Dragonfly Mast-raising System (1995 Macgregor 26S)

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We keep Dragonfly at home on the trailer, and tow and launch every time we sail, so the effectiveness and time-efficiency of the mast-raising system is very important to us. Because most of the boat launches we use are frequented mainly by power boats, and because I'm excessively concerned with not being the guy at the boat launch who holds up everybody else, it was important to me to have a system that allowed us to launch the boat with minimal preparation, like a power boat. With this system, all we have to do at the boat launch is remove the bow and stern straps, drop the fenders over the side (we tow with them strapped on deck, ready to go), and attach the Windex to the top of the mast.

A note on terminology: I've chosen to use the terms "raising" and "lowering" the mast, rather than "stepping" and "un-stepping." Since the mast always stays attached to the boat, I think "stepping" isn't really the best term.

Design Requirements

The goal was a system that met the following requirements.

1. Capable of raising and lowering the mast when on the trailer, tied to a dock, or while motoring.
2. All components remain attached to the hull or standing rigging when not being operated.
    a. Has no components than can fall overboard during operation.
    b. Requires nothing to be stowed below deck, in a locker or lazarette, or left behind at the tow vehicle.
3. Capable of raising the mast, from fully stowed to fully rigged (without the boom), or the reverse, in under 10 minutes.

The current iteration of the design doesn't quite meet 2 (a) or 2 (b). The roller for the mast crutch stays in the engine well while not in use, and it's too easy to drop it overboard while installing it. Also, installing and removing the roller wastes time. I've tried a few different methods of leaving the roller permanently attached to the crutch, but I'm not satisfied with how they work when towing. I'm still optimizing this part of the design.

Operation

The overall operation of the system is similar to most other mast-raising systems: a gin pole positions a line so that a B&T can rotate the mast to the vertical position.

One thing I've done differently is that I use the forestay to raise the mast whereas most systems seem to use one of the halyards. Using the forestay is a huge advantage because, once the mast is raised, the gin pole holds the forestay turnbuckle right where you need it to be to attach it to the deck fitting. I assume other systems don't do this because it's trickier to accommodate a roller furler. Since I use hank-on head sails, that's not an issue for me. However, it's probably possible to do the same thing with a roller furler, and I plan to do that on my next boat. Yes, I did do load calculations on the forestay to ensure that the load of raising or lowering the mast would be safe.

Another important difference is the baby stays. I use baby stay chains, rather than lines, cables, or tubing. I hadn't originally intended to use chains and only discovered their advantages by accident. Now that I know the advantages, my future systems will likely use chains, too. There's more on the baby stays, below.

Towing Condition

Figure 1: Gin pole, baby stay chains, and B&T as stowed for towing

Everything remains attached to the boat when stowed for towing. The gin pole pivot is attached to the mast foot bracket and the forestay turnbuckle is attached to the top of the gin pole. The gin pole is lashed to the mast to keep the end from banging around, and to help secure the forestay.

I used to leave the turnbuckle dangling from the end of the gin pole while towing. Then, one day, it spun itself loose and fell off on the highway. My bad. Now I attach it to the deck fitting once everything else is secure, so that can't happen.

Figure 2: Gin pole end fitting detail

The end fitting on the gin pole is custom made. It's a fork that goes over the clevis at the top of the turnbuckle, with a slot for the pin that connects the turnbuckle to the forestay.

There's a cap that fits over the end fitting to ensure that the pin can't slip out of the slot if the tension goes slack, such as in rough seas. I've removed that for the photo so you can see the end fitting detail more clearly.

The pin for the B&T (block and tackle) shackle also holds the end fitting to the gin pole. Because the shackle is stainless steel and the gin pole and fitting are aluminum, I have dielectric grease in the hole, hoping it will stave off galvanic corrosion.

Step One: Position the Mast for Raising

Figure 3: Mast crutch with roller

Moving the mast back from the pulpit to the foot bracket is the same as on any Mac, except for two things. I use a bow roller in the mast crutch so the mast rolls back easily (which I think most Mac owners also do), and the gin pole and B&T remain attached to the forestay while the mast is rolled back.

To install the roller, un-pin the mast from the crutch and install the roller, using the same pin.

Figure 4: Mast moved back and pinned to foot bracket

Next, the mast is un-pinned from the pulpit and shifted back to the mast foot bracket on the deck.

To do this, first remove the sail ties that secure the baby stay chains, the gin pole, and the rest of the standing rigging. Then walk the mast back to the deck foot bracket, and pin it.

The gin pole rotates to the upright position as you walk the mast back because the forestay is already attached. Note that the baby stays are also already attached to the mast and the pivot bracket.

The bungee on the B&T lines is there to keep the lines tight as you walk the mast back, so that they can't become tangled. Works like a charm. I disconnect the bungee from the B&T lines before raising the mast, but the other end remains attached to the foot bracket and is used later to lash the coiled-up B&T line.

Step 2: Raise the Mast

Raising the mast is un-dramatic. After confirming that the stays are attached, clear, and untangled, raise the mast with the bock and tackle. I've adjusted the number of turns on the B&T so that the pulling force is quite low, even at the start of the raise. The length of the gin pole (over nine feet) also helps reduce the lifting load.

Cleat off the B&T line once the mast is fully up, or if you have to stop for any reason on the way up.

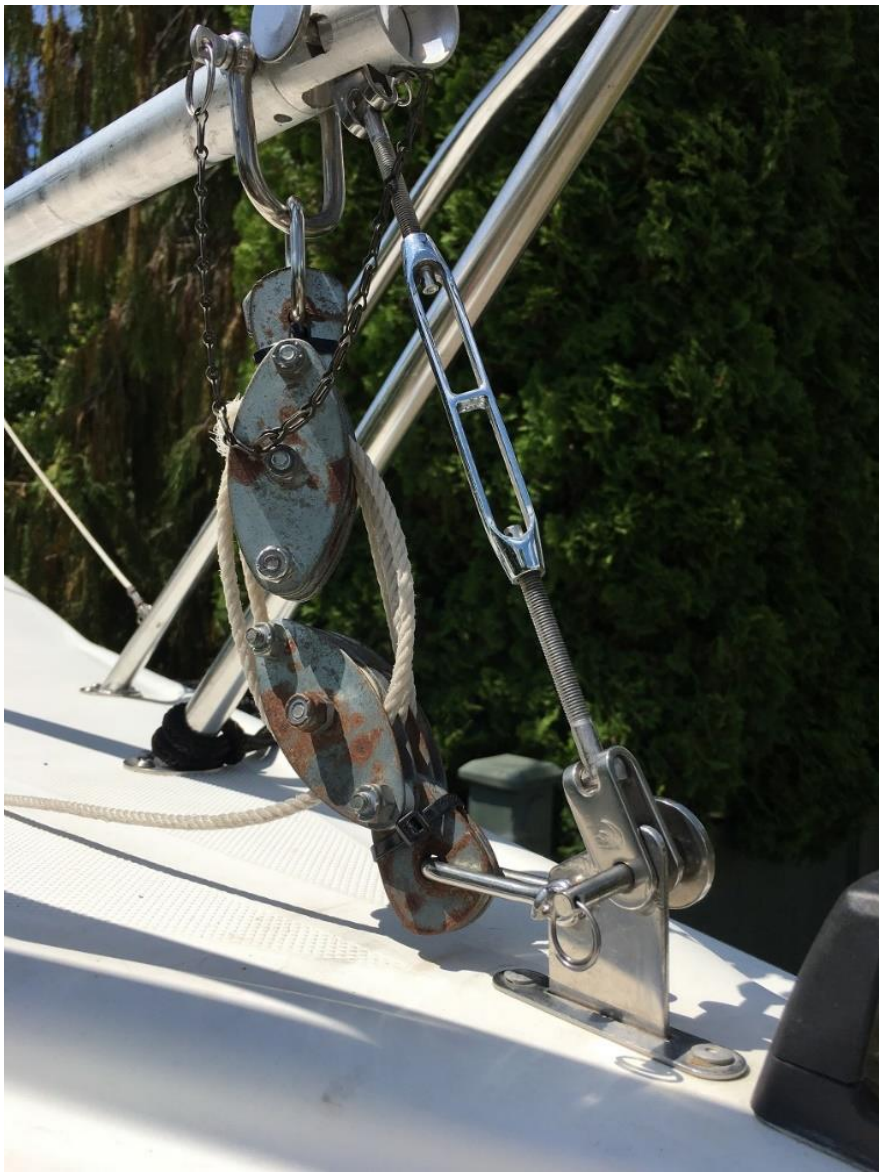

Figure 5: The gin pole positions the forestay turnbuckle so that it can easily be attached to the deck fitting

Once the mast is raised, the gin pole is positioned so that the forestay turnbuckle is within reach of the deck fitting. Attach the turnbuckle and roughly adjust the forestay tension. (Final adjustment comes later.)

Yes, I do plan to replace the cheap, hardware-store B&T with proper marine blocks and line. But I wanted to prove out the system first, before spending all that money. To be honest, it's mainly vanity on my part because the hardware-store B&T works just fine. (It had most of that rust on it long before I ever used it on a boat!)

Step 3: Secure the Gin Pole

Figure 6: The gin pole secured to the mast, ready for sailing

Remove the pin that attaches the B&T to the deck. Detach the gin pole from the forestay by removing the safety cap and lifting the end fitting off the turnbuckle. Replace the safety cap so it's not dangling loose.

Stand the gin pole up against the front of the mast and lash it to the mast with a sail tie. The sail tie should be below the boom gooseneck, so as not to interfere with mainsail operation.

Remove and slack from the B&T line and secure the line, using the bungee.

All that remains is to tension the forestay and attach the boom, which is the same as on any Macgregor so I haven't documented it.

Figure 7: Detail of the mast foot assembly

Lowering the Mast

Lowering the mast is the reverse of raising it, of course. Another benefit of the baby stay system is that the baby stays locate the mast so well that it usually drops right into the crutch on the first try. If the conditions are wavy or windy I sometimes have to ask the first mate to guide it into the crutch, but that's not normally required.

The Baby Stays

I generally remove the baby stays and stow them in the compartment I built for the anchor rode. They could easily remain attached while sailing, as the Hunter 260 baby stays do, but they are more in the way than the Hunter stays are, and they're quite easy to remove and re-attach.

Figure 8: Baby stay pivot detail

The pivot end of the baby stays attaches to a modified railing fitting that is free to rotate on a rail that I mounted between the two stanchions that the boat comes with. The pivot fitting (modified rail fitting) is axially constrained by an aluminum shaft collar on either side.

The Zerk fitting allows me to put grease into the pivot. I might be mis-remembering, but I think the tapped hole for the grub screw that normally stops the fitting from rotating was exactly the right size for the Zerk fitting, which is handy.

This pivot fitting is positioned so that the pivot point of the baby stay is approximately on the axis of the mast pivot, so that chain tension remains fairly constant as the mast rotates. That allows the baby stays to be adjusted with some tension all the time, meaning that the mast is very securely located, laterally, meaning that it can be raised and lowered even in fairly rough water.

The advantages of chain baby stays, in decreasing order of importance, are as follows.

- Because the chains attach to the mast via a rotating, through-mast fitting, I can adjust the length of the chains simply by rotating the fitting to twist the chains. That allows the chains to be long enough to allow easy positioning of the mast when walking it back and forth, and to allow the stays to be easily attached or detached, but then shortened to properly constrain the mast while raising and lowering it. I rotate-tension the chains in the direction so that they get slacker as the mast goes up and tighter as it comes down. Because of the standing stays, the baby stays are less necessary the closer the mast is to the raised position.
- Chains are, for all practical purposes, infinitely rigid in this application, so they constrain the mast very well.
- Chains stow easily and don't get easily tangled.
- Chains don't (in this application) stretch or wear appreciably, nor are they affected by UV or weather. (I don't use stainless chain for this application because I think it would be overkill.)
- Chain is cheap and easy to work with.

The Windex Sub-system

Figure 9: Windex bracket, which positions the Windex within easy reach when the mast is down

While not part of the mast-raising system, per se, the way I've attached the Windex is also important to reducing the time it takes to prepare the boat for launching. The main problem with attaching a Windex in the normal position is that the top of the mast is about nine feet above the ground when the boat is on the trailer. So, I've made an extended Windex bracket that sticks out about three feet behind the mast. When the mast is down and the boat is on the trailer, that brings the Windex attachment to within easy reach of someone standing on the ground.

The Windex attaches via a ball-lock pin.

My apologies for the Windex being so hard to see, with the background.

Commentary and Future Improvements

Having a lathe and mill made construction of the gin pole easier and allowed me to use rod end bearings for the pivot. It was also necessary to bore the shaft collars that constrain the pivots for the baby stays, because shafts are sized nominal-minus but stainless tubing is sized nominal-plus. But I think this system could be built without access to a lathe or mill, it would just require a different approach in some areas.

I had originally planned to upgrade the B&T to proper marine hardware once I was happy with how the system worked. But, now that I plan to sell Dragonfly this summer, I'll probably leave that for the new owner. The hardware-store B&T works just fine, it just doesn't look very nautical.

As I mentioned earlier, I'm stilling trying to figure out the best way to have the roller permanently attached to the mast crutch. The problem is that, when the mast sits on the roller while towing, there's nothing to longitudinally constrain the top of the crutch. The crutch bows aft under load, putting a huge load on the transom fittings that I'm sure they were not intended to handle. I've tried various methods of constraining the roller/crutch to the mast, but none of them is simpler than just removing the roller and pinning the mast. Send me suggestions if you have them!

For cost and ease of machining, some of the parts are aluminum when they should, ideally, be stainless steel or brass, to minimize galvanic corrosion. Stainless steel shaft collars are crazy expensive, so I'm loath to replace the aluminum ones. I'm keeping an eye on them. Before replacing them with stainless I'll first try painting the insides to isolate the aluminum from the stainless rail. The gin pole top fitting is also aluminum and I'm keeping an eye on that for galvanic corrosion, too. If necessary, I'll paint it. If that proves inadequate, then I'll make a new one in brass.