

## LIGHTNING: GROUNDING YOUR BOAT

Lightning can kill: Carrying as much as 100 million volts, lightning can smash a hole through a hull, explode a mast and electrocute several people in a single flash. The thunderstorms of the Chesapeake Bay, described by Captain John Smith as among the most violent he had ever seen, pose a lightning threat every boater should know about.

## WHAT IS LIGHTNING?

Lightning is simply nature's way of equalizing contrasting charges, often built up when cool and warm air masses collide. As negative charges in the base of a storm cloud pass over the earth, they induce a positive charge in the normally negatively charged terrain. This positive charge actually works its way up tall objects, pulled by the negatively-charged clouds. When an arc breaks through the insulating air, lightning strikes. Not all lightning follows the same scenario: It can leap from cloud to cloud, from cloud to earth or from earth to cloud.

## HOW DANGEROUS IS LIGHTNING?

In the United States, lightning kills, over time, more people than do hurricanes, floods or tornadoes. Although lightning rarely reaches the catastrophic dimensions that make headlines, it consistently kills over a hundred people a year in this country. Not everyone struck by lightning dies: researchers estimate that two-thirds of those struck by lightning survive, and often people apparently "killed" by a lightning strike can be revived by cardiopulmonary resuscitation. But risks remain high for those who spend time outdoors — farmers, fishermen or boaters.

Because water conducts electricity so well, and because a boat — or even a person — may present a high profile on water, boaters need to take special precautions. Records show that lightning has killed people who were standing in or fishing from boats or starting outboard motors. One study shows that out of 494 people killed while involved in outdoor recreation, 200 were in, on or near

open water. This same study listed an additional 177 who were injured while on or near open waters. Water and lightning are a natural combination.

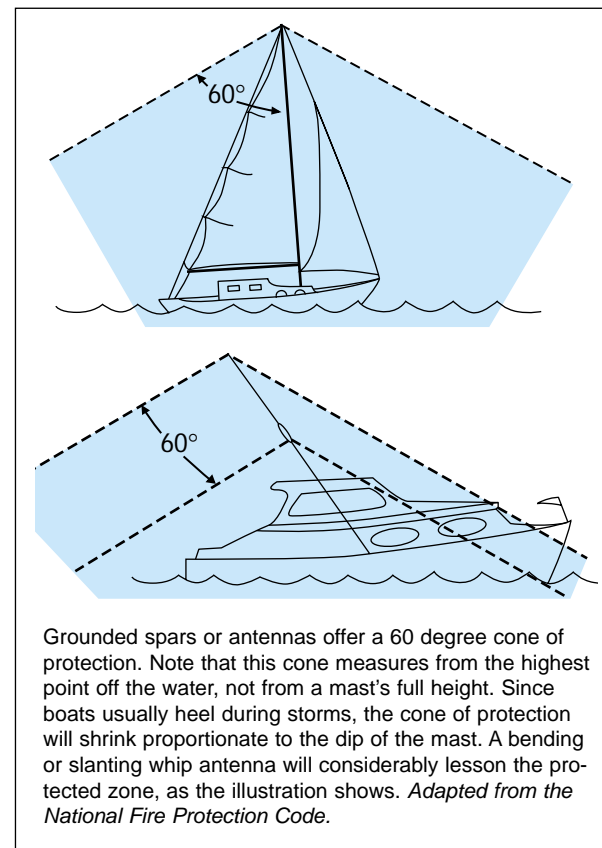
## WHAT CAN YOU DO?

To protect yourself in a boat, the important thing is to give lightning a ground. Boats made of steel, such as naval vessels, have an automatic ground in their metal hulls; but most small boats, usually constructed of fiberglass or wood, prevent the lightning easy access to the water and pose a grounding problem. Small boats may also lack tall objects which could deflect lightning, and even boats that do have tall spars — like sailboats — can run into problems if their spars are not properly grounded. The following grounding system will minimize the risk of lightning damage:

On a sailboat, make a lightning rod using a piece of aluminum which sticks about 1 foot (30.48 centimeters) above the mast. Sharpen the rod to reduce resistance at the top. A radio antenna can also conduct electricity but may lead lightning to the radio and may well vaporize during a strike.

From the rod, lead a wire down a wooden mast; an aluminum mast can serve as its own conductor as long as a wire is led from its base to direct the charge to the ground. (A wooden mast with a metal sail track can be grounded as though it were a metal mast.) The Coast Guard finds a #8 wire adequate, though a larger gauge, say #4, further reduces heat and resistance.

Attach this wire to a copper ground plate mounted on the hull beneath the waterline or dangled underwater. A square foot of copper flashing, easily obtained at many hardware stores, will make an adequate ground plate. If you decide to attach a permanent ground, use large stainless steel bolts, say 1/2 inch, to prevent their cracking under large electrical discharge. To increase safety, some recommend all stays be grounded to the plate.



On a motorboat which has no high spar, use a metal radio antenna (not a fiberglass one), attaching a wire to a ground plate, as described above. If there is a loading coil on the antenna, use a shunt of 31-strand, 17-gauge, bare lightning grounding mesh to bypass it — this will make the whole height of the antenna an effective ground. Quick-release clamps will allow an easy temporary attachment. (On a fiberglass antenna you can clamp the wire to a metal rod, letting that act as a lightning interceptor.) Use a "lightning arrestor" to protect your radio.

When leading the wire to a ground, avoid sharp bends or turns. Any bend in the wire should have a radius of at least 60 degrees.

One alternative calls for leading the grounding wire to a metal strip which runs down the bow or stern and maintains constant contact with the

water. This offers the advantage of carrying the charge, at a gradual angle, safely away from the engine and the helm.

Both the mast and the whip antenna will provide a “cone of protection” with a radius of approximately the same dimension as the rod’s height. For most small boats, this will include the entire deck area. There may be, however, induced electrical surges created by the lightning, and for this reason large metal objects — engines, for example — should be avoided during a storm. (Remember that an engine will have its own ground in the propeller and the shaft.) Induced electrical charges can cause arcing and electrical shocks strong enough to knock you unconscious, perhaps producing dangerous heart arrhythmias. A lightning strike can also magnetize a keel or other, metal fittings, rendering your compass useless.

### FIRST AID FOR LIGHTNING

After a shipboard lightning strike, check to see that everyone is all right — it is, of course, perfectly safe to handle someone who has been hit by lightning. Check for burns, which should receive normal first aid treatment. (Don’t put ointment on severe burns; cover them with clean cloth or plastic to keep out air.)

If someone has been knocked unconscious, act immediately: Check for breathing and heartbeat.

If you feel a pulse, but no breathing, begin mouth-to-mouth resuscitation (a handkerchief over the mouth will help the squeamish). If there is no heartbeat, begin cardiopulmonary resuscitation, a technique every serious boater should know.

### PRECAUTIONS

Grounding your boat and unplugging radios and electrical equipment during a storm are good ideas, but the best precaution against lightning is avoidance. Especially in small craft, keep a weather eye out for the coppery haze and building cumulonimbus clouds that signal thunderstorms, heading ashore well *ahead* of the turbu-

lence. Remember that lightning can lash out for miles in front of a storm, and it can strike after a storm has seemingly passed. Remember, too, that, storms can bring high winds and waves, making a last minute trip to shore a dangerous dash. The best maneuver of all is to think ahead.

### REFERENCES

[www.lightningsafety.noaa.gov/](http://www.lightningsafety.noaa.gov/)  
[www.nssl.noaa.gov/education/svrwx101/lightning/](http://www.nssl.noaa.gov/education/svrwx101/lightning/)  
<https://www.youtube.com/watch?v=PPcgOr24sWY>  
<http://edis.ifas.ufl.edu/sg071>



Cooperative Extension Service Leaflet 138. Cooperative Extension Service, University of Maryland, College Park and Eastern Shore. The lightning photo on the front of this brochure is from the NOAA National Severe Storms Laboratory.



Maryland Sea Grant Publication UM-MAP-MM-80-17. This work is the result of research sponsored by NOAA Office of Sea Grant, Department of Commerce, under Grant #NA79AA-D-00058. The U.S. Government is authorized to produce and distribute reprints for governmental purposes notwithstanding any copyright notation that may appear hereon.

Issued in furtherance of Cooperative Extension work, acts of May 8 and June 30 1914 in cooperation with the U.S. Department of Agriculture, U. S. Department of Commerce, University of Maryland and local governments. John M. Curtis, Director of Cooperative Extension Service, University of Maryland.

The University of Maryland is an equal opportunity institution with respect to both education and employment. The university’s policies, programs and activities are in conformance with pertinent federal and state laws and regulations on nondiscrimination regarding race, color, religion, age, national origin, sex and handicap. Inquiries regarding compliance with Title VI of the Civil Rights Act of 1964, as amended: Title IX of the education amendments: Section 504 of the Rehabilitation Act of 1973; or related requirements should be directed to the Human Relations Coordinator, Maryland Cooperative Extension Service, University of Maryland, Room 1214, Symons Hall, College Park, Maryland 20742.

*Please note that no system is foolproof. According to the American Boat and Yacht Council, Inc., “In view of the wide variation in structural design of boats, and the unpredictable nature of lightning, specific recommendations cannot be made to cover all cases.”*

Marine Advisory Program First published 1980-81

# LIGHTNING



# GROUNDING YOUR BOAT