

**Famous sayings about flashlights:**

- If you have one, you have none (because you can't find it, or its battery is dead, or...)
- If you have two, you have one (see above)
- Three is better
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- It's better to light a flashlight than to curse the darkness
- "Whether you need them for indoor or outdoor use, having a *working* flashlight is a necessity."

*Some General Comments:*

- *Many, many opinions regarding flashlights; one online reviewer even feels that name-brand AA flashlights are the only way to go and no flashlight < \$40 is worthwhile. Get five reviewers in a room and you'll probably have ten opinions.*
- *Lots and lots (and lots) of knockoffs especially with flashlights costing <\$10; be wary of odd spellings for "name" brands. Construction quality can vary widely.*
- *Vendors can play various specsmanship games. Be suspicious of extravagant brightness claims: some of those high values are impossible to achieve given LED specs and battery capacities.*
- *AA and AAA flashlights are generally smaller, lighter, and easier to handle than C and D flashlights.*

Mike Jones has discovered a very nice, bright, small, and inexpensive flashlight: the Alonefire XML-T6 (available from Amazon for \$7.99 <http://a.co/aSxKjD7>; lower prices available through other vendors or by volume purchases, but beware of cheap clones using counterfeit LEDs).

**Caveat emptor:** Brightness (lumens, abbreviated lm) specs for this flashlight and its clones are often exaggerated (e.g., 2000 lm or more); such levels cannot be achieved given the flashlight's battery capacities and LED specifications<sup>1</sup>. Real lumens are probably in the 400 — 600 range (still plenty bright and not something you'd want to shine directly into your eye).

- Basis for stating flashlight's brightness is < 1000 lm (GEEKY ENGINEER ALERT!)
  - Three AAA batteries in series provide ~4.5V @ ~ 850 mAh typical; 1000 — 1250 mAh capacity (alkaline — lithium)
  - The official Cree XM-L T6 LED in the flashlight can provide 1040 lm **max.** (@ 3A! — may be able to get that much current or more from an AAA battery, but it's only going to last for a few minutes); min. 280 lm @ 700mA, min. 388 lm @ 1000mA, min. 551 lm @ 1500 mA, min. 692 lm @ 2000 mA; Vf = 3.1V @ 1500mA typical.
  - Pumping more current through the LED may give a bit more brightness but it's a diminishing return. It would also require that the LED be attached to a good heatsink with fan cooling and be supplied from a bigger battery. These things work against having a small handy flashlight. The basic questions are: How long do you want to run it, and can you dissipate the heat?

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<sup>1</sup> This comment about brightness is not meant to imply that the Alonefire XML-T6 is not a good flashlight, it is just a heads up regarding the misleading advertising I've seen by some vendors (especially a few on eBay) for this and similar flashlights. The Alonefire works well, is very bright, and is a worthwhile addition to your CERT equipment

Before you venture out into the darkness with any flashlight, let's discuss some battery information:

- **Don't** use alkaline AAA batteries as they can leak and damage the flashlight (see the Consumer Reports note "Why Do Batteries Leak" for details)
- Use lithium AAA batteries
  - they're less likely to leak
  - they have a long shelf life (i.e., low self-discharge)
  - they perform better over a larger temperature range
- **OR** use a rechargeable Li-ion 18650 battery (works in the Alonefire with the plastic support sleeve that comes in the box); make sure the Li-ion battery has built-in protection circuitry
  - Fenix 18650
  - Streamlight 18650 USB

But wait, there's more:

- You can also use three AAA Low Self-Discharge Nickel Metal Hydride (LSD NiMH) rechargeable batteries
- Look for new NiMH batteries that advertise "Low Self Discharge," "LSD," or even "Precharged!" that will hold a charge for months or years as opposed to mere weeks. Most versions can be recharged 500 to 2000 times.
- Energizer Recharge and Panasonic Eneloop are two highly-rated makers of AA batteries in this category (<http://thewirecutter.com/reviews/best-rechargeable-batteries/>)
- More details here [http://batteryuniversity.com/learn/article/nickel\\_based\\_batteries](http://batteryuniversity.com/learn/article/nickel_based_batteries)
- LSD NiMH batteries have a lower voltage (1.2V) that may be an issue for some applications, but they appear to work fine in flashlights.
- The Eneloops claim operation down to -4°F
- Panasonic K-KJ17M3A4BA Cell Battery Charger with Eneloop AAA New 2100 Cycle Rechargeable Batteries, 4 Pack available at Amazon <http://a.co/fPDaetP>
- Panasonic BK-4MCCA4BA Eneloop AAA 2100 Cycle Ni-MH Pre-Charged Rechargeable Batteries, Pack of 4 at Amazon <http://a.co/1apbTEu>
- Eneloop AAAs available at Walmart, <https://www.walmart.com/c/kp/eneloop-batteries>, other online vendors, and sometimes at Costco; be careful of eBay "clones"
- Energizer Recharge batteries available at Amazon, Target, ...
- I have used Eneloop batteries in many applications (e.g., flashlights, wireless mice and keyboards, ...) and they've worked well, lasted a long time, and recharged quickly. I don't have any experience with the Energizer Recharge batteries.

If you are going to use rechargeable batteries, you should have two sets: one set in the flashlight, and one backup set already charged.

To summarize regarding AA & AAA batteries:

- Alkaline
  - Pro — inexpensive and relatively easy to find
  - Con — Prone to leakage; do not work well in cold temperatures; **NOT** rechargeable
- Lithium Primary
  - Pro — Lightweight; approximately double run time in most lights; much greater operational temperature range
  - Con — NOT rechargeable; expensive compared to Alkaline
- NiMH
  - Pro — Rechargeable (manufacturers claim between 500 & up to 2000 times)
  - Con — Large additional expense unless already own appropriate charger; about half the capacity of Alkaline cells

Other flashlights and flashlight-related items we have discussed in past CERT meetings (you might be able to find better prices via a Google search):

- 9V lights <http://www.9voltlight.com/home>
- Battery charger bundle option for Alonefire flashlights inc. Fenix 18650  
<http://www.fenixlight.com/ProductMore.aspx?id=2223&tid=16&cid=32> (be careful when buying off-brand Li-ion batteries; they may not have built-in protection like the Fenix 18650)
- Fenix USB Battery <http://www.fenixlight.com/ProductMore.aspx?id=2228&tid=16&cid=32>
- Streamlight 18650 USB Battery; [https://www.lapolicygear.com/st-22102-18560-usb.html?trk\\_msg=MTIJK49BH2D4V3ER84QMAP0874&trk\\_contact=D22KMGPCTGDC7GIRBFNTU616AG&trk\\_sid=CE72FVCVF17DPUG1Q57HIJVGSO&utm\\_source=Listrak&utm\\_medium=Email&utm\\_term=https%3a%2f%2fwww.lapolicygear.com%2fst-22102-18560-usb.html&utm\\_campaign=All+New+Streamlight+Flashlights](https://www.lapolicygear.com/st-22102-18560-usb.html?trk_msg=MTIJK49BH2D4V3ER84QMAP0874&trk_contact=D22KMGPCTGDC7GIRBFNTU616AG&trk_sid=CE72FVCVF17DPUG1Q57HIJVGSO&utm_source=Listrak&utm_medium=Email&utm_term=https%3a%2f%2fwww.lapolicygear.com%2fst-22102-18560-usb.html&utm_campaign=All+New+Streamlight+Flashlights) or  
<http://www.brightguy.com/Streamlight/Streamlight+18650+USB+Battery+22102>
- Nebo Larry light <http://a.co/0FvJRT6>
- Nebo Redline <http://a.co/a8P8k5R>
- Life Gear Glow Stick <http://a.co/flC1Trz>
- ZTS Mini Multi-Battery Checker <https://www.ztsinc.com/minimbt.html>
- PowerPax Battery Caddy for six AAAs <http://a.co/fe8SAVu> or <http://www.storacell.net/>
- Nightcore Tube USB Rechargeable Flashlight <http://a.co/5h6oL4j>

**N.B. NONE OF THE ABOVE IS MEANT TO ENDORSE A BRAND OR WEBSITE OR CLAIM ANYTHING AS OFFICIAL CERT EQUIPMENT; IT IS SOLELY THE OPINION OF THE AUTHOR BASED ON HIS OBSERVATIONS, EXPERIENCE, AND RESEARCH.**

**NO GUARANTEES. YOUR MILEAGE MAY VARY. THINK AHEAD. MEASURE TWICE, CUT ONCE. CHECK THE MAP AND THE GAS TANK BEFORE YOU LEAVE THE DRIVEWAY. DON'T SWEAT THE SMALL STUFF. YOU GET WHAT YOU PAY FOR. HAVE FUN. RELAX. DESPITE WHAT EVERYONE SAYS ABOUT YOU, YOU'RE ALL RIGHT.**