

CFC Recommendations for Experimental Aircraft Illumination For Rotax/Jabiru Single Alternator Systems.

Most small experimental sport, light sport, or even ultralight aircraft have one thing in common, the low amperage electrical system. Today with solid state avionics, the builder/owner of one of these types aircraft will eventually want to be seen, or where allowed, fly at night. This brief will cover some ideas and equipment suited for these amperage limited sport type aircraft.

Interior Lighting:

Every pilot has his own desire for lighting. With many of the panel instruments/displays having their own backlighting, post lights and lighted rings are only needed in typically 3-4 instruments and in specific task lighting.

Dimmers are very critical. LED interior lights need an LED dimmer to work properly over a wide range. A good LED dimmer will also control or send a signal to the trim and radio/nav displays to allow their internal dimming to work.

Flight instruments require post lights or ring lights. Post lights are LED and properly installed, are excellent for instrument and switch lighting. Round gauge instrument lights normally have interior lighting, which is incandescent, but LED bulbs are available (see superbrightleds.com for a source). Flight instrument and instrument lighting should be on separate dimmers or as we do add a pot to adjust the instrument lights to allow independent tuning over the instrument lights.

Ring lights may need a specific A/C dimmer as they are mostly neon technology but there are also available in LED or incandescent technology. Light pipes are unique but require a bit of plumbing to work properly. Ring lights are very clean looking but must be ordered to fit the instrument pattern.

Dimmers:

The instrument light manufacturer normally dictates the type of dimmer. Our all-time favorite is the Perihelion Design by Eric Jones:



This dimmer really delivers. With a click on of the knob it gives a variable voltage, perfect for LED control and also supplies a 12 volt signal to cause the auto dimmers on the radio/nav and trim indicators to go to auto dim. \$35

Post Lights:

Whelen Posts:

These LED post lights come in 1 and 1.5 inch and are repairable. Simple through the instrument hole install. About \$38 apiece.



Nulites: Nulites can be installed by anyone in just a few minutes without special tools and are wired into any existing dimming system without the need for extra circuits, inverters, or remote boxes. Each draws .125 amp and are incandescent.



\$38 each. Dimmer is separate.

The UMA EL (Electroluminescent) Light Bezel System provides a uniform light around the dial of each instrument using a solid-state electro-luminescent element rather than an incandescent bulb. The system consists of a bezel or "wedge", DC to AC inverter, and a connector kit. These can be ordered in white, green or red light.



The rings are about \$56 each, the power supply is about \$65 and the pot is another \$55.

Exterior Position Lights and Strobe combo lights:

The old Whelen incandescent wingtip lights would draw nearly 10 amps which killed most electrical systems. Today every experimental and TSO'd light has an LED option. Whelen has many options of their older wing tip lights, but all have gone to a much cleaner and aerodynamic wingtip light:

Whelen:

The Orion has a complete tip for about \$1100 in all LEDs.

It is a bit taller than I would like, but typical Whelen, well engineered.



Aveo:

Andromeda:



Scorpion:



Aveo makes a great looking and low draw wingtip light but a bit expensive at \$1000 for the Andromeda, and \$800 for the Scorpion. I have installed the Aveo Powerburst for only \$500 a pair and work great. These are well engineered and easy to install. My favorite choice.



Skybright Strobe and tip lights:



We have used these lights and find them inexpensive and a great value for the cost conscious. The strobe is a conventional strobe light with box and the green, red and white are LEDs. Only about 2.5 amps because it is a standard strobe. Over time they get hazy but buff right out. \$330.

Aircraft Spruce carries the **Wing LED X Pak** Strobe kit which is similar at \$399.

Landing Lights

Night landings do not require a landing light, however, as Gary Leinberger says “you may feel like Helen Keller trying to find the runway”. Standard incandescent landing lights used on general aviation aircraft die quickly and consume roughly 10 amps, but provide acceptable illumination for landing. A landing light has a 10 degree spot and a taxi about 25 degree flood. The diameter of many of these lights is 4-5 inches and many experimental aircraft cannot be equipped with a light that large in diameter without severe drag penalties and also can’t use the light due to power limitations. Many experimental aircraft use inexpensive auto off road lights which are small, but frequently use H-4 halogen bulbs which pull about 4.5 amps at 12 volts and the quality varies. LED lights have become very popular for their low amperage, lower heat, and bright light, but most are not very focused and are not up to the task of runway illumination. Recently, LED technology for aircraft and off road lighting has improved dramatically. New LED lamps are focused and are the same candlepower and focus of comparable incandescent lights. HID lights (arc lights) are very bright, sized about right for most experimentals

but require a high energy ballast and are very hot in use. The amp draw is the same as an H-4 initially, but once the arc begins, current draw drops in half. The blue light actually is harder to for the naked eye to see far objects.

Landing lights compatible with low amperage aircraft electrical systems such as the Rotax 9 series of engines are presented by aircraft PAR style lamps, then Aftermarket non TSO lights, then automotive/motorcycle technology:

LED Landing Lights to consider:

These aircraft quality Par 36 replacement LED lights are roughly 3.6-5 inches in diameter and fit a standard PAR receptacle hole.

Aveo Engineering:



Aveo Engineering has a landing/taxi (bright/dim) option and are of excellent quality. At \$755 they are very expensive, but the pattern and low amperage are acceptable. Taxi, Landing and both beams draw only 15/46/61 watts or at 12 volts 1.3/4/5 amps. It has a hot center beam and a dim for taxi. It is very large for a Par 36 but very good.

Teledyne:



At 4.4 inches the Teledyne Alphabeam is a direct Par 36 replacement. Good beam pattern for landing or taxi, and low amp draw at 45 watts or 4 amps. \$275 is a reasonable price. Again somewhat large.

Aero LED:



The Alpha beam is roughly the same size and amps and costs about \$335.

Next is the experimental only “Recognition Lights”. These are acceptable on most runways:

Kuntzelman:



The Kuntzelman **LTR** consists of 9 extremely bright LEDs, focused through special lenses. This results in a white beam of light that has been measured with a light meter to be 2 1/2 times the brightness of a 55 watt halogen lamp while drawing 1/3 the current and 1 1/2 that of an HID lamp at about the same current. Powered by 12 to 14 volts DC it uses only **1.35 Amps of power**. The **LTR** dimensions are 3” Dia. X 1” deep and weighs less than 6 ounces. The beam is fairly narrow and it is only useable out to 250 feet. About \$335. I put a light in a pod for under the aircraft in the fuselage flap bracket area. It worked OK. No cowl mod this way. Didn’t seem to detract from cruise speed any but it had no heat sink, so I opened up the top and put in an air exit in the rear to keep it cool when using as a recognition light in the pattern.

AeroSun:

The AeroSun™ (shown below) is a wing-mounted or nose mounted LED landing light with a built-in wig wag mode in addition to its standard operation as a landing/taxi light. The AeroSun™, constructed of extruded aluminum, is a very intense light source that uses 12 high power LEDs to produce up to 1200+ lumens of light using just 24 Watts of power. The product is ideal for installations in aluminum aircraft or composite aircraft where some airflow within the wing cutout exists. Typical installations include aircraft such as RV8,9,10; Zenith, Kitfox and Sonex.

Don't expect to see far with this light at only 1200 Lumens.



Automotive lights are used by many experimental aircraft:

One has to be careful selecting off road or automotive lighting. I have routinely used H-4 bulbs in inexpensive "Walmart" driving lights. The H-4s must be carefully aligned to be usable for landing and taxi and produce only just enough light to be useable on a well painted runway. I have tried using LED recognition lights sold by Whelen and Aerosun and found anything under 3-5000 lumens, depending on beam width, to be less than usable on anything but a well lit and painted runway. I have not used HID lights because of their cost and the lights beam is normally only 10 degrees wide and makes seeing on landing like looking through a soda straw. Off road and motorcycle lights have more of the beam pattern I would prefer. A round beam of 15 degrees minimum and 5000 lumens or more power so as to illuminate at least 500 feet out in front is desired. The pattern is important. Some 3000 lumen lights have excellent distance and beam width, yet 5000 lumen lights have a great hot spot in the center, but during the flare, are useless. Pattern counts. These are mounted on Brett Browns aircraft and are equivalent to six Cree LEDs.

HID lights used by many experimental aircraft:

XeVision HID: Very bright and average \$550



XV-23

with XV4D ballast and premium D1S bulb (XV4D shown). 35 or 50 Watt output, 12/14 VDC or 24/28 VDC input, 3200 or 5300 lumens, Lamp fixture, rectangular, only 2.25" high.



XV-36-SL

with XV4D ballast and D1S bulb (XV4D shown). 35 or 50 Watt output, 12/14 VDC or 24/28 VDC input, 3200 or 5300 lumens, PAR 36 conversion, lamp diameter 4-5/16"

Motorcycles are limited in their power output so their spot lights/driving lights, and such are fairly high tech. Well liked lights follow:



Clearwater Erica, (at left) are 6000 lumens, 5 amps, 3.75 inches diameter \$850 Good light but expensive. \$400 typical.

Denali DX (left below is the wide beam), 1.5 amps each and you need both of these 10 degree spots which reach about 600 feet out. The D4 (right below) have both wide and spot. 4 inch square. And are acceptable for landing and taxi. \$375 ish.



Cree 3500LM LED Lights 2.15 inch diameter (55mm by 66mm). Look good and well liked in the motorcycle community. Draw is 3 amp each or 6 total. \$200 ish.



Off Road lights should not be overlooked. They do consume a bit more power, but the light pattern and lumens are there for us to consider.

Rigid SR 2Q High & Low Dual Function LED Lights –



Rigid Industries High & Low Dual Function LED Lights provide the option of high or low intensity LED lighting to suit any environment. These lights feature a three-wire harness, and the high, low, power gives you the option of running at full intensity on high power or 20% intensity on low power. An oversized heat sink provides the cooling power to deliver the 50,000-hour lifespan. With its unbreakable polycarbonate lens, durable UV-resistant powder-coat and patented optics, the High & Low Function LED Lights are only \$200 normally. 3100 Raw Lumens, and 50 lumens illumination at 300 ft. That is enough to read a newspaper at 300 feet. Good focus and beam width. At just under 6 by 2 inches fits under the spinner of most aircraft easily.



This light keeps relatively cool in extended operation due to the good heat sink. Since it is off road it is also pretty tough. May work under the belly but the cowl duct exit may block light from shining off to the right. Be careful not to buy the wide angle lense.