



Interrupted Laptop Shutdown Can Create Heat and Fire Hazards

LL-2017-LLNL-3
LLNL-POST-719538
January 24, 2017

An LLNL employee on vacation was using his personally-owned laptop in the airport before his flight. Upon completing his task, he clicked through the two steps that gave the computer the shutdown command. Upon seeing the blank screen, he immediately closed the laptop, placed it inside his computer bag, and closed the bag.

When placing the computer bag under the seat in front of him on the plane, he noticed that the zipper pulls for the computer bag laptop compartment were warmer than room temperature. Being aware of LL-2016-LLNL-31, *Responding to an Overheating Lithium Ion Battery*, he suspected that there may be a problem with the lithium-ion laptop battery.

Upon accessing the laptop, he discovered that it had reached a temperature approaching too-hot-to-touch. Observing that there was no smoke, scent, or sound, he removed the laptop from the computer bag, immediately removed the battery from the computer and placed the battery on the floor. While he prepared to pour water on the battery if necessary, he informed his row-mates of the situation and let them know that they should be prepared to leave their seats if he told them that the battery's condition worsened.

The battery and the laptop soon cooled as hoped and were returned to the computer bag after reaching a comfortable temperature. Later use of the laptop indicated that the battery had sustained some damage - its post-event charge lasted approximately 15 minutes, down from approximately 90 minutes before this event.



Analysis

Closing the laptop apparently interrupted the shutdown process, and the laptop continued to run and emit heat after it was placed inside the computer bag. The close fit of the computer bag compartment, the cushioning that protects the laptop from physical damage, and the closed compartment combined to contain the heat given off by the laptop. This caused the temperature inside the compartment to increase and damage the lithium ion battery. Fortunately, the situation was discovered before the battery experienced a thermal runaway which can result in a fire or explosion.

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Recommended Action

Laptop shutdown for storage:

Verify that the shutdown process has been completed and the laptop is at a safe temperature for storage before placing it into any computer bag or other container:

- The screen is blank.
- The power switch is not illuminated.
- The backlit/illuminated keyboard (if so equipped) is not illuminated.
- Air is not blowing out of the laptop.
- The laptop is not making any sounds (e.g., exhaust fan or spinning hard drive). NOTE: This can be difficult in a noisy environment.
- The laptop and battery feel cool enough to be stored (temperature can be above room temperature, but it should not be hot to the touch and the temperature should not be increasing).

General:

It is essential that we consciously adapt to any technology we adopt. In most cases, it is a matter of being mindful when using our devices. As you go through your week, take notice of how many times the first touch produced no action or one different from what you intended, and why. Then, because the device is not going to change, figure out what you will do to adapt to it to make it work for you.

This level of vigilance may seem unnecessary when, in most instances, there is no real harm –

- the screen does not show the next picture,
- the video does not start, or
- the text needs a spelling error corrected

and correction is made with an additional touch or two.

However, the result can be starkly different and potentially harmful without appropriate vigilance –

- something that should have been completely shut down and secured, such as a vehicle, is not;
- a temperature entered is incorrect by tens or even a hundred or more degrees;
- the timer that controls some action never starts the action, starts it at the wrong time, or causes the action to run for the wrong amount of time (e.g., one extra digit on the microwave oven timer typically is ~10X the intended cook time); or
- an important message does not get transmitted.

Where to Get Help or More Information

- Your supervisor.
- Instruction manuals for whatever device you are using.
- To search for other LLNL Lessons Learned, go to the "Lessons Learned" web site (https://cao-int.llnl.gov/lessons_learned/), select the topic of interest or click on "Search" and enter a keyword.

Priority Descriptor: Yellow / Caution.

Work/Function Categories (HSS entry): Fire Protection.

Hazard (HSS entry): Electrical / NEC, Fire /Smoke / NFPA, Personal Injury / Exposure – Other.

ISM Category (HSS entry): Analyze the hazard, develop / implement controls.

Keywords (HSS entry): battery, laptop, lithium ion.

Subject Category (LLNL LL web page): Electrical, Emergency Preparedness and Response, Fire Protection.

Please Post

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