**THE COASTAL ARTILLERY AND ITS GUNS**

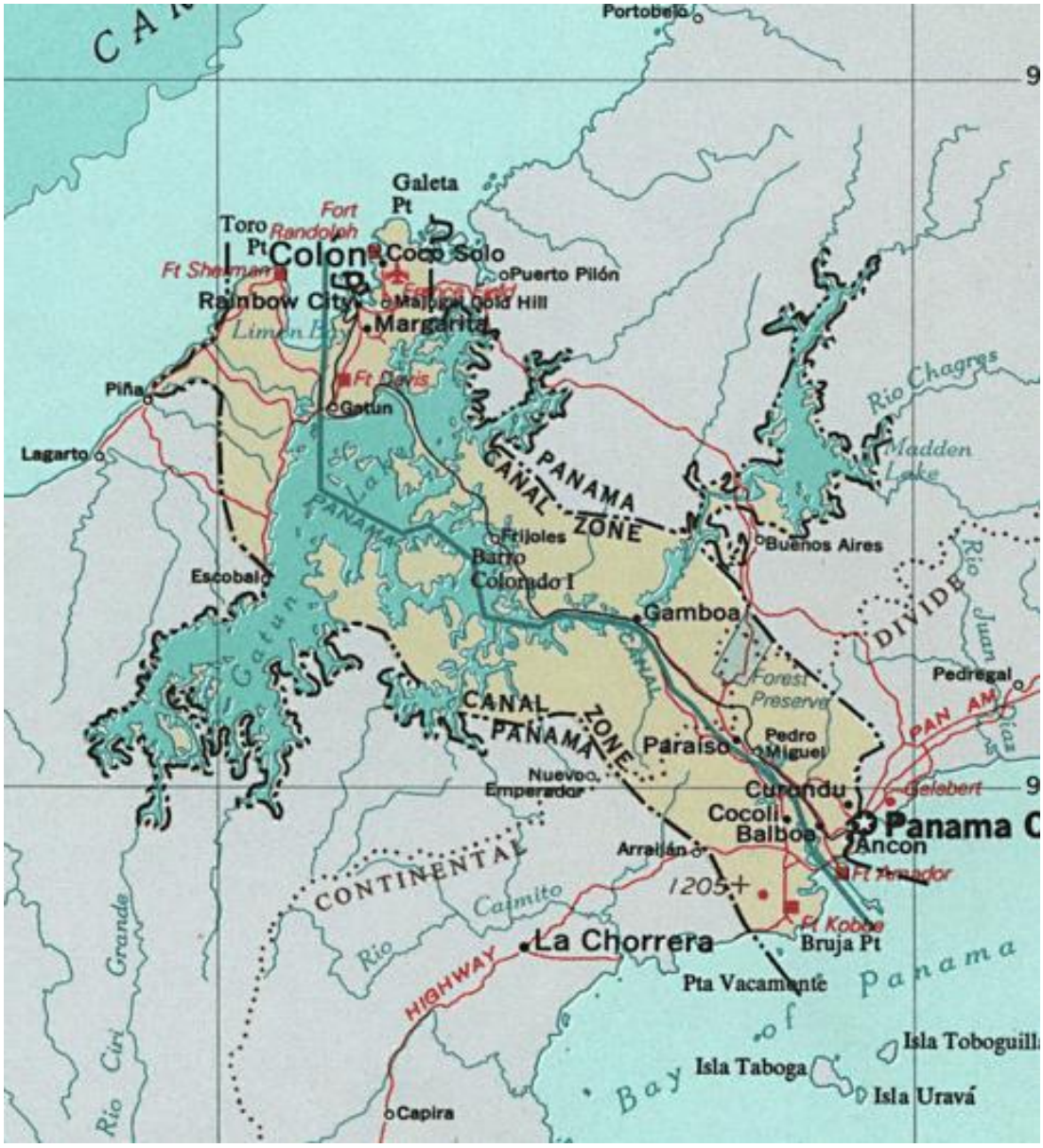
Even as construction was underway, it was clear that the completed Canal would need protection. In the early years of the 20th Century, as in the 19th Century and earlier, the great risk was seen as coming from the sea – by direct attack or by the landing of troops.[1] So, a great deal of money was expended on building forts and gun batteries at either end of the Canal, with large calibre artillery intended to keep attacking ships at a safe distance, backed up by supporting guns to provide close-in protection, and to counter assaults by small craft.

In fact, the initial Canal proposal had envisioned no special expenditures for its defence. The Isthmian Canal Commission, which had overseen the construction, had believed that the Canal was essentially indefensible, since "*a small party of resolute men, armed with a few sticks of dynamite, could temporarily disable it without great difficulty*". [2] However, the 1903 Hay-Buana-Varilla Treaty had given the US the implicit right to fortify (or protect) the Canal Zone[3], and the Canal was built when the battleship was the major strategic weapon and when being a great power implied being a naval power.

[1] As was the case at the fall of Singapore, the defending fixed batteries faced the "wrong way" and could not counter an attack mounted overland (the railway guns could, in theory, be redirected, as could a handful of the guns at newer sites) – that would be the role of mobile infantry, supported by pack artillery – carried by mules or towed by vehicle.

[2] https://www.laestrella.com.pa/nacional/220319/fortaleza-mercado-planes-defensa-antigua

[3] "*If it should become necessary at any time to employ armed forces for the safety or protection of the Canal, or of the ships that make use of the same, or the railways and auxiliary works, the United States shall have the right, at all times and in its discretion, to use its police and its land and naval forces or to establish fortifications for these purposes*": https://www.dipublico.org/100531/panama-usa-convention-for-the-construction-of-the-isthmian-ship-canal-1903/




In October 1909, with construction of the Canal underway, the Secretary of War appointed a Joint Army-Navy Fortification Board to draw up plans for the defence of the Canal. A field inspection followed in 1910, and the Board's final plan called for strong defences at either end of the Canal, with fieldworks in the vicinity of the locks and other vital installations, backed up by a mobile force of 7,000 troops, with light artillery, for close-in defence from an enemy's beach landing. Obviously, at the time, the danger of an air attack was not seriously considered (although, in due course, the Coastal Artillery Corps would become responsible for anti-aircraft defences too).

The big guns at the Canal entrances were intended to outrange or equal the range of any known naval weapon of the time – the main threat being seen as being from bombardment from the sea. The idea was to engage the enemy before they could bring the port facilities or locks within range of their guns. By the time of World War 2, the concept was modified somewhat, with US Army Air Corps (USAAC) bombers intended to detect approaching fleets, and attack them while still outside the range of the defending artillery.

In April 1910, the Joint Board recommended fortifications with 10 14-inch (355 mm) guns, 12 6-inch (152 mm) guns and 28 12-inch (304 mm) mortars. Estimated costs were put at $14.1 million.

*A 12-inch mortar pit. There were 28 such weapons*[4]

US military forts would provide protection for the Canal - Forts DeLessups, Sherman[5] and Randolph at the Caribbean end, and Forts Amador (including fortified islands) and Grant at the Pacific end.[6] Many other military installations, and airfields, were to follow, including those established outside the Canal Zone during World War 2, and sites on strategic offshore islands, such as Taboga[7], which is close to the Pacific entrance of the Canal.

Never tested during World War 1, and with little improvement after that, by the start of World War 2 it was becoming clear that the big guns provided for Canal defence were, or would soon become, obsolete. Attack from the sea by then could also mean attack from the

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[4] Photo: Missouri University of Science and Technology.

[5] Established in 1911, it consisted of seven batteries armed with artillery and mortars, a landing strip, command centres, barracks, and recreation areas, all set on about 22,200 acres (8,900 hectares) of land — it is now blanketed by tropical jungle in the San Lorenzo Nature Park (San Lorenzo hosts a clifftop fortress built by the Spanish in 1575, where the US Army mounted an anti-aircraft gun battery during World War 2).

[6] In fact, the first was Fort DeLesseps at Colon in 1911.

[7] And the tiny El Morro Island, just off Taboga, hosted a unit of PT Boats (US motor torpedo boats aka "mosquito boats)". There was a PT Boat training base on Taboga itself, as well as searchlights, anti-aircraft guns and bunkers, which were finally abandoned by the US military in 1960. During World War 1, the island had been used as an internment site for Germans.

air, mounted by ships far out of artillery range, no matter how powerful the guns were – although the USAAC was expected to provide warning and a means of defence. In addition, many of the batteries lacked adequate (or any) protection from air attack.

[8]

As it transpired, the real threat of direct attack on the Canal during World War 2 would be almost as low as that in the earlier war. Hence, the defending guns were once more not tested in combat and, by the end of World War 2, the heavy weapons in the batteries had been mothballed, or even removed altogether.

After the war, the Coast Artillery Corps itself would soon become a thing of the past, being disestablished in 1950. As a result of this, added to the apparent amnesia in Panama of the country's wartime history, the Corps history, or even its very presence in the Canal Zone, is largely forgotten, despite the remains of some of its bunkers and gun batteries still being present.

As in the Continental US and other overseas possessions, it was the US Army that provided coastal and harbour defences, with its Coast Artillery Corps the organisation responsible for those defences. As was the case in the Canal Zone, the Corps employed not only the artillery that its name reflected, but also large-calibre mortars, rapid-firing weapons, sea mines, searchlights, and anti-aircraft guns.

[8] https://storymaps.arcgis.com/stories/44e0b1e30a71455987b4f179d709b5d4

In this piece, we shall concentrate on the large-calibre artillery deployed by the Corps in the Canal Zone. Its anti-aircraft role, should be considered separately, and for more on the sea mines operated by the Corps in the Canal Zone, see - https://raytodd.blog/2024/06/30/panama-in-world-war-2-coastal-artillery-and-its-sea-mines/

The 1886 report of the Endicott Board[9] had brought about a new era of coastal defences in the US and, later, the Canal Zone. It had detailed the recommended strategy and weaponry. The objectives identified in the Report were to protect commercially important coastal cities from bombardment, and provide a safe haven for the US merchant fleet and to protect merchant shipping.

This was felt necessary as numerous countries in 1886 had, or were building, navies of a respectable size.[10] The basic idea was to protect the guarded area from invasion and capture, bombardment, and submarine or surface torpedo attack. The approaches to ports and anchorages would also be protected to allow the US Navy to emerge and counter enemy warships.[11]

In 1905, President Theodore Roosevelt directed the establishment of what became the National Defense Board (aka the Taft Board) to review and revise the Endicott Board report and incorporate developments since its publication. The resulting 1906 report included a recommendation that the Canal Zone be added to the list of locations protected (bearing in mind that the Canal was still then under construction, and would not open until 1914).

One of the main recommendations of the 1906 report was that the 14-inch (355 mm) gun replace the 12-inch (305 mm) and, over the following 15 years, the 14-inch gun, mounted on the

[9] Convened by the US Government in 1885 to devise and recommend a new system of coastal and harbour defence using the latest weaponry.
[10] *Evolution of Major-Caliber U.S. Coastal Defense Guns, 1888-1945* by William H Dorrance (*Army History* No. 37, Spring 1996), US Army Center of Military History: https://www.jstor.org/stable/26304359?seq=1
[11] https://www.globalsecurity.org/military/facility/coastal-forts-ww2.htm

"disappearing carriage"[12] became the heaviest coast defence gun manufactured in quantity. The report had rejected the 16-inch (406 mm) gun.

*14-inch gun on a "disappearing" mount. There were 7 of these guns[13]*

In 1907, US Army artillery was split into the field artillery, with a regimental organisation, and the Coast Artillery Corps.[14]

When the US entered World War 1, the coastal defences of the Canal were under what was called the Panama Coast Artillery District, which was a part of the Coast Artillery Corps.[15]

In 1915, came a further review of coastal defences, this time from the Scott Board (named for the Army Chief of Staff who chaired it), which considered the coastal defences of the US, the Canal and insular possessions.[16] It made recommendations, including identifying the need for 16-inch guns and mortars, and mounting the many spare 12-inch guns on a new carriage with a lighter projectile to give an improved range. However, there was a lack of suitable guns and mortars, and the war was long over when the first 16-inch guns called for by the Scott Board report were emplaced in 1923.[17]

In 1920, as US forces were run down after the war, the Canal Zone harbour defences were designated as a Coast Artillery district within the Panama Canal Department, the Army

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[12] The "disappearing carriage" was developed in the 19th Century, and the theory was that the gun could crouch behind 20 feet of concrete, with another 20-30 feet (6 to 9 metres) of hard packed earth in front of that, it would rise up to fire, then return to crouch down behind its barrier, and thus be invisible from the sea.

[13] Photo: Missouri University of Science and Technology.

[14] https://cdsg.org/coast-artillery-corps/

[15] The Corps had been created in 1907, when Congress split field and coastal artillery into separate organisations.

[16] Insular Possession were defined as territories outside the customs territory of the US, and included the US Virgin Islands, Guam, American Samoa, Wake Island, Midway Islands, and Johnston Atoll.

[17] As part of the defences of Long Island, New York.
These 16-inch (406 mm) guns could hurl a 2,240 lb (1,016 kg) projectile to a nominal maximum range of 45,100 yards (25.6 miles, 41.2 km).

command in the Canal Zone created in 1917. Although the size of the Corps as a whole was reduced substantially in the cutbacks, overseas and insular possessions required garrisons strong enough to withstand attack until relief could arrive. This would mean that the Canal Zone, having among the largest coast artillery garrisons, despite reductions, remained of significant size, and also became one of the principal training locations for all of the Corps assigned missions: seacoast artillery, anti-aircraft artillery, as well as mobile railway and tractor-drawn artillery.[18] Further changes in 1927 allowed the Corps to focus its meagre resources on seacoast and anti-aircraft defence.

Shortly after World War 1, surplus 75 mm and 155 mm guns were assigned to the Canal Zone, intended for beach defence use, and to provide close-in harbour defence. The 155 mm guns were also involved in experiments which led to the so-called "Panama Mount". This was a circular concrete mount, with small wheels on the trail arms of the gun which ran in a track that encircled the gun, allowing it to swing through 360◦.

Postwar improvements of the defences saw four long-range 12-inch guns on barbette carriages added at Fort Sherman and, in 1928-29, four 16-inch guns were installed at Bruja Point (later to be renamed Fort Kobbe) as Batteries Haan and Murray.[19] These newer 16-inch guns had a much greater range than earlier versions (45,000 yards or 41 km, compared to 22,000 yards or 20.1 km), and were also capable of 360◦ traverse. Additionally, in 1928, two 14-inch railway guns arrived, with firing points at Fort Randolph and on Culebra Point at Fort Grant. These too had a greater range than earlier examples of the same calibre – double at 48,000 yards (44 km).

[18] By June 1924, only 144 of the Corps' coastal artillery companies were active.

[19] Battery Murray still stands, empty of course, near the former Howard Air Force Base, now an international airport, technology centre and habitation. The tunnels below the mound can still be seen and one can, if one chooses to risk snakes, climb to the top of it. How long it will remain, with the development going on close by, is uncertain, Panama not being very good at preserving its recent history.

*A 16-inch gun, three being located at Forts Amador (1) and Kobbe (2)*[20]

At the Pacific end of the Canal, the line for the railway guns connected to the Panama Railroad system at the Balboa dock area, running from Culebra Point along the Causeway, behind the Fort Amador barracks and through the housing area of the 15th Naval District.[21]

As early as 1923, the War Department had recognised the need to improve coastal defences, and that a larger fleet or a large number of aircraft could provide better protection for harbours than the existing defences. However, the cost was considered uneconomical, with the cheapest option being seen as continuing to rely on guns and mines.[22]

In 1924, Corps units were redesignated as regiments, with the 1st, 2nd and 4th Coastal Artillery Regiments in the Canal Zone.[23]

In 1925, Harbor Defense Commands were established (in succession to predecessor bodies dating from 1895, with their immediate predecessors being the Coast Defense Commands, which dated from just before World War 1).[24] The name change was intended to describe their true role more accurately, and to emphasise that the coast artillery was to defend key

[20] Photo: Missouri University of Science and Technology.

[21] There were further plans, as a reaction to improvements in naval armour, for two 16-inch guns to be placed at Fort Randolph and on Taboga, with eight 16-inch mortars also to be placed on the island. Some barrels were shipped before the project was abandoned.

[22] https://www.globalsecurity.org/military/facility/coastal-forts-ww2.htm

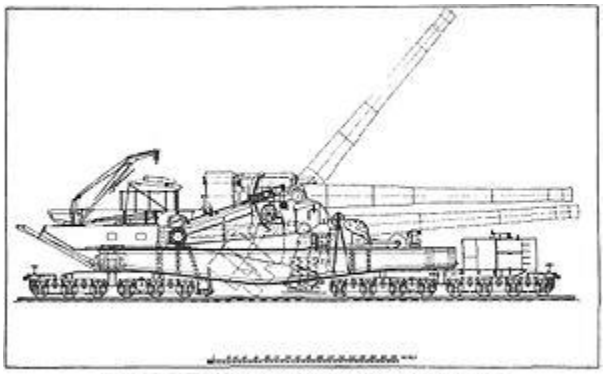
[23] These adopted the historic lineage of artillery regiments abolished in an earlier reorganisation in 1901.

[24] As well as the Continental US, there were Harbor Defense Commands in Hawaii, Puerto Rico, the Philippines, as well as the Canal Zone. After the 1940 Destroyers for Bases Agreement with the UK, further overseas Commands were established in Newfoundland, Bermuda, and Trinidad, continuing until they were disestablished in 1946.
https://cdsg.org/wp-content/uploads/pdfs/FORTS/CACunits/CACorg2011.pdf

locations, rather than the entire coastline. Each command was an administrative and tactical unit provided for the defence of a harbour or other area of water. The harbour defence would consist of one or more "forts", at which the elements of the harbour defence were located. Tactically, the harbour defence would embrace one or more groups of seacoast artillery, usually supplemented by submarine mine defences, and other means for local defence against attack from sea, air, or land, together with the personnel, materiel, and accessories required for their administration and tactical employment.

**THE 14-INCH RAILWAY GUN**

The M1920 Railway Gun was the last model railway gun to be deployed by the US Army, an upgrade of the US Navy 14-inch 50-calibre (355 mm) railway gun. Only four were ever built, with two ending up in the Canal Zone. The M1920 carriage made the gun much more flexible. It allowed for the standard practice of using a curved piece of rail to traverse the gun, and it enabled the gun to be used in a fixed position.



Each gun and carriage cost $430,000, and the gun, carriage, and flatcar on which it was mounted weighed 365 tons. The flatcar had 14 axles, eight in front and six in the rear to distribute the loads on the rails. The 14-inch gun could fire a 1,560 lb (707.6 kg) projectile for 27 miles (43.4 km). It came with a support train of about 18 cars that were pulled by Sterling locomotives. The guns were 50-calibre, 715.2 inches (18.1 metres) long, manufactured at the US Army's Watervliet Arsenal[25] located in Watervliet, in New York State.[26]

[25] The arsenal is the oldest, continuously active arsenal in the US having begun operations during the War of 1812

[26] https://www.militarymuseum.org/BtyErwin.html

Several of the Harbor Defense Commands were disarmed and disestablished between the wars, with nearly all the Continental US harbour defences reduced to caretaker status. However, the two in the Canal Zone were retained - one based on Balboa and the other on Cristobal, though somewhat downgraded, as military budgets remained meagre until the late 1930s. Many of the big guns were placed in caretaker status, so that they had to be rehabilitated and tested before becoming operational.[27]

In 1931, the Harbour Defense Board was constituted by the Army to supervise defence projects in various harbour areas, though funds remained meagre.[28] In July 1940, responding to the criticisms expressed by the Chief of Coast Artillery, it would recommend adoption of the 16-inch gun as the standard seacoast gun[29] (with the 6-inch gun (152 mm) as the secondary weapon), alongside other improvements, and this plan was approved by the General Staff in September 1940 and funding made available.[30] Of course, the US entered the war before most of the construction plans could be completed and, in fact, only 15 of the planned 39 16-inch gun batteries across the Continental US and elsewhere had been put in place before the Coast Artillery was disestablished in 1950, and the plan suspended even before the end of the war.

During the 1920s and 1930s, it was said that the US allowed its coastal defence to decay, with the result that, in 1940, the Chief of Coast Artillery said that "*With a few exceptions our seacoast batteries are outmoded and today are woefully inadequate*", noting that most had no overhead cover to protect against air attack.[31] One of the few notable important improvements seen during the period had been the despatch of the pair of 14-inch railway guns to the Canal Zone.

[27] All harbour defence regiments were constituted in the 1930s with a regimental HQ and HQ Battery, a searchlight battery, band, and a varying number of battalions, each of which contained an HQ and HQ Battery or Detachment and three firing batteries.
[28] https://www.globalsecurity.org/military/facility/coastal-forts-ww2.htm
[29] The Army had opted for the 16-inch gun mounted in a protective barbette as the standard harbour defence weapon against capital ships, but few had been installed by the outbreak of World War 2.
[30] In February 1940, it was estimated that to complete all planned projects would cost $60 million. The July 1940 report gave an estimate of $82 million for all projects, taking three years to complete them.
[31] Nonetheless, in 1940, the War Department's view was that the shortage of anti-aircraft guns was so severe that no mobile, and no more fixed, weapons could be spared for harbour defences.

*14-inch railway gun at Culebra Island (site of a Smithsonian Institute station today)*[32]

**THE PANAMA MOUNT**

Some of the large artillery pieces were mounted on what was called a Panama Mount.[33] This was a gun mount developed by the US Army in Panama during the 1920s for fixed artillery positions, and they were widely used before and during the war.[34] Note, however, that the term Panama Mount is often incorrectly used to describe other gun mounts with similar layouts or purposes.

The growing tension with Japan saw most of the limited funds available for harbour protection between 1933 and 1938 being spent on improvements on the Pacific coast of the Continental US. Despite the greater distance from Japan of the Canal Zone, it too faced a notional increased threat.[35] However, it would take the threat of war in Europe to prompt greater appropriations and improvements on the Atlantic coast as well.[36]

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[32] Photo: Missouri University of Science and Technology.

[33] The mounts could be constructed as either full, three-quarters or half circles of steel rail set in concrete with a diameter of approximately 36 feet. A concrete column with a diameter of 10 feet was constructed in the centre of the circle to support the gun and carriage. The concrete column was connected to the outer concrete ring by concrete beams for alignment/stability. Originally traverse was accomplished with several men and prybars to move the trailing arms around the steel ring. Later installations included a geared steel ring just inside of the outer steel rail for improved traverse: https://en.wikipedia.org/wiki/Panama_mount

[34] *American Seacoast Defenses, A Reference Guide, Second Edition* by Mark A Berhow as editor (Coast Defense Study Group), 2004.

[35] During the war much effort was expended on safeguarding the Pacific approaches to the Canal, with bases established in other coastal states and the Galapagos Islands. Sea and extensive air patrols were also undertaken. However, unlike the Caribbean approaches, no threat, Japanese or German, was to affect this area.

[36] https://www.globalsecurity.org/military/facility/coastal-forts-ww2.htm

In 1935, Congress authorised an additional 5,918 men for the Corps, representing an increase of almost 50%, but with no increases in officer numbers, and with no new units created.[37] Then, in 1940, the Selective Service Act resulted in the first peacetime draft in US history, and a rapid build-up of all Regular Army coast artillery regiments (and existing National Guard coast artillery regiments called into federal service, originally for a year's training).

In 1939, it was said that the Coast Artillery Corps includes all fixed artillery, all anti-aircraft artillery, all railway artillery, all tractor-drawn artillery especially assigned for coast-defence purposes, all controlled submarine mine installations, and all subaqueous sound-ranging installations, together with the searchlights, power plants, communications, trains, and other accessories necessarily incident to the maintenance and tactical employment of these weapons. It consists of units of the Regular Army, of the National Guard, and of the Organized Reserves.[38]

On 5 September 1939, with the outbreak of war in Europe, an Executive Order by President Roosevelt transferred command and control of the Canal Zone from the Governor to the Commanding General of the Panama Canal Department.

*Army train transporting ammunition and crew between the guns, probably at Fort Sherman*[39]

A modernisation plan for coastal defence was approved by the Army in September 1940, over objections of the Chief of the Air Corps, who argued that land-based bombers would provide a

[37] The National Guard units were also expanded.
[38] https://cdsg.org/wp-content/uploads/pdfs/FORTS/CACunits/CACorg2011.pdf
[39] Photo: Missouri University of Science and Technology.

better option than additional coastal artillery guns. $62 million was authorised, with a completion target of the end of June 1942. However, the project had to compete with the general expansion of the Army and Navy and, by mid-1941, the plans were already far behind schedule, while the growing air and sea power assets of the US would seem likely to make them unnecessary. The priority given to the Canal Zone also affected plans for improvements in the Continental US. It was eventually decided to limit activity to just those projects which could be completed by the end of June 1944 – explaining why only 15 of 39 new batteries contemplated had been completed. As we shall see, however, many of the defensive guns and mortars in the Canal Zone had been mothballed (or even disposed of) by mid-1944. After all, it could take over a year to complete a casemated gun emplacement, with its optical base end stations and ranging radar.

At the time of the attack on Pearl Harbor on 7 December 1941, US Army forces then in Panama and the Canal Zone included the following Coast Artillery Corps units[40] –

- 1st Coastal Artillery (Harbour Defence) Regiment;[41]
- 4th Coastal Artillery (Harbour Defence) Regiment;[42]
- 75th Antiaircraft Artillery Brigade, which comprised the 72nd, 82nd and 88th Coast Artillery Antiaircraft Artillery Regiments – and provided air defence for the Canal areas on the Pacific side, including the Pedro Miguel Locks, Miraflores Locks, Spillway and power plant, Madden Dam, Albrook Field, Howard Field, and the Navy facilities of the Balboa Dry Dock and tank farm; and

[40] http://navsource.org/Naval/usaaf.htm
Following Pearl Harbor new regiments were formed, one being the 36th Coast Artillery, originally assigned to Puerto Rico, then later to the Canal Zone.

[41] Constituted in February 1924 and organised in Cristobal. Various reorganisations followed during the war, including various batteries detached to Honduras and the Galapagos Islands. Inactivated 3 October 1944, with some personnel to US for reassignment, and remainder transferred to 1st Coastal Artillery (Harbor Defence) Battalion.

[42] Constituted February 1924, and organised at Fort Amador on 18 August 1924. Again, various reorganisations took place during the war, with the running down of gun defences by 1944 and after. Eventually the consolidated remainder, as 4th Coastal Artillery Battalion, that had been activated on 1 November 1944, was inactivated on 15 January 1947, with Batteries A and D, Harbor Defense of Balboa inactivated on 15 May 1950.

- 76th Antiaircraft Artillery Brigade, which comprised the 73rd and 83rd Coast Artillery Regiments – and provided air defence on the Atlantic side, at Gatun Locks, Dam and Spillway, Mount Hope Filtration Plant, France Field and Coco Solo.[43]

These were assigned to the Panama Canal Department. They were supported by infantry, pack troops with portable light artillery (with mules initially) and elements of a Signals Company, and in 1940 had the responsibility for –

- the defence of the Atlantic side of the Canal Zone from the Gamboa Bridge north and east to the Atlantic Ocean, including harbour defences at Cristobal; and
- the defence of the Pacific side of the Canal Zone from the Gamboa Bridge south and west to the Pacific Ocean.

As of 1939, these units operated 11 coastal gun batteries at the Atlantic end of the Canal, and 12 at the Pacific end.[44]

The 1st Coastal Artillery (Harbour Defence) Regiment was in the Atlantic Sector, with Forts Randolph, DeLesseps, and Sherman, with other batteries on islands, and Railway Battery No.1, with its mobile 14-inch (355 mm) guns.[45]

The 4th Coastal Artillery (Harbour Defence) Regiment was in the Pacific Sector, with Forts Kobbe, Amador, and Grant, with batteries on islands including Taboga, with Railway Battery No.8 based at Fort Grant.

In February 1940, the mobile units available for defence, such as the infantry and pack howitzer units, were reassigned the to the newly-established Panama Mobile Force – intended to counter any landings away from the Canal.[46]

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[43] *Security and Defense of the Panama Canal, 1903-2000* by Charles Morris (Panama Canal Commission).
[44] https://apps.dtic.mil/dtic/tr/fulltext/u2/a388262.pdf
[45] Understandably, the railway guns could be used in support of either end of the Canal, given that they could be transported along the trans-isthmus railway network.
[46] The Army's Mobile Force was activated on 16 February 1940 and the plan was to conduct a mobile defence in depth beginning at the beaches and not by the preparation of static defence positions. From the 1920s, the concept of using defence in depth to counter beach landings to attack the Canal Zone had been adopted, with the widespread acceptance of Brigadier General Haan's 1920 proposal of a flexible mobile defence-in-depth

The 1st and 4th Coastal Artillery Regiments, with a central headquarters at Quarry Heights, near Balboa at the Pacific end of the Canal, were designated as the Panama Separate Coastal Artillery Brigade on 16 February 1940, and then further redesignated as the Panama Coastal Artillery Command 1 September 1941.

A coastal battery of fixed artillery was designed to consist of a number of permanently emplaced guns of the same calibre and characteristics, grouped with the object of concentrating their fire on a single target and of being commanded by a single individual, together with all personnel, structures, installations, and equipment provided for their protection, command, and service.

The guns, for use against surface and air targets, were supplemented by the sea mines, which formed part of a submarine mine battery, an administrative and fire unit employed for the installation, maintenance, and operation of a controlled mine field.[47]

*3-inch anti-aircraft gun, as located at many sites, including Forts Amador/Grant, Sherman and DeLesseps*[48]

The gun batteries were also assisted by searchlight batteries. By the time of the Taft Board Report in 1906, the importance and use of searchlights was considered a high priority, and the Board had recommended the installation of 36-inch (91.5 cm) and 60-inch (152 cm) searchlights and their electrical plants at all defended harbours. However, it was later realised that the 36-inch searchlight was not powerful enough for use, and the 60-inch light became the standard[49], and was the type used in the Canal Zone. By the late 1930s, the

doctrine which still seems modern in overall concept: https://www.ibiblio.org/hyperwar/USA/USA-WH-Guard/USA-WH-Guard-12.html

[47] For more on such mines and minefields, see https://raytodd.blog/2024/06/30/panama-in-world-war-2-coastal-artillery-and-its-sea-mines/

[48] Photo: Missouri University of Science and Technology.

[49] These searchlights had an effective range of less than 8,000 yards (4.5 miles or 7.3 km).

Coast Artillery had switched to using mobile searchlights and replaced fixed searchlights where at all possible. The primary use of the searchlights was illumination of hostile naval targets during periods of darkness. In addition, they could be used to search water areas, to search or illuminate beaches, to serve as barrier lights[50], and to serve as a means of signal communication.[51]

**TARGETING**

The batteries established the positions of its target ship at stated intervals of time (such as every few minutes), then used this to predict the position at the next point in time. This allowed the battery to mathematically relate the predicted location to the position of the gun, so that the ship and shell would arrive at the same point at the same time.
Known as "position-finding", this involved two observation posts at the ends of a measured base line, and equipped with powerful optical equipment, that could triangulate on the target. A system of signal bells was used to established the time intervals, and information telephoned from the posts to the battery's plotting room, which then calculated the distance and bearing from the gun. This was used to adjust the gun, using scales found on the gun or its carriage, which was electrically fired at the appropriate moment.[52]

It has been said that morale in the Corps in the Canal Zone was at its highest in early 1942. The war might not be going that well for the US and its Allies, with the Japanese still apparently running riot in the Pacific, and the conflict in Europe and North Africa still undecided – but troops were busy and seen to be doing an "*important job working against time*". However, quite soon the monotony of being continually on alert, with little obvious threat – apart for a few months in 1942, with the U-boat offensive in the Caribbean, but then only on the Atlantic side – had an effect. The situation was even worse for troops confined to fixed installations, such as the gun batteries, some of which were positioned far from the nearest town or village (with poor roads that took time to improve as the war continued). The only recreation was a pass to town, and, if allowed into Panama City or

[50] To detect passage of vessels toward or through a channel or harbour entrance.
[51] https://cdsg.org/coast-artillery-searchlights/
[52] https://si.maps.arcgis.com/apps/Cascade/index.html?appid=e65d5058a32a4b939965915b61aab678

Colón, most US dollars went on alcohol and women.[53] The defence of the Canal Zone was described as "*no headline-making assignment…but a grim, tedious task of 'watchful waiting' for days and weeks and months on end*".[54]

From 1943, an effort was made to address morale. A Special Services Program was developed, with contributions by civilian organisations. Athletic equipment was made available and inter-battery and intra-battery competitions organised. Radios were installed at all positions, dayrooms and, in some places, mess halls. Magazines and movies from home were made available. Clubhouses and the YMCA provided entertainment facilities, including bowling alleys, and cinemas opened. The USO provided entertainment and, in conjunction with the USO Auxiliary, women provided respectable companionship at such things as dances and bingo nights – in contrast to somewhat less respectable entertainment that could be found outside the Canal Zone.

Most vulnerable to air attack were the batteries of 12-inch (304 mm) mortars that dated from World War 1.[55] These were regarded as virtually defenceless from air attack, and in 1943 the pits in which they were sited were stripped and the mortars removed.[56]

The expansion and improvements of the defences of the Canal Zone had included a series of projects that were approved in the years before the Pearl Harbor attack, and known as "Special Item Projects" or SIPs. There were about 45 of these emergency projects, mostly concerned with locks and non-locks structures, installing emergency equipment and generally preparing for wartime conditions, such as providing camouflage. None of these were directly concerned with the coastal defence guns.[57] There were improvements to the

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[53] Fort Randolph had a casual barracks where a soldier could spend a night on post.

[54] *150th Infantry Regiment in Panama*, press release by Doral Chenoweth Jr, 1946; from Headquarters, Caribbean Defense Command: https://media.library.ohio.edu/digital/collection/mss/id/834

[55] With a range of 8.6 miles (13.8 km), the plunging shells from these would target the decks of attacking ships, where they would be less protected, using heavy deck-piercing (armour-piercing) half-ton shells with hardened steel caps. Mortars could also be supplied with so-called "torpedo shells" weighing 800 lb or 1,000 lb (360 or 450 kg), which exploded on contact, scattering shrapnel. Of those still in place during World War 2, only those in the Philippines saw any action, during the Japanese invasion in 1942.

[56] Probably the only US 12-inch mortars to ever see action were those in the Philippines in 1942.

[57] *Security and Defense of the Panama Canal, 1903-2000* by Charles Morris (Panama Canal Commission).

gun batteries, for example, in September 1942, the completion of the case-mating of Battery Pratt at Fort Sherman to provide protection from air attack.[58]

By early 1944, another reorganisation was undertaken with harbour defence regiments being broken up into battalions in 1943–44, in line with an Army-wide policy for all units except infantry.[59] Also in 1944, all work on new coastal defence batteries was halted, with the recognition that most potential naval threats had been neutralised or otherwise no longer existed.[60]

With the mortars already removed, even the large guns were to be used rarely, even for practice, with the last firing taking place in 1944 and, after this last practice, many remained unmanned and most were finally removed between 1946 and 1948.[61]

In 1946, the two Harbor Defense Commands in the Canal Zone were disestablished. By then many of the large guns located in the Canal Zone had been mothballed or removed, as had all the mortars. It would soon be decided that few (and soon no) such gun defences were needed, and by 1948 almost all the US seacoast defences had been scrapped. The remaining role of the Coast Artillery Corps was in providing anti-aircraft defences.[62]

Also in 1946, the Patch-Simpson Board[63] recommended that the Coast Artillery be disbanded altogether, or rather that the Coast Artillery (with its coastal defence and anti-aircraft units) and

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[58] A casemate is the fortified or armoured structure from which guns are fired.

[59] https://cdsg.org/coast-artillery-corps/

[60] Ironically, at the time the Japanese were still planning an attack, using large submarines to carry attacking aircraft. See: https://raytodd.blog/2024/06/30/panama-in-world-war-2-the-genuine-threat-the-planned-japanese-attack-on-the-panama-canal/

[61] In fact, some of the guns were never fired at all during the war, even for practice. Those in Battery Weed at Fort Randolph, for example, were last fired in 1929.

[62] It would lose its sea mines defence role, with some of its mine planter vessels Used to lay and maintain the minefields) transferred to the Navy and designated Auxiliary Minelayers (ACM, later MMA).

[63] The War Department Reorganization Board – which was convened to apply the lessons learned during the war and recommend new War Department organisations and processes. It was renamed from the Patch Board to the Simpson Board following the sudden death of the original chairman. The post of Chief of Coast Artillery had anyway been in abeyance (together with the posts of Chiefs of Field Artillery and Infantry), since 1942, when an earlier reorganisation, intended to better equip the Army for the war that was now underway, and had seen the Army Ground Forces established in March 1942. Thus, the Coast Artillery Corps became a part of this new organisation.

the Field Artillery be combined into a single artillery branch – which required an Act of Congress[64] to disestablished the Coast Artillery Corps.[65]

*14-inch railway gun awaiting disposal at Culebra Island*[66]

A continuing reminder of the defences of the Canal today is (or perhaps should be) the Amador Causeway, a popular area much used by locals for exercise and entertainment[67], and which stretches out into Panama Bay – away from the noise and pollution of the city. During the construction of the Canal, a huge amount of waste material (particularly from the Culebra Cut[68]) was used the create a breakwater that eventually linked the mainland to one of the small offshore islands, Naos, with work completed in 1912. The site was named Fort Amador[69] and Fort Grant[70]. In due course, the causeway was extended from Naos to further small islets, ending at Flamenco[71]. It grew (at over 344 acres or 139.2 hectares) to involve

[64] The Army Reorganization Act of 1950.
[65] *Transformation of the Artillery Branches* by Col. Samuel R White Jr (US Army War College, 2007)
[66] Photo: Missouri University of Science and Technology.
[67] https://www.lonelyplanet.com/articles/the-amador-causeway-panama-citys-booming-boardwalk
[68] The Culebra Cut (called the Gaillard Cut from 1915 to 2000 after the US officer who had led the excavation, and who died a month after the breakthrough there in 1913), is an artificial valley that cuts through the Continental Divide and it was one of the great engineering feats of its time. Culebra is the name for the mountain ridge it cuts through and was also originally applied to the cut itself. After the canal handover to Panama in 1999, the name was changed back to Culebra (*Corte Culebra* in Spanish).
[69] Named for the first President of Panama, Manuel Amador Guerrero.
[70] Named as US President Grant had ended his transit of the isthmus there in 1852.
[71] Later an important radar site, there remains a radar station on Flamenco, adjacent to a marina, cruise liner terminal, shops, and restaurants.

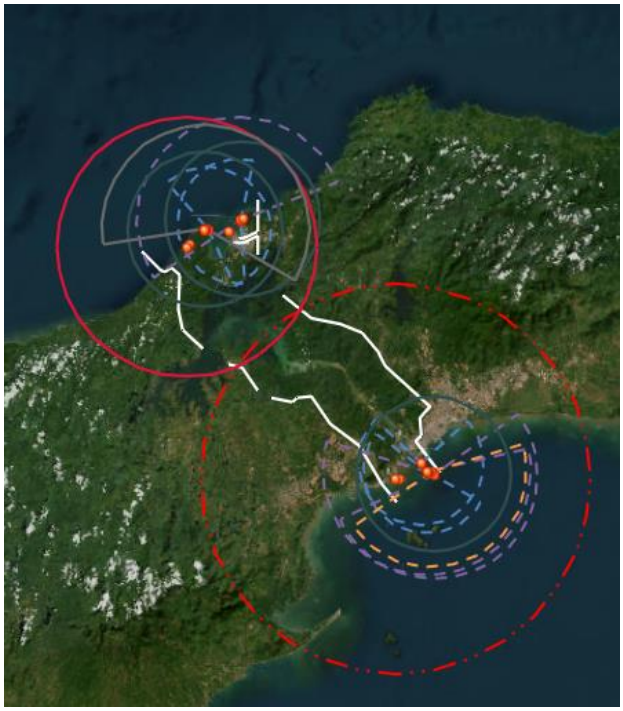
not only artillery[72], but other facilities, including a large tank farm. On Flamenco alone, there were no less than four batteries.[73]

Ray Todd

Panama City

Republic of Panama

20 August 2024



*Approximate ranges of defending guns*[74]

[72] As noted elsewhere, such artillery gradually fell out of use; the Fort Amador batteries being disused (and buried) from 1943.

[73] Something of which one can still find today, although derelict and overgrown: https://www.panorama2go.com/en/military-fortifications-of-the-isthmus-of-panama/
In the Smithsonian Institute's centre at Punta Culebra one can see remnants, including the railway lines used by the 14-inch railway gun and supply trains.

[74] https://storymaps.arcgis.com/stories/44e0b1e30a71455987b4f179d709b5d4

## ANNEX

## US SEACOAST BATTERIES BUILT OR MODIFIED 1935-1945[75]

**The Harbor Defenses of Cristobal, Panama** (Panama Canal Zone, Atlantic side)

| | | | | | |
|---|---|---|---|---|---|
| FORT RANDOLPH | Margarita Island | 1911 | to Panama, 1979; commercial development | | ** |
| Webb | 2 | 14" 1910 | D 1907MI | 1912-1948 | |
| #1 | 2 | 14" 1920 | RY 1920 | 1928-1948 | 2 guns for Panama, 4 empl. (#1 & #8) |
| Tidball | 4 | 12" 1912 | M 1896MIII | 1912-1943 | |
| Zalinski | 4 | 12" 1912 | M 1896MIII | 1912-1943 | |
| Weed | 2 | 6" 1908MII | D 1905MII | 1912-1946 | |
| X(4A) | 4 | 155 mm | PM | 1940 | |
| 2C | 4 | 155 mm | PM | | |
| 5A | 4 | 155 mm | PM | | |
| FORT DeLESSEPS | Colon | 1911 | to Panama, 1950s | | ** |
| Morgan | 2 | 6" 1908MII | P 1910 | 1913-1944 | modified casemate mounts M1910 |
| AMTB #3b | 4 | 90 mm M1 | F M3 | 1943-1948 | Cristobal mole, built over |
| FORT SHERMAN | Toro Point | 1911 | ME, MC to Panama 1999 | | **** |
| *(#151)* | 2 | 16" | CB | *Not Built* | |
| Mower | 1 | 14" 1910 | D 1907MI | 1912-1948 | |
| Stanley | 1 | 14" 1910 | D 1907MI | 1912-1948 | |
| Howard | 4 | 12" 1912 | M 1896MIII | 1912-1943 | |
| Baird | 4 | 12" 1912 | M 1896MIII | 1912-1943 | |
| Pratt | 2 | 12" 1895MI | B 1917 | 1924-1948 | Iglesia Pt., casemated-WWII |
| MacKenzie | 2 | 12" 1895MI | B 1917 | 1924-1948 | Iglesia Pt., not rebuilt |
| Kilpatrick | 2 | 6" 1908 | D 1905MII | 1913-1946 | |
| W | 4 | 155 mm | PM | 1940 | |
| Other sites | | | | | ? |
| U | 4 | 155 mm | PM | 1918 | Tortuguilla Point (the original "Panama" mounts) |
| V | 4 | 155 mm | PM | 1940 | Naranjitos Point |
| Y | 4 | 155 mm | PM | 1940 | Palma Media Island |
| Z(1A) | 4 | 155 mm | PM | 1940 | Galetta Is. |
| 1B | 4 | 155 mm | PM | | Galetta Is. |

**The Harbor Defenses of Balboa, Panama** (Panama Canal Zone, Pacific Side)

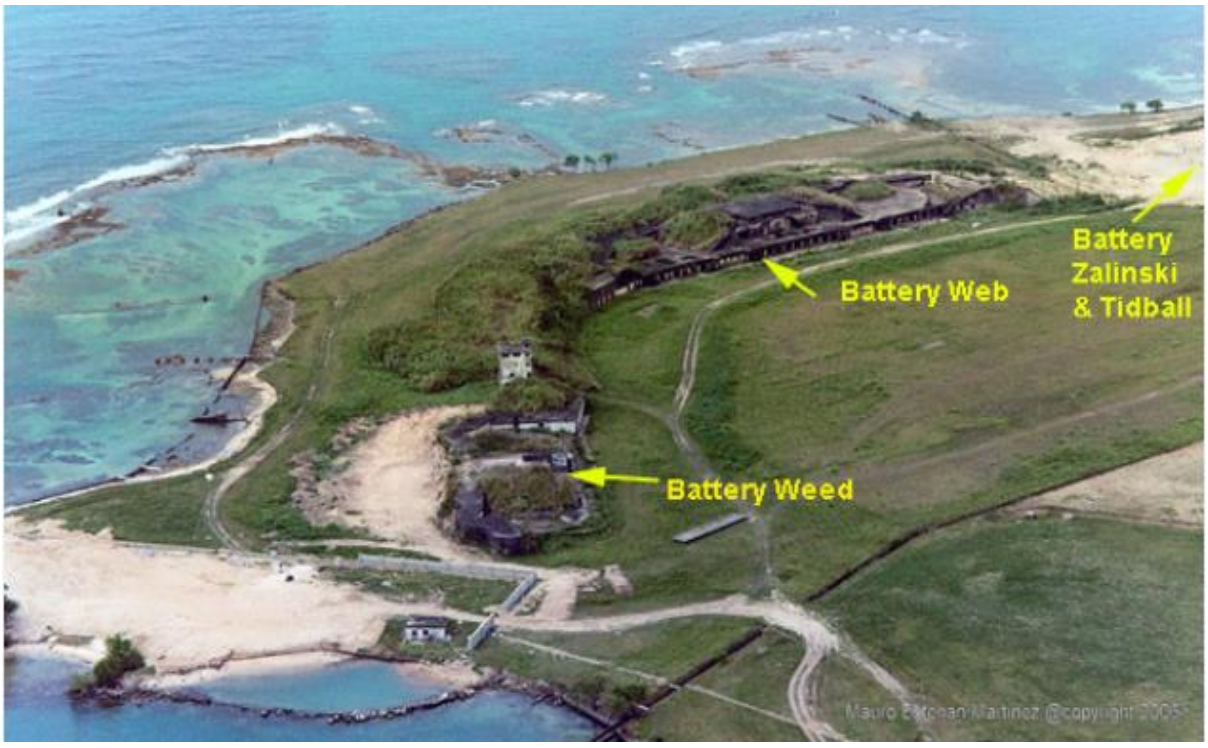
| | | | | | |
|---|---|---|---|---|---|
| FORT KOBBE (ex-Ft. Bruja) | Bruja Point | | to Panama 1999 | | ** |
| Murray | 2 | 16" MkIIMI | B 1919MI | 1926-1948 | Bruja Pt., casemated-WWII |
| Haan | 2 | 16" MkIIMI | B 1919MI | 1926-1948 | Batele Pt., not casemated, empl. buried |
| AMTB #6 | 4 | 90 mm M1 | F M3 | 1943-1948 | |
| Z (3A) | | | | | |
| FORT AMADOR | Balboa | | to Panama, 1997; commercial development | | * |
| Birney | 2 | 6" 1908 | D 1905MII | 1913-1943 | buried |
| Smith | 2 | 6" 1908 | D 1905MII | 1913-1943 | buried |
| FORT GRANT | Balboa | | to Panama, 1979 | ME, MC | ** |
| Newton | 1 | 16" 1895 | D 1912 | 1914-1943 | Perico Is., filled to loading platform level |
| Buell | 2 | 14" 1910 | DC 1907MI | 1912-1948 | Naos Is., one emplacement filled |
| Burnside | 2 | 14" 1910 | DC 1907MI | 1912-1948 | Naos Is., emplacements filled |
| Warren | 2 | 14" 1910 | DC 1907MI | 1912-1948 | Flaminco Is., empls. filled to parapit edge |
| Prince | 4 | 12" 1912 | M 1896MIII | 1912-1943 | Flaminco Is., modified for shopping center |
| Merritt | 4 | 12" 1912 | M 1896MIII | 1912-1943 | Flaminco Is., modified for shopping center |
| Carr | 4 | 12" 1912 | M 1896MIII | 1912-1943 | Flaminco Is. |
| Parke | 2 | 6" 1908 | D 1905MII | 1912-1948 | Naos Is., destroyed for condominiums |
| #8 | 2 | 14" 1920 | RY 1920 | 1928-1948 | Culebra Is., empl (see #1, Randolph), covered |
| T | 2 | 155 mm | PM | | Flamenco Is. |
| U (10A) | 2 | 155 mm | PM | | Flamenco Is. |
| V (10B) | 2 | 155 mm | PM | | Culebra Is. |
| Other sites | | | | | ? |
| W (1B) | 4 | 155 mm | PM | | Taboquilla Is. |
| 2B | 2 | 155 mm | PM | | Taboquilla Is. |
| | 4 | 155 mm | PM | | Paitilla Pt. |
| X | 2 | 155 m | PM | | Urara Is. |
| Y (1A) | 4 | 155 mm | PM | | Taboga Is. |

[75] https://cdsg.org/wp-content/uploads/pdfs/CDSG/CDSG%20WEBSITE%20UPDATES/CDSG%20Downloads/CDList12.pdf

## BATTERIES' COMPOSITION IN 1940

| Battery | Location | | Guns |
|---|---|---|---|
| | **ATLANTIC END** | | |
| Stanley | Fort Sherman | | 14-inch |
| Mower | | | 14-inch |
| Pratt | | Iglesia Point | 2 x 12-inch |
| Mackenzie | | Iglesia Point | 2 x 12-inch |
| Baird | | | 4 x 12-inch mortar |
| Howard | | | 4 x 12-inch mortar |
| Kilpatrick | | | 2 x 6-in |
| W | | | 4 x 155 mm |
| AA No.1 | | | 3 x 3-in |
| AA No.2 | | | 3 x 3-in |
| Webb | Fort Randolph | Margarita | 2 x 14-inch |
| Railway No.1 | | Margarita | 2 x 14-inch mobile |
| Tidball | | Margarita | 4 x 12-inch mortar |
| Zalinski | | Margarita | 4 x 12-inch mortar |
| Weed | | Margarita | 2 x 6-in |
| 2C | | Margarita | 4 x 155 mm |
| 5A | | Margarita | 4 x 155 mm |
| X | | Margarita | 4 x 155 mm |
| 75 mm | | Margarita | 4 x 75 mm |
| 75 mm | | Toro Point | 4 x 75 mm |
| Morgan | Fort DeLesseps | | 2 x 6-in |
| 1B | Galetta Island | | 4 x 155 mm |
| Z | Galetta Island | | 4 x 155 mm |
| U | Tortuguilla Point | | 4 x 155 mm |
| V | Naranjitos Point | | 4 x 155 mm |
| Y | Palma Media Island | | 4 x 155 mm |
| | **PACIFIC END** | | |
| Haan | Fort Kobbe | Batele Point | 2 x 16-inch |
| Murray | | Bruja Point | 2 x 16-inch |
| Z | | | 4 x 155 mm |
| 75 mm | | | 4 x 75 mm |
| Newton | Fort Grant | Perico Island | 16-inch |
| Warren | | Flamenco Island | 2 x 14-inch |
| Carr | | Flamenco Island | 4 x 12-inch mortar |
| Merritt | | Flamenco Island | 4 x 12-inch mortar |

| | | | |
|---|---|---|---|
| Prince | | Flamenco Island | 4 x 12-inch mortar |
| T | | Flamenco Island | 2 x 155 mm |
| U | | Flamenco Island | 2 x 155 mm |
| 8 | | Culebra Island | 2 x 14-inch mobile |
| V | | Culebra Island | 2 x 155 mm |
| 75 mm | | Culebra Island | 2 x 75 mm |
| Burnside | | Naos Island | 2 x 14-inch |
| Buell | | Naos Island | 2 x 14-inch |
| Parke | | Naos Island | 2 x 6-in |
| unnamed | | Naos Island | 2 x 155 mm |
| AA No.23 | | Naos Island | 3 x 3-in |
| Smith | Fort Amador | | 2 x 6-in |
| Birney | | | 2 x 6-in |
| W | Taboquilla Island | | 4 x 155 mm |
| 2B | Taboquilla Island | | 2 x 155 mm |
| X | Urara Island | | 2 x 155 mm |
| Y | Taboga Island | | 4 x 155 mm |
| unnamed | Paitilla Island | | 4 x 155 mm |




*The remains of batteries of Fort Randolph in the 1980s*[76]

[76] https://storymaps.arcgis.com/stories/44e0b1e30a71455987b4f179d709b5d4

| | Completed | Last fired | Unmanned | |
|---|---|---|---|---|
| Fort DeLesseps | | | | |
| Battery Morgan | 1916 | March 1944 | 1944 | |
| Fort Randolph | | | | |
| Battery Webb | 1915 | October 1943 | 1944 | Scrapped 1946-48 |
| Battery Weed | 1916 | October 1929 | 1944 | Scrapped 1946 |
| Tidball & Zalinsky | 1914 | | | Scrapped 1943[77] |
| Fort Sherman | | | | |
| Battery Mower | 1915 | December 1943 | 1944 | Scrapped 1946-48 |
| Battery Stanley | 1916 | December 1943 | 1944 | Scrapped 1946-48 |
| Baird & Howard | 1915 | | | Scrapped 1943[1] |
| Battery Kilpatrick | 1916 | October 1943 | 1944 | Scrapped 1946 |
| Battery Pratt | 1923 | | | Casemated 1942 |
| Battery Mackenzie | 1923 | | | |
| Fort Amador | | | | |
| Birney & Smith | 1917 | | | Scrapped 1943 |
| Fort Grant | | | | |
| Battery Warren | 1917 | December 1944 | | Scrapped 1948 |
| Merritt, Prince & Carr | 1916 | | | Scrapped 1943 |
| Battery Newton | 1917 | | | Scrapped 1943 |
| Buell & Burnside | 1916 | November 1943 | 1944 | Scrapped 1947-48 |
| Fort Kobbe | | | | |
| Haan & Murray | 1929 | | | Casemated 1942, scrapped 1948 |

[77] As defenceless from air attack.