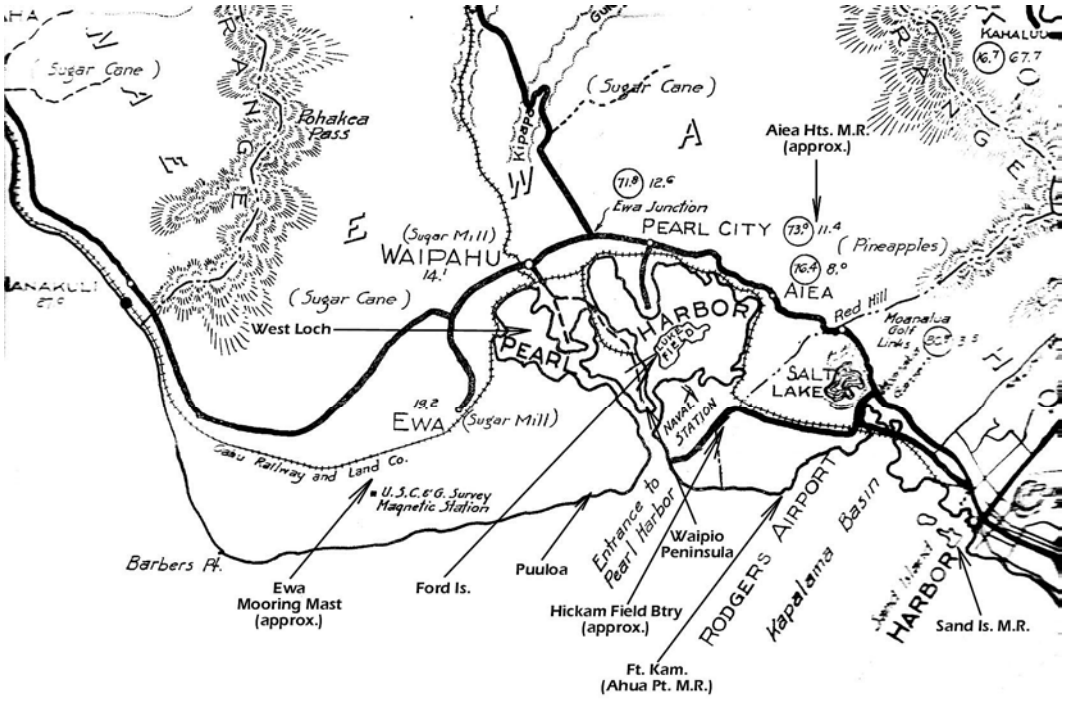
Oahu's World War Two 5-Inch Naval Antiaircraft Shore Batteries

John D. Bennett

Much attention has been devoted to the fixed seacoast weapons the navy provided the Hawaiian Department of the army for emergency seacoast batteries on Oahu shortly after the December 7, 1941, Japanese attack. Less well known are the 5-inch naval antiaircraft guns removed from sunken or badly damaged warships and provided to bolster Pearl Harbor's antiaircraft defenses in the early months of the war. The author thanks CDSG member Roger W. Davis for providing vintage photographs of the 5-inch AA batteries, which ultimately led to writing this essay.



Pearl Harbor and vicinity showing general locations of navy 5-inch AA shore batteries.

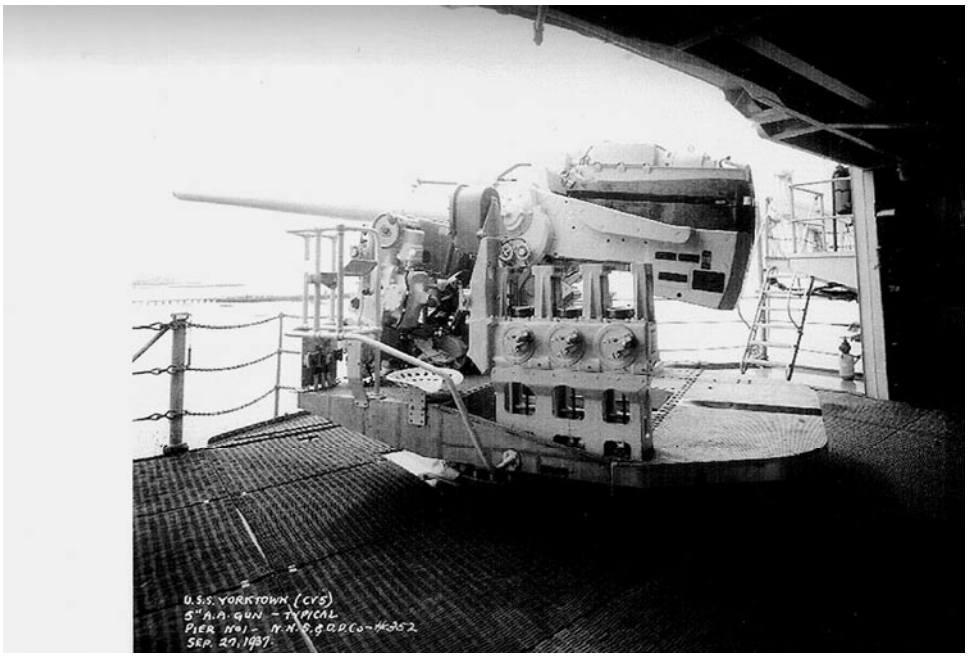
Naval 5-inch/25 and /38 guns equipped nine emergency AA shore batteries that ringed the perimeter of Pearl Harbor on the island of Oahu, T.H. The navy built and manned the first two 5-inch/25 batteries, which were completed on February 9, 1942. Sailors, temporarily displaced from damaged warships, manned the antiaircraft batteries. Eight batteries were armed with four 5-inch/25 naval AA guns each, and one was equipped with four 5-inch/38 dual-purpose naval guns.

The initial 5-inch/25 batteries were armed with guns removed from the badly damaged battleships *California* (BB-44) and *West Virginia* (BB-48), each ship having been equipped with eight.(1)

Battleship gunnery officers considered the 5-inch/25 gun a dual-purpose weapon. The guns, origi-

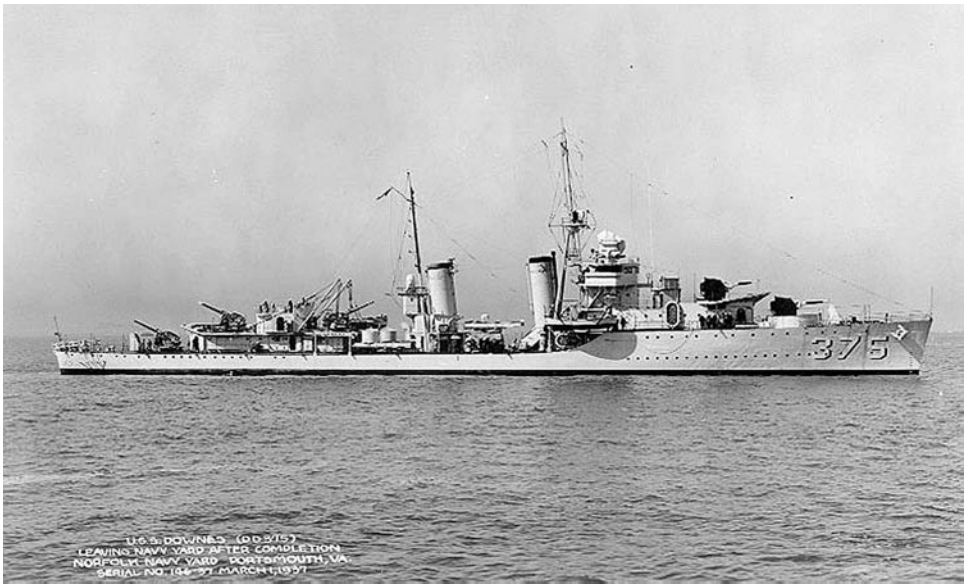
high on front and sides, which provided minimal protection.

5-inch/25 battery onboard U.S.S. *New Mexico*. *USN*

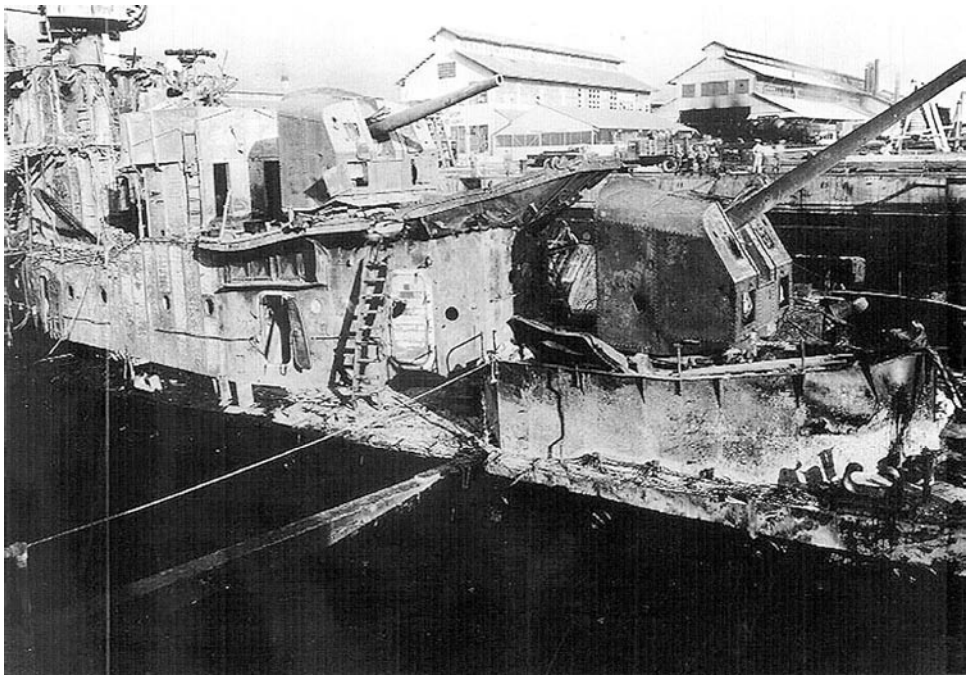


5-inch/38 gun onboard U.S.S. *Yorktown,* c.1937. *USN, NHC*

Additional 5-inch/25 guns were removed from the sunken battleship U.S.S. *Arizona* (BB-39), which had also mounted eight of them. Additional equipment removed from the *Arizona* included 12-foot rangefinders and 36-inch searchlights. The items were placed aboard the Hawaiian Dredging Company's crane barge *Gaylord* and taken to the navy yard for refurbishing.(2) It is not clear if *Arizona's* 5-inch/25s armed any emergency naval AA batteries on Oahu, however, during that time any guns removed from damaged warships in firing condition, and all others able to be refurbished, were most likely pressed into use on shore.



U.S.S. *Downes* after completion on March 1, 1937. *USN, NHC*



U.S.S. *Downes*

USN, NHC

Damaged destroyers in dry-dock after December 7, 1941 attack; Left, *Downes*, Right, *Cassin*, battleship *Pennsylvania* at rear. *USN, NHC*

Three *Mahan*-class destroyers seriously damaged during the Pearl Harbor attack, *Cassin* (DD-372), *Downes* (DD-375) and *Shaw* (DD-373), provided the armament to equip one antiaircraft battery with four 5-inch/38 guns, along with a gun director. The *Mahans* were initially armed with five 5-inch/38s; later in the war the No. 53 5-inch mount was replaced with a twin 40 mm automatic weapon. Both forward mounts (Nos. 51 and 52) were equipped with steel open-ended shields, whereas the three after

main batteries starting forward and working aft; the first digit referred to the gun caliber, the second digit to its position.

Sailors, both officers and enlisted men, "beached" because their vessels were sunk or badly damaged during the attack on Pearl Harbor, provided the workforce for constructing and manning the early naval antiaircraft shore batteries. When army coast artillery units eventually took over manning

the handling of the guns. The sailors, critically needed in the fleet, were eventually returned to their original vessels after they had been repaired, or to other ships.

The Honolulu District engineer (Lt. Col. Theodore Wyman, Jr.) assumed responsibility for constructing the 5-inch AA shore batteries sometime in February 1942. This included building splinter-

generators. All structures were built of 12-inch reinforced concrete. Design and construction of all gun emplacements and fire control stations in the Hawaiian Department was carried out in cooperation with representatives from the Signal Corps, Ordnance Department, and the AA and Seacoast Artillery Commands.(3)

On March 15, 1942, all functions of the Honolulu District Engineer's Office, except for civil works, were transferred to the commanding general of the Hawaiian Department, who also appointed the department engineer, Col. Albert K.B. Lyman, as district engineer. Colonel Lyman kept the two offices separate.(4)

L to R: RADM Furlong, ADM Nimitz, and CAPT Wallin, OIC salvage operations at Pearl Harbor. *USN, NHC*

On February 8, 1942, RADM William R. Furlong, commandant of the Pearl Harbor Navy Yard, wrote the commanding general of the 53rd CA (AA) Brigade at Fort Shafter in Honolulu regarding the engineering work to be considered in conjunction with mounting the naval AA batteries. Admiral Furlong brought up 12 points to be considered, and offered the expertise of naval officers and civilian engineers who had been involved in obtaining materials in conjunction with "the four 5" batteries now mounted." The points were:(5)

1. The manufacture of mounting plates and bolts: The army was to provide the top plate to the navy yard, which would match it to a particular gun.
2. Installation of guns on foundations: Insuring that they were level, and that foundation bolts were tightened securely to insure satisfactory training of guns.
3. Providing 150 lbs of air pressure to gun rammers, to include manufacturing air manifolds.
4.

   of copper tubing.
5. AC to DC motor-generators were needed to supply DC power to the gun directors.
6. Electrical power: Either high-line supply to battery locations, auxiliary engines, or preferably both.
7. Connecting guns to director, installing inter- and intra-battery telephones, connecting motor-generators to high line power supply.

8. Installing fire control switchboards.
9. Providing and installing ready-service ammunition boxes.
10. Providing ammunition racks in magazines.
11. Providing suitable gun covers.
12. Providing messing and berthing facilities, constructing roads to batteries, providing camouflage, water supply, exterior field communications, and sand bags.

Manning Detachments

The 53rd CA (AA) Brigade assumed from the navy the task of manning the 5-inch AA batteries. Six provisional batteries, the 710th through 715th Coast Artillery Batteries (Separate), were organized on Oahu by Hawaiian Department G.O. No. 84 on May 18, 1942, from reinforcements that had arrived on the island since the beginning of 1942. Three of the batteries were assigned to mobile 3-inch AA guns shipped to Oahu early in the war, in the vicinity of Pearl Harbor at Pearl City, the Puuloa Dumps, and at Aiea. The three remaining batteries manned three 5-inch naval AA gun batteries close to the naval station.(6)

The 711th CA (AA) Battery (Separate) was activated at Camp Malakole, Oahu, on May 15, 1942, under 1st Lieutenant C.C. Mast with 1st Lieutenant M. McNeil as executive officer and a cadre of 22 enlisted men from the casual detachment at Schofield Barracks. The battery was assigned to the 713th CA (AA) Battery for rations. On May 26, 1942, the battery moved to Pearl City Peninsula. With additional personnel received on the battery's arrival at its new tactical position, the battery strength was two officers and 107 enlisted men.(7)

Service practices were carried out at Camp Malakole due to the close proximity of populated areas and Pearl Harbor. Live firing with 3-inch AA guns was held two or more times a week during the early stages of the war. The 711th CA (AA) Battery (Separate) prepared a new firing position at the Waipio Peninsula by mid-July 1942. On July 26, 1942, the battery left Pearl City for Waipio in several trips, since there was not enough transport to move the battery and equipment in one transfer. During the remainder of July, the battery improved the new firing positions for the four M3 3-inch AA guns.(8) The 711th CA Battery manned a 5-inch naval AA battery as reported below, presumably the completed Waipio Peninsula battery.

The 714th CA (AA) Battery (Separate) was activated at Camp Malakole on May 15, 1942, under 1st Lt. William M. Thiz, with 1st Lt. Richard E. Marsell as executive officer and an initial cadre of 22 enlisted men. The 714th was attached to the 713th CA (AA) Battery (Separate) for rations until assigned to the 710th on May 17. The arrival of an additional 106 men on May 24, 1942, brought the battery's strength to two officers and 128 men. The battery trained at Camp Malakole until July 11, 1942, when it was ordered to the Pearl City Peninsula to man the position previously manned by the 711th CA (AA) Battery. The 714th continued to man the Pearl City position until July 26, when it was moved to a new position in the same vicinity. The battery remained in the Pearl City area until November 24, 1942, when it was reassigned to man a 5-inch/25 naval AA battery on Aiea Heights.(9)

Prior to the reorganization of the AA units on Oahu on December 12, 1943, the Puuloa battery was manned by Battery G, 97th CA; the 710th CA (AA) Battery (Separate) manned Battery No. 5 at Fort Kamehameha; and the 714th CA Battery was assigned to the Aiea Heights gun position.(10)

A November 18, 1943, memorandum listed seven of the nine units manning the guns: Batteries H and F, 95th CA; C and G, 97th CA, and the 711th, 712th, and 714th provisional CA batteries, but the

The author knows nothing further regarding the locations or identities of other units that manned the 5-inch naval AA batteries.

Emplacements

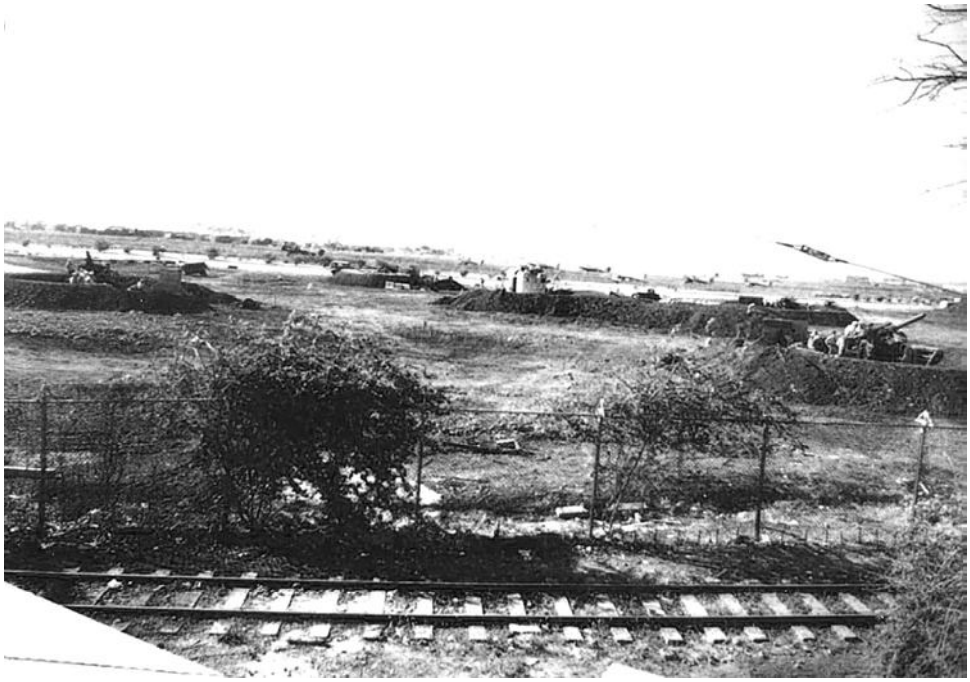
The earliest 5-inch navy antiaircraft gun emplacements were basic field fortifications that included reinforced concrete gun blocks 15 feet square and four and one-half feet deep, weighing some 76 tons. Period photographs showed the emplacements revetted with several courses of sand bags to provide some measure of protection during an attack.

A photograph illustrating field fortification techniques employed at the early batteries depicts a gun emplacement at the Ewa Mooring Mast Battery. The sand bags were lower in the front to permit the gun to fire against surface targets. Also incorporated into the design were two offset splinterproof entrances in the right and left perimeter walls, with vertical steel or iron panels some six feet high, which provided side and overhead protection at the entryways. Similar, but shorter, panels protected the ready-ammunition boxes at the left and right rear portions of the emplacement. Horizontal panels may have been placed above the ammunition boxes, as sand bags were shown atop the right hand box.

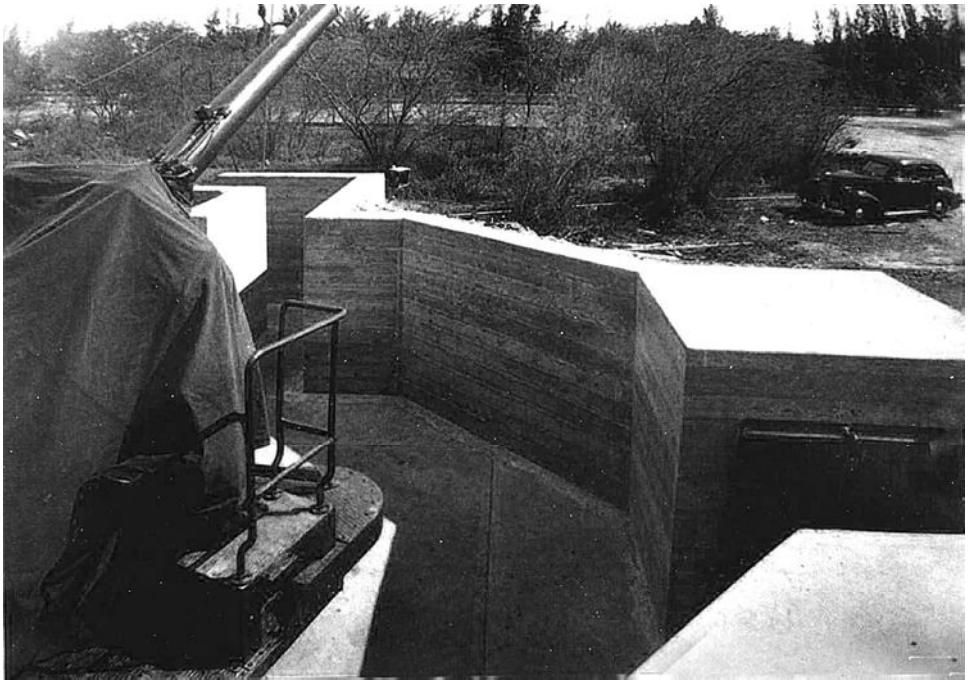
battleships damaged at Pearl Harbor.

The gun emplacements were improved after army engineers took over construction of the 5-inch AA batteries. The emplacements included heptagonal reinforced-concrete structures with parapets some four feet high and about one foot thick, three ready-ammunition storage lockers with steel doors, one open storage space, an offset double-walled entryway, and a larger opening at one corner. Sturdier than the early field fortifications, the concrete emplacements were not susceptible to cave-ins.

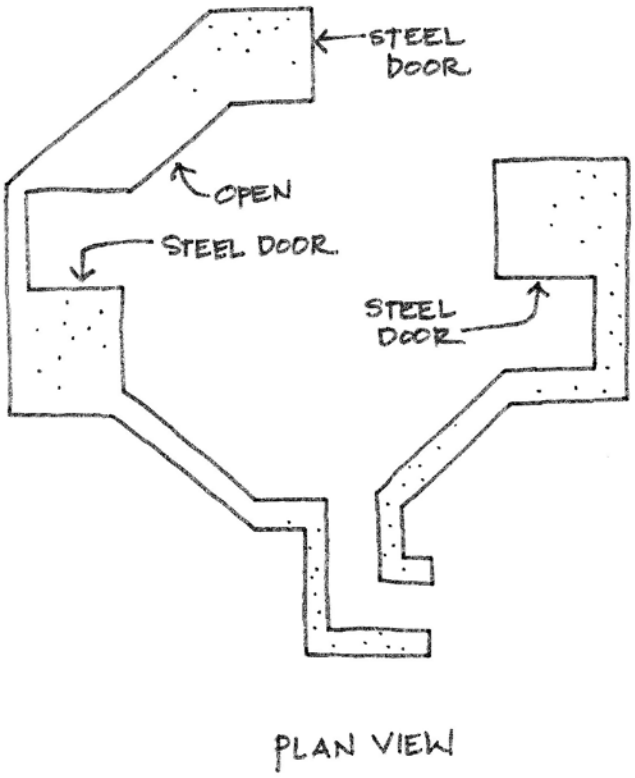
Ewa Mooring Mast Battery, showing typical gun emplacement. (Annotations not the author's). *Courtesy of*



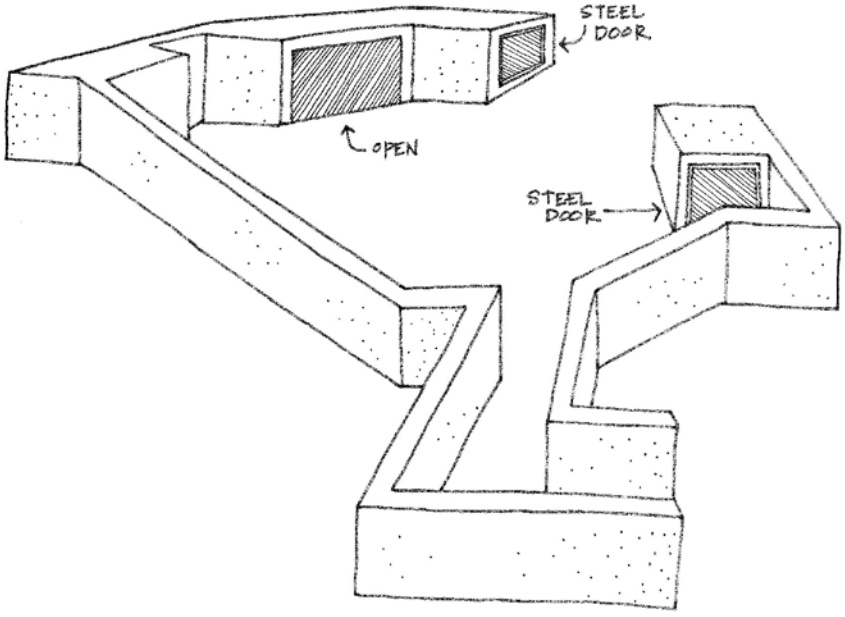
Hickam Field Battery, showing layout including Mk19 gun director in the middle. *Davis Collection*



construction. *Davis Collection*



Plan view of 5-inch navy AA Gun emplacement at Waipio Peninsula. (No scale and orientation.) *Katharine Slocumb*



Perspective view of same gun emplacement. (No scale and orientation.) *Katharine Slocumb*

The typical 5-inch naval shore battery was equipped with the following splinterproof structures:

1. Four gun emplacements, including reinforced-concrete gun blocks.
2. One navy gun director and rangefinder*.
3. One battery command post.
4. One emergency generator room.
5. One air compressor/air storage bottle room.
6. One or two reserve-ammunition magazines.
7. One fire control switchboard room.

* It is not known whether the batteries were equipped with navy directors and rangefinders after construction was assumed by the army engineers.

Specifications for 5-inch naval AA and DP guns

5-inch/25, single pedestal mount

Weight of gun and mount:	20,300 to 20,240 lbs
Rate of fire:	15 to 20 rounds per min.
Projectile weight:	53.85 lbs HE (fixed)
	54.00 lbs AAC* Mk28 (fixed)
Propellant charge:	9.6 lbs
Muzzle velocity:	2,200 f/s
Barrel life (approx.):	3,000 rounds
Range:	14,500 yds @ 45º
	27,400 ft, AA ceiling

5-inch/38 Mk 21, single open-back pedestal mount

Weight of gun and mount:	29,260 to 30,140 lbs
Rate of fire:	12 to 15 rounds per min.**
Projectile weight:	54.0 lbs AP (semi-fixed)
	55.18 lbs AAC Mk31 & 35
Propellant charge:	15.5 lbs NF (flashless)
Muzzle velocity:	2,500 f/s
Barrel life (approx.):	4,600 rounds
Range:	9,506 yds @10º (AAC Mk49)
	17,392 yds @45º (AAC Mk49)
	37,200 ft, AA ceiling (AAC Mk49)

* Antiaircraft common projectiles
** Mounts lacking internal hoists.

Sources: John C. Reilly, Jr., *United States Destroyers of World War Two.*
"United States Naval Guns."

5-inch/25 and/38 Naval Guns

The Bureau of Ordnance began work in 1921 on the 5-inch/25 naval AA gun equipped with a vertical sliding-wedge breech. It was designed to fire fixed ammunition, and included a power ramming mechanism.(12) The gun was placed in service in 1926. The Mk17 variant submarine gun fired separate-loading ammunition.

The 5-inch/38 naval DP gun was equipped with a vertical sliding-wedge breech mechanism, hydraulic recoil and hydropneumatic recuperator, power rammer, power elevating and training gear, and a movable-prism telescope. The breech mechanism was similar in operation to the 3-inch/50-caliber naval gun, with a few minor differences. It fired semi-fixed ammunition that included antiaircraft common, common, illuminating, and WP smoke. The gun was capable of firing 15 rounds per minute, with 22 rounds per minute reported.(13)

The rammer mechanism, a semi-automatic, electric-hydraulic unit mounted alongside the loading tray on the upper rear portion of the slide, functioned at any gun elevation. Power was provided by a 7.5 h.p. electric motor.(14)

All mounts were equipped with electric-hydraulic power drives for training and elevating the gun.

Naval Gun Director Marks 19 and 33

Two basic types of naval gun directors were used in conjunction with the early naval AA shore batteries on Oahu, the Mk19 and Mk33.

The Mk19 gun directors was the first DP director for the 5-inch/25 naval gun. Its development began in 1922; it first appeared in 1928, and by 1939 was still installed in the *Oklahoma, Pennsylvania, California, Maryland, Lexington,* and *Augusta* classes, as well as the *Pensacola*.

The Mk19 was the first effective heavy AA director in any navy. It originally consisted of a Mk4 electromechanical computer, called a "rangekeeper" by the navy, a ballistic computer, and a transmitter. The Mk28 and Mk33 directors superceded it. Fifteen-foot stereoscopic rangefinders were added in 1940, the directors were obsolete by 1941, but not replaced until 1943-44.(15)

The Mk19 director mount was positioned about the middle of the foremast, on the port and starboard sides, of the *California*, *Maryland*, *Oklahoma* and *Pennsylvania*-class battleships. It was also mounted on several other classes of U.S. naval vessels including the *Lexingtons, Pensacolas* and *Augustas*, in conjunction with their 5-inch/25 gun batteries.

The Mk33 mounted atop the pilothouse of *Mahan*-class destroyers was the gun director for their main battery of five 5-inch/38 DP guns. Photographs identified as the Hickam Field and West Loch 5-inch batteries portray what appear to be Mk19 gun directors at each site.

The Mk33 director, first mounted on *Farragut*-class destroyers in 1934, incorporated an optical rangefinder and a rangekeeper. Besides solving the two-dimensional surface gunfire problem, it could also handle three-dimensional antiaircraft control. The mechanical brain of the system was the Ford rangekeeper, which could cope with target speeds up to 275 knots and diving speeds up to 400 knots.(16) Radar was later fitted to the Mk33, although difficulty was experienced in balancing.

Naval gun directors controlled a battery of guns from a remote position. Target data from the director in the form of elevating, training, fuze setting, and sight setting was electrically transmitted to

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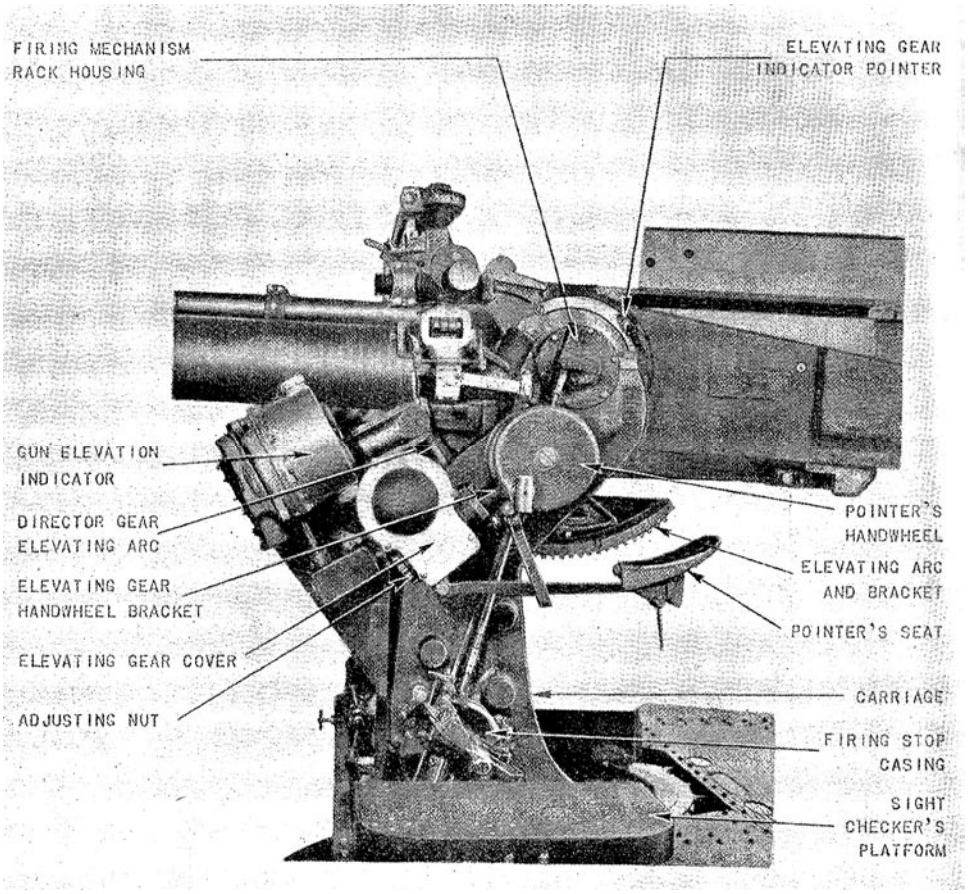
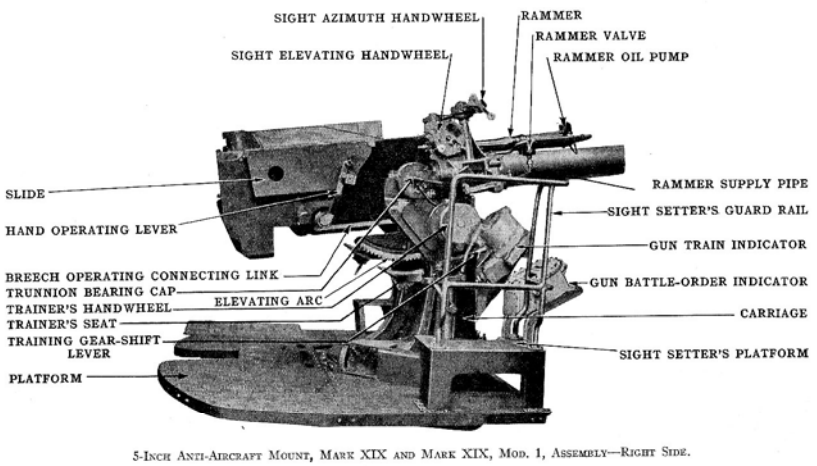
tor-generator in the director mount, which converted alternating current from generators powered by internal-combustion engines, or commercial power when available, into 125 volts DC, the standard shipboard power supply.(17)

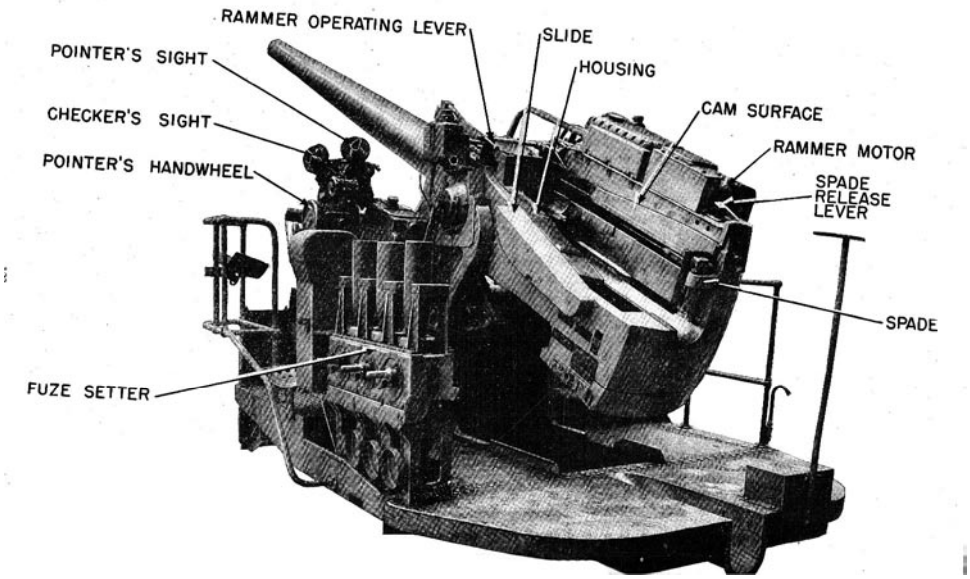


5-inch/25 gun mount Mk XIX, pointer's side. *Naval Ordnance, 1933*

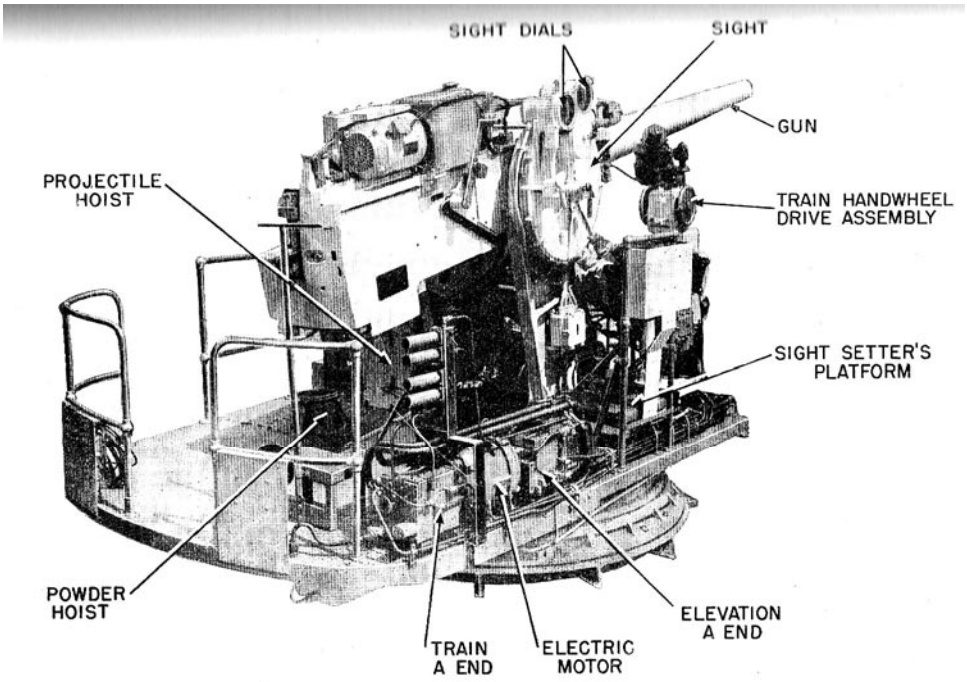


5-Inch Anti-Aircraft Mount, Mark XIX and Mark XIX, Mod. 1, Assembly—Right Side.

5-inch/25 gun mount MkXIX, trainer's side. *Naval Ordnance, 1933*



5-inch/38 gun, pointer's side. *Naval Ordnance and Gunnery, 1944*



5-inch/38 gun, trainer's side. *Naval Ordnance and Gunnery, 1944*

The fire control switchboard provided the switching terminals from the director to the individual guns of the battery.

Pointers and trainers at the guns had to keep their dials matched continuously to avoid losing director's line-of-sight was on the target. Firing keys at each gun held the firing circuits open when the shields varied from thin weather-proof types used on destroyers to 1-1/2 inches on battleships.

U.S.S. *West Virginia* showing port Mk19 gun director. *USN, NHC (edited by author)*

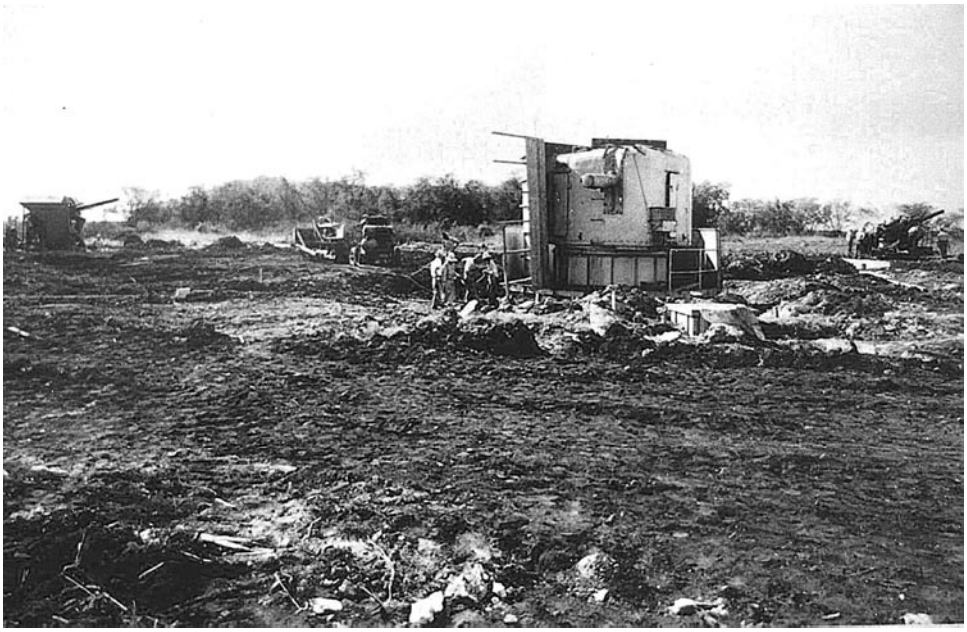
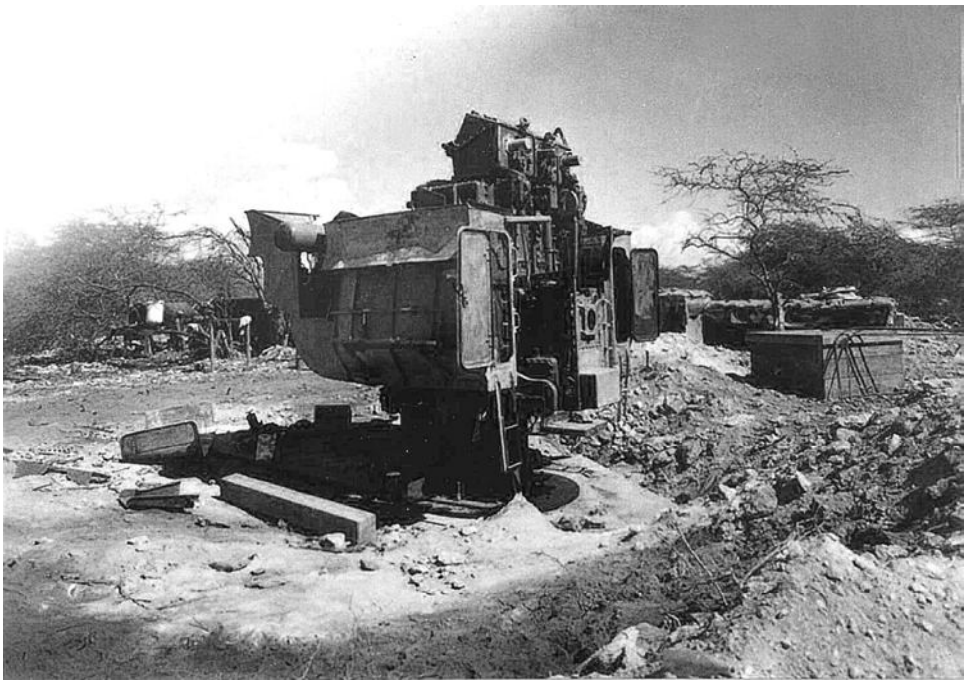
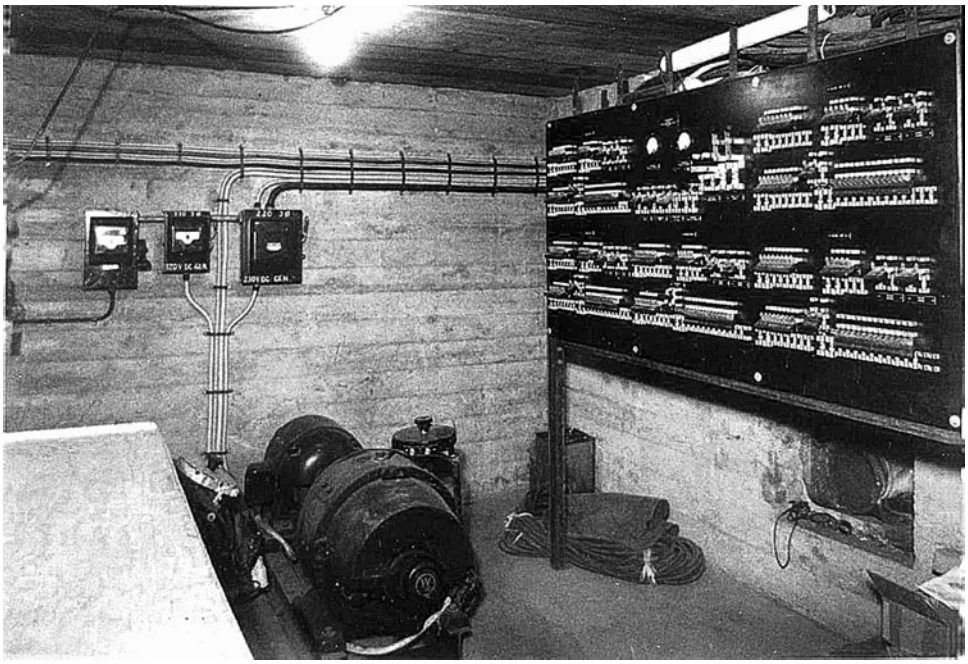


Photo described as "West Loch Director," identified as a Mk19 gun director. Note the modification to the
Davis Collection



Mk33 gun director used in conjunction with the Ewa Mooring Mast Battery. The director removed from the U.S.S. *Cassin* was used with the 5-inch/38 guns. *Davis Collection*



Davis Collection

Battery No.1 (Hickam Field)

The first numbered battery was located near the border of the Army Air Forces' Hickam Field and the Pearl Harbor main gate (now the Nimitz Gate), on AAF property. The site was selected on January 20, 1942, and completed by February 9 of that year.(19)

Battery No. 1 was built and initially manned by personnel from the U.S.S. *California*. Lt. Fred Purdy, USN, fire control officer onboard the *California*, was the initial battery commander. Known as "Naval Antiaircraft Shore Battery (NASB) No. 1," it was later manned by army coast artillery troops. The battery was four 5-inch/25s and one Mk19 gun director removed from the *California*.(20)

The emplacements of NASB No. 1 were a basic design, reinforced-concrete gun blocks revetted with sandbags that appeared to be placed in a circular pattern, stacked to permit firing at surface targets. A thin layer of gunite applied to the sandbags prevented them from tearing when the gunners sat on them. Capt. Cary Hall, USN, described the parapets as "a favorite roosting spot." Ready-ammunition boxes were recessed within the interior of the emplacements. A sandbagged magazine, some distance away, held reserve 5-inch ammunition.(21) The exterior walls of the emplacements were embanked with earth.

To compensate for mud around the emplacements during wet weather, crushed rock was obtained without benefit of official requisition by a battery crewmember, Boatswain's Mate 2nd Class (BM2) Dotson. After about ten loads of rock were delivered, the antiaircraft gunners had the benefit of new gravel paths throughout the battery area. Dotson and Seaman Jones appropriated barbed wire, a scarce commodity in those days, and soon the battery was encircled by coils of the defensive wire.(22)

Navy sound-powered telephones were employed at the battery, which confused one army major, who attempted to find the power source by lifting up every foot of the wire to no avail.(23) It is not known if the three other antiaircraft batteries constructed by the navy, Ewa-Mooring Mast, Puuloa, and West Loch, were also equipped with sound-powered phones, or the five subsequent batteries.

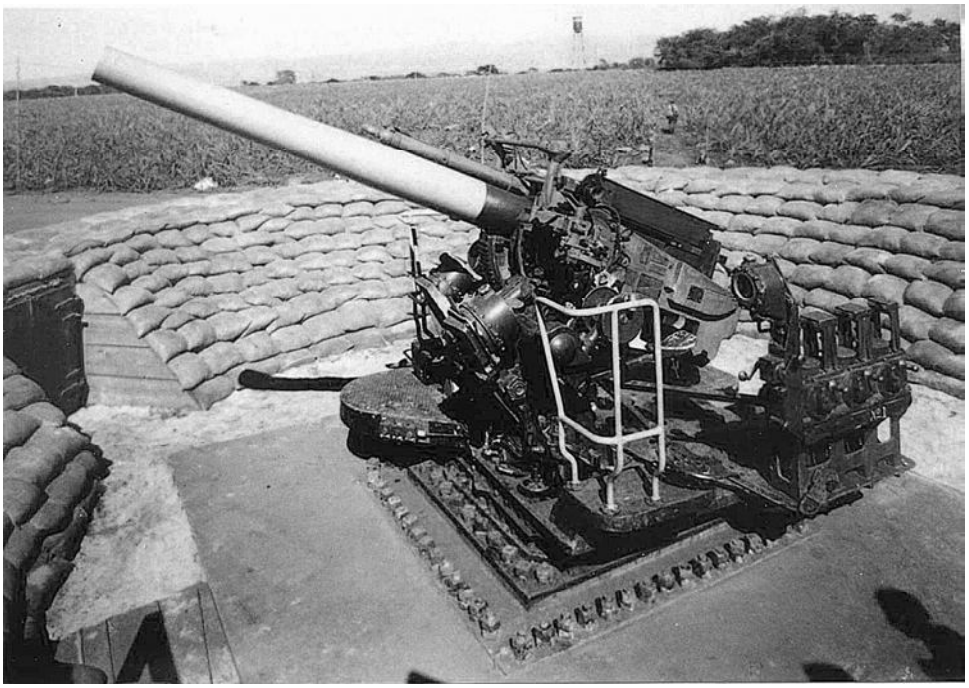
Battery No. 1 seems to have been designed in a diamond formation, which appeared to be the style employed by marines at two locations on Johnston Atoll in World War II. "Batteries Godbold" (3-inch M3) and Lewis (90 mm) were built on Johnston Island and nearby Sand Island Annex, respectively in the formation.(24)

Battery No. 1 became the standard by which all other AA batteries were judged, after HQ, 53rd CA (AA) Brigade, at Fort Shafter ordered all AA batteries to camouflage their positions. BM2 Dotson soon showed up with truckloads of fence posts, coils of wire, rolls of chicken wire, and bundles of dyed burlap, called "garlands." The poles were erected, the chicken wire spread between them, and the garlands were woven between them as directed by an army pamphlet, "How to Camouflage for Fun and Profit." Battery No. 1 became the first AA battery in Hawaii to apply camouflage after the order was issued; soon every battery commander was ordered to take a short course in the application of camouflage by observing the methods employed at the battery.(25)

Captain Hall recalled with regards to training army personnel that were to eventually take over manning the naval AA batteries, "Our battery trained all of the Army crews that relieved the Navy crews. We would absorb an Army company [battery] mostly composed of men who had never fired a gun, and deluge our soldier allies with lectures and drills for three or four weeks. They graduated during a firing exercise at the Navy battery on Ewa Beach." (26)

The approximate battery coordinates are: 21° 20' 47" N, 157° 56' 40" W (NAD 83/WGS 84.

complex for Hickam AFB is the approximate location of the former AA gun battery.



"West Loch 1," 5-inch/25 gun presumed to be Gun No.1. Note the sandbag revetments. *Davis Collection*

West Loch looking southeast. *Author, July 2006*

Battery No. 2 (West Loch)

The second battery was built at West Loch, the farthest west of all the Pearl Harbor lochs (loch being the Scottish name for lake or an arm of the sea). Naval personnel built and initially manned the battery. The location of the West Loch AA battery has not been pinpointed; it could have been built on land cultivated by the Ewa Plantation Company, which grew sugarcane around West Loch ca. 1939.(27)

Battery No. 2 was completed on February 9, 1942, armed with four 5-inch/25s removed from the *West Virginia*

January 9, 1942, the port 5-inch AA battery having been removed earlier.(28) A photograph labeled "West Loch Director" shows what appears to be a modified Mk19 director with a vertical apparatus at-

apparatus ran from top to bottom, and appeared to be equipped with several short horizontal dipoles that protruded forward. This may have been an early radio ranging antenna (fire control radar), but this has not been confirmed.

The same photograph also depicted what appears to be a 5-inch/38 gun enclosed in a shielded

to the right of the Mk19 director. The placing of the 5-inch/38 guns and a Mk 19 director at the West Loch site was a bit out of the ordinary, as the only battery reportedly armed with 5-inch/38s was the Ewa Mooring Mast battery, with one Mk19 director and four 5-inch/38s, all removed from the destroyers *Cassin, Downes,* and *Shaw.* The author is unaware of any sources that would account for an extra battery of 5-inch/38s built on Oahu.

On December 18, 1941, all farms adjacent to West Loch were ordered evacuated for security

give two days for preparation, and the men were allowed to return to their farms during daylight until livestock could be moved and crops harvested. The farmers had only recently been relocated to the West Loch area by the Farm Security Administration (FSA), consequently, the farmers lost practically all their life savings plus considerable money borrowed from the FSA.(29)

Battery No. 3 (Puuloa)

The third numbered antiaircraft battery was in the ancient Hawaiian sub-district of Puuloa, above the shoreline, west of the Pearl Harbor entrance channel. Battery No. 3 was completed by naval personnel in May 1942.(30) The location was ideally suited for firing at surface and aerial targets.

A photograph shows one emplacement armed with a 5-inch/25 naval AA gun and a ready service ammunition box with "USS Utah" painted on the door, possibly by survivors of the capsized *Utah* (AG-16), the former-battleship converted into a gunnery/target ship. Battery No. 3 became the firing battery for army coast artillerymen being trained on naval AA guns by navy gunners.

The battery may have been built adjacent to the Fleet Machine Gun Training School, at Fort Weaver, the site on December 8, 1941, of three batteries of 20 mm automatic weapons and .50-caliber AAMGs manned by marines. Coordinates for the southwestern edge of the present Marine Corps Puuloa Rifle Range are 21º 18' 51" N, 157º 59' 24" W.

Navy gunners slept under canvas near the gun battery in an area cleared of algaroba trees, as shown in a photograph. It is not known whether theater-of-operations structures were later built to house the men and the battery support functions.

A 3-inch battery, Fixed AA Battery No. 18, was built at Fort Weaver in 1927. The four M1917 3-inch AA guns on fixed M1917 carriages were arranged in the then-standard foursquare pattern. The battery was manned by Battery A, 15th CA (HD) Regiment, as an alternative assignment until August 13, 1944, when the 15th CA was inactivated. The personnel were transferred to Battery A, 53rd CA (HD) Bn; the primary assignment of the battery was to man both 16-inch 50-caliber M1919 guns of Battery Edward B. Williston at the fort.(31)

In the spring of 1941, AA detachments were formed in several seacoast batteries of the 15th, 16th, and 55th CA (HD) Regiments to man the fixed AA batteries in the harbor defenses. These detachments th CA were incorporated into the 97th CA (AA) Regiment just prior to the war and the detachments from Batteries A and C of

Emplacement No. 4 at Puuloa armed with a 5-inch 25-caliber gun. Ammunition ready box marked "USS *Utah.*" Note armed naval sentry. *Davis Collection*

distance. *Davis Collection*

Gun No. 3 at Puuloa, showing tent encampment at the rear of the battery. *Davis Collection*

Author, July 2006

the 16th CA and Batteries E and F of the 55th CA manned the batteries at Forts DeRussy and Ruger and at Sand Island M.R.(32)

In October 1941, the 3-inch AA guns of Fixed AA Battery No. 18 were taken over by Battery G of the partially organized 97th CA (AA) Regiment. The 3-inch M1917 AA guns were soon replaced with 90 mm M1 DP guns on fixed M3 mounts. It appeared that Battery G, 97th CA, also manned the 5-inch naval guns of Battery No. 5, as reported by General Perkins in his November 18, 1943, letter to the CG, Hawaiian AA Command.(33) Before the war's end, the 90 mm guns had been replaced by 4.7-inch (120 mm) AA guns.

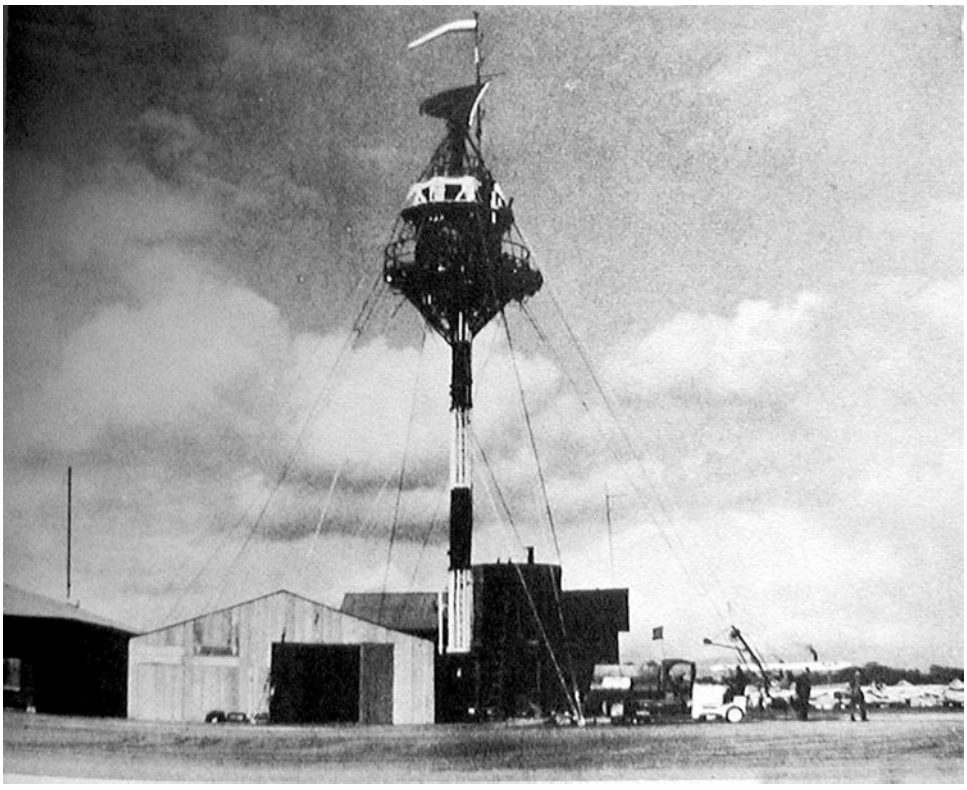
On December 12, 1943, the air defenses of the Hawaiian Department underwent reorganization, and Battery G, 97th CA (AA), was assimilated into Battery B, 754th AAA (Gun) Bn. Battery B of the 754th continued to man the 4.7-inch AA guns at Fort Weaver until the unit relocated to another battery site in the Pearl Harbor/Hickam area in 1945. The 881st AAA Battery (Gun) took over Fort Weaver's AA guns in August 1945 and manned them through December 1945, when the fort was placed in caretaking status.(34)

Battery No. 4 (Ewa Mooring Mast)

Battery No. 4 was located on the Ewa Plain near the unused navy mooring mast west of Pearl Harbor. The site became the Ewa Marine Corps Air Station (MCAS), commissioned on April 15, 1942, that eventually evolved into the Pacific Marine Corps aviation headquarters during World War II.

The battery was built on sand and limestone coral in a clearing of thorny algaroba trees, which grew profusely on the southwest and west coasts of Oahu before housing and industrial development. The SW end of the MCAS runway was approximately 2.7 miles NE of the NE tip of the adjacent Barbers Point Naval Air Station runway. The Ewa MCAS was closed down and disestablished in 1952.

The Ewa Mooring Mast Battery was built and initially manned by navy personnel. Armed with four 5-inch/38s, one from U.S.S. *Downes* and the other three from U.S.S. *Shaw*, it was equipped with *Cassin*.(35)



Ewa Mooring Mast. *USMC*

Davis Collection

Closer view of the gun block of a 5-inch/38 gun, "Ewa 4," showing conduit for electrical and air compressor lines. *Davis Collection*

Battery No. 5 (Fort Kamehameha)

Construction of this battery, begun by the navy, was completed by army engineers, under Job Order 508-W. The battery was on the Ahua Point M.R., at the eastern edge of Fort Kamehameha, along with a variety of other coast artillery installations including a series of steel-tower fire control stations, a 3-inch M3 AA battery, and a 5-inch/51 naval gun battery built in the early months of World War II.

Battery No. 5, built between May and June 1942, included four 5-inch/25 guns on concrete gun blocks, two magazines, an air-bottle storage structure, machine-gun pillbox, and a battery command post. By April 9, 1942, the installation was reported complete, with the exception of electrical connections and telephones, and the guns had been test fired.(36)

The 710th CA (AA) Battery (Separate), activated in May 1942, manned the battery. On December 12, 1943, the 710th was redesignated Battery D, 97th CA (AA) Bn. Battery No. 5 remained active well into 1944, after the Hawaiian Department recommended that six naval AA batteries be replaced by 90 mm guns with remote controllers and M9 directors.(37)

Battery No. 6 (Waipio)

Preliminary construction of the Waipio battery was started by the navy and finished by army engineers and their civilian contractors, Hawaiian Constructors, on November 26, 1942, under Contract No. W-414-eng-602 and Job Order 599-W.(38)

Battery No. 6 was built near the shore on the eastern section, about the mid-point of Waipio Peninsula of Pearl Harbor, on navy land leased to the Oahu Sugar Co., who cultivated sugarcane on three fields on the peninsula, Nos. 32-34, as depicted on an April 1925 map. The battery was situated in Field No. 33.(39)

The completed work transferred to the coast artillery on October 21, 1942, included "Installation of 5"/25 Naval AA Guns at Waipio, T.H." Supplemental Addition No. 4 to Job Order 599-W called for "construction of two splinterproof shelters for standby generators and air compressor room," which

No. 6.(40)

Gun No. 2, Waipio 5-inch/25 AA battery under construction in June 1942. *NARA*

One of the Waipio 5-inch/25 AA gun emplacements. *Katharine Slocumb, 1995*

Ready-ammo locker of the Waipio 5-inch/25 AA gun emplacement. *Katharine Slocumb*, 1995

The 711th CA (AA) Battery (Separate) is presumed to have manned Battery No. 6, as they occupied an M3 3-inch AA position on the peninsula on July 26, 1942. A November 18, 1943, memo by Brigadier General R.M. Perkins, CG, 53rd CA (AA) Brigade, listed the 711th as manning a 5-inch naval AA battery.

The Waipio Peninsula comprises some 1,471 acres, of which 1,259.67 acres of Naval Reservation No. 526 (Waipio N.R.) had been leased to the now defunct Oahu Sugar Co., which shut down in 1995.(41) Harvested sugarcane was hauled to the nearby mill in Waipahu by 3-foot-gauge steam locomotives during World War II.

Katharine Slocumb, Architect-Historian for Mason Architects, in Honolulu, conducted an archaeological survey of the Waipio Peninsula in March of 1995 for Paul H. Rosendahl, Inc., who was hired by the navy to produce a cultural resources management plan for NAVMAG-West Loch.

Several World War II-era constructions were found mainly on the eastern portion of the peninsula. Of interest were four reinforced-concrete structures found near the east shore in a sugarcane field, including two gun emplacements, one smaller than the other. A photograph was taken of what has been identified by the author as a 5-inch/25 navy AA gun emplacement. Ms. Slocumb prepared two drawings of the gun emplacement in question, which were compared to NARA photographs of the Waipio AA Battery's Gun No. 2 being constructed and one of a completed Ewa (Mooring Mast) gun emplacement. Another photograph was tentatively identified as a fire control switchboard room.

The Parks and Recreation Department, City and County of Honolulu, currently leases 260 acres of navy land for 50 years. The site has been turned into a soccer complex, located on the north end of the peninsula. The park site is within a 1-1/2 mile radius "blast zone" of Naval Magazine Pearl Harbor's West Loch Branch, which prevents building non-blast-proof structures.

Battery No. 7 (Ford Island)

The Ford Island AA battery, started by the navy, was completed by army engineers under Work Order 600.118-B-102.0, including "transportation and installation of four 5-inch/25 AA guns, and other necessary construction." A May 12, 1943, report of inspection by a board of army officers noted that the two air compressors and tanks had not been installed in the generator and compressor rooms, and the fuel tank for the generator had not been connected.(42)

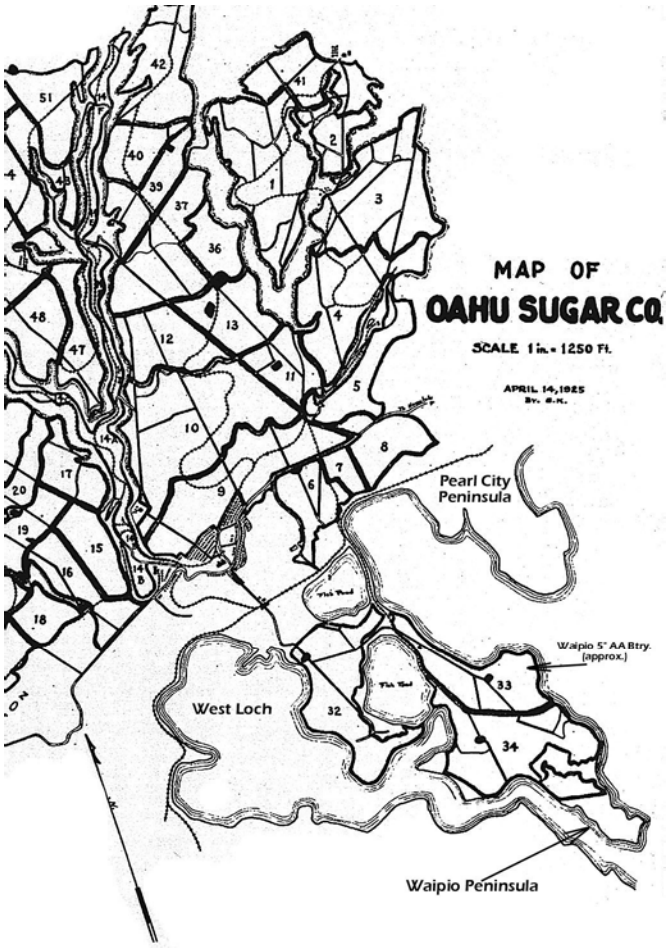
The location of this battery site has not been established. The island was the site of Naval Air Station Ford Island in 1941, used jointly by the army and navy, which evolved from the Army Air Corps' Luke Field (1919-1939). It became the headquarters of the Commander U.S. Naval Air Forces, Pacific Fleet (COMNAVAIRPAC), established on September 1, 1942, as well as an important overhaul and repair base.(43) The land area totals 0.707 square miles (452.5 acres). The famous Pearl Harbor "Battleship Row," the location of great devastation to several of the Pacific Fleet battleships and their complements during the December 7, 1941, attack, was off the northeastern portion of the island.

Battery No. 8 (Aiea Heights)

Detailed plans for the Aiea Heights Battery were completed and preliminary fieldwork commenced by April 9, 1942. Hawaiian Constructors, under contract to the army engineers, built the battery un-

of four 5-inch/25 naval AA guns emplaced in reinforced concrete at the Aiea Heights M.R. Work was completed on November 26, 1942. George Wills, civilian superintendent for the Corps of Engineers, reported on September 18, 1942, that all four guns and the director were being mounted, and am-

Possible fire control switchboard/plotting room for the Waipio AA Battery. *Katharine Slocumb, 1995*



Map of Waipio Peninsula showing approximate location of the 5-inch AA battery.

Extant reinforced-concrete WWII bunker at Napuanani Park, location of the Aiea Heights AA Battery. *Author, 2006*

Author, 2001

munition storage shelters and gun bases were sufficiently cured to fire the guns. The base camp was 90% complete, but work had not commenced on the generator room. Wills thought a temporary fire control system could be improvised using the "old Model 1917 RA corrector [antiaircraft data computer, M1917], which will give fairly good firing data to the batteries pending approval from the AA Command."(44)

A report of completed works (RCW) dated October 26, 1942, acknowledged that installation of four 5"/25 naval AA guns had been completed on October 21, 1942. The RCW further mentioned that Addition No. 5 to Job Order 526-W, which included the construction of a splinterproof stand-by generator and air-compressor rooms, as had been completed, as had Addition No. 6 for unspecified work.(45)

Battery No. 8 was built near the 53rd CA (AA) Brigade Command Post (CP), which became the Hawaiian Antiaircraft Command (HAAC) CP later in 1942. The 714th CA (AA) Battery (Separate), assigned to the Aiea Battery, was redesignated in mid-December 1943 as Battery B, 754th AAA (Gun) Bn.(46)

The former Aiea Heights M.R. site is now the City and County of Honolulu's "Napuanani Neighborhood Park," 4.425 acres just above the 600-foot elevation. The acreage is leased from the State of

before residential dwellings were built, and is approximately 2.9 miles northeast of Ford Island at Pearl Harbor. Coordinates: 21° 23' 20" N, 157° 54' 51" W.

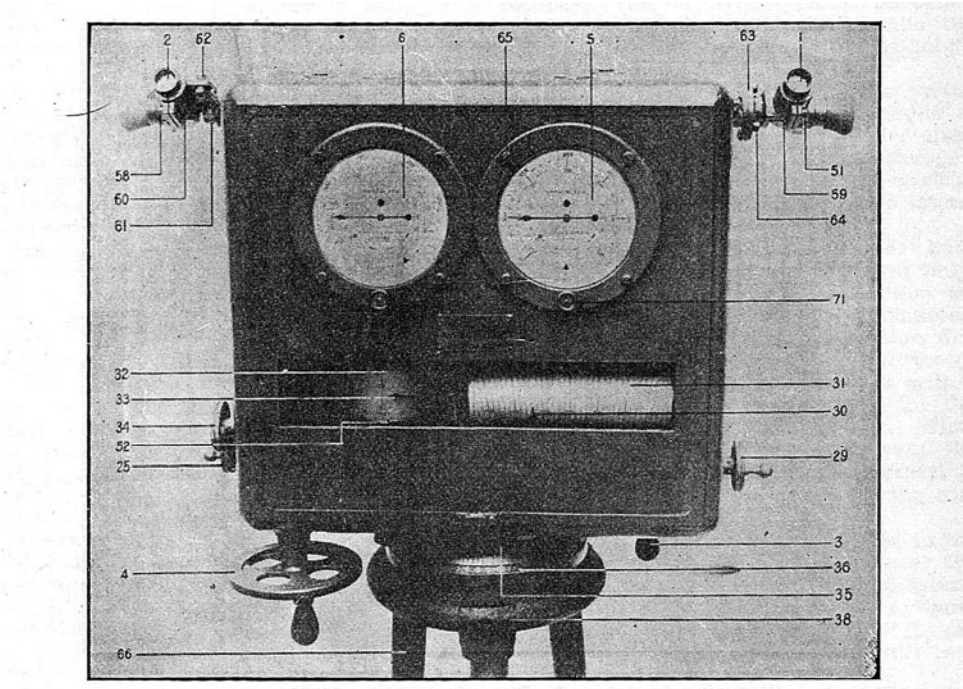
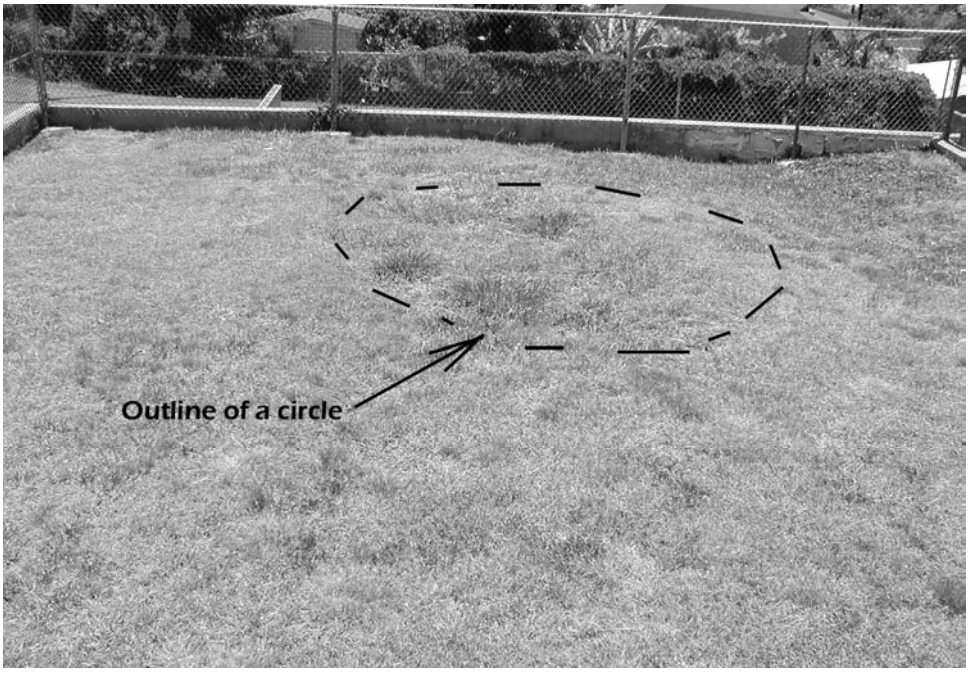


Plate 7. Antiaircraft Data Computer, M1917 (Front)

1. Vertical telescope
2. Lateral telescope
3. Elevating handwheel
4. Traversing handwheel
5. Vertical speedometer
6. Lateral speedometer
25. Altitude-pointer operating-knob
29. Dead-time-pointer operating-knob
30. Dead-time pointer
31. Dead-time cylinder
32. Complementary-term cylinder
33. Complementary-term pointer
34. Complementary-term-cylinder operating-knob
35. Azimuth index
36. Azimuth scale
38. Tripod head
52. Lateral-deflection-setting index
59. Vertical-telescope support
60. Lateral-telescope support.
66. Tripod
71. Vertical-speedometer correction operating knob

Model 1917 RA Corrector. *ROTC, Basic*

Looking towards Pearl Harbor from Napuanani Park, Aiea Heights. *Author, 2006*



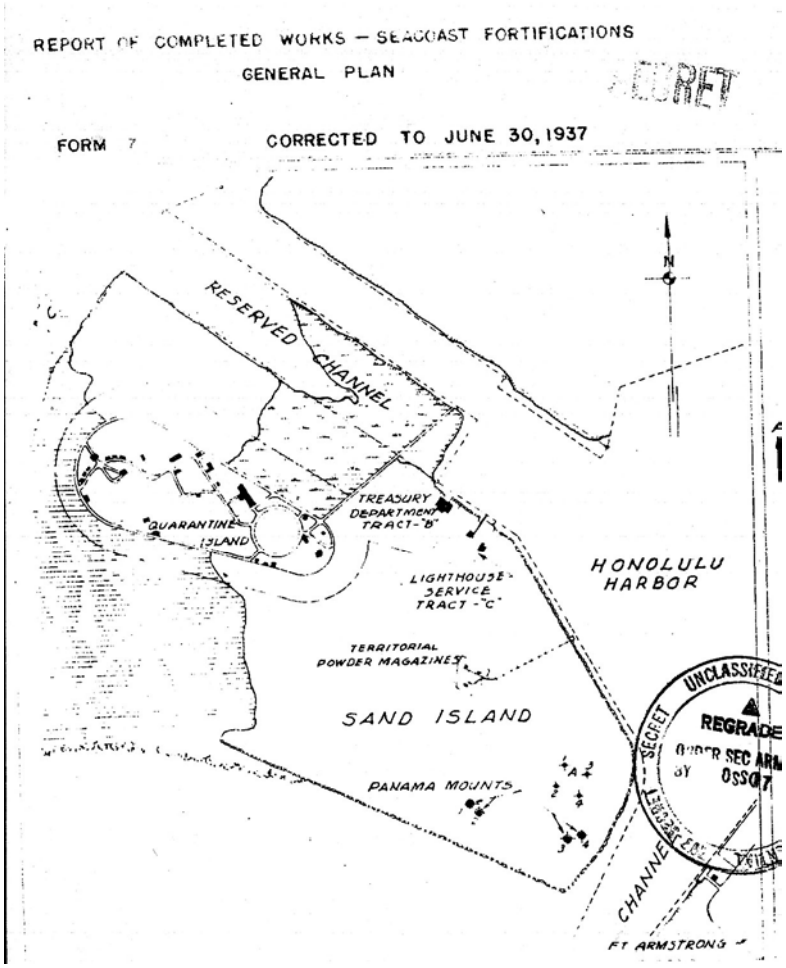
Possible AA gun emplacement at Napuanani Park. *Author, 2001*

There are no traces of antiaircraft gun emplacements at the park. The sole remnant is a reinforced-concrete World War II-vintage bunker, which may have been the bombproof CP for the HAAC or munitions storage. The padlocked steel-plate doors prohibited inspection of the interior. A faint circular outline in the grass several yards above and to the right of the bunker could have been a gun emplacement, but this has not been confirmed.

Battery No. 9 (Sand Island)

The Sand Island 5-inch AA battery was built on the military reservation of the same name on the west side of Honolulu Harbor, on land composed of limestone coral and sand. The battery, four 5-inch/25 naval AA guns in reinforced-concrete emplacements, was scheduled to be completed on October 15, 1942.

The battery was built in addition to "Fixed Antiaircraft Battery No. 7," a pre-existing antiaircraft gun battery armed with four 3-inch M1917 guns. The 3-inch battery was manned after December 7, 1941, by members of Battery F, 55th CA, who also manned four 155 mm GPF guns on Panama mounts (Battery Sand Island) until December 14, 1942, when the 155 mm battery was relocated to the Punchbowl Crater overlooking Honolulu and the harbor.(47)



155 mm GPF battery as of June 30, 1937. *NARA*

Battery No. 9 was sited to protect Honolulu Harbor on its immediate left flank, and Pearl Harbor, approximately 6 1/2 miles to the west.

On September 18, 1942, it was reported that all four guns had been mounted and could be fired manually. Additional work to be done included hooking up the gun director within 10 to 15 days, and in puzzling statment, the report stated that "work on case mates (*sic*) is continuing. Two case mates (*sic*) being completed, the third case mate (*sic*) probably procured today or tomorrow, and the fourth case mate (*sic*) to be started as soon as possible." The report went on to state that the battery would be able to be fired "with power hook ups in approximately ten days pending the necessary approval from Punahou."(48)

The reference to "Punahou" was in regards to the headquarters of the Honolulu District engineer,

Young Hotel in downtown Honolulu before moving to Punahou, "New Spring" in Hawaiian. On December 8, 1941, the district engineer commandeered the prestigious private preparatory school located at the mouth of Manoa Valley in Honolulu for his headquarters and moved in without advance warning. Two days after the occupation of the school property, the trustees received a letter informing them that, "The forces of the United States District Engineers have occupied the grounds (for an indefinite period)." The campus was also the headquarters of "Hawaiian Constructors," a consortium of private contractors employed by the Honolulu District engineer on defense contracts.(49)

The precise location of Battery No. 9 is not known, as there are no identifiable remains of the battery. The fixed 3-inch AA battery was in the southeast portion of the island, the 155 mm GPF battery was somewhat west of the 3-inch AA battery, and Battery Harbor's 7-inch naval guns were northwest of the GPF battery.

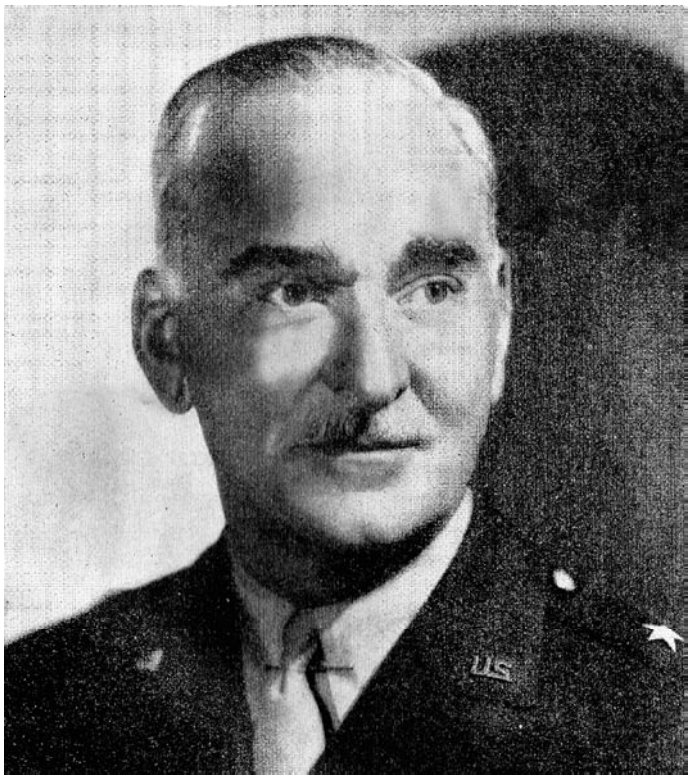
The portion of the island used by the coast artillery has been extensively grubbed and planted with trees by the State of Hawaii after the army departed. The Department of Land and Natural Resources,

include Battery Harbor's four concrete gun emplacements, eight magazines, plotting room, power room, and several unidentified structures. The double-tier battery command post/harbor entrance control post (HECP) atop a 50-foot steel tower exists, as do a 1934 prototype concrete machine gun pillbox, and several World War II concrete bunkers and machine gun pillboxes. Coordinates of the main gate to the state park are: 21º 18' 11" N, 157º 52' 17" W.

5-inch Naval AA Batteries Scheduled for Replacement

A June 18, 1943, army engineer inter-office memorandum addressed stronger replacement bunkers for the 5-inch AA batteries on Oahu. Replacing the 5-inch navy guns with 90 mm guns would take some time; in the meantime, it was decided that no new permanent bunkers should be built for the 5-inch batteries.

inside the present gunited surfaces of the emplacements to protect artillerymen from injury when slabs of gunite fell. Under Troop Work Order No. 34.132, troop labor was to be furnished by the AA Command, and the 34th Engineer Regiment was to provide supervision and construction materials as requested.(50)

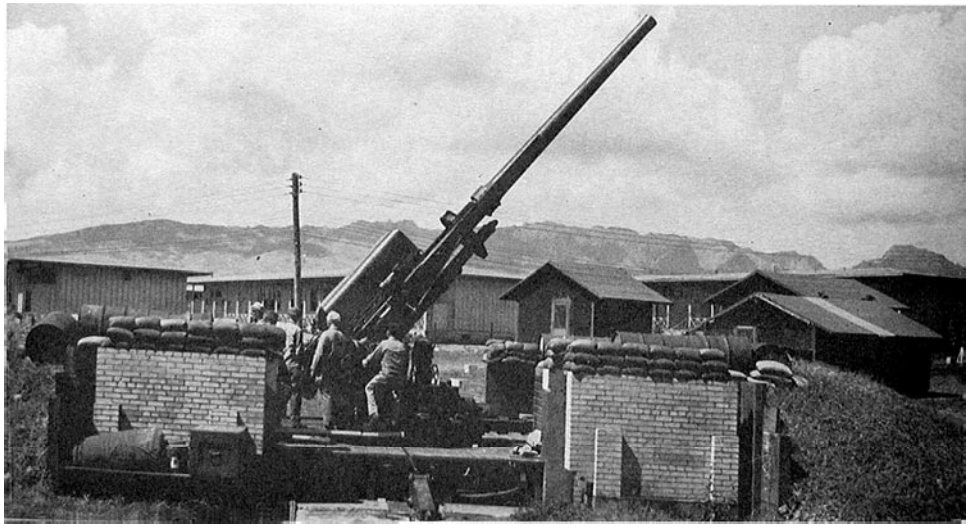


Brigadier General R.M. Perkins. *From HAAC Scrapbook*

On November 19, 1943, Brigadier General R.M. Perkins, CG, 53rd CA Brigade (AA), recommended the present gun bunkers manned by CA batteries C-97, G-97, H-95, 711, 714, 712, and F-95 be remodeled to accommodate either 90 mm or 4.7-inch (120 mm) guns. Remodeling was to be accomplished as each battery received new guns and the 5-inch/25 guns were removed. General Perkins further recommended outrigger slots be cut into the sides of the revetments to accommodate either 90 mm or 4.7-inch gun carriages.(51)

On December 6, 1943, Brigadier General H.F. Nichols, CG, Hawaiian AA Command, wrote the Engineer's Office, Central Pacific Area, approving remodeling the existing gun bunkers of Battery F, 95th CA (AA), to accommodate the 90 mm guns, without specifying the location. General Nichols also suggested that new bunkers for 4.7-inch guns be made similar to the 90 mm gun bunkers depicted on Engineer Drawing No. F-145/1121. Nichols went on to say that all battery positions on government land should be constructed with bunker retaining walls more permanent than timber. The general felt the new bunkers should be built of concrete with minimum reinforcement, or of masonry, with the exception of the movable wall at the entrance that permitted the guns to be moved in and out of the emplacements.(52)

On December 2, 1943, Work Order No. XB-343.0 authorized the area engineer, 2nd Field Area, to return one 5-inch/25 battery to storage, in accordance with prior indorsements, but did not name the battery site. Also included in the authorization was the removal of a 3-inch M1917 (fixed) antiaircraft battery, again with no location given. The work was to be coordinated with the AA Command and Lt.



4.7-inch AA gun at Waipahu High School during World War II. Note the use of bricks, timber, and sandbags to reinforce the emplacement built on territorial government land.
U.S. Army Photo from Waipahu At War

4.7-inch AA gun in sugarcane field near the town of Waipahu during World War II.

Concluding Remarks

It is not known if any remnants of Battery No. 1 (Hickam Field) exist today, although it is highly unlikely, as the area is the location of Air Force housing. Battery No. 2's (West Loch) location has not been pinpointed; portions of the former sugarcane lands bordering the loch at Waipahu have been extensively developed in the past 40 years for housing and light industrial use. The area also includes the West Loch Branch of Naval Magazine, Pearl Harbor, off-limits for any site inspection.

Battery No. 3 (Puuloa) was on navy land occupied by Fort Weaver, which was developed for housing following the end of World War II. Battery No. 4 (Ewa Mooring Mast) was on land occupied by the Ewa MCAS, which was decommissioned in 1952. Portions of the former Ewa MCAS have been turned into stables; the navy uses a large portion of the former MCAS for a golf course.

Battery No. 5 (Fort Kamehameha-Ahua Point) was on land that has been incorporated into the taxiway leading to the reef runway of Honolulu International Airport.

A March 1995 reconnaissance of the Waipio Peninsula discovered remnants of Battery No. 6 on the eastern portion of the peninsula. The structures included one concrete 5-inch/25 gun emplacement, a smaller concrete gun emplacement, a splinterproof power generator housing, and another concrete structure that may have housed the fire control switchboard.(54) Access is restricted, as the peninsula is within a security zone and a 1 1/2 mile blast-zone around the West Loch Branch of Naval Magazine, Pearl Harbor.

Remains of the superstructure removed from the U.S.S. *Arizona*, including the deckhouse and fore and aft masts, have been lying in storage at Waipio Point since being removed from the ship. Access is restricted to the site.(55)

The location of Battery No. 7 on Ford Island is unknown. Jeffrey Dodge, architect-historian for Pearl Harbor Naval Station, has not located any remains of the 5-inch/25 AA battery.

As for Battery No. 8 (Aiea Heights), the one remaining World War II-era structure found there is a reinforced-concrete bunker situated on the left at the entrance to Napuanani Neighborhood Park. The outline of a circle beneath the surface on a grassy mound on the right just above the comfort station may have been a gun emplacement.

Nothing remains of Battery No. 9 (Sand Island), as the State of Hawaii has done extensive brush clearing, grading, and planting since acquiring the land. Other Coast Artillery remnants exist at the park as reported earlier in this paper.

Acknowledgements

CDSG member William Gaines graciously provided copies of his unpublished manuscripts, reviewed this paper, and sent additional material via e-mail. In addition, the author wishes to thank Bolling Smith for material from NARA, College Park, MD, Wray Taylor, and Ann Yoklavich. Jeffrey Dodge, Pearl Harbor Naval Station historian also assisted, as did Katharine Slocumb, architect-historian for Mason Architects, who provided photographs and drawings of the Waipio AA battery.

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47. John D. Bennett, "Sand Island's Military Past 1916-1945, *CDJ*, Vol. 16, No. 3 (August 2002), pp. 66, 68, 70.
48. Wills, Fortification Projects. AA guns could not be casemated, by their very nature. Although Battery Harbor was not casemated because there were enough AA guns in the immediate vicinity, Wills also refers to constructing casemates for that battery. It seems likely that Wills, a civilian, meant to refer to emplacements, rather than casemates.
49. Allen, p. 236.
50. U.S. Engineer Office, Inter-Office Memorandum, "Replacement of Gun Bunkers," 1st and 2nd Indorsements, 18 June 43, HDE.
51. Perkins, 18 Nov. 1943.
52. H.F. Nichols, CG, HAAC, to Office of the Engineer, C.P.A., "Remodeling of 5"/25 cal. Gun Bunkers," 6 Dec. 43, HDE.
53. "Return to Storage, 5"/25 caliber AA Battery, 3" M1917 (fixed) AA Battery," AA letter, 29 Sept 43, Indorsement 18, HDE.
54. Jeffrey Dodge, historian for the Pearl Harbor Naval Station, e-mail to author in 2005.
55. No. 127, 2005, pp. 30-31.

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