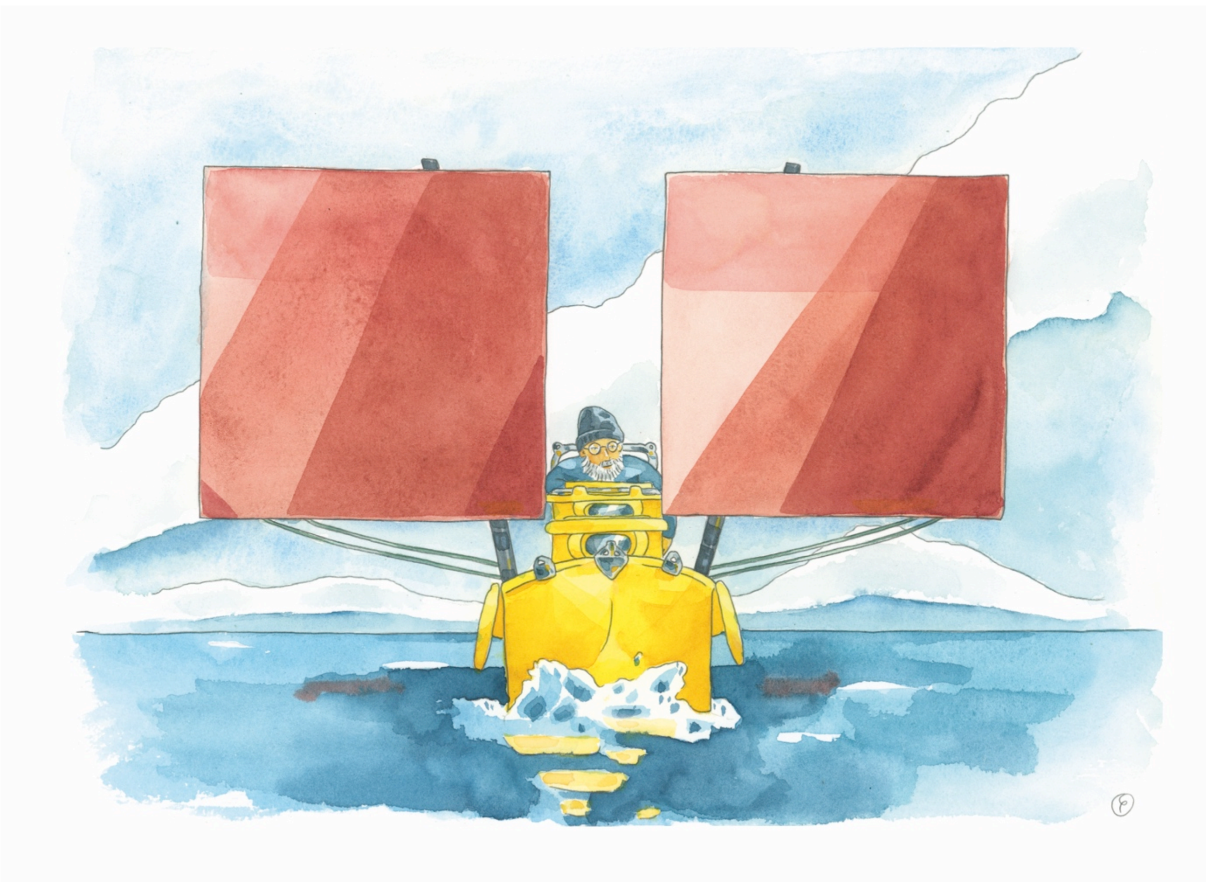
WITH FOUR SQUARE METERS OF SAIL AND ONE OAR

79 YEAR OLD IDEALIST PLANS A LONG VOYAGE IN HIS SMALL HOMEMADE BOAT



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THANK YOU

ATLANTICA FÖRSÄKRINGAR

BEPPE WEBDESIGN

BUMAX FÄSTELEMENT

DIAB DIVINYCELL

EPIFANES FÄRG

EXIDE BATTERIER

GARMIN ELEKTRONIK

HAMEL SEGEL

LAGERMETALL BRONSER

MARSTRÖM COMPOSITER

MEKONOMEN VÄSTERVIK BÅTGREJOR

NILS MALMGREN EPOXI

PYLADS PLÅT LIVSMEDELSGAS

TANSO KOLFIBER

TEUFELBERGER REP

UW-ELAST POLYURETHAN

VALVEA IT

CONTENT

1. THE DELUSION

Many people misunderstand life. They think comfort is happiness, but unfortunately, that kind of happiness only works in the short term because, like drug abuse and instalment purchases, it burns energy intended for your future well-being. Those who enjoy effortless comfort are constantly deprived of energy. They lose strength, become lazier and fatter, have less good health and are more easily bored.

If you want to feel well, it is better to start exercising than to buy a softer bed.

Rest reduces your energy levels. It's only by using energy that you can create energy and it is an abundance of energy that makes you happy and healthy.

It's this lack of insight that causes many people to waste much of their lives in the pursuit of increased comfort.

Modern man requires more and more comfort both at home and in the car. Sailors, too, want more comfort in their cruisers, but comfort cannot be combined with simplicity. And when life is no longer simple, it loses both beauty and joy.

The requirement for comfort makes the boats bigger and more complicated.

* * *

2. BIG BOATS ARE DANGEROUS

Large production boats are inherently dangerous. To make them safer by making the storage spaces lockable, installing waterproof bulkheads and flotation elements so that they become unsinkable and to make them completely self-righting is of course possible, but it is too costly and complicated to function commercially. However, small safe boats can be profitable to produce and practical to use because they have the laws of nature on their side.

I suppose it is in order to accommodate the boat industry that the EU bureaucrats in charge of recreational boats don't require ocean-going production boats to be designed to cope with storms.

Both bureaucrats and everyone else obviously realize the devastation that follows when a big boat capsizes. When such accidents are fatal there are no survivors who can testify as to what happened. But there are accidents where crew members have been able to save themselves against all odds and their stories make fascinating reading.

To read the books *Once is enough* by *Miles Smeeton* and *Hard seilas* by *Erling Tambs* is a good start.

You can continue with the books and Youtube videos depicting the *Fastnets catastrophy of 1979* and *The Sydney to Hobart Yacht Race Tragedy 1998*.

The above-mentioned texts and a lot of other documentation clearly show that the dangers and horrors to which large boats are exposed at sea are well known. Therefore, bureaucrats and politicians can't deny knowledge of them.

Stalin said:"A single death is a tragedy; a million deaths is a statistic."

Spirits and tobacco harvest the lives of millions of people. In the twentieth century one hundred million people smoked themselves to death. Their death was usually protracted, rarely painless. Compared to tobacco manufacturers, Stalin was a saint.

Our politicians approve of alcohol and tobacco sales even though they are fully aware that the products have been proven harmful.

The use of alcohol and tobacco is by nature harmful. Sailing the ocean, on the other hand, is a healthy leisure activity that can be enjoyed in a more risk-free way. Below I present some of my views in the hopes of bringing about a better understanding for small functional cruising boats.

* * *

When large boats collide or ground, they are significantly damaged. The reason is well known. The kinetic energy increase with the weight of the boat multiplied by its speed squared. For example, if you sail with the speed of 3 knots in a boat that weighs 1 ton and switch to a 12-ton boat that is sailing with the speed of 9 knots the living force becomes 108 times as dangerous.

A lot of objects are drifting around in the ocean, including thousands of containers, tree trunks from the great rivers, half-filled oil barrels and abandoned pontoon bridges, to name a few. In the same way as animals cause traffic accidents, containers and other things that are drifting around are a danger to big sailboats. There are also whales swimming around and several species are larger than most cruisers.

Since the impact energy of large boats in motion is so dangerous, it is neither practical nor economical to design them so that their hulls can handle collisions with drift goods and, since they are not fitted with waterproof bulkheads, they will subsequently sink.

Large boats, however, are naturally equipped with auto-inflatable lifeboats and emergency transmitters that can call for rescue via satellites.

* * *

When the wind pushes into the sail of a boat it starts to lean. Waves can make boats capsize. Stability is a boat's ability to recover its balance after it has lost it.

If the boat is properly constructed, the center of buoyancy moves faster than the center of gravity in the same direction as it's heeling. Then the boat will rise, or more correctly, the boat's center of gravity will rise in relation to the water's surface. The force created is the boat's stability. If this doesn't happen, the boat is wrongly designed and will capsize.

Think of it like this: The mast is like an iron lever that lifts a rock from a pit when the wind is blowing on the sail. The boat's center of buoyancy is the fulcrum of the lever. The designer's job is to ensure that the center of buoyance always is to the lee of the center of gravity.

When the boat is lifted, it gets potential energy. Nature is always striving for a state of minimal potential energy so when the wind's pressure drops or when the dangerous wave has passed, the boat uses the energy supplied to straighten itself up.

Although important, the EU doesn't require ocean-going boats to have positive stability up to 180°. Without that requirement, many manufacturers choose to give their boats a righting moment of no more than 120°. At that angle of heel, the boat will lose all of its righting moment. It will capsize and place itself in a stable upside down position.

* * *

Je suis né deux fois is a French book written by Alain Kalita, a young ocean sailor. The title of the book means *I was born twice* and reflects how he felt after his boat, which had been floating in an upside down position in the Indian Ocean for a long time, miraculously came back on even keel.

A wave had capsized his 10-meter-long boat. Alain was inside, standing on its ceiling. His only hope was that a big wave would straighten it up.

He waited an eternity. Although many big waves hit the boat that was drifting with its broadside against the wind, nothing happened except that the water inside the cabin kept rising. It reached Alan's knees. Hours went by. It reached his waist. Hours went by. Tons of water finally swirled around inside the cabin.

Alain wondered how far off his end was, how long would it take before he and the boat were going to sink.

Suddenly, when the water had reached his neck, the boat flipped over and straightened up.

Alain had barely managed to survive, but inside the boat there was chaos and the boat had lost its mast.

It was not, as you could be made to believe, the weight of the keel or a big wave that had straightened the boat.

No, it was the effect of the free water surface. When enough water had leaked into the boat and started moving back and forth, it created a kinetic force that eventually straightened the boat.

* * *

The stability range is not always better on racing boats, although they have deeper keels and higher ballast percentage.

On January 5, 1997, in heavy weather in the Indian Ocean, the boat *Pour Amnesty International* capsized. The captain was Thierry Dubois, who participated in a solo, non-stop race around the world, the Vendée Globe. The 60-foot-long and 6-meter-wide Open 60 boat with a draft of 4.5 meters ended up in a stable upside-down position.

Here is a description from Liz Byrski's: *Spectacular Australian Sea Rescues* from 1997.

The wind speed was around 70 knots, force 12 on the Beaufort scale: a hurricane, in other words. A number of times the boat had been hit so hard that the mast had touched the water. Eventually it broke and the pieces smashed a window. Tons of water entered the boat. Things that had been stuffed away got lose and began floating around.

Thierry got up on deck and managed to cut the rigging wires and dump the mast parts overboard as they threatened to break holes in the hull.

After that, he went to his cabin for a rest, exhausted.

The hurricane continued unabated the entire night.

The next day, the boat capsized and ended up upside down, despite its deep heavy keel.

The waves were enormous. Thierry calmly put on his survival suit. He trusted that the waves that had capsized the boat would soon straighten it up again. I can tell the ones of you who are land lubbers that sales people have been given sailors the false impression that when a boat with a keel capsizes, it will immediately return to its upright position.

A lot of water had poured in and after two hours the boat was still upside down, much to Thierry's despair.

He decided to send an emergency signal from the outside because he was uncertain whether the signal could penetrate the hull, which was probably built of carbon fiber.

He prepared his life raft and went out through the emergency exit in the stern.

He managed to climb up to the rudder and attach himself to it. There he triggered the emergency transmitter.

As he turned around, he saw to his horror that the lifeboat had been torn off and was drifting away with the rescue equipment.

The situation was now precarious. In addition, huge waves kept pushing him off the slippery boat bottom, but he managed to fight his way back again.

Long before he had counted on it, he saw a rescue aircraft. It came in extremely low and threw two lifeboats tied together with a rope into the water. The idea was that they would drift toward the boat so that Thierry could reach them, but it failed since the boat was drifting faster than expected.

The plane made a new attempt but also this time they ended up too far away.

He assumed that this was a last attempt. Desperately, he jumped into the water and succeeded, against all odds, to reach the life raft. When he entered it, it turned out that it was so damaged that it was sinking.

He had to start swimming back toward his own boat. It was not easy in the storm and the airplane had had to leave him to his destiny.

After half an hour of swimming, fighting the waves, he finally reached his boat. Fortunately, a new aircraft arrived and released another life raft. This time everything worked out.

The plane made a turn and came back and released a radio transmitter that he managed to catch. Now he could talk to his rescuers.

On January 9, after four days, Thierry was picked up by a helicopter that belonged to a rescue mission from Fremantle. He was by then extremely fatigued and almost dead due to the cold.

On the same mission, not far away, the Australian rescuers saved Tony Bullimore, another Vendée Globe sailor, whose boat had capsized. In this case the capsize had been caused by the loss of the boat's keel. Tony survived in an equally dramatic way.

Incredibly, a third boat, Raphaël Dinelli's, had also capsized. It had happened on Christmas Day a few weeks earlier. There were winds with hurricane strength then, too. What a lot of sailors don't know is that there is often worse weather in the southern part of the Indian Ocean than at Cape Horn.

The boat was lying upside down for three hours before it straightened up. During that time the broken mast had worn a large hole in the deck and the windows had been broken. Slowly the boat was flooded and threatened to sink.

Also Dinelli's lifeboat had been torn off. Pete Goss, a competitor who was 160 miles away, succeeded, at the last moment and after a 24-hour grueling beat, to save him.

* * *

It did not end as well for Gerry Roufs, an acquaintance of mine who participated in the same race. January 7 was the last time anyone heard from him. On July 16, more than half a year later, his boat was observed floating upside down, thousands of miles further away. Eventually, the wreck was found among the cliffs of southern Chile.

Although the boat's 4.5 meter deep keel, which was fitted with an over three ton heavy lead weight at the bottom, was pointing to the sky, the boat had such a huge negative stability that it was drifting around upside down for more than six months. Not even the enormous waves of the South Ocean had managed to straighten it up.

The death of Gerry Rouf and the dramatic rescue of Thierry Dubois, Raphaël Dinelli and Tony Bullimore forced the racing committee to tighten the rules. Nowadays, the boats must have a full positive stability range, i.e. to be self-righting after a full capsize.

For a big and wide boat to become completely self-righting, it's not enough to have a deep heavy keel, as many people seem to think.

The designers have solved this problem by arching the deck, which makes the boats float higher and more unstably in the upside-down position. In addition, the ballast keels have been made rotatable so that the sailor from within can move the lead weight sideways. This combination allows the boats to straighten up even after a complete capsize.

The race committee has tough but legitimate demands. A piece of paper with a lot of calculations on it is not enough. Nowadays, before start, every boat must perform a 180 ° rollover test to show that the system actually works.

These are well-known proven solutions and if the EU bureaucrats had used their power to increase the safety of sailors instead of meeting the interests of the boat industry, they would also have demanded that ocean-going production boats must successfully complete a rollover test before being put on the market.

* * *

The rig on large boats is a weak point. Therefore, a broken mast is a common consequence of capsizes.

As I will show below, the intrinsic ability of small objects to cope with great stress is due to the fact that a number of factors interact favorably. The same laws of nature act the opposite way on large objects and make them fragile.

Dimensioning a large boat's mast so that it can withstand capsizes would make it very heavy and expensive. I even want to go as far as saying that the task is impossible with regard to huge boats.

It follows that the smaller a boat is, the better its rig is able to cope with capsize.

* * *

In order to counteract the heeling moment of the rig, production boats are equipped with a deep ballast keel.

To safely fix a keel onto a small boat is a small problem but the stresses increase with the fourth power of the scale. That is, a boat that is twice as big experiences sixteen times as much stresses on its keel. The weight of the boat increases with the cube, i.e. 2x2x2 and the lever with 2, thus 16 times the stress, while at the same time reducing the strength of the supporting structure to half. The problem can be solved through dimensioning, but that is working against the laws of nature.

Some boats suffer from a swaying keel. This means that the keel moves sideways, leeward, when the boat turns. The phenomenon occurs because the plastic of the hull around the keel's attachment has softened, for example due to material fatigue. It's important to carefully check the keel because the fatigue can cause the keel to drop and the boat will subsequently almost always capsize. Many such accidents have occurred; some have ended in death.

In addition to a swaying keel, the keel can be lost due to a variety of other reasons.

Another thing about keels is that the lead lump, like tall masts, adversely affects the moment of inertia. This makes the boat's ability to respond to sea waves, much worse. The closer the mass is to the boat's rotation center the dryer, more comfortable the boat will be. In addition, it will reduce the boats resistance.

* * *

A common belief is that the larger the boat, the safer it is moving around on its deck, but this is a false sense of safety. It's harder to be connected to a lifeline on a big boat. Being on a boat's deck without a safety line is actually really dangerous, it just doesn’t feel like that.

Most of us wouldn’t dare to go out on a rock ledge with a 10-meter drop to the ground, especially not if it was swaying back and forth.

The difference between tumbling down a rock wall and falling off a boat without a lifeline is that the suffering for the person in the water is prolonged. Miracles excluded.

Despite lifelines on larger boats, incidents where people fall overboard occur. The high freeboards of larger boats often turn these incidents into accidents. To prevent this, it is important that the lifeline of the crew member is short, since it isn’t obvious how to get a person back on board, even in nice weather, despite the lifeline.

If there is a bathing ladder it’s placed in the stern and of what benefit is that for the person who has fallen overboard from the bow, where the crew is most exposed? Since large boats often move quickly, the person is frequently dragged under the water’s surface.

Not even a short lifeline provides complete safety for a sailor in a storm on the deck of a big boat.

If the boat capsizes, the sailor will be stuck under the boat that is laying upside-down and risk drowning. This happened during the Fastnet storm of 1979.

If the crew cuts his lifeline while he is in the water under the boat, he might be able to make it back to the surface, but how will he be able to return to his boat without a lifeline in stormy weather?

* * *

In 1967, the Baltic trader *Klaraborg* left Gothenburg for a sailing trip around the world. Outside Portugal the weather was nice. To shoot the stately ship, with all sails set, it was decided to tow one of the guys in a dinghy behind the ship by means of a long rope.

At first everything went well. The ocean was calm. But then there was a breeze. For the boat with its long waterline, the increase in speed was barely noticeable, but the rubber dinghy, which could not handle the increased speed, was pulled under the surface.

What could be done?

The boats ancient hot-bulb engine would take forever to get started and a big boat doesn’t turn on a dime.

They cut the towline. Relieved, the crew saw how the rubber dinghy re surfaced and how their mate happily waved that everything was OK, although the camera now was wet. But it took a long time to turn the big ship around and before they could make contact darkness came.

After a month, on a beach in Portugal, a stranded body was found, which, most likely, was that of the lost crew member.

That accident has carved itself into my memory, because at this time I myself was planning a long sailing trip to foreign countries. In addition, we had being hanging out with the same people down at the quay.

It was not hard for me to imagine how the guy in the dinghy felt when he was left alone on the endless ocean with his wet movie camera and it eventually became apparent to him that his friends would never come back and pick him up.

* * *

Big boats are divided into lots of small spaces, cabins, toilets, storage compartments and engine rooms. It limits the crew's ability to check for and fix issues with leakage, fire, corrosion and cockroaches.

* * *

To get a nice surface on the outside of a boat, production boats' glass fiber hulls are made in a female mold. The problem is that this process doesn't give the inside of the hull any marketable, acceptable finish.

The commercial, but not particularly weight-and-space-saving solution is to build a second hull, an inner hull, now on a male form, which brings the desired finish on the inside. The inner hull is mounted onto the outer hull, the two rough surfaces facing each other and voilà, you see only shiny surfaces. The problem is that the cavities that will arise due to technical compromises between the two hulls are impossible to access.

If the outer hull starts to leak, for example because of having hit something, it is impossible to find and seal the hole. A decimeter wide gap is enough to let more water in than any pump can handle.

The boat will sink.

To be able to save a boat that has started leaking, you must know where the hole is and be able to get to it. Unfortunately, this is impossible due to the inner hull.

* * *

Less dramatic is the fact that the inaccessible cavities between the inner and outer hulls are great places for cockroaches and other vermin.

How are you going to keep them clean?

* * *

As everyone knows, or ought to know, it's not considered good seamanship to try to be nice and use one's body power to try to prevent a larger approaching boat from colliding with a dock when its crew has lost control of it. A large boat's impact energy can cause serious injury.

* * *

During the great summer days when sailboats travel around our archipelagos, you can see that most of the big boats are using their engines or sailing with their engine turned on. Sometimes they use only their foresail, sometimes only their main sail. It's pesky to hoist big sails and big boats have big sails. A boat of twice the length requires four times the sail area.

Using an engine is more comfortable. Fuel cost is a fraction of the boat owners' other expenses. Owners of motorized sailboats don’t seem to have a bad conscience about destroying the environment or creating noise, either.

The power of the diesel engine is great, many times greater than the force achieved with sails.

Motoring is usually faster than sailing, and you don’t have to beat. You can go straight against the wind. A sailboat can even, thanks to the engine, travel when there is not wind at all.

Under those conditions, it is easy for the rational contemporary man to ignore the sail. He instead turns the ignition key and thinks he will do the sailing another time.

Traveling by motor doesn’t bring any sailing experience. As the sailboat owner becomes more and more insecure over time, he uses the sails less and less. This leads to a vicious circle and, ultimately, he will only use the engine, if he gets out of the harbor at all.

One can’t help but wondering. If you visit a sailboat harbor on a summer’s day with ideal sailing weather, you will see abandoned well-moored boats. Sailboats have become an unused status symbol, something to brag about, but nothing to actually use.

* * *

Climbing mountains is strenuous!

In the same way that motoring has replaced sailing, one could also modernize and make mountain sports more comfortable by means of cable cars equipped with pressurized gondolas. Restaurants and toilets would also be nice. A lot of effort could be saved when climbing Mount Everest. In addition, the climbs could be made significantly safer.

The current system where only well-trained alpinists, who through muscle power, supplemented with native carriers, can reach the top, is not really nice to the elderly and disabled. It's simply not democratic.

Well, the idea of the motorization of mountain sports was just a joke to show that engines have made people lazy, unchallenged, bored and sickly fat.

* * *

Feelings are nature's most mysterious invention. Nature has equipped us with emotions to guide us through our existence, to help us survive. Therefore, our brain rewards us with joy when we have been successful, when we have accomplished something difficult.

Letting the engine instead of the sail handle the progress of a boat doesn’t require any great skill. Consequently, using the engine brings neither stimulus nor joy. To move a sailboat by means of engine operation is the most boring thing there is. It’s no longer worth the effort.

Nevertheless, in some cases, for example for older people, an engine in a sailboat can be a good choice. It should then be an auxiliary engine to get in and out of narrow ports. One horsepower is sufficient, provided the boat is of reasonable size and that the propeller is large and slow-turning, since such a propeller brings many times more power than a small with a high number of revolutions.

* * *

Stories of long sailing trips with large boats sometimes sound like an endless list of troubles and repairs.

A large part of the crew's time in port is used for maintenance and in waiting for spare parts.

A small, simple boat, which lacks a lot of equipment and amenities, is gentle to itself and its equipment. It’s rarely affected by problems.

Rich people don’t have to worry about what a boat costs, but a big boat requires a lot of maintenance and there is a lot of hassle. That affects even the rich, because even though he has a full crew with a captain and mates down to the third degree, he is forced to wait for spare parts in remote countries.

* * *

It’s good to know that if you have a production boat and want to get a bigger one of the same type that is 26% longer, then it will cost you twice as much. It will require double the maintenance. Your annoyance and anger will grow proportionally. Strangely enough, most people choose a boat that is so big that their economy will be strained. It would be better to choose a boat that is 21 % shorter. You would then have the same amount as the boat cost left to buy other things.

No, I have no confidence in big boats, they attract greater forces; they are too unsafe and too expensive.

They are capricious, complicated. I don’t trust them. In addition, a boat that is 26 % longer than your current boat will require twice as much of Mother Earth's non-renewable resources and damage our environment twice as much.

Hereby, I invite you who have been enslaved by comfort: break the chains of laziness!

A prerequisite for saving the world is for you to give up your comfort.

A bigger boat is simply a very bad idea.

It's morally wrong.

It's financially wrong.

It’s wrong for safety reasons.

It’s wrong for health reasons.

It's wrong for happiness reasons. A larger boat gives you lots of worries that will reduce your happiness.

> Real happiness is created through the victory of the will over the flesh, not through being spoiled.

* * *

My grandmother told me a tale of a prince. He had been out hunting, but had been separated from his company and was now lost. After much trouble, he finally came to a simple cabin in which an old woman lived.

The prince was very hungry and asked for something to eat.

The old woman became terribly frightened. How would she be able to cook something that a noble prince could eat? But it was the prince who decided and to her great surprise, he found her simple dish delicious.

Refreshed and on the right path again, he was soon back at the castle where he immediately told everyone of the old woman that had cooked him the best meal he had ever had.

Everyone at the castle was amazed at the old woman's cuisine. She was ordered to come to the castle to prepare a meal for a banquet.

It didn't taste good.

Moral of the story: Hunger is the best spice and even princes misunderstand life.

* * *

For the spoiled, for those who comfortably burn life energy meant for their future well being, for those who are addicted to drugs, for those who demand immediate satisfaction, the path to simple, natural, happiness is difficult, if not impossible.

Of course, my small ocean-going boats will not give joy to princes and those who are spoiled, to those whose will is not stronger than their flesh. However, my small boats will give happiness to those who enjoy solving problems, to those who feel comfortable when they use their bodies, who enjoy the movements of their muscles, to those who keep trying, to those who don't eat until they are hungry and don't drink until they are thirsty, to those who don't rest until they are tired, to those who respect nature, to those who are prepared to fight for a long time and sacrifice things to achieve their goals, to those who have an ideology and know that life without struggle for higher values is meaningless.

* * *

3. THE RECREATIONAL CRAFT DIRECTIVE

In its ruthless wrath, the sea is cruel, but bureaucrats are now the biggest danger to ocean sailors, as they force manufacturers to build boats according to regulations rather than ocean requirements.

The EU Recreational Craft Directive of 16 June 1994 deals with the approximation of the laws, regulations and administrative provisions of the Member States relating to recreational craft, designed to harmonize safety requirements for recreational craft in all Member States and to eliminate barriers to trade in pleasure craft between Member States.

One would assume that safety requirements exist in order to create safety, why else?

Well, countries often have other things on the agenda than safety when they introduce safety requirements, namely to create trade barriers and force boat people to buy unnecessarily large boats and a lot of unwanted and unnecessary equipment.

France used to be Europe's, or even the world’s, largest boat exporter, but they themselves did not import many boats. Not because other countries' boats were bad, but because France had a lot of special rules, i.e. trade barriers, making it terribly difficult to export boats to France.

Boat manufacturers in other EU countries didn’t think this was okay. They wanted to remove trade barriers. They would harmonize safety requirements for recreational craft in all Member States and eliminate barriers to trade in pleasure craft between Member States.

They teamed up, including France.

France had shown how effective trade barriers could be. EU boat manufacturers decided to set up an iron curtain, fortress Europe, in order to exclude overseas boat manufacturers. Boats from above all the USA and Taiwan were cheap and ruined the profit. The more complicated they could make the regulations the more effective they were as trade barriers.

One could, of course, ask oneself how boat manufacturers have been able to become legislators.

The answer is, by using lobbyists.

The lobbyists turned to Brussels and explained that approximation of the laws and regulations of the Member States regarding recreational craft to harmonize safety requirements for pleasure craft in all Member States and eliminate obstacles to the trade of pleasure craft between Member States should come about.

Brussels thought this sounded reasonable.

* * *

Is this true?

The Swedish Transport Agency has published a letter called:

The CE Handbook, About the Recreational Craft Directive.

You can find the script on their website. On page 6 you can read:

The accession of the Recreational Craft Directive has thus been affected by market economy circumstances, although the directive by nature is a document focusing on technical aspects. The Recreational Craft Directive can be considered as initiated by the boat industry and not by the EU authorities. The work was begun by some twenty national industry organizations within the framework of the industry's international organization ICOMIA. Within the boat industry, there was a concern that Member States might use their own standards, which in the future would continue to limit the free trade of boats in Europe. Therefore, the decision was made to elaborate uniform European recreational craft legislation and international standards in support of legislation. The boat industry was also worried that within the EU bodies, boat legislation would be created without the boat industry having sufficient influence. Therefore, it was preferred that the initiative for the Recreational Craft Directive came from the ICOMIA.

* * *

In order for it to be difficult, or rather, practically impossible to show that a construction meets the requirements of the directive, it is deliberately so unclearly written that it's usually not possible to show that a boat meets the requirements. In this way, manufacturers are forced to use the boat industry standards that have been made into ISO standards that have been made to EN standards, i.e. European standards for the recreational crafts. This means that the boat industry has in reality established its own laws.

* * *

Boats are divided into four categories.

A. Ocean: Designed for the purpose of undertaking longer journeys under which the wind force may exceed 8 (Beaufort scale), corresponding to 17 m/s. The significant wave height may be over 4 meters, ***except for abnormal conditions, such as storm, equivalent to 24 m/s, severe storm, hurricane, tornado and violent sea or heavy waves.***

(My italics.)

B. Outside open coast and offshore: Designed to undertake offshore trips with wind power of up to 8 (Beaufort scale). The significant wave height can be up to 4 meters.

C. Coastal water and inshore: Designed to undertake travel near the coast, in large bays, estuaries, lakes and rivers where the wind force may be up to 6 (Beaufort scale). The significant wave height may be up to 2 meters.

There is a category D with even lower requirements.

* * *

The standard that concerns stability makes it impossible for smaller cruisers to meet the requirements.

Using a variety of data and more or less complex formulas, seven factors can be identified.

The seven factors thus obtained are multiplied with each other, after which the square root is extracted from the product. The result is then multiplied by a linear factor in which the length comes in multiplied by 2.25.

To be classified as ocean-going, the final product must be at least 32. For a small boat this is impossible.

The only simple thing in all this is that they have shortened the "stability index" to STIX.

Interestingly, there are no rules for the rig. Not that I'm striving for more regulations, but isn't it strange that the bureaucrats dare to leave such an important thing to the designers? After all, they have been declared ignorant when it comes to hulls.

Does the Recreational Craft Directive work? It works for the purpose for which the boat industry designed it: To be an obstacle for non-European boats and as a way to ban the production of small deep-sea cruisers. It's also an efficient way to get rid of boat production on a small scale.

* * *

Does STIX work to prevent boats from capsizing?

Definitely not!

The Vendée Globe boats, the Open 60, with a length of 18 meters, width of 6 meters and depth of 4.5 meters, and a 3-ton heavy lead weight attached to the bottom of the keel, get a huge STIX value. Despite this, four of them capsized during a race in 1997, as mentioned above.

I guess the Brussels bureaucrats believe that a high STIX gives seaworthiness because the bigger the boat, the smaller the waves in relation to it. That strategy works satisfactorily in wind forces up and gale force, and so Brussels is pleased. "Category A. Ocean: Designed to undertake long journeys without external assistance" is strangely not designed to work in wind forces exceeding gale force.

The EU believes that storms, hurricanes and heavy waves are abnormal conditions.

That's wrong. There is nothing abnormal with storms. On the contrary, the day when everything is quiet at sea, when the storm has ended, Judgement Day is near.

Storms are completely natural weather phenomena. They have always existed. Both Odysseus and Noah had to deal with them. Even Jesus encountered a storm when he was out in a boat with his friends.

Storms arise when a low pressure center develops in a high-pressure area.

Deep-sea sailors, as well as land lubbers, love life and if you are at sea in a boat that wasn't designed to be seaworthy, but rather to meet the demands of bureaucrats from Brussels and a storm approaches, you are exposed to the rage of the sea. It won't be enough to try to remove the wind by shaking an EU certificate that says the boat is rated "Category A. Ocean".

In a storm, all boats are small. The waves of the ocean can be 30 meters high and then it really doesn't matter if the freeboard is 50 cm or 1.5 meters.

If you want to sail safely, you must count on storms and change your strategy. Instead of a high STIX value, you should invest in a small safe boat that uses the laws of nature to its advantage.

I have safely ridden out both storms and hurricanes in my boats.

Had a larger boat been more suitable?

I'm glad you asked because the answer is definitely no.

It's thanks to small boats that I have successfully completed my voyages. Has the Recreational Craft Directive benefited yacht design and brought it to new heights?

No, Colin Archer designed more seaworthy boats already a hundred years before the Recreational Craft Directive was introduced.

The design of deep-sea cruisers has ancient history and was a ripe craftsmanship already in the 1950's. It doesn't require any new stuff in the form of troublesome bureaucracy. As soon as bureaucrats get hold of a business, hassle spreads like a cancer. What has improved seaworthiness is modern material.

Classical Swedish boats such as *Havsfidra, Laurin 28, Allegro 27* and *Vega*, boats that have for decades successfully crossed oceans and circumnavigated the globe, now can't be marketed as ocean-going due to the new EU rules.

Observe the Recreational Craft Directive not from an economic perspective but from the perspective of the environment and good seamanship and just abolish the darn thing!

* * *

4. SMALL BOATS, SMALL PROBLEMS

Annie Edson Taylor, a 63-year-old teacher, adhered to the idea, "If you want a safe boat, it should be small", already in 1901. She managed to sail down to the 54 meter tall Niagara Falls in a barrel. The happy outcome testifies to the intrinsic ability of the small boat to sustain great strain.

When a 1.5 meter tall wooden barrel, with a diameter of 90 cm, in a model dating pre-1901, is able to protect a 63-year-old schoolmistress from the horrific forces of the Niagara Falls, which far outweigh the sea's worst hurricanes, there are no storms that a small boat built in modern sandwich composites cannot handle.

* * *

Annie, the heroine from the Niagara Falls, with her barrel.

The intrinsic ability of small objects to cope with great stresses is due to the fact that a number of factors favorably interact.

It's well known that some ants can lift fifty times their weight, but an elephant can only lift one tenth of its weight.

It was Galileo who clarified the physics of such phenomena. He showed that when an object undergoes a proportional increase in size, its new surface area is proportional to the square of the multiplier and its new volume is proportional to the cube of the multiplier.

Volume creates stress while surfaces bring strength.

Take two cubes. The one's edge is twice as long as the other's.

The volume of the large cube is eight times the minor, hence it is exposed to eight times as much stresses, but its supporting surfaces are only four times the size. Therefore it only has half the strength of that of the smaller cube. In other words, stresses grow much faster than the strength. There is thus a limit for how large a structure can be.

The length of a rope doesn't contribute to its strength. On the other hand, a rope's strength increases proportionally to its cross-sectional area. The rope's length times its cross-sectional area is its volume.

The relative strength of an object is inversely proportional to its size.

Double the size gives half the strength.

Three times the size gives a third of the strength.

Ten times the size gives a tenth of the strength.

Hundred times the size gives a hundredth of the strength.

Thousand times the size gives a thousandth of the strength.

Endless times the size gives zero strength.

(see: Square-cube law).

Mother Nature has long known about this, which is why she has used a much larger part of the elephant's mass to create legs than she has in the case of our friend the little ant.

The larger the structure the greater part of its resources is used to make it strong enough not to collapse from its own weight. Eventually, you reach an upper limit where all structures crash.

The square-cube law is universal and sets limits for how long bridges and how tall buildings can be.

On the other hand, to construct a very short bridge or a dollhouse, that is child's play.

* * *

Small animals such as cats and mice, not to mention my friends, the industrious ants, can handle falls from heights better than larger animals such as humans or cows. Not even elephants, although they have such big legs, are especially good at falling from heights.

* * *

Another reason why small things don't break is that destructive forces don't get a good grip on them. Take a match and break it. It's not difficult. Breaking the broken piece, which, necessarily, must be shorter than the original, becomes a lot more difficult. The rate of difficulty increases rapidly the smaller the match pieces are.

* * *

A third reason for the durability of small things is that they, when free, as floating objects mostly are at sea, they become unbreakable because, if free, they can give way instead of resist.

If you put a nut on the table, a slight stroke of a hammer is enough to crack it. If you hold it in the air, between your index finger and thumb, it's unbreakable because it moves with the blow. Free to move, it will not break no matter what size hammer you use.

In the case of boats in large waves, the boat's own weight is the resistance, or physically more correct, it's when the boat's own inert mass is accelerated by rough water that a counter force arises.

Thus, because of the small mass of a free-floating little boat, it is impossible for a wave to hit it hard. The respondent power becomes insignificant.

Small things like bottles, wooden boards and other "flotsam and jetsam" swim happily, for years, around the world without worrying about storms.

"We are too small to be hurt by the great waves," they laugh.

A bigger boat is like a cliff. The bigger it is the bigger the hits it has to endure when the sea releases its mighty forces.

* * *

Another phenomenon that favors the little boat in hard weather is that it can hide in the boundary between the waves and the wind, at least in part. Just at the water's surface, the wind speed is zero, even in full storm. The wind speed then increases with the height above sea level.

The very lowest part of the air space is full of turbulence, caused by friction, waves and foam. There the wind can't speed up. Since a small boat is right there, it is not affected by bad weather as much as a big boat.

* * *

On December 6, 1982, approximately 45 cruisers had anchored in lee of Cabo San Lucas México, waiting to get out onto the Pacific Ocean. At night, the wind turned and increased to a storm. Many boats were washed ashore. Around 20 of them were completely destroyed. One of the victims was Bernard Moitessier, the famous long-distance sailor. He lost his well-known boat *Joshua*.

Had the boats been small with strong flat bottoms, the crews would have been able to haul them up on the beach and save them with the help of simple technical aids, which they could have brought along.

Patrick van God is a renowned long-distance sailor and author from Belgium. He had rounded Cape Horn in *Trismus*, a copy of Moitessier's boat and was sailing in the Pacific Ocean. Due to faulty navigation, he got stuck on a reef. The wind force wasn't that great at the time and steel is strong, so the boat fortunately wasn't badly damaged. Unfortunately, the 12 meter long steel boat was so heavy that it could not be moved, despite the help of locals. It became a total loss. Had it been a small boat with a strong flat bottom, the crews would have been able to drag it of the reef themselves without much power and by means of simple technical aids.

* * *

If you want to sail safely, it's best to have the laws of nature on your side and they speak clearly:

"Stay small if you want to do well on the big oceans."

* * *

"I would be claustrophobic in such a boat," I hear many say when they see any of my boats.

To you who are afraid of sailing small boats I would like to say: The fear is completely unreasonable.

Today, there is fortunately effective treatment for all forms of phobias that limit and adversely affect life.

If you are afraid of small boats, you need to seek professional help. The simplest is that you turn to your nearest health center, but remember that it is very important not to avoid the feared object. Keep in mind that because you seem to experience the confrontation with small boats difficult, gradual exposure is necessary.

In most cases, claustrophobia can be cured and doesn’t constitute a rational basis for obtaining a large boat.

* * *

A reasonable question might be: Where do you draw the line between small and large boats? The answer: "A big boat is a few meters longer than the one you have and an old person is ten years older than yourself" doesn’t satisfy a bureaucrat who wants a number, preferably with a few decimals. In addition, boats shrink over time.

When the first Nordic Folkboat was launched on April 23, 1942, at Arendal in Gothenburg, it was considered too big. In addition, it was criticized for its high freeboard.

* * *

In 1968 I sailed to England in *Anna*, a 4.25 meter long skiff that I had converted to a cruiser. During the journey that lasted from the beginning of May to the end of September, I visited some fifty ports in Sweden, Denmark, Germany, Holland, Belgium and England.

Toward the end of the journey, there was a lot of attention due to the fact that such a small boat had sailed so far. I received lots of warnings, but above all I was advised to get a bigger boat.

A bigger boat, everyone said, would be much safer, more comfortable and much faster. It would make it easier for me to meet girls and last but not least make me happier.

Whoever listens to advice is wise, while the ill-judged thinks that only his way is the right one.

With some doubt, because I was completely satisfied with my faithful little boat that gave me so much joy and no hassle, I followed the advice of the adults.

I did not have much money but eventually found an old wreck.

It was an old riveted iron hull that had started her life in 1885 as a steamer. Her length was twelve meters. I converted her into a cruiser.

Proud of my motherland, I named her *Duga*, the beginning sounds of our beautiful national anthem.

I rigged her as a staysail schooner. To prevent leeway, I equipped her with a daggerboard like the one of an Optimist.

Compared to *Anna*, she was a giant boat, terrifyingly big, but I quickly got used to her. After a few months she had shrunk in size in some strange way and was actually just as big as necessary.

In August 1969 I left Gothenburg. Thirty hours and 230 nautical miles later I reached Kiel. Indeed *Duga* was faster than *Anna*.

After having crossed the Bay of Biscay in October, I found myself anchored in Las Palmas in the Canary Islands.

One day, a 78-foot Camper & Nicholson ketch with a Norwegian flag arrived and dropped her anchor next to *Duga*.

Onboard were a father and son on their way to the Caribbean to start a charter business. The boat was going to look nice. I was hired to varnish the masts.

The mizzenmast alone was enormous. First it had to be scraped and then varnished seven times. After that I started with the even bigger main mast. It took its time.

All meals, a negotiated salary benefit, were enjoyed in the yacht's stately deckhouse in pleasant forms.

After a few weeks of nice company aboard the 78-foot boat, it seemed to be the perfect size, so it felt both embarrassing and unfair that I had to row over to my pathetic little 40-foot boat every evening.

I had quickly adapted to the larger format and yet, how big hadn't *Duga* seemed the year before, when I switched from my faithful 13-foot skiff, which until then had been big enough.

The one, who has a lot, wants more and I'm certain that if Onassis had anchored his 325-foot long *Christina* and let me have it, I'd soon outgrown her too.

Humans were not created be satisfied, but as man is the most adaptable creation in the known universe, it is better to have a rationally-sized boat, a boat that is manageable both physically and economically, instead of being ruled by primitive urges.

When you can’t sheet in the sail without winches; when you can’t, in case of light winds, move the boat forward with an oar, but have to use a motor; when you can’t pull your boat up on a beach and when you can’t transport her on a trailer behind a car or put her in a container, then your boat is not only big, but way too big.

Man is the measure of everything, but it’s extremely important to point out that small size alone doesn’t make a boat safe. The boat must be well-conceived and designed for its task.

Unfortunately, most boats are faultily designed. My boats make no exception. They are far from perfect. The reality is too complicated for everything to always be right and I make mistakes, lots of mistakes.

Therefore, you need to understand what you do if you want to copy me, so that you copy the good things I’ve done and not my mistakes.

What's the correct way then?

There is a simple answer:

The final judge, the highest instance, is the sea.

Only that can be trusted what the sea, in all its different states and during a long period of time, has tried and found seaworthy.

* * *

5. THE LOW ENERGY PRINCIPLE

The low-energy boat is no macho boat, she's human. She sails calmly and doesn't attract great forces.

During the years that I've worked with small boats, I've often thought about a low-energy boat, about a way to design a boat with less resistance, about a boat with less ballast percentage and a smaller sail area, but because I have believed the adults and been blinded by conservative rules and regulations, conventions and codes of practice, my thoughts have stayed thoughts.

When inefficient behavior is locally dominant, it becomes the truth. Even if a better way is presented, it is ignored. Take the oar, the British drill box and the calendar as three examples.

Several years ago I lived among oyster farmers in a small town in northeastern Japan. I was there to study the Asian sculling oar *yuloh*, which, thanks to its force-uptaking rope, is significantly more efficient than ours.

One day down in the harbor when I was discussing oars with some older, educated gentlemen, one of them pointed at me and burst out: "In Europe, you use oars to row."

The others laughed cordially. They had a hard time imagining how one could use an oar for anything as ridiculous as rowing.

In China and Japan, sculling is preferred.

Thousands of European sailors came in close contact with the yuloh during the sailing ship area. They saw how they were used in *sampans* (the difference between a *sampan* and a *junk* is that on a *junk* you can put a water buffalo crosswise) when they were transported from their anchored sailing ships to the shore and back again. Nevertheless, the yuloh was never introduced in Europe.

* * *

Are adults rational?

Answer: Far from it. The smart metric system came into general use during the French Revolution, but since the English were mad at Napoleon, they still use fractions in their drill boxes and refuse to use the system.

Check the drill box below. It was bought by me in England a few years ago for my gallery of ridiculous stuff.
It's simply not possible to keep track of all the different fractions. Which is bigger? 13/32 or 7/16 or 29/64? Had their drill boxes, like in the rest of the European countries, been marked with decimals, the size aspects would have been clearly visible.

Which is the largest of 12.38, 13.34 and 13.81? No problem.

However, we are no better. Take the calendar, as my last example. In it two systems are fighting each other, the weekly system and the monthly system. Sometimes it's week 24, sometimes June 18, sometimes my birthday is on a Sunday and sometimes on a Wednesday, sometimes Easter in March and sometimes in April. There is simply no order to it.

Fortunately, there is a solution. To get rid of the stupidity I have a modest proposal.

Add a month, a holiday month, for example called “Yrvind”, after the one who conceived it.

All holidays are removed except Sundays and New Year's Day. New Year's Day is moved to the winter solstice. It has no date. Leap years will have two New Year's Days. 364 “date days” are left.

364 days divided by 13 are 28 days. Each month, therefore, will have 28 days, giving it four seven-day weeks.

In this way, each date will always be on the same day of the week whatever year it may be.

The system also makes it possible to eliminate Friday 13. That alone will be worth the initial trouble because it will prevent any number of accidents and the population will no longer need to suffer from paraskevidekatriaphobia.

Conservative laws and regulations, conventions and customs blind you. This means that good solutions don’t always make it, that people keep sailing large boats, even though small ones are often more efficient. The world is far from logical, despite all these adults.

* * *

The measurement rules that have been developed for centuries by authorities and racing committees in order to tax, punish and limit boats have primarily taxed, punished and limited *the length* of boats, since length is the dominant speed-giving property. However, pettifoggers have always found so many loopholes that boats have been shaped more by unhealthy loopholes than by the ocean.

How do you measure a boat's length? The question may seem too elementary and childish, but adults actually have split opinions on the matter.

In my passport you can find my height and there is no ambiguity about it. Naturally, it seems that it would be as easy or even easier to measure the length of a boat because it is rigid and can’t bend its knees like I can when I want to appear shorter, or stand on its toes to appear taller.

That's not the case because the length of boats is measured in a variety of ways. Let me name a couple:

A boat's length can be obtained by measuring the hull length. It's called hull length.

You may include the bowsprit, rudder and attached swimming platforms. It's called length over all.

There is also length of the waterline.

Another measurement is the distance between the perpendiculars, perpendicular length.

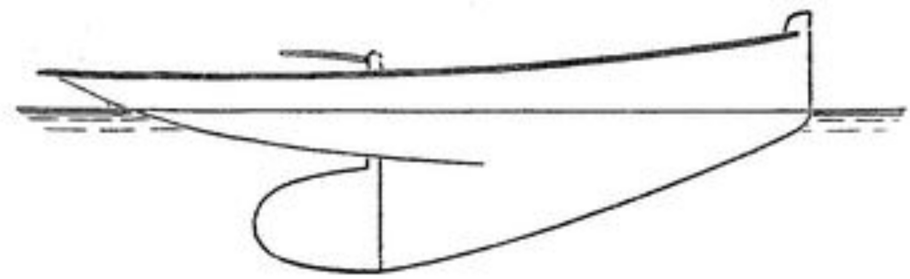
Perpendicular is Latin and means vertical. The fore perpendicular is the point where the stem meets the waterline. The aft perpendicular is the point of intersection between the waterline and the center of the rudder post.

In the past, the rudder post was hinged on the stern, but then a brilliant person came up with the idea of moving the rudder post forward and placing it nearly in the middle of the boat, and voilà, his big boat had a measurement certificate stating that it was small.

He could even have added a stem rudder. Then the perpendicular length would be zero regardless of the size of the boat.

Obviously it's quite bad to have a rudder in the middle or at the front of the boat, but a long boat is faster than a shorter and because racing boats are divided into groups by measurement certificates and not real length, speed becomes more important than seaworthiness.

Below is a picture of how Vanderdecken alias William Cooper maximizes the length between perpendiculars. The rudder post is almost in the middle of the boat and consequently the boat is almost twice as long as the measurement certificate says.



Vanderdecken's tonnage cheater.

The bureaucrats in Brussels don't want to be left behind. They have their own definition of a boat's length. To get to that figure, you take the hull length plus twice the waterline length. You then divide that number by 3.

A boat has volume and mass. Trying to determine the size of a mass by measuring only its length is completely misleading.

Take, for example, an Olympic single scull, a rowboat that is 8.20 meters long. It weighs 14 kg.

The sailboat Allegro 27 is 8.03 meters long, 17 cm shorter, in other words. It weighs 3400 kilo and is of course not smaller than the 14-kilo row boat mentioned above.

Another example.

There was an old man who announced: "Whiskey at all measurements".

A joker came into the store and asked for a meter of whiskey.

The old man, without missing a beat, tore a strip of wrapping paper. He dipped his finger in a bottle and drew a one meter long wet stripe on it.

It's inevitable that racing regulations impair and mess up the performance and seaworthiness of race boats.

The idea of race rules is that all sailors must have the same chance, regardless of the boat.

The rules are meant to prevent a less skilled sailor from reaching the top of the podium because he has spent a lot of money on a faster boat. Therefore, the rules punish the boats' ability to sail fast, meaning that all boats with the same handicap must reach the goal equally slowly. But, the reality is too complicated and boat designers keep finding loopholes in the rules. Despite all the rules it's still not quite fair, but the end result is badly designed boats.

Long-distance sailors sail far. They should have boats that can slide on the waves and not boats that are prevented from going fast because the race rules have abused and disfigured them.

Each design should have a clear goal. "Horses for courses."

If you are going to take your family for a car holiday at a leisurely pace, it's not advisable to choose a sports car. Then a camper is better suited. Nevertheless, since the owners of the long-distance cruisers are blinded by habits, routine thinking and hidden rules of the establishment, they choose boats that are handicapped by race rules.

* * *

Every long-distance cruiser has its practical maximum speed (hull speed) and it's essentially the length of the boat that determines it.

When the boat approaches hull speed it begins to devour unreasonable amounts of energy.

The natural explanation is that when a boat moves, it must, as it is immersed in water, push away the water that it has in front of it.

Subsequently a wave system forms, consisting of a bow wave and a stern wave. Obviously, the faster the boat moves, the faster the wave system also must move.

Waves are not what they seem to be, a lot of water moving across the surface of the sea.

No, it is the waves, but not the water, that is travelling away from its point of origin. What happens, but one doesn't see, is that the water particles move vertically in circles. At the crest of the wave the particles move in the direction of motion of the wave and at the trough of the wave they move toward it.

This is not intuitive, but seems rather like magic to the uninformed. Hopefully two comparisons can create some clarity.

Take a rope and shake it up and down. Waves are formed that disappear. The rope, however, remains in place.

In the summertime you can see how the fields of wheat move when the wind is blowing. The wave travels in the direction of the wind, but the wheat remains stuck to its root system.

It's the same with water particles. They rise up and go down in vertical circles. It's not water that disappears; it's energy. The water is the media that transports the energy away from the boat without itself moving.

If you really think about it, you will understand that this is correct. In strong onshore winds, there are many cubic meters of water in each wave rolling into a bay. Yet the water at the beach doesn't rise. There is also no strong current at the bottom that transports a lot of water out to sea.

The above example serves to explain how the speed of the wave determines its length.

The faster a boat wants to sail the faster it has to push away the water in its path. The faster the water has to make room for the boat, the bigger a circle its particles will require. With a larger circle, the waves necessarily become longer.

When the waves become so long that the boat's bow and stern waves coincide, a trough forms where the boat ends up. The sails can't bring the boat enough energy to get it out of the trough. The boat has reached hull speed.

The longer the boat is the further it will necessarily be between the bow wave and the stern wave. If two boats with different lengths weigh the same, the longer boat requires less energy to achieve the same speed because its bow and stern waves are so far apart that they have not yet formed the trough that requires more energy of the boat to get out of than its sail can supply.

* * *

Sailing race rules still make designers of production boats build boats that are far too short in relation to their weight. If the boats had been elastic and if it was possible to pull them out so that they had become longer and narrower, they would consume less energy.

The fact that boat owners still buy energy-consuming boats can be put down to the fact that a boat or copy of a boat that has won competitions achieves high status. It makes the owner feel regal and influential.

Race sailors want to sail fast, faster than anyone else. It’s the nature of things, so they’re doing everything to make their boat reach the fastest speed that its hull can handle. This completely without taking energy consumption into account. It's important to be first, regardless the cost.

Cruising sailors don’t have to worry about race rules. Instead of considering the length they should find out what speed they find to be satisfactory and enjoyable. Once that has been determined, it is easy to calculate which hull length, which with reasonable economic energy consumption can provide the desired speed.

When a designer only focuses on the length of a boat and when he has to add lots of weight and volume-intensive comfort to that length, he will design a boat that will inevitably consume huge amounts of energy.

A boat’s wake testifies to the amount of energy it consumes, but as wakes are so common, they are accepted without being reflected upon.

It doesn’t have to be that way. Here's an educational example, a comparison between my 4.8 meter long *Amfibie Bris* and my imaginary dream boat, an 8.4 meter long low-energy boat.

8.4 meters is 840 cm, so first a few words on the number 840.

840 is a very nice number. Certainly, I have chosen the length of 8.4 meters because it provides a good balance between hydrodynamic, anthropocentric, economic and aesthetic demands, but I still want to explain the beauty of the number 840 to the reader.

840 can be factorized to 2^3x3x5x7. This fact makes it possible to evenly divide the number with 32 different denominators, 2, 3, 4, 5, 6, 7, 8, 10, 12, 14, 15...and so forth. It may be interesting to know that the number is the sum of the four squares $24^2 + 14^2 + 8^2 + 2^{2.} = 840$.

Back to the educational example.

I built *Amfibie Bris* in the late half of the 1980's and sailed her in 1989 with a girlfriend, from France via Ireland to Newfoundland and later in the same year in New England.

Amfibie Bris was a good boat, excellent for sculling. She was open for general visits at the National Maritime Museum in Stockholm for twenty years, in the Boat Collection Halls next to the Wasa Museum. Now she has been deported to northern Sweden.

In order to make a meaningful comparison between boats of different lengths, boat designers use dimensionless numbers. It's not as strange as it sounds – compare it to how physicians use the body mass index when they want to know how fat people are.

In order to compare the weight of boats of different sizes relative to their waterline, boat designers use the concept of displacement/length ratio. The number is obtained by dividing the weight of the boat by one hundredth of the waterline in cubic. The waterline is measured in feet, the weight in tons. The lower the number of a boat, the more lightweight it is. Race boats usually have values around 200 while cruisers usually end up with numbers well over 300. For a boat to plane, the value must fall below 150.

Froude numbers are also dimensionless. They are obtained by dividing the boat's speed with the square root of the product of Earth’s acceleration and the length of the boat's waterline. Using a boat's Froude number you can get a picture of the wave formation along its hull at different speeds. The dreaded trough that requires more energy of the boat to get out of than its sail can supply is just above Froude number 0.4.

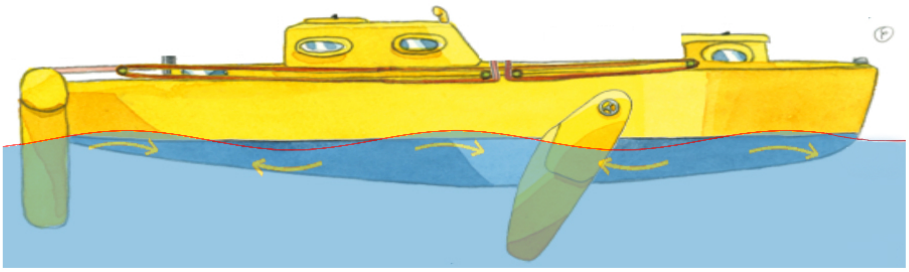
Here are some of the data for the two boats. *Amfibie Bris* is 4.8 meters long and 1.6 meters wide. She weighs 650 kilograms when empty and 1.2 tons fully provisioned for a three-month trip with two people. Her displacement/length ratio is 373; her waterline length is 4.5 meters. Her Froude number at 5 knots is 0.4.

The planned low-energy boat is 8.4 meters long. She is 7.9 in the waterline, 1.2 meters wide and intended to weigh 650 kilos when empty and about 1.2 tons fully provisioned for a three-month trip for two people. Thus, it’s the same weight and the same load capacity for both boats and they have about the same volume. The low-energy boats Froude number at 5 knots is only 0.3.

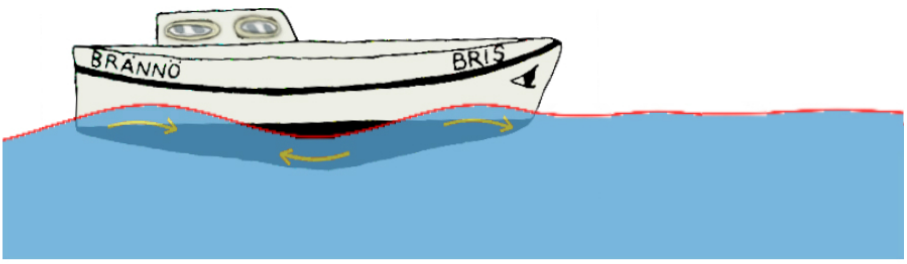
As for the displacement/length ratio, there is a significant difference between the two boats. The number for the low-energy boat is an incredibly 70, significantly lower than for race boats. One of the conditions for making a boat plane is, as mentioned above, that the displacement/length ratio must be below 150. At 70, the low-energy boat meets the requirement with good margin; *Amfibie Bris* with 373 doesn’t even get close to planing.

When you are sculling against a headwind, but also when you have anchored in heavy weather, it's important to have low air and wind resistance. It's proportional to the front surface. The low-energy boat's air resistance is almost half of that of *Amfibie Bris'*.

Because the low-energy boat is long and slender she can at the same speed, 5 knots, hold a significantly lower Froude number: 0.3 compared to 0.4 for *Amfibie Bris*. That means a lot for energy consumption, which I will soon show.



The low-energy boat 8.4 m 1.2 tons 5 knots



Amfibie Bris **4.8 m 1.2 tons 5 knots**

Illustration:

The low-energy boat at Froude number 0.3 and 5 knots. She has a gap between the bow and stern waves, which means she doesn't end up in the trough of a wave.

Amfibie Bris at Froude number 0.4 and 5 knots where she has ended up in a trough and doesn't have the energy to get out of it.

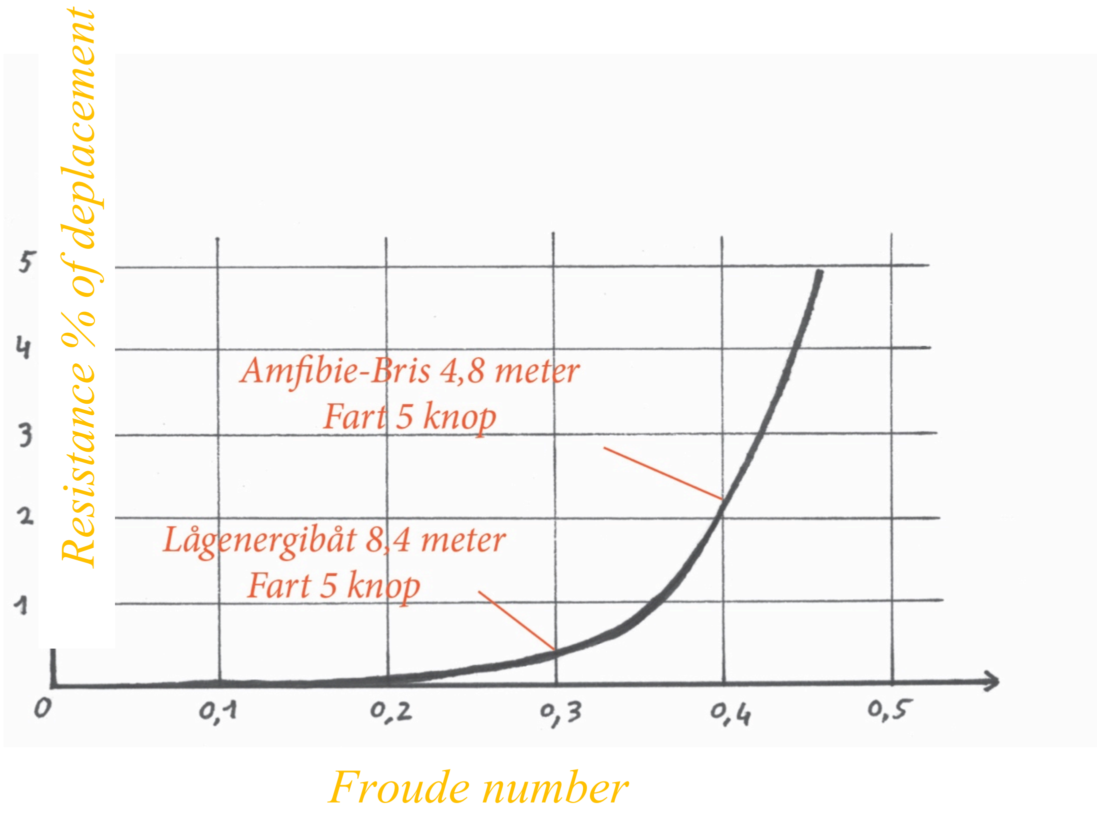
The yellow arrows show how the water particles circulate in the vertical plane.

At five knots, due to her short length, *Amfibie Bris* is forced to consume six times as much energy to create waves as the low-energy boat.

Amfibie Bris can, because of her high displacement/length ratio, never reach a higher speed than 5 knots, i.e. begin to plane. Therefore, she should be slowed down as she runs down the wind so that she doesn't stumble over herself.

The low-energy boat with its low displacement/length ratio easily planes in hard winds. She usually has a low Froude number. These two factors contribute to good speed, but more importantly, I think they benefit safety.

Conventional hull shapes tend to stumble over themselves when they run down the wind in heavy weather. The reason is that they don't have the necessary speed reserves in the form of a low Froude number and low displacement/length ratio to cope with the counter current they run into in the trough.



When the 8.4 meter-long low-energy boat makes 5 knots, its Froude number is 0.3 and its wave resistance is about 0.35% of the hull weight.

When *Amfibie Bris* makes 5 knots, its Froude number is 0.4 and its wave resistance is about 2.25% of the hull weight.

As shown above, the wave resistance of *Amfibie Bris* is 6.43 times greater than of the low-energy boat, which has the same weight and makes the same speed. In other words, by making the boat longer and narrower, the wave resistance is reduced to only 15% percent of a normal cruiser's.

* * *

There are other forms of resistance, but the wave resistance is what matters to most cruising boats. It will most likely mean that the total energy consumption of the low-energy boat is reduced to less than a third of that of *Amfibie Bris'*.

Sailors who only cruise in smooth waters don't understand the effect ocean waves have on small offshore sailing boats. In fact, that goes for most sailors and yacht designers, too. It was I who discovered it. Here's a summary. Most people think that waves only have to do with the surface of the sea, but as already mentioned, waves are not what they seem to be, a lot of water moving horizontally across the ocean surface. It is water particles moving in vertical circles. As shown in the illustration above, this means that the water particles move with the wind in the crests, but against the wind in the troughs.

For example, if the water on the crest moves at 2.75 knots in the direction of the wind, which is not uncommon when it's really windy, and *Amfibie Bris* is sailing in the direction of the wind at 5 knots over the water, she is moving at 7.75 knots over ground.

Unfortunately, the speed of the current that helps the boat move forward decreases when she enters the trough of the wave. There she encounters a 2.75 knots counter current. In order to maintain her speed over ground, she would have to increase her speed through the water to 10.5 knots, 7.75 + 2.75 = 10.5 knots, corresponding to a Froude number of 0.8. Neither she nor any other cruiser has enough energy to handle this, since already at a Froude number of 0.45, *Amfibie Bris'* wave resistance has increased to 5 % of its weight. And at Froude number 0.6 = 7.75 knots, the resistance is at least 10 % of her weight.

When ships in ocean waves suddenly face a counter current caused by the orbital motion of the water particles they are slowed down by the increased resistance and much of their kinetic energy is lost.

The resistance increase is limited to the time the boat is in the trough because when the boat again reaches the crest of the wave she is back in the current that moves her forward. There she can regain her lost kinetic energy. The process is sinusoidally time dependent.

In addition, the vertical circular motion of the wave particles creates a centrifugal force which, in heavy weather, can change the Froude number from 0.35 in the trough to 0.55 on the crest. It's like if you were going to sail alternately on the moon and Jupiter with its different gravity field. One of the factors that determine the Froude number, as you might recall, is gravity or more general the field force. This makes the wave resistance up to ten times higher on the crest than in the trough.

If you are running downwind you will face a counter current in the trough of the wave. Fortunately, the Froude number and hence the resistance there are low, otherwise there would be awful broaches. Still, running with the wind in bad weather puts great demands on both boats and sailors.

The low-energy boat can handle such conditions better than other boats, thanks to her low Froude number.

Sailing to windward takes its toll on cruising boats. This is because when a boat comes out of the trough of a wave going with the current, the boat faces the counter current of the wave crest while the Froude number increases drastically. In addition, due to the centrifugal force, the boat loses half its stability and hence much of its ability to carry sails.

A good piece of advice: Avoid sailing to windward especially in heavy weather as the distance is twice as long, the speed toward the goal one third and the pain four times as great.

For more details on wave dynamics, see my book: Yrvind, *Konstruktören* from 2003, pages 86-92.

* * *

Each wave passing a displacement boat taxes its kinetic energy and limits its average speed.

To row down a river one nautical mile and then row back takes longer than to row the same distance in calm water. If the current is faster than the speed at which you are rowing, you will never be able to return even if you keep rowing for ever.

* * *

The principle of the low-energy boat is not magic. Its speed, weight and volume are the same as the production boat's, but she is cheaper, safer, has more load capacity and it requires less energy to move her.

It's by making her slim that I can increase her length with retained weight and reduce her energy consumption to the fraction of the production boat's.

For more information about the application of Froude numbers on boat construction, see for example: *Principles of Yacht Design Larsson & Eliasson.* Fourth Edition.

* * *

Since the low-energy boat has such low energy consumption and is making such small waves, she needs only one third of the sail area an equally heavy production boat would require to maintain the same speed.

A boat with such a small sail area can make do with a much shorter mast, especially if one makes the sail surface square instead of the more common triangular shape. An additional advantage is that a square sail area is more efficient than triangular sails when running downwind.

A shorter mast is lighter for three reasons.

1. Cutting the length of the mast in half means cutting its weight in half. This also makes the mast four times as strong - according to Euler's Formulas for buckling – a short stick resists buckling better than a long.
2. Since the mast is now hyper-strong, one can make it thinner. Again, weight is saved.
3. Because the mast only needs to carry one third of the original sail area, there will be less stress on the mast. The mast can then be constructed in a substantially easier and cheaper way.

My imaginary boat's small sail area and her low rig give her a low center of gravity and a low heeling moment. This, in turn, means that the boat can make do without a heavy and deep ballast keel. Without it, the boat becomes lighter and requires even less sail area. This is an upward spiral that can be turned many times, saving energy, the environment, money and a lot of hassle.

You can say that the low-energy boat is a Columbus' egg, because before I arrived at the idea the problem seemed insoluble, but now that I know how to do it, the solution is trivial.

6. HOW ABOUT A LIFE BOAT?

It's a pleasure to sail, but it can also be a necessity. At home I have fire extinguishers and escape rope, in the car seatbelts. I probably will never have to use them, but if an accident happens, they can prevent major damage.

It's advisable to invest in an insurance to protect oneself against an unlikely event that can cause serious damage.

* * *

Should we live today and enjoy life while we are young or forsake it to have a pleasant life when we get older?

In the end we are all going to die, but if we use everything we have today, tomorrow is going to be hell. This is a big question to ponder.

This is how the kind Jesus argued for the position of "living today":

Therefore I say unto you, Be not anxious for your life, what ye shall eat, or what ye shall drink; nor yet for your body, what ye shall put on. Is not the life more than the food, and the body than the raiment?

Behold the birds of the heaven, that they sow not, neither do they reap, nor gather into barns; and your heavenly Father feedeth them.

And which of you by being anxious can add one cubit unto his stature?

And why are ye anxious concerning raiment? Consider the lilies of the field, how they grow; they toil not, neither do they spin: yet I say unto you, that even Solomon in all his glory was not arrayed like one of these.

Be not therefore anxious, saying, What shall we eat? or, What shall drink? or, Wherewithal shall we be clothed? Be not therefore anxious for the morrow: for the morrow will be anxious for itself.

Sufficient unto the day is the evil thereof.

The more realistic, opposing view, that one should gather things for one's old age, Aesop illustrated with the moral fable of the Cricket and the Ant:

A Grasshopper, who had enjoyed the beautiful time of summer with joy and laughter, was without food, without a home, when the harvest month had passed.

When the autumn winds started to blow there were neither mosquitoes nor worms.

She was hungry. She couldn't even find the smallest bite to eat.

Good advice was dear.

She goes to her neighbor, a Mrs. Ant, owner of an anthill both high and wide.

How fortunate, she says, that there is such abundance in my neighborhood in this difficult time!

To her neighbor, she finally complains about her need:

"Lend me a little bread for the winter, I'm in a bit of a pinch. In August, I will repay each grain, times four.

That I may not perish for hunger, for God's sake, help me, gracious Ant!

"What has Miss Grasshopper been doing all this time?" She asks the pennyless.

"Oh, I was singing, my dear woman, just singing like crickets do!"

"You were singing? Then, young lady, you can dance now, it will warm you up just as well as food! "

Unlike most, I believe more in the philosophy of Aesop, than the philosophy of kind Jesus.

I believe that man's short-term perspective, that we live more for today rather than thinking of old age and future generations, is the cause of almost all of humanity's problems.

For a long time, man has overused his assets. Oil and other natural resources will be a shortage because we have been wasting them. The economy is likely to crash because our money is no longer based on gold. The environment has been and is being destroyed. Earth's population now exceeds what it can naturally feed. Therefore, processed food, not fit for human consumption, is our only choice now.

Without oil, society will collapse.

Without real money, society will collapse.

Without suitable climate, society will collapse.

Without a population adapted to Earth's resources, society will collapse.

I see signs that the energy supply, economy, climate and environment are collapsing.

Modern man will not survive long without food, heat, healthcare and law & order.

When I see that the barometer falls and that the stormy clouds are gathering, I reef down to ride out an approaching storm.

Does that make me a pessimist and doomsayer?

By acting 15 minutes before a storm, bad weather becomes a routine experience.

As soon as the storm is over, I let out the reef and sail on. It’s a test of good seamanship.

When I see signs that society is collapsing, I try to protect myself.

Obviously I have taken in a reef when it wasn’t necessary many a times, but it has not hurt me, on the contrary, it has made me good at reefing.

To take in a reef, to have fire extinguishers and an escape rope at home, to use a seatbelt in the car is to invest a small expense in an insurance to protect yourself against an unlikely event that can cause serious damage. These are actions that show my love for my fragile life, the only one I have.

* * *

I think it is a good idea to have a small boat that can be used as a pleasure boat if everything stays OK and as a lifeboat if the world as we know it perishes. As the Water Rat said to the Mole:

”Believe me, my young friend, there is nothing - absolutely nothing - half so much worth doing as simply messing about in boats.”

* * *

The cows only eat grass and the wolves only eat meat. Neither the cows nor the wolves get tired of their diet.

Unlike humans caught in the hamster wheel of today’s society, animals in freedom are never bored, even though the bird just sits on a branch and chirps or, like the albatross and dolphin, follow me on my trips.

Even the snail, despite moving so incredibly slowly, finds her journey varied and interesting.

When I’m quietly sailing my boat, I'm not bored. I don’t need to be entertained, my food doesn’t have to be varied and it doesn’t need to be spiced, since I am one with nature on the endless sea.

Fortunately, a person in a small functional offshore cruiser is equally capable of making long ocean passages in his boat as he is of staying at sea for a long time on his own, waiting for a societal crisis, whatever kind it may be, to vanish.

* * *

In the USA there are lots of preppers. They are preparing for the Major Disaster by building bunkers, arming themselves, storing food and ammunition.

How much fun is it to be stuck in a bunker?

I think a shrewder and more flexible solution is to have a small seaworthy, shallow-draught, low-energy boat ready to weigh anchor. To sail the deep, blue, wet, eternal, endless, unchanging sea, that is enjoyable. In addition, compared to a life in a bunker, it's safer, healthier and cheaper.

* * *

A good idea is to have a shallow-draught boat because it easily gets into protected waters. The smaller the draft of a boat, the closer it can get to land. If the boat has a draft of two meters, it must stay outside the two-meter depth curve. If it has a draft of one meter, it must stay outside the one meter depth curve. *Exlex* with a draft of a mere 30 cm has the ability to get so close to land that I can wade ashore.

With a strong flat bottom she can be left on dry bottom in tidal zones. She also doesn't require much power to be hauled up on lonely beaches using some simple technical aids that I can carry with me in the boat or complete on-site.

Small boats require less maintenance than large ones. This makes the small boat owner less dependent on civilization.

With a boat that can withstand the wrath of the sea, the boat owner becomes independent of geographical locations, seasonal changes and hurricanes; he can sail wherever he wants, when he wants to.

* * *

7. EXLEX

Yrvind in *Exlex*

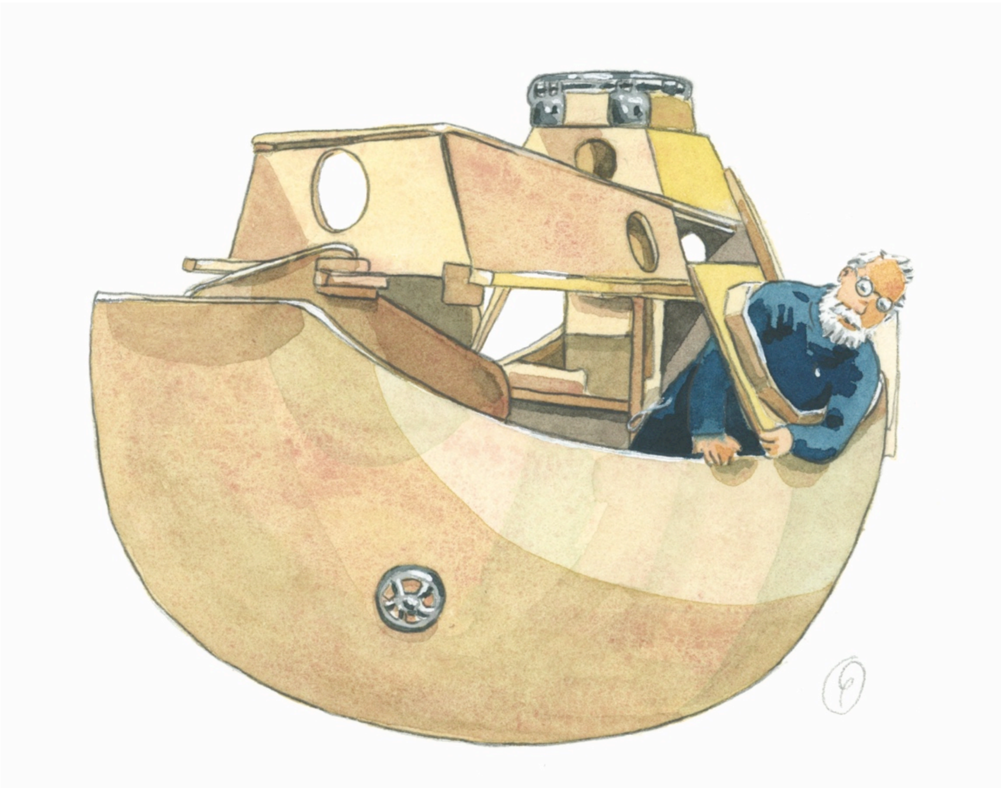
By reducing my comfort requirements, simple things have become great sources of joy. The simplicity in itself makes me not miss anything. Quality of life doesn't consist of owning a lot of stuff. Quality of life is about being able to rejoice over small things.

A world record contest had been announced. It was about sailing around the world in a ten foot boat. I thought, if I have a world record in my back, I will probably be provided for. My retirement money is non-existent, because I've spent most of my life reading books and thinking about my existence, as well as building small boats and sailing across large seas to remote islands.

The challenge seemed technically interesting to me. In January 2012, after thinking about it for a few months and testing some models, I started to build.

At the beginning, I kept good pace. To be able to store food and equipment I had designed the boat wide and high. This was contrary to my conviction, but now it was all about securing my future supply. Hence I could compromise my conscience, I reasoned.

After three years it turned out that when I worked against my conviction I was not very productive. My motivation decreased more and more.



The hated three-meter boat.

I also had problems with my teeth. My dentist said it was because they were old.

I realized that I could not afford to have them fixed. That would also take a lot of time, but worst of all was that as long as I had my teeth there was the risk that I would start having problems with them at sea; the dentist had said that they were old.

During classes of Christianity at school, I had learned that if my eyes made me commit a sin, I should tear them out and throw them away.

My teacher had claimed that it is better to have eternal life with God than to be thrown into the fire of hell with both eyes intact.

Even though the thought of eternal life with God was not very exciting, I understood her sentiment.

The dentist pulled out the lot, apart from a few front teeth.

Painkillers are incompatible with my worldview, so in the night between November 19 and 20, 2014, when the anesthesia stopped working, I woke up with a persistent ache.

"You can't stay awake all night without achieving something positive," my inner voice whispered.

I started writing my autobiography. After a few weeks, the pain had completely disappeared.

My writing, on the other hand, continued month after month. It was fun and I thought the text was developing well.

When the script was ready and had been sent to the publisher and I had returned to the workshop after my long absence, the desire to complete the ten-footer had decreased rather than increased. To be truly honest, happiness had been replaced by agony. In addition, the boat was far from ready.

I had been naïve when I started the project. I had never dealt with sail races and records before. Certainly, I had read in boat books and boat magazines how one could manipulate measurements rules in the same way that rich companies manipulate taxes so that they pay zero taxes although they actually earn billions.

I had read about how boats had won races, despite passing the finishing line long time after the first boats, thanks to more advantageous measurements.

I had seen it as another sign of the world's falsehood, but ignored it since I did not race myself.

But, as I now had entered the record hunt myself, and as I continued the construction and became more familiar with my project, I, too, started thinking about loopholes. When I started building the boat it was obvious that her length was to be measured between her two extremes. This is strangely enough not the usual approach, rather the opposite. Authorities such as the US Coast Guard, the European Recreational Craft Directive's harmonized rules, the International Towing Tank Conference, the Nordic Boat Standard and other recognized authorities exclude bowsprits, rudders, screwed-on pulpits and bath platforms from the measured length, but it was the New Zealand America Cup boat from 2003 that made me go ahead.

She had something called a "hull appendix", which soon became known under the name "the Hula". The rule allowed you to have appendix, i.e. keel and rudder, attached to the center of the hull with a width of 50 cm. The smart New Zealanders attached such an appendix, but instead of following the rule the way it was attended, i.e. to go straight down like a keel, it only went down to a distance of 5 mm from the hull, then it broke out in all directions and followed the hull with a space of 5 mm. This way they got a second hull 5 mm below the real hull. They had found a loophole and made themselves a bigger boat. There were powerful protests, but it turned out that the Hula was legal.

Racers and those trying to beat the record consider themselves obliged to "stretch and cheat the rule". It’s said that: "In war and love everything is allowed". I got the impression that it also applies to yacht racing.

Rudders, as mentioned, are not included in the length, but they are displacing.

"Why not build a 1.5 meter long, displacing, streamlined, integrated, giant rudder with lots of storage space. Nothing prevents it from having a trim tab that you can easily steer with. Then you would get a boat that in fact is 15 feet long, but according to most of the authorities' accepted measurements, it would only be ten feet long," an inner voice from some obscure part of the brain kept tempting me.

Having had the thought, it was impossible to get rid of it.

I was split. On the one hand, of course, I wanted a boat that gave me as much of a chance as possible, on the other hand, I wanted to stay honest.

The project no longer felt real. My thoughts began to wander and found their way toward a low-energy boat. The basic idea could be traced far back in time, something that I occasionally had thought of during the years I had worked with small boats, but because I was blinded by conservative rules and ordinances, conventions and tradition, the thoughts had never materialized.

The first time it became clear to me that the idea of a low-energy boat was realistic and not a mere fantasy was when I sailed from St. Helena to Martinique in my boat *Bris*.

The Southeast trade wind had given me good speed up to the equatorial doldrums. I then caught the Northeast trade wind. I could drop anchor in Baie de Fort-de-France after 45 days.

Bris was 6 meters long and weighed, when fully equipped, around 1.3 tons. I used only 4 square meters of the sail area, even though I could carry at least 10. We had managed the approximately 3800 nautical miles with an average speed of 3.5 knots. The year was 1974.

The second time was 37 years later, in 2011. Then I sailed the yellow boat, 4.8 meters long, with a weight of maybe a ton, from Madeira to Martinique in 45 days. This time the sail area was two square meters.

Both trips were truly enjoyable. In both cases, I could have shortened the trips by a few days by adding more sail, if that had been important to me, but I preferred the joy and harmony of being at sea in favor of the stress and hassle on land. I build boats to sail, not to get back to land as fast as possible.

The now so hated ten-footer was an eye-opener. She had made me think deeper and break with traditions. The world is too complicated for us to have time to go back to the fundamental principles for every issue.

* * *

The thoughts outlined above were thoughts that were spinning around in my head while I was reluctantly working on completing the ten-footer.

To ease my agony, I built a model of the low-energy boat on a reduced scale. Then I started sketching on a sailable plywood model. Its length scale was to be 1:2; its beam scale had to give the model sailing stability and sitting room for me.

It was supposed to be 4.2 meters long and 80 centimeters wide, something I could quickly and cheaply build to get out onto the water some nice day.

While I was thinking, my thoughts just continued. I work alone in my workshop. In order to hear my inner voice, there is total radio silence.

"If you add 20 cm to her width, you could easily be out for a weekend in nice weather." That's what I heard.

The morale with respect to the ten-footer was at this point very, very low. The more eager I was to test the low energy concept.

"If you build her in Divinycell, she will be warm, comfortable and unsinkable." My inner voice continued.

* * *

On April 3, 2015, I started the construction. I built her using 4 cm thick Divinycell and NM epoxy. Divinycell is a structural cellular plastic material that provides good insulation and high buoyancy.

In view of the EU's criminalization of small offshore sailing boats, I named her *Exlex*, a Latin word. Ex means outside and lex means law, Simply an Outlaw.

Stupid and unfair laws should be broken for humanity's sake, if we will ever have a better world.

* * *

The wide high ten-footer was big like a colossus and tied to high energy consumption. At the same time she falsely stated, referring to her now apparently short length, that she was small. The sleek low-energy model was quiet and didn't have any fake pretentions.

It was only when I saw my two half-finished boats side by side that I realized how absurd and morally wrong it would be to sail around the world in a wide, high, ten-footer, even if it would help to secure my future.

I thought, oh my God, what am I doing?

I don't know how doped athletes think, but if I were to succeed with my ten-foot project, I would never be able to enjoy the victory because it was based on false pretenses.

On Friday, April 17, 2015 at seven o'clock in the evening, to save my soul, I picked up the tiger saw and cut the colossus to pieces. Next Monday, with the help of some friends, I took the pieces to the dump.

The three and a half years of thinking and constructing this boat had not been in vain. The project had motivated me to further dig into the fundamental principles underlying boat construction. The foundations had brought me good ideas and given me a jumpstart into the future. Life became bright again.

* * *

Unfortunately, the publisher rejected my book. Had I burnt my bridges? Had I painted myself into a corner? Was I completely lost?

I heard my inner voice speak to me and suggest a way out of my dilemma:

"*You belong to that part of humanity that, even though you eat so unbelievably little, still walks around with a layer of fat around your belly. You have been given Stone Age genes, made to survive long, severe, Nordic winters on crumbs. With a couple of hundred kilos of food you could sail non-stop all the way to the antipode with Exlex, if you extend her a bit.*

If everything goes well and your ideas work, you can complete a full-scale version of your long-awaited dream boat after completing the trip."

I went to my dear old globe and blew off the dust. Boat workshops are always dusty.

I found that my antipode was out in the ocean, but not far from Dunedin, a city in southeastern New Zealand.

Dunedin seemed to be a nice destination. Among other things, there was a large chocolate factory there.

It was just over 15,000 nautical miles of non-stop sailing away, with a speed of just over 2 knots, *Exlex* could take me there in about 300 days.

A man like me, 167 cm tall, 70 kilos, about 80 years old, with a lifestyle that includes a lot of sitting, or rather lying down, can support himself well on 2000 calories a day. Foods, such as muesli and sardines, contain 200 to 300 calories per 100 grams. It would be about 250 kilos of food. No provision problem then. How about water?

It would certainly be possible to collect rainwater, I guessed.

After an extension, *Exlex* is now 5.76 meters long. Her width is 1.04 meters and when she is fully loaded at start, she will have a depth of approximately 35 cm.

* * *

It would have been better if I had had this idea when I was in my youth. I'm not twenty anymore, but I can't do anything about my age since my way back in time is closed. Since I would very much like to sail the deep, blue, wet, eternal, endless sea, the choice was not difficult. I was betting everything on *Exlex*.

Below you can find some of her characteristics.

* * *

Because of the complexity of existence, one doesn't know what one's actions will lead to. If one had known that, there would have been a lot fewer accidents.

When I build a boat, I don't dimension it for the forces I'm expecting it to be exposed to. No, I build as strong as I possibly can so that she can withstand as much of unforeseen abuse as possible.

A boat should be strong, super strong!

Boatbuilding is my hobby, so I make boats better than I have to. It gives me great satisfaction.

Professionals become skilled because they do the same thing over and over again, but when financial and time requirements are imposed on them, they build the boat as bad and weak as they can get away with.

My way of building makes the boat far too heavy and expensive for commercial use. On the other hand, if something happens beyond the ordinary, she has great ability to cope with it. The whole thing is a question of values, cricket or ant, live for today or think of one's old age.

Racing sailors, on the other hand, believes that a boat is not correctly constructed if it is built so strong that it doesn't disintegrate as it passes the finish line. From the above it is obvious that I don't share that view.

* * *

Future capsizes should not hurt either the boat or me because of the following: *Exlex* is unstable when she's upside down; therefore she can't remain in that odd position for long. Her stability range is positive up to 180°. It isn't thanks to a heavy deep keel but due to the fact that the hull is high in relation to its width. The height of the hull from bottom to deck is 84 cm, her beam is 104 cm, and the ratio is 0.8. In addition, the superstructures are relatively large in relation to the displacement of the boat. Production boats are more like cans of sardines; once upside down they stay upside down, despite their ballast keels.

When the volumes of *Exlex* superstructures comes into the water, they supply lots of corrective forces while all the equipment and supplies, stowed low, in lockable spaces, wants to get rid of the potential energy that was added when the wave capsized the boat. They want to tip *Exlex* back to her upright position. *Exlex* wants return to her upright position for the same reason that a rock that has been thrown up in the air wants to come back to the ground again and an air bubble wants to get up to the surface. In short, in an upside-down position, the boat wants to get back to her original state of minimum energy.

* * *

I always use a lifeline, even in fine weather. On my little boat, I don't need such a short lifeline as is used in big boats to prevent their crew members from falling overboard. It creates freedom of movement. The thing is that I'm always connected to the boat whatever happens.

Before I get up on the deck, I attach my lifeline to a strong fitting, close to the hatch. Because my rope is so long that I can reach everything on the entire boat, I don't need re-attach myself with a hook like I would on a bigger boat. It's safer, because hooks are not failsafe.

I tie one end of the line with a secure mountaineering knot, like a bowline with a Yosemite finish. The other end I tie with an equally secure knot around my waist.

Because my rope is so long, I can never be pulled down under my boat if it capsizes when I'm on deck.

If I fall into the water, *Exlex'* four square meters of sail area won't put any great stress on the lifeline, instead, the speed of the boat will slow down because the sail will be unable to both drag me through the water and maintain the speed.

However, the line has a good diameter so that I can get a good grip and comfortably haul myself back to the boat.

The low freeboards and a footstep on each side of the hull make it easy for me to get onboard again.

Practice makes the master and climbing onboard after a swim is part of life on board so I know how to do it.

I've never fallen overboard, but I love to go for a voluntary swim. I like to swim in fine weather, often several times a day. That way, I've grown familiar with the boat's surroundings and know that if I should ever fall overboard, I don't have to be afraid even if it should happen at night.

* * *

A lot of things have been said about life jackets, but what benefit are they to me? To me, the lifeline is the thing that works. Although a life jacket prevents me from sinking, how much fun would it be if I were alone far out on the ocean, watching my boat sail toward the horizon?

* * *

It's important to keep the boat's bottom smooth and nice so as not to reduce the speed due to bottom growth. Certainly there is poisonous antifouling paint, but it doesn't seem to work on *goose barnacles*, a kind of crustacean that looks like a shell on a stalk. They can be several centimeters long and if there are many of them they will substantially slow the boat down.

In a small, narrow, shallow-draft boat it is easy to dive in and scrape them off with the same kind of scraper that you would use to get rid of the ice on your car windows, especially if you do it frequently before the goose barnacles have had time to attach themselves properly.

Using poisonous paint isn't good for the environment, but a small boat requires much less paint than a big one, especially if, like *Exlex*, it doesn't have a keel.

And as Paracelsus (1493-1541) said:

"Poison is in everything, and no thing is without poison. The dosage makes it either a poison or a remedy."

* * *

Big boats are wide, four meters are not unusual. The Vendée Globe boats, the Open 60, are actually six meters wide.

When a four-meter wide boat heels 90 degrees, the man in the windward bunk is almost 4 meters up in the air. A fall of four meters is usually OK for young people, if they don't land on a sharp corner, but older people like me with fragile bones can really hurt themselves if they land badly.

Can I be hurt when *Exlex* capsizes?

Judge for yourself.

The inner width of the boat is 68 cm, not counting the storage space on the portside which forms one side of the berth. Up to deck level it is about 55 cm depending on the thickness of the mattress. Not counting the width of my body there are only a few centimeters space left sideways or up to the ceiling. Consequently the fall cannot be higher than that.

In addition, the berth is fitted with a sturdy safety belt.

* * *

My cool, self-designed, homemade, little boat requires no engine. When the winds are weak I simply move the boat forward by applying body power to an oar. The almost silent movement through the smooth water brings peace of mind and the harmonious movements of the muscles make me healthy.

And what is health worth?

Ask the person who is ill!

For me, the propulsion of the boat with the help of muscle power is as important as reaching the goal. City-dwellers who like to go out for a walk through the park or along the water when the evening is nice, just for pleasure, can probably understand that I enjoy moving my boat with the help of an oar through the calm water.

Even at sea there is often no wind. Even at sea there are things that will raise your curiosity. For the one who uses his eyes, the sea offers an endless spectacle.

Every feeling is associated with muscle movements: joy brings laughter, lust brings erection and despair brings crying.

The reverse is equally true. Muscle movements trigger emotions.

Smile and you will be happy.

Stand tall and you will be brave.

Shrink and you lose your self-esteem.

By sculling on a calm sea, I create positive feelings through my muscles.

The poor people who have such large boats that they can't move them without a motor that both thunders and emits smelly unhealthy exhaust, miss a great deal of the mental and physical health-promoting effects of boating.

1988 Yrvind sculls *Amfibie Bris*

* * *

In addition, unlike an engine, there are not many things that can break a strong oar on a small boat, handled carefully by an old feeble man.

Therefore, compared with an engine, it is easy to keep the oar in peak condition.

Peak condition is an important concept. The first time I clearly realized its fundamental importance was in 1957, when I proudly showed my newly purchased, used motorcycle, a Husqvarna Rödmyra, to my manager and teacher Harry Eriksson.

Harry had a mechanical workshop in a room in the basement of a rental house in Kålltorp. He had an employee, me, and it was Harry who gave me the basic knowledge of engineering.

Harry watched the motorcycle for a while and then he asked:

"It’s in peak condition, isn’t it?"

No, it was not in peak condition! I was delighted that I had been able to even start the thing.

To have something in peak condition!

A vision of a state where motorcycles started at first try, where machines, appliances and equipment worked impeccably, where I was in full control, filled my mind.

It was a new thought, an almost utopian thought. The following weeks, I pondered on the term **“peak condition”**, but I was too young and eager to make it my true standard. I was sloppy when I was in a hurry, but as the years passed and I calmed down, this rule of life became more firmly established in my mind. Every now and then my thoughts go back to Harry and his question: “It’s in peak condition, isn’t it?” I noticed how much smoother life seemed to pass and how much better control I had when my stuff was in peak condition. I started to understand that if it was worth owning a product, then it was worth keeping it in peak condition. In the short term it's hard, but the longer you keep doing it, the more you benefit from it. It doesn’t just apply to physical tools, but also to your body and soul. It applies to your brain’s tools such as vocabulary, foreign languages, mathematics, problem-solving abilities and other things, including honesty, because every lie complicates life, as it requires a new reality of which to keep track.

If the product you want to keep in peak condition is complicated, the task becomes difficult and time-consuming or even impossible, however proficient you are. This leads to frustration and failure.

An oar surpasses an engine in terms of simplicity. A boat with an oar instead of an engine is easier to keep in peak condition. A boat that is not in peak condition is a burden.

* * *

The likelihood that any part of a construction will interfere with any other component included in the design increases with the faculty of the number of structural elements involved.

The factorial function is a bit of a mystery to the public when it comes to mathematical functions, but it's a very easy to use and a really handy function. It’s above all a function that increases very quickly.

The factorial of a number equals the product of all positive integers less than or equal to the number.

With the help of factorial operations one can calculate how many possible combinations a given number of elements can bring.

For example, 4 people can be placed around a table in 1x2x3x4 = 24 different ways. The first person can be placed in all four available places; the next person has three places to choose from and the third only two places.

6 people can be placed around a table in 720 different ways 1x2x3x4x5x6 = 720 different ways. This means that if calculating one meal a day, six people can sit around a table in different ways every day for two years.

With 24 people around the table, the combination increases to six times ten to the power of twenty-three.

It's remarkable, because if you want to try all the combinations, you'll have to do it for a period of time that is thousand times longer than the universe has existed, even if you make a thousand changes every second.

This proof of the complexity of our existence ensures that there is always a risk that something goes wrong on a boat, as few boats consist of fewer than 24 elements.

In the best of worlds, the designer should have made sure that everything was working properly, but life is not easy. The buyer is probably not the average Joe that the constructor had in mind. Actually, there is no average Joe. The buyer will go on and use the boat in a way that it was not designed for.

In addition, after some time of use, inevitably things will happen with the components. “All structures break down”, it's just a matter of time.

A small simple boat, which lacks the plethora of equipment and amenities, is a good start for anyone who wants to get his boat in peak condition.

Order makes it easier to keep the boat in peak condition. Every object has its place and there is a place for every object.

Large parts of the day are dark. Often the boat is caught by big waves. Few incidents occur at an appropriate time. It’s enough that a small thing is not where it should be to turn a trivial incident into a horrific accident.

For want of a nail the shoe was lost.
For want of a shoe the horse was lost.
For want of a horse the rider was lost.
For want of a rider the message was lost.
For want of a message the battle was lost.
For want of a battle the kingdom was lost.
And all for the want of a horseshoe nail.

1989, *Amfibie Bris* in France on its way to Newfoundland.

* * *

As no fossil fuel is stored on board, the risk of fire is small.

My oar requires no fuel.

Insulation, not a fireplace, keeps the *Exlex* warm.

My meals can't create fires or burns because I eat muesli and sardines, foods that I don't heat.

Nor do I drink hot drinks like coffee and tea, but regular water.

If, for some unexplained reason and against all odds, a fire would start aboard the *Exlex*, I will detect it while it's still small. Small fires are less dangerous than big ones because fire is actually one of the few processes that functions worse on a small scale than on a big. The explanation has to do with the square/cube law because it's the fire volume that creates the reaction heat while the fire surface creates the cooling. In order for a larger fire to be in energy equilibrium, the temperature in it must be higher than in a smaller one. The higher the temperature the better the combustion and that makes the fire even warmer. In addition, the greater the fire, the less its cooling surface is in relation to its volume.

During World War II, this phenomenon was used to burn people to death. The scientists of the Allies calculated that if you released many thousands of fire bombs simultaneously across a city, a fire storm would be formed and you could destroy entire cities.

Among other cities, Tokyo, Hamburg and Dresden were thus bombed despite the fact that it is forbidden to hurt civilians in war. Everything was on fire, not only the houses, but also the asphalt of the paved streets. Children, women, elderly, hundreds of thousands of innocent civilians burned to death. The number of dead and injured was more than at the nuclear bombing of Hiroshima and Nagasaki.

Small fires, on the other hand, are difficult to keep going, as you can deduct from the above. My friends, the little ants, may be able to set fire to the whole anthill, but they can't have campfires. To do that, a much larger critical mass is required.

Small fires are easy to extinguish. On my boat a fire can't get big before I find it.

* * *

I can sail across oceans with complete confidence because *Exlex* can handle any storm that may hit her. This allows me to live in full harmony with the ocean.

* * *

Exlex differs on a number of points from the commercially produced offshore yachts, naturally in terms of size, as it is now criminal to sell small ocean going boats, but also conceptually.

Exlex' total sail area is four square meters. The area is divided into two balanced, square lug sails of 2 square meters each.

The fact that the masts are free standing and are placed side by side gives me the opportunity to release the sail more than 90 ° from the centerline when going downwind. Certainly, I always use preventers, but this is an aerodynamically stable system that avoids jibes. It helps to make the boat course-stable because when she wants to get up into the wind there will be more pressure in the windward sail and less in the leeward sail. The resulting force pushes the bow back leeward.

Without stays and with the sail on the leeward side of the mast, there is nothing, as with a square sail, that is chafing at it. It will not be worn out.

Balanced lug sails don't need any kick because the boom's downhaul is attached 20 % into the boom and acts as a kick.

Balanced lug sails are easy to jibe voluntarily because the sail area is distributed on both sides of the mast. The sail is balanced, as we can deduct from the name. This means that in the same way as a balanced rudder, it requires only limited control power. In the case of the rudder, little force on the tiller. In the case of the sail, little force on the sheets.

For the reader who is not familiar with the balanced lug sail, I would like to mention that the sail is not attached to the mast with slides and that the mast has no track. The boom is attached to the deck with a downhaul and the yard is attached to the mast top via the halyard. It's a simple rig to keep in peak condition because it lacks fittings, mast tracks and slides; only ropes hold the stuff together.

* * *

Exlex has no fixed keel. That eliminates weather helm. Weather helm is good when going to windward, but cruising is mostly about sailing downwind. Having weather helm sailing downwind is a pain.

This, like her sails, makes *Exlex* course-stable running before the wind.

The spoon-shaped bow, the low Froude number and the low displacement/length ratio are other factors that help make her comfortable downwind.

80 - 90% of the passages that I and many other cruisers make are downwind (if you have headwinds, you're facing the wrong direction). Therefore, I don't copy production boats, which, like racers, are optimized for windward work.

Exlex doesn't suffer from windward helm and not from lee helm, either. Her helm is variable and controllable, as it should be.

When sailing to windward, I lower a leeboard. That moves the lateral area forward. The sail center is moved aft, thus obtaining the desired degree of weather helm.

Going downwind I raise the leeboard and move the sailing center forward. In that way, the desired lee helm is obtained.

The thing is that both the sail area and the lateral area can be moved for or aft as desired.

Exlex has leeboard like traditional Dutch boats. They prevent leeway when going to windward. They don't require any space inside the boat. Unlike the lateral area of a production boat, they don't give any resistance at all when they are raised. A boat with leeboards has even less resistance when running downwind than a centerboard boat with a raised center board, since it has no centerboard trunk that causes turbulence.

Exlex' draft is 30 cm. She has a strong flat bottom fitted with 3 mm thick plate of phosphor bronze. This increases her safety as it gives me the opportunity to land on beaches. This can save the day in places beyond civilization where there are no ports or anchorages.

Beaches exist all around the world. Even in tidal harbors, it's beneficial to have a boat with a strong bottom because the boat is dried out twice a day.

Exlex' strong bottom simplifies transport on land, on a trailer behind a car or in a container.

* * *

Thanks to the fact that the *Exlex* hull is made of 4 centimeter thick buoyant Divinycell, which weighs only 100 kilos per cubic meter and has a lot of waterproof compartments, she is unsinkable.

* * *

Exlex' free-standing carbon fiber masts are short; the top of the masts is only 2 meters above the deck. It's total length is 2.5 meters. They weigh 4 kilo each. The masts' center of gravity is 0.7 meters above deck.

One of them, with its top and base resting on two horses, weighed down in the middle by me and two of my more powerful friends, i.e. 100 kilos + 100 kilos + 70 kilos (me) = 270 kilos, yielded only a tiny bit. It certainly could have supported more.

In addition, a short mast doesn't attract great forces. The shorter the mast, the lower its peripheral speed when the boat is capsizing.

Because the *Exlex* mast top has such a low speed, it hits the water softly when it slowly gets wet during capsize. Consequently, the mast is not exposed to any major stresses.

During reefing, the yard is lowered and attached to the mast further down. In this manner, the mast is relieved from halyard compression when it is most needed.

The masts are as easy to handle as a powerful oar. They can be placed into three different holders.

When going downwind, the masts are side by side. This has several advantages. The sails don't give each other lee and the masts are not in my way when I move around on the deck. With the front mast holders along the sides of the boat, I could put a sliding hatch where I wanted it, just in front of the forward bulkhead and midship. On a narrow boat, the hatches should be in the middle.

If I want to give the boat weather helm, for example when I'm sailing against heavy weather or when I have anchored, one of the masts can be placed in a holder aft. To reduce air resistance and bring down the center of gravity in heavy weather, a mast can be lifted and laid down on deck.

* * *

Exlex has two independent rudders. The conceivable advantage is that they will replace the drogue in heavy weather. In port, they can serve as a brake when I approach a landing with the wind in my back. In addition, an extra rudder is always good. Rudders are one reason why big boats are abandoned and sunk. Stories of such accidents are recurring reading in boat magazines.

* * *

Exlex' rudders are controlled through ropes that follow the inside of the hull just below deck. That way, I can steer the boat from my bed, the lunch room; pretty much from anywhere. I must be able to adjust the rudders around the clock because the wind doesn't follow office hours. Self-designed winches allow me to fine-tune the settings. This system gives me more rest in gusty weather.

* * *

Exlex is not in any need of self-steering or autopilot. It not only simplifies everything, saves space and energy, it's a matter of safety.

Many sailing trips have been canceled due to failing self-steering devices.

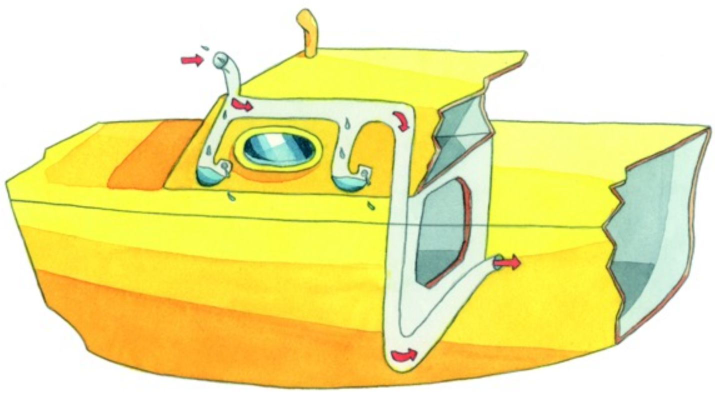
If the boats are not completely useless and you understand natural forces, you can balance them on most courses. Almost all of my trips I've carried out without self-steering devices. With *Exlex*, it will be even easier because of the double independent rudders, the side-by-side balanced lugsails and the variable helm, but also the slim shape of the hull and the spoon-shaped bow that reduces broaching tendencies.

* * *

Exlex is divided into a number of waterproof compartments. It keeps the storage dry and makes the boat unsinkable.

Sealed deck hatches and a ventilation system that keeps the water on the outside means that the boat's interior climate doesn't change even in case of capsize.

Exlex' ventilation system separates splashes from incoming air. When the boat capsizes in rough weather and momentarily is upside down, the inner parts of the system are above the waterline, which stops the water from entering into the boat.



Exlex' ventilation system that keeps water out, in all conditions

* * *

The environment has a big impact on how things work.

If it's really cold outside, the car doesn't start and the grass doesn't grow.

Butter that comes straight out of the fridge is difficult to spread on your sandwich. It's way too hard. On the other hand, if it's terribly hot, like in the Tropics, the butter will melt. It doesn't make for great sandwiches, either.

Homeostasis is a great idea that the animals invented insanely long ago. The intention was to give their cells a stable and constant environment so that they would function optimally regardless of the environment.

The person that introduced the idea was Frenchman Claude Bernard. He used the term *milieu intérieur,* internal environment.

Some of the most important homeostatic mechanisms are thermoregulation, osmoregulation and regulations of blood glucose levels, but there are many more.

Thanks to homeostasis, everything has become as good as it can be; it makes the system man work optimally.

We want our cells to work as well as possible so that we get strong and can think properly.

In my design thinking I have the concept of homeostasis as my model. It will allow me to live in *Exlex* under the best possible conditions.

* * *

As you understand, dear reader, the thing is to have control, order and stuff in peak condition.

During my planned trip, I will travel through the world's storm belt where cold, moisture and strong winds are common. *Exlex'* homeostasis will help give me better conditions than other sailors to realize my intentions.

Exlex is a capsule that will provide a comfortable inner temperature and moisture level. Because every item is secured in its proper place, every item will remain in its place as the boat is being thrown around.

However awful the conditions are outside, it will be snug, comfortable and cozy inside my durable capsule.

* * *

Exlex' windows consist of tempered glass from Emmaboda.

Glass is a much better heat conductor than Plexiglas and polycarbonate, materials of which most boat windows are made. In bad weather, the glass windows get cold in relation to the insulating Divinycell from which *Exlex* is built. That's the point.

"The law of the cold surface" is a physical principle, which states that condensation of moisture always starts at the coldest place.

Everyone is attracted to something. Moisture loves cold surfaces. Pour a cold beer into a glass a warm summer evening. What happens? Within a few seconds, the outside of the glass is wet. Moisture consists of water molecules. They can be found in the air of the room, but are so small and scattered that you can't see them, but as soon as a cold surface appears they all react really quickly and move there. The cold surface becomes a focal point for the surrounding water molecules. And like anything else, the small water molecules can't be in two different places at the same time. The places that they left become dry when the beer glass becomes wet.

It's the same thing in my boat. The vapor that enters the cabin in humid weather moves to the cold surfaces of the windows where it's condensed and drips down into handholds at the bottom of the windows where I can easily collect it.

Consequently, the remaining parts of the interior of the boat remain dry.

It's a simple, energy-efficient and environmentally-friendly way to keep the interior of the boat dry.

And it works. In 1989, when I arrived at St. John's in Newfoundland, the world's foggiest place, after crossing the northern

North Atlantic against the prevailing west winds with *Amfibie Bris*, the salt could be poured out of its container as if it had been in a modern apartment.

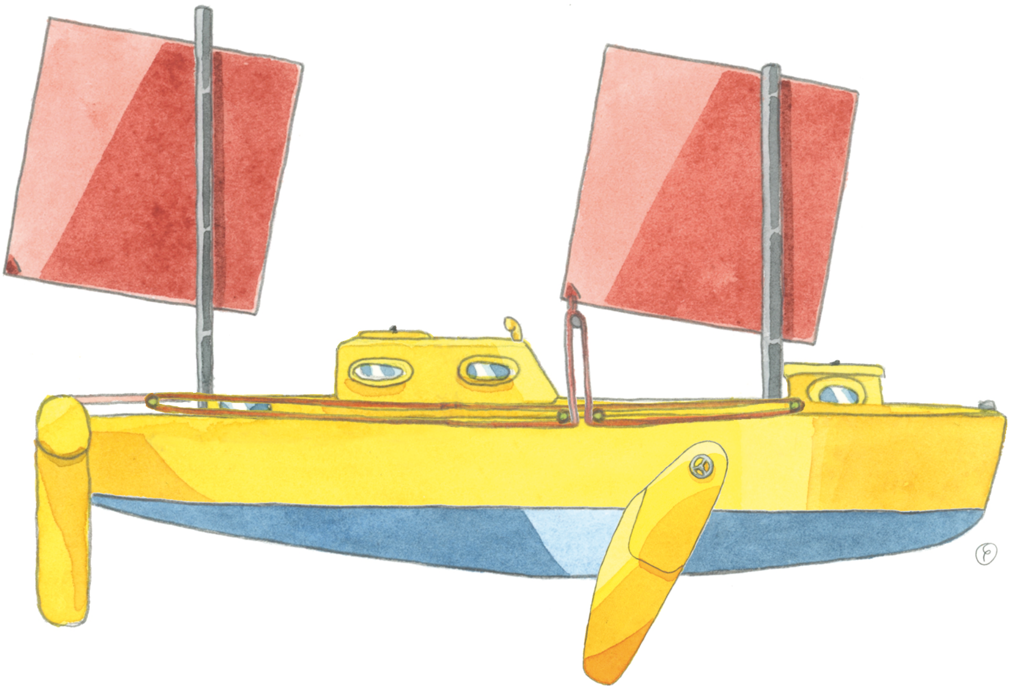
* * *

Many times when I've heard the stormy weather outside, I've carefully opened the hatch a little and checked the windy seas. Breaking water surround the boat, the wind is screaming, the night is black, dark clouds rush above the water. Thinking of the rage of the sea and the awful weather, I've slowly closed the hatch, sealed it tight and returned to my little, warm, snug, cozy cabin, which, despite the storm outside, is as sweet and comfortable as if the boat had sailed on a lake with completely calm water. Such experiences warm my heart and soul.

* * *

Exlex's sheets are endless loops which allow the sails to be trimmed both from the deckhouse at the fore end and the deckhouse at the aft end of the boat without loosening the other cam-cleat, much like a multi-way switch for turning a light on or off from either end of a flight of stairs.

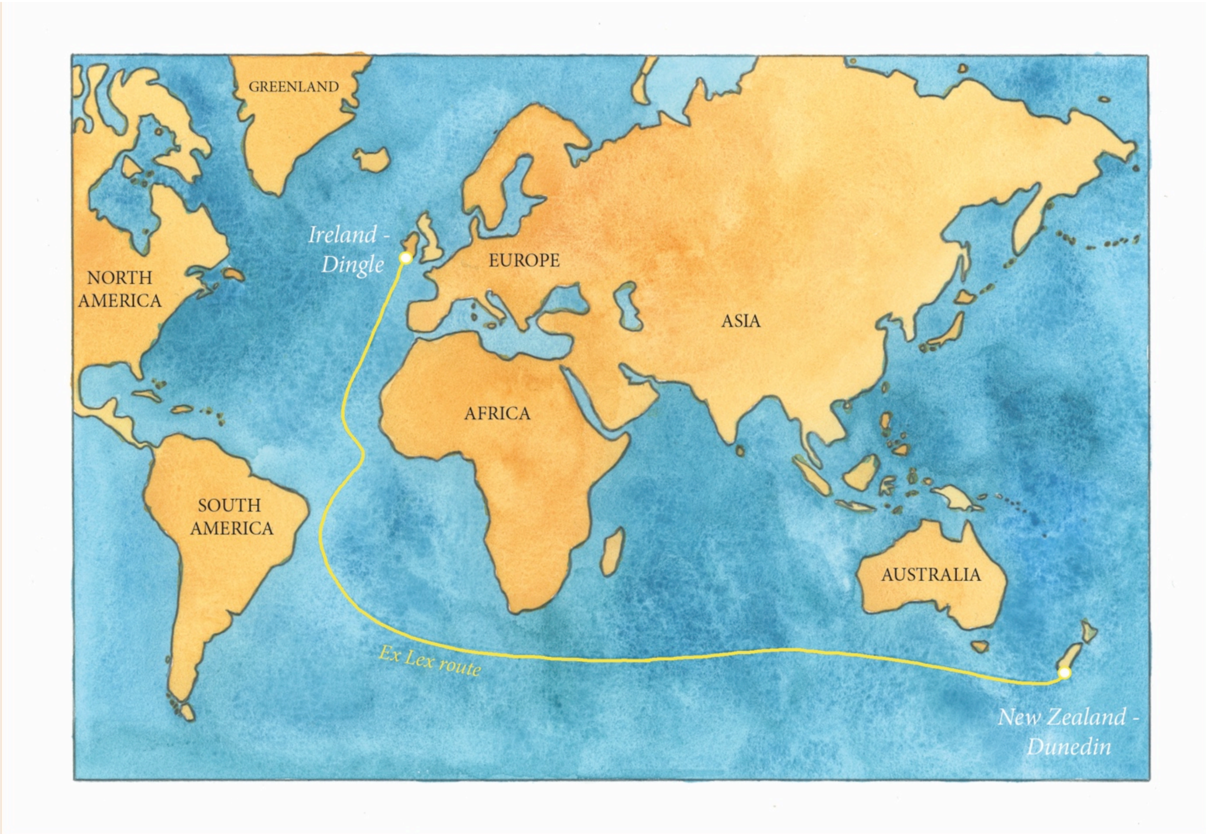
* * *



Exlex is constructed of 4 cm thick 100-kilo Divinycell sheets and NM epoxy. The Divinycell brings buoyancy, stiffness and insulation. The NM epoxy absorbs only very limited amounts of water and is an excellent adhesive.

* * *

8. THE ROUTE, plan A.



I wish to start the sailing trip in May 2018. That year marks the 50-year anniversary of the Golden Globe Race, the first non-stop race around the world. The anniversary will be much celebrated. Not one but two replica races will start in 2018, one from France and one from England. So far a total of fifty boats have signed up, with crews from many nations. My route is the same as theirs the first half of the trip.

In order to make it into open water as quickly as possible, i.e. outside the continental shelf and beyond the shipping lines, I will start my sail toward the intended antipode from Dingle on the west coast of Ireland. It is Europe's westernmost port. Dingle is located further west than both Spain and Portugal.

I will transport the boat to Dingle on a trailer behind my car.

I will sail south, west of Madeira, the Canary Islands and Cape Verde Islands.

A few degrees north of the Equator, I will meet the Southeast trade wind, strong winds that are pure southern there. Then I will go on a port tack.

I intend to cross the Equator as far east as possible so that the Equatorial Stream doesn't take me past the eastern end of Brazil and, against my will, take me back to the North Atlantic.

I will head south on the Brazilian side of the South Atlantic.

In November I should be at latitude 30 °- 40 ° south and have the sun accompanying me. November of the Southern Hemisphere corresponds to our May.

I will continue east, south of Africa's southern tip, pass the southern coasts of Australia and New Zealand. The final goal is Dunedin in New Zealand, 15,200 miles away. I will hopefully arrive in the autumn of the southern hemisphere in good time for my 80th birthday on April 22.

At the start in Ireland, I intend to have food for 400 days on board, in order to be able to make the entire trip non-stop.

The reason why I want to sail the whole distance in one go is not because I want to push any record, but because I'm so unbelievably afraid of coming too close to the coasts. Coasts are dangerous; the farther out to sea the safer I feel.

Cape Town would otherwise be an ideal place to stock up on supplies since it is located along the route and just about halfway, but there is lots of traffic in the area. If you end up in the middle of the shipping routes and there is no wind, that's dangerous.

The intention is to make the trip without a stopover, but if I pass a nice uninhabited island, I might be tempted to stop and purchase supplies and stretch my legs if it proves practical and safe. It's the boat that is to be tested, not me.

My intended trip is, as I've already mentioned, no record attempt. It's an experiment, with a sailable model on a reduced scale, which will give me the opportunity to figure out how my ideas about a small simple functional low-energy cruising boat will work under difficult conditions.

I am now 4.6 times as weak as I was in 1962 when I first left my own country as captain of my own boat for adventures in the great wide world. Naturally you wonder how I have come up with such an exact figure. Easily, actuaries have developed the basis and I have calculated it by calling my insurance company and asking what a health insurance for a foreign trip would cost me. SEK 23,000 was the answer. Then I asked one of my younger friends to call and ask what the same insurance would cost him. Now the price was SEK 5,000.

Apart from something bad happening to me or my boat, sharks are always a risk. For easy-to-understand reasons, I look carefully into the water to detect dangerous animals, but some sharks come straight from below at great speed and attack directly. Should it happen then I'm toast. Sharks are dangerous because they have developed their hunting strategy for hundreds of millions of years.

There is risk of piracy off the west coast of Africa. Certainly, my boat has no commercial value and I don't have any precious goods on board, but because Sweden usually pay large sums of money for kidnapped citizens, pirates and terrorists have become a danger even to poor elderly people in small commercially worthless boats.

Another danger that I could possibly encounter when I get down to the South Ocean is icebergs. There are small icebergs, "bergy bits" and "growlers", no bigger than cars and fortunately of no danger to my strong boat. My problem is the giant icebergs. They can be thousands of square kilometers, some of which are larger than the Swedish island of Gotland. If it's a dark night with bad visibility and I'm running before a gale, I could potentially hit one. They are tall like high-rise buildings so hitting them is like driving into a rock wall. It's not my speed against the iceberg that is the problem, but rather me being thrown against it by meter-high breakers, again and again. Should such a situation occur, then I'm lost.

The risks of being eaten by hungry sharks, getting my head cut off by disappointed pirates or being crushed against huge icebergs are real, but they are small compared to what I'm being exposed to here at home on a daily basis.

The conclusion is: I can have a sigh of relief when I see land disappearing below the horizon because I'm safer in my little boat on the deep, blue, wet, endless, eternal, unchanging sea than in the Kingdom of Sweden.

* * *

The principle behind my low-energy craft is based on basic fluid mechanics and is not controversial. On the contrary: freight ships can never hold a speed around Froude number 0.4 even with huge engines and so much fuel that there is no space left for the freight.

* * *

Should my ideas prove to meet Neptune's requirements, the intention is, as mentioned above, to build a full-scale version of my imaginary low-energy boat that I will name *Exlex Rex* and with it spread the message of safer and more environmentally-friendly sailing.

As it stands, the balance between the many independent parameters seems to produce a boat that is 6.4 meters long and 1.2 meters wide, i.e. I hope to make her 64 cm longer and give her 16 cm more beam than Exlex. I guess she will weigh about 1 ton loaded with provisions for a year. The empty weight is probably going to be about 500 kilograms. In a boat that big I will have room for a girl.

The dimensions are thus smaller, with a good margin, than ocean rowboats and Venetian gondolas. The typical dimensions of a gondola are 10.8 meter length and 1.4 meter width, with a weight of approximately 600 kilos without passengers. The gondola takes six passengers plus the boatman. I think that a fully loaded gondola and the ocean-going rowboat is the upper limit for what an elderly man, for a longer period of time, is capable of propelling with muscle power.

* * *

Exlex obviously suffers from a lot of shortcomings because she has been modified again and again when I have had new ideas that interfere with what has already built, but it's normal for development work.

An author begins with a draft, then he rewrites it a number of times until he finds the result to his taste.

My experiment started with a model that I have modified again and again in a construction spiral, until I am finally getting close to the now satisfactory solution.

I hope my experiment will inspire people who are interested in low-energy solutions to create their own low-energy constructions. The need is enormous.

For example, cars get bigger and bigger. The first model of the Volkswagen Golf weighed 790 kilos. My car, a Golf from 2002, is twice as heavy, 1600 kilos. It should be the other way round; cars should become lighter not heavier.

Housing is also getting increasingly bigger. It's a waste. It's better to make them smaller and more efficient.

If I can live on a boat month after month on less than two square meters of living space, ordinary people on land can live in significantly smaller homes than they do now.

Boats are my area of expertise. I have since 1962, when I left Sweden for the first time as captain on my own boat, been involved in boat construction. Within this field I would like to leave my contribution to dear Mother Earth that has been so kind to me. In order that she may suffer less, at least in that field, it's important that we all help out, everyone according to his or her ability. Therefore, I urge, please contribute! Everyone is good at something.

With an ideal as a guiding star, anything is possible. Even the longest journey begins with one step. You only have to divide the problem into small enough parts.

* * *

Crowd funding without intermediaries

Donations and sponsorships are appreciated.

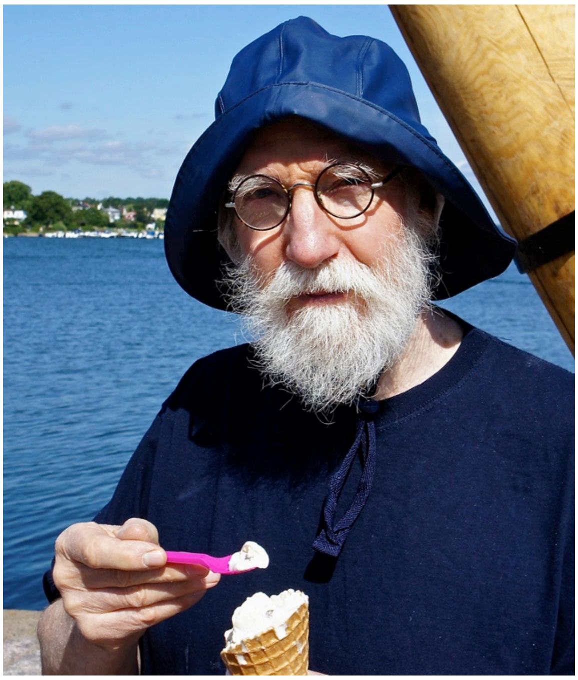
To anyone who wants to support my project, please use Swish to send your contribution to: 0706 200 550.

Alternatively, there is a donation button on my website yrvind.com

To book a lecture, please call 0706 200 550

References can be found on my website: yrvind.com

With respect and affection,
Deep Sea Captain Yrvind



The author on a festive occasion.
Photo: Petter Gustavsson.

Yrvind was born on April 22, 1939, as Sven Lundin. He grew up in a happy house 50 meters from the sea on the windward side of Brännö, an island on the Swedish west coast, with his sister, mother and grandmother. His father, like his grandfather, was a sea captain. They had both rounded Cape Horn on sailing ships.

His father unfortunately died in 1941 when the English sunk his ship the *Ningpo* in Hong Kong.

Due to severe dyslexia, Yrvind went to the School of Viggbyholm from 1950 to 1956, Sweden's first boarding school with a groundbreaking experimental reform education program. It was a happy time for him.

In 1958 he was one of Sweden's first greasers. During the day he worked as instrument maker at KTH (Royal Institute of Technology). In the evenings he went to the city center in a Plymouth convertible from 1936 which he had bought for SEK 600.

At that time there weren't any parking machines, mandatory car inspections or seat belts. There were no limits to either speed or love.

In 1961, Yrvind lived for a short period of time among Eastern-Orthodox monks in the Autonomous State of Athos in northern Greece.

In 1962, he left Sweden on his own for the first time with a 4.75 meter long converted "blekingseka", a Swedish-designed wooden row boat.

In 1974 his boat was the first to land on the world's most isolated island, Tristan da Cuhna. He had built the 6 meter long boat *Bris* in his mother's basement. The island has no harbor but the boat was lifted up and placed on the beach. There he got a job as a math teacher.

In June 1980, during the southern winter, he was the first Swede to round Cape Horn solo. Not only the cold and the storms put high demands on the boat's captain. The sun's altitude at midday was no more than 11 degrees and navigation before GPS was carried out with a sextant. His boat was 5.9 meters long.

In 1989 he sailed against the prevailing westerlies from France via Ireland to Newfoundland in a 4.8 meter long boat.

Yrvind invented a sextant in 1997 whose function is based on completely new principles. It's the biggest thing that has happened in the history of the sextant over the past 200 years, according to The Royal Institute of Navigation.

His sextant weighs only 3 grams and is no bigger than a fingernail. It can be attached to one's glasses and doesn't need to be adjusted.

Despite dyslexia, he has written four books.

He has an aptitude for engineering.

On occasion he can be seen eating ice-cream, but is otherwise strictly puritanical.

Nowadays he is a hermit.

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