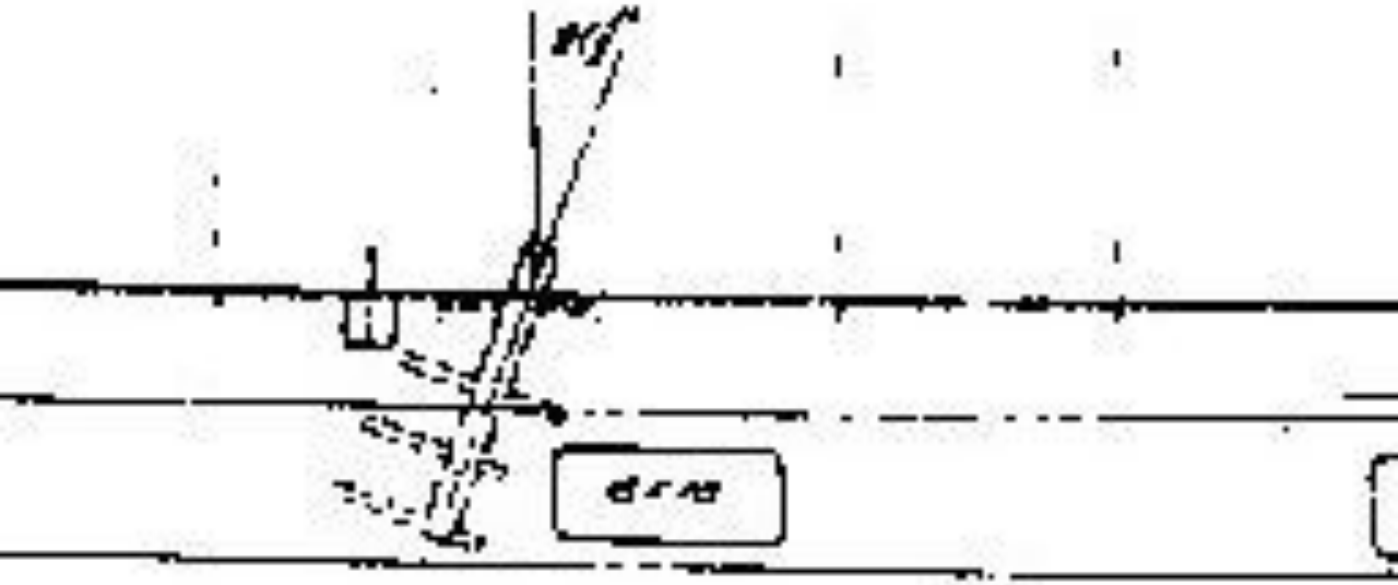
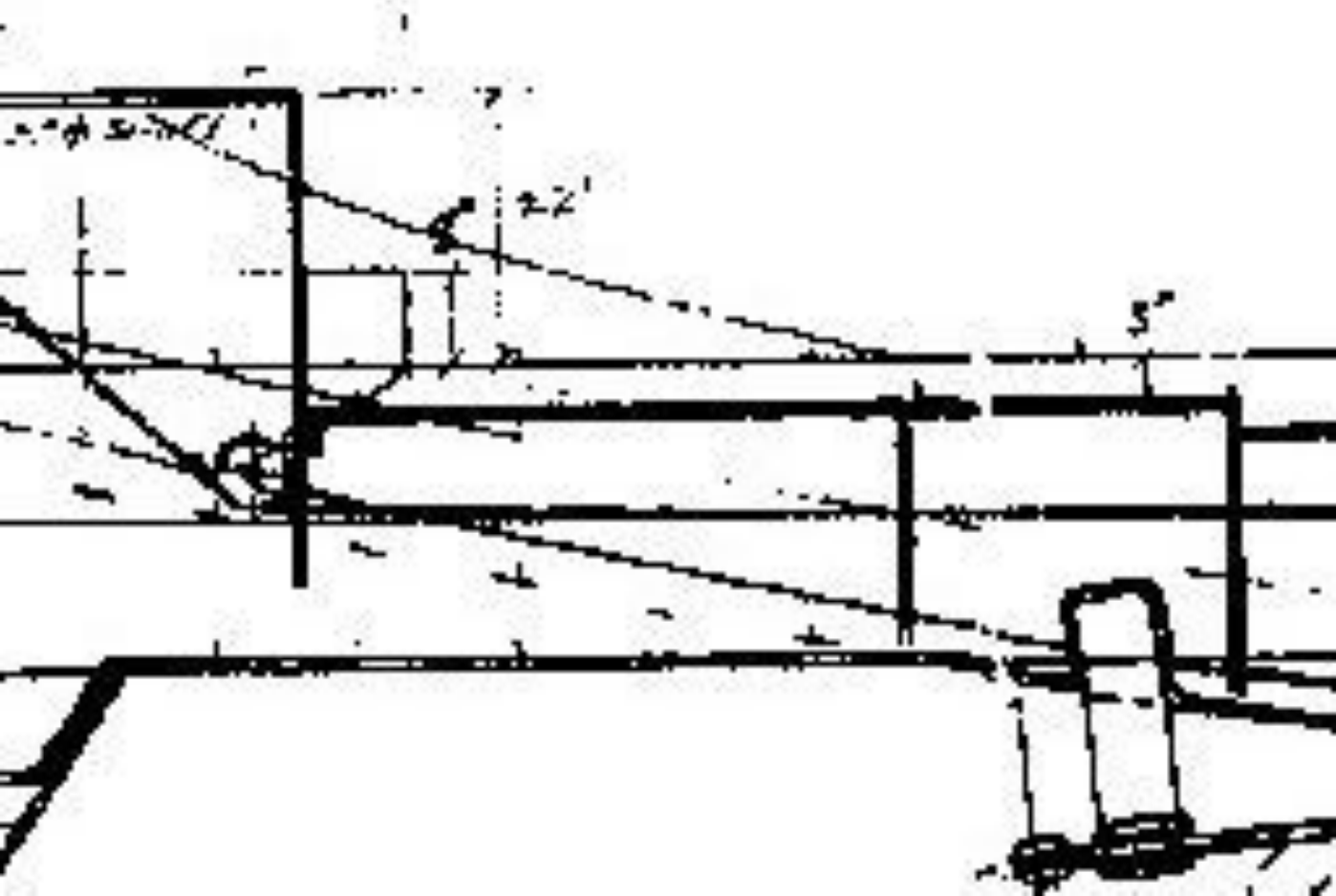




COMMENTS APPLY TO THE ARTICLE BEGINNING ON PAGE 3

In 2004 I happened to have had a client make an offer on the Irwin 52, “Elizabeth Ann”, the boat featured in this story and now in Florida. We turned down the boat prior to survey, as it was undoubtedly one of the worst condition boats I have ever viewed. It is remarkable that the Chain plate x-rays proved the integrity of the design. It is also unusual that the mentioned “Sister ship” that had a failed chain plate, never came to Ted Irwin’s or my attention.

· The meat of the story about X-Raying is quite good and may be helpful to some owners....Gene Gammon

By Van Markos

X-raying Pandora's box

If you can't see your chainplates, there's only one way to inspect them

Buying a used boat is like opening Pandora's box. Sure, you can and should get a survey, but marine surveyors are limited to searching for flaws they can uncover without destructive testing. In fact, most surveys disclaim liability for failing to find problems that are hidden by sheathing or similar coverings.

Because I've usually sailed boats I designed and built myself, I could make sure I had easy access to all systems. Recently, however, I changed tack and purchased a used Irwin 52. Neglected by a defunct charter business in Trinidad for seven years, *Elizabeth Ann* obviously needed some TLC. Nonetheless, I was confident that my comprehensive prepurchase survey had revealed the vessel's obvious shortcomings. The real challenge was uncovering flaws invisible to the naked eye. The aged and inconspicuous chainplates on my secondhand Rose were such a case.

Each of *Elizabeth Ann*'s chainplates is a welded stainless-steel assembly fiberglassed into the hull. The only visible part is the top portion that protrudes through the caprail. This is a very common installation, one I've used on boats built in my shop. I had misgivings about *Elizabeth Ann*'s invisible chainplates; in addition to her history of neglect, a sistership had been dismasted when a chainplate fatigued and crystallized out of sight below the caprail. What I couldn't see on *Elizabeth Ann* might bring her mast down, too.

Most boats built since the 1960s have stainless-steel chainplates. Whether they are constructed of type 304 or type 316 stainless, the latter of which is more resistant to saltwater corrosion, they are highly susceptible to fatigue and crystallization with age. Don't be fooled just because the chainplates are stainless steel and the part you can see is bright and shiny.

It's coming down. Faulty chainplates, corroded inside the hull, can bring down your rig if not properly inspected.

Before raising sail I wanted to be confident *Elizabeth Ann* wouldn't lose her rig with the first strong gust. What were my options? Of course, I could do nothing and hope for the best, but that went against the grain. Thirty-odd years of boatbuilding, surveying, and cruising have convinced me that Murphy lives perched on everyone's shoulder, including mine. I could chop off the exposed portion of the chainplates at the toerail, then through-bolt a stainless-steel flat-bar to the outside of the hull using the old chainplates as backing plates. This was a reasonable plan, but it could be costly and labor-intensive—and the chainplates could be in good shape under their sheathing of fiberglass.

Or I could have the chainplates x-rayed. If I could actually see the chainplates, I could accurately assess their condition. I was confident there must be industrial x-raying facilities in Trinidad. The large oil business and its

related industries require sophisticated welding, and these welds must be x-rayed. Whether someone would x-ray a boat's chainplates—and at what cost—was another question. I discovered several appropriate companies, and Trinidad Inspection Services Ltd. presented a written quote. Although the company frequently x-rays welds on freighters, mine was the first sailboat they had worked with. Operations manager Manichan Roopchand hoped it wouldn't be the last.

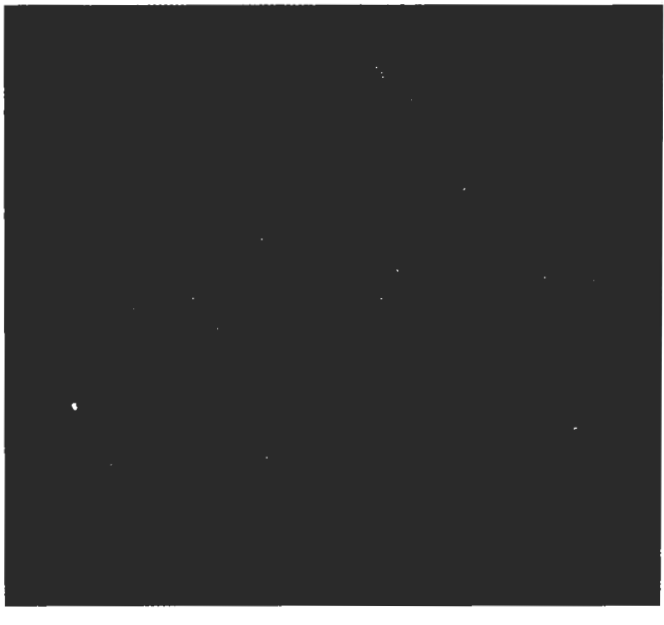
The equipment consisted of a very heavy metal box about 12″ long by 6″ square, a long Morse-like cable with a crank mechanism on one end, and a supply of film in heavy sleeves. No electrical power was needed. It took three men about three hours to x-ray eight chainplates while *Elizabeth Ann* swung at anchor, though some time was lost to rain. Fair weather is required for taking x-rays, but a small sprinkle of rain doesn't matter as long as the film is covered.

The procedure is actually quite simple. Because *Elizabeth Ann* has very high forward gunwales (6″ to 8″) and the area of concern was below the caprail, the technicians simply taped their film on the outside of the hull with the top slightly above the caprail. The metal box was set up on deck close to the area to be x-rayed.

Inside the metal box is a radioactive isotope. The cable pushes the radioactive isotope out of the box to the end of a flexible metal-capped tube positioned to direct the radiation toward the film. It is allowed to radiate energy for a specific amount of time and then pulled back into the box. During the procedure everyone stood at least 30 feet away. A Geiger counter was used to monitor radiation levels and ensure crew safety.

Results were obtained the same day, and the exposed x-rays were ours to keep. The cost was determined by the size of film needed for each shot. The bigger the area x-rayed, the larger the film needed. This project required 14″--by-17″ films. Fortunately, Murphy was on a coffee break, and the x-rays showed all the chainplates were in good condition.

Had the x-rays shown that the chainplates needed to be replaced, I would have chosen to bolt new ones to the outside. This method requires minimal removal and reassembly of joinery. Replacing the chainplates would have involved removing a substantial amount of the interior to



Just because the top half of the chainplate shines doesn't mean it's sound (top, left). The part fiberglassed below the caprail is what we're worried about.

Three men, three hours, eight chainplates to inspect. *Elizabeth Ann* ready to be x-rayed (top, right).

A technician tapes a piece of 14″ × 17″ film to the hull before moving 30-feet away for safety (middle).

An x-ray of one of *Elizabeth Ann*'s chainplates (right). Fortunately, no cracking. Everything looks good.

gain access. The fiberglass would then have had to be ground away to expose the chainplates. New chainplates would have been glassed in and the interior reconstructed. The average owner would need professional help to accomplish all this.

Chainplates that are bolted to bulkheads or hanging knees are prone to failure where they pass through the deck. This type of installation is simple to dismantle and inspect regularly—say, every 7 to 10 years.

Coincidentally, at the time of this writing, a longtime cruiser whose boat is rigged this way nearly lost his mast when one of his chainplates parted at the deck in light wind shortly after he left Isla Margarita, Venezuela. Fortunately, he was able to return to Margarita for repairs.

Another common chainplate installation consists of a large stainless-steel plate with a short stub welded in the center almost at a right angle. A slot is cut through the deck, the chainplate is pushed up from the bottom into a bed of filler, and the plate is glassed over to prevent the assembly from falling out. I have often used this installation. It can be x-rayed quite simply by taping the film to the underside of the deck and shooting through the deck from the outside at about a 45-degree angle.

All types of chainplate installations can be x-rayed. Chainplates welded to a steel or aluminum deck can be x-rayed to examine the integrity of the weld. Externally bolted chainplates can be x-rayed to reveal the condition of their fasteners. Any installation that requires disassembling the interior to gain access for inspection is a candidate for x-raying.

What price should you pay for this peace of mind? In February 2003, Trinidad Inspection Services Ltd. charged me US$130—six shots at $21.66 per shot. This is a small price to pay for assurance that the rig won't fail—at least not because of cracked chainplates.

I knew *Elizabeth Ann*'s rigging was replaced just before the boat was laid up for those seven years, but the mast fittings…well, that's another story. Perhaps I'd better inspect them closely. After all, Murphy might return from his coffee break.

I believe that x-rays should be part of all surveys of boats over 10 years old. Besides chainplates, other hidden metal fittings, such as keelbolts and fiberglass-encapsulated rudder assemblies, can be x-rayed. Check the Yellow Pages. You'll probably find such services available—and much closer to home than Trinidad. ❑

Resources

While no company specializes exclusively in x-raying sailboat rigging, many nondestructive testing companies can perform the service. Cost is usually by the hour (average $100/hour minimum) and can run from $250 to $500 to x-ray all of a boat's fittings. Three companies with experience inspecting sailboats include: Decisive Testing, 619-285-9006; Non-Destructive Testing Group, 800-748-0208, www.nondestructivetesting.com; SI-Tech, Inc., 800-895-2553, www.si-tech.us

To locate a nondestructive testing company in your area, visit the American Society for Nondestructive Testing on line at www.asnt.org/links/corpcommunity.htm.