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## Do-It-Yourself Loran Installation

One of the most important developments in this country in the last ten years has been the growth of the consumer electronics industry. Although we boatowners represent a tiny fraction of the total electronics market, we have been major beneficiaries of this development. Nowhere is this trend more obvious than in the popularization of Loran-C, which has gone from an exotic piece of gear consuming a lot of space and electricity, to today's compact, inexpensive units consuming less electricity than a single 12-volt light bulb.

Another, parallel development in the recreational boating industry has been the astounding growth of the mail-order marine supply businesses. The massive buying power of mail-order outlets, and their relatively low overhead compared to traditional marine chandleries, have led to significantly lower prices for the typical boating consumer.

These two developments—the growth of the mail-order business, and the proliferation of low priced Loran-C units—are not without their drawbacks. Just a few years ago, if you wanted to purchase Loran, you simply went to your local marine electronics dealer, bought what he recommended, and sat back while he tended to the dirty business of installing the set and making it work.

Now, the chances are that you dial a toll-free number, give them your charge card number, and wait nervously for a week until a surprisingly small parcel shows up in the mail. You open the package, and there you have it; a compact, innocuous box, a few electrical odds and ends, lots of wire, and a manual that may range from a lo-page pamphlet

*Right: In the last ten years, the size of a typical Loran unit has shrunk from that of a breadbox down to a size small enough to fit in the palm of your hand.*



to a 100-page book. Your next order of business is to break out into a cold sweat. How can you possibly transform this thing on your kitchen table into the navigation marvel of the century, which can get you to Bermuda with the same accuracy as the saltiest of old-time sea dogs?

Relax. It isn't true that anyone who can turn on a light switch can install Loran while blindfolded; but it is true that anyone with patience, a modicum of common sense, and the ability to tell a black wire from a red wire, should be able to get the job done. If you have doubts about your abilities, make a careful study of the owner's manual of the Loran set you want to buy. And do this studying before you lay out your money.

If you really don't have enough confidence to attempt installation yourself, buy your Loran from a local dealer who is willing to do the job. You may pay a premium in terms of price, but you are also likely to get the job done right.

Either way, before you decide which Loran to buy, figure out where you are going to put it. Don't

get so excited about the prospect of a new toy that you choose a model that simply won't fit any convenient place in your boat.

Like all electronics, Loran sets hate water in any form. Spray, mist, rain, and solid water are all inimical to the long, successful life of electronics. Rule number one, therefore, is to find the most protected location possible for the Loran set.

If your boat has a chart table, the set should be mounted in close proximity to the navigator's working position. It is most convenient if the navigator can look directly from the Loran display to the chart without having to change position, particularly if the boat is used for racing, or sails frequently in bad weather or areas of limited visibility, where a quick, precise position is essential.

A Loran set should not be located under an opening port. It should not be located any nearer the companionway than is absolutely necessary. The common navigation station location in the production sailboat—off to port or starboard, adjacent to the companionway—may be

convenient in terms of communication between helmsman and navigator, but it is frequently too exposed to spray coming down the companionway.

Solid state electronics generate relatively little heat compared to their vacuum tube predecessors; nevertheless, it is important to provide adequate air flow around your Loran for cooling. If you mount the unit using one of the typical brackets provided, there should be adequate ventilation. If, however, you recess the set into a bulkhead to provide a finished look, you're going to have to provide some extra ventilation. While cutouts in the bulkhead may be adequate, a small, 12-volt fan mounted in the locker may be necessary if there is more than a few degrees of temperature rise in the enclosed space. By the same token, you should not mount the set near external heat sources, like the engine, stove, or cabin heater.

## Wiring

Connection of the Loran to the boat's electrical system, wiring of the preamplifier, and installation of the antenna cable varies from set to set. The basic rules, however, don't.

Some compromises are generally necessary in wiring. The manufacturers usually like you to wire the set directly to the battery, bypassing the ship's electrical system. To some extent, this is a good idea. The battery will function as a giant capacitor, protecting the Loran from voltage surges, and reducing electrical noise from other pieces of gear aboard the boat.

However, the manufacturers of all the electronics on your boat would prefer that you wire directly to the battery. If you followed their recommendations, the wiring to your battery would be a rat's nest, and there's a good chance that some of the wiring would not be adequately protected against overload.

Therefore, run the wiring for your Loran through your regular distribution system, using a separate circuit just for that unit. You don't have any circuits left? That's why you're going through a dry run of installing the Loran before you even purchase one. There may be hidden costs and complications you

haven't even thought about.

To minimize voltage drop, use 12-gauge wire between the set and the electrical panel. Almost all Loran units have a fuse in the positive lead. It is imperative that this be left in place, as chances are that the circuit you wire to will have overload protection permitting higher current than is needed. For example, the in-line fuse provided with the Loran may be four amp, while the breaker for the circuit may be five amp or more.

Even when using 12-gauge wire, minimize the length of the wire run to the electrical panel. Allow only enough wire to easily disconnect the set for removal. The fuse holder will

electrically isolated from ground. The same goes for metal-hulled boats. If there is an effective barrier system on the hull, it may make it a mediocre ground.

Use the same 12-gauge stranded copper wire for the ground connection that you use to wire into the electrical system. Use an appropriate connector to the Loran set's ground attachment. Don't just wrap the ground wire around the terminal, like you do when you wire an electrical plug in your house. If the ground terminal on the back of the set is a stud with a wing nut, use a crimp-on or solder ring connector that is the correct size for the stud.

Likewise, make a good connec-



Above: The Raynav 520 from Raytheon, first cousin to the Apelco DXL 6300, is typical of compact, power miserly, low-priced units. Both units have features that until recently, were only available on units costing several times as much.

act as a quick disconnect in the positive lead between set and panel, but you will have to put a disconnect fitting in the negative lead. If you don't go to the trouble to make the Loran easily removable, you're not as likely to remove the set when the boat is laid up. Leaving it in place with the boat out of commission will make the boat a tempting target for thieves.

## Grounding

Nothing is more important to the installation of Loran than the provision of a good ground. An external metal ballast keel usually makes a pretty good ground, although keels that are heavily protected with epoxy bitumastic may be effectively

tion to the ground point on the hull. In the case of a sailboat with an external metal keel, you can connect the wire to a keel bolt. This may take some ingenuity. Simply attaching the bare end of the ground wire to the bolt using a hose clamp will normally work, but there's no guarantee of a good electrical connection. You can fashion a ring or spade connector to fit over or around a keel bolt out of sheet copper, soldering the end of the ground wire to your homemade connector with rosin-core solder. Slip the connector on the keel bolt, then add a washer and another nut on top to hold things firmly in place.

If none of the keel bolt projects above the existing nut, you'll have to

use some imagination to provide a connection. If the bolt is large enough, you can tap into the top of the bolt for a small stud, using a ring connector on the end of the ground wire.

It is also possible to avoid most of this hassle by using a ready-made ground plate such as the Dynaplate or Wonderbar. These devices provide an excellent ground, at the cost of a certain amount of drag. Because they will induce drag, they should be mounted as far aft on the hull as is practical, although they must be in a position that will always be submerged.

For powerboats and sailboats with internal ballast, it's better to use an external ground plate rather than the practice of grounding to through-hull fittings or engine blocks. For a ground to the engine to be effective, it must not be electrically isolated from the shaft by an unbridged insulating vibration absorber.

Whatever grounding system is used, the wire from the Loran to ground should not be shared by any other equipment. Do not tap into an existing ground wire, such as one used for SSB radio. The ground plate can be shared, but not the ground wire.

If your boat has a floating (non-grounded) electrical system, as is common on aluminum boats, isolating capacitors will have to be installed in the ground wires from the set and the preamplifier, if that also has provision for grounding.

## Antennas and Preamplifiers

Most preamplifiers are designed for use with a standard 8-foot land mobile CB antenna. The base of this antenna simply screws into the preamplifier. It is important that moisture be kept out of the amplifier/antenna connection. After assembling the antenna, the connection should be sprayed with clear urethane sealing spray, available at any electronics store. Corrosion in the antenna/preamp connection will greatly affect reception. If the function of your set deteriorates over time, this is the first place to look for problems.

The antenna should be mounted as high on the boat as possible. This

may mean compromising the efficiency of other gear dependent on an external antenna, such as your VHF radio. Mounting both the VHF antenna and the Loran antenna at the masthead is a poor idea.

In the case of a sloop, the best compromise usually is to leave the VHF antenna at the masthead, and mount the Loran antenna on the stern of the boat. Since it is line-of-sight, VHF range is a direct function of the height of the antenna. On powerboats, the antenna is commonly installed on the opposite side of the bridge from the VHF antenna.

individual Loran sets will specify the requirements.

In any case, stern-mounting the antenna may affect the use of other equipment, such as man overboard gear and boarding ladders, and it makes them vulnerable to damage. When mounting a Loran antenna on the stern, mount it as far off center as possible, keeping it away from the backstay. If you have a split backstay, centerline mounting may be better.

Because of their length, SSB antennas are usually mounted on the stern rail to take advantage of the



*Above: A good connection to ground is the key to good Loran performance. The Dynaplate, shown here, is a good example of an effective ground plate. It can also be used for grounding fuel tanks and other electronic equipment.*

When mounting the Loran antenna, remember that no metal objects (stays or masts, for example) should fall within a cone whose apex begins at the bottom of the antenna whip, and projects upward and outward with an included angle of 90 degrees. If the antenna is mounted on the stern rail near the backstay, it may be necessary to angle the antenna aft, rather than keeping it vertical, to keep the backstay out of this cone of interference.

Care must also be exercised in the attachment of the antenna coupler to the boat. Some couplers (preamplifiers) can be attached directly to the stern rail with hose clamps, but other coupler bodies may not be. The installation instructions for the

extra support. Unfortunately, a SSB antenna is much longer than a Loran antenna, violating the principle that the Loran antenna should be the highest. The solution is to mount the Loran coupler and antenna atop a fiberglass extender which projects the Loran antenna higher than the SSB antenna. An 8-foot extender maybe required between the base of the coupler and the deck to get the Loran antenna high enough. Do not simply use a longer antenna. It will be the wrong length for Loran reception.

Installation of a Loran antenna in two-masted vessels is simpler. Mount the antenna atop whichever mast isn't used for the VHF antenna. Remember to keep metal objects

outside the 90 degree cone of interference.

The neatest solution to the VHF/Loran antenna installation problem is that used by Datamarine, which makes a single antenna for both functions. Unfortunately, it will only work with the Datamarine Loran, although it is compatible with all VHF radios.

## Interference

Unfortunately, there are a lot of electrical items on most boats that pose potential problems for good Loran reception, and no installation is complete without checking out these problems.

Other electrical gear may put out electrical "noise" that reduces the signal-to-noise ratio heard by your Loran. Imagine yourself at a crowded party, trying to pick out one person's voice above the din, and you get a pretty good idea of what happens to the poor Loran when there is a lot of spurious electrical noise on your boat. It may hear that one person's voice, but it may not accurately translate what is being said.

While one of the characteristics of a good Loran set is the ability to track signals at low signal-to-noise ratios, there is no reason to handicap even the best of units by having an electrically noisy boat.

Common sources of electrical noise include: alternators and generators; voltage regulators; electric motors, such as bilge pumps; autopilots; freewheeling propeller shafts; fluorescent lights; and ignition systems of gas engines. This is by no means an exhaustive list.

If the antenna is far away from these sources of noise, such as at the masthead, you are less likely to get interference. Nevertheless, remote mounting of the antenna is not necessarily a cure-all. Noise suppression kits exist for gasoline engine ignition systems, and it is also possible to reduce electrical noise from alternators and generators with the use of the proper in-line capacitors. Other problems may not be so simply solved.

Fluorescent lights are frequently the biggest bugaboo. Someone coming below and flipping on the fluorescent lights when the navigator is

making a critical approach, or passing a dangerous hazard, is guaranteed to put him or her in a murderous mood. It is not usually practical to suppress the electrical noise from fluorescent lights. The best solution is to forget them while the Loran is in use, or just forget them altogether. In any case, you must check your installation for possible electrical interference before making a final decision on the placement of the antenna.

While exact test procedures vary from model to model, the general method of locating electrical interference is the same. Turn off all other electrical gear in the boat, including shutting down the engine. With the Loran on, call up the signal-to-noise ratio function, and record the numbers. Repeat this several times, turning off the set each time. This will give you the base SNR of the master station you are receiving, in most cases.

This procedure is repeated with the engine running at idle, then at cruising rpm. Recording the SNRs and comparing them with the base SNRs (no electrical gear on) will indicate the amount of electrical interference generated.

This can be repeated for every piece of electrical equipment on the boat. While the acceptable drop in SNR from electrical interference varies from unit to unit, as a rule, a drop of two decibels or more from any piece of gear means that noise suppression is required. If you don't bother with noise suppression, the usefulness of your Loran will be limited.

The SNR test function of the Loran can also be used to optimize antenna placement. By temporarily securing the antenna in various locations on the boat (duct tape is great for holding it), the location with the highest SNR can be found. That's where you want to put the antenna. It is important that the ground and power supply wiring be securely hooked up before doing any of these tests, either for antenna location or electrical interference.

In addition, the test procedures will be more accurate if your boat is away from potential sources of interference, such as power lines or other vessels, and if the tests are

conducted at an electrically calm time of day. Morning is usually best, early evening worst, and when there is no thunderstorm or major frontal activity about.

## Conclusion

The time to figure out where and how you're going to install your Loran is before you purchase the unit. Make sure that the model you've selected will physically fit in the space allocated, and make sure **that** it will be convenient to use once you put it there.

Expect to spend some time with your installation. The effectiveness of Loran is very dependent on the care that goes into the installation. Most complaints of poor reception, slow signal acquisition, and unreliable fixes can be traced directly to faulty installation.

Don't, in your hurry to get **the set** working, skimp on the requirements for grounding and wiring. Do take the time to experiment with antenna location.

The importance of testing for electrical interference cannot be overemphasized. Even the best Loran will be limited in effectiveness and range if it must sort through a wide variety of extraneous noise to find the signal. Follow the manufacturer's instructions on installation and test procedures to the letter. They do vary.

Use common sense in selecting a location. If the set's readout utilizes light emitting diodes, rather than a liquid crystal display, don't put it in a location that is normally brightly lit by sunlight, or the display may be almost impossible to read.

If you're willing to put in the time, you can install Loran yourself, but it does require patience and care. Most instruction manuals are quite complete, and are designed for comprehension by the owner who will do his own installation.

Loran is almost like magic. It can help you navigate with almost pinpoint accuracy in horrible weather. It is not, however, foolproof. Land path errors, extreme distance from the signal sources, and mediocre engineering in the original design can limit Loran's usefulness. Don't complicate things further with a "quick and dirty" installation. ■