

Zap! Boom!

LIGHTNING
AND BOATS,
AND JUST
HOW TERRIFIED
YOU SHOULD BE
ABOUT THE MIX?



Q&A

Someone at the marina told me that there's a warning out about TV antennas messing up GPS. Please explain.
B.T., via e-mail

That someone is correct. Late last fall the U.S. Coast Guard and Federal Communications Commission issued a joint warning concerning certain models of active television antennas, the kind that look like big Frisbees and are designed to pull in regular TV signals as opposed to satellite ones. The problem is a bad transistor that got into some of the amplifier sub assemblies used by Tandy, Radio Shack, and Shakespeare. In certain conditions, when actually amplifying a TV signal, this part goes a little whacky and becomes a miniature transmitter on the GPS frequency. Fairly few antenna units were manufactured with the faulty piece (Shakespeare estimates that only 400 left its factory), but if you have an active TV antenna, you should definitely check it out. For starters, turn on your GPS at the dock with the TV antenna turned off, then turn it on and tune in a TV station and see if your position

Every ancient culture had some wonderful explanation for lightning. The Vikings, for one, said it was their god Thor whacking his mega hammer to an anvil while riding his chariot across the clouds. A boat is a wonderful platform for observing this awesome natural phenomenon, if it weren't so terribly exposed. "I play it safe and keep the boat in port when scattered thunderstorms are forecast, even though it is otherwise a nice summer day," a Chesapeake Bay boater wrote us. He went

on to ask about the actual probabilities of a boat being struck by lightning, possible consequences, and means of protection.

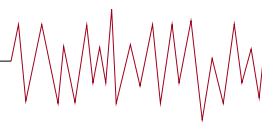
I'm afraid I cannot give this gentleman definitive answers; in fact, the science of lightning and just how to protect humans and property from it is much more tentative than one might assume. Oh, there are some statistics around that are a bit chilling. Annually in the U.S., an estimated 40 million lightning strikes, which NOAA terms "an underrated killer", account for nearly a 100

NEW AUTO ANCHOR

The New Zealand firm RMSD has been building the Auto Anchor 500C remote windlass control and chain counter for a while, but has now introduced models that can handle combination line-and-chain rodes, and has begun U.S. distribution. All models feature up and down presets, a safety lock, non-volatile memory, and extensive anchor system diagnostics. The top-of-the-line 500RCX includes solid-state switching instead of interfacing to a windlass's standard solenoid controls, and thus gains speed control and the ability to bring an anchor completely home on its own. Installation involves fitting a magnet and sensor to your windlass. Prices range from \$595 to \$1495.

Auto Anchor ((508) 995-8188. www.autoanchor.co.nz.





deaths—more than worries like hurricanes and sharks. Florida, with the most thunderstorms, averages more than ten deaths and thirty injuries from lightning per year, and approximately 25% of those are water-related. While it's true that most of the marine fatalities occur in open boats, it's also true that NMEA dealers report substantial amounts of lightning damage to big boat electronics.

The current thinking is that lightning happens when particles within the violent up and down drafts of a thunderstorm cloud become charged through collisions. Different sizes acquire plus and minus charges, then separate into layers, producing enormous electrical potential both within the cloud and between the cloud and ground. There's no question that millions of volts can accumulate, eventually overcome the insulation of the air, and flash in multiple strokes as much as 5 miles long. In

the lightning's path the atmosphere is heated to about 50,000°F (three times the surface of the sun), producing a shock wave. Zap! Bang! Since light travels almost a million times the speed of sound, the flash is often seen before the thunder is heard. In fact, if you count the difference in seconds and divide by five, you'll have an approximate distance to the strike in miles. It's also said that just before a very close flash, your hair will literally stand on end!

Lightning can strike cloud to cloud harmlessly, cloud to water harmlessly, or cloud to water via your boat. While it's true that sailboats with their tall masts are more susceptible to hits than powerboats, that is not the whole story. Tall masts also provide what's called a "cone of protection." If you have a significant conductor overhead, and you can stay out of the conductive chain to ground, you are safer. Thus it is that leading lightning expert Dr. Ewen Thomson writes, "An ocean-going power yacht has more risk factors than any other type of boat. Large open deck spaces with an absence of natural lightning rods raise the risk of a direct attachment to anyone on deck." Moreover, on a power yacht without a prominent mast, "The natural path to ground is via on board wiring through the main instrumentation cluster, likely destroying most other electronic systems as well."

You may at this point be interested in a Lightning Protection System (LPS). It is in a

NEW BLUE SEA BREAKER PANELS

The #8678 12- or 24-volt DC panel shown is only one of many new models from Blue Sea Systems. This one features a digital multimeter able to monitor amperage flow as well as the status of up to three battery banks, with high and low voltage alarms. "Circuit energized" LEDs are included along with 30 common labels, which can be optionally backlit. Behind the panel are pre-wired positive and negative buses, along with a ground bus suitable to the lightning protection bonding discussed in the column. Do-it-yourselfers will be pleased to find that Blue Sea provides excellent instructions with their products, as well as a wealth of useful information about boat electricity issues on its Web site. The #8678 costs \$384.

Blue Sea Systems (800) 222-7617.
www.blueseasystems.com.



Q&A

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changes or gets lost. You might also go to the U.S.C.G. safety site at www.uscg-boating.org to get a list of affected models. If you have such a model, you'll find that the manufacturer has a program to further identify and replace defective units.

Over all, this is not a huge problem, but there is an aspect to it that all navigators should consider. The authorities have documented cases when the faulty antenna didn't just jam the GPS signal but actually caused false positions, and even affected GPS's on other boats within 2,000 feet of the bad transistor. This confirms the fears of many, including some observations I made in my April, 2002, column called The Dark Side of GPS, and subtitled Why we really, truly shouldn't rely on satellite navigation. As marvelous and 99.9% reliable as GPS is, it is always a good idea to use other, independent means—radar, loran, soundings, visual bearings, etc—to double check your position.

Got a marine electronics question? Write to Electronics Q&A, Power & Motoryacht, 260 Madison Ave., 8th Fl., New York, NY 10016. Fax: (917) 256-2282. E-mail: PMY-Electronics@primediamags.com. No phone calls please.

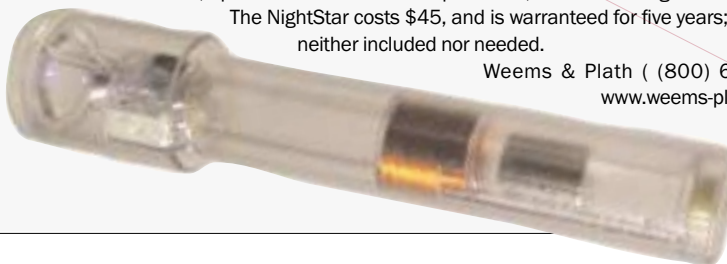
NEW NIGHT STAR FLASHLIGHT

This is the science fair of flashlights, combining the wondrous energy efficiency and durability of LEDs with a "Magnetic Force" energy supply. With this second generation model, a mere 30 seconds of gentle shaking (internal magnet through coil) pushes enough juice into its capacitor to produce 10 to 15 minutes of light that can be seen a mile and illuminate a five foot diameter circle at 50 feet. It is ten-inches long, waterproof to over

400-feet, operational in extreme temperatures, and its switch glows in the dark.

The NightStar costs \$45, and is warranted for five years; batteries neither included nor needed.

Weems & Plath (800) 638-0428.
www.weems-plath.com.



You may at this point be interested in a Lightning Protection System (LPS). It is in a sense a misnomer, as there is no proven way to actually protect a boat from lightning, only a technique for limiting damage when it strikes. Actually, there is a widely held myth, particularly among sailors, that an LPS—which is primarily a straight, highly conductive path from mast to water—causes more harm by attracting lightning than it does good. But there are also numerous documented cases where lightning blew a hole in a boat while trying to find a way out. Dr. Thomson, an Associate Professor of Electrical Engineering at the University of Florida, conducted an extensive survey on this issue and concluded that grounding a sailboat mast does not increase strike risk, but does reduce damage. Thomson also cites several studies that question the effectiveness of the one device promoted as a lightning stopper, the so called “ion dissipater”, a sort of stainless steel wire brush you’ll sometimes see affixed atop a sailboat mast that is supposed to leak off a boat’s attractive ground potential. Yet, despite negative conclusions drawn by multiple agencies including the FAA and NASA, the device is advocated on a large marine insurer’s Web site today. As I said, the science of lightning protection is still evolving.

This uncertainty was echoed by a representative of the American Boat and Yacht Council (ABYC). The organization has modified their specifications for an LPS in recent years, and says there will likely be more changes in the future. The existing standard calls for an “air terminal”, or lightning rod, as high above the boat as possible, connected via heavy conductor to a ground plate or strip on the bottom. All major metal objects and electronics are bonded to this ground. A boat advertised as built to ABYC standards does not necessarily have such an LPS, which is not mandatory. While the ABYC and Dr. Thomson agree that an LPS will help lead a strike’s massive power safely out of the boat, hopefully with a minimum of the “side flashes” that can also hurt people and electronics, both are emphatic that there are no guarantees. And the primary goal of the ABYC specs is protection of humans, not electronics. NMEA and ABYC intend to work together toward a more comprehensive electronics protection standard, and Thomson has a private company (www.marinelightning.com), which is developing a device to channel side flashes away from sensitive areas. It’s also worth noting that Dr. Thomson is currently conducting a survey of powerboaters who have endured lightning strikes, and, should you be so qualified, you can help advance the science at his university site, www.thomson.ece.ufl.edu/lightning.

Another approach to lightning protection is to run away from it, and there are some gadgets that can help. One is StrikeAlert, a pager-like device that hears lightning’s RF disturbances and lights a series of LEDs indicating range up to about 40 miles. Apparently you can use it to figure out whether the strikes are approaching or going away, but you do not get any directional information. It costs about \$80, (719-536-9990, www.strikealert.com). A much more sophisticated system is the Boltek Storm Tracker, a directional antenna and decoder which connects to PC software that can map lightning strikes over a 300 mile radius. Models start at \$500 (905-734-8045, www.boltek.com). This product is not particularly designed for marine use; actually many users have it set up as part of amateur weather stations connected to the Web, and you may find a usefully nearby station at www.weathermatrix.com.

Of course, approaching thunderstorms are often quite visible to the naked eye, with the lightning potential in their famously tall, dark, anvil-shaped clouds frequently proportional to their drama. And some skippers adjust their long range radar to maximize rain clutter and can thus track even embedded and/or distant activity. But as to our correspondent’s habit of staying in port when thunderstorms are predicted...well, I suspect he’s erring on the side of caution, as often do the weather forecasters.

Of course, it’s wise to stay sharp and have a plan. Getting to a mooring, disconnecting electronics, getting folks inside and away from metal objects—all these moves can help. But ultimately it’s about risk management, a topic perhaps too much on the collective mind these days. There’s so much to worry about—including, at this writing, idiot rock bands and security guards—that even a powerful, unpredictable force of nature seems to pale in comparison. My advice: learn about lightning and take care, but—for Thor’s sake—go boating.

Update 2/14/2020: I don’t know of any major advances in practical lightning protection for boats since I wrote this article for PMY in 2003. But Dr. Ewen Thompson did develop a system and there is a great deal of valuable information still up on his company site:

<http://www.marinelightning.com/>