AustinLivingReefs.com - LED Cannon Assembly

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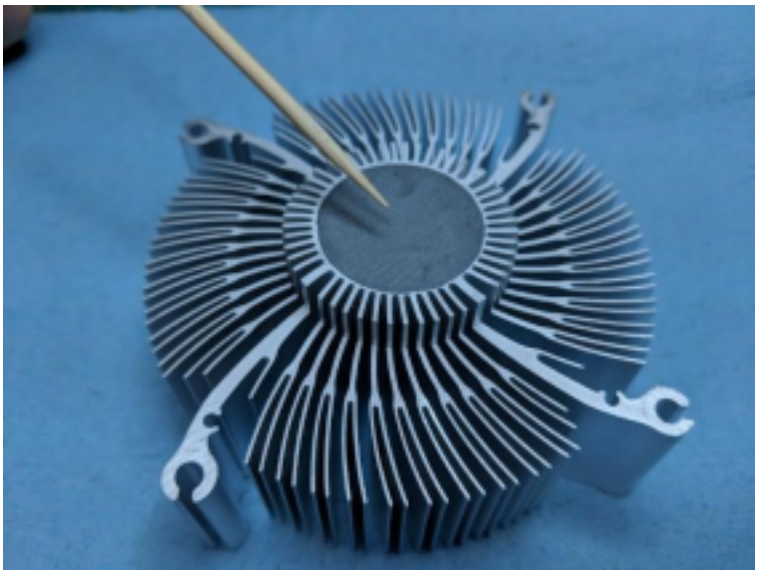
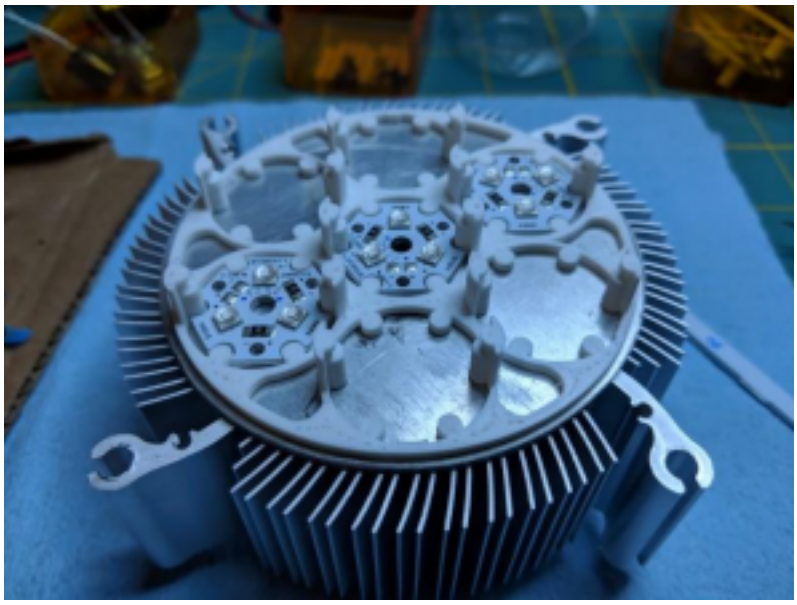
These DIY instructions are for a highly customizable 42 watt LED light fixture. Using the narrow lenses that are available, it can easily give very high PAR levels for hanging or mounting several feet above a reef system. Care must be used as this fixture can put out PAR levels up to 3500 PAR. See the review by Dana Riddle for spectral output and PAR readings.

Source a heat sink; CPU heat sinks are typically a good fit. This design can easily be adapted to different heat sinks though. For example, the remotely mounted lights we designed and built for the rimless system in this link https://youtu.be/aCRYfIZs8N8, a large 4” x 12” x 1.5” aluminum heatsink was used with 26 LED stars and 2 fans. Be sure to clean any thermal compound from the heat sink; scrape with a razor blade, then sandpaper (600 grit). A paper towel with some rubbing alcohol can be used to clean the aluminum afterwards. To assist in the mounting of the LED stars to the heat sink, a 3 inch aluminum disc (stamping blank) is used but is not essential. A thin coat of JB Kwik Weld is applied to one side of the disc and pressed to the heat sink. Allow several minutes for the Kwik Weld to set.



Once the disc has set in position, there are several options for mounting the LED stars. The stars have notches along the circumference to allow mounting with screws. Holes for the screws would need to be drilled and thermal paste applied underneath the stars. Thermal epoxy or kwik weld can be used to fix the stars to the blank stamping disc or directly to the heatsink if a stamping blank is not used. We use a custom 3D printed alignment jig to hold the seven LED stars in position and space them out evenly as well as hold the lenses in place (link to the 3D print file at the end of this article).

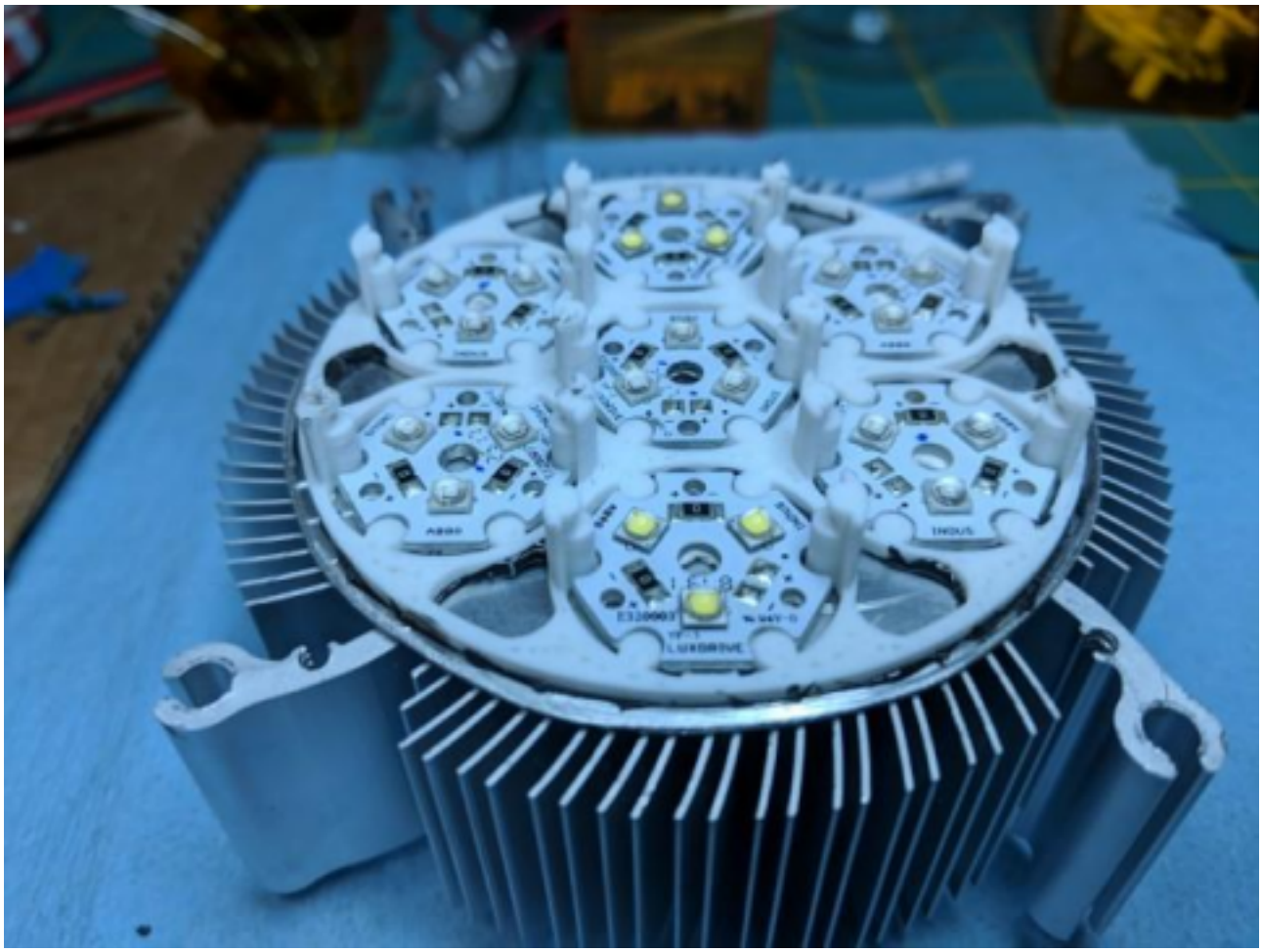


It helps to arrange the LED stars such that the power pads are near the outer edge of the heat sink. This will help make the wiring easier to solder and manage.

When building a fixture using the jig, press the LED stars into the alignment jig from the bottom. This will ensure the stars are flush with the bottom of the plastic jig and are making good contact with the aluminum disc. If inserted from the top, the stars may not seat all of the way down, leaving a gap between the aluminum disc. Apply a thin coat of thermal paste to the bottom of the LED stars. Now apply a thin coat of Kwik Weld to the outer edges and some of the larger surface areas of the alignment jig. Press the assembly into the disc. There are several holes in each LED star; if sufficient thermal paste has been applied to the stars, you should see some of the paste pressing up into those holes. We suggest placing a book or similar weighted, flat object on top of the jig to maintain firm, even pressure while the Kwik Weld sets. Allow several minutes for the Kwik Weld to set. Alternatively, if a jig is not used, the LED stars can be glued to the aluminum disc or directly to the heatsink with JB Weld. (Feel free to use thermal adhesive if desired, we use JB Weld and JB Quick Weld because it's cheaper, lasts years, is readily available and demonstrates how easy it is to do DIY LED fixtures.)

Begin wiring the LED drivers. Depending on your selection of LED stars, you can typically run two stars per driver. There are various colors available and custom stars can be ordered with multiple colors on one star, but care should be used to make sure all LEDs on a star use the same current and voltage. I suggest selecting a position for each driver, then hold the driver in position with a rubber band to help gauge the length of wires needed. Excessive length in wiring will hinder the ability to build a compact fixture. Also, if you plan to use lenses with the

LED stars, be aware not to block the lens mounting holes on the stars. I've been able to solder the LED wiring at 750F; try to work with the lowest temperature possible to avoid destroying the LEDs. Be careful not to touch any part of the alignment jig with the soldering iron! It will melt very quickly. Remember to slide your heat shrink tubing down away from the end of the wires you will be soldering; heat will travel down the wiring and the tubing will begin to contract if it is too close.

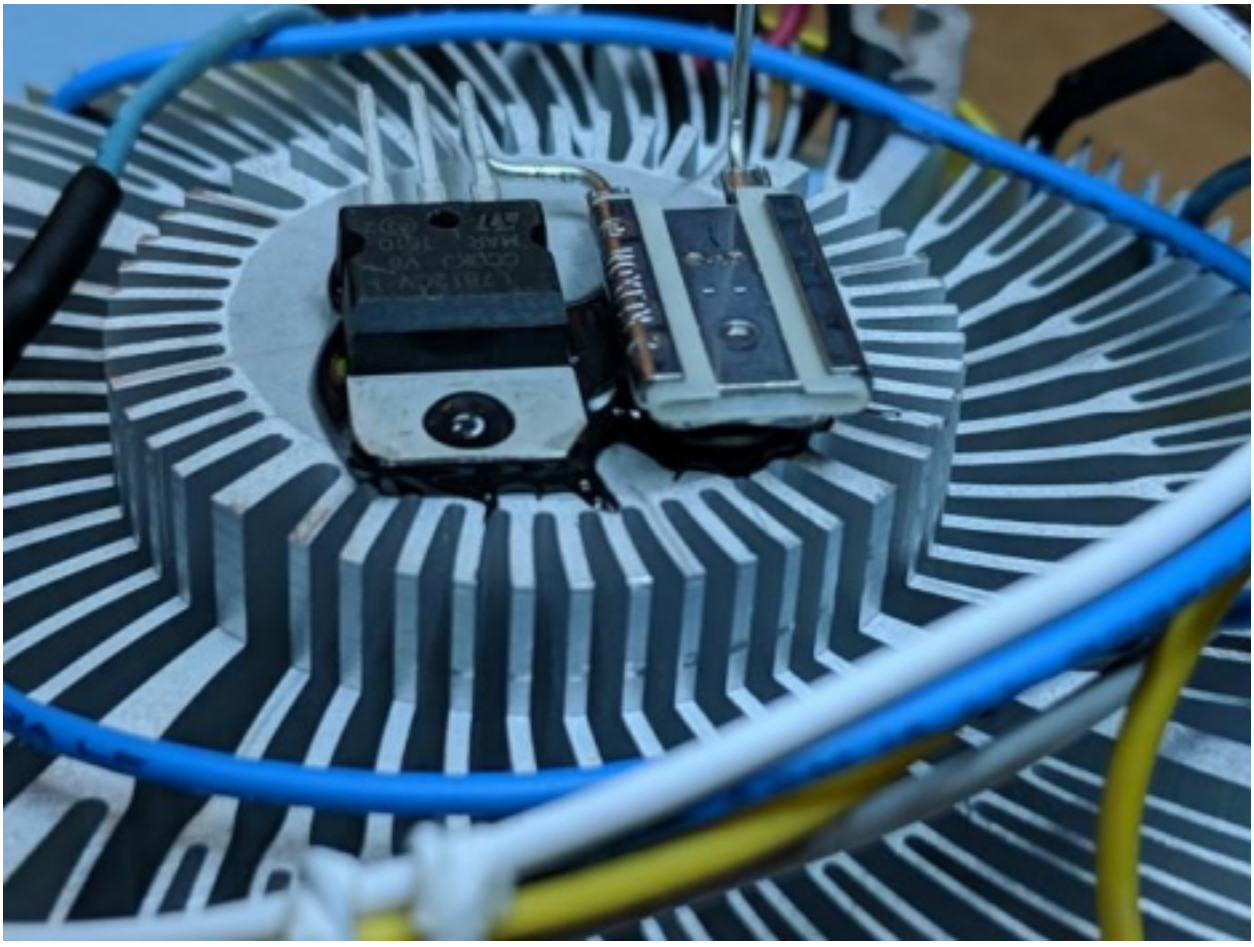


Once the LED stars and drivers are connected, I use tie wraps to temporarily keep the wires organized near the edge of the heat sink. I will replace these with zip ties once I'm happy with the position of everything.

Since this build is designed to use any DC input between 12V to 28V, besides a thermostat, a 12V voltage regulator is needed to run a 12 volt fan with whatever source voltage. Note: the schematic shows the LED stars connected in a parallel configuration for each buckpuck which allows for a wider input voltage to be used. If the LED stars are connected in series the minimum voltage needed will be 22 VDC. The circuit protector and voltage regulator are attached to the back side of the heat sink using JB Kwik Weld. This should allow for thermal

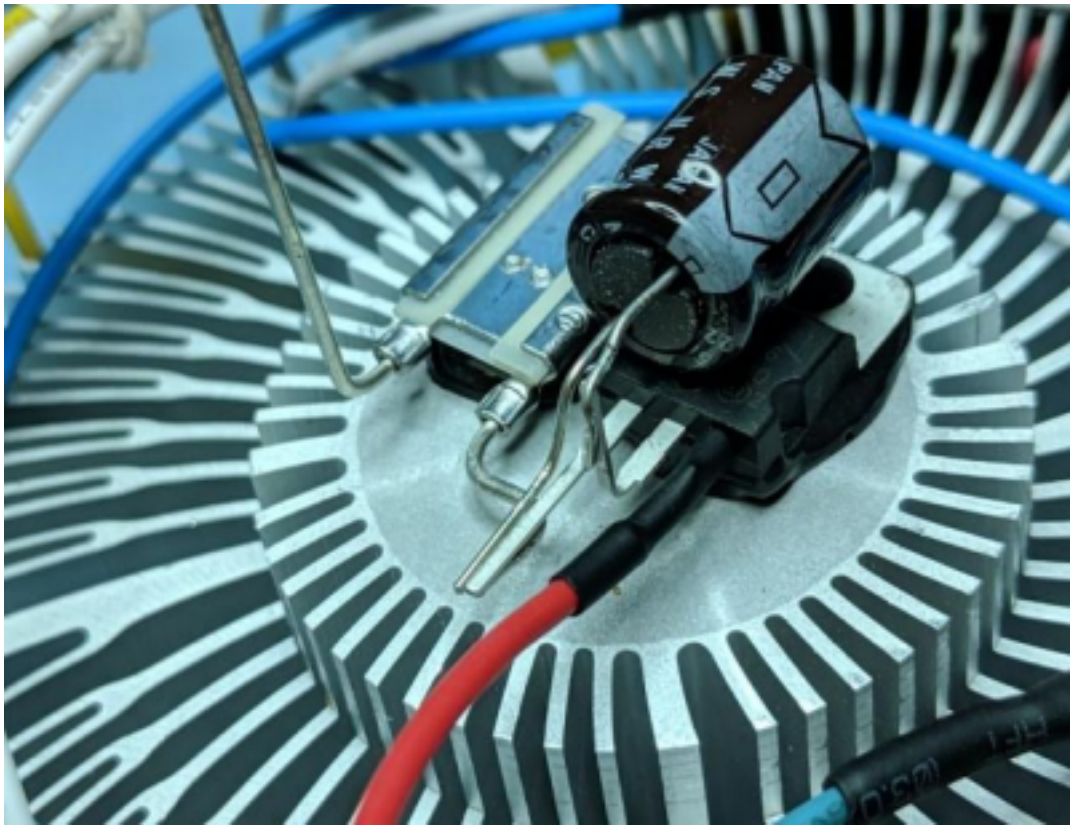
conduction while insulating the parts electrically.

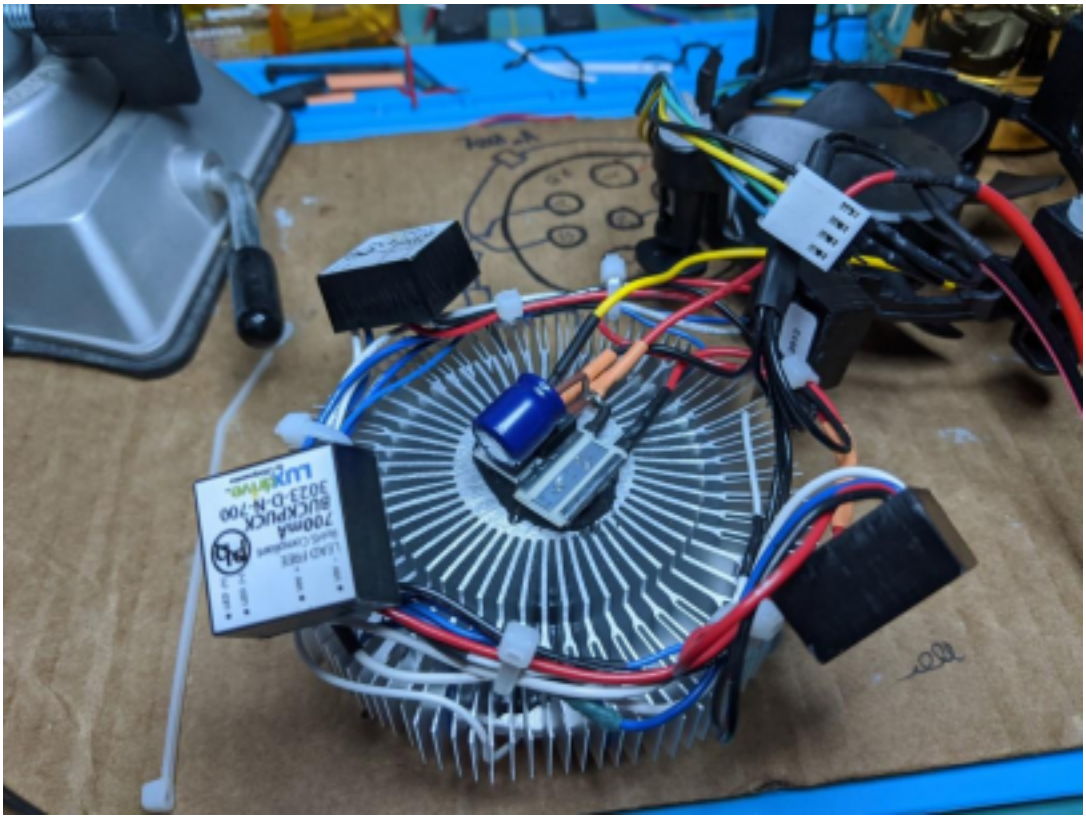
Review the circuit schematic for ideal placement of the components on the heatsink so that connecting pins are close together. It can be helpful to carefully bend the component leads prior to mounting. For the LED driver power wires, all of them can be soldered together prior to soldering them to the thermostat. I'll strip one of the power wires slightly further than the other power wires, separate one conductor, then trim the remaining conductors.



Wire wrapping the stripped ends together with the conductor will provide a mechanical bind and help the solder to flow through all of the conductors. Heat shrink tubing should be slipped over the wire bundle prior to soldering the thermostat lead. Another conductor can be used to wrap the wire bundle to the thermostat lead, then soldered.

I took a section of wire and pulled conductors to wire wrap the other component lead connections. I try to cover the component leads with heat shrink as well. You can also use silicone to insulate any bare wiring or leads.



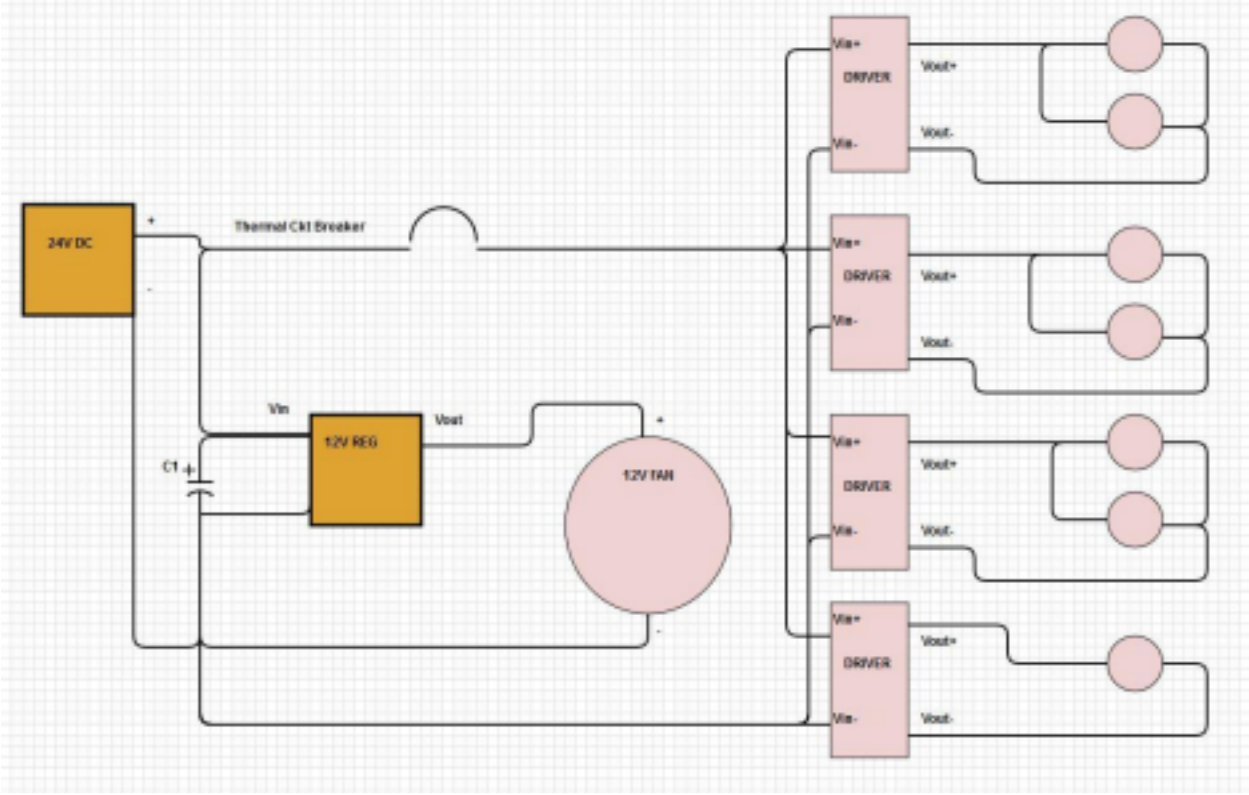

700mA
BUCKPUCK
3023-D-N-700

Parts List:
1 Luxdrive 1000ma Buckpuck
3 Luxdrive 750ma Buckpucks
1 6500K 3-up LED star
1 5000K 3-up LED star
3 Royal Blue 3-up LED stars
2 Blue 3-up LED stars
1 20uF / 50V capacitor
1 7812 voltage regulator
1 Thermal circuit protector, NC, opens at ~150°F - 170°F
Carclo 3-up Narrow Lenses

3-Up Stars, BuckPucks and lenses we purchased from LEDSupply.com.
Other parts are available from Amazon and other online suppliers.

Link to the LED Mounting Jig Assembly print files:
https://drive.google.com/drive/folders/1hWdRWEovNNMSlY6Nu99EmyvYVarRh2dN?usp=sharing

Schematic:



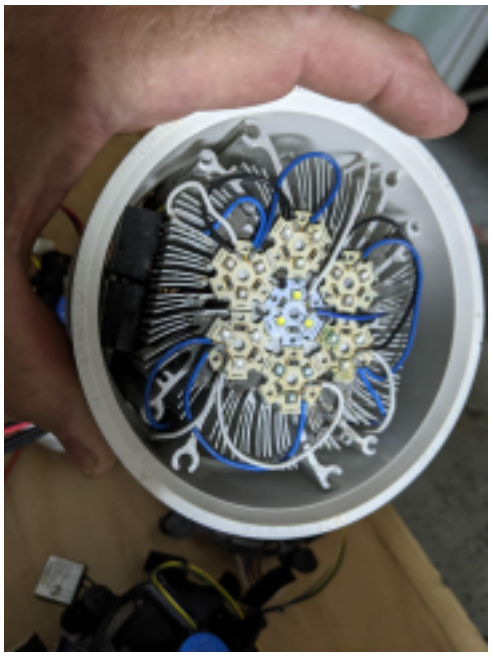
Additional notes:

Several lenses are available for the LED stars. New PAR readings will be needed if used or if no lenses are used.

Caution should be taken in using other brands of buckpucks. Some may require the LED ground to be kept isolated from the input ground.

3-UP Stars can be ordered with custom LED configurations from online stores. For external control, buckpucks with dimming inputs can be used (see the data sheets for the brand and model used for specifics). If external dimming is used this cannon can easily be run as a 4 channel fixture. With each star individually controlled using a separate buckpuck, 7 channels are an option. 3-UP Stars are also available with each LED isolated from the others allowing for each LED individually controllable, potentially providing 21 channels if you just want to make it as complicated as you can.

For a bluer spectrum first consider using just 6500K or higher LEDs before swapping out white LEDs for blue LEDs.
Housings can be pretty much whatever you can think of. We use PVC and customwood housings.



These LED cannons can be run directly off solar panels if desired. For safety be sure the solar panel’s max output voltage is not more than the 28 VDC of the voltage regulator’s max input

voltage. For solar panels with higher voltages two cannons can be connected in series or different buckpucks can be sourced that accept a higher voltage.