Stormtactics for Sailing Yachts ... a Synopsis

This article analyzes strategies for monohull sailing yachts in strong winds and storms, specifically comparing
long-keel and short-keel designs.
The techniques of lying a-hull, heaving-to, running before the wind, and beating to windward are discussed.
The use of sea anchors is addressed separately.
(Download as PDF: Stormtactics for Sailing Yachts.PDF)

"Stormtactics..." is a translation of "Sturmtaktik für Yachten ".

Written by me originally in German I translated this essay into English. Please excuse the linguistic errors.

I hope the meaning is comprehensible and the informations may offset my restricted English.

The German sailing literature does not deal with storm tactics for the different types of sailing yachts.
You have to look in the books of our sailing heroes to get their experiences and insights.
I try to identify and systemize what is fundamental, including English literature.
In doing so I shall restrict myself to **monohulls**.
In this context two key criteriia must kept in mind:

- Which type of yacht?
- Which crew?

I personally always have been sailing undermanned.
Constantly I asked myself: What should I do, if the situation gets worse ?

Thus what could be done, if the wind increases?

I Basics

The best storm tactic is ... not to get into severe seas !

By ...

- avoiding stormy **seasons**,

The ***"Pilot Charts"*** provide information about the wind directional distribution for each month

and about the storm frequency. Call up “Marine Safety Information” (msi.nga.mil), followed up by:

Publications – Atlas of Pilot Charts - ... e. g. North Atlantic.

- choosing proven **routes**,

"Ocean Passages for the World", edited by United Kingdom Hydrographic Office.

- not traversing **dangerous seas** under ***certain weather conditions,***

Golf du Lyon and Mare Sardegna (Mistral), Biskaya (onshore gales),
Velebit–Chanel (Bora) ...

- avoiding regions with **rising seabed** in onshore storms ...

Skagerrak, Fastnet, some entrances of Norwegian Fjords etc.

- ...and **shallow waters** under storm conditions,

e. g. banks in the North Sea, shoals ...

- staying away from dangerous **local spots** under ***storm against tide*** conditions

e. g. inlets, estuaries of rivers, races, overfalls ...

- steering clear of **ports**, which cannot be entered ***in all conditions***.

"Reeds Nautical Almanac" (www.reedsnauticalalmanac.co.uk) provides information about harbors

between Lerwick (Shetlands) and Gibraltar.

A deterrent example: https://www.youtube.com/watch?v=n_jz708oeVI ("Sailing yacht accident")

- **Hurricanes**

- ***avoiding*** neither to ***sail*** during the **hurricane season** in the regions at risk nor ***leaving your ship*** there.

- ***current forecast*** of hurricanes:

Atlantic - National Hurricane Center (NHC): **https://www.nhc.noaa.gov**

worldwide: **https://www.windy.com** >

Hurricane tracker

- ***general informations:***

  hurricane tracks of the Atlantic: Wikipedia – "Atlantic Hurricane Season"

  hurricane tracks throughout the world: Wikipedia – "Tropical Cyclone"

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Weather Reports ... *may fail*.

- When we left the Islands of Vestmannaeyjar (Iceland) in July 2010 eastbound to the Faroe Islands I had three weather reports:
  - weather report by Internet with the Islandic forecast,
  - DWD (German Weather Forecast) via phone by my friend Thomas,
  - meteorological advice via smartphone by a Danish professional.

  They all agreed: Bft 7, not higher.

  Nevertheless we got it in the neck: Bft 9, and for more than 5 hours Bft 10!

- At the Fastnet Race disaster in 1979 there indeed a low-pressure system has been forecast with wind force
of Bft 8. But by no means windforce 10, not to mention the murderous cross seas.

Yet it is important to receive the weather report on the high seas, too: ham radio, satellite-communication.

Reliability

Wikipedia, Weather Report (Oct. 2018)
A forecast for the following 24-hours may achieve a prediction accuracy of good 90 %.
The accuracy for the coming 3 days is slightly more than 75 %. ...
The prediction accuracy may vary considerably depending on the weather situation.
In case of a stable high pressure zone in winter it may be possible to predict the weather for one week with 90 % certainty without any problem
while the forecast quality frequently is significantly lower than 70 % for 24 hours in summer in case of thunderstorms.

70 % is somewhat better than 2/3. In difficult weather situations only two forecasts are correct out of three.
For the next day!

The data for the current state of the atmosphere stem from a network of surface monitoring stations ...

Additionally, data coming from radiosondes, weather satellites, commercial aircrafts and weather ships are used.
The problem is the irregular distribution of these observations and measurements, as well as the fact
that there are relatively few measuring stations in less developed countries and on the open sea. ...
Reasons for the lack of reliability:
1. *Incomplete understanding what really happens within the earth` s atmosphere. ...*
   Not all relevant data are collected, and when they are collected they inevitably are incomplete.
2. *There is a percentage of weather events that principally is not explicable ? chaos research, butterfly effect.*
3. *The mathematical constructs, which describe the rules of the weather events, are so called non-linear equations.*
   That means, that even the slightest modification in the initial state may lead to a relatively big change in the result
   of the mathematical calculation. ...

Deutscher Wetterdienst (DWD; German Weather Service)
"The numerical models will never be able to forecast the weather 100 %, neither today nor in the future.
This impedes a fundamental feature of the atmosphere: its chaotic inner life.
This ensures, that even smallest fluctuations or instabilities within the initial data may lead to completely different weather forecast
for the following hours or days."

(from: Wie entsteht Wettervorhersage, https://www.dwd.de/SharedDocs/broschueren)

Meeno Schrader ("Sicher wissen was kommt", from: Nautische Nachrichten, Kreuzer-Abteilung, 4/2017), analogously:

The processing power of large-scale computers is too low to include all weather data worldwide.
Therefore the calculating programs have to make a choice. They set different priorities, e. g. wind, precipitation.
As a result the calculation programs which are available internationally have different strengths (= prediction accuracy).
The forecasting models of the providers refer to the raw data of these mainframe computers and set calculating priorities for their part again.

- ***GFS*** Global Forecast System
  The American model is free of charge; it is the basis for almost all the prediction models.
  Weaknesses in longterm forecasting.
- ***WRF*** Weather Research and Forecasting Model
  Further development of GFS. The program calculates for smaller spaces with hourly

resolution.
Therefore it may record better e. g. local thunderstorms.
- ***ECMWF*** (European Centre for Medium-Range Weather Forecasts; a European joint project)
and
- ***UKMO*** (British weather forecast)
are the best. But expensive.

Trip consulting:
In the end the meteorologist decides which program may forecast the weather most likely.

(So far Meeno Schrader, www.wetterwelt.de)

www.Windy.com - *Wheather Chart on the Internet*
Windy accesses two computational models worldwide (GFS and ECMWF), in Europe 5 models at the moment.
It is possible to retrieve separately the weather forcasts respectively the weather charts resulting from it.
And they can be compared - tabular or in the form of wind tabs on the reference site, which is set by a mouse-click.
It`s really astonishing how much the forcasts diverge.
But the key feature is that you as a prudent sailor will get the option to prepare for the worst case (which still may be wrong).
Windy is user-friendly designed for the mobile phone as well in contrast to nearly all the present electronic weather charts. (Jan. 2019)

Patrice Geffroy
During the last 10 years weather forcasting made much progress.
And it will move forward in combination with the new satellite Aeolus, which was sent into space by ESA (Europa Space Agency) on 21. of August 2018. A leading role thereby will play the precise measuring of the wind speed by laser techniques.
According to ESA a weather forecast up to 15 days will be possible.
That approximately is the period of time needed for the North Atlantic passage. ...
Nowadays there is more and more ***route planning software*** *on the market to steer a boat across the ocean taking account of weather charts*
and the basic characteristics of the vessel, particularly of her speed in the specific situations of sea and wind. ...
Added to that there is the new generation of Iridium satellites (NEXT) which at sea soon will allow to download large data volumes.

Sail-the-World (https://stw.fr)
The French Sailing Club says (Oct. 2016, analogously):

- *Weather reports have a reliability of 3 to 4 days at present.*
- *It is possible to avoid the dangerous areas with high probability if one plans his route according to the weather situation*
  even for a slow cruising yacht
- *It may be advisable to make use of a professional router.*
  (Note: A professional has a broader knowledge, i. g. about the tracks of low pressure areas,
  and he has a wider range of possibilities at his disposal to interpret the meteorological data than
  the layperson aboard.)
  (Look above: Meeno Schrader, Wetterwelt)
- *The commission points out that it is imperative to* ***prepare ship and crew*** *for* ***storm conditions,***
  if the avoidance manoeuvres
  fail. (accentuations by myself)

Navigation

Whatever tactic you use in heavy weather, do not forget to verify the ***position*** regularly.

- When running off an astonishing amount of miles may add up.
- If you are beating, nonetheless you may loose height.
- Even if the wind in a storm always blows from the same side of the ship, one may end up on the opposite course.

During the above mentioned gale when we left Iceland we sailed upwind under selfsteering (Aries),
covered a distance of ~ 150 nm within 48 hours and drifted away ~ 80 nm from the course line.
In the end the bow of our vessel pointed 180 degrees against the course we had at the beginnning,
although we had always been sailing against the wind from starboard.

Wave and Breaker

Height of Waves

They depend on ***fetch***, ***wind strength*** and ***time of impact***.
An example:

Bft	Duration of impact in m	significant wave height in m	velocity of wave in kn
8	2	2,10	10,2
8	4	3,4	13,5
8	10	6,00	19,4

8	24	7,90	26,0
8	48	9,1	34,1

- "The ***significant wave height*** ... correlates to the arithmetic average of the third of the highest waves"

(www.bsh.de; translated)

- ***10 %*** of all waves are ***of 25 per cent higher*** than the significant wave height.

(according to: Hal Roth, "Handling Storms at Sea")

- ***Fully developed sea***

"Further duration of exposure (to the wind) *does not have influence on the height of the waves;*

input of energy by the wind and dissipation by breaking of the seas are balanced."

(Dr. Wolfgang Sichermann; translated)

Breaking Crests

Breaking seas offshore are produced by the wind.

In the following I exclusively deal with this situation.

- **There *are no breakers if there is no wind or if the wind decreases considerably.***

Hal Roth:

"Deepwater sailors have long described the front of a breaking wave as a waterfall. ...
A yacht caught in a breaking wave is liable to be pitched forward, out of control.
Then the boat is not only subject to tons of falling water from above, but ... the boat is dropped or catapulted into the wave trough below."

(This and all the further quotes of him from: "Handling Storms at Sea")

Tests of ship models ... confirm this sequence.

Andrew Claughton shows a series of photos:

1) The ship model lies at right angle to the wave; height of wave: ~ 3 x beam of the model; slope of the wave: ~ 45 degrees.
2) The wave lifts the ship nearly up to the crest.
3) The crest begins to break.
4) The ship`s rotation starts.

5) The breaker flows across the ship; the keel points vertically upwards.
6) The ship is pushed forward by wave and breaker towards the trough, the rotation continues.
7) The total roll over (360°) is completed; the model is located approximately at half height of the wave
and then is lifted across the crest subsequently.

(in: Peter Bruce, "Heavy Weather Sailing")

There is a **different use** of the term "**breaker"**

- In ***seaman`s language*** it means *"a big overturning sea"* (translated from: Claviez, Seemännisches Wörterbuch)
- in ***scientific usage***:
  If the height of a wave exceeds 1/7 of the wavelength the crest starts to break.
  That happens to wavelets as well.

In accordance with latter one has to expect ***breakers*** at ***every windstrength.***
The key **criteria** whether a **breaking sea** is **dangerous or not** only depends
on the ***relation*** of ***wave height*** *to* ***size of the ship***

- ***Seas without breakers are not dangerous***.

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- **Breaking Seas and Size of the Ship**

Andrew Claughton

"During the model tests that were carried out to investigate the problem,
when the breaking wave was 30 per cent of the hull length high, from trough to crest, it could capsize some of the yachts,
while waves to a height of 60 per cent of the hull length would ... overwhelm all of the boats we tested." (in: "Heavy Weather Sailing")

Hence it starts to become crucial when the ***breaking sea matches*** the ***beam of the ship***.
On the other hand it is comforting that the state of the sea cannot be dangerous for a ship up to this wave height.
Concurrently it is confirmed that – on condition that it is the same design - ***the bigger ship*** also is ***more seaworthy than the smaller one.***
Earl Hinz puts it somewhat differently:
"... two quantitative measures of when to consider your vessel in danger form the

seas:

The first is when the wave height nears a match with the width of the vessel` s beam.
At that point it is dangerous to take the seas beam-on.
To continue sailing across the wind is to invite a capsize or, even worse, a 360° roll."

- ***It starts to become crucial when the breaking sea matches the beam of the ship.***

To continue ***sailing transverse to the sea*** *is* ***dangerous.***

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- **Capsizing of Yachts**

First one should get rid of the idea that yachts are "hit" by waves.
This only applies when the yacht is not able to move upward fast enough because of lack of buoyancy.

The Water Particles within the Wave
The crest of a wave must get his water from somewhere: the wave sucks the water in front of it (and behind of it).
This means that the water level falls in front of the wave (and behind of it)
(See also the retreat of the water level in the case of a tsunami.)
A water particle in front of a wave therefore first will move in the direction of the incoming wave.
Then the particle will climb up and simultaneously it will be shifted in the direction of the moving wave.
At the very top of the crest the particle nearly has obtained wave velocity.
Then
- the particle will descend into the trough at the back of the wave ...
  This water particle executes a nearly circular movement (orbital motion).
  Thereby it is shifted in the direction of the wave.
  (See Wikipedia, “Wind wave” / part: Formation; video “Water particle motion of a deep water wave”)
- ... or the particle will become part of a breaker:
  When the wave is breaking the water particles will be accelerated additionally and flung in wave direction.
  On the front of the breaking wave there will be formed something like a waterfall.

- ***Wave and Yacht***

Now let us assume a yacht instead of the water particle.
She will follow the orbital motion of the water particles provided she has enough buoyancy.

The boat will climb up the front of the wave like one of the water particles (more precisely: she will be pushed up abruptly),
then she will be carried over the ridge of the wave and will sink down into the following trough.
The same will occur even when the waves are very big and very steep (but without breakers).

- **Breaker and Yacht**

Presumed

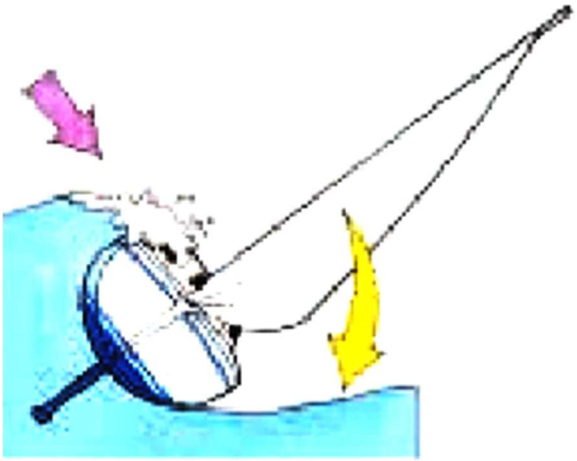
- the yacht is lying a-hull or is sailing transversely to wave direction,
- and the height of the breaking wave corresponds roughly to the beam of the vessel:

The water particles move that part of the yacht, which they touch. So the yacht lying a hull at first will be moved towards the wave.
Then one side of the yacht will climb up the front of the wave, thus being lifted.
When this side of the yacht will reach the breaking crest the opposite side of her just will be in the trough.

At that moment the following forces are acting on the vessel:

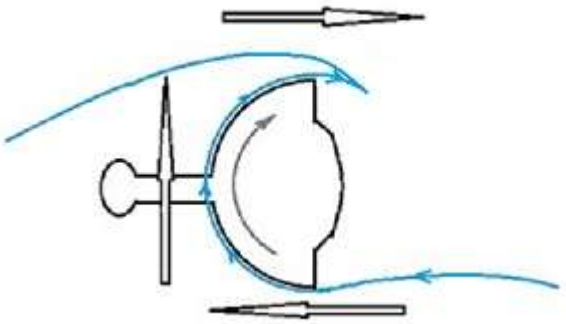
- The part of the yacht down in the trough is accelerated towards the wave.
- The middle section – bottom and keel – is hoisted by the water particles.
- The other side of the vessel at the crest of the wave is accelerated in direction of the wave motion by the breaker.

Consequence: The current of water causes a ***rotation*** of the yacht.



- from: Stability Guidance Booklet
  https://www.lowestoftcruisingclub.co.uk/information/stability-guidance/

My drawing intends to show the movement of the water, the forces involved and the resulting rotation of the ship:



(A more extended description of the processes I tried to give in “Brecher und Yacht”; on this website.)

(**Dynamic *Stability"*** does not enhance anything.
It is a force which helps to stay the course.
But it does not decelerate a rotation.)

Back to the topic "Breaking Sea and Size of Ship":
"The second measure applies, when the wave height nears a match with the vessel` s length.
At that point, pitchpoling of the boat becomes a distinct possibility." (Earl Hhinz)

- ***If the height of breaking wave matches the length of the ship the yacht might suffer a pitchpole.***

- **Breakers and Running Yachts**

High steep seas affect a **running yacht** in the **following** way:

- If the yacht steers bad or if she doesn` t accelerate fast enough the rear may be moved sideways: the yacht broaches.
  Dangerous for her is the following sea.
- The situation exacerbates if a breaker hits the stern:
  Maybe the yacht will be speeded up to such an extent that her bow will penetrate the water of the wave trough
  respectively in the backside of the wave in front.
  The movement of water particles here are heading for the opposite direction.
  Therefore the yacht will be stopped abruptly and will suffer from a broach or a capsize.

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Slick of the Keel ?

All the tests with ship models I know, also those of Jordan, work with stationary models. Models with long keels suffer a capsize as well as models with fin keels or moderate keels.

But: Stationary remaining ships are not able to produce a slick.

- Many **long keel yachts** however produce a ***slick*** when heaving to and ***drifting***.
  Therefore the results of the above mentioned test with ship models are not necessarily relevant for long keel yachts , which are drifting.
  Look further down: III Stormtactics / Heaving to

But beware: Not each "long keel yacht" produces this slick.

Unfortunately there is no investigation in relation to the behavior of drifting long keel yachts.

At the best, there are reports based on experience, e. g. from ***Helmut van Straelen, "Beidrehen? ... Im Orkan?"***

(*"Heaving to? ... Amidst the hurricane?"*; on this website)

The question is where to get information whether your own long keel really produces this slick adequate?

- ***Fin keel yachts, which are heaving to, do not produce any slick (or in an insufficient way).***

That means:

- ***Heaving to might be lethal for fin keel yachts.***

More informations in: III Stormtactics / Heaving to

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Beam on to the seas - ***Personal experience***

End of June in 2008.

SUMMERTIME is harboured at Lerwick/Shetlands. She is a modern sailing yacht with moderate fin keel.

We, that is Christof and me, intend to sail to Bergen, across the North Sea.

But it`s blowing; N, Bft 7 to 8.

A fleet of racing yachts have to go back to Norway. Because of the heavy winds they postpone their departure by one day to Monday 22th of June.

"What they can do, we also can do!" – On Monday we will start. Eventually, I have a strong yacht!

The Banks of Bergen and Viking, which extend between the Shetland Islands and Norway we will pass with ~ 280 feet of water under the keel.

No problem at all!

In the following morning the winds are 4 to 5 Bft from the N. State of the sea: high. Waves: also from the N, 9 to 12 ft.

The waves are long. No danger! When the yacht is sailing in the trough one just can see the top of the masts of the overtaking yachts.

At around midnight the sea becomes uneasy, steeper. The reason probably is the Bergen Bank which we are beginning to cross at the moment.

About 0200 at night I leave the cockpit. (Christof rests in the bunk.) I am hungry! I need some calories.

In the meantime the motions of the ship have become so violent, that I crouch, bread in one hand, sausage in the other, back against the stove not to be lifted.

Darkness.

I don`t need light, I know every toll of my boat.

All of a sudden a flick, a being blown off like by a badminton racquet. The shuttlecock ... that´s me!

I am catapulted crossways through the pantry and across the companionway, pitching from above on the edge of the navigation seat below me, gasping for air ...

The ship had been heeling presumably nearly to 90 degrees.

Inconceivable the abruptness and the easiless of being punched. In a fraction of a second!

If I had been staying in the cockpit I would have been kicked over board even I would have been harnessed.

Not even I had held on tight.

So I get off with a broken rib.

Lessons to be learned

- It was right to orientate myself to the more experienced, to the regatta participants. It was wrong to copy them.

I should have addressed myself to them. Supposedly they would have talked about the perils of the Viking – Bergen - Bank.

- Unknown to me was that a breaking wave become perilous for a yacht which sails beam on to the waves which match in their height the beam of the boat .

When the sea became agitated I at least should have luffed up.

- I never would have thought of the possibility that at the North Sea the waves could have been altered by the sea bed at a water depth of 280 ft.

(The bottom there rises from ~ 550 ft to 260 ft.)

Long seas had been developping to a dangerous sea state.

- You have to pay attention at all rising sea floors; not only at the edges of the continental shelf.
- Inside of a yacht one should have the possibility to leash oneself by the lifebelt.

Supplement (2022)

I still keep on thinking how suddenly and how easy I have been catapulted off and pitched across the boat.
An explanation may be found at Donald Jordan (see Donald Jordan, „Ausgewählte Texte“, on this website). Especially his sketches are instructive
(see ... "Winston Churchill with Drogue").
I believe that Summertime has been caught laterally by a breaking wave, was heeled extremely, was picked up and thereby accelerated up to the speed of the wave within a fraction of a second.
According to Jordan then a yacht slides down the slope at the front of the wave nearly without friction and finally crashes into the trough.
There the vessel is decelerated abruptly ...
... but inside of the yacht I kept on flying at the speed of the wave.

The Winston Churchill hit the trough at a speed of 80 km/h (IV Don-Jordan-Series-Drogue, Fig. 7).
The wave which hit Summertime certainly has been much smaller. Hence the wave`s velocity has been less (and concerning me the acceleration as well).
But it has been quite enough!

The elasticity of the material will also have contributed to this.
I had experienced it before that a steep, diagonally running wave can produce a similarly whipping blow.

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Suggestion
In the courses of Deutscher Seglerverband (= German Sailing Association) there are taught important subjects: navigation, shipping law, meteorology.
In my opinion one essential teaching content is missing: the basics which are discussed in this chapter.
Those venturing on the open sea e. g. should know that one should not sail beam-on to steep, possibly breaking waves once a certain wave height has been reached.

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II Design Characertistics for Heavy Weather

Dashew:

"Today, the vast majority of production yachts are simply not designed for heavy weather. ...

Another problem is that very few builders, designers or marketing people ever actually go to sea.

And of those few that do, a small percentage experience severe weather."

(This and the following quotations from: Steve & Linda Dashew, "Offshore Cruising Encyclopedia")

- **General Criteria**

Offshore yachts

- should be built solidly,
- should not capsize,
- should right themselves if it happens after all,
- at the same time take over water as little as possible
- and stay afloat, even if there is a heavy ingress of water.

Olin Stephens:

"When I think of the boat in which I should be happiest in meeting heavy weather I visualize one that is moderate in every way,

but strong as possible.

I should avoid extremes of beam to depth or depth to beam, either very light or very heavy displacement, or a very high rig.

I should like the ends buoyant, but neither very sharp nor full, and neither long nor chopped right off. ...

In the final analysis I recommend moderate proportions and lots of strength."

(Olin Stephens, "Yacht design and construction for heavy weather", quoted according to P. Bruce in: Heavy Weather Sailing, 2008)

- **Strength**

Every Offshore cruiser should meet defined **quality criteria**.

- The requirements for the CE-label "Category A" (*Recreational Craft Directive 2013/52/EU*) - wich means "open sea" - are ***not sufficient.***
- Offshore yachts should not only be designed but also built according to ***"Germanischer Lloyd - Rules for Classification and Construction"*** *("Ship Technology Pleasure Craft")*
- or according to an ***organization*** which is ***equivalent*** in its requirements to Germ. Lloyd.

Rudder

This would probably exclude delamination of the rudder which for instance happend to SY *DOVE II*:

http://www.ybw.com/news-from-yachting-boating-world/coombes-family-atlantic-rescue-drama-offer-10k-get-yacht-dove-ii-back-46494

Hull

The sailing yacht of Manfred Jabbusch is coming from New York and heading to the

Azores.
The yacht is running deeply reefed in force 6 to 7 Bft (Beaufort scale: ~ 30 knots):

Manfred Jabbusch:
"I was on my way back to the cockpit, when I suddenly saw a huge, black wall, coming up towards us. ... the yacht suffered a 360 ° - roll.
She righted herself some seconds later.
Due to the pressure of the tremendous masses of water the mast was broken some four metres above deck.
The stub of the mast was lifted from its base and penetrated the coachroof with unbelievable noise destroying everything.
Tons of water came in through portlights and hatches, which had been destroyed.
The part of the mast, which has been broken, floated in the sea. With each wave it battered against the hull impending to smash a hole into it.
The butt of the mast was crunching the cabin more and more with every wave . ..."
(in: Trans-Ocean, July 2016; translated)

- The ***hull*** should be strong enough that parts of a mast, which are floating and punching against the hull,
  should not be able to cause the yacht to sink.
- The same applies for the ***deck***. In a situation as mentioned it must remain undamaged.

Both aspects speak in favor of
- **hulls** from ***metal, woodchore*** or ***kevlar reincorced solid laminate***
- and **masts** from ***carbon fibres*** (less weight = less kinetic energy).

Collision with floating object
This is feared by everybody. That`s the reason why all sailing vessels are fitted with a collision bulkhead.
On our yacht we have foamed the storage space under the berths in the forecabin with expanded polystyrene (EPS) up to the waterline.
EPS has no capillarity. It is a "closed cell" – synthetic. His absorption of water when stored underwater amounts 0 to 5 percent.

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- Loss of the Keel

From 1984 until today (Sept. 2018) there happened

"75 to 80 losses of the keel, depending on the references; one only may speculate about the dark figure."
Cause of damage:
"*Clear favorite are severe groundings which led to a weakening of the structures of the hull and the keel and to a later tear-off of the keel."* ("Albtraum Kielverlust", Palstek 5/18)
I assume that particularly GRP yachts are involved.
One of these cases is the fate of ***CHIKI RAFIKI:*** loss of keel, then capsized; 4 persons dead.
(https://en.wikipedia.org/wiki/Cheeki_Rafiki)

GRP consists of a lot of singular fibres of glass, which are adhered by resin.
If ***high force*** is applied some fibres break, but not the whole bundle. This recurs with the next force ... and so on.
GRP totals these damages without anybody noticing it. When a certain limit has been reached it fractures.

When a modern yacht with fin keel severely hits a rock or solid sand the keel will be pushed backward.
Due to the lever the front side of the upper part of the keel will be ripped out (downward out of the hull),
the rear side will be bumped upward (into the hull).
Water ingress not always takes place; however the laminate will probably be damaged.

The problem is exacerbated by ***modern designs*** which aim at speed: long, narrow keels with
the center of gravity as low as possible. This means a large lever arm and high forces.

A weakening of the laminate also takes place due to **water absorption**.
Glass fibres absorb water in combination with resin.
Polyester absorbs twice as much water as vinylester, and this in turn twice as much as epoxy resin.

After ***complete wetting***
an ***epoxy glass fibre laminate*** will have a structural stability of ***90 %*** of the ***shear strength*** of the starting position,
a laminate combined with ***vinylester*** will still have about ***80 %,***
in combination with ***polyester*** only ***65 %.***
(data acc. to "Klebrige Sache" by Ralf Weise, Palstek 2/10

Ralf Weise is a sworn-in expert for sailing yachts http://www.yachtgutachten-weise.de)

All the more necessary is a ***watertight protective coating***. Best is epoxy resin.
(look "Loss of the Rudder", further down)
When the Laminate shows **hair cracks** (grounding) water will be absorbed nevertheless. But **through hulls** and unprotected **bores** in the section of the bilge are possible weakpoints as well.

Difficult to assess is the ***resilience*** of ***old GRP vessels*** (embrittlement, fatigue).
Yachts which have become "soft" by sailing in principle the same took place as what has happened when running aground:
namely the breakage of glass fibres caused not by one heavy overload but by lower repeated loads, which total up.
In the end not even a grounding is necessary to cause the keel break out. Maybe the abrupt motion of a violent wave is sufficient.

The **owner** of a GRP yacht should be aware of the **limits of the material:**

- ***Hairline cracks*** in the laminate are alarm signals if they can be associated with the keel.
- In the case of a ***grounding*** an inspection by an ***expert*** needs to be initiated.
  He can carry out an ultrasonic test in addition to a moisture measurement,
  although it is not possible to determine exactly the extent of the damage.
  (acc. to R. Weise; Email, Okt. 2018)
- If GRP absorbs ***water*** more than ***2 %*** then there a serious defect exists.
  By a measuring instrument every owner is able to ascertain whether the hull of his vessel contains water.
  Thereby one should check particularly: the linkage of the ***keel*** to the ***hull,***
  the laminate under the ***engine base*** and the ***rudder blade***.

Measuring instruments for material moisture (informations from www.conrad.de)

- In principle there are two ***types of devices :***
  - devices with tips; the tips have to prick the material ("invasive")
  - devices which determine the moisture by contact (***non invasive, "capacitive"***)
- Measuring depth of capacitive units: "*normally 10 – 40 mm"*
- Quality, price:

"*Lower-end products are suitable for assessments, whether a moisture problem exists."*

"Better equipped units provide display values of the ***percentage of the moisture content***

*instead of dimensionless parameters." (*The latter are insuitable.)

- One has to know limit ***average values*** if you want to evaluate a measured value.

Ralf Weise*:*

- *"The value of the* ***water content*** *normally is* ***less than 2 %*** *..."*
- Immediately after hauling out the boat the hull is moist.
  The yacht should have been onshore for some weeks when measuring.
- Gauging the laminate: above the waterline and below the waterline.
  "If the moisture of the laminate on the underwater hull exceeds 30 percent of the moisture of the surface vessel a serious defect exists. This has to be classified as alarming."
  (Note: This applies to osmosis, but presumably in general, too.)
  (Schreckgespenst Osmose, Palstek 4/15)

If the **measured value** raises ***concern*** you should contact an ***expert***.
It is not possible to issue a definite judgment for a layman. Too many influencing factors must be taken into account.

- - - - -

- Loss of the Rudder

I do not know ***any*** really ***usable emergency rudder***. Therefore an intact rudder is exceedingly important.
The spinnaker pole to which a bottom board is lashed, a system which always is recommended, doesn`t work everywhere. Reports and tests illustrate this.
("Steering a boat without a rudder" shows the options:
YouTube, https://www.youtube.com/watch?v=99KSZ3mEoKQ
One should test whether they work.)

The ***GRP - rudder*** is subject to the same problem of **moisture penetration** as GRP-hulls made from fiberglass and polyester (look above).
The loss of strength of laminate and foam is serious if it is soaked. Therefore in principle ***seepages*** should be ***avoided.***
That applies to old and to new yachts. Therefore a coating is necessary with ***epoxy resin*** of at least ***0.8 mm.***
(acc. to Ralf Weise, "Schreckgespenst Osmose", Palstek 4/15)
In the case of a new rudder the corresponding application will meet the requirements. But if the rudder is soaked with water it has to be dried before.
Yachts which are infected by osmosis have to be sandblasted or “stripped off” by

means of a “gelcoat plane” up to the laminate.

(It is advised against of grinding because the laminate might be damaged all too easily.)

After that the yacht has to be dried and the outer skin rebuilt with epoxy. Either the resin is applied by rolling or the coating

is redone with epoxy putty.

In the case of a soaked rudder supposedly you have to proceed in a similar way.

An additional problem may arise when **water enters** the rudder blade ***immediately***.

The weak point is "*the connection or transition between the fiberglass of the blade and the rudder post made of aluminum and coming from above.*"

For under load the two materials expand differently: the connection is parting, sea water forces its way in causing the foam core to rot.

U. Baykowski (expert) believes, "*that nearly every yacht is affected by moisture problems at the rudder when older than ten years.*"

(from: "Rund ums Ruder", Palstek 4/2018)

Maybe water penetration can be identified because of the darker color of the antifouling near the bottom of the rudder.

More reliable and recommendable at any rate would be to gauge.

Ralf Weise:

To **prevent** the **intrusion of water**

… *“a fillet of **elastic sealing compound** is made between rudder post and rudder blade as regards serial ships.*

*With custom built yachts sometimes **epoxy resin** is infused into a V–gap between rudder post and blade. Then the mentioned **elastic fillet** is set.”*

Ralf Weise continues:

*“About rudder blades off the shelf it` s a common **misconception** that **drying** is **sufficient** to regain the former strength in the case of strong water ingress.*

Polyester resin is not water-resistant. It changes its chemical composition by hydrolysis and looses rigidity as a result.

It looses its firm bond to the glass fibre as well whereby the entire adhesion is weakened.

Rudder blades** should be **replaced** if **water** has been embedded **over a longer period.”

(Ralf Weise, Palstek, 11/20)

Wolfram Heibeck (http://spezialbootsbau.de):

*„If you want to obtain an exceedingly durable result you may work the rudder stock from **GRP-** or even better from **CFK – laminate.”***

(Palstek, 1/2021)

“The advantage of a stock made from reinforced plastic material is that the connection

between stock and blade is homogenous
and absolutely
watertight." (Email)

Jefa Rudder, website (https://jefa.com)
*Before factory dispatch Jefa technicians apply a **fillet** of **Sika 221** along the rudder stock/rudder blade join line.*
*The integrity of this fillet seal should be **inspected** on a **regular basis** and renewed as necessary.*
*Jefa recommends usage of Sika 221 or similar polyurethane based sealant, to be renewed at least once every **3 years.***

Questions to Jefa:
- There has been a lot of problems with delamination of rudders the last years. Have ***rudders*** made by ***Jefa*** been ***affected?***
- Experts are telling that it is not possible to seal the critical point, because aluminium and GRP have different characteristics.
  Therefore the rudder shaft should be made from ***GRP -*** or even ***CFK - laminate.*** Why does Jefa not use this technique?

Thor Christen Hermann (https://jefa.dk) answering:
- *"We only hear that **water comes in** … when boatowners **don't service their rudders** as recommended.*
Our blades are also glued from the inside of the blade when closing the moulds together. We use Sikaflex to be double secure.
- *The reason that we don't produce **GRP stock** is cost, safety and the fit of bearings.*
As the GRP stock can't be completely round it needs sleeves (Gleitlager), *which increases the size of the bearing …*
which again increases the prices on the whole system.
- *Regarding the **Carbon stock,** it is something we are going to do, but … it is difficult just to jump to Carbon,*
as it … needs a lot more time, perfection and mainly an autoclave (s. Wikipedia: Autoclave) …
Also, Carbon costs 3 times more than GRP …
- *A last note, the only big boat yard which is using GRP rudders is Beneteau, which only does it when the blade needs to be extra slim.*
*Hanse, Bavaria, Contest, Solaris, X-Yacht, J-boat etc. use … a **full carbon rudder,** when the **customers ask** for it …"*

- **Unsinkability**
  … of course would be a desirable feature.

Wilfried Erdmann
His sailing yacht *KATHENA NUI* was equipped with ... *"three watertight sealed off compartments: forecabin, cabin, aftcabin. ...*
The three hatches (hinged): aluminium provided with rubber seal and screw caps."
(This quotation and the following from: "Segeln mit Wilfried Erdmann"; translated)

Unsinkability normally is achieved by watertight sections. But to get a ship really unsinkable is very difficult.
There are too many small holes in the hull: companionway, bench lockers, exhaust, engine instrument panel, fuel tank ventilation, pumps, seacocks ...
It is nearly impossible to get compartments watertight at a completed boat.

Foaming
... cannot be the slution. You would need ~ 9 m^3 of EPS for a yacht of 8 tons.
There would remain hardly any space to live.

Dashew:
"Most conventional yachts suffer significant water ingress when rolled. ...
It just may be a contributing factor to selfrighting."

When one puts a water glass in the water with the opening down, surprisingly little water will enter.
According to that principle the **companionway** should be closed watertight as high as possible or be accessible only from the level of the deck.

- **Self-righting**

Wilfried Erdmann paid attention
"... especially to the self-righting characteristics.
*The **beam of the hull** was narrowed considerably and the **ballast** was placed lower so that KATHENA NUI got a low-lying center of gravity. ...*
*In order not to remain upside-down the **freeboard** of my boat was not raised. ...*
*Nevertheless a noticeable **superstructure** was designed.*
*A **flush-deck vessel** may seem to be of greater seaworthiness but in reality it is lacking ... b*
ecause flush-deck vessels tend to stay in the inverted position when rolled. ...
*Especially in combination with an oversized beam they are **at risk of a capsize**."* (Translated)

Andrew Claughton:
"The static stability analysis indicated that a further increase in coachroof size could eliminate the range of inverted stability completely

(a concept used with great success in many lifeboats), thus rendering even a very light and beamy craft self-righting."

Yachts with daggerboard, centerboard, stump keel

How prone to a capsize are these types of yachts? What about their self-righting abilities? What happens in a 180° – roll if their keel has been retracted?

If yachts retract their keel when running and they are hit by a breaker which is fading away, it may be that they slide sideways because of their flat bottom now.

This may be an advantage.

But if they are immediately involved in the dynamics of a breaking sea this ability is of no use.

They will be catapulted into the wave trough and there they suffer a capsize like all the other vessels.

Then only will count their strength, watertightness and their self righting ability.

I fear that a ship without or with a small keel will have bad cards in a capsize.

(Look "Brecher & Yacht" in: "Sturm", on this website.)

The new generation of offshore racing yachts

... is designed for speed. That leads to lightweight, beamy boats.

The monohulls, which take part in offshore races are characterized by a very flat hull with an extremely slim,

at the same time extraordinarily deep fin with bulb and by twin rudders in addition.

Olin Stevens:

"I see and have tried to emphasize the dangers of decreasing displacement and increasing beam

because we know their part in producing characteristics that research has clearly shown to be linked to capsize."

Steve Dashew with regarding to the yacht *POUR AMNESTY INTERNATIONAL* (participant at Vendee Globe 1996/97):

"The vessel in question lost its rig in the capsize although it should have had an LPS of around 140 degrees.

However it did not right itself ... over several days. The Ocean 60s have very wide decks, devoid of camber or deck structure.

Even though this deck shape/structure is a factor in calculating the LPS, its lack may be a contributing factor to the lack of righting."

(LPS = Limit of Positive Stability; spot of a yacht`s curve of statical stability where it is impossible for her to right herself;

a bit further on and she will go upside down.)

In January 2015 a **Pogo 8.50** was rolled when sailing the Trade Winds` route in not at all spectacular conditions.
But it lasted more than one hour until she righted herself.
Eric Mezieres, one of the two sailors involved, reports:
https://www.facebook.com/permalink.php?id=755407214573106&story_fbid=766809736766187

Patrice Geffroy:
"Possibly the boat was sailing too fast ... A particular heavy wave made her spinning out. Dashew designated it:
´Boat designs with large beam in the stern and a narrow prow tend to spin out when reaching a certain heel ...´
The Pogo has a length to beam ratio of 8.60 / 3.60 = 2.36. With most of the offshore yachts the value is 3 or somewhat more.
This could be the reason of the capsize and the persistence in the reverse position." (Translated)

In my opinion, there is something additional: When one views the images of the Pogo, one will realize
that she has a very short and - respective to the volume - all too small deck structures to produce enough buoyancy.
(Image of the Pogo 8.50 on http://www.pogostructures.com/croisiere/les-anciens-bateaux/pogo-850. 2017)

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Supplement (2022)
The center of the offshore yacht`s gravity should be kept as low as possible by all means.
Adverse effects are produced by

- teak deck
- In-mast furling mainsail
- equipment rack
  „These light solarzells which we sewed on the bimini-top really are improving. You do not need any longer the heavy rear rack, which is unbalancing the vessel."
- dinghy
  It should be stowed below deck at least during an ocean passage.

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- **Minimum Size of the Seagoing Yacht**

Donald Jordan
"History shows that the probability of a yacht being capsized and damaged by a

large breaking wave

is strongly influenced by the displacement of the vessel.

Yachts ***under 35 ft*** *have a* ***poor history*** *while yachts over 50 ft are rarely capsized and damaged."*

(Donald Jordan, "Wave Science",

accentuations by myself)

The ***RORC `s*** (Royal Ocean Racing Club; promoter of the Fastnet-Race) ***Fastnet-Report*** ... tried to analyse the reasons for the Fastnet-Desaster in 1979. In the report there are various parameters tabulated:

Table 1.2 (excerpt)

Class	***No. of Crew lost***		***Yachts abandoned***
		Since recovered	***Lost Believed Sunk***
0	-	-	-
I	-	1	-
III	**2**	**4**	**2**
IV	**1**	**7**	**1**
V	**2**	**7**	**2**

Table 3.2 (excerpt)

"Knockdown beyond horizontal, including a 360° roll"

Class	***Yachts***	***Knockdowns***	***Knockdowns in %***
	(235)	(76)	
0	8	-	0 %
I	40	5	8 %
II	40	4	5 %
III	52	**24**	**31** %
IV	46	**20**	**26** %
V	47	**22**	**25** %
No answer	2	1	1 %

Both lists show that the accidents dramatically increase starting at Class III.
The Classes II and I got off comparative cheaply; in Class 0 there is no knockdown including a 360° roll.

(All the yachts of Class 0 have presumably been southerly of the worst sea area because of their higher speed potential.

Annex 2A of the Fastnet-Report shows that zone. For this reason these ships don`t come into the following considerations.)

It would be import to know the length of the yachts which got off from this gale more or less unscathed.

From this fact there could be drawn conclusions regarding a recommendable minimum size of seagoing yachts.

Length of the yachts in ***Class II (RORC) ?***

The Classes of RORC are grouped corresponding to "feet rating" in a complex procedure.

„The rating of a yacht is a measure of her effective sailing length, with certain allowances for factors such as engine weight and propeller drag
and penalties for features such as very light displacement or excessive sail area.“

(Fastnet Race Inquiry - Report, Section 1, Background / 1.6, S. 7)

Class V, the class of the smallest yachts, begins at "Rating 21" and ends up at "Rating 22.9". (ibid., table 1.2)

The commentory states: "*The minimum size of boat which might qualify for entry is about 28 ft length ...*" (ibid., 1.6)

So 28 ft is the minimum size of the yachts permitted.

And it corresponds to the lowest figure of the "Rating Limits", namely rating 21.

Class II starts from Rating 29.

If Rating 21 is corresponding to 28 ft (8.53 m) then Rating 29 means 38.66 ft (= 11.78 m).

Conclusion:

In the ***Fastnet Race*** 1979 yachts ***got off lightly*** starting from ***>38.66 ft.***

Dashew

"Of the 85 boats that finished the race, only 13 were smaller than 38 feet (11.7 m).
*Of the 24 boats that were **abandoned,** all but one were **38 feet ... or smaller.***
*All the **15 sailors** who **died** were from this large population of smaller boats.*" (Highlightings by myself)

"The bigger boats did not excape unscathed: 6 entries larger than 44 feet (13,4 m) have been rolled over..."

Nevertheless Dashew draws the line at >38 ft as well.

Minmal size of the **seagoing yacht:**

Size is no guarantee but too small was fatal in the Fastnet Gale.

The accident statistics of the Fastnet Report suggests:

- ***Offshore yachts should be not smaller than 38.66 ft (11.80 m).***

Dashew

"One clear lesson from Fastnet is that for offshore sailing given a choice between boats of different sizes, take the larger boat.
(This assuming that her beam and displacement are not extreme in width and lightness, and also assuming that she is strongly built and rigged.)"

Back to Pogo 8.50 once again:

8.50 m LOA corresponds to 27,88 ft. In 1979 the yacht would not have been approved to the Fastnet Race because of her too small LOA.

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- Heavy-displacement / full keel - Light-displacement / fin keel

The classic, heavy full keel yacht with wine-glass-shaped bulkheads, a deep going keel across nearly the full length of the hull and with the rudder attached
got competition in the second part of the 19th century
by the "modern", light short keel yacht characterized by a shallow bowl shaped hull, fin keel and spade rudder .

Wilfried Erdmann

... chose a moderate fin keel made of aluminium, a light displacement design:

"The underwater hull doesn` t offer much resistance, and the fin keel boat picks up speed faster in gusts
and thus takes a great deal of the impact of the seas." (Translated)

Combined with his spectacular and successful single handed voyage round the globe in 1984/85
his views became the credo of entire generations of sailors in Germany.

Full keel yachts today are not any longer made of steel but of all common materials (GRP, Alu, Woodcore). Hence they are not heavy in principle.

Thus the terms ***"heavy-"*** *or* ***"light – displacement"*** are ***inapprobriate,*** determines ...

Dashew*:*

„You can quite easily have a heavy-displacement yacht that is very light constructed and carries a small payload,
and a light-displacement cruiser built like a tank, that carries lots of gear.
The problem comes in the formula typically used ... the displacement-length-ratio (DLR)."

Using the example of his yachts *INTERMEZZO* and *SUNDEER* he demonstrates how you can change from one categorie to the other only by small modifications.

On that basis Dashew develops a ***new formula*** with regard to the ***seaworthiness of yachts:***

- Yachts with steering control

... in contrast to **less controllable yachts**

Less controllable yachts:
Dependent on construction the full keel yacht is hard to steer; but included are all the other types of ships which you cannot steer by the tip of your finger in heavy seas.

"Offshore in a blow, traditional boats were a real to steer and had to be slowed down due to the risk of broaching."

Yachts with excellent steering control:

"The spade rudder is by far the most efficient, skeg-mounted rudder second, and keel-attached rudder least effective."

"In our opinion, the single most important heavy-weather issue is the ability to steer the boat in big seas."

"Nothing is more important than steering control."

I try to summarize **Dashew` s design ideas** :

Steering control will be achieved

- by a ***flat U-shaped hull***

  "The flat shape does not lock into the water as does the V, so it is more easily turned."

- with ***lines*** as ***balanced*** as possible

  Yacht designs with a wide stern and tapered in the prow are not controllable when heeled beyond a certain magnitude.

  They tend to head up into the wind.

  In the worst case they will capsize.

  In contrast a balanced yacht will keep her control capability.

- by ***separated keel*** and rudder configuration in combination with ***spade rudder.***

  "The keel provides a pivot point about which the rudder turns the hull."

  "The long keel only makes it more difficult for the rudder to get the boat back on course."

Moreover the **ideal offshore yacht** is characterized by

- ***moderate beam***,
- ***high freeboard,***

  "If the decks stay dry until 30 or 35 degrees, you` ll be in much better shape than if they start to get wet at 25 degrees."

- a ***deep center of gravity,***
- ***moderate keel*** (~ ¼ of WL)
- and a ***limit of positive stability*** for

  25- to 30-footers 135 to 140 degrees,

  30- to 35-footers 132 to 137 degrees,

  35- to 40 footers 130 to 135 degrees.

"You could ... take an additional 2 degrees off for 5 feet of increased length, to a minimum LPS of 125 degrees. ...

If you are heading into areas known for breaking seas, add some insurance to these heel angles."

- - - - -

- Classification of yachts based on steering control

Taking Dashew`s criteria to classify offshore yachts there are three categories:

1) Ships with **bad steering control** - But they produce a **slick** to windward when **heaving to**

and therefore are ***able to heave to*** even under bad conditions.

(Note: "Heaving to" as an abbreviated linguistic idiom instead of "Heaving to is a safe storm tactic

for this type of yacht which preserves the yacht from capsizing." In the following always in this sense.)

This is the classic **full keel yacht**.

More precisely: It is the long keel yacht of the type **Skorpion III A** (longitudinal section in the appendices).

I assume that other classic full keel designs with deep keel and comparably large lateral area of the keel will behave in a similar manner.

2) Ships with **good steering control** - However they **don`t produce any slick** when heaving to

and therefore are ***not able to heave to*** under bad conditions, yet are <u>able to ***run off***</u>**.**

This is the modern **fin keel yacht**.

3) Ships with **bad steering control** - which furthermore (!) **don`t produce slick** (or too less) when heaving to.

Therefore these vessels are ***not able to heave to*** <u>as well as</u> ***to run off*** under severe conditions.

These are **all yachts in between**.

However:

Boats which are running off in a gale – even with extraordinary steering control – have to be steered in the end. Possibly very long.

Maybe that is no problem with a crew of professionals.
But the crew of a cruising boat - are they able to do this?

Wouldn`t it be better the yacht would care for herself?

- - - - -

III Stormtactics

- ***Up to a wave height which matches the beam of the boat ...***
  ... it does not matter what tactics one uses.

If there is not enough room to a **lee shore** the situation is different.
Then the following alternatives may be feasible:

- ***Beating*** ; possibly by assistance of the engine
- ***Heaving to***
  Nevertheless the ship will be driven downwind.
  Hence it is an alternative limited in time.
- Deploying a ***drogue***
  ... generates the same difficulties as above.
- Drop the ***anchor*** as a last resort
  Requirements: 30 - 50 m of chain, plus (!) nylon cable of the same length (or both longer).
  A rope of nylon is elastic and it is able to absorb the movements back and forth. Chain alone can`t achieve that.

Breaking seas over a height which matches the ***beam*** of the boat
... may ***capsize*** the yacht when heaving to or sailing beam-on to the waves.

Hence it is necessary to choose the right tactics.

- Lying a-hull (Lying barepoles)

Technique
You take off all the sails, fix the rudder centrally and leave the boat to winds and waves. Most yachts will take a position of 100 to 120 ° to the seas and will drift.

Dr. Jens Kohfahl:
„The fact, that abandoned ships ... have been found somewhere even after months later or have been stranded

does not speak in favor of this method but underlines the fact that ships often have been abandoned too early ... "

(in: Trans-Ocean, July 2008; translated)

Dashew succinctly:

„If the waves are not breaking, lying ahull is fine. If they are breaking, monohulls ***are asking for a rollover****."*

There would be nothing more to add,

... if there would` nt be ...

Wilfried Erdmann*:*

Summery: At 10 Bft with breakers Erdmann put down all the sails.

The yacht was lying barepoles, drifting in an angle of 60 degrees from astern to the waves.

But he manifested himself differently, too. (Cp. "Beating" and "Running")

W. Erdmann` s most horrible gale in the Agulhas Current:

Summary: First he has been steering. But later, when the seas grew too high and he feared to be washed out of the cockpit

he lashed the tiller and went down into the cabin. There he has been laying down on the floor and stiffened.

Tthe weather has been blustering for two long days. ...

Link: "Allein gegen den Wind, meine Nonstop-Weltumsegelung" at "spiegel.de/eines Tages")

Erdmann had no alternative. Looking back to it he writes:

„Only one thing remains: lying a-hull, if possible downwind. ...

Maybe drag a rope of at least 30 m in addition to reduce drift velocity."

("Allein gegen den Wind"; translated)

Comment:

Although Erdmann got away I never would put my boat lying a-hull if there are alternatives.

I remember Dashew all too clear:

„If the waves are not breaking, lying ahull is fine. ***If they are breaking, monohulls are asking for a rollover."***

All new authors warn against a mere lying a-hull.

- - - - -

- **Heaving to**

Years ago at Elba I was invited to sail as a guest on an old wonderful two-mast-yacht. It has been pleasure and practice simultaneously in windforce Bft 6 – 7.
At some point the skipper hove to explaining that one could weather in this way even an "uragano", a hurricane: Heaving to ... "basta!"
I mention this episode as a proof that heaving to is a proved and tested survival technique even under extreme conditions with big full keel yachts.
It seems to me that it will fall into oblivion.
At that time in the German sailing magazines there was the discussion how to cope with the weather: "active" or "passive"?
These terms are misleading; they grade up ("active") and devalue ("passive").
For this reason in my opinion these terms should not be used.

Technique

Reaching under main and foresail, then tack, the foresail should be left in the old position. After tacking rudder a little bit windward (tiller leeward).
The forces of foresail and main neutralize each other.
The ship will drift to the waves nearly at right angles.
In heavy winds the stormjib alone could be hoisted. The absent main is compensated by the hull, acting as a sail.
If the wind increases when heaving to, one has to reef down the sails as usual.

- **Full keel yachts**

The hove to drifting hull of a Skorpion III A e. g., a classic heavy-displacement-yacht, produces a zone of swirling water (slick),
into which the breakers tumble without catching the ship.
(Explanation of the physical correlations in: "Brecher & Yacht", on this website)

Helmut van Straelen: ***„Beidrehen? ... Im Orkan?“*** *(Heaving to? ... Amidst the Hurricane?)*

While crossing the Gulf Stream on the way from Annapolis to the Bermudas on board of JOSEPH HAYDN, a Skorpion IIIA, built by Feltz at Hamburg,
Helmut had been running. He hove to, completely exhausted after having stood on the wheel for 24 hours while the increasing wind
attained hurricane force:

"The second breaker is boarding, washing me nearly out of the cockpit. I am just able to keep the course of the heavy laboring vessel.
I am nearly unable to see something, the air is full of water ... I hardly can think anymore...

I have to do anything! ...
Heaving to?
Under these crazy conditions?
Aren`t we overrun, capsized within seconds ?!

It`s an act of despair: after the next passage of the sea ... I put the helm.

The yacht is heeling in such a way, that we have to cling to, not to be thrown out of the cockpit. – Then JOSEPH HAYDN comes up again.
Curbed by the incredible wind she fast slows down ...
Now the yacht starts drifting, abeam the wind ... the terrific wind pressure is jamming the vessel into a breathtaking inclination ...
The ship is going up and down, like in a fierce elevator ...
Her long keel is producing a wave turbulence, against which the waves are running like against a beach, loosing their energy, collapsing. ...
It`s like a miracle."

(Translated)

Note: With the help of "National Oceanic and Atmospheric Administration" (NOAA) of the United States I could verify the particulars
stated by Helmut van Straelen. (see "Beidrehen? ... Im Orkan?" / Verifikation)
Everything has been confirmed.

In Oct. 1976 Gary Griffin transfers a Wauquiez, modell Amphitrite MS45 (full keel yacht, 13.50 m).
In the Bay of Biscay he drove into a gale up to 11 Bft. with seas over 10 m. He has been heaving to, successfully.

Gary Griffin
The third time we are heaving to. The INDECISE virtually is stopped during the following 18 hours
in waves over 10 m and gusts of more than 60 kts.
The sea is white and the noise deafening.
The boat doesn`t have any problem.
Only the most vicious crests are reaching the deck but without endangering us.
http://www.uneinvitationauvoyage.eu/wp-content/uploads/2014/06/recit-de-mer.pdf

(Translated)

Bernard Moitessier
... the most renowned sailor of heavy-displacement-yachts remarks:

"In the high southern latitudes a gale from the east will not produce extraordinary high waves...
In such a situation it may be possible to stay hove to ...
The slick abeam the drifting boat will calm the breaking crests ...

The situation however will be quite different, when the gale is blowing from the west, from the same direction from which the high swell
always is coming in the high southern latitudes. ...
Under the pressure of a gale this swell may become very soon huge and may generate tremendous breakers,
onto which the windward slick of a yacht which lies hove to will have no affect at all, in no case to the slick of a heavy 12-m-boat. ...

On the northern part of the hemisphere the crests of the waves, which result out of gales from the west in principle are less high ...
Therefore yachts which lie hove-to seldom are bung up. But seldom does not mean never ...
In the book "Heavy Weather Sailing" (Note: by Adlard Coles) *you see pictures of breaking crests, which never could have been rode out*
by absolutely no yacht hove to. ...
These pictures have been made at the Atlantic between 30 ° and 35 ° north."
(Moitessier, "Weite Meere, Inseln und Lagunen"; translated)

- **Fin keel yachts**

... produce little or no slick to windward. Heaving to should never be considered.

Dashew:

"The heavy-displacement, full-keel boat ... might create a slick to windward ... "
"Very few (if any) modern yachts create a slick – or enough of one to be valuable in these conditions."

Barry Pickthall:

„The greatest advantage of modern yachts ... is their manouvrability.
***Never heave to** ... a severe knockdown would be the presumable consequence."*
("Blauwassersegeln manual"; translated)

- **Yachts in between**

Maybe vessels with rather long keel but split lateral plane do not create enough slick.
Just the same holds true for long keel yachts with a comparatively small lateral plane, e. g. vessels with centerboards
or long keel yachts of the type of Joshua Slocum`s *SPRAY*.

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- **Further Aspects**

Angle to the wind

By modifying the sail balance you may influence the angle to wind and waves.

- More foresail (or less main): the boat will bear away somewhat.
- Less foresail (or more main): the boat will position itself closer to the wind.
- Sometimes it`s enough to ease out or haul in the main.

Dashew:

"In breaking seas, you`ll want to have the bow as close to the seas as possible. ... the best angle in heavier weather is the closest angle to the wind, with oscillations down to 50 degrees."

Heaving to as a possibility to renew strength

If the seas don`t break heaving to is applicable for the short keel yacht, too.
But it is limited in time, that is to say until the front passes.

Risks when heaving to

Involuntary tack

If you choose an angle too pointed to the seas it might happen, that the yacht will be pushed to the other bow by a wave
which is out of the normal.
Suddenly you lie abeam to the waves, without drift.
A very dangerous situation!

Passage of the front, crossing seas

When the front passes, there is a windshift of about 90 degrees. This change of the direction of the wind causes crossing seas.
When in the northern hemisphere at the beginning the wind blew from SW, the wind normally will come from NW after the passage.
The boat should be kept in such a manner that the bow now bisects these directions of the wind.
That means that the bow now should point to the W. In northwesterly winds it would be port side.
If she would be sailing on starboard she would have the old swell abaft and diagonal or even abeam.
Furthermore one has to consider, that the wave system may superimpose and the wave

heights may duplicate.

Dashew:

"If the seastate is not threatening, the passage of the front is simply a sign to resume your course.

But if you are dealing with breaking waves, the passage of the front may bring on the most dangerous phase of the storm,

where you now have to deal with crossing seas. In this situation passive tactics – such as being hove to or lying to a sea anchor –

may have to be changed to those which are more active, so you can maintain better wave alignment."

These considerations are obviously valid for full keel yachts, too.

My conclusions

The report of Helmut van Straelen shows two aspects:

- Running off was the wrong tactic for his yacht.
- By heaving to his full-keel yacht resisted windforce 12, perhaps more.

In fact only a rogue wave may exceed the corresponding seas.

Personally I am convinced by Helmut`s report:

*I would **heave to** with a big classic **full keel yacht** under nearly **all conditions.***

It is essential that nobody has to remain at the wheel. The yacht is doing the job by herself.

Perhaps the passage of the front will be difficult.

My solution would be in this case: JSD (Jordan-Drogue. About this equipment and about freak waves later.)

However for yachts which rather belong to the **light displacement design** heaving to will really become a problem:

the yacht lies at right angles to the breakers with her most vulnerable point, namely her side.

Once more Barry Pickthall:

"Never heave to ... a severe knockdown would be the presumable consequence."

With **"moderate" full-keel yachts** or vessels with a **small lateral area** of the **keel** (e. g. yachts with centerboard, daggerboard or twin keels) I would ***not heave to*** under severe conditions.

Does one really know, whether the necessary slick is produced?

One should try to obtain informations whether the own yacht is able to heave-to (shipyard, designer; other sailors

who sail the same type of yacht).

Maybe one could test heaving-to under not too dangerous conditions.

In sum:

- ***Heaving to is a relative safe stormtactic for the classic full keel yacht.***
- ***Fin keel yachts may not heave to, a "knockdown would be the presumable consequence."***
- ***Yachts in between: ? (In doubt don` t heave to !)***

- - - - -

- Beating (Beating to Weather)

Most of the authors are write that Beating is not possible in windsforce Bft 9, definitely not in Bft 10.
This depends on the sea area, the height of the waves and their steepness.
My friend ***Horst Oelerich*** sailed with a modern fin keel boat on the North Sea against Bft 10, because the Dogger Bank was lying in wait in his back.
There was water in the cockpit, repeatedly, but he could hold position.

Requirements

- You need a good tacking yacht. Ideal would be fin keel, spade rudder, sharp bow and an appropriate rigging plus sails.
The weight should be centered as far as possible, that means forecastle and stern as light as possible.
This indeed is valid for every kind of storm tactic.

- It is important, that the yacht can gain height upwind in the crucial moments.
Thus the deeply reefed main (third reef) is more important than the storm jib.
A trysail is rather not suitable, because it opens the leech causing the wind to flow off.

- One of the conditions is that you can see the waves at night or at least the direction of the wind.
Helpful are flags under both spreaders as dark as possible; superior would be an electronic wind direction indicator.

Technique

When the wave has passed one should sail diagonally down the slope of the wave, gain momentum (may be you bear away for a moment),
then luffing and up the new crest close-hauled.
Turn the yacht (bear away) on top of the wave in order she does not to overshoot the crest, and down again diagonally into the trough.

Speed

Not too fast! The boat has to be well controllable and should not blast over the crests.

But it needs power to have enough impact to oppose the whitecaps on top of the waves.

Optimal sail area

Dashew:

"The norm is to set up for the gusts.

This means you are somewhat underpowered during the average wind strengths and extremely underpowered in the lulls."

„... given the correct sails, a good helmsman or two, and a boat that is efficient to windward, there are many situations

where beating to weather with just enough speed for good steering control is the best survival tactic."

Breaking Seas

Dashew:

„However, if the seas are breaking, and speed is necessary for good steering response, (and perhaps for blasting through the crests),

then you need ... enough sail area to keep you moving in the lulls."

Risks

- Breaker
  The yacht may be dragged aback; she then ends up in the trough.
- Passage of the front
  Crossing seas: There is always a tack which is worse and one which is better against the seas.

Dashew:

"With breaking crests the best tack will typically be the one which takes you most directly up the crest.

With crossing seas, in breaking conditions you will need to choose the tack which allows you

to adjust course into the cross sea if that is necessary."

Motorsailing to Weather

Maybe the engine might grant the required thrust to the ship.

Requirements

- Clear fuel and clean tank. Ideal would be two diesel filters, installed parallel and reversible.
- Continous cooling! Not every engine tolerates heel.

Dashew:

"Using the engine ... it provides the extra thrust that is occasionally required

to get your bow through a breaking crest."

"In many situations motorsailing may just be the ultimate storm tactic. Consider the advantages:

- *quickly variable speed control,*
- *improved slow-speed rudder efficiency,*
- *the ability to take breaking crests at a tighter angle than is possible by sails alone,*
- *possibility of eliminating the storm jib, which means you can sail closer to the wind without risk of getting caught aback.*

For vessels that are inefficient to windward it may be the only way to sail upwind in storm conditions."

Where is the Limit of Motorsailing to Weather?
Helmut van Straelen

Could you have imagined to sail upwind in these conditions? (Bft 12)

"No, by no means. Beating against weather on a heavy full-keel yacht - no way!" (Translated)

Wilfried Erdmann on his circumnavigation against the wind:

"Up to windforce 8 I had the yacht sailed. That means: The storm jib was up and the main triple reefed ...
I had some speed ahead. May be 3 knots. The yacht lay to weather 60 to 70 degrees. ...
Massive water didn` t reach the deck in this situation – only spray.
During this kind of stormy sailing the automatic windvane (Aries) confidently kept course.
But when the windforce augmented and when there was foamy water on deck and the spray spouted across the boat up to the stern
then it was high time to shorten sails. I took away the stormjib.
The yacht kept beating under the leftover of the main sail somewhat eased out.
At least I could keep position using this tactic. ... It has been the most exerted solution to weather a gale."

"In the region of Cape Horn and in severe weather I tried to sail under storm canvas against wind and seas.
The speed of the yacht was okay, but she vibrated frenziedly, smashing into the seas violently with her bow.
Very soon I resigned beating to weather i. e. taking the waves on the bow."

On board of SY GATSBY (15 m LOA), Bft 8 – 10, reaching at 60 – 70 degrees, 5 – 7 kts:

"The yacht was covered totally by steep seas a number of times, then it was not possible to steer her on course –

she simply was swept away laterally, at right angles to the waves."
"But you also can sail less offensive against the wind hauling in the sheet getting less speed ...
The less speed against the seas the less risk and the more comfortable, however the more leeway, too."

(Translated)

Barry Pickthall:

"The worst situation will occur when nasty cross seas will develop caused by a wind shift.

If one of these cross seas superimposes the underlying long waves may be it will develop a rogue wave in combination with a steep back. ...

Even if the helmsman bears away on top of the wave the yacht will fall down like a rock in the following trough. ...

Therefore the vessels of the ´Global Challenge´ are made like tanks."

("Blauwassersegeln manual"; translated)

Remark:

The last Global-Challenge-Race took place in 2008, round the world from E to W.

The yachts had been specifically designed for this event, made from steel, 72 ft (22 m), manned with 11 sailors plus skipper.

My Conclusions:

I think that beating to weather first depends on the fact whether you are en route against weather or not.
Of course there are situations where beating is unavoidable e. g. when you are pressed onto a leeshore.

In generall I appreciate beating to weather up to a certain sea state.
You can use the windvane, and maybe the engine running.
But when the windforce arrives Bft 9 one has to stay on deck in order to adjust the rudder in case of very steep seas.
When the wind increases even more the moment will come when you have to quit sailing upwind.
Then you should have a ***plan how to proceed.***

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- Running off / Running under Bare Poles

An impression will be conveyed by a brief video: sailingwithalbie.blogspot.com

Definitions

German ***"Lenzen"*** means:

"... running off before the storm up with the smallest possible canvas."

(Claviez, "Seemännisches Wörterbuch"; translated)

"Lenzen vor Topp und Takel" (Running barepoles)

... is the result, when sails are shortened and at the end have been taken away totally.

In Germany normally there is no difference in the meaning of "Running off" and "Running under bare poles".

The Fastnet Report however classifies them as different storm tactics.

Hal Roth:

„When there` s too much wind for heaving-to or lying a-hull, the next step is to run off ..."

Dashew:

"Assuming you have sea room to leeward, running off at speed under control offers one of the safest ways

of dealing with breaking seas."

Requirements

- The yacht has to be well controllable.
  Modern yachts with fin keel, spade rudder and a flat hull are most suitable.
  Ships with a deep and sharp stem (V-shape) dig in and don` t turn fast enough.
- "Well controllable" is not a matter of personal feeling.
  The yacht has to react at once answering to the slightest swing of the rudder, without the need for any muscle strength.
  Even at high speed, even in inclined position.
- Full keel yachts are headstrong. Whenever they take a direction you hardly can bring them around.
  "They say ´dependable in keeping course´. But in a crucial situation you can` t get around the stubborn horse!"

(Mr. Erwin Oelerich, my sailing instructor and mentor; translated)

- The helmsman has to steer very concentrated.
  Because of this generally it is necessary to replace him soon.
  Thus you need at least two good helmsmen, better more.
- It is important again, that at night the helmsman is able to realize the crests or at least the direction of the wind.

Technique

- When running it is necessary to keep the yacht in right angles to the seas.
It is advantageous to set the sails as far ahead as possible and to take off the main thus improving the capability of steering
because the distance between "center of effort of the sails" and "center of effort of the rudder" is enlarged.
- The waves may block the wind when they get a certain height and the yacht is sailing in the trough.
Then it could be better to use the furling jib instead of the storm jib.
- When the wave overtakes the yacht the effect of the rudder is neutralized for a moment.
Cause: the orbital movement of the water particles (well illustrated in Wikipedia).
In this moment the particles flow in the same direction as the yacht sails (and the rudder moves).
Thus the rudder looses its incident flow.
When we have been running off in the Golfe du Lion with our yacht (28 ft) (in windforce 9 and waves of 12 ft with storm jib up only),
it was not the problem to run into the wave tail of the sea before us but to keep the yacht controllable
immediately when the crest of the wave has been passing.
In our case the jib has been dragging the yacht in a straight line ahead.
- In order to maintain to some degree the steerageway of a yawing ship in strong winds one aid might be to set the stormjib centered,
that means to haul close both sheets.
The wind has to be so strong that the sail no longer is necessary as propulsion.

Nevertheless ***Running*** is one of the most ***controversial*** discussed ***issues.***
I categorize under three headings:

1) Running off up to hullspeed
2) Accelleration beyond hull speed
3) Running off at very high speed (surfing)

1) Running Off up to Hullspeed

- Fin Keel Yachts

Wilfried Erdmann:
"In the end I realized:
My boat behaves best running with quartering wind and sails up ... how high or how long, whatever the seas have been.
This will remain my tactics: running off at hull speed having set small and distributed sailareas."
Prow and stern *"... have been almost emptied, to give more buoyancy to these sections.*

Due to the low total weight of the boat, KATHENA NUI fast accelerated taking away some force of the breakers."

"When the wind developed up to gale-force and green water washed over the deck …

(I put up) … *a tiny storm jib … running off in front of the waves ensuring to reach not more than hull speed.*

The boat remained controllable with this tiny piece of canvas. …

These courses with the wind on the quarter or astern I always steer manually."

(Translated)

- **Full Keel Yachts**

Helmut van Straelen

… has been running with his heavy full keel yacht having set a tiny hurricane jib initially.

"At each passing of the waves the ship has first been lifted with her stern. Then from my seat behind the steering wheel
I have been seeing into the wave trough, into which the yacht seemed to rocket downwards.
This has been the most dangerous moment, because for an instant the rudder has been without effect.
Afterwards the sea lifted the bow.
Sometimes the prow has been there on top of the wave, one or two meters totally free, then heavily pitching downward."

Did you have a problem with the speed?

"No. She has been picking up speed slowly because the boat has been so heavy, 20 tons.
There was no tendency to undercut the waves.
Though she has been sweeping down the slope of the wave with more than hull speed (ca. 10 kn) she did not undercut the next wave
because of her plenteous bow.
An extraordinary design of Karl Feltz!"

Did you see the crests of the waves? It was night, spray!

"Absolutely no visibility! Steering merely via feeling of the buttocks and electronic wind gauge.
A very important instrument in heavy seas! I learned to appreciate it!"

(Translated)

At some point the yacht could be kept aligned to the waves only with greatest effort.
After 24 hours of steering Helmut van Straelen hoves to totally exhausted.

If he had known how his yacht behaves subsequently he doubtless would not have been running until his physical limits.

Hazards

- **Broaching**

For all yachts there is the danger of broaching if getting transverse to the waves, of being pushed out of course by a breaking sea
or only being lifted one-sided at the stern.
A good controllable yacht can be brought back to course without difficulties, a bad steerable yacht will get into troubles.
She will break out, will lay beam-on to the waves and maybe she will be capsized by the following sea.

Dashew:
„In survival conditions, the key point is having the boat` s axis aligned at right angles to the wave.
It reduces the chance of the wave grabbing the stern quarter and rotating it around, starting a broach or roll."

Dashew about **full keel yachts:**
„This type of vessel is difficult to steer downwind in heavy going … and is at extreme risk in a broach.
With such a design there is no choice but to adopt a slow-down approach to the elements."

This would imply for these yachts to decelerate, to drag ropes or deploy modern drogues. (Look there.)
Van Straelen hove-to. Dashew thinks nothing of heaving-to.

- **Outmanouver Dangerous Seas ?**

Andrew Claughton:
"The simple answer to avoid capsizing is to avoid breaking waves. …
During the 1979 Fastnet Race many yachts were able to keep sailing … avoiding the breaking part of the seas ….
The risk is that a mistake in steering might cause a broach which results in the boat being left beam-on to the waves.
This technique does, however, need a strong and competent crew ….

It is nevertheless a well-established and successful technique
....”

(Bruce: "Heavy Weather Sailing")

Wilfried Erdmann

"When the wind shifted too rapid ... then it developed a hair-rising sea.
My task was to avoid the biggest seas in the proven way (note: running off). *In such a situation I sailed a zigzag course.*
Occasionally I broached ...
Fortunately we have not been hit by a second terrible high wave, which would have capsized the boat."

(Translated)

Donald Jordan

... analyses the correlations **completely different**:

"Another optical illusion is that in a survival storm it should be possible to reduce the hazard by running off before the waves and,
by skillful seamanship, to outmaneuver a dangerous wave.
This is a particularly unfortunate choice. The waves are moving faster than the boat can go.
A 40 ft breaking wave will be moving at a speed of approximate 23 knots.
The breaking wave is completely random (zufällig, willkürlich).
Furthermore, by far the most important concern is that, if the boat is moving through the water, the chance of being caught by the wave
and surfing to a dangerously high speed is greatly augmented. ..."

2) Accelleration beyond hull speed

C. A. Marchaj:

"When the yacht ... is surfing down a wave ... the velocity may be augmented so much, that the seas are becoming seas from ahead finally; then the bow is digging in the back of the wave ahead ..."

("Seetüchtigkeit – der vergessene Faktor"; translated)

The bow will be blocked abruptly, the stern will be pushed around and the yacht will lie abeam to the seas or she will be capsized.

Donald Jordan analizes the process as follows (I summarize):

The yacht not only will be lifted by the advancing sea but accelerated as well.
On the verge of catching the crest of the wave the yacht has adopted the speed of the sea.
If a breaker hits the ship in this moment it will act as an additional speed-up.

In the case of the 25-ton *WINSTON CHURCHILL* and a wave height of 14 m roughly there has been generated an impact of 90 t.

(according to Jordan: "The Loss of the Winston Churchill")

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Interim result

It seems, that yachts which are not excellently controllable, have to be decelerated, while good steerable yachts (still) can be sailed without appropriate aids. Provided the crew is able to do this.

Running off under high speed Jordan considers wrong even for good controllable yachts. As a consequence the yacht has to be decelerated ?

There are two diametrically opposed opinions: ***Slowing down – Not slowing down.***

2.1 Not slowing down

- Full Keel Yachts

Bernhard Moitessier

... cuts the ropes, which has been dragged by the yacht in a survival-gale.

The classic text section as follows:

"... It becomes more and more difficult to keep JOSHUA in front of the seas.
The slowing down effect of the ropes provokes that she is less controllable the more the sea rises.
More and more frequently she is getting out of control...
And what I had feared vaguely comes true finally ... thrown out of course
JOSHUA broaches ... breaker ...
then a fast heeling which increases relentlessly ..."

Moitessier cuts off all the ropes.

"Now she is running barepoles, free, heeling, when the sea is running up at an angle of 15 to 20 degrees,
is accelerating like a surfer ...
and is responding to the helm, when I bring her back downwind."

(Kap Horn – der logische Weg; translated)

This passage has affected innumerable sailors.

Helmut van Straelen

Did you ever think of deploying ropes to slow down the yacht?

"Since Moitessier everybody knows that this is just the wrong for a long keel yacht."

Did she sail too slow in the troughs? Breakers have been catching the cockpit.

"No, not that. It only happened when a big chunk broke immediately behind us in the 6 to 8 hours of extreme windspeed.

Then the huge white crest burst into the cockpit." (Translated)

Bobby Schenk about Moitessier:

"One should beware of taking over uncritically experiences of other sailors.
I remember .... Bernhard Moitessier, who recommended running off barepoles ... and skidding down each sea in an angle of 20 degrees.
Some years later, after another round the world sailing tour in the same waters he remarked to me quite relaxed
that he now not at all would have used this technique ..."

(This and all following quotes of Bobby Schenk from: "Blauwassersegeln"; translated)

- **Fin Keel Yachts**

Wilfried Erdmann

... has no positive experiences with deployed ropes or sea anchors.

"Even in our most severe gales we ran barepoles without deploying anything. On the open sea
we kept the stern against wind and waves."
"Conventional tempests, which means windforce about 8, I normally weathered in the cabin."

Which means the Aries wind vane was steering.

"Even in light storms the Aries did her job – admittedly with deviations up to 30 degrees. Only in heavy gales, in windforce 9 and beyond, I had to enter the Cockpit and operate the helm by hand.
Fortunately the periods have been not too long – the longest time, where I had to steer has been 30 hours approximately."

(Translated)

Each time when I read these lines I feel very small: ... t h i r t y hours !
Helmut van Straelen had been at the wheel for 24 hours without a break. This also is not possible for me.

Eric Taberly:

"I think, that lightweight ships are able to run in every weather ... Enough speed is very important in my opinion.

Therefore I don` t believe in running and dragging ropes."

(cit. from Alain Grée; translated)

Dashew

... considers running without deploying any kind of drogue as one of the safest techniques as well.

"Assuming you have sea room to leeward, running off at speed under control offers one of the safest ways

of dealing with breaking seas."

Whereby Dashew recommends rather more speed.

"The key is the physical ability of the crew to control the speed and the direction of the vessel ..."

2.2 Slowing down

I don` t know whether ***Willam Albert Robinson*** was the first who made an attempt to use warps at his yacht VARUA.

But Bernard Moitessier reports that he has studied the book of him ("To the Southern Seas")

and that he has talked to Robinson personally to learn as much as possible about this technique.

Dashew:

"This type of vessel (full keel yacht) *is difficult to steer downwind in heavy going ... and is at extreme risk in a broach.*

With such a design there is no choice but to adopt a slow-down approach to the elements."

Bobby Schenk:

"Usual one will start running under small sails.

After some time the wind has built up such high seas and steep waves that the yacht exceeds her hull speed by far because she starts surfing. That's the moment where you feel that you have to change something.

You will take off all the sails because the yacht herself generates so much wind resistance that she achieves hull speed without any sail up.

Now it is imperative to reduce speed in such a way that she will not be swept away by a crest."

(Translated)

- **Slowing down by using warps or tyres**

The principles are valid both for full keel and for fin keel yachts.

Bobby Schenk

"You have several possibilities to decelerate the speed..."

"If necessary one may add more ropes or take warps on board again respectively open the bights."

(Tran
slated)

Even automobile tyres would be suitable.

Dashew

"Tires have been used ... to increase the drag of the bights ... These are strong, cheap, and readily available throughout of the world."

"Ideal the bight of line will trail behind the boat 300 feet or so, which means you need 600 feet of line to start."

"You` ll need some system of keeping the line immersed. This can be sections of chain, anchors, or both.

The important thing is to keep the bight from surfing or planing on the water` s surface. Once this happens,

drag will be substantially reduced.

There is also the risk of having the bight of line complete with attachments tossed into the cockpit by an overtaking wave."

- **Slowing down by means of modern drogues**

In order to decrease velocity warps are used usually.
This is the familiar method here in Germany.
The remarks of Dashew concerning length of the ropes, additional weights and – nevertheless - of ineffectiveness
may cause every skipper not to try it with ropes or tyres. Respectively only in the case that he had not made other provisions.

In Germany the refusal of sea anchors has been made permanent by the bad experiences of well-known German sailors.
Overseas the people has been more unprejudiced. They have experimented. The result are the so called "drogues".
They work absolutely different in comparison to the sea anchors (parachute anchors).
In dragging they don` t stop the boat but they slow down the yacht in different ways.

Meanwhile there are various types. Among others:

Galerider, Seabrake, Delta, Para-Anchor MK 2, Don-Jordan-Series-Drogue

(Photos and descriptions in: Bruce, "Heavy Weather Sailing", test results are attached.

The ***Series Drogue*** ist one of them. About it later.)

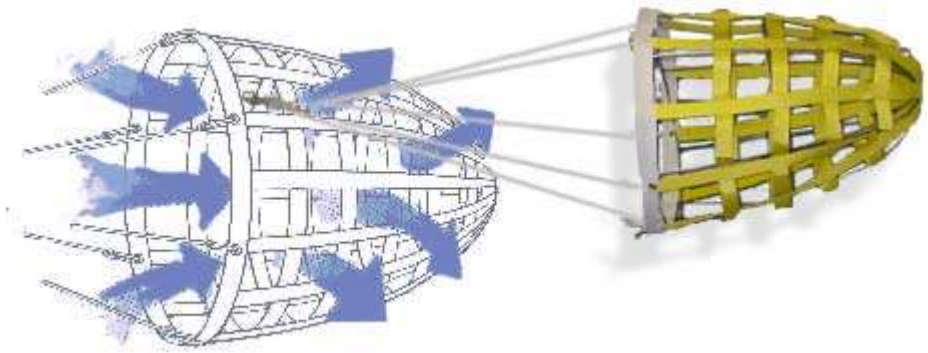
Peter Bruce:

„The ideal drogue will cause the vessel to maintain a comfortable speed: neither too fast which might involve a broach,

nor too slow, which could bring about loss of steerage way."

The **Galerider** seems to me to be the most suitable alternative instead of using warps. It consists of broad belts which are conjoined to a web like a sack. The Galerider is sold in different sizes.

The following drawing is taken
from: http://www.landfallnavigation.com/galerider.html



I pick out one of the accompanying comments:

"We deployed Galerider while running under bare poles in Force 10 conditions, surfing at 10 to 12 knots.
There was no shock at all when the slack was taken up. In a couple of minutes our forward speed was a steady three knots.
The act of slowing the boat down in that big seaway was magical.
Even though the motion wasn't all that comfortable with cross seas rolling us, the boat was safe:
We were fortunate Galerider was aboard."

http://www.hathaways.com/galerider/default.asp

https://wavetrain.net/2014/09/24/galerider-drogue-for-steering-and-heaving-to/

Not quite as euphoric yet affirmative ...
Hal Roth comments:
"The Galerider is simple to use, uncomplicated, and can certainly help a yacht in difficult circumstances.
Nevertheless, it is essentially a surface instrument. ...
In a large breaking wave ... I fear that the Galerider might skip down the front of a big overtaking wave
and fail to hold the stern of the yacht into the wave.
Nevertheless, this device is an excellent product because of its modest cost, simplicity ...
and is ***a hundred times better*** *than* ***towing automobile tires."***

(Accentuations by myself)

New problems
When deploying the Galerider or other drogues the danger of broaching is reduced at the moment. At the same time new problems may develop.
That`s the case when

- the yacht is ***too slow*** to be steerable.
- or when you can`t steer because the warps ***hold the stern*** of the yacht.

(Therefore I never would fix drogues at the clamps astern but would fasten them to the pivot point of the yacht as near as possible,

e. g. at the winches on the coachroof near the companionway.)

Addendum February 2026
The website www.hathaways.com no longer exists. Hathaway, Reisen & Raymond were the manufacturers.
It may become difficult to obtain the Galerider in the future.
Currently still available at www.landfallnavigation.com or www.westmarine.com (both USA).

3) Surfing downwind

Vito Dumas

... has been the first, who was running downwind with extreme speed:

"The wind – even blowing in gale-force - never made me shorten the sails."

("Auf unmöglichem Kurs"; translated)

This in wind speeds of 140 km/h and seas of 18 m!

For a long time people did believe that the etmals of Dumas have been so large because his measurements of the longitude by sextant
on the small rolling *LEGH II*, a "Spitzgatter" (sharp stern) of only 9,55 m in length, would simply have been wrong.
Today while offshore regattas are sailed with similar velocities, people know, that he told the truth.

Technique

Dashew

... explains several techniques how light-displacement-yachts may deal with high speeds.
One of these is to luff (up to beam reach) in front of the crest to reduce speed ...

„... and then pull the bow downwind before the crest actually impacts – so that you are aligned
heading down the wave 15 or so degrees up from a right angle to the wave` s direction of travel."

Mr. Körner, designer of our yacht (Van de Stadt – Forna) reports something similar.
He has been host on a big American racing yacht and told that the crew has been surfing diagonally down the waves.

Wilfried Erdmann

"Just before Cape Hoorn it nearly would have happened.

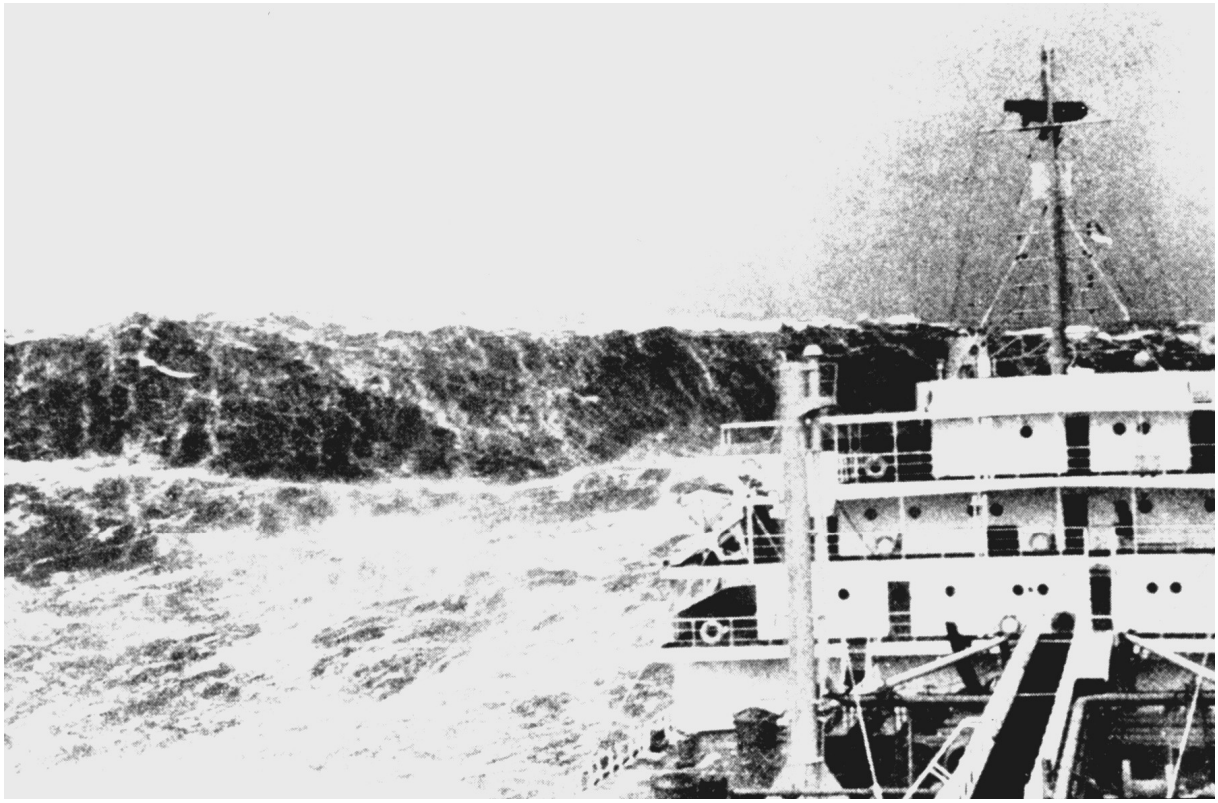
KATHENA NUI had to much sail up again and had herself catapulted over the crest of the wave in a surf.
You could say she had taken a header into emptiness, into the trough.
The impact occurred with such a violent momentum ... the hatch of the companionway has been torn open ...
a stanchion has been bent (by the collision with the water), wind vane broken.
Quite frankly, this sailing in a surf has been sheer madness.
I wouldn` t like to do it again, remember it, even discuss this technique." (Translated)

Barry Pickthall
The Global-Challenge-Racing-Yacht
"... is equipped with a storm spinnaker. Thus her average speed is 12 kn and in a surf up to 25 kn."
"You feel like riding on a vertical rollercoaster. When surfing on crests the smallest inattention suffices and the yacht broaches ...
The helmsmen have to be replaced every 15 to 20 minutes ...
while the remaining crew is trimming the sheets in a tunnel of spray up to the first spreader. ..."
"On no account let luff the yacht! That could lead to a broach." (Translated)
I definitely will keep off my hands of such kind of sailing.

- - - - -

IV Freak Waves (Rogue Waves, Monster Waves)

Wikipedia: Freak Wave



Freak wave in the french part of the Biskay. Water depth approx. 200 m. (Shot about 1940).

The wave height can only be estimated.

Wolfgang Quix and ***Herbert Weingärtner***
... have been caught in a gale with heavy cross seas on board of *JEANTEX*, an Open 40 – Design, in 1986 during the “Twostar”,
the Atlantic Crossing Race between Plymouth and Newport.

Herbert Weingärtner:
"Some seas looked like the Matterhorn
Image: https://en.wikipedia.org/wiki/Matterhorn
Shortly before the end of his watch ...
"*something caused me to look up: a vertical wall of water stood immediately above the ship laterally in front.”*
In the next moment *JEANTEX* capsizes.

The yacht rights herself up again. Herbert - harnessed - had been catapulted overboard.
He is able to pull himself up on board with his own force.

“I had tried to sail against the wind from the West, that meant to run on port tack as close-hauled as possible.

We only had up the small storm jib. Estimated windforce: about 10 Bft.
The seas had been huge, most of them more than 10 m high.
In my memory the freak wave has been as high as our rig, unimaginable 17 meters.
At the upper edge there has been something like a broad waterfall.
It approached in my back i. e. from portside ` cause I was sitting windward steering by tiller extension.
Everything happened unbelievable fast. I have been realizing the wall, in the next moment it already became dark.
When it became bright again and I emerged from the water the mast just appeared out of the water.
It was important that my lifebelt did not tear.
Because I had been outboard for a moment, strangely enough the broken tiller extension in the right hand holding it firmly.
Below deck there has been chaos. It took us days to put everything in order again. ...

14 yachts did not succeed in reaching the destination.
The crew of the Italian 60-ft-yacht BERLUCCI, aboard Beppe Panada and Roberto Kramer, is still missing till
today."
(Translated)

SY FREYDIS also faced the brink of a disaster by a freak wave.
Erich Wilts:
"We have been lying hove to under storm jib some 60 to 70 degrees to the wind in this heavy gale in the middle between Heard Island
and Ile St. Paul in the south of the Indian Ocean when FREYDIS was hit by a wall of water.
She fell into the wave trough ...
Fortunately she righted herself
fast." (Translated)

Heide Wilts *is* staying inside the yacht:
"*When hove to FREYDIS mostly is lying calm like a fortress. This quality of her we appreciate very much.*
But this time she is heeling extraordinarily which is unusual for us. She is riding seas of 10 to 12 meters, which are breaking and foaming.
Some are thundering against her windward side, pushing her downwind.
When I am looking out of the bulleye, because for a moment it has been unusual quiet, I see a wall of water rushing towards us as high as a house. ....
"W-a-h-r-s-c-h-a-u !", I shout.
A terrible bang is following.
The breaker is hitting FREYDIS full at the side.
Thousands of liters of water are exploding at her hull.

The ship is fulfilling a giant leap through the air downwind – is stumbling, toppling – tumbling in free fall down an endless trough –
is hitting the water, hard like concrete, on her leeside.
Darkness around us, rumbling, masses of water, swooshing …
I find myself on the floor. Eric is catapulted … against the foot of the mast, Erhard across the stove.
Heavy projectiles are soughing through the air, impinging somewhere.
Cascades of water are pouring down the companionway.
Now the ship comes up again. …
One can hear a fizz, bubbling spray …
Then silence." ("Auf der Route der Albatrosse"; translated)

Barry Pickthall:
„Against freakwaves you hardly can do something …
These waves are similar to big mountains of water, vertical walls five floors high, with foaming crests,
which appear from nowhere and move ahead at the rate of 30 kn.
They are generated by the superposition of some smaller waves and maintain their height only for seconds.
But in this short period they break everything which stand in their way."
(Translated)

Wikipedia:
"Freak waves exceed the ´significant height of waves´, i. e. the average value of the highest waves in a sea state, more than twice.
They have a comparatively short wavelength.
Known are three kinds of freak waves:
*1. the **Rogue Wave**, a big relatively fast wave, which does not follow the normal direction of the seas;*
*2. the **Three Sisters**, three waves succeeding fast in series;*
*3. the **White Wall**, a very steep sea followed by a deep trough. Down from the crest of the wave there is sputtering the spray."*
(Translated from German Edition)

The Agulhas Current on the Southern tip of Africa is particularly notorious, the Bermuda Triangle has a bad reputation, too.
But nowhere on the oceans you are safe.

Consequences

Superpositions of waves are not dependent on windforce.
Referring to W. Quix and H. Weingärtner the windforce had been 10 Bft when the

rogue wave hit the yacht.

With E. and H. Wilts it had been maybe 9 Bft. *("We soon have heavy gale again.")*

In the case of M. Jabbusch in contrast there it had been 6 – 7 Bft.

That is particularly alarming because nobody will take emergency measures in windforce 6 – 7 Bft.

All the more important is

- ***the yacht` s ability to right herself***
- ***the state of the yacht of being locked***
- ***and her watertightness.***

- - - - -

Interim result

- The classical full keel yacht is able to heave to.
  Example: Helmut van Straelen and his yacht JOSEPH HAYDN.
- But I am owner of a fin keel yacht.
  If Beating no longer is possible and Heaving-to fundamentally is out of question then
  Running becomes inevitable.
- The next alert level will be, when it threatening that the yacht is becoming to fast.
  Why not slow down in this case?
  Therein I follow Dashew` s and Bobby Schenk` s arguments.
- In Running - irrelevant if decelerating or not – it is necessary to steer the boat.
  At some point the small crew will get to their limits.
  What next?
  In the long run it cannot be the right tactics to stand at the helm without a predictable end,
  no matter wether heavy or light displacement yacht.

Which possibilities remain?

- Lying a-hull?
  From that I shy away. I still can hear Dashew all too clear:
  „If the waves are not breaking, lying ahull is fine. If they are breaking, monohulls are asking for a rollover."
- Running under use of autopilot or wind vane?
- Are there other possibilities?

Let` s turn to the aids.

- - - - -

V Auxiliary Means

Best and most simple would be if one could disembark.
"Life" is promised by ...

- **Life rafts**

„Life rafts clearly failed to provide the safe refuge which many crews expected."

... because of the promise which is present in the promotional designation.

"Seven lives were lost in incidents associated with rafts of which three were directly attributable to the failure of the raft
and the yachts which these seven people abandoned were subsequently found afloat and towed to harbor."

(Fastnet-Report)

If these seven people would have ***remained on board*** they (probably) would ***not*** have been ***drowned.***

- **Autopilot**

Meanwhile autopilots became the norm in the sailor`s sphere. Corresponding battery banks and means to generate energy are necessary.
(For that reason alone I favor the wind vane.)

Abby Sunderland used several autopilots while trying a circumnavigation in an Open 40.

Jessica Watson applied a wind vane plus autopilots on her S & S 34.

In heavy weather both had controlled their yachts by autopilots; both retreated into the cabin.
Probably it is handled in a similar way at all long-distance singlehanded races.
Abby Sunderland suffered a capsize, Jessica Watson nearly.

- **Windvane**

Not every ship is suited in the same way for a vane.

Wilfried Erdmann

"It was essential for me that KARHENA NUI stayed maneuverable even at high speed, that she followed the movements of the rudder.
To this end a boat has to be built light, that it has a flat stern which is lifted when surfing."

Therefore when designing KATHENA NUI Mr. Dübbel equips her with a narrow stern. (Translated)

Dashew

"In heavy weather you have to be able to control the boat while it is being buffeted by wind and sea.

If your hull design has the capacity to handle heavy-going downhill with minimum risk of broaching,
then your selfsteering will be able to do a better job."
"Beam-to-length-ratio is the first criterion.
The longer and narrower the hull, the more directionally stable it will be and the less tendency it will have to change course when heeled."

Erdmann
"Normal storms – with windforce around 8 Bft – I mostly weathered in the cabin."
That means, the Aries has been steering.
"Even in moderate gales she was working – indeed with deviations from the course up to 30 degrees."
In the Agulhas-Gale he had to entrust the yacht willy-nilly to the windvane, because there was no alternative.
"Moreover I fear to be dragged out of the cockpit by a breaker and washed into the sea.
I engage the mechanical selfsteering again and move hand over hand into the cabin, lie down on the floor and stiffen."
*(*Homepage, link to spiegel.de; translated)
In this inferno the vane of the selfsteering has been smashed.

Result
Wilfried Erdmann has not been rescued by the windvane.
This device however is helpful in the "lower" windforces. Erdmann had to steer by hand starting at ~ 9 Bft.

At our cruise to Iceland I myself experienced similarly the same (my yacht: 37 ft, modern cruising design, well steerable, 7 t).
With more than ~ 9 Bft the Aries had been overstrained with particularly steep and high seas.
I had to enter the cockpit, the Aries remained engaged.
When there was approaching a particularly high wave I turned the wheel while the Aries was engaged and put the yacht on a closer reach.
The engine always has been running in neutral.
Not to be pushed back by the breaking crest I could increase the energy of the ship by speeding up.
I have been demanded approximately for 5 hours , what I could stand.
I think that Bft. 9 to 10 could have been controlled in the same way.

- **Parachute Anchors**

In German there is only the term "sea anchor", namely for
"a bag made of canvas in the shape of a cone respectively a truncated pyramid."

(Claviez, "Seemännisches Wörterbuch"; translated)
... which is deployed from the bow or the stern and which holds the yacht as if she lies at anchor.

Modern drift anchors are like parachutes. In theorie they hold a yacht against the oncoming waves with her strongest part, the bow.
Nevertheless nearly all the authors reject the classic sea anchor as well as the parachute anchor.

There are reasons:
- When a yacht is kept in a seaway almost unmanageable powers are generated by the forces of the sea,
  which try to push the vessel away against the drag of the parachute anchor.
- At anchor every yacht is swinging, at parachute anchor, too. That may add up to 90 degrees to the direction of the waves.
  If a breaker hits the ship in this moment the yacht has no chance.

Only ***Lin*** and ***Larry Pardey*** ("Storm Tactics Handbook") are well-known proponents of the parachute-anchor,
which they deployed from the bow. They placed their yacht at a kind of bridle behind the parachute anchor:
one rope led to the bow the other to the stern. In this way they could influence the angle of her yacht to the seas.
It seems that there has not been the above mentioned swinging of the yacht.
That`s exactly why people are amazed (e. g. Hal Roth).
Theoreticians suppose, that this effect was provoked more by heaving-to (slick created by their full keel yacht) than by the parachute anchor.
It may well be that parachute anchors which are deployed from the bow are more suitable for vessels,
which turn their bow to the wind, e. g. for big motor ships or fishing vessels.

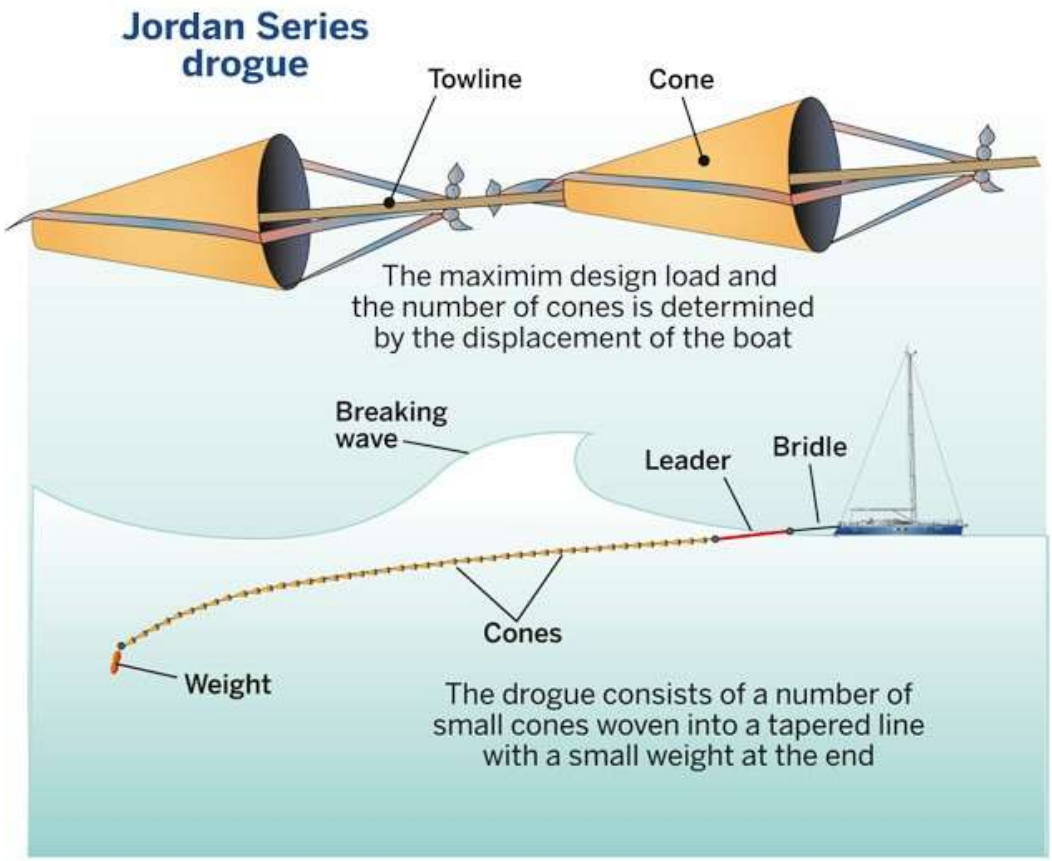
- **Drogues**
  - ***Galerider***
    Look above.
- ***Don-Jordan Series Drogue***
  Hal Roth:
  "The Jordan Series Drogue® (JSD) is the best of the lot in my judgment."

This device I would like to discuss next.

- - - - -

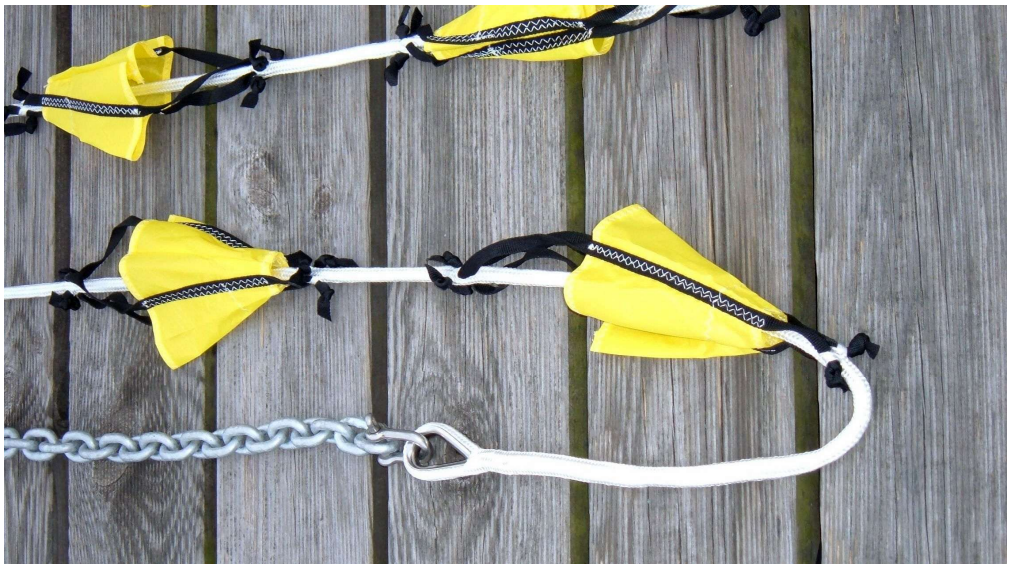
VI Don-Jordan - Series - Drogue (JSD)

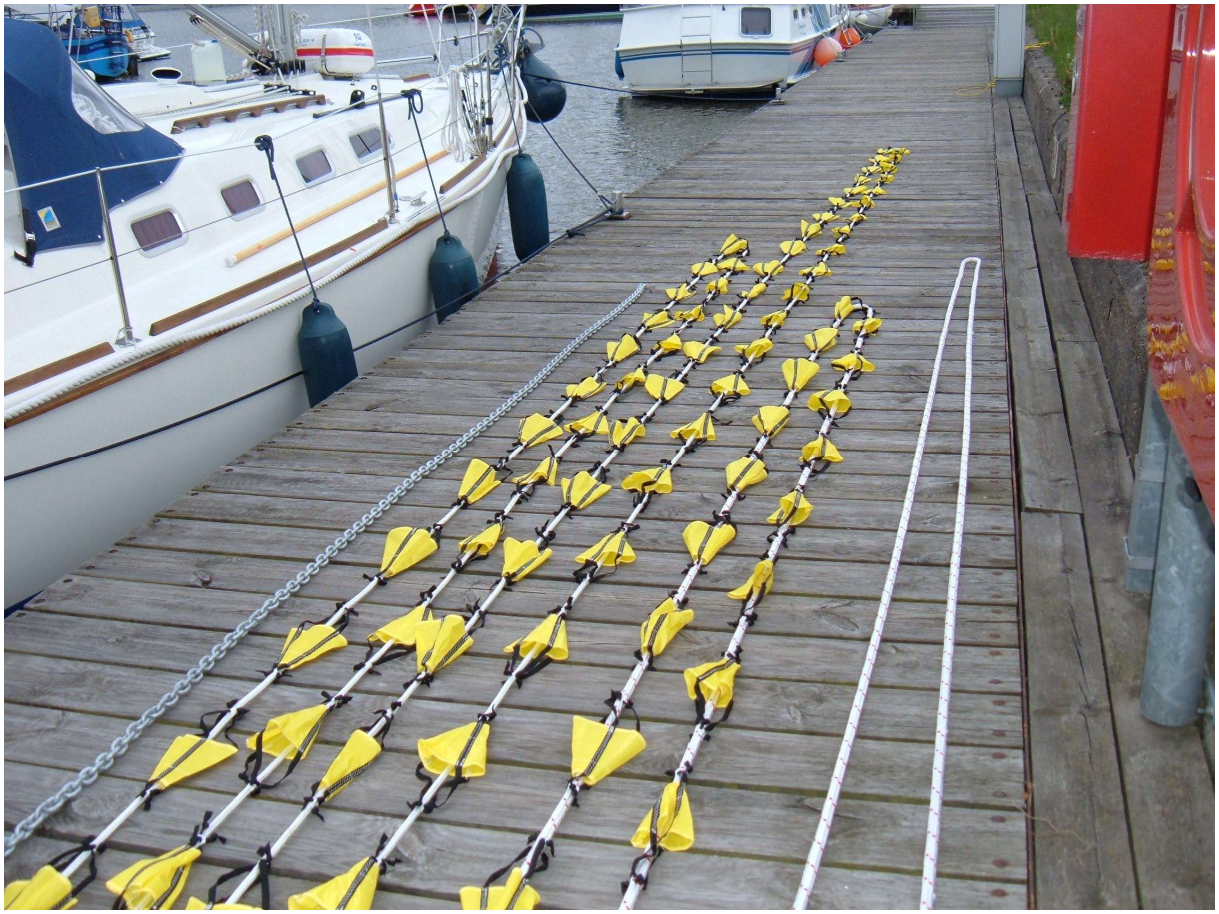
The word "series" reflects the construction: a lot of conical tubes like School Cones made from canvas are sewed together.
They are open on both ends and fixed at a strong cable at intervals of ~ ½ m the way that the cable runs through both openings.
The cable gets a weight at the end in order to keep the systems under water and to maintain tension.



https://keyassets.timeincuk.net/inspirewp/live/wp-content/uploads/sites/21/2015/04/Storm-Sailing-Drogues.jpg

The following fotos are taken from my equipment.





The number of the conical pieces complies with the displacement of the yacht. Between the stern of the yacht and the cable fitted with cones there is lashed a "rein" consisting of two ropes which form a "V".

The JSD has been designed for the worst situation namely when a breaker wants to toss the yacht into the trough of the wave,
then rolling her over.
(What happens when a yacht is thrown into the trough I tried to describe in "Brecher & Yacht"; on this website).
The JSD prevents this.

But it is also possible to use the JSD as a conventional device to slow a yacht down (similar to the Galerider e. g.)

Thus the JSD performs **two tasks**:

1) ***Reduction of Speed***

Like other drogues the JSD reduces the speed of the yacht to ~ 2 kn.

In comparison to the Galerider the JSD has a decisive advantage: ***nobody*** has to stand ***at the helm.***

The yacht is held with the rear against the oncoming seas.

According to reportsi n the interior of the yacht the rising and falling of the yacht feels "like bunjee jumping".

2) ***Prevention of Capsizing***

When a yacht is ***catapulted*** by the breaker ahead in wave direction the JSD is ***lassoing*** her, straightening her and ***putting her***

into the water again.

Maybe the process is a little bit comparable with the decelerating of a jet fighter when touching down on board of an aircraft carrier.

In the following I only talk about this second function.

In

"Research and Development Program"

Donald Jordan describes how he proceeded in the development of his invention.

His fundamental considerations (shortened):

- *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.***

- *The drag device must be a drogue, i.e. the boat must be tethered from the stern. ...*
- *A sea anchor cannot be designed to protect the boat. When tethered from the bow, The boat will yaw and develop unacceptable loads. ...*
- *The strength of the drogue and the number of drag elements must be adjusted to be compatible*

with the displacement of the specific yacht.

- *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."

(www.jordanseriesdrogue.com; in: Technology)

The **American Coastguard** made themselves available for the practical tests of his new development.

The

***Coast Guard* – Report (DG-D-20-87)**

... has been published under the patronage of this organization.
The report describes how the JSD works, comments the tests, includes tables about the loads,
the number of the necessary cones, size of the cables.
Furthermore it gives instructions how one could make the JSD himself.

Donald Jordan did not apply for a patent: Every sailor may copy the JSD according to the details of the Coast Guard Report.
The internet provides additional informations.

Herbert Weingärtner and Wolfgang Quix
... capsized with ***JEANTEX III*** - maybe you remember - when beating to weather; the cause has been a wall of water of 17 m.
A similar fate was experienced by Mr. and Mrs. Wilts and their crew on ***FREYDIS***.
Every yacht will be rolled by freak waves like that, regardless of which underwater hull and unimportant which storm tactic the yacht has been using.

Donald Jordan
... analyzes the sinking of the ***WINSTON CHURCHILL*** in the Sidney-Hobart-Race caused by a similar rogue wave.
This yacht has been a Sparkman & Stevens – Design, built from wood, 25 t. The "Winston" has been jerked into the wave trough by a breaker.
There she has been smashed when impacting the water.
Jordan`s drawing could possibly reflect the proportions of the wave which hit *JEANTEX III*.
These designs show the Winston with JSD:

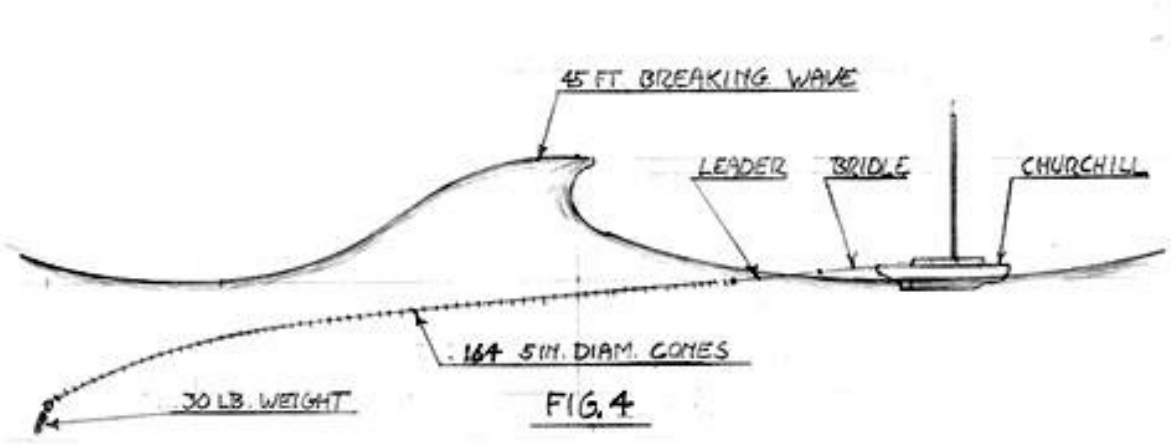
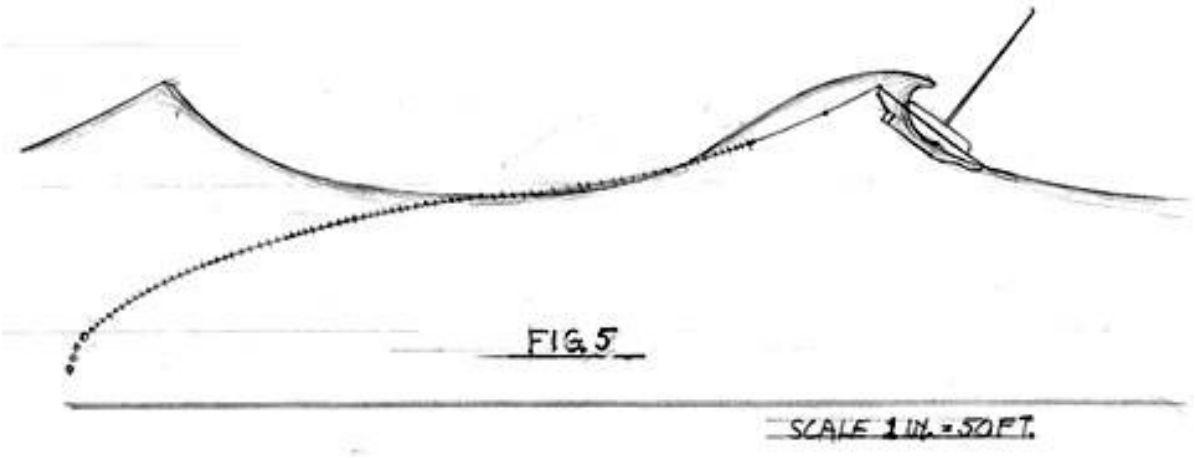


FIG. 4

In addition one has to imagine the speed at which the wave moves forward: 21 kn (if the sea developped from a superposition of two waves each of them at a height of 26.5 ft).
A wave of 26.5 ft has a period of 7 sec. That means that a ship (as above in the trough)

finds herself below the breaking crest
within 3 sec.



Would the Jordan-Drogue have defused this situation?

Yes,
... **if** it is true, what Jordan affirms ...
"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."
... and **if** the Racing Committee would have demanded a JSD in the equipment prescriptions.
... and ***if*** the crew would have deployed the JSD which is highly doubtful during a race.

Cruising sailors rather than racing crews would do everything possible to guard against a menacing situation and deploy the Jordan-Series-Drogue.

I recommend as reading:
Donald Jordan, "The Loss of the Winston Churchill" (www.jordanseriesdrogue.com)
Realizing how much technical know-how there is in the analysis of the disaster and in the conceptual design of the JSD
the healthy scepticism at first against any kind of promises may turn into a cautious "perhaps".

It is worth noting that ***Dashew*** changed his former critical position against the JSD.
Now (2015) first of all Dashew designs big motor cruising vessels.
His notes on his website regarding storm tactics may refer primarily to these ships. But they are worth reading for sailors, too.
Here are his comments referring the JSD:
"We can foresee two types of drogues being used.

In severe but not survival conditions we may want to deploy a simple drogue like the Gale Rider.

This will hold the stern more or less into the seas, and allow us to move forward at anywhere from four to eight knots,

with control of our direction still under the command of the autopilot or one of us.

The second situation could occur in survival weather – absolute horrendous conditions – with the boat disabled,

in which case our choice would be the Jordan Series Drogue."

(www.setsail.com/heavy-weather-issues)

Dashew is one of the most renowned designers in USA today. He wrote the most important book about stormtactics.
There is no greater honour if he recommends something.
Dashew equips his vessels with Galerider as well as with JSD. - Why not!

My conclusions relating the JSD
I think that the JSD ...

- can help an exhausted crew in heavy weather conditions.
  It is not necessary to steer the yacht by hand, when the JSD is deployed.
  At the same time the position is kept, at least to some extend.

- opens up a viability to a yacht being in a dramatic situation with uncontrollable breaking seas.
  To the full keel yacht as well.

- Indeed there are heavy loads, when a sea is breaking over the yacht`s stern.
  With GRP-yachts maybe there are some reinforcements necessary to absorb the forces.
  Further informations in:
  Jordan Series Drogue - Upgrade of the Sailing Vessel (on this website).

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Suppplement 5/2019
Susanne Huber-Curphey
... in interview after 251 days at sea singlehanded (Hobart, Tasmania), after 33.043 nm without contact to land:

"The enormous braking effect of the Jordan Series Drogue ensures that an uncontrolled surfing or a knockdown
will be prevented in dangerous breaking seas.

It is not possible, that yachts will broach and subsequently will be rolled including a nearly inevitable dismasting.
I take the JSD for my life insurance. ...

The JSD is dragged astern. It offers a number of unique advantages which are not attained by other drogues or the dragging of ropes.
There is no sudden tug because the JSD consists of a large number of small funnels. One cone after the other takes the load. ...
In case of the vulnerable rudder blade the flow of water permanently will come from the safe side because the boat always is moving forward.
The principle of the JSD even works when wind and seas are from different directions. ...
It really is regrettable, that there is so little knowledge about the JSD in Europe. Definitely it saved my life more than once."

"Emotiionally it was very charging to me when two participants of the Golden Globe Race in 2018 had been capsizing
not far from our position in a gale.
They lost their rigging.
NEHAY (note: her yacht) *as the nearest boat was lying absolutely safe behind her Jordan Series Drogue in windforces up to 11 Bft*
whilst at the same time the Indian skipper Abhilash Tomy has been in his berth, hurt and nearly totally paralyzed."

(The whole interview in: segeln 5/2019; translated)

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VII Stormtactics - Summary

1) Full keel yachts

Dashew prefers the fin keel yacht. His positive assessment of this type of yacht may be the result of it and it makes understandable his devaluation of the full keel yacht.
The big full keel yacht produces enough ***slick***.

The classic full keel yacht is able to heave-to.
For a very long time and up to high windforces.
That compensates a lot of disadvantages.

In the case of Helmut van Straelen it has been 12 Bft., maybe more.
Helmut estimates the height of the seas up to 10 – 12 m (in comparison to his mast of 19.80 m).

"When night began, when the gale augmented and the seas have been starting to break I believe

that it has been 1 – 2 m
more." (Translated)

(Draft of the "Skorpion" in: Appendices)

However:

Sufficent slick is not produced by every full keel vessel when hove to.

The problem results from the fact that it is not known whether it is possible to conclude from one full keel yacht to all types.
One should contact the designer, the dockyard, other sailors of long keel yachts, sailing associations ... in order to ask
whether the own full keel yacht is able to heave to and up to which height of wave.
The alternative is to approach the problem by trial.
Those who don`t want to take a risk will not heave to but will act like in 3) (look below).

Passage of a cold front
During the passage the direction of the wind changes; cross seas will develop.
When hove to the bow should bisect the old and the new wave direction.
Valid for the **northern hemisphere**:

- If the passage of the ***low*** is in the ***N*** of your position the wind changes from ~ WSW to ~ NNW.

  Heave to on ***port tack*** !

  The yacht turns with the wind. When she has been on S-tack at first, now the bow will point to ~ NW.

  Now both swells encounter the yacht more or less from ahead.

  But not from aside or from the back quarter. – This would be the case when the yacht would heave to on starboard tack.

- If the passage of the ***low*** is in the ***S*** of your position:

  Heave to on ***starboard tack*** !

For the ***southern hemisphere*** everything is mirror-inverted.

But if **cross seas** are generated under conditions like the ***Fastnet Race*** (Bft 10) heaving-to probably would be wrong for the full keel yacht as well.
Jordan however claims to have developed a rescue system just for such conditions.

2) Fin Keel Yachts
(to be more precise: **"well controllable yachts"**)

They don`t produce slick or ***too less.*** Therefore these yachts have to apply different techniques, beating e. g.
But in the end the yachts have to ***run***. Then high and sustained concentration is

required. That is why Dashew recommends for cruising sailors to heave to as long as possible with the view to the crew to rest and to draw strength.
The situation is exacerbated further during the **passage of the cold front**. The wind vane now is unable to cope with. Now at least you have to steer the fin keel yacht manually. From a certain wave height respectively wind force the yacht starts ***surfing***. I would trust Erdmann: a racing crew may handle speeds like that, but not cruising people.
It becomes imperative to reduce speed.
Galerider or ***JSD***
... are now the means of choice to the current state of the art.
The JSD has the additional advantage that nobody has to steer the vessel.

The JSD is a last option for all yachts.

3) Less Controllable Yachts

Yachts which cannot heave to and which are not excellent controllable have to reduce their speed if hull speed is exceeded.
If conditions become even worse only the JSD remains again.

The new option: the JSD

For all categories of ships the Don Jordan Series Drogue represents a new final weapon against the forces of nature.
That is implied by all younger authors if you leave aside their cautious vocabulary and take as valuation the sequence in which they describe.

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VIII Injuries

Dr. Jens Kohfahl, physician, sailor, author ("Medizin auf See"):
„Besides the strategy itself concerning the course of the ship and the sails
the safety and the physical integrity of the crew plays an equally important role.
Many reports based on experience describe how objects and persons fly through the air during a capsize
and members of the crew have been injured severely.
On every boat one can improve a lot in seaworthy securing and stowing of moving parts.
...
Not only batteries should be lashed adequately but also tools, victuals, stove, floor boards, cupboards, drawers etc.
One needs not to be badly hurt, a broken hand will do and one is no longer fit for action.
Therefore the persons below deck must have possibilities to secure themselves (e.g. harness systems, studding sails, handrails).
Watchkeepers on deck have drowned because they couldn` t get rid of the lifebelt at the inflated life jacket and below the capsized ship

(there are snap shackles, which can be opened under load).
And there are many head injuries, also leading to death, which could have been avoided by wearing a protective helmet.
We should perhaps also get used to the idea of wearing a kayak helmet at least in bad weather and especially
when working on the forecastle.

(in: TO 2008; translated)

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IX My Roadmap

Our yacht ***SUMMERTIME*** is a "Van de Stadt Design – Forna 37", a modern design with moderate keel and spade rudder,
well controllable according to Dashew.

- **Up to ~ Bft 7** (more precisely: up to a wave height which roughly matches the beam of my ship)
  … I would ***maintain the course***.

- **Bft 8**
  It is important not to sail beam-on to the seas.
  I would switch to running or to beating.
  Upwind course:
  - Storm jib on the cutter stay, 3rd reef in the main,
  - using the selfsteering as long as possible,
  - somebody near the helm, who takes the wheel if necessary,
  - maybe with additional support of the engine

  Running:
  - steering manually
  - main with 3rd reef or stormjib only

- **Bft 9**
  Upwind course
  - main only, 3rd reef
  - steering manually,
  - with additional support of the engine,

  … as long as the seas permit.
  Running
  - under storm jib solely

- **With fatigue** or …

- in wind force of **10 Bft** and more
  ... I would deploy the ***Jordan Drogue***.
  At the same time:
  - ***retreat*** of the crew into the ship, ***close off*** the vessel, the crew ***buckling up***, ***safety helmets***
  - reporting the position on ***VHF:*** *"Restricted in manoeuvrability"*

One should consider the possibility of a **rogue wave**.
The sooner you deploy the JSD the better.

- - - - -

"It wont work without guardian angel !"

... my friend Klaus states.

- - - - -

Appendix

1) Fastnet-Report 1979
(https://keyassets.timeincuk.net/inspirewp/live/wp-content/uploads/sites/21/2019/07/fastnet-race-inquiry.pdf)
excerpts, shortened

Mo, 13 of August
In the sea area "Fastnet" the wind has been blowing from the S with 30 – 40 kn in the afternoon.
During the passage of the front the direction of the wind changed to W while the wind force increased to 50 kn (Bft 10).

Tu, 14 of August, 0400
Culmination, wind force approx. Bft 11. The emerging wave system is superimposing the old swell.
Wave heigths: *„If one accepts the validity of yacht reports of force 11 and over it might have approached 14 meters (46 ft)."*

Altitude readings of heights are averages. The highest waves probably have been twice as high (20 m) with almost vertical walls
and moved forward at an average speed of 60 – 75 km/h.

A disaster occured: 23 ships have been abandoned, 5 ships sunk.
15 regatta participants and 4 of the rescuers died despite the deployment of all rescue teams available.

It was not possible to draw conclusions concerning the efficiency of the different survival tactics which have been adopted.
This is shown in the following table:

Excerpt of Table 4,8 SURVIVAL TACTICS

Survival Tactics Adopted	Number of Yachts	Knockdown/Capsize
Heave to	26	3 (12 %)
Lie barepoles	86	18 (21 %)
Run off barepoles	57	12 (21 %)
Stream warps	46	10 (22 %)

„Others have reported ... (Remark: The Fastnet-Report is based on an inquiry.) ... *that at the height of the storm there were some waves*
which were of a size and shape such that there was no defensive tactic which would prevent them from rolling or severely damaging a yacht
caught in their path."

The conclusion which the authors draw:
„No magic formula for guaranteeing survival emerges from the experiences of those who were caught in the storm.“ (4.14, S. 36)

Four replies, which reveals how helpless one can be:

- *"Two bad knockdowns while hove to."*
- *„Rolled and dismasted by exceptional steep wave. The sea was very confused and the actual angle of approach of the wave*
  was impossible to judge."
- *“Lay a-hull for half an hour, then rolled over by a wave which would have capsized us whatever angle it had approached from."*
- *"Ran directly before waves for several hours, but then rolled over when caught by a cross sea which appeared from nowhere."*

(Fastnet Race Inquiry, 1979, pg. 36)

2) Persons

Olin Stephens

Besides Nathanael Herreshoff he is the most important American yacht designer of the last century,
was founding member of Sparkman & Stephens (S & S) and designer of successful yachts (in transatlantic races, Fastnet-Race; Nautor`s Swan).

Donald Jordan

... inventor of the JSD (Don-Jordan Series Drogue) and aeronautical engineer during the Second World War
was involved in the development of aircrafts which are able to take off from air craft carriers and land there again.
Himself a sailor he has been shocked by the Fastnet disaster. He started reflecting how yachts could resist weather and sea conditions like that.
By using methods and tools of modern engineering he developed the JSD, something like a brake which is deployed from the stern,
consisting of a large number of cones from canvas on a long rope.
The US Coastguard made itself available to perform the practical tests.
Everything of significance has been published under their auspices in the so called ***Coastguard - Report.***
Jordan`s new findings and his conclusions are to some extent in contrast to the axioms of famous sailors.
Donald Jordan died in 2008.
His texts are available on: www.acesails.com and www.jordanseriesdrogue.com.
There you can find the Coastguard-Report from the year 1987, too.

Steve Dashew

... is one of the outstanding yacht designers in America of today.
He is sailor, designer, theoretician, author - at the same time.

"Steve and Linda Dashew have been sailing together for 40+ years.
They courted on small racing catamarans in the 1960s.
In 1975 they moved up to a 50-foot monohull for what was supposed to be a one-year cruise through the South Pacific.
As sometimes happens, plans changed, and it was six years before they came back to land.
During their circumnavigation Steve and Linda home-schooled their two young daughters,
built several advanced cruising yachts that became the foundation for a successful design and construction business,
and wrote the first of eight books about life aboard and ocean seamanship.
In the past 25 years, over fifty of their yachts (Deerfoot, Sundeer, Beowulf, and now the FPB series) have been launched.
They have cruised more than 250,000 miles.
Their most recent yacht, FPB 83 Wind Horse, is a groundbreaking 83-foot (25 m) ocean-crossing motor yacht
in which they logged over 50,000 miles in five years." (www.Setsail.com)

I consider Steve & Linda Dashew`s ***"Surviving the Storm"*** (1999, 662 pages) the most important reference book concerning heavy weather sailing.

Among all authors Dashew argues the most clearly. He particularly knows to explain how design features affect the sailing behavior of yachts.
The quotations refering sailing tactics come mainly from the chapter "Choosing the Right Tactics".
In ***"Offshore Cruising Encyclopedia"*** ([4]1999, 1232 pages) Dashew deals profoundly with design and equipment of seegoing yachts.
Both books are available via www.Setsail.com

Wilfried Erdmann
Wikipedia:
"From 1984 to 1985 Erdmann sailed non-stop and alone around the world in West-East-direction ... with KATHENA NUI,
an aluminium design (type Nordsee 24), shipyard: Dübbel & Jesse (Norderney) ...
In 2000 and 2001 he succeeded in a solo circumnavigation non-stop westbound, that means against the prevailing westerly winds.
He was the fifth sailor worldwide who did this.
..." (Translated)

There are drawings and pictures of *KATHENA NUI* in several books of Erdmann and on his homepage.
He contributed the lines plan in ***"Segeln mit Wilfried Erdmann"***. In this book he comments on all relevant offshore cruising issuues.

Helmut van Straelen
... took charge of the needs of the German circumnavigators for a long time as webmaster of Trans-Ocean (the German ocean cruising club).
His yacht *JOSEPH HAYDN* is a steel vessel of the type ”Skorpion III A” (14 m, 20 t), built by Feltz-Werft, Finkenwerder.
During his way back from America to Europe while crossing the Gulf Stream he got into a hurricane with wind force Bft 12, perhaps more.
With his big full keel yacht he hove to after running off having been on the helm for 24 hours.

"Beidrehen? ... Im Orkan?" is a substantial contribution about seaworthiness of full keel yachts (on this website).
I verified Helmut van Straelen`s assertions.
The NOAA (National Oceanic and Atmospheric Administration) of America confirmed his statements by isobar charts,
records of the weather buoy 41001, reports of ships.
(Further details in "Verifikation" at the end of "Beidrehen? Im Orkan?", on this website)

Herbert Weingärtner

... has been the long-standing partner of Wolfgang Quix, initially at *JEANTEX III*, later at *WOLFIE´S TOY*.

JEANTEX III has been an OPEN 40, LOA 12.19 m, B 3.0 m, displacement 4 t, draft 2.85 m, built by Wolfgang Quix himself and friends according to the West-System in a Bavarian farmyard in 1984. (www.die-weingärtners.de)

Barry Pickthall

... is a sailing journalist.

He has been coastal manager of Cornelis van Rietschoten`s successful second Whitbread Round the World Race - campaign with FLYER.

In "Blauwassersegeln manual" he is handing down his experiences of his "Challenge" - Regattas round the world.

"Our aim was to make available a well-researched book to those sailors who want to participate in an ocean-race or want to go to sea." (Translated)

The couple ***Erich*** and ***Dr. Heide Wilts*** (SY *FREYDIS*)

... is the most renowned long term sailing couple of Germany.

They repeatedly sailed around Cape Hoorn, made circumnavigations and extreme voyages into Antarctica.

(Further details on www.freydis.de and https://de.wikipedia.org/wiki/Erich_Wilts

In 2017 they succeeded in sailing through the Northwest Passage from W to E with changing crews.

Erich Wilts died in Dec. 2022.

Dr. Ing. Wolfgang Sichermann

Head of Research and Development - Thyssenkrupp Marine Systems GmbH, Technische Universität Hamburg-Harburg

Patrice Geffroy

French author, composer and sailor maintaining a website which receives high attention in France:

www.uneinvitationauvoyage.eu

He gave me a lot of hints concerning the actual cruising scene and links to blogs of other sailers.

Pattrice Geffroy has been translating "Stormtactics for Sailing Yachts" into French. "Quelles solutions pour affronter la tempête?" is available on his website.

Susanne Huber-Curphey

German single-handed and extreme sailor:

- Northwest Passage 2017 as the first woman; from W to E.
- Longue Route 2018/19 (non-stop round-the-world race, single-handed); 251 days, 33.043 nm
- Longue Route 2023/24, the second time; 270 days, 33.532 nm.

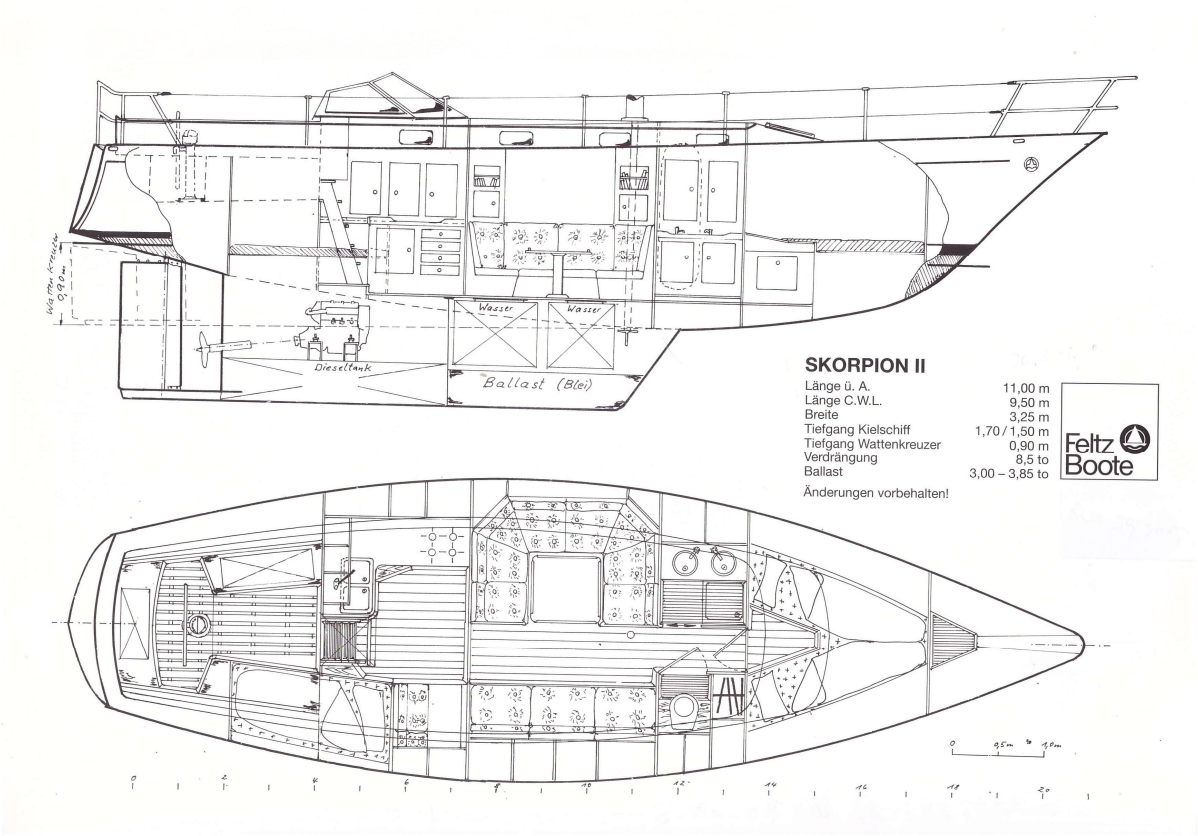
3) Interviews

... with ***Helmut van Straelen*** and ***Herbert Weingärnter***, in 2014.

I am friend of both; hence the informal way.

4) Elevations of long keel yachts

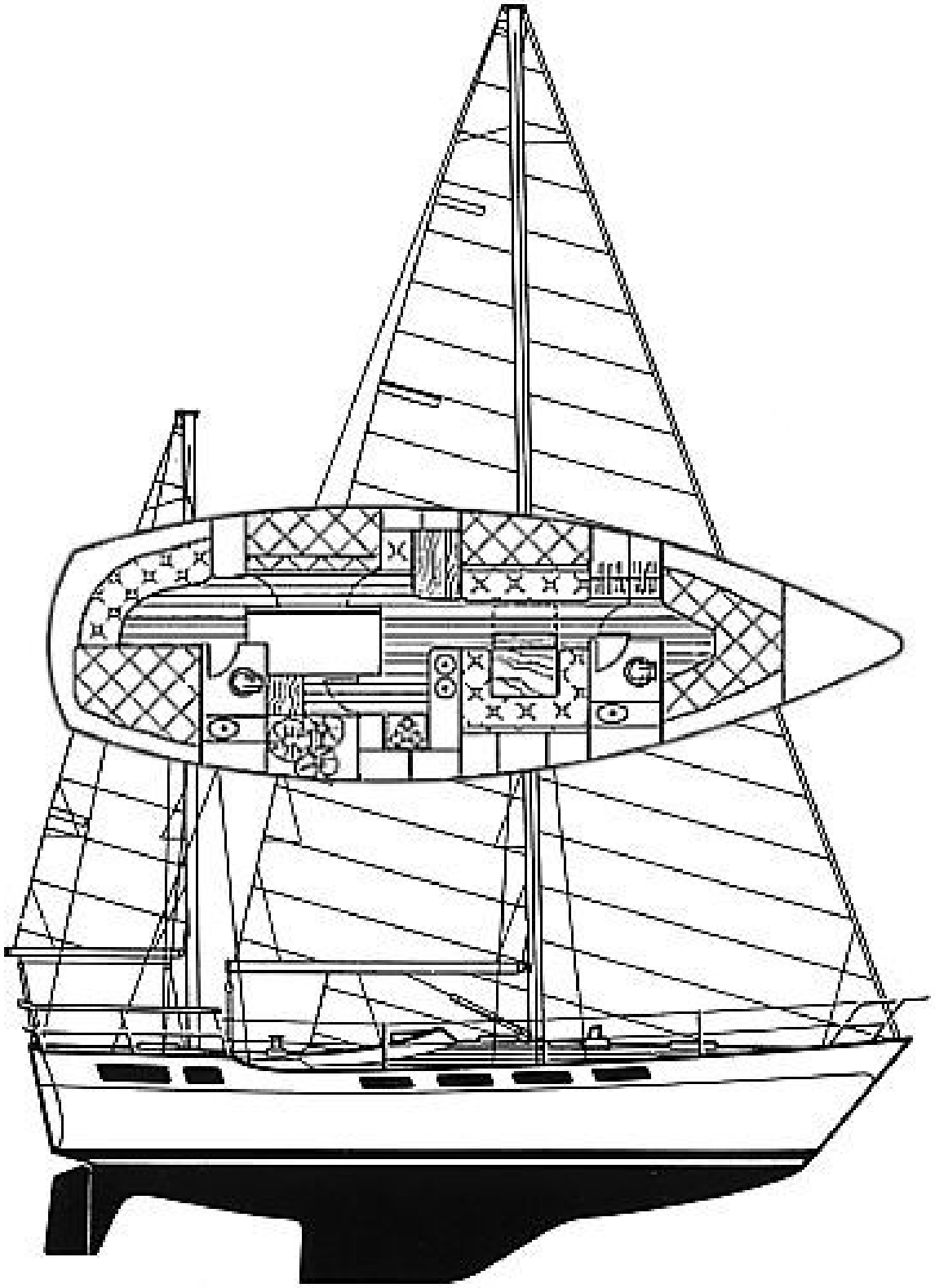
4.1 Construction drawings of **SKORPION II**



The plan of **Skorpion III** corresponds to that of the Skorpion II.

The dimensions: 13.85 m x 4.00 m, displacement: 14 t

4.2 Elevation of **Amphitrite 43** (13,03 m)



4.3 Bernard Moitessier`s **JOSHUA**

LOA 14 m, LOD 12.396, LWL 10.250, BEAM 3.760, DRAFT 1.620, Disp. 15 t, Ballast 4000 kg

(Specifications according to Moitessier, Kap Horn der logische Weg)

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Abbreviations

TO "Trans-Ocean" Periodical for members of the association of the same name www.trans-ocean.org

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translated into English, 2025

revised, 2026