



20mm Mk 4 Mod 2 Gun Mounts Stabilization Report

Owner – Texas Parks and Wildlife Department
Project – Stabilize Four 20mm Gun Mounts

Scope of Project

This project entailed the disassembly, removal of all existing coatings and corrosion, applying new preservative coatings, and reassembly of each mount and its gun.

Initial Condition

Mount# 3 (2019.1002.26)

The mount was found to be in overall stable condition and in a similar condition as all eight of the ship's current 20mm mounts, not just the four-undergoing conservation. Several parts of the mount were either missing or severely deteriorated. The column raising handwheel and the pedestal head cover, the plate that keeps rainwater from entering the mount, was missing. The missing plate allowed the hardware securing the carriage to the stand to become heavily corroded yet intact. The carriage locking bolt was frozen in place and with at least half of the bolt missing from corrosion. The carriage and cradle were tack welded together to keep the gun from elevating. However, the gun could rotate freely.

Its gun was found to be in a state of deterioration with the visible signs of the long-term effects of corrosion. This condition is consistent with that of the other eight 20mm guns on the ship. The internal mechanical components of the trigger assembly were corroded entirely away. The buffer springs and interior of the trigger casing were heavily corroded and showed signs of water standing being retained inside the gun. The breach casing was covered in paint, and the breech block was frozen in the place by rust. The barrel was filled with rust and externally had pitting where the barrel spring interfaced with the barrel. The barrel casing was heavily pitted on the interior lower surface, where rainwater would collect. Surprisingly, where parts were fitted with tight tolerances the interfacing surfaces of those parts were free of degradation, given the overall poor condition of the gun.

Below is the list of missing parts on the gun itself:

- Missing Double Loading Stop Assembly
- Missing 1 Bolt and 1 Nut for securing Ring Sight Mount to Gun

Mount#5 (2019.1002.29)

The mount was found to be in overall stable condition and in a similar condition as all eight of the ship's current 20mm mounts, not just the four-undergoing conservation. Several parts of the mount were either missing or severely deteriorated. The column raising handwheel and the pedestal head cover, the plate that keeps rainwater from entering the mount, was missing. The missing plate allowed the hardware securing the carriage to the stand to become heavily corroded yet intact. The carriage locking bolt was frozen in place and with at least half of the bolt missing from corrosion. The carriage and cradle were tack welded together to keep the gun from elevating and rotating. Additionally, the pedestal head locking catch was found welded in the locked position preventing the gun from rotating.

Its gun was found to be in a state of deterioration with the visible signs of the long-term effects of corrosion. This condition is consistent with that of the other eight 20mm guns on the ship. The internal mechanical components of the trigger assembly were corroded entirely away. The buffer springs and interior of the trigger casing were heavily corroded and showed signs of water standing being retained inside the gun. The breach casing was covered in paint and the breech block was frozen in the place by rust. The barrel was filled with rust and externally had pitting where the barrel spring interfaced with the barrel. The barrel casing was heavily pitted on the interior lower surface, where rainwater would collect. Surprisingly, where parts were fitted with tight tolerances the interfacing surfaces of those parts were free of degradation, given the overall poor condition of the gun.

Below is the list of missing parts on the gun itself:

- Missing 1 Bolt and 1 Nut for securing Ring Sight Mount to Gun

Mount #6 (2019.1002.30)

The mount was found to be in overall stable condition and in a similar condition as all eight of the ship's current 20mm mounts, not just the four-undergoing conservation. It was coated coat of polyurethane paint in 2019 over the existing coatings. Several parts of the mount were either missing or severely deteriorated. The column raising handwheel and the pedestal head cover, the plate that keeps rainwater from entering the mount, was missing. The missing plate allowed the hardware securing the carriage to the stand to become heavily corroded yet intact. The carriage locking bolt was frozen in place and with at least half of the bolt missing from corrosion. The carriage and cradle were tack welded together to keep the gun from elevating. The pedestal head locking catch was found welded in the locked position preventing the gun from rotating.

Its gun was found to be in a state of deterioration with the visible signs of the long-term effects of corrosion. This condition is consistent with that of the other eight 20mm guns on the ship. The internal mechanical components of the trigger assembly were utterly corroded away. The buffer springs and interior of the trigger casing were heavily corroded and showed signs of water standing being retained inside the gun. The breach casing was covered in paint and the breech block was frozen in the place by rust. The barrel was filled with rust and externally had pitting where the barrel spring interfaced with the barrel. The barrel casing was heavily pitted on the interior lower surface, where rainwater would collect. Surprisingly, where parts were fitted with tight tolerances the interfacing surfaces of those parts were free of degradation, given the overall poor condition of the gun.

- Missing Double Loading Stop Assembly
- Missing 1 Bolt and 1 Nut for securing Ring Sight Mount to Gun

Mount #8 (2019.1002.32)

The mount was found to be in overall stable condition and in a similar condition as all eight of the ship's current 20mm mounts, not just the four-undergoing conservation. It was painted with polyurethane paint in 2019 over the existing coatings. Several parts of the mount were either missing or severely deteriorated. The column raising handwheel and the pedestal head cover, the plate that keeps rainwater from entering the mount, was missing. The missing plate allowed the hardware securing the carriage to the stand to become heavily corroded yet intact. The left and right cheek plates were missing from the cradle. The carriage locking bolt was frozen in place and with at least half of the bolt missing from corrosion. The carriage and cradle were tack welded together to keep the gun from elevating. Additionally, the pedestal head locking catch was found welded in the locked position preventing the gun from rotating.

Its gun was found to be in a state of deterioration with the visible signs of the long-term effects of corrosion. This condition is consistent with that of the other eight 20mm guns on the ship. It was coated with polyurethane paint in 2019 over the existing coatings. The internal mechanical components of the trigger assembly were wholly corroded away. The buffer springs and interior of the trigger casing were heavily corroded and showed signs of water standing being retained inside the gun. The breach casing was covered in paint and the breech block was frozen in the place by rust. The barrel was filled with rust and externally had pitting where the barrel spring interfaced with the barrel. The barrel casing was heavily pitted on the interior lower surface, where rainwater would collect. Surprisingly, where parts were fitted with tight tolerances the interfacing surfaces of those parts were free of degradation, given the overall poor condition of the gun.

- Missing 1 Bolt and 1 Nut for securing Ring Sight Mount to Gun

Treatment Performed

Mounts

The major external components of the mounts were removed from each mount for individual treatment. The components removed were the gun, cradle, shields, and shield brackets, which left the stand and carriage as the significant components of the mounts still together. The treatment for each of the four mounts was identical and any difference in treatment is identified in the treatment narrative. The treatment of the guns will be addressed in the following section.

- Cradle – Separating the gun from the cradle required cutting the securing shoes on the cradle that hold the gun in place due to the gun securing bolt being frozen from rust. Soaking the gun securing bolt in penetrating oil and heat cycling were repeated tried before prior resorting to cutting the securing. Cutting and repairing the securing shoes was deemed a necessary invasive measure to allow for proper treatment of the gun, given the extreme level of deterioration of the gun. The securing shoes were cut using a thin cutting wheel and were welded back in place once the gun was removed. The welds on the shoes were ground flush with the original material.

Removal of the cradle from the carriage was facilitated by removing the trunnion pins. Once the trunnion pins were removed, the carriage locking bolt remnants were removed, and the two components were separated. The trunnion pins on mounts #3 (2019.1002.26) and #8 (2019.1002.32) were replaced due to excessive corrosion. Reproduction pins and nuts were machined and installed at reassembly.

The paint was removed using a pneumatic needle scaler and the surface was cleaned by abrasive blasting with glass bead/aluminum oxide blast media (10/70 mesh, 220 grit). The blast media removes any corrosion and paint remnants and creates a fine profile in the surface, giving a better surface to anchor the primer. The cradle was then primed with two coats of Amerlock 2/400 and then painted with two coats of PSX One in Navy Blue 5N.

All bearing surfaces were cleaned and polished, coated with compressor oil (a light oil) for rust prevention until reassembly.

- Shields and Shield Brackets

The shields (2) and shield brackets (2) were unbolted from the carriage and whereupon the brackets were separated from the shields. The paint was removed from the shields and brackets with a pneumatic needle scaler and they were blasted with a glass bead/aluminum oxide blast media (10/70 mesh, 220 grit). The blast media removes any corrosion and paint remnants and creates an anchor profile to give the primer more surface area to adhere to. The shields and shield brackets and hardware were then primed with two coats of Amerlock 2/400 and then painted with two coats of PSX One in Navy Blue 5N. After painting, the shields and brackets were put back together with new hardware due to the deteriorated condition of the existing nuts and bolts. The shields and brackets were reinstalled once the carriage was ready to receive them.

- Carriage and Stand

The carriage and cradle were only slightly broken down further by removing the trunnion spring housing assembly and the trunnion spring from the cradle. The welds holding the pedestal head locking were removed using a cutting wheel. This action was taken to remove corrosion between the catch and the carriage; it allows the mount to be rotationally freed up in the future. Mount #3 (2019.1002.26) was already able to freely rotate. Mount #6 (2019.1002.30) became rotationally free once catch was unlocked.

The carriage and stand were stripped of paint with a pneumatic needle scaler and blasted with a glass bead/aluminum oxide blast media (10/70 mesh, 220 grit). The blast media removed any remaining corrosion and paint remnants and created an anchor profile to give the primer more surface area to adhere to. The carriage and stand were then primed with two coats of Amerlock 2/400 and then painted with two coats of PSX One in Navy Blue 5N.

Once all mount parts received treatment, the mount was reassembled. All grease fittings (grease zerks) were replaced, and the mount was lubricated with marine-grade grease.

Gun

Each gun was broken down into its base components for treatment. The components removed were the shoulder rest assembly, sight assembly, barrel spring case, forward and rear barrel springs, left and right breach bars, breech block, breech bolt, and in the case of mounts #5 (2019.1002.29) and #6 (2019.1002.30) the barrel was removed. The treatments for each of the four guns were identical and any difference in treatment is identified in the treatment narrative below (narrative is sequential). Missing parts were

- Exterior Components Disassembly - The barrel spring case, barrel springs, breach bars, the shoulder rest assembly, and sight assembly were removed from each mount without great effort.
- Rust Chelation Treatment—The gun was soaked in a rust chelating agent (EvapoRust) for two weeks. After the rust chelating bath was complete, the gun was further disassembled.
- Final Disassembly – The last three major components of the gun to be removed were the trigger casing, breech block/breech bolt assembly, and the barrel. The trigger casing was removed with relative ease. The breech block/breech bolt assembly was frozen in place with corrosion. The breech block was fused to the breech by corrosion. After heat cycling the afflicted area and soaking with copious amounts of penetrating oil (Kroil), the breech block/breech bolt assembly was removed from the gun with great difficulty by placing a soft steel alloy rod (softer than the face of the breech block) down the gun barrel and applying percussive force to the rod over a long period with a hammer. This methodology separated the breech block/breech assembly from the breach casing without damaging the gun components.

On mounts #5 (2019.1002.29) and #6 (2019.1002.30) the barrel was removed from the gun with great difficulty. All guns were immersed in a bath of penetrating oil (Kroil) and the barrel connection area was heat cycled. After which, a custom-made wrench, patterned after a period barrel wrench, was used to unlock the barrel. But only on mounts #5 and #6 did the barrel unlock and separate from the gun.

- Electrolysis Treatment – Electrolysis was used to clean paint remanent and corrosion from the hard-to-clean interiors of specific components. The barrel spring casing and trigger casing for all four mounts went through electrolysis. The breech casings for mounts #5 (2019.1002.29) and #6 (2019.1002.30) went through electrolysis because they were able to be separated from their barrels. None of the barrels went through electrolysis due to their chromium content and the possible release of hexavalent chromium gas. Hexavalent chromium is a known carcinogen byproduct when alloys containing chromium undergo electrolysis.

The electrolytic solution used was one cup Arm & Hammer Super Washing Soda (Na_2CO_3) per gallon of tap water. Each component was suspended in the solution and a mild steel anode was placed through the open center of each component. The electric current supplied was 12 volts dc with upwards of 30 amps for up to seven days, with daily cleaning of the steel anode.

- Parkerization – all gun components were bathed in acetone, bead blasted with a glass bead/aluminum oxide blast media (10/70 mesh, 220 grit), washed with acetone, heated evenly to at least 100 degrees F with a heat gun, and parkerized with zinc phosphate. After leaving the parkerization tank, each component was washed with hot water and placed in a bath of very light oil (WD-40) and allowed to rest for a few days.
- Missing parts – all identified missing parts on the gun were not replaced, as their replacement would not contribute to the stabilization or the long term preservation of the gun.
- Reassembly and Final Preservative Treatments – After the parkerization process was complete, the gun was reassembled and the exterior painted black with PSX 1001 (PPG). The gun was then reinstalled on the gun mount. The interior of the gun and its moving parts were coated with Royal Purple Compressor Oil to preserve the gun's interior further.

Temporary Protection

Once all work was complete on each mount, the mount was placed on a pallet and covered with heat shrink wrap to protect the guns from the elements while awaiting reinstallation on the ship. The heat shrink encapsulation is vented to prevent a microclimate from forming.

Maintenance Plan

It is recommended that each gun be covered with a cover that approximates the look of period gun covers to forestall deterioration, namely rainwater accumulation. Completely covering each gun may not be possible to achieve, given the desire to exhibit these guns. At a minimum, each gun should have a muzzle cover to prevent rainwater from entering the gun. Further, it is recommended that each gun is inspected annually for signs of preservative coatings failure (paint, parkerization, oil) and those coatings renewed as necessary. Depending on the level of deterioration found in annual inspections, the inspection frequency may need to be increased to twice annually.

Addendum



Mount #8 – mounted on ship, prior to removal



Mount #5 – mounted on ship, prior to removal



Mount #6 – mounted on ship, prior to removal



Mount #3 – mounted on ship, prior to removal



Corrosion filled interior of trigger casing/breech casing



Breech casing after treatment, prior to final preparation for parkerization



Representative trigger casing after electrolysis.
The interior of the casing is almost entirely corroded away, revealing the corrosion damaged springs.



Representative barrel spring casing after electrolysis and bead blasting. Note the heavy pitting in the interior surface.



Representative gun in rust chelating bath



Representative gun being pressure washed to remove loose rust scale and rust chelating agent.



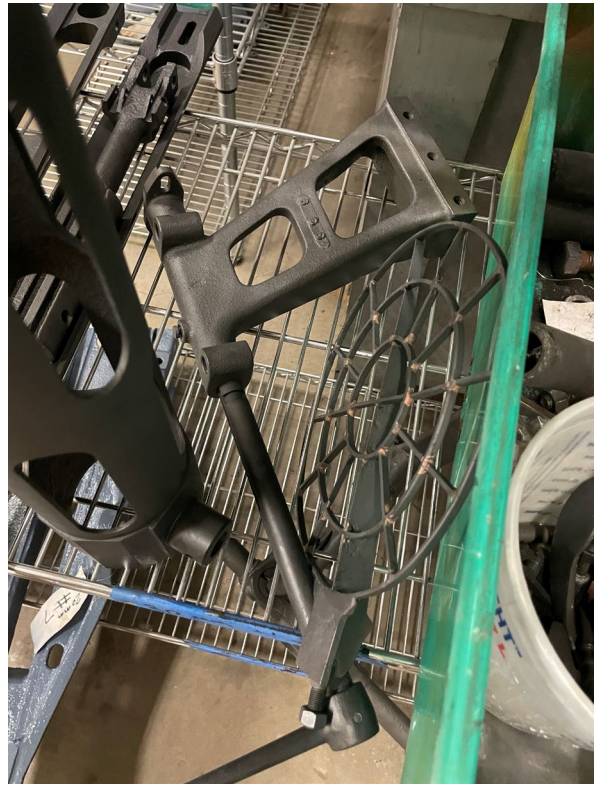
Trigger casing undergoing electrolysis. The film floating on top is rust.



Barrel springs undergoing parkerization.



Representative barrel springs, breech bars, breech block, and trigger case cover after parkerization



Representative barrel casing, ring sight, and ring sight mounting bracket after parkerization



Representative barrel spring casing after parkerization



Representative trigger casing after parkerization



Representative mount after being reassembled with gun parkerized, prior to gun being painted



Representative assembled mount after gun has been painted black.



Two completed mounts awaiting heat shrink wrap.



All four mounts heat shrink wrapped and stored outside.