A Compendium Of Information Pertaining To The Composition And Operation Of Civil War Mounted Artillery Batteries

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This work was originally just a collection of notes I had made from various sources for my own purposes. After several requests were made to see my notes I decided to organize them and clean up the wording and abbreviations and that has led to creating this document. As it isn't an academic work or intended for publication I've not included footnotes. That would be more work than I wish to do so the reader will just have to trust that if something is stated as a fact or statistics are provided that the source for these can be found in one or more of the references provided in the bibliography.

I've also not included illustrations as that would require permissions and also be more work than I wish to do as well as making the piece longer than it needs to be. Several very useful web sites where images are available are noted in the bibliography. And there is a wealth of images and videos easily accessible on the internet. Simple Google searches will reveal many.

My hope is that this work will be a useful guide and reference for someone with some knowledge of the American Civil War and an interest in field artillery used in that conflict. While my goal was to condense a lot of material into a relatively small space this work is not intended to be encyclopedic and some assumptions are made regarding what the reader is likely to already know.

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Some Terms

Cannon: a smooth-bore piece of artillery (but not generally including mortars).

Howitzer: a shorter-barreled cannon with a chambered bore producing a very curved trajectory. Howitzers were most commonly used at close ranges to place case* and shell* behind fortifications or other physical barriers but could also fire canister* and solid shot* although no solid shot was included in a howitzer ammunition chest (* see Ammunition).

Rifle: a piece of artillery with a rifled barrel. Rifled guns had greater range and accuracy than smooth-bore guns. However, rifles fired smaller projectiles; thus, they were best employed in longer-range, offensive firing.

Mortar: a short, smoothbore piece of artillery used to fire shells at high angles.

Gun: a general term for cannons and rifles (i.e. not accurately applied to howitzers or mortars).

Battery: a group of artillery pieces commanded as a single unit. For field artillery, batteries were composed of four to six pieces and their associated crews and equipment. At the beginning of the war a battery would have had a mix of cannons and howitzers. Before long, though, howitzers were generally abandoned by the Union in the eastern sector and replaced with Napoleons (see Common Guns). Eastern sector Union batteries were also most commonly equipped with either rifles or cannons but not both (although some mixed batteries did exist). The Confederacy, however, continued to employ a mix of cannons, rifles, and howitzers throughout the war.

Carriage: the wheeled, mostly wooden part of a gun that supported the barrel (often called the tube).

Limber: a two-wheeled cart to which the horses were hitched and which pulled a gun or a caisson. It also carried one ammunition chest on which three crew members could sit (although it was a perilous ride).

Caisson: a two-wheeled cart which was hauled behind a limber and carried two ammunition chests and a spare wheel. Three crew members could also sit on the caisson's first ammunition chest as well as on its limber's chest.

Fuse (sometimes spelled fuze): fuses were inserted into a projectile and were what caused the projectile to explode (see Notes Regarding Ammunition and Fuses).

Vent: the hole in a gun's barrel into which a friction primer was inserted to ignite the powder.

Worm: a wood pole with a pointed iron tip consisting of two branches twisted in a screw-type fashion, used to clean debris from the barrel of a gun or to remove an unfired round.

Ammunition train: the supply wagons dedicated to carrying ammunition. The supply trains were often miles long with thousands of wagons and were kept well behind the lines so as not to be captured. Ammunition trains were usually the first in line if a battle was expected. When

heavily engaged a battery might have to send caissons back to the train to be re-stocked as a battery could only carry a limited supply of ammunition.

Types Of Artillery Batteries

Foot Artillery
The official but seldom used term for what was commonly called "heavy" artillery. Foot batteries generally manned coastal, river or town fortifications - but in the eastern sector also sometimes followed an army in a "siege train" - and were equipped with one or a combination of three types of weapons: large, immobile guns; medium-sized pieces known as siege guns mounted on semi-movable carriages; or mortars. The men manning these batteries typically did not carry side arms or swords but did, on occasion, serve as infantry.

Field Artillery
The official term for batteries assigned to operate in the field with infantry or cavalry (sometimes incorrectly referred to as "light" artillery which is actually horse artillery). Field artillery is subdivided into horse and mounted artillery.

Horse Artillery
The official term for field batteries assigned to operate with cavalry (unofficially sometimes also called "light" or "flying" artillery). On the Union side these were only in the Army of the Potomac (AOP) and manned almost entirely by regulars. In order to keep up with the troopers all the men in these batteries were mounted. These batteries were typically armed with lightweight Ordnance rifles (or perhaps howitzers in the Confederate army) which also had lighter ammunition chests. If Napoleons were used then eight-horse teams might be employed (and certainly no fewer than six per team). The men in these batteries carried side arms and sabers and could function as cavalry if needed.

Mounted Artillery
The official term for field batteries assigned to operate with infantry. The term "mounted" comes from the 1830s when the drivers served in a different branch than the cannoneers and doubled as cavalry (i.e. mounted troops). The men in these batteries typically did not carry side arms or swords although such were initially issued to officers. Mounted artillery is the focus of this work.

Artillery Organization

Before 1863 field batteries were assigned to infantry brigades or divisions with some kept as a reserve. While artillery was sometimes massed early in the war, lack of a centralized command made concentration of fire and command difficult. To address this the Confederate armies in the eastern sector began grouping four batteries into an artillery battalion which was assigned to an infantry division. Union armies in the east grouped four to five batteries into an artillery brigade which was assigned to a corps. Western theater armies continued to assign batteries to infantry brigades. Prior to 1864 the AOP, unlike western-theater armies, held five brigades of artillery in reserve that could be assigned as needed. The Confederate Army of Northern Virginia (ANV) assigned a reserve of two battalions to each corps, although they dropped the army-level reserve. Artillery brigades and battalions typically supported infantry divisions. Artillery brigades and battalions were typically commanded by a colonel although in a pinch a lieutenant colonel or a major might command.

Early in the war Union batteries had a mix of smooth-bore guns and howitzers but by 1863 eastern theater armies were mostly standardized with six guns, all of the same type, although there were still some mixed batteries and, in practice, four- and five-gun batteries were not uncommon. Western theater armies continued to have batteries composed of "every variety of gun known to the service" (John C. Tidball) until very late in the war. Confederate batteries, with about 2/3 of their guns captured from the enemy, almost always had four guns which were usually of mixed type and caliber.

Mixed batteries were more difficult to supply as they required different types of ammunition and other equipment peculiar to a given type of field piece. In addition, fire power could be better directed and concentrated in standardized batteries as all the guns had the same range and ammunition capabilities.

Composition Of A Mounted Artillery Battery
(common to both armies)

- The battery was commanded by a captain.
- Each two-gun "section" was commanded by a 1st or 2nd lieutenant ("section chief") who was responsible for inspections and requisitioning ammunition, supplies, and rations. He could take over command of the battery if necessary and rode abreast of his section when on the march.
- A 2nd lieutenant ("chief of the line of caissons") who had overall command of the caissons, their drivers, the chiefs of the caissons (corporals), the caisson horses, and ordnance. He was the junior officer in the battery and might serve as adjutant (i.e. personnel manager).
- Each piece was commanded by a sergeant ("chief of piece") who commanded the men and equipment of one platoon (a gun, its limbers and caisson and horses for them, the gunner corporal, and the privates). In a four-gun battery he might also fill the quartermaster position. On the march he rode beside the left lead horse and served as a guide for his platoon. When the battery was in action he was dismounted (see Loading and Firing).
- A first/orderly sergeant who assisted the captain, was responsible for training, and did battery paperwork. He was the ranking non-commissioned officer (NCO).
- A quartermaster sergeant who was responsible for drawing and issuing clothing, gear, and rations to the men and for the wagons and their drivers. He kept the appropriate records and received his orders from the captain or the orderly sergeant.
- Two corporals per gun: a gunner and a chief of the caisson. The gunner had command of his gun's crew, aimed the piece, and controlled the rate of fire as per the chief of piece's commands. He issued all commands to the gun crew. The chief of the caisson took care of the limbers and the caisson for his gun and made sure the ammunition was properly packed and in good condition. On the march he walked near the caisson.
- One or two buglers (the 1861 manual called for two). Buglers were privates but rode with the captain and were on his staff. In camp they could be assigned orderly or clerk duties.
- One guidon (flag) carrier. He was a private and carried and took care of the battery flag as well as serving as a marker for directing platoons on the march and positioning the battery for action. He rode with the captain and was on his staff. In camp he could be assigned orderly or clerk duties.
- Privates to serve as drivers for the gun and caisson teams. Each six-horse gun and

caisson team had three drivers, each in control of two horses, who rode the left-hand team horses (lead, swing, and wheel front to back). Drivers were also responsible for care of their horses and harnessed and un-harnessed the horses when needed. During combat they might lie down and hold the reins of the horses (they were left tethered during combat). Drivers were under the command of the chief of the line of caissons.

- Privates to serve as teamsters/wagoners to drive the battery wagon, forge, baggage wagon(s), forage wagon(s), and ambulance. They also cared for those vehicles and their contents and took care of the battery's extra horses. Most were paid extra at the rate of corporal. Teamsters/wagoners were under the command of the quartermaster sergeant.
- A saddler, a carriage maker, a smith, and a farrier (smith and farrier were usually one and the same), all referred to as artificers. They repaired the vehicles and tack and kept all the horses and mules shod. They were privates but most were paid extra at the rate of corporal. They were under the command of the first sergeant.
- Unassigned privates to fill in where needed (such as guard duty) and replace casualties. These were usually under the command of the chief of the line of caissons and walked with the caissons when on the march. Some, however, might be detailed to the quartermaster sergeant.

The 1861 manual called for 25 to 30 men per gun with a minimum of 25 per gun.
Thus, full manual strength was 100 for a four-gun crew and 150 for a six-gun crew. In practice Confederate batteries rarely if ever had that many men and most Union batteries had fewer until quite late in the war.

In March 1862 McClellan had 92 batteries with 520 guns, 12,500 men, and 11,000 horses. That's 136 men and 120 horses per battery. At Gettysburg the AOP had 370 guns and 6,948 artillerists or 19 per gun and 107 per battery (65 batteries; 50 six-gun). The ANV had about 270 guns and 6,080 artillerists or 23 per gun and 92 per battery (67 batteries; 54 four-gun).
Five strength reports from 1861 to 1863 reveal an average of about 19 men per gun or about 115 per six-gun battery for the AOP.

An estimated minimum for a fully-functional six-gun battery: (94)

- 1 captain, 4 lieutenants, 8 sergeants, two artificers, 1 bugler, 1 guidon carrier.
- 39 drivers for the limbers, caissons, battery wagon, forge (assume one baggage wagon, no ambulance, and six-horse gun and caisson teams). Six for each gun and caisson and one each for the wagons.
- 12 corporals (two per gun/caisson pair)
- 42 privates for the gun crews (six seven-man crews)

Allow 10% of the above total for extra privates not assigned other duties and to replace casualties

110 & 11 extras = 121 total
98 & 10 extras = 108 total if four-horse gun and caisson teams used

In a pinch the first and quartermaster sergeant positions could be combined, the caisson corporals eliminated, and six-man crews used for the guns. With those reductions the minimums would be 107 if six-horse teams were used for the limbers and caissons and 94 if four-horse teams used (still allowing for 10% of the total for extra privates).

The 1861 manual showed how the gun could be manned with fewer than seven privates but the fewer the crew the slower the possible rate of fire and the quicker crew members would tire. So, it would seem that any fewer than 94 would mean the battery likely would not be able to move all the guns and caissons, repair the battery assets or adequately man the guns.

An estimated minimum for a fully functional four-gun battery: (64)

- 1 captain, 3 lieutenants, 6 sergeants, 2 artificers, 1 bugler, 1 guidon carrier
- 27 drivers for the limbers, caissons, battery wagon, forge (assume one baggage wagon, no ambulance, and six-horse gun and caisson teams). Six for each gun and caisson and one each for the wagons.
- 8 corporals (two per gun/caisson pair)
- 28 privates for the gun crews (four seven-man crews)
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Allow 10% of the above total for extra privates not assigned other duties and to replace casualties

75 & 8 extras = 83 total
67 & 7 extras = 74 if 4-horse gun and caisson teams used

If the same reductions were made regarding sergeants and gun crews as with the six-gun battery then the minimums would be 73 if six-horse teams were used and 64 if four-horse teams used (allowing for 10% of the total for extras). So, it would seem that any fewer than 64 would mean the battery likely would not be able to move all the guns and caissons, repair the battery assets or adequately man the guns.

For a battery of Napoleon smooth-bores the 1861 manual called for six-horse teams for the guns, caissons, and wagons or 150 total. In practice batteries rarely had that many. One AOP strength report from 1863 showed about 109 horses per battery, another about 128, and one from 1865 showed about 122.

If necessary four horses could be used for the guns and caissons (common in Confederate batteries) and mules could pull the wagons (common in both armies) although with heavier guns it would he hard on the horses over rough ground or for prolonged periods. Small howitzers (12-pdr) and 3 inch guns were light enough that it could be done regularly although it still would have been more of a strain on the horses.

An estimate of the minimum needed for a six-gun battery (74 horses & 14 mules):

- two six-horse teams per gun (one for limber and gun, one for limber and caisson)
- a four-horse or mule team each for the forge and battery wagon
- one or two horses for an ambulance
- six horses or mules for each supply wagon
- 17 total for officers, sergeants, bugler(s), and the guidon-bearer
- 10 spares

Each six-gun battery would thus need a minimum of 113 horses (with one supply wagon and no ambulance) or 99 if mules were used to pull the wagons. If four-horse teams were used for the guns and caissons it would reduce the number to 89 (75 if mules were used for the wagons).

If two of the sergeant positions were combined then the numbers could be reduced by one. Thus, fewer than 74 horses and 14 mules would begin to make it impossible to move or command the battery.

An estimate of the minimum needed for a four-gun battery (43 horses & 14 mules):

- two six-horse teams per gun
- a four-horse or mule team each for the forge and battery wagon
- one or two horses for an ambulance
- six horses or mules for each supply wagon
- 12 total for officers, sergeants, bugler, guidon bearer
- 7 spares

Each four-gun battery would thus need a minimum of 81 horses (with one supply wagon and no ambulance) or 67 if mules used for the wagons. If four-horse teams were used for the guns and caissons it would reduce the number to 58 (44 if mules were used for the wagons).

If two of the sergeant positions were combined then the numbers could be reduced by one. Thus, fewer than 43 horses and 14 mules would begin to make it impossible to move or command the battery.

Horses were preferred for the guns, limbers and caissons because mules were too skittish under fire. A horse can generally pull three times its weight on good surfaces, two times its weight on

bad or hilly surfaces, and its own weight on very bad surfaces or in mountains but only about half that if it also carries a rider. Since the average horse weighs about 900 to 1,100 pounds that's about 3,000 pounds on good roads, 1,900 on bad roads, and maybe 1,000 on very bad or steep ground and half that with a rider (as with limbers and caissons). The military's goal was to proportion loads so as to not be more than 700 pounds per horse.

Watering and feeding of horses was paramount because if not adequate the battery would be immobilized. The typical horse would have required about 5-10 gallons of water per day and 15-20 pounds of forage or hay. Grains, if available, could have been substituted for part of the forage.

The average artillery horse lasted about eight months. On campaign they were often not fed or cared for as well as needed. They were also specifically targeted by the enemy because without horses a battery couldn't move, couldn't easily bring ammunition from the caissons, and couldn't re-supply ammunition from the ammunition train.

At best a battery could make about five miles an hour on good, level surfaces and with good horses but not for sustained periods. About two miles per hour for six hours (15 miles per day) would have been average and twenty to twenty-five miles per day would have been the typical maximum (although there are reports of up to as many as 37 miles in one day).

Note regarding horses and the 20-lb Parrott rifles: the consensus appears to be that an eight-horse team was needed to move them although that may not have always been implemented in practice. I've not attempted to estimate numbers for batteries equipped with these rifles as they were not typical of field batteries (i.e. being more of a siege weapon) although they were part of a minority of batteries, at least early on.

Accessory Equipment

At a minimum:

1 caisson and 2 limbers per gun
1 battery wagon with a limber
1 forge with a limber

and maybe also:

extra caissons (the 1861 manual called for one extra per gun; rarely that many in practice) and 1 to 5 supply/baggage wagons (three seemed to be the dedicated number for the AOP)

1 ambulance

Limber, Caisson, and Ammunition Chests

Each limber had one ammunition chest, a grease bucket, a couple of canvas water buckets, gunners tools, and a tarpaulin strapped on top. A limber weighed 695 pounds without a chest, 1,510 pounds with equipment and a chest filled with ammunition for a Napoleon gun.

Each caisson had two ammunition chests, axes, a shovel, buckets, and a spare pole, handspike, and wheel. A caisson weighed 792 pounds by itself and 3,811 pounds with equipment, limber and three chests filled with ammunition for a Napoleon gun (slightly lighter for rifles).

An ammunition chest weighed 182 pounds and carried 490 pounds of ammunition for a Napoleon (672 pounds total when full) and was covered in sheet copper to prevent embers from setting it on fire.

Rounds per chest:

6-pdr 50
12-pdr Napoleon 32
12-pdr howitzer 39
24-pdr howitzer 23
32-pdr howitzer 15
3-inch Ordnance rifle and 10-pdr Parrott 50
20-pdr Parrott 25

Types of rounds per chest:

6-pdr - 25 solid shot; 20 spherical case; 5 canister.
12-pdr Napoleon - 12 solid shot; 12 spherical case; 4 shells; 4 canister.
24-pdr howitzer - 15 shells; 20 spherical case; 4 canister.
Ordnance rifle and 10-pdr Parrott - 25 shells; 20 case; 5 canister

Each chest also contained two spare cartridges, friction primers, and appropriate fuses.

Rounds per gun:

Armies reported taking 200 to 270 rounds per gun on campaign (the 1861 manual stipulated 200 each be carried by the battery and 224 total per gun, the extra carried by the ammunition train or extra caissons). 250 seems to have been the standard although Colonel John Tidball of the AOP stated about 400 was common.

A 12-pdr battery carried 128 rounds with the battery so the rest would have to travel with the ammunition train which could carry 112 rounds per wagon. Thus .6 - 1.25 wagons would be needed to carry the extra rounds for the battery (or an extra caisson or two with the battery). A rifled gun battery could carry 200 rounds with the battery so half a wagon (or an extra caisson) would be needed to carry the extra rounds.

Ammunition was shipped from the arsenals in different colored boxes:

sold shot - olive;
shell - black;
case - red;
canister - drab.

This made it easy to identify the type of ammunition on the wagons of the ammunition train without the need to read what was labeled on the box.

Battery Wagon and Forge

The battery wagon was towed by a limber and carried oil and paint, spare gunner's tools, axes, spare stocks and spokes, over 200 pounds of spare harness, scythes, spades, picks, and forage in the rack on the back. The chest of the limber contained carriage maker's tools - planes, saws, chisels, etc. - and a set of saddler's tools. Total weight of the limber, wagon, and equipment was 3,574 pounds.

The forge was towed by a limber and carried tools, coal and supplies including horseshoes, nails, spare hardware and iron. Its limber contained the smith's hand tools. Total weight of the limber, forge, and equipment was 3,383 pounds.

Bringing The Battery Into Action

The site selected for the battery might have to first be cleared of interfering brush and trees. The guns could then be brought into approximate position so that they faced the enemy.

The guns were then unlimbered and the limbers pulled in a big circle such that the limbers were about six yards behind the guns (with the end of the limber pole to the end of the trail handspike on the gun being six yards), the horses facing the guns. That positioned the limber so that members 6 and 7 (see Loading and Firing) would be facing the gun and the ammunition chest would open with the copper-covered top protecting the contents from sparks and flying, spent primers. While the gun was in action the horses typically remained harnessed although there are accounts where that wasn't the case.

The caisson, its limber, and its horses would be positioned somewhat to the rear and, if possible, behind some natural cover (33 yards to the rear as per the 1861 manual but it varied in reality).

The gun was supplied from its limber chest. When the gun's limber chest was empty the caisson's limber was moved forward to replace the gun's limber which was then moved back to the caisson.

Once at the caisson, the empty chest was removed from the gun limber and the caisson's rearmost chest was moved onto the limber. Keeping the gun's limber chest supplied was necessary so that there would adequate ammunition with the gun should the gun have to be moved suddenly. Often a section was served from a single caisson, the other moved to the rear for more protection.

The caisson team would travel to the ammunition train to get more chests if the first four were depleted.

It was reported that a good crew could unlimber and fire a round in twenty six seconds. Guns could also be fired as the battery retreated by pulling the gun with the prolonges (ropes) behind a limber with the crew walking beside the gun, loading as they went (see Use Of The Prolonge).

Loading and Firing

A full gun crew consisted of seven men, each with specific functions, whose positions were simply numbered one through seven, and one gunner. The men were positioned on the right or the left of the gun facing down range. Number one was in front of the wheels on the right and two was in front of the wheels on the left, both near the gun's muzzle. Number three was behind the wheel on the right so as to service the vent. Number four was behind the gun and off to the left. Number five was behind number four and delivered the ammunition from the limber. Numbers six and seven prepared the rounds at the limber. The gunner sighted the gun and gave the commands. The following is the sequence followed to load and fire the gun.

On the "load" command:

1. the chief of piece determined the type of ammunition to use and told the gunner
2. the gunner determined the range
3. the gunner communicated the round type and range to 6
4. 6 read the elevation needed from the table in the limber, relayed that to the gunner, and then set the fuse (could be assisted by 7) and gave the round to 7
5. 4 hooked the lanyard to a primer and waited
6. 5 got the round from 7 at the limber and carried it to the gun in a leather pouch (which protected the round from sparks)
7. 3 cleaned the vent and covered the vent with the thumbstall (a leather thumb cover)
8. 1 sponged the bore using two turns of a wet lamb's wool sponge mounted on a long pole
9. 5 showed the round to the gunner
10. 2 received the round from 5 and placed it in the muzzle, then stepped away so as not to be exposed should there be a premature detonation of the round
11. 5 returned to his station between the gun and the limber
12. 1 rammed the round to the rear of the barrel and stepped away
13. after the round was seated 3 went to the trail to move gun right or left as directed by the gunner
14. the gunner inserted the sight and aimed, raising both hands to signal he was done

On the "ready" command:

the gunner removed the sight and stepped back

15. 1 and 2 stepped clear
16. 3 pricked the powder bag by poking a special tool down the vent
17. 4 put the primer in the vent and hooked on the lanyard (if not already done)
18. 3 held the primer in place so the lanyard could be extended while 4 moved to the rear with the lanyard

On the "fire" command:

19. 3 stepped clear and all leaned away and covered one ear
20. when 3 was clear of the wheel 4 pulled the lanyard downward and to the rear

A good crew could fire two solid rounds or three of canister per minute with a smoothbore gun although typically the pace was more like one round every one to three minutes so as to aim and not use up ammunition too quickly. Rifled guns required more time to load as the powder and

the projectile were loaded separately.

In the heat of battle loading and firing might not be performed by the manual as men sometimes knelt or dispensed with steps so as to reduce their chances of being hit. For instance, if subject to being overrun a crew might dispense with sponging so as to fire more rapidly although this would have been dangerous.

Unloading

The manuals specified that guns were not to be transported if loaded. If, for some reason, an unfired round remained in a gun when it was time to limber the gun then man #1 used the worm to remove it. The worm is currently used by re-enactors after every shot for safety reasons but, while the worm certainly might occasionally have been used during the war to clean an excessively fouled bore, no period records could be found noting such a use. The manual only mentions the worm's use in unloading and the location of the worm on the carriage would have made access to it difficult while firing so it would seem that it was an accessory tool for use in clearing a plugged barrel and was not used unless that need arose (similar to the worm tool used to unload a musket).

The space needed for a six-gun battery left to right as directed by the 1861 manual was two yards for each gun with 14 yards between for a total of 82 yards or 246 feet wide and 33 yards deep (not counting caissons). Captain J.F. Rusling, quartermaster, reported in 1865 that on the march a six-gun battery was about 300 yards in length.

Batteries were generally not placed along or directly in front or behind the infantry line but batteries could be placed between regiments or brigades if such were dispersed or separated. If so placed, they generally were sited 60 yards in front of the line of battle. One exception was if a battery was covering the retreat of infantry which might leave a battery out front of the line after the infantry had moved back.

Batteries were thought best placed on the flanks of a corps so as to provide converging fire. Also, oblique angles of fire were considered best as more of the target was exposed.

Sections, and in some cases individual pieces, were sometimes deployed in separate places on the field - i.e. the battery was divided up - in order to take advantage of terrain, to support multiple regiments, or because of obstacles such as heavily wooded areas that reduced clear fields of fire. In some cases only one or two guns might have been needed such as protecting an asset like a bridge. Additionally, sections were much more mobile than an entire battery and could be placed so as to cover a wide front when it was unknown exactly where the enemy might strike. In a fight, splitting a battery might also have had the effect of diluting the enemy's counter-battery fire by creating multiple, separated targets.

As a battery needed an avenue of retreat, the ground behind it needed to be easily traversed.

Hard ground (but not rocky) was best for a battery location to allow recoil and easy movement of the gun and limber.

Batteries were best not placed on rocky ground or behind stone walls due to fragmenting of the rock. Stone walls also impeded loading and swabbing. Being close to trees was also avoided due to splinters and falling limbs.

A battery might be placed so as to take advantage of protective cover such as buildings.

Placement behind a slight rise (about two feet or less) protected against solid shot as it would skip over.

Siting on the reverse side of a slight rise with the gun muzzles looking over the crest was desirable as this protected the guns and limbers although the horses and caissons might still be exposed.

A battery was best only placed on slopes the battery could itself defend (i.e. that allowed for direct fire to the base of the hill). When protecting high ground, it was best placed lower on the slope.

Best slope placement would be on ground where the height of the guns above the target would be about 1% of the distance to the target. For example, at 800 yards that would be 24 feet.

Putting the battery in front of rolling ground could mask dust caused by the impact of the enemy's rounds thus making it hard for the to enemy to sight in.

Guns could be lowered slightly by digging a hole about 1 ½ feet deep that sloped slightly to the rear and lowered their profiles.

Mixed batteries presented problems ensuring the right ammunition combination was available and necessitated less than ideal placement due to the differences in effective ranges of the different guns.

A battery had to be able to see its target from its location and long-range fire was to be avoided generally as it wasted ammunition and accuracy suffered. Most field artillery was employed at ranges of less than 1,000 yards.

Salvo fire - i.e. simultaneous firing of all the battery's guns - was to be avoided as it wasted ammunition, did not allow for sighting corrections, and left all the guns empty at the same time. Against another battery it was advised to concentrate on one or two guns at a time.

One round per minute was generally considered the best rate of fire as it was impossible to accurately aim the gun when firing faster than that and the tube could quickly overheat which could cause premature detonation. Bronze tubes could become overheated to the point that expansion of the metal prevented the gun from being loaded. The exception to the rule was if the enemy was within 350 yards. If so, then canister was used at two rounds per minute.

Double canister was used if the enemy was within 150 to 160 yards (one charge, two cans) at two to three rounds per minute.

The doctrine of the day was that artillery used on the offensive should be directed against enemy batteries, a function ideally suited to the longer-range rifled guns. However, when used offensively batteries tended to use up ammunition with less effectiveness due to the ranges which were necessary so as to not be within range of rifled muskets. Used defensively, though, gunners could wait for the enemy to reach the ideal range before opening fire and could employ canister using the larger smooth-bore guns. Thus, many felt that artillery was best employed on the defensive and historians seem to agree that is how it was most effectively utilized.

Some felt that artillery was best used against infantry or cavalry and not against other batteries because anti-personnel fire caused more casualties and was directed against the front of the attacking forces. Counter-battery fire and battery duels were nevertheless fairly common.

It was not advised to fire case or shells over friendly troops as inconsistent fuses could cause premature detonation. Even solid shot fired too close to friendly troops could rain pieces of debris on them (sabots, metal bands).

Batteries were weakest on their flanks and were typically protected there by cavalry or infantry, cavalry being thought best on open ground due to its greater mobility and infantry best on broken ground.

Defensive or offensive uses combined, it's estimated that only about ten percent of the casualties in the civil war can be attributed to artillery. This does not mean artillery was not effective, just

that it didn't cause as many casualties as small arms fire. Even if it didn't directly kill, artillery fire could demoralize attacking troops causing them to take cover or divert their attack. Used against cavalry it could also cause the horses to panic.

Howitzers were used somewhat like mortars because their high trajectory was ideal for use against troops behind works or terrain features but also put a battery at somewhat of a disadvantage due to their short range and relatively light projectiles. Confederate General Edward Porter Alexander was fond of turning howitzers into mortars by digging a trench for the tail and putting the carriage wheels up on skids. This pointed the barrel upward and by using a reduced powder charge the howitzers became mortars.

If guns had to be abandoned they were usually spiked which involved driving a metal spike - often carried with the gun for that purpose - into the vent hole and then using a rammer to bend it inside the gun so it couldn't be pulled out. In a pinch any piece of metal that could be crammed into the vent could be used if an actual spike wasn't available. Spikes could be removed with the right tools but obviously not during a battle. If time permitted, the guns were dismounted and the carriage wheels destroyed or a solid shot was wedged in the bottom of the bore by wrapping it with felt.

Use Of The Prolonge

The prolonge, a 26 foot 7 inch long rope, was used to pull a gun over terrain where it was not possible to maneuver when hitched to a limber and to move the gun and fire while retreating (using the prolonge was a quicker maneuver than hitching the trail to the limber). On one end there was an iron bar, about seven inches long, and at the other end an iron ring, about four and a half inches in diameter. The iron ring was placed over the limber's pintle hook and the iron bar went through the lunette of the cannon.

In a retreat the gun was hauled backwards with the crew loading and firing on the move. Recoil would hasten the movement. After the gun had fired the driver would walk the team slowly forward taking up the slack caused by the recoil while the crew reloaded the gun. Once the gun was reloaded, the team was stopped for the next shot. The prescribed method was usually to withdraw one two-gun section to the rear of another section that remained stationary and firing. Once the first section had passed the second section, it would be able to cover the withdrawal until it was time to leapfrog again.

Early Guns

Initially a mix of 6-pd and 12-pd smooth-bores left over from the Mexican war were commonly used by both sides although that generally changed quickly as the 6-pounders didn't deliver much of a load and could only fire solid shot and better, lighter, 12-pounders were soon in production.

1841 6-pdr
- Bronze
- 884 lb. tube & 900 lb. carriage = 1,784 lbs total
- 3.67 in. bore & 6.1 lb. projectile; they could not fire shells.
- Effective range less than 1,500 yards.
- Most were quickly abandoned by both sides and melted down to make Napoleons although a few remained in service. There was one at Gettysburg.

James conversion rifles (often called type I rifles)
- Pre-war 6-pdr bronze guns retro-rifled by boring them out in the James rifling pattern; an early attempt to make rifled guns.
- 3.67 in. bore; 12 lb. James or Schenkl projectile
- The bores wore out after about 400 rounds and they quickly fell out of use.

Common Guns

1857 12-pdr "Napoleon" (named for Napoleon III) or **Light 12-pdr**
- Bronze (the Confederacy made some 120 cast iron Napoleons starting in 1864 after their only copper mine was lost with the fall of Chattanooga)
- 1,227 lb. tube & 1,128 lb. carriage = 2,355 lbs total
- 4.62 in. bore & 12.3 lb projectile; 2.5 lbs powder charge for shot, 2.0 lbs for canister
- Shot and shell accurate to 1,600 yards; canister to 300 yards.
- The most common smooth-bore on both sides.

10-pd Parrott rifle
- Cast iron with a wrought iron band around the breach
- 890 lb. tube & 900 lb. carriage = 1,790 lbs total
- Model 1861 had a 2.9 in. bore and Model 1863 had a 3 in. bore. After 1864 Union batteries were standardized with the 1863 model but the Confederacy continued to use both (sometimes creating a problem because different ammunition was required).
- Parrott and Absterdam shells used; the Confederacy produced some others such as the Reed shell. 1,900 yard range (canister to about 150 yards). It used a one-pound powder charge.

1861 3-inch Ordnance rifle
- Wrought iron (and a very small number of steel ones)
- 816 lb. tube & 990 lb. carriage = 1,716 lbs total
- 3.0 in. bore & 10 lb. projectile; one pound powder charge. Hotchkiss and Schenkl shells used but could also fire Parrott shells. Extremely accurate to 1,850 yards (canister to about 150 yards), reliable, and lighter than a Parrott.
- The Ordnance rifle was the most widely used rifled gun on both sides.

20-pd Parrott rifle

- Cast iron with a wrought iron band around the breach
- 1750 lb. tube & 1,128 lb. carriage = 2,878 lbs total
- 3.67 in. bore & 20 lb. projectile. Parrott and Absterdam shells used; the Confederacy also produced Reed shells. This gun used a two pound powder charge.
- 2,100 yard range
- Not used as often as 10-pounders in AOP field batteries due to the weight but more common than the 1841 guns. The Confederate Army of Tennessee (AOT) only had six.

1841 12-pdr

- Bronze
- 1,757 lb. tube & 1,175 lb. carriage = 2,932 lbs total
- 4.62 in. bore & 12.3 lb. projectile
- 1,600 yards effective range
- Used by both sides but not generally in field batteries as they were too heavy. Most were replaced by the Napoleon which was as effective and lighter. It required an eight-horse team.
- (it had lifting handles on the tube like the 24-pdr howitzers)

1841 12-pdr howitzer

- Bronze
- 4.62 in. bore & 8.9 lb. projectile; one pound powder charge.
- 788 lb. tube & 900 lb. carriage = 1,688 lbs total
- 1,000 yards maximum range; effective range more like 775 yards
- Very effective against troops at ranges under 400 yards.
- The Confederacy continued to use them throughout the war but most Union guns were melted down to make Napoleons although howitzers were favored in the west due to better mobility.

1841 12-pdr mountain howitzer

- Bronze
- 4.62 in. bore & 8.9 lb. projectile; half pound powder charge.
- 220 lb. tube & 280 lb. pack carriage or 720 lb. prairie carriage = 500-940 lbs total
- The pack carriage allowed the gun to be carried disassembled on three mules. The prairie carriage allowed it to be pulled by two horses
- 1,005 yards maximum range; effective range more like 900 yards maximum
- Designed for use in mountains and where roads were not common
- Typically fired case or canister but could fire solid shot
- Canister for mountain howitzers held 148 .69 musket balls, considerably more than 12 pdr. cannon rounds
- Used by both sides, most commonly by cavalry for which larger pieces were not practical
- These continued to be used after the war in the Indian wars until about 1870

1841 24-pdr howitzer and Austrian 24-pdr howitzer

- Bronze
- 1,318 lb. tube & 1,128 lb. carriage = 2,446 lbs total
- 5.82 in. bore & 18.4 lb. projectile
- 1,322 yard range
- Its weight was a problem for field batteries so they were more commonly used in fixed defensive positions and field fortifications. Most in Union service were eventually replaced by Napoleons but the Confederacy continued using them throughout war.
- (1841 24-pdr guns can be identified by the lifting handles on the tube)

24-Pdr Coehorn mortar (12 pounders were also used but were fairly rare)

- A short-barreled smooth-bore gun used to lob shells into the air at high angles
- Bronze (a few iron, and even a few improvised wood, guns were used but were also fairly rare)
- mounted on a wood block with handles; 296 pounds total and moved by four men.
- 5.82 in. bore, 16.8 lb. projectile
- 1,200 yard maximum range although typically used at shorter ranges. Range was regulated by altering the powder charge. Used by both sides but considerably more by the AOP. Not typically part of a field battery these became more common later in the war as entrenching and sieges also became more common.

Rare Guns

James rifle (often referred to as type II or "true" James rifles)

- Bronze or (rarely) steel
- 915 lb tube & 900 lb. carriage = 1,815 lbs total
- 3.8 in. bore & 14 lb. projectile; James shell used; 0.75 pound powder charge.
- 1,530 yard range
- Later-produced guns that were manufactured new (about 400 made); none were made after 1862.
- Not widely used once Parrott and Ordnance rifles became available although one Union battery had them at Gettysburg.

Blakely rifle

- Wrought iron or steel; had an extra band encompassing the trunnions.
- 800 lb tube & 900 lb. carriage = 1,700 lbs total
- 3.5 in. bore & 12 lb. bolt projectile most common; other calibers made. One pound powder charge
- 1,850 yard range
- English made and imported by the Confederacy only. Very rare but the ANV had four at Gettysburg. About 400 total were made.
- Light tube and carriage weight caused severe recoil that tended to damage the carriage.

Whitworth rifle

- Steel
- 1,000 lb. tube (could not find specifications on the carriage)
- 2.75 in. bore & 12 lb. projectile; 1.75 pound powder charge.
- Breech loading and used special shell that fit the hexagonal bore.

- 2,800 yard effective range but could travel close to twice that
- Only used by the Confederacy in the field although the Union had a few. Rarely used as the ammunition was hard to get and manufacture and the mechanism not reliable.
- The ANV had two at Gettysburg. Only 50 are known to have existed.

Armstrong rifle (sometimes called the Armstrong twelve-pounder)
- Steel reinforced with wrought iron bands.
- 975 pd. tube
- 3.0 in. bore & 10.8 - 11.4 lb. studded Armstrong projectiles
- (can find no specifications for weight of the carriage)
- 3,400 yard range
- English made and imported only by the Confederacy.
- Only a few used; very rare.

Other oddities, calibers, and shell types were made and used but the above represent the overwhelming majority of the guns used in field batteries by both sides.

Effective ranges were less than possible ranges due to reduced accuracy at increasing distances, crude sights, and the necessity of being able to see the target. Exact ranges cannot be stated absolutely as each gun performed slightly differently than others of the same model, there were differences in powder, and variations in weather conditions. In general the effective range of smoothbore howitzers was three quarters of a mile, that of smoothbore cannons one mile, and that of rifled three-inch guns one and a half to two miles.

Smooth-bores were preferred for close-range use because they were more quickly loaded and their projectiles were larger. Also, with canister they delivered heavier projectiles. It has often been said that the rifling affected the pattern of canister distribution in a negative way but a 2015 test seems to cast doubt on that contention*. Rifles were preferred when engaging enemy batteries or other long-range targets because they were more accurate and had greater range than smooth-bores.

Metallurgy and Manufacture of Artillery

As can be seen in the list of artillery there was a progression from bronze to cast iron to steel tubes. While it is beyond the scope of this article to discuss details of manufacturing processes, some notes on the differences in materials and the development of iron and steel rifled guns seems appropriate.

Guns and howitzers from the Mexican War era were made from bronze which is an alloy of copper and tin. Bronze is softer than iron or steel and is easy to mold and bore. It's also not brittle and exhibits low friction with other metals so made a very good material for artillery tubes. However, when the relatively soft bronze tubes were re-bored so as to be rifled the rifling didn't last very long and so they were soon retired and were often just melted down. Thus, while bronze continued to be used for smooth-bore guns it was not adequate for rifled guns.

Rifled guns were made from cast iron which is an alloy of iron and 2-4% carbon. While brittle, it is easy to cast in a mold (hence its name), has a relatively low melting point, and is fairly easy to machine but cannot be bent, stretched, or hammered into shape as it will fracture before it

distorts. It does, though, have high compression strength. Also, iron rifling did not easily erode as iron is harder than the lead or copper bands on the projectiles that were used to engage the rifling (called a sabot). An additional advantage to rifles is that, because they didn't need as much powder as a smooth-bore (the sabot and rifling "sealing" the bore), the barrels didn't have to be as thick which made them lighter.

The first iron rifle was the Parrot but the brittleness of the cast iron caused it to sometimes burst at the breech. The remedy was to attach a ring of more flexible wrought iron around the breech. Wrought iron is an alloy of elemental iron and slag (a by-product separated from the metal during the smelting of ore) and is worked with tools (i.e. not poured into a mold and thus "wrought" or worked). It contains less carbon than cast iron, is highly malleable, and is resistant to fatigue. The fix worked but just tended to move the point of failure forward of the breech. Early ammunition also tended to explode before leaving the barrel due to the friction from the rough internal edges of the shells causing the powder to explode prematurely and exacerbating the problem of burst barrels. This, too, was soon remedied by coating the inside of the shells with a tar-like substance to reduce friction. We don't have good statistics regarding barrel failures but, while most Parrott tubes provided long service, some artillerists didn't trust the Parrott. This may have been because those of larger bore than the 10-pdr guns did, in fact, sometimes burst just beyond the wrought iron bands. That the 10-pdr guns were not reliable appears to be a bit of a myth but is commonly mentioned in the literature. The reader is advised to take such claims with a grain of salt.

A modification of a technique for making wrought iron easier to work - the Reeves's process - soon led to the development of the 3 inch Ordnance rifle which not only did not burst but was also some 100 pounds lighter than the Parrott. In short, multiple sheets of wrought iron were wrapped around a solid or tube-like core and forged and welded in place. When the finished tube was bored and rifled almost all of the original core was removed. These tubes were far superior to the cast tubes of the Parrott and the Ordnance rifle soon became the favored rifled gun although many Parrotts remained in service. While the confederacy was able to produce Parrott copies they didn't posses the technology to produce Ordnance rifles so only had those they could capture. So good were the Ordnance rifles that they remained in service until 1880 - when they were replaced by breech-loading guns - while the Parrott was permanently retired at the end of the war.

Steel is just iron that has less than 2% carbon content. It is less brittle than cast iron but, while not a new thing in the nineteenth century, was difficult to produce so not common. However, with the development of the Siemens open-hearth process good quality steel could be produced in industrial quantities. Thus, toward the end of the war steel started to be used in the manufacture of artillery (e.g. the Whitworth and Armstrong rifles) although it wasn't yet the standard.

Note: for more detail on the manufacture of Parrott and Ordnance rifles the reader is referred to Hazlett et al (see Sources).

* See: The Artilleryman, Vol 36, No. 2, Spring 2015

Ammunition

Shot (called a "bolt" with rifled guns)

- Solid.
- Used against fortifications, buildings, wagons and guns or massed troops at ranges of 350 to 650 yards. Round shot would skip along the ground which made it very effective against troops but bolts, not being round, tended to dig in and not skip so were not a good choice against infantry or cavalry.

Shell

- Hollow and filled with powder; exploding.
- Used against troops behind obstacles or against wooden buildings to set them on fire.
- Used against targets at 650 to 1,500 yards.
- Shells were aimed and timed to explode about 15 feet above troops so as to rain the fragments down. It was not as effective against troops as was case due to the small number of fragments, their less-directed pattern, and lower velocity of the pieces. It was reportedly more effective against cavalry as it spooked the horses.

Case (or "spherical case" with smooth-bores)

- Hollow, exploding, and filled with lead (Union) or iron (Confederate) balls packed in sulfur. Used against troops at 650 to 1,500 yards.
- Fuses were difficult to precisely time so it was rarely used if the enemy was quickly closing.
- Case was aimed to explode above and in front of the troops (50 to 75 yards) so as to fan the shrapnel down and out.
- There are records of case for rifles sometimes being used without a fuse as a substitute for shot. In a real pinch, case could be used in a smooth-bore gun without a fuse so as to explode near the muzzle as a substitute for canister. This was called "rotten shot" and was quite risky.

Canister

- A can filled with lead (Union) or iron (Confederate) balls packed in sawdust. Confederate canister originally used lead balls also but a lead shortage required a later change to iron.
- It could be fired from smooth-bores and rifles. Smooth-bore canister shot was larger but rifled gun canister rounds contained a larger number of shot.
- Given the right soil conditions, it could be fired low and in front of advancing troops - like solid shot - so as to skip and hit the advancing troops at an upward trajectory.
- It was only effective at a maximum range of 350 to 400 yards for smooth bores and perhaps half that for rifles. There are reports of case being fired without a fuse (so as to explode in the gun or at the muzzle; referred to as "rotten shot") as a substitute for canister although it would have been a dangerous practice.

Notes Regarding Ammunition and Fuses

Smooth-bore rounds were attached to a wooden sabot and the powder bag was tied to a groove in the sabot so the rounds could be loaded as one piece. Powder and round were loaded separately for rifled guns. Powder bags were made of serge, merino wool or close-textured flannel.

There were three types of fuses: timed fuses which were lit by the flame as the round left the barrel of the gun; percussion fuses which caused detonation upon impact using a percussion cap; and concussion fuses which were activated by the shock of striking an object (often employing a chemical vial which broke on impact). Timed fuses were the most common, followed by percussion.

Smooth-bore ammunition used time fuses only while rifled gun ammunition could be fitted any of the types (or a combination of timed and percussion). The most common timed fuses were made of paper cylinders packed with a slow-burning powder. The burn time was adjusted by cutting the fuse using a marked guide stored in the limber. The Bormann timed fuse, used for smooth-bore shells and case ammunition, was also common but it was metal and screwed into the shell of the ball. Powder was held in an internal circular tube and times were marked on the surface. To set the Borman fuse a hole was poked at the desired time mark and that allowed flame to enter the fuse. Ammunition for rifled guns was often fitted with more complicated timed fuses than the simple paper ones, some peculiar to a specific gun.

Fuse failure was a continual problem for both sides but more so for the Confederacy. Union Bormann and Parrott fuses had an overall failure rate of about 25% while paper fuses on both sides had a failure rate closer to 50%. Confederate Bormann fuses were so defective that they were often removed and replaced with a plug fitted to accept a timed paper fuse. Rifle rounds would sometimes tumble which often prevented their concussion fuses from working and their tight fit in the barrel sometimes prevented ignition of timed fuses as the required flame might not pass the round and reach the fuse. Inconsistent and imprecise burn times were also problems as rounds would often detonate too early or too late which was a prime reason not to fire over friendly troops.

Confederates had a problem for a while with fuses that had inconsistent burn times. Prior to the summer of 1863 the ANV got its fuses from the Richmond arsenals. Due to shortages after Chancellorsville fuses were also made in Charleston, SC and Selma, AL. Those proved to have longer burn times (one second longer for a given length) so would cause shells to explode later than Richmond fuses of the same length. This was largely corrected by January 1864 but Confederate ammunition was never the same general quality as that of the Union.

Note: the subject of fuse systems is a complicated one, the details of which are largely beyond the scope of this article. Several good sources regarding fuses are noted below. One can also find useful articles on the internet.

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