Health & Safety

Live Ordnance and Response

The discovery of live ordnance in a museum's collections is frequently unexpected and always nerve wracking.

Last year, the Virginia Department of Historic Resources (VDHR) discovered live ordnance from the Revolutionary War in storage during work being performed as a part of a National Maritime Heritage grant. Ultimately, 140 Hollinger boxes of artifacts were checked for ordnance as we worked closely with the Richmond bomb squad, the Virginia State Police bomb squad, the ATF, and FBI, amongst other local authorities. We came away with a much better understanding of safety protocols to be taken when dealing with historic black powder and felt that sharing this information was worthwhile.

Most crucial when dealing with possible live ordnance is to stay calm. Everyone around will be taking their cues from the person in charge and in many cases, this is the conservator. Staying calm, making clear decisions, and explaining the process to those around you goes a long way towards keeping everyone safe. Work with the bomb squad to determine the level of threat and if evacuation is necessary. If your site is not prepared to evacuate staff and the public safely, it is important to use discretion and prevent panic; ordinance should remain undisturbed until the proper authorities can be contacted and a determination is made as to whether the objects and/or people should be removed from the premises.

Learning about the extreme danger posed by static was the largest gain; the smallest spark can cause gunpowder to ignite. If gunpowder is ignited while it is in a container, it will explode and cause shrapnel to be propelled from the explosion site. If gunpowder is ignited out in the open, it catches on fire and anything near it will catch fire. We did everything we could to limit the chances of a spark creation, including:

- Raising the humidity in the lab and storage room.
- Setting aside special carts covered in cotton cloth for use with possible live ordnance.
- Removing any plastic coverings from tables and carts.
- Replacing foam required for padding out tables with pink, static-free foam designed for working with electronics.
- Tables were also covered with electrostatic discharge (ESD) mats, including a metal bracelet that connects the mat and the handler to prevent static electricity build up while handling artifacts. All boxes were grounded on a mat prior to accessing the contents and each bag was grounded on the mat prior to accessing the artifact within. Plastic bags holding the artifacts that were being checked were also grounded prior to handling (see figure 1).

Figure 1. Left: Electrostatic discharge mat on workbench ready for ordnance. Above: Metal bracelet worn in conjunction with an electrostatic discharge mat to ground the user. All images courtesy the Virginia Department of Historic Resources.

- Carts and chairs were also prepared by applying an anti-static spray that we made in-house to prevent any static during transportation (2 tablespoons liquid fabric softener and 2 tablespoons of ethanol per 1 cup of water in a spray bottle).
- Cotton bumpers filled with material that would not hold a static charge (bentonite clay conditioned to 50%RH in cotton socks) reduced static potential during handling and transport.
- Only wooden or other non-metal tools were used when working with possible live ordnance.

The campaign against static involved choice of staff clothing, including cotton clothes, leather shoes with thick rubber soles, and nitrile gloves. The bomb squad also provided bulletproof vests and bomb helmets (see figure 2). The helmets ultimately proved too heavy and awkward to use during an eight-hour day and were abandoned, because they continually slipped down and obstructed vision. Helmets were replaced with protective glasses that were also provided by the bomb squad.

In many cases, storage in water is considered a safer option for preventing ignition of live ordnance. We were uncertain about how artifacts from our site would react with water due to incomplete records for previous treatments and decided the risk to collection items was too great. Instead, we were extremely cautious in handling any artifacts; any hard knock or fall could cause ignition because gunpowder can be ignited if there is enough friction between the grains of powder. Even if water has been employed, the potential for complete wetting of all surfaces might be compromised by casings or archaeologically induced corrosion.

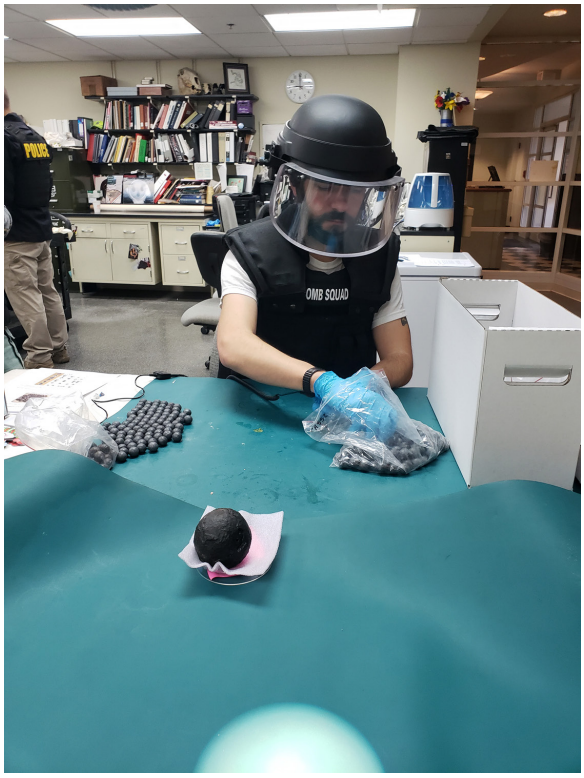

Figure 2. Collections Manager Andrew Foster wears a bullet proof vest, bomb squad helmet, cotton shirt, and nitrile gloves as PPE for the live ordnance search.

Once possible live ordnance was visually identified, it was placed on a prepared cart and photographed, with the understanding that these photographs might remain as the only record of the artifact, if it had to be destroyed (see figure 3). A pXRF was used to test for sulfur levels. If sulfur levels were above what was expected from a shipwreck environment and if the smell and weight (lighter than expected for solid iron) of the artifact were suspicious, it was considered live ordnance and the bomb squad took it to a room that had been emptied for the storage of ordnance only. The next day all the ordnance was weighed, measured, and x-rayed by the bomb squad before removal to a secure magazine until it could be destroyed.

Figure 3. Cart prepared with materials to prevent static and impact while transporting possible live ordnance.

Our goal was to discern if the artifacts were comprised of a ball of gunpowder from a grenade, solid iron shot, or some other non-explosive material. As a part of the chain of custody, we witnessed the bomb squad detonate all of the ordnance containing gunpowder. They let us check the explosion sites to see if there was any material to recover, but usually there was nothing to recover.

Although the bomb squad's only recourse is to destroy artifacts, Explosive Ordinance Disposal (EOD) officers at Quantico have the ability to deactivate without destruction, if live ordnance is present and the artifact must be saved. EOD officers will supply you a certificate that the artifact has been rendered safe and will help you label the artifact so that others will know it is safe to handle. However, not every group that handles ordnance can do this; the Marines are the only organization allowed to certify ordnance deactivation and then return an artifact to its owner.

During this project, we asked if a trained canine could sniff the boxes and find those containing live ordnance. We were informed that this was not feasible because the dog would not be able to smell the gunpowder charge if the iron casings were intact and that if a dog inaccurately identified a non-live artifact, the bomb squad would be required to destroy it. The bomb squad also pointed out that the conservation lab "smells like a bomb" to a dog, so they would tell their handler that everything in there was live (which would be unhelpful).

Identification of live ordnance is of utmost importance to ensure the safety of staff, the public, and artifacts for collections containing potentially explosive artifacts. Many resources are available to help with the identification of ordnance, frequently organized by time period, war, or type of weapon. At the VDHR, items that might contain live ordinance most commonly date to the Revolutionary War, the War of 1812, the Civil War, or possibly more modern periods (due to testing by military bases in the Commonwealth), and our library of reference material is built upon these parameters.

Understanding what ordnance dangers might lurk in your collection is your best defense; learning to identify the kinds of live ordnance you might have and sustaining a good working relationship with your local bomb squad can prevent harm or unintended explosive events. The VDHR owes a debt of gratitude to the Richmond bomb squad for taking the time to work with our staff in ensuring safety for everyone and everything involved during our search for ordnance from the Revolutionary War.

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