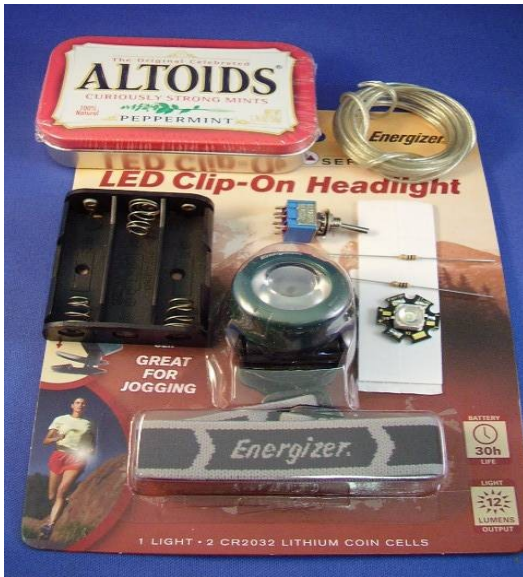


## How to make a bright green LED headlamp.

Hiking at night in the snow with a typical white LED headlamp is somewhat harsh on the eyes and affects your night vision. Red LED lights are not nearly bright enough to be of much use. Green on the other hand works rather well. It is less harsh on the eyes, helps persevere night vision and happens to be the color the eye is most sensitive to. High intensity Green LEDs are available which makes a green light headlamp possible. This document shows how to modify an off the shelf white LED headlamp to use a ½ watt Green LED. It has two brightness settings, full brightness and half brightness. At full brightness, one can easily see 20 feet into the woods. Current consumption is high, about 240 ma on bright and 120 on dim, so AA batteries are used. Even so, expect about 10 hours of use on bright and 20 hours of use on dim.

Parts needed:



1. Empty Altoids tin
2. Cheap clip on LED headlamp (Energizer, Wal-Mart, \$5.48)
3. 3-4 feet of #24 speaker wire (Radio Shack)
4. 3 cell "AA" battery holder
5. Center off SPDT toggle switch
6. 3, 36 ohm ¼ watt resistors
7. Green LED mounted on "star" board
8. Double sided foam mounting tape (Wal-Mart)

Electronic parts from Mouser.com

LED: part # 604-AAD19090ZG10ZCS (\$9.07)

Battery holder part # 12BH331D-GR (\$1.10)

Switch part# 612-100-C1112 (\$2.96)

Resistor (10 piece min) 291-36-RC (\$0.40 for 10)

Total cost for the parts (less shipping) including headlamp will be about \$20.00

Note: I used speaker wire for the connections from the headlamp back to the battery pack (which will be in the Altoids tin), as I had some handy. Any reasonably thin, flexible, two conductor wire could be used. Also note that I used a toggle switch for the on/off switch, but a slide switch would be better as not to be accidentally turned on while in a pack or pocket. The only problem with a slide switch is that it would be more difficult to mount in the tin.

Tools needed:



1. Hobby knife (Xacto, #11 blade)
2. Fine tipped philips screwdriver
3. Hole reamer
4. Side wire cutters
5. Needle nose pliers
6. Not shown: Soldering iron, solder, hot glue gun, drill and assorted sized drill bits

## Building steps:



Disassemble the headlamp into its component parts as shown above. First, unscrew the back cover to expose the batteries. Remove the batteries, then the O-ring, remove the two small screws near the outside edge of the casing. Pull the white plastic piece out from the front lens housing. Pull out the front reflector plate with the circuit board mounted to it from the white plastic piece. (clip the little metal battery connection tab off the red wire). Remove the two screws holding the circuit board to the reflector piece.



Rework the reflector piece by removing the plastic stand on the back side which the circuit board was mounted to. The easiest way to do this is to snip around the edges with the wire cutters, then smooth it off with the hobby knife.



Enlarge the hole so that the new green LED lens will fit through it. This is best done with a tapered hole reamer, but if you don't have one, you'll have to come up with another method of doing so, maybe with a drill bit.



Solder the speaker wires to the + and – terminals on the LED star board as shown. Note that the solder tabs on the upper right and bottom left are not connected back to the LED. These are used for LEDs with an additional two connections inside the lamp. If possible, mark the other end of the wire to indicate which wire you connect to the + and – terminals. Some speaker wire use two different color wires inside the insulation, sliver and bare copper, to tell them apart.



Now that the wires are attached to the LED, attach the LED assembly to the reflector piece with hot glue. Liberally squirt the glue into the gap between the bottom of the reflector and star board, making sure they stay square to each other as you do so.



Pass the wire from the LED assembly through the hole in the center of the white plastic piece, then re-assemble the pieces. Drill a hole large enough for the wire to pass through in the center of the back piece. It must be in the center so that the wire does not twist when you screw the two pieces back together. Although I forgot to do it, it would be a good idea to put a knot in the wire before passing it through the hole in the back piece. This would keep stress off the wire connections inside if the wire is pulled on.



To further reduce stress on the wire as it comes out the back of the headlamp, route it as shown in the picture to the right.

#### Making the battery holder from an Altoids tin:

Remove the contents of the tin, if it is not already empty. Drill a 1/4" hole in the short side for the toggle switch to mount into. Locate the hole half way from the bottom of the lip of the cover when closed and the bottom of the tin.

Drill a hole in the long side of the tin for the wire to the headlamp to pass through. Drill two more smaller holes about an inch below the hole for the wire and either side of center.



Before mounting anything in the tin, pass a couple of inches of the wire from the headlamp through the hole into the tin and tie a knot in it so it can't pull out the hole again. Secure the wire to the side of the tin with a twist tie. This will eliminate chaffing of the wire where it enters the tin, as the edges of the hole will be fairly sharp. Once you are all done, squirting a little hot glue around the wire and into the hole will also help.



Now mount the toggle switch into its hole and secure the battery holder to the bottom, inside of the tin with double sided foam tape.

Note that I didn't think to put the wire in the hole and secure it to the side of the tin first in this picture and had a devil of a time doing it after the battery holder was in place!



Connect and solder the resistors from the + terminal of the battery holder to the switch as shown. The resistors go to the two end terminals on the switch and the plus (+) wire to the headlamp to the center pin. The low brightness setting uses just one 36 ohm resistor to the battery, while the high brightness setting uses two of the 36 ohm resistors, connected in parallel, that is one across the other. This make it an 18 ohm resistor.

The negative (-) lead going to the headlamp of course goes to the - terminal on the battery holder. If you don't know which end is which, put the batteries into the holder and touch one wire to the - terminal and the other wire to one

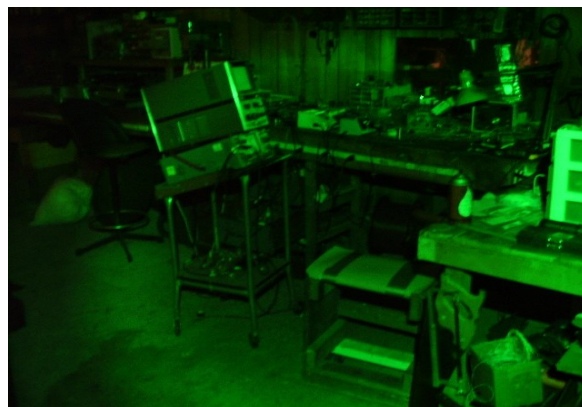
of the resistors connected to the switch. If the LED lights, you have it correct. If it does not light, reverse the wires and it should come on. If it doesn't come on either way, the connections to the LED are open.

Once you have the wires connected to the battery holder and switch, your all done!

NOTE! The plastic on the battery holder and switch body melts easily. Do the job as quick as you can and don't linger too long with the soldering iron.

One final touch if you used the toggle switch is to make some kind of switch guard, maybe a "U" shaped piece of metal to keep the switch from being accidentally turned on when you don't want it to be.

I used this green headlamp for a couple mile snow shoe walk in the woods recently and was quite pleased at how well I could see with it.



My work shop lit up in green light.