



Naval Safety Center

LESSONS LEARNED



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LITHIUM BATTERY FIRES

The information era has resulted in numerous innovations to the military's technological arsenal. We have computers with significantly advanced functions, gear with increased lethality, and we even have robots and aircraft that fly themselves. One of the things that helps these innovations to operate is lithium batteries. These new and improved energy sources allow advanced equipment to operate for extended periods and more effectively. The down-side, however, is they have the potential to be quite volatile. Here are a handful of first-hand lessons to help us grasp the hazards of this volatility and why we need to respect it.



Why you don't store your expensive toys next to those that catch fire

The Navy SEALs are some of the most lethal fighters in the armed forces due to advanced training and some very high tech gear. Unfortunately, some of the training regarding storing this gear wasn't up to par. A unit was conducting routine training with a Puma unmanned aerial system (UAS). Once completed, they decontaminated the UAS and components with fresh water and stored them in a weapons cleaning and maintenance armory. Regrettably, they were unfamiliar with the guidance that the lithium batteries for the Puma should be stored in individual HAZMAT containers to mitigate the risk of damage in the event of a battery fire, which of course, is precisely what occurred once they secured the armory. About two hours after being locked away, a fire started that destroyed almost 2 million dollars in equipment. The fire department determined the fire resulted from a failure of the lithium batteries for the UAS.

What happens when your bomb detection robot becomes combustible

This incident leaves a little ambiguity as to causes, but is worthy of a look. During a training exercise, a unit had a "FirstLook" robot charging in a hard-sided expandable small air-mobile shelter (HESAMS). The robot had not been used for eight days and was left on the charger the entire time. A service member first discovered that a fire had started in the container when he opened the door and was hit by a smoke cloud. The fire destroyed the robot and other equipment. A fire investigator determined the fire started with the robot, but was unable to identify if it was the battery or the robot components that started the fire, due to the amount of damage. Even with some uncertainty about the cause, we can still make some judgments. First, you probably don't want to leave a lithium battery on the charger for more than a day, let alone eight days. Lithium batteries are not something you want to over-charge. Second, when charging these batteries, it may be wise for someone to be in the room. If they make us unplug something as non-volatile as a coffee maker when we leave, then we should probably unplug items that have the potential to be exceedingly volatile, like lithium battery-operated robots.

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Don't be a hero when it comes to noxious fumes

This incident is potentially worthy of some admiration, but not necessarily encouraged. A service member was replacing lithium batteries for equipment on an aircraft when he noticed one of the batteries was hot and producing smoke. He identified the battery was in thermal runaway, so he secured the power to the station and removed the glowing battery. This action potentially saved the aircraft from severe damage, but caused the service member to inhale a large volume of fumes. Medical personnel put him on several days of light duty, but fortunately, he made a full recovery. His actions warrant respect, but the Navy and Marine Corps would prefer damage to equipment than damage to their people. According to the Technical Manual for Navy Lithium Battery Safety Program Responsibilities and Procedures (NAVSEA S9310-AQ-SAF-010), if you see a lithium battery getting hot or swelling, you are to evacuate the area and call Explosive Ordnance Disposal (EOD). If the battery is actively venting or burning, you are to contact the fire department, ensuring they know there is a lithium battery incident. Let the pros take it from there.

Why you don't keep lithium batteries in your pocket

This mishap report didn't provide a lot of detail and may not directly relate to the military's operational world, but we can still learn from it on an individual level. A Sailor had two lithium batteries in his pocket (*now, I wonder what prohibited device these batteries belonged to...*). Anyway, the report says the batteries must have made contact with the Sailor's keys and shorted, because they "exploded in his pocket," resulting in several burns (*burns aren't pleasant anywhere, but definitely aren't good there*). Now come on, if something has the chance of blowing up, regardless of how small that chance is, do you really want to carry that thing in your pants?

Key Takeaways / Lessons Learned

The diversity in mishaps recorded here should tell us something about the nature of lithium batteries. No matter what environment you use them in, there is a potential for a hazardous event like thermal runaway or fire. For that reason, it's crucial to know what equipment within our units uses lithium batteries, and if we have gear that uses them for power, what to do if something goes wrong. Consider these points when planning how to handle lithium batteries.

- 1. Know the storage criteria.** NAVSEA S9310-AQ-SAF-010 provides some general guidance on this, but the technical manuals for specific equipment often have more detailed guidance for that item.
- 2. Keep an eye on things.** Watch over the equipment when it's in use or charging.
- 3. Most importantly, have a plan for when something goes wrong.** NAVSEA S9310-AQ-SAF-010 also provides guidance on emergency procedures. These should be reviewed and applied to your emergency action plan as appropriate. Ensure your unit knows when to deal with an issue on their own and when to call for professional responders. At the very least, they must know how to recognize a venting or burning battery and who to contact. These can pose serious health risks and should be dealt with by professionals.

This product is posted on the NAVSAFECEN public website at
<https://navalsafetycenter.navy.mil/Safety-Promotions/Lessons Learned>.

To give us feedback, contact us at NAVSAFECEN_CODE522_LESSONS_LEARNED@navy.mil.

And remember, let's be careful out there...