

## We See The Light

By Chris Edmonston

**Navigation lights for nighttime boating are a federal requirement. But how visible are they? Some real-world tests prove enlightening**

**F**or some boaters, the idea of taking a nighttime voyage would be just about unthinkable. While there are certainly some different and perhaps more difficult situations faced at night, a host of new experiences can make boating at night very rewarding. One constant in any nighttime voyage is the need for navigation lights. Federal requirements demand navigation lights on just about every vessel that operates at night or in periods of reduced visibility.

The BoatU.S. Foundation has tested navigation lights and found that commercially available lights pretty much perform as advertised. Since our first test in the 1990s, a whole new range of nav lights are now on the market, many using new technology — primarily Light Emitting Diode (LED) lights. In this latest Foundation Findings, we take a look at the rules regarding navigation lights, as well as what we found out in nighttime tests on the water.

### Rules Of The Road

There have been regulations requiring nav lights since 1838, when the first requirement for white lights was introduced for steam ships, with red and green side light requirements first appearing 10 years later in England. By the end of the 19<sup>th</sup> century, there was an international agreement governing shipping, and by extension navigation lights. Shortly after World War II, the Safety of Life at Sea (SOLAS) conference revised the rules governing ship lighting: 60 years later, we're still using essentially the same rules.

Under the Rules of the Road, vessels are required to have lights displayed from sunset to sunrise and in periods of restricted visibility. Lights should also be used in all other circumstances when deemed necessary. Just as there is a wide range of vessel types and sizes, there's an equally wide range of lighting configurations that comply with the Rules of the Road. The rules governing lights exist, like all the other rules, to prevent accidents. They

govern the color, placement, and intensity of lights, designed to help other vessels determine vessel size and course and know whether a dangerous situation exists. As a member of the International Maritime Organization (IMO) U.S. rules are actually set by international agreement, not by the U.S. Coast Guard.

For this test we only reviewed lights typically found on recreational vessels under 12 meters (39.4 ft.) in length. We also tested some portable lights that you might have on your dinghy. The requirements for the typical recreational vessel consist of red and green port and starboard lights, a stern light, and a masthead light. The stern lights and masthead light must be visible from two miles and the side-lights must be visible from one mile. One important note — manufacturers are not required to produce lights to any standard, and the Coast Guard does not “approve” individual lights *per se*. However, if a boat-builder includes nav lights on a new model, they must be installed correctly and comply with Coast Guard requirements. Even so, operating the lights from dusk to dawn and maintaining the lights, such as replacing burnt out bulbs, is the responsibility of the boat owner to stay in compliance.

### The Lowdown On Light

Incandescent lights have been with us for more than 100 years, but appear to be a technology on the way out, in favor of newer LEDs. Both types of lights have distinct advantages and disadvantages, all related to how they produce light. Incandescent bulbs heat a filament that glows. An advantage of incandescent bulbs is that they produce light across a very broad range of the visible light spectrum, which makes the light appear warmer and more natural. A disadvantage of incandescent bulbs is that they take more energy to produce light because they're only able to convert about 10 percent of the energy used into light. Incandescent bulbs are better at producing heat than light. The high



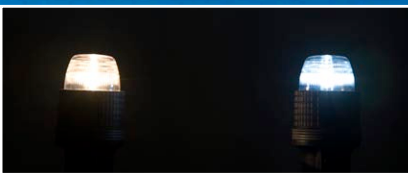
Improper navigation lights



Correct navigation lights



Our 11-year-old lens (on the left) appears cloudy and can be replaced for less than \$15.



Top: Incandescent and LED versions of the same fixture with brand new batteries. Bottom: The same two fixtures after five hours of continuous use; the incandescent quickly died.

heat leads to another disadvantage — a shorter life. Because of the heating and cooling cycle, the filaments become brittle and break after a relatively short span of about 750 to 2,000 hours.

In contrast, LED lights are four to six times more energy efficient at producing light, one of the best selling points for LED lights, particularly for cruisers concerned about the high power draw of traditional lighting. LED lights are unique in that they only produce light on a very narrow frequency of the visible light spectrum. This makes a white LED appear blue-toned to many people, which could be a drawback depending upon the intended use of the light. One of the benefits is that LED lights don't produce the type of light that attract bugs at night, so they'd be good for outdoor evening use.

LEDs are semi-conductor diodes that use electricity to create electroluminescence. Because of the structure of the semi-conductor, LED lights are very focused in their light output. This beam of light works well for traffic lights, for instance, but it's less effective for area lighting such as a table lamp. Because LED lights don't create much heat and don't have moving parts, they have a long useful life — as much as 25 times longer than an incandescent bulb.

While LED lights are very durable, they must have a steady electrical source. A fluctuating power supply is the primary reason LED lights die before their time, which is why many LED lights come with a power regulator. As a result, if you're looking to buy an LED replacement bulb for an incandescent fixture, it's highly unlikely the bulb will last for its rated lifetime.

### **Putting The Lights To The Test**

The Foundation wanted to see if the differences between incandescent and LEDs made one better than the other as boat lighting, or if they were even different enough to merit changing lights. We tested new incandescent lights, as well as a variety of commonly found LED lights. We also compared the new lights to the lights installed on the Foundation test boat. These lights, installed at time of manufacture in 1998, are incandescent, but the lenses have become cloudy and hazed with age.

The Foundation conducted testing on the Magothy River, just north of Annapolis, Maryland. The weather was clear and calm, with a waxing moon. Being on a river with a fairly heavily populated shoreline, there were numerous lights visible along the

shore, as well as a good deal of ambient light. We set up a test range using distances of a half-mile, one mile, two miles, and three miles from a stationary observation platform. At each distance, we displayed each test light from our test boat, in the proper onboard position required by law. We had six observers take notes on a variety of subjective criteria, but mostly the test was a check to see which lights were the most "visible."

As expected, our 11-year-old lenses fared poorly compared to the same fixtures using new lenses. If you have old lenses, changing them will greatly improve your visibility to other boats at night. Our other limp lights were the portable lights for dinghies. While perfectly fine for confined anchorages, the lights were poor performers at a half-mile and barely visible at more than one mile.

The two LED lights, one by Attwood and the other by Navilight, were both comparable to the incandescent light at a half-mile. At farther ranges, the LED lights were markedly better, particularly for the sidelights. At a range of three miles, it was difficult to tell what color the incandescent sidelights were, which can be attributed to the nature of the lights. The incandescent light used a white light bulb behind

a red or green lens. The LED lights used red or green LEDs behind a clear lens. Additionally, LED light is focused into a beam, which most likely enhances the range.

Overall, the Navilight 360 was our top performer, with the Attwood a close second. That said, it's hard to say that the differences between LED lights and incandescent lights are dramatic enough to merit a wholesale replacement of your current lights. The exceptions would be if you have limited electrical availability and power draw is a concern, or your navigation lights are in a location such that it would be difficult to change the bulbs.

### Additional Observations

Testing on a well lit waterway gives different results than what could be expected on the open ocean. Nav lights will be visible far in excess of legal requirements on a clear but otherwise ink-black night. Our observers had great difficulty distinguishing the navigation lights from background lights at the farther ranges, which made us wonder if it's even necessary to have lights be visible as far as two miles.

This question was answered rather quickly when another vessel was seen

approaching at a relatively high speed. In this situation, there were only seconds to determine that it was a boat, and in which direction the boat was headed. Having lights visible from farther ranges can give the extra time needed to determine if a dangerous situation exists.

Glare was another concern. The glare from nav lights can greatly reduce your vision at night, so we looked at types of light to see which produced the least glare, and which hurt night vision least. Our boat drivers tended to prefer the LED lights, which makes sense as LED lights produce light in a focused beam.

Placement of the lights also had an impact, and is described in detail along with more information about the Foundation test and results at [www.BoatUS.com/Foundation](http://www.BoatUS.com/Foundation).



This nonprofit 501(c)(3) organization is devoted to generating ideas and projects that keep boaters safer, and our environment protected. The Foundation is independently funded by donations from organizations and individuals, and by grants. [www.BoatUS.com/Foundation](http://www.BoatUS.com/Foundation)

## The Truth Is In The Numbers...

**We compared incandescent and LED lights by measuring their actual current consumption at 12.6 volts DC. LEDs are more visible and four times more efficient than incandescent.**

■ **1,955 milliamps for a 25-watt incandescent bulb**

■ **240 milliamps for an LED lamp**



A light meter, used in a darkened room, records brightness in foot candles (Fc).