



avoiding a A BENT MAST

by RALPH SKEA

For some, a bent or broken mast can be a rude introduction to Paper Tiger sailing. Here are some basic steps that can be taken to reduce the risk.

If you have been around PTs for a while you will no doubt have seen the occasional on-water mast realignment. You may even have engaged in this form of non-productive rig adjustment yourself. If the result is a “nice” even curve in the mast where there shouldn’t be one (and there shouldn’t be one anywhere) then the problem may well be fixable. If, on the other hand, the curve in the mast is interrupted by a sudden change in width and direction, then it is probably time to be philosophical - at least you shouldn’t have to sell one of your kids or a spare body part to afford a new one.

In my 30 years of racing PTs I haven’t destroyed a mast on the water and have only curved one on a few occasions in strong winds. So it is not a given that PT sailing equates to broken masts, but luck can play a part in this. Getting caught out in severe conditions may not end well, especially if you and your boat part company.

My biggest concern is for the newcomers who starts

damaging masts as soon as strong winds are encountered. This usually occurs because they are unaware of a few basic precautions that will protect the mast under most conditions. The aim of this article is to increase awareness of the risks and suggest a tried technique for straightening a bend, should it occur.

Paper Tigers have always carried a lightweight section mast. The advantages are a lighter boat overall, less weight aloft to cause pitching in short, steep waves, less tipping moment when the boat heels, and a more tuneable rig. The disadvantage is an increased risk of damage to the mast if sufficient care isn’t taken.

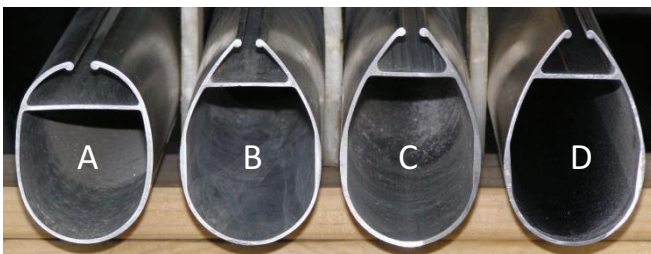
Before I get into the nitty gritty, I’ll take a moment to give the uninitiated a brief history of PT masts. The mast size on the PT is controlled by a couple of basic dimensions as set out in the class rules. These are a maximum length of 6780mm, maximum cross section size of 80mm long by 62mm wide, a minimum weight of 0.95kg per metre and a stipulation that the mast cannot be tapered but can be internally stiffened.

During the early years of the class, the common mast used had an oval shaped section of 65mm x 50mm (A), significantly less than the maximum section allowable. Some larger sections were tried, but the smaller section prevailed as it was lighter than the alternatives.

The rigging was set up tight, inducing mast pre-bend to try to reduce the risk of mast failure in the event of a nosedive downwind. The lower forestays were not adjustable on the water, so had to be set up to suit the forecast conditions, i.e. loose for light weather or tight for heavy weather. If a strong front came through unexpectedly mid race, things could get pretty hairy.

In the late eighties, a new, larger Australian teardrop mast section of 75mm x 50mm (B), which was stiffer but still relatively light, was adopted by many skippers. Lower forestay tension still had to be determined onshore, so the risk of getting caught out remained.

During the nineties, the class rules were changed to allow on the water adjustment of the lower forestays. As well as enabling better control of the sail shape, this also enabled action to be taken to protect the mast should conditions change mid race. An imported light but stiffer mast section of 80mm x 50mm (C) also became available at this time. The combination of the two enabled the rig to be set up without induced mast bend, and some boats today carry very loose rigs. An 80mm x 50mm modified section (D) was developed by NSW skipper, Garry Williams, and is now available.



So what is the upshot of all this? Well, we now have a boat with a very adjustable rig; the ability to adjust that rig mid race when necessary; the opportunity for an expensive afternoon on the water if the necessary adjustments aren't made when required.

Now let's get into it. What can be done, before going on the water, to increase the chances of coming back in one piece?

First, ensure that all the rigging is sound, i.e. no broken strands of wire in the stays, no cracked stay thimbles, no bent shackles, no cracked hounds, no loose or badly corroded hound fastenings, a tightly attached mast base, and a properly sealed plug in the mast head (see **Failsafe**, August APT).

Second, ensure that all shackles and stay adjusters attaching the mast to the boat are tightly done up. If distracted whilst attaching a shackle, you may forget to tighten it when you return. Get in the habit of finishing the task before helping others. How would you feel if they beat you because your mast fell off?

Finally, ensure that there is no way that the boom can contact the stays. This is possibly the number one cause of mast damage for novices because no one thought to tell them. Basically what happens here is that the boom rockets across the boat when gybing and slams into the backstays. As the majority of the sail is outboard of the stays, the sail and boom try to carry on to some point forward of the mast. However, as the boom is attached to the mast at the gooseneck and the centreline of the mast is held in line with the boom by the now tightened vang, the mast gets levered sideways along its narrowest (and weakest) axis by the boom. If the wind is strong enough and the impact with the stays great enough, the mast can be bent beyond its elastic limit.

To set your boat up so that the boom won't contact the stays, tighten the vang, let the mainsheet traveller out to the end of the track, release the mainsheet, release the lower forestays and push the boom out till it touches the stays. Now tie a knot in the mainsheet (a simple half hitch or figure of eight will do) so that it comes up against the first mainsheet block in your system when the boom is at least 25mm off the stays and the mainsheet is pulled tight. Then pull the lower forestays on tight and test again to ensure that there is still no way that the boom will make contact.

OK, now secure in the knowledge that the boat is up to the task, it's onto the water. There are three main areas where you are at risk of mast damage when racing; the capsize, the nosedive and the gybe.

Capsize

I have witnessed a number of situation where a capsize has ended in mast damage. These were:-

- A capsize in shallow water where the mast top touched the bottom and the skipper tried to hang on to the elevated hull, thus overloading the unsupported top section of the mast.
- A capsize in shallow water where the mast became stuck in the mud and was damaged while the boat was being righted by an inexperienced power boat crew.
- A capsize in very strong wind where the skipper lost contact with the boat and the wind flipped it repeatedly, breaking the mast.

In the first two situations, by all means hang on to the boat but get off the top hull before the mast sinks. Of course the best remedy for these situations is not to capsize in the first place. Some of the more common reasons for capsize are:-

- Inability to release a cleated mainsheet in a gust.
- Forgetting to release a cleated mainsheet when tacking.
- Getting feet caught in ropes, when tacking.
- Breaking a hiking strap while hiking out.
- Gybing in strong weather.
- Gybing unintentionally.



Capsize on a beat – well almost, he recovered

Most of these situations are due to sloppy boat handling. Practicing tacking and gybing and thinking before you act are the best remedies. Make sure that ropes aren't tangled around themselves, or your legs, before launching into a tack or gybe. The mainsheet must be uncleatable whilst hiking out as far as you would be when frantically trying to stop the boat tipping over. This usually means that the cleat has to release downwards, i.e. the cleat positioned upside down so that it releases when the mainsheet is pulled level with the deck. Unfortunately this can make it a bit more awkward to use. The alternative is a good pair of sailing gloves, a good ratchet block and strong arms.

Nosedive

It is worth noting here that a **doubling in wind strength can result in a quadrupling of the power generated by the sail**. This may help explain why things can go wrong so quickly when reaching or running in strong gusty conditions. The most notable feature of a serious nosedive is the rapid deceleration of the boat. In a worst case scenario, the skipper may also be introduced to skydiving.

Nosediving is most likely to occur in fresh to strong winds:-

- On a reach or run on flat water because of a rapid power increase from a strong gust pushing the masthead forward and the bows under water.
- On a reach or run in short steep waves when the pitching bows bury in the back of the next wave and the flat, downward sloping foredecks force the bows under.
- During a gybe if the boat is allowed to slow too much, or the bows are buried in the back of a wave, when the sail fills on the new gybe.
- When turning from a beat onto a reach or run if the boat is allowed to rapidly accelerate during the turn, especially if the centreboards are still down.

Here are a few things that can be done to reduce the risk of a nosedive, or at least help you survive:-

- Raise the centreboards to allow some sideslip of the boat in a gust.

- Tighten the lower forestays so that the mast is straight or curved slightly forward in the middle and is well supported. Do not over tighten the lowers or the upper stays will go loose leaving the upper mast vulnerable.
- Sit well back on the boat to keep the bows up. Sitting behind the back beam will be necessary at times and will stop you sliding forward and making matters worse should you stop suddenly.
- Don't cleat the mainsheet when sailing off the breeze in strong winds. Wrap the mainsheet once around your hand so that it can be released quickly.
- If the bows bury, release the mainsheet, push the tiller away from you quickly and hike out hard so that the boat begins to turn into the wind before the rudders lift out of the water.
- Check that the mainsheet and traveller ropes aren't getting tangled so that when you release them they run out quickly and freely.
- If the boat is travelling too fast on the run and burying in the backs of waves, pull the boom in enough to reduce the sail area presented to the wind and thus slow the boat to a safer speed.
- When bearing away onto the reach or run, turn sharply and release the traveller at the same time so that the boat doesn't get a chance to accelerate before it is on the new heading. If one or both of the centreboards can be raised before commencing the turn, all the better.



Nosedive and recovery on a reach





Cartwheel on a run – no recovery here

During a cartwheel, let go of the boat before the mast hits the water or you may overload it. Try not to land on the rig if thrown forward as this may break somethingthen again, you may not get a say in the matter.

Gybe

Gybing can be a traumatic experience for the novice in fresh winds.....scares the heck out of me at times too. To protect the mast during a gybe:-

- Tighten the lower forestays so the mast is straight for maximum support.
- Keep the vang tightish so that the sail leach helps support the mast.
- Gybe when the boat is travelling quickly, not when it is slowing on the back of a wave. If you can't pull the boom across, you are probably travelling too slowly.
- Don't gybe in a gust. Look for wave patterns and the behaviour of boats astern that may indicate an approaching gust.
- Sheet the main in before gybing on the run so that the boom doesn't swing as far (and therefore as fast) across the boat.
- Don't gybe just as the bows are burying in the back of a wave.
- Turn quickly and further into the wind than required for the next leg of the race when gybing from one reach to another. This will reduce the impact on the rig when the boom reaches the opposite gybe.

RIGHTING A STUCK PT

A safe and effective way to right a PT with its mast stuck in the mud (using a power boat) is to wrap the tow rope around the front beam a few times just below the top hull (never over the top of the hull), stand on the chine on the bottom hull next to the front beam and hang on to the loose end of the rope. Ensure that the lower forestays are tightened, the mainsheet is uncleated, and the power boat pulls slowly but firmly in line with the mast.

When the mast pulls free of the mud and lifts clear of the water, or if the power boat starts to drift sideways while the mast is still stuck, let go of the tow rope. The mast can be bent if the PT is turned whilst the mast is still stuck. It is safer (and cheaper) to reposition the tow boat and try again.

- Remember, there is always the option to tack instead.

While I have probably not covered every possible situation that could lead to mast damage, the risk should be significantly reduced if the principles I have mentioned are followed. Some skippers will be much more aggressive and daring on the water than I have proposed here and will get away with it, but they may also place more importance on a win and be prepared to wear the cost if things go wrong. Hopefully the less experienced skipper will now be better prepared to avoid a bender.

On the next page I outline the procedure I use to try and put things right when they go wrong.



Nosedive and recovery during a gybe



BENDER MENDER

So, in spite of all the well meaning advice and your best efforts, you've done the deed anyway. As I said earlier, if the mast is kinked, it is pretty much terminal. However, if it is only curved there may yet be hope.

If you are serious about rescuing the situation, take your time. I can't recall how many times I've seen a bunch of guys, mid regatta, levering a bent mast between a couple of trees, usually accompanied by the following... *"it's nearly there.... just a bit more.... Ohh S###!!!"*. This is not the best way to fix a mast. A pressure point (like a tree) can collapse the side wall of the mast, even with a cloth pad.... and that's game over.

The following is a technique that I have used to straighten quite large bends successfully on a number of occasions. However, there can be no guarantee that it will always work, and the bend characteristics of the straightened stick are unlikely to be identical to the original extrusion.

The first step is to use a straight edge or string line along the mast track to determine the start and end of the bend. Mark these points on the mast. If the bend extends through the hounds, remove them, as pressure applied to them during the process could kink the mast.

Get a straight, clear grained timber board 12mm thick, 75mm wide and at least a metre long. The timber has to be as bendy as the mast and not likely to break. You will need two solid points that will be the anchor point and the bending point (like the trees mentioned above), but horizontal is better. I use the end of the house and a sawhorse.

Tie the board to the mast so that the mid point of the board is positioned at the start of the mast bend. If the board is flexible enough it will spread the load and prevent a pressure point which could kink the mast. If it is too stiff it will create pressure points at each end.

Place the mast base under the anchor point and the centre of the board on the bending point with the mast bend uppermost. Measure the height of the end of the mast off the ground.

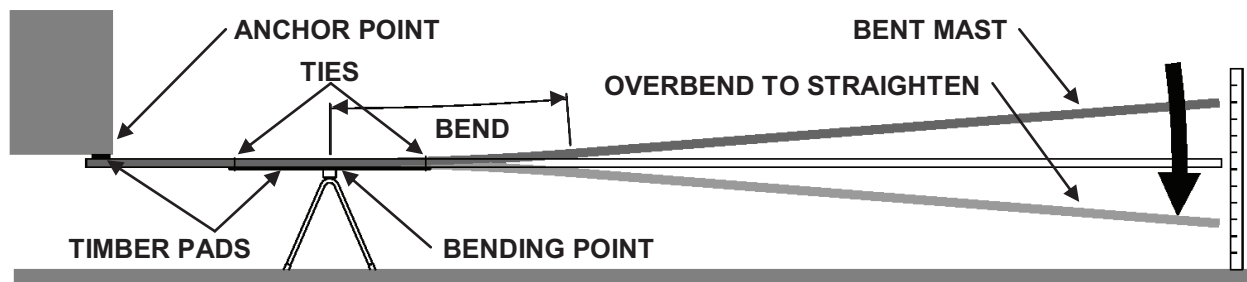
Now push down gradually on the end of the mast until it is bent below horizontal by about 30cm. Hold it there for about 10 seconds, then let the mast up and measure the height of the mast end off the ground again. If it hasn't changed, repeat the process but push down a little further until the measurement changes (don't get too carried away now, 50mm extra at a time will do). Once the mast starts to respond, you will have a better idea of how much pressure is required, and you can develop a feel for when the mast gives. Don't bounce it up and down, use your body weight and steady pressure.

Now use a straight edge, string line or a good eye to check if the first section of the bend is now correctly aligned. If so, reposition the board and mast so that it is at the new start of the bend and repeat the process. Once the bend is pretty much removed, work carefully back along the mast until it is all looking pretty true.

Warning!!!...resist the urge to hurry and bend too far in one go. Protect the mast at the anchor and bend points as dents aren't removable. Take special care when bending near the hound rivet holes as this is a weak point and the mast can crack there.

Straightening the mast sideways is not too difficult, but if it has also bent backwards you may not have much success straightening it because of the greater rigidity and the sail track.

There are certainly other methods for straightening a mast that people swear by, including bending it over a tyre....choose the one that works for you. By all means accept help if offered, but don't be rushed...it's your money after all that will have to pay for a replacement.



For more on PT mast issues, visit the APTCIA website and look under - Help and Advice / Sailing a Paper Tiger
<http://www.papertigercatamaran.org/>