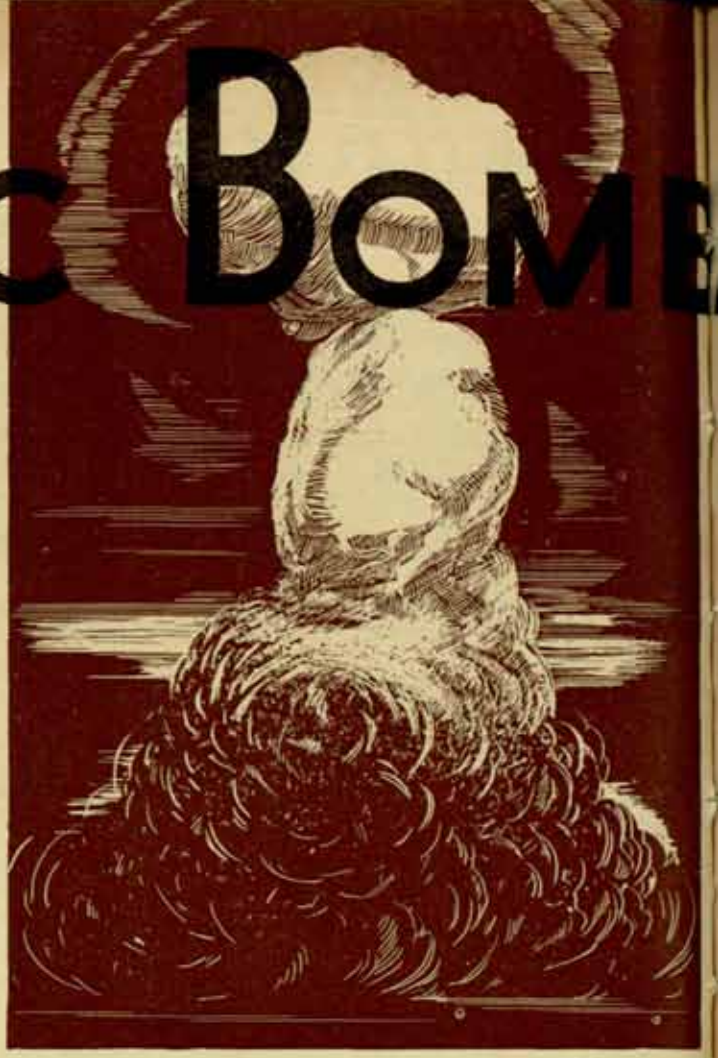
ATOMIC BOMB

PAST AND FUTURE



By

Major General Leslie E. Groves

About 7:15 on Monday morning, August 6th, 1945, the Japanese early warning radar net had detected the approach of some American aircraft headed for the southern part of Honshu. The alert was given and radio broadcasting stopped in many cities, among them Hiroshima. The planes approached the coast at very high altitude. At nearly 8:00 o'clock the radar operator determined that the number of planes coming in was very small—probably not more than three—and the air raid alert was lifted. The normal broadcast warning was given to the people that it might be advisable to go to shelter if B-29s were actually sighted, but no raid was expected beyond some sort of reconnaissance.

Editor's note: General Groves was Deputy Chief of Construction under General Thomas M. Robins in the Washington Office of the Chief of Engineers when he was selected to become associated with the atomic bomb development in the summer of 1942. As the Deputy Chief of Construction, he aided in all military construction in the United States, with expenditures averaging $600,000,000 monthly, a program which included his supervision of the erection of the Pentagon Building.

His work from September 1942 up to the present is now a matter of common knowledge as is the fact that he has been the driving force of the atomic bomb project and the one who fitted together the multifarious pieces of the vast country-wide jigsaw, the Manhattan District, giving us the most powerful weapon ever known.

At 8:16 A.M. the Tokyo control operator of the Japan Broadcasting Corporation noticed that the Hiroshima station had gone off the air. He tried to use another telephone line to reëstablish his program, but it too had failed. About twenty minutes later the Tokyo railroad telegraph center realized that the main-line telegraph had stopped working just north of Hiroshima. And from some small railway stops within ten miles of that city there came unofficial and rather confused reports of a terrible explosion in Hiroshima. All these events were reported to the air raid defense headquarters of the Japanese general staff. The staff called again and again to the Army control station at the big headquarters in Hiroshima. Something had happened in Hiroshima, but the men in Tokyo Headquarters were puzzled; they knew that no large enemy raid could have occurred, and they knew that no sizable store of explosives was in Hiroshima at that time.

A young major of the Japanese general staff was ordered in. He was instructed to fly immediately to Hiroshima, to land, survey the damage and return to Tokyo with reliable information for the staff. It was generally felt at Headquarters that nothing serious had taken place, that it was only a terrible rumor starting from a few sparks of truth. The major went to the airport and took off for the southwest. After flying for about three hours, still nearly 100 miles from Hiroshima, he and his pilot saw a great cloud of smoke over their destination. In the bright afternoon, Hiroshima was burning.

ATTACKS

Pre-strike aerial view of Hiroshima showing the high density of the built-up area. Fire lanes cleared by the Japanese are clearly visible.

The major's plane reached the city, and they circled in disbelief. A great scar, still burning, was all that was left of a large city. They flew over the military landing strip to land, but the field was deserted and its installations smashed.

The major landed south of the city and made a report on what he had seen, but the first inkling of what had really happened to Hiroshima came to Tokyo in the White House public announcement from Washington, sixteen hours after Hiroshima was hit by the first atomic bomb.

The approximate date for the first use of the bomb had been set back in 1942 when the Army was first asked to take over the engineering, construction, and operation of the Manhattan Engineer District, as the atomic bomb project was called. At that time we set various contingent dates, dependent upon the exact values of certain physical and chemical data yet to be determined for the time when sufficient production could be achieved to make possible the actual construction and utilization of a nuclear bomb. One of these contingent dates was August of 1945, and the progress of development, through the stages of calculations, devising of techniques of constructing and detonating—even through the building of test models—fulfilled the contingent predictions almost exactly. In theory, our scientists proved by means of their calculations that the bomb would work. However, it was not until 16 July 1945, when we had the first full-scale test, that we really knew that the theories and calculations were correct and that the bomb would be successful.

The test in New Mexico was held six days after sufficient material had become available for the first bomb. The Hiroshima bomb was ready and awaiting suitable bombing weather on 31 July and the Nagasaki bomb was used as soon after the Hiroshima bomb as it practicable to operate a second mission.

However, as early as April 1945, we began work on the selection of targets for the possible use of the atomic bomb. We decided to have the selection of targets made by individuals who were experts in particular fields. We selected an outstanding mathematician, a theoretical physicist, Air Force experts on target selection and on the blast effects of bombs, and an expert consultant on weather. To this group we added one of our own representatives to supply technical information that would be needed.

In the first meeting we outlined our thoughts on the fundamental criteria that should govern the selection of all targets. These fundamental criteria were:

A. The maximum range of the B-29 would govern what target would be selected.
B. Visual bombing was essential, because we did not want to take the chance of using the bomb ineffectively by not placing it where it would do the most damage.
C. Targets should be selected in areas where general weather conditions were most likely to be satisfactory.
D. There should be one primary and at least two alternate targets, so that if weather conditions prohibited bombing one of the targets, there would be at least two alternates.

Aside from these fundamental criteria, we also desired to

Aerial view of Hiroshima after the atom bombing.

View of a Hiroshima bridge 4,400 feet of explosion.

select targets the bombing of which would produce the greatest psychological effect. We desired to impress the Japanese people with the effectiveness of the weapon and have them realize the full potentialities of it. We also desired to make the initial use of atomic bombs sufficiently spectacular for the importance of the weapon to be recognized immediately internationally. These considerations led to the following additional requirements that the selected targets must meet:

A. Since the atomic bomb was expected to produce the greatest amount of damage by primary blast effect, and next greatest by fires, our target should contain a large percentage of closely built frame buildings and other construction that would be most susceptible to damage by blast and fire.
B. We calculated that the maximum blast effect of the bomb would extend over an area approximately a mile in radius; the target city therefore should contain a densely built-up area of at least this size.
C. The selected target should also have a high strategic value.
D. The target selected should be relatively untouched by other bombings, in order that we could ascertain the actual extent of the damage caused by our bomb.

As we left the meeting we told the committee that we felt that we would be ready to use our bomb some time during July, August, or September and therefore we desired the weather experts to attempt to forecast as accurately as possible the best days for visual bombing of the selected target during those months.

During the next thirty days the target committee did research on possible targets and studied the weather. They met at intervals during this period to report on their work and to obtain further information.

The committee selected a list of five tentative targets that would meet all of our requirements and which the Air Forces would be willing to reserve especially for our use. Among the originally selected targets was Hiroshima—which was recommended because of its importance as an army depot and port of embarkation, and because it was surrounded by hills which would be likely to focus the blast effect and create greater damage.

The possibility of bombing Tokyo was discussed but it was realized that Tokyo was already well on the road to destruction and that while the Emperor's Palace would be a spectacular psychological target, there was no strategic value to it. This comment is made in respect only to its connection with atomic bomb use, and the general considerations of the Joint Chiefs of Staff in making the decision as to the bombing of Tokyo, whether by atomic or by ordinary bombs, is not touched upon here.

The weather experts of the committee had made a thorough study of the weather over Japan for a ten-year period for the months of July, August, and September, and presented a report that was disconcerting. Our weatherman informed us that only once in five years had there ever been two successive good visual bombing days over Tokyo, which gave us an idea of what we might expect over other targets near by. Based upon their study of the weather of Japan, the weathermen believed that the very worst month of the year for the visual bombing of targets on the Japanese home islands would be June, and that the weather would improve only slightly during July and August and become worse again during September. The adverse report on weather conditions necessitated intensive plans and preparations in

order that we would be able to secure an accurate weather forecast sufficiently far in advance of the proposed mission to prepare the crews, plane, and bomb. The weathermen stated we could expect them to forecast the weather reasonably accurately, for a specific target, forty-eight hours in advance, providing they had sufficient data.

Since we so urgently needed accurate weather forecasts to assure the success of our mission, it was decided to have the best available weatherman stationed at our operational base in the Marianas. To aid him in securing weather reports, Navy submarines were to surface near target areas and to act as radiosonde stations, secure weather information and radio it back to the base. Aircraft on other missions were to perform the same function. With these plans, we felt that we had a reasonable chance that weather closure would not occur over all of the primary and secondary targets after the take-off of the mission for the actual dropping of the bomb.

The Target Committee made final recommendations on three targets for use initially. The Air Forces agreed to reserve these targets for our exclusive use.

We secured approval of these three targets from higher authority and the Commanding General of the Army Air Forces issued instructions to the Air Forces that they should be reserved exclusively for use by our special group. The Joint Chiefs of Staff were informed of our plan by a memorandum which they approved and Admiral King orally discussed the reservation of targets with Admiral Nimitz, who concurred.

After our original three targets were selected and approved, General Arnold recommended that several additional targets be placed on the list. One of these additional targets was Nagasaki.

Although the actual selection of targets was not made until May of 1945, and was one of the final steps before the actual mission took place, preparations and plans for the first combat mission were actually made many months before. The Operations Division of the Manhattan Engineer District had to coördinate the general plan, training program, and all of their activities with our production schedule. They were responsible for seeing that all of our efforts were coördinated to achieve final combat success.

In September of 1944 a special composite group of the Air Forces was activated to do nothing but conduct actual test drops of practice bombs for us, and to receive special training and practice for their combat assignment. This group continued at their base in the United States until approximately the last of May, and then a portion of the group proceeded to a special base located in the Marianas Islands, where they continued dress rehearsals until the actual bombing. A second section of this special group remained at their base to continue doing test work for our laboratory.

At Nagasaki, only rubble remains near the point where the atom bomb was dropped.

Our special base in the Marianas called for exceptionally difficult construction, and our Operations Division was in charge of planning and executing all of the work there.

The climax of many intensive years of research and hard work, on the part of all personnel connected with the project, was near at hand in July. The special Air Forces group had arrived in the Marianas in June. Scientific and technical personnel began arriving soon after and set up their laboratories. On the morning of the New Mexico test, the heavy cruiser *Indianapolis* departed from San Francisco carrying essential elements of the bomb that was used on Hiroshima. Ten days later, after a near-record run, the *Indianapolis* arrived at our base and discharged its important cargo. (Three days later, on 29 July the *Indianapolis* was sunk by enemy action.)

Other components of the bomb arrived at the base near the end of July. My Deputy, Major General T. F. Farrell, and the last of our project personnel arrived there on July 31st.

The Twentieth Air Force had orders to drop the first bomb as soon after 1 August as weather permitted. The tremendous importance of weather on all military operations, and especially on ours, impressed itself upon our minds.

In Washington as well as at Oak Ridge, Hanford and Los Alamos, key personnel of the Manhattan Engineer District waited for word of results. It was a period of anxiety and tension that was so tremendous it could only have resulted from an accumulation of years of work, planning, and responsibility.

We were entirely dependent on cable messages through the War Department message center and Telecon messages through the Twentieth Air Force for all of our operational information. We felt that this would be the safest, most dependable method of communication, and would give the greatest speed. At the time we made that decision, we did not know how minutes would seemingly drag into hours, and hours into days, before the messages we were expecting finally arrived.

We knew that any time after 31 July we could expect to hear that the mission had left its base. Beginning that day, we had officers on duty twenty-four hours a day. One officer remained in the Pentagon Building to be on hand at the message centers when our expected messages were received and to courier the messages to our offices as soon as they arrived. In our offices in the New War Department Building, there were other officers on duty at all times who were

Terraced hillsides surrounding Nagasaki did little to lessen the destructiveness of the atom bomb.

to decode the messages and conduct any necessary liaison with other branches of the War Department. Certain key officers moved cots into the office and worked, ate, and slept there during this whole period.

Routine communications began to arrive at the office. Then came last minute questions and reports, and finally a statement that weather conditions would delay the mission, for how long we did not know. We tried to be patient and calm, but the strain of intense work, long hours, and lack of sleep put many nerves on edge.

At 6:55 P.M. on the Sunday afternoon of 5 August, a message arrived at the office that put us one step nearer the goal. The first bombing mission had departed at 2:45 A.M., Marianas time, 12:45 P.M., Washington time. Three additional planes had preceded the strike plane to observe weather conditions over the primary and secondary targets, and to report which one would offer the best target.

Transmission of that message began at 12:53 P.M., Washington time, and we received it six hours and two minutes later. It was delayed to some extent by the coding system used. This was almost long enough to have permitted the plane to reach its target, drop its bomb, and radio "bombs away." We should receive a "bombs away" flash at any moment now—or had something happened to the strike plane? Had it been destroyed in combat? Had our calculations been incorrect and the strike plane destroyed by the tremendous blast of the bomb? Or was it again a case of our messages taking an unexpectedly long time in transmission?

Every possibility flashed through our minds. I had already reported the delay in transmission of our first message but I checked the message center again to make certain that all personnel were alerted for the expected incoming messages.

Finally, at 10:40 P.M., 5 August, Washington time, the message arrived. "Target Hiroshima. Bombs away at 7:15 P.M., Washington time, 8:15 A.M., August 6th, Japanese time. Results excellent beyond all expectations."

We were able to relax a little when we knew the bomb had been delivered and had gone off; however, we were anxious to know details and the extent of the damage. The Japanese radio was silent. We could get no information from that source. We could only wait for the interrogation of the crew and our personnel aboard the strike and accompanying planes when they returned to their base.

The detailed report from General Farrell, based upon interrogation of the crew and our personnel, reached us at 5:50 A.M., on 6 August. At 8:15 A.M., after preparing a report, I went to the Pentagon Building and gave an oral report to the Secretary of War. The President, who was then at sea returning from Potsdam, was informed that the bomb was a success. 11:00 A.M., 6 August, was set as the hour to make our story known to the public. The Japanese radio had remained silent.

At 11:00 A.M., the President, while at sea, and simultaneously the White House in Washington, announced that Hiroshima had been struck with one atomic bomb that had the force of 20,000 tons of TNT and that the city had been virtually destroyed.

Reconnaissance planes were unable to secure a clear picture of the damage until over twelve hours after the strike. The photographs, however, revealed how effective the bomb had been. Sixty-six per cent of the built-up area of

Pile of fused glass left by secondary fire which swept the Nagasaki Medical School one-half mile from the explosion.

Despite its extreme importance, the first bombing mission on Hiroshima had been almost routine. The plane crew, including the weaponeer (the officer responsible for actually handling the atomic bomb), the pilot, and the bombardier, had been specially trained and selected and they were a superb organization in every way. The weather was good, the plane performed perfectly, the bomb was dropped at the end of a 1,500-mile flight exactly on schedule, almost to the second. The return home was without incident.

The second mission was not so simple. Again the crew was superb, but the weather was very bad. The plane, unable to fly over Iwo Jima with its available emergency landing field, had to take a direct route to the Japanese Empire. It was scheduled to rendezvous with observation planes just off the coast of Japan, but because of the long flight and for various other reasons, one of the planes did not join within the expected time limit. So, after a delay which was much too long, the bombing plane continued on its way to the primary target.

Weather planes had just previously reported satisfactory visibility over the primary target, but on arrival the bombing plane found that the target was obscured by haze and smoke. Three runs were made at the target, but in each instance it was impossible to see the target clearly. A decision was then made by the weaponeer and the pilot to proceed to

influenced by two factors: first, they were running short of gasoline; and second, Japanese fighter planes were on their way up. En route to Nagasaki it was determined that there was only enough gasoline for one run on Nagasaki and that if the bomb were not dropped, thus lightening the load, there would not be enough gasoline left to take them back to the emergency landing field at Okinawa. As the plane made its approach on Nagasaki, the target was obscured but fortunately at the last moment a hole appeared in the clouds and because of the skill of the bombardier, the bomb was dropped squarely on the designated target. After a hasty circle around the target, the plane headed for Okinawa where it landed with its fuel tanks virtually empty.

The following brief account of the operation against Nagasaki was related by the weaponeer, who was our Project officer on the mission:

"The night of our take-off was one of tropical rain squalls, and flashes of lightning stabbed the darkness with disconcerting regularity. The weather forecast told us of storms all the way from the Marianas to the Empire. Our rendezvous was to be on the southeast coast of Japan, some 1,500 miles away. There we were to join our two companion observation B-29s that took off a few minutes behind us. Skillful piloting and expert navigation brought us to the rendezvous without incident.

"About five minutes after our arrival at the rendezvous point, we were joined by the first of our B-29s. The second, however, failed to arrive, having apparently been thrown off its course by the storms during the night. Thirty minutes later we proceeded without him to the target area.

"During the approach to the target the special instruments installed in the plane told us that the bomb was ready to function. We were prepared to drop the second atomic bomb on Japan. But fate was against us, for the target was completely obscured by smoke and haze. Three times we attempted bombing runs, but without success. Then with meager antiaircraft fire bursting around us and with a number of enemy fighters coming up after us, we headed for our secondary target, Nagasaki.

"I am sure you all know of the successful results of the attack. The bomb burst with a blinding flash and a huge column of black smoke towered toward us. Out of this column of smoke there boiled a great swirling mushroom of gray smoke, luminous with red flashing flames, that reached to 40,000 feet in less than eight minutes. Below, through the clouds, we could see the pall of black smoke ringed with fire that covered what had been the industrial area of Nagasaki.

"By this time our fuel supply was dangerously low, so after one quick circle of Nagasaki, we headed direct for Okinawa for an emergency landing and refueling."

So goes the story of the first two atomic bomb attacks on military targets in time of war. In any future war, the pattern of atomic attacks will probably be entirely different. The differences which are pertinent to this article are those in the way the atomic explosive material will be carried to the targets.

The most significant development which might occur in connection with the atomic bomb appears to be that of the guided, pilotless missile. In the past, the bombs were carried by conventional aircraft; in the future, as pointed out by the former Commanding General of the Army Air Forces, General of the Army Arnold, improvements in aerodynamics, propulsion, and electronic control may enable unmanned devices to carry atomic and other explosives to targets at distances up to many thousands of miles.

The guided missile in its final development, as its proponents see it, will offer several exceptional advantages over aircraft-carried bombs. "First, it will have a much greater range; it seems likely that at some future date there will be a missile which can be successfully dispatched to a target halfway around the world, perhaps employing some means of control that will make its accuracy independent of its range. Secondly, it will have a tremendously greater speed than any aircraft now known; this speed will greatly enhance its offensive power, and make it almost invulnerable to antiaircraft defenses as they are known today. Finally, it will be independent of visibility or weather conditions."

I have already mentioned that the great speeds of the jet-propelled missile make it invulnerable to our present antiaircraft defenses. As far as is known the German V-2, with its speed of well over 3,000 miles per hour, was never hit by any defensive shell or plane. It is to be expected that great strides will be made in the development of target-seeking missiles, and it is possible that such missiles, propelled at speeds comparable with those of the attacking missiles, may neutralize the power of the new weapons even more than modern antiaircraft defenses have neutralized modern air attacks. The race for supremacy between the guided missile and the target-seeking anti-missile may be analogous to that between armor plate and armor-piercing artillery in which each new development in either line was followed immediately by a corresponding development in the other. It is certain that, among all weapons now known, the atomic bomb is by far the most deadly. Its potential use will shape the destiny of the world.

The use of atomic energy for propelling aircraft or guided missiles has been suggested. Its immediately apparent advantage would be the great amount of power that could be carried in a comparatively tiny package. It is well known that the total energy releasable in the nuclear fission of a pound of uranium is some 5.5 million times as great as that releasable in the explosion of a pound of TNT. If this energy could be utilized in that fashion for propulsion, a large guided missile could be sent entirely around the world with only a few ounces of atomic fuel. However, the day of atomic-propulsion is not yet at hand, and no valid predictions can be made as to when it will be, if ever. Work is being done in harnessing atomic power for peaceful uses and at the moment the most likely early atomic power plants will be those for large stationary electrical generating stations. The heavy shielding required around any atomic power unit would preclude the use of atomic power in aircraft until some entirely new techniques are evolved.

It is the combination of these hoped for advantages of the guided missile with the tremendous power in a relatively small weight of the atomic explosive, which would produce the terrifying weapon of the future. As soon as any nation had succeeded in producing a reasonable quantity of such weapons, it would then have the power to wipe out in a few minutes all the major cities of all the other countries on the globe. This makes the necessity for international control of all such weapons of mass destruction so all impor-

Guided Missile Center Established at Bliss

Establishment of the Antiaircraft Artillery and Guided Missile Center at Fort Bliss, Texas, has been announced by General Jacob L. Devers, Commanding General of the Army Ground Forces.

Major General John L. Homer, now Deputy Commander of the Panama Canal Department, was named as Commanding General of the Center. General Homer is returning at once to assume his new duties.

The Center is being established in order to coördinate all antiaircraft artillery and guided missile activities of the Army Ground Forces and to promote their development, General Devers said. This move also is in line with the Army Ground Forces policy of keeping abreast of every new development in military science. Plans call for extensive development and practical tests and demonstrations in the guided missile field, with special reference to their related use as artillery weapons. One of the steps is the development of tactics, techniques and organizations of guided missile units for use in the Army Ground Forces.

Major General John L. Homer

General Homer, an outstanding officer with a long career in antiaircraft, will be in charge of the following elements which now compose the Center: Antiaircraft Artillery School; Antiaircraft Replacement Training Center; Army Ground Forces Board No. 4, which will handle antiaircraft and guided missile matters; 1st Antiaircraft Guided Missile Battalion, now at White Sands, New Mexico; general reserve troop units at Fort Bliss as well as the post at Fort Bliss. The newly created AGF Board No. 4, of which General Homer will be president, will take over the functions formerly assigned to the AA Service Test Section of AGF Board No. 1.

Purpose. The purpose of AGF Board No. 4 is to carry out the following functions with respect to Antiaircraft Artillery and Guided Missiles:

a. The evaluation of all recommendations for the development of new or improvement of existing equipment which may be submitted to it.

b. The review and study of foreign equipment.

c. Preparation of military characteristics and recommendations for development of new equipment.

d. Assisting this headquarters in maintaining contact with development agencies during all phases of development and engineering tests when directed by this headquarters.

e. Performing users' tests of equipment when directed by this headquarters.

f. Recommending modifications in or standardization of items tested.

g. Recommending reclassification of standard items of matériel.

h. Recommending basis of issue of items to be standardized.

i. Assisting in the preparation of basic training literature on the drill (service of the piece) and technical care of matériel tested.

j. Continued observation and review of reports of performance of standard items.

k. Recommending maintenance procedure, replacement parts, and equipment for items tested.

Coördination. Tests will be closely coördinated by General Homer, with the schools having a primary user interest in the equipment being tested, and with such other Army Ground Forces Boards as may be appropriate. A free interchange of ideas between Boards and with schools, where applicable, will be encouraged.

Born September 16, 1888 in Mount Olive, Illinois, General Homer was graduated from the United States Military Academy and commissioned a second lieutenant of Coast Artillery on June 13, 1911. After a year at Fort Monroe, Virginia, he served three years at Fort Mills, Philippine Islands, before reporting to Fort Adams, Rhode Island, for duty with the 117th Company and later the 2d Company.

Promoted to first lieutenant on July 1, 1916, he received his captaincy on May 15, 1917, about the time he was graduated from the Coast Artillery School at Fort Monroe, Virginia. After a brief tour at Fort Rodman, Massachusetts, he sailed on August 13, 1917 for France.

Serving with the 6th Coast Artillery, he participated in the St. Mihiel and Meuse-Argonne offensives. Given a temporary appointment of major on July 11, 1918, his rank was made permanent on July 1, 1920.

Promoted to the temporary rank of brigadier general on April 7, 1941, he was assigned to command the 40th Coast Artillery Brigade at Fort Sheridan.

From August 1941 to September 1942 he served as Chief of Staff, Iceland Base Command.

He became a temporary major general on August 3, 1942.

After his return to the United States he became Commanding General, New York-Philadelphia Sector, Eastern Defense Command, with station at Fort Hamilton, New York, and in February 1944 was named Commanding General, Southeastern Sector, Eastern Defense Command, at Raleigh, North Carolina. In April 1944 he was assigned to the Western Defense Command, Presidio of San Francisco, California, as Commanding General of the 4th Antiaircraft Command. He became Deputy Commander of the Panama Department in January 1945.

General Reserve units attached to the Antiaircraft Artillery and Guided Missile Center include: 165th AAA Operations Detachment, 337th and 338th Signal Radar Maintenance Units, 284th AAA AW Battalion, 1st Field Chronograph Unit, 267th AAA Group, 322d AAA AW Battalion, 384th AAA Gun Battalion, 450th AAA AW Battalion, 261st Ordnance Maintenance Company, 241st, 335th and 336th Signal Radar Maintenance Units and the 62d and 247th AGF Bands.

Stabilization and Control of Rockets

By Gifford White

Editor's Note: **After completing pre-doctorate requirements at the Massachusetts Institute of Technology in 1941, Mr. White became affiliated with the Sperry Gyroscope Company as Research Engineer for that company in charge of research and development of ground fire control devices for the Army Ordnance. He is now in charge of the Special Weapons Engineering Department, carrying on research in guided missiles and pilotless aircraft.**

In addition to his work at M.I.T., Mr. White attended the University of Texas from 1929-1934 graduating in Electrical Engineering and again in 1938-1939 when he received an A.B. and M.A. in Physics.

He is a member of Eta Kappa Nu, American Physical Society, Society of Exploration Geophysicists and an Associate Member of Sigma Xi and the Institute of Radio Engineers.

Many accounts of the efforts of the pioneers in the field of rocketry in the United States and in Europe have appeared in the technical and popular press over the last two decades, and recently several informative books have been published which display in highlight the struggles which have been in progress to achieve proficiency in the new and difficult techniques involved in rocket flight. Most of the early experiments were naturally on a small scale to investigate the fundamental sciences of fuels and motors, of aerodynamics and control, and of instrumentation. Successes were mingled with many failures, and the approach of World War II during the embryonic phases of the technology diverted the whole field into a tunnel of secrecy from which it has now partially emerged so that some information on the tremendous strides of the war years has been released. Whereas in prewar years, flights of a few miles were considered highly successful when payloads of only a few pounds could be carried, now we know that rocket-powered missiles carrying payloads measured in tons can travel hundreds of miles, and there is no bound to the increasing estimates to be had from the speculatively inclined.

A rocket motor is one of the most fundamental of the known means of obtaining a propulsive force. It has no essential moving parts except the burning fuel, working on the reaction principle familiar to everyone who has participated in Fourth of July pyrotechnics. The noise and flame of the rocket motor and the strange appearance of new aerodynamic shapes, coupled with imaginative predictions of flight into space and time, immediately fasten attention on the more spectacular aspects of rocket design. Not so apparent is a problem which has dogged inventors and scientists from the beginning. That is the problem of controlled flight, for without added control means, the larger rockets are as unstable and unpredictable in flight as the powder skyrocket. For practical purposes, a military rocket must travel over a predictable path and arrive at a previously selected destination, whether its payload be a warhead, propaganda leaflets, or passengers.

Some of the smaller sizes of rockets can be propelled for a short distance after firing along a tube or rails so that they may gain some initial velocity in a controlled direction, and after that an arrangement of aerodynamic surfaces serves to maintain a measure of directional stability along a desired trajectory. The bazooka and the ordinary artillery rocket are of the type which gains initial velocity in its launcher so that air flow past its fins can give it usable accuracy of aiming and freedom from oscillation in flight. It is not this particular problem of design which interests us, but the application of a different principle of stabilization to the larger sizes of missiles of which the German V-2 is by far the best known example.

The large rockets, running to many tons of initial weight, have fired the imagination of serious thinkers and crackpots alike for many years, not only because of their devastating military applications, but because of the possibility that they may open up a new realm of transport for the future in which independence of the atmosphere and unbelievably high speeds will be attained. The development of economical fuels and motors has been one of the paramount tasks in this field, but when to these problems are coupled the technical difficulties of aerodynamic design and the analytical and experimental difficulties of controlled flight, it becomes an accomplishment of the first magnitude that rockets of the German V-2 type have been successful. The basic data on the size of the V-2, its trajectory, its fuel and motor design, and its military characteristics have been given a publicity since V-E Day which makes it familiar to every reader of the technical and popular press.

In these larger craft, the aerodynamic surfaces of the missile must become movable as in an airplane, and a complete set of internally self-sufficient control elements must be provided to actuate the control fins or wings. These internal controls must cause the missile to follow a previously selected path without wavering or oscillation, and

must allow it to receive radio-transmitted instructions after take-off if this is required in the particular system being used. The instrumentation to accomplish this action is often of a complex nature, yet the basic principles involved are simple and make use of no new concepts of mechanics or electronics. Considering the difficulty of presenting a simplified analysis of the internal instrumentation of the V-2 which is responsible for its operational accuracy, it is not strange that little detailed description of it has appeared outside of technical reports.

Although the V-2 was not the first, and is emphatically not the last, of the large rockets planned for long-range flight, its internal instrumentation can be taken as typical of the solution of rocket path stabilization. Because of its large size, the V-2 is required to take off under its own power without the use of a launching tube or guide rails, and an initial vertical position on its launching platform is almost a necessity. The rocket thus rises, after the initiation of thrust by firing its motor, without any original velocity, and in a vertical direction. Since the net acceleration available from the motor is only about one g in excess of gravity at the start of flight, the upward travel appears amazingly slow, and an important result of this method of ascent is that the external fin surfaces are useless because of the low relative velocity of the air. Without additional control elements, it is probable that a large rocket like the V-2, if launched in this way, would make the first stages of its flight on a very irregular path, leading to frequent spectacular accidents.

The problem of take-off stability was solved by pairing each of the movable surfaces of the four symmetrically constructed tail fins with a carbon vane internal to the throat of the rocket motor which makes up the tail section of the body. The vanes are of a carefully constructed shape, and although they erode in the hot gases at a relatively rapid rate, their useful life is required to be only a minute. If one of the carbon vanes is deflected in the jet, it develops forces arising from the reaction of the hot exhaust gases, and by appropriately moving each of these four vanes, it is possible to cause the missile to roll, pitch, or yaw. During the take-off period, it is possible to operate the jet vanes by servo motors in such a manner that any attempt of the missile to fall over from a vertical position, or roll because of unpredictable dissymmetry, will be resisted by forces generated from the deflection of the high velocity exhaust jet while passing by the vane control surfaces. As the velocity increases, the aerodynamic forces from the external fins also become an appreciable source of control moments which are also available after the cessation of fuel burning.

On the assumption that the control surfaces in the jet and in the air stream offer a means of controlling the direction of flight of the large rocket, let us review the fire control problem of the V-2 as being typical of the long-range ground-to-ground application.

In an ordinary artillery piece, it is possible to construct a set of ballistic tables or curves which for a given set of conditions relating to the gun, the ammunition, and the atmosphere, will give the elevation and azimuth angles of the gun barrel in terms of the range and azimuth of the target. If the gun can release its projectile at a standard velocity in a specified direction, then the projectile will travel to its destination as predicted by its ballistic tables by acting as a freely traveling body affected only by the force of gravity and the reactions of the atmosphere. In the long-

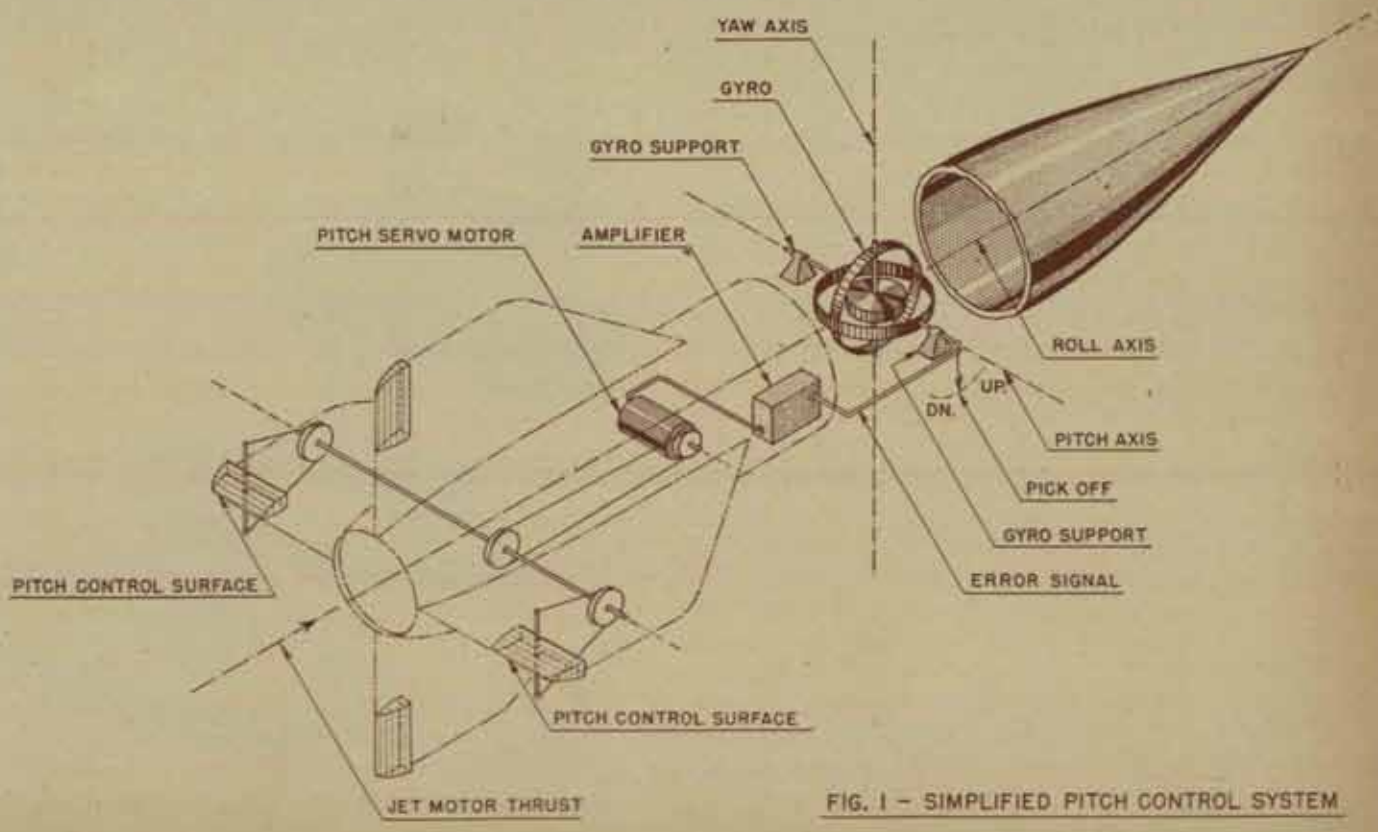
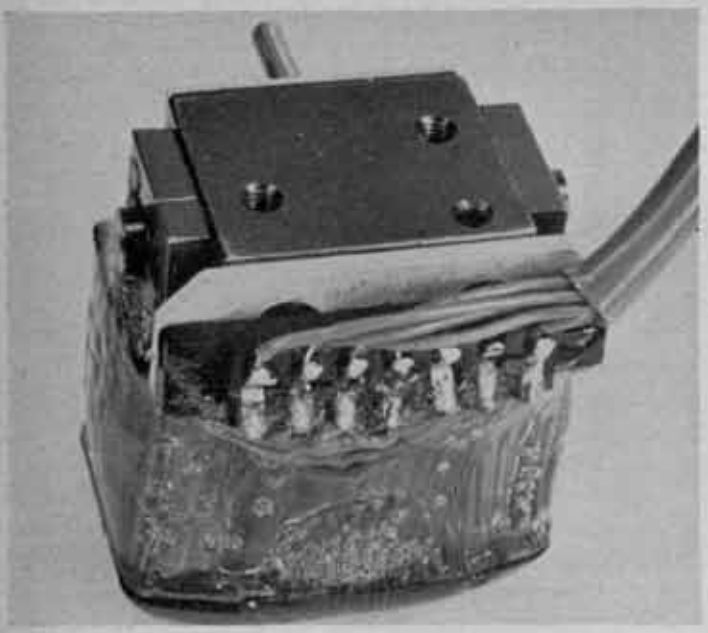


FIG. 1 – SIMPLIFIED PITCH CONTROL SYSTEM



CONTROL SERVO FROM GERMAN V-2

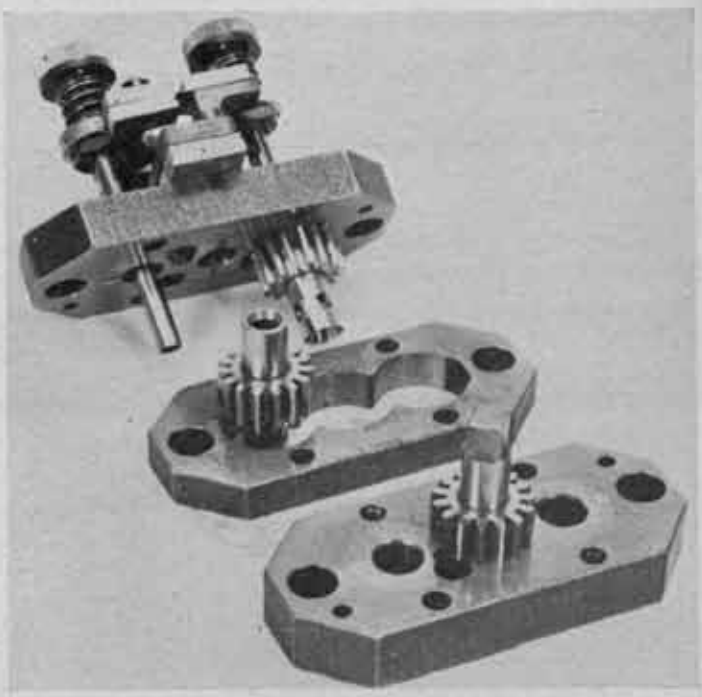
The output shaft extends from the right side of the main casting. The power motor is inside the black cylindrical cover. The cap just above the scale is the cover for one end of the hydraulic cylinder.

range rocket, the velocity of the missile is developed by continuous thrust over a considerable period in a time of about a minute, but even so the concept of the artillery piece is useful. Suppose that we are able to control the flight path of the rocket during its thrust development period, keeping account of the several variables involved. If it can be arranged that the missile has the proper velocity vector at the proper point in space at the instant of jet cutoff, its subsequent motion will be similar to that of a gun emitted projectile, and it will arrive at the impact point with the same order of accuracy. The rocket can thus have constructed for it a set of trajectory curves which will relate the initial azimuth angle and the shape of the path in the vertical plane to the thrust characteristics of the motor, so that any desired range and direction of fire can be obtained.

The V-2 rocket motor develops thrust for about a minute, tilting over from the vertical direction during that time so that it achieves the desired angle analogous to the quadrant elevation of a gun at a height of twenty miles or so. To obtain the maximum range, the final angle at the end of burning is about forty-five degrees just as in the case of a gun. It is the function of the internal control equipment to guide the rocket along this twenty-mile gun barrel so that the proper "muzzle velocity," "quadrant elevation," and azimuth direction to produce impact at the target are obtained.

The internal control mechanisms must first guide the missile in a vertical direction during the critical period of take-off, automatically allowing for variations in the direction of motor thrust and accidental disturbances. As soon as take-off has been successfully accomplished, the rocket must be slowly tipped over on a smooth trajectory directed toward the target, with the expectation that at the end of burning of the jet, the velocity vector of the missile will have the desired azimuth direction, the desired elevation angle, and the desired magnitude to allow the missile to proceed afterward as a free body to the intended objective. This requires that there be an internal mechanism which will measure azimuth directions with respect to the earth, and that there be another device which will measure angles with respect to the true vertical to determine the trajectory in the vertical plane. Further, there must be a mechanism to prevent roll of the missile so that one pair of fins can always control the azimuth direction or yaw angle, and the second pair the elevation or pitch angle. Finally, there must be a means of controlling the fuel flow so that thrust is ended when the necessary velocity is obtained.

The gyroscope appears to be the only instrument capable of indicating an angle with respect to a direction in space without the use of external references. As is well known, a rotating gyroscope wheel has the property of maintaining its original orientation in space so long as no external torques are applied to disturb it. As commonly used in aircraft instrumentation, a well-balanced rotor weighing perhaps a pound is rotated at 10,000 to 20,000 rpm by pneumatic or electric power on low friction bearings, and when suitably mounted on gimbal rings it can be made to indicate the angular position of its carrier with respect to the original setting of the gyroscope axis. By the use of pickoffs which exert no appreciable reaction on the gimbal rings, signals can be obtained which may be applied to a control system to maintain the missile on the heading supplied to it at the time of take-off. A single gyro can be arranged to indicate two angles, such as pitch and roll, in the two planes at right angles to its rotational axis. Thus the minimum gyro instrumentation for three axis control is two gyros, but for the attainment of design simplicity, an independent gyro for each angular axis is often used. These gyro instruments, along with many of the other control instruments, can be located at any point in the missile that



HYDRAULIC PUMP AND VALVING ASSEMBLY

The assembly is shown mounted on a block which contains the pressure relief valves.

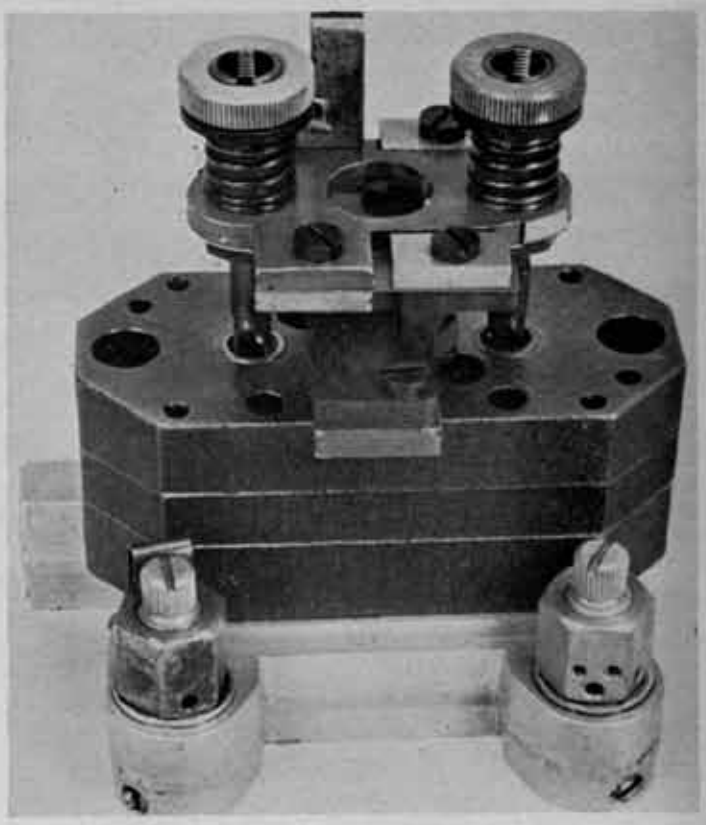
may be dictated by design requirements. The emphasis for the construction of the control equipment is on lightness, compactness, insensitivity to acceleration, and reliability.

Assuming that a properly mounted gyro instrument can indicate deviations from the desired course direction, a control system must be designed so that corrective torques will be applied to the missile to bring it back to the proper heading. A simplified diagram of one axis for a theoretical missile is shown to illustrate this sequence of operations. In order to convert the gyro indications to control torques, a servo motor capable of considerable power (perhaps a horsepower or even more) must be controlled through a suitable amplifier. This servo motor may derive its power from electric, hydraulic, or pneumatic sources. As an example, the V-2 servo consists of a storage battery operating an electric motor which supplies high pressure oil through a hydraulic pump. This high pressure oil flows continuously and is by-passed when not needed. The output member consists of a piston operating a crank arm, and the direction of movement of the piston is controlled by a balanced reversible valve assembly. Exhaust oil is returned to the sump to be used again by the pump. The position of the two-way valve is controlled by an electric torque motor of excellent design which derives its signals from the electric signals obtained from the gyro equipment.

A torque motor is a commonly used device for the conversion of electric signals into liquid or gas flow by the operation of a multiple valve. It is designed much like a common motor except that its movement is restrained, and its armature swings a small amount to the right or left according to the servo effort to be produced.

The servo motor must be connected to the movable fin surfaces by a cable or other mechanical gearing, and the normal construction of a rocket motor requires that a separate motor be provided for each control fin. Each servo motor must be controlled so that it effects the needed corrections as calculated for it by the instrument complement. It will be obvious that the horizontal pair of fins controls pitch and the vertical pair controls yaw. In order to maintain these pairs in their proper horizontal and vertical positions, at least one pair must also be arranged to respond in opposite directions to correct for any tendency to roll. This differential movement to correct for roll is added to any movement simultaneously required for correction about the other control axis common to that pair of fins.

In tracing through the simplified control diagram, suppose for the moment that the pitch axis is along a fixed angle in space as referred to the vertical. If the gyro rotor stays fixed in its space direction, then it will be noted that any movement of the missile in pitch will result in rotation of the outer gimbal ring of the gyroscope relative to the body. This rotation is measured by a sensitive pickup which produces a signal proportional to the angular deviation of the missile from the reference direction. This signal must be amplified (electrically, pneumatically, or mechanically, as the case may be) so that it can control the high power level motor. The control motor then operates to produce a torque on the control fin proportional to the deviation, or rotates the fin an angular amount proportional to the deviation, or a mixture of the two. As the fin is displaced in a direction to correct the deviation, the missile is

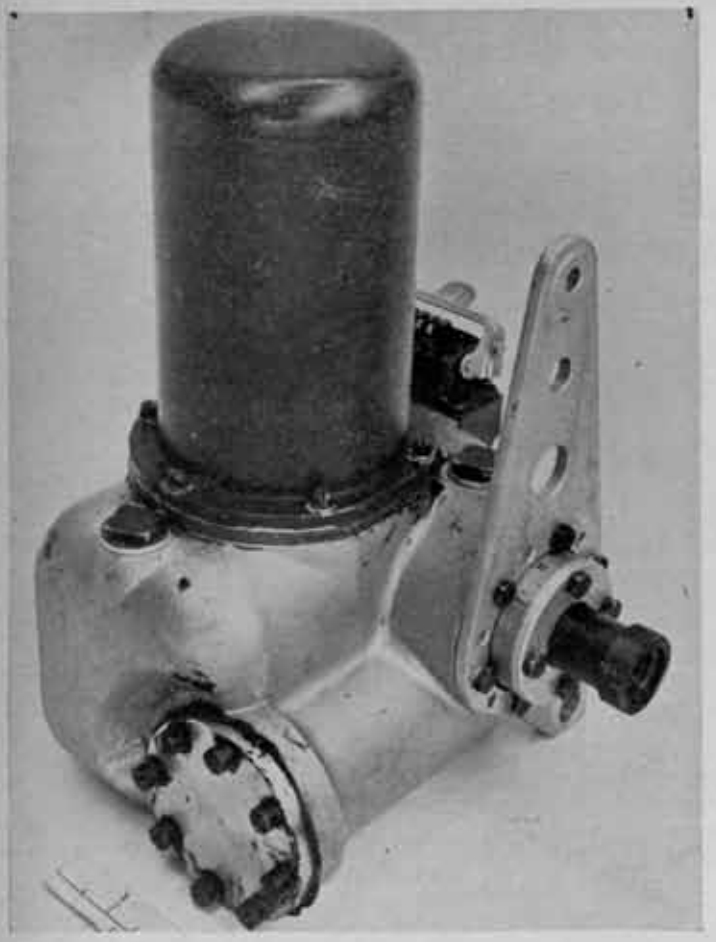


"EXPLODED" VIEW OF GEAR PUMP AND VALVING MECHANISM

brought back on course, the deviation wiped out, and the servo motor returns to neutral.

At this point, an important consideration comes into the design of the control system. It is highly probable that such a simple control loop as that sketched here will be unstable (*i.e.*, it may oscillate or hunt violently). The analysis and design of the control is complicated by the tremendous range of variation of the aerodynamic effectiveness of the fin as a control surface, and the complex behavior of the control fin in the jet, which is omitted from the illustration. The control designer makes use of additional parameters in the servo system, such as requiring that the amplifier or an auxiliary device measure rates of change of the deviation. This rate of change of angular position of the missile in effect generates a signal as soon as any deviation begins and before the actual departure has become appreciable. As an ordinary example, a pilot of an aircraft can keep his craft on a straight heading by watching his rate of turn instrument. By keeping the rate of turn small, he prevents any short period wandering from the desired course. By reference to his compass or directional gyro, he can also prevent any long period wandering from the course. If the rate of change of heading of the missile is appropriately mixed with the deviation signal, it can have the effect of adding damping to the missile system and thus cause any oscillations to decay, or cause the oscillatory behavior to disappear completely. Thus it will be seen that the properly designed servo will maintain short term stability while at the same time keeping the missile along a chosen direction.

In the firing of the V-2 or a similar ground-to-ground missile, it was marked that a definite time variation of the angle



THE TORQUE MOTOR

of pitch (elevation angle) of the missile was required to direct it along a precomputed trajectory toward its target. One simple method of accomplishing this result is to rotate the reference index on the pitch gyro in accordance with the desired pitch schedule. When this is done, the deviation measurement pickoff applies signals to the servo system to keep the pitch angle of the missile set according to the schedule being generated at the gyro. This pitch schedule is, of course, varied to suit the range to the target, and is a complex function of the design parameters of the missile and the retardation effects it will experience in flight.

It will be appreciated that the measurements relating to azimuth and roll be made and applied to the control surfaces in the same manner as in the case of pitch.

In order to have the control gyros provide angular references to the earth, their axes must be aligned properly with respect to the desired direction of flight previous to launching. In the V-2, the pitch gyro starts off with a vertical axis, the roll gyro is oriented with respect to the two sets of control surfaces, and the azimuth gyro must be oriented with respect to the direction of fire. This is accomplished by caging the gyros, that is, clamping the gimbals to the frame of the missile. The whole missile is then carefully set up to point vertically, and the fins are surveyed in on the launching platform so that one pair points toward the target. At the moment of launching, and after the gyros are rotating at their rated speed, the clamping devices are removed by remote control, and the gyros become directionally free in space. So long as they are free from outside torques, they will maintain this direction. As a practical matter, all free gyros have an appreciable rate of drift because bearings are imperfect, masses cannot be completely balanced about the gimbals, and the pickoffs are not as a rule really torque free. Drifts of perhaps fifteen degrees per hour or better can be obtained, but this is satisfactory since no appreciable deviation will result in the critical minute in which the future trajectory is being determined.

The final variable to be controlled in this method of fire control of a rocket relates to obtaining the proper velocity magnitude at the end of the controlled thrust period. One possibility which has not been found practical is that of loading a predetermined amount of fuel into the tanks so that at the complete expenditure of the fuel the velocity will have the proper relation to the direction of flight and the position. Since the process of burning is not under exact control, other means had to be devised for the V-2. If the velocity could actually be measured during the thrust period, then a slight excess of fuel could be loaded, and then shut off from the motor at the attainment of the predetermined conditions. This was actually accomplished in several ways, one of which was to integrate the acceleration, taking into account several related variables. As soon as the integrated acceleration, which is the velocity, reached the critical amount, control valves were actuated to shut off the fuel and the thrust, thus insuring the attainment of the correct final velocity.

It will be noted that the V-2 is an example of a missile which is navigated or controlled entirely by internal means, not depending upon any information to be transmitted to it from the ground. This is a most desirable design characteristic to obtain, making the rocket entirely independent of radar or radio communication channels which are always susceptible to jamming or interference. This dependence upon a dead reckoning type of internal control naturally has its disadvantages, the principal one of which is the difficulty of obtaining a high order of accuracy. Dependence is placed on gyros which are never drift free, and the effects of atmospheric vagaries can be only estimated at best. Needless to say, the development of this type of internal control for the long-range ground-to-ground problem will form one of the major problems for future research in the navigation of both inhabited and uninhabited aircraft and rockets.

The case of guiding a missile to a moving target is one of the most fascinating and one of the most difficult of the control problems related to guided missiles. In the control of conventional antiaircraft artillery, the intended target is observed for a short period by optical or radar tracking so that its position, course, and velocity can be determined. Knowing these quantities, it is possible to compute through knowledge of the ballistic properties of the gun and projectile the direction in which the gun must be pointed at any given time to fire and obtain a hit. Unfortunately, the preliminary observations are often inaccurate, and more distressing still, the intended target may not continue in the expected flight path, and the best results that can be hoped for are the arrival of a few per cent of the shells in the vicinity of the target. If the projectile could be given guidance after its release, refining the guidance data on the

basis of later tracking information, then the probability of a hit could be increased tremendously.

In general, a scheme could be imagined in which a stabilized and guided rocket or jet-propelled aircraft is launched toward the point in space calculated to obtain a collision with the desired surface or air target. The missile would fly stably toward its destination without outside assistance by the use of the type of controls already described. This ability of the missile to maintain its own internal stability, free from hunting or oscillation about any of its axes will likely be a required characteristic for successful tactical flight. By observing the missile and its target during the time of flight, information to change the trajectory slightly on the basis of refined estimates of the expected collision point could be transmitted to the missile through a radio or radar communication channel.

Such a system as this for antiaircraft use has actually been disclosed as a German development. A rocket-propelled missile carrying internal flight controls and signal receiving gear could be launched toward an air target. Optical trackers would follow it in its flight, transmitting path change signals to it so that it would close on its target. It can be imagined, of course, that a device of this sort might be designed to have homing characteristics by the inclusion of a sensitive head based on radar or other principles. In this way, the navigation system would have only the burden of guiding the missile into the vicinity of the target in such a way that the homing mechanism could control the critical portion of the course.

Looking further toward the speculative side of the field, one encounters the problem of developing a device to combat or neutralize enemy rockets. The ground-to-ground missile is a potentially powerful offensive weapon, and is doubly dangerous until a countermeasure is developed for it. If an enemy missile of the type which is not jammed by any known means is approaching a vulnerable target from high altitude at higher than gun projectile speed, then it appears that the only solution is to shoot it down before it arrives at a dangerous zone. The V-2 on its downward flight reaches a speed of approximately 5,000 feet per second. A moment's thought will convince one that it is hopeless to fire at it with an artillery shell which moves much more slowly at the high altitude where an encounter must take place.

It is conceivable that an interceptor type missile might be developed which would have a useful probability of obtaining a hit, although as we speculate further, we come upon a baffling array of formidable engineering problems which would demand solution. First of all, warning of the approach of the missile must be obtained at ranges greater than the reach of present radar sets to allow some time for defensive action. Position data on the enemy missile must be obtained and assimilated in a control center. Then a guided missile must be fired which reaches a higher velocity than its target, and which has a comfortable margin of maneuverability over the enemy missile. The control mechanisms both in the interceptor and on the ground must be swift and accurate. Above all, there is not a single second of time to be lost; perhaps there is not even enough time.

Solutions to these problems can be demonstrated singly in some cases. To bring them all together into a cooperative system to accomplish this task even on a proving ground basis will demand herculean efforts. To arrive at a system which will function at any hour, day, and year selected by an unknown and unsuspected enemy is beyond the grasp of a practical engineer's imagination. Clearly a war of missiles will find the defender in a dangerous position.

Whatever the missile systems chosen out of the multitude of combinations of the techniques made available to the field, it appears certain that each of them will stress the instrumentation necessary to obtain stable flight through the manipulation of control surfaces and jets. It is to be expected that this internal equipment will undergo metamorphosis and development in keeping with the strides being made in the other important phases of jet propulsion. The peacetime applications alone will be enough to insure rapid technological development. Add to that the impetus of military needs, and we can expect the attainment of goals whose form we cannot yet imagine, and whose significance we are only slowly beginning to grasp.

Range of 20,000 Miles for Guided Missiles

Ordnance scientists are probing the possibilities of using special warheads on antiaircraft weapons which will neutralize the threat of high altitude bomber formations, according to Major General Everett S. Hughes, Chief of the Army Ordnance Department.

It is anticipated that some of the bombers of the future will fly at altitudes far above effective antiaircraft gun ranges. It is difficult now for our pursuit craft to attack enemy bombers flying in formation because of the protection furnished by enemy bombers to each other, according to Army airmen. In order to solve this problem, the scientists at the Ordnance Department's Ballistic Research Laboratories at Aberdeen Proving Ground plan the development of a guided missile which would carry a charge intended to be exploded in the midst of an enemy bomber formation where it would be highly destructive.

Ordnance scientific strategists think that if enemy bombers are prevented by the threat of such a weapon from flying in formation, they will become vulnerable to the attack of individual fighter aircraft.

The Ordnance Department, according to General Hughes, is now testing rockets with potential ranges of 200 miles at White Sands Proving Ground, New Mexico, but, he reports, the rockets of the future are expected to be capable of traveling thousands of miles. A joint Army-Navy Commission of which the Ordnance Department is a member is searching the United States, Caribbean and Pacific areas for a range where it will be possible to test contemplated rockets over a distance of 2,000 miles.

Long-range planning by Ordnance scientists, however, forecasts the ultimate range of guided missiles to 20,000 miles—weapons capable of circling the globe.

The History of Flak Intelligence

By Earl W. Thomson, Colonel, Coast Artillery Corps

Editor's Note: Colonel Thompson was the first flak officer in the United States Army and is today the outstanding authority in this field. During the course of the war he was Flak officer of the Eighth Air Force and VIII Bomber Command for over a year. After the end of the European War, Colonel Thompson was sent to Pearl Harbor as Chief of Flak Intelligence Section, Joint Intelligence Center, Pacific Ocean Areas and as such helped direct the Flak program for the Army, Navy and Marine Air Forces until VJ-Day.

Flak Intelligence and Flak Analysis are of benefit to all types of airplanes whose missions require them to fly over enemy territory, but this intelligence becomes of particular value to the bombers of a strategic air force which must fly straight and level for several minutes over heavily defended areas.

The Eighth Air Force

The history of the Eighth Air Force, the largest of our strategic air forces, commences with the arrival of Brigadier General Ira Eaker in England in February 1942 with a directive from General Arnold to "make the necessary preparation to insure competent and aggressive command and direction of our bomber units in England." The first all-American raid was that over Rouen on 12 August 1942 in which twelve Fortresses participated. The first real "head-on collision" between the heavy bombers of the Eighth, the fighter planes of the Luftwaffe, and the antiaircraft defenses came on 9 October 1942, when 108 Fortresses and Liberators tackled Lille. Flak was not severe, but four bombers were lost to fighters, and the percentage of abortives, and of those not bombing the primary target, was high. The planning and operations staff of the Eighth thereafter emphasized the securing of heavy fire power through close defensive formations against the enemy fighters, but in the early planning regarded flak merely as a deterrent.

In September 1942 the Twelfth Air Force was "borned" from the Eighth, leaving the mother rather weak while making "Junior" strong, and two groups of bombers proceeded to Gibraltar on 5 November to take part in the African invasion.

In October and November 1942, the tonnage in the sinking of Allied shipping by the German submarines reached a new high. The concrete submarine pens of Brest, Lorient, Saint Nazaire, La Pallice and Bordeaux became priority targets. High altitude missions were flown beyond the range of flak but the bombing was inaccurate, and "pickle-barrel" bombing became a bitter joke; lower level attacks were then tried but every plane came back damaged.

Over St. Nazaire, three groups tried out an experiment in surprise. The lead group of Fortresses flew in at 20,000 ft. unscratched; a group of Liberators came over at 18,000 unscratched; and then a group of Fortresses barged in at 8,000 ft. with one squadron as low as 7,000 feet. Every ship in the last group was hit by flak, and three planes went down in flames over the target. What remained of the last squadron limped home with the questionable nom de guerre of the "Clay Pigeon Squadron"; St. Nazaire became known as "Flak City"; the experiment was a failure.

On 3 January 1943 the Fortresses and Liberators attacked St. Nazaire for the sixth time. Sixty-eight bombers made the bombing run into a 115-mile-per-hour gale. For ten minutes the bombers, like "sitting ducks," flew straight and level at 20,000 ft. The gunners on the ground had a field day; the flak was deadly. Three planes were shot down by flak, four by fighters, and practically every ship was damaged.

In January 1943 Generals Arnold and Eaker were called upon at Casablanca to defend the concept of American high level daylight precision bombing, with a record which was far from good, but with undeveloped potentialities. The British idea was that of area bombing at night, which until that time had been more productive and efficient. It was finally decided by the Combined Chiefs of Staff that the two types of bombing could be made complementary, and that "round-the-clock" bombing would be commenced to "accomplish the progressive destruction and dislocation of the German military, industrial and economic system." A system of target priorities, in which submarine pens, aircraft factories, and enemy lines of communication were declared paramount targets, was set up, based upon the excellent British Intelligence, and the Combined Bomber Offensive was started.

But something had to be done about Flak!

The Antiaircraft Command, ETOUSA

The Headquarters of the Antiaircraft Command, ETOUSA, under the command of Brigadier General Claude M. Thiele, during the summer of 1942 had, in the heart of London's Mayfair, laid plans for the defense of American air fields. However, all Antiaircraft units in England, and those en route and promised, were requisitioned for the North African invasion, and the Antiaircraft Command found itself a headquarters without any troops. At this nadir, on 26 November 1942, ETOUSA stepped in and absorbed the Antiaircraft Command into Hq., ETOUSA, as the Antiaircraft Artillery Section.

Early in November 1942, as AA-2 of the Antiaircraft Command I had published the first Antiaircraft Command Intelligence Summary, which under various names continued throughout the war. In December 1942 Major Melvin Russell and I became interested in the factors affecting flak effectiveness against our bombers and computed a "Flak Effectiveness Chart" assuming that the probability of hitting was inversely proportional to the time of flight. At about this same time, Major E. R. T. Holmes, of the Royal Artillery, British Army, who had been attached to the First Bombardment Wing of the Eighth Air Force, as

From photographs such as this, enemy defenses were plotted on a flak map.

Flak Liaison Officer, had developed an apparatus for measuring the number of shots which could be fired against a plane at any ground speed, and along any course, when the ground defenses were known. Major Holmes' gadget was the first one used in the VIII Bomber Command, and it gave good results, as it computed the relative number of shots along various courses. This apparatus required that a gun circle chart be drawn for the proposed altitude of attack, and then solved the formula that the ground speed equals the vector sum of the air speed and the wind speed. This computation therefore included the effect of the wind, but did not include the factor of probability.

Early in January 1943 a conference was held at which Russell, Holmes and I were present, together with Major G. O. Allen, British Army, Chief of the Flak Intelligence Section of the British War Office and Dr. L. E. Bayliss of the Army Operations Research Group (British). Dr. Bayliss was asked to analyze the mathematical aspects of the problem and on 2 February transmitted a "Curve of Total Probability" which gave the relative probability of hitting a plane along any crossing course. This curve was developed for a definite ground speed and altitude, and it was pointed out that the total probability was inversely proportional to the ground speed of the plane, and that the computation for priorities of course for a particular altitude could be applied to other altitudes without appreciable error. In Dr. Bayliss' computation, the probability data was taken from British sources which showed that outside of a horizontal range of 2,500 yards at 250 miles per hour, the probability was inversely proportional roughly to the cube of the slant range. Inside 2,500 yards horizontal range, the probability was assumed constant.

On 28 February 1943, the Antiaircraft Section, ETOUSA, published AA Intelligence Memorandum No. 2 on "Enemy Antiaircraft Defense Analysis" which gave charts, the method and an example of the computation, of a flak defense analysis. The method of presentation in computer form was similar to that used in Proposed Changes to FM 4-105, "Coast Artillery Field Manual: Antiaircraft Artillery Organization and Tactics of the Antiaircraft School, Camp Davis, on 1 June 1942." This included Bennett-Devereux Strength Computers to a scale of 1:62,500 for altitudes of 15,000 and 18,000 feet and a ground speed of 125 yds per second. These computers gave relative values for the strength of an antiaircraft defense from various angles of approach and thus allowed the antiaircraft commander to compute the effectiveness of his own defense. The Antiaircraft Command computer, upon which the later battery-centered computers of the VIII Bomber Command were based, reversed the process by telling the air commander which were the easiest courses over a known defense with a known wind and altitude.

After his return from Casablanca, General Eaker, conscious of the growing dangers from flak, had several conferences with General Thiele on the subject of defensive measures against flak. These resulted on 23 February 1943, in the transfer of two senior antiaircraft officers from the antiaircraft Section to the Eighth Air Force.

Prehistoric Flak Analysis

In October 1944, Major General Lawrence Kuter, AC, then AC/AS Plans, Hq. AAF, Washington, stated that when he was at the Air Corps Tactical School at Langley Field in 1933 he discussed the subject of antiaircraft effectiveness and the calculation of relative probable damage along various courses. This could have been the birth of flak analysis.

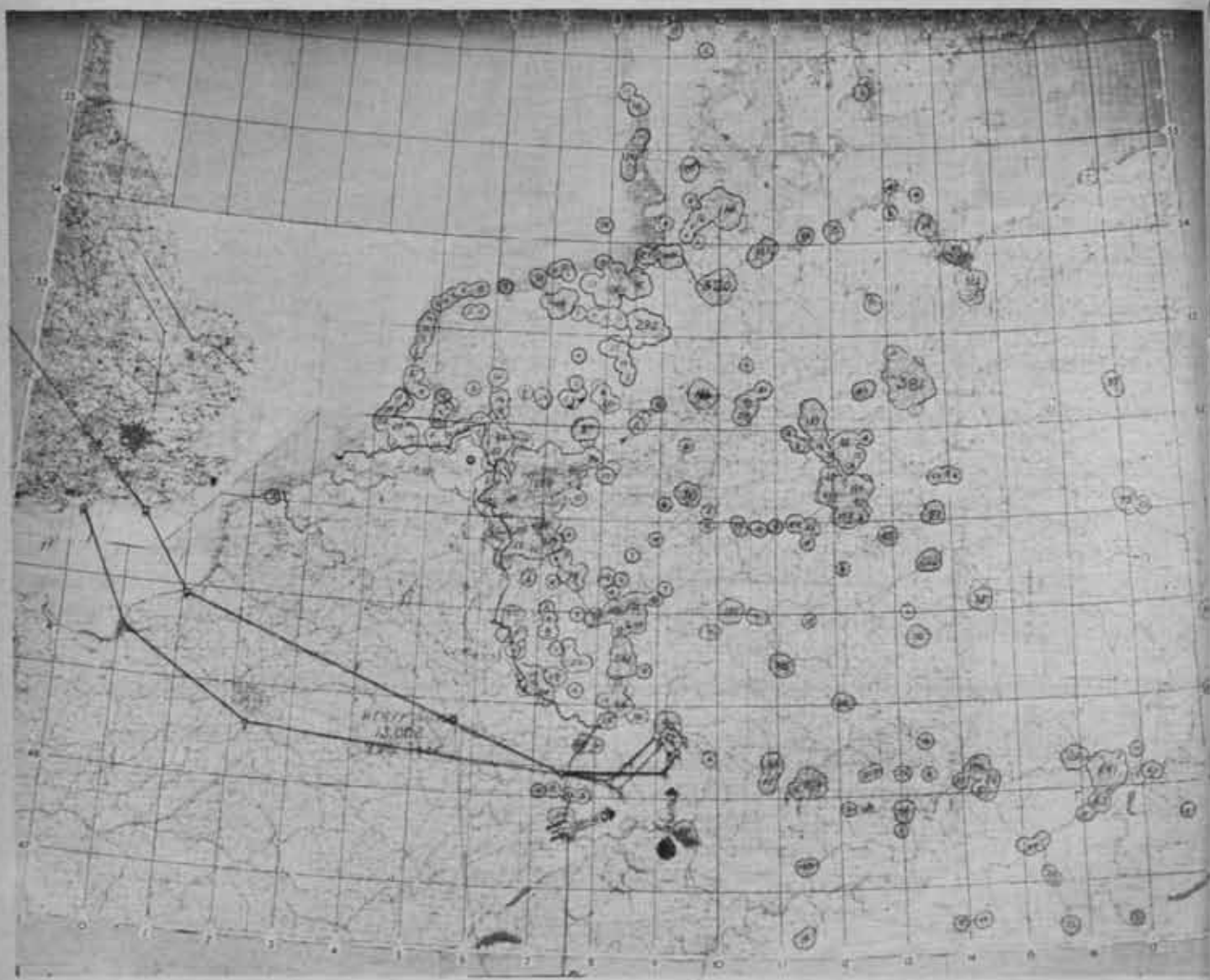
The Coast Artillery in estimating the effectiveness of a

harbor defense has always drawn gun circles on its maps at the maximum range of the guns and mortars. Overlapping circles in certain areas showed an effective defense. The same technique will give an approximate estimate of the strength of an antiaircraft defense, if the circles are drawn with a radius equal to the horizontal range for the altitude of attack. Colored pencil, cross-hatching, and red danger zones where numerous circles overlap will show the air commander, with even the most rudimentary understanding of antiaircraft, that certain zones or courses are dangerous.

Early flak analysis of the Twelfth Air Force in the Mediterranean, the Fifth and Thirteenth in the Pacific, and the Navy, followed this gun circle method. Major Holmes' apparatus summed up the product of distance and the number of guns bearing for any course over the target, and was thus essentially a mechanical variation of the gun circle method, taking into account the speed and direction of the wind.

Flak Analysis, VIII Bomber Command

On 25 February 1943, I was assigned to the staff of the VIII Bomber Command at High Wycombe, Bucks, as Antiaircraft Officer, and on 1 March was sent on temporary duty to Headquarters of the First Bombardment Wing, at Brampton Grange, and visited the air groups at Thurleigh, Chelveston, Bovingdon and Molesworth. On 3 March, flak analysis computations were made for the target at Hamm using the gadget developed by Major Holmes, and the results were compared with those obtained with the probability "pie-plate" of the Antiaircraft Section. The mission was flown, flak "barrages" were encountered along the route and in and out from the target. Four planes were lost. On 6 March, the target was Lorient. Computations were made with both Major Holmes' and the probability computers, and these checked only on priorities one and two, the variation being as great as 35% in the values of effectiveness. It was therefore decided to use the computer which included the probability factor, for American planning. For Lorient, the flak officer recommended to go in at 180° and out at 235°, and the planners, in order to come in from the Sea, adopted the reverse course of in at 35° and out at 0° which also gave low priority. This was the first time known in



The Eighth Air Force flak situation map showing (1) the antiaircraft defended areas, (2) range of guns and (3) routes used to avoid flak.

which the recommendations of an American Flak Officer, based upon flak analysis, were adopted by the Air Forces in their planning.

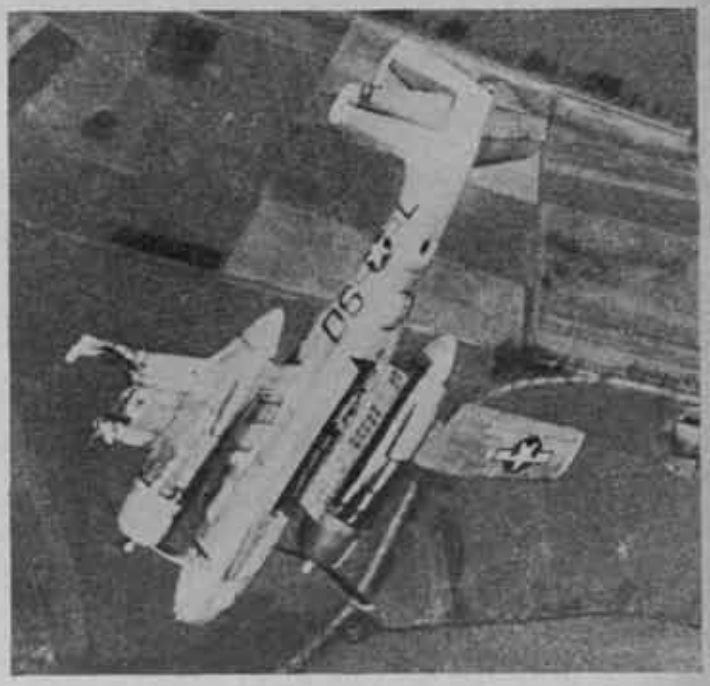
After Lorient, Brigadier General Frank Armstrong, who led the mission with the 306th Group, held a critique at Thurleigh at which I was present. Three of the sixty-six planes over the target had been lost to flak, two from the lead group. General Armstrong stated: "Flak is our worst enemy because flak damages the machine and the flak cripples are then taken on by the enemy fighters." The Commanding General of the 306th estimated that 90% of the losses in various missions were initially caused by flak. The flak officer therefore became a necessity, and his advice was listened to, although not always heeded. It was in one of these early conferences that the flak officer gave General Armstrong a No. 1 priority of in at 90° (heading east) and out at 270° (heading west), and "Frankie" made the classic flak crack: "What the hell am I supposed to do—Fly in and back out?"

As a result of conferences with the operations and intelligence officers it was decided to ask for American flak officers for the planning and intelligence staffs at Command and Wing Headquarters. Colonels W. L. Richardson and Samuel Morrow, CAC, assisted in preaching the doctrine in London and at headquarters, Eighth Air Force. Colonel William M. Garland, AC, an authority on bombing from Hq. AAF became interested in the flak analysis probability computer and preached the gospel in the air forces.

It was decided to make flak analysis computations at Command and Wing Headquarters and to have the priorities of the various courses checked by telephone, usually before the field order for the operation was approved at Command. In the Eighth Air Force no flak officers with antiaircraft training were asked for at the group level. Here the flak officers, who were air force intelligence officers, accepted the decision as to route and axis of bombing from the higher echelon, were given sufficient material for proper briefing, and handled the flak interrogation and reports. In any air force where the route planning was done at group level it became a necessity to have trained antiaircraft flak officers on the group staffs.

On 17 March the axes were computed for the target on Vegesack for the VIII Bomber Command. Attack in the 180°-210° sector was recommended and the flak losses were less than expected. Flak intelligence was considered to have proved itself and a flak intelligence director was approved on 30 March.

Several problems immediately faced the Flak Officer of the VIII Bomber Command; the securing of trained personnel, the training of flak officers in proper flak analysis methods, the checking of the sources of flak data and intelligence. The British already had a flak intelligence section at the War Office in Whitehall which was turning out faded flak maps based upon photographic reconnaissance of British, and later American, Photograph Reconnaissance Squadrons. This Section was given a list of target priorities of the Eighth Air Force and turned out flak overlays for the existing 1:100,000 maps of France and Germany. As Medmenham, where the photo-interpretation was accomplished, was not far from High Wycombe, in cases of emergency the



With bombs still in the bay, an A-26 Invader hurtles earthward after a direct hit by enemy flak shears off the left wing.

Too much cannot be said for the help given U. S. Air Force Intelligence by the staff of Air Chief Marshall Harris at British Bomber Command, by the other staffs of the RAF, and by the British War Office.

The training of air force and antiaircraft officers in flak analysis commenced with the publication on 14 April 1943, at Hq. VIII Bomber Command, of AA Memo. No. 1 on "Computation for Effectiveness of Enemy AA Defenses for Varying Axes of Attack by Heavy Bomber Aircraft." This discussed the methods of flak analysis using the circular computer, recommended the calculation between (BRL-45) and BRL on the In course, and from Target to the periphery of the defenses on the Out course. It also explained construction of the Flak Clock for presentation of the results to the air planning staff. This memo was followed on 24 April 1943, by AA Memo. No. 2 on "Accuracy of Heavy AA Fire as Affected by Altitude of Target Aircraft." This gave the rule-of-thumb that above 15,000 ft. with existing German antiaircraft the total chance of damage was decreased by approximately one-half for each increase of 5,000 ft. in altitude, or decreased by about 14% compounded for each 1,000 ft. increase.

Early Flak Intelligence Personnel

The first flak officers with the Eighth Air Force were the Flak Liaison Officers borrowed from the British, Major E. R. T. Holmes, RA, with the First Bombardment Wing, and Major William King, RA, with the Second Bombardment Wing, which consisted of Liberators flown from the air fields around Norwich. Later, in early May, Major Brett, who had been an intelligence officer with Group 2, British, became Flak Liaison Officer for the Third Bombardment Wing, which was flying B-26s. This Wing later became the Bomber Command of the Ninth Air Force. The early attempts of this Wing at medium and low level bombing were not particularly successful as one group had 100%

Ijmuiden and Haarlem in Holland. Majors Holmes and King regarded instruction of the pilots in flak evasion as one of the most important parts of flak intelligence and insisted on classes for pilots and crew members newly arrived from the United States.

Captain L. B. Frost, CAC, a graduate of the Antiaircraft Artillery School at Camp Davis who was on duty as a transportation expert for the air force, was given some instruction and appointed on 30 April 1943, Flak Officer for the Fourth Bombardment Wing, which later became the Third Bombardment Division. Captain Frost was one of the most successful of all flak officers, as he had the esteem and confidence of the Commanding General and the planning staff, and knew when to compromise and when to stand by his calculated priorities.

During these early months, various mathematically minded air intelligence officers were being trained as group flak officers. But the need for trained antiaircraft artillery officers was apparent and on 20 May the Commanding General of the Eighth Air Force cabled: "To Arnold from Eaker signed Devers" asking for "five antiaircraft artillery officers in the grades of major or captain for duty as enemy antiaircraft evaluation officers." These officers arrived on 14 June and were immediately shot through a three-day get-rich-quick intelligence training class and a week of enemy antiaircraft evaluation.

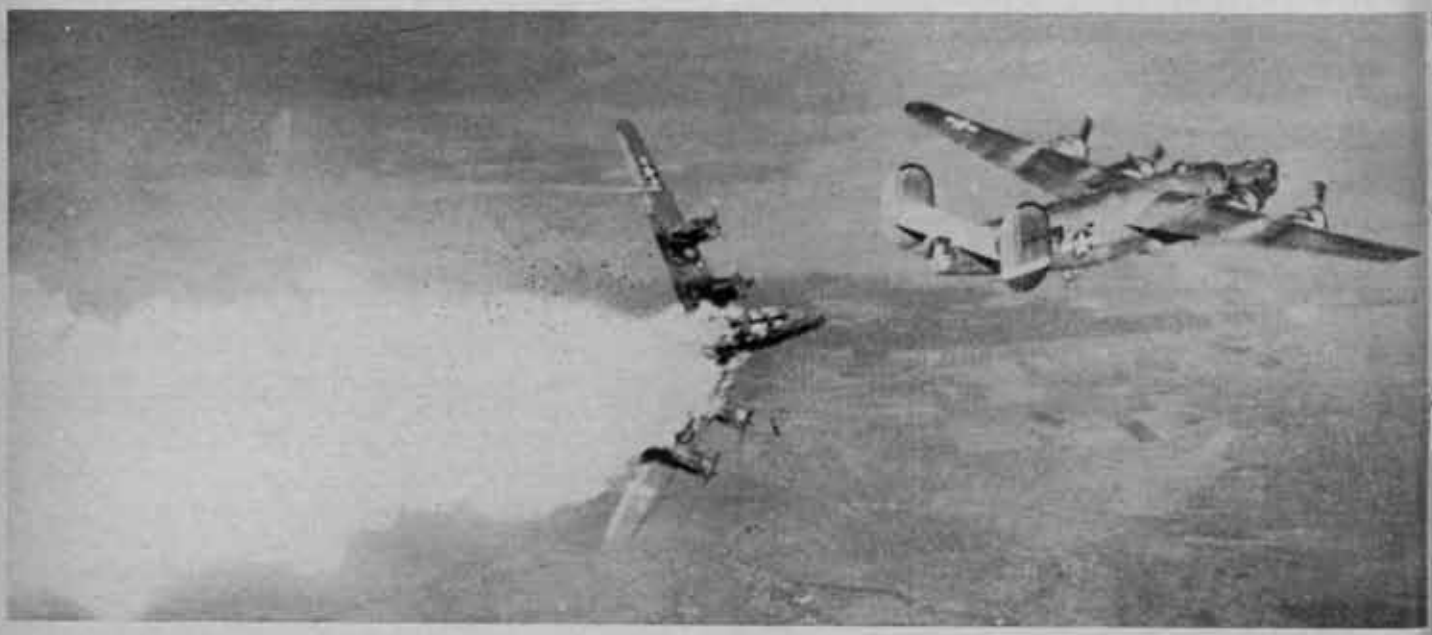
Captains Jesse O. Gregory and Robert L. Marietta were then retained at Hq. VIII Bomber Command as Assistant Flak Officers. Captain Harry C. Johnston went to 1st Bombardment Division with Major Holmes. Captain Simon L. Grimes, Jr., went to 2d Bombardment Division with Major King. Captain William F. Hill went to 3d Bombardment Division with Captain Frost.

From then on flak analysis of potential targets became a working system. Nightly the various flak officers at divisions checked with the command on the calculated effectiveness and priorities for various targets over the operational lines. They checked battery and target positions in code, and even questioned one another's mathematical prowess. Groups were visited during briefings and interrogations, instruction in flak evasion was given pilots, and instruction on flak analysis to interested air intelligence officers. Two American officers were assigned to Major Allen at the War Office to assist in the preparation of the 1:100,000 flak overlays, and the 1:500,000 Flak Map.

This latter map, kept corrected periodically, was used for most route planning at Command, divisions and groups as it gave the gun defended areas printed in red and showed safe routes to and from the targets. In the operations room at Hq. VIII Bomber Command, you could always find several operations officers with map tacks and colored yarns discussing possible routes to targets. Entrance into "Fortress Europa" was made through several gaps in the coast line defenses. For months these holes remained strangely open and the Command often suspected the Germans of a mousetrap play. Post-hostilities interrogation of German flak generals proved however that this was not the case—the Germans just did not want to spread their defenses too thin. One of the best entrances to northern Europe was over the islands of the Scheldt Estuary. One evening a Division Fortress Officer called up excitedly: "One of our pilots on today's mission reports forty-two antiaircraft gun emplacements on Nord Beveland. Will you check?" The War Office had nothing on the maps; Medmenham could find nothing on the photos, so a special photographic mission was put on for the next morning. By nightfall Medmenham sent over a set of slightly damp prints with a somewhat humorous note: "By careful study we have found forty-two fishermen's cottages on Nord Beveland, each surrounded by a white picket fence. Please verify."

The information obtained from crews on interrogation was used to verify photos, but it is safe to say that 95% of the specific information which could be pin-pointed on target photos or maps came from photo-reconnaissance or strike photos.

Flak analysis required also accurate information as to the



Bombs tumble from the bays of an overturned Liberator bomber when the plane is caught in a heavy flak belt as it makes its bomb run over Blechhammer, Germany.

speed and direction of the wind at the altitude flown. The meteorological section of VIII Bomber Command gave this data twenty-four hours in advance, and it was surprisingly accurate. If the wind shifted, the flak officer could make corrections to show the changes in priorities. One night, for example, during the planning on Bremen, the wind shifted from the southwest to the north, the axis of No. 1 priority changed from 30° to 210°, and this reversed course was adopted by the operations officers and correction to the previous field order was sent out.

Antiaircraft Memoranda

At the end of June 1943, AA Memo. No. 3 on "Evasive Action Against Enemy AA Heavy Guns" was finally published. This memo., the first American publication on this important subject, summarized the various methods of lessening the effect of antiaircraft fire by proper evasive action. This was followed by No. 4 on "Enemy AA Artillery," which tabulated the various German guns, automatic weapons, and methods of fire, and by No. 6 on "AA Terminology for Briefing and Interrogation." Memo. No. 5 was an interesting study by Major Holmes on "German AA Defenses Against Daylight High Altitude Bombing Formations." This included an analysis of all bombings by the First Division from 1 January to 1 July 1943, together with a number of interpolated comments by the writer.

The various AA Memos. from the VIII Bomber Command were all republished by AC/AS Intelligence, Hq. AAF, Washington, in the Command Informational Intelligence Series, and became the basic documents on the subject of flak analysis. Nos. 1 and 2 were also republished as Special Intelligence Report No. 59 by Hq. Northwest African Air Forces, with a highly colored flak clock on the cover. Hq. Mediterranean Air Forces also started writing reports on flak analysis methods, and began requesting flak personnel from the United States.

Increasing the Accuracy of Flak Analysis

Late in November 1943 Lt. Col. Richard A. Devereux, CAC, of the Department of Tactics, Antiaircraft Artillery School, Camp Davis, was sent over to England on 60 days temporary duty with Hq. VIII Bomber Command, and was given the job of improving the accuracy of flak analysis. Data was secured from the Army Operational Research Group (British) and the Operational Research Section of VIII Bomber Command and new flak curves were computed and drawn. These introduced the "group probability factor" to express the increase in probable damage to airplanes in a group formation because the airplanes are within the dispersion volume of bursts fired at a single airplane. On 31 January 1944, as Colonel Devereux returned to the Antiaircraft Artillery School, AA Memo. No. 8 "New Curves for Flak Analysis" was published by Hq. Eighth Air Force.

Flak Instruction at Camp Davis and Fort Bliss

The first formal Flak Analysis Course was started at Camp Davis on 7 February 1944, after the return of Colonel Devereux from Temporary duty in England. This class lasted for six weeks, and as part of its instruction helped [illegible] TM 4-260 (UBE) on "Flak Analysis" which was published by the War Department on 1 May 1944, and became the bible of flak intelligence.

Prior to "Flak 1", a brief informal course was held in December 1943 for antiaircraft officers being sent to the Eighth and Ninth Air Forces in England and Twelfth and Fifteenth in the Mediterranean since all had requested flak officers. These requests were expedited by Major General "Barney" Oldfield, Antiaircraft Officer for General Arnold at Hq. AAF.

Three other flak courses were held from March until June 1944, the last of which, Flak 4, several naval officers attended, thus stimulating interest in Flak Intelligence in the Navy. The Antiaircraft Artillery School which later moved to Fort Bliss now has a Flak Analysis Research Section and a Flak Analysis Test Firing Project carrying on the development work based upon more accurate firing data.

Flak instruction also was carried on in the Air Officers' Courses at Davis and Bliss from September 1943 until V-J day.

The Army Air Officers' Tactical Center at Orlando, Fla., saw the need for flak instruction and early in 1944 Lieutenant George McGowan was assigned there where he gave the instruction in flak analysis to many air officers until V-J day.

Automatic Weapons Computer

The original flak computers were for high altitudes and for heavy guns only. The need for estimating the effectiveness of automatic weapons, 20mm, 25mm, 40mm for low flying planes was evident, particularly to the Ninth Air Force in the pre D-day planning, and to the Navy for their glide and dive bombers. The lesson of Ijmuiden had not been forgotten. In one of the early flak classes at Davis an automatic weapons computer was attempted, but was never published. Captain Norman H. Ball, CAC, in peacetime a mathematics professor at the Naval Academy and Lieutenant Frederick G. King, CAC, in the spring of 1944 analyzed several sets of data from the Antiaircraft Board automatic weapons practices. These data showed that the probability of hits was not only a function of time of flight, but also of the tracking rate in the slant plane. These two antiaircraft officers from then on worked closely with a group of Navy Department civilian analysts, among whom were Drs. Jastram and Steenrod, and numerous automatic weapons computers, for low level, dive and glide bombing were developed late in 1944 and early in 1945.

Problems of Flak Analysis

Flak Intelligence made a start in World War II and proved its worth. There are however many problems yet to be solved.

(a) *Accurate Photographic Intelligence.* It is axiomatic that no analysis can be more accurate than the information upon which it is based. Pin-point gun positions are best secured by photo-reconnaissance and proper photo-interpretation. This should be all-inclusive, continuous and current. As the Germans concentrated their defenses into "grosse-batterien" and threw heavy screens around vulnerable [illegible] flak analysis demanded more and more accurate

data. Late in 1944 and early in 1945 accurate flak data was difficult to obtain in the Pacific area, and many times flak officers reverted to peripheral gun circles as the best solution under the conditions of inaccurate data.

(b) *Accurate Firing Data.* With the Test Firing Project at Fort Bliss, the various questions relating to the factors affecting probability of hits with antiaircraft guns and automatic weapons should be answered. How does time of flight enter?—speed and size of planes?—elevation of guns and rate of elevation?—rate of traverse?—dead zones due to gun elevation, director, rate of traverse and elevation? When these factors are evaluated, proper computers can be constructed. One of the troublesome questions is whether the probability of hits decreases with decrease in slant range, time of flight, or altitude, after a maximum value has been reached at some optimum range.

(c) *Speedier Methods of Flak Analysis.* The early gun-computers were of the battery-centered type, and in an extended defense it was necessary to rotate the computer about each battery in order to read the "contour differences." Target-centered computers were developed by Major Frank Howard of the Flak Intelligence Section, Pacific Ocean Area, and by several others. These were much speedier, required rotation only about the target, but required various approximations in their construction. These were however coming into use in the Pacific area prior to V-J day.

One method of speedier solution was that of Flak Analysis Tables developed by Major Hays at the Antiaircraft Artillery School at Fort Bliss, Although having some advantages these never came into general operational use.

(d) *Automatic Weapons Flak Analysis.* A satisfactory method of flak analysis against automatic weapons has not yet been worked out, although target-centered computers were constructed for glide and dive bombing. With accurate firing data from Fort Bliss, this should be accomplished. It is just possible that the use of computers may be abandoned, and effectiveness will include factors of terrain and sun, which are now neglected in flak computation, but are very important in operational planning for low level attacks.

(e) *Application to Tactical Employment of Antiaircraft.* The original Bennett-Devereux curves were for the use of the antiaircraft commander in laying out his defense. The cycle is now complete, as methods are being worked out in which flak analysis can be used by our own antiaircraft. The factors of probability work the same way for us as for the enemy antiaircraft. The problem for the flak officer was always to find the unbalance in the enemy defenses and to exploit it. The problem of our antiaircraft commanders is to lay out his defense so that it is balanced, or at least unbalanced only in the direction of expected attack and prevailing wind.

Conclusion

New bombs and methods of bombings are being developed. Radar, radio-controlled guided missiles, and nuclear energy have all changed the picture. Flak analysis as practiced in World War II is ancient history. The history of flak analysis indicates however that the air forces and the antiaircraft artillery must get together to plan effective means of defense and effective countermeasures against enemy defenses. There must be coöperation between those who will use the successor to flak analysis, and those whose antiaircraft training gives them the fundamental knowledge.

This history has carried Flak Analysis from its conception in London in December 1942 until it became an adolescent child in the summer of 1944. Neither the air force nor the antiaircraft artillery ever fully claimed its paternity. The history of Flak Analysis in the Pacific and in the Navy will have to wait until some time in the atomic age post-Bikini before time may be devoted to its completion.

Changes of Address

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An Assessment of Guided Missiles

By Julian M. West

Editor's Note: After graduation from the United States Military Academy in 1927, Mr. West served for three years in the CAC. He left the service in 1930 to join the Technical Staff of the Bell Telephone Laboratories, Inc. In August 1941 Mr. West began research on microwave radar systems and proximity fuzes among other military projects. He became Expert Consultant to the Army Air Forces in October 1943 and studied particularly the application of radio countermeasures equipment as applied to air operations.

He rejoined Bell Telephone in October 1945 and is now a member of the Military Research Group of that company.

A great deal of interest is now centered on guided missiles. Of the many uses to which it is planned to put them, perhaps the antiaircraft problem is receiving major attention. In this article an effort will be made to analyze the problem which it is hoped that the guided missile will solve. This will then be followed by an assessment of the probable effectiveness of antiaircraft guided missiles.

Many people believe that the anti-missile problem is of greater importance than the antiaircraft problem. Even though this may be so, it is outside of the scope of the remarks to follow. The antiaircraft problem is certainly more immediate and therefore, deserves first attention. It is important to note that these are distinctly different problems and that the defense against missiles will be far more difficult than the defense against aircraft attacks.

The probable characteristics of attacking aircraft, for some years to come, indicate maximum speeds of about 600 miles per hour, maximum ceilings of about 60,000 feet and maneuverabilities of about 3 g at 40,000 feet. Perhaps a word of explanation of the maneuverability figure is in order. The ability of an aircraft to change its direction rapidly is limited by its design and by the crew reactions. After all factors have been considered, including the use to which the plane will be put, the above estimate has been given by many independent sources. The "3 g" figure means that the aircraft can be accelerated in a direction normal to its flight by 3 times the acceleration due to gravity or a little less than 100 ft/sec/sec. The significance of the stated altitude is that maneuverability is a function of altitude. At lower altitudes, the aircraft is maneuvering in denser air and can, therefore, turn more sharply. Limitations of structural strength and crew reactions are the controlling factors. At higher altitudes the thinner air rapidly reduces the maneuverability until it has essentially vanished at the ceiling.

Aircraft, of the above characteristics, should be assumed attacking a defended area singly, in small numbers, or in saturation quantities. The planes may be grouped, dispersed, or attacking from many directions simultaneously. It can be assumed that bombing equipment will automatically compute the bomb release point during violent maneuvers of any nature the pilot chooses. This means that it is no longer possible to assume that the bomber will fly straight and level just prior to bomb release. Considering crew reactions and aircraft capabilities, it seems reasonable to assume that the attacking aircraft can change the direction or magnitude of maneuver about once each ten seconds.

Before considering the significance of these characteristics of the attacking aircraft, it is desirable to review the present capabilities of antiaircraft equipment. Automatic tracking radar, plus electrical gun directors, plus proximity fuzes have already demonstrated that low flying, non-maneuvering targets (the German V-1 flying bomb) can be effectively shot down. It, therefore, seems reasonable to assume that improved equipment of these types can be considered perfect defenses against this sort of attack. By increasing the range and muzzle velocity of antiaircraft guns, it can be safely assumed that non-maneuvering targets can be successfully destroyed at much greater ranges and altitudes than has yet been demonstrated.

In the above, it has been stipulated that the target was not maneuvering. The effect of target maneuver on the above conclusions is rather striking and clearly brings into proper perspective the critical importance of time of flight. Suppose the target under attack is in a 3 g turn; it can be seen, from the familiar formula, $S=1/2\ at^2$, that the course will depart from a straight line by 50 feet in one second, 200 feet in two seconds, 450 feet in three seconds, 800 feet in four seconds, etc. These departures from a straight line course indicate that a "straight line" predictor would be of little value. A "curved course" computer, however, would easily give predicted points in a satisfactory manner. Such computers exist and improved models can be made. What then are the limitations of these more complex computers? It is the time required for the pilot to change the maneuver from one kind to another which we earlier assumed to be about once every ten seconds. It is, therefore, easily seen that when the time of flight exceeds the period required for the pilot to complete one maneuver and start another one it is impossible to shoot him down. It has been assumed that this time, in the future, may be about ten seconds. Thus at ranges and altitudes requiring more than about ten seconds time of flight, predicted fire is no longer satisfactory

The revolutionary "Flying Stovepipe" takes off from a ground launching platform. This model of ram jet propulsion is capable of speeds up to 1,500 miles per hour making it a potential propellant for interceptor missiles.

against a clever, maneuvering target. This emphasizes the importance of increasing muzzle velocity and improving the aerodynamic shape of the antiaircraft shell so that maximum ranges and altitudes can be obtained within this limiting time of flight.

The problem for the guided missile is to attack maneuvering aircraft beyond the effective range of guns. It is, therefore, not a competitive weapon but is designed to supplement predicted fire from guns. It may be considered that through the guiding technique, time of flight (that is time of uncontrolled flight) will be kept at a small value. This oversimplification is quite a satisfactory way of approaching the guided missile problem. In predicted fire, the shell is guided while it is still in the gun barrel. It then flies freely through the air for the time of flight to the vicinity of the target. In the missile case, the guidance continues during the entire flight so one might say the "uncontrolled time of flight" has been reduced to zero. Practically it will be found that for many technical reasons the last short part of flight is essentially uncontrolled or might just as well be uncontrolled. Thus it is more correct to say that "time of flight," in the sense of uncontrolled flight, is reduced to a small value but not to zero.

It is now timely to consider how successfully guided missiles can exploit this enormous potential advantage. A review of the guided missile art indicates that the field of propulsion is in such a state that a missile can be propelled to great distances at high speeds. Although many advances in this art can be expected even in the immediate future, these are not necessary to produce a practical propulsion system right now. Little is known exactly of the behavior of control surfaces, of lift and drag of bodies, fins and other parts of missiles and many other aerodynamic factors in supersonic flight. In spite of this lack of knowledge it appears that missiles can be made to maneuver in essentially the required manner. It is certainly to be hoped that further studies will increase our knowledge so that this part of guided missile projects will be on much firmer theoretical ground. The present lack of knowledge will be reflected in designs which are not optimum but which will behave in a usable manner. Thus we can without doubt build missiles which will be capable of the required maneuvers.

In the field of control, the picture is not quite so clear. Many systems of control have been tried with only moderate success. Control systems of the homing type, of the beam following type and of the truly remote control type have all been tried. Experimental work to date indicates that small amounts of control can be applied with relative ease. The amount of control required in an antiaircraft guided missile is relatively large due to the high speeds involved and to the target's ability to maneuver. Although no country has yet successfully developed guided missiles with adequate control for antiaircraft use, there do not appear to be any fundamental problems to overcome. The stability problem is very complex, but the solution is straightforward and does not require new developments.

A subdivision of the control problem of equal importance to stability is that of observation or more explicitly obtaining the data necessary for the exercise of control. The types of instruments involved are optical, radar, heat or other means of obtaining the relative positions of the target and the missile. Wartime developments in these fields have produced the necessary basic knowledge for assessing this part of the problem. A study of these developments indicates that adequate equipment can be designed for this part of a guided missile system for limited but useful ranges. Of course again it can be expected that great strides will be made within the next few years, but these are not required for an immediate solution.

The data which are obtained from one or more of the above means of observation must be converted into a form for the control of the missile. This must be done by some computing device. The design of computing devices is in such an advanced stage that the main problem appears to be that of deciding what is desired in the form of missile responses. It is in considering the computer problem that it becomes clear that there is the equivalent of a "human

trolled time of flight" just prior to impact. The data which the computer element in the system receives is not perfect. To correct, at least in part for these imperfections, the data must be smoothed to eliminate the greater part of the random effects. This takes time and means that the present relative position of missile and target is not known and therefore must be predicted from their known positions at some fixed interval in the past. The flight during this time interval must certainly be considered "uncontrolled." In addition, once the computer element decides what to order the missile to do, there is a delay before the missile responds to the orders which it receives. These effects may add up to as much as a second or two.

It, therefore, appears that with considerable confidence one can predict that a missile can be propelled, and controlled until it is within a lethal distance of a target. A more exact study would, after considering the warhead and the probable minimum approach distance, indicate "probability of a kill." Such studies have indicated relatively high probabilities of target destruction for attacking single aircraft having the characteristics outlined earlier in this article within a range of ten to twenty miles.

The importance of defense weapons which are capable of a very high probability of a kill with a single round and essentially certain of a kill with a very small number of rounds should not be underestimated. However, the problem of defense against thousand-plane raids such as were used during the last war is far from solved by the development of such a defensive weapon. Perhaps it would be better to use the term "saturation raids" rather than "thousand-plane raids." During the last war the principle was developed, and proved, that as the number of attacking aircraft was increased eventually a point was reached where the defense was no longer able to exert more effort. This was the saturation point. Additional aircraft attacking the target after this point had been reached were essentially immune to defensive action.

This then is the real antiaircraft problem. A defensive weapon capable of effective destruction of a single attacking aircraft is well within the reach of present technical developments. How effectively will a system of many of these weapons defend a target against multiple attacks?

The study of this problem is most complex. It involves early detection of the enemy's intentions, identification of enemy aircraft, and all the command functions associated with the control of a large network of defensive weapons. The implication of these remarks is that problems in these fields plus the communication systems to knit the defense system together are further from solution than the specific weapon development. The rapidity with which the "situation" can change requires new ideas for communications which will be required for the exercise of command functions. There is probably no doubt that paper solutions to these problems can be formulated. There is real doubt that the necessary expenditures in equipment and manpower can be afforded.

The reason behind this quandary in which the defense now finds itself is easily understood. The mobility of air attack is so great and such large concentrations of strength are available that adequate fixed defenses cannot be created in all the required areas to be defended. Therefore it is essential to create a defense which has equal or superior mobility and greater strength. In order to obtain a practical picture, from the logistic point of view, it is essential to postulate a guided antiaircraft missile with an effective range of at least one to two hundred miles. There are many technical problems to be solved for which no immediate solution is visible, before such missiles and their companion control systems can be designed.

An attempt has been made in this article to give the student of the antiaircraft problem a broad picture of the part which guided missiles should play in future defense systems. It has been intended that the following points would be brought out:

1. The guided antiaircraft missile should not be thought of as a weapon competing with guns when the time of flight is low enough for the latter to be effective.
2. At ranges up to ten to twenty miles antiaircraft guided missiles can confidently be expected to destroy single attacking aircraft having the performance characteristics noted.
3. Against massed attacks such as were used against Germany fixed defenses do not appear to be adequate with missiles which can be designed in the immediate future.

Figure I—Factors affecting Refractive Index.

WEATHER A

By Lieutenant Colonel L.

Editor's Note: This is the fourth of a series of articles by Lieutenant Colonel Orman who is now an instructor in the newly reorganized Department of Electricity and Electronics at the United States Military Academy. Prior to this assignment he was connected with the Communications and Electronics Branch, Development Section, Headquarters, Army Ground Forces and is a graduate of the Army-Navy Radar School at Harvard and MIT.

Previous articles in this series have discussed the performance of radar sets under normal operating conditions. However, as every experienced radar operator knows, the performance of radar equipment frequently departs from normal. The two reasons for the abnormal behavior of properly operating radar sets are enemy countermeasures and weather.

This section will attempt to evaluate the effect of weather upon radar sets. This topic will be discussed under the three following subheadings.

1. Effect on Radar Performance.
2. Meteorological Factors That Cause Trapping.
3. Prediction of Nonstandard Propagation.

1. *Effect on Radar Performance.*—Radar detection ranges are pronouncedly affected by meteorological conditions. Enemy ships far beyond normal radar range have been located by radar and sunk by radar-controlled fire. Convoys have been tracked on some occasions to 100 miles beyond normal radar range. On the other hand, the same radar sets a few hours later have failed entirely to pick up targets clearly visible to the eye. Experiments have shown variation in performance of a particular radar set over a three-day period. At all times during this period the set was in excellent electrical condition. Hence it may readily be seen that serious errors and false evaluation of radar presentation may result if the effects of weather and atmosphere are not considered.

As the reader will recall from his study of physics, light rays tend to bend or refract when passing from one medium to another as, for example, from water to air. Radar waves, too, are bent because the atmosphere is not a homogeneous mass. When the atmosphere is well mixed so that no unusual layers exist, standard propagation conditions prevail. Under standard conditions, the radar detection range is increased about 15% beyond the distance to the optical horizon. Wave propagation deviating from the standard occurs under special weather conditions. Weather conditions may result in an increase or a decrease of normal radar range. Those cases in which the radar detection range is increased are called variously; guided propagation, anomalous propagation, or trapping.

The main feature of guided propagation is a pronounced bending of the radar beam toward the surface of the earth. This pronounced bending is due to refraction and occurs in the layers of the atmosphere which are less than 5,000 feet high. The amount of bending in the regions above this height is almost always normal. There will be formed within this lower area a sort of duct* or waveguide in which the radar waves can be trapped, hence the term "trapping." The duct in the atmosphere may be formed along the surface of the sea or elevated above the earth. In either case the coverage of the radar will be changed by the great extension of detection range for targets within the duct.

The location of the antenna relative to the duct is the most important factor in controlling the effect of trapping. If the antenna lies within the duct, the radar pulse can be trapped and carried out to very distant targets and back to

*A duct is a region in the atmosphere where temperature and humidity conditions cause radio energy to travel between two levels (the top and bottom of the duct) much the same as in waveguides. Usually the bottom of the duct is the surface of the ground or sea.

ND RADAR

rman, Coast Artillery Corps

the radar. Trapping is less likely to take place if the antenna lies below the duct. The location of the antenna above the duct may create some blind zones not present in normal weather. An airplane flying over a ground-based duct will experience no change in its radar coverage pattern due to the presence of the duct.

Since ground force radars are located at ground level they are the type most likely to experience ground based ducts. Experiments both abroad and in this country have indicated that low sites are generally affected by trapping while high sites experience this phenomenon relatively infrequently. Directly above the duct there may be little or no energy and targets flying there may be undetected. Targets well above the duct will be detected because they will be reached by energy which has entered the duct at too great an angle to be trapped.

The wave length that can be trapped in the duct formed by abnormal weather conditions varies with the height of the duct. The effect of weather on radar detection ranges increases with an increase in radar transmission frequency. If the duct is 400 feet high all radar frequencies will be trapped within it. Decreasing the height of the duct shortens the maximum wave length that can be trapped. Since all radars now adopted as standard by Army Ground Forces use microwave lengths, these radar sets are very likely to be affected. A duct almost always exists within the first twenty feet above the water. Although this duct is too low to trap wave lengths now being used, the present trend toward shorter and shorter wave lengths may cause additional problems in the future.

When radar is used for antiaircraft fire control, the targets are usually at medium or short ranges and the angle between the line of sight and horizontal is usually large enough so that no trapping will take place.

When radar is used for long-range air search, performance will be affected by meteorological conditions only for those targets below 1° position angle.

A coverage diagram of a particular air search radar set is shown in Fig. II to illustrate duct formation.

The diagram clearly indicates that the great change in range is caused by the formation of the duct.

The accuracy of measurement of altitude by radars that use lobe switching, such as Radio Set SCR-584, should not be affected by trapping conditions, because when targets are at a position angle at which accurate measurement is possible, the radar waves make too great an angle with the horizontal for them to be trapped.

A very serious operational consequence of trapping is the misleading of radar

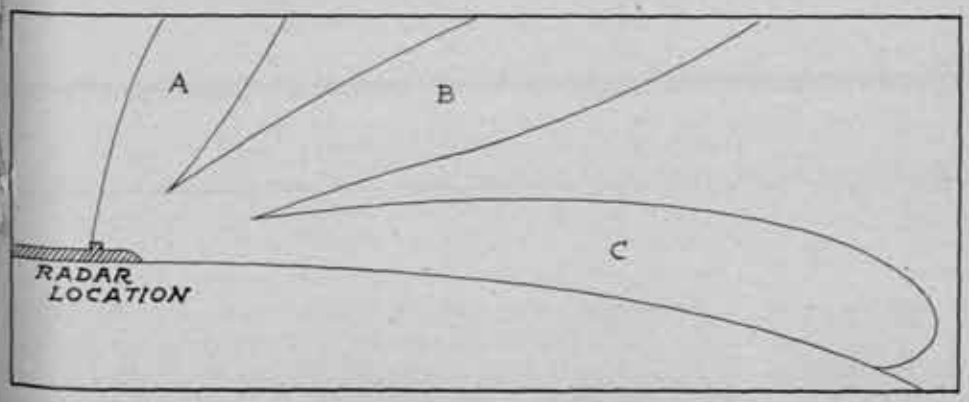
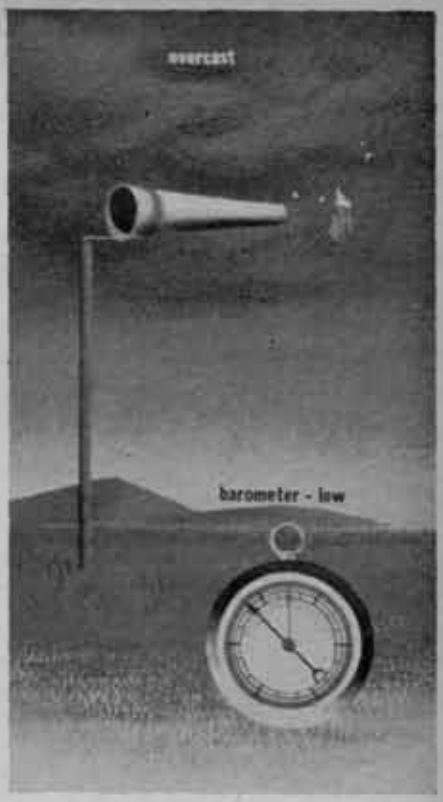


Figure II—Lobes of type A and B unaffected by meteorological conditions. Lobe C is the type of lobe which forms ducts.



The sketch above indicates conditions which tend to standard propagation.

The sketch below indicates conditions under which guided propagation may be expected.

Figure III—Atmospheric conditions and propagation.

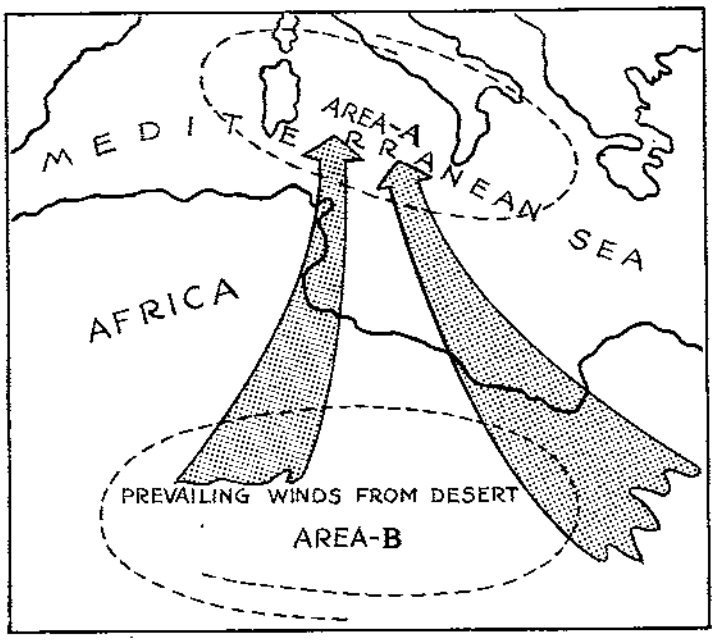


Figure IV—Conditions causing temperature inversion and moisture lapse.

operators as to the over-all efficiency of the set. It seems logical to assume that when targets are being picked up at extremely long ranges the equipment is operating at peak performance levels. Precisely the opposite may be the case. However, targets which are near by may still be used as a criterion of over-all set performance since the echoes from objects well within the optical horizon are not affected appreciably by propagation variations.

In rare cases, skip distances may be responsible for the failure of IFF.

Violent fading of echoes appears to be a characteristic feature of trapping conditions. This fact should aid the operator in realizing when such conditions exist. Such fading is of large amplitude perhaps involving an echo power change of 1,000-fold, and the echoes vary over a period of approximately 15 minutes.

Other abnormal weather conditions tend to bend radar waves up instead of down thus tending to decrease the detection range obtained. Fortunately these conditions are rare.

Airplanes often try to sneak in, avoiding radar detection by flying very low. If a duct is formed near the surface of the water such action would probably result in the detection of the plane even earlier than normal.

To summarize, the changing propagation conditions that radar waves may encounter can have considerable effect on radar performance.

The effect of trapping may be to:

(a) Increase the range of detection for surface vessels and low-flying airplanes.

(b) Reduce the range of detection for surface vessels and low flying planes in some instances.

(c) Reduce the range of detection for airplanes flying just above a duct.

(d) Cause errors in height finding for radars that do not use lobe switching.

(e) Increase the extent of sea return clutter, and thus reduce the operational efficiency of radar equipment.

However, weather effects cannot be blamed indiscriminately for variable radar performance. In general, internal conditions or poor adjustment will cause greater changes in range performance than variation in weather. For example, the failure of an air search set to detect a high-flying plane at short ranges cannot be attributed to abnormal propagation conditions since trapping affects the detection of targets only at *low* angles above the horizon.

2. *Meteorological Factors That Cause Trapping.*

(a) Standard Conditions.

When the atmosphere is well mixed so that no unusual temperature or humidity gradients are likely to exist, standard propagation conditions should prevail. Considerable mixing of the atmosphere occurs with high gusty winds or in a region of low barometric pressure which is usually accompanied by turbulence. Standard propagation is likely also when the sea is colder than the air, or over land when cooling of the earth by radiation is limited by overcast skies. If rain is falling, the lower atmosphere in general will be saturated with water vapor, so that the existence of abnormal humidity gradients is prevented and propagation should be standard. (Fig. III.)

(b) Nonstandard Conditions.

In the standard atmosphere, both the air temperature and the moisture content decrease uniformly with height above the surface of the earth, so that the index of refraction of the atmosphere also decreases uniformly. However, the atmosphere is subject to many changes. Changes in atmospheric conditions will result in a change in the index of refraction of radar waves as we have seen. The temperature may, for example, first increase with height and then begin to decrease. This situation is called a TEMPERATURE INVERSION. Or, the moisture content may decrease markedly with height. This latter condition is referred to as a MOISTURE LAPSE. A moisture lapse alone, or in combination with a temperature inversion, may produce the formation of ducts and cause the guided propagation (trapping) that we have discussed. The humidity gradient is such that the rays from the radar antenna are bent an excessive amount, and they are trapped in a zone near the surface of the water.

To illustrate the conditions for temperature inversion and moisture lapse, the Mediterranean area north of Africa can be taken as an example. (Fig IV.) Winds blowing from the south across the Sahara Desert produce a movement of dry air which flows over the cooler moist air above the Mediterranean. This warm air from the desert region flowing over the cooler air of the Mediterranean areas produces temperature inversion. Likewise the air from the desert regions will be drier than that over the Mediterranean area and an increased moisture lapse is produced. The result is that in the Mediterranean area extended radar detection ranges are the rule. Conditions similar to these occur anywhere that wind is blowing from land to sea. However, the results may not be so pronounced as in areas similar to the Mediterranean area. Ducts of this sort will form only when there is a distinct temperature difference between the sea and the air blowing from the land. Hence, conditions are most favorable for trapping in the summer months.

Over the open ocean, a surface duct may be formed by cool air blowing over a warmer sea. The entire effect is ap-

parently caused by the evaporation of water into the lower levels of the atmosphere since temperature inversion is not present in this case. The height of the duct increases directly with wind speed. Ducts of 50 to 60 feet high are common throughout the Pacific Ocean. These ducts are high enough to entrap the frequencies of Army Ground Radar sets and are important because they extend for long distances.

SUBSIDENCE is another weather phenomenon favorable to trapping. Subsidence may be defined as the slow downward movement of air masses combined with horizontal movement. In general, subsidence occurs at an altitude of from 4,000 to 5,000 feet and is therefore unlikely to affect most radars which are usually located at much lower altitudes. Lower subsidence areas do, however, occur along the southwestern coast of the U. S. and in parts of the world which have a monsoon type of climate.

Other meteorological conditions that may produce trapping are cooling of land at night by radiation and the mixing of the masses of air as at a warm or cold front. The ducts formed by these effects are likely to be of such limited extent that they are unable to modify radar propagation by any appreciable amount.

3. *Prediction of Nonstandard Propagation.*

In spite of the fact that the relation of weather to the production of trapping conditions is not fully understood, enough is known to permit a meteorologist to make a fairly reliable prediction. Considerable equipment is required to measure the several variables that must be known to determine the structure of the atmosphere, and rather specialized meteorological skills are needed to interpret the data. However, even in the absence of specialized equipment and personnel, it may sometimes be possible to predict the formation of ducts from observation of weather conditions.

For a number of reasons the meteorological conditions in a region of high barometric pressure are favorable for the formation of ducts. Among the favorable factors are: subsidence, which creates temperature inversions, and which occurs in areas where the air is very dry so that evaporation can take place from the surface of the sea; calm conditions that prevent mixing of the lower layers of the atmosphere by turbulence, allowing thermal stratification to persist and clear skies which permit nocturnal cooling over land. Near the coast, trapping will be found to be the strongest just after noon and weakest just before dawn. The conditions in a barometric low, on the other hand, generally favor standard propagation. A lifting of the air, the opposite of subsidence, usually occurs in such regions and it is accompanied by strong winds. The combined effect of these factors is to destroy any local stratification of the atmosphere by a thorough mixing of the air. Moreover, the sky is usually overcast in a low pressure area and nocturnal cooling is therefore negligible. Very often rain falls in a low pressure area and the falling drops of water have the effect of destroying any nonstandard humidity or temperature gradients that may have been established.

In all of the weather conditions that produce trapping, the atmosphere must be sufficiently stable to allow the necessary stratification of the atmosphere to be established and to persist. Thus, continued calm weather or moderate breeze

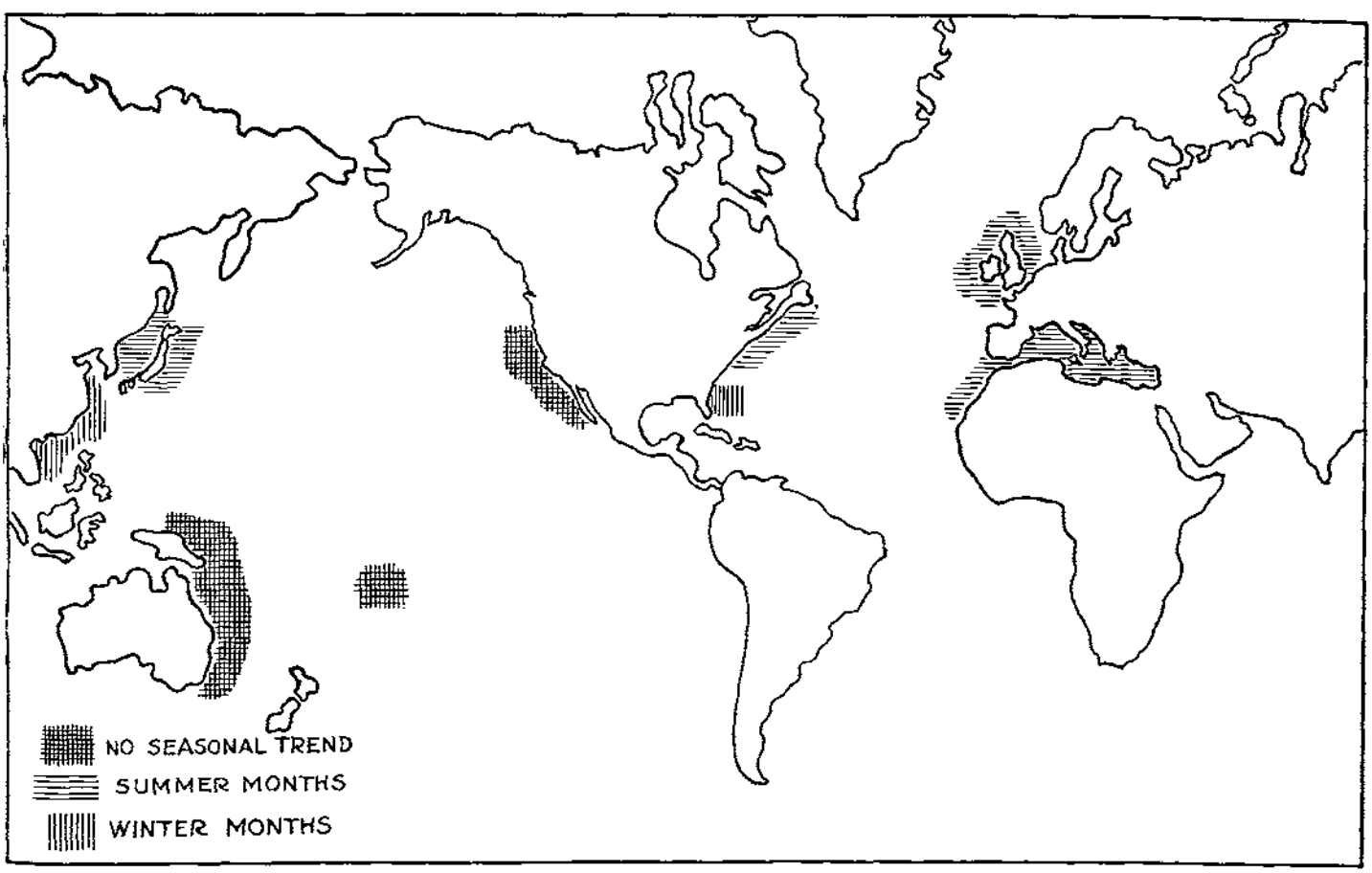


Figure V—Areas known to experience trapping conditions.

is necessary. It must be emphasized, however, that even if weather conditions may favor the formation of ducts, they do not always produce them.

In terms of the readily observable phenomena, the weather conditions that may favor trapping are:

(a) A moderate breeze that is warmer than the water, blowing from a continental land mass.

(b) Clear skies, little wind, and high barometric pressure.

(c) A cool breeze blowing over the open ocean far from large land masses, especially in the tropical trade wind belt.

(d) Smoke, haze or dust fails to rise but spreads out horizontally, indicating quiet air in which a temperature inversion may exist.

(e) The air temperature at antenna level definitely exceeds that of the sea or land, or when the moisture content of the air at antenna level is considerably less than that just above the water and the air is relatively calm.

Although trapping conditions can occur at any place in the world, the climate and weather in some areas make their occurrence more likely. In some parts of the world, particularly those possessing a monsoon type of climate, variation in the degree of trapping is mainly seasonal and enormous fluctuations from day to day may not occur. In other parts of the world, especially those in which low barometric pressure areas recur often, the extent of nonstandard, propagation conditions varies considerably from day to day, even during the season of greatest prevalence.

Even though the geographical and seasonal aspects of trapping are not yet firmly established, it is possible to make a general summary. (Fig. V.)

(a) Atlantic Coast of U. S.—Along the northern part of this coast, trapping is common in summer while in the Florida region, the seasonal trend is the reverse with a maximum in the winter season.

(b) Western Europe—On the eastern side of the Atlantic, around the British Isles and in the North Sea, there is a pronounced maximum of trapping conditions in the summer months.

(c) Mediterranean Region—Reports indicate that the seasonal variation is very marked, with trapping more or less the rule in summer, having been observed then on 9 days out of 10, while conditions are approximately standard in winter. In the wintertime, however, the climate in the central Mediterranean is more or less a reflection of Atlantic conditions and hence, it is not favorable for duct formation.

(d) The Pacific Ocean—This region appears to be one where, up to the present, least precise knowledge is available. However, there seems to be definite evidence of the frequent occurrence of trapping around Guadalcanal, the east coast of Australia and around New Guinea. Observations along the Pacific coast of the U. S. indicate frequent occurrence of trapping but no clear indication of its seasonal trend is available. The meteorological conditions in Japan are approximately like those off the northeastern coast of the U. S. Therefore, trapping in this area should be common in the summer. Conditions along the south China coast approximate those off the southeastern coast of the U. S. only during the winter months when trapping can be expected. During the rest of the year, the Asiatic monsoon modifies the climate in this area and no data are available as to the prevalence of trapping during this time. The trade winds in the Pacific lead to the formation of rather low ducts quite generally over the open ocean.

In general, we may summarize by saying that radar operation is NOT completely independent of weather conditions as was originally thought to be the case. Weather conditions can cause an increase or a decrease in maximum range detection. With a forewarning that such conditions do exist in certain parts of the world during certain seasons and that they may possibly occur almost any place at any time, the user of the radar set expects such conditions and is better able to recognize and evaluate them properly when they do occur.

AUTHOR'S NOTE: Thanks are expressed to Lieutenant Colonels Rex Heinlein and R. E. Applegate of the Department of Electricity, U. S. Military Academy, for their helpful suggestions in the preparation of this article.

Address for Christmas Cards

It has been proposed by several subscribers that the JOURNAL aid members of the Coast Artillery Corps in mailing out their Christmas cards by publishing a list of addresses of members of the Corps in the September-October issue.

To make this possible we must have the cooperation of all our subscribers and friends.

Please publicize our intention among your Coast Artillery friends and ask them to send their addresses to the JOURNAL. If you are a subscriber and we have your correct address please do not forward it as we plan to extract all the addresses from our files.

Infantry Conference at Fort Benning

On 10 June, more than 200 officers gathered at Fort Benning, Georgia, for the first peacetime Ground Forces Infantry conference in history.

The session lasted until 22 June and during the twelve-day period the conferees studied current training conditions and methods, analyzed the needs of the Infantryman, witnessed demonstrations of the latest in weapons and equipment and planned the future of that slugger who has never lost a war—the American Doughboy.

From every American theater of operations came battle-wise war veterans, schooled in the Pacific's coral islands and on rugged campaigns from Normandy to the Aleutians, all seeking to pool their knowledge and map future plans for the Infantryman in an age where "push-button" war may become a reality.

The commanding generals of the six American armies were present at the sessions in the field and at the conference table. Also included in the list of delegates were General Jacob L. Devers, Commanding General, Army Ground Forces; General Omar N. Bradley of the Veterans' Administration and senior commander of ground troops in the Normandy invasion; Major General Leslie R. Groves, head of the Army's atomic bomb developments; and Major General William J. Donovan, war leader of the "cloak and dagger" group of Office of Strategic Services.

Host at this meeting, the third of a series of conferences, was Major General John W. O'Daniel, Commandant of the Infantry School and former commander of the Third Infantry Division which fought from Anzio to Berchtesgaden under his leadership. Two former conclaves, the first at Fort Sill, Okla., and a second at Fort Knox, Ky., discussed plans for the Field Artillery and the Armored Forces. The Field Artillery conference was discussed in the May-June issue of the JOURNAL. The CAC conference will probably be held at Fort Bliss in the near future. The JOURNAL will publish complete details when available.

The pace-setting program led off with discussions of past lessons, emphasizing utilization of fire power to protect the foot-trooper and allow him to advance under better protective cover. However the real problem of the conference was to devise how best to fit the Infantryman into warfare where the atomic bomb is but one of his worries.

Significant to all Coast Artillerymen, much of the allotted time was occupied in discussions on the Advancement in Radar technique and recent "guided missile" tests at White Sands, New Mexico. Dr. H. J. Stewart, pioneer in

The various contemplated uses of the versatile helicopter are explained to conferees.

Civilian technician demonstrates the new portable ground radar set which is capable of detecting the enemy at extremely close ranges.

the field of guided missiles, flew from the California Institute of Technology to address the delegates on this subject while Dr. I. A. Getting and Prof. W. H. Radford of the Massachusetts Institute of Technology discussed advances in radar equipment and technique.

Discussion of the possibility of an inter-planetary missile propelled by nuclear reaction such as made possible by the atom bomb came in Dr. Stewart's lecture. He said "If as much as one per cent of the energy released in the nuclear disintegration of uranium or plutonium could be made available in a propulsive system, it should be possible to produce an inter-planetary missile."

A demonstration conducted by Army Ground Forces Board No. 3 showed the characteristics of the helicopter and some of the uses to which it can be adapted such as evacuation, reconnaissance, observation, photography, column control, wire laying and courier missions. It was stressed however that at its present stage of development, the helicopter should be considered as a supplement to, rather than a replacement for, the standard liaison planes.

One of the highlights of the demonstration phase of the conference was the joint Air Force-Airborne tactical exercise. In this exhibition, emphasis was placed on the features and characteristics of powered aircraft and gliders with particular emphasis on their capabilities to transport the personnel and equipment of an infantry division. The precision, coördination and close coöperation necessary between air force and airborne units to effectively accomplish an airborne mission was colorfully demonstrated. Although not a record, it was interesting to note that the 75mm pack howitzer was in operation four minutes and fifty seconds from the time the crew and the weapon left the aircraft. The aircraft was at an altitude of 800 feet when this demonstration was initiated.

Much of the matériel and some of the discussions were of a classified nature with the result that publication of particulars is forbidden at this time.

In this category falls the fifty-minute address by Major General Leslie R. Groves on atomic energy and details of the Ground Radar set AN/PPSI which is used for the detection of enemy personnel at close ranges.

The demonstration of the 90mm gun mounted on a medium tank was most impressive. Three blazed away at a target almost 20,000 yards away, firing thirty rounds of A.P. ammunition in one minute. During this firing, many direct hits were made to the obvious delight of the conferees.

The modified version of the M-1 rifle was viewed with much interest. The rifle with the modification becomes a magazine fed shoulder weapon with a greatly increased rate of fire. The magazine is the same one as used on the Browning Automatic rifle and the relative fire power is as great if not greater than this weapon yet the modified version of the M-1 weighs but one pound more than the present rifle.

In addition to the demonstrations and discussions, both The Infantry School and The Airborne School presented descriptive exhibits which included tanks, recoilless rifles, rocket launchers, flame throwers, radios, homing devices, communications equipment and airborne large caliber howitzers. One very interesting piece of communications equipment was the emergency switchboard SB18-TG. This board weighs only 2¼ pounds and is really a "vest pocket" model but can accommodate six trunk lines in addition to the operator's.

To accomplish the studies of the 61 separate questions which formed the basis for concrete recommendations pertaining to the Infantry organization, the conferees were divided into five separate committees and twenty-one subcommittees.

The committee on Organization was headed by Brigadier General Frederick McCabe, Headquarters, Sixth Army; Personnel, Policies and Procedure by Brigadier General I. C. Thorson, Headquarters, First Army.

Two committees on Tactics and Technique were headed by Major General James A. Gavin, Commanding 82d Airborne Division and Brigadier General H. N. Hartness, President of AGF Board No. 3, Fort Benning, respectively. The committee for Equipment and Supplies was led by Brigadier General Clyde D. Eddleman, AGF.

The last two and one-half days of the conference were devoted to the presentation of the committee studies before the assembled delegates at which time final discussions were held and votes cast.

At the conclusion of the conference there was a decided optimism and satisfaction expressed by all delegates not only at the manner in which it had been conducted but on what had been accomplished.

Battle Accomplishments of the 34th AAA Brigade

By Lieutenant Colonel Tom W. Sills, Coast Artillery Corps, Brigade S-I

(Editor's Note: This is the first of a series of short histories of the major antiaircraft commands of the war. For complete details of our contemplated program turn to the News and Comment section of this issue.)

The outstanding achievements of the 34th AAA Brigade in the battles of North Africa, Sicily, Italy and later in France and Germany, are a matter of record. Arriving in England in July 1942 the long path of its battle accomplishments led it successively to North Africa, to Sicily, to Italy and finally to Germany via Southern France. In North Africa its units first defended the critical port of Oran and later the vital airfields of the strategic air force from which flew the planes that helped to smash Rommel's last drive in Tunisia while softening the enemy resistance in Sicily and Italy for the coming invasion. In Sicily, among other objectives, its units defended the vital port of Palermo against repeated attacks. In Italy, beginning at the Gustav line it joined the French forces and fought with them up the Italian peninsula far beyond Rome before it left to join in the great drive against the main enemy armies in Europe.

To start at the beginning, the brigade was activated 10 February 1941 at Fort Bragg, N. C. with Colonel Claude M. Thiele assigned as commanding officer. Units initially assigned to the Brigade were the 67th, 76th and 77th AAA Regiments. With the arrival of selectees to bring all units to full strength, the task of training commenced.

Training in those days was a bit difficult because of the lack of equipment; there were all too few 3", 37mm, and 50 caliber weapons in the brigade. However, the troops gained familiarity with their weapons by rotating such guns and fire control apparatus as were available among the units. Better luck was had with searchlight equipment, for the full complement of lights, sound locators, and other apparatus reached all units with little delay. In May 1941 a practice firing range was established near Myrtle Beach, S. C., and each of the three regiments stayed there for about a month, firing at both sleeve targets and waterborne targets. In the fall of 1941 the Brigade took part in the Carolina maneuvers, including a joint maneuver with the 3d Interceptor Command along the Carolina Seaboard, during which the working effectiveness of interceptor aircraft, antiaircraft artillery, and the civilian warning service in detecting and repelling enemy aircraft was tested and developed. The experience gained was invaluable. Troops were hardened to field conditions.

With the declaration of war against Japan on 8 December 1941, the Brigade (less attached units) moved immediately to defensive positions along the Atlantic Coast. Brigade Headquarters was set up in Norfolk, Virginia where it assumed command of the AAA Regiments which had already arrived there to form the antiaircraft defenses of the Norfolk region.

In July 1942 the Brigade, then commanded by Brigadier General L. L. Lemnitzer was ordered to England, where its first job was to complete the training and equipping of all U. S. AAA units in the United Kingdom scheduled to take part in the invasion of North Africa. On 8 November 1942 Brigade units landed at Oran and Arzew. The Brigade was charged with the antiaircraft defense of the Oran area, which included the ports of Oran, Mers-El-Kebir, Mostaganem, and Arzew, and the airfields of LaSenia, Tafaroui, Perregaux, and Nouvian. As the front moved eastward the Brigade was ordered to Constantine, Algeria in February 1943, where it took over from the British 52 AAA Brigade the responsibility for antiaircraft defense of airdromes and installations in the Constantine-Telergma area as follows: City of Constantine and supply installations there; the important railhead at Ouled Ramoun; Telergma Airfields and Air Corps supply depot there; airfields at Berteaux, Ain M'lila, Chateaudun, St. Donat, Navarin, Canrobert, Oulmeme, Sedrata, and Monesquieu (all airfields of the Bomber Command which was playing such a big part in the campaign by knocking out Axis strategical centers). Toward the close of the Tunisian campaign the enemy on several occasions dropped Italian parachutists in the Telergma-Constantine-Tebessa Areas with primary mission of blowing up allied planes, bridges, and dumps. Several of these parachutists were captured by searchlight sections of the Brigade before they could carry out their missions.

Signal Corps Photo

Brigade experiences in Africa, Sicily and Italy contributed to the fortification of this 90mm battery position in France.

Signal Corps Photo

The alert sounds and men of Battery G 209th AAA Regiment rush to their guns in Berteaux, North Africa.

In May and June 1943 the Brigade assisted in the planning for the invasion of Sicily by the U. S. Seventh Army. Units of the Brigade were attached to assault forces which landed at both Licata and Gela on 10 July. At Gela a 40mm Battalion saved the day by destroying German tanks at close range when it seemed certain that our forces would be driven back into the sea. In Sicily the mission of the Brigade was the antiaircraft and coastal defense of all airfields and ports in the U. S. (western) half of the island, which included the ports of Termini, Palermo, Porto Empedocle, Licata, and Gela; airfields at Termini (2), Palermo, Trapani Milo, Bo Rizzo, Castelvetrano, Sciacca, Licata, Gela (3), Ponto Olivo, and Comiso. There were more than 15,000 antiaircraft artillery troops under the Brigade, then commanded by Brigadier General Aaron Bradshaw, Jr., who relieved General Lemnitzer on the eve of the departure of the Brigade from Bizerte for Sicily. In three enemy raids on Palermo in August 1943, Brigade units destroyed 12 German bombers. During the preparation for and landing phase of the initial landing of the U. S. Fifth Army in Italy in September 1943, Brigade units were given the responsibility of protecting troop landing areas and beaches used to rest troops on their way to the invasion beaches. Immediately after the landings were made in Italy, Brigade units began movement to Italy, and later to Sardinia and Corsica. During the period the Brigade remained in Sicily after the close of the campaign there, a rigid training schedule was prescribed for all units.

On 26 March 1944 the Brigade moved by convoy from Palermo to Venafro, Italy where a Fifth Army order attached it with its assigned units to the French Expeditionary Corps, then stalled before Cassino by stout German resistance. On 22 March 1944 the Germans made a daylight raid in force over the Fifth Army front. Twenty planes were brought down by antiaircraft fire of Brigade units, and never again did the Germans risk their dwindling air force in a mass daylight raid in Italy.

In the Allied push on Rome which began on 11 May 1944, the Brigade experienced its first really tough field "soldiering" of the war. From then on canvas pitched in the mud became its regular habitat. By 4 July the Brigade had moved twelve times in the rapid advance of the French Corps that swept the Germans before them. Brigade Units covered themselves with glory in repelling nightly air attacks and in supporting Corps artillery in ground missions. At Siena on 8 July 1944 the Brigade received orders to move at once to the Naples area for assignment to the U. S. Seventh Army then preparing for the invasion of Southern France. After the landings at St. Tropez on 16 August 1944, the original plans for the Brigade to provide the antiaircraft defense of Toulon and Marseille upon their capture were changed, and the Brigade moved instead to Aix-en-Provence where it was attached to French Army B. The Brigade served with the French during their drive up the Rhone Valley, having the mission of providing heavy antiaircraft defense of the entire army zone of action and light antiaircraft defense of army installations such as dumps, railroads, and bridges. With the halt of the French offensive and the German threat to retake Mulhouse in December 1944, it became necessary to readjust all forward antiaircraft units. AW units were deployed in the front lines with or in front of the infantry. Nearly all 90mm units had to redeploy to escape artillery fire.

On 24 March 1945 the Brigade was relieved from attachment to the French Army and attached to the U. S. XXI Corps for operations. In addition to controlling all antiaircraft artillery for the Corps, the Brigade was also charged with rear security. Air activity at this time was greater than at any time since Italy. From this time until the end of the war there was rapid advance into Germany. The Brigade crossed the Rhine River bridge at Worms on 29 March. On 29 April the Brigade crossed the Danube River at Dillingen and moved to Haunstetten, south of Augsburg. The city of Haunstetten had been surrendered to an officer of the Bri...

de on 28 April. The end of the war found the Brigade lo-ated at Nussdorf across the Inn River.

For the period throughout the campaigns that led the rigade from Southern France to the heart of Germany, a otal of 75 enemy planes were destroyed and 37 probably estroyed by Brigade units. The "Nineties" were used in upport of field artillery to the extent of 87 successful mis-ons. Damage to installations in the Brigade areas of re-onsibility from enemy air action was negligible.

From Pearl Harbor to VE-Day the Brigade travelled from ort Bragg to Norfolk to England to North Africa to Sicily o Italy to France and to Germany. It was the "travelling-st" Brigade of them all. It won the respect and friendship f both U. S. and Allied units with which it worked. The llowing letters of commendation from General Alphonse uin of the French Expeditionary Corps and Lt. General Mark W. Clark of the U. S. Fifth Army attest to this fact.

* * *

HEADQUARTERS
FRENCH EXPEDITIONARY CORPS
IN ITALY

10 June 1944

Col. J. S. Robinson
Commanding Officer
34th AAA Brigade

Dear Colonel:

It gives me great pleasure to congratulate you on the part aken by the 34th AAA Brigade in the breakthrough on the Garigliano front and the advance on Rome.

Please transmit my congratulations to all the units under our command for their part in the battle both for the ground fires supporting the Corps Artillery and their fires gainst night air attacks. Like yourself, all your personnel have given proof during these operations of fine comradeship and coöperation. This has contributed in cementing the ties of affection which unite our two armies in their common effort against the German Army.

(Signed) A. Juin,
Commanding General.

HEADQUARTERS FIFTH ARMY
A.P.O. 464, U. S. Army

26 August 1944

SUBJECT: Commendation.
TO : Commanding Officer, 34th AAA Brigade.

1. It was with deep regret that I noted the departure of your excellent unit from my command.

2. During its period with Fifth Army your command rendered most outstanding service. Not only did you perform your difficult mission of organizing and coördinating the operations of both French and American AAA units in support of the French Expeditionary Corps in a highly efficient manner, but in so doing you evoked the highest coöperation and lasting admiration and respect of your French comrades in arms, an accomplishment which is worthy of the highest praise.

3. Your command contributed greatly to the efforts of your fine arm, which has consistently done so much to prevent the German Air Force from ever materially interfering with any of our combat operations. Please convey to your officers and men my sincere thanks and appreciation for their outstanding services and my best wishes for their welfare and continued successes.

(Signed) Mark W. Clark,
Commanding
Lieutenant General, U.S.A.

Officer Candidate Training Consolidated

In order to standardize the training of officers for the ground arms and services, a new Army Officer Candidate School program has been established at Fort Benning, Georgia. All schools now in operation will be discontinued after graduation of those classes which were enrolled prior to September 1, 1946.

Training will be extended from the present 17-week course to a 24-week course composed of two phases. During the first phase of eight weeks, the candidates will be thoroughly screened to insure retention of only the most promising cadets. The subjects to be studied during the trial period include physical conditioning, weapons training, elementary infantry tactics and military courtesy.

Those who meet the requirements will receive instructions in administrative, supply and disciplinary functions of company officers in the second phase of 16 weeks.

Three classes of 200 men each will enter every two months from quotas allotted each arm and service. The successful candidates will be commissioned second lieutenants in the Army of the United States.

Following graduation, the new officers will attend an associate basic course of their arm at one of the following ground force or technical schools for three months or five months, respectively:

The Armored School, Fort Knox, Kentucky
The Infantry School, Fort Benning, Georgia
The Field Artillery School, Fort Sill, Oklahoma
The Antiaircraft Artillery School, Fort Bliss, Texas
The Coast Artillery School, Fort Scott, California
Transportation Corps, Fort Eustis, Virginia
Signal Corps, Fort Monmouth, New Jersey
Engineer Corps, Fort Belvoir, Virginia
Ordnance Department, Aberdeen Proving Ground, Maryland
Quartermaster Corps, Camp Lee, Virginia
Chemical Warfare Service, Edgewood Arsenal, Maryland
Chaplain's School, Fort Oglethorpe, Georgia
Adjutant General's School, Fort Oglethorpe, Georgia
Provost Marshal's School, Camp Bullis, Texas

Upon completion of the associate basic course the officers will be available for assignment.

In Vain Do They Seek a Defense Against Lightning

By Lieutenant Colonel Albert J. Weinnig, Coast Artillery Corps

Editor's Note: Colonel Weinnig has been AAF Liaison Officer with the Navy since October 1945 and for the purpose of working with the Navy's Guided Missile Project at Johns Hopkins University. This is the project with the code name "Bumblebee."

Is there no defense against the V-2? Responsible American citizenry, both lay and professional, sink deeper and deeper into an abyss of frustrated meditation when they are assured of the potentialities of the German rocket projectile (V-2) armed with an atomic warhead. They sense complete ruin and devastation not only of civilization but of humanity itself—unless a positive means of defense can be devised. Authoritative thought on the problem is represented by a collection of articles in the recent publication *One World Or None*, especially that of Dr. Louis N. Ridenous who like the ancient Roman, Publius Syrus, writes under the title of "There Is No Defense." I cannot ascribe to the dismal (although perhaps realistic) views of most professional thinkers of an impending cataclysm, but I do think that it is highly proper for antiaircraft people to consider how they will fit into the scheme of national security in the light of new methods of warfare and to seek out probable developmental trends in antiaircraft material. This article represents my personal thoughts on the future role of antiaircraft at the outbreak and during the first phase of the next war, and my speculations on future antiaircraft weapons.

"Push-Button War"

By far the most absorbing study is the general conception of the "push-button war." It is interesting because all of the problems are solved simply by the easy statement that our scientists can develop this or that gadget of extraordinary characteristics. As representative of the age of push-button war, we visualize a world around which are revolving an undetermined number of rocket satellites armed with atomic charges. It is an unfriendly world, keyed for instantaneous counterattack, sensitive to slight rebuke and insults and triggered to cascade complete devastation on a neighbor at the slightest affront. Civilization, having "progressed back" to the age of cave dwelling, has sought protection underground. It is an age of the political-scientist and scientific-militarist, of universal television and radio telephony, of world-wide radar coverage and perhaps of interplanetary travel. Man's use of atomic energy has advanced from the present beginning of initiating destructive atomic fission to the state where he can control and use the energy which the atom releases as it is dismembered. This means tremendous power and the logical development of the long-heralded death ray or destructive beam. This, however, is a situation beyond my belief. I believe, perhaps ideologically, that man will have either devised a social order which outlaws war or that being impossible *one* strong nation will impose a world-wide peace by force.

The above thoughts are not founded on present scientific achievement or attainable objectives but are philosophical thinking (crystal ball gazing) pure and simple. However, they are valuable in any attempt to assess the role of the antiaircraft people in the distant future.

Role of Antiaircraft in the Immediate Future

Antiaircraft artillery will play an important part in our plan for national security in the peacetime era. In order to visualize this role, one must make an estimate of the situation—an operation which is in itself fraught with pitfalls as it is based upon calculated guesses. It concerns such unpredictables as the ambitions of the nations of the world, the American public, the size of the postwar armies, military legislation by Congress, and the use of the atomic bomb. All too often in the past, the planners were prone to prepare for the future defense on conditions that existed at the last phase of the preceding war. Fortunately, wise publicity has impressed us all with our present weaknesses. Today, we do not have the best Army, Navy or Air Force in the world as we did on V-J day. We do not enjoy preponderant air superiority. And so, even the nonmilitary writers have foreseen the development of a defense by counteroffensive. As General Arnold has said "Our first defense is the ability to retaliate even after receiving the hardest blow the enemy can deliver." So the initial and active role of antiaircraft in the immediate future will be the protection against air attacks of air bases, industrial centers and communication centers in an attempt to minimize the destruction of an initial surprise attack so that a retaliatory atomic counteroffensive can be launched.

I believe that the antiaircraft defense in the immediate future must cope with the high-flying, globe-circling super bomber of the B-29 type which will attack with atom bombs in numbers designed to saturate the antiaircraft and fighter defense. I do not believe that missiles of the German V-2 type will be a threat to the United States in the near future. Their range is relatively short (200 miles) and cannot be increased with present means of propulsion without the missile losing the characteristics which make it invulnerable. The Germans had planned on using a long-range V-2 missile against the United States, but this had wings which decreased its speed and introduced large-scale aiming errors. Our objectives for the present must be the improvement of conventional antiaircraft weapons and the development of a ground-to-air guided missile which will enable us to secure the 100% destruction of improved aircraft.

Indicated Trends for Conventional Antiaircraft Artillery

One needs only to study carefully the sagas of two antiaircraft campaigns of World War II to discover the indicated developmental trends in antiaircraft artillery in the immediate future. One story concerns the successful engagement of the V-1 by the antiaircraft defenders of London and Antwerp; the other is the frantic all-out effort

*Member 1938 of Public Speaking 42 B.C.

the German antiaircraft to drive the American Air Force from their targets. The German effort and experience will probably exert the greatest influence on future antiaircraft trends in our Army as our problems of antiaircraft defense will very likely be the same as those which confronted Germany in 1944 and 1945. After studying the above campaigns (and avoiding the complex study of necessary organizational changes), I believe that the following lessons should be learned:

1. The mission of antiaircraft is the 100% destruction of enemy aircraft and long-range guided missiles. The deterrent mission must be discarded because of the demonstrated determination of the aviator to press home an attack regardless of losses and because of the advent of pilotless guided missiles.

2. Early warning must be improved. Range of radar coverage must be extended perhaps by means of the so-called stratoliner type of flying antenna to overcome line-of-site difficulties. Dissemination of information must be made instantaneous and widespread to the individual organizations.

3. A positive means of recognition must be developed. The system must be simple, foolproof, secure, and adaptable to combined and joint operations. This might require the development of "gadgetry" based on an entirely new principle, or more probably, the coordination of all the present methods of recognition.

4. Gun-laying radar must be improved: it must be developed for automatic weapons firings; it must have improved early warning characteristics; it must be fully automatic in tracking (azimuth, elevation and range); it must not be susceptible to jamming.

5. Fire control centers must be standardized and must incorporate the latest wizardry in electronics and mechanics to assist the antiaircraft commander in fire direction and control.

6. Heavy guns and gun fire techniques must be further developed to a high degree. This means: (1) higher muzzle velocities (5,000 ft./sec.) and higher ceilings (60,000 ft.) to cope with higher speeds and altitudes; (2) higher rates of fire; (3) automatic loading, tracking, and laying; (4) experimental and mathematical analysis of characteristics of equipment to develop optimum rules of fire. Field chronograph and field recording units must be developed. The chronograph should be integral in the gun-radar of each battery; muzzle velocity could be timed on cathode ray tube perhaps receiving impulses from the travel of the projectile in the gun tube.

7. Directors must be improved to include: (1) prediction on a curving course; (2) decreased settling time; (3) reduced time for prediction.

8. A computing device which is capable of furnishing firing data to a large number of dispersed batteries from a central location is a necessity. This will probably require the development of new relay systems for transmitting data.

9. The caliber and range of automatic weapons must be increased and the volume of fire augmented by increased rate of fire or by multiple mounts. They must be directed by radar and able to engage successfully hedge-hopping attacks that usually evade early warning radar devices.

10. The fuzing of antiaircraft projectiles is already being improved. The new projectile must be equipped with a combination of VT (proximity), impact and time fuzes.

11. The field of antiaircraft explosives and fragmentation must be thoroughly investigated. Latest developments indicate the prospects of more powerful explosives, shaped charges, and pattern—fragmentation by means of grooved projectiles.

12. The searchlight must be modified for night work with the automatic weapons against low-flying aircraft.

13. The development of a ground-to-air antiaircraft guided missile with an increased effectiveness (25 to 50%) must be stressed.

Notes On Guided Missiles

The antiaircraft weapon of the future is the ground-to-air guided missile. While it is imperative that we improve conventional antiaircraft artillery as I have outlined, nevertheless, the antiaircraft weapon of the type we know today is dated. The increased speeds of aircraft and the phenomenal speeds of rockets make an impossible problem of prediction for a projectile of unalterable trajectory. It is evident that the antiaircraft projectile of the future must be capable of guidance in flight. A guided antiaircraft missile is a revolutionary development and probably will be slow. Its first role will be a supplementary one, probably the engagement of high-flying attacking aircraft before they can enter into the range of ordinary weapons. The first missile will be complex, bulky, with slow rate of launching and guidable only at high angle of elevation; however, the indications are that a ground-to-air guided missile will be perfected. The time scale of development is anybody's guess. It is not too early though to start talking about them, because general familiarity will help to speed development.

Missile

From what we know of German missiles the components of a guided missiles are (1) The launching system; (2) A propulsion or motor unit; (3) The body or frame of the missile; (4) The guidance system; and (5) The warhead.

Each component necessitates a major research program in a particular field which is separate and distinct from the others. This is so much so that perhaps the biggest problem will be the integration of the various components when successfully developed into a successful missile. It is practical to consider the launching systems and warhead as tactical accessories whose specification will be relatively easy to achieve. The development problem looms darkest in the propulsion and guidance systems.

Guidance

As the speed of attacking aircraft increases, the ability to control and direct missiles in flight becomes more and more important. In fact, the future of antiaircraft depends on the successful development of a system of guidance. Unfortunately, the guidance of a projectile type missile in flight presents problems that can discourage even the most intrepid scientist.

The objective is difficult to attain, we must develop a system that can automatically alter the trajectory of a supersonic missile in flight so that the missile is brought into such

proximity to the target aircraft that the probability of a "kill" is assured in many instances (lethality of 25 to 50%). In order to appreciate the magnitude of the development problem, it is desirable by way of introduction to describe the basic functions common to all types of guidance systems. After the initial detection of an enemy aircraft, three functions must be performed by the guiding system of the firing unit, namely: *tracking*—the continuous following of the aerial target and of the missile to be guided; *computing*—the analysis of the behavior and relative positions of the aerial target and the missile in order to determine what alterations in course are required of the missile; and *directing*—the transmitting of intelligence to the control mechanisms in the missile. These functions are not new to the antiaircraft artillerymen as they are very similar to the functions of present fire control equipment; however the task of tracking the target and guiding the missile after firing has never been attempted before. It is this latter phase of the guidance problem to which the antiaircraft artillerymen must be introduced.

There are a variety of systems of guidance that might be explored for possible adaptation to an antiaircraft missile. Only the possible systems are listed, although many other systems are available; however, they are obviously unsuited for the specialized work of antiaircraft. Possible systems are as follows:

(1) Pre-set control (present prediction system using directors)
(2) Interception
(3) Beam Rider
(4) Homing
(5) Combination of (2), (3) and (4)

Interception

The interception system, sometimes called *Direction by Commands*, involves a control system which attempts to *direct* the missile to a predicted future position of the aerial target. The position and behavior of both target and missile must be known at all times, that is, target and missiles are tracked separately. A ground computer is necessary to predict the future point of interception and to determine the commands that must be sent to direct the missile to the point of interception. These commands must be determined for a specific missile and if more than one missile is employed, each must be identified, tracked and directed individually. Because of this serious limitation in traffic handling capability, the system can be easily saturated by an aerial attack in great numbers. However, the system has many distinct advantages: it is flexible and can be adapted to a ground-to-ground role very easily; it is accurate; it permits the use of the optimum course for interception; and, perhaps the ability to engage several targets simultaneously can be improved by automatic devices.

Beam Rider

The "Beam Rider" is the system in which a "path" is indicated and moved in space and the missile automatically "climbs" in the indicated direction after being launched. The path in which the missile must travel is a beam of some sort, radar, light, infrared or possibly sound.

The missile must be launched into the beam or directed into the beam after launching. Once the missile is in the beam it is forced to fly up the beam by a "brain" mechanism which generates error-signals as soon as the missile is off the beam axis and automatically and continuously actuates aerodynamics surfaces until the missile is again flying a stable course in the center of the beam. A Beam Rider of the radar variety possesses many superlative characteristics for antiaircraft adaptation: (1) a single radar might be used to search, detect and track the target, and also serve as the beam for guiding the missile; (2) the beam can accommodate a large number of missiles simultaneously; (3) its range is adequate; (4) it obviates the need of a computer. It has certain inherent disadvantages, such as, possibility of jamming, curvature of earth restrictions (line of sight), and the missile must carry a maze of complex equipment.

Homing

Homing is that system of guidance in which the missile directs itself to a collision with the target by being able to distinguish the target from its background. The missile is forced to "seek out" the target. As a compass needle must always try to aline itself with the magnetic pole, the homing missile is irresistibly attracted to the target which it "sees." It is this ability "to see" which limits a homing system to short ranges and to operational uses based upon special characteristics inherent in the target, such as the target's ability to deflect radar or light waves to radiate heat or to emit sound.

Homing by radar devices seems to afford the best possibilities at the present, although the Germans were well along in the successful development of "seekers" based upon the infrared and photoelectric principles. For antiaircraft adaptation the radar "seeker" has the necessary range and is aided by the ease of distinguishing the target against the sky.

Guiding by homing has the advantages of requiring no attention after being locked on a target and its traffic capability (number of missiles) is limited only by the remote possibility of mutual interference. The disadvantages of a homing device are that its range is short and that excessive accelerations might be required by an unfavorable approach to the target. The latter is especially true at supersonic speeds.

Probable Antiaircraft Guided Missiles

As has been stated before in this article, conventional artillery as we know it today is dated. Its official demise is probably more than a quarter of a century away but as the guided missile goes through the various stages of development, it will be able to perform more effectively the role now performed by conventional artillery. Eventually, the guided missile will supplant all antiaircraft cannons with the possible exception of the short-range, automatic gun.

The antiaircraft guided missile will first supplement the gun by being able to destroy the high-flying (60,000 ft.) aircraft at relatively long ranges (30,000 yds.). This missile probably will be a solid or liquid fuel missile of the beam-rider type equipped with homing device and with a probable effectiveness of 25% in destroying every target engaged. Any statement by me of a time scale would be crystal ball gazing at its worst.

Employment of Radar by XV Corps Artillery

By Brigadier General Edward S. Ott, USA

Recognition of the value of radar as a means of locating targets for Field Artillery came to the XV Corps as early as 1 March 1944, when the Corps Commander, Lieutenant General Wade H. Haislip, and I were en route from Anzio to Naples aboard an American destroyer.

The skipper invited us to make a tour of the ship during which we visited the radar station. There I noticed several closely grouped echoes on the horizon and asked about them. The commander said they were reflections from objects upon a small island which we were passing. It then occurred to me that it might be possible for a radar to pick up targets on a battlefield. This possibility lingered in mind despite discouragement from some sources and finally, early in October, 1944, Brigadier General James F. Brittingham, Artillery Officer of the Seventh Army, furnished the XV Corps Artillery with an SCR 584 for ground use. Captain Richard C. Matlack, Radar Officer of the 214th AA Gun Battalion, who believed that we might be able to pick up ground targets, accompanied the set to Luneville, France, to demonstrate the technique.

Major John W. Green, radar officer, 44th AAA Brigade was placed in charge in December and handled most of the technical problems in person. He offered to further demonstrate equipment initially in the rear area, but he was told that we would have ample opportunity to test the scheme in battle over favorable terrain. Later, when another corps rejected the idea, General Brittingham gave us two additional sets, operated by Captain John W. Post, Radar Officer, 68th AAA Gun Battalion. Captain Post, though skeptical at first as to the capabilities of the equipment in this unexplored field, soon became an enthusiastic convert.

Much credit for the success of the subsequent tests must go to Lieutenant General Haislip, the Commander, and Colonel Joseph B. Frazer, Antiaircraft Officer XV Corps. Recognition also is due the Sixth Army Group, commanded by General Jacob L. Devers, and the Seventh Army, commanded by the late General Alexander M. Patch.

Our tests progressed in actual battle under various conditions of weather and terrain from October, 1944 until April, 1945. They primarily concerned the employment of radar for general field artillery use, rather than for countermortar missions. The SCR-584 was used to provide battlefield intelligence, to locate moving ground targets for corps artillery, and to adjust friendly artillery fire. In February, 1945, nine per cent of the Corps Field Artillery missions were based on radar.

Since the completion of the XV Corps battle tests, reports in service journals have noted the success of radar for field artillery work, and in one instance ascribed credit for this pioneering effort to the Field Artillery School.* The purpose of this article is to assist in completing the record upon these significant and interesting experiments.

The radar sets of the XV Corps were kept in operation until the end of the war. When we started, the Corps front was along the La Vesouze River near Luneville, France. The last actual mission, fired as a result of radar intelligence, was at the crossing of the Danube River in the Donauworth area, on 26 April 1945.

Listed in Fig. 1 is a tabulation of some statistics for the period October, 1944–April, 1945, as taken from my diary. These figures are not complete since they do not include missions except for artillery under the direct control of XV Corps Artillery (that is, no missions are included which were fired by artillery organic to or attached to the divisions, although many radar missions were fired by such artillery). Furthermore, these are missions which the tactical situation and the ammunition supply made it possible to *fire*; none of the multitudinous reports by radar which gave us *intelligence*, but which led to no immediate firing are included. Brigadier General Beiderlinden, 44th Infantry Division Artillery Commander, concurs in my belief that during January, February, and the first half of March, 1945, at least two—and perhaps three—times as many radar missions were fired by *division* artillery than were fired by Corps Artillery. Furthermore, no effort was made by me to get *all* corps artillery radar missions entered in my diary until February, 1945.

COMPARISON OF AIR OP, GROUND OP AND RADAR MISSIONS, WITH PERCENTAGE OF TOTAL MISSIONS OF XV CORPS ARTILLERY, OCTOBER 1944 TO APRIL 1945, INCLUSIVE

Month	*Total Missions*	*Air OP Missions*	*Ground OP Missions*	*Radar Missions*
1944				
October	3095	711 (22.94%)	284 (9.17%)	23 (.74%)
November	4441	300 (6.76%)	257 (5.79%)	76 (1.71%)
December	5507	367 (6.67%)	562 (10.21%)	7 (.12%)
1945				
January	5307	302 (5.69%)	399 (7.52%)	75 (1.41%)
February	5165	381 (7.37%)	684 (13.24%)	471 (9.1 %)
March	5064	407 (8.03%)	276 (5.45%)	330 (6.51%)
April	1584	259 (16.35%)	136 (8.58%)	7 (.44%)
Totals	30163	2727 (9.04%)	2598 (8.61%)	989 (3.27%)

Figure 1.

Some explanation of these charted results is necessary in order for the deductions to be sound. In October, the ammunition supply was limited. Although I was anxious to

*See COAST ARTILLERY JOURNAL dated March-April 1946. See *Field Artillery Journal* dated January 1946. See *Infantry Journal* dated November 1945.

Radar site located behind a Maginot Line fort between Rohrbach and Guising in the Bitche area. The ramp was constructed by the engineers so that the radar antenna would have clearance over the top of the fort.

fire missions reported by the radar, in order to keep up interest of the individuals concerned therewith, it was necessary to balance carefully the use of ammunition during this static period in order to support a future offensive which was being prepared.

In November, the same situation continued until the 12th of the month. We began a great offensive from the Luneville area on the 13th and after four furious days of fighting, achieved a complete breakthrough and a fluid battle lasted the remainder of the month and into December—a battle which took the 2d French Armored Division and the XV Corps to the Rhine River and Strassburg.

We continued to have a fluid situation during the first part of December and here again used available shells to hammer the great Maginot Line forts in the Bitche area. During the latter part of the month we were on a very wide corps front, on the defensive, and again with the ammunition situation so tight that practically all of our available ammunition had to be expended in observed close support of our front-line troops. The radar was not in position until the 30th of the month.

The same type fighting prevailed to a large extent in January. It will be noted that in this defensive period, division artillery did much radar firing. However, the front became stabilized and in certain critical areas we used the radar to give us some effective results in hampering the enemy in his supply of his troops.

During February three radars were in operation along the XV Corps front instead of two which partially accounted for the fact that the radar fired more missions in February than were fired by air OP's. Flying weather was bad, the front was still stabilized as it had been in January, and we had worked out a more effective application of artillery fire to a moving radar target. This was achieved by having a section of the fire direction center physically at the radar set with authority to use certain amounts of ammunition on these missions and with a communications system (often direct to a corps or a division battalion) to make quick firing possible. The terrain on the right of the corps front was mountainous (Low Vosges), but elsewhere was broken and rolling.

During March, XV Corps passed to the offensive on th 15th of the month, broke through the Siegfried Line, an turned the Germans completely out of position. By carefu pre-planning we had the radar sets where they could chec upon the rearward movements of the Germans and w capitalized on this form of intelligence, with some amazin results, including intelligence missions around 30,000 yard (although normal radar intelligence extended from ou front lines out to about 25,000 yards). The situation was fluid the latter part of March. We crossed the Rhine.

During all of April, the situation remained fluid an although the radar was in position much of the time, ex tensive use was neither possible nor vital. This is reflecte in the small total number of missions fired for this month as well as in the small number of air and ground observed missions.

The results of using radar in a ground rôle were checke from many sources, especially from prisoners of war an from examination of targets which had been overrun. On one occasion, the Sixth Army Group Commander, General Devers, observed the destruction of a battalion of German artillery along a road running northeast from Zweibrucken, caused by a 240mm Howitzer and based on radar information. Many other individuals from the supported divisions and from corps artillery units made observations of the results. Most of these were not recorded in my diary and verification is impracticable now except by a search through voluminous after-action reports. On one occasion, I took steps to have two radars in widely separated locations observe a given portion of a road. The picking up and evaluation of targets by the two sets completely confirmed the reliability of radar in the ground rôle.

Among the interesting experiences afforded by referring to my memory and that of Brigadier General William A. Beiderlinden, Artillery Commander, 44th Infantry Division (whose units fired a great many radar missions not shown in the tabulation above), and that of Colonel John A. Berry, Jr., Executive Officer, XV Corps Artillery, the following are typical:

In late October and early November, on the La Vezouze Front, a German main supply road passed through a village named Leintrey which was located on a prominent hill. Time and again the radar picked up movements on the road at or near this village and we fired on the targets with a gun, a battery or a battalion. After we captured Leintrey, French civilians told an officer of the 173d F.A. Group that the Germans had searched every house in the village in an effort to find a concealed radio set which they thought was giving the Americans information of movements on the road.

* * *

In the Gros-Rederchering area, the radar picked up what appeared to be a considerable tank concentration moving down the road towards the 44th Inf. Division. This target was plastered by both divisional and corps artillery weapons. Prisoners of war later stated that this was a movement of tanks in preparation for a counterattack, but that the artillery fire had been so destructive the plan had to be cancelled.

* * *

On another occasion in the Gros-Rederchering area, the

radar picked up what appeared to be a horse-drawn vehicle in front of the 44th Inf. Division. This target was given a "cat and mouse" treatment by a single gun. If the wagon stopped, fire would stop. If the vehicle started forward or turned around and started back, a single round was plunked down in front of the vehicle. This went on for some time. The personnel at the radar set certainly had relief from the monotony of war through cogitating as to what the German driver must be thinking!

* * *

On a semi-dark night the radar picked up a patrol in "No Man's Land" and reported it to the infantry regiment on that front. It was ascertained at the regiment that this was a *friendly* patrol (whose dispatch had not been reported to the radar). The regiment requested that the patrol's progress be tracked. In the course of tracking, radar picked up what appeared to be a stalking German patrol. Alerted by radio, the friendly patrol leader attacked the enemy patrol and captured some prisoners, in addition to inflicting other casualties.

* * *

In the Sarreguemines area, the radar picked up what was evaluated as a battalion forming to attack the 63d Inf. Division. Heavy artillery fire was placed on this concentration, and it was learned later from prisoners of war that a counterattack had been forming but that the artillery fire had been so devastating that it was never launched. In the same area, photographic interpretation showed that the Germans were using a road leading north from Sarreguemines extensively during the night. A radar was moved to take this road under observation. The first night many "juicy targets" were attacked as a result of the radar; the second night the targets were fewer; and the third night they were almost nonexistent. A few days later another photograph, taken after snow had fallen, showed that this road was no longer being used by the Germans.

* * *

As the XV Corps was preparing to cross the Rhine River, and was in a "silence policy" period of artillery fire, one of the radars picked up some extensive movement of what appeared to be armor on a road well back from the river and on the extreme left of the Corps zone of action. The officer at the radar set correctly deduced that this was American armor, since it was in much greater quantity than any German armored movement which had been noted for some time, and that it was probably from an American element of General Patton's Army which had forced a crossing earlier. This radar intelligence resulted in getting the Third Army units moved back into bounds so that our artillery support and our attack of enemy targets between the river and road on which the armor had been moving would not result in damage to friendly troops.

The obstacles met and overcome by Major Green, Captain Post and the veteran crews of the 584 radio sets were incredibly great. These obstacles must have seemed exceptional to members of the group in the early days when the project was still purely experimental. Great credit is due the ability of this group to overcome these obstacles, not least of which must have been a lowering of morale

Terrain view from the Maginot Line fort site. This picture shows the type of gently rolling terrain in which the radar detection of ground targets is most successful.

because so frequently there was no ammunition available to expend on targets which, they were certain, were lucrative. The radar matériel was very heavy, having been designed for an entirely different purpose, and the exceedingly muddy conditions coupled with the necessity to get the equipment on high ground, where suitable roads were not available caused many a headache to the officers and men engaged on the work. Radar requires "line of sight." Exposure during daylight in most locations was too risky, so locations had to be evacuated *before* daylight and reoccupied *after* dark. The task of interpreting the echoes developed constantly from the beginning, and presented many interesting situations. For example, echoes did show up in familiar terrain which had never been there before simply because a rain had fallen and a piece of wooded ground or a house produced reflections. In the earlier part of the work, we fired on several targets detected by the radar and suspected of being weapons of vehicular concentration areas. After the terrain on which these targets were located was overrun, investigation proved that occasionally the echoes thought to be from targets were in some cases apparently from terrain features which had been made more sensitive by wet weather.

The emergence of radar in the ground rôle from a "screwball experimental dream" to an accepted, dependable, and much desired intelligence agency was amazingly rapid and widespread in the divisions of the XV Corps. So great was the need for an agency that could see the enemy during periods of low visibility and complete darkness; so urgent was the necessity to find a means with which to warn the front-line infantryman that something was approaching him from "No Man's Land"; and so quickly were factual results from radar disseminated, that almost overnight there was a clamor from the divisions for radar coverage on their fronts. From all sides I was offered assistance in laying communications to my radar sets. Brigadier General Beiderlinden of the 44th Division Artillery, Brigadier General Murphy of the 100th Division Artillery, Brigadier General McGaw of the 63d Division Artillery and many others told me that if I would tell them where the radar set was to be emplaced they would lay any lines I needed to tie it in with their artillery units or with their infantry.

Flak versus Fighters

By Major John B. B. Trussell, Jr., Coast Artillery Corps

One field of study to determine the effectiveness of Antiaircraft Artillery against aircraft which has not, to the knowledge of the writer, been explored by the Antiaircraft is the consideration of the number and details of losses of fighter aircraft to antiaircraft fire. It might be difficult to obtain such information on the losses of enemy aircraft to our antiaircraft fire but certain information is already available on the losses of our own aircraft to enemy antiaircraft. A few such figures were collected by the writer. It is proposed to discuss them and analyze them, partly with the idea that perhaps a clearer insight may be gained into the most vulnerable aerial tactics (and, as a corollary, into the best types of targets for the antiaircraft) and with the hope that additional and more enlightening information may be brought out by other officers with more complete data.

The losses discussed in this article were sustained by the fighter units of the Eighth Air Force during the last eleven months of the war in Europe. It is not intended to imply that the operations of that organization were any more significant than those of any other or even that they were, necessarily, typical. Each air force was affected in its tactics by its mission, the conditions under which it fought, the phase of the war which is being considered and a number of other variables. However, the data on the Eighth Air Force fighters between June of 1944 and April of 1945 have at least one merit: namely, that during that time the units of the Eighth Fighter Command were equipped with P-38's, P-47's and P-51's—the three types of fighter aircraft in general use during the most part of the war.

It might be appropriate at this point to explain how the information was obtained so that the validity of the figures can be established. In order that the flak experience of any fighter group could be made available to all the other fighter units of the Eighth Air Force in time to be used for the next day's mission, a section of each mission summary report was devoted to flak. In addition, the flak analysis officer of each fighter wing obtained all available details of the flak losses sustained by any of the groups of his wing. If possible, he talked to the wing-man of the pilot who had been lost. The resulting information was sent by TWX to all fighter wings and to headquarters of Eighth Fighter Command. In some cases only the barest details could be obtained but in most cases it was possible to get a fairly complete picture of what happened.

To begin with, it ought to be pointed out that generally speaking, there was little difference in vulnerability to flak between the types of aircraft used. There was a tendency to reserve some of the tougher strafing missions for P-47 groups because of the construction of that airplane. Also, both the P-38 and the P-51 possessed one disadvantage common to all aircraft with liquid-cooled engines: a flak hit anywhere in the cooling system could well be as disastrous as a burst tearing off a wing. Nevertheless, it was never possible to discover any appreciable difference between the percentage of losses of the various types of aircraft.

Altogether, between 1 June 1944 and 30 April 1945 the Eighth Air Force lost a total of 386 fighters to German antiaircraft artillery; during the same period the Eighth's fighters flew 163,070 sorties—a sortie being one aircraft completing one mission. The rate of loss, therefore, was 2.4 aircraft for every one thousand sorties flown. (See Table I.) Forty-eight (12.4% of the total) of the losses resulted from the fire of antiaircraft guns (75mm or larger). Unfortunately, there is no way of determining how often

CAL. AA			TACTICS									CAUSES							
			STRAFING											AVOIDABLE					
AA GUNS	AA AW	SMALL ARMS	AIRFIELDS	CONVOYS	TRAINS	AA EMPLACEMENTS	MISCELLANEOUS	ESCORT	PATROLLING	DIVE-BOMBING	AERIAL COMBAT	UNKNOWN	UNAVOIDABLE	NO EVASION	LINE-ASTERN	REPEATED PASSES	TOTAL FLAK LOSSES	TOTAL SORTIES	FLAK LOSSES PER 1000 SORTIES.
48	295	43	134	23	64	31	44	30	35	15	7	100	127	5	105	49	386	163,070	2.4

Flak Losses, VIII Fighter Command 1 June 1944-30 April 1945

heavy guns took fighter aircraft under fire, so there is no way of ascertaining the effectiveness of the engagement of fighters by heavy guns. However, it should be pointed out that most of these losses occurred when the fighters were escorting bombers at high altitudes and that the bursts which hit the fighters were most probably intended for the bombers. Actually, provided a fighter were not hit by the first burst of a string put up by a German battery, he would go immediately into such violent evasive action that no director yet in existence could make any sort of prediction of his course and he could be hit only by chance.

The remaining 338 fighters which were lost were destroyed either by the fire of small arms or of automatic weapon artillery. 296 of these (76.7% of the *total* flak losses) were lost while strafing. While it is not intended to minimize the vulnerability of aircraft while strafing, the number of strafing losses is out of proportion to the relative danger of strafing as opposed to certain other types of low-level missions, such as dive-bombing. Since the Eighth was a strategic air force, its fighters flew more high-altitude escort missions than low-level missions; it did relatively little dive-bombing for example and little or no direct support for ground troops. Such low-level work as was done was almost entirely strafing.

There were four main types of targets for strafing attacks: airfields, convoys, trains and antiaircraft positions. Airfields were, perhaps, the most dangerous targets due to the fact that they were usually defended by antiaircraft troops and due to the number of weapons which could be located around a target as large as an airfield. Altogether, 134 of the strafing losses occurred when airfields were the targets.

Sixty-four fighters were lost while attacking railroad trains. Attacks on enemy communications were important missions and the Germans took correspondingly strong countermeasures. Perhaps in an attempt to discourage the strafing of trains, the enemy adopted the practice of setting up "flak traps," the technique of which might be of some interest to antiaircraft artillerymen. The most common type consisted of a train with flak cars located toward either end; this train would be parked in a defile of some sort, deep enough to afford protection against an attack from the sides. Thus a strafing aircraft was forced to make his attack along the length of the train, flying "down the barrels" of the weapons in the flak cars. Usually, the sides of the defile were also heavily defended by antiaircraft. The train then made steam to attract attention and waited for its victims.

Some of the most dangerous types of target were enemy antiaircraft emplacements. Only a little over 10% of all strafing losses (thirty-one aircraft) resulted from attacks on antiaircraft positions, but of the thirty-one losses, thirty occurred in three fighter groups on a single mission. This was a mission flown in support of the airborne invasion of Holland in September, 1944; the groups in question were to strafe the antiaircraft positions in the dropping area. They accomplished the mission—at a cost of almost one-third of their strength.

There were twenty-three losses of aircraft while strafing convoys and forty-four while strafing targets of a miscellaneous nature. Escort missions cost the fighters thirty aircraft and patrolling another thirty-five (the forty-eight lost to antiaircraft gunfire fall in these two types of mission); only fifteen were shot down while dive-bombing, which is merely testimony of the relatively slight amount of dive-bombing done by the units in question.

Seven aircraft were shot down by antiaircraft fire while engaged in combat with enemy aircraft; although the number of this type of loss is small, it might be worth while to describe the manner in which the planes were lost. There must have been close coördination between the German antiaircraft artillery and the German flyers, for the enemy aircraft would, apparently deliberately, lead our fighters over strong antiaircraft defenses. As soon as the American ships were drawn into range, the antiaircraft opened up. Admittedly, this method involved some risk for the German pilots but it produced results.

Examining the causes of the losses as far as possible with the information available, it was found that in an even one hundred cases none of the circumstances—other than that the losses were caused by flak—were obtainable and these may be classed as "unknown flak losses." Another 127 occurred when the pilots were taking all reasonable precautions to counter antiaircraft fire, such as evasive action, formations least vulnerable to flak, etc., and these may be classed as unavoidable. The remaining 159 (41%) were lost under circumstances in which it is possible to find some error of maneuver, formation or tactics and these were, perhaps, avoidable. These should be considered in some detail.

The greatest number of "avoidable" losses (105) occurred when the aircraft were flying in a line-astern formation and it is not unreasonable to conclude that, had the formation been a less vulnerable one, many or even most of these losses would probably not have occurred. The line-astern formation was vulnerable because, if the ships composing it were strung out to any extent, any one antiaircraft weapon would quite possibly have an opportunity to fire on more than one of the planes; furthermore, in firing on the second target the gunner would be able to correct his leads. If the aircraft were bunched up, a round meant for the lead ship might well hit one of the planes behind, particularly since the predominant error of automatic weapon gunners seems to be to shoot behind a target. However, pilots were not always able to maintain a line-abreast formation during a strafing pass. Besides, the most profitable targets on airfields, for example, were the enemy planes in the dispersal bays around the perimeter of the field. More damage could be done by aircraft flying one behind the other around the perimeter than by the same aircraft flying abreast, since in the former case all pilots would get favorable shots at the grounded planes. Therefore, a flight making a strafing attack might deliberately take an extra risk to make possible better results.

Forty-nine fighters were shot down during a second or subsequent strafing pass. Obviously, the more an aircraft is exposed to fire, the greater its chances of being hit. Furthermore, on each pass after the first one, antiaircraft fire presumably will be more accurate than during the preceding pass, due to the fact that as mentioned in the paragraph above, the gunners can correct their estimates of former leads. Nevertheless, a pilot would sometimes make more than one pass at an objective which was particularly favor-

able either because there were a number of good targets or because he had failed to accomplish as much as he wished on previous passes or because opposition had been slight.

In summary, certain conclusions may be justified:

First, the fire of antiaircraft guns is relatively ineffective against light, fast, maneuverable military aircraft such as fighters. Such fighters as were shot down by guns were hit either by one of the very first bursts fired by the enemy before evasive action could be taken or were hit by a lucky shot whose trajectory happened by chance to terminate at some point of the aircraft's course of evasive action.

Second, any target which is well defended by antiaircraft automatic weapons, be they classed as artillery or as small arms, is a formidable obstacle when attacked. The best available example of this is an airfield for German airfields were almost invariably well defended.

A third conclusion—perhaps an obvious one—is that an antiaircraft emplacement is a very dangerous target for direct attacks.

The success of the German "flak traps," such as the case of the trains cited above and of the use of enemy aircraft to lure fighters into range of antiaircraft concentrations, furnishes another conclusion: it shows that ingenuity in tactics pays dividends.

A final conclusion to be drawn is that, since pilots will often disregard probabilities in their anxiety to make successful attacks, they play into the hands of the antiaircraft. This is not justification for overconfidence on the part of the antiaircraft artillery personnel but it does mean that the antiaircraft has every reason to feel sure of the effectiveness of its equipment and training provided its tactical dispositions and its technique are sound.

Inventor of Flak Suit Discloses Future Plans

The advent of very high performance aircraft has completely changed the problems of aerial medical research, Brigadier General Malcolm C. Grow, Air Surgeon of the AAF, said in disclosing some of the future plans of the Research Division of the Air Surgeon's Office.

General Grow, who invented and produced the flak suit long used by American air crewmen, told of some of the difficulties in developing new equipment for future use in supersonic aircraft. He cited as an example the length of time and study required in the development of the lightweight AAF flak helmet, first used in the last stages of the European war.

Bomber crews originally used the M-1 Infantry helmet early in the war, but found its bulk made it unsuitable for the cramped space of gun turrets. After months of study, General Grow discovered that cold-rolled manganese steel offered greater protection from high velocity flak particles than the heat processed M-1 type helmet, which had been modified for aircrew use. Under combat tests, it was determined that a 50% greater efficiency could be expected from the AAF helmet.

The AAF helmet weighs two pounds, one pound lighter than the M-1 helmet.

However, the problems of supersonic aircraft are infinitely greater than those conquered during the war.

To protect an airman against possible rupture to his pressurized cabin at extremely high altitudes, a pressure suit was needed which would support life in a vacuum, and, at the same time, permitting complete mobility. Pressure suits had been developed which did not allow mobility since the suit became almost completely rigid when inflated. After years of experimentation the AAF has developed a pressure suit which meets all requirements, but will need approximately another two years of work before the suit is available for general use, General Grow disclosed.

The safe ejection of a flyer at high speeds is another problem being considered by the Air Surgeon's Office. It has been determined that a human can be forcibly ejected from an aircraft at speeds up to a maximum of 450 miles per hour. After that speed, the human body cannot withstand the terrific force of the blast of air without probable injury.

General Grow pointed out that the ultimate development of safe escape at extremely high speeds and altitudes will have to be an entire pressurized cabin or capsule which can be ejected with the flyer safely inside, and which will descend decelerated by a parachute at a speed lower than that of a free fall to enable the airman to jump out at a safe altitude and use his individual parachute.

Another problem being studied is the ability of the human eye to identify aircraft at supersonic speeds. Experiments about to be held in the School of Aviation Medicine at Randolph Field, Texas, involve the use of films of aircraft flying at 350 miles per hour. The films are then projected at double speed, and are finally stepped up to an equivalent speed of 1400 miles an hour. The experiments will determine at what speeds identification becomes impossible.

Activation of ORC Units

On 1 July, orders were issued authorizing the Commanding Generals of the First, Second, Fourth, Fifth, Sixth and Seventh Armies to begin activation of Organized Reserve Corps units assigned to their areas.

To facilitate organization and control higher headquarters will, in general, be activated before lower units.

Units in the Active Reserve will be organized as follows:

(1) Class A-1—Service type units organized at full strength of officers and enlisted men, fully equipped and trained during peacetime. A maximum number of Class A-1 units will be affiliated with civilian industry. Those units for which no sponsor can be found will be organized on a nonaffiliated basis.

(2) Class A-2—Combat type units organized at full strength of officers and enlisted men, fully equipped and trained.

A portion of the equipment for these units will have to be retained in storage, since the ORC is not expected to have sufficient armories or adequate facilities to maintain full equipment with each unit.

(3) Class B—Combat and service type units organized with full strength of officers and at least a cadre of enlisted men. Essential individual and training equipment will be provided these units.

(4) Class C—Combat and service type units organized with full strength of officers only.

The Inactive Reserve will be composed of officers only, and will be unorganized except for the retention of existing records pertaining to each individual.

All units will initially be activated as Class "C," which will include both combat and service type units, organized with full strength of officers only. Priority of activation will be given to units for which expansion to Class "A" is planned, and then to units which will be expanded to Class "B." Activation of Class A-1 units, full strength service type units affiliated with civilian industrial organizations, will be held in abeyance pending further study by the War Department.

Location of home stations of units will be determined by Army commanders, on the basis of distribution of Reserve personnel, population of military age, availability of personnel for units requiring technically trained men, and location of Regular Army and National Guard units of similar type, with a view to utilizing training facilities.

Nondivisional service type units will be activated only in those localities which would not be capable of supporting Class A-1 affiliated units of the same type.

When other conditions permit, several units of the same type will be located in the same vicinity, to permit maximum economy in instructor personnel, installations and equipment.

Since no legal authority exists at present for the payment of drill or armory pay (*i.e.*, nonactive duty pay), units may progress from Class C to Class B on a voluntary basis, pending a change in the law to cover such pay for officers and men. Statutory authority is also required for the inclusion of warrant and flight officers in the ORC, but their enlistment in grade one will be encouraged pending changes in the law.

Requirements for activation of Class C units include availability of a qualified commander, sufficient officer personnel to organize the unit at 60% strength under appropriate T/Os, and storage facilities for essential training equipment, office space and conference rooms.

To expand from Class C to B, a unit must fulfill all requirements of a C unit, have available for assignment 80% of officer and 80% of noncommissioned officer cadre personnel, and receive the approval of the Army commander.

To expand from Class B to A, a unit must fulfill all requirements of a B unit, have assigned its complete authorized cadre, and have available for assignment at least

ALLOCATION OF CAC ORC UNITS TO ARMIES

Type of Unit	T/O&E	1st Army Class A-2	B	C	Total	2d Army Class A-2	B	C	Total	3d Army Class A-2	B	C	Total	4th Army Class A-2	B	C	Total	5th Army Class A-2	B	C	Total	6th Army Class A-2	B	C	Total	Total Class A-2	B	C	Total
Antiaircraft	44																												
Hq & Hq Btry, Brig	10-1	1			1		1		1									1			1		1		1	2	2		4
Bn, AW (Sp)	75	1	1		2	1			1		1		1			1	1	1			1		1	1	2	3	3	2	8
Bn, AW (Mbl)	25	2	2	2	6	1*	1	1	3	1*	1	1	3	1*	1	1	3	1	1	1	3	2	2	2	6	8	8	8	24
Det, Ops	7	1			1		1		1									1(2)			1		1		1	2	2		4
Total		5	3	2	10	2	3	1	6	1	2	1	4	1	1	2	4	4	1	1	6	2	5	3	10	15	15	10	40
Seacoast Artillery	4																												
Hq & Hq Btry, Hd	260-1	2	2	2	6	1	1	1	3													2	2	2	6	5	5	5	15
Btry, Gun Hd	67	3	3	3	9	1	1	1	3					1	1	1	3					2	2	2	6	7	7	7	21
Btry, Mine Hd	69	2	2	2	6																	1			1	3	2	2	7
Btry, Mine Planter	104	4	3	3	10	1	1	1	3													1	1	1	3	6	5	5	16
Btry, S/L Hd	68	3	3	3	9																	2	2	2	6	5	5	5	15
Btry, 155mm Gun	157	3	3	3	9	1	1	1	3	2	2	2	6	1	1	1	3					3	3	3	9	10	10	10	30
Total		17	16	16	49	4	4	4	12	2	2	2	6	2	2	2	6					11	10	10	31	36	34	34	104

*Colored Units.

Recapitulation

AAA	1,232 officers	96 W.O.	9,443 E.M.	Total 10,771
SCA	646 officers	173 W.O.	4,843 E.M.	Total 5,662
Aggregate	1,788 officers	269 W.O.	14,286 E.M.	Total 16,433

80% of officer personnel and 40% of enlisted strength (including cadre), plus approval of the Army commander.

When a Reserve unit has met these requirements for expansion, Army commanders may authorize the expansion if it is provided in the ORC Troop Basis allocated their respective areas. After authorization is obtained, orders will be issued assigning personnel to the unit to bring it to required strength.

Subsequent to this action, an inspection of the unit will be made by the Army commander or his representatives, and the results of this inspection will determine whether or not the unit will be officially recognized as a unit of higher classification. If the first inspection does not meet the standards, other inspections may be arranged until recognition is accepted or rejected.

Any unit that is authorized to expand to a higher classification is not eligible to initiate the training program of the higher class until officially recognized as a unit of that class, and no unit will be recommended for expansion or recognized as a higher class unit which does not maintain its initial requirement of personnel, and does not meet the training standards prescribed by Army commanders.

In order to retain recognition, all units must maintain the initial requirement for expansion and meet the training standards prescribed. In addition, units which do not fulfill the following requirements are subject to reclassification and personnel reassignments:

a. Class C units will attain 80% of officer strength within nine months of activation.

b. Class B units will attain 80% of officer strength and enlisted cadre strength within one year of recognition as a B unit.

c. Class A units will, by the end of the interim plan, have attained a minimum of 60% enlisted strength, with a procurement objective of at least 80% enlisted strength.

Army commanders will, whenever practicable, organize into composite organizations such officers and enlisted men as are not assigned to T/O units, in order to maintain interest of individuals, further their training, and facilitate administration.

The Organized Reserve Corps will include the Active Reserve and the Inactive Reserve.

The mission of the Active Reserve is to be capable of furnishing, in the event of emergency, units effectively trained and organized in time of peace for rapid mobilization, expansion and deployment, in types and numbers which will, together with the Regular Army and the National Guard, constitute forces for the Army of the United States, and to further furnish additional trained commissioned and enlisted personnel for necessary expansion of the Army of the United States.

The Inactive Reserve will provide a reservoir of officers, with military experience, available for assignment as needed to positions for which their past experience and current capabilities qualify them.

Except for purposes of combined training, organizations larger than a division will not be organized wholly within the Reserve component. The basis of organization of Reserve units will be the war strength Tables of Organization and Equipment of the Regular Army. Whenever two or more separate battalions or similar units are organized, a commander and headquarters may be included, if appropriate.

Overstrength in all units is authorized, and is encouraged in the initial organization, in order to reduce the number of unassigned personnel in pools. In the assignment of personnel to units, due consideration will be given to the location of the individual's home with respect to the unit's location. Assignment will not be made in cases where it would be impractical for the individual to attend drill periods with the unit.

Officers of the Active Reserve will meet minimum requirements of training, efficiency, and physical qualifications, be under statutory retirement age, and be of appropriate age in grade according to their potential assignments. Officers of the Inactive Reserve will be those who fail to meet standards for the Active Reserve.

All boards of officers appointed to examine applicants for appointment or promotion, or to determine the efficiency of officers, will be composed of an equal number of Regular Army and Reserve officers.

In the organization of ORC units, initial assignments of officers will be made in the grade held in the ORC. However, officers with wartime experience who have satisfactorily performed duties of a higher grade may be promoted to fill T/O vacancies in units.

Former warrant officers of all components and enlisted men of the ORC who have had war service in the first three grades, and who may be nominated for appointment as second lieutenants, may be exempted from attendance at an OCS by examining boards when their wartime experience clearly satisfies the required standards.

Procurement of officers will be continued from among individuals with honorable and creditable service as commissioned officers in any of the armed services of the United States, graduates of accredited Senior R.O.T.C. units, graduates of officer candidate schools, graduate aviation cadets, flight officers who have served honorably and creditably in time of war, and specialists such as ministers of the gospel, doctors, and such technical experts as may be essential and as prescribed by the Secretary of War, regardless of previous military training.

A mandatory age in grade provision as prescribed by the War Department will be adopted, insuring appropriate age for the actual assignment of every officer.

During such period as may be required to reorganize the ORC, and in any event not to extend beyond January 1, 1951, the assignment of all officers of the ORC, except Air Corps Reserve, will be limited by the ages below. Assignment will be terminated upon reaching the following birthdays:

Assignment	*2d Lt.*	*1st Lt.*	*Capt.*	*Major*	*Lt. Col.*	*Col.*
AGF (including AGF Service Troops)	30	35	42	47	52	55
All others in ORC	40	43	46	51	55	60

No officer, who is under 21 or over 60, will be given an assignment, nor will he be given an assignment unless his age is such that he can serve at least one year before his assignment would be terminated by the age limit above.

General officers may receive an assignment irrespective of having reached their 60th birthday.

An annual physical examination will be given all officers of the Active Reserve by a medical board composed of equal numbers of Regular Army and Reserve officers.

Professional efficiency of officers will be maintained by active duty, attendance at service schools or local branches of service schools, and at other schools which may be made available to service personnel, attendance, if a senior officer, at schools up to and including the highest level, inactive duty training, and army extension courses.

Successful completion of an appropriate course at the Command and Staff College, or a local branch of the C & SC, will be a prerequisite to detail in the General Staff Corps, except for officers who by service and experience in time of war are qualified for such duty.

Full opportunity will be given competent officers of the Active Reserve to acquire practical experience through temporary active service, and to rise by successive steps to any grade for which they can qualify. Efficiency reports will be rendered on each officer of the Active Reserve. Officers, to include the grade of lieutenant colonel, who fail to qualify for promotion during the established period of service in grade will be transferred to the Inactive Reserve, but every opportunity will be offered to those in the Inactive Reserve to requalify for transfer to the Active Reserve. Officers of the Inactive Reserve will be ineligible for promotion.

Promotion of officers will be based on length of service in grade, efficiency, and demonstrated command or staff ability at the appropriate level.

Successful completion of an appropriate course at the Command and Staff College, or at a local branch of the Command and Staff College, will be a prerequisite for promotion to general officer or to colonel of a combatant arm, except where an officer has in time of war performed satisfactorily in the same or a higher grade, or has clearly demonstrated his qualifications by actual performance of the duties of the higher grade.

All officers nominated for promotion will be examined by a board of officers composed of an equal number of Regular Army and Reserve officers.

Resignations of officers from the ORC may be accepted for reasonable cause. Entering an incompatible occupation or holding an incompatible office, conviction by a civil court of a felony involving moral turpitude, or entry into the service of a foreign country may be considered grounds for immediate discharge of an officer. Involuntary separation from the service of commissioned officers for other causes will be by means of reclassification proceedings.

An officer whose civilian profession is the same as the branch in which he is commissioned, and who has been denied, for cause, by competent professional or legal authority, the right to practice his profession as a civilian, will be discharged from his commission and separated from the service.

Transfer between sections of the ORC will be made only in the interests of the service, and when made will be without change in grade or date of appointment. The officer concerned will serve the unexpired portion of his five-year appointment in the section to which he is transferred. Transfers between sections of the Active Reserve will be made only with the consent of the officer concerned, and no transfers will be made between sections without the approval of the general officers exercising supervision over the two sections concerned.

Enlisted men will be assigned to ORC units as far as practicable, and when not assigned to units will be carried in the Active Reserve Reservoir. All training and service of enlisted men will be on a volunteer basis, except in the event of a national emergency.

Initial procurement of enlisted men will be on a volunteer basis from among veterans of the armed services of the United States who have served honorably in World War II; continuing procurement will be voluntary enlistment of those who have served in the armed forces. Should Selective Service terminate, the requirement of prior service will be inoperative.

Military efficiency of enlisted men of the Active Reserve will be maintained by active duty, attendance at service schools, inactive duty training, and army extension courses. Selected enlisted men will be detailed to officer candidate schools, and will become eligible upon satisfactory completion for commissions as second lieutenants.

Regulations covering promotion and reduction of noncommissioned officers and privates first class will parallel the regulations prescribed for the Regular Army. Only enlisted men assigned to ORC units will be appointed noncommissioned officers and privates first class.

Individuals who have voluntarily enlisted, after having served in the armed forces, may be discharged for reasonable cause upon their own application. Enlisted men will be discharged from the ORC at the termination of their period of service, and may be discharged at any time during their service because of physical disability or undesirable habits or traits of character, or for any of the reasons for which officers would also be separated.

Training

Individual training will embrace scheduled periods of home (armory) training, assignment of selected officer and enlisted personnel to staff and technical courses at established service schools; appropriate Army Extension Courses, and extended or temporary active duty with the Regular Army, National Guard and units of the ORC.

Armory training will be held in periods of not less than two hours each, and will be utilized to complete the individual and unit administrative and technical training, and the training of staffs, to the maximum extent possible, so that field training may be devoted exclusively to qualifying a unit to perform its primary mission. This training is predicated on the assumption that legislation will be enacted authorizing pay for such inactive duty training; pending enactment of such legislation, inactive duty training will be conducted on a nonpay, voluntary basis.

The objective is fifteen days annual field training of all ORC units, with a minimum of time lost in travel and processing. Training periods will normally begin on Sunday and terminate on the second succeeding Sunday. In so far as possible the personnel of B and C units will be trained as units, utilizing to the greatest possible extent the personnel and matériel of "A" ORC units of the same type and personnel and matériel of the Regular Army

Short courses, not to exceed three months, parallel to regular courses, will be established for ORC personnel at all service schools, and extension courses will be prepared at appropriate schools.

Training of the Inactive Reserve is not contemplated.

Equipment

The over-all program for facilities and supplies of the Army of the United States will include for units of the ORC the supply of standard equipment, with adequate provision for spare parts, facilities for maintenance and storage, and provision for essential training facilities, within the funds appropriated by Congress. Issue of equipment to any type unit will be based on an investigation to determine adequate storage facilities, means available for care and maintenance, and provisions to properly safeguard the equipment.

Class A-1 units, organized on an affiliated basis, will be provided with federal facilities for administration, schoolroom training, and storage for equipment and supplies. Other Class A-1 and A-2 units will be provided with federal facilities for indoor training, administration, schools, local field exercises, and storage for equipment and supplies. Other units, including composite units, will be provided with essential training and administrative facilities, including adequate storage for essential equipment.

The maximum utilization will be made of facilities now owned or controlled by the War Department. United States military reservations and installations used for training of the Regular Army and National Guard will also be made available for field training, including range firing.

Enlisted personnel of Class A and B units will be issued uniforms and equipment. Replacement, repair, renovation and salvage instructions will be prescribed by the War Department.

Military Districts

Based on the present troop basis, instructors in grades from captain to colonel will be necessary when all Army Ground Forces Reserve units have been activated. Officers of the civilian components may be called on extended active duty to act as instructors in the ORC program.

The provisions of the ORC plan are applicable to the Organized Reserve Corps outside the continental United States, and appropriate territorial commanders are responsible direct to the War Department for ORC activities.

Military District Headquarters will be the field representatives of the Army commander in each State, and will supervise and coordinate the activities of the civilian components within the military district.

An office of the Senior State Instructor will be organized in each state, responsible for the activities of ORC instructors in that state. Unit instructors will be provided for units down to and including battalion level, or equivalent grouping of smaller units and service type installations, with the number of instructors dependent on geographical distribution of units and work within a given area. Commissioned instructors for unassigned and unattached personnel will be provided on an approximate basis of one per 200.

By consulting the chart on page 45 the allocation of the various types of Antiaircraft and Seacoast Artillery units to the armies may be ascertained.

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MAN FOR MAN*

By Lieutenant Lawrence A. Sanders

They wormed their way up to the ridge line, Doc leading d looking back once or twice to Gunnar. They rested st below the topographical crest, and Doc spat disgustedly. ll this snoopin' and poopin'," he said. "Hell, they're so ahead of us we couldn't catch them on bicycles. I'm ing to take a look."

He stood upright. There was the sharp, high crack of rifle, and he groaned once and slumped. The bullet had tered his right cheek two inches below the eye and erged high up on his skull. Gunnar caught him as he ll and eased him to the earth.

He stripped the dead man of his papers, dog tags, water d rations. He felt nothing, neither fear nor sorrow nor gust with Doc's carelessness. Some day he'd get careless nself. Everyone did. You couldn't be perfect all the me.

He left the body there, took Doc's carbine and crawled wn the slope. He hid the weapon under the thick, eling bark of a dead tree. His own M1 was heavy enough carry. Then he crawled up the ridge again, taking it w this time.

It was almost half an hour before he peered cautiously und the shadowed side of a boulder. He saw then that was on the rim of a large wooded draw, almost a perfect ucer. The sides were steep and stony. A creek bed rmed its way down the center and made its exit through slice in one side. There were plenty of spots for the iper.

He studied the terrain carefully, fearing to unsling his sses lest they reflect the sun, now low in the west. Two-an patrols were not so good, alone it was worse. He fig-ed the rest of the squad was 5,000 yards behind him. hey'd be up by noon tomorrow. Meanwhile he was alone, e only man so deep in enemy territory.

His water and rations were adequate, and he had his M1 and five clips. Good enough. Thing to do was to keep s wits, keep calm, not get to worrying. There was a man t there waiting for him to worry, waiting for him to do mething foolish.

He dropped down a bit and hoisted his helmet upon his yonet. Corny trick, but if the enemy was green it might ck. It didn't. He heard nothing, saw nothing. The aw was filled with silence.

He grabbed a rock and still lying below the crest, slung far over to his right, then grabbed his rifle, crawled up ickly and waited. The stone crashed into a scrub growth, d immediately there was an answering shot.

Gunnar cursed bitterly when he saw he had missed the ash. But in a few seconds his sharp eyes caught a faint isp of smoke drifting up from a thickly wooded patch ross the draw. This guy was probably hidden behind e rocks or dug into the roots of some giant tree. It was oing to be tough to pry him out.

He had just taken his rifle from his shoulder when a figure bent double dashed from the trees across the draw and disappeared behind a heap of rugged boulders. He snapped off a quick one but he knew it was too late. His shot was low, and he adjusted his sights.

His mouth was dry now, and his throat tight. He wet his lips from his canteen, wrapped in a sock so as not to rattle in the cup. He wasn't beginning to worry, not yet he wasn't, but he didn't like the idea of this guy working around the draw toward him. Evidently the Nip was an old hand at this business; he wasn't going to let himself be cornered or holed up.

Gunnar crawled slowly around the outside of the crater-like draw. He wanted plenty of space between them. Mostly he wanted time; time to think and plan carefully, time for the other scouts to come up and help him against this enemy who seemed to know all the tricks of the trade and wasn't afraid to use them.

He had moved almost 50 yards, working his way cautiously around the slope before he realized what was happening. The Nip was maneuvering so as to place himself between Gunnar and the setting sun. Gunnar was already squinting against the blinding rays, and he knew his wily enemy would be below the ridge line, inside the draw so he wouldn't be silhouetted. Gunnar would have no chance of aiming in that light.

He cursed his own stupidity but at the same time moved quickly. He worked his way over the ridge, flat on his face, pulling himself forward by his elbows, his rifle cradled in his arms. Now he was down inside the bowl; might be lower than the Nip, might get a chance to pick him off against the sky. Best of all, now he was in comparative dusk.

Gunnar crawled into the undergrowth, stuck his bayonet in the ground, and listened with his ear to the blade. But he heard nothing. Somehow he was convinced there was only one Nip in the draw, but he was a sly one, probably a veteran scout himself.

There was a sharp crack of a rifle—

*From *The Leathernecks*

He made a quick visual reconnaissance by the rapidly fading light and picked himself a night position where he had cover on three sides and good concealment on the open end. But he didn't crawl into it yet.

He dug out his cigarettes and matches, kept dry in an old tin D ration box. He shielded the cigarette in his helmet while he took two or three long, satisfying drags. Then he broke off a slender reed and impaled the burning cigarette on one end. Lying flat on the deck, he hoisted the reed and slowly turned the burning end toward the opposite slope. The Jap might think he was holding the cigarette about chest high.

When the rifle cracked this time, he saw the flash clearly and had his enemy definitely located. He dropped the cigarette and ground it out. He picked up his rifle, crawled into his boulder-protected den and waited. He lifted the patch of adhesive tape from the luminous dial of his wrist watch. It showed 2000. Somehow he'd have to stay awake till dawn, and already his eyelids were sliding shut. He was weary.

But his opponent was too crafty to come and investigate a single shot at night. There was no sound in the draw, and night filtered down. Gradually the ridge lines merged with the sky, and soon the moonless night had filled the crater.

Then began an eight-hour struggle with sleep, a lulling, dope-like sleep that dulled his senses and numbed his brain. He pinched his skin, bit his lips so deeply the blood flowed, did everything he could think of to rouse his sinking body, to flog his senses back into action. Sleep was impossible. Sleep was an invitation to death.

And somehow he stayed awake, thinking of every meal he'd like to have, of all the women he had known, of every city he had visited; thinking anything to keep his mind functioning, to keep his senses alert, to stay alive. And all through those long, terribly swollen hours after midnight when time seemed to stand still, he stayed awake and listened for the night sounds, the danger sounds, the sounds of the enemy.

When dawn came he was ready and moved slowly around so that the rising sun would not blind him. Once, during the first hour of daylight, he caught a sudden glimpse of a knitted cap raised over a boulder, and though it served to locate his man it wasn't sufficient to draw a bead or risk a shot.

Thereafter he called his enemy Knitted Cap. He had reached that stage of exhaustion where talking or mumbling to himself seemed perfectly natural, and he swore at Knitted Cap in an undertone and vowed vengeance for the death of Doc.

He risked a short trip down to the tiny stream to douse his face with cold water and let his wrists and hands soak for a moment. It was now almost a day since he had dared stand upright. The knees and elbows of his dungarees were worn through. His palms were cut and bleeding, and he longed to stand erect and stretch his tightened back and shoulder muscles. But his training and experience had disciplined his body, and he slithered through the undergrowth, scarcely moving the brush as he passed.

Making his way slowly downstream, he halted at a faint trail crossing and studied the ground. Evidently Knitted Cap had used the trail recently. His keen eyes picked o broken and trampled reeds down by the bank, and h thought he caught the faint, sweet scent of cheap Ja perfume.

He unslung his pack and dug out what Doc once scorn fully referred to as the Individual Demolition Kit, Mk I It contained three grenades, a few blocks of TNT, safe fuse, tape and some nonelectric blasting caps. He had tosse in a few odd articles at the last moment, some fishhook dug into a bar of soap, a spool of tough fishing line, couple of nails; things he thought might come in handy.

Now he rigged a trip wire low in the grass across th trail. He pulled the pin from one of the grenades an wedged it down between two branches so the handle wa still in position. A light tug on the length of fishing lin would be enough to pull the grenade free and let th handle fly off. He set his trap, brushed up the ground an retreated the way he had approached.

Crouched back in his den, he unpacked what food h had left, three sandwiches with thick slices of liverwurs two candy bars, and a K ration can of cheese. He ate tw of the sandwiches slowly, munching the heavy bread an washing it down with the tepid water in his canteen. H hoped the squad would catch up soon. They had 10-in rations with them.

He had waited almost two hours, trying to keep as mo tionless as possible, when suddenly the explosion of th grenade shattered the silence, and the marine heard th singing of the shrapnel. But he knew better than to rus recklessly down the trail to see what his trap had caugh He waited for a quarter of an hour, then began the tortuo crawling down the stream bed, resting every now and the to press his ear to the earth.

As he drew near the trail, he became more cautious Here the vegetation showed signs of the explosion, and h pressed forward eagerly, searching for signs of death. Bu he found only blood-spattered earth near the trail and a lin of blood spots leading away toward the opposite slope. H studied them, trying to decide whether it would be wise t follow a wounded man.

A shot decided him. It cracked out about 100 yard ahead of him and smacked into the trunk of a tree by hi side. He hit the deck, rolled swiftly, crawled and slithere behind a fallen log. He was trembling with tension, an he withdrew toward his den, knowing Knitted Cap ha only been wounded, and evidently not seriously.

Back in the den, he pondered his situation. He coul withdraw to meet his squad and with their help clean ou the sniper, or he could stay where he was and keep Knitte Cap occupied, or he could go out and get him.

Ordinarily he would have played a tight hand and waite for the other men. But this duel had become somethin personal and important to him. The weariness, the hunge the discomfort had centered in his desire for this one in dividual victory, had focused in his hate and fury Knitted Cap, who held up Gunnar's advance by his ski and ability in keeping alive.

Now it was a test of strength, of ability, of cunning, an stealth. Playing a tight hand was a tacit admission of d feat, of acknowledging that he had met his match, that h needed help to take care of one man.

He swore suddenly, and a cruel light came into his eyes. He had a plan now, a daring plan that might work. Crouching almost double he ran back over the ridge line to his original position where Doc had been killed.

He worked swiftly and stripped the body of carbine magazines. He retrieved the carbine from the hiding place.

It was almost 1000 by the time he returned to the stream bed. He laid his M1 close by and set to work. He wedged the carbine under a log, weighted it with stones and aimed it roughly up the trail. He dug out his spool of line again and tied one end to the trigger. He let the bolt home on a full magazine and pushed off the safety.

Unreeling his line carefully, he backed away almost 20 yards, then turned obliquely to his right, letting the line bend in the smooth wood of a notch he cut into a tree near the base. The line was only a few inches off the deck and invisible in the grass. He found the spot he wanted, up on a slight rise but covered with undergrowth so that he could see out clearly without being seen.

Holding his breath, he took up the slack of the line slowly and carefully. It tightened, and for a moment he feared it would snap. But instead there was a satisfying report from the carbine and a film of smoke drifted up from the spot near the stream bed.

He waited, clutching his M1 with trembling hands and watching the terrain anxiously. In a moment he pulled the line again and saw the carbine slug clip some leaves that fluttered to earth.

The Jap was stirring the bushes, getting a little more confident now as he moved in for the kill, almost behind the weapon that was firing.

Then Gunnar could see no motion, and fear sprang up in his heart that he had lost his quarry, that this enemy had outguessed him again. He fired another carbine shot and was rewarded with a glimpse of Knitted Cap moving almost erect now, gliding through the trees, exposing himself only for a fracton of a second.

Gunnar felt something almost like admiration for his wily opponent; playing the game to the end for all he was worth, containing his impatience to finish off once and for all the danger this invader represented. He shifted his M1 slowly, trying to track the Nip as he advanced. Now the man was only 50 yards from him, but still using concealment well. It would have to be one shot and that a good one. The Jap might see the decoy carbine any minute.

He held his breath and tensed his finger. The Knitted Cap poked cautiously from the side of a bush. He fired, and immediately he knew it was no good. He had missed; the cap had ducked down out of sight.

Filled with a sudden rage, maddened by the continued presence of this seemingly invincible enemy, Gunnar forgot all his painfully learned lessons, plunged out of the brush and holding his rifle at his hip advanced toward the Jap. His mouth was working, and his fingers were clenched so tightly on his rifle stock that his wrists ached.

He came up to the bush and began firing, fanning off one clip as quickly as his heavy finger and the filed-down trigger hooks would allow. He loaded another clip swiftly and accurately and continued to advance, spraying the bush and yelling at his enemy, taunting him, using every vile curse in Jap and English he could think of to tempt this swine into the open where he could finish him.

His empty clip twanged up, and at almost the same moment his adversary stepped out from behind the bush. He was a tall, slender man dressed in what looked like a burlap jacket. He carried no rifle, for his left arm hung useless, wrapped in a bloody bandage. In his right hand he held a pistol.

For a split second there was a shocked silence as each man saw his enemy face to face. Then the Jap raised his pistol. At the same time Gunnar's muscles unfroze, and he went into action.

He hurled his M1 sideways and flung himself in right behind it. The pistol shot rang in his ears and the smoke blinded him, but his man was down and the pistol was knocked from his grasp. The Jap fumbled for his knife, and Gunnar hurled himself upon him, reaching for the knife hand and clawing at the other's face.

They rolled about in the clearing, not yelling, but occasionally grunting with effort, each strained against the other, muscles taut. The Nip rolled to the side, then rolled back and brought up his knee with all his force into the marine's groin. For a moment Gunnar thought it was the end. His senses dimmed. He was horribly sick, and the pain made him scream with anguish.

The Jap's lips parted in a grimace of triumph, and he slashed for Gunnar's throat. But the long enforced training and rigid physical discipline had done their work, and instinctively Gunnar protected himself, rolling away from his enemy, trying to fill his lungs with air, trying to conquer his sickness.

Then the Jap was on him again. Gunnar could see his shining eyes and smell his breath. But now the heel of his hand found the Jap's face, and with a short, sharp blow he broke the other's nose, the hot blood leaping up his wrist. The Jap squirmed with pain, and Gunnar pounded his fist into the bleeding arm wound.

Their movements were frantic now, filled with the imminence of death. The Nip fought viciously. His fingers clawed at Gunnar's eyes, and he tried to stagger to his feet.

But he was not to live. Filled with a sudden fierce exultancy and a prescience of his own victory, the marine clawed, bit, hacked at the other with the edge of his hand. Now the Nip's face was a red shambles, one nostril ripped loose, his mouth battered and purple.

Gunnar struggled to his feet, and waiting until the Nip rolled over, he shattered his jaw with a single kick of his combat boot. He drew his own sheath knife then, a long, heavy blade. The Jap was finished, rolling on the ground

The knife rose and fell; once, twice. The Jap was still.

And Gunnar leaned weakly against a tree and sobbed.

The rest of the squad came up a little after noon. They found Gunnar facing in the direction of the enemy, just inside the far slope. He had washed in the stream, cleaned both his weapons, and seemed ready to go on.

He led the sergeant back to the dead Nip. The sergeant rolled the body over curiously with the tip of his boot.

"Looks like a tough customer," he said. "Have much trouble with him?"

"Naw," Gunnar said, "he wasn't much trouble."

But when he lit his cigarette, the sergeant noticed that his hands were still trembling.

National Guard CAC Program

With the acceptance of the formal allotment of troops by seventeen of the twenty-five states scheduled for anti-aircraft units, the National Guard program is beginning to crystallize.

Orders have been issued for the detail of instructors as follows: Acting Senior Instructor for Alabama, Colonel Paul O. Franson, Inf.; Acting Senior Instructor for California, Colonel Leonard R. Boyd, Inf.; AAA Brigade Instructor for California, Colonel John H. Harrington, CAC; Acting Senior Instructor for the District of Columbia, Colonel Charles M. Myers, CAC; Acting Senior Instructor for Florida, Colonel Harold Haney, Inf.; Acting Senior Instructor for Louisiana, Colonel Francis A. Woolfley, Inf.; Acting Senior Instructor for Maine, Colonel Joseph L. Ready, Inf.; Acting Senior Instructor for New Hampshire, Colonel Carroll A. Bagby, Inf.; Acting Senior Instructor for New Jersey, Colonel Frederick Herr, Cav.; AAA Brigade Instructor for New Mexico, Colonel Clarence E. Rothgeb, CAC; Acting Senior Instructor for New York, Colonel Charles E. Ravens, Inf.; Acting Senior Instructor for North Carolina, Colonel William T. Fitts, Inf.; Acting Senior Instructor for Pennsylvania, Colonel Leo T. McMahon, FA; AAA Group Instructor for Pennsylvania, Colonel Donald McLean, CAC; Acting Senior Instructor

AAA NATIONAL GUARD ALLOTMENTS

State	Hq. and Hq. Btry. AAA Brig.	Hq. and Hq. Btry. AAA Group	AAA AW Bn. (S.M.)	AAA AW Bn. (S.P.)	AAA Gun Bn. Type A	AAA S/L Bn. Type A	AAA Ops. Det.	Formal Allot. Accepted By State	Auth. to Organize Sent to State
Alabama	0	1	1	1	1	0	0	No	No
California	2	4	3	2	4	?	2	No	No
Connecticut	1	2	1	1	1	1	1	Yes	Yes
Delaware	0	2	2	1	2	1	1	Yes	Yes
Dist. of Columbia	0	1	1	0	1	1	0	Yes	No
Florida	0	1	1	1	1	0	0	Yes	No
Georgia	1	1	0	1	1	1	1	No	No
Hawaii	0	1	1	0	1	0	0	No	No
Illinois	1	2	1	1	2	1	1	Yes	Yes
Louisiana	0	1	1	0	1	1	0	Yes	Yes
Maine	0	1	1	0	1	0	0	Yes	Yes
Massachusetts	1	2	1	1	2	1	1	Yes	No
Michigan	1	2	1	2	2	1	1	Yes	Yes
Minnesota	0	1	1	1	1	0	0	Yes	Yes
New Hampshire	0	1	1	0	1	0	0	Yes	No
New Jersey	0	2	2	1	1	1	0	Yes	Yes
New Mexico	1	2	1	1	2	1	1	Yes	Yes
New York	2	6	5	3	6	2	2	No	No
North Carolina	0	1	1	0	1	1	0	Yes	No
Ohio	0	1	0	0	1	1	0	No	No
Oregon	0	1	1	1	1	1	0	Yes	No
Pennsylvania	1	2	2	3	4	2	1	Yes	Yes
Puerto Rico	0	1	1	0	1	1	0	Yes	Yes
Rhode Island	0	1	1	0	1	0	0	Yes	No
South Carolina	0	1	1	1	1	0	0	Yes	No
Texas	0	0	0	1	0	0	0	Yes	No
Virginia	1	1	1	1	1	0	1	Yes	No
Washington	1	2	1	1	2	1	1	Yes	No
Totals	13	44	34	25	45	21	14	22	11
T/O and E	44-10-1	44-12	44-125	44-75	44-115	44-135	44-7		

HARBOR DEFENSES NATIONAL GUARD ALLOTMENTS

State	Batteries 16"	12"	8"	6"	90mm	Mine	Total Gun and Mine Batteries	Bands	Group Hq. and Hq. Det.	Bn. Hq. and Hq. Det.	Bn. Hq. & Hq. Det. Sep. Bn.	Formal Allot. Accepted By State	Auth. to Organize Sent to State
ew Hampshire	1	0	0	1	2	1	5	1	1	2	0	Yes	No
ssachusetts	2	2	0	4	4	1	13	2	2	5	0	Yes	No
ode Island	2	0	1	3	2	1	9	1	1	3	0	Yes	No
ew York	4	2	0	2	4	1	13	2	2	5	0	No	No
rginia	3	0	0	3	2	1	9	1	1	3	0	Yes	No
uth Carolina	0	1	0	0	2	0	3	0	0	0	1	Yes	No
orida	0	1	0	1	3	0	5	0	0	0	2	Yes	No
exas	0	1	0	1	1	0	3	0	0	0	1	Yes	No
regon	0	0	0	2	2	1	5	1	1	2	0	Yes	No
ashington	1	0	0	2	2	0	5	1	1	2	0	Yes	No
Total	13	7	1	19	24	6	70	9	9	22	4	9	0
O and E	4-67	4-67	4-67	4-67	4-77	4-69		20-107	4-62	4-66	4-66		

r Rhode Island, Colonel Horace Harding, Inf.; Acting enior Instructor for Texas, Colonel John T. Murray, Inf.; cting Senior Instructor for Virginia, Colonel Harry F. eyers, CAC.

The following officers have tentatively been selected as dicated but orders have not yet been issued: Acting enior Instructor for Delaware, Colonel Charles W. ettys, CAC; Acting Senior Instructor for Illinois, Colonel Harwood C. Bowman, FA; AAA Group Instructor for ew Mexico, Colonel John R. Seward, CAC; AAA Battalion Instructor for New Mexico, Lieutenant Colonel Seneca W. Foote, CAC; AAA Brigade Instructors for New York, Colonel Harry W. Lins, CAC and Colonel Harold P. Detwiler, CAC.

Accompanying charts show the status of all states scheduled for Coast Artillery units. The last two columns in both charts show the exact status of organization as to whether the states have accepted the formal allotments of troops and whether authority to organize has been sent to the states.

*Constant Research and Development Needed**

The men who have fought this war, either in the air or on the ground or on the surface of the sea or under it, have little doubt as to the need for constant development of our own air power. For this war has shown above all, both in our own experience and that of the enemy, that the second-best airplane is almost as bad as no airplane at all. It is vital, therefore, that research and experimentation in air power be continued in peace as in war. Much remains to be discovered in engineering, in metallurgy and chemistry, and in production. Much must be developed by a manufacturing industry that should have enough orders not only to survive but to progress. This body of learning must be applied, tested, and developed further by our military air force, by a vastly expanded commercial air transport system, and by a volume of personal flying which should and can be large enough to supply markets for the manufacturers that are beyond the political power of government or the economic power of the commercial airlines to provide. And behind this chain of processes is the need for continued research in basic science to assure American leadership.

*From Wings Over America, Public Affairs Pamphlet, No. 114.

Souvenir Shootin' Irons*

By W. H. B. Smith

Recent newspaper publicity, plus the influx of many of the actual weapons themselves as "souvenirs" in the hands of returning GIs, seem to have broken the veil of secrecy that has existed for so long regarding the cheap, single-shot, caliber .45 pistol pictured below. This weapon was made for our Office of Strategic Services and was distributed by them to the various "underground" movements. The idea was that a man so armed could, at close range, kill an enemy soldier or agent, and possibly, obtain from him his weapons for use in further fighting.

The picture tells the story pretty graphically. The pistol is all metal and suitably welded. Over-all length is five and one-half inches. The barrel is four inches long and is smoothbored. As originally shipped, the pistol was packaged with a really well-worked-out instruction sheet, printed with a series of crude but graphic line drawings showing, step-by-step, how to load, fire and extract. No word description is used or needed, so that instructions could be understood regardless of language. Also enclosed in the cardboard box were twelve .45 ACP cartridges and a stick for punching the empty shell out after firing.

At ten or fifteen feet the smack of the key-holing bullet tears an unbelievable hole in anything it is capable of penetrating. The accuracy drops off rapidly beyond about twenty feet, quite naturally.

If you have one of these pistols, hang it on the wall as a nice memento. And, if the urge ever should strike you to fire it, remember this: The .45 ACP cartridge develops a maximum breech pressure of 14,000 pounds per square inch. With that figure in mind, examine the pistol. Takin chances is a part of the game, in war, but the war is over!

*From *The American Rifleman.*

Photos courtesy of *The American Rifleman.*

The American-made single-shot .45 caliber "underground" pistol.

The only revolver of Japanese manufacture extensivel used by the Jap forces was the Model 26, adopted in 189 as a cavalry sidearm. This revolver is often mistakenly re ferred to as a Japanese copy of the Smith & Wesson. Whil it utilizes the method of hinge-frame operation and the bar rel lock on the barrel extension as originally introduced b S&W, the lockwork is modified from the types develope by Gasser, in Austria, in the 1880s.

The revolver weighs about thirty-six ounces. It has barrel length of about 4.7 inches, an over-all length of eigh and a half inches, and a cylinder capacity of six cartridges Sights are the customary pinned-in blade front and oper notch rear. Opening the pistol automatically ejects the con tents of all chambers simultaneously in standard fashion I have never seen one of these pistols which did not thro lead. It is unwise to stand on a shooting line with anyone firing one of these revolvers, as the lead particles shaved from the bullet as it jumps the gap from cylinder to barre can result in serious eye injury.

The caliber is 9mm Special and is not adapted to an American arm. The cartridge case is of brass and has a ver thin rim. The bullet is lead with a round nose.

Japanese armament design has long been influenced b Italian thought and experience. This revolver is no excep tion. The arm itself in its lockwork indicates the Austria influence of the 1880s as encountered in Northern Italy while the cartridge design patterns very much along th lines of those found even today in Italian revolver ammu nition.

The Japanese characters on the right side plate of the Model 26 revolver means merely "26th year Model."

The Japanese used three types of automatic pistols o their own design. The first was the Nambu. The second the Model 14, appeared with two types of trigger guard and with other minor differences, but both are essentially the same pistol. Both follow the general construction and lock design of the Nambu, but they are unlike it in many details. The third, the Model 94, is an entirely different weapon, having practically nothing in common with the other types except caliber.

The Japanese on the Asiatic Continent used quantitie of Mauser and Luger pistols captured from the Chinese but there is no need to deal here with those arms. As matter of passing interest, it might be noted that when Premier Tojo attempted suicide it was with a .32 Co Automatic!

All the Japanese pistols listed use the same ammunitio —an 8mm cartridge closely resembling the 7.65mm Luge in appearance but not interchangeable with the Germa cartridge.

The Nambu was the first Japanese semiautomatic pi tol. It appeared about 1914 and derived its name from th

WALTHER PP AND PPK

When made of steel or of duralumin, these two models are alike except for weight, length and magazine capacity. Both were made in calibers .22 Long Rifle, 7.65mm and 9mm Browning short.

The PP model (Police Pistol) shown is a presentation arm which is not intended to be fired. Receiver, slide and barrel are all made of a soft bronze-like metal.

The PPK (Police Pistol "Kriminal" meaning a short pistol for hidden plainclothes work) is also engraved, but is of plated steel and is intended for use.

Before firing engraved arms of this sort, check to be sure that the barrel is of steel.

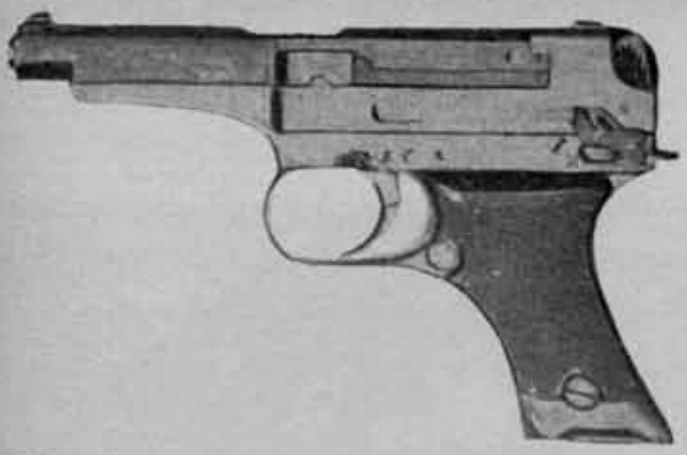
designer, Colonel (later General) Kijiro Nambu, an outstanding small-arms designer. This pistol is usually listed as being derived from the German Luger, but except for superficial details and appearance it has nothing in common with that arm.

Colonel Nambu was influenced in designing this arm by the 1910 Italian Glisenti (which in its turn was influenced by the Mauser pistol). In design and construction, however, the original Nambu is simpler, safer, and sturdier in every way than the Glisenti. It suffers solely from the point of caliber, as its cartridge is far from being a satisfactory military one.

From the standpoint of number of parts, simplicity, ease of takedown, ease of manufacture, and security of lock, it would be difficult to find a better design than the Jap Nambu.

One warning is necessary about this pistol and about the Model 14. As in the case of the Walther P-38, it is possible to reassemble these pistols after dismounting without the locking block being inserted. If the Walther or the Nambu contains its locking block, no safer pistol is made. If the block is not replaced, you have an unlocked blowback which will function for the first shot but which may be jammed open and ruined. While there is little danger of

Jap Model 14 with large trigger guard for use with gloves.



Jap Model 94, one of the poorest and most dangerous of pistols.

injury to the shooter from firing the comparatively low-powered Nambu without its lock, there is definite danger of injury to the pistol.

The Nambu weighs about thirty-one ounces, has a four-and-a-half-inch barrel, measures about nine inches over-all, and has a magazine in the butt carrying eight cartridges. One shot can be fired for each pull of the trigger.

This pistol, as commonly encountered, has a blade front sight mounted on a T-base and a leaf rear sight. The butt is usually slotted to receive a detachable stock which converts the weapon to a "carbine."

Essentially, the Model 14 (in both its modifications) is like the earlier Nambu in locking and operation. Its changes were made to facilitate production. It weighs about thirty-two ounces, has a four-and-a-half-inch barrel, measures about nine inches over-all, and has an eight-shot magazine.

While the front sights resemble the Nambu, the rear sights are open V-notches machined into the top of the receiver. In standard issue, these pistols are not provided with slots to permit attachment of shoulder stock.

The Model 14 may be found with two types of trigger guards. When the trigger guard is large and bulged at the forward end, it indicates a pistol designed for use with a glove—presumably for Manchurian or other cold-climate use.

The ideographs near the safety read *"Ka"*—(fire) for the forward one and *"An"*—(safe) for the rear one. The marking on the left rear of the receiver reads *"Juyonen Shiki"* which translates "14th Year Model."

The Model 94 is of radically different design from other Japanese pistols. It is often reported incorrectly as a Japanese "Browning design." Actually, its design and construction differ radically from that of any other automatic pistol ever commercially manufactured, and it does not resemble any of the Browning designs in either locking system or lockwork.

It was originally manufactured as a more compact arm than the regular service pistols and, unlike them, was advertised for commerical sale. It was adopted by the Japs as a substitute pistol in 1934, and was much used by Jap fliers.

From the standpoint of design, manufacture, and safety, the Model 94 ranks very high in the race for the *worst* automatic pistol ever produced. The sear is exposed and projects slightly from left side of the receiver when the striker is cocked. It is possible to fire the pistol deliberately or accidentally by pressing in on the sear.

The Model 94 weighs about twenty-seven ounces, has a three-and-one-eighth-inch barrel, measures seven and one-eighth inches over-all, and has a magazine in the butt carrying six standard 8mm Japanese caliber cartridges. The inscription on the left side of the receiver above the trigger reads *"Kyuyon Shiki"*—or "94 Model."

Book Sales

In an effort to stimulate our book sales and to provide our readers with a readily accessible source of information on current books, the JOURNAL devotes two pages in each issue to a section titled "Best Sellers."

Through the information in this feature, the 15% cash discount and expedient service we hope to make the JOURNAL the standard book agency for our readers and friends. To the best of our knowledge, our discount rate is better than all other agencies and we are making a special effort to expedite delivery of all book orders.

We welcome any comments regarding our "Best Seller" section to include suggestions for its improvement and to assist in determining whether or not it should remain a permanent part of the JOURNAL.

The Current Military Situation

By Colonel Conrad H. Lanza, (Retired)

EDITOR'S NOTE: *This is the third of a series of articles by Colonel Lanza.*

During his military career, Colonel Lanza participated in the Philippine Insurrection and saw action as commanding officer of the 66th Field Artillery Brigade and for a time as G-3 of the First Army Artillery in the first World War.

He is a graduate of the Artillery School at Fort Monroe, The Staff College, and in 1915 was an honor graduate of The School of the Line.

He subsequently served as an instructor at Leavenworth for four years where he was head of the G-2 section which included History and Strategy. For his work in the field of history, he was decorated by the French Government.

Colonel Lanza was retired in 1942 after 44 years of service.

Introduction. The subjects discussed below are short military studies of areas in which the United States hold interest. The studies are intended to be factual as to what has occurred and impartial as to current conditions, and are based on information available to the author. They do not necessarily imply War Department indorsement of factual accuracy or opinion.

THE GENERAL SITUATION.

The military situation has revolved around the relations between Russia and the Western Powers consisting of the United States and the British Empire. These relations have been steadily deteriorating. A new conference met on 15 June. If this too fails, it will certainly tend to hasten World War III.

To obviate such a catastrophe, our Secretary of State, Mr. Byrnes, has announced that if there is no agreement at the conference, he proposes to refer the matters in dispute either to the United Nations or to a Peace Conference of the twenty-one nations who took part in World War II on the Allied side. That would be a confession of failure of direct liaison, and a change of procedure. It would in no way offer a solution to the divergent views between Russia and the Western Powers.

In an exchange of speeches and interviews, American Foreign Minister, Mr. Byrnes and British Foreign Minister, Mr. Bevins, accused Russia of unreasonable refusals to cooperate with them. The Russian Foreign Minister, Mr. Molotov has made the same accusation against the Western Powers.

In the following paragraphs are some essential facts.

RUSSIA

The Polit Buro directs the policy of the Government. At date of writing the Polit Buro is composed of thirteen statesmen, each of whom has other key duties. The Premier, Marshal Stalin, is also Commander in Chief, Defense Minister and Secretary of the Communist Party. He is an influential member but is bound by the decisions of the Polit Buro. The same is true regarding Foreign Minister Molotov who is another member.

As nearly always happens in political bodies, opinions are seldom unanimous. As events develop throughout the world, opinions and decisions change.

The Polit Buro is satisfied that neither the United States nor the British Empire will attack Russia unless provoked to an extraordinary extent. There is disagreement as to how far a Russian policy of expansion can be safely pushed without leading to a conflict, which they do not want at this time.

Russia, as represented by the Polit Buro, considers the world as divided between two types of Government: Communism, of which Russia is the leading representative and Capitalism. They consider the Western Powers the chief capitalistic states and their probable next antagonist in war. Russia claims to be the sole nation representing the interest of the poor man and of labor in general. She considers herself a democracy and does not consider the Capitalistic states as democratic.

Consequently the organization of republican forms of government in border states, such as Poland and Rumania, are considered as highly dangerous to Russian security and in no ways to be tolerated. She insists on Communists governments throughout all areas controlled by her and the expansion of such areas outward from the homeland in the same manner as the United States desires to establish air and naval bases in all directions away from its basic territory.

Russian Communism is atheistic. It has no Christian sense of morals. Anything that will further the end sought is justified.

In the border states in east Europe, Communism has declined and in no case are Communists in the majority; usually they are a very low proportion—about 6% in latest elections in Germany and Hungary. To correct that condition, Russian occupying forces have installed Communist governments who have undertaken to liquidate opposition parties. A special section of the General Staff has been organized to direct this activity.

The special section of the General Staff is responsible for adapting the most appropriate measures for each country undergoing reconstruction. These measures are immediately effective in some cases, and are hoped to be eventually so in all.

Hatred of Russia has resulted in extensive Underground movements. The largest movement is reported in Poland, which has been noted for its previous anti-Communist sympathies. Large numbers of Poles, reinforced by men of numerous other nations including Germany, have taken to the forests and are conducting a guerrilla warfare. This has caused the Russians considerable concern as it has been necessary to employ a number of divisions, including one armored, to prevent constant raids on critical points. Similar, but smaller movements exist in Yugoslavia and the Baltic States.

The Underground is a military factor. In case of war in central Europe, the Underground would be in a position to materially interrupt lines of communication. It would give aid to Russia's enemies. The Underground has military training, avoids contact with superior forces and so far has avoided suppression. This is expected to be corrected by the slow, steady liquidation of every individual not supporting the Communist Government. The theory is that he who does not favor Communism, is a potential traitor.

Another factor, affecting war, is lack of food. Russia has survived the past season by avoiding famine conditions, partly from substantial help from the UNRRA, which has been furnishing food to the Ukraine, White Russia and Poland. Famine may appear during the coming winter. A large part of central Russia has insufficient rains on an average of two years out of five. If two such years occur together, which occasionally has happened, millions might die. Prior to World War II, food reserves had been accumulated to cover dry years. These disappeared during the war and are now nonexistent. Up to mid-June, the current year has been a dry one, presaging a short crop. The winter wheat appears to have been a nearly complete loss. Whether the spring wheat and other crops can be saved to produce anything like a normal return is uncertain. If rains do not come, the food situation will be most serious.

A third factor that might contribute to war is the lack of industrial production coupled with long lines of transportation. There was terrific destruction of industries in European Russia during the years of fighting. Producing industries now are largely in the Urals or east thereof. To reach central Europe, rail lines are few, long and insufficiently equipped with rolling stock.

Perhaps the main factor in Russia desiring to avoid a major war at this time is that the people do not want it. Many have learned by now, that the statements of their own government as to the superiority of Communism have been [illegible] propaganda. It will take years behind an iron cur- tain to reinstill in the Russians the idea that their own government is the superior one which it claims to be and worth fighting for.

The public speeches of Marshal Stalin show that the major mission for his country is to build up an armed force superior to all others, together with an industry capable of supplying it in a major war. Russia expects to have atomic ammunition in the future but it hasn't got it yet and knows very well that the United States has it right now. Best opinion is that Russia won't have any before 1948, at the earliest.

To engage in war with the Western Powers, Russia would need a great navy and a vastly improved air force. It will take years to provide such a navy and air force. According to Jane's latest report on navies, progress on warships within Russia is slow. Among major vessels, only one battleship and one aircraft-carrier are under construction. The battleship was laid in 1939 and worked on until 1941. This project was resumed in 1945 and isn't finished yet. The ship is probably already obsolete.

Russia's estimate as to what she needs for the expected war against the Capitalistic States is covered by three five-year plans. The first started this year and the last is to be completed in 1960. The latter date is just an objective for planning purposes—the plans may be completed sooner or later. This means that for the next 14 years Russia will avoid initiating a major war. As there is no state which wishes to attack Russia, there seems to be that much time available to arrive at a settlement of differences with the Western Powers. This is by no means an impossible task.

The danger of a war earlier than about 1960, lies in incidents arising from Russia's present desire to expand. In China, in Iran, in the Levant, in the Balkans, at Trieste, in Germany, there is Russian aggressive pressure. Each movement is a separate project. If one is halted, advance may be made in others. If a mistake is ever made, it might provoke a major incident.

A part of the Polit Buro believes that the United States and the British Empire are weakening. The expected withdrawal of the British from India and Egypt is considered a sure sign that the British Empire is disintegrating.

The failure of the United States to insist on retaining its bases in Iceland and in the Azores, together with an extraordinary series of disabling strikes within the country is looked upon as good evidence that the present government at Washington is weak and can be pushed around without too great fear of a military reaction. Letters and speeches from the State Department have little weight. Russians are realistic—acts talk, words alone do not.

The present Russian policy is one of expediency. Avoid a major war, but stand by in readiness to take advantage of favorable opportunities to expand Russia and Russian interests.

The change of Russian policy has alienated some Communist support in foreign countries. Neither French nor Italian Communists can swallow all of Moscow's desires. Russia has been unable to induce the Communists of Poland and Czecho-Slovakia to settle their frontier disputes. It seems probable that the new Russian policy will result in a reduction of the fervor of foreign Communists to act as fifth columnists and blindly support Moscow.

A major difference between Russia and the Western owers is the desire of the latter to have a permanent peace, hich is expected to be followed by expanding trade and a eneral improvement of economic conditions. This seems asonable to Americans, who fail to understand Russia's fusal to coöperate, particularly as to treaties with European untries.

Russia's interests are not the same as those of the Western owers. Regarding European states within the zone of Russian occupation, it is immaterial to Russia whether there is peace treaty concerning them or not. She already controls ese countries. She intends to continue to do so. She is ingrating their economy and their trade with her own. What e would treaties with the Western Powers be?

With regard to states outside the Russian zone, including ermany, Russia does not plan to enter their economic life trade before 1960 at the earliest. Again it is immaterial hether there be peace treaties or not. She wouldn't gain if ere were. If there was chaos, it might weaken the Western owers by requiring expensive relief measures and cause a ss of trade. So why rush to settle a peace treaty? From a ilitary point of view it might be better to continue the esent status however unsatisfactory it might be to others.

All differences between Russia and the Western Powers e based on the military situation. Russia wishes to inease her military strength. Any advance to new bases or rritories useful to her, she will favor. She is watching her pportunities.

SOUTHEAST EUROPE

Czecho-Slovakia

Only a small number of Russian troops are in this coun-. Nevertheless it is being slowly changed into a Commun-t state. Elections were held on 26 May. They were preumably free, and resulted in the combined Communist d Socialist party receiving 152 out of 300 seats in Parliaent. The other 148 went to Catholic parties.

However the elections were not everywhere exempt from overnment interference. They were held under the direcon of the Interior Department whose head is a Commun-t. In one district, on the day preceding the election, the lice were given names of 24,000 people alleged to have een Nazis, or in sympathy with Nazis. As Nazis were ot privileged to vote, those named were barred from the lls. Naturally they were all anti-Communists. This ethod was so apparent that the President, Mr. Benes, reused to vote—an unprecedented action.

The Czecho-Slovak Government is now headed by a mmunist prime minister, with Communists in key poons. Main opposition is in Slovakia, where there is a genne movement for independence from the Czechs. The evious Slovak leader, Msgr. Tiso, executed as a war ominal, is becoming a national hero. This is a good ilstration of the futility of attempting to destroy ideals by lling leaders through the might of foreign armies.

Yugoslavia

At the beginning of April, the bulk of the Yugoslav rces were opposite the Greek frontier—two corps, consist-g of nine infantry divisions and one armored division. Discipline was reported as bad. Soldiers were mostly Communists. As not enough Communist recruits could be obtained, the battle strength of each division was down to about 3,500, with desertions frequent.

In view of this unsatisfactory situation, Russian troops moved in early in April, and the Yugoslav divisions were reorganized. Each received a certain number of Russian officers as instructors. By the end of May, the reorganization was so far completed as to enable a new disposition to be taken.

The main force was moved to the Greek border, from the Italian border, presumably as a threat to bolster Russian aspirations presented at the Paris Conference demanding the cession of Trieste to Yugoslavia (a Russian puppet state). Intelligence reports from Italy state fifteen Yugoslav divisions, including the one armored, are in line close to the frontier, with an estimated strength of over 250,000 men. In the rear, two Russian divisions have been identified. There are reports that four other Russian divisions are in army reserve. Also, there are probably about five Yugoslav divisions engaged in battling the remains of Mihailovitch's forces. In addition two new centers of resistance have appeared in Croatia and Slovenia.

Rumania and Bulgaria

Rapid advances are being made in forming these countries into Communist states. Bulgaria had a sizable Communist party which has been expanded to take over the country. Rumania was very anti-Communist, and Russia has moved more slowly in that country, with less interference in local government than elsewhere although American protests against lack of free elections are being ignored, except for evasive replies.

Permission has been given by Russia to reconvert the railroad gauge in Rumania from the Russian wide gauge to standard. This, coupled with an apparent reduction of Russian troops in Bulgaria and their appearance close to Italy, is an indication that temporarily an offensive towards Istanbul is not now contemplated. In line with this decision the bulk of the Bulgar divisions are now on the Greek frontier.

Albania

A pro-Russian and atheistic government under Enver Hoxha is in command. Due to Russian connections, the Orthodox Church is not being interfered with. The other two religions, Catholic and Moslem, are being suppressed.

Two divisions are being organized, with stations along the Greek border. Liaison has been established with Bulgaria for joint action against Greece.

IRAN

Iran is of great military importance to Russia. From air bases in that country, the great oil fields of Caucasia are close—450 miles from the center of Azerbaijan. Russian oil production for 1945 is stated to have been 25,000,000 tons, which is 10,000,000 tons less than what is considered necessary. Consequently Russia seeks new oil fields. The geological conditions indicate that oil could be obtained generally throughout north Iran, although no fields have yet been opened.

Above two-fifths of the original Azerbaijan is already

within Russia and has been for over a half century. Its people have become Communized and its military forces incorporated within the Soviet armies. To add to these the remainder of Azerbaijan, whose people speak the same language, have the same religion and customs would seem to be an easy and desirable task. Iran, less Azerbaijan, is Persian. The Iranian government is inefficient and corrupt. Azerbaijan people are a Turkish race and could be expected to willingly separate from Persian Iran.

Russia completed evacuation of Azerbaijan on 9 May. Troops and their stations were taken over by a recently organized Azerbaijan army, estimated as about two divisions. These troops are Russian trained, wear Russian uniforms, have Russian equipment and Russian instructors. Joint maneuvers with Russian troops were held prior to the withdrawal of the Russians. The Azerbaijan Government is Communist and has made considerable progress in making the entire country Communistic. Due to the Iranian government having signed the agreement to negotiate with Azerbaijan "in a benevolent spirit" no forceful measures can be taken to restore previous Iranian authority.

The net result of the events in Azerbaijan, is that Russia under pressure of the United States and the British Empire through the United Nations, has withdrawn its forces from Azerbaijan. In place thereof a new Communist Azerbaijan puppet state has been constituted and is functioning in close liaison with Russia. Lines of communication from Russia into Azerbaijan by rail, road and water are much superior to those from Iran. Russia is in a position to reinforce the Azerbaijan divisions faster than concentrations could be made against them from the side of Iran. Besides Iran hasn't got two divisions available.

For practical purposes Russia has complete control of Azerbaijan. Besides it has the oil concession. Under these circumstances Russian influence at Teheran with the Iranian government has increased and that of the Western Powers has decreased.

CHINA

Just as in Iran, Russia has withdrawn her troops from Manchuria. This was accomplished by 30 April. A garrison estimated at two divisions holds Port Arthur and Dairen. This force is isolated by land from other Russian forces, due to the Chinese civil war fighting along the Port Arthur & Harbin Railroad. Replacements and supplies for Port Arthur are forwarded by sea from Vladivostock and from north Korea.

Chinese Kuomintang Armies at the beginning of the period were attacking Szepingtai with their 1st Army on the way to relieve a detached garrison at Changchun; with their 52d Army southwestwardly from Mukden and with their Sixth Army southwardly from Mukden.

The Russians evacuated Changchun on 17 April. On the 15th the Communist Northeast Army had attacked the Kuomintang detached force of 6,000 men at Changchun and had defeated it by the 18th. The Communists thereupon took over all remaining districts in Manchuria as the Russians left. The Kuomintang Force held only a Corridor along the railroad from Shanhaikwan through Mukden to

On 1 May, the Kuomintang GHQ at Chungking closed. It reopened on the same day at Nanking, which becomes the capital of Kuomintang China. The Comm nist capital remains at Yenan, but they had maintained CP at Chungking, which has now moved to Nanking. T two hostile forces maintain close liaison with adjacent C This is a peculiarity of Chinese warfare and is the basis American attempts to get the leaders to stop the war. T efforts of the energetic American Ambassador, Gene Marshall, have produced numerous conferences, but wi apparently no special success in arresting the fighting.

The Communist leader, General Mao Tse-tung, mad liaison visit to Moscow where he was reported to ha stayed from 12 to 14 May. Just exactly what he did the isn't yet known. Upon his return, there was a pronounc change in Communist strategy. General Lin's Northea Army, which probably has about 40,000 well equipped a disciplined men had successfully held Szepingtai since ea April. About 10,000 men were at that place, and the r maining 30,000 were at Changchun and Kirin. He was no ordered to concentrate near Kirin.

Just at this time, the Kuomintang First Army had bee joined by the Seventy-first Army. Their combined atta entered Szepingtai on 18 May, and continuing onwar reached Changchun on the 23d. Thereafter they push north and as this account closes, had arrived on a line sou of Harbin. In the meantime the Communists had open negotiations at Nanking for a general truce. After numero conferences presided over by General Marshall, a fifteen-d armistice was signed on 6 June, on the usual Chinese arm tice terms of freezing troop positions. The results remain be seen.

PALESTINE

On 20 April 1946, an Anglo-American Commission Inquiry submitted a report on Palestine. This is an exhau tive summary of the Arab-Jew controversy. The reco mendation of immediate importance was that 100,0 refugee Jews from Europe be admitted into Palestine, gardless of Arab objections, and as expediently as possib during the current year. It called attention to illegal Und ground armies of Jews estimated as 58,000 strong.

On 1 May, the British Prime Minister, Mr. Attlee, nounced that before approving the above report he wish to know to what extent the United States would share t military and financial responsibilities involved. Preside Truman on the same day approved the prompt admission the 100,000 Jews to Palestine. Later the United Sta agreed to furnish transportation, but has not since agre to furnish military support or meet the expense involved settling the refugees within Palestine.

The Arab reaction to the report has been severe. T Arab States have united to form a Higher Committe which on 2 May protested the admission of any Jews i Palestine and announced preparation to mobilize th forces to prevent any such action. Approaches were ma on 8 May by wire to Russia seeking its support. So far th is no information as to what Russia intends to do. On May, the Arab States lodged formal protests through th Ministers at Washington. In view of the Arab reaction

announced on 20 May that their High Commissioner at Jerusalem would welcome the views of both Arabs and Jews provided these were submitted prior to 20 June. Until then no action would be taken on the basic report.

The military forces available should hostilities develop appear to be approximately as follows:

BRITISH: There are about ten divisions, complete with armor and artillery. Together with air forces, supporting and service troops, the entire strength is about 200,000. Supporting air forces are located on Cyprus and Iraq, with excellent air bases in both areas.

JEWISH: There is a small division of 8,000 men, of which 25% are on full time. This is complete with transportation. A trained force of 16,000 is on an organized reserve status. An additional 40,000 men have arms but are not organized and operate as guerrillas. The Jews have neither armor nor artillery, but are plentifully supplied with infantry weapons, including flame throwers and mortars.

ARABS AND JEWS MIXED: This is a British controlled MP force of 19,000 men, of which 12,000 are Arabs and 7,000 Jews. To date these have been loyal to the British.

ARAB STATES: The states of Lebanon, Syria, Transjordan, Saudi Arabia and Egypt have armies exceeding 125,000 men, fairly well equipped and good fighters. However it would be difficult to concentrated these armies about Palestine, with the British holding a central position with a superior force. As of 1 June, there had been a decided increase in numbers of Arab light troops along the Palestine border.

A new political element was injected on 8 June, when the Grand Mufti "escaped" from his place of internment in France and arrived unexpectedly at Damascus on the next day. This official, Haj Amin el Husseini, was originally appointed to his office by the British, in the belief that his title would be solely honorary. He disappointed the British about this and made his office one of major importance. He led revolts in Palestine in 1936 and 1937. The British, expecting a new revolt in 1939, attempted to seize him but he fled and joined the Axis. He was in Germany until the French captured him in 1945. Since then he has been interned. As late as 8 May, the French Government assured the British that the Grand Mufti would not be permitted to escape.

The Grand Mufti was received at Damascus with great enthusiasm. Everywhere the Arab press welcomed his return. As this account closes, the Grand Mufti seems to be engaged in establishing himself as the chief of an Arab HQ with apparent chances of success.

No one seems to know who engineered the return of the Grand Mufti, and who is backing him. Until this is known, it is impracticable to evaluate the effects of his return to the Arab States. It may be very important.

SOUTHEAST ASIA

Burma. The British have established a government under the prewar Governor Sir Reginald Dorman-Smith. On paper, the natives have much more authority. The opposition is headed by Aung Sang, Major General Japanese of Thailand (Siam). General Aung Sang demands complete independence, and has warned that war will come unless this is granted. There is a great deal of guerrilla warfare, details of which are blocked by the censor. It has been necessary to reinforce the British ground troops with Naval Forces. As a result of the fighting, banditry has grown, and has so terrorized certain districts as to result in a marked reduction of the rice crop, at the very time when all rice possible was desired for India where famine stalks the land.

Malaya. Censorship prevents an accurate description of the situation. All nine Sultans are united in opposition to British rule but they have not as yet broken openly with the British.

Indo-China. On orders from the Combined Chiefs of Staff in Washington, repatriation of the Japanese troops started on 14 April.

France has relinquished her authority over her old colony, under the agreement of last March granting local independence and the gradual withdrawal of French troops at the rate of 20% per annum. Elections held in June were to determine the nature and boundaries of the new states, of which there are five. They are to have the right to remain separate or join together as they wish.

France has demanded from Thailand (Siam) the return of certain border provinces, seized by the French prior to World War II. Japan gave these back to Thailand. Thailand has offered to return them provided a plebiscite is held and the people express a desire for French rule, or alternately that the matter be referred to the United Nations for investigation, report and recommendation. France declined that proposition.

Netherlands Indies. The negotiations between the Javanese and the Dutch have not succeeded. On 8 June, the Java government at Jogjakarta issued a mobilization warning alleging that war with Holland is imminent. The Javanese have an estimated force of ten divisions, reasonably well equipped and trained, including an air force of some sixty fighter planes. The Japanese 16th Army, which is functioning in Java, has issued an order directing all deserters to return to their colors without delay. It is reported that some 12,000 Japanese "deserters" have joined the Java forces.

The British are withdrawing from Java, turning over the five besieged cities garrisoned by them to Dutch troops. Due to the negotiations with the Dutch, there has been no fighting other than patrol activities.

As of 1 May, the Japanese 16th Army had over 300,000 men on duty. Large sections of Sumatra are held by the Japanese who are fully armed, and using Japanese currency and regulations. The allies believe they have located 290,000 Japs, and have started a movement to repatriate them. At least 10,000 more and possibly 35,000 have not been located and either are "deserters" or are holding out in other islands and the difficult terrain in Java and Sumatra.

Cause of the breakdown in negotiations with Holland, has been the insistence of the latter that the Netherlands Indies shall be granted only local autonomy. The natives want independence and are preparing to fight for it. Handicap of the Javanese is their lack of industries to replace war matériel expended in action and marked deficiency in artil-

Coast Artillery Journal

Fifty-fifth Year of Publication

COLONEL W. I. BRADY, Editor
LT. COL. DONALD MAC GRAIN, Associate Editor
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The JOURNAL prints articles on subjects of professional and general interest to personnel of all the components of the Coast Artillery Corps in order to stimulate thought and provoke discussion. However, opinions expressed and conclusions drawn in articles are in no sense official. They do not reflect the opinions or conclusions of any official or branch of the War Department.

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The United States Coast Artillery Association

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The purpose of the Association shall be to promote the efficiency of the Coast Artillery Corps by maintaining its standards and traditions, by disseminating professional knowledge, by inspiring greater effort towards the improvement of matériel and methods of training and by fostering mutual understanding, respect and coöperation among all arms, branches and components of the Regular Army, National Guard, Organized Reserves, and Reserve Officers' Training Corps.

News and Comment

About the Cover

The following is a brief history of the origin and e ployment of the type of half-track shown on the cover this issue. This picture was taken during the Tunisi Campaign.

General George S. Patton in the early part of 1942 quested that a dual-purpose weapon for antiaircraft a antitank be developed for the invasion of French Moroc The T-28E1 half-track with one 37mm gun and two caliber machine guns, water-cooled, was constructed. T was the experimental forerunner of the present M- model. There was no armor plate shield and the sighti system consisted of two telescopic sights controlled by o operator setting leads by means of a very small central co trol box. Eighty of these experimental half-tracks we constructed and seventy-eight were assigned to the 44 AAA AW Bn (SP). The remaining two half-tracks we sent out to the Desert Training Center for experiment purposes. In the French Moroccan Landing the 443d AA AW Bn (SP) protected the 3d and 9th Inf Divisions a the 2d Armored Division in the assault landings at P Lyautey, Fedala and Safi, French Morocco. The 44 AAA AW Bn (SP) also protected the 1st Armored D vision in the Tunisian Campaign, the 3d Inf Division in t Sicilian Campaign, the 36th Inf Division in the Cassi operation in Italy, the 85th and 88th Inf Divisions in t operation from the Garigliano River through the Ponti Marshes and beyond Rome, and the 36th Inf Division aga in the Southern France Landing to Alsace, Germany a Austria. On VE Day in Austria the Battalion had thir two (32) of the original T-28E1 experimental half-trac after two and one-half years of continuous combat.

Schools For New Officers

All second lieutenants of the Regular Army commission in Field Artillery or Coast Artillery in 1946 or 1947 w attend schools of twenty-four weeks at Fort Sill, Oklahom and eight weeks at Fort Bliss, Texas. While at Bliss they w receive a small amount of seacoast artillery and submari mine instruction.

Regular Army second lieutenants commissioned in 19 or 1948 in either branch will attend the Cavalry School Fort Riley, Kansas for seventeen weeks and the Field Art lery School at Fort Sill, Oklahoma for fourteen weeks. T group will then be split up and each officer will either tend the Antiaircraft School at Fort Bliss for eight wee the Coast Artillery School at Fort Scott for eight weeks the Field Artillery School at Fort Sill for eight weeks.

The Coast Artillery course will include instruction submarine mines in its curriculum.

Which of the last three eight-week courses an officer

Publication of Histories

After consulting numerous officers from all of the theaters of operation we have tentatively arrived at a sequence for the publication in the JOURNAL of brief unit histories of the major antiaircraft commands.

There is no doubt that the New Mexico National Guard Brigade known as the Philippine Provisional Coast Artillery Brigade which fought so valiantly in the Philippines heads the list, but since this history is not ready for publication we are proceeding with the next on the list. This history however will be published in the first issue after receipt.

Exclusive of the mentioned brigade the sequence is as follows:

34th AAA Brigade	(Lemnitzer)
14th AAA Command	(Marquat)
626th AAA Brigade (later the 71st AAA Brigade)	(Hendrix)
32d AAA Brigade	(Case)
35th AAA Brigade	(Starr)
68th AAA Brigade	(French)
45th AAA Brigade	(Rutledge)
40th AAA Brigade	(Colburn)
31st AAA Brigade	(Hewett)
53d AAA Brigade	(Handwerk)
44th AAA Brigade	(Tobin)
58th AAA Brigade	(Barber)
First Army AAA (Including 49th AAA Brigade, Timberlake)	(Patterson)
55th AAA Brigade (To be included with Ninth Army)	(McCroskey)
47th AAA Brigade	(Finley)
51st AAA Brigade	(Curtis)
Third Army AAA (Including 38th AAA Brigade, Hines)	(Chamberlain)
54th AAA Brigade	(Hickey)
Seventh Army AAA	(Kelly)
IX A.D.C.	(Richardson)

Ninth Army AAA (Murphy); 50th AAA Brigade (Armstrong); 52d AAA Brigade (Burnell); 56th AAA Brigade (Badger); and the 74th AAA Brigade (Meyers) will be published in the order in which they became operational in France.

It will be noted that we have alternated units between the Atlantic and Pacific Theaters to the extent possible.

Although we have given careful thought to this plan and consulted a number of officers we are still amenable to changes so please do not hesitate to forward any comments or suggestions for presentation to the Executive Council before the final sequence is decided upon.

Army Promotion System

Gentlemen:

Prior to the war, promotions in the Officers Reserve Corps were based on time in grade and certificates of capacity. These certificates were issued to officers satisfactorily completing certain courses of study and qualified them for promotion to the next higher grade upon completion of a given number of years service in their present rank.

This system with certain modifications might well be adapted to regular army promotions also.

It is suggested that completion of prescribed schools, performance of certain types of duty and standards of efficiency be the criterion for application for a certificate of capacity.

An officer filing an application would, after its approval, then appear before a selected board of disinterested senior officers for final consideration.

Then the allied papers would be forwarded to the War Department from where the certificate of capacity would be issued.

In this way outstanding officers could be promoted in a minimum of time and other officers not qualifying for promotion within a specified time could be "selected out."

For example a first lieutenant could be promoted with say not less than five years service in grade nor more than ten years providing he obtained a certificate of capacity any time during that period.

Promotions would then be issued on a combined merit and service in grade basis.

Ambitious officers would early in their careers be well on the way to success and officers of the "mark time" variety earmarked before much government time and expense had been wasted.

COLONEL, CA-Res.

Duty With Troops

Gentlemen:

I have just been reading the May-June issue of the JOURNAL, and the massive school system as outlined on page 19 had me "floored," and then I got over to page 62 and read your essay on "Troop Duty for All Officers"—which is as a Voice crying in the Wilderness! I suppose that it would be too much to hope that someone in high authority would recognize that the "art of commanding troops" is learned only by actual (not theoretical) long and hard duty with troops.

When I get to be President I'm going to put this in effect:

1. All officers attend a six months (no use padding) basic course sometime during their second to fifth year of service.
2. All officers attend an advanced course of six months during their fifteenth to twentieth year of service. No other schools.
3. No officer to serve on the WDGS more than four years out of his thirty years service.
4. No officer to serve more than four years out of thirty years on GS with troops.
5. Make the majority of all officers service actual duty with troops.
6. Forbid perpetual adjutants, supply officers, staff officers, etc.
7. A selection *out* for the unfit.
8. No officer to be selected for General officer unless his record showed he had been a successful battery, battalion and regimental commander.

BRIGADIER GENERAL, USA

General Lutes' Farewell to General Oldfield

Brigadier General Homer R. Oldfield
Room 3D 1071, The Pentagon
Washington 25, D. C.

Dear Barney:

I have just learned of your plans for retirement from the Army after 35 years in the Coast Artillery Corps.

Throughout your service you have been an outstanding artilleryman, you have kept pace with the advancement of the branch by studying new weapons and equipment and no officer has displayed greater enthusiasm and untiring effort in the progressive development of the Corps.

By your frequent visits and friendly advice to the Coast Artillerymen serving their weapons throughout the world you have won the respect and admiration of all loyal members of the Corps.

Although many of us did not agree with your recommendations for the future employment of the Corps, we had nothing but the highest respect for you and your decisions, knowing that you had followed the dictates of your conscience and convictions.

You shall be missed and long remembered by those in whom you have instilled the same progressive attitude that you yourself possessed.

I wish you good luck and long life to enjoy your well earned rest.

Sincerely,
LeR. Lutes
Lieutenant General, USA
President.

Editor's Note: I would also like to add my best wishes to General Oldfield. Likewise, it is my privilege to say farewell to General James B. Crawford and General James R. Townsend, both of whom have served the Corps nobly during their long careers. In parting, these outstanding officers leave many friends behind who cherish the memory of their associations with these soldiers who won the affections of all who were privileged to serve with them.

Signal Corps Photo

Alerted GIs of M-51 antiaircraft section are silhouetted against a German sky streaked with vapor trails from Allied and enemy planes engaged in a dogfight.

Certainly other retiring officers have been held in hi esteem throughout their service and it is my regret tha have not had the privilege of serving with them.

No Runs, No Hits, One Error

Dear Sir:

I hate to do this, but I just can't let that caption on pa 34 of the May/June Issue go by like that. The Capti claims that the German weapon shown is an abandon *Nebelwurfer* which was one of the early enemy ventu as far as rocket weapons go.

True enough, but what the picture shows is one of t later versions of the *Wurfgerat*. And the proper spelling the weapon mentioned in the caption is *Nebelwerfer*.

Very truly yours,
/s/ Willy Ley
Willy Ley

Editor's Note: We apologize to reader Ley and all t other readers whom we might have offended with our m nomer. Now you know why I flunked German.

Guided Missile Group Established

WASHINGTON, D. C., July ...—Establishment the Guided Missile Antiaircraft Artillery and Coast Art lery Group in the Plans Section of the Army Ground Forc has been announced by General Jacob L. Devers, AG Commander.

This group is charged with the responsibility for ov all planning and formation of AGF policies pertaining guided missiles, Antiaircraft and Seacoast Artillery, rep senting the Commanding General AGF in cooperation w the Commanding General AAF on matters pertaining antiaircraft and allied subjects and over-all planning f the integration of the Coast Artillery Corps and the Fie Artillery into a single arm of the Ground Forces.

Colonel Clare H. Armstrong, who commanded the an aircraft defenses of Antwerp, Belgium, and its port durin the battle of the buzz bomb—October 1944 to April 194 —has been named Chief of Section for the GM, AA an SCA Group. Other officers assigned to the Section a Colonel John W. Davis, former Chief of the Antiaircra Section, Headquarters, 12th Army Group; Colonel Dav B. Routh, former Assistant AA Officer and Assistant G Headquarters 8th Army; and Major John C. Parker, form S-3, 386th AAA AW Battalion.

Unit Histories

The following unit histories have been received at th Journal office since publication of the May-June issue:

38th AAA Group
547th AAA AW Battalion
562d AAA AW Battalion

Other units which have published histories or conte plate doing so are urged to send copies to the Journal our permanent file, which will be used as a readily accessi source of CAC history.

Recruiting at AARTC, Fort Bliss

The following letter was written as a result of the outnding program instigated by recruiting personnel of the ARTC at Fort Bliss.

* * *

ajor Wiltz J. Bethancourt
ublic Relations Officer
ARTC Fort Bliss, Texas

ear Major Bethancourt:

My attention has been called to the article and picture hich you submitted to the COAST ARTILLERY JOURNAL.

I wish to extend my appreciation to you and those officers d enlisted men who work with you on the splendid efforts u are putting into the Recruiting Program, and for the ar, logical, and informative article which you submitted the COAST ARTILLERY JOURNAL.

Through such interest and efforts as you have displayed, e duties of recruiting officers and enlisted men are brought favorable public recognition.

Sincerely yours,
s/ EDWARD F. WITSELL
EDWARD F. WITSELL,
Major General
The Adjutant General.

* * *

More On Inspections and Troop Duty

The following is an extract of a letter written by one of r subscribers endorsing the articles in the May-June issue "Troop Duty for All Officers" and "To Instruct or spect?"

"While I'm at the typewriter, I can't resist going on recd as heartily endorsing the ideas expressed in two unned articles under News and Comment in the May-June ue. The authors of 'Troop Duty for All Officers' and o Instruct or Inspect?' made what I consider highly imtant and often overlooked points in efficient command.

"I realize that the circumstances of the rapid expansion the Army in the war made it impossible to give every staff cer troop experience before he was assigned to staff. The ly thing that really used to infuriate me as a battery comnder was my dealings with the numerous staff officers I countered, who because of lack of experience had only e haziest ideas of the BC's problems. It takes an unusually able man to write good orders and recommend sound licies under the best of circumstances. It can't be done less the writer is able to translate the abstractions of his as into a good picture of their concrete effects on the ps in the field. For all except the gifted few—and in all ness, that few did exist—the ability to visualize the acns of field.

"In the matter of inspections, I think there is another imtant point to be considered in emphasizing frequent, nannounced informal inspections over the formal type and at is the effect on morale. We're all agreed that it's a great ost to morale if the men know that their COs right up e line take a definite and clear-cut interest in their welre. Rightly or wrongly, the CO who relies on the formal inspection to make his appearances creates the impression among the men that he doesn't really care what's going on as long as the 'eyewash' is good. When the men see a CO of any echelon who turns up any hour of the day or night, any day or night, they get the feeling that here's an officer who wants to know how they're getting along. They feel that he doesn't want to know only if the mess hall is clean at 0900 Saturday but if it's clean all the time and if the food is good, etc."

* * *

Schools for Latin-American Republics

During the month of June 1946, six new classes for personnel of the Armies of the Latin-American Republics were begun in the Panama Canal Department. A total of seventy-three military representatives from throughout Central and South America are attending these classes.

Four hundred and thirty-nine commissioned and five hundred and thirty enlisted men from the Armies of the American Republics have been graduated from various courses conducted in practically every phase of army service. This military training center in Panama offers detailed programs of instruction in infantry, coast artillery, engineering, and aviation.

The Coast Artillery Command Training Center offers courses of instruction in the latest methods of the American Army. Students from the Americas have studied radio, radar, and antiaircraft defense. This school has been in continuous operation and has had the largest enrollment of all the army schools on the Isthmus.

From time to time, aside from the regular courses offered to students, observers are invited from the Armies of the American Republics to visit the various courses offered by the Panama Canal Department and to see their students in training. Early in 1946, the Chilean War College observed training for two weeks and seven Guatemalan Zone Commanders were entertained in the Department for four weeks. Last week Colonel Francisco Bertrand, Assistant Chief of Staff G-1, of the Honduran General Staff, was on the Isthmus for a brief visit.

Signal Corps Photo

Latin-American soldiers learning essentials of jungle warfare while attending US Army schools in Panama Canal Department.

Thank You, Kind Sir

Gentlemen:

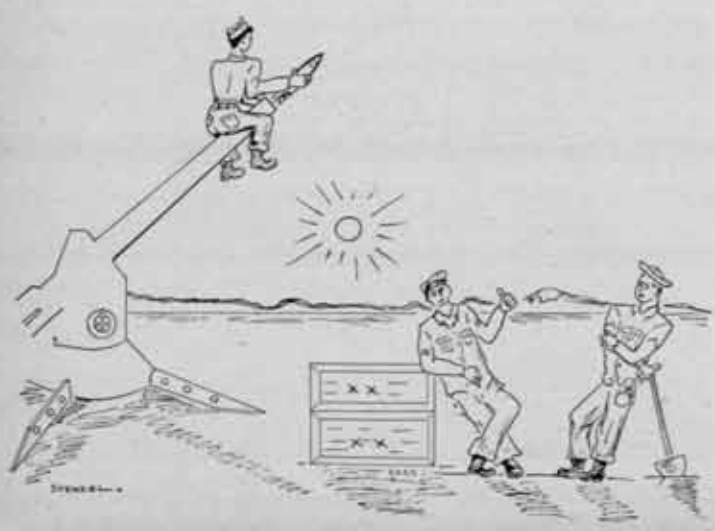
I am Infantry, but I am at present assigned to one of the States installations having to do with the administration of the Organized Reserve Corps, and as such, am on the mailing list for your JOURNAL. When I first received your May-June number, which, incidentally, is the first I have ever seen, I looked at it and said to myself, "Well I suppose I better read it, because it may have something in it that I need."

I apologize, gentlemen, because I have now read it from cover to cover and ENJOYED every word of it, and am eagerly awaiting your next copy, which I assume I will get in about a month or two. It is not just a CAC journal, it is interesting to all the branches, and the articles are sort of friendly articles—you know, the kind you feel as if the writer was a friend of yours although you never saw him, and probably never will. It is straight from the shoulder sort of stuff, and anyone that was Over, will sure like its pages.

I was especially enthused over the article, "The Psychology of Surrender" by Lt. Theodore Draper. It sure took me back when, and it was so very unexpurgated that it just seemed to hit the spot. I am glad that someone, the author and you, have found it best to write and print what really happened and not the "whitewashed" stuff that one usually reads. Yes sir, even though you are probably all CAC, you sure speak my language, but that is not so strange, either, is it, when you stop to think that all of us that were Over, sort of worked hand and glove for D-Day, VE-Day and VJ-Day.

All I can say, is good luck to all of you, and keep the swell JOURNAL coming my way. Being an Infantryman, the best compliment I can think of, is that your JOURNAL is just as good as my own *Infantry Journal*, and that is really a concession, from one of us "foot sloggers" as you well know.

R. E. R., INFANTRY AUS.



"Casey just got transferred out of a mortar squad."

AAF Tests Prove Radar Harmless

Disproving rumors that the electro-magnetic pulses radar had effects similar to X-ray or other ultraviolet ra ation, the Army Air Forces Aero-Medical Laboratory Wright Field has completed extensive experimentati which indicates the pulses to be entirely harmless.

The experiments were conducted by Lieutenant Colo Richard Follis (now of Duke University) who exposed male guinea pigs to radar pulses three hours daily for a proximately seven weeks. At the end of this time, they we killed and their vital organs studied. No deviation from t normal was found. There was no loss of hair, and no ev dence of sterility. It was also proved that no X-ray wav which might have been harmful, were mixed with the rad pulses.

The extremely short radio waves of radar were used e tensively during the war, exposing military personnel radiation. Though there was no reason to believe that t radar waves had any detrimental biological effects, the ex effects were unknown, and led to disquieting rumors.

These rumors, which indicated that long exposure radar pulses would cause baldness and sterility, were due confusion with the known effects of other types of rad tion, which are at the other end of the spectrum whe wave lengths are much less than those of visible light. Ho ever, the radar waves are thousands of times longer and a called "short" only in comparison with other radio waves.

Field Equipment

To the Editor:

There is no doubt that we had the best equipped army the world during the recent conflict and certainly our ar aircraft matériel was second to none.

Ironically though we still used number ten cans wi punctured holes as showers, slit trench latrines, canvas fl for kitchens and were incessantly hauling water in fi gallon cans.

Admittedly, the Quartermaster established shower un but usually they were a short sleeper jump from batte positions.

I would like to advocate that each unit be equipped wi portable shower units, chemical latrines, built-in tru kitchens and water tank trailers. We spent almost a milli dollars to equip each gun battery but neglected to incor rate the small additional expense consistent with providin few of the simple necessities of life.

The argument may be advanced that production p orities precluded the manufacture of these items or that was anticipated existing facilities would be adequate.

The fact still remains that units were meant to be se sufficient and that facilities were not available except rear areas and during the latter stages of the war.

I hope that when current T/Es are revised the equ ment mentioned in this letter will be incorporated as, in opinion and I know many others, they are in a priority ca gory for sustained periods of combat if the hygiene a welfare of the men are to be considered.

CAPT. CA-RES

General Lutes Writes to New R.A. Officers

The following is an extract from General Lutes' letter to CAC officers newly commissioned in the Regular Army ler the recent integration legislation:

"The Coast Artillery and the Ordnance Department de-oped the antiaircraft weapons and we are anxious to as-me the responsibility for the development and employ-ent of the guided missile.

The Antiaircraft School, the Antiaircraft Service Test ction of Army Ground Forces Board No. 1 and the 1st AA ided Missile Battalion are even now deeply engrossed in s project.

The Coast Artillery School and Board are laying the oundwork for the research and development of a ground-ship guided missile.

However, until these weapons are developed and pro-ced in sufficient quantities, it is of paramount importance t present weapons be maintained and personnel made ficient in their use. When the seacoast artillery guns d submarine mines become obsolete, we ourselves, want be the first to recommend that they be relegated to the p pile.

The importance of seacoast artillery is well illustrated the defense of Corregidor and the German defenses of e French coast. Isolated from all support, seacoast artillery Corregidor, with obsolete and outmoded armament and placements, denied the vital waters of Manila Bay to the panese until, weakened by fatigue, disease and shortages supplies, it was overrun by landing forces from the main nd of Luzon but not until valuable time had been af-ded for the strengthening of other Pacific outpost de-nses and our own west coast. The Allied invasion plan and en the campaigns in Normandy and Northern France re dictated to a great degree by the location and capabili-s of German seacoast defenses.

It is well to remember that many of the civilian scientists, cers and enlisted men now assigned to seacoast artillery ties made valuable contributions to the development of tiaircraft.

Many Regular Army officers will be detailed to duty with r civilian components in one of the most important as-nments of all. Being an instructor constitutes but a part of s particular type of duty. It entails the obligation to intain harmony and unity of purpose between the Army, e National Guard and the Organized Reserve Corps. The ison must be flawless and officers involved must be thor-ghly imbued with the idea of "winning friends and in-encing people."

Coast Artillery Association Awards to R.O.T.C. Students

After a lapse of three years, the Coast Artillery Associa-n has resumed the practice of presenting medals to out-nding junior year students in all the senior R.O.T.C. its.

It is hoped that the medal will be similar to the previous ard. This was a gold-plated silver medal with the name of e student, the year and the name of the college or uni-rsity engraved on it.

The first award will be presented in the spring of 1947 to students completing their junior year at that time providing no manufacturing difficulties arise.

Snooperscope and Sniperscope*

By A. C. Monahan

"HANDS UP or I'll shoot!"

This order pierced the dark of night, and the thief obeyed the order of the policeman who had surprised him.

"How did you see me breaking into the back entrance?" the prisoner asked. "I couldn't see where I was going myself."

The policeman told him he used his snooperscope.

Thanks to infrared radiation and new devices for making use of this invisible heat-light, the guardians of the law will soon be using the same kind of applied science that tricked the Japs on Iwo and other tough, bloody islands.

For GIs in the closing months of the war could see in the dark, without being seen.

The snooperscope the policeman mentioned has a companion device called a sniperscope. In general they are identical. The first is a complete instrument held in front of the user by one hand. The other is in two pieces that are attached to a carbine.

Both have an infrared lamp that sends out an invisible beam of what some call "black" light. Both have receivers that pick up returned light from the object observed and convert it from invisible light to a visible image. The object appears greenish in hue, but is plainly outlined.

Infrared rays played other important rôles in the war. They were used for the quick drying of protective coatings on tanks and soldiers' helmets, and for warming up engines in jeeps and trucks. They were also used in photography, enabling camera men high in airplanes to take accurate pictures of camouflaged enemy installations and ships at sea, and also to snap photographs through haze.

They were used to detect impurities in certain chemical solutions, and in medical treatment. Both Japs and Germans employed them in a short-range system of telephonic communication where wires could not be used and radio would be detected.

*Copyright, *Science News Letter*.

SNIPERSCOPE—Used by the Army and Navy for night operations, this instrument converts invisible light to a visible

Coast Artillery Newsletters

2273d AAA Command (HAW)

Colonel Leonard L. Davis, Commanding

During the early part of the period covered by this news letter, the personnel situation within the command hit an all-time low; all enlisted men with twenty-four months service as of 30 June cleared Hawaii for the mainland by March; and category V officers with forty-two months service were gone by June. The command placed all equipment in short time storage, concentrated remaining personnel at permanent stations, and put forth its maximum effort in assisting the Army Port and Service Command with the tremendous task of clearing this island of the vast stores which had been here to support the intended assault on Japan.

However, with the recent assignment of a sizable number of local inductee replacements, the gradual influx of regular army re-enlistees, and the prospect of additional replacements from the states, the present enlisted strength has gradually built up to approximately 1,900 and the prospect of future training and development of units has begun to improve. As an initial step in rehabilitating the command, a fixed number of men was placed on detached service with the Army Port and Service Command for labor and Prisoner of War guard duty. This permitted unit commanders to plan for the future and allowed on-job-training for key replacements utilizing the understudy system. A comprehensive training program that will utilize remaining trained personnel as instructors prior to their release from serv and permit full-scale participation in athletics, in the T and in artillery training has been inaugurated.

Activation of the 40th AAA Brigade and reduction the overhead strength allotted to the 2273d AAAC (HAW has brought about the assignment of Colonel Davis to co mand both units. Colonel F. T. Folk and Colonel H. Tubbs serve in dual assignments respectively, as Exec tive Officer and S-3 of both units. Inactivation of the 3 AAA Group and the 392d AAA AW Battalion was co pleted during this period; inactivation of the 295th A S/L Battalion was scheduled. The 865th AAA AW B talion was activated simultaneously with the de-activation the 392d AAA AW Battalion and a general transfer personnel between the two units resulted in no loss of ficiency. Activation of the 993d AAA S/L Battalion (c ored) was effected 28 June, and at such time as this u becomes operative it is planned to de-activate the 295 AAA S/L Battalion.

Units are now stationed as follows: 98th AAA Gro 867th AAA AW Battalion, 295th AAA S/L Battalion a 993d AAA S/L Battalion at Schofield Barracks; 139th A Group and 865th AAA AW Battalion less B Battery at F Ruger; 750th AAA Gun Battalion at Fort Kamehame 2273d AAAC (HAW), 40th AAA Brigade and 53d In ligence Battery at Fort Shafter; B Battery 865th A AW Battalion at Fort DeRussy.

From this it can be seen that an antiaircraft artillery coming to the islands has an opportunity to serve at one numerous choice posts.

32d AAA Brigade, Luzon, P.I.

Brigadier General Frank C. McConnell, *Commanding*

The 32d AAA Brigade became inoperative at Leyte on 1 June 1946 after almost six months of work unique to this type of organization. Most of the missions performed during this period consisted of gathering up the loose ends of the Southern Philippine battlefields and the diversity ran from affecting the surrender of a Jap stronghold on Mindanao to payment of natives for hauling ammunition from the beachhead to the original 1944 battlelines on Leyte. Then it might be a two million peso sale of surplus property or the demobilization of a Philippine Army unit. In this respect 41,843 enlisted men and officers were discharged.

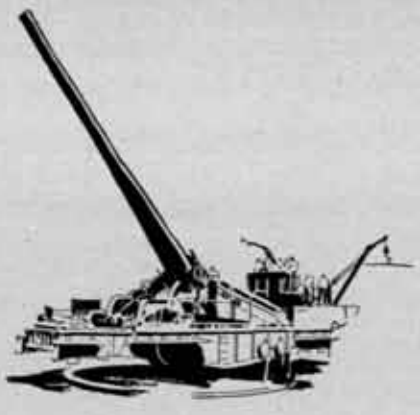
By the time this letter is published, Brigade personnel will have established a new home on Luzon and will be directing their efforts along still different lines.

The present general mission is to support the new Philippine Ground Force Command Headquarters in the execu-

General McConnell is assigned as Deputy Comman and Chief of Staff of the new headquarters and with h several Brigade staff officers have been transferred to th headquarters for duty. The Brigade Headquarters Batte has been assigned the responsibility for the maintenan and administration of the camp and the security of the ne installation.

There are two antiaircraft groups in the Philippi Ground Force Command which operate independently the Brigade: The 70th AAA Group commanded by Colon Francis A. House, which operates a training center at S Marcelino, Luzon and the 94th AAA Group presently co manded by Lieutenant Colonel Bernard J. Drew, whi operates a Philippine Ground Force Command supply poi at San Fernando, Pampanga, Luzon.

The antiaircraft battalions in the theater have beco inoperative due to the transfer of personnel to other orga zations. These battalions however are scheduled for re ignation in the near future when they will become Phil pine Scouts units. Further information on this reorga zation will be included in the next news letter from t



ne Coast Artillery School

Major General Robert T. Frederick, *Commanding*

PERSONNEL CHANGES
1 MAY 1946—5 JULY 1946

Arrivals

ame	*New Duty*
Daniel W. Hickey	Actg Asst Comdt, CA Sch
Parmer W. Edwards	Ex O, Hq & Hq Btry, CA Sch
Carl W. Holcomb	Director, DA, The CA Sch
ol. Kenneth A. Eddy	Tng Publ O, DTP CA Sch
ol. Walter E. Christie	Plans & Tng O, Hq & Hq Btry, CA Sch
ol. E. Carl Engelhart	Mine Comdr, Hq & Hq Btry, CA Sch
Walter H. Knox, Jr.	Duty unasgd, Hq & Hq Btry, CA Sch
Carroll L. Lancaster	S & E PO, Hq & Hq Btry, CA Sch
Jack V. Barton	Adjutant, CA Sch
Herman T. Sutphin	Tng Publ O, CA Sch
Richard Irvin, Jr.	Instructor, Arty Gunnery, CA Sch
William J. Oakes	Asst S-3, Hq & Hq Btry, CA Sch
Marvin H. Lucas	Intelligence O, Hq & Hq Btry, 61st CA
Charles S. Dronberger	Asst S-3, 61st CA
John C. Bulmer	Btry CO, Prov CA Btry, CA Sch
Victor DE Stephanis	Radar O, 61st CA
George A. Sense	Btry CO, Hq & Hq Btry, CA Sch
Edwin Kalbfleish, Jr.	Asst S-3, The CA Sch
Charles S. Druck	Post Dental O, Hq & Hq Btry, CA Sch
John R. Higgins	Post Medical O, Hq & Hq Btry, CA Sch
Wells Oviatt	CO, Hq & Hq Det, HDSF
Thomas F. Whelan	Mil Police O, Hq & Hq Btry, CA Sch
Thomas L. Carey	Arty Maint & Repair, Hq & Hq Btry, CA Sch
Warren R. Fritze	Acft Warning O, Hq & Hq Btry, CA Sch
Joseph T. Donohue, Jr.	Aide-de-camp, The CA Sch
1st Lt. Henry R. McCrone, Jr.	Asst S-3, Hq & Hq Detach, CA Sch
1st Lt. Ira S. Eintracht	Btry O, Hq & Hq Det, HDSF
1st Lt. Lahma W. LaFon	Btry CO, Mine Tng Det, CA Sch
CWO Lloyd R. Meyers	Asst Pers O, The CA Sch
CWO Thomas H. Miller	Band Leader, 69th AGF Band
CWO Anthony Akromas	Asst Sig Prop O, Hq & Hq Btry, CA Sch
CWO Charles R. Berg	Asst Pers O, CA Sch
CWO Carl J. Keller	Asst Supply O, Hq & Hq Btry, CA Sch
CWO James Kelly	Adjutant, Hq & Hq Btry, CA Sch
CWO Alfred A. Mulzet	Instructor, Dept Sub-Mine, CA Sch
CWO William H. Passey	Asst Tel & Telg O, Hq & Hq Btry, CA Sch
CWO Vincent J. Rooney	Asst Comm O, Hq & Hq Btry, CA Sch
WOJG Louis M. Sieber	1st Mate, 29th Camp Btry
WOJG Emmit A. Joyner	Asst Pers O, The CA Sch
WOJG Henry G. Pankey	Asst Mine Prop O, Mine Tng Det, CA Sch
WOJG Harvey R. Hastings	1st Asst Engr, 29th Camp Btry
WOJG Edward V. Sargent	Asst Sig Prop O, Hq & Hq Btry, CA Sch

Departures

Name	*New Duty*
Lt. Col. Frederick E. Day	Trfd to Second Army
Lt. Col. John M. Moore	Trfd to HDCB
Maj. Kenneth O. Alberti	Separated from Service
Maj. James T. Hennessy	Trfd to o/s Repl Depot
Maj. John F. Hall	Separated from Service
Maj. Richard R. Moorman	Trfd to 2d Army
Maj. William J. Lynch	Trfd to 1st Army
Capt. Walter T. Biggar	Separated from Service
Capt. Hubert V. Davis	Separated from Service
Capt. Paul S. Burger	Trfd to o/s Repl Depot
Capt. Steve L. Watts	Trfd to o/s Repl Depot
Capt. Thomas H. Clements	Trfd to o/s Repl Depot
Capt. Charles E. Kirkwood, Jr.	Trfd to HDCB
Capt. Richard L. Barton	Trfd to o/s Repl Depot
Capt. Earl S. Brown	Trfd to o/s Repl Depot
Capt. Charles V. Grier	Trfd to o/s Repl Depot
Capt. Benjamin I. Hill	Trfd to 2d Army
Capt. George F. Heide	Separated from Service
1st Lt. Charles C. Reischel	Trfd to HDCB
1st Lt. Francis X. McNamara	Separated from Service
1st Lt. John T. Noyes	Trfd to HDCB
1st Lt. Francis W. Welch, Jr.	Trfd to o/s Repl Depot
1st Lt. Milton H. Anderson, Jr.	Trfd to HDCB
1st Lt. John L. Lester	Trfd to o/s Repl Depot
1st Lt. John A. Spacek	Separated from Service
CWO Kenneth E. Seaver	Trfd to Armd Sch, Ft Knox, Ky.
CWO Charles B. Duckworth	Trfd to Armd Sch, Ft Knox, Ky.
WOJG Lester O. Haines	Trfd to Armd Sch, Ft Knox, Ky.
WOJG Burton E. Archer	Trfd to Armd Sch, Ft Knox, Ky.

FORT BLISS, TEXAS

COLONEL ROBERT H. VAN VOLKENBURGH
Acting Commandant

Colonel Robert H. Van Volkenburgh, Acting Commandant of the Antiaircraft Artillery School, assumed Command of Fort Bliss Tuesday, 11 June under the new Army reorganization program. Colonel George Forster, former Post Commander, assumed the duties of Deputy Post Commander. Colonel Van Volkenburgh also retained his duties as Acting Commandant of the School.

Ten branch libraries are being opened in various sections of the Antiaircraft Artillery School. At the disposal of these installations, the School central library now has more than 140,000 books, documents and periodicals.

Two courses for Professors of Military Science and Tactics have been finished and a third is now in progress. Instructors who are to teach ROTC students at various colleges and institutions throughout the country are being trained in the latest antiaircraft technique and tactics.

The Annual Air Defense Show was staged by the School and units from Biggs Field, Texas. Using OQ target planes to represent fighter aircraft and PQ target planes to represent bombers, 90mm guns, 40mm guns and weapons on half-tracks were used to demonstrate antiaircraft methods used to combat enemy air attacks. The rôle of antiaircraft weapons in ground defense was also demonstrated. Aircraft, including B-29s, A-26s and P-51s, dropped 500-, 250-, and 100-pound general purpose bombs, 100-pound parafrag bombs, fire bombs, and strafed targets as the Ninth Air Force's contribution to the show.

Ten officers from the School have been given two-year assignments to study at colleges and universities. Assigned to do studies in Guided Missiles and Aerodynamics at Johns Hopkins University are Lt. Col. Ralph H. Pryor, Captain Robert P. Detwiler and Lt. John B. Bone; Lt. Col. Gerald M. Donahue, Major Phillip Hatten and Captain Robert T. Blake went to the California Institute of Technology and Captains Gordon H. Gershon and Donald Simon and Lt. James Lothrop to New York University. Captain Howard D. Elliot was assigned to the University of Chicago to study Nuclear Physics.

Enlisted Men's courses now being taught at the Antiaircraft Artillery School include Auto Mechanic, Radio Operator, Radio Repairman, Master Gunner, Draftsman, Fire Control Electrician, Radar Operator, Radar Repairman and Artillery Mechanic.

The 384th AAA Gun Battalion, commanded by Lt. Col. Andrew S. Gamble, and the 322d AAA Automatic Weapons Battalion, commanded by Lt. Col. William Branan have been activated here and are in training under the supervision of the School. Both organizations are under the n activated 267th AAA Group, commanded by Co Hubert McMorrow.

PERSONNEL CHANGES

The following changes during the month of May occurred at the Antiaircraft Artillery School:

ARRIVALS

Name	*New Duty*
Col. Hubert McMorrow	267th AAA Group
Lt. Col. Arthur A. Adams	267th AAA Group
Lt. Col. Francis L. Beaver	Dept. of Training Liter and Visual Aids
Lt. Col. Lawrence Byers	Dept. of Fire Control
Lt. Col. William Branan	322d AAA AW Bn
Lt. Col. Raymond C. Cheal	Dept. of Material and nique
Lt. Col. William F. Curren, Jr.	Dept. of Material and nique
Lt. Col. Carl Lentz	S-3, AAAS
Lt. Col. John P. Mial	Dept. of Miscellaneous jects
Lt. Col. James K. Saunders	Inspector General, AAAS
Lt. Col. Wm. A. Strickland, Jr.	284th AAA AW Bn
Lt. Col. Russell Utke	Flak Analysis Test Firing ect
Lt. Col. John C. Wilkerson	Division of Instruction
Lt. Col. William J. Wuest	Dept. of Fire Control
Maj. A. M. Ahrens	384th AAA Gun Bn
Maj. C. B. Byrd	FATFP
Maj. Clinton Feeney	322d AAA AW Bn
Maj. Elbert M. Kidd	FATFP
Maj. William I. King	Dept. of Material and nique
Maj. Maurice H. Matthews	384th AAA Gun Bn
Maj. Franklyn J. Michaelson	FATFP
Maj. George R. Mitchell	Dept. of Tactics
Maj. Herman E. Pringle	FATFP
Maj. John J. Shoemaker	FATFP
Capt. Rollin A. Lanpher	S-4, AAAS
Capt. Paul Loesser	S-2, AAAS
Capt. Horace C. Lorck	384th AAA Gun Bn
Capt. Edward T. Maguire	Dept. of Fire Control
Capt. Dan A. McCartney	Recruiting Officer, AAAS
Capt. William P. McKinney	School Troops
Capt. Gerald W. Rowe	Asst. Secretary, AAAS
Capt. Robert G. Rutherford	Headquarters Commanda Section
1st Lt. Joseph T. Flanagan	School Troops
1st Lt. Ernest C. Natal	Dept. of Radar
2d Lt. Leroy W. Roark	322d AAA AW Bn
CWO Elmer E. Terry	1st AAA Guided Missile
WOIG Andrew M. Hayden	284th AAA AW Bn
WOJG Raymond J. Vrba	384th AAA Gun Bn

DEPARTURES

To Overseas Replacement Depot, Camp Kilmer, New Je

Capt. Samuel E. Barger	Capt. Evan A. Williams, J
Capt. Richard E. Brown	1st Lt. Ralph R. Cacchiott
Capt. David E. Deines	1st Lt. John M. Coonan
Capt. Peter F. Ramme	1st Lt. Roy K. Hanna
Capt. William C. Matthews	1st Lt. Joseph H. Huneke
Capt. Earl F. Klindienst	1st Lt. Howard Jackson
Capt. Vincent J. McManus	1st Lt. Walter E. Rahte
	1st Lt. Foy T. Wilson

Overseas Replacement Depot, Camp Stoneman, Calif.

Edgar R. Brooks	1st Lt. Leo D. Babba
Lt. Joe W. Alexander	1st Lt. Edward E. Leseman

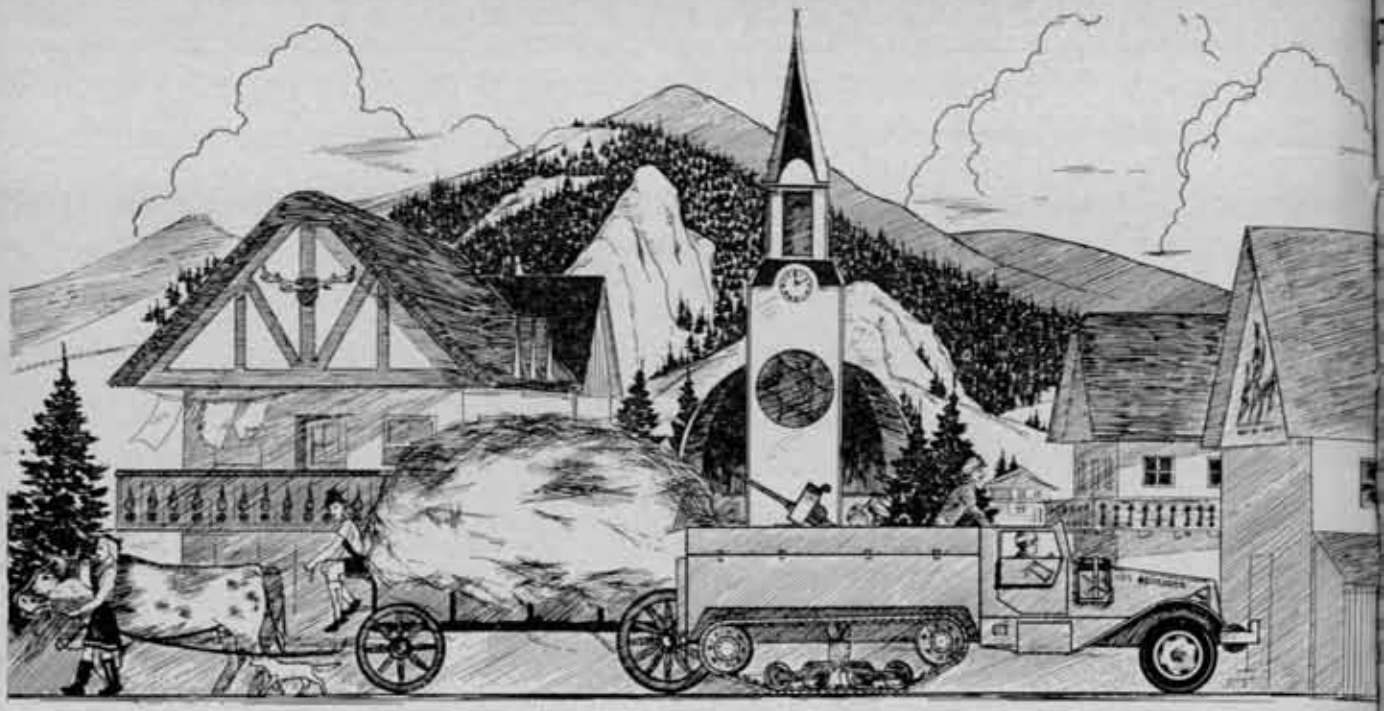
The following changes occurred during the month of June:

ARRIVALS

Name	Duty
John B. F. Dice	Dept of Misc Subjects
Col. Alvin T. Bowers	Director TL&VA
Col. William F. Curren, Jr.	Dept of Material and Technique
Col. Philip V. Doyle	Division of Instruction
Col. Robert J. Jones	Dept of Fire Control
Col. Kermit R. Schweidel	Dept of Instructional Method
Col. Willard L. Wright	267th AAA Group
Ernest M. Bailey	284th AAA AW Bn
Joseph C. Cox	Dept of Material and Technique
John J. Downey, Jr.	Dept of Misc Subjects
Glenn P. Elliot	Dept of Material and Technique
Matthew A. Hutmaker	322d AAA AW Bn
John N. Walters	Asst. Claims Officer
Joseph W. Zimmerman	Unassigned
Charles R. Arvin	367th AAA Group
Edmund H. Berg	384th AAA Gun Bn
Harold Dudley	Dept of Radar
Robert V. Hall	267th AAA Group
John F. Kilcoyne	284th AAA AW Bn
Elwyn E. Leslie, Jr.	Dept of Radar
Nicholas P. Mastores	Dept of Misc Subjects
Robert C. Mitchell	S-1, AAAS
Frances Murphy	S-4, AAAS
Fred Patterson	267th AAA Group
Isom C. Threatt	Liaison Officer, AAAS
Robert W. Veatch	Executive Officer, Enlisted Detachment
Lt. Clarence F. Craw	Public Relations, AAAS
Lt. Robert R. Cooper	1st AAA Guided Missile Bn
Lt. Dwight R. Crum	267th AAA Group
Lt. John H. Holland	1st AAA Guided Missile Bn
Lt. Thomas A. Moore	1st AAA Guided Missile Bn
Lt. Glenn A. McFetters	S-1, AAAS
Lt. Abraham Niver	School Troops
Lt. Norman L. Pruette	S-4, AAAS
Lt. Leroy A. Schmidt	1st AAA Guided Missile Bn
WO William F. Eisenbarth	S-4, AAAS
WO Jesse I. Sallis	Unassigned
WJG Frank Dudowicz	School Troops
WJG Andrew M. Hayden	Unassigned
WJG Lawrence J. Wofford	S-1, AAAS

DEPARTURES

Name	To
Col. Ramond C. Cheal	Camp Kilmer, N. J.
Col. Raymond C. Dougan	Overseas Repl Depot, Camp Stoneman, Cal.
Col. William J. Wuest	Overseas Repl Depot, Camp Kilmer, N. J.
Benjamin T. Baird, Jr.	Overseas Repl Depot, Camp Stoneman, Cal.
Maj. Ernest M. Bailey	284th AAA AW Bn
Maj. Clinton Feeney	Overseas Repl Depot, Camp Stoneman, Cal.
Maj. Kenneth Glade	College of Engineering, Univ. of Michigan
Maj. Willard J. Hodges	Overseas Repl Depot, Camp Stoneman, Cal.
Maj. Charles E. Hogan	322d AAA AW Bn
Maj. Woodrow J. Stichen	Overseas Repl Depot, Camp Stoneman, Cal.
Maj. Marvin N. Stanford	Princeton Univ., Princeton, N. J.
Capt. Roy R. Carpenter	Overseas Repl Depot, Ft. Lawton, Wash.
Capt. David E. Deines	Camp Kilmer, N. J.
Capt. Clark W. Hayes	Overseas Repl Depot, Ft. Lawton, Wash.
Capt. Howard W. Feindel	Overseas Repl Depot, Camp Stoneman, Cal.
Capt. Edward E. Klindiest	Camp Kilmer, N. J.
Capt. John F. Kilcoyne	284th AAA AW Bn
Capt. Clair LeJ. Hall	Overseas Repl Depot, Camp Stoneman, Cal.
Capt. Vincent J. McManus	Camp Kilmer, N. J.
Capt. James L. Quinnelly	College of Engineering, Univ. of Michigan
Capt. Edward X. Ridgeley	Overseas Repl Depot, Ft. Lawton, Wash.
Capt. Charles W. Thompson	Overseas Repl Depot, Ft. Lawton, Wash.
1st Lt. Joe W. Alexander	Camp Kilmer, N. J.
1st Lt. Leo D. Babb	Camp Stoneman, Calif.
1st Lt. Elmer J. Coffey	Overseas Repl Depot, Camp Stoneman, Cal.
1st Lt. Gerald W. Curo	Overseas Repl Depot, Ft. Lawton, Wash.
1st Lt. David L. Eickhoff	Carlisle Barracks, Pa.
1st Lt. Charles L. Fulton	Sep Cen, Ft. Sheridan, Ill.
1st Lt. Ray Glenn	Overseas Repl Depot, Ft. Lawton, Wash.
1st Lt. William P. Guild	Overseas Repl Depot, Ft. Lawton, Wash.
1st Lt. John H. Holland	1st AAA Gun Bn
1st Lt. Howard Jackson	Camp Kilmer, N. J.
1st Lt. Cletus L. Luebbe	Overseas Repl Depot, Ft. Lawton, Wash.
1st Lt. Walter D. Savage	Overseas Repl Depot, Ft. Lawton, Wash.
1st Lt. Robert V. Suhrke	Sep Cen, Ft. Sam Houston, Texas
1st Lt. William W. Weaver	Overseas Repl Depot, Camp Stoneman, Calif.
1st Lt. Willard J. Wicker	Overseas Repl Depot, Camp Stoneman, Calif.
2d Lt. Henry F. Dombrowski	Overseas Repl Depot, Camp Stoneman, Calif.
CWO Roy G. Replogle	WBGH, El Paso, Texas
WOJG Lester L. Hill	384th AAA Gun Bn
WOJG Francis A. Klaiber	Sep Cen, Ft. George G. Meade, Md.



Third United States Army Antiaircraft Section, Germa

Colonel Frederick R. Chamberlain, AAA Officer Third Army

The antiaircraft strength of the Third United States Army is continuing to decrease in accordance with the redeployment policy of the War Department to reach the final Occupational Troop Basis for Germany. Some units are working generally on occupation jobs under the direction of the Infantry Divisions and others now are in training directly under army control.

The 571st AAA AW Battalion (SP), located in the vicinity of Karlsruhe, Germany, is in the area controlled by the 9th Inf. Division. The battalion is responsible for the occupation of five landkrieses and has its batteries deployed throughout this area. In addition, the unit has approximately seventy-five miles of border between the French and American occupied zones on which it must enforce border crossing regulations and patrol. It is responsible for the Rhine River traffic in and north of Karlsruhe also. The battalion has recently received the job of setting up a military community for fifty families in Karlsruhe, the first of whom have already begun to arrive. The 571st AAA AW Battalion (SP) obviously has no time for training in an antiaircraft rôle, however, it is fully equipped and ready to begin training if the opportunity presents itself.

The 133d AAA Gun Battalion, located in the vicinity of Ludwigsburg, Germany, is also in the area controlled by the 9th Inf. Division, and is operating five civilian int camps in addition to occupying two landkrieses. The talion is required to transport civilian internees all Germany for the purpose of testifying in various war c trials. Fritz Kuhn, the notorious American Bund L was recently released from one of these civilian int camps.

The 644th AAA AW Battalion (SP) is a colored newly activated in May 1946. It is located in the vicin Kassel, Germany, and is going through a training pro similar to the regular mobilization training program scribed by the War Department. The battalion ha 218th AGF Band attached, and both units are ma fine progress toward becoming active members of the pation forces.

Planning is now under way for the establishment antiaircraft automatic weapons firing point for the u units now in training. The relative density of the popul in Europe presents a difficult problem in conducting aircraft artillery target practice in accordance with s regulations. Detailed reconnaissance of former Ge firing ranges at Wildflecken and Graphenwohr is unde to determine their suitability for antiaircraft use.

Panama Coast Artillery Command

gadier General Francis P. Hardaway, Commanding

ames of veteran "Jungle Mudders" dot the rosters of nt shipments of enlisted men, filling the personnel re-ements of the Panama Coast Artillery Command.

hese old-timers, most of whom served in combat theaters ng the war, but who boast previous Panama Coast lery service of from three to twenty years, are being ibuted among various organizations within the com-d as instructors and group leaders to facilitate the train-nd orientation of men new to this department.

he balance of each arriving group is made up of re-kees, who have served in other theaters but have re-ted the Caribbean for their postwar tour of duty, and oung men recently drafted or enlisted in the Coast llery Corps.

traditional Coast Artillery style of welcome is pro-d at Fort Amador, where the men spend a short period, casual group, awaiting assignment to their respective s in Panama Coast Artillery organizations. All recre-n and entertainment facilities are made available to n and special programs are arranged.

robably the most interesting and popular feature of this ssignment schedule is the "County Fair," put on by the st Artillery Command Training Center, where the men ess exhibitions and demonstrations of the weapons and pment which they will use in their rôles as Panama al guardians.

he Coast Artillery Training Center, located at Fort dor, is a special source of pride to the Command. e its organization, this school has provided technical ing for more than five thousand soldiers, including a many from various Latin-American armies. It is cur-y under the direction of Colonel E. M. Benitez, who me Commandant in April, relieving Lt. Col. A. B. l, who has since returned to the United States.

olonel Paul W. Rutledge has taken over Colonel Be-'s former duties as Commanding Officer of the Atlantic r, with headquarters at Fort DeLesseps and of Anti-aft Defenses, Atlantic Side, with headquarters at Fort ck.

ourses at the Training Center include: Antiaircraft chlights, Automatic Weapons, Radio and Wire Com-ications, Radar Maintenance, General Maintenance of nical equipment and other special courses which are n from time to time as the need arises.

he latest class of Latin-American students to graduate the Training Center included noncommissioned of-from Peru, Guatamala and Paraguay. At the gradu-ceremonies they were addressed by Major General J. lomer, Deputy Commander of the Panama Canal De-ment, who presented the diplomas; Brigadier General P. Hardaway, Panama Coast Artillery Commander, nel E. M. Benitez, Training Center Commandant, by diplomatic representatives of their respective coun-each of whom praised the school as an important factor toward furthering the Good Neighbor policy between the Americas.

A number of officers and enlisted men of the Panama Coast Artillery Command have been awarded the Army Commendation Ribbon during the period covering April and May of this year. Typical of the enlisted men whose superior work has been recognized with the commendation is First Sergeant Frederick J. Harrington, a Puerto Rican soldier, now serving as First Sergeant in Battery "B" of the 766th AAA Gun Bn. Sergeant Harrington was cited for his initiative and outstanding efficiency while on duty as First Sergeant with the 346th AAA Searchlight Bn., then set up in isolated jungle positions.

Brigadier General R. W. Berry, Commanding General of 76th AAA Brigade, until its inactivation in April of this year, is now commanding the Antiaircraft Defenses, Pacific Side, with headquarters at Fort Clayton.

Former Executive Officer of the 76th AAA Brigade, Colonel Wayne L. Barker, is now commanding the Corozal General Depot. He replaced Colonel W. H. Sweet, who is due to return to the United States the latter part of June, for duty with the Oregon National Guard.

Colonel H. A. Brusher has been relieved of his duties as S-2 at Panama Coast Artillery Command Headquarters, Fort Amador, and is now serving as Director of Civilian Personnel for the Panama Canal Department, with headquarters at Quarry Heights.

Lieutenant Colonel John E. Wood, former Executive Officer of Harbor Defenses of Balboa, Fort Amador, has assumed duties as Executive Officer, G-3 Section, of the Panama Canal Department, Quarry Heights.

Lieutenant Colonel J. F. Taylor, former Adjutant General and S-1 of Panama Coast Artillery Headquarters, Fort Amador, will return to the United States in June for reassignment.

Officers who returned to the United States from the Panama Coast Artillery Command, during April and May, included: Lieutenant Colonel Francis C. Sweeney, Lieutenant Colonel Wesley H. Armstrong, Lieutenant Colonel Adolph B. Juell, Major William N. Felton, Major Lawrence N. Chamberlin, Major Paul W. Colby, Major Ralph J. Balsey, Major Herman T. Sutphin, Major Mathew Santino, Major Juan O. Gonzalez, Major Harry B. Olson, Major Arthur LaCapria, Captain Benjamin S. Wathen, Captain Herbert M. Lazarow, Captain Joseph O. Self, Jr., Captain Frank Hawthorne, Captain Philip J. Moore, Captain Robert L. Marcus, Captain Byron S. Smith, Captain John J. Petresky, Captain Francis M. Manoney, Captain George H. Bradford, Captain Raymond A. Keenan, Captain James F. Latham, Lieutenant Willard L. Dowling, Lieutenant Angelo P. Gori, Lieutenant Philip N. Smith, Lieutenant Joseph G. Richardson, Lieutenant John A. Feroli, Lieutenant Harold O. Taylor, Lieutenant Eugene F. Arend, Lieutenant David T. Taylor, Lieutenant William H. Tomlinson, Lieutenant John E. Senati, Lieutenant Wallace M. Akey, Lieutenant Harry D. Nelgner, Jr., Lieutenant Sidney A. DeBarathy, Lieutenant Nathan M. Jartman, Lieutenant John J. Zingsheim, Lieutenant Willis E. Powell, Lieutenant Jacob Verniel and Lieutenant John J. Sheehan.

The following troops are assigned to the Panama Coast Artillery Command:

PACIFIC SIDE

Panama Coast Artillery Command Headquarters: Brigadier General F. P. Hardaway.
Headquarters and Headquarters Battery.
Harbor Defenses at Balboa:
Headquarters and Headquarters Battery, HD of Balboa
Battery "A," HD of Balboa
Battery "B," HD of Balboa
Antiaircraft Defense, Pacific Side: Brigadier General R. W. Berry
Headquarters and Headquarters Battery, 903d AAA AW Bn. (Less Batteries C and D.)
Battery "A" 903d AAA AW Bn.
Battery "B," 903d AAA AW Bn.
Battery "A," 766th AAA Gun Bn.
Battery "B," 766th AAA Gun Bn.

ATLANTIC SIDE

Harbor Defenses of Cristobal:
Headquarters and Headquarters Battery, HD of Cris
Battery "A," HD of Cristobal
Battery "C," HD of Cristobal
Antiaircraft Defenses, Atlantic Side: Colonel Paul Rutledge
Headquarters and Headquarters Battery, 764th Gun Bn.
Battery "A," 764th AAA Gun Bn.
Battery "B," 764th AAA Gun Bn.
Battery "C," 764th AAA Gun Bn.
Battery "D," 764th AAA Gun Bn.
Battery "C," 903d AAA AW Bn.
Battery "D," 903d AAA AW Bn.

AATC San Marcelino, Zambales, P. I.

LIEUTENANT COLONEL ROYAL L. LEIDY, CAC
Commanding

The outstanding event of the past month was the arrival at San Marcelino of 1,600 Philippine Scouts. These troops were organized into five provisional units established by order of the Philippine Ground Force Command:

1st AAA Group (PS) (Prov)
2d AAA AW Bn (SP) (PS) (Prov)
3d AAA Gun Bn (Type A) (PS) (Prov)
Btry C, 4th AAA S/L Bn (Type C) (PS) (Prov)
5th AAA Ops Det (PS) (Prov)

The Philippine Scout personnel will be given 13 weeks' basic training after which technical antiaircraft training will begin. However, outstanding men will attend the Antiaircraft Schools operated by the AAATC during the period of basic training. Courses include instruction for motor mechanics, radar operators, and automatic weapons crewmen.

The 70th AAA Group is providing all the American personnel for the training of the Philippine Scouts as well as continuing its usual mission of providing the personnel to operate the AATC. Continued redeployment has placed a serious strain on the American personnel, especially the personnel of the School.

Qualified officers and enlisted instructors for the schools are very few, especially in the Radar School where soon one officer will be responsible for the entire course of radar instruction for selected Philippine Scouts. The Radar is under the direction of Second Lieutenant James D. Ingham, CAC, the Automatic Weapons School under direction of Second Lieutenant Ray A. Cavanna, C and the Motor School under Second Lieutenant J Russo, CAC. Over-all supervision of the schools is u the direction of Major Harold P. Wills, CAC, who serves as S-3 of the 70th AAA Group. Supervision of Pl pine Scout training is under Captain Bruce B. Langfi

The S-4 Section of the 70th AAA Group serves a ordinating agency for all supply in the AAATC. Group S-4 is at present Second Lieutenant Jonas Stuckey, CAC, who recently succeeded Captain Harr Patten, CAC, who returned to the States under rede ment. Captain Patten had over two years consecutive ice with the Group at the time of his departure. Th Section has the tremendous task of requisitioning and ing full T/O&E equipment for the five Philippine S units.

During the month several officers departed for the U States and separation from the service. They were Ca Edward H. Dennis, CAC, First Lieutenant Delbert J. son, FA, First Lieutenant Robert W. Anderson, C First Lieutenant Stanley L. Corman, FA, and First tenant Bankston Waters, FA.

Quarters for nine families are nearing completion. dwellings are of a prefabricated type and are ideally to the tropical climate of the Philippines. Filipino ci have been used extensively in construction and g maintenance work and have proved to be capable and working men.

Colonel Francis C. Hause, Commanding

owing from San Marcelino, Zambales to San Fernando, panga on 15 June 1946, the 94th AAA Group com- d its tenth move since landing in Sydney, Australia in ch 1942. The 94th is assigned to the Philippine nd Force Command and is operating Army Supply t No. 3. At present classes I, II and IV supplies are lled as well as a railhead near Camp O'Donnell and a ry. Headquarters and Warehouses are in the mill of the panga Sugar Development Company, It is contem- d to expand the Supply Point to handle all classes of ly plus Signal and Ordnance property. In addition plans are under way for installing an ice plant, ice cream plant and shoe repair shop. The 94th Headquarters Battery absorbed an inactivated QM Railhead Company and Bakery Company.

The personnel were reluctant to leave the beautiful camp at San Marcelino, but everyone welcomed moving to the Manila side of the far-famed Zig Zag Pass over Bataan.

Colonel Francis C. Hause is assigned as Commanding Officer, but he has been in Manila on TDY as president of one of the War Crimes Commissions since last December. He is popularly known as "Hanging Frank." Lieutenant Colonel Laurence H. Brownlee, executive officer, is on TDY in the US as is Major Oliver E. Wood. Major William H. Lambert is in command at present. Captain Joseph P. McElligott is Executive Officer. Other Officers who made the move with the 94th are First Lieutenant Ralph C. Wilde, Hq. Battery Commander and First Lieutenant Theodore Shook, Adjutant. First Lieutenant Jerry F. Hardy and Second Lieutenant Stanley J. Salant have been assigned from units inactivating at the Supply Point.

As is the case with most organizations, the 94th has been hit hard by discharges, especially among the older and more experienced Noncommissioned Officers. The enlisted strength present for duty is 217.

Since the 94th took over the Supply Point it has become a popular stopping point for the personnel from the AATC in San Marcelino.

260th AAA Group, Washington, D.C.

Colonel Leroy S. Mann, Commanding

he 260th AAA Group, District of Columbia National rd, has been informed that the FBI which now occu- the huge modern Armory, will be completely moved y 1 September. The structure is expected to be avail- for occupancy by the Guard 1 October since some al- ons are required to restore the Armory to its original condition. Guard units of the District have never enjoyed the use of this Armory as it was completed after all units were called into Federal Service.

Colonel Charles M. Myers, CAC, reported 24 June for duty as Senior Instructor for the District Guardsmen. This tour of duty is a return to his parent unit for Colonel Myers as he was a member of the First Company, Coast Artillery, District of Columbia National Guard, in 1917. This First Company was redesignated Battery D, 60th Coast Artillery, served throughout World War I, and after being mustered out of Federal Service, was reorganized in 1924 as the 260th Coast Artillery.

Expedient service to all and 15% discount to members of the Coast Artillery Association on orders of $2.00 or more — cash or charge.

BEST

General

THE EGG AND I. By *Betty MacDonald*. In 1927 the author married a man who was fired with the idea of opening a chicken ranch in the Northwest. They moved to a ranch on the Olympic Peninsula, and with a great deal of humor she chronicles her complete disenchantment with chickens and farm life. There is much, too, in her story about her neighbors, the thrifty and critical Hickses and the carefree and borrowing Kettles. *Lippincott* $2.75.

PEACE OF MIND. By *Joshua Loth Liebman*. Rabbi Liebman correlates the findings of psychoanalysis with the basic religious teachings in order to give man a clear understanding of himself and through that understanding, wisdom and peace. *Simon and Schuster* $2.50.

I CHOSE FREEDOM. By *Victor Kravchenko*. Kravchenko was born and grew up in the Russian revolutionary faith. He became a famous engineer and a trusted member of the Communist party. Then he suddenly quit his job and the party when he was part of a Soviet Purchasing Commission in the U.S.A. He relates the gradual disillusionment that led him to break with his whole previous life. *Scribner* $3.50.

TOP SECRET. By *Ralph Ingersoll*. A frank history of the invasion of the Continent, with no mercy for mistakes or obstructions. His reports on the campaigns on the blunder that lengthened the war by weary months, on the mishaps and muddling is incisive. *Harcourt Brace* $3.00.

LAST CHAPTER. By *Ernie Pyle*. A short account of Pyle's trip to the Pacific front and the invasion of Okinawa, written with all the homely detail and warm interest that made big best sellers of *Here Is Your War* and *Brave Men*. Like the previous books, tains an index of the names mentioned in the text, also a bri ture section. *Holt* $2.50.

A SOLO IN TOM-TOMS. By *Gene Fowler*. A humorou biography in which other people are given chief attentio Baldwin, the high-wire walker; Jack Dempsey; the Barry prostitutes and gamblers and celebrities. A picture of Americ 1890 to 1938 and a personal narrative. *Viking* $3.00.

MY THREE YEARS WITH EISENHOWER. By *Captain C. Butcher*. The personal diary of General Eisenhower's Aide, old and close friend, who shared the General's quarter the invasion of North Africa to the final surrender of Ger Besides being an inside view of three years of war, it is also cellent portrait of Eisenhower. *Simon and Schuster* $5.00.

THE AUTOBIOGRAPHY OF WILLIAM ALLEN WHIT biography of a great American liberal editor and proprietor *Emporia Gazette*, which he developed into one of the most small newspapers of the United States; friend of presidents, men and common Americans. His own story is also that of hi and people. *Macmillan* $3.75.

THE SCARLET TREE. By *Sir Osbert Sitwell*. Second volu Sir Osbert Sitwell's autobiographical writings, the first of was *Left Hand, Right Hand*. In this narrative of his bo (1899-1909) we learn more about his distinguished family, are now forced by financial difficulties to leave their ancestral in Derbyshire and move to London. A portion was serializ *Atlantic Monthly*. Fair sales. *Atlantic-Little Brown* $3.50.

EARTH COULD BE FAIR. By *Pierre Van Paassen*. An mate account of a Netherlands town and its people—Gorcum city of Van Paassen's birth, from his boyhood to World W Here is an excellent view of a way of life that is totally unfa to many of us; a portrait of people with all their motives, fear hopes; a story of the rebellion of man against the forces of sion. *Dial* $3.50.

DETROIT IS MY OWN HOME TOWN. By *Malcolm B* A racy informal picture of Detroit through sketches of its figures, inside stories about titantic feuds, yarns about ba players, and other interesting people and places. The autho known Detroit for many years as only a newspaper man *Bobbs-Merrill* $3.75.

IMPRESARIO. By *S. Hurok and Ruth Goode*. This book w by S. Hurok in collaboration with Ruth Goode takes you b the scenes with the brightest stories of the Ballet, Concert and Opera. The last of the world's grand style showmen po a horde of information which he passes on. The book contains than forty intimate photographs. *Random House* $3.00.

YANKEE STOREKEEPER. By *R. E. Gould*. The autobiog of a Somerset County, Maine storekeeper, written with sly England humor. It deals rather with Yankee "horse-trading" with personalities. Gould tells of business coups, of apparent takes which he manages to turn to profit, now and then o turesque customs of his store. Although he was an old-fash storekeeper, he was a smart businessman who licked the stores at their own game. Eight full-page drawings by Steph Voorhies. Originally announced by Stephen Daye under title *Country Storekeeper*. Condensation in one issue of Sat *Evening Post*. Looks like a possible best seller. *Whittlesey* $

ALEXANDER OF MACEDON: THE JOURNEY TO WO END. By *Harold Lamb*. A masterly presentation of the great lonely conqueror, Alexander the Great—the general who foug battles on journeys of exploration, Persia, Babylon, Asia etc., and who hoped to chart the boundaries of the world. *D day*. $3.50.

A FEW BRASS TACKS. By *Louis Bromfield*. Mr. Bromfi lieves that the industrialization of the world is largely responsi its present ills. The people have lost touch with reality; they no faith in themselves or others because of this divorcement pleads for a return to the basic things. *Harper* $2.75.

BOOK CLUB SELECTIONS
JULY

Book-of-the-Month Club
BRITANNIA NEWS $2.75
By Margery Sharp. *Little, Brown*

People's Book Club
THE TURQUOISE $2.50
By Anya Seton. *Houghton Mifflin*

Literary Guild
SINGING WATERS $2.50
By Ann Bridge. *Macmillan*

Junior Literary Guild
6, 7, 8 Year Olds
THE MITTY CHILDREN FIX THINGS $2.50
By Nura. *American Studio*
9, 10, 11 Year Olds
MISS PENNYFEATHER AND THE POOKA $2.50
By Eileen O'Faolain. *Random*
Girls 12-16
MISTRESS OF THE WHITE HOUSE: THE STORY OF DOLLY MADISON $2.00
By Helen L. Morgan. *Westminster*
Boys 12-16
WILD WATERS $2.00
By Lewis S. Miner. *Messner*

Religious Book Club
MAN AND SOCIETY IN THE NEW TESTAMENT $2.75
By Ernest J. Scott. *Scribner*

Scientific Book Club
APES, GIANTS, AND MEN $2.50
By Franz Weidenreich. *University of Chicago*

LLERS

Expedient service to all and 15% discount to members of the Coast Artillery Association on orders of $2.00 or more — cash or charge.

Fiction

E HUCKSTERS. By *Frederick Wakeman*. A rip-roaring satire the advertising agency business, including some marvelous con- nces in New York and glimpses of radio work in Hollywood. e thread of the story is woven around Vic Nordman, in charge the Beautee Soap account of the Kimberly & Maag agency. All well until Vic falls in love with Kay Dorrance, wife of an y man, and has a torrid affair with her. He thinks of marriage the first time, but abandons the idea out of deference to Kay's ing husband. *Rinehart* $2.50.

IS SIDE OF INNOCENCE. By *Taylor Caldwell*. A novel of erican life in one of the most absorbing periods of our national ory—the decades immediately following the Civil War. The r concerns two rebels against the conventions of their times . . . l who was as clever and resourceful as she was beautiful and a who would stop at nothing to attain his desires. *Scribner's* 50.

EN AND NOW. By *Somerset Maugham*. In 1502 the city Florence sent Machiavelli to treat with the Duke of Valentinois, ar Borgia, who was pressing Florence for an alliance or else—. ugham draws a plausible picture of the times, of the wily hiavelli, of the shrewd and treacherous Duke. There is, as , Machiavelli's attempted seduction of a pretty wife only to his eighteen-year-old nephew has succeeded where he has d. *Doubleday* $2.50.

E SNAKE PIT. By *Mary Jane Ward*. An autobiographical unt of life in an asylum. She tells of wet packs, the tubs, of ondidness and despair of institutional existence, of the gradual th of hope. It takes place entirely in the asylum. *Random se* $2.50.

TANNIA NEWS. By *Margery Sharp*. The story of Adelaide n 1875 to 1944, a Victorian virgin who married a ne'er-do-well t and went to live in his slum house, only to discover, in middle- , that she had become a celebrity in London's smartest apartment . A long, ironic comedy, rich in detail and subtly humorous. le *Brown* $2.75.

CHESS HOTSPUR. By *Rosamond Marshall*. Like the author's ry," this mixture of sex, sentiment, and rather stereotyped plot hit the sales gong. Wanton spitfire Percy, Duchess of Harford, in love with the poor but ambitious newspaper owner, Tom nier. A villainous cousin does his best to break up their at- ment but romance triumphs after plenty of tumbling in bed plenty of melodrama. *Prentice-Hall* $2.50.

NGING WATERS. By *Ann Bridge*. The remaking of bored re Thurston when exposed to the earthy simplicity of the Al- ns. Nils Larsen persuades her to stop off at Zagreb; Gloire, dow, had hated the world but in Albania she recaptures a joy fe and at the end gives up Nils, the man she loves, to act as tant to Dr. Emmeline Crowninshield. *Macmillan* $2.50.

ORLD TO WIN. By *Upton Sinclair*. This is another Lanny d novel. It is the story of Roosevelt's secret agent behind the es of recent history. Once again Lanny is involved with the us and notorious of our day: in the United States (where he vers a plot on the President's life); in Europe (where he is lved in Hess's mysterious flight); in Russia (where he inter- s Stalin). *Viking* $3.00.

CH OF TRIUMPH. By *Erich Maria Remarque*. Ravic is a an refugee doctor in Paris, just before the war, who must ce clandestinely and be ready for flight or deportation at mes. He falls in love with Joan Madou, breaks with her se she becomes the mistress of an actor, and kills the Gestapo who had tortured him in Germany. With the outbreak of war off to a French concentration camp. The story is long, not too and full of philosophical conversations. *Appleton-Century* 50.

ST ALL DISHONOR. By *James M. Cain*. The succinct style direct, machine-gun action of the early Cain. Roger Duval, g Confederate acting as a spy in Civil War California, meets ina just as she is being accused of theft on a river steamer. It long until the infatuated Roger learns his darling is a pros- e—but he still loves her. Then begins Roger's swift degenera- tion into treachery, brutality, and outlawry for Morina's sake. *Knopf* $2.00.

SPOONHANDLE. By *Ruth Moore*. Aggie, who would share in the proceeds if brother Willie sold Little Spoon Island to the rich summer people, called Willie and Hod shiftless; whereas they simply preferred their island to the prejudiced and gossipy Maine village. Then Ann Freeman, author-rebel, and Joe Sangor, the "Portygee," brought Hod out of seclusion, while Willie took over the upbringing of a half-wild orphan boy. *Morrow* $2.75.

WE HAPPY FEW. *By Helen Howe*. A very sophisticated, satirical novel set chiefly in Cambridge and holding up to ridicule the Harvard faculty members and their wives who call themselves "the little Group." Dorothea is the leader—poised, beautiful, dignified. With the war, however, Dorothea's complacency is rudely shattered —her husband is killed, her lover jilts her, an old flame refuses her overtures. Dorothea suddenly sees herself not as a cultured aristocrat but as an egotistic prig. *Simon & Schuster* $2.75.

THE KING'S GENERAL. By *Daphne du Maurier*. This is probably the best of the author's historical novels. After a rather movie-like prologue, it skips sixteen years and becomes a straight romantic adventure story of the English Civil War, with the spotlight on Sir Richard Grenville, arrogant General whom the Parliamentarians called "Skellum" and whom the bigwigs on his own side hated for his caustic tongue and his military brilliance. Crippled Honor Harris tells the story—set largely in a manor with a "ghost," a secret tunnel, etc. *Doubleday Doran* $2.75.

★The Retail Bookseller.

BOOK CLUB SELECTIONS

AUGUST

Book-of-the-Month Club

INDEPENDENT PEOPLE $3.50
By Halldor Laxness. *Knopf*

Literary Guild

THE AMERICAN $3.00
By Howard Fast. *Duell, Sloan & Pearce*

Junior Literary Guild

6, 7, 8 Year Olds

SAMMY $2.00
By May Justus. *Whitman*

9, 10, 11 Year Olds

BRIGHT APRIL $2.50
By Marguerite de Angeli. *Doubleday Doran*

Girls 12-16

JUNGLE JOURNEY $2.50
By Jo Besse McElveen Waldeck. *Viking*

Boys 12-16

THE SCRAPPER $2.00
By Leland Silliman. *Winston*

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COAST ARTILLERY ORDERS

(WD and WGF Special Orders covering the period 1 May through 5 July 1946. Promotions and demotions are not included.)

Brigadier General (Colonel)

Garrett, Robert C., to retire.

Colonels

Aldrich, Harry S., to MI Sv., Washington, D. C.
Atwood, Roy S., to retire.
Benz, Herbert T., to retire.
Blunda, Gaspare F., to OC of S, Washn DC for dy in Office Dir of Intelligence.
Bogart, Frank A., detailed in QMC and to OC of S, Washn DC for dy in Office Dir of Sv Supply and Procurement.
Boswell, James O., to OC of S, Washn DC for dy in Office Dir of Intelligence.
Case, Homer, relieved fr detail in GSC and fr Asmgt to GSC w/troops.
Chaplain, Robert T., to Army Industrial College, Washn DC.
Cooper, Avery J., Jr., to OC of S, Washn DC for dy in Office Dir of Sv Supply and Procurement.
Cordell, Ben E., to National War College, Washn DC.
Cory, Ira W., to OC of S, Washn DC.
Cunningham, Frank J., to retire.
Diestel, Chester J., to OC of S, Washn DC for dy in Office Dir of Sv Supply and Procurement.
Donaldson, William H., Jr., detailed in TC.
Dunham, William H., Jr., to retire.
Duvall, Ward E., to retire.
Elias, Paul, 2 yr course on Guided Missiles, College of Engineering, NY Univ., University Heights, N. Y.
Featherston, John H., to OC of S, Washn DC for dy in Office Dir of Sv Supply and Procurement.
Freeland, Ellicott H., to retire.
Gallagher, Ferdinand F., to HD Long Island Sound, Ft. H. G. Wright, N. Y.
Gough, A. Deane, to OC of S, Washn DC for dy in Office Dir of Sv Supply and Procurement.
Greenwood, Donald B., to retire.
Gross, Felix E., to retire.
Handwerk, Morris C., to Air Tactical Comd, Langley Fld, Va.
Harris, William H., to Central Intelligence Group, Washn DC.
Hartman, Norman E., to Fordham University, Fordham, N. Y.
Harvey, Thomas H., to OC of S, Washn DC for dy in Office Dir of Sv Supply and Procurement.
Hennessey, Harold P., to Army Industrial College, Washn DC.
Hill, Ira B., to retire.
Hincke, John I., to OC of S, Washn DC for dy in Office Dir of Sv Supply and Procurement.
Hoge, Daniel L., to OC of S, Washn DC.
Jolls, Ephraim P., relieved from Active Duty.
Kahle, John F., to Fld Agencies III Sec WD Manpower Board, 1401 Tower Bldg., Baltimore, Md.
Kemble, Franklin, to retire.
Krueger, Robert H., to Hq Air Defense Comd, Mitchel Field, NY.
Lovell, John R., to OC of S, Washn DC for dy in Office Dir of Intelligence.
Mansfield, Herbert W., to OC of S, Washn DC for dy w/Research and Development Div.
Mellnick, Stephen M., to OC of S, Washn DC for dy in Office Dir of Intelligence.
Metzler, John E., to USMA West Point NY.
Morrow, Samuel H., to Air Defense Comd, Mitchel Field, NY.
Myers, Charles M., to atchd unasgd Hq Second Army w/ sta in Washn for dy as Actg Senior Instructor, DC NG.
McCormick, Thomas C., to AAA Repl Pool, Fort Bliss, Tex.
McLean, Donald, to NG Instr, Allentown, Pa.
McManus, Charles F., to AAA Repl Pool, Ft. Bliss, Texas for dy w/116th Counter Intelligence Corps Det.
Nelson, Paul B., to OC of S, Washn DC for dy in Office Dir of Sv Supply and Procurement.
Papenfoth, William H., to OC of S, Washn DC for dy in Office Dir of Sv Supply and Procurement.
Rothgeb, Clarence E., to AAA Repl Pool, Fort Bliss, Texas.
Russell, Sam C., to National War College, Washn DC.
Rutter, Warren C., to G-1 Sec, Hq AGF, Washn DC.
Schabacker, Clarence H., to Hq AGF, Washn DC.
Sinclair, Jesse L., to retire.
Strickland, Henry E., to Field Agencies III, Sec., WD Manpower Board, 1401 Tower Bldg., Baltimore, Md.
Sturman, J. Foxhall, to Hq Second Army, Baltimore, Md.
Sullivan, Andrew P., to OC of S, Washn DC for dy in Office Dir of Sv Supply and Procurement.
Tarrant, Legare K., to National War College, Washn DC.
Taylor, Wentworth H., Jr., to ASF Tng Center, Fort Eustis, Va.
Tischbein, Carl F., to Policy Hq, ASF., Washn DC.
Turner, Robert A., to OC of S, Washn DC for dy in Office Dir of Intelligence.
Vandersluis, Howard J., to OC of S, Washn DC for dy in Office Dir of Sv Supply and Procurement.
White, Leon A., to retire.
Whitney, Henry W., relieved from Active Duty.
Wilson, Arthur E., to University of Pittsburgh, Pa.
Winton, Arthur V., to OC of S, Washn DC for dy in Office Dir of Sv Supply and Procurement.
Wolfe, Walter J., to Office Dir of Supply Hq, ASF, Washn DC.
Wood, Francis O., detailed in IGD.
Young, Ellsworth, to OC of S, Washn DC for dy in Office Dir of Sv Supply and Procurement.

Lieutenant Colonels

Ackert, Thomas W., to OC of S, Washn DC for dy in Office Dir of Sv Supply and Procurement.
Adams, Gilbert N., to Hq AGF Washn DC.
Alexander, Dana S., to atchd unasgd, Det of Pat, WRGH, Washn DC.
Anderson, Robert B., to OC of S, Washn DC for dy in Office Dir of Sv Supply and Procurement.
Barrield, Thomas H., to OC of S, Washn DC.
Barrett, John T., to 526th AAA Gun Bn (semi-mobile), Orlando Air Base, Orlando, Fla.
Beaumont, Charles R., to OC of S, Washn DC for dy in Office Dir of Sv Supply and Procurement.
Belardi, Raymond J., to OC of S, Washn DC for dy in Office Dir of Sv Supply and Procurement.
Bellonby, Emory E., to OC of S, Washn DC for dy in Office Dir of Intelligence.
Bertolet, John H., to AARP, Fort Bliss, Texas.
Brown, William H., to OC of S, Washn DC for dy in Office Dir of Sv Supply and Procurement.
Chandler, Homer B., Jr., to SIS Hq AGF, Washn DC.
Cordes, Clifford F., Jr., detailed in JAGD.
Cory, Ira W., to AAA Repl Pool, Fort Bliss, Tex.
Cottam, Robert D., relieved from Active Duty.
D'Arezzo, Alfred J., to USMA, West Point, NY.
Dutton, Francis W., to OC of S, Washn DC for dy in Office Dir of Intelligence.
Davis, Edward G., to OC of S, Washn DC for dy in Office Dir of Intelligence.
Davis, Lee J., to University of Cincinnati, Cincinnati, O.
Day, Frederick E., 2 yr course in Electr[illegible] Illinois Inst., of Tech, Chicago, Ill.
Day, John B., relieved from Active Duty.
Donahue, Gerald M., to 2 yr course in G[illegible] Missiles, Cal. Inst. of Technology.
Easton, William G., detailed in JAGD, [illegible] of Minn., Minneapolis, Minn.
Eubank, Perry H., to 2 yr course in Guided [illegible]siles, Cal. Inst. of Technology.
Fraser, Richard H., to Office Dir of Procure[illegible] for dy with Research and Development D[illegible]
Fritz, William G., detailed in Ord Dept., [illegible] Camp Kilmer, NJ.
Gallagher, Robert E., to OC of S, Washn[illegible] for dy in Office Dir of Sv Supply and Pro[illegible]ment.
Gay, Alfred C., to Hq AAF, Washn DC.
Hackett, Charles J., detailed in AGD.
Harding, Stanley L., detailed as membe[illegible] GSC and asgnd dy w/WDGS.
Hoffman, Theodore, to 2 yr course in Electr[illegible] Illinois Inst. of Tech, Chicago, Ill.
Janowski, Raymond A., to Sch of Mil Go[illegible] Areas, Carlisle Bks, Pa.
Jordan, Ralph E., detailed In JAGD w sta [illegible]vard University, Cambridge, Mass.
Kasper, William R., to University of North [illegible]lina, Chapel Hill, N. C.
Kimm, Virgil M., detailed in IGD.
King, Edward A., to AAORP, AARTC, [illegible] Bliss, Texas.
Lane, John J., to Naval War College, Ne[illegible] R.I.
Luczak, Bernhard P., to 2 yr course in G[illegible] Missiles, Cal. Inst. of Technology.
Max, George S., to 2 yr course in Optics, C[illegible] of Engineering, NY Univ, University [illegible] NY.
Crae, James L., relieved from Active Duty.
McGoldrick, Francis M., to 2 yr course in G[illegible] Missiles, Cal. Inst. of Technology.
Newcomer, Francis K., to OC of S, Washn[illegible] for dy in Office Dir of Intelligence.
Pervier, George W., relieved from Active [illegible]
Peterson, Arthur C., to OC of S, Washn D[illegible] dy in Office Dir of Intelligence.
Phillips, Hal B., to Manhattan Engr Dist, [illegible] Ridge, Tenn.
Pratt, Ford E., detailed member of GSC a[illegible] w/WDGS.
Ostenberg, Frank T., to OC of S, Washn D[illegible] dy in Office Dir of Sv Supply and Pr[illegible]ment.
Rehkop, Russell G., to First Army Hq, Gov[illegible] Island, NY.
Remaley, John W. C., detailed in QMC.
Richards, John R., to OC of S Washn DC[illegible]
Rule, Donald D., relieved from Active Dut[illegible]
Russell, Melvin R., to USMA, West Point,[illegible]
Shaver, Maurice P., relieved from detail i[illegible]
Sills, Tom W., to OC of S, Washn DC for [illegible] Office Dir of Sv Supply and Procurem[illegible]
Smith, Robert G., to OC of S, Washn DC [illegible] in Office Dir of Sv Supply and Procure[illegible]
Smith, Robert G., Jr., to Beloit HS, Beloit, [illegible]consin.
Waterman, Bernard S., to OC of S, Wash[illegible] for dy in Office Dir of Sv Supply an[illegible]curement.
Weber, Donald B., to OC of S Washn D[illegible] dy in Office Dir of Intelligence.
Weyand, Fred C., to OC of S, Washn D[illegible] dy in Office Dir of Intelligence.
Williams, James M., to OC of S, Wash[illegible] for dy in OAC of S, G-2.
Williams, Robert L., Jr., to Fort Monroe, [illegible]
Wolfe, John B., relieved from Active D[illegible]

MAJORS

son, Leland H., to Oversea Repl Dep, Ft. Lewis, Washington.
Marshall W., to Hq Second Army w/sta Oceana, Va. w/Air Support Control Unit 2.
Robert S., to Oversea Repl Dep, Camp Roberts, Cal.
Frank A., Jr., to 2 yr course in Automotive Engineering, Univ of Mich, Ann Arbor, Mich.
Warren S., detailed in IGD.
Robert L., to OC of S, Washn DC for dy in OAC of S, G-3.
Jerome S., to 2 yr course on Guided Missiles, Coll of Engineering, NY Univ, University Hgts, NY.
James M., to OC of S, Washn DC for dy in Office Dir of Sv Supply and Procurement.
Rawlins M., Jr., to OC of S, Washn DC for dy in Office Dir of Sv Supply and Procurement.
Chester V., to OC of S, Washn DC for dy in Office Dir of Intelligence.
Francis, to ETO.
Richard B., relieved from Active Duty.
Clarence M., Jr., to Inf RTC, Fort McClellan, Ala.
Edmund L., to 2 yr course in Nuclear Physics, Univ of Chicago, Chicago, Ill.
Elmer W., detailed in QMC and for dy in OQMG, Washn DC.
Warren P., to AAARP, Fort Bliss, Texas.
William J., to OC of S Washn DC for dy in Office Dir of Sv Supply and Procurement.
Kenneth, to 2 yr course in Automotive Engineering, University of Michigan, Ann Arbor, Mich.
Henry J., relieved from Active Duty.
William E., resigned.
Sedgie V., to Seacoast Artillery Repl Pool, Fort Winfield Scott, Cal.
Albert G., to 9th Sv Cmd, Presidio of San Francisco, Cal.
William H., to OC of S, Washn DC for dy in Office Dir of Sv Supply and Procurement.
Donald H., to OC of S, Washn DC.
Harry C., to Intelligence School, Fort Riley, Kansas.
Jack H., to OC of S, Washn DC for dy in Office Dir of Intelligence.
William M., to OC of S, Washn DC for dy in Office Dir of Sv Supply and Procurement.
Jease L., to OC of S, Washn DC for dy in Office Dir of Intelligence.
Alexander H., Jr., to The Citadel, Charleston, S.C.
Clemens P., to OC of S, Washn DC for dy in Office Dir of Sv Supply and Procurement.
William J., to 2 yr course in Guided Missiles, Coll of Engineering, NY Univ, University Hgts, NY.
John F., to AGF Liaison Office, Fort Sheridan, Ill.
Wilson E., to OC of S, Washn DC for dy in Office Dir of Sv Supply and Procurement.
Edward J., to Hq Seventh Army, Atlanta, Ga.
Robinson R., detailed in CE.
Thomas J., to OC of S, Washn DC for dy in Office Dir of Intelligence.
John G., detailed in Ord Dept.
Grant, Jr., to resign.
Charles C., to OC of S, Washn DC for dy in Office Dir of Sv Supply and Procurement.
Philip M., detailed in IGD.
William T., to 2 yr course in Guided Missiles, Cal. Inst. of Technology.
Salmon, Eugene H., to OC of S, Washn DC for dy in OAC of S, G-3.
Scott, Edwin G., to ETO.
Smith, Calvin O., to OC of S, Washn DC for dy in Office Dir of Intelligence.
Snow, John R., to Hq AGF, Washn DC.
Stanford, Martin N., to 2 yr course in Nuclear Physics, Princeton, NJ.
Sullivan, James A., to University of New Hampshire, Durham, NH.
Twomey, Lawrence A., to Los Angeles High School, Los Angeles, Cal.
Wahlgren, Nelson C., to OC of S Washn DC for dy in OAC of S, G-3.
Walker, John W., to OC of S, Washn DC for dy in Office Dir of Intelligence.
Ward, Frederick G., to HD of Boston, Fort Banks, Mass.
Wardrop, Malcolm S., to Camp Kilmer Overseas Repl Dep, New Brunswick, NJ.
White, John M., to Central Intelligence Group, Washn DC.
Wilson, Harry L., Jr., relieved from Active Duty.

CAPTAINS

Allen, Frank D., to OC of S, Washn DC for dy in Office Dir of Intelligence.
Aye, Ralph C., relieved from Active Duty.
Beckham, Willie S., to MDW, Vint Hill Farms Station, Warrenton, Va.
Brooks, Engle R., Jr., to Riverside Academy, Gainesville, Ga.
Brown, George T., to AAA Repl Pool, Fort Bliss, Texas.
Brown, James R., relieved from Active Duty.
Brown, Milton H., to OC of S, Washn DC for dy in Office Dir of Intelligence.
Buck, Charles A., to University of California, Berkeley, Cal.
Bullard, William R., to Overseas Repl Dep, Fort Lawton, Washington.
Cassell, Rupert M., relieved from Active Duty.
Clower, Thomas M., relieved from Active Duty.
Collins, Lehman R., detailed in TC.
Downer, William V., Jr., to AA Sv Test Sec, AGF Board No. 1, Fort Bliss, Texas.
Falconer, Donald P., to OC of S, Washn DC for dy in Office Dir of Intelligence.
Fisher, William H., detailed in JAGD.
Flick, Ferdinand H., to University of California, Berkeley, Cal.
Gaffney, Edward J., to AAA Repl Pool, Fort Bliss, Texas.
Gallette, Henry A., detailed in Sig. C. RP Ft Monmouth, NJ.
Gaynor, Wayne J., detailed in AGD.
Gershon, Gordon M., to 2 yr course in Guided Missiles, Coll of Engineering, NY Univ., University Hgts, NY.
Goetzke, Albert F., detailed in TC.
Haddad, Edward G., detailed in FD.
Hall, Robert V., to AAA Repl Pool, Fort Bliss, Texas.
Hill, Benjamin I., to 2 yr course in Electronics, Illinois Inst. of Tech, Chicago, Ill.
Hough, Gerald R., to OC of S, Washn DC for dy in Office Dir of Intelligence.
Hull, Albert C., Jr., detailed in CE.
Josephson, Stanton W., to 2 yr course on Meteorology, UCLA.
Lafaver, Amos E., detailed in FD at FD Tng Center, Fort Benjamin Harrison, Ind.
Leaf, William R., relieved from Active Duty.
Levie, Howard S., to OC of S, Washn DC for dy in Office Dir of Sv Supply and Procurement.
List, Herbert C., relieved from Active Duty.
Maker, Charles M., to 2 yr course in Nuclear Physics, Princeton University, Princeton, NJ.
Marshall, James E., to OC of S, Washn DC for dy in Office Dir of Intelligence.
Michael, George P., to OC of S, Washn DC for dy in OAC of S, G-3.
Miller, James L., Jr., to Staff and Faculty Intelligence School, Fort Riley, Kansas.
Morris, Thomas E., Jr., to 2 yr course in Meteorology, UCLA.
Muecke, Harry K., to OC of S, Washn, DC for dy in Office Dir of Sv Supply and Procurement.
Muller, Walter G., to Abn Sch, Fort Benning, Ga.
McDonald, Francis A., relieved from Active Duty.
McKesson, James D., relieved from Active Duty.
McPheron, Wesley F., to Hq AGF, revoked.
Nadler, Seymour I., relieved from Active Duty.
Nuta, Alexander, to National Hq SS System, Washn DC.
Powers, Edgar N., to OC of S, Washn DC for dy in Office Dir of Intelligence.
Pullen, Richard C., to Seacoast Service Test Sec, AGF Board No. 1, Fort Winfield Scott, Cal.
Purrington, Richard B., detailed in AGD.
Qinnelly, James L., to 2 yr course in Automotive Engineering, University of Michigan, Ann Arbor, Mich.
Redinger, Joseph C., to Station RC, Fort Snelling, Minn., for dy as AGF Liaison Officer.
Redmond, Joseph J., relieved from Active Duty.
Reed, Prentice B., Jr., detailed in Ord. Dept.
Roy, John T., Jr., to AAA Repl Pool, Fort Bliss, Texas.
Sarles, Theodore, to 229th Sig Operation Co., Ft. Monmouth, NJ.
Schutze, Walter, to OC of S, Washn DC for dy in OAC of S, G-2.
Schweppe, Homer W., to Holabird Signal Depot, Baltimore, Md.
Sells, Bryant M., detailed in TC, SFPE, Ft. Mason, Cal.
Shaw, William G., to OC of S, Washn DC for dy in Office Dir of Intelligence.
Shultz, John J., Jr., to 2 yr course in Nuclear Physics, Princeton University, Princeton, NJ.
Simon, Donald E., to 2 yr course in Guided Missiles, Coll of Engineering, NY Univ, University Hgts, NY.
Skalnik, Yaro J., relieved from Active Duty.
Stecker, William W., detailed in CE.
Truex, Ralph J., to 2 yr course on Guided Missiles, Coll of Engineering, NY Univ, University Hgts, NY.
Watts, David E., relieved from Active Duty.
Wood, Franklin, to OC of S, Washn DC for dy in Office Dir of Intelligence.

FIRST LIEUTENANTS

Alessi, Humbert, to AAA Repl Pool, Ft. Bliss, Texas.
Baen, Spencer R., to AAAORP, AARTC, Ft. Bliss, Tex., revoked.
Broussard, Douglas E., relieved from Active Duty.
Burgett, Glenn A., relieved from Active Duty.
Clymer, Benjamin F., to OC of S, Washn DC for dy in Office Dir of Intelligence.
Coughlan, John C., detailed in TC.
Gabriel, Jack E., to 2 yr course in Meteorology, UCLA.
Gillen, Joseph K., to OC of S, Washn DC for dy in Office Dir of Intelligence.
Hereth, Raymond J., to Overseas Repl Depot, Camp Kilmer, NJ.
Lowman, Harry F., Jr., relieved from CAC and detailed in Cav.
Metz, James L., to CA AAAORP, AAARTC, Fort Bliss, Texas.
McCandliss, John H., relieved from Active Duty.
Norlong, Malcolm R., to Eastern Signal Corps School, Ft. Monmouth, NJ.
Plastino, Felix A., relieved from Active Duty.
Saunders, Warren S., detailed in TC.
Schnitzer, Herbert, to Hq 2d SvC, Governors Island, NY.
Schwab, Doyles, relieved from Active Duty.
Skelly, Joseph P., to 1st Coast Artillery Cable Ship Btry (USAMP *Mills*), Ft. Adams, R.I.
Spruce, John K., relieved from Active Duty.
Wampole, John H., to ETO.
White, Thomas I., relieved from Active Duty.
Withers, Percy L., relieved from Active Duty.

Coast Artillery Officers Appointed in Regular Army

Rank Indicated Is Permanent

MAJORS (25)

Martin, Murry J.
Hill, Cyril D.
Heathcote, Earl W.
Mackenzie, Alan F. S.
Tauer, Myron B.
Miller, Gay E.
Cooley, Lavell I.
Kimball, Donald G.
Naght, Bernard T.
Barrett, Archibald B.
Lee, Robert V.
Dixon, Fred
Juell, Adolph B.
Utke, Russell O.
Fish, James H.
Fisk, Samuel W.
Jones, Robert J.
Stone, Robert O.
Wellenreiter, F. L.
Staub, Leslie J.
Larson, Werner L.
Wuest, William J.
Broyles, Harmon E.
Joseph, Henry B.
Woodes, Raymond C.

CAPTAINS (107)

Volkel, Forrest B.
Foster, Kenneth W.
Nunamaker, Royal O.
Cummings, Lawrence E.
May, Metticus W., Jr.
Monnett, John R.
Martin, Robert J.
Page, Roger M.
O'Connor, Daniel A.
Ledeboer, F. W. C.
Shaver, Maurice P.
Tilton, Kenneth E.
Chirico, Carl F.
Barton, Chester T.
Reagon, Paul R.
Robinette, William R.
Holt, Roger H.
Herrod, John T.
Gallant, Edward B.
Davis, Lee J.
Thompson, Estel A.
Stewart, Joseph C.
Snodgrass, John T.
Corothers, Earl M.
Hutchinson, George W.
Blumenfeld, Charles H.
Smith, Robert G., Jr.
Bush, Ernest L.
Meinert, Fred H.
Kriegel, William W.
Smith, Kimball C.
Leidy, Royal L.
O'Connor, John P.
Sills, Tom W.
Pryor, Ralph H.
Barker, James W., 2nd
Ballach, Robert S.
Von Kolnitz, Henry
Thompson, Douglas G.
Ahrens, Ambelten M.
Johnson, Bruce H.
Brasington, Dalton K.
Smith, William A.
Snyder, Marvin H.
Ringgold, Charles L.
Lewis, Donald L.
Shoemaker, John J.
Lee, John K., Jr.
Banks, Curtis M.
Clifton, John R.
Myers, Shelly P., Jr.
Nagel, James R.
Messner, Arthur E.
Reed, Albert L.
Mize, Willard W.
Bellamy, Paul E.
Larner, Thomas M.
Vardas, Constantine
Alley, Stuart M.
Poor, George L.
Wilkes, John S.
Allan, Edgar, 3rd
Butler, Sanford J.
Seitz, Frank N.
May, Arthur G.
Shearhouse, James D.
Eason, James F.
Mayers, Thomas H.
McCann, James H., Jr.
Bogue, William B.
Pringle, Herman E.
Jennings, Cleveland H.
Mathes, Edward S.
Fitzgerald, Edward W.
Stevens, Pat M., 3rd
Hewitt, Harry
Smith, Eugene
Dougan, Ramon C.
Kahl, Alfred W.
Snyder, Charles E., Jr.
Haskell, Harold G.
Duvall, John O.
Fisher, Albert P.
Baldry, George A.
Horton, Roy W.
Sweek, Jack G.
Lanpher, Rollin A., Jr.
Land, James D.
Evans, Graham
Healy, Patrick J.
Twinning, Elmer E.
O'Connell, Francis J.
Bendler, Fred D., Jr.
Shogren, Hugo T.
Mitchell, Donald E.
Caulfield, Thomas D.
Linn, Lavon P.
Lutz, Robert R.
Thames, John W.
Ridgell, Joel M., Jr.
Clanton, Henry M.
Smith, James P.
Ogilvie, John M., Jr.
Price, William P.
Nicolson, William H.
Claffee, Robert A.
Beal, Bert L., Jr.

FIRST LIEUTENANTS (301)

Williams, James M.
Tawes, John P.
Brightman, John Y.
Anson, Paul A.
Turner, John G.
Pratt, Ford E.
Fultz, William J.
Stricken, W. A., Jr.
Malone, Duane W.
McElligott, Joseph P.
Worley, Thomas G.
Voyatzis, Polyvios A.
Lagasse, Frederick J.
Priest, Perry B.
Vaughn, Francis M.
Sanford, Arthur L., Jr.
Chittenden, Albert O.
Roach, Richard R.
Cahn, Joseph M.
Taylor, Robert R., Jr.
Grotte, Helmer, M.
Philbrick, Kenneth R.
Holland, Charles H.
Goettl, John P.
Herman, Benjamin J.
Fuller, Carl W.
Mitchell, Allan W.
Tutt, Junius R.
Dudley, Harold M.
Clark, James B.
Clements, Thomas H.
Walker, Robert M.
Hudiburg, Howard B.
Hall, Robert E.
Bergquist, Donald P.
Mastrucci, Joseph P.
Walton, Henry L.
Parker, John C.
George, Claude D., Jr.
Smigelow, Howard G.
Pyles, Dixon L.
Gregory, Francis G., Jr.
Cushing, C. B., Jr.
Creasy, Roy V.
Berendt, Herbert W.
Armstrong, C. H., Jr.
O'Reilly, Charles A., Jr.
Stacy, Robert S.
Nelson, Henry H.
Walker, Norman M.
Ritchey, Andrew W.
Young, Claude C.
Van Gundy, Daniel F.
Polifka, Frank J. F.
Pope, William P.
McCormick, John K.
Blue, Daniel L.
Ackert, Thomas W.
Regan, James L., Jr.
White, Howard S.
Dueker, Fred E.
Leneski, Stanley V.
Robideaux, Robert J.
Lavell, Robert G.
Owen, Henry M., Jr.
Rolph, Herbert F.
Twomey, Lawrence A.
Harding, Stanley L.
Evans, John T.
Gillespie, John J.
Grandin, Daniel G.
Pierre, George H., Jr.
Butts, Robert E.
Laughran, John J.
Bruns, Stockton D.
Mannes, Conrad O., Jr.
Holt, Arthur E.
Casey, Charles W.
Durgin, Chesley, F.
LeMee, William S., 3rd
Brooks, Edgar R.
Helfert, Peter A.
Helmuth, Oliver J.
Jacks, Fred W., Jr.
Loosen, Herbert L.
Petrilli, Frank J.
Fisher, Norman E.
Hood, Ralph E.
Ackner, Ned E.
Schunn, Frederick L.
Cole, Norman E.
Buntin, Thomas J.
Wendell, Perry F.
Brooks, Robert L., Jr.
Molloy, Robert W.
Page, Benjamin N.
McGrath, Donald B.
Macaulay, George B.
Campbell, Guy L.
Sydnor, William D., Jr.
Wolff, Paul B.
Marshall, John F.
Keisler, David S.
Dodson, Minot B.
Fatten, James H.
Worrell, Raleigh O.
Montrone, Alfred J.
Heim, Harry V.
Watson, William W.
Guth, Henry T.
Twyon, Donald E.
Woodman, Ernest A. H.
Carson, Thomas M.
Cormier, Everett L.
Rohan, Thomas C.
Wilder, Richard L.
Gerard, Max H.
Crowe, John H.
Schafbuch, Donald V.
Matthews, Maurice H.
Roberts, Sam A.
Malone, Robert H.
Ruck, Fred M.
Wilson, Lucius E., Jr.
Skipper, John D.
Reitz, James T.
Wanner, William S.
Fairbanks, G. C., 3rd
Bowman, John E.
Guy, John J.
Paciorek, Stanley J.
Werner, Franklin A.
Pryor, Frank D., Jr.
Loiselle, Postford A.
Gooding, Earl R.
Burge, Roland C.
Schuler, Richard H.
Waugh, Edgar S.
Lucas, Peyton R.
Shenk, David E., Jr.
Davidoff, James E.
Doane, Leslie O.
Sobke, Llewellyn
Miller, Robert J.
Brown, Harry C.
Schuck, Edwin G.
Shelton, Frank W.
White, John M., Jr.
McCarthy, Paul N.
Lacey, Peter J.
Meseroll, Melvin R.
McKenna, John J.
Weyand, Frederick C.
Farr, Richard
Keogh, William T.
Stauffer, Charles J.
Wendle, Hugh M.
Penson, David
McNair, Donald C.
Hinman, John M.
Davis, Gerald W.
Heimer, Gerard
Burton, Lewis R.
Rogers, Jack A.
Kasler, Charles L.
Morris, Howard A.
Via, Harold F.
Buck, Charles A.
Casey, Jack M.
Spann, Charles W.
Ligon, Lawrence R.
Reid, Samuel L.
Edmunds, James M.
Stanford, Marvin N.
Courtney, Ralph H.
Gregory, Samuel S., Jr.
Castle, Edmund
Isenson, Raymond S.
Donahue, Patrick H.
Minch, Howard G.
Boardman, Dumas H.
Walker, John K., Jr.
Lowe, Henry A.
Wreidt, Niel M.
Brooks, Engle R., Jr.
Semmens, Clifton P.
Burns, Burton
Temme, Eugene J.
Williamson, R. H., Jr.
Jones, Bruce B.

Kjeldsen, Donald E.
Hearn, John V., Jr.
Rutherford, Robert D.
Steichen, Woodrow J.
Jenkins, James R.
Anderson, George K.
Palizza, Maurice J.
Neill, William H.
Classen, Chester E.
Connor, John E., Jr.
Tate, Roy A.
Rainey, William R.
Williams, Albert C.
Lanterman, Jack V.
Witt, Emitt C., Jr.
Schreiber, William L.
Rountree, Councill P.
Farrar, William L.
Chapman, Daniel T.
Jeffries, Charles C.
Gray, Asa P., Jr.
Pettit, Norris N.

Cannady, Preston B.
Hubbard, William H.
Parker, James C.
Flint, Brilsford P., Jr.
Denby, Roland E.
Murphy, James O.
Ayer, Franklin A.
Smith, William J.
Barfield, Thomas H.
Kennedy, William D., Jr.
Smith, Phillip R.
Atterson, Fred
Perry, Ben W.
Ohea, John T.
Chappelle, Thomas O.
Williams, Daniel B.
Redheffer, George E.
Cook, Charles W.
King, Arthur J.
Rowe, Gerald W.
Ducey, Donald L.

Woods, James R.
Boomer, Eugene F.
Harlan, Robert D.
Denham, William O.
Sutton, George N.
Titley, Richard J.
Hickok, James N.
Silvis, Bruce V.
Stevens, Donald K.
Black, Don W.
Janousek, Neal F.
Marconi, Sabatine R.
Wilson, Louis A.
Robinson, John L.
Heisler, William F.
Hamilton, Stuart A., Jr.
King, William I.
Ream, Ellis A.
Thorne, John H.
Walker, Berrisford H.
Mazzucchi, Reno A.

McCarthy, Max R.
Deadwyler, W. H., Jr.
Sprigg, William H.
Casey, Edgar L.
McManus, Vincent J.
Kissan, Richard V., Jr.
Lorck, Horace C.
Lingner, Frederick A.
Arnold, William E., Jr.
Anderson, Edward G., Jr.
Rettgers, Forrest I.
Daley, Edward J.
Finch, Peyton N., Jr.
Surum, Henry
Brindley, Arthur F.
Callahan, Walter
Herold, John W.
Sullivan, Vincent J.
Coonly, William J., Jr.
McCauley, Robert H.
Campbell, Harold E., Jr.

Aquilina, Raymond F.
Kolesar, Armand H.
Haughton, Richard E.
Lochrie, Wilmer R.
Burt, William A.
Gossett, Henry M.
Smith, James W.
Caffall, Joseph M.
Jemmott, Arthur H., Jr.
Duke, Thomas A., Jr.
Ladner, Gerard J.
Hogan, James H.
McCrory, R. J., Jr.
Bright, Charles W.
Barrett, Robert F., Jr.
Peyer, Gustave A.
Walker, Junior L.
Willis, Jean P.
Buchanan, R. B., Jr.
Young, Curtis F.
Erdman, George W.

SECOND LIEUTENANTS (30)

Halle, William W.
Foster, Charles H.
Igersheimer, Milo
Ingham, Frederick L.
Tassie, Willis H.
Cooney, John T.

Boechler, Andrew J.
Newman, James W.
Loudermilk, James A.
Cann, Richard T., 4th
Godfrey, Hampton J.
Thomure, Richard F.

Hodges, Warren D.
Reid, Raymond T.
Yantis, Myron D.
Rokey, Ned W.
Walker, Joseph W., Jr.
Hite, Merle L.

McDaniel, Henry B., Jr.
LeVan, C. J.
Dickhoner, William H.
Birnbaum, Stanley J.
Adams, Edwin C.
Stanley, Spencer G., Jr.

Mendenhall, F. E., Jr.
Latimer, Harry D.
Childress, Floyd S., Jr.
Stogner, Hulen D.
Von Tongeln, Walter W.
Bezich, Vincent W.

Graduates U.S.M.A. Class of 1946, Second Lieutenants, Coast Artillery Corps

Andrews, James L., Jr.
Ash, Alvin
Ashton, Shirley S., Jr.
Bacon, Richard H., Jr.
Bowley, William T.
Bramblett, Lawson D., Jr.
Byrne, John J.
Carter, James E.
Caruso, Frank S.
Cunningham, Elmo E.
Daniel, Robert S., Jr.
David, Ralph C., Jr.
Drinkwater, Edward C., Jr.
Dwyer, John W., 3rd

Elliott, James S.
Fair, Stanley D.
Farris, Philip A.
Fields, Jesse A., Jr.
Finnegan, Daniel J.
Geary, John C.
Ghrist, Meridith W.
Gillespie, John W., Jr.
Hagel, Jack B.
Halloran, Jerome V.
Title, Samuel H.
Hibbard, Preston H.
Hickey, Daniel W.
Hirschberg, Thomas V.

Hirschfield, Howard B.
Horne, Harold W.
Hoskins, Lynn W., Jr.
Ingham, Henry L., 2nd
Inskeep, James H. Wallace
Jones, Edward W.
Kane, Robert V.
Kelley, Paul A.
Kelso, Minor L.
Kenney, William J.
Kline, Roland A.
Love, Stanley J.
Marberger, John
Matejov, Stephen A.

Mendenhall, Clarence M.
Meola, Ralph A., Jr.
Moriarty, Daniel R.
McCoy, Robert W.
Palmatier, Francis M.
Papatones, Alexander J.
Parker, William R.
Pepin, Ernest A.
Pfauth, Eugene V.
Pfeifer, Thomas E.
Pleuss, Howard E.
Porter, George J.
Prestidge, Billy M.
Provenzano, Thomas G.

Rovis, Del P.
Ruble, Richard L.
Rush, Robert I.
Sadler, John A.
Schoen, Frank C.
Sheffield, Robert X.
Stark, Dudley S., Jr.
Storm, Robert W.
Tharp, Blucher S., Jr.
Thayer, Raymond E.
Wagner, Robert T.
Whitlock, Prentice E.
Wieringa, John S., Jr.
Williams, Benjamin B.

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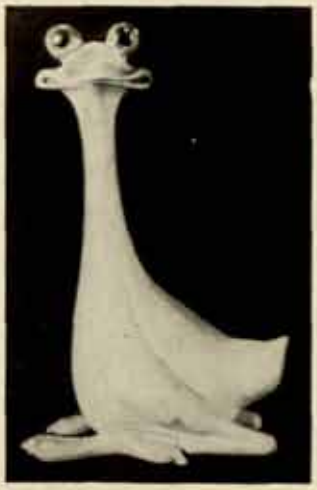

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