

# PERFORMANCE at SEA

The series drogue has been at sea for over 20 years. No boat has ever been damaged and every skipper has expressed satisfaction with its performance.

## **Team Philips**

Perhaps the most dramatic example is the story of the giant catamaran Team Philips, a boat that was designed for "The Race", a non-stop race around the world with essentially no design restrictions. The boat was highly unconventional with two 135 ft. hulls and two 135 ft. unstayed rotating wing masts, one on each hull. A crew pod, the bottom of which was 11 ft above still water, was attached between the hulls.

The boat, which was built in England, was launched much later than intended. Finally it was taken to London and ceremonially blessed by the Queen. Problems encountered during early trials caused further delays. To qualify for the race it was necessary to complete a transatlantic round trip crossing. The time was Dec. 01 and the time for further trials had run out. The skipper resigned rather than attempt the crossing. Another skipper took over and the crew of 6 set out in early Jan. About 800 miles out they encountered a typical winter storm. They had no choice but to run before it. The boat surfed down the face of the large waves at 15 to 20 knots and plunged into the trough with a violent impact. In the middle of the night the crew pod began to break loose from the attaching structure.

By the greatest good fortune, one of the shore crew had insisted that a series drogue be carried and that it be pre-rigged so that it could be launched from the pod simply by dropping the length of chain in the water. Within minutes of launching, the boat slowed down to 1.5 knots and rode comfortably. They reported that they could feel the drogue gently decelerate the boat as it rode the wave face.

In the morning they managed to contact a container ship. When it arrived they retrieved the drogue, which was in good condition, and managed to maneuver the boat alongside the container ship where all six were able to scramble up a net and board the ship.

The next day the epir signal stopped and an aerial search failed to find the boat. It was presumed to have sunk.

The crews comment: "It was a real life saver". .

### **Practical Seamanship Magazine**

Contest 40, 250 mi. N. W. of Bermuda. " Gusts were furious now. The seas were 25 ft with faces at 45 degrees and breaking crests. Deployed drogue. Slowing effect was phenomenal. Deploying the drogue was like jumping off a 30 ft. wave with a 40 ft. yacht. The feeling of being elastically tied to the sea itself is hard to imagine. We slowed to 1.5 knots with the stern pointed aggressively into the sea. It was as though we had entered a calm harbor of refuge. With the reduction in the yachts motion our situation seemed to be not too bad. We were exhausted and took the opportunity to get some sleep".

Many skippers have commented on the bungee type feel to the boats motion with the drogue deployed. This important characteristic was developed from model testing in the U.S. Coast Guards flow channel, which has glass walls so the underwater motion of drogue models could be observed. In a major storm, a yacht moves forward as it passes over the crest and backward in the trough for a distance of 50 ft. or more. The length of the drogue and the weight at the end is designed so that the drogue normally assumes a hook shape with the weighted end hanging almost vertical. When the boat is passing over the crest the drogue tends to straighten out and more of the cones take up the load thus checking the boat. In the trough, the weight sinks, taking up the unwanted slack in the towline. Thus the drogue is always aligned to respond to a dangerous breaking wave strike. The cones are attached at

both ends so they cannot turn inside out if moving backward.

Model tests clearly show that the behavior of a parachute or cone drag device is unacceptable. As the device is pulled forward, it forms a wake behind it. When the towline goes slack the water in the wake continues to move forward and turns the chute or cone inside out, often causing it to tumble or foul the shroud lines. In the Coast Guard full scale tests in breaking waves on the Columbia River bar, the series drogue performed flawlessly and was retrieved with no damage, while a cone type drogue was destroyed.

### **Hurricane**

A Tartan 38 left Beaufort, N. C. just after Hurricane Gordon passed over Florida and into the Gulf of Mexico. Unfortunately, the storm reversed direction and recrossed Florida back into the Atlantic, catching the boat a couple of hundred miles out. The storm brought 75 knot winds and 30 ft waves. The crew deployed the drogue at 2.00 PM and rode throughout the night in relative comfort. The boat was undamaged.

During the same storm, the Coast Guard airlifted to safety the crew of the 42 ft. ketch Seaflower.

### **Rough Crossing , Ocean Navigator, No. 88**

This is an interesting and instructive description. The skipper and his wife in a 35 ft. aluminum cutter were on a passage from Newfoundland to England in August, 97. They ran into a storm with two successive lows reaching Force 10 (48 to 55 knots). The eye passed directly over the boat. Waves were estimated up to 25 ft. with numerous breaking crests. The drogue held the boat to a yaw of less than 20 degrees and ride was reasonably comfortable. The boat incurred no damage and the drogue was retrieved in good condition.

Since the skipper was aware that the wind would return from a different direction, he left the drogue deployed when the boat was in the lull. He

reported considerable rolling and yawing as the wind shifted 180 deg. The cockpit filled several times as random waves slopped aboard. The skipper said that he never felt endangered in the force 10 conditions. The series drogue is designed to sink straight down when the boat has no way on - as was the case here. There have been a number of instances where a single cone type drogue has drifted or been driven forward and has fouled the propeller or rudder.

### **Other Uses**

Magazine Latitude 38, from a 35 ft. Sloop captain ...."but the surprising thing is that you don't have to experience storm force winds in order to get good use out of the drogue... Rita and I were alone in near gale conditions. After fighting the weather for two days we were both exhausted. Deploying the drogue was quicker and easier than heaving to. Further, it allowed us to continue on our downwind course at a speed of 1.5 knots, despite the 35 knot winds. During the night the conditions got much worse and I was quite happy to stay on the cabin sole and feel sorry for myself. I remembered when Rita was building the drogue I'd pronounced that we would "never use that thing".

### **New Skippers At Sea**

With the advent of fiberglass yachts and modern navigation gear more sailors are venturing offshore, even if only for one or two nights at sea. The drogue has proven useful in a number of instances:

"My wife, two sons, and I recently sailed our catamaran from Miami to Tortola, B.V.I.

We took the offshore route through Providence Channel, and stayed north until 65 west.

Two days out and 150 miles from land we were caught in a full gale, wind speeds to 40 knots and wave heights 16 to 20 ft. The boat began to surf down into the troughs under bare poles. I had pre-rigged the drogue so that all I had to do was to drop the chain over the stern. In

less than one minute the world went from life threatening to easy motion and one knot drift.

I feel strongly that without the drogue we would have gone end over end. We stayed on the drogue for 24 hours" ..

### **32 ft. trimaran competing in a feeder race to Europe 1 STAR**

"A Busy Month For The U.S. Coast Guard's Vessel Rescue Net Work"

- Port hull forward cross member had snapped- 700 miles southeast of Nantucket-gale force winds, 20 ft. seas- mast blown down - hulls smashing together.
- Set series drogue and activated EPIRB - readied life raft and donned survival suit.
- Skipper David Dietz: "When something so out of control as this happens there isn't much else you can do other than having a good meal and listening to some Jimmy Buffet" which is what he did.
- A cargo ship was directed to him by a Coast Guard aircraft and he was picked up about 5 hours later and taken to Norway.
- Note that he reported no further damage to the boat after the drogue was deployed.

### **Rough Trip to Iceland**

Yachting Monthly Retired couple with 3 years of experience cruising their Victory 40 ketch. Voyage from England to Iceland in late May. Small depression had formed South of Iceland. By morning the wind had picked up to 45 knots and veered about 45 degrees, which produced quite confused seas. Within an hour it had increased to 55 knots gusting to 70, and occasional seas were breaking into the cockpit. At last, we thought, a chance to tryout our series drogue and see if the long hours making it had been well spent.

The effect was immediate: from hurtling full tilt down the face of the huge waves, we slowed down and the waves passed under us. The motion on deck became comfortable and safe. A sight I shall never

forget was the drogue warp, stretched bar taut, disappearing into the cliff of water as the next wave approached.

Lessons learned: Series drogues do work. Once deployed, the motion of the boat became safe and we were no longer surfing down the waves with little control. During the seven hours it was trailed we drifted 5 miles through the water, 10.5 miles over the ground according to the G.P.S.

### **35ft. Cheoy Lee Lion**

My wife and I were on a passage from Block Island, R.I. to the Azores. - approaching Georges Bank with a falling barometer. Running off under bare poles, sustained winds near 60 knots, taking a lot of breaking waves causing some minor damage. We decided to launch the series drogue. Used a primary winch to ease it out slowly and keep it under control.

After deployment our boat speed dropped to 2 to 4 knots and the drogue created a slick behind the boat that split the breaking waves. The waves would roar past on either side, but no more water came on the boat. Relative peace, it was great. The boat felt like it was tethered to a huge rubber band, always being pulled back if the speed increased too much. Sixteen hours later we winched the drogue back aboard and resumed our journey, with confidence level greatly increased.

This is the only report I have where the skipper controlled the drogue during the launching process. The normal procedure is to stow the drogue properly in a bag and then just drop the weight over the stem. There have been no problems with this system. Controlling the drogue might be difficult since significant loads could develop if the drogue were restrained.

### **Rhode 41, 70 degrees south in the Atlantic**

"I heard this one wave approaching like a steam train, [it] threw the

boat over and [I] felt the shocking sensation of huge amounts of water over me; at the same time the noise of breaking glass and all kinds of stuff flying on top of me. The wave threw So Long sideways onto the water; the mast-top was below the surface (toplight was ripped off) and maybe 2,000 liters of seawater entered through the only partly closed companionway. After the knockdown on Friday morning we steered downwind bare-poled, without any sails, and the Aries self-steering kept the boat on course at about 5-6 knots speed. By noon Friday the still increasing wind made the situation critical with still building seas and huge breaking waves. It was not safe anymore to keep the boat unsupported at this speed. For the first time we deployed our new sea-anchor over the stern, a system of 120 little parachutes attached to 200 meters of rope [Jordan Series drogue]. The boat then settled at about two knots of speed and took the breaking seas in a very safe angle over the stern. We could feel the gentle pull of the drogue to keep the boat at a secure angle to the sea... Between Thursday evening and Friday noon the barometer had dropped 18 hp to 992hp, wind north Force 9-10. For the next 41 hours, all day Saturday, until Sunday morning we were drifting with the sea anchor with the wind at storm force and shifting from north to southwest."

### **A Tense Moment in Drogue History**

National TV news showed a picture of a dismantled yacht located in the western approach to Cape Horn. The picture was taken from a Chilean patrol aircraft. The sea was relatively calm, and trailing from the stem was clearly seen a series drogue. The emails poured in. How did a 44 ft steel yacht manage to capsize with the drogue deployed.

After a day or so a fishing boat managed to rescue the solo skipper. He was in good shape and sent back the following message to Dave, who had sold him the drogue.

"The drogue was set after rollover. I was still moving at less than hull

speed with the staysail and did not feel the need to take defensive measures yet. I was making good time and wanted to get around the Horn to avoid the next storm that was coming.

Boy was I wrong. Wouldn't go to sea without one.”...

### **Trawler Yachts 3-06**

More diesel powered trawler yachts are making ocean voyages these days. Some of them are carrying the drogue.

Several were built in China and had the drogue aboard for the delivery trip to the U.S. I have no reports of the performance of trawlers with the drogue deployed. The drogue should provide a comfortable and safe ride through a storm.

However, I believe there is one situation, which should be checked. Unlike sailing yachts which, when lying ahull, have the wind force tending to blow the bow down because of the mast and rigging, a trawler has no mast and often has a house in the stern. Thus, the windage tends to blow the stern down.

With the boat lying ahull when the drogue is deployed, the drogue must provide enough drag to pull the stern into the wind and sea. Once the stern is into the wind the water forces are such that the drogue will firmly maintain this position even in a dangerous breaking wave strike. I have added extra cones to the trawler drogue to handle this condition.

However, it would be prudent for a trawler skipper to deploy the drogue in a brisk breeze and with the boat lying ahull, to check whether the stern is pulled into the wind and sea.

### **A Good Ride**

The drogue has been at sea for over 20 years. The performance has been flawless. Every skipper has reported favorably.



However, a number of skippers, after riding out a very severe storm, have offered some comments, which puzzled me: "As soon as the drogue took up the load the situation changed dramatically. It was like sailing into a harbor of refuge, there seemed to be less wind and the noise of the storm actually diminished. The surface of the sea was less disturbed and the drogue seemed to create a "slick" around the boat." etc.

Of course, the drogue can do none of these things. I attributed these comments to the psychological sense of relief that the skipper felt when the boat was no longer rolling, yawing, and charging down the face of the steep waves.

However, some skippers I knew were not prone to loose statements and I now think I understand how such impressions can actually be experienced.

In a severe storm with large waves, the boat is carried forward as the wave lifts it up the face. Then the crest passes under the boat and the boat descends into the trough. As the severity of the storm increases, the waves become steeper and often have whitecaps with some moving water at the crest. It becomes increasingly difficult for the boat to make it over the top and the boat spends a longer time on the face.

Finally, as was the case with the Winston Churchill, a wave may break with enough moving water at the crest to drive the boat down the forward face of the wave, a very dangerous event.

With the drogue deployed the boat is quickly pulled over the crest of each wave and does not linger on the forward face, the boat spends a much longer time in the trough. Where the wind is less and the surface of the sea is less disturbed. Even the noise or the storm would be reduced when the boat is in the lee of a 15 to 25 ft. wave. Thus the average wind and noise would be less with the drogue deployed, the sea

would appear calmer and a more benign ambience is actually experienced.

### **An Epochal Change In Storm Tactics**

I chose the incidents described above as being representative of different boats and circumstances. Actually I am aware of at least 50 occasions of storm encounters and drogue deployments reported to me by the sailors involved or described in marine publications. In all cases the stories are remarkably similar. The effect of the drogue is dramatic. The situation changes from frightening to relaxing, and the crew often sleeps through the remainder of the storm in relative comfort.

Conventional storm survival lore and literature is no longer necessary or pertinent. Whenever the situation deteriorates to the point where further progress is no longer possible or even when it becomes unpleasant, the logical choice is to ride to the drogue until conditions improve. This also applies in the event of crew fatigue, illness, or the need for a stable platform to permit rigging repair.

Although the drogue was developed using sophisticated engineering tools and procedures, the device itself is very low tech. There are no special materials, no moving parts or controls, no special hydrodynamic shapes. The only material subjected to high loads is the double braided nylon rope. It is poignant to realize that every sailing vessel which went to sea from the time of the Romans had on board all the materials and skills needed to build a drogue which would have been capable of bringing the ship safely through a survival storm. They had strong hawsers used for anchoring, spare sail cloth for sail repair, and a sailmaker with the skill to fabricate the cones.

With the help of the drogue; St Paul on his biblical voyage across the Great Sea could have safely made passage to Rome instead of being shipwrecked in the wilderness, and the spread of Christianity would have taken a different course. The settlement of the American

continents might have been advanced by 400 years if the Vikings had the drogue. Their vessels, although ideal for fast coastwise voyaging, were hopelessly unsafe on the open sea under storm conditions. Since they were undecked, they could not lie ahull without swamping, and if they tried to run off they would surf and plunge into the next wave. The Viking ships had no structural bulkheads and would have split open like a pea pod on impact with the green water in the preceding trough.

With the help of the drogue, the Vikings might have been able to support their colonies in the New World.

So much for conjecture!

### **Research and Development Program -- Don Jordan**

With the data from the 1979 Fastnet Race in hand, I started by making scale models of some of the boats in the race and testing these models in natural waves and man-made waves. It is a fortunate fact that small waves behave like large waves and small models behave like full scale yachts if some simple dynamic similarity rules are observed in the model design and testing. I had no preconceived ideas on what these tests would reveal.

At the same time, extensive tests were being conducted in the U.S. and Europe to determine whether the Fastnet tragedy was caused by the design features of modern yachts compared to traditional designs. " Killer Yachts" they were termed by some leading naval architects. After much effort, it was concluded that there was no significant difference in the capsize vulnerability of modern yachts or traditional designs. I repeated these tests and got the same results. The Fastnet disaster was caused by the severity of the storm, not the boat design or the tactics of the skippers.

I then undertook a program of basic research and development to

understand and find a solution to the storm survival problem. In this effort I was greatly assisted by the U.S. Coast Guard, who made all their applicable facilities available for my use, and finally tested the series drogue in breaking waves at their motor lifeboat test site. The program, which continued for four years, led to the following general conclusions:

1. To protect a yacht in a hurricane, an outside force must be applied from a drag device.

No design changes to the boat and no storm tactics on the part of the skipper can result in a significant reduction in risk.

2. The drag device must be a drogue, i.e. the boat must be tethered from the stern.

(I have found this to be the most difficult concept to get across)

3. A sea anchor cannot be designed to protect the boat. When tethered from the bow, the boat will yaw and develop unacceptable loads. The reason for this is that all boats must be designed to be directionally stable when moving forward - or it would not be possible to steer the boat. Therefore, if moving backwards, the boat will be unstable and will yaw and turn broadside to the sea.

4. The drogue must consist of multiple drag elements strung out along the tow line. A single drag device of any size or shape will not provide protection.

5. The drogue must be designed so that a significant number of the drag elements are deeply submerged and do not lie on the surface.

6. The design of the multiple design elements must be such that, in a "worst case" breaking wave strike, peak transient load will not exceed the design value for the drogue components or the boat attachments.

7. The strength of the drogue and the number of drag elements must be adjusted to be compatible with the displacement of the specific yacht.
  
8. With a proper drogue, a yacht and crew can survive a storm of the severity of the Fastnet or 1998 Sydney-Hobart storm with no serious storm damage or crew injuries.

### **Quality Control**

I am an old aircraft engineer. In the design of aircraft, certain machinery and equipment is in a separate category, "safety of flight". These items must be absolutely reliable and must be capable or enduring the worst environment that the aircraft may encounter. The series drogue is designed to this strict safety standard. None of the other various drogue and sea anchor types can meet this requirement.

However, there is only a very small chance that any one drogue will ever encounter a worst case-breaking wave. I have made a strong effort to prevent any compromise or substitution, which might reduce the size, weight or cost of the drogue but might compromise the safety/ Dave Pelissier, has been very conscientious in maintaining the design integrity and quality control.

All series drogues are built to a rigorous specification various skippers have proposed ways to "simplify" or reduce the cost of the drogue – such as using 3 strand line or using larger and fewer cones. I have managed to hold the line so far – but I have no control over individual builders.