Adding PHRF Adjustable Genoa Tracks to the J/105

Several new owners have recently inquired about how to add PHRF genoa tracks to a J/105. As the “At Large Member” of the class Executive Committee, representing the many sailors who are not able to race in local OD fleets, I thought I’d tackle the question in some detail.

When I first got LEGACY (hull #198), in 1998, there was only one other J/105 racing in my area, so we were not able to race as a One Design class. To compete in the local PHRF fleet, we both added adjustable genoa cars and 155% genoas. Let’s face it, the J/105 is a “substantial” boat and the added horsepower provided by a large, powerfully cut genoa in light air makes a huge change in the boat’s performance. In fact, according to the IMS polars, the addition of a 155% genoa increases boat speed by .6 kts across the entire 6-10 knot true wind speed range. Differences are probably even greater below 6 kts. true wind speed. If you race PHRF, adding a genoa really changes the otherwise miserable experience of being toasted by slug racer/cruisers with their big gennies while you're doing perverse things to the rig to power up the OD jib!

You should remember, however, that the J/105 was not designed for a genoa and there are several issues that need to be considered. The shroud base is very wide, so the genoa must be carefully shaped to curve around the turnbuckles at the deck yet trim close to the spreaders up high. The added draft created by the wide shroud base does create a full, powerful sail shape, but it also challenges the sail maker trying to create a narrow entry angle to improve pointing. Because the J/105 has such great righting moment the boat can easily carry the genny up to 15 knots or higher depending on the crew weight. If the genoa is constructed properly, it is possible to race the boat with a two-headsail inventory, though some PHRF racers prefer to go “full-race” with a three-sail inventory that adds a #2 between the genny and the class jib. If you elect to go with the two-headsail inventory, your sailmaker will probably recommend building a slightly heavier and less deep genny that you can carry all the way up to12-15 knots of true wind.

You will also need to decide whether to have the sail cut to fit the roller furler. Although the Harken foil has two slots, if you are using the furler, you will not be able to do side-by-side sail changes since only one sail at a time can be connected to the upper swivel. If you want to do side-by-side changes you will also need to install a second genoa halyard. If most of your PHRF sailing is on short windward/leeward courses, you’ll find that you can usually wait for a downwind leg to change the headsail. If you are planning to invest in a three-sail PHRF inventory where you are more likely to do upwind sail changes, you may prefer to configure the sails to attach at deck level and add the second halyard. Remember you’ll need to drop the swivel below the luff-feeder so it won’t interfere with the sail changes. On LEGACY I wanted to maintain the “ease of use” concept of the J/105 design, so I decide to have my genoa cut for the furler and preserve the ability to roll the sail up down wind. Only once, when the wind died at the beginning of a windward leg after a squall, have we had to change a headsail upwind. In that case my crew set everything up, then we went bare-headed for about 45 seconds while the jib was dropped and the genoa was hoisted.

One you’ve decided to add a genny, the configuration of the lead system takes careful planning. The J/105's deck slopes down rapidly as you move aft or outboard from the jib and genoa lead positions. This is why the turning blocks on the rail are required with the class jib lead, which is located well above the winches. The genoa lead system can't use this solution because the leads are so far aft that the angle out to the turning blocks is greater than the angle up to the genoa’s clew. This causes the lead cars to slide forward rather than aft when the sheet is tensioned. Adjustable lead systems typically depend on the angle change from the sail’s clew to the winch causing the car to move aft against the puller system. On the J/105, the genoa lead system must be very low profile so it can lead directly to the winches without creating overrides. Additionally, on the port side, the sheet must lead to the inside of the winch. This adds an additional angle change that prevents the use of non-articulating "stirrup cars” for the lead, since these only lean side-to-side and don't swivel or pivot fore and aft. Also, note that the genoa can only be cross-sheeted by wrapping it around the leeward primary then leading it to the windward winch. This makes for very slow tacks and is not recommended.

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One thing you won't have to worry about when you add the genoa track is sealing a cored deck area. J/Boats has provided a 4'-plus area of solid glass to support the genoa tracks. This area is located just outside the cockpit coaming running from just abeam of the dodger bracket aft to abeam of the turning blocks. From inside the cabin this area is very evident because the deck thickness obviously tapers down to a non-cored area. In the picture above, looking aft on the port side, you can see the row of caped bolts that denote my genoa track. The outboard taper marks the beginning of the cored deck area. The inboard taper is the raised cockpit coming. The area continues aft of the bulkhead visible in the picture. Make sure you keep your track in this area and you should avoid the possibility of any water intrusion into the balsa core of the deck. It is still good technique, however, to drill oversized holes, fill them with epoxy, then drill the actual mounting holes through the epoxy plug along with a counter-sink area to accept the sealant. This ensures that no water can penetrate the layers of glass laminate in your decking. Also, note the of use large SS fender washers to distribute the load and cap-nuts to cover the bolt ends and provide a finished look.

Now that we've discussed the general issues of adding a genoa and lead system, let's look at a specific example. For LEGACY, Paul Andersen, of Andersen Boat Works in Deltaville, VA, developed a very elegant solution using a mix of Lewmar OCEAN and Race parts. In general, the Ocean Series components are lower and sleeker than either the Lewmar Racing Series or the Harken Small or Midrange Series components. The components Paul used on LEGACY are:

- Lewmar Ocean Series 1 sliding bolt track - 4' per side (2916-1100)
- Lewmar Racing Series 1 mainsheet car with standup and tangs (3104)
- Lewmar Racing Series 60mm high-load single block in the standup (1611)
- Lewmar Ocean Series 1 control line end stops with integral sheave on each end (2917-1030)
- Lewmar Ocean Series 1 control line single sheave mounted on the control line end stop (2917-1011)
- Lewmar Racing Series 30mm double block with a twist shackle connected to the front tang of the car (1302)
- Ronstan medium cam cleat with fast-track fairlead on the cockpit side

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The installed system is shown in the picture looking aft on the starboard side. As you can see, this system provides a low-profile, fully-articulated lead with 4:1 purchase on the car puller. Although the Lewmar sliding-bolt track is slightly taller in profile than the corresponding Harken track, it has more rounded edges and lower-profile end stops. When compared to the height of the cockpit coaming, the track and aft end stops are unnoticeable when sitting on the side deck in that area. You can see how the integral sheaves and beckets in the end stops allow for a very clean layout (despite the blown out shock cord in the picture) with only one additional sheave being required on the forward end stop to create a 4:1 purchase for the puller. The use of a twist shackle between the lead car and the 30mm double block in the puller system allows the sheaves to be oriented horizontally so they lay flat on the track. The Ronstan cleat with Fast-Track fairlead can be adjusted from any angle in the cockpit.

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Here's a close-up of the front end-stop and the lead car showing the routing of the lines. The lead line on the car puller is the maximum that would fit through the integral sheaves, which caused the spliced end to be a little over-sized to fit through the double blocks. In the future I will replace this with a smaller, more flexible line. The Lewmar 60mm High Load block uses brown Torlon™ roller bearings for the main loads and Torlon™ ball bearings for the side loads. Note that the standup support and spring on the mainsheet car allow a full range of articulation including, swivel, pivot, and lean to ensure a fair lead to the winch. Surprisingly, this system actually results in a lower lead position that a typical Harken or Lewmar stirrup car. The only disadvantage of this configuration is that it does not allow the passing of two jib sheets through the sheave for sail changes, but this is not a problem for a two sail inventory since the jib sheet is rigged through the outboard turning blocks.

While we were designing this setup I did a lot of research on sizing the genoa lead system. The standard formula for determining sheet loads generated by a headsail is:

Load = SA x AWS^2 x 0.00431 where
SA = Sail Area in square feet
AWS^2 = square of Apparent Wind Speed in knots
0.00431 is a constant

Note that the sheet force increases linearly with sail size and with the *square of the apparent wind speed*. This means that doubling the apparent wind speed from six knots to twelve knots quadruples the loads on the sheet, block, car, winch, and puller. However, increasing the sail size 45% from a class jib to a genoa only increases the loads by the same 45%. Doing some quick calculations we find that the loads generated by the genoa at 15 knots apparent wind are actually smaller than those generated by the class jib at 18 knots. This gives us some confidence that the Lewmar 44 AST 2-speed primary winches have plenty of power to deal with the loads generated by the genoa. The lead car, lead block, and track should be appropriately sized so their SWL (Save Working Loads) are less than the maximum loads your system will generate. Remember, low-balling the wind speed at which you will switch to the jib may induce you to save a few dollars when you buy the equipment, but cost much more when a surprise gust blows up the car or block.

As for the lead adjustment system, standard rigging guidelines assume that an average sailor can generate 25 to 35 lbs. of force with one hand on a control line like a car puller or traveler. This means we need enough purchase in the system to get the maximum puller loads down to this level. Puller loads very with the angle change the sheet goes through as it enters the lead car. If the sheet enters at a 45-degree angle, which is typical for a genoa, the load on the puller system will be 30% of that on the sheet. You should then add enough purchase to reduce this load to the level your headsail trimmer can handle. Typically a 4:1 system will allow for easy adjustment.

Here's the raw data on the loads generated by a J/105 genoa of 433 sq. ft. size, which you should consider if you choose to develop your own configuration.

Apparent		**Lead Block Load**		**Car Puller Load**	
Wind Speed	**Sheet Load**	**45°**	**60°**	**45°**	**60°**
12 kts.	269 lbs.	201 lbs.	269 lbs.	81 lbs.	135 lbs.
15 kts.	419 lbs.	315 lbs.	419 lbs.	126 lbs.	210 lbs.

While most of us bought our J/105s to enjoy the great OD racing and wonderful shorthanded sailing qualities of the design, if the only option for racing in your area is PHRF, the addition of a genoa with adjustable leads can definitely improve your light-air performance.