



## **HEAVY WEATHER SAILING**

### **A paper for the OCC Forum**

**(Editor's Note:** This paper was prepared by Tony Gooch based on lessons learned over 35 years and 160,000 miles of ocean sailing and with input from OCC members via the Forum. Tony and his wife, Coryn, have spent much time in high latitudes ... Bering Sea, Labrador, Iceland, Svalbard, Chile, Antarctica and South Georgia. Tony has made two solo circumnavigations via the Southern Capes.)

This paper is presented under the following headings:

- Philosophy
- Boat preparation
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- Securing the crew
- Before the storm
- During the storm
- Heavy weather sailing tactics
- Heaving to
- Lying a-hull
- Speed limiting drogues
- Parachutes (sea anchors)
- Series drogue

### **Philosophy**

With due regard to the seasons and with careful monitoring of forecast weather, most ocean passages, particularly in the mid-latitudes, can be made in winds that rarely exceed 25-30kn. Most often the heavy weather can be handled by heaving-to while the gale passes. However, it is probable that in a number of years of

ocean sailing you will, at some time, run into stronger winds that will require different tactics.

Although heavy weather can be uncomfortable, with good preparation and thorough knowledge of your boat, it is not something to be particularly worried about. Offshore sailing in heavy weather can best be described as the 'art of waiting'.

Assuming you have sea room, the best approach is to take it easy. There is no point in fighting the weather. Make the boat as comfortable as possible in the current sea conditions and sail with patience until the weather improves.

## **Boat Preparation**

Do everything possible to make the boat easy and safe to sail. Here are some recommendations:

- Easy mainsail reefing system with three reefs. The tried and true slab reefing system is best. Single line reefing systems inevitably lead to problems. Mainsail reefing systems that have all lines led back to the cockpit usually have too much friction in the system, with the resultant risk of breaking something by applying winch strength when you should be looking up from the base of the mast to see what has become stuck.
- One of the hardest things to do when putting in a reef in heavy weather is to attach the new tack cringle to the twisted hook (ram's horn) at the gooseneck, which comes as standard gear on most booms. Here is a solution. Cut away the curly parts of these hooks and weld a large spring-loaded Wichard snap shackle to the stub end of the curly hooks, one on each side of the gooseneck. Make up 3in loops of multi-part webbing tape, which pass through each of the mainsail luff reef

cringles, and have a 1in or 1½in stainless steel ring at each end.

- (These webbing straps with a ring at each end are widely known as 'spectacles' by sailmakers.) To take in a reef, use one of these rings to secure the cringle in the Wichard snap shackle. Bulletproof, and the attachment of the cringle can be done with one hand. Picture from Al Shaheen



- If a winch is used for the reefing lines, it is best located on the mast under the gooseneck or on the deck where it can be operated from a seated position with a good view of the clew as it is being drawn down to the boom. A winch on the boom can be hard to reach when running downwind and is on the down side of the boat when hard on the wind.
- Cruising boats have traditionally carried a trysail stored in a bag at the foot of the mast ready to hoist on a dedicated track beside the mainsail track. The trysail was usually sheeted to the stern quarters. This might have been useful when running, but provided no means of adjusting sail shape when reaching or beating. This can be solved by running a single sheet to a block on the end of the boom and then to the mast where it is adjusted with a three part tackle to improve sail shape. The mainsheet is then used to control the boom. See pictures below from *Dodo's Delight*.



Few modern boats are rigged with trysails, opting instead to rely on the third reef of a well cut, fully battened mainsail. This option suits larger, stiffer boats. Smaller boats might find that the third reef still has too much power and are therefore better off with a well cut, sturdy trysail in its own dedicated track on the mast, using it to sail (make progress) to windward in strong winds or to heave to or forereach in storms.

- A boom vang system that makes it easy to control a gybe and acts as a preventer, holding the boom forward on a run.
- Roller reefing, high cut headsail(s). One of the problems with roller reefed genoas is that as the sail is furled, the centre of effort rises. When reduced to 50% or less, this force above the deck causes the boat to oscillate around the centre of effort which has now moved forward of the mast. This becomes more noticeable when running under just a reefed genoa with the mainsail stowed.
- Inner headstay for a hanked-on staysail or storm jib, or a roller reefing staysail. If possible, the staysail should have separate sheeting tracks, well inboard, to enable the achievement of efficient sail shape. With a staysail and double- or triple-reefed mainsail, the centre of effort

is low and centred on the mast, giving improved stability and easier steering.

- Adequate (tending towards oversized) cockpit winches. Self-tailing winches are best, greatly improving safety, especially at the mast.
- Easy to deploy running backstays to the head of the inner forestay.
- Where possible, have all lines, such as jib sheets, boom vang lines, jib furling lines, running backstay lines etc, led aft to rope clutches so that they can be controlled with cockpit winches.
- A boom gallows is almost essential, so that you can secure the boom when the mainsail is furled. Without a gallows, and if only supported by a topping lift, the boom will flail around. Another benefit is that a boom gallows gives a great handhold as you leave the cockpit.
- The best rig for running downwind, particularly in heavy weather, is two headsails boomed out by twin spinnaker poles mounted on the mast. Each pole is held in place (and can be adjusted by) a topping lift, a downhaul, an after guy and a fore guy. The downhaul, after and fore guys are led aft to the cockpit. With this rig, and the mainsail furled, all the force is at the bow of the boat. Without the mainsail there is no force trying to cause the boat to round up and, as a result, steering is much easier. The headsails can be



progressively reefed as the wind increases. The above picture is in Force 8 in the Southern Ocean

- If your boat does not have twin spinnaker poles, always run down wind wing and wing. Trying to run down wind with the mainsail out and the genoa sheeted on the same side is both inefficient (the main blankets the genoa) and makes steering difficult, because all the force is on one side of the boat. It is better to run under genoa alone than to try to run with both sails on the same side.

When running wing and wing, either strap the boom down with a vang that goes out to the rail (as opposed to the foot of the mast) or run a preventer from the end of the boom to the bow and back to the cockpit.

#### The Junk Rig Solution

Reefing and running is greatly simplified on junk rigged boats. All reefing is executed from the cockpit simply by easing out the halyard, and taking in the sheet, which also functions as reefing lines, and two other control lines, which are to adjust the set of the sail. When running (with a single masted rig, or the foresail of a schooner) all effort is well forward making for ease of steering. For a full description of the advantages of junk rigs go to <http://www.junkrigassociation.org>

- Use jammers (line clutches) on as many halyards and lines as possible. Jammers are faster and easier to use than cleats and are more positive.
- Keep all running rigging as simple and as friction free as possible to minimise chafe.
- Perhaps the most important piece of gear needed for short-handed sailing in heavy weather is a top-grade self-steering system backed up by an electric-hydraulic

system. A short-handed crew should never try to steer a boat for long periods in heavy weather, it is just too tiring and lack of sleep often leads to a disaster.

## **Keeping the boat watertight**

- Make sure all hatches seal tightly. Subject hatches to a high pressure hose to test for watertightness. If all else fails, use duct tape.
- If you have large windows, consider whether you need plywood covers that are easy to install from the outside.
- Devise a shut-off for the anchor hawse pipe (oily rag, Plasticine etc). On a long trip, consider removing the anchor from the bow and storing it in the chain locker, which will allow the hawse pipe to be sealed with a wooden plug. Removing the anchor has the advantage of getting some weight out of the bows, which reduces the boat's pitching motion.
- Ensure that the lid to the anchor locker/well can be secured shut.
- Dorades should be able to be shut off from the deck.
- Cockpit drains should be of a size that can empty the cockpit in a few minutes.
- Pay special attention to maintenance of all through-hull fittings and bilge pumps. Have the right sized wooden plug attached to each through-hull fitting (including the prop) and know where a mallet is stored.
- Good maintenance of all the boat's systems is critical for safe passage making. Any weakness on a boat will be found by the sea and, when something goes wrong, it

often escalates into a series of problems, such as crud in the bilge fouling the pump, water backing up, the engine electrics being flooded, and so on. Or, a winch jams, the line can't be released, a sail tears and while trying to get it down, someone falls overboard.

### **Ability to 'secure the ship'**

This is an old sailing term referring to the actions needed to prepare the ship for bad weather.

- On deck, have good tie down points to secure the dinghy, the liferaft and anything else carried on deck.
- Carrying a dinghy in davits puts more weight in the stern and increases pitching. It also increases windage and is a problem waiting to happen.
- Anchor lockers often contain a lot of loose gear, including a huge weight of chain. On long offshore passages consider securing a piece of heavy gauge fishing net over everything, so that in the event of a knockdown it will all stay in place and not try to push through the locker lid.
- If you have cockpit lockers, make sure they can be positively closed.
- Companionway wash boards and the sliding companionway hatch should be capable of being locked in place by easy to deploy barrel bolts or similar
- Below decks, make sure everything can be securely stowed. This can't be over emphasised. Look at your boat – imagine her upside down or on her side. Better to be prepared than sorry.



- All lockers should have positive closures. Consider stringing netting on shock cord across the front inside the doors, so that when the locker on the weather side is opened, the contents can't fall out. All top-loading lockers should have straps fitted to keep their lids in place.
- The gimbals on the stove should be wired so that the stove can't jump off them.

- Most cooking stoves come with inadequate fiddles. Consider adding a 3in high railing on top of the standard fiddle with removable, adjustable cross-rails (pot holders) that can be arranged to fit whatever size pot is in use.



- Install a grab bar (crash bar) in front of the stove to stop the cook being thrown onto the stove.
- Install a detachable strap to hold the cook in place.

- Batteries should be well and truly secured either in a bolted down box or with steel bars and vertical threaded rods, as shown in this picture.



- Engine covers and floorboards should be securable.

## Securing the crew

- It is good practice to wear a life harness (deck harness) at all times at sea, but it's especially important in heavy weather.
- The best arrangement is to have a harness lifeline (also called a jackstay) along the deck on both sides of the boat. Ideally, you should be able to reach any point of the boat from the bow to the stern without having to unclip your life harness tether. The jackstay can be plastic covered wire or low stretch line, but the preferred material is 1in wide webbing tape. Wire and line carry the risk of rolling under your foot. Tape is easier under foot and quieter. The tape should be double over lengthwise and sewn. The resultant shape makes it easier to attach the carabiner at the end of your tether. Conventional wisdom is that dark coloured tape and stitching is more UV resistant than white. Research shows that UV protection has more to do with the engineering of the web and stitching than with the colour. The tape should be kept snugged reasonably taut.
- A good practice is to leave life harness tethers attached to the jackstay at all times, one on either side of the cockpit. The length of the harness tether should be enough to let you clip on or off below decks. Tethers should not be longer than about 6ft, so as to minimise the chances of being thrown overboard. When going forward, where possible, go along the weather side of the boat, so that if you do slip your tether will stop you before you go overboard.
- If you fall overboard aft of the mast you will be swept aft and have a good chance of hauling yourself back on board at the stern. If you fall overboard forward of the

most your life harness will stop you at the shrouds where the higher freeboard and shortened tether will make getting back on board most difficult. When working on the foredeck it is good practice to stay on your knees or stay seated.

## **Before the storm**

Have a checklist on a laminated sheet that that you can refer to as bad weather develops. Here are some of the actions that might be on such a check list.

- Shut off the anchor hawse pipe.
- Make sure the anchor locker/well lid is secured.
- Hank on the staysail and make sure runners are ready to set up. (On long passages consider leaving the staysail in its bag, hanked on and with the sheets run aft.)
- Charge the batteries.
- Make sure nothing is loose in the cockpit or on deck. This includes lines. Make sure the dinghy is well strapped down, also any spinnaker poles carried on deck.
- Shut off dorades – start in the bow and work aft as the weather deteriorates.
- Pump all bilges and shut off the galley and head sinks, also the head itself, but remember it's shut off when you need to use it. Bilge pump handles should be secured somewhere close to their pumps or left in the pump.
- Secure all cockpit lockers.

- Secure the engine covers and all top loading locker lids.
- Plot your position.
- Prepare some food.
- Rig lee cloths on all bunks.
- Take anti-seasickness pills. Stugeron is a well proven brand (available in the UK and Mexico).

### **During the storm**

During heavy weather it is important to remember to:

- Eat
- Sleep
- Drink
- Stay dry, warm and well rested
- Reduce sail sooner rather than later. There is an old adage that says “if you think it’s time to reef, you should have done it already”
- Plot your position every hour and keep track in the log of changing weather – barometric pressure, wind direction and speed.
- Monitor weather reports, weather faxes and grib files.
- Maintain a watch system so that there is always someone ‘on’ and in wet weather gear (even if they are down below), while the other person(s) gets some sleep.

- If you had a timetable you were trying to keep to, forget about it. It is more important to arrive in one piece. Schedules are the antithesis of the cruising life and too many yachts have left port to meet a schedule when they should have waited until bad weather passed by.
- In planning heavy weather tactics it is important to remember that as the wind increases, the force it exerts is disproportionate to the amount of the increase in the wind. For example, an increase of 5kn from 25 to 30kn carries much more force than a 5kn increase from 10 to 15kn, and this 'disproportionality' continues to increase at higher wind speeds – an increase from 40 to 45kn puts a substantially greater load on the sails and has a larger effect on boat speed than an increase from 25 to 30kn would. All of which emphasises the advisability of reefing early.

## **Heavy weather sailing tactics**

The appropriate sailing tactics in heavy weather depend on:

- Present and forecast wind direction and speed
- Sea conditions
- Proximity to land
- Sailing characteristics of the boat
- Experience and strength of the crew

It is a learning curve.

With the wind from forward of the beam, most yachts over 35ft LOA can keep going, progressively reducing sail, until the wind is up to 35kn apparent. (This limit varies from boat to boat.) From 30-35ft LOA, the limit may be around 30kn of apparent wind. For smaller boats the limit may be down to 25kn. With the wind above 35-40kn, most boats will heave to and wait for it to blow

over. If building seas make it too dangerous to stay hove to, a drogue may be deployed, but more of that later.

Changing headsails (genoa to staysail) when going to windward in a building gale can be a wet and potentially dangerous exercise. It is often advisable to turn down wind, allowing the sail change to be made on a stable platform in the lee of the mainsail.

Another very useful tactic is forereaching when you want to maintain a position against the wind, e.g. when there is land to leeward or when your destination is to windward and you don't want to be blown off, especially if there is the prospect of a favourable wind shift.

When forereaching, the main is deeply reefed and over-sheeted, i.e. brought almost to the centre of the boat; the staysail is sheeted in tight, maybe even hauled in towards the centreline; the helm is either lashed amidships or, better, you can engage a wind vane and set it to keep the boat pointing a bit too high. While forereaching the boat will jog along at low speed, but with a fair degree of leeway as the waves on the bow and the force of the wind push her downwind.

With the wind abaft the beam, particularly if it is, say, 120° or more on the quarter, the tactics change. With plenty of sea room, most yachts can keep sailing until the wind is above 40kn apparent. The boat is going in the same direction as the wind and the seas and, up to a limit, it's safer to run with it, progressively reducing sail all the way down to bare poles, with maybe just a sail bag on the bow. Most boats will run or broad reach very well in strong winds under just a small headsail, so hand and stow the mainsail early (say, above 25kn). In these conditions you have to have good self-steering gear. Try not to steer by hand. It is too tiring and tired sailors make mistakes.

## Heaving to

To heave to, sail fairly close to the wind, sheet the jib in and tack. Leave the jib sheeted on what is now the weather side of the boat. The mainsail flops over to leeward. Lash the helm down on the same side as the main. The boat will try to come up and tack but it will be pushed back by the jib. Keep the main close in. In strong winds the mainsail should be down to three reefs and only a small or reefed staysail should be set.

Older style boats with long keels and full bilges can usually lie hove to with considerable comfort and stability. Fin keeled boats can be quite lively when hove to. Larger yachts can lie hove to in wind and seas that would overwhelm smaller yachts. All boats behave differently. Practise the manoeuvre in winds of 15 - 25knts and play with different angles of the boom and the amount of belly in the jib. ( Note: a ketch usually heaves to with a jib and mizzen) The objective is to get the boat lying at 70 degrees to the wind or higher. When making the actual tack try to time it for a calmer break in waves.

Heaving to is a useful manoeuvre. It takes little effort and is an easy way to stabilise the boat while you have a meal or make a repair. To get going again, simply unlash the helm, release the weather jib sheet, bring in the leeward one and you are off sailing again. If

*When lying hove to or lying to a drogue, it is advisable to put out a periodic call on the VHF: "All ships, all ships, yacht XXX in position lat/long is lying hove to, etc".*

## Lying a-hull

If the seas are big and breaking, you feel rather vulnerable as the boat tends to lie with the seas broad on her beam and you

feel every wave. The danger in lying a-hull comes from a large wave heeling the boat to the point that the leeward gunwale goes under water and trips the boat into a knockdown or, in the worst case, a rollover.

If you don't have a series drogue then, up to a point, lying a-hull becomes an optional tactic, particularly for larger yachts. Many a yacht has survived bad weather by battening down completely with everyone down below in their bunks. The helm is lashed and the boat left to look after herself. To reduce the risks associated with lying beam on to the seas, an effort should be made to at least partially turn the stern into the wind. To help get the stern into the wind lash a full sail bag into the pulpit or set a rag of a storm jib, induce some drag from the stern by streaming some long lines, maybe with a sail bag attached.

### **Speed limiting drogues**

Traditionally, yachts running down wind used long warps trailed from the stern to retain steering control, by reducing surfing boat speed, and to reduce the tendency to round up as the boat accelerated down the following waves. Some sailors enhanced the performance of the warps by attaching tyres or perhaps an anchor with 100+ feet of chain over the stern. Not an easy task, but boats have used this as the ultimate 'stop the world' device with success. The drag would be such that a storm jib might be needed to keep the boat aligned with the wind and the waves.

Older style yachts (heavier, full keel, slack bilges) are slower to start surfing than modern designs (moderate displacement, fin keel, separate rudder, tight bilges), which will often start surfing in 20-25kn of wind.

Several commercially made drogues are now available that have proven particularly beneficial in reducing speed and enhancing control of modern yachts when running in 30+kn. Two well



known examples are the Galerider and Seabrake. For details see [www.hathaways.com/galerider](http://www.hathaways.com/galerider) and [www.seabrake.com](http://www.seabrake.com). [www.burkemarine.com.au/pages/seabrake](http://www.burkemarine.com.au/pages/seabrake).

Speed limiting drogues should be deployed from a bridle leading to very strong stern cleats or dedicated anchor points via chafe-free fairleads. With such drogues, boat speed (4-7kn) is maintained with an appropriate amount of sail area. Experience and recommendations vary between boats and manufacturers as to the distance the drogue should be from the boat (anywhere from 100-600ft), however all agree that if in doubt, further out is better. As noted on several websites, there is a risk that the drogue could be pulled from the water by a particularly large following wave. This could lead to pitchpoling or broaching to and a knockdown. Reports indicate that it can take two hours or more to retrieve a Galerider drogue and the crew must continue to steer the boat all the time the drogue is in use.

If you are not using a speed limiting drogue and the wind is just getting too much, it's time to deploy a series drogue that will slow the boat down to a knot or two. This particularly applies if you are approaching land or if the weather front, which is giving you all the strong wind, will pass over if you slow down. The conditions will likely then be such that lying hove to or lying a-hull will be too dangerous and it's better to go straight to a series drogue. See later discussion on series drogues.

### **Parachutes (sea anchors)**

Parachutes are deployed off the bow with the intent of effectively 'anchoring' the boat in the open ocean. Many boats have survived using this defence against strong winds (50+kn). However, they are not recommended in comparison to a series drogue.

The following is extracted from an article on heavy weather sailing from the UK magazine *Yachting World*, October 1999, siting an experience with a parachute:

*A 55ft ketch with three people on board in a northerly gale and winds gusting to 47kn. They decided to deploy their 18ft diameter Para-Tech sea anchor. The rode was led through a closed fairlead, through a snatch block on the starboard rail and onto the starboard primary yankee winch and across the cockpit to the port winch.*

*While lying a-hull the pick-up buoy and line were fed out over the weather rail followed by the bag containing the sea anchor ... an extremely anxious minute followed – the trip line and the partly deployed anchor washed along the weather side of the boat and until the whole lot cleared the keel, prop and rudder, my heart was in my mouth.*

*Once the anchor was fully deployed, the motion was appalling. The boat was pitching heavily and rolling her gunwales under and yawing up to 30-40° either side of the wind. We led the rode through the starboard bow fairlead hoping the boat would lie on the starboard tack, but couldn't get the bridle arrangement to work. The strain on the rode was so great that there was terrific strain on the two Lewmar 65 winches. On large breaking crests, the boat was surging sternwards at some speed, which presented a real risk of damage to the rudder.*

Their conclusions were:

It took two hours to rig and set the sea anchor.

There was considerable chafe on the lines.

Extreme and violent movement was experienced while lying to the sea anchor.

Another reported experience is that of the yacht *Orca*, which lay to a 24ft diameter Cape Hatteras parachute off Queensland,

Australia in 1997 when cyclone Justin was close by. Again the movement of the boat was violent, the parachute held them between 10° and 60° from the wind and green water regularly broke over the boat causing damage on deck. However, although the boat was slammed over and propelled sideways, the masts never hit the water.

Renowned ocean sailors, Lin and Larry Pardey have had good success deploying a relatively small (8ft diameter) parachute anchor off the bow with a pennant or bridle line led through a midships fairlead back to a cockpit winch. The bridle line is attached to the main parachute with a snatch block, which let them position their 30ft LOA *Taleisin* at approximately 45°-55° to the waves and about 250ft from the parachute. A storm trysail was set in a tightly sheeted position. By keeping the boat from lying head to sea, yawing is completely eliminated. The slick created by the boat as she drifts down wind smooths the seas. Some people have reported trouble in achieving this position, which may be due to trying to practise deployment in winds under storm force or to the particular underbody configuration and windage of their boats. The parachute works well for the Pardey's boat, helped by Lin and Larry's practised and perfected deployment technique.

### **Series drogue.**

In response to the loss of 15 lives in the 1979 Fastnet Race disaster, Don Jordon, a US aeronautical engineer and long time sailor, spent 10 years developing an efficient, easily deployable drogue. He was greatly assisted by the US Coast Guard who provided testing facilities at their Motor Life Boat School on the Columbia River bar. The result was the series drogue. Jordan kept no proprietary interest in the design and made it available for all to use. Over the past 30 years many offshore sailors credit

the series drogue with saving their lives and their boat. No boat deploying a series drogue has ever been lost.

Many offshore cruisers have built their own drogues. Several sailmakers around the world make and sell series drogues.

A series drogue is deployed from the stern. It consists of:

- A bridle attached to cleats or dedicated anchor points on each side of the stern.
- The legs of the bridle should be 2.5 times the width of the stern.
- At the apex of the bridle is a large swivelling shackle.
- The drogue itself consists of a long rope onto which are fastened a series of small fabric cones.
- At the end of the drogue is a length of chain for weight.

The exact number of cones, length and diameter of line and chain varies according to the size of vessel, but a vessel of 30,000lb displacement needs a 300ft x  $\frac{3}{4}$ in (19mm) double braid line with 120 cones attached at 20in intervals. At the end of the drogue will be a weight of about 25ft of  $\frac{3}{8}$ in (10mm) chain. Detailed specifications can be found on websites listed below.

Notes on the deployment and retrieval of a series drogue:

Pack the bridle, drogue and chain in three separate bags stored in the lazarette or cockpit locker. Make sure that the drogue is properly 'flaked' with the two ends accessible. Anticipating heavy weather, attach the bridle and bring the apex on board through the gap in the stanchions through which the drogue will be deployed.

Deploying the drogue is relatively easy. Attach the inboard end of the drogue to the bridle and the outboard end to the anchor chain weight. Make sure you and your life harness will not be caught by the drogue as it pays out. Feed the chain out beside one of the bridle attachment cleats and let it go. Keep clear – it will run out very quickly once it starts to bite.

Once deployed, the drogue will bring the stern around into the wind and waves. Boat speed will drop to 1½kn. Lash the helm, take down the staysail, go below and have a cup of tea. The boat will slowly surge forward with each passing wave while the drogue gently pulls her back.

The load on the drogue is such that it is not worth trying to retrieve it until the wind has dropped to 15-20kn. First, let go one leg of the bridle and, using a rolling hitch, attach a line to the released leg and use this line on a winch to grind the bridle in. Next, use a rolling hitch to attach another line to the leading end of the drogue line and wind it in to the point where you have a couple of wraps of the drogue on a winch. In case anything slips, keep all lines and the bridle attached to the boat until all the drogue has been hauled aboard. When retrieving the drogue, it helps to run the engine in astern to take some of the strain off the drogue and make it easier to retrieve.

When using a winch to haul the drogue in be careful, because the cones tend to get caught in the line-stripper on the winch and tear. You might find it easier to fold the cone as it goes on the winch – just watch your hands. It can take 60 to 90 minutes to retrieve the drogue.

Some sailors have constructed drogues using permanent cow hitches to attach the bridle to the drogue. Recently, drogues have been constructed with spectra line instead of braid, thus reducing the bulk to be stored.

Further details, specifications and user testimonials can be found at:

[www.jordanseriesdrogue.com](http://www.jordanseriesdrogue.com)

[www.acesails.com](http://www.acesails.com)

[www.oceanbrake.com](http://www.oceanbrake.com)

The 1987 US Coast Guard report on the development of the series drogue concluded:

*This paper documents the investigation of the use of drogues to prevent small sailing yacht capsizing in breaking seas. The following conclusions were reached:*

- 1 *In many and possibly most cases, a properly engineered (series) drogue can prevent breaking wave capsizing.*
- 2 *For fin keel sailing yachts the drogue should be deployed from the stern, not the bow.*
- 3 *A series type drogue provides significant advantages over a cone or parachute type drogue.*
- 4 *A full-scale series drogue demonstrated satisfactory handling and durability characteristics under simulated storm conditions and in actual breaking wave conditions.*

Full details of the Coast Guard report can found at:  
[www.seriesdrogue.com/coastguardreport/droguereport.htm](http://www.seriesdrogue.com/coastguardreport/droguereport.htm)

The advantages and benefits of a series drogue are:

- It is simple to assemble.
- It can be deployed from the cockpit.
- It requires no adjustment once deployed.
- It is almost impossible to foul it or entangle it enough to make the drogue ineffective.
- The motion of the boat is a gentle surge forward followed by a gentle pull back as the drogue restrains forward motion. There is no yawing or snapping.
- There is no chafing or undue strain on deck fittings.

- There is no load on the rudder as there can be with a parachute off the bow.
- Quoting from the 1987 US Coast Guard report: *“When a breaking wave strikes, the drogue must catch the boat quickly to prevent a broach. The series drogue, since some of the cones are near the boat where towline stretch is low, will build up load faster than a conventional cone or chute at the end of the towline. A computer study shows that two seconds after wave strike, the series drogue will develop 40% more load than an equivalent cone or chute. Similarly, if the breaking wave strikes at an angle to the towline rather than directly astern, the series drogue will build up load much faster than the conventional types.”*

One final note: Do practise the deployment of a series drogue, not in calm conditions, but in 15-20kn winds. Ensure plenty of both sea room and time for your trials.

Fair winds

