

Keel Change 101 Walt Nuschke, Captain, Fleet 3

In The Beginning

Fleet 3 of J105's had its beginnings in the early 90's. At first a few boats were sold and sailed PHRF. These boats were configured with shallow draft keels, which is not an usual thing to do given the shallower waters of the Chesapeake Bay. The J105 caught the attention of a lot of Chesapeake sailors who were looking for a less complicated way to enjoy the sport. The fleet grew, first gradually, and then later at a rapid pace until members numbered in the mid-forties. All the new members went with the shallow draft configuration in the spirit of one design competition.

Out of sight and out of mind, other fleets were growing with equal rapidness. Before we knew it there were over 600 J105's racing in fleets around the country. One major problem became obvious, Fleet 3 was sailing in a boat called a J105, but when the shallow draft boat sails against the deep draft boat, it becomes eminently clear that they are not the same boat. A small number of owners took notice of this and started to make some noise about changing their keels. A meeting was held in the spring of 2003 to discuss the possibility of changing. This effort was met with general apathy and only four boats indicated the willingness to put up the \$10,000 it would take to get the keel changed. Of these only one boat, Tenacious owned by twin brothers Scott and Carl Gitchell, was willing to make the change. They immediately set in motion plans to have a convertible keel installed at Custom Offshore. The others were not willing to give up the joys of large fleet racing and in their minds it was either all change or no change.

Developing A Consensus

In the subsequent months it became clear that Fleet 3 had a major problem. With approximately 50 boats in the area the market for J105's was saturated. Some owners wanted to sell their boats but the local market could not absorb the number of boats for sale. These same boats were of no value outside the Chesapeake Bay unless the owner was willing to cough up the \$10,000 needed to change the keel and this would only be possible if the buyer could not find a deep draft boat to purchase. A key factor in sustaining a racing fleet is the ability for owners who have lost interest to sell their boats and for active participating sailors to purchase the same boats. Without this cycling of owners the fleet will degrade into a small core of racers and a large group culturing algae in the slip.

The fleet held its annual meeting in December of 2003. At that well attended meeting I took an informal poll of the members. The question asked was, "Raise your hand if you would change your keel if the costs was \$X". The answer was nearly 100% at \$0, and subsequently less as the number increased. There were only a couple of hands showing when the figure hit \$8,000. The message was very clear, find a way to do this for less money such that a critical mass of boats would change keels. Twenty-three became the number of boats that would have to commit because this is the number of average starters we have through a complete season. With this number I felt that the other boats (I called

them the “fence sitters”) would come along if only for the sake of preserving their investment.

I did some basic research on the power of mass purchasing. The keel was a simple matter of going to the original manufacturer, I. Broomfield and Son of Providence, RI, and getting a quote on keels. They gave us a price of \$0.72 a pound for new keels and \$0.20 a pound for old keels for recycling. The initial price was actually much less than this but we fell victim to the resurging world economy which drove the cost of all metals upward by the time the fleet was ready to purchase keels. Some quick math results in a net price of \$1676 for each keel.

The next problem was how to move the keels. Getting 3300 and 3500 pound chunks of lead around is not a trivial problem. Some conversations with trucking companies convinced me that the cost of a round trip from Annapolis to Providence would be about \$300 to haul each new keel to the contractor and its recycled counter part back to Providence.

Next up was finding contractors. The assumption was that numerous contractors would be needed to handle what seemed an insurmountable task.. I made up a simple bid package that included photos of Tenacious going through keel change at Custom Offshore. I was a bit shocked when the contractors did not respond. Foolishly I had expected some active interest in the project. I soon learned that the boat repair contractors are for the most part suffering from “one off” mentality. The idea of working out methods with the goal of doing each successive keel change with ever increasing efficiency is not part of that mentality. I also believe that some of the contractors thought this was the craziest thing ever and would never happen.

Our regularly scheduled fleet meeting was held in July of 2004 with the sole topic of thumbs up or down on the keel change. All of my planning had revolved around doing the change over the winter so we could all finish out the 2004 high point season. There had been an obnoxious amount of debate about this over our fleet email network and the meeting was the way to bring finality to the discussion. The result of this meeting was very surprising, at least to me. 24 boats said they were ready to change and 10 said they were ready to change immediately. A small but eloquent faction tried to convince otherwise but it was very clear that the winds of change were blowing hard. Within a month this critical mass had complete momentum as virtually every active racer in Fleets 3 and 10 had verbally committed to change.

Verbal commitments do not buy keels. I set a deadline of September 1, 2004, to make deposits to cover the keel purchase and transportation. The plan was to purchase the keels in lots of about ten and at the end of the project rebate the net funds from re-cycling the old keels. This effort resulted in financial commitments from 35 owners not including a few who either already had keels or chose to go a different route.

The first load of 10 keels was delivered in mid-August and the process was under way.

The Well Disguised Angel

One contractor, Bob Muller of Muller Marine, proved to be the angel we needed. Bob has done several keel changes in the past and he is a well known supporter of Annapolis racing fleets. Most importantly, Bob is a person who makes things happen. While the other contractors were circling us like we were a pack of enraged lunatics, Bob was working out details and wondering when he could go to work. He came up with a set price that included a fully faired, race ready keel. Bob doesn't believe in putting his name on quick and dirty. His pricing turned out to be the magic bullet. We had quotes in hand for lower cost, factory equivalent change, but in the end no one chose this over the Muller Marine package deal.

Other contractors who helped out were Custom Offshore, Whitehall Yacht Yard, TPI Services, Hartge Yacht Yard, Steve's Boat Repairs, and Osmotech. All are very competent contractors who have done a masterful job for the owners.

Huge Logistical Problem

Changing the keel of a boat is not a new thing. It has happened frequently on J105's as boats move from shallow draft fleets to deep draft fleets. The normal procedure has been to pull the old keel, develop a template for the bolts, and then wait for the factory to make a matching keel. This approach uses about two months of yard time. Considering this process in relation to changing a large number of keels in the shortest time, it was immediately clear that there had to be another way. There isn't enough room in all the yards combined to have boats sitting there waiting for the new keel.

We immediately set about finding a way to have keels made that would match up to the boat. This would greatly shorten the process because the new keel could immediately be installed and the boat turned around in minimum time. Researching this meant a lot of phone conversations with Hank Williams of TPI, and Tom Pratt of Broomfield plus valuable input from Bob Muller (Muller Marine) and Jon Udell (Custom Offshore). The disturbing news was that while the keel mold has remained the same, the bolt patterns have been modified several times to adjust to changes in the stringer arrangements. No one was sure how many versions had been made, all the old templates had been destroyed, and there were no drawings to reference back to. Further bad news came when the contractors said that the bolts were never an exact match even when a one off template was supplied. When the lead is installed on a new boat at TPI, a template of the keel bolts is made and the holes are drilled to match. This means that each keel is custom fitted to the boat.

Fitting Round Plugs in Square Holes

Faced with the fact that we couldn't just order a keel and expect it to fit, I set about finding a way to measure the boats in advance so that a keel could be ordered that had a reasonable chance of fitting into the boat without major reconstruction. To this end, I built a jig constructed from plastic pipe fittings that would allow us to measure the spacing and offsets of the bolts by inserting the jig into the sump of each boat. We

formed an impromptu committee of owners, dubbed the “Bilge Water Boys” because our activities included the removal of some very stinky stuff from the bilges , and set off on Denis Seynhaeve’s launch to measure some boats and see what we could learn.

The data we collected confirmed that the keels were indeed different and that we needed a better way to measure things. The hastily constructed pipe jig suffered from some alignment problems that affected the accuracy. Not only was the bolt spacing different, the fore and aft positions of the bolts were not the same. I went back to the drawing board and came up with new jig that used a laser referenced to a frame fitted with a large T-square to precisely measure the positions of the ends of the bolts relative to the main bulkhead. Offset marks allowed us to also measure the relative lateral positions of the bolts. The laser insured that the measurements in the depths of the bilge were repeatable and accurate.

We also added a measurement from the stem fitting to a shock cord stretched between the upper shrouds to give the position of each boat’s main bulkhead. This measurement was necessary because the bulkheads are not all in the same location. So much for those tuning guides were they tell you how far to position the mast from the main bulkhead! The one thing that has remained constant in the molding of all J105’s has been the hull mold. This measurement, combined with the bolt head measurements, allowed us to get a measure of the positions of the bolts relative to the hull mold, which proved to be a very reliable way of getting new keels made.

The Bilge Water Boys once again hit the water, and in the period of one day managed to measure 19 boats covering the full spectrum of hull numbers. The measurements were all added into a spreadsheet and after numerous statistical manipulations, patterns jumped out of the fog of numbers. We were able to tell that there were four different patterns (among the boats we measured) used to make keels. Pre-scrimp up to 156, 157 though about 200, 200 – 258, and 258 to present. The pre-scrimp keels have six bolts and they are not in line down the center of the lead. The back bolts (back two on pre-scrimp) are 18 inches long and are almost never set square to the lead. These back holes, through about 17 inches of fiberglass, are drilled by hand at TPI and this results in holes that are not perfectly square to the hull. The pre-scrimp bolts follow a general pattern but there is significant deviation within the pattern. The fore-aft position of the bolts varies across all boats by about 1 inch. This variation is completely random. Some bolts are on center and some are offset to one side or the other in the lead.

Armed with the measurement information, I was able to instruct Broomfield on how to make custom racks that would position the bolts. This was accomplished by sending them plywood templates drilled to match the corresponding bolt patterns. The templates were converted by Broomfield into racks that position the J-formed, one-inch bolts in the lead as they are molded. Hulls after 258 could use the existing production bolt rack. Hulls from 157 – 258 could use the same template with the knowledge that one of the holes in hulls 157-200 would need to be filled and re-drilled. Since we only had one hull number in this range this option was preferable to creating another custom template. The pre-scrimp keels were so variable that Bob Muller and I decided to create a completely

different template and then fill and re-drill holes as necessary. This was preferable to spending a lot of time and money creating individual templates that wouldn't fit well anyway.

The Magic Tool

Jonathan Udell, from Custom Offshore, supplied some very valuable help in the form of information about a custom hole saw that he uses to remove the bedding material from around the bolts of the old keel. This makes short work of removing the old keel, which would otherwise be very difficult. I ordered some carbide tipped hole saws and steel tubing to match. A machine shop cut the saw bit in half, welded in a length of steel tubing, turned down the tubing to the correct diameter, and voila we had custom 19 inch deep hole saws. I also picked up some oversized cobalt steel drill bits and had the shafts extended to 18 inches so any major reconstruction could be easily handled. These tools were provided to the contractors at no cost to them.

Soon after the delivery of the first load of keels I showed up at Whitehall Yacht Yard where John White and his crew had just started work on changing Hull #216. They had ground away the band of glass that joins the trunk to the lead and were busily pounding away with a very large hammer and wedges. They were obviously getting nowhere with their efforts and had that look of desperate frustration. This is not fun work on a hot August afternoon. I pulled out one of the Magic Tools and explained its use. The keel was off by the end of the day. The right tool makes experts of us all. Thank you, Jonathan Udell.

Mission Accomplished

The final load of 11 keels was delivered in early December of 2004. The entire project has gone better than I could have imagined. All of the new keels will be installed by April of 2005, and the days of second-class, shallow draft citizenship will be completely and officially a bad memory.

Repetition makes for perfection. Originally Bob Muller had claimed he could change one keel a week. I certainly never took this very seriously because everyone else said two weeks. In reality Bob was able to change a keel in less than a week. He kept three boats in the yard, each at a different stage of changing. While the glass was curing on one he was fairing on another and so forth. The quality of his work as well as the other yards has been fantastic. We have ended up with a fleet that is 100 percent race faired, and all of the boats will have their float lines and be weight certified. Prior to the keel change only a small percentage of the boats had keels that were race prepped to templates.

J105 Fleet 3 started sailing as a mixed fleet with separate results during the fall events of 2004. By the end of October we were able to sail the Chesapeake Bay Championship with two starts of 15 boats with each keel type. When the last load has been installed we will have 39 member boats configured for one design racing governed by the J105 One Design Rules.