Antiaircraft JOURNAL

JULY-AUGUST, 1949

Featuring the Tenth Army AAA

MISSION OF ANTIAIRCRAFT ARTILLERY

The latest approved Mission of AAA has just been formulated. It will be officially published in all Field Manuals pertaining to AAA.

a. *General.* The mission of AAA is to attack and destroy hostile targets in the air, on the ground and on the water.

b. *Antiaircraft Mission.* With guns, guided missiles and automatic weapons, to attack all forms of enemy aircraft and guided missiles, to destroy them, to nullify their effectiveness or to force them to abandon their hostile mission.

c. *Surface Mission.*

(1) With guns and guided missiles to support infantry (armored) units by neutralizing or destroying those targets which are most dangerous to the supported arms; to provide or reinforce field artillery fires; and to attack and destroy targets of opportunity, on land or on water.

(2) With automatic weapons to provide close fire support for infantry (armored) units by reinforcing the fires of infantry heavy weapons, and to attack and destroy targets of opportunity, on land or on water.

Employment of Antiaircraft Artillery

a. Commanders whose forces include antiaircraft artillery will assign it that mission dictated by considerations of the greatest threat to the over-all mission of the force.

b. Antiaircraft artillery will be so emplaced as best to accomplish the assigned mission. Whenever possible without prejudice to the assigned mission, it will also be so sited as to facilitate attacking targets other than those specifically included in that mission.

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 toward the improvement of matériel and methods of training and by fostering mutual understanding, respect and cooperation among all arms, branches and components of the Regular Army, National Guard, Organized Reserves, and Reserve Officers' Training Corps.

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 Department of the Army.

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ACTIVITIES OF THE

Btry C, 866th AAA AW Bn on Zamami Shima overlooking anchorage in the Kerama Retto.

By Colonel John I. Hincke, CAC

TENTH ARMY AAA

The Ryukyus Campaign

A discussion of any major part of the Ryukyus campaign requires a brief description of the over-all organization for this operation. The campaign, known by the code name ICEBERG, lasted from March through June 1945 and was in every sense of the word a joint operation. Top command was exercised by Commander, Fifth Fleet. His principal subordinate in the Ryukyus area was Commander Joint Expeditionary Forces. The next lower level of command included several task forces, one of which was Expeditionary Troops, better known in Army parlance as Tenth Army.

The Expeditionary Troops conducted tactical land operations in the Ryukyus initially under Commander Joint Expeditionary Forces. When our forces were securely established ashore, the Navy relinquished control, and command of all ground combat and service units, as well as tactical Marine Air Groups and certain Naval forces, passed to the Commanding General, Tenth Army, operating directly under the theater commander.

Viewed in its broad aspects, that portion of the operation devoted to air defense included the activities of fighter aircraft of the U.S. and British Navies, U.S. Marine Aviation and later the Army Air Forces, as well as both ground and ship-borne antiaircraft artillery. The Tenth Army AAA Command (Brig. Gen. C. S. Harris) comprised all the Army and Marine Corps AAA assigned to Tenth Army.

Mounting Out

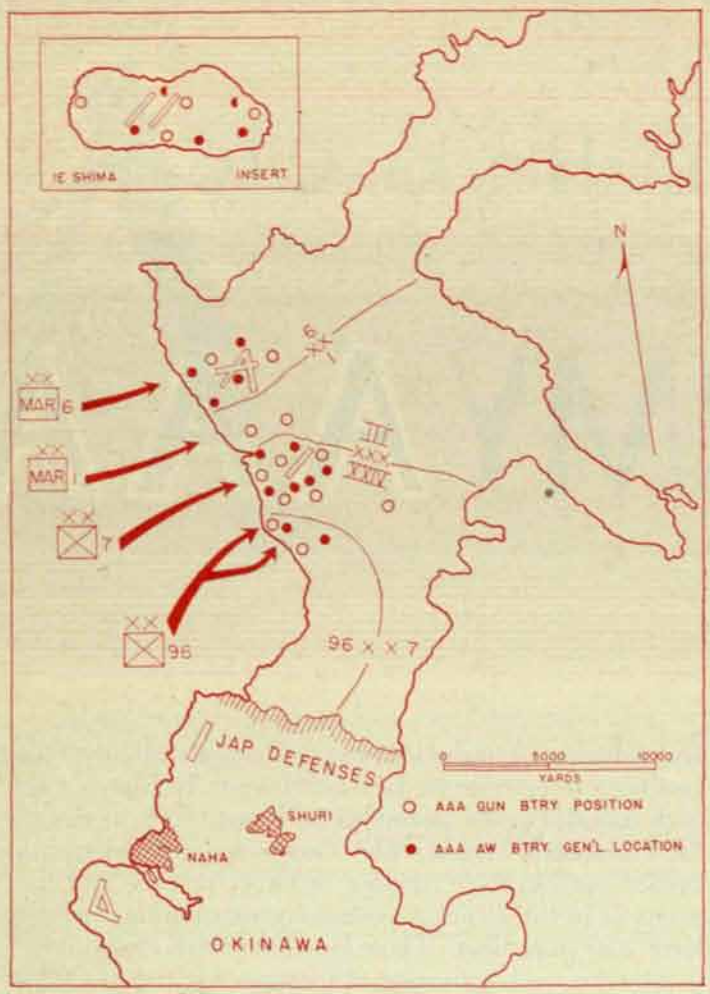
The AAA units for the operation were gathered from a number of sources. Those units initially attached to Army divisions for the assault landings had participated in the Leyte Campaign and mounted out from the Philippines. Lack of facilities and time for rehabilitation and training handicapped these units in their preparation for the Okinawa campaign.

The Marine assault AAA battalions attached to the III Amphibious Corps (Marine) were more fortunate. One had participated in the invasion of Tarawa while the other had been in garrison on Johnston Island. In March 1944, both battalions were assembled on Kauai, T.H., under the 1st Provisional Marine AAA Group and for ten months carried out extensive training in target practice and field exercises in the identical tactical organization they were to have later in combat. These battalions were composite organizations, each consisting of four gun batteries, two AW batteries and a searchlight battery. Tenth Army AAA, then on Oahu, established liaison with these units in September 1944. In January 1945 the Marine Group was moved to the Marianas to augment the defenses of Guam and Tinian where it later mounted out for the assault on Okinawa.

In addition to the Army and Marine AAA units attached initially to the two assault Corps, Tenth Army AAA included those garrison battalions which arrived in several echelons of shipping after the first. Of these units, two Marine battalions had seen combat on Funafuti and Apamama. Two of the Army battalions came directly from the States while the remainder were furnished by the Hawaiian AAA Command. Some of the latter were trained at Oahu, initially under control of the 53rd AAA Brigade and later under the 44th and 43rd AAA Groups. As each was made available to Tenth Army AAA, it was moved to an area near Schofield Barracks where intensive training continued. Some units became available too late for training and consequently devoted their remaining time to preparation for mounting out.

Liaison between Tenth Army and AAA units on Oahu and the Marine AAA units on Kauai presented no problems. Frequent visits served to keep the subordinate units fully abreast of plans and developments insofar as permitted by rules for security. Subordinate staffs were briefed as necessary.

Early liaison with units on Leyte was inadequate. Exchange visits could not be arranged. The Army AAA Commander and two staff officers proceeded to target via Leyte where personal liaison was established while the units were



The assault landing beaches, Division zones of action, principal Jap defenses and AAA positions on Okinawa and Ie Shima ten days after each landing.

mounting out. Although this left much to be desired, the deficiency was overcome through the splendid preparations made by the Commanding General, XXIV Corps and his staff, as well as the Commanding Officer, 97th AAA Group, Colonel Lawrence L. Clayton, who displayed commendable judgment and resourcefulness.

Principal Operations

The principal AAA operations in the Ryukyus campaign took place on the islands of Okinawa and Ie Shima. L-Day for the landings on Okinawa was 1 April. Landings on Ie Shima commenced on the 15th. The operation on each island had its assault phase during which certain AAA units were attached to the Corps and Divisions. At the end of each assault, these AAA units reverted to the control of Tenth Army AAA. After the capture of Ie Shima, the AAA activities on both islands were closely related and merged into a single series of operations, all of which can best be considered chronologically.

The Headquarters of Tenth Army AAA Command and 53rd AAA Brigade (Brig. Gen. Morris C. Handwerk) arrived at Okinawa on the day of the landings, 1 April 1945. Other AAA units participating in the assault on this island were initially attached to the Corps and Divisions as follows:

XXIV Corps
Hq and Hq Btry, 97th AAA Gp (Col. L. L. Clayton)
Hq and Hq Btry, 230th AAA Slt Bn (Lt. Col. A. E. Sadler)

7th Inf Div
502nd AAA Gun Bn (Lt. Col. M. V. Douglas)
861st AAA AW Bn (Lt. Col. L. W. Byers)
Btry A, 295th AAA Slt Bn (less 2nd Plat)
Brty C, 866th AAA AW Bn (Capt. Willie Davis)

96th Inf Div
504th AAA Gun Bn (Lt. Col. J. B. McCumber)
485th AAA AW Bn (Lt. Col. A. H. Garvey)
Btry C, 294th AAA Slt Bn (less 2nd Plat) (Capt. Hersel S. Harley)

III Amphibious Corps (Marine)
Hq and Hq Btry, 1st Prov AAA Gp (Marine) (Col. K. W. Benner)
2nd Marine AAA Bn (Lt. Col. M. C. Chapman)
16th Marine AAA Bn (Lt. Col. A. F. Penzold)

After a heavy preparatory bombardment of the beaches, the assault on Okinawa began at 0830. Landings were made on a two Corps front, four divisions abreast. Before noon, reconnaissance parties of the 861st and 485th AAA AW Bns were ashore and selecting positions. By nightfall three batteries of these units were ashore and operational. The remainder were landed the next day and, together with two gun batteries, were operational by evening. By the night of 4 April all assault AAA units with the XXIV Corps had landed and were operational.

With the exception of the first night when one enemy plane was destroyed by M-51's of the 861st AAA AW Bn, there was little enemy aerial activity within range of the AAA units during the assault phase, 1 to 4 April.

On the 5th all Army AAA units ashore on Okinawa reverted to XXIV Corps under control of the 97th AAA Group. Units were displaced to cover the Yontan and Kadena airfields, both of which had been captured on L-Day. Protection was provided for the field artillery areas and one gun battery was detached to Corps for field artillery support. The 97th AAA Gp assumed responsibility for coordination of AAAIS within the Corps area.

The heavy strikes against Japan by planes of the Fast Carrier Force prior to L-Day, together with the protection of the beaches by combat air patrols, prevented any effective Jap air attack on Okinawa during the assault phase. However, on 6 April there was a marked increase in enemy aerial activity. In the early morning hours, one Zeke strafing Yontan from 1500 feet and one Kate over the field at 3000 feet were picked up by spread beam searchlights and engaged by AAA fire. No damage was observed although both planes departed when fired upon.

In the late afternoon a flurry of activity occurred with damage to both sides. At 1605 one Jap plane was shot down as it attempted to crash dive a battleship off the beaches. At 1617 another enemy plane at 7000 feet was destroyed over the transport area by ship and shore AAA. One minute later a friendly Navy plane approached the beaches at about 1500 feet altitude from the southeast. With no attempt at recognition, a machine gun of a non-AAA unit near the beach opened fire and gave the signal which set off a heavy volume of fire from the ships and other automatic weapons

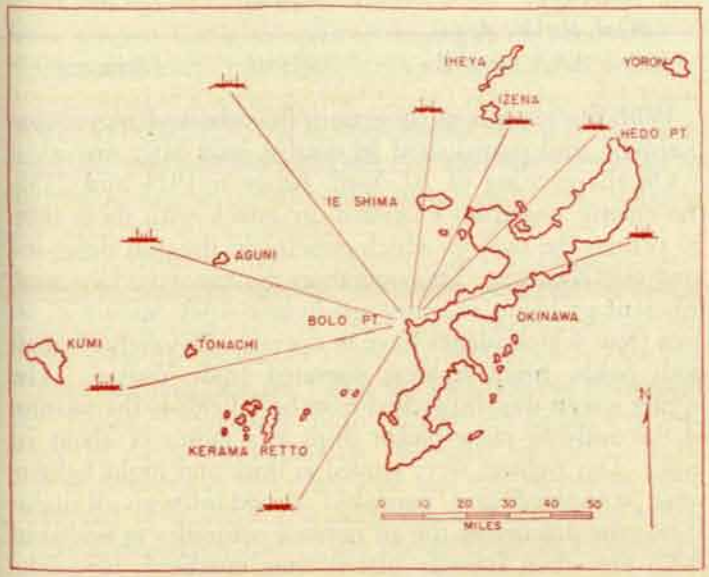
on the beach. The plane lost altitude as hits were registered, then burst into flames, headed downward and crashed.

Within the hour a Zeke was engaged over Yontan by AW fire and destroyed. This was followed three minutes later by the destruction of an enemy plane over the north end of the transport area. Then over the beach from the south came another friendly Navy fighter which immediately drew fire from every type of AA weapon mounted on shipping, plus some machine guns on the beach. The plane took evasive action and attempted to show its markings, but lasted only a few seconds under a tremendous volume of fire which resembled a volcano in eruption. The firing continued until the plane crashed, with Navy 20-mm, 40-mm and 5-inch projectiles landing directly in the area a few hundred yards inland from the beach. An ammunition dump near Kadena was hit and exploded, an oil barge was destroyed and casualties to personnel ashore were estimated at 7 killed and 90 wounded. Shortly thereafter, one Zeke at 1200 feet over Yontan was probably destroyed and a few minutes later one of three Vals in a glide over the anchorage was destroyed by 90-mm fire.

During the engagement of these two friendly planes, Army AAA expended only one round of 40-mm and about 500 rounds of caliber .50 ammunition before the planes were recognized and firing stopped. None of this fire was responsible for bringing down these planes.

Unloading of the Marine AAA with the III Amphibious Corps was delayed because of poor landing beaches and higher priority traffic across them. Reconnaissance parties from the Marine group and each of the two battalions landed on 3 April and began to select positions. Landing of the battalions started 8 April and all Marine AAA units were operational by 12 April. Headquarters of the 53rd AAA Brigade, with the 162nd Opns Detachment, began unloading on 8 April.

On the night of 11-12 April the Japanese launched an aerial attack in great force. Although the fighter screen which bore the brunt of this attack claimed the destruction of 108, several enemy planes penetrated to the gun defended area. During the early morning hours four planes strafed



Locations of early warning radar and fighter direction picket ships off Okinawa as of 25 April 1945.

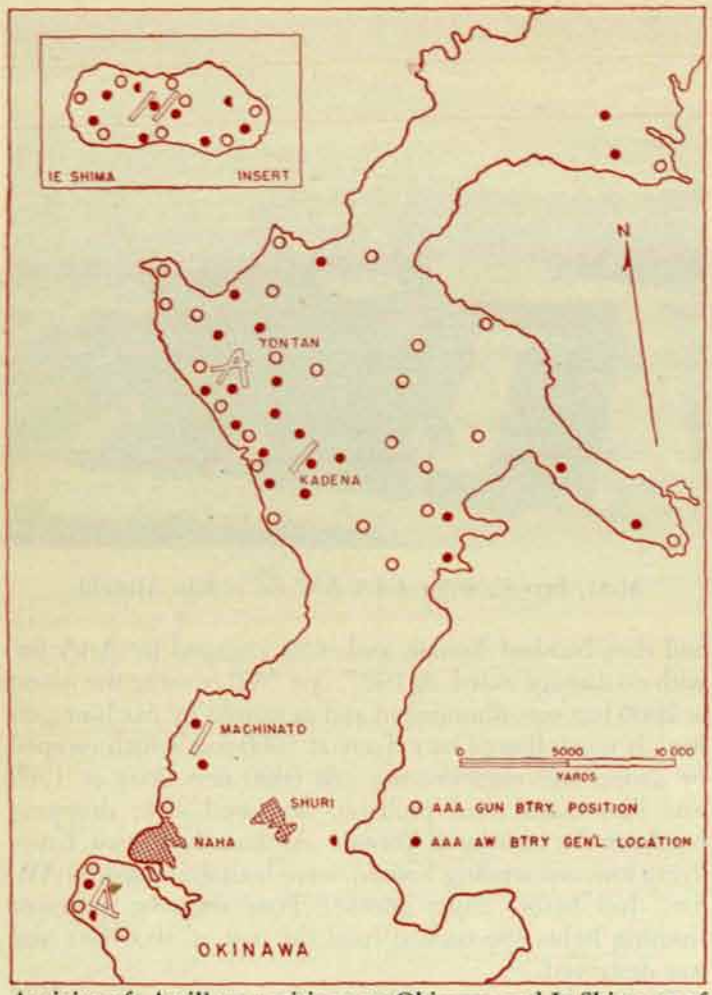
M-51, Btry C, 861st AAA AW Bn at Kin Airfield.

and dive bombed Yontan and were engaged by AAA fire with no damage noted. At 0407, one Nell crossing the island at 2000 feet was illuminated and destroyed by machine-gun fire. It was followed by a Tony at 5000 feet which escaped by diving and maneuvering. At 0430 one Betty at 1500 was illuminated and probably destroyed after dropping bombs in the vicinity of Yontan. An hour later, two Tonys flying low, one strafing Yontan, were both destroyed by AW fire. Just before dawn another Tony showing improper running lights approached from the east at 3000 feet and was destroyed.

During the evening of 12 April an enemy plane of unknown type was engaged by radar controlled gunfire and destroyed. Just before midnight three raids penetrated the gun defended area but AAA was in Control GREEN and not permitted to fire. One of these planes showed friendly IFF signals and dropped bombs in the vicinity of an AAA position without damage.

Although several alerts and a few minor raids occurred on 13 and 14 April, the Japs renewed their attack on the evening of 15 April with considerable aerial activity. At 1840 two Oscars and one Zeke approached from the east while a Hamp came up from the south, at low altitude. All were destroyed by AAA fire. At 1920 two Bettys flew across the island at 7000 feet from the west. Window was dropped by both planes with little effect on radar tracking. AAA was in Control GREEN and the raid was not engaged. At 1946 one Oscar strafing ground installations was illuminated, engaged and probably destroyed. Ten minutes later two planes of unknown type strafed Kadena airfield and one was destroyed by AW fire. At 2100, four planes came over the gun defended area and were engaged. One was destroyed and two probably destroyed by radar controlled 90-mm fire. At 2140, after orbiting 15 miles east of the island, an unidentified enemy plane came in at 15,000 feet and was fired on by 90-mm guns with unknown results. Simultaneously one Betty was engaged and damaged. This was immediately followed by the destruction by radar controlled gunfire of an enemy plane flying over the island at 6000 feet.

The assault on Ie Shima by the 77th Infantry Division



Antiaircraft Artillery positions on Okinawa and Ie Shima as of 30 June 1945.

began on 15 April. AAA units attached to this division were the 93rd AAA Gun Bn (Lt. Col. A. H. Vail), 7th AAA AW Bn (Lt. Col. R. F. Murphy) and the 2nd Plat, Btry A, 295th AAA Slt Bn. Because of the slowness of the initial advance from the beach, no AAA was landed on the first day. On 16 April, certain AW elements were put ashore and became operational. Personnel of the gun battalion also were landed and assisted the shore parties as infantry in repelling Jap counterattacks during the night. Unloading of AAA equipment progressed slowly during the next two days partly because the beach area remained under intermittent sniper fire. Movement into position was hampered by the great number of mines that the Japs had emplaced throughout the island. Reconnaissance was made difficult by the necessity of remaining on roads which had been cleared and marked. However, by 19 April all AAA assault elements were in position and operational. The two AAA battalions had removed approximately 56 mines varying in size from small box type to 300-pound aerial bombs. AAA units also assisted in clearing out isolated Jap pockets of resistance in the vicinity of the AAA gun positions. On 19 April, the AAA units passed to the control of Tenth Army AAA with attachment to Island Command, Ie Shima.

The first AAA action on Ie Shima took place on 26 April. Three single plane flights flew over the island, headed for Okinawa. They were engaged by radar controlled gunfire, but with no evidence of destruction. On the night of 27-28 April the Japs attacked Ie Shima itself. At 2200 one plane was engaged by radar controlled fire at 1700 feet. Between 0015 and 0330 nine planes attacked. One plane was destroyed and two damaged by gunfire with VT fuze.

Meanwhile on Okinawa the unloading of Hq and Hq Btry, 53rd AAA Brigade, and the establishment of communications and AAOR had been completed. The AAA on Okinawa reverted to control of Tenth Army AAA on 20 April and was attached to the 53rd AAA Brigade. Marine units were attached for operational control only. Air warning teams which had been with XXIV Corps reverted to control of the Air Defense Command. The positions of AAA units and their responsibilities remained unchanged.

As the ground fighting progressed and the front moved forward, additional AAA units arrived at Okinawa and the outlying islands. The build-up of the AAA defenses on all the islands was phased to keep pace with the base developments and to provide AAA protection for the ever-increasing number of installations to be defended. The garrison AAA units, with arrival dates and locations, were as follows:

866th AAA AW Bn (less Btry C)	*5 April 1945*	*Okinawa*
(Lt. Col. Adolph C. Nasvik)		
8th Marine AAA Bn	*19 April*	*Okinawa*
Hq and Hq Btry, 136th AAA Gp	*27 April*	*Ie Shima*
(Col. Harry Martin)		
834th AAA AW Bn	*27 April*	*Okinawa*
Hq and Hq Btry, 137th AAA Gp	*3 May*	*Okinawa*
505th AAA Gun Bn	*3 May*	*Kerama Retto*
(Lt. Col. Beaver)		
779th AAA AW Bn	*3 May*	*Okinawa*
5th Marine AAA Bn	*5 May*	*Okinawa*
870th AAA AW Bn	*10 May*	*Kerama Retto*
(Lt. Col. W. F. Lucas)		
388th AAA AW Bn	*15 May*	*Ie Shima*
(Lt. Col. Malcolm F. Gilchrist)		
98th AAA Gun Bn	*7 June*	*Okinawa*
948th AAA Gun Bn	*7 June*	*Ie Shima*
Hq and Hq Btry, 44th AAA Gp	*8 June*	*Kerama Retto*
(Col. R. W. Argo)		
503rd AAA Gun Bn	*23 June*	*Okinawa*

With few exceptions these units disembarked, moved into positions, and participated in combat soon after arrival.

On the evening of 20 April, between 1911 and 2335, the enemy staged an extended air attack with more than 50 planes, the bulk of which penetrated the gun defended area on Okinawa. This operation portrayed vividly some inherent problems in combined fighter-AAA defense of an area from which planes have to operate. Day fighters used both fields; night fighters operated from Yontan. The fighter screen was dispatched from both fields to the vicinity of the outlying radar picket ships at a radius of about 70 miles. Day fighters were landed at dusk and night fighters were "scrambled" and "pancaked" at odd intervals all night. It was the practice of the air defense controller to withhold AAA fire when friendly planes were overhead, regardless of the comparative effectiveness of fighters and AAA.

Jap pilots soon learned to follow our fighters in and bomb

the airfields while AAA was in Control GREEN and not permitted to fire. On this night they did exactly that with unusual success. The area containing Yontan and Kadena airfields and the landing beaches was the main objective of six separate raids, flown about 45 minutes apart. Window was dropped a number of times. The third raid was tracked at 17,000 feet; the others at from 100 to 1000 feet. During the course of the attacks some of the enemy flew low over the airfields with running lights on, circling the field with friendly fighters. They strafed, and dropped approximately 40 incendiary and high explosive bombs. Fires were started on both airfields, necessitating the evacuation of one Marine AAA 40-mm gun position. During the entire period, AAA was held in Control GREEN except for 15 minutes when no enemy planes were in the area. The only AAA firing was by automatic weapons at strafing planes.

After this episode the AAA Commander conferred with Commander Air Support and achieved some improvement in the handling of fighters so as to facilitate the release of AAA fire when required. Favorable results were first demonstrated on the night of 27-28 April when the enemy renewed his aerial activity over Okinawa. Aided by clear weather and a full moon he struck in force at Yontan airfield. Seven raids between 2053 and 2400 reached the gun defended area. A large quantity of window was dropped and the use of IFF by the Japs was reported. Air defense control was excellent and friendly fighters were held out while enemy planes were within range of the AAA. Four planes were destroyed and one probably destroyed at altitudes from 3000 to 9000 feet. This attack on Yontan carried over into the early morning with two raids at 0252 and 0301. The first, a bomber at 19,000 feet, was shot down on his third attempted bombing run. The second raid of two planes, one fighter very low and one bomber at 6000 feet, made unsuccessful attacks on Yontan. The fighter was destroyed and the bomber driven off.

The next evening, 28 April, an enemy force estimated at not less than 100 planes started for Okinawa. Of these, 18 penetrated to the gun defended areas. Raids ranged from single flights to multiple groups. Attacks came from all directions at altitudes from very low to 15,000 feet and were pressed home in spite of heavy AAA fire. Violent evasive action was taken by planes when under fire. Bombing occurred at Yontan during the first raid when AAA was in Control GREEN, but damage to the field was not great. AAA fire was released after the first raid and succeeded in destroying five of the attacking planes, plus one probably destroyed and one damaged.

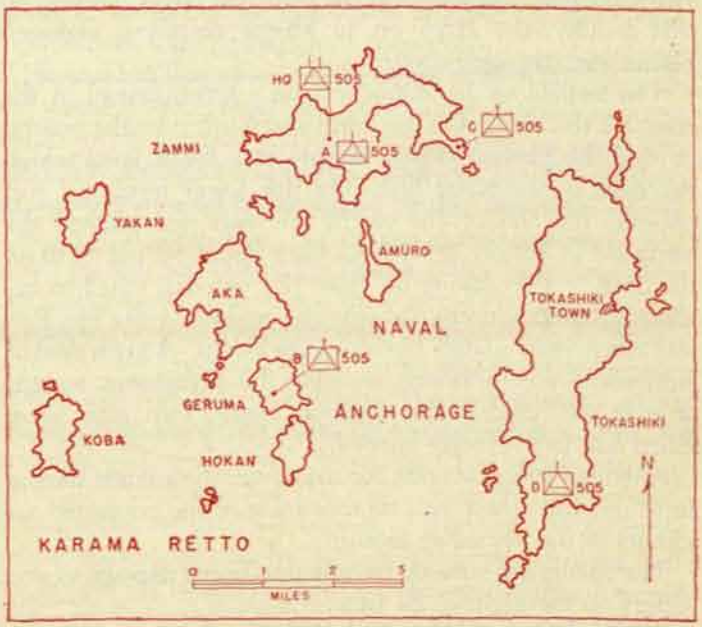
During the early morning hours of 4 May the Japs again raided installations within the AAA defended area on Okinawa. Bombs were dropped nine times—twice on the beach area, five times on Yontan airfield, once on Kadena airfield and once near the CP of the 16th Marine AAA Gun Bn. During the second raid four different flights were engaged by AAA simultaneously. All raids approached from directions between the northwest and east, dropping large quantities of window and adopting violent evasive action when under AAA fire. Two planes were shot down by 90-mm gun batteries.

The Ie Shima phase of this attack saw fourteen planes over that island. They came in from all directions at altitudes from 2000 to 8000 feet. Radar controlled gunfire destroyed one, probably destroyed one and damaged two.

On 16 May a raid of five enemy aircraft at high altitude dropped bombs on both of the Okinawa airfields. One plane was damaged by AAA gunfire. That evening two more planes made bombing runs over Yontan and were taken under heavy AAA fire but with no apparent results except that the bombing was unsuccessful.

Although raids occurred daily from the 17th through 22 May, that period can be classified as relatively quiet. However, on the 24th between 2000 and 2400, both Okinawa and Ie Shima experienced the most intense enemy aerial activity of the campaign. The moon was full and the weather was perfect for bombing. With seven raids consisting of 16 planes, the enemy made a desperate attempt to destroy Yontan airfield and the neighboring installations. The first six raids were made at medium altitude with planes dropping quantities of window and approaching from all directions. Bombing runs were pressed home through heavy AAA fire and bombs were dropped on Yontan and vicinity.

The attack culminated in an attempt to land suicide troops on the airfield. While one plane at high altitude appeared deliberately to attract AAA fire by maneuvering south of Yontan, five Sallys approached at very low altitude from the northwest and east. These planes were illuminated by spread beam searchlight and engaged by a heavy volume of automatic fire. Every AAA weapon that could be brought to bear was in action. Four planes, exploding in midair, crashed and started fires near Yontan. The fifth was badly damaged and crash landed on the airfield. At least eight heavily armed Japanese soldiers got out of the wreckage and began tossing grenades and incendiaries into the aircraft parked along the runway. Two Corsairs, four C-54's and one Privateer were destroyed. Twenty-six other planes were damaged. Two fuel dumps also were ignited before the Jap airborne troops were disposed of. While the actual damages inflicted by this suicide squad were not material, the confusion and cross fire put the field out of action until the last raider was killed early the following morning.



The Keramo Retto group of islands, showing battery positions of the 505th AAA Gun Battalion.

IFF Antenae of Hqs. Btry 504th AAA Gun Bn overlooking Buckner Bay

Of the sixteen Jap planes in these attacks, ten were destroyed and one probably destroyed. One plane crashed in flames into a searchlight position, killing two enlisted men and wounding one officer and seven enlisted men.

The attacks over Yontan continued after midnight with a raid of two planes at 0220. The first strafed the field from an altitude of 200 feet while the second attempted a bombing run at 18,000 feet but was destroyed by radar controlled gunfire. After daylight at 0757 an attack occurred against our shipping. Although the AAA was in Control GREEN, one plane came within range of shore AW, was definitely recognized as a Tony and was destroyed.

While the attacks and attempted landings were in progress over Okinawa, the enemy made twenty raids on Ie Shima. These were mostly single plane attacks although two flights of several planes hit the airstrips and fuel dumps. Window was used extensively but damage to installations was slight. The attack continued during the early morning with twelve additional raids over the gun defended area. After daylight, shipping was the principal target. During all this activity, the AAA on Ie Shima destroyed eighteen planes and damaged seven.

The airfield on Ie Shima was on a level plateau in the center of the island. On the north and south sides the ground beyond the plateau sloped sharply to a lower level which extended to the water line. On this lower level and just opposite the end of one of the runways was pitched the camp of Hq Battery, 93rd AAA Gun Battalion. At 1130 on the 25th, a P-43 taking off from this runway failed to become airborne and crashed into the middle of the Hq Battery camp, immediately bursting into flames. A great deal of equipment was destroyed, as were the permanent records of over 400 officers and enlisted men. Two men were killed and five severely burned.

Although sporadic raids occurred over the islands during June and July, there was no repetition of the concerted air activity of the preceding month.

The enemy did succeed in inflicting heavy damage to one battery on the night of 24 June.

Fifteen Japanese Naval PG 60-kg bombs landed in and near the position of Battery D, 93rd AAA Gun Battalion. One bomb struck inside the bunker of one of the guns, instantly killing the entire crew. Intense fires from the explosion consumed all inflammable material and spread among the wooden boxes where ammunition was stored in the emplacement. Fires and explosions continued for an hour before being brought under control. Much unexploded ammunition was scattered over the battery position. However, in seven hours the debris had been cleared away, damage to fire control equipment repaired and the battery, less one gun, was again operative.

Activities on Kerama Retto

The Kerama Retto is a small group of islands about thirty miles west of the southern end of Okinawa. The islands were captured during the period 26 to 30 March, prior to the Okinawa landings, for the purpose of providing a sheltered Naval anchorage and site for a seaplane base. The 77th Inf Div secured the islands with little opposition, although several hundred Japs were driven to the hills. Elements of the 7th AAA AW Bn provided AAA defense for the landings and remained with the garrison force of one infantry battalion until 18 April.

The Naval anchorage grew rapidly and included extensive floating repair facilities required for the many ships damaged by Kamikaze attacks. Naval tactics for the air defense of the anchorage were largely passive, consisting mostly in obscuring the ships in a cloud of smoke produced by smoke generators mounted in LCVP's. When Japanese planes were overhead the sound of their motors could be heard on board the ships but nothing could be done about it. The local Admiral recommended that the base be moved to another location but Commander JEF disapproved and directed that a battalion of AAA guns be sent to the islands to provide radar controlled fire over the anchorage. The 505th AAA Gun Bn with one platoon of AW was allotted for this task. The terrain was especially rugged and the assistance of engineers was required in building roads and clearing sites for the guns. The AAA battalion arrived on 25 May and the batteries became operational during the first week in June.

Thereafter, the Jap flyers changed their tactics and approached the Kerama Islands at very low altitude, defiladed by the hilly terrain from AAA gunfire. The battalion engaged only two targets but established the enviable record of 50% by shooting down one of them. However, this was only a small part of this unit's activity. Batteries were so sited that a large part of the islands and most of the beaches inside the anchorage were covered by the AA guns employed as field artillery. The known locations of Japs who had withdrawn to the hills received periodic harassment. Points along the beaches were zeroed in and surprise fire was brought to bear on Jap scavenger parties searching the floating debris and garbage for "Roosevelt rations." Much was done by the AAA guns to add to the discomfort of these people.

Air Defense Control

During the entire campaign, the AAA was controlled from the Combat Information Center afloat. Control was exercised by Commander Air Support through his Force Fighter Director. Radar picket ships were stationed in all

directions from Okinawa and furnished early warning data to the Fighter Director for the control of interceptors and the release of AAA fire. Because of their relative isolation, these picket ships took a terrific pounding from Kamikaze attacks. However, replacements were effected and the system was not interrupted. This feature did lead to the early initiation of operations to capture the smaller outlying islands and establish AWS bases to replace the picket ships.

In addition to the strict control of fire of AAA units, exercised by Commander Air Support, Army orders were explicit in regulating antiaircraft fire of non-AAA units. These regulations provided that AA weapons in the hands of those units were authorized to fire only when under direct attack by hostile aircraft during daylight, and under no circumstances during darkness.

AAA commanders on Okinawa can justly take pride in the fire discipline of their units and in the ability of their gunners to recognize targets and use judgment before opening fire. The same cannot be said of gunners in non-AAA units, whose lack of fire discipline and failure to observe Army orders caused appalling results during the first week of the campaign.

Large numbers of light AA weapons were emplaced along the beach. Service units came ashore and immediately promoted AA machine-gun defense with weapons picked up from somewhere. Other ground and Naval units were likewise armed. Amtracks, LCT's and small naval craft had mounted AW for AA defense. With adequate training and proper control these gunners could have afforded tremendous defensive fire power. However, they were untrained in target recognition and unfamiliar with Army orders governing the control of AA fire. Many of these units lacked the communication facilities necessary for proper control. Their motto was to shoot. One burst of fire from any gunner against any type of plane set off a terrific volume of fire which, when started, was impossible to stop.

In addition to the two tragic instances of firing on friendly planes noted above, the following occurred on 7 April. At 1155, warning was passed on the AAAIS net that three friendly planes were going to land on Yontan airfield. The planes drew no fire as they passed over AAA installations. But as they circled to land, fire was initiated from amtracks near the field and was taken up by other gunners on the beach and shipping. One plane was destroyed, one crash-landed and the third was damaged.

This situation made it necessary for AAA commanders in each area to search out and take control of AA weapons in the hands of non-AAA troops. A few were incorporated into the AAA control net. Some were allowed to continue if it was established that Army orders regarding AA fire were being followed. All others were dismounted and stored. Only in this manner was it possible to solve the problem of insuring the safety of friendly planes operating from two airfields in the middle of a highly congested area.

It is true that these incidents contributed to the caution of the Fighter Director in withholding AAA fire and preventing the full employment of AAA capabilities on a few occasions during the early days of the campaign. However, by close liaison between Tenth Army AAA and Commander Air Support, as well as strenuous efforts on the part of all AAA commanders, errors were corrected and a system of coordinated control of fighter aircraft and AAA fire was developed which by the middle of the campaign, was a model for effectiveness.

Mark 20 Radar and Searchlight of the 2nd Marine AAA Bn, Point Bolo.

Ground Activities

Late in May the infantry units which had been garrisoning the Kerama Retto were relieved from this duty by the 870th AAA AW Bn, under command of Lt. Col. Wilmer F. Lucas. This unit, formerly the Automatic Weapons Battalion of the Harlem National Guard regiment, already had a fine record of service as infantry in World War I. After deploying on the principal islands of the Kerama Retto, the battalion initiated an active campaign of mop-up and harassment against the remaining Japs. Patrols covered the islands' perimeters and destroyed suicide motorboats and caches of ammunition, food and other supplies. On one occasion a pocket of about thirty Japs was located in a deep gulch on Zamami. After a well planned preparation by mortar fire and grenades delivered from the ridges above, a patrol advanced up the gulch and killed every one of the Japs without a single casualty to our troops.

Hq and Hq Btry, 44th AAA Group, arrived early in June and was sent to Kerama Retto where its commander assumed control of all garrison activities. One battery of the 870th AAA AW Bn had occupied the empty village of Tokashiki on the eastern coast of the island by that name, the largest island in the group. The Japs occupied positions in the surrounding hills and caused fire from machine guns, knee mortars and snipers to fall within the town. With the arrival in Tokashiki of over two thousand civilians from Ie Shima with Military Government personnel, the situation became more acute. On 24 June a well planned and effective attack was made by the 870th AAA Bn to oust the Japs from the principal hill overlooking the village. The attack was supported by naval gunboat fire and field artillery concentrations by the 505th AAA Gun Bn. Although considerable resistance was offered by Japs in prepared positions, our troops took the hill and completed the organization of a new perimeter by early evening. Two pillboxes were knocked out with flame throwers. Machine guns, mortars and a quantity of ammunition were destroyed. Our losses were one

M 15 Half Track, 834th AAA AW Bn (SP) Machinato Beach. Protecting right flank of the III Marine Corps.

officer and two men killed and nine men wounded. Over twenty dead Japs were counted.

Several instances of ground activity involving AAA troops also occurred on Okinawa. On 12 May, a patrol from an isolated Marine radar unit near Yontan was ambushed by a Jap force estimated at fourteen men. In the ensuing skirmish three Japs were killed. The patrol escaped with only three wounded. Another patrol was immediately organized and searched out the enemy, developing a fire fight in which the Japs were driven into a cave. One Marine was killed. After receiving reinforcements during the night, the patrol finished off the Japs the next morning. Thirteen bodies were counted and identified as paratroopers, equipped with demolition kits and an up-to-date aerial photo of Yontan airfield.

During the latter part of June, a platoon from the 325th AAA Slt Bn went into position near Yonabaru. Platoon headquarters and one searchlight section established a wired in perimeter with foxholes, trip flares, etc. Soon after dark a Jap patrol of twelve men approached and engaged the searchlight crew in a lively exchange of fire after which the Japs withdrew. The next day a patrol from the light crew flushed a small group of Japs and killed all except the leader, an officer who committed suicide with a hand grenade. The Japs continued the harassment in increasing strength for three nights. When the searchlight went into action it drew rifle and machine-gun fire. One Jap attempt was made with a satchel charge to blow up the control station. This attack was liquidated by infantry assisted by the searchlight in a bit of local battlefield illumination.

Rarely did a day pass without an incident of ground contact between an outlying AAA unit and Jap ground troops. Miles behind the front, by-passed pockets of Japs which had escaped the mop-up were a source of harassment to our troops. Contacts increased as the campaign drew to a close and groups of Japanese, escaping from the southern part of the island, attempted to work their way through the American lines to the comparative safety of the northern hills. The need for local security of isolated units was axiomatic. Positions had to be wired in, perimeter defenses established and active patrolling maintained.

Results and Lessons Learned

Results obtained by Tenth Army AAA during the Ryukyus campaign included 127 enemy planes destroyed, 20 probably destroyed and 56 damaged. Battle casualties to AAA personnel totalled 39 killed, 139 wounded and 18 injured. Nonbattle casualties came to 289.

Lessons concerning supply, administration and the technical aspects of ammunition and equipment served mostly to confirm what had already been known from other operations. The principal lessons learned in this campaign pertained to training and emphasized the necessity in large amphibious operations for,

(a) Thorough indoctrination in target recognition and fire discipline on the part of AA gunners in non-AAA units, to include complete dissemination of Army orders for the control of AA fire to the lowest echelons.

(b) Provision of protection from AA fragments for all troops, especially those near beaches exposed to Naval AA fire at planes in line with the shore.

(c) Continued stress on local security of AAA positions, to include offensive patrolling.

The end of the Ryukyus campaign was officially declared when organized resistance ceased on 2 July 1945. The Japanese commander performed his traditional rites to the Emperor by committing hari-kari, and the United States flag was hoisted above his command post. Thus ended the last and largest amphibious operation in the Pacific.

Termination of the major ground combat activities actually had little effect on the antiaircraft artillery in the Ryukyus. Air alerts and occasional raids occurred throughout July and the first half of August, but with less frequency and intensity. The AAA units continued in the performance of their primary mission to the end of the war. Headquarters Tenth Army AAA Command concerned itself principally with preparation for the scheduled invasion of Japan.

TRAILER LIFE AT FT. BLISS

By Maj. V. B. Cagle, CAC

One of several approaches to the solution of the service housing problem, the possibility of increased use of house trailers by service personnel should receive careful consideration at the highest level.

A centralized purchasing and financing program could bring a trailer within the reach of many service families badly in need of relief from high rents and inadequate housing.—Editor.

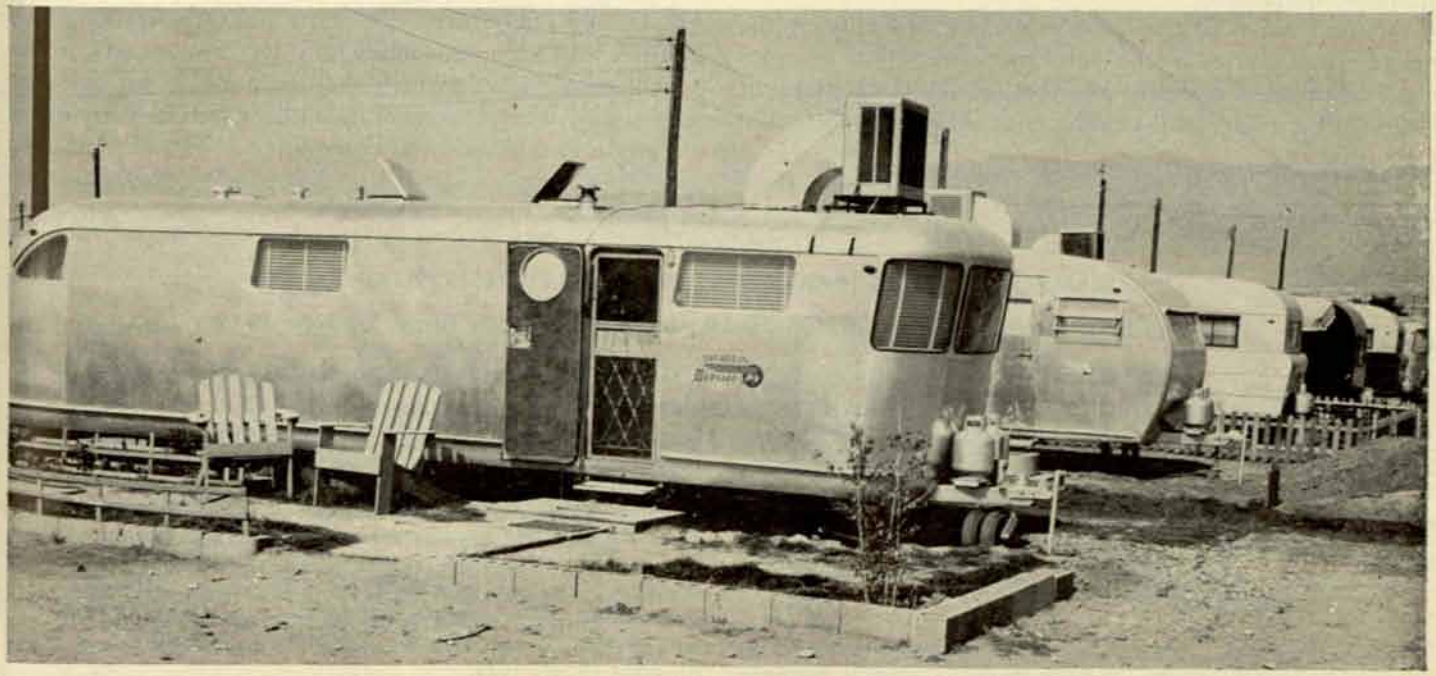
Military personnel arriving at Ft. Bliss, Texas, this summer or fall via automobile and house trailer will be glad to know that the critical housing situation here has been solved for them to some extent. Opening in January 1949 with 46 spaces, the Fort Bliss trailer park has been expanded to provide accommodations for 112 trailer spaces, and work is now progressing on 39 additional spaces to bring the total to 151. Still on the waiting list, however, are the names of 61 applicants for parking space.

The trailer park is only one of several means employed at Ft. Bliss, to relieve a critical housing shortage caused by the arrival of several thousand persons to cadre and fill new units being activated here. On October 15, 1948, Maj. Gen. John L. Homer, Commanding General, Fort Bliss, announced a drive to combat the housing shortage. Among the steps taken to provide housing were two immediate relief projects: Construction of a park for privately owned trailers, and acquisition of 400 government owned trailers to be assigned to the first three grade NCO's as family quarters.

At the same time every effort was being made to secure rental units in El Paso. For a long-range solution to the problem, Fort Bliss encouraged low-cost housing projects in El Paso to supplement permanent type quarters to be constructed with funds appropriated by Congress. These plans are now materializing. The Ft. Bliss Housing Service is doing good work, the Housing Association completed the 100th prefab on 30 June, and the Post Housing Board is well along with plans to put up 1200 low-cost homes. In addition, the Department of the Army has also recently announced that authority has been granted to construct 72 permanent quarters at Ft. Bliss this year.

Located at the corner of Wilson Road and J. E. B. Stuart Road, the trailer park is served by Post shuttle as well as El Paso busses from Biggs Field. It is understood that telephone service will be available soon upon individual request. Trailer spaces are 30′ x 60′ and are provided with water taps, electric outlets and sewerage. Each resident has been encouraged to plant grass and flowers, and some shade trees have been set out, although it will be several years before these will mature.

A uniform storage box has been provided at the rear of each lot to store garden tools, oilcans and the like. Sturdy clothes lines have also been installed. Trailers now in the park run from small 23-footers up to luxurious 35-foot jobs.



One of the many types of trailers at the Fort Bliss trailer park, this unit is occupied by the author. The air-conditioning unit mounted on top keeps the temperature comfortable despite desert heat.

The larger of these are equipped with showers and flush toilets. These are connected directly to the sewer system on each lot. For the convenience of residents, but used largely by the occupants of the smaller trailers, there are six utility trailers scattered through the park equipped with showers and rest room facilities. Two additional utility trailers have been equipped as laundries and the latest type washing machines have been installed. The children's playground is at the rear of the park and is complete with swings, merry-go-rounds, slides and sandboxes.

Trailer life represents one answer to the vexing army housing problem, and while there are some disadvantages, there are numerous advantages and more and more officers and enlisted men are deciding that it is the most economical and most comfortable way to live and perform military service in the Continental U.S. or anywhere in North America that is served by roads. While it is true that annual state licenses are required for trailers if they are operated on the highway, most residents are exempt from numerous taxes and assessments ordinarily paid by house dwellers. Omitted too are the expensive utility bills for electricity, gas and water. Small utility charges are usually included in the space rental fee. Most of the new trailers now utilize bottled gas of the Butane type for cooking purposes. My experience over a period of years is that one bottle costing $1.50 will prepare three meals a day for two adults from about six to eight weeks. Heat for the trailer in the winter using oil or gasoline rarely runs over $5.00 a month.

Air conditioning of the trailer, both in summer and winter is a relatively simple matter as compared to a house and is easy to maintain. Parking fees over the nation average from $12.00 to $20.00 per month (utilities included), but of course Service owned parks are considerably cheaper. At Ft. Bliss the rent has been set at $5.00 per month with approximately $3.00 of this amount going for the utilities. The balance is used by the park fund to provide orderly service in the bath trailers, cleaning materials, and new items of equipment.

Administration of the park is the responsibility of the park council, elected by the members of the park to serve for a period of three months. Members of the council are, of course, all residents of the trailer park. At present the council consists of:

Park Commander ..... *1st Lt. W. R. McNeil*
Custodian of the Fund ..... *Capt. W. D. Sowers*
Billeting Officer ..... *Sgt. T. R. Roberts*
Utility Officer ..... *SFC R. S. Merrill*
Park Manager ..... *SFC Thomas Hicks*
Advisory Members ..... *Mrs. M. A. Peterson, A. C. Miller, P. Michael*

Park rules require that one adult member of each family be present at monthly meetings of the council. Usually these meetings last from one to two hours depending on the amount of business to be transacted and are very lively affairs. Improvements are suggested and voted on, rules of conduct are established and rents are collected.

The average trailer coach is 23 feet long and is a complete dwelling, containing more than 200 square feet of floor space, comparable to many "efficiency" apartments. The front part is usually a living room with a sofa that opens into a double bed, two comfortable lounging chairs and usual accoutrements, such as a radio, lamp, pictures, rugs, and bookcases. The center room, usually called the "galley," is a compact kitchen, complete with gas stove, refrigerator, sink and cupboard.

Most trailers now have an automatic electric hot water system. The rear room of the modern coach consists of a full-size double bed, two wardrobes, a dressing table and sometimes a bathroom. These trailers represent an initial investment on the part of the owner from $1200 to $4500 depending upon the size. The average at Ft. Bliss runs upwards from $2500. A large number have been purchased from dealers in El Paso and have never been moved.

Born in the depression, the trailer coach industry is today a billion dollar business. There are from 300,000 to 500,000 trailer coaches on the highways or parked to provide shelter for more than one million persons. Today there are from 175 to 200 established trailer coach manufacturers in this country. Some of these plants turn out as many as 20 coaches per day. Writing for the *Trailer Topics* magazine, Mr. Harold Helfer says: "In many ways, the trailer coach industry is like the automobile industry 25 years ago. Then a lot of people wondered whether the horseless carriage was here to stay. The pioneers of the trailer coach industry today are just as enthusiastic and determined as Henry Ford ever

ARMY AUTHORIZES TRAILER SITES ON MILITARY RESERVATIONS

Extract from Special Regulations 405-50-10, Department of the Army, 24 June 1949

1. General.—In order to alleviate the existing shortage of accommodations available for the housing of families of personnel of the Department of the Army, the establishment of trailer camps within military reservations will be approved in appropriate situations. In such instances, the Department of the Army will lease a suitable plot of land to interested personnel and provide necessary utilities and other services to the lessee on a reimbursable basis. The trailers will be furnished by prospective lessees.

2. Authority.—Effective immediately, post commanders are authorized to grant revocable leases to military personnel and civilian personnel authorized to occupy public quarters under provisions of paragraph 3-4, CPR P16.3, for the use and occupancy of individual trailer sites, approximately 30 feet in width and 50 feet in depth, within approved trailer camp areas, and to revoke or renew such leases. Leases will be granted under the authority of the act of 5 August 1947 (61 Stat. 774) and will provide for a uniform rental charge of $42 per annum. In no event will the term of the lease exceed a period of 2 years. DA AGO Form 373 (Lease of Trailer Site) will be used exclusively for this purpose. This form will be available through normal publications supply channels on or about 15 July 1949.

was about his first cars. They say, whatever revolutionary effect it may have on the country as a whole, trailer coach life is destined to become an important and integral part of the American scene."

So far the Department of the Army has recognized the need for privately owned trailers by allocating sums of money to construct parks at certain posts, but what about policy on a National Military basis? What happens when a 1st Lieutenant at Ft. Bliss transfers to Ft. McPherson, Ga., or Ft. Meade, Maryland? He does not need to ship household furnishings at Government expense as other officers do, but he receives no increase over the usual eight cents per mile for moving his entire house.

On the other hand, it may be that there are no Government trailer parks at these or other posts—if not the lieutenant must park outside the reservation, for he may endanger the quarters allowances of other officers on the post. If he is an enlisted man he may not be able to pay high trailer rents and still operate his car to and from work. (Commercial trailer parks are usually located outside city limits.)

Worse yet—from some viewpoints—the newly arrived officer from Ft. Bliss may find that adequate Government quarters are available at certain posts and he is immediately ordered into quarters—in which case he has to lay out varying amounts of his folding money to buy furniture, sell his trailer at a big discount, and give up his quarters allowance.

The life of a trailer coach varies, depending upon the care and the amount of travel to which it is subjected. Probably 10 years would be close to the average life span for a house-on-wheels, although some have been on the road for 15 years. Usually the trailer resident trades in his coach for a new one at the end of two or three years.

Resale of the trailer coach can be handled probably as quickly as the resale of a home. That is, the lieutenant could sell his trailer upon leaving Ft. Bliss equally as quickly as one could sell a house. However, since trailers have a shorter life than houses, they have a larger depreciation.

Some concrete suggestions for improvement of conditions for the Service trailer resident would be:

(1) Establishment of a uniform mileage rate for all personnel travelling PCS with a trailer at 12 cents per mile. No shipment of household effects would be permitted when drawing this rate.

(2) Establishment of a small trailer park at all major posts and military schools to provide accommodations, if desired, for personnel on duty for 30 days or more.

(3) Establishment of uniform regulations which will permit officers to retain quarters allowances for a period to allow them to dispose of their trailers prior to assignment of quarters.

(4) Directory service on a nation-wide basis of all posts which have trailer parks with brief data on size and rates.

(5) A central agency for financing and insurance should be set up on the same basis as Army Mutual Aid insurance.

At larger posts, trailer parks should be complete with recreation facilities and children's playgrounds. A community house would serve well for afternoon bridge parties, monthly meetings and Sunday school services. Lots of shade trees, lawns and flowers will help toward the comfort of residents and will serve to remove some of the stigma ordinarily associated with trailer parks and trailer people.

Trailer parks are now located at the following major Posts.

Ft. Bliss, Texas	Ft. Lewis, Washington
Ft. Knox, Kentucky	Ft. Dix, New Jersey
Camp Campbell, Kentucky	Hanford, Washington
Ft. Ord, California	Ladd Field, Alaska
White Sands Proving Ground, New Mexico	Bolling Field, Washington, D. C.

The first step in achieving public understanding of your profession lies in your own understanding. If a soldier does not understand his own motives, he will never be able to explain them to anyone else. In short, always make certain that you are oriented upon the important, basic facts of your career of service. The next group to be so oriented consists of the men you will lead—and I doubt that there will be any work you will do which will be more important than this: to lead your subordinates to a full understanding of the importance of their mission. No citizen is going to respect an Army which does not respect itself.—THE HON. GORDON GRAY, SECRETARY OF THE ARMY.

Three and One-half Times the Speed of Sound*

Martin Designs and Fabricates the Vehicle, Which Uses a Rocket Power Plant, Now Being Tested by the Navy

A second Navy *Viking* rocket, incorporating design modifications and improvements prompted by the flight of the first *Viking* on May 3, 1949, is being assembled for the Office of Naval Research at the Baltimore, Md., plant of The Glenn L. Martin Company. This second *Viking* will be test-fired at the White Sands Proving Ground, Las Cruces, New Mexico, where the initial rocket of the *Viking* series reached an altitude of 51½ miles and a speed of 2,250 miles an hour on May 3.

A total of 10 *Viking* rockets is to be built and launched under the Navy's long-range program which is aimed toward the development of an American high-altitude rocket that will exceed in performance the German V-2. The development program provides that the experience gained from each rocket will be used to advance the design of the next and all succeeding rockets of the *Viking* series.

The first flight was a test of the *Viking's* propulsion and control systems, both of which performed well. The 51½-mile altitude, though sufficient to prove the basic design, did not utilize the rocket's full capacity. It is planned to try for optimum performance and higher altitude in future flights.

The *Viking's* development and launchings are directed by the Naval Research Laboratory of the Office of Naval Research. The Glenn L. Martin Company designs and fabricates the vehicle, which uses a rocket power plant developed and built by Reaction Motors, Inc., at Dover, N. J. The rocket is tested and readied for launching by a servicing crew composed of men from the Martin company, the Naval Research Laboratory, and Reaction Motors. Officers and enlisted men of the Naval Unit at White Sands assist in field operations.

Although the *Viking* was originally conceived and will be used as a vehicle for carrying research instruments into the upper atmosphere, its development will materially advance the guided missile art and the national defense. The 45-foot-long pencil-like vehicle weighs five tons when fully loaded. It burns liquid oxygen and alcohol in a rocket engine that develops ten tons of thrust for more than one minute. During flight, the *Viking* is stabilized in pitch, yaw and roll by means of internal controls.

The first *Viking* was accepted by the Navy and delivered to White Sands in January, 1949. Servicing shops were set up, launching area installations were made and then two static firings were conducted: one in March, the other in April. In the static firing, the rocket is checked out, fueled and fired as for a flight, except that it is securely fastened to its launching stand and therefore remains on the ground.

Although the idea of static testing is not new to the rocket art, the use of static firings as pre-launching checks of the assembled rocket is a *Viking* innovation. In addition to providing valuable data on the rocket's performance, the static tests indicated that the first *Viking* was in good operating condition before its flight firing. Minor defects which appeared during the first static test were corrected before subjecting the rocket to a final, confirming static firing. On the basis of favorable test data, the rocket was readied for launching and finally flown on May 3.

Excellent records of the rocket's flight performance and detailed data on the functioning of its various components and systems were obtained during the first flight. From analysis of these data, numerous design modifications and improvements have been decided upon, and many are being incorporated into the second *Viking* rocket.

The first *Viking* reached its peak altitude 163 seconds after take off. After ascending 15 miles under powered flight, the giant rocket coasted to its zenith and then fell back to the earth 10 miles from the launching site about 6 minutes after take off. The maximum velocity attained is 3½ times the speed of sound.

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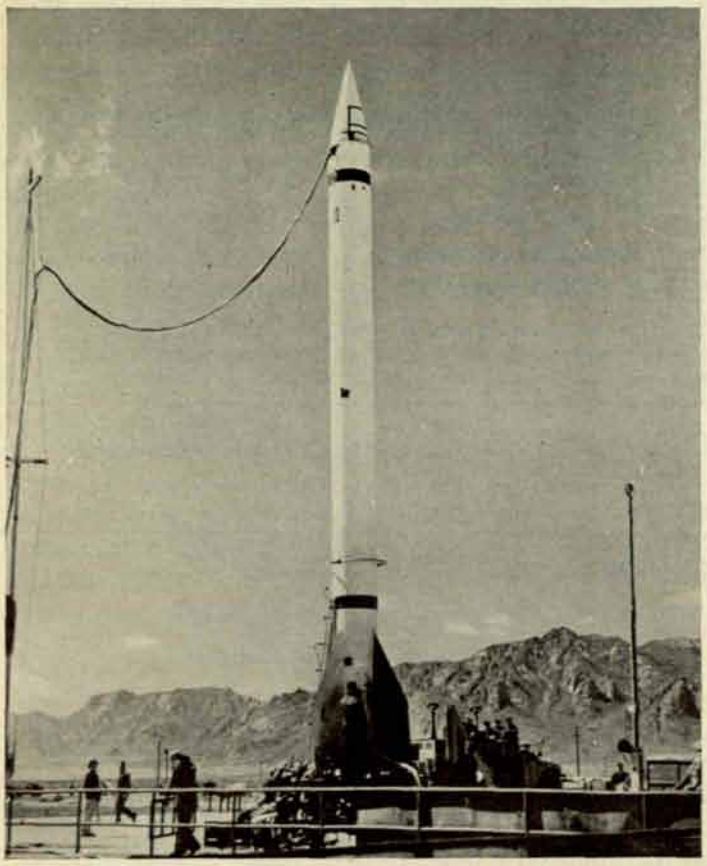


MARTIN BUILDS FIRST AMERICAN-DESIGNED HIGH ALTITUDE RESEARCH ROCKET

The "Viking," constructed for the U. S. Navy, was launched successfully on May 3, at the White Sands Proving Ground, Las Cruces, N. M. Pictures of the initial launching have just been released by the Naval Research Laboratory under whose direction the "Viking" was built. The single stage upper atmosphere rocket reached an altitude of 51½ miles, and attained a speed of 2,250 miles an hour, which is three and one-half times the speed of sound.

Introduction To Ramjet Propulsion

By Lieutenant Commander J. P. Field, U. S. Navy

(Author's Note: The first part of this article is a revision and extension of a preceding very excellent article in the Coast Artillery Journal by Majors D'Arezzo and Sigley, CAC, entitled "The Flying Stovepipe—How It Works." Those authors are due credit for their contribution to this work. A large percentage of all the material presented here was derived directly or indirectly from The Applied Physics Laboratory, The Johns Hopkins University, and thanks are expressed to members of that organization. However, responsibility for errors and misplaced emphasis rests solely with the author.)

Introduction

Modern military requirements for very high velocity propulsion systems have led to extensive study of several types of reaction motors. A general characteristic of all these engines is their ability to propel a structure at higher velocities than "conventional" systems are able to match, but each type of reaction motor has certain advantages and limitations peculiar to it alone which govern the adaptability of that type to suit particular requirements.

The ramjet engine has attracted close scrutiny primarily because of its: (1) very high power per pound of weight; (2) high power per unit frontal area (implying low drag); and (3) extreme simplicity and economy of construction. The ramjet consists essentially of a shaped duct open at both ends through which air passes and is accelerated by the addition of heat energy. It derives thrust from the reaction of accelerating combustion gases.

Although the ramjet was first conceived by a Frenchman named Lorin almost forty years ago, it was not until the urgent need for a new high velocity propulsion system became apparent to military planners during World War II that serious development was undertaken. The Applied Physics Laboratory, The Johns Hopkins University, working under contract with the Navy Bureau of Ordnance, undertook this task late in 1945, and by June, 1946, it was announced that successful ramjet flights had been accomplished for the first time. Unlike many other new weapon developments and in spite of its French origin, the development of the ramjet has been almost exclusively American so far as we know.

Since the original successful flights, other government agencies and industrial concerns having military contracts have interested themselves in the ramjet engine, and the Applied Physics Laboratory has continued as a prominent leader in development of this propulsion system. In the flight first publicized in June 1946, the ramjet, having been boosted by rockets to a velocity of 1900 feet per second, then accelerated under its own power to about 2200 feet per second or 1500 miles per hour. This is twice the speed of sound. It flew five miles, burned one gallon of gasoline, and though constructed essentially of the exhaust pipe of a Thunderbolt airplane engine, it developed horsepower comparable to that of the Thunderbolt engine for which the exhaust pipe was intended.

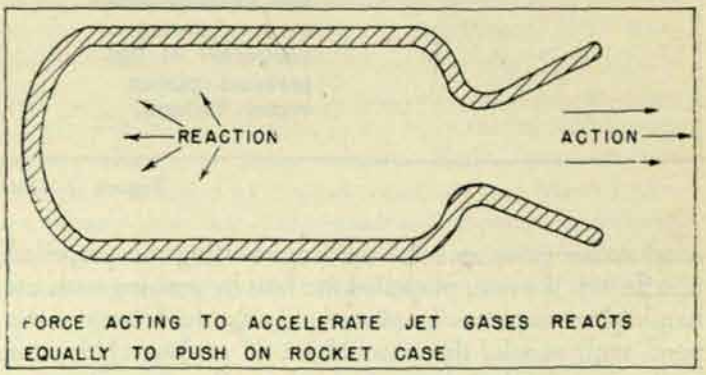


Figure 1—Rocket.

Thrust Development

Like all reaction engines, the ramjet engine derives its thrust from the increase of momentum which it imparts to the working medium, in this case, air. Newton's third law of motion states that for every action there is an equal and opposite reaction; applied to this case, it means that whatever force accelerates the hot gases backward also pushes the missile forward. The magnitude of this force may be computed, according to Newton's second law, from the time rate of change of momentum of the gases and hence the force pushing the missile can be determined.

The reaction idea as exemplified by rockets is immediately clear upon first introduction. (See Figure 1.) The unburned fuel is at rest with respect to the rocket, but when it burns and expands through the nozzle it gains a certain velocity relative to the rocket. The mass of fuel burned per second multiplied by the jet velocity gives the change of momentum of these gases and this is equal to the thrust which pushes the engine ahead. Note that the thrust is derived from the *change of velocity* of the ejected matter and *not* from its pushing against the atmosphere or against any other resisting medium outside the rocket. If a man jumps off the bow of a small boat in the middle of a pond the boat will be shoved backward through the water with the same momentum that the man gained ahead, and this is analogous to a reaction engine's operation, the man representing the

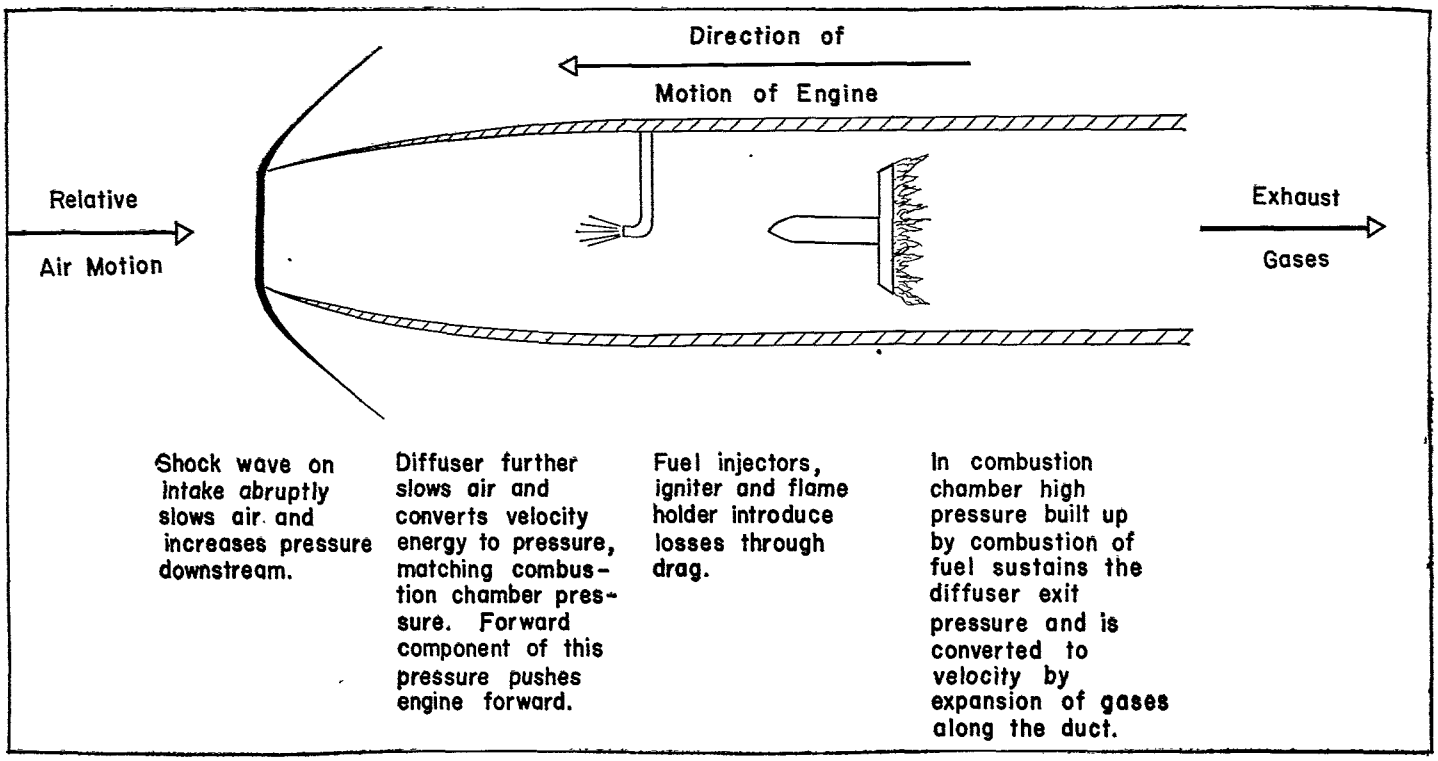


Figure 2—Supersonic Ramjet.

accelerating gases and the boat representing the propelled missile; but if a man propelled the boat by pushing with his hand against a pier or by pushing against the bottom of the pond with a pole, there would be no analogy. Hence, a rocket can develop thrust high above the atmosphere or even in a total vacuum; in fact, it will develop about 20 per cent more thrust when discharging to a vacuum than when discharging to atmospheric pressure because its jet velocity will be greater when discharging to a vacuum.

In a ramjet the same principle applies: namely, that an acceleration of a hot jet gas produces a reaction that shoves the engine through the air, but in this case the medium is not initially at rest with respect to the missile, as in the case of the rocket, for it has an initial velocity as it enters the intake. Nevertheless, the air undergoes a change of momentum because the combustion of fuel adds heat energy which is converted by the duct into pressure and velocity changes. The increase in velocity multiplied by the mass rate of flow is again proportional to the force that propels the engine assuming that the gases exhaust at ambient pressure. Because the ramjet looks so much like a long open pipe it is sometimes difficult at first introduction to see just where the actual physical pushing takes place. The following paragraphs will attempt to make this apparent; but it should be clear that, regardless of the physical details involved, a force is actually present pushing against the engine whenever gases are being accelerated out the exit. This is the salient point to hold in mind during the following discussion.

Figure 2 is a schematic representation of the ramjet. The diffuser is a frustrum of a cone with a very small angle, the exit area being perhaps 2½ or 3 times the intake area. When the air flows down the diffuser it has a greater and greater area to fill the farther it flows, and consequently it goes slower and slower the farther it goes unless the flow separates from the walls. Because of the thermodynamic relations between pressure, temperature, and velocity, the kinetic energy represented by this change of velocity is converted into potential energy which appears in the form of a progressive rise in pressure along the duct. At the diffuser exit the slow-moving high-pressure air discharges into the combustion chamber. It is one function of the diffuser to produce as high a pressure rise as possible for a given change in velocity. However, the diffuser will not function in this manner to produce a pressure rise from velocity energy unless its exit pressure is sustained by a matching pressure in the combustion chamber. This matching pressure is supplied as follows.

The air flowing into the combustion chamber is mixed with fuel, ignited, and burns in a very short distance. The increased temperature tends to increase the volume of a given mass of mixture and hence the hot expanding gases seek to escape in every direction. Radial escape is impossible, of course, because of the chamber walls, and escape upstream is blocked by the diffuser exit pressure. Due to these flow restrictions the pressure in the diffuser chamber goes up greatly causing the gases to take the only possible escape route out the combustion chamber exit at a very high velocity. Now the same high pressure (created by expansion of the heated gases) that accelerates this gaseous mass out the combustion chamber exit also offers an opposition to the influx of air from the diffuser causing its velocity to be reduced and thereby further raising its pressure. This increased pressure is transmitted upstream through the air in the diffuser and results in higher pressures throughout the diffuser.

In fluids static pressure is exerted equally in all directions and therefore the walls of the diffuser will have a high pressure acting normally upon them. This pressure may be considered to be composed of two components, one normal to

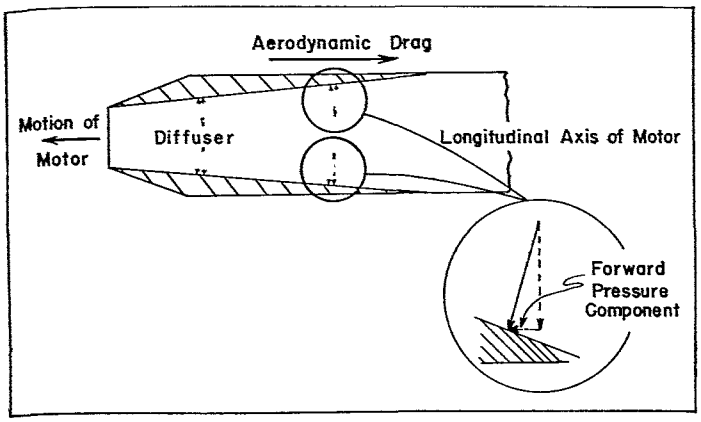


Figure 3—Ramjet Thrust.

the diffuser axis and the other parallel to it. (See Figure 3.) Those normal to the axis will cancel out with those on the opposite inner wall but those components parallel to the axis will add together to give a net force pushing the diffuser forward. This is the force that propels a ramjet.

For a given mass of air flowing per second and a given size combustion chamber exit, the pressure in the chamber is determined by the rate at which fuel is burned, and the pressure throughout the diffuser adjusts to match this pressure imposed by the combustion rate. Since a supersonic diffuser is designed to produce one particular Mach Number at its exit and since this Mach Number is actually set by the rate of fuel combustion (via the pressure so developed), it is apparent that only one air-fuel ratio will give proper matching between combustion chamber pressure and diffuser exit pressure.

There is a high pressure in the combustion chamber and only ambient atmospheric pressure outside the combustion chamber exit. In between, there is the pressure gradient which keeps the gases accelerating throughout the length of the chamber. Pressure relations are such that for a ramjet flying at a Mach Number of about 1.2 and above, the gases will reach sonic velocity inside the chamber near the exit because the pressure available at the diffuser exit plane will be about twice atmospheric pressure, and the pressure ratio will produce sonic velocity at the jet exhaust plane. If higher pressures are produced in the combustion chamber by faster flight and proper heat addition, the Mach Number 1 condition will still be maintained at the exit and the same pressure ratio will be maintained; therefore, the only result will be to raise the pressure of the exhausted gas. A nozzle may be added to convert this excess pressure into velocity as is done for rockets, but for many cases the added weight and drag of the nozzle would more than offset the advantage so gained. For supersonic ramjets not equipped with a nozzle, the gases at the exit plane are invariably exactly at sonic velocity.

Formation of Shock Waves

An introduction to the formation of shock waves will be a useful preliminary to discussing in detail the history of the air which passes through the ramjet.

The velocity of propagation of small pressure disturbances, such as sound, in a gaseous medium is proportional to the square root of the absolute temperature of the medium. It is a very important thermodynamic quantity not because of its relation to audible sound but because it places certain limits upon the transmission of pressure changes and the flow of gases through constrictions. The term "Mach Number" is used to define the velocity of a body relative to this velocity of propagation of small pressure changes. For Mach Number 1, the body moves at the propagation velocity, or sonic velocity. Mach Numbers less than one correspond to subsonic velocities and Mach Numbers greater than one correspond to supersonic velocities. Consider a stationary point source of pressure fluctuations. Pressure waves travel out in concentric expanding spheres at a given rate, the sonic velocity. A cross section would resemble Figure 4(a). Now let the source be moving at approximately 0.7 sonic velocity, i.e., Mach Number 0.7; a set of circles will still be produced but their centers will be successively displaced along the path of motion of the source since their origin moves with time. Older circles are bigger. (Figure 4(b).) If the source is moving at approximately sonic velocity, Mach Number 1, the configuration will resemble Figure 4(c). If the source is moving at supersonic velocity, Mach Number greater than 1, it will be continually overrunning the sectors of the circles which otherwise would be ahead of it causing them to add together and make a severe pressure wave. The envelope of all the circles would form a thin surface representing a pressure discontinuity whose intensity decreases with distance from the source. The geometry would resemble Figure 4(d). This

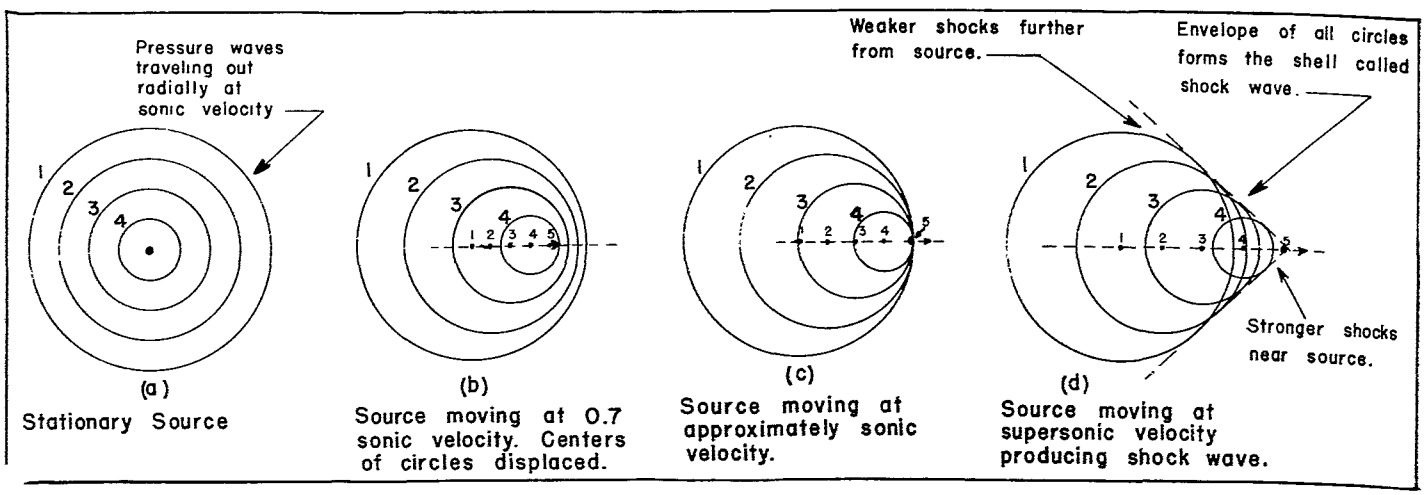


Figure 4—Formation of Shock Waves.

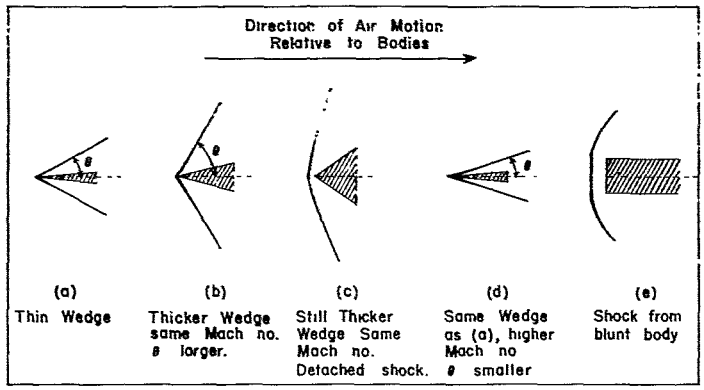


Figure 5—Shapes of Shock Waves.

is known as a shock wave and will be present whenever a relative speed exists between an obstruction and a stream of gas because relative motion continually creates pressure disturbances that spread in a manner similar to that just described. It represents a severe discontinuity of extremely small thickness. On passing through it, the air experiences a very sudden increase of pressure, temperature, density, and entropy, with a corresponding decrease of velocity. Unless the shock wave is normal to the direction of flow, as it can be under some conditions, the direction of flow is also changed on passing through the wave. Real bodies can be considered made up of many points and hence they form shock waves similar in origin and nature to, but differing in shape from, the oversimplified pictures given above for point sources. Figure 5(a) shows a shock from a thin wedge. Figure 5(b) shows the shock from a thicker wedge at the original Mach Number, and Figure 5(c) shows the shock from a still thicker wedge at the original Mach Number; here the shock has detached itself from the edge and formed a "bow shock." Figure 5(d) shows the original wedge at a higher Mach Number. In general, a higher Mach Number produces a smaller angle δ and a thicker wedge produces a larger angle δ. Figure 5(e) shows the shock obtained from a blunt body.

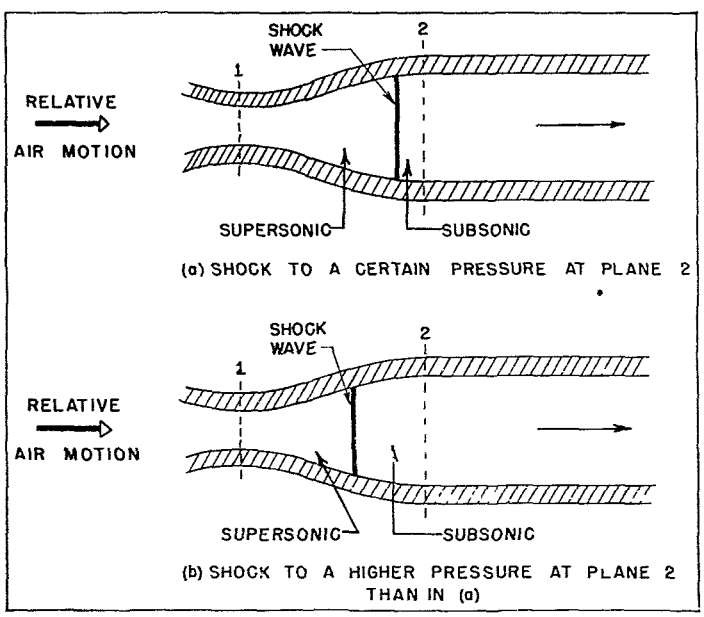


Figure 6—Normal Shocks in Diverging Ducts.

In addition to the shock waves originated as described above, a shock wave may occur in a duct even without any obstructions. The gaseous medium uses the shock process as a mechanism for adjusting its pressure, volume, velocity, etc., to suit the requirements of pressure and flow area imposed upon it. For example, Figure 6(a) shows such a shock in a diverging duct. It will appear when certain conditions of pressure are imposed at the exit end of a diverging section, but for a certain very low pressure at the exit relative to the pressure at the intake the whole flow may be supersonic throughout and no shocks at all will appear in this section. For a certain imposed exit pressure, a shock will be present at some place such as shown in Figure 6(a). For a slightly higher exit pressure, the shock will form as in Figure 6(b).

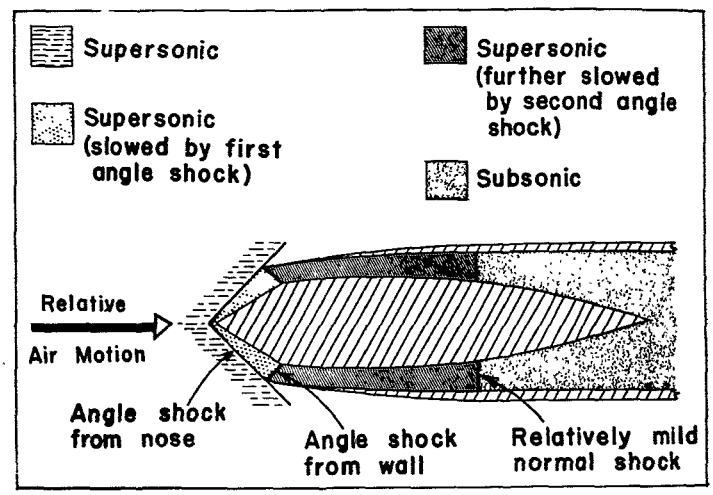


Figure 7—Multiple Shock Diffuser.

All shocks perpendicular to the flow direction are called normal shocks. Normal shocks can be considered as more severe than angle shocks since they introduce higher pressure losses than angle shocks; that is, more of the total pressure of the stream is converted into heat or turbulence and cannot be recovered as useful pressure. Also, as the Mach Number goes up these pressure losses increase very rapidly; and this will set an upper limit on the efficient flight velocity of a ramjet utilizing normal shock on the intake. For this reason, attention has been given to the construction of diffusers which utilize angle shocks instead of normal shocks to slow down the high Mach Number air. Since some kind of shock is inescapable in supersonic flight, such diffusers as that shown schematically in Figure 7, and others, have been designed to reduce the supersonic velocity of the stream in easy stages through one or more angle shocks followed by a weak normal shock. In this way, more ram pressure can be recovered than with the straight normal shock occurring at high Mach Number. Each type of diffuser has other problems which may offset this great advantage; for example: instability, low efficiency at an off-design Mach Number, and mechanical complexity.

History of Air Passing Through Ramjet

A useful way to summarize all the foregoing discussion is to follow the history of the air as it passes through the ramjet paying attention to the pressure, velocity, and tem-

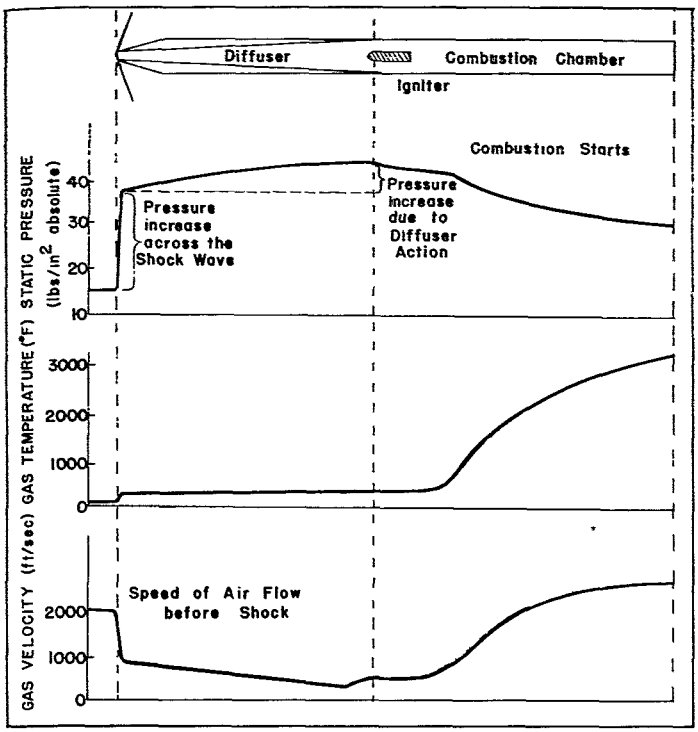


Figure 8—History of Air Passing through Ramjet.

perature with the assistance of Figure 8 which has some approximate members. Consider a ramjet using a simple conical diffuser flying near sea level at a Mach Number about 1.6. The air ahead of the shock will be at ambient atmospheric pressure, about 14.7 pounds per square inch absolute. On passing through the shock wave there is an abrupt large rise in pressure and an accompanying decrease in velocity and increase in temperature. The air then flows down the diffuser which further slows it and builds up the pressure still more with a corresponding slight temperature increase. This large pressure rise has been derived by the action of the shock wave and the diffuser geometry from the kinetic energy associated with the initial high velocity of the air relative to the ramjet; it is because of this method of converting the velocity or "ram" pressure into usable static pressure that the name "ramjet" has been given to this type engine. It is lack of a source of such ram pressure that makes the ramjet ineffective at low velocities; and it is largely losses in intolerably severe normal shocks that set the upper speed limit for effective use of this type diffuser.

Now consider again the problem of matching the diffuser exit pressure and the combustion chamber pressure, since it is this delicate dynamic balance that makes ramjet operation possible. The pressure at the diffuser exit is fixed for a given flight condition not by the diffuser but by the rate of heat release, and the diffuser pressures must adjust to suit this imposed pressure at the diffuser exit. If the imposed pressure is too high the pressures all along the diffuser will be raised and this will cause the shock wave to be detached from the nose and moved ahead of the intake a small distance as in Figure 9. This will cause some of the air which otherwise would have entered the intake to be diverted and spill over the edge of the intake. This "spillover" condition has the effect of reducing the amount of air that flows into the ramjet and of increasing the pressure of the incoming air by external diffusion before this air enters the diffuser. Both results are undesirable. The greater the mass flow passing through the duct, the greater is the possibility of deriving more thrust. And if there is to be a pressure rise ahead of the diffuser intake, there is no way to take advantage of it; the diffuser might better have been built extending out to the point of beginning pressure rise in the first place so as to provide a wall for this high pressure to push upon and thus add to the total thrust developed. If the imposed pressure at the diffuser exit is too low the shock will then enter the diffuser and take some intermediate position as in Figure 6. This condition is also very undesirable since supersonic flow, unlike subsonic flow, accelerates and experiences a pressure drop in a diverging duct. Hence, the forward part of the diffuser inner wall will have a very low pressure on it which results in less total thrust; and furthermore the normal shock that eventually does occur introduces large energy losses into heat and turbulence because it occurs at a higher Mach Number and this results in lower efficiency of operation.

For these reasons it is highly desirable to design the diffuser carefully to match the ram pressure produced by flying at the intended Mach Number with the back pressure

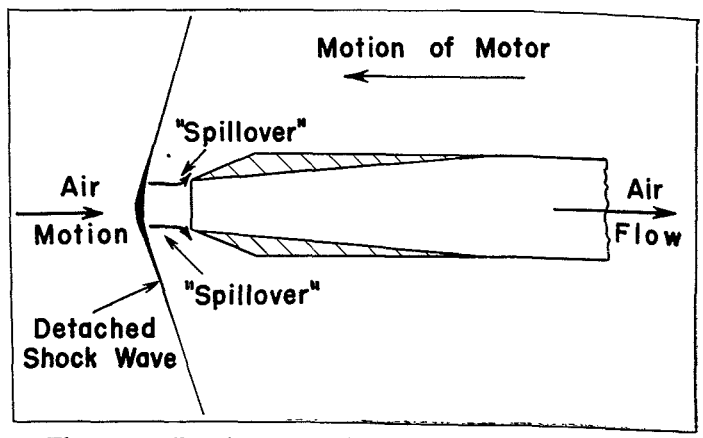


Figure 9—Ramjet Operating With Detached Shock.

produced by fuel combustion at the intended rate in such a way that the shock will be precisely on the nose. Once a certain design has been built, if it is flown at detached shock conditions, the total thrust may be somewhat greater but the efficiency will be lower than for operation with shock on the nose. For swallowed shock, if it operates at all, the thrust produced as well as the efficiency will be smaller than with shock on the nose.

Referring again to Figure 8, it is seen that when the air passes over the fuel injectors and the igniter and flame holders which are required to start and maintain flames in the rapidly flowing gases, some pressure drops occur because of the evaporation of fuel, decreased flow area, and the dissipation of energy through drag of these components. Since this drag represents energy losses, it must be kept as low as possible without excluding fulfillment of the difficult function of holding the flame.

Where the fuel is burned, there begins a very rapid increase in temperature followed shortly thereafter by an increase in velocity, and a decrease in pressure. These trends continue until the gases reach the end of the tailpipe. From published data it can be deduced that conditions at the exit plane of the tailpipe are approximately represented by a

pressure of 2 atmospheres, a temperature of about 3200° F., and a velocity of about 2700 feet per second.

Performance

Now that it is clearly understood how the dynamic balance of pressure in the combustion chamber from burning fuel against the ram pressure due to rapid motion through the air is able to maintain on the sloping diffuser walls a high steady pressure that pushes the missile forward, let us consider why this remarkable device attracts such intense interest of the military planners. First of all, it is important to know that the desire of our armed services for extremely high speeds arises from an urgent and real military requirement and not from a juvenile delight in breaking into headlines or smashing new speed records. It is practically impossible to intercept and attack an offensive mission of any sort unless the interceptor has a marked speed advantage. The development of high speed bombers makes imperative the development of higher speed interceptor craft or guided antiaircraft missiles. The development of a high speed offensive bombardment guided missile will demand development by the defender of a still higher speed antiaircraft missile. And so, the cycle goes round and round. Always, the cry is for more and more speed both for offensive and defensive weapons.

The serious contenders in the field of high speed military propulsion are the rocket, the ramjet, and the turbojet. The exact qualities most desirable in such engines vary somewhat with the specific purpose for which the engine is intended but certain qualities may be considered always desirable. Some of these are: high power per pound of engine weight; high power per unit frontal area (because at such high velocities a large cross section area means very large energy losses from air resistance); operational simplicity; adaptability to mass production; reliability; economy; availability of fuels; and many others. It must be noted that no one engine can be expected to satisfy all such requirements. The military planners are obliged to compromise and choose from the arsenal made available by scientists and engineers the engine that best meets the tactical situation regardless of some undesirable characteristics inherent in the chosen engine. For instance, reliability may be sacrificed to the need for mass production, or economy may be sacrificed to the need for high power, etc.

What does the ramjet offer? Table 1[1] gives some approximate figures that are useful for crude comparison of several types of engines although direct comparison is difficult because of differences in speeds of operation and other factors.

TABLE 1

Type Engine	*Power (HP/lb of wt)*	*Specific Fuel Consumption (lb fuel per hr per lb thrust)*	*Thrust (lb thrust per lb wt)*
Rocket at M 1.8 ...	*12.0*	*19.0*	*3.0*
Ramjet at M 1.8 ...	*25.0*	*3.2*	*6.0*
Turbo Jet at M 0.8 .	*3.5*	*1.1*	*2.0*
Internal Combustion	*1.0*	*0.7*	*0.6*

Some idea of the tremendous horsepower attainable with

[1]W. H. Goss and Emory Cook, The Ram Jet as a Supersonic Propulsion Device.

Rocket is shown on launching ramp. The rocket is fitted with a cone shaped dummy nose.

the ramjet has already been given when it was stated that a ramjet the size of a thunderbolt exhaust pipe developed horsepower comparable to that of the thunderbolt engine. Another basis of comparison is that in the ramjet flight first reported by the Applied Physics Laboratory horsepower was delivered at the rate of about one horsepower for each ½ ounce of engine weight. This should be compared with a figure of about one horsepower delivered for each one pound of weight by a conventional reciprocating engine. The first column indicates clearly one of the great advantages of the ramjet, its high power delivered per pound of weight. This is a most significant advantage. It means that compared to other available engines a vehicle propelled by this engine will be lighter for a given power requirement. Its wings can be smaller for the same weight supported and, therefore, the wing drag will be less for the same velocity. This is particularly important at supersonic speeds. The second column gives an indication of its fuel economy.

The important thing about fuel economy is not that less money is required to buy fuel, but that the more energy an engine takes out of each pound of fuel the farther it can go on the limited amount of fuel that it carries. The ramjet uses more fuel than the turbo jet and internal combustion engines operating at their lower speeds but far less than the rocket when compared on this basis. The amount of drag inherent in size should be considered in interpreting this column; both the rocket and ramjet have smaller cross sections than the other two engines, hence would have lower body drags at the same speeds. The third column gives the thrust per pound of weight and this is a valuable measure of engine capabilities. Horsepower, being strictly sensitive to velocity, gives a different sort of measure than thrust.

From the foregoing, it should be clear that the ramjet gives thrust and power deliveries superior to any of the other engines on a per weight basis while still retaining a fuel consumption of the same magnitude as the more conventional engines; and it is able to deliver this in a most desirable range of speeds; namely, in the low supersonic range. Speeds below this are not sufficient to meet modern military requirements, and at speeds above about Mach Number 3, other great troubles connected with high temperatures from air friction in the atmosphere and with high lateral accelerations may make operation of missiles more

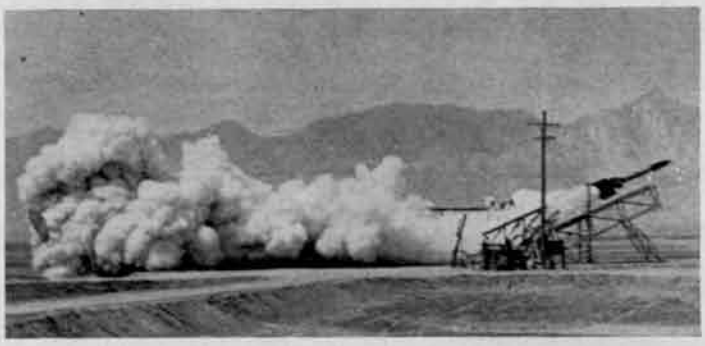
and more difficult. Add to this the facts that (1) the ramjet has practically no moving parts, no precision manufacturing problems, no lubrication problems, which means that it can be mass produced economically and rapidly; (2) once designed, no matter how difficult that design may be, it will be simple to operate; (3) fuels are the conventional kerosene or gasoline types, readily available, nontoxic, easily handled. It is now abundantly evident that the military potentialities of this engine are tremendous.

What are its limitations? First of all, its greatest drawback is that it cannot develop thrust from a standstill, and therefore must be boosted up to a high velocity before it becomes operable. This means that a rocket booster or catapult of some sort must invariably be used, and these add additional expense and operational difficulty. Secondly, the ramjet cannot fly out of the atmosphere since it takes oxygen from the air for burning its fuel; and in this respect it is inferior to the rocket. Various experts estimate the maximum altitude to which a ramjet can be flown as between 80,000 and 100,000 feet, but the optimum altitude may be somewhat less. Excluding the case of orbiting missiles, the degree to which the ramjet will suffer from this restriction on its field of operation is not entirely clear.

Development Problems

It should not be inferred from the foregoing that the ramjet is a fully developed completely documented engine available upon immediate notice for any or all applications. It is definitely in the stage of functioning regularly, reliably, and efficiently; but a brief statement of some of the problems yet to be solved will be revealing—not only of the limitations but also of the future potentialities.

Combustion is one of the oldest yet least understood of the processes controlled by man, and maintaining a productive flame in a high velocity stream is a problem whose solution is not understood because combustion in general is not understood. This problem becomes even more complex with operation at altitude since combustion conditions are generally less favorable at low pressures and temperatures. However, as in internal combustion engines, an acceptable working solution has been obtained wtihout fundamental understanding and as knowledge is increased performance will improve. Another problem is that plague of all high powered heat engines, the problem of obtaining metals that retain their strength at high temperatures. Since gas temperatures around 3500° F. are encountered and most metals soften in the 1500° to 1800° range, it is obvious that some cooling process must be employed. The exterior supersonic air stream is itself a coolant, and other methods are also available. The better the metals developed, the less severe this problem will be. Probably the greatest obstacle to development of large ramjets is the tremendous power required for the blast of supersonic air used for ground tests. For testing the ramjet shown being launched in the photographs, the air supply for the blast furnace of a steel mill was required. For ground testing of a four-foot diameter ramjet, it has been estimated that horsepower comparable to the total output of Hoover Dam might be required. Hence, scientists must learn how to build big ones by thoroughly understanding the little ones. There are many other problems unsolved, problems such as the best diffusers for various applications, the best fuels, and so on. But ramjets have been flying only about three years; the development of this new engine is in its infancy. We can confidently expect that, as time and effort go into further research and development, remarkable improvement in performance and capabilities will emerge.



Largest ramjet flies at supersonic speed in first Navy test.

Military Applications

A few words should be said regarding how the characteristics of the ramjet determine its probable military applications. Since this is a device for supersonic flight and since supersonic flight by humans is rather rare, the discussion will be confined to uninhabited missiles. Consider first the very short range requirements such as direct artillery fire, short air-to-air missiles, and the like. It is obvious that since the ramjet requires a booster it is not likely to become effective at these short ranges, because the booster could better accelerate a warhead alone than a ramjet and warhead. At the other extreme, we know that the ramjet can never be used for interplanetary travel or for orbiting missiles because it can never operate beyond the atmosphere. In the intervening ranges, that is from a few thousand yards to several thousand miles, there is room for a great deal of discussion.

Because it does not have to carry its own oxygen, and because no heavy combustion chamber to withstand high pressures is required, the ramjet will become more economical than the rocket for flights beyond a certain range. The exact value of this range where ramjets become more desirable will depend upon the exact situation, the speed required, the payload to be carried, etc., but to pick arbitrarily an approximate figure, one might say that somewhere in the range between fifteen and thirty thousand yards the ramjet becomes more economical to use than the rocket for certain purposes. Beyond some such range for flight within the atmosphere the ramjet will be superior as a supersonic propulsion device to any other engine. However, for very long ranges the rocket begins to have another advantage of its own: for long ranges its flight will be through the stratosphere where the resistance to its motion is near zero while a ramjet traveling the same distance will be plowing along through the air down below continually dissipating energy through air resistance. At some very long range, the amount of energy dissipated through air resistance by the ramjet may exceed the amount of energy wasted by the rocket through inefficient fuel utilization and by the channelling of its available energy into excessive velocities not useful at the target. Beyond this range the rocket may again become more economical.

The decision to use one or the other of these engines for various applications is obviously not as simple as the foregoing paragraph may seem to suggest, but there is no reason why in its effective area of use the ramjet cannot be applied to surface-to-air, surface-to-surface, or air-to-surface types of missiles. Many other factors must also be taken into account: guidance problems; manufacture, handling, and supply problems; fuel production and handling; and so on. But the ramjet is clearly outstanding as a versatile supersonic propulsion plant by virtue of its high power, low drag, efficient fuel use, and mechanical simplicity. "For sustained high velocity propulsion no other engine can compare with the ramjet." It suffers from its requirement for a boost, and possibly from its altitude limitations; but taken altogether it is a very strong contender in the supersonic propulsion field; and, because its promise is so clear and well-proven even while still in the earliest stage of development we may expect new advances in ramjet design and application greatly to extend its usefulness.

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New Device Rapidly Corrects Firing Errors

Antiaircraft artillerymen at Fort Bliss can now tell almost exactly how close they are to scoring a direct hit on a speeding 300-mile-per-hour aerial target 6000 feet in the air. Wrapped up in a compact unit officially known as a "Firing Error Indicator," the device informs a ground control station of the relative positions of artillery projectile and target within certain zones.

The radius of each zone may be varied by operating personnel but the military requirements of automatic weapons training have indicated that at a range of 1500 yards, a 2½-yard radius for caliber .50 machine-gun fire and 4 yards radius for 40mm weapons is the most effective limitation for the "bull's-eye" zone.

The firing error indicator consists of a radio transmitter (mounted on the plastic tow target) and a receiving unit on the ground near the gun. Only one man is required to operate the receiver. This operator tunes the receiver to the transmitter, keeps score of each round fired, and informs the gunners of their scoring.

Stripped of technical details, the transmitter consists of two opposed condenser microphones mounted so their diaphragms are flush with a hollow plastic sphere. The shock-waves striking this sensitive sphere actuate the microphones just as the human voice sets a telephone diaphragm in action to transmit the spoken word.

The signal reaching the firing error indicator receiving equipment is converted from an electrical impulse to a mechanical movement before it is fed into a "counter" unit. The automatic counter informs the firing battery through which of three circular zones around the target the projectile has passed.

In addition to the three radio zones used for scoring antiaircraft fire, there are also two directional informing zones. Their function is to indicate whether the error in a particular shot is due to excessive leads or insufficient leads. (Leads, as used here, indicate the distance ahead of the target that a gun must aim so that moving target and projectile will meet in space.)

Operator of the receiver of the Firing Error Indicator points to the small plastic cased microphones of the transmitting portion of the apparatus, as they hang in the midst of the almost transparent sleeve. In the foreground is a portion of the equipment that actually registers the hits and shell positions.

The counter unit, a part of the receiving set, contains five individual counters that register whenever a shot passes through their respective zones. The receiver picks up the transmitted signal from the target on a folding dipole directional antenna.

The firing error indicator is used to improve training and to furnish a means for determining the results of automatic weapons training. Its use reduces the number of personnel needed to accurately observe fire and speeds correct information to the gun crews so they may make corrections subsequently in a matter of seconds.

The Air Defense of the United States

By Lieutenant Colonel Floyd A. Lambert, USAF

The Air Force is intensifying its efforts to defend the United States against air attack. The erection of the permanent radar screen was recently approved by Congress through the enactment of Public Law 30. While awaiting funds to be appropriated by Congress for the permanent installations, the Air Force is going ahead with training, utilizing stations located temporarily on existing government owned property.

If war were declared tomorrow, these sites undoubtedly would be used to defend the United States against air attack. To add realism to the training, a two months training maneuver named, "Operation BLACKJACK" was conducted during the months of May and June. May was devoted primarily to the organization and improvement of the elaborate communications system so necessary for an effective air defense. June was devoted to actual flight tests flown by Strategic Air Command bombers in formations simulating enemy air attacks. The SAC bombers flew at times and on courses prescribed by the Air Defense Command, but were unknown to the units being tested. As this was the first USAF air defense exercise conducted over a large area since the war, much valuable training was received by the pilots, radar operators, Controllers, and others.

"Operation BLACKJACK" is the first of a series of air

Fig. 1. A Control Center in France during World War II. If World War III comes the Air Force will utilize similar control centers. Twenty installations of permanent type construction are to be built for the Air Defense of the United States.

defense exercises which will be conducted to improve the effectiveness of the United States Air Defense System. Secretary of Defense, Louis Johnson, has announced that thousands of American citizens will take part in September 1949 in an air defense exercise called "Operation LOOKOUT." It will be conducted under the sponsorship of the Air Defense Command assisted by the Office of Civil Defense Planning. The exercise will be on a much larger scale than "Operation BLACKJACK." Its object will be to intercept simulated enemy attacks by SAC bombers flying at various altitudes and in different directions above the United States. Some of the attacking aircraft will fly over Canada to test the Canadian Air Defense System as well as that of the United States. The bombers will be intercepted by USAF fighters after they enter the United States.

During the six-day exercise, 1300 ground observer posts located in ten states will be manned by civilian volunteers. The Office of Civil Defense Planning is cooperating by contacting the governors of the states concerned to recruit observers. The Air Defense Command between the 30th June and 1st September will undertake the training of the civilian observers through direct correspondence with the chief observer of each post. Telephone companies will cooperate by tabbing OP phones and giving priority to their calls during test hours. The ground observers are needed to augment the radar coverage by spotting aircraft not detected by radar stations when flying below the radar optical horizon. They will offset this inherent line-of-sight limitation of radar and provide information for identification purposes. Individuals selected as observers for "Operation LOOKOUT" will be asked to man their posts in all future times of need. The ten states in which ground observers will be recruited are: Delaware, Pennsylvania, New Jersey, New York, Connecticut, Rhode Island, Massachusetts, Vermont, New Hampshire, and Maine.

The air defense system which the USAF is building up is to be organized into a number of Air Defense Divisions having authority to take independent action in all matters pertaining to air defense within their area of responsibility. The ultimate number of Air Defense Divisions to be organized in the United States is twenty, twelve of which will be Air National Guard Divisions and eight Regular Air Force. During peacetime the eight Regular Air Force Air Defense Divisions will be responsible for the air space over the entire United States, but in event of war or National Emergency, the Air National Guard Air Defense Units will be ordered into Federal Service and assigned areas of responsibility.

The principal air defense installation required by each Air Defense Division Commander is termed an Air Defense Control Center (ADCC) manned by the Aircraft Control Squadron of the Aircraft Control and Warning Group. One group is normally assigned to each Air Defense Division. The group also contains squadrons for operating the radar stations of each division. The ADCC is briefly the communications or nerve center of the Air Defense Division. All operational orders received by the forces allocated for the Air Defense of each area are issued in the name of the Division Commander or by order of a higher commander. Figure (1) is a picture of a control center operated in France during World War II. The USAF control centers will be similar but will be permanent type installations. The drawing, figure (2), shows the lines of communication which are maintained in a modern ADCC. The lines represent one or more communication channels and not necessarily command channels. A casual perusal of this diagram may leave the impression that the modern air defense system is not much different from World War II systems. This is not an accurate impression. Different techniques are used throughout the system. The channels of communications are approximately the same but the speed with which information is transmitted is greatly increased. The radar equipment and the fighter aircraft are to be of advanced designs different from any employed in World War II. Many aircraft control functions exercised during World War II by the Control Center have been decentralized to radar stations for reducing the delay time between initial target pick-up and interception.

The Air Defense Commander or his deputies employ the facilities of the ADCC to perform the following air defense functions for each area:

1. *Command Functions*—The Air Defense Division Commander commands:

a. The fighter wings and groups assigned.
b. The aircraft control and warning group.
c. Other units assigned to his command.

2. *Operational Control*—The Air Defense Division Commander exercises operational control over:

a. Antiaircraft artillery and other Army units allocated by the Joint Chiefs of Staff for the air defense of his area.
b. Aircraft carriers, shore-based Navy and Marine fighter aircraft and other Naval units physically present in the United States available and allocated to him for active participation in the Air Defense of the United States.

3. *Control of Deceptive Air Defense Means*—The Air Defense Division Commander either commands or exercises operational control over Deceptive Air Defense means, which include:

a. Control of radio broadcasting for deception.
b. Control of electronic jamming or deception means.
c. Control of visual deception, fires, lights, smoke, artificial fog, etc.
d. Control of heat for infrared deception.

4. *Functions Performed by the AC&W Group*—The Aircraft Control and Warning Group Commander deputizing for the Air Defense Division Commander exercises:

a. Command of the Air Defense Control Center.
b. Command of Aircraft Control and Warning Squadrons and Radar Stations.
c. Ground Control of fighter aircraft by use of GCI radar stations and air-ground radio.
d. Coordination of antiaircraft fire with fighter interception.
e. Coordination of Navy and Marine fighters and AAA with other air defense forces.

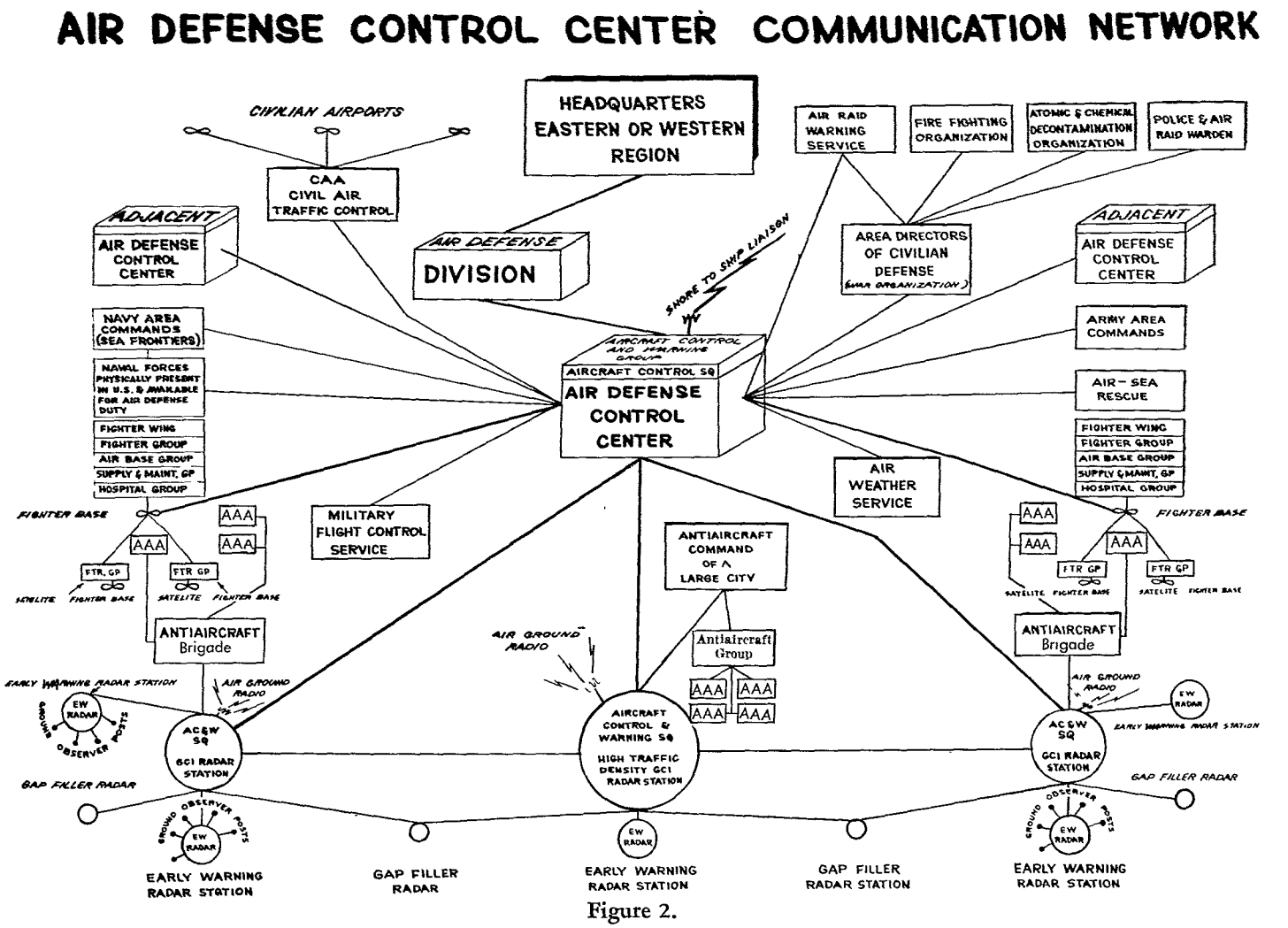


Figure 2.

f. Control of civilian aircraft through CAA representative.

g. Coordination and utilization of radio intercept information.

h. Coordination and utilization of civilian ground observer information.

i. Coordination of emergency air-sea rescue of military personnel.

5. *Control of Passive Air Defense Means*—The Air Defense Division Commander effects coordination of passive air defense means through State Civil Defense Directors for civilian population centers and through military area commanders responsible for military posts, camps, and stations. The passive air defense functions are as follows:

a. Dissemination of air raid warnings.

b. Provision and use of air raid shelters.

c. Means to control fires started by enemy bombings.

d. Dispersal of personnel, material and facilities in potential target areas.

e. Means of bomb disposal, incendiary and missiles.

f. Evacuation of personnel and material in connection with air defense.

g. Enforcement of air raid precautions and discipline (air raid wardens and police).

h. Rail and highway traffic control during air raid.

i. Emergency air rescue and aid associated with air defense.

j. Emergency repairs of air defense facilities.

k. Decontamination of areas affected by air raids.

l. Public information, education, and advice pertaining to air defense.

m. Radio broadcasting silence during air raids.

In any future war, the operational control of antiaircraft artillery will not be accomplished as it was in World War II. Time will not be available to pass radar data from the radar station to the control center, thence to the AAA brigades and groups for action. Radar data will be passed directly from the early warning radars to the ground control intercept (GCI) radar stations for identification, and then direct to all local antiaircraft commands. (See channels of communication shown by Figure 2.) Standing orders probably will be issued to all local AAA commands to use their own discretion in firing upon unidentified targets entering their "gun defended area." GCI radar stations will control all friendly aircraft within their coverage area and will notify local AAA commanders of the approach of friendly aircraft. If an enemy formation approaches a gun defended area the local AAA commanders will be notified and the flight identified as enemy. A television picture of the GCI radar scope will be transmitted to each local AAA commander with enemy targets well marked. If no "hold fire" orders are passed down from the Air Division Commander, the local AAA commander may fire at will. When Air Force fighters

are equipped with air-to-air guided missiles, it will not be necessary to close with the enemy as close as formerly when using automatic weapons. With each local AAA commander in possession of an instantaneous television picture of the air situation, the friendly fighters and enemy aircraft will be separated far enough to permit both AAA and fighters to engage the enemy at the same time.

It is expected that the accuracy of AAA guns and guided missiles will be much more precise than in World War II and that the radar picture will show more discrimination between detected aircraft which will enable accurate and very close control of the fighters. When the fighters and AAA are working together as a team, the enemy should suffer heavy casualties and almost unendurable harassment at the time he is attempting to release his bombs. It is expected that the enemy will be capable of dropping bombs from altitudes of 40 to 50 thousand feet and above using radar bomb sights. Sighting of AAA guns, surface to air guided missiles, and air to air guided missiles must also be accomplished by radar and remote control devices. Radio and radar jamming should, therefore, prove quite profitable in another war with so much dependence being placed on electronic sighting aids.

The National Guard Air Force and antiaircraft units have an important function in the air defense of the United States. In fact, over fifty per cent of the total forces allocated are National Guard Troops. An article on this subject will appear in a subsequent issue.

Air Force Guided Missiles Program*

Extracted from a recent address by Brig. Gen. William L. Richardson

Development of guided missiles for the Air Force is being handled by the same methods as are employed for conventional aircraft development. *Industry* is invited to participate in research and development as well as later production. Generally, the aircraft companies and the electronic manufacturers are primarily concerned. Other members of the industrial family are invited to participate.

Educational institutions are called upon to perform basic research and to assist in the fields of mathematics, physics and other pure sciences.

Government agencies monitor the research and development and assist in test flights. They also engage in some applied research.

The successful development of guided missiles, from conception of the requirement to the finished operational items, requires a large number of varied and specialized facilities.

Among these is the new Joint Long Range Proving Ground recently authorized by Congress. There is no existing facility in this Country where guided missiles with ranges greater than about 100 miles can be properly flight tested. But the Army, Navy and Air Force have an urgent requirement for such a facility. Two years ago they pooled their interests and jointly planned a single proving ground for use by all three. It is, and will continue to be, a joint project. It is an excellent example of the kind of voluntary unification which the services are practicing but which seldom appear in the newspapers.

The technical requirements for a long range guided missile proving ground are stringent, and we had quite a time finding a suitable site. The location finally chosen will place the launching area at Cape Canaveral on the east coast of Florida, about halfway between Jacksonville and Miami. During the War, the Navy had an air training base nearby at Banana River. This has been taken over as the administrative base for the proving ground.

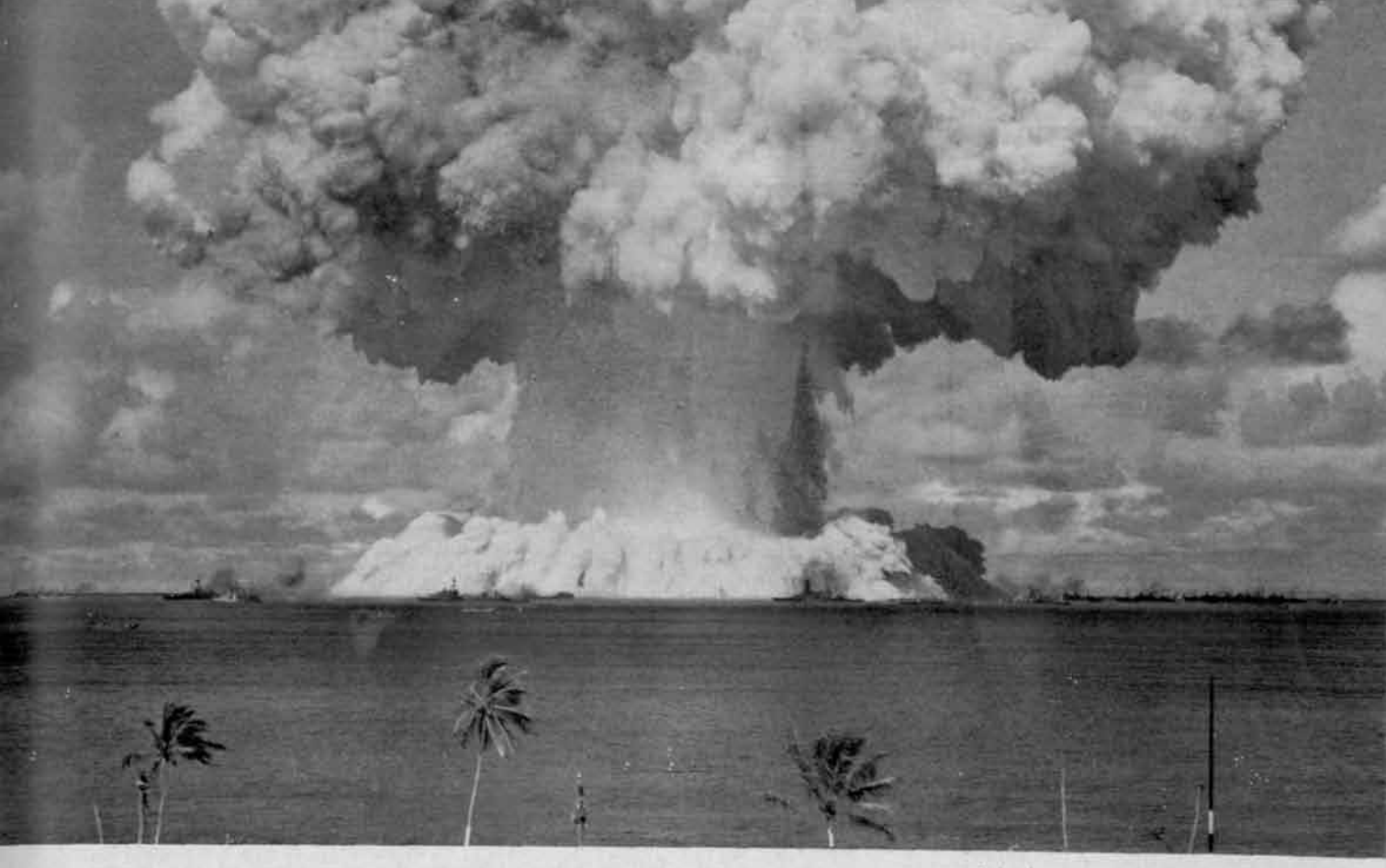
The flight test range will extend to the southeast down through the Bahama Islands, and out over the Atlantic Ocean for several thousand miles. For the first 500 miles through the Bahamas, we will have observation stations at intervals equipped with radar and other devices to follow the flight of the missile to tell its location and how its various components are functioning. We hope to complete the construction of this new proving ground and have it in operation in about two years.

In a project as large and complex as the guided missile program of the National Military Establishment, it is necessary to go to considerable lengths to avoid undesirable duplication and make efficient use of the funds and personnel available.

Coordination through the Services is largely effected by the Guided Missiles Committee of the Research and Development Board. The Board reports directly to the Secretary of Defense. The Air Force, Army and Navy are represented on the Guided Missiles Committee, with prominent civilian authorities. The Committee, through its panels and working groups, continually monitors all phases of research and development on guided missiles. It also provides a medium for the working members of the Services—in the presence of qualified civilians—to thrash out any differences that might arise and thereby insures an integrated guided missile program for the United States. The Guided Missiles Committee is headed by Dr. F. L. Hovde, President of Purdue University.

On 11 December 1948 the Secretary of Defense established the Weapons Systems Evaluation Group to provide rigorous, unprejudiced and independent analysis and evaluation of present and future weapons systems under probable future battle conditions. These technical and operational evaluations, prepared on an inter-service basis, will consider all of the guided missile systems now being developed.

*Delivered at Memorial Day Exercises, Allentown, Pennsylvania, to civic organizations. Program arranged by Major General Charles C. Curtis, Pennsylvania National Guard.



THE UNDERWATER EXPLOSION AT BIKINI *Joint Army-Navy Task Force One Photograph*

The atom bomb blew a column of water a mile and a half in the air, and produced radioactivity equivalent to hundreds of tons of radium.

ATOMIC BOMB—THE X-FACTOR OF MILITARY POLICY*

By Lieutenant Commander H. B. Seim, U. S. Navy

A belief that is fast becoming the central core of our national defense thinking appears consistently in many of our national forums; namely, that the atom bomb is a miraculous panacea for all of our military ills. For example, a recent article, based on an interview with General George C. Kenney, then head of the Strategic Air Command, states that "... today, strategic bombing authorities are concerned with only one bomb load—the atom bomb." However great and awe-inspiring the power of the A-bomb, it is but simple common sense to attempt an evaluation before we accept it as the main shot in our weapons locker. This is particularly important in view of the above-expressed tendency to rely completely and solely on this weapon to preserve our national security. Are we jeopardizing the safety of our nation by such complete reliance?

No one can dispute the fact that the five publicized explosions of atomic bombs have demonstrated almost unbelievable power. Observations and reports from the first experimental blast in New Mexico, the wartime bombings of Hiroshima and Nagasaki, and the two test explosions at Bikini indicate decisively that mankind has found the key to unleash tremendous force for destructive purposes. The United States Strategic Bombing Survey has estimated that to produce results similar to the Nagasaki attack approximately 2,200 tons of conventional high explosives and incendiaries for physical damage plus 500 tons of fragmentation bombs for casualties, a total of 270 B-29 loads of 10 tons each would be required. The subsurface explosion at Bikini on July 25, 1946, was reported to have been at least as destructive as 20,000 tons of TNT. When a force of such potentialities has been revealed as a part of our arsenal, it

*The opinions or assertions in this article are the private ones of the author, and are not to be construed as official or reflecting the views of the National Defense Department. Reprinted with permission of *U. S. Naval Institute Proceedings*.

is certainly not amiss to investigate its effects on both the enemy and ourselves, and the military and political considerations which may govern its employment.

Effect On Enemy

There are but two examples of the use of the atomic bomb in actual warfare—the destruction of Hiroshima and Nagasaki. A review of the results of these two attacks can provide us with an understanding of the effect of the atomic bomb when used against urban targets. In addition, certain lessons may be inferred from the meager reports which have been published concerning the effectiveness of the A-bomb during the Crossroads operation. From these experiences we may make a general assessment of the capabilities and limitations of the bomb insofar as it affects the target.

The Hiroshima attack on the morning of August 6, 1945, caught the Japanese almost completely by surprise; in fact, the explosion came 45 minutes after the "all clear" had been sounded from a previous alarm. The complacency of the Japanese population can be easily understood. Hiroshima had never been attacked in force, but the people were accustomed to seeing stray American planes flying around the city The U. S. Army Air Force had been using Lake Biwa to the northeast of Hiroshima as a rendezvous point for bombers which had assaulted the larger Japanese cities. Therefore, little notice was paid by the Japanese to the small group of three planes which approached Hiroshima on that fateful morning. Only one bomber, the *Enola Gay,* carried a bomb; the other two contained observers and their instruments. Because of this indifference and the lack of adequate warning, most people had not taken shelter.

The bomb burst slightly northwest of the center of the city. The nature of the terrain at Hiroshima was such that the blast and ensuing fire levelled nearly five square miles of the city. The exact number of casualties will probably never be determined. Seventy to eighty thousand people were killed, or missing and presumed dead, and an equal number were injured. The casualties at Nagasaki were somewhat smaller—about 35,000 killed and a similar number injured.

Nagasaki was scarcely more prepared for an atomic bomb attack than Hiroshima, although three days had elapsed since the first drop. Once again the appearance of the small raiding group of only two planes caused little concern. The newspapers had made only vague references to the Hiroshima disaster. The devastation caused by the explosion was as horrible and complete as at Hiroshima. However, due to the uneven terrain and the absence of a "fire storm," less than two square miles of the city were destroyed.[1] Nevertheless the destruction far exceeded that which any conventional bomb would have achieved. What are the miraculous qualities of the atomic bomb to enable it to inflict such tremendous damage?

The bomb is nothing supernatural or incomprehensible. As do ordinary high explosives, atomic bombs release energy, though on an unprecedented scale. The energy takes three forms--heat, blast or pressure, and radiation. Heat and blast effects are evident in ordinary TNT explosions; the radiation effect is unique to the atomic bomb. The energy released in atomic explosion is of such magnitude and from such a concentrated source that its physical properties are of much greater intensity than in the case of an ordinary bomb. This is because the energy produced in an atomic explosion results from the splitting of an atom of uranium or plutonium into two major fragments, a process called "fission," whereas an ordinary explosion is accompanied only by the rearrangement of the atoms of the explosive material. An illustration of this rearrangement may be found in the simple chemical process of burning. For example, the carbon in coal is combined with the oxygen of the air to form carbon monoxide or carbon dioxide, liberating heat and light in the form of fire. The end products—carbon monoxide or carbon dioxide —still contain the original carbon and oxygen atoms. In an atomic explosion, however, there is a transmutation of the fissionable material. In the fission of uranium (U-235), typical end products are barium and krypton, two entirely different elements. These residual particles have masses whose sum is less than the mass of the original material. This reduction in mass results in an enormous release of energy. In theory, the matter is converted into energy at the rate of 11 billion kilowatt-hours per pound change of mass.

The magnitude of this potential energy supply can best be appreciated if we consider that the entire production of electrical power in the United States in 1946 amounted to 223 billion kilowatt-hours, the equivalent of the energy contained in about 20 pounds of matter. However, in practice there are severe limitations on the amount of energy which can be released in an atomic explosion. Actually only a very small percentage of the matter is capable of being converted into energy. The reduction in mass accompanying the fission of uranium or plutonium varies somewhat according to what are the final products, but has an average of about 1/10 of one per cent. This represents the optimum energy release. Apparently the energy of the bombs used against Japan was actually less than this because the reaction was not complete. Fission in the Japanese bombs was only a small percentage of the theoretical potential. In spite of its fractional efficiency in terms of the theoretical potential, the atomic bomb far overshadows all previous explosives, as demonstrated by the physical results.

As previously mentioned, energy release in an atomic explosion is manifested by heat, blast or pressure, and radiation. The heat energy alone was estimated by Japanese physicists at the astronomical figure of 10-to-the-thirteenth power calories. A fire ball several hundred feet in diameter is formed and the temperature at its core runs into millions of degrees Centigrade. At its edge the temperature has been estimated to be from 3,000 to 9,000 degrees Centigrade. The fire ball is in effect a small sun, and the heat and light which radiate from it can cause charring, start fires, and kill people. At Hiroshima and Nagasaki charred telephone poles were found as far as 13,000 feet from "ground zero," the point directly beneath the center of the explosion. Mica, with a melting point of 900 degrees, fused on gravestones a thousand feet from the center of the blast. Victims were charred beyond recognition in the immediate vicinity of ground zero. These effects are vastly more intense than any which could be experienced from an ordinary bomb.

[1]The Japanese city of Kokura was designated the target for the second atom bomb. However, the raiding force found the primary target weathered in, and thus Nagasaki, the alternate objective, became the hapless victim.

Pressure at the center rises to tens of millions of atmospheres. At ground zero its force was estimated by the Japanese at from 5.3 to 8 tons per square yard. The blast effects, with their resemblance to the aftermath of a hurricane, were most striking at Nagasaki. Concrete buildings had their sides facing the blast stove in like boxes. Long lines of steel-framed factory sheds, over a mile from ground zero, leaned their skeletons away from the explosion. That the blast effect is tremendous can be readily comprehended from the many pictures of the devastated cities that have been published, and from the damaged wrecks of the Bikini tests. It is much more destructive than the blast from an ordinary bomb. In regard to the third form of energy release, radiation, the atomic bomb is vastly more effective than the usual explosive.

In addition to the emission of heat and light radiation which is common to the ordinary bomb, the atomic explosion also produces dangerous radiations in the form of high-speed neutrons and gamma rays. Gamma rays, like x-rays, can be deadly. Neutrons also have a degenerative effect on the body cells that can be lethal. The high concentration of radioactive emissions at both Hiroshima and Nagasaki caused heavy personnel casualties, even though their duration was very short. The rays proved deadly for an average radius of 3,000 feet from ground zero, and mild effects were observed on people who had been almost two miles away from the blast. An odd characteristic of radiation disease is its delayed effect. People who had survived the explosion itself succumbed to the effect of the radiation overdose several days after the attack, in some cases two or three weeks later. Japanese casualties from the air bursts were limited to those who had been exposed to the direct radiation from the bomb. People in the underground shelters were largely protected, but the thin walls of buildings proved no barrier to the invisible rays. At Hiroshima and Nagasaki the radioactive by-products of the explosion and the induced radioactivity in other substances (water, earth, machinery, building debris, etc.) were of little consequence. This was not true in the second Bikini test, however. The explosion of the atomic bomb under the surface of the lagoon produced intense radioactivity in the water. It is estimated to have been the equivalent of many hundreds of tons of radium. A column of this radioactive water a mile high and nearly a half mile in diameter rose into the air and then engulfed about half of the target array. These contaminated ships became radioactive stoves, and would have burned all living things aboard them with an invisible and painless but deadly radiation. The implications of possible wartime applications of such methods of radioactive contamination are awe-inspiring.

Effect On Us

A tremendous economic and industrial effort is involved in the development and manufacture of atomic bombs and related atomic weapons. Great quantities of raw materials in the form of pitchblende and carnotite ores are required from which the fissionable U-235 or plutonium may be derived. Huge industrial plants containing hundreds of thousands of delicate and precision-made instruments and other equipment are necessary. Great numbers of men, from laborers to highly skilled and trained scientists and top-flight engineers and technicians must be available. In certain of the processes huge amounts of power are required, and in others an abundant supply of cooling water is a necessity. All of these factors have potential limitations, especially when they may conflict with other possible wartime demands.

The quantity of fissionable material which can be made available is subject to limitation. So far, only U-235 and plutonium have been used in the manufacture of atomic bombs. Both of them are derived from uranium present in raw uranium ores. Uranium is a fairly plentiful material —about four parts in a million in the earth's crust, more plentiful than gold, for example. But only two ores, pitchblende and carnotite, are of value as a source of the uranium metal with the present method of extraction. Usable deposits of these ores are rather limited. Uranium metal, a combination of U-235 and U-238, represents only a small fraction of the ore. U-235, the part of the uranium metal which can be used as the fissionable material in the manufacture of atomic explosive, is in turn present in very minute proportion. Seven-tenths of one per cent of the uranium metal is U-235. The remaining U-238 can be processed in an atomic pile to form plutonium, another source of fissionable material.

The separation of U-235 from the uranium metal extracted from pitchblende or carnotite could not be accomplished by chemical methods. Instead, other processes had to be developed to capitalize on the infinitesimal weight difference between the lighter U-235 and the heavier U-238. Four methods were finally devised—gaseous diffusion, thermal diffusion, centrifugal, and electromagnetic. All of these methods called for the mass production of precision instruments and equipment, some more delicate than any that had ever been manufactured for laboratory work. In the gaseous diffusion process, for example, thousands of containers about the size of a depth charge case were needed. Yet the gas, uranium hexafluoride, was so fiercely corrosive that ordinary metals were unsatisfactory. Only nickel was found to be acceptable, but the first increment of these tanks would have required all of the nickel mined in America for two years! The problem was finally solved by electroplating nickel on steel to standards of perfection that were undreamed of in the commercial world. New techniques in cutting and welding glass piping were developed; huge numbers of high speed pumps of new design were made. Unbelievable standards of operation were achieved. For example, although a vacuum of one inch is very good in power plant practice, the gaseous diffusion plant maintained a vacuum *twenty-five million times greater!*

Tremendous amounts of power are required to operate the plants at Oak Ridge, Tennessee. Though they were located in the Clinch River Valley in order to top the TVA supply, one of the world's largest steam power plants was also erected there. In the manufacture of plutonium a plentiful supply of cooling water was necessary. For this reason, the Hanford Engineer Works was built near the Columbia River in the State of Washington. With three atomic piles in operation in 1945, the liberated atomic heat had raised the temperature of the river fractionally, even though the water underwent a long decontamination period before flowing back into the river.

As can be readily seen, the development and manufacture

of atomic weapons imposes a huge burden on our economy. The capital outlay for the construction of the plants alone is staggering. The original cost of the Hanford Works was $350,000,000. The gas diffusion plant at Oak Ridge, only a part of the establishment at that location, consisted of 63 buildings costing half a billion dollars. It was the world's greatest continuous chemico-physical process factory. The principal building was a windowless U-shaped structure, 4 stories high, 2,500 feet long, and 400 feet wide.

Military Considerations

The adoption of a policy which places sole reliance upon the atom bomb would have severe effects on the pace of military progress, in that it would bring about a stagnation in the development of other weapons and techniques. Having committed ourselves to the use of one weapon and one method of delivery, we would find no incentive to invent new and different means of employing military force. In a world in which scientific achievement can tip the balance in time of war, we would be channelling all of our effort toward one limited objective—progress in atomic explosives to be used solely with long-range bombers.

Our own history provides an example of the damaging effect of sole reliance on an imperfect weapons system. After the Barbary Wars, Congress adopted a "gunboat policy" which called for the construction of large numbers of small non-seagoing coastal gunboats, to the exclusion of seagoing vessels. It was reasoned that such a force would deter an attack from overseas and yet would not permit our involvement in conflicts in foreign waters. In the later War of 1812, however, larger enemy frigates and sloops had no difficulty in deeply penetrating our territorial waters. Washington itself was burned by the British. Our internal commerce, dependent upon coastwise seaborne trade, was paralyzed; foreign trade virtually ceased to exist. The resultant depression was one of the worst in our history. Our fleet of 176 gunboats was useless. Our few naval victories were the result of individual frigate and sloop actions in distant waters. A few American ships-of-the-line, in place of the numerous small gunboats, and at no greater cost, could have stopped much of this, besides affording a reasonable measure of protection to our ocean-going coastwise commerce, and even some support to our foreign trade. The gunboat policy was a blunder both from the naval viewpoint and that of national economics. From a purely military point of view, the stagnation brought about by exclusive reliance in a faulty weapons system can lead to fatal weaknesses in other lines which would cause our downfall. This is particularly true when we consider that the effectiveness of an atomic assault is dependent upon our means of delivery.

We face the danger of complete impotency if an enemy is able to develop countermeasures against our delivery agent. In other words, if we confirm as our policy the sole reliance upon one weapon—the atom bomb delivered by aircraft—an aggressor must merely devise a way to counteract either the bomb or the plane in order to render us powerless. At present, the development of a counteragent to the bomb itself seems unlikely. Likewise, under present conditions, aircraft appear to have the upper hand over the means of defense. Such superiority is not guaranteed.

There are also several other military considerations which limit the use of atom bombs. Undoubtedly it restricts the variety and flexibility of offense, both from a strategical and tactical viewpoint. Strategically, sole reliance on an air-atomic policy would not only eliminate the possibility of employing the many other forms of military power but also would exclude the varied use of economic, psychological, intellectual, political, and moral forces. Tactically, it is the same as issuing an arbitrary ruling to field commanders that nothing but flame-throwers shall be used in any and all tactical situations and against any and all targets.

We must also note that the use of atomic bombs can, under some conditions of employment, so pollute and contaminate the objective area that the devastated region is denied to us as well as the enemy.

Finally, it should be remembered that the atom bomb is not economical for use against pinpoint targets. Would we employ the atom bomb, capable of demolishing an entire city, to destroy an isolated railroad bridge? Certainly not, when we recall that the bombs may be limited in number and that each one represents a large investment in dollars alone.

Thus, in deliberating whether to adopt an exclusive policy of absolute dependence on the atom bomb, we must realize that from a purely military standpoint such a course can lead to stagnation of progress in other weapons systems, will create the danger of impotency due to countermeasures against the delivery agent, will seriously limit the diversity of offensive means, can contaminate an objective to our disadvantage, and will demand uneconomical usage against certain targets. Employment of the atom bomb is also subject to political considerations.

Political Considerations

In discussing some of the political factors which influence the employment of atomic bombs, we must bear in mind that military policy is a means to an end. Military policy is an adjunct and corollary to national policy, and is governed directly by our broader national aims. Therefore a policy of sole dependence on atomic weapons must be compatible with the larger policy.

It is a matter of public record that the United States has encouraged and continues to support the world-wide adoption of measures which will bring about effective international control of atomic energy. An integral part of any system of international control would be an international authority to prevent the manufacture and use of atomic bombs for war purposes. A treaty covering this subject would guarantee the right of free and full international inspection and would provide for deterrents against offenses and punishment of offenders, without the privilege of a veto to protect willful violators or to hamper the operations of the international authority. Even though the first attempts to establish such an authority have met with failure, we have not officially abandoned or reversed our policy. If, in the face of this, we adopt a military policy of absolute reliance on the atom bomb, we are either incredibly stupid or blatantly hypocritical. Presuming that we are sincere in our desire to establish international control of atomic energy, a clever potential enemy could cause our complete disarmament by the simple expedient of agreeing to outlaw atomic weapons and institute a system of international inspection.

On the other hand, if we are not prepared to accept complete disarmament under these circumstances, we cannot honestly continue to support our previously announced national policy. The choice of a military policy of sole dependence on atomic bombs would be interpreted by most people as a *de facto* repudiation of our position on international control.

Politically speaking, it would not be necessary to outlaw the use of atomic bombs by treaty to reduce us to impotency. There are many instances in which the employment of atomic weapons would be entirely practicable from a military point of view but would be impossible from a political standpoint. For example, could we justify the use of atomic weapons in a "lukewarm" war?

If in the ideological struggle between communism and democracy, internal communistic elements should overthrow the established constitutional government of a friendly nation, could we use atomic bombs in support of the democratic forces? Could we drop a bomb in Italy, or France, or Latin America, if the local communists usurped control of the government? Obviously, no. Nor could we retaliate against the tide of communism by dropping an atom bomb on the original source of communistic strength.

Even if a "hot" war should break out, we would find occasions when we couldn't employ atomic bombs. It would not be politically or morally feasible to use the A-weapons in overrun countries. Could we have blasted Brest or Manila into atomic dust in the last war, merely because enemy forces were using those ports as bases for operations against us? Are we to murder hundreds of thousands of former allies or friends just because a few of the enemy are in their midst?

Aside from the moral implications of the adoption of a military strategy which places exclusive reliance on the atom bomb, there are several other practical considerations. Most observers agree that a psychological campaign to wean the enemy population from their leaders would be of marked consequence in a future conflict. Some go so far as to say that the split already exists, and that the exploitation of this fissure would play an important part in achieving victory. Yet, by relying solely on the atomic weapons, we sacrifice this psychological advantage. An announced policy of mass population extermination would insure the unity and last-ditch struggle of an aggressor nation, would weld together the people and their leaders under the barbaric threat of wholesale genocide.

From a purely material point of view, an exclusive air-atomic military policy would have severe repercussions. Atom bombs cannot be made in the small, handy pocket size. Due to the inherent characteristics of atomic fission, the bomb cannot be reduced below a certain critical magnitude. Hence there is also a definite irreducible minimum to its explosive power. It is quite probable that the bomb cannot be made much smaller or less powerful than the Hiroshima or Nagasaki type. Therefore each time an A-bomb is dropped, a large area will be laid waste, including without doubt a considerable number of nonmilitary targets. At Hiroshima, out of a total of 90,000 buildings in the urban area, 62,000 were totally destroyed and another 6,000 severely damaged. Most of these were residential structures, or other nonmilitary targets such as hospitals, schools, stores, etc. This poses the tremendous problem of postwar rehabilitation and reconstruction.

Thus, when considered in connection with our broad national aims, such a policy of absolute dependence is in marked dissonance. It would call for abandonment of our announced position on international control of atomic energy, would deprive us of the conventional instruments of military force for use in a lukewarm war, would leave us powerless to wage war against an aggressor in occupied areas or overrun countries, would make untenable our present strong moral position as the champion of freedom and democracy, would condemn to failure a psychological campaign to exploit a rift between an enemy population and their leaders, and would cancel out the anticipated fruits of victory through the overburdening weight of wide-scale postwar relief and reconstruction.

Conclusion

In this discussion we have reviewed briefly the broad capabilities and limitations of the atomic bomb. We have examined the effects of its employment, both on the recipient and on the deliverer, and have analyzed the major military and political considerations which govern its use. From this scrutiny we must conclude that the adoption of a military policy of exclusive reliance on the atom bomb would jeopardize the security of our nation. The strategy of victory through the sole agent of mass atomic destruction is not only morally untenable, but has dubious chances of success politically and militarily.

However, since the threat of atomic warfare still hangs over us, we cannot cease to maintain our atomic advantage, if only for insurance. Under these circumstances, a sound program for national security would include atomic weapons as well as the conventional forms of military strength. On the other hand, it must be remembered that military force is only a segment of our national power. Military policy must be the servant and not the master of national policy; military might must be used in harmony with the economic, intellectual, psychological, political, and moral factors which also form a part of our national strength. We must keep the atom bomb in our arsenal of weapons, but we must also be prepared to fight a war without it. We must realize fully what an atom bomb *cannot do* as well as what it *can do*.

National Guard Encampment at Camp Stewart, Georgia and Camp Pendleton, Virginia

Thousands of antiaircraft artillery veterans of World War II will vividly remember the grueling summer sun on the firing range at Camp Stewart, Georgia. On a recent visit to what had been one of the largest AAA wartime training centers, the editor called upon the AAA units of the South Carolina, Georgia, Florida, and Mississippi National Guard who were undergoing their annual two weeks of field training.

The first units visited were from South Carolina, commanded by Colonel David W. Bethea, Jr. These units were engaged in firing at towed sleeves, and so engrossed were all personnel that they continued their practice until 8:00 P.M. without a pause for supper. The instructors stated that the shooting compared favorably with the firings of experienced units during the war, a statement which can be appreciated when one realizes that a number of the officers commanded or served with similar units during the war and many of the enlisted men are old-timers.

Long Hours—High Morale

One difference between the personnel of these units and those who served at this camp during the war was that the personnel of these units volunteered to spend their annual vacation at intensive training from sunup to sundown for fourteen days in the sunny south in midsummer. Perhaps they considered their obligation to their State and their Country, but certainly they love to soldier.

It was late at night before the commanders completed their paper work and plans for the following day, which would begin at 4:00 A.M.

Despite the long hours, all members were in high spirits and enthusiastic about their assignments.

Accompanying the National Guard units were 11 Reserve officers who were attached for the training period. Regular Army instructors on duty with the guardsmen were assisted by instruction teams from Fort Bliss. All of these individuals were lavish in their praise of the manner in which instruction was absorbed and put into practice with a minimum of errors or confusion. One captain with an instruction team commented, "We told them all we knew—they listened to every word—and then they took over while we observed."

Many Units In Training

The officers in the Guard were high in their praise of Regular Army instructors, the instruction teams from Fort Bliss and the Reserve officers. They were particularly appreciative of the full-time assignment of administrative assistants in battalions and batteries.

Many enlisted men were consulted as to their reaction to the fourteen-day program. All indicated that they were exceedingly well pleased with their officers, their food and their equipment. Every man expressed a desire to return.

After visiting the units from South Carolina, the editor visited the units from Georgia, Florida, Mississippi, and the District of Columbia where he found the same high state of efficiency and morale as was evidenced previously. The units from Georgia were under the command of Brig. Gen. Joseph B. Fraser. Those from Florida were under the command of Colonel Percy L. Wall. Colonel LeRoy Mann commanded the units from the District of Columbia and Lt. Col. Benjamin T. Ferguson commanded the Mississippi units.

The following brigade, groups and battalions were present at the two camps:

108th AAA Brigade, Georgia NG
(Brig. Gen. Joseph B. Fraser)
214th AAA Group, Georgia NG
(Colonel Jack C. Johnson)
227th AAA Group, Florida NG
(Colonel Percy L. Wall)
228th AAA Group, South Carolina NG
(Colonel David W. Bethea, Jr.)
260th AAA Group, District of Columbia NG
(Colonel LeRoy Mann)
115th AAA Gun Battalion (M), Mississippi NG
(Lt. Col. Benjamin T. Ferguson)
101st AAA Gun Battalion, Georgia NG
(Lt. Col. Henry J. Ellis)
250th AAA Gun Battalion, Georgia NG
(Major Albert J. Twiggs)
950th AAA AW Battalion (Mbl), Georgia NG
(Lt. Col. John P. Wallis)
178th AAA Operations Detachment, Georgia NG
(Major Harry L. Dickey)
107th AAA AW Battalion (SP), South Carolina NG
(Lt. Col. Thomas H. Pope, Jr.)
678th AAA AW Battalion (Mbl), South Carolina NG
(Lt. Col. M. T. Sullivan)
713th AAA Gun Battalion, South Carolina NG
(Major W. B. Pollard)
148th AAA AW Battalion (SP), Florida NG
(Lt. Col. Edward F. Henry, Jr.)
712th AAA Gun Battalion, Florida NG
(Lt. Col. Henry H. Taylor, Jr.)
265th C.A. Battalion (AMTB), Florida NG
(Captain Henry Botts)
260th AAA Gun Bn, District of Columbia NG
(Lt. Col. Given W. Cleek)
340th AAA AW Bn (Mbl), District of Columbia NG
(Lt. Col. George Y. Selwin)
380th AAA AW Bn (Mbl), District of Columbia NG

Among these units are men who, prior to or at the outbreak of the war, as members of National Guard antiaircraft regiments, established or strengthened our defenses on the West Coast, Hawaii, Australia and Corregidor; and who were among the first units to move into Africa. They realize that the same lot probably will befall them at the beginning of any future war and they assume their obligation with an enthusiasm which should be an inspiration to all of us.

OPERATION COMET

Over the week end of June 4th and 5th the Organzed Reserve Corps of Western Pennsylvania undertook a vast defensive operation involving an atomic attack, parachutists and saboteurs.

Although lamentably lacking in AAA protection, the many-sided problem managed to utilize a score or more of military and civilian agencies in what is believed to be the first such training exercise of its kind. ED.

Two thousand Army Reservists, backed up by civil defense forces, turned Western Pennsylvania into a battlefield for a deadly serious war game early in June.

They were welding a coordinated defense system for the district.

Whether war is inevitable or merely a remote possibility, they know they must be prepared for the worst. For it COULD happen here. An enemy could strike suddenly and without warning.

The Pittsburgh industrial district is the "Workshop of the World." It would be singled out for lightning attack in an atomic war.

During the last war Pittsburgh alone produced a third of the vast mountain of steel used by the American forces.

How would an enemy strike to cripple this arsenal?

Suddenly, from the air, and with all the one-punch might he could muster. There would be sneaking stabs in the back by fifth columnists.

All of us would be in the thick of it. There would be no noncombatants.

General Situation

These are the considered assumptions, based on the latest "refinements" in modern warfare, that the Reservists worked on in OPERATION COMET. For realism they chose a situation which they think is as plausible as it is terrifying.

Enemy submarines surfaced along the northeast coast and they have begun a rocket bombardment of the Eastern Seaboard. Simultaneously aggressor forces launched a devastating air attack from island bases.

Jet bombers, cruising at 600 miles an hour and each carrying two Hiroshima-type atomic bombs, have struck 28 key cities.

Two bombers appear over the Pittsburgh District. It is eight o'clock in the morning and just another day to workers in hundreds of humming industries.

One bomber wheeled over Aliquippa. There was a blinding flash, accompanied by a deafening concussion. Another bomb was dropped over the Westinghouse Electric Corp. plant in East Pittsburgh.

Only radioactive dust remains where Aliquippa and East Pittsburgh once stood.

Also in ruins are the Carnegie-Illinois Edgar Thomson Works, Westinghouse Bridge, Route 30 through East Pittsburgh, Westinghouse Air Brake and the Westinghouse Research Laboratory.

The second bomber dropped its load, intended for the aluminum center of New Kensington, over Ford City. The town was wiped out, along with a Pittsburgh Plate Glass plant, the Elgin Pottery Works and an auto bridge over the Allegheny River.

Well briefed fifth columnists struck.

They commandeered radio stations in Pittsburgh, Uniontown, Johnstown, Altoona, Greensburg, Butler, New Castle, Sharon and Erie.

Propaganda broadcasts began, adding to the panic and confusion which gripped the living among the countless thousands of dead and dying.

Saboteurs contaminated the water supplies of Pittsburgh, Erie, Altoona, Johnstown, Washington, Beaver Falls, New Castle, Sharon, Butler, and DuBois. Others blew up telephone exchanges, power stations and bridges.

Mysterious trucks appeared at both ends of the Liberty Tubes and the Allegheny Mountain Tunnel on the Turnpike. Delayed action charges went off, sealing the tunnels.

Two hours later "enemy" jet troop transports drop two parachute infantry divisions near Detroit. Another eight parachute battalions land near Washington, D. C.

Many-Sided Problem

All this has happened within a few hours. First attack was launched on M-Day. The Reserves already had sprung into action.

They assembled for a briefing by military and civil defense experts in Soldiers and Sailors Memorial Hall, Oakland.

The military situation of OPERATION COMET was explained by its director, Colonel F. J. Gillespie, and his

Deputy Chief Herbert Polhmeyer, Auxiliary Police, Pittsburgh, Colonel Sacks, G-5, 2003 Logistical Division, A. W. Rainey of Fire Coordination Department Allegheny County, and Chief Kaiser, Auxiliary Police, Pittsburgh, discussing the role Civilian Agencies played in "Operation Comet."

assistants, Colonel Malcolm Hay, Colonel William L. Montgomery, Lt. Colonel William J. Ruano and Lt. Colonel Daniel J. Horney.

Others who spoke included County Commissioner John J. Kane, Works Director James S. Devlin, Police Superintendent Harvery J. Scott, University of Pittsburgh Physics Instructor John H. Neiler and Captain Joseph P. Fay, training instructor of the Pittsburgh Bureau of Fire.

Later the Reservists mobilized as units.

Lt. General Leonard T. Gerow, Second Army Commander at Fort George G. Meade, Maryland, meanwhile declared martial law and Colonel Gillespie, Western Pennsylvania Military District Executive, assumed combat and military government command of the area.

Intelligence reports on the attacks streamed into the Army headquarters in the Old Post Office Building.

As if it were the real thing, Reserve units of civilian soldiers set up nerve centers throughout the 26-county Western Pennsylvania "battlefield."

The 2271st Infantry Training Division and the 2003rd Logistical Division set up task force headquarters in South Park, Altoona and Erie.

The Follow-up By the Enemy Began

Parachutists started landing in the Pittsburgh area. A brigade of airborne infantry and a parachute artillery battalion landed along Routes 19 and 422 and Pennsylvania Route 8 north of the City.

Another battalion dropped north of Johnstown. Still another, with heavy guns, dropped near Duncansville. More infantry and artillery landed near Edinboro, south of Erie, and in Wattsburg. The infantrymen carried automatic weapons, mortars, antitank rockets and flame throwers.

These enemy landings were simulated by 80 Civil Air Patrol pilots, who dropped 1000 tiny parachutes which carried leaflets.

Civilians who caught the 'chutes reported the leaflets, which represented paratroopers, saboteurs and unexploded bombs, to the nearest Army outfit.

Intelligence men plotted the information on "enemy" activity on their situation maps.

CAP planes also were busy during the maneuver transporting doctors to "bombed-out" areas, flying supplies, carrying messages, evacuating the "wounded," demolishing facilities which would have been helpful to the "enemy" and strafing and bombing ground forces of the "invader."

Among the installations "destroyed" to hamper the "aggressor" was the big Emsworth Lock on the Ohio River at Neville Island.

Communications

Squadrons of the CAP "mosquito air force" were based at the Greater Pittsburgh Airport and at airstrips in New Kensington, Coraopolis, Rochester, New Castle, Oil City and Mt. Union. All belong to the CAP's Second Tactical Command for Western Pennsylvania.

Reserve pilots also ran an air pickup and drop of messages at the South Park Oval.

Short-wave radio played a vital role in the field training exercises. Army, police and amateur "ham" operators aired messages which detailed "invader" activity and directed moves of the troops and supplies to repel the attack.

Because many of the sending stations were powerful enough to reach around the world, precautions were taken to prevent a scare. At the beginning and end of each message was an explanation that it was being sent only for a war game to perfect Western Pennsylvania military and civil defenses.

Powerful mobile Army-type radio stations, some of them borrowed from the National Guard, supported this network.

Walkie-talkie sets provided communications among units of the ground forces and helped connect them with observation planes.

The Reservists also drafted about 1000 pigeons for "war" duty.

Pigeon lofts provided two-way messenger service connecting the three task force commands. Three loft owners in Pittsburgh, three in Erie and three in Altoona took part. Others in Greensburg, Washington and Beaver Falls also helped out.

Three pigeons were sent on each message flight to make certain at least one got through.

G-2 Problems

As tactical and supply troops concentrated on enveloping and destroying "enemy" forces, U.S. Counter-Intelligence agents also had a busy time of it capturing saboteurs.

The targets of small groups of highly trained fifth columnists, directed locally by enemy undercover chief "Adolp Mussolini," were communications, water supplies, power stations, bridges, tunnels and key industrial plants.

The Counter-Intelligence men first captured two professional spies, "Gunther von Mueller" and "Steve Lolich," whose primary targets were the Liberty Tubes, Armstrong Tunnels and the central signal system at Pennsylvania Station.

They also captured but weren't immediately able to identify a saboteur who was caught in the act of "dynamiting" the Pittsburgh & West Virginia high-level bridge at Banksville Rd. and Saw Mill Run Extension, West End.

Applied Unity

Marine Corps officers and enlisted men also took part in the maneuver.

About 15 officers of the volunteer training unit of the Marine Corps Reserve Officers Association of Pittsburgh were attached to the staff of the 314th Infantry Regiment for the problem. Men of the Signal Platoon, 21st Marine Infantry Battalion also helped with communications.

Tactical maneuvers in connection with the exercise were run by Co. D, 21st Marine Infantry Battalion in connection with preparations for summer training at Camp LeJeune, North Carolina.

Personnel from the Army Reserve, Coast Guard and the Army District Engineer's office patrolled the rivers in six privately owned launches to protect locks and river-front installations from "enemy action."

Notify the Journal your change of address.

INFORMATION, PLEASE*

By Lieutenant Colonel Alvin B. Auerbach, Engr.

With the most perfect and complex of the newest sound recorders we cannot produce a single sound unless a stimulus from some external source has placed magnetic impulses upon the tape. Until recently few have realized that the most sincere and interested Army officer, to speak intelligently and soundly, likewise needs external stimulation in the form of facts.

The policy of directing that the American people be kept informed of their Army to the maximum possible extent under security restrictions is a wise one. Equally sound is the idea of effective, widespread dissemination of information through the corps of officers. The complexity of the last war and the feverish international situation of today have made the public more demanding of military news. A constant flow of questions is directed at both the public information officer and the individual officer of any branch who is identified by civilian associates as a professional military man.

Both groups, but particularly the officer who represents the Army to his civilian community, are severely handicapped by lack of information. To try to answer without facts at hand is simply bluffing. To fail to answer either builds suspicion or intensifies belief in the stupidity of the military mind. Yet today the average officer still lacks a ready means of getting the information he wants, despite the progressive steps of past months in which the Department of the Army has begun the official publication of *Officer's Call* and *Report to the Army*.

The limited flow of information from top to bottom is not a new problem. That it still is a problem is indicated by a quotation from the first issue of *Officer's Call:* "But it is true of all headquarters and all individuals in the Army that they function best when best informed of the objectives and plans of 'higher headquarters.'"

In 1939, when the triangular division was being readied to replace the square division, the students at one service school were given instruction from slides made out of an issue of *Life* magazine. The presentation was excellent, for the magazine had combined charts with pictures. But this was the sole source of data for the students.

In the fall of 1948, the student body of the Command and General Staff College heard a secret lecture on new developments in ordnance. Part of that lecture covered the new ordnance engine. Just two weeks later the same engine was presented in *Time* magazine—with a picture, and with more details than the students had been given. Realizing that a magazine requires some time to prepare a technical article, it was apparent that this material had been declassified well before the lecture.

These two incidents are cited only to develop my first constructive principle: *The dissemination of information to a public medium should be preceded by dissemination to the corps of officers.*

Morale is intangible but sensitive to almost trivial impact. An officer likes to feel that he belongs to the family of professional soldiers. It is a slap at his pride to find that his family news is coming to him through the public press and not through family media. He wants to feel that he knows a little more about new military matters than his civilian friend—and that he knows it first.

The urge to know, and the desire to be a source of information to others is a powerful, vital force common to most men, which was indicated by the bumper crop of rumors during the war. We can and we should exploit this normal, healthy urge. The press may feel that it has privileges. But so have the officers, along with a far more vital stake. Moreover, the preparation of information for release to the corps of officers would be somewhat more complete and thoroughly prepared, and this would insure that any digest of these facts given out as a press release would be fully accurate.

The principle of supplying facts to officers first should not be carried to absurdity. Time is the essence of many announcements made by the Services, and the public press must get them immediately, and perhaps exclusively in certain cases. But to delay for a week or two the release of information on formerly classified developments, both of equipment and organization, in order to permit officers to be told about it first, could hardly disturb the amiable relationships between the Services and the press.

If we accept this first principle, then the question of timing arises. Basically, when should information be released?

Students and faculties in higher Service schools than the branch schools are cognizant of the main new trends and developments. The major headquarters each contain officers with similar knowledge. But these two groups total not over three or four per cent of all officers. True, not every officer needs to know every planned change. But to have 96 per cent generally ignorant of changes approved in principle is not sound.

In one sense, the readers of the ANTIAIRCRAFT JOURNAL are a selected group. For the Coast Artillery Association is a voluntary group of readers who profess an interest in the military field. It is doubtful whether ten per cent of the readers can now state with any degree of confidence the general mission and organizational plan of a Logistical Division. Yet this division is one of the soundest postwar developments in the support of large combat forces. It has been approved in principle officially, and firmly enough conceived

*Reprinted with permission from July issue of the *Infantry Journal.*

to have been discussed for over a year. It is likely that in the event of another international conflict, a large number of officers now on duty will serve in such a division or have close contact with one. Yet almost no information is available to the average officer, largely because the final form of the division is not yet approved.

This brings us to a second point: *General information about major changes in the Army should be disseminated without waiting for approved TO&Es or approved Field Manuals.*

To pour out through information channels all ideas that have merit but are untried and untested would be just as unsound as to withhold news of probable changes. More and earlier information is needed chiefly on *approved* ideas and changes.

The information can be general without being vague. It can, for example, give an organizational scheme without exact details of strengths. To use the Logistical Division as an example, a terse presentation much as follows would give an understandable meaningful picture of the divisional mission:

"A logistical division is a basic unit of the combined Army services. It will contain a balanced nucleus of some 17,000 men around which a larger balanced service force can be quickly built by expansion. The division can, by proper choice of units, act as the service element of an independent corps or field army; or as an advance, intermediate, or base section of a communications zone; or as a very small communications zone in itself."

This is not meant to show the scope of an ideal presentation, but simply as a fragment to show that a sound statement can be made without the detail that will be available when final approval is given.

Such advance information on *approved* ideas would be of inestimable value to the many hundreds of officers on duty with the civilian components. Not only would it make them feel that they were not divorced from their professional brothers by their somewhat isolated assignments, but their instruction would be enhanced by the definite knowledge that they were always teaching current trends and thoughts. And those they instruct would feel that the scope of their instruction was not merely that of the last-fought war. Civilian component instruction is, by the limited hours available, ideally suited to general rather than detailed presentations.

Perhaps the biggest problem is how best to disseminate the information. *Officer's Call* is almost too new to discuss in detail, but the first issues have clearly showed its concern with national and international affairs and personal problems of conduct and leadership. It has a very real mission here in reaching all officers with these broad Army problems. And through discussion groups it will further promote closer understanding and relationships.

Report to the Army, to judge from the trial issues, will fill a long-felt need as a source of information for those officers who do not have ready access to the multitudinous flow of circulars and letters that give the official changes in policy and regulation. *Report to the Army* should be the source of all information Army-wide in nature, that officially published in detail elsewhere, but also the *approved* but not yet officially adopted plans and policies.

But modern war has made the need for fresh technical knowledge equally mandatory. The officer in a technical service is faced with a big problem in keeping abreast of his branch, but he is not alone in that need. The modern infantryman wants to know about a new ordnance weapon he is to shoot, a new ordnance vehicle that he will drive or ride in, a new engineer map technique that he will use, a new quartermaster ration he will eat in combat. All officers of all arms and services of the Army have technical interests that range through the entire Military Establishment. They will ride in airplanes and be supplied partly or wholly by airplanes in many operations. In others the Navy will provide the means of transportation. Both Air Force and Navy may furnish powerful support.

In the past there have been technical branch publications. From before World War II, there have been informal monthly newsletters of several kinds. When issued by a branch, such newsletters keep its officers alert, and give them a strong feeling of a tie between themselves and their chief.

But the whole question of how to spread the needed information demands thorough study, keeping fully in mind the *esprit* of all officers on detached duty.

Thus we may take as our third important principle the following: *The technology of modern warfare requires the continual dissemination of technical information.*

If every branch of the Army were headed by a chief, it might at first seem appropriate to delegate to him the flow of all technical information to his branch. But the last war too clearly showed the interdependence and the interrelationship of the branches to make such a plan feasible. Equally, any solution using the Army Field Forces as the parent organization for the combat arms would appear to be unsound.

But the officers of the technical services do need a detailed source of information. They do not need an engineering specification but a military analysis that evaluates capabilities and limitations, advantages and disadvantages.

It would meet the needs of all arms and services if each technical service published for its own officers a monthly digest of technical notes. All notes of wide interest and similar data from Air Force and Navy should be distributed quarterly or semiannually by some central agency, with the information stripped of technical verbiage and complex detail, presenting only the clearest possible picture of the proposed use, limitations, and capabilities of the item as it affects all services.

Whether this central agency should be a part of the newly created office of the Director of Public Information under the National Military Establishment or whether it should be the Army Field Forces would not affect the soundness of the plan, although the first seems likely to be more concerned with policy matters, and not with operations. What is important is that the editing be skilled, the presentation attractive to ensure attention, and the format conducive to filing. A standard 6- by 9-inch sheet, punched for standard 2¾-inch, three-ring notebooks, could be adopted for as many publications as possible, rather than the different sizes we now have.

Recently a radio newscaster described an explosion in an Ordnance plant in Iowa. After describing the blast with superlatives, he quoted the officer in charge of the plant as

having said that this was some new, super-secret explosive, many times more powerful than any used in the recent war. The subject has never been mentioned again, and no one who heard that newcast has the least idea whether the Army has such an explosive. Officers who heard the broadcast must certainly wonder why, if it was so secret it was mentioned at all, or if it wasn't secret, why they have not heard more details about it. This is but one of countless minor instances in which an officer wonders just what is happening in military technology, and wonders even more just how such information may reach him officially.

If the program for disseminating information outlined here were made effective, the impact on the various service magazines should be most beneficial. The chief value of these magazines lies in their ability to present new ideas. The fact that at present they do carry some "bulletin-board" information is but proof of the need of officers for such information. Given an increased stimulus of ideas by provocative articles in service magazines, and adequate factual data by a complete Army information program, the modern officer could then have the raw materials with which to do his own creative, constructive thinking.

Existing conditions which reflect the present attitudes of aggressor nations would convince any but the apathetic that we must maintain a military stature—not only as reassurance to ourselves, but as a protection to the economic, political and psychological position we are taking in the heart of Europe.

We Americans must resolve the conflict between our actions and our attitudes. For we send our resources and our ideas to influence people, while we hesitate to acknowledge the need for a working combination of military power and peaceful intention. We must not send our representatives to world council tables with diminished authority—encouraging to the enemy, and disheartening to our friends. We must not enter the arena of discussion with one hand tied behind our backs.

If we Americans intend the direction we are taking today, then we must assimilate, as part of our leadership, a working union of continuing military readiness and our peaceful intention. With it, we must have the vision, and the courage, and the constancy, that inspires reliance on American ideas, as well as material production.—GENERAL OMAR N. BRADLEY, CHIEF OF STAFF.

Excerpts from A STUDY OF AMERICAN ANTIAIRCRAFT EQUIPMENT dated 29 May 1945

By 71st Antiaircraft Artillery Group, Colonel P. W. Lewis, Commanding

Foreword

The greatest concentration of American antiaircraft material was assembled under the command of Brigadier General Clare H. Armstrong for the protection of Antwerp, Belgium, against the attack by German V-1 flying bombs. The ultimate success of the antiaircraft defense was attested by the fact that this most important port remained open and in constant operation, providing the vital supplies for our Armies. Field Marshal Montgomery has expressed it in these words: "But this success which has kept in full operation the main supply base of both the 12th and 21st Army groups, has profoundly influenced the present battle (the march through Germany) and made the success of present operations administratively possible." This success was maintained, in spite of the determined effort of the Nazi regime to annihilate Antwerp as a functioning port. The success was due to the effectiveness of the combination of all matériel employed: the 90mm gun; the M-9 Director; the SCR-584; the elaborate Early Warning system, including radars, visual observers, and the efficient communications; the Pozit fuze; and last but not least, the splendid morale and esprit of the personnel.

This concentration of antiaircraft matériel from October 1944 to April 1945 afforded a splendid opportunity to study the effectiveness and stamina of American matériel. These defenses were under the British High Command and included British matériel, but for the purpose of this study only American matériel will be discussed except in specific instances where British items were used to substitute for American equipment.

Due to the consistency of round-the-clock attacks over a period of over five months, the stamina of both matériel and personnel was sorely tried. This constant operation naturally demanded periods of recuperation, but the recuperative powers and stamina exhibited by both personnel and matériel is beyond the imagination.

This study is an evaluated composite picture of the experiences of all grades of officers and noncommissioned officers of this command. This evaluation has attempted to eliminate individual and personal ideas unless those ideas had been proved or supported from other sources.

An expression of commendation and admiration is given to the many unnamed heroes responsible for conceiving this equipment—the scientists, the inventors, the laboratory technicians, the manufacturing and production men, and many others—without whom, this success would not have been possible.

Section A—General

On 4 September 1944 Field Marshal Montgomery's forces had captured the great Port of Antwerp practically intact. The capture of this port was a stroke of good fortune, as it was by far the nearest port to the Armies opposite the industrial Ruhr. It was necessary for the vital flow of supplies. The Germans, naturally, realized this and determined to render it useless to the Allies.

This port comprised some thirty miles of docks capable of handling ocean-going vessels, 632 sets of hoisting apparatus capable of loads up to 150 tons, 186 acres of covered shed space, 12 dry docks, 500 miles of double track railway, and oil storage facilities capable of holding over 100 million gallons. The port was capable of handling 90,000 tons of supplies each day.

The German V-bomb attack started 27 October 1944 and continued for 24 hours each day until 30 March 1945. During this time, 4883 flying bombs were sent over the Antwerp defenses. Also during this time, the Antwerp defenses expended 531,968 rounds of heavy antiaircraft gun ammunition, of which 463,130 rounds were American 90mm and 68,838 British 3.7 inches. This figure of ammunition expenditure covering 154 days may be compared to the figure of 67,951 which was the amount of heavy gun ammunition expended during the first 148 days after D-day by our heavy antiaircraft units with the 1st, 3rd and 9th U.S. Armies.

The defenses, "Antwerp X," were under the superior command of Major General W. R. Revell-Smith, commander of the CHQ AA Troops of Field Marshal Montgomery's 21st Army Group. The approximate 22,000 men of "Antwerp X" were under the immediate command of Brigadier General Clare H. Armstrong, U. S. Army. The IX Air Defense Command of Brigadier General William L. Richardson, U. S. Army, furnished two AAA Brigades, five AAA Groups and sixteen AAA Battalions as well as many smaller service units; the British furnished one Brigade and twelve Regiments (or small portions of them at various times); the Poles furnished one Regiment.

Section B—Characteristics of V-1 Flying Bomb

Vulnerability to Antiaircraft Artillery Fire.

a. The V-1 flying bomb was definitely a hard target to kill. With limited experience in the use of automatic weapons against this target it can be said that the M-51 machine gun was about 95% ineffective in that the rounds had no explosive power on impact with the target and had either

the tail of the Y pointed toward the direction

Pages 39-42 inclusive have been withdrawn because of security. This material was not cleared by the Review Branch of the Public Information Division but was printed through error.

check.
roducing an

se.
t the radar
d by setting
in azimuth
ings at the

computer.

(11) Moisture in the wiring of the slip rings.

b. It is believed that, with the present Fire Control equipment and conscientious attention to details of adjustment of this equipment, an extremely accurate orientation can be obtained and maintained and such accuracy will be directly reflected in the ability of the unit to deliver effective fire.

3. *Trial Fire.*

a. The conduct of trial fire was made the subject of study and instruction, especially by the Gunnery Instruction Teams assigned to the Command. Generally, trial fire was conducted:

(1) When a new major lot of ammunition (100 rounds or more) was used.
(2) When there was reason to believe that the met message was very much in error. (This seldom if ever occurred.)
(3) To determine developed muzzle velocity after approximately each 100 rounds was fired per gun.
(4) The above firings normally provided sufficient opportunity for firing trial shots, but if they did not, at least one problem per week was fired by each battery.

b. In order to determine developed muzzle velocity accurately by means of trial fire, every effort was made to eliminate errors from other sources. Accurate calculation of firing data by longhand methods served to eliminate range equipment errors. Selection of a trial shot point at a short range minimized the effects of exterior ballistics. All guns were carefully oriented in azimuth and fuzes were set exactly and checked to the proper value. Before and after each round was fired, the levels of the guns were checked and the guns laid in elevation with a gunner's quadrant. Where possible, a surveyed base line was established to provide a T angle of at least 1000 mils and range deviations were determined from both 0_2 and radar spotting. If radar spotting was the only means of determining range deviations, the 2000 yards scope was calibrated. A well trained spotter, it was found, could spot bursts within 20 yards of the correct range.

c. For utmost accuracy and simplicity, firing data calculations were standardized and the following longhand methods were adopted.

(1) Select convenient values of quadrant elevation and fuze from FT 90 AA-B-3 corresponding to even values of H and R. Select a firing azimuth in the field of fire. These values are firing data and are set on gun and fuze setter without change.
(2) List the ballistic effects on altitude, range and azi-

Gunnery

1. *General.*

Beginning early in the period, teams of offic
specialists worked with range sections through
mand to correct deficiencies and improve proc
detailed corrections and improvements were
served to increase technical knowledge of th
and the fire control problem generally throughout the units. Always, stress was placed upon accurate and precise orientation and synchronization of equipment. Trial fire was studied with the aim of insuring that personnel obtained its maximum benefits. A system of firing by salvos was instituted, which is generally believed to have increased all around effectiveness of the equipment against this small fast target.

2. *Orientation and Synchronization.*

a. Daily checking of the orientation and synchronization of the AA gun battery has long been recognized as vital in maintaining an accurately firing battery. Battery officers and range personnel were aware of this and strived for extreme accuracy in their daily checks. In many instances, batteries found it necessary to make 2 or 3 mil corrections in either orientation or synchronization or both almost daily, giving the personnel the impression that the data transmission system did not hold its adjustments. Actually, the selsyn data transmission system was very stable and once properly synchronized should not require special readjustment. Likewise, the potentiometer data system is very stable and will hold adjustment. When daily checks indicated that either type of data transmission was unstable, trouble in that system was indicated. Rather than continually making adjustments to eliminate the effect of this trouble, it was found wiser to analyze the error, locate the trouble and correct it. Daily check of orientation and synchronization became a daily check of the data transmission system. Care had to be exercised, that no change was made in orientation and synchronization without a careful check as to the reason for the error. It was found that a few possible sources of small errors are:

(1) Failure to check level before orienting.
(2) Personnel errors in reading the dials.
(3) Personnel errors in backsighting.
(4) Small inherent errors in either the azimuth or elevation potentiometer at the radar may cause slight variations in synchronization when checked at different points. These errors may be reduced to a minimum by synchronizing in the field of fire and at the approximate firing elevation.
(5) A good selsyn system has a 1 mil backlash error in the fine data. Excessive backlash must be eliminated.
(6) A low slant range on the radar potentiometer (less than 1000 yards) may throw azimuth and elevation potentiometer data, as read on the AZ and QE dials at the computer, off by several mil.
(7) A correction such as battery parallax, wind, or a spot left on the correction panel, when checking potentiometer synchronization with the computer in

muth of all *non-standard conditions and parallax based on altitude, range and azimuth selected in step (1).*

(3) *Determine the coordinates of the trial shot point by adding algebraically these ballistic effects to the altitude, range and azimuth selected in step (1).*

(4) *Using the altitude and horizontal range thus determined, solve for angular height and slant range to the TSP with the Slide Rule, M-1.*

(5) *Set the slant range to the TSP on the radar and lay the radar on the azimuth and elevation to TSP as directed by selsyn indicator at the tracker. Check dial readings at computer in tracker test. The radar is now laid on the TSP and may be used to determine the lateral, vertical and slant range deviations of the burst.*

(6) *Set necessary corrections for non-standard conditions and parallax on the computer. If the problem has been properly computed, any difference between director output data and firing data originally set in the guns will be an indication of range system errors. If errors exist beyond the director tolerances, and the director is known to be in good operating condition as a result of check problems, then calculations should be rechecked.*

d. The above method was easier and quicker than the old method because there is no double interpolating for QE and fuze. The M-9 Director calculates firing data in this same manner by applying effects to the point of aim in order to arrive at the point of burst, and not by applying corrections to the point of burst in order to arrive at the point of aim.

c. This method of calculating firing data lends itself readily to spotting only from 0_1. If spotting is from 0_1 and 0_2, it is necessary to compute 0_1—0_2 data after firing data have been calculated and the coordinates of the TSP determined.

4. Salvo Fire.

a. As mentioned above, it was found that certain advantages could be gained by the conduct of controlled salvo fire against the robot bomb, instead of the normal "free fire." The plan adopted consisted of firing all four guns in the battery at the same instant, usually at intervals of four seconds between salvos. This increased the blast or concussion effect at the target and, more important, it fixed the dead time factor as a constant four seconds for all guns.

b. The dead time factor has always been an item worthy of considerable attention, but in the case of fire with mechanical fuzes, against the fast flying buzz bomb, it was readily realized that its effect on accurate fire had become even more important. It had always been the policy to determine the average dead time for the four guns in a battery and use that figure in the director or computer. That data, at best, was an average of all guns and not accurate necessarily, for any one gun crew, and since crews are not normally consistent throughout a course, it allowed many rounds to be fired with incorrect fuse settings.

c. It is believed that the use of salvo fire eliminated or greatly reduced this error. The mechanics of this type of fire employed are very simple. A time interval between rounds fired was fixed at four seconds, which established a rate of fire of 15 rounds per gun per minute and allowed sufficient time for each crew to complete the drill. The drill consisted of inserting a round into the fuze setter and cutting it immediately, but allowing it to remain in the setter until the signal for firing was given. By keeping the pointers matched, the fuze was correctly set and, when the signal to fire was received, a round already in the gun was fired and the one in the fuze setter was removed and loaded. Crews became immediately adept in this type of firing and realized that their actions must occur precisely on time or unnecessary errors were introduced.

d. The results of salvo fire against pilotless aircraft were noticeably more effective than ordinary random fire and further tests were conducted including the combining of two batteries into an eight-gun unit. Fire observed from this battery had an apparent increase blast effect on the target but tests did not prove that its effect was as great as that of two four-gun batteries. Sufficient evidence on its performance to draw definite conclusions is not available since the test period was interrupted by the cessation of attacks.

HONOR ROLL

****88th Antiaircraft Airborne Battalion**
16 April 1949—Lt. Col. Page E. Smith

****11th Antiaircraft AW Battalion (SP)**
12 May 1949—Lt. Col. Roy A. Tate

On July 8th four units of the South Carolina National Guard were entered on the JOURNAL Honor Roll:

***228th Antiaircraft Artillery Group**
Colonel David W. Berthea, Jr., Commanding

****107th Antiaircraft Artillery AW Battalion (M)**
Lieutenant Colonel Thomas H. Pope, Jr., Commanding

***678th Antiaircraft Artillery AW Battalion (M)**
Lieutenant Colonel M. T. Sullivan, Commanding

***713th Antiaircraft Artillery Gun Battalion (M)**
Major W. B. Pollard, Jr., Commanding

****260th AAA Gun Battalion (M)**
District of Columbia National Guard
28 July 1949—Lt. Col. Given W. Cleek

Still a long way to go!—

Have you helped place your unit in this space?

Read the criteria printed below and join the Honor Roll of Antiaircraft Journal supporters.

1. To qualify for a listing on the JOURNAL Honor Roll, units must submit the names of subscribers and total number of officers assigned to the unit on date of application.
2. Battalions with 80% or more subscribers among the officers assigned to the unit are eligible for listing, provided that the unit consists of not less than 20 officers.
3. Brigades and groups with 90% or more subscribers among the officers assigned to the unit are eligible for listing, provided that the unit consists of not less than seven officers.
4. Units will remain on the Honor Roll for one year even though they fall below the 80% requirement during the year.
5. Lists of subscribers and statement of number of assigned officers must be submitted annually by units in order to remain on the Honor Roll.
6. Battalions with 90% of officers subscribing will qualify for one star placed after the unit's designation on the Honor Roll. Battalions with 100% subscribers will qualify for two stars.
7. Groups and brigades cannot qualify for one star but may qualify for two stars by having 100% subscribers.

(Units of all components will be listed together in the order of their percentages, beginning with the unit with the highest percentage.)

(Each unit listed on the Honor Roll will be given a one-year complimentary subscription to the JOURNAL.)

(Name of unit commander and date unit initially qualified for the Honor Roll will be listed with the designation of the unit.)

THE BATTERY COMMANDER STILL SWEATS IT OUT!

By Captain Peter P. Genero, CAC

Any skeptic who doesn't hold with the title should be present during a joint property inventory, when the outgoing battery commander is turning over his property to the incoming battery commander. Let him notice the beads of sweat break out on the forehead of the responsible officer as the total cost of shortages is being tallied. Some battery commanders are fortunate in that their unit had been in the field during the preceding thirty days. Others have friends in neighboring units or in the local depots or salvage yards. If it weren't for these two loopholes, no one could afford to be a battery commander. The fault does not lie in the supply system. It has been developed over a long period of time by some of the nation's most experienced supply personnel. The blame does not always fall upon the officer personnel. They are no better or worse than their predecessors. However, paper work and additional duties have become more numerous for the line officer. In some instances it almost becomes ridiculous. For example, an acquaintance recently had fifteen additional duties, at a battalion level, plus the primary duty of being battery commander to a full T/O & E battery.

Most difficulties originate with enlisted personnel who operate the unit supply rooms. This lies in four directions. First the T/O & E's authorize only the third grade for the unit supply sergeant. His only chance for a promotion is to be transferred to a higher headquarters. It is odd that a man who is accountable for all the property of a unit valued at hundreds of thousands of dollars should have a rank subordinate to that of other NCO's who are accountable for only a fraction of the property. Promotions to higher ranks are now permissible in most all battery sections with the exception of supply. This leaves little incentive for both present and future supply sergeants. Second the T/O & E provides no responsible NCO to assist the supply sergeant. This is an extremely important deficiency since no man can be in two places at the same time. This is necessary in routine supply work as well as during moves. A basic or a filler is the only person who may now be spared to work in the supply room. This places the least responsible individual in the battery to work at a most responsible task. The third factor requires that a supply sergeant must be a clerk typist. This has prevented many an excellent NCO from becoming a supply sergeant. The last and most important deficiency is a culmination of the above three. At present there is no method by which an enlisted man may work his way up to the job of supply sergeant. He must first show promise in some other field before being transferred into the supply room as supply sergeant.

According to the present T/O & E, a supply sergeant would have to possess the following characteristics. He would have to be very industrious with great initiative and attention to detail, but not interested in advancing beyond the third grade. He would have to be a responsible NCO stymied at the third grade while NCO's with less responsibility were advanced to higher grades. He would have to be a hard worker while NCO's of lesser rank merely supervised work details. He would have to be an NCO who, after working his way up from the bottom in one section, must be capable of stepping into the supply room and running it correctly without previous extensive supply training. He would have blind loyalty to his unit, so that he would never transfer when the opportunity for promotion in a higher headquarters, presented itself. He would never utilize hi accrued leave or his reenlistment leave. There would be n one to take his place. He would have to be capable of keeping the supply room open while making turn-ins, drawing supplies, taking laundry to and from the post laundry and at the same time be constantly out begging, trading, and borrowing necessities which somehow were not issued correctly or on time. He would have to account for supplies which invariably are at two different places, particularly during moves when so much equipment is lost. In addition he must be a clerk typist and should possess a typewriter. He would never marry or raise a family for some posts require the supply sergeants to sleep in the supply room. This may sound absurd, but before passing judgment check your own T/O & E and post regulations.

The following recommendations would correct these conditions:

1. Raise the rank of a battery level supply sergeant to the 2nd grade.
2. Authorize an assistant to the supply sergeant in the 3rd grade.
3. Authorize a supply clerk in the 4th grade.

These are the minimum requirements, if supplies are to be accounted for and maintain in the manner intended by the Department of the Army.

The acceptance of these recommendations would also go far, towards eliminating that distastefulness which many company grade officers attach to line duty.

FORT BLISS PHOTOS

A Page of Spring and Summer Training Activities

An Air Force B-26 lets out a tow target for Automatic Weapons Antiaircraft training. This photo shows the conventional type sleeve, and contains the new Firing Error Indicator.

AAA O.P. hidden on desert during training activities. Men are from 34th AAA Brigade.

U.S. Army Photograph

Corporal Richard Cheney, gun commander on a 90-millimeter gun, explains the working of the fuze to General Jacob L. Devers, Chief of the Army Field Forces, during the General's visit to Fort Bliss in mid-April. Watching the demonstration, at left, is Major General J. L. Homer, Commanding General of Fort Bliss.

M-19 inspected by General G. M. J. Revers, French Army Chief of Staff, on recent visit to Fort Bliss.

Salute to the reviewing party as antiaircraft units at Fort Bliss pass in review before General Thomas H. Handy.

Operations tent of 22d AAA Group in field, plotting course of target plane.

WHAT IS CHARACTER GUIDANCE?

By Major General John M. Devine

Department of the Army Memo 600-900-1 defines character guidance as follows: "Character guidance is a term developed to define all actions which tend to encourage the growth of moral responsibility, spiritual values, and strong self-discipline in the individual. It is founded upon the assumption that the Army has an obligation to the parent of the youthful soldier to duplicate the wholesome influences of the home and the community, so far as practicable under condition of military service."

This definition is a perfectly good one. It is apparent, however, that its implications have been appreciated by very few people. In the minds of too many of us, a character guidance council is simply another term for a VD control council. Such a limitation in meaning has no justification, and was never, I am sure, contemplated by the author of that circular.

Character guidance is an essential part of military training and must be so considered. We are dealing with men, and in training men we must not only build them physically, we must stimulate them mentally, teach them the fundamental human values, and impress upon them the basic Christian virtues. This is character guidance—a positive and aggressive effort to teach moral responsibility and to encourage the development of the whole personality of the soldier.

The chaplain's weekly hour is the heart of the character guidance program. Here is his opportunity to raise the social, moral and spiritual tone of the organization; to teach the really important things in life.

But the chaplain alone cannot accomplish very much. All leaders are also instructors in character guidance. By their words and by their example, they must never cease to teach high standards to men who never had them, and to help those who do have them to maintain them. The Troop Information Program (TIP) Hour is an important part of character guidance. Here the company commander has his opportunity to impress upon his men his own personality, to make personal contacts with all of them, to listen to their complaints, and to answer their questions, and to acquaint them with things of military significance in the world immediately around them.

The chief objective of TIP, of course, is to stimulate the soldier mentally, to arouse his interest in topics which concern him, and to stimulate discussion of problems of national interest. The accomplishment of this purpose does not conflict with the more fundamental one of raising the general moral tone of the unit.

The Information and Education program is intimately wrapped up with character guidance. It is a real test of character to complete a correspondence course. Any man who participates voluntarily in an educational program, after a hard day's work, is building character.

A major part of the Special Services program is likewise character guidance. It is building character to encourage a taste for good music, which all service clubs do, or should do. It is building character to stimulate interest in hobbies of any kind, to give our soldiers some resources within themselves for their own entertainment. Whenever we can substitute active recreation for the purely passive, we are building character. Historical tours, trips to places of interest, anything of that sort which teaches our own or foreign history is likewise stimulating to the individual, and helps to make him a better and more alert citizen.

If in conjunction with our sports program we also teach sportsmanship, fair play, we are building character. If at the pay table we can convince the average soldier that it is to his benefit to save a considerable portion of his pay, we are likewise building character. If we can raise the standards in our barracks to the point where obscenities cease, and a man can leave his wallet on his bunk when he goes to the showers, then we are building character indeed.

The essential thing is for us to visualize military training as a unit. Such training must take cognizance of the fact that to develop the well-rounded man, we must develop all sides of his nature. The training must be not only military, but physical, mental and spiritual. We have the agencies to accomplish these things, but the tendency to look upon I&E, Special Services, TIP, and the chaplain's program as mere appendages, superfluous excrescences, which contribute nothing to the development of a soldier—this attitude is a serious handicap to the accomplishment of our whole mission, because these items are not superfluous at all. They are essential parts of an integrated program for training young men, and they must be so regarded. When this attitude is generally accepted by all our people, and understood from the lowest to the highest, the question of character guidance will take care of itself, because it will be only a part of an integrated program for making men out of boys.

The Decline and Fall of Flak

Extract from a Military Intelligence Report of an Air Force unit in the latter part of 1945.

Study of a collection of official documents, captured in the possession of high ranking GAF officers and dated for the most part shortly before the German collapse, has provided a great deal of valuable information on the size of the GAF Flak organization, particularly during the last six months of the war, and has afforded a comparison with information previously published on this subject. The documents do not, however, give any information about naval flak, and include only one reference to army flak.

The following notes are a résumé of the various items covered.

Order of Battle

A return dated 1 February 45 stated that, at that date, there were still operating:

Seven Flak Corps, 29 Flak Divisions, 13 Flak Brigades, 160 Flak Regiments, 852 Flak Abteilungen (batteries).

Personnel

A statement, dated 6 April 45, of the total personnel of the GAF at various dates gives the following information:

Date	*Flak personnel*
15 Nov 44	803,700
15 Dec 44	816,167
15 Jan 45	842,200
15 Feb 45	821,200
1 Apr 45	656,000

Since 15 November 44, Flak had consistently absorbed around 35% of the total GAF personnel. This proportion became slightly higher toward the end of the period, as was only to be expected, since flying personnel probably included a higher proportion of younger men more likely to be affected by repeated "comb-outs" in favor of other services.

Auxiliary Personnel

From time to time reference has been made to the increasing manpower difficulties which were being experienced by the Germans and to their efforts to alleviate the position by introducing inferior personnel, such as Reich Labor Service personnel, women, youths and foreigners. Periodical Summary No. 17 set out the types of auxiliary personnel being used and the classes into which they were divided.

The official statement gives the proportions of service personnel and auxiliary personnel in Flak as follows:

Date	*Service Personnel*	*Auxiliary Personnel*	*Total*
15 Nov 44	573,000 (71%)	230,700 (29%)	803,700
15 Dec 44	569,527 (70%)	246,640 (30%)	816,167
15 Jan 45	567,900 (67%)	274,300 (33%)	842,200
15 Feb 45	510,200 (62%)	311,100 (38%)	821,100
1 Apr 45	368,000 (56%)	288,000 (44%)	656,000

Age Groups of Service Personnel

The documents show that service personnel in Flak on 1 April 45 were made up of:

44% aged 39 and younger, fit for active service;
21% aged 39-48, fit for active service;
35% of higher age groups and low medical categories.

Equipment

The documents include returns at various dates of the number of Flak guns deployed by the GAF. As mentioned previously, no figures are yet available for naval flak. Only one figure is available for army flak in April 45, this is given below.

Position in February 44

A statement dated 18 May 45 states that GAF Flak reached its peak deployment in February 44 when it had 2,600 heavy Batterien (including 400 Batterien of Home Guard and Emergency Flak), with 13,500 heavy guns. There were also 1,600 light and medium Batterien, which would be equivalent to approximately 21,000 guns; other returns of later date show numbers in excess of this figure and it is apparent that Home Guard and Emergency Flak Batterien are not included. Large numbers of such units are known to have been employed.

In addition there were 450 Searchlight Batterien with approximately 7,000 heavy searchlights and 100 balloon barrage Batterien each with 24 balloons. It is known from other information that the number of balloons was subsequently considerably reduced.

Position as at 31 January 45

A more detailed return was made of the position as of 31 January 45, showing the calibres of the various guns, but this return apparently again excludes light and medium Home Guard and Emergency Flak. The numbers of the various calibres were shown as:

Calibre	*No. of guns*
2 cm	12,324
2 cm four-barrelled	3,952
3.7 cm 18, 36, 37	2,915
3.7 cm 43	1,040
3.7 cm twin-barrelled	366
5 cm	47
	20,644
8.8 cm 18, 36, 37	9,930
8.8 cm 37/41	13
8.8 cm 41	318
10.5 cm	1,902
12.8 cm	570
	12,733

It will be seen that the proportion of 2 cm and 8.8 cm guns represented approximately 80% of the total light and heavy guns respectively, this being somewhat higher than the corresponding estimates of 70% and 65%.

Position as at 18 February 45

A report dated 18 February 45 gives the following numbers of guns in GAF Flak. The number of light guns shown is substantially greater than the number shown for the peak period of February 44, which lends support to the

assumption that the February 44 figure was, in fact, exclusive of Home Guard and Emergency Flak, and suggests that the 34,750 guns estimated in M.I.15/N & Ap/281/45 was substantially correct.

Calibre	*No. of guns*
2 cm	27,759
3.7 cm	4,386
	32,145
8.8 cm	9,793
8.8 cm·41	251
10.5 cm	1,097
12.8 cm	661
	11,802

Position at end April 45

A further return was made of the position as at the end of April 45; it was not a complete return as no particulars were included in respect of one corps and one Luftgau area. As was to be expected, the number of guns had become considerably reduced as a consequence of the march of events. The numbers had now become:

Calibre	*No. of guns*
2 cm	17,645
3.7 cm	3,381
	21,026
8.8 cm	5,968
8.8 cm 41	92
10.5 cm	964
12.8 cm	229
	7,253

Army Flak

Exclusive of the figures in paragraph on "Position at end April 45" above there were 6,199 light and medium guns and 515 heavy guns held by the Army. As these had also become a wasting asset in the same way as GAF Flak, it is probable that the number of light and medium guns, 12,500, shown with the Army and SS in M.I.15/N & Ap/281/45 was approximately correct. The number of heavy guns given in the estimate, on the other hand, must have been too low, the correct figure probably being 750-1,000.

In Berlin

as at 19 April 45, the following were deployed in Berlin:

Calibre	*No. of guns*
2 cm	316
3.7 cm	123
	439
8.8 cm 37	293
8.8 cm 41	22
10.5 cm	55
12.8 cm	24
	394

*** ***

Of the 394 heavy guns, all the 12.8 cm guns and practically all the 10.5 cm guns were on static mountings, but all the 8.8 cm 41 guns and practically all the 8.8 cm 37 guns were on transportable mountings. This state of apparent mobility of the 8.8 cm guns was, however, offset by the fact that the necessary trailers were available for only 40% of them.

The turn of events since the end of the war has placed upon the United States, as the citadel of freedom and the strongest of the free nations, the major responsibility for world recovery, world peace, and world progress, and at the same time has confronted this nation with potentially the gravest challenge ever offered to our principles and our way of life. This situation results from the decision of the leaders of Soviet Russia to turn away from the cooperation which we hoped would prevail after the war, and instead to seek to impose communism upon the world. The consequent resistance of the free peoples of the world to subjugation and enslavement has brought about the world-wide struggle in which we are now engaged.

In any such conflict, the first requirement is to understand the nature of the opposing force. In analyzing Soviet communism, we can distinguish certain basic characteristics or elements. The first element is a group of ruthless and ambitious men, animated by a lust for power and bound by a fanatical doctrine which holds that the end justifies the means, no matter how brutal or unjust. The second element is the seizure by this group of absolute control of a large and powerful nation, whose strength and resources are used by the arbitrary rulers to carry out their aggressive and expansive policies. The third element is the control and manipulation by these rulers of subservient groups in other countries so as to subject those countries to the will of the dominant power, as has been done throughout Eastern Europe, as is being done in China, and as will be done wherever freedom and democracy do not prove themselves strong enough to resist.—*Lieutenant General Walter Bedell Smith, Former United States Ambassador to the U.S.S.R. in a recent address.*

Winners of the Coast Artillery Association ROTC Medal

Listed below are this year's winners of the United States Coast Artillery Association ROTC Medal. The recipient of this annual award is selected from the students in each of the Coast Artillery Corps Senior ROTC units.

A short sketch of the individual winners follows:

University of Alabama: Daniel J. Meador, of Selma, Alabama. Cadet Meador is 22 years old. He was formerly a student at The Citadel and is a graduate of Alabama Polytechnic Institute and is active in four campus societies.

University of California: Robert R. Johnston, of Oakland, California. Cadet Johnson, 20 years of age, after attaining rank of Cadet Colonel in High School, came to University of California as an honor student. He is majoring in music and seriously considers the Regular Army as a career.

University of California at Los Angeles: John D. Stern of Beverly Hills, California. Cadet Captain Stern is a veteran, having served in the Army from March 1946 to September 1947. He is 21 years of age, is majoring in Economics, a member of the local chapter of Scabbard and Blade, and is active in several other school activities.

University of Cincinnati: Richard E. Glaser, of Cincinnati, Ohio. As a Cadet Lt. Colonel, 24-year-old Glaser leads a battalion in the University ROTC. He served overseas during World War II in Armored Infantry, being discharged from the Army in February 1946. He is a past Captain, Scabbard and Blade, Scarab.

The Citadel: William T. Cooper, of Conway, South Carolina. Cadet Cooper is 20 years old and is working toward to a degree in Business Administration. He takes part in several campus activities and next year, as a Cadet Lt. Colonel, will command the Artillery Battalion.

Texas Western College: Stuart H. Lassetter, of El Paso, Texas. Cadet Lassetter, a 23-year-old veteran of the Army Air Forces, is pursuing a course in business administration and hopes to obtain a Regular Army commission.

University of Delaware: Edward J. Davis, of Newark, Delaware. Cadet Master Sergeant Davis is 24 years old and is a Junior in the School of Agriculture. During his 36 months of service in World War II, he saw combat duty in the Asiatic Pacific Theater of Operations and was discharged from the Army in February 1946. He is a member of one campus society.

Fordham University: Louis R. M. Del Guercio, of Larchmont, New York. Cadet Captain Del Guercio was designated as a Distinguished Military Graduate. He is 20 years of age and graduated with a BS degree in Biology. He is a member of five campus societies and has accepted a commission in the Regular Army.

Hampton Institute: James A. Hammond, Tampa, Florida. Cadet Staff Sergeant Hammond was in command of the Drum and Bugle Corps during the past year. He is majoring in Architectural Engineering and plans to make the Army his career. He was designated a Distinguished Military Student and was chosen as Cadet Lt. Colonel for next year and will hold the position of Battalion Commander.

University of Kansas: Robert C. Bransfield, of Leavenworth, Kansas. Cadet Bransfield, age 20, after completing high school ROTC with honors, is continuing military studies while he majors in Engineering.

University of Maine: Parker W. Gray, of Damariscotta, Maine. Cadet Gray is a 24-year-old veteran of World War II, having seen service in France and Germany. He is President of an Engineering Society and a member of Tau Beta Pi. He will graduate next year.

University of Minnesota: Girard L. Stewart, of Cloquet, Minnesota. Cadet Stewart is 22 years old and is an honor student in Business Administration. He served 18 months in the Army in Korea. He was chosen as a Distinguished Military Student and is active in two school societies.

Mississippi State College: Joe H. Collier, of Jackson, Mississippi. Cadet Sergeant First Class Collier, age 20, is a junior in the School of Engineering and is a member of two fraternities. He was designated as a Distinguished Military Student.

University of New Hampshire: Thomas N. Richmond, of Portsmouth, New Hampshire. Cadet 1st Sergeant Rich-

mond served two years in the Navy during World War II seeing action on Saipan. He is majoring in Business Administration and takes part in school athletics.

University of Pittsburgh: Robert A. Fletcher. Cadet Fletcher was chosen from the advanced ROTC unit as the outstanding cadet. Besides attaining a high scholastic rating, he was active in several campus activities.

University of Puerto Rico: Luis R. Canetti, of Caguas, Puerto Rico. Cadet Canetti is a Junior, 21 years of age, and is pursuing a course in Civil Engineering. Since his schooling began. Cadet Canetti has been an outstanding student and is widely known on the campus for his keen military bearing. He is active in several campus societies.

University of San Francisco: Francis L. Williams, of San Francisco, California. Cadet Colonel Williams is 24 years old, is married and has two children. During the war he served two years in the Air Forces as a gunner and flight engineer on a B-29. He was selected as the most outstanding cadet at the ROTC Summer Camp, Fort Lewis, Washington, in 1948. He is a member of Scabbard and Blade Society.

A & M College of Texas: Samuel H. Barnes, of Chester, Texas. Cadet First Sergeant Barnes is an Agricultural Engineering student, and was selected from cadets in the Coast Artillery Unit as being outstanding in scholarship, military proficiency and personal qualifications. He is active in the Society of Agricultural Engineers and other campus activities.

Utah State Agricultural College: Ralph Downs, of Bountiful, Utah. Cadet Lt. Colonel Downs is 22 years of age and is majoring in Physical Education. During the war, Cadet Downs participated in the Army Student Training Program. At college he is proficient in athletics. He is a member of three school societies.

Virginia Polytechnic Institute: Wayland W. Rennie, of Richmond, Virginia. Cadet Sergeant Rennie, 20 years of age, has an outstanding record in the Coast Artillery ROTC. Cadet Rennie is pursuing a course in Agronomy. He is a member of several school fraternities and societies and also takes an active part in athletics.

Washington University: Jack D. Minner, of Clayton, Missouri. Cadet Second Lieutenant Minner is 20 years old and was chosen as the outstanding cadet in the Artillery Unit of his University. He is active in three campus societies.

University of Washington: Loren E. Radford, of Seattle, Washington. Cadet Radford, 20 years of age, is now attending Summer Camp at Fort Bliss, Texas. His past military achievements point toward his being qualified as a Distinguished Military Student next fall. Cadet Radford is considering a career in the Regular Army.

Notify the Journal of your change of address.

Among the principles on which our postwar training philosophy is based, three tenets are paramount: (1) the human approach; (2) recognition and protection of the dignity of the individual; and (3) provision for maximum personal liberty, consistent with the performance of military duties.

The human approach is manifest in the student-instructor relationship in the training units. There the student learns because he wants to—not because he is driven by threats or coercion. Pride in self and pride in unit instil in the soldier a desire to acquit himself with credit, for his own self-esteem as well as for the reputation of his unit. High standards of discipline and performance result from this kind of enlightened leadership, developing in the individual a marked degree of initiative and *esprit.* The same principle applies in the soldier relationship in combat units. The new approach contrasts with the hard-boiled method, sometimes resorted to by incompetent commanders, by which a man was driven rather than led—induced to obey from compulsion rather than from his own desire and initiative.

At its core, much of today's philosophy of troop handling is based upon a recognition of the dignity of the individual. The military history of this Nation is replete with evidence that a man is a better fighter when he retains his individuality. This individuality is an element of strength that the totalitarian nations do not possess.

Recognizing that every soldier is an individual who has his own aspirations, interests, and desires, the good leader manifests a high regard for every soldier in his command. He realizes that the morale and efficiency of his troops are frequently more dependent on individual recognition than on material rewards

A new approach has been made to the problem of moral guidance among troops. The chaplain has been made a staff officer, charged with certain troop welfare functions in addition to providing religious guidance. One of his biggest tasks is the teaching of sex hygiene, with emphasis on continence rather than on prophylaxis.

In all stages of training, unnecessary restrictions on the soldier's personal liberty have been avoided. The average American, it is recognized, chafes under unnecessary restraints but accepts restrictions without complaint when the necessity is clearly evident.

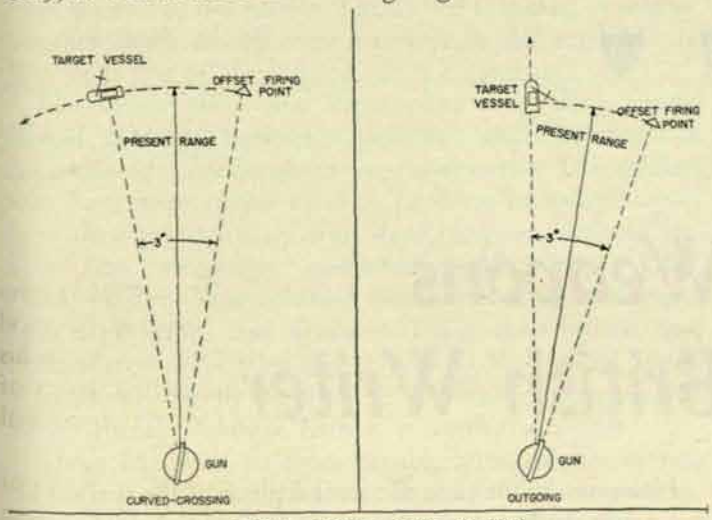
I have great faith in the American youth. I believe he is essentially sound, instinctively decent, and will usually do the right thing if we show him what is right and explain why we think it is right. Our responsibility is not limited to teaching military techniques. To make the man a better fighter we must make him a better citizen. We must help him relate the task at hand to the greater goals of our free American society.—*Extracted from Gen. Jacob L. Devers' article "Training of the Army Today" in the April 1949 issue* Army Information Digest.

SEACOAST SERVICE TEST SECTION NOTES

COLONEL R. E. DINGEMAN, Coast Artillery Corps, Director

Seacoast Artillery Firing by Offset Methods: The offset firing system was adapted to Standard 155-mm gun and allied fire control matériel; *i.e.*, 155-mm M2 Guns, AN/MPG-1 Radar and the M8N Gun Data Computer. The radar set was modified by installing a different azimuth mark disc in the antenna assembly to provide three-degree vertical marks on the tracking scope. Tracking a point in the water offset from the target was found to be a comparatively simple problem.

This offset method makes it possible to fire target practices on a variety of courses from curve-crossing to outgoing (see cut), as well as at a maneuvering target.

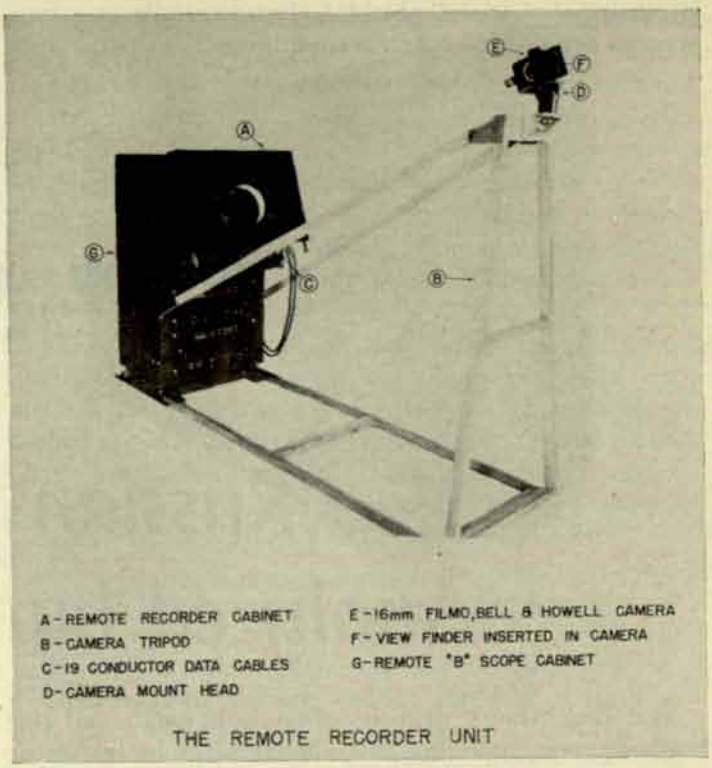


TYPICAL OFFSET FIRING COURSES

Two subcaliber firings and one service firing were conducted during the latter part of April. These firings furnished sufficient data for completion of both this and the Remote Recording System projects. In the service firing, which was conducted on a crossing course at an average range of 14,550 yards, fourteen rounds were fired for effect. Seven of these rounds were bow-on hits and two were broadside hits.

It was recommended in the Report of Test that the method of offset firing be adopted for training of AN/MPG-1 Radar equipped 155-mm artillery units assigned a seacoast defense mission. Further recommendation was made that the system be considered for use with any future developed gun-fire control combinations to which it might be applicable.

Remote Recording System for Service and Target Practice Firings: The final development of the remote Recording System comprises additional selsyn motors in the AN/MPG-1 Radar tracking trays and a Remote Recording Unit. This unit consists of a Remote "B" Scope Assembly CY-234/MPG-1 to which has been added a Remote Recording Cabinet, camera with camera mount and connecting cables. The cabinet contains range and azimuth dials, driven



THE REMOTE RECORDER UNIT

by selsyns, which present data identical to that on the parent radar.

As reported above, the target practices conducted in April furnished the information necessary for completion of this project. Results of the test disclosed that the system devised for remote recording was more efficient and economical than present standard methods of recording data for the analysis of firing as well as simplifying record keeping. Using the Remote Recording System the number of personnel required for recording data was reduced from 29 to 16. This system was found to be the only means of obtaining complete data for the analysis of firings conducted by the offset firing method.

It was recommended that all existing AN/MPG-1 Radars be modified for use with the Remote Recording System and that the system be adopted for use by all AN/MPG-1 equipped batteries. Suggested basis of issue was one unit, mounted in Trailer M14, per 155-mm artillery battalion equipped with AN/MPG-1 type radar.

Gun Data Computer M8N: During the service test of Gun Data Computer M8N in 1945, it was noted that adjacent communication radio transmitters interfered with computer operation. Several simple tests were made to determine the magnitude of this effect, but no specific conclusions were reached. An M8 type computer designated T20 has been utilized recently for a thorough investigation of radio interference and means necessary to prevent detrimental effects on computer operation.

As a result of the investigation conducted with this computer, a project was assigned this section to determine the susceptibility of the Gun Data Computer M8N to interference from radio and radar sources and necessary corrective action to eliminate such interference. The M8N has different ballistic circuits and scale factors than the T20 and is trailer-mounted for mobile use. Although the trailer is capable of being hermetically sealed and is sheathed with metal, it is not as well shielded electrostatically as a computer in a reinforced concrete structure.

In a recently completed test it was determined that by improved chassis shielding and installation of filters and by-pass capacitors, the M8N would operate within manufacturer's tolerances in the presence of powerful radios and radars. Recommendation was made that all M8N Gun Data Computers be modified accordingly.

Distribution Box Boat L-73: Service test of the modified distribution boat was completed on May 20th and a report submitted thereon.

Conclusions reached as a result of this test were that the modifications increased the effectiveness of the boat in controlled submarine mine operations; and that the L-73 is now more suitable than existing Standard distribution box boats.

Notify Journal of your change of address.

Russian Weapons Analyzed by British Writer

The Red Army's weapons often look rough and unfinished, even crude, but they should never be underestimated on that account, warns Capt. B. H. Liddell Hart, well-known English military analyst, in the technical journal, *Ordnance* (May-June). The Germans made that error —and had to unlearn it the hard way.

When the Nazi forces attacked Russia in 1941 they soon discovered that the rifles and machine guns in the hands of their Soviet opponents were more modern than their own, with better fire rates.

The Russian mortars, states Capt. Hart, "were so simple in construction and roughly finished that they looked like the product of a village blacksmith, yet they were most efficient. Their apparent crudeness was far outweighed by the advantage of rapid output."

The Red Army's great weapon-superiority over the German foe, however, lay in their tanks, declares the English writer. This was not true at the outset, for the Russians were caught in a transition period between an obsolescent model which they possessed in numbers and a newer type not yet in mass production. So in the initial campaign the Nazis "cleaned up" on the Russians.

However, by the time the second phase of the war set in, the newer tanks were ready, and after that the advantage remained with the Soviet forces. The newer Russian tanks were low-built, presenting more difficult targets. They had wide treads, enabling them to maneuver on soft ground, particularly in spring, when the sandy soil of the Russian plain became a miry mud that bogged down the ponderous German "Tiger" tanks. These newer tanks were modifications of an American model, the Christie tank, which the inventor sold to the USSR after he had been repeatedly turned down by U. S. Army authorities, Capt. Hart adds.

Like much of the rest of the Russian equipment, their tanks had a rough and unfinished appearance. They were not even painted. They were cramped and uncomfortable inside, exceedingly tiring to any crews less tough than the Red soldiers, and they were lacking in most of the radio and optical aids considered essential by Western tank commanders. But they had good guns, they could be depended on to keep going, and they could be produced rapidly in the hard-pressed Soviet factories. Most important of all, they could fight.

—*Science News Letter May 7, 1949.*

Bernard M. Baruch at The 25th Anniversary Of The Formation Of The Industrial College Of The Armed Forces*

The Journal seldom finds space to publish in much detail the great speeches of our times. In making Mr. Baruch's address an exception, we pass on to our readers the pronouncement of one of the Nation's great leaders at his inimitable best.—Editors.

I should like to say a few kind words for the so-called Brass Hats, who are being sneered at and sniped at so unjustly. They deserve better at the hands of the public.

We should stop thinking that the soldier is set apart from the rest of the people. This is bad thinking. A soldier, whether he be an officer or a private, is still a citizen. In fact, he is first of all a citizen. So is a veteran!

The whole thesis that there exists some deep fundamental cleavage between "civilians" and "military" in American life, breaks down on examination. The soldiers who have been called upon to function in spheres apart from their profession of arms have rung up enviable records. Our occupation commanders—MacArthur, Clay, Clark, Hodge—have handled themselves with ability and tact, with justice and firmness. They, their officers and enlisted men, have won new respect for the United States.

In Bedell Smith we had an excellent ambassador to Soviet Russia. Admiral Kirk is a worthy successor.

There has been no more capable administrator of veteran affairs than General Omar Bradley. Less conspicuous, but no less real, was the ability shown by Marine General Erskine as Retraining Administrator in an impossible situation.

No Secretary of State has been less militaristic and more devoted to searching for peace than General Marshall.

Our civilian life has been greatly enriched by the addition of professional soldiers, General Eisenhower being only the most recent example.

There is no basis for the accusation that our military leaders think exclusively in terms of "war." Today the professional soldier is trained in the arts of peace as well as those of war. That, as you know, has been one of the objectives of this Industrial College.

I know of no group who has been so loyal to the country as a whole. The question never arises of protecting one region—say New York or Texas—at the expense of others. The military has always thought of the whole national interest, which is more than can be said for some of their critics.

By whom have American liberties been threatened in the past? By the military? Or by reckless civilian politicians and rabble-rousers? The role of the soldier in the United States has always been that of the protector of our liberties. In times of peace all too many people have tended to jeer at members of the armed forces, to laugh off their warnings, to give little heed to what they have sought for defense. Then, suddenly, war erupts! The much-maligned military are expected to spend billions in furious yet efficient haste, to recruit and train in a matter of months millions of men who never held a rifle before, to organize global operations touching places most Americans had never heard of. Certainly it is one of the marvels of American history that our armed forces have not failed us in time of war, despite the treatment given them during peace. This story is told in Kipling's "Tommy Atkins."

The pay we civilians give our soldiers has never been commensurate with the responsibilities we thrust upon them. That is particularly true now, when inflation has slashed the real value of all pensions, savings and salaries. Grave responsibilities with inadequate reward and exposure to unfair criticism is too often the lot of occupants of the Pentagon—which I hope to see renamed the James V. Forrestal Building.

Not all who have been wounded in the service of their country wear purple hearts.

Were today's abuse of the military merely a question of the specific charges being made it would be of small concern since the evidence refuting these accusations is so readily at hand. However, the outcry against the "brass" is the outward sign of something deeper.

In ancient, more primitive times it was often the practice to beat or kill a courier who brought bad news. That is somewhat the plight of the military in America today. Because of the cold war, the atomic bomb and other ocean-shrinking weapons, the collapse of European and Asiatic power, preparations against war intrude ever more insistently into all our lives. Before Hitler, defense appropriations cost each American only a few dollars a year. We now pay $100 annually—each of us. For the first time in our history, young men have been drafted before actual war.

These and other actions being forced upon us clash violently with the traditional American hatred of war. Is it surprising that some people should lash out at the messengers bearing the sad tidings which make these changes necessary as if the messengers, themselves, were to blame?

Bear this fact in mind—the American people are currently in the throes of tormenting, frustrating readjustment.

*From an address by Mr. Bernard M. Baruch at the Commencement Exercises Commemorating the 25th Anniversary of the Formation of the Industrial College of the Armed Forces, at Washington, D. C., June 28, 1949.

Both as a nation and as individuals we grew up accustomed to regard war and peace as distinctly separate states, like day and night. Today we live in an around-the-clock twilight of neither war nor peace. Reared to think of war as a brief emergency to be rallied to temporarily, we find ourselves confronted by a continuous threat of war, which required something Americans have habitually lacked—a see-through constancy in action between peace and war.

This necessity to adjust to the inexorable continuity between peace and war which prevails in our world will force revolutionary changes in the thinking of the military as well as civilians. In the past, for example, defense appropriations fluctuated wildly in a "feast and famine" cycle. Unfortunately our budgetary habits are still attuned to that cycle. For the cold war we must scale defense expenditures so they can be sustained indefinitely—paced to the needs of changing world developments—without overburdening our economy.

So much is being spent by all nations today in fear of war. If these resources were turned to peaceful uses, how many of the world's problems could be solved!

Our military strength cannot be permitted to lapse to where it invites aggression. Neither dare we overload our economic system with destructive, unnecessary taxes or to divert so large a proportion of our resources from productive use so that living standards cannot continue to be lifted. The cold war is as total as actual war. It requires not military readiness alone but a strategy embracing all fronts, a strategy which rises above the race of selfish groups who seek to better themselves at the expense of others, even to where it endangers our very government.

To arrive at the proper balance will require painful decisions by both the military and civilians. With the defense establishment a unified strategic concept must be agreed upon, with expenditures restricted to what is absolutely needed—not what is wanted or even desired.

On the part of the civilians, there must be an end to prevailing indecisions. An over-all global strategy for prolonged peacewaging must be formulated. I have always believed in civilian control of our national life, both in war and peace. But civilian dominance has its price—a readiness to make the decisions which the military must have, to carry out their assigned duties. The failure to enact a mobilization plan is only one instance of this vacillation and neglect.

Lack of self-discipline and weird economics, strange ethics and perverted logic, if persisted in, will surely destroy us. These internal dangers are as great as the external ones. Still I have never seen a situation that could not be cured by competence. And that holds for our problems today.

Materially, we have all that we had yesterday—and more. The test is one of choosing between the wisdom and follies in man's experience.

For more than half a century I have been associated with members of the armed forces. In all that time I have never met a so-called military man who was not as fervently desirous for peace as the ordinary civilian. I have watched the defense agencies spend billions and, while there have been lapses, on the whole the record has been better than any comparable operation in civil life. Nor have I ever detected in the military any tendency to usurp power or to do anything other than safeguard our freedoms.

The men who commanded on land and sea and in the air and those whom they commanded, gave new dignity to the spirit of America. I resent the implication that these war leaders are less able or less willing to discharge their duties in peace. I reject the theory that they think narrowly and rigidly in terms of war. I oppose any effort to force them into secondary citizenship.

You gentlemen can leave this institution with pride in the training you have received and with greater pride in what you symbolize—the ability of the American democracy to fuse professional soldiering with a love of liberty. *If at any time in the future you find yourself being called a "brass hat" take it as a compliment. I would be proud to be known as one.*

Long-range military policy must ultimately be interpreted by men with missions, trained and equipped to perform them. Civilians must set the policy, but they will continue to rely upon their trusted military advisers for the practical applications. Without sacrificing any of the economies or progress which can be opened by modern research and invention, some down-to-earth readiness must be the foundation of our present plans. This is our most pressing military problem. —GENERAL OMAR N. BRADLEY.

News and Comment

Principal Commanders and Staff Officers of the Antiaircraft Artillery and Guided Missile Center at Fort Bliss
28 June 1949

HEADQUARTERS, AAA AND GUIDED MISSILE CENTER:
Major General John L. Homer* ..... Commanding
Colonel Bryan L. Milburn ..... Chief of Staff
Lt. Colonel Robert B. Barry, Jr. ..... Deputy Chief of Staff
Lt. Colonel Lavell I. Cooley ..... Asst. C/S, G-1
Captain Adolph Serfin ..... Asst. C/S, G-2
Colonel Daniel W. Hickey ..... Asst. C/S, G-3
Lt. Colonel Lincoln A. Simon ..... Asst. C/S, G-4
Colonel Granger Anderson ..... Asst. C/S, G-5
Colonel James W. Ross ..... Adjutant General
Lt. Colonel William J. Wuest .... Deputy Post Commander
Colonel Arnold D. Amoroso ..... Inspector General
Colonel Frederick A. Ward ..... Quartermaster
Lt. Colonel Lewis G. Bolt ..... Special Service Officer
Colonel Nelson A. Myll ..... Surgeon
Lt. Colonel Charles Malumphy ..... Chaplain
Major George Burgett ..... Engineer
Lt. Colonel George W. Durham ..... Fiscal Officer
Major William W. Wipf ..... Judge Advocate
Major Edward W. Corcoran ..... Provost Marshal
Major Lloyd H. Briggs ..... Transportation Officer
Major Stanley S. Ehresman ..... Signal Officer
Lt. Colonel Arthur Barratt ..... Ordnance Officer
Captain Herbert Hampton ..... Public Information Officer

ANTIAIRCRAFT AND GUIDED MISSILE BRANCH, THE ARTILLERY SCHOOL:
Brigadier General Charles E. Hart..Assistant Commandant
Colonel John H. Madison ..... Director of Instruction
Major Charles Jeffrey ..... Secretary
Major Daniel B. Williams ..... Registrar
Lt. Colonel Charles F. Heasty ... Director of Administration
Colonel Laurence W. Bartlett .... Director, Gunnery Dept.
Colonel Robin B. Pape ..... Director, TP & A Dept.
Colonel Ernest B. Thompson ..... Director, Tactics Dept.
Colonel John A. Sawyer ..... Director, Electronics Dept.
Lt. Colonel Russell O. Utke .... Director, Res. & Anal. Dept.
Lt. Col. Laurence W. Byers .. Director, Guided Missile Dept.
Commander Keith E. Taylor ..... Senior Naval Instructor, GM Department

ARMY FIELD FORCES BOARD NO. 4:
Colonel Charles E. Shepherd ..... Deputy President
Lt. Colonel Francis M. McGoldrick ..... Executive
Colonel Ovid T. Forman ..... Director, AASTS
Lt. Colonel Maxwell A. Tincher ..... Director, GMSTS

31st AAA BRIGADE:
Brigadier General Frederic L. Hayden ..... Commanding
Lt. Colonel Peter Schmick ..... Executive
Colonel Andrew Samuels .. Commanding, 5th AAA Group
Colonel William H. Hennig, Commanding, 10th AAA Group
Lt. Col. Henry G. McFeely, Commanding, 11th AAA Group

34th AAA BRIGADE:
Brigadier General Paul W. Rutledge ..... Commanding
Colonel William McNamee ..... Executive
Colonel William McFadden, Commanding, 68th AAA Group
Lt. Colonel Lloyd Corkan..Commanding, 80th AAA Group
Colonel Harry R. Boyd....Commanding, 22nd AAA Group

35th AAA BRIGADE:
Brigadier General Robert W. Berry ..... Commanding
Colonel Pierre B. Denson ..... Executive
Colonel Wm. J. McCarthy, Commanding, 12th AAA Group
Lt. Colonel Calvin L. Partin, Commanding, 19th AAA Group

1st GUIDED MISSILE REGIMENT:
Colonel Arthur H. Bender ..... Commanding
Lt. Colonel Laurence W. Cummings ..... Executive

*Also Commandant, AA & GM Branch, The Artillery School and President, AFF Board No. 4.

Buildings at Bliss Named For 6 AAA War Dead

Memorial Day observances at Fort Bliss were climaxed with special services in which six permanent buildings in the Antiaircraft Artillery and Guided Missiles Branch, The Artillery School area of the Post were formally named for and dedicated to the memory of six antiaircraft artillerymen who gave their lives in service during World War II.

Buildings named and the heroes whom they commemorate are: Sylvester Hall for 1st Lieutenant William G. Sylvester; McNeely Hall for Colonel O. D. McNeely; Bander Hall for Chief Warrant Officer Morris Bander; Brady Hall for 1st Sergeant Dewey G. Brady; Cooper Hall for Captain Robert G. Cooper; and Breitung Hall for Lt. Colonel H. E. C. Breitung.

Dedicatory services opened at 9:30 A.M. on Noel Field with Major General John L. Homer, Commanding General of the Antiaircraft Artillery and Guided Missile Center and Fort Bliss making the principal dedication address. Later brief dedicatory services were held at the individual buildings. A bronze memorial plaque to the honored dead was unveiled at each building by the next of kin. In the case of Bander Hall, the next of kin not being present, the plaque was unveiled by Brigadier General Charles E. Hart, Assistant Commandant of the School. After the unveiling, the senior officer of each building accepted its custody.

Relatives of the honored artillerymen who were present for the ceremonies included: Mrs. Robert C. Anderson of Bakersfield, California, mother of 1st Lieutenant Sylvester and Mr. Anderson; Mrs. McNeely, mother of Colonel McNeely, and Mr. and Mrs. William R. McNeely, brother and sister-in-law, all of Enid, Oklahoma; Mrs. Gussie B. Hunter of Plainview, Texas, sister of 1st Sergeant Brady; Mrs. Ona Gibson Cooper, mother of Captain Cooper, of Chevy Chase, Maryland; and Mrs. Lethe Breitung, wife of Lt. Colonel Breitung, and her daughter from San Francisco, California.

The dedication ceremonies preceded the traditional memorial services at the Fort Bliss National Cemetery in which the dead of all wars were honored. Fort Bliss personnel cooperated with veterans' organizations and civic groups from El Paso, Texas, in the Cemetery memorial program.

GM Regiment Fires First Rocket

The first guided missile to be fired by a tactical unit of the United States Army was launched at White Sands Proving Ground, New Mexico, at 11:05 A.M., Monday, April 9, 1949.

This missile was of a type similar to the WAC CORPORAL rocket used in the record-shattering 250-mile-high flight made by a two-stage rocket last February. It is the first missile of several types to be fired in a program designed to gain training experience, and for tactical and logistical experimentation.

The rocket was fired by personnel of the 1st Guided Missile Regiment, perhaps the most exclusive of present army

units, since it is the only one of its kind. This unit was organized in 1945 as a battalion and was enlarged to regimental size last year. It has been engaged in assisting Army Ordnance and some of the foremost American scientists in tests conducted in connection with research and development projects, with the purpose of perfecting the guided missile as a weapon, and exploring upper atmospheric regions.

Services Take Part In Civilian Defense

A nation-wide Government project for planning civilian defense in the event of war, atomic or otherwise, has been launched by the National Security Resources Board.

On orders of President Truman, the acting board chairman, John R. Steelman, has assigned to the Armed Forces and other Government agencies the roles they must develop for combating sabotage and for meeting attacks of all kinds —atomic, chemical, biological, or "conventional."

Steelman has appointed William A. Gill, director of Mobilization Procedures and Organization for the board, as temporary coordinator for the project. Under a permanent setup to be established for defending America's millions, the entire defense program will be placed under civilian control.

Mr. Steelman revealed that the Government also will undertake later to plan a peacetime disaster relief program for reducing the suffering inflicted by such national scourges as floods, fire and disease.

The brunt of the planning and training for wartime civilian defense will be borne by the Armed Forces, the Federal Works Agency, Federal Security Agency, Atomic Energy Commission, and the Agriculture, Commerce, Interior, Treasury and Justice Departments. The AEC is now working on an "atomic weapon effects" handbook for the guidance of civilian defense officials.

New Bazooka Fire Power

A "super bazooka" that will enable the Infantryman "to carry by hand the punch of medium artillery," has been developed by the Army Ordnance Department.

The new weapon fires a 3.55-inch rocket and has more than twice the power of the World War II model, which fired a 2.36-inch rocket.

Army Vehicle Rebuilding Program Saves Millions in Germany

Army Ordnance installations in the United States Zone of Germany have rebuilt and reclaimed vehicles, engines, tools, tires and miscellaneous machine parts having a total estimated original cost of more than $110,000,000 in the past two years, the Department of the Army announced.

Cost of replacing this equipment at present prices is estimated at $220,000,000. Restoration was accomplished at an expenditure of approximately $35,000,000, including $5,250,000 for American materials, and $29,750,000 for German labor and German materials.

Working with stocks of American war materials that remained in Germany after substantial quantities had been shipped back to the United States or transferred to allies through the Office of Foreign Liquidation, Ordnance shops in United States-occupied Germany rebuilt nearly 38,000 vehicles and trailers of all types in the two-year period ending April 1, 1949.

In addition, some 300,000 tires, 93,000 tubes, and thousands of engines, transmission assemblies, axles, and other automotive parts and Ordnance supply items were rebuilt, reclaimed, and returned to depot stocks in serviceable condition, according to a report by Brigadier General E. E. MacMorland, Chief Ordnance Officer, Headquarters European Command.

Contribution of the huge "rebuild" program in support of the Berlin Airlift, and its benefits to the German economy, are also cited in the report.

From reserve stocks of tractors, trailers and automotive parts supplied by the program, Ordnance outfits were able to re-equip or replace without delay the more than 1,000 Air Force vehicles and truck-tractors and trucks of seven heavy-truck companies engaged in out-loading at the Rhine-Main and Wiesbaden fields and off-loading at the Berlin terminus.

Clark B. Millikan Named Chairman of Guided Missiles Committee of Research and Development Board

Dr. Karl T. Compton, chairman of the Research and Development Board, National Military Establishment, announced the appointment of Dr. Clark B. Millikan as chairman and Fred A. Darwin as executive director of the Board's Committee on Guided Missiles.

Dr. Millikan, acting director of the Guggenheim Aeronautical Laboratory, California Institute of Technology, Pasadena, California, has been a member of the committee since its formation. Dr. Millikan is a lieutenant commander in the U. S. Naval Reserve, which he joined in 1934.

Mr. Darwin, who will direct the activities of the Committee Secretariat, has been with the Hazeltine Electronics Corporation, Little Neck, New York since 1946. During the war he served as a Naval Reserve Commander in the Electronics Division of the Bureau of Ships of the Department of the Navy.

Army Creates Separate Command in Austria

The Department of the Army announced that the long considered plan of creating a separate Army Command in Austria has been approved and placed into effect.

Since Lieutenant General Geoffrey Keyes has been the High Commissioner in Austria and John J. McCloy has become the High Commissioner in Germany, a separate Army Command in Austria is deemed necessary for the efficient operation of the two offices in their relation to the State Department and the Department of the Army.

The approximately 9,000 military personnel in Austria will constitute a command separate from the European Command except for certain logistical and administrative support. The principal change in the status of the Austrian Command with respect to the European Command is that henceforth in purely military matters General Keyes will deal directly with the Joint Chiefs of Staff.

New National Guard Units

The following National Guard CAC units have been Federally recognized since the last issue of the JOURNAL.

Georgia.
Medical Detachment, 101st AAA Gun Battalion, Swainsboro.
Battery "C," 250th AAA Gun Battalion, Moultrie.
Battery "D," 950th AAA AW Battalion, Toccoa.
Illinois.
179th AAA Operations Detachment, Chicago.
Indiana.
Battery "C," 138th AAA AW Battalion, Bluffton.
Battery "D," 138th AAA AW Battalion, Kempton.
Mississippi.
Battery "D," 115th AAA Gun Battalion, Brookhaven.
Oklahoma.
Battery "C," 145th AAA Battalion, Vinita.

ORC Units Combine CPX with Social at Fort Tilden, New York

The 1352d AAA Training Group, ORC, Brooklyn, N. Y., commanded by Colonel Julius F. Mercandino, held a CPX at Fort Tilden, N. Y., 8-9 July. The problem presented was the movement of Group and Group Headquarters with the assigned battalions, the 1354th AAA Gun Bn and the 1335th AAA AW Bn (SP), from Fort Tilden to Camp Edwards, Mass.

The exercise involved all the elements of an actual movement: preparation of march orders, march graphs, strip maps, etc. The highlight of the CPX was provided by an inspection by Major General Lawrence C. Jaynes, Commanding General, New York-New Jersey Military District.

The General delivered an informal critique for each of the three units participating. At the conclusion of the critique, he expressed gratification at the progressive program of the Group and pledged cooperation to the Group Commander in improving facilities for the reservists in his area.

Combining the social with the training program, the officers' families joined the Group at 1300 for a beach party at the Officers' Beach at Fort Tilden. Lockers, beach umbrellas and chairs were available and the Post NCO Beach Club's cafeteria furnished sandwiches and drinks. The evening's entertainment ended with a buffet supper and dance at the Officers' Club.

Unit History Exhibit at N. Y. Library

At The New York Public Library, the Independence Day week end began with the opening of an exhibition of World War II military unit histories. The Library's collection of material on the activities of the armed forces units is the largest to be found anywhere in the country.

The Library has acquired nearly a thousand unit histories. Currently displayed in the Fifth Avenue lobby of the Central Building are Army units, grouped by arm of service: Artillery, Infantry, Air Force, Airborne, Armor, Tanks and tank destroyers, and the Service Forces.

Army History of Guadalcanal Published in July

The United States forces' first assault operation in World War II, the battle of Guadalcanal, is the subject of the fourth volume of the Army's official history of the war, the Department of the Army announced. The book, entitled "Guadalcanal: the First Offensive" will make public for the first time much material hitherto classified secret.

Published by the Government Printing Office at $4 a copy, the book will harmonize in format and binding with others of the published Army histories. The first "operational" volume and the third in the series was published last January under the title of "Okinawa: the Last Battle." The first two volumes were issued last year and dealt with organization of Army units.

First of 17-Volume History of AEF Published On Fourth of July

Publication of a 17-volume documentary history of the American Expeditionary Forces in World War I was initiated with simultaneous release of the first two volumes on July 4, by the Department of the Army.

Subsequent volumes will be released individually at intervals of approximately six weeks. Volumes I and II deal with General Pershing's organization of the AEF, and with policy formulation.

Unlike the Army history of World War II—three volumes of which have already appeared—the preparation of the history of the earlier war was undertaken after hostilities had ended. The series did not get under way until 1939, when the War Department directed that "complete and accurate accounts of the participation of the military forces of the United States in the World War" be prepared for publication from official records.

Many hitherto unrevealed letters between high Allied officials are included among the selected documents which constitute the *U.S. ARMY IN THE WORLD WAR, 1917-1919*, as the 17-volume history is titled. These documents are presented in such continuity as to afford a broad understanding of day to day developments of World War I.

Uniform NME Pay System Effected July 1

A uniform pay system for the National Military Establishment which will enable soldiers, sailors and airmen to draw their pay promptly anywhere in the world was put into effect July 1.

Each serviceman's pay data will be centralized on a pay card in the finance office of his service. He may draw it all, or draw out only what he needs and let the remainder stay in his "drawing account" if he so desires. His pay card will be kept in the local finance office until he is transferred, at which time it will precede him to his new station, so that his records will be instantly available for use in payment. Every six months a new pay card will be issued, and the old one sent to his service's finance center, where it will be kept as a permanent record.

Advantages resulting from the new system will be more uniform pay records and procedures, prompt and accurate payment of personnel regardless of location by the utilization of scientifically designed equipment, and more efficient administration of allotments. No additional personnel will be required and disbursing officers will benefit by a substantial reduction in paper work. Records and equipment will be more compact, and subject to greater mobility which

should reduce losses incident to operational casualties in the field.

35,000 Vehicles Worth 60 Millions Put Into Shape By Guardsmen

Approximately 35,000 cargo and personnel transport vehicles with a value of about $60,000,000 have been repaired or put into usable condition by the National Guard and are now being used in armory and field training.

The task was accomplished by personnel of the 61 National Guard State Maintenance Shops who are also members of the Guard.

Of 43,334 general purpose vehicles with a value at World War II prices of approximately $78,007,249.00 delivered to the National Guard by the Army, a total of 34,583 valued at $58,986,685.00 had been repaired and were in training use by National Guardsmen on March 1. The remainder is being put into shape.

The equipment was requested and accepted by the Guard in NRFI (not ready for issue) condition and ranged from new partially assembled vehicles in crates to World War II equipment in varying need of repair. This matériel was inspected prior to its acceptance to determine in turn the Guard's capability to effect repair.

ABOUT OUR AUTHORS

Colonel John I. Hincke, CAC, graduated from the U.S.M.A. in 1924. During World War II, he served as executive officer, Tenth Army, in the South Pacific. At present he is PMS&T at the University of Pittsburgh.

A graduate of the Naval Academy in 1940, Lieutenant Commander Seim served in South American, West Indian, and Pacific waters before World War II. He was assistant gunnery officer of the U.S.S. *Independence* when she was torpedoed in the Tarawa campaign, and subsequently was gunnery officer on the staff of Commander Carrier Division 4 and 5 in Task Force 38. After Japan's surrender he served in the Western Pacific, Philippines, China, and Japan, and is now on duty in the Office of the Chief of Naval Operations, Navy Department, Washington, D. C.

Lt. Col. Floyd A. Lambert, USAF, is assigned to duty with the Operations Division, Directorate of Plans and Operations, Headquarters, United States Air Force, Washington, D. C. He is one of the "old-timers" in the radar field receiving his Reserve Commission in the Signal Corps upon graduation from Texas A&M College in 1938.

Lieutenant Commander J. P. Field was graduated from Millsaps College, Jackson, Mississippi, with B.S. in Chemistry. Served as Gunnery Officer, Executive Officer, and Commanding Officer of destroyers during the war. Attended U. S. Naval Academy Post Graduate School and Rensselaer Polytechnic Institute in Ordnance Engineering (Jet Propulsion) Course, receiving M.S. degree. Has been stationed at the Applied Physics Laboratory, The Johns Hopkins University for 18 months. Now commanding USS *Burdo* (APD 133).

Major V. B. Cagle was graduated from Mississippi State College in 1929 with B.S. in Mechanical Engineering. He is a graduate of the Adjutant General's School, Associate Basic AAA Course, Associate Basic Seacoast Artillery Course, Associate Advance AAA Course and the Command and General Staff College. Major Cagle is now en route to Yokohama, Japan.

Captain Peter B. Genero, CAC, is serving at Fort Bliss, Texas, where he has entered upon a competitive tour of extended active duty. Throughout his service, his experience has been with troops.

COAST ARTILLERY ORDERS

DA and AF Special Orders Covering May 1 through June 30, 1949. Promotions and Demotions not included.

Colonels

Armstrong, Marvil G., to AGO, Washington, DC.
Badger, George M., to ret fr active ser.
Cardwell, Eugene F., to 4052d ASU AAA and GM Cen, Ft. Bliss, Tex.
Cowen, Edward G., to 3441st ASU Cp Gordon, Ga.
Daneker, John L., to Far East Comd, Yokohama, Japan.
Edwards, Parmer W., to US Army Europe, Bremerhaven, Germany.
Evans, William D., to AGO, Washington, DC.
Featherston, John H., to Ryukyus Comd, Okinawa.
Flory, Lester D., to ret fr active ser.
Gard, Harold P., to First Army 1204th ASU NY & NJ Mil Dist, Ft. Totten, NY.
Gleim, Robert F., to Far East Comd, Yokohama, Japan.
Hatch, Melton A., to 5402d ASU ROTC Univ of Ill, Urbana, Ill.
Hewett, Hobart, to US Army Pacific, Ft. Shafter, TH.
Jacobs, James P., to 5260th ASU S Dak Sr A Instr ORC, Sioux Falls, S Dakota.
McCarthy, William J., to 4052d ASU AAA and GM Cen, Ft. Bliss, Tex.
Shepherd, Charles E., to 4053d ASU AFF Bd No 4, Ft. Bliss, Tex.
Smith, Donald H., to Marianas-Bonins Comd, Guam, Marianas.

Lieutenant Colonels

Abrahams, Rolland S., to Far East Comd, Yokohama, Japan.
Andrews, Charles L., to Far East Comd, Yokohama, Japan.
Ashman, Alfred, to Stu Det Hq MDW, Washington, DC.
Ashworth, Edward T., to 4052d ASU AAA and GM Cen, Ft. Bliss, Tex.
Baker, Philip I., to 1272d ASU Off of the Sr Instr NG for NY, 270 Broadway NY, NY.
Blumenfeld, Charles H., to 4052d ASU AAA and GM Cen, Ft. Bliss, Tex.
Brassel, Alfred L., to Stu Det Hq MDW, Washington, DC.
Brown, Spencer A., to 2506th ASU Ohio NG Instr, Ft. Hayes, Columbus, Ohio.
Douglas, Marvin B., to Second Army 2502d ASU Penn NG Instr, Indiantown Gap, Pa.
Dows, Samuel R., to First Army 1108th ASU, Ft. Adams, Newport, RI.
Dunham, Charles E., to 4052d ASU AAA and GM Cen, Ft. Bliss, Tex.
Durschnitt, Samuel, to US Army Antilles, San Juan, PR.
Farren, James H., to 1156th ASU Off of the Sr Instr NG Conn, 360 Broad St. Hartford, Conn.
Fisk, Wallace S., to OC of S, Washington, DC.
Gilbert Charles M., to Stu Det Hq First Army, Governors Island, NY.
Grendon, Alexander, to Stu Det Hq Sixth Army, Presidio of San Francisco, Calif.
Hamelin, Rolland W., to Stu Det Hq First Army, Governors Island, NY.
Hampton, William A., to Far East Comd, Yokohama, Japan.
Hart, John E., to Stu Det Hq First Army, Governors Island, NY.
Hudiburg, Howard B., to Army Comd Joint Long Range Pr Gr, Banana River Naval Air Sta, Cocoa, Fla.
Johnson, Bruce H., to 6705th ASU Org ORC Instr Gp, Portland, Org.
Jordan, Ralph E., to Stu Det Hq Sixth Army, Presidio of San Francisco, Calif.
Kemper, Wilmer G., to Far East Comd, Yokohama, Japan.
Linderger, Lawrence W., to First Army 1100th ASU New England Mil Dist Army Base, Boston, Mass.
McCumber, James B., to Far East Comd, Yokohama Japan.
May, Metticus, to Stu Det Hq Third Army, Ft. McPherson, Ga.
Nelson, John G., to Far East Comd, Yokohama, Japan.
O'Malley, Charles S., to Far East Comd, Yokohama, Japan.
Partin, Calvin L., to Far East Comd, Yokohama, Japan.
Piram, Joseph S., to 4052d ASU AAA and GM Cen, Ft. Bliss, Tex.
Priest, Perry B., to Far East Comd, Yokohama, Japan.
Ratcliffe, Lamar C., to 4054th ASU AA and GM Br, Fort Bliss, Tex.
Rew, Edward A., to 1242d ASU Off of the Sr Instr ORC NY, 90 Church St. NY, NY.
Romlein, John W., to Hq Sixth Army, Presidio of San Francisco, Calif.
Steele, Preston, to Stu Det Third Army, Ft. McPherson, Ga.
Underwood, George V., to US Army Alaska, Ft. Richardson, Alaska.
Vestal, William M., to First Army Stu Det Governors Island, NY.
Zeller, Frank J., to US Army Europe, Bremerhaven, Germany.

Majors

Aber, John E., to Hq First Army Governors Island, NY.
Ashley, Charles M., to 4052d ASU AAA and GM Cen, Ft. Bliss, Tex.
Baer, Joseph C., to 4052d ASU AAA and GM Cen, Ft. Bliss, Tex.
Barker, Troy A., to Far East Comd, Yokohama, Japan.
Bayer, Kenneth H., to 4054th ASU AA & GM Br TAS, Ft. Bliss, Tex.
Boggs, Kenneth L., to 1202d ASU Rctg Det No 3, Burlington, Vt.
Bruns, Stockton D., to 1273d ASU NG Instr for NJ, Trenton, NJ.
Byrd, Cohen B., to 4053d ASU AFF Bd No 4, Ft. Bliss, Tex.
Cagle, Virgil B., to Far East Comd, Yokohama, Japan.
Chotas, Matthew E., to Far East Comd, Yokohama, Japan.
Doyle, Joseph H., to Far East Comd, Yokohama, Japan.
Elliott, Glenn P., to Ryukyus Comd, Okinawa.
Epley, Albert D., to Stu Det Hq Second Army, Ft. Geo G. Meade, Md.
Evans, John E., to 2327th ASU Off ORC Instr for Conn, Hartford, Conn.
Flint, Brilsford P., to Stu Det Hq Sixth Army Presidio of San Francisco, Calif.
Gildart, William J., to Far East Comd, Yokohama, Japan.
Glock, Robert W., to Div of Fin, Washington, DC.
Haviland, Morris E., to Far East Comd, Yokohama, Japan.
Johnson, Charlie W., to 3340th ASU Ill ORC Gp, Chicago, Ill.
Lash, Eugene L., to Far East Comd, Yokohama, Japan.
Lake, Gerald A., to Far East Comd, Yokohama, Japan.
Lanpher, Rollin A., to Far East Comd, Yokohama, Japan.
Lee, Daniel R., to Ryukyus Comd, Okinawa.
Ledbetter, William R., to Far East Comd, Yokohama, Japan.
Limberg, Earl W., to Far East Comd, Yokohama, Japan.
Linn, Lavon P., to Far East Comd, Yokohama, Japan.
McCracken, Reed J., to 4054th ASU AA and GM Br, Ft. Bliss, Tex.
McElligott, Joseph P., to 4404th ASU N Mex. NG, Santa Fe, N Mex.
Materi, Joseph T., to 5447th ASU ROTC, Washington Univ, St. Louis, Mo.
Mathes, Edward S., to Far East Comd, Yokohama, Japan.
Mellett, Earle C., to Div of Fin, Washington, DC.
Miner, Ralph E., to 4051st ASU Stu Det Arty Sch, Ft. Sill, Okla.
Norris, Robinson R., to Stu Det Hq First Army, Governors Island, NY.
Paciorek, Stanley J., to Far East Comd, Yokohama, Japan.
Pafford, Parnell M., to 1283d ASU ROTC Fordham Univ. NY.
Panneck, Theodore W., to 5213th ASU Sr Army Instr Indiana NG, Indianapolis, Ind.
Parr, William R., to 4052d ASU AAA and GM Cen, Ft. Bliss, Tex.
Perry, Ben W., to Far East Comd, Yokohama, Japan.
Reed, Henry M., to US Army Alaska, Ft. Richardson, Alaska.
Roberts, Sam A., to 5043d ASU ROTC Ga Sch of Tech, Atlanta, Ga.
Robinson, John L., to 4051st ASU Arty Sch, Ft. Sill, Okla.
Shoss, Morris L., to Stu Det Sixth Army, Presidio of an Francisco, Calif.
Smith, Eugene, to 6601st ASU Calif NG Gp, Sacramento, Calif.
Smith, Vallard C., to 4053d ASU AFF Bd No 4, Ft. Bliss, Tex.
Stabler, Joseph P., to 4054th ASU AA & GM Br, Ft. Bliss, Tex.
Toomey, Rex F., to 4052d ASU AAA and GM Cen, Ft. Bliss, Tex.
Treadway, Joseph E., to Stu Det Hq Sixth Army, Governors Island, NY.
Trussell, John B. B., to Stu Det Hq First Army, Governors Island, NY.
Tubb, Hubert D., to US Army Forces Antilles, San Juan, PR.
Walmer, Richard, to Ryukyus Comd, Okinawa.
Young, Claude C., to Stu Det Hq Second Army, Ft. Geo G. Meade, Md.

Captains

Adcox, George E., to 3263d ASU ROTC Fla A&M College, Tallahassee, Fla.
Baray, Albert A., to 4052d ASU AAA and GM Cen, Ft. Bliss, Tex.
Betts, George, to CIC Cen, Cp Holabird, Md.
Bigger, Walter K., to US Army Caribbean Quarry Heights, CZ.
Blashill, Norman G., to Far East Comd, Yokohama, Japan.
Boardman, Dumas H., to Stu Det Arty Sch, Ft. Sill, Okla.
Boller, Quellen D., to 4054th ASU AA & GM Br, Ft. Bliss, Tex.
Buchanan, Russell B., to Stu Det Second Army, Ft. Geo G. Meade, Md.
Cassell, Robert S., to 4052d ASU AAA and GM Cen, Ft. Bliss, Tex.
Chilton, Paul G., to 4052d ASU AAA and GM Cen, Ft. Bliss, Tex.
Connor, Robert G., to Far East Comd, Yokohama, Japan.
Dinapoli, Edward B., to Far East Comd, Yokohama, Japan.
Duke, Thomas A., to Far East Comd, Yokohama, Japan.
Finley, William Z., to US Army Caribbean, Quarry Heights, CZ.
Fordyce, Lester J., to 4052d ASU AAA and GM Cen, Ft. Bliss, Tex.
Foster, Jack W., to 4052d ASU AAA and GM Cen, Ft. Bliss, Tex.

Gerome, George W., to 4054th ASU AAA and GM Br, Ft. Bliss, Tex.
Gilman, Bernard A., to 1202d ASU Det No 1, Syracuse, NY.
Hall, James M., to Stu Det Army Lang Sch, Presidio of Monterey, Calif.
Hampton, Herbert B., to Far East Comd, Yokohama, Japan.
Holmes, Robert M., to OMA, Ankara, Turkey.
Jacobs, Harold J., to 4052d ASU AAA and GM Cen, Ft. Bliss, Tex.
James, Harry M., to 4054th ASU Stu Det AAA and GM Cen, Ft. Bliss, Tex.
Johnson, Ralph L., to Far East Comd, Yokohama, Japan.
Jones, Philip I., to 109th CIC Det, Ft. Geo G. Meade, Md.
Keogh, William T., to Stu Det Hq Sixth Army, Presidio of San Francisco, Calif.
Klein, Patrick L., to 2034th ASU Virginia Mil Dist, Richmond, Va.
Leachman, Thomas E., to Ryukyus Comd, Okinawa.
Lockyer, Robert H., to US Army Alaska, Ft. Richardson, Alaska.
Lopez, Raymond A., to 10th CIC Det Fifth Army, Ft. Riley, Kans.
McCarty, George, to 4052d ASU AAA and GM Cen, Ft. Bliss, Tex.
McCoy, John P., to 4052d ASU AAA and GM Cen, Ft. Bliss, Tex.
McGovern, James F., to 5205th ASU Off of the Sr Instr Mich NG, Lansing, Mich.
McKenna, John J., to OC of S, Washington, DC.
McMorrow, Leslie P., to 7071st ASU, Ft. Belvoir, Va
Massingill, James H., to Far East Comd, Yokohama, Japan.
Maykovich, John J., to 4054th ASU Stu Det AAA and GM Cen, Ft. Bliss, Tex.
Miller, James L., to Far East Comd, Yokohama, Japan.
Moore, David J., to Far East Comd, Yokohama, Japan.
Mosher, Kenneth A., to 4052d ASU AAA and GM Cen, Ft. Bliss, Tex.
Neill, Harold A., to OMA, Damascus, Syria.
Okert, Fred H., to Sixth Army 6502d ASU, Ft. MacArthur, Calif.
Pashley, Walter A., to 4052d ASU AAA and GM Cen, Ft. Bliss, Tex.
Perrine, Kenneth I., to 4052d ASU AAA and GM Cen, Ft. Bliss, Tex.
Pinkham, Walter R., to 111th CIC Det Third Army, Ft. McPherson, Ga.
Profita, Vincent, to 4052d ASU AAA and GM Cen, Ft Bliss, Tex.
Pruett, Lloyd O., to Far East Comd, Yokohama, Japan.
Ream, Ellis A., to 4051st ASU Stu Det Arty Sch, Ft. Sill, Okla.
Reay, Joseph R., to 4052d ASU AAA and GM Cen, Ft. Bliss, Tex.
Shook, Theodore, to Far East Comd, Yokohama, Japan.
Sullinger, Carl O., to Office of the Political Adviser, Frankfurt, Germany.
Smith, Gerald W., to 4052d ASU AAA and GM Cen, Ft. Bliss, Tex.
Smith, James L., to Far East Comd, Yokohama, Japan.
Spence, Laurence A., to First Army New Haven Rctg Det No 3, New Haven, Conn.
St. Ours, Frederick E., to Far East Comd, Yokohama, Japan.
Surum, Henry, to US Army Forces Antilles, San Juan, PR.
Vandervort, Charles E., to 4052d ASU AAA and GM Cen, Ft. Bliss, Tex.
Ward, John J., to Far East Comd, Yokohama, Japan.
Weaver, Richard W., to Far East Comd, Yokohama, Japan.
Wickert, Howard T., to 4051st ASU Stu Det TAS, Ft. Sill, Okla.
Young, James W., to 4054th ASU Stu Det AAA and GM Cen, Ft. Bliss, Tex.

First Lieutenants

Adkins, Clodeon, to Far East Comd, Yokohama, Japan.
Allison, Paul W., to 4052d ASU AAA and GM Cen, Ft. Bliss, Tex.
Armstrong, Rodney M., to New York POE, Brooklyn, NY.
Baldwin, Broeck W., to 4052d ASU AAA and GM Cen, Ft. Bliss, Tex.
Bennett, Hyman, to Far East Comd, Yokohama, Japan.
Boone, Daniel L., to Far East Comd, Yokohama, Japan.
Brown, Vivian C., to 4052d ASU AAA and GM Cen, Ft. Bliss, Tex.
Canellos Peter J., to Stu Det Lang Sch, Presidio of Monterey, Calif.
Childs, Clyde F., to 502d AAA Gn Bn, Ft. Bliss, Tex.
Constantine, Walter J., to 4052d ASU AAA and GM Cen, Ft. Bliss, Tex.
Darling, Byron P., to Far East Comd, Yokohama, Japan.
Dick, Arthur J., to 4054th ASU Stu Det AAA and GM Cen, Ft. Bliss, Tex.
Gallimoto, Michael R., to Far East Comd, Yokohama, Japan.
Gentille, Paul J., to 4052d ASU AAA and GM Cen, Ft. Bliss, Tex.
Giammarco, Dante A., to Far East Comd, Yokohama, Japan.
Gillespie, John W., to 4052d ASU AAA and GM Cen, Ft. Bliss, Tex.
Hall, Thomas J., to 4052d ASU AAA and GM Cen, Ft. Bliss, Tex.
Hickey, Edward J., to 4054th ASU Stu Det AAA and GM Cen, Ft. Bliss, Tex.
Hoffman, August A., to Far East Comd, Yokohama, Japan.
Jess, James R., to US Army Caribbean, Quarry Heights, CZ.
Jones, Edward W., to 4054th ASU AAA and GM Cen, Ft. Bliss, Tex.
Kelley, Paul A., to 4052d ASU AAA and GM Cen, Ft. Bliss, Tex.
Lindgren, Elmer A., to 4052d ASU AAA and GM Cen, Ft. Bliss, Tex.
Lindstrom, William R., to US Army Caribbean, Quarry Heights, CZ.
Logan, Mehl M., to US Army Caribbean, Quarry Heights, CZ.
McDonald, Theodore, to 4052d ASU AAA and GM Cen, Ft. Bliss, Tex.
Mecartea, Louis J., to 4052d ASU AAA and GM Cen, Ft. Bliss, Tex.
Melanson, Joseph E., to 4054th ASU AA and GM Br TAS, Ft. Bliss, Tex.
Monroe, Harry J., to Far East Comd, Yokohama, Japan.
Noakes, Ray W., to 4052d ASU AAA and GM Cen, Ft. Bliss, Tex.
Osborn, Preston H., to 4052d ASU AAA and GM Cen, Ft. Bliss, Tex.
Phillips, Robert N., to US Army Alaska, Ft. Richardson, Alaska.
Piserchia, Joseph, to Far East Comd, Yokohama, Japan.
Richman, Murray L., to Far East Comd, Yokohama, Japan.
Ryan, Stanley T., to 4052d ASU AAA and GM Cen, Ft. Bliss, Tex.
Sage, Alfred E., to Stu Det Army Lang Sch, Presidio of San Francisco, Calif.
Smith, George A., to CIC Cen, Cp Holabird, Md.
Stright, Robert M., to 4119th ASU White Sands Proving Ground, Las Cruces, N Mex.
Thomas, Frank J., to 4052d ASU AAA and GM Cen, Ft. Bliss, Tex.
Varney, Roderic A., to US Army Caribbean, Quarry Heights, CZ.
Vasil, Leon N., to US Army Caribbean, Quarry Heights, CZ.
Wells, Edmund L., to US Army Caribbean, Quarry Heights, CZ.
Wightman, Joseph W., to Far East Comd, Yokohama, Japan.
Williamson, Robert N., to 4052d ASU AAA and GM Cen, Ft. Bliss, Tex.

Second Lieutenants

Howe, Marion T., to 4052d ASU AAA and GM Cen, Ft. Bliss, Tex.
Keeling, William O., to Grd Gen Sch, Ft. Riley, Kans.

Address Supplement in the September-October Issue

In the next issue of the Journal will be published a complete listing of all Journal Subscribers as of 15 September 1949. This supplement is an annual feature of the Journal and is useful to readers in making up or revising Christmas card lists.

Make sure that we have your latest address!

Retired officers of the Regular Army and Civilian Components are requested to send their present address.

Nonsubscribers wishing to receive a copy of the September-October issue containing these addresses may do so by mailing fifty (50¢) cents.

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OKINAWA: THE LAST BATTLE. By Roy E. Appleman, James M. Burns, Russell A. Gugeler, and John Stevens. Historical Division, Department of the Army. 1948. 530 Pages; $6.00. For sale by Superintendent of Documents, Government Printing Office, Washington 25, D. C.

This book is the first of the combat volumes to appear in the U. S. ARMY IN WORLD WAR II series, an official record of the war, for which more than ninety volumes are in preparation. The story of *Okinawa: The Last Battle* will be a treasure to the men who fought there. It also gives the thoughtful reader a vivid understanding of the furious fighting that took place in that Pacific area. The authors were members of historical teams who accompanied combat divisions observing the action, interviewing officers and men, including key commanders, and accumulating action photographs. They later revisited the scene of conflict, drew sketches, and finally returned to Washington to complete their study by reference to all pertinent official American documents and journals, and captured enemy records. Every conceivable source necessary to the preparation of an authentic narrative was tapped by these historians, many of whom had held prewar posts at leading American universities.

Okinawa: The Last Battle reanimates one of the most savage encounters in history. The Japanese defended Okinawa as one of their home islands, pitting all their war experience against the total war experience of the Americans. Deeply entrenched in the coral rock of the island, in a system of fortified caves and tombs, the Japanese clung tenaciously to every foot of ground and had to be routed by "blowtorch and corkscrew," as General Buckner called his flame thrower and tank attacks. Relentless as Greek tragedy the battle moves to its conclusion—the total collapse of the Japanese, with suicide for their top commanders and the death of ten Japanese soldiers for each American. Nor was the cost to the victors light. Lieutenant General Simon Bolivar Buckner, Jr., Commanding General of the U. S. Tenth Army, was himself killed in action as the campaign drew to a close.

No aspect of the struggle has been neglected. By their access to official records, the authors have been able to present a full account of high-level planning even concerning matters that were once controversial and secret. They have told how the battle was won by close teamwork on the part of the Army, Navy, Air Force and Marine Corps. Problems of supply, military government of the civilian population, hospital care for the wounded, tactics, and the use of newly developed weapons are abundantly treated. Because of the limited terrain and the concentration of forces, it has been possible to give unusual attention to small-unit action and to individual deeds of heroism. No major battle has ever been more completely recorded.

Like other volumes in the series, this book conforms to high standards of historical scholarship. All statements of fact are exhaustively checked and documented; the appendices include troop lists, charts, and statistical tables; and the whole work is fully indexed. Of more interest to the general reader are the two hundred action photographs and the fifty-four superb maps that detail the progress of the fighting. The format of the book—with its well-designed pages and its binding of green buckram stamped in gold—is both handsome and appropriate to the significance of the content.

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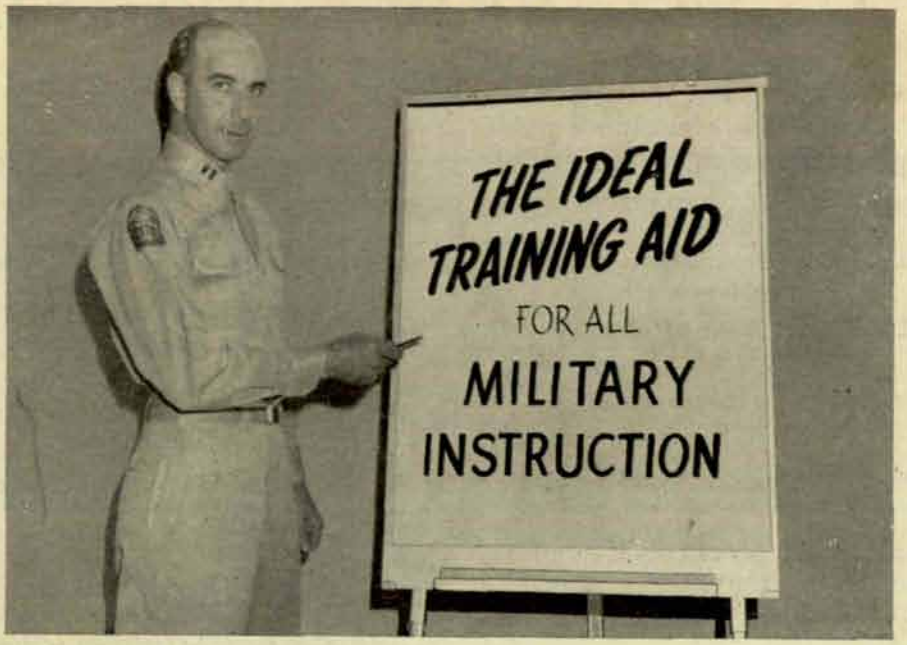

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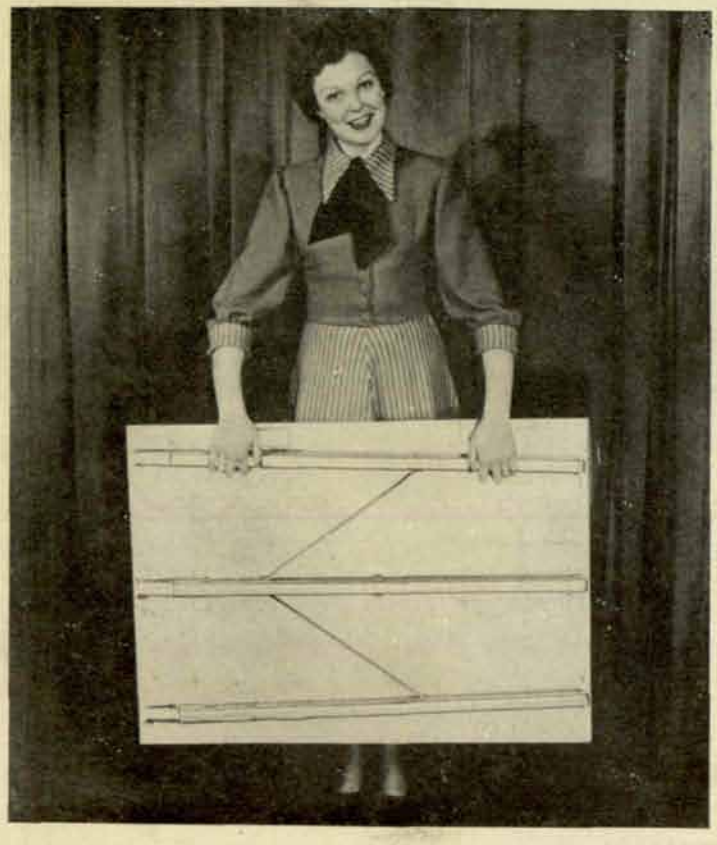

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