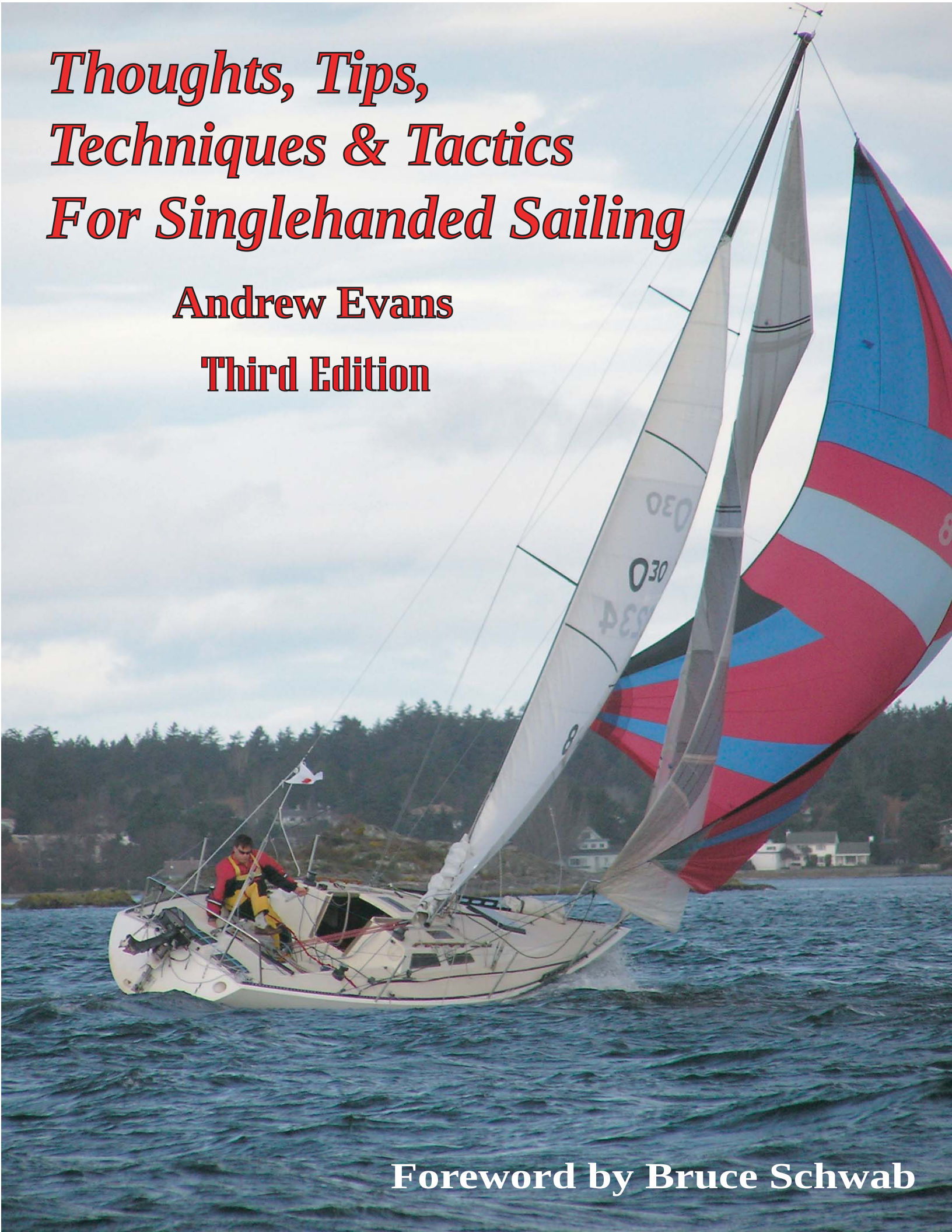
Thoughts, Tips, Techniques & Tactics For Singlehanded Sailing

Andrew Evans

Third Edition



Foreword by Bruce Schwab

This book is only available as a free download from
The Singlehanded Sailing Society at
www.sfbaysss.org/tipsbook

Front and back covers
by Andrew Madding,
club photographer for the
Royal Victoria Yacht Club.

The front cover represents everything it
means to be a singlehanded sailor:
High winds (two reefs in the main and
a storm jib lashed on the bow) the tiller
under my knee with the spin sheet in
one hand – bracing myself with
the other.

The back cover represents everything else
it means to be a singlehanded sailor:
the afternoon nap.

Foreword

I met Andy when he came to help out my preparations on Ocean Planet for the 2004-2005 Vendee Globe. A nice guy and good sense of humor; after all he's Canadian.

In many ways he represents all those who have become successful solo sailors on their own nickel; learning slowly from a mix of hard-earned experience, digging up obscure info, and sharing with each other.

It's not like this sort of experience is falling off trees. While a lot of jabber about singlehanded sailing can be found on discussion forums and the odd magazine articles, this is the first collection of the varied aspects of the sport put together in one place. It takes thousands of hours of sailing to get the kind of knowledge contained in this book. It also takes a lot of experimentation and a willingness to be wrong nine times before getting it right on the tenth.

There are many recipes for successful solo sailing; as many as the actual sailors who do it. And there are many different levels of personal priorities. However many, many of the same mistakes are made over and over by those new to the sport, and by those who simply think they have it already figured out. Most of those mistakes can be prevented by carefully analyzing what Andy has put together.

This is good stuff, and I'm especially glad that he did it, because now I don't have to.

Cheers,
Bruce Schwab

OBITUARIES:
Rewrite man won
Pulitzer Prize, B11

THE CAPITAL
AND VANCOUVER ISLAND

TC B1
Classified, B3
Colour comics, B5
Weather, B12

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SAILORS TAKE ON STORMY SEAS

The freighter Maersk Bering and a sailboat make their way through whitecaps just off Trial Island yesterday as yet another storm hit the area with winds forecast up to 70 kilometres per hour.
Debra Brash/ Times Colonist

This book is dedicated to my wife Sharon, who tells me to "go sailing" every time I get underfoot.
This is why I can sail so often.

Thoughts, Tips, Techniques and Tactics for Singlehanded Sailing
Andrew Evans on Foolish Muse

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If I was the richest man in the world, I'd have a bigger boat and newer sails. But on a Saturday afternoon with only God and the wind, I wouldn't be any happier than I am right now.

Over the past ten years I've gone singlehanded sailing more than eight hundred times. I started just four days after getting my first boat and have rarely looked back. Included in this are more than 250 individual races. In total, it adds up to perhaps 3,500 hours of singlehanded sailing – a reasonable start.

With all of these times that I have left the dock, I have never – not even once – had a bad day on the water. I've had days when things went wrong; difficult things, expensive things. I've had days when the wind blew more than most could handle, and I've had days when it didn't blow at all. But I have never had a day that didn't live up to its full potential, when I wished I had been somewhere else. I am certain that very few sailors in the world can make the same claim.

Sailing gives me a sense of joy that is quite rare. I imagine it is the same sense that the monks in Tibet achieve. It is certainly the sense that the Dalai Lama seems to show every time he laughs.

But not all sailing gives me this feeling, only single-handing. I have raced many times with a full crew, but found myself frustrated more often than not. Why is this? I've had some great crewmates; friendly people who were fantastic to spend time with. Perhaps I found it too exhausting, as skipper, to be responsible for not only my own actions, but the actions of every other person on the boat.

When I'm alone, I rarely need to consider what I'm doing. The boat just reacts to my desires - automatically. One day I was sailing alongside another yacht and the skipper told me that I "wear my boat like a glove." So I guess it could be said that for me, sailing alone is like putting on a comfortable body suit that reacts to my every whim; but sailing with a crew is like wearing a suit of armor, where every move must be considered, communicated, then performed. It's just too much work.

I do know that if singlehanded sailing was not possible, I wouldn't sail at all; I'd take up some other hobby – perhaps jigsaw puzzles.

With this number of trips under my keel, it is reasonable to guess that I am one of the more experienced singlehanded sailors in the world. Not in miles, but certainly in number of times I've left the dock, number of tacks, number of gybes, spinnaker launches and douses, and number of learning experiences.

By nature, I have a real interest in efficiency. I have always tried to find the best, most efficient way to perform any task. Over the past decade I have looked at every aspect of singlehanded sailing and tried to find the best way to do it on my boat. This compulsion gets right down to the how long should I pause during a tack to do the least work hauling in the sheets, and it even includes a detailed plan on how to urinate. I've taken every action down to a precise science.

I am also not at all shy about asking questions of other sailors. I get some funny looks at the bar and some nasty comments on the forums, but I would rather look stupid and learn, than look smart and remain stupid. When I speak to other skippers, I don't just ask "do you use a spinnaker?" I ask, "Tell me the exact steps you take to pull the halyard, guy and sheet to raise the spinnaker without fouling it?" My Olson 30 is named Foolish Muse, and my forum name is Foolish. Some have pointed out that this seems appropriate.

This book is the result of an almost "academic" study of the techniques of singlehanded sailing. It is also the result of trial and an incredible number of errors. For the first eight years of sailing, I can confidently say that something

went wrong every time I went out – every single time. It got to the point where if I was returning to the dock and something bad had not happened yet, I knew that it still would happen. I have always pushed my boat and myself to the limit. Of course things will go wrong when pushed.

Every time something went wrong, I took it as a learning experience. Most times it took making the same mistake over and over again before I figured out a better way. I can give an example of raising the spinnaker. I'd had too many broaches to count before finally figuring out the perfect method. Because of these I know exactly how far the water will come into my cockpit on a broach and no longer have any fear, or even concern, about broaching. But since the day that I figured it out, I have not had a single broach in any wind conditions.

But I am not finished. That things have stopped going wrong over the past year is only an indication that I need a faster boat to start the learning process again.

The purpose of this book is to impart these many, many lessons to the reader in the form of tips, techniques and tactics. In some cases I will go into a painful level of detail. My intention is that a new singlehander should not have to go through the trial and error phase that I followed. If he or she can learn from my mistakes before they leave the dock, they can push their boat further and create their own, new mistakes. After reading this book, and with perhaps one or two thousand hours of practice, every sailor should be able to wear their boat like a glove.

This book has been downloaded about twenty thousand times so for, and a Google search finds more links that I could ever have imagined. Parts of it have been translated into a dozen languages, some of which I don't recognize at all. An attempt is even being made to translate the whole thing into Polish! I've received messages and contributions from all over the world. Thank you very much.

My Heroes:

The single-handed community is fairly small and a few names are well known. My office has autographed posters of Dame Ellen MacArthur and Sir Robin Knox-Johnston. (It seems that of any activity in the world, singlehanded sailors have the best odds of being Knighted.)

My greatest admiration goes to everyone who left the dock on their own, personal voyage. Some of these skippers have met their goals, while others have not. One circumnavigator stayed at sea for over 1,000 days, while another ended her voyage after just a week. But they have all been successful in undertaking a significant life adventure. They all have stories to tell and they are all worthy of our admiration. Offshore singlehanded sailing is a challenge taken by less than one out of every ten million people in the world. In our over protective society, it is one of the few activities where an individual is responsible for his own safety. For this reason alone, every singlehanded sailor made it onto my hero list the moment they left the dock.

My dream started back in 1989 when I read John Hughes "The Sailing Spirit" about the BOC Challenge (forerunner of the Around Alone and 5 Oceans.) I followed the races very carefully in a time before the internet, when the only news was a recorded voice over an expensive long distance telephone call. I plotted the positions with coloured lines on a world map. Eleven years later I said to my wife, "If I'm going to sail around the world, I'd better get a boat," and this adventure began.

By profession I am a lawyer and Chartered Financial Analyst, but mostly I am President of a small company in the solar power industry. I live in Victoria, on the west coast of Canada and sail out of the Royal Victoria Yacht Club. I am blessed that this is the only region of a cold country where I can sail year round.

Sextant Users Guide:
A few years ago, Santa gave me a new sextant for Christmas. I borrowed five books from the library, but was more confused than ever. They all go into a level of mathematical complexity that is well beyond my understanding, and they all assume that I am on the deck of an aircraft carrier, not bucking the waves on a 30' sailboat with the tiller under my knee. I got fed up and determined that the only way to learn the darned thing was to write my own guide. It can be downloaded at:
http://estarzinger.com/estarzinger/pdf/sextant.pdf
Have fun.

Comments and Suggestions are welcome:
The best part of a web based book is the simplicity of making changes. Readers are welcome to send comments. With enough updates I'll publish a fourth edition:
FoolishMuse@aol.com

Corporate Sponsor Wanted:
I am looking for a significant corporate sponsor to take racing to the next level in offshore events. Please contact me at FoolishMuse@aol.com.

Here is a quote from Jerry Freeman, from the Solo Offshore Racing Club website (www.offshoresolo.com)

For most of us normal yachties the prospect of spending 20 to 30 nights alone at sea is so far off the scale as to be impossible to contemplate. A recent gathering of singlehanders provided an ideal opportunity to study these rare creatures in their natural habitat before they dispersed for their hibernation.

Is it a macho thing, this solo ocean racing? If so why is it that two of the biggest boats were sailed by the two most petite lady skippers? They will claim that solo yacht racing is a cerebral sport like chess; brawn is not required and if it is you must be doing something wrong so have a nap and try again. What other sport is there where the contestants out-sleep each other?

From this group, it seems the overriding qualification for solo sailing is advanced age, being a paid up member of the 'Last Chance' brigade. Time is running out as the years of procras-tination accumulate towards a crisis. Grandpa, casting off the responsible years of family and school fees, enjoys a financial second wind. The prospect of dying and not knowing becomes more scary than the prospect of going.

The legend of the oldest race goes back to 1960 when men were made of sterner stuff and by gum they had to be. That's the trouble with young people, no respect, they just toddle across the Atlantic like it was a Sunday school outing. Where is the drama, the passion, how are they going to get a book deal out of 21 days and no problems?

The art of tuning a cat's whisker on the wireless has been lost in the mists of time as the Iridium phone connection brings Mum and Dad into the cabin with the clarity and convenience of normal conversation. There's not even Test Match cricket on short wave of the BBC World Service to endure, all gone! What about enjoying a pipe of Condor 'ready rubbed' and a glass of fine claret under the spray hood to

celebrate a good day's run? You can forget that. We are all athletes now.

Numerous reviews have been written about this book. Here is my favorite, from The Watchorn:

This month I'd like to switch gears and get a little philosophical with you about boating. I was recently reading a lengthy article titled "Singlehanded Tips," written by Andrew Evans, who has logged more than 3,000 hours of singlehanded sailing in the last ten years. The article is a great read that runs for 147 pages. I highly recommend it to anyone interested in the mental and physical affects that singlehanded sailing can have on an individual, or for those who are toying with the idea of rigging your vessel for singlehanded operation.

The subject that interests me most in this article is the underlying desire for these eccentric boaters to try singlehanded sailing in the first place. Yes, at times everyone has a reason for taking their boat out by themselves and partaking in a little solo cruise, but this type of sailing is a far cry from bashing through fifteen foot seas with a triple reef in the main and sixty knot winds trying to knock the boat over on her ear. And to do this by yourself, with no one there to relieve you at the wheel or to make you a hot cup of coffee when you are tired, must require a hearty individual indeed. If these men and women weren't finding their thrills sailing they would probably be getting them by fighting the Taliban in Afghanistan, base-jumping off of cliffs or, even more terrifying, trying to eat my girlfriend's meatloaf without making a funny face. (To be fair, she is a vegetarian. Trying to get her to cook meat is like asking a blind man to describe a rainbow.) I guess some people see a mountain and just have to climb it.

I wonder if some people have a natural inclination towards danger. Certainly the idea goes against Darwin's thoughts; natural selection does not favor those who stick their necks too far into the fire. And yet I have known too many people who simply must do something dangerous in order to truly feel alive. Is this rush of adrenaline really worth the chance of perishing in Arctic waters during a heavy storm? Being the polar opposite of these adrenaline junkies, I guess I really cannot say. I can tell you I'm jealous every time I read literature like the aforementioned article, and can't help but daydream of what it must truly be like to fight tooth and nail for every second of survival. I can also tell you that it simply must be better to feel those fleeting moments of danger and survive them than to have never felt them at all. Andrew Evans, I salute you.
D.H.jr

Pablo Neruda:
…and now, nothing more,
I want to be alone with my essential sea…
I don't want to speak for a long time,
Silence! I want to learn,
I want to know if I exist.

Ch. 2: The Mental Challenge:

Many sailors consider "shorthanded sailing" to be comparable to "singlehanded sailing." In my view, having two people on the boat is no different from having eight. The reason is not because of the physical challenges. The reasons are entirely because of the mental and emotional challenges facing a singlehander that the crew of a double handed or fully crewed boat will never see. Mental challenges occur during even the shortest trips. Emotional challenges can appear on trips as short as eight hours, but more likely after 12 hours or a day.

The internet has become the best resource to prove this point. Skippers in round the world races are posting daily video to the web. These videos show sailors who are physically, mentally and emotionally exhausted from days without adequate sleep. It is obvious that they are working with significantly less than full mental faculties. The pictures are completely different from double handed or crewed boats, where sleep is possible. Solo sailors are forced into complex decision making processes at the very time when they are least able to perform.

Quoting from Ellen MacArthur's incredible story in "Taking on the World:"
"It was more than just physical exhaustion; it was causing more pain inside than I had ever felt before. I clenched my teeth and threw my head down against the hard, wet floor and wept. I cried like a baby till I was so numb with the cold that the pain was dulled. Shivering and weak, I crawled into the cabin and slept in my waterproofs, curled up in a ball in the footwell by the engine."

From John Hughes' "The Sailing Spirit:"
"The tears ran unabated down my face as I watch Turtles, the boat carrying my girlfriend, Vick, my mother, and my close friends turn and scuttle back to the shelter of Newport harbour. The image of that parting will never leave me. It came almost two hours after the starting gun was fired to signal the start of the BOC race, two hours of beating to windward that had left me physically and emotionally exhausted."

From the Singlehanded Transpac logs:
"Last thought for now: it is so beautiful out here, I am finding myself crying over every happy memory I have with family and friends. I don't know why that's going on."

Another Transpac memory:
"I spent two solid hours bawling half way to Hawaii. Every sad possibility crossed my mind. "What was in the half-way package that my wife gave me? Was it a note that she was leaving me? Was it a note that she was dieing?" I knew that these were both incredibly ridiculous concepts, but I'd been alone for more than a week with very little sleep and no contact from home, emotions can run wild."

From Adam Mayers' "Sea of Dreams:"
"John Dennis turned fifty-eight on the fleet's third day back at sea after the Bay of Biscay storm. The boyish glee he'd felt on leaving Newport was long gone and he felt old, tired, depressed, and guilty about the toll the trip was taking on his family, something he had not fully considered before he set sail. He had expected to miss them, but had not expected the pangs of loneliness to outweigh the pleasure of the journey. Phone calls and e-mails became painful stews of anticipation and regret."

In a later chapter, when Dennis is forced to retire from mechanical problems, Mayers continues: **"It was over; John Dennis was not going to sail around the world. "I'm so drained, I don't have any tears left", he said, "It is a dream and I know now I am never going to achieve it. I'm devastated."**

As far as I know, singlehanded sailing is the only sport where one needs to be physically, mentally and emotionally ready, just to finish. I have read many books on sailing the great races. I have never read that the skipper of a Volvo Ocean Race boat broke down and cried. It just does not happen on a crewed boat. This is the difference between singlehanding and crewing, even with just two on board.

Consider how rare it is in modern society for someone to be totally alone and totally self reliant. This does not mean reading a book with a family member in the next room. This does not mean sitting with a telephone or computer nearby, ready to electronically communicate. Being totally alone means the sailor must rely completely on his own abilities with no recourse to any assistance from any other person.

Some might counter that with radio, cell phone or satellite phone a singlehander is never alone and can always call for assistance. This is true in the long term, but has no standing for the hundreds of things that do go awry and require immediate resolution. A VHF serves no purpose when a boat is broached and the cockpit is half full of water. A cell phone won't help with strong winds and a lee shore. A single side band radio cannot unwrap a spinnaker.

In one race with a 20 knot wind, I wrapped my spinnaker around the forestay attempting a gybe. I was about 3 minutes from the rocks, but because of the spinnaker half out, could not turn up. I went to the bow and got the chute down with about 30 seconds to spare. After the race, the skipper of a crewed boat told me that they were just about to come to my aid when I got the mess sorted. I could only ask him "What were you going to do?" My actions alone were the only possible source of a solution to the problem. If I couldn't do it, the boat was lost.

The singlehanded sailor must understand that he is completely, 100% self reliant. It is up to him alone to solve every situation that he faces, whether it be a simple knotted line or a life threatening danger. I believe that this is why we are rare. One only needs to look at a single/ double handed race, regardless of it being a two hour club event or a professional around the world adventure. There will be ten double handed boats for every singlehander. The reason is not that the double handers are physically incapable of sailing their boat alone. The reason is that only the singlehanders are willing to take on the challenge of 100% self reliance. This can be a very uncomfortable position. It is such a rare situation that most people will never face it.

Stress and Coping

Several studies have concentrated on the specific stresses of long distance, singlehanded sailing.

"Medical and psychological problems in the 1972 singlehanded transatlantic yacht race" Glin Bennet, The Lancet 2, 1973.

Bennet performed an in-depth, real time study of thirty-four competitors in the Observer Transatlantic race. Each competitor was designated by a letter A-Z.

Sailing in general is an exhilarating activity most of the time. However, when a man has to spend hours on end at the helm, is cold, soaked through, seasick, hungry, uncertain about his ability to handle the boat in all conditions, and does not know his position, he is liable to make mistakes observing lights and landmarks, reading his charts, and planning rational courses of

action. This is borne out by numerous personal accounts reported to me, and is in line with experimental work on the effects of fatigue on performance.

Visual Experiences:
R reported on day 10: "Spots… before.. my eyes when looking at the sky. I feel my tactics in staying south and east so long may have backfired with this weather and more or less put me out of the competitive race." He was sleeping adequately but feeling tense and physically uncomfortable. On day 26 "spots before my eyes again. Not serious and only occasional… I think I've been spoiled by all that calm weather. Conditions have not been all that rough but I'm really exhausted".

Day 35: "usual spots before eyes when tired. Three days of gales and storms. Very miserable. Poor progress." He had little sleep during this period, made errors in navigation and sail handling: a tape recording made at the time records his distress and despair in the most poignant fashion.

T was setting his twin foresails for the first time in the race at about noon on day 33 in good visibility when he saw an object in the water. "A baby elephant", he thought: "A funny place to put a baby elephant." A little later, looking at the same object: "A funny place to put a Ford Popular." He accepted these observations without question until on closer inspection he realized that the object was a whale. This occurred 3 days before arrival, and he was feeling alert, only trying out a maneuver for the first time.

Much more complex visual experiences were reported in the qualifying trip. K had been continuously at the helm for 56 hours because of bad conditions, and was making do with only occasional snacks. He saw his father-in-law at the top of the mast. They were aware of one another's presence, and the experience was in no way alarming.

Sailing his 52ft trimaran up from the Bay of Biscay around Ushant, A could not put into any harbour west of St. Malo, and because of the treacherous coast and the shipping he could get little rest. Further he had only 1 day's food remaining, to last for 6 days. He was lying on his bunk when he heard a man putting the boat about on to the other tack. He had "seen" nothing at that point, but when he went up on deck to investigate the man passed him in the passageway coming down as he went up. The boat had indeed been put about and was on the correct course.

Amongst singlehanders the difference between sleeping and waking was often blurred even when apparently well rested, so what was a premonition while awake and what was a dream dreamed in sleep was hard to diminish.

What is striking is the frequency and range of the psychological phenomena reported. Taken out of context they might be said to provide evidence of severe mental disorder, but what is their significance in context? Is there something special about the business of singlehanded sailing that makes such phenomena common, or are they due to some peculiarity in the sailors themselves?

Experimental work on sensory deprivation and sleep deprivation shows that gross disorders of perception and thinking processes can be produced quite reliably. Further, these reactions are more likely if the subject is fatigued or anxious. The sustained exposure to the elements, the seasickness, and lack of nourishment certainly contribute to the development of fatigue. Sensory deprivation also occurred, but mainly in the form of seduced patterning. The whine of wind in the rigging, the steady noise of the waves, the lack of anything on the surface of the sea or in the sky, especially in foggy conditions, all reduce the sensory input and increase the likelihood of the development of visual and auditory experience from within.

Published accounts of perceptual disturbances which would lead the subject to disaster suggest that insight generally prevents total destruction. For instance, a very weary sailor on another occasion was close to the Belgian coast and saw two men on the shore beckoning him and pointing to the harbour entrance. He did not go in for some reason but anchored offshore. In the morning he woke after a long sleep to find only rocks along that stretch of coast. On the other hand one is not likely to have many records from the very fatigued whose insight was totally suspended.

It is hoped that those who have to maintain a high level of function in adverse physical conditions will come to recognize the subtle ways fatigue can place them at risk and take measures to protect themselves.

Hallucinations are fairly common among singlehanders. This is a predictable byproduct of lack of sleep and an unfamiliar environment. During the Singlehanded Transpac, I climbed on deck in the middle of the night to find three men crouched at the bow as I sailed down a river in Germany. They were ignoring my commands. After a couple of minutes I sat down in the cockpit and realized that something was wrong. I gained hold of my senses and thought "wow, that must be an hallucination."

In the 2002 Transpac, Mark Deppe reported:

I had my first set of lucid dreams in awhile last night. A lucid dream is unlike any normal kind of dream. It is so vivid and detailed that it is very close to being awake. But the most interesting aspect is that the dreamer is aware that he is dreaming, and can control how the dream develops.

I've only experienced lucid dreams a handful of times, and most always on a boat or ship after a week or so. In my case, being extremely fatigued helps initiate the special conditions required to enter the lucid state, since you must remain aware of the fact you are dreaming without actually waking up. It's a very fine line. The dream rivals reality in how detailed and lifelike it is. My favorite thing to do while lucid dreaming is to fly. Since I can control any aspect of the dream, I can move my body about freely without any of the normal constraints of gravity. Fun stuff.

Hearing Voices: While crossing the Pacific, I heard distinct voices inside the boat. It sounded like a group of people having a conversation in a foreign language, as if over a radio broadcast. I have never had this experience with short

voyages, so it is not simply because of water on the hull. Fatigue must play a roll.

This is a very common phenomena on long distance voyages, as indicated by Mark Deppe aboard the J-120 Alchera in the 2008 Transpac logs:

I've started hearing voices again. Seems to happen every Transpac at some point. I could swear there's a radio with a talk show tuned in located somewhere in the forward berth under the spinnaker I have spread out drying from the last dunking it took. And in the sound of the water going by outside the hull I hear what sounds like party conversations going on very faintly.

In 2002 Mark reported:

Got to go, it sounds like there's an argument going on in the forward berth, and someone else is knocking on the outside of the hull for attention. There's another voice that keeps saying 'Got Milk?' 'Got Milk?' over and over again, I wish it would get it's milk and shut up.

Al Hughes on the Open 60 Dogbark reported the same:

Dogbark has had a relatively slow trip for her so far but the skipper is showing signs of cracking. I remember this from the first trip, I start hearing things, like a radio playing or voices in the background. After a while you can start talking to them, strange but true. I guess it is a little bit of sleep deprivation, near constant stress and limited contact with others, sound like the solo sailors lament or dream depending.

I know of one skipper who searched his boat for stowaways during the 2006 Transpac.

"Psychological breakdown at sea: hazards of singlehanded ocean sailing," Glin Bennet, British Journal of medical Psychology, 47, 1974. In his second study, Bennet carefully analyzed the stresses faced by Donald Crowhurst in his ill fated attempt at the first round the world race, based on the research in the book "The Strange Last Voyage of Donald Crowhurst" by Nicholas Tomalin and Ron Hall: 1970.

"**It is perhaps the most completely documented account of a psychological breakdown."**

His speculative writings begin proper off the southern part of South America while he is waiting to "re-enter" the race. He becomes aware of the tremendous reception awaiting him, the B.B.C. coming out to meet him, and he finally retreats from reality altogether. Until the last few days of course he is sailing his boat competently and navigating with adequate precision, and later when he was apparently totally preoccupied with his thoughts he was able to send messages in morse concerning his arrival home. These are all relatively complex tasks which one might not expect of someone as detached from reality as presumably Crowhurst was. Or does it mean that someone apparently absorbed with their own thoughts does have a greater ability to switch back into contact than is generally supposed?

On the whole, the evidence points to a breakdown in the face of an utterly impossible situation: a tumultuous homecoming with national television and radio coverage as the winner of a unique contest, through a deception that was certain to be discovered. The disgrace would be bigger enough for anyone to bear, but for Donald Crowhurst

this was to have been the triumphal moment of a life that until now had been marked by many false starts and failures. This success had possibly been achieved in his mind from the moment he first thought of circumnavigation. The realities of the voyage had proved too much for him, and when after the first fortnight of the voyage success seemed to be slipping out of reach, he began to manipulate he realities until he had adjusted the world to match his requirements. Then in his mind he gained mastery over the world, over the universe, over god, until there was no longer any point in remaining in the world which most people regard as real.

One of the functions of tragedy in the theatre is to present an intensified view of ordinary life. With the story of Donald Crowhurst we have such a story but, alas, one that is true. The crisis and the breakdown occurred on the high seas, but the steps which led to it in the first place and the remorseless way in which he became more firmly caught in the trap are clearly discernible, and the parallels with ordinary life are not hard to find. Individuals will make their own interpretations, but one powerful message that comes through from this story is the need to provide those in distress with the opportunity to express their real feelings when all around them the barriers are going up and the avenues of escape are closing.

Read the 2nd half of the last paragraph one more time, just to absorb it again.

I strongly recommend that every singlehander read "The Strange Last Voyage of Donald Crowhurst" AND "The Long Way" by Bernard Moitessier. I have never seen an instance where the line between genius and insanity was so fine.

"Voluntary Solitude: Studies of men in a singlehanded Transatlantic sailing race", H.E. Lewis, J.M. Harris, D.H. Lewis, C. deMonchhaux, The Lancet 1, 1964

This was a detailed real time study of the participants in a 1960 race from Plymouth, England to New York, USA.

The men have certain features of reported mood pattern in common. On the whole they tended consistently to be calm and relaxed rather than irritable and excitable, to feel keen to do well rather than regretful at having started, and to be confident rather than scared.

There is even more resemblance among the men in the pattern of interrelation between their moods than there is in the mood profile itself. Thus the positively toned emotions tended consistently to occur together, and likewise the negatively toned ones. Calmness, relaxation, self-sufficiency, keenness, confidence and physical freshness were closely related to each other in all the records, and conversely excitability, irritability, tension, boredom, loneliness, exhaustion and fear waxed and waned together.

"Stress and Coping in Single-Handed Round-the-World Ocean Sailing" Neil J.V. Weston, et. al: University of Portsmouth, UK. Journal of Applied Sport Psychology. 21 – 2009

Weston performed a detailed psychological assessment of five single-handed sailors entered into the 2006/2007 Velux 5 Oceans round-the-world race.

All skippers stated that poor yacht performance as a result of light winds was one of the most difficult stressors to deal with. Although much of the responsibility for the poor progress lay outside their control, skippers would spend a lot of time and energy trying to find wind and get the yacht moving. These efforts would subsequently result in less sleep, greater physical exhaustion, emotional instability.

As discussed above, singlehanders do not face their greatest stress in storms, but rather in calms. I believe that this study is applicable: David Maister, "The psychology of waiting lines" 1985

Uncertain Waits Are Longer than Known, Finite Waits: The most profound source of anxiety in waiting is how long the wait will be. For example, if a patient in a waiting room is told that the doctor will be delayed thirty minutes, he experiences an initial annoyance but then relaxes into an acceptance of the inevitability of the wait. However, if the patient is told the doctor will be free soon, he spends the whole time in a state of nervous anticipation, unable to settle down, afraid to depart and come back. The patient's expectations are being managed poorly.

A good example of the role of uncertainty in the waiting experience is provided by the "appointment syndrome." Clients who arrive early for an appointment will sit contentedly until the scheduled time, even if this is a significant amount of time in an absolute sense (say, thirty minutes). However, once the appointment time is passed, even a short wait of, say, ten minutes, grows increasingly annoying. The wait until the appointed time is finite; waiting beyond the point has no knowable limit.

Solo Waits Feel Longer than Group Waits: One of the remarkable syndromes to observe in waiting lines is to see individuals sitting or standing next to each other without talking or otherwise interacting until an announcement of a delay is made. Then the individuals suddenly turn to each other to express their exasperation, wonder collectively what is happening, and console each other. What this illustrates is that there is some form of comfort in group waiting rather than waiting alone.

The most successful predator introduced to hunt down unproductive and anxiety-producing wait times has been the Blackberry. Aptly dubbed the "Crackberry" by some, this device lets people be productive in the most naturally unproductive locations, like waiting in line. I guess this would apply to text messaging on phones or other things that can be done silently in lines.

The above studies prove that calms of indeterminate length cause the greatest stress to singlehanders. With a crew there are others to talk and joke with. By oneself there is nothing that can be done to improve the situation. A simple, inexpensive handheld video game might be the best solution to this problem. A small game of Tetris will keep one occupied for hours.

Weston provided the following as stress coping mechanisms from their study:
Using social support (e.g., team, family, friends, supporters, organizers) enabled skippers to deal with the difficult

environmental conditions, isolation, and possible threat stressors. Anshel (1996) suggested that such emotion-focused coping approaches are more likely under low perceived controllability situations. Nevertheless, although the present findings provide partial support for this assertion, the skippers also employed other problem – (e.g., staying calm), appraisal – (e.g. rationalizing the situation), and approach – focusing efforts on controllable factors) focused coping to deal with these uncontrollable environmental stressors.

Boredom:

Surprisingly, boredom can set in even when sailing conditions are perfect and the boat is moving at top speed. I was very bored in the steady trade winds a few days out of Hawaii. The boat was steering itself perfectly. There were no steps that I could take to increase performance, so I had nothing to do. During an afternoon radio chat, one of the other skippers mirrored my thoughts exactly when he commented, "I never expected to be so bored."

A skipper is advised to bring numerous books on any voyage. Modern society does not train us on how to sit still and do nothing. It is much more difficult than most people desire.

I have found tremendous relief by listening to audio books. The website www.librivox.org contains thousands of classic books in the public domain and free to download. I will never have a chance to actually read massive volumes such as the 1,946 pages in 135 chapters of Moby Dick. But I was very happy to listen to it over 24 hours, 37 minutes. Another fascinating book was "The Eventful History of the Mutiny and Piratical Seizure of H.M.S. Bounty: Its Causes and Consequences" running ten and a half hours. Both of these go well beyond anything we have seen in the movies. Virtually all of the classic novels are represented at librivox.org and skippers will find them welcome friends on long voyages.

Emotional Inertia:

"Fear Paralysis" is a well understood phenomena where a person is in such fear that they are unable to move. I know of one sailor who experienced this during the famous Fastnet storm. He was so paralyzed that his crew moved him below, where he simply curled up on the bunk for the duration of the storm.

I have developed a different theory that seems to be applicable to singlehanded sailors or others who perform dangerous tasks alone. This theory is based on my own experience and what I have seen from others. "Emotional inertia" occurs in a highly stressful situation in unfamiliar circumstances. The result of the inertia is that the singlehander continues to actively sail on his present course and hope for the best, even though the course will lead to certain doom, rather than take the potentially dangerous action required to resolve the situation.

There are three keys to recognize in this situation. First is that the singlehander continues to actively sail the boat, trim the sails and steer on the present course.

Second, the present course will lead to certain doom. That is, there is no question that (at least in the skipper's mind) the course will lead to a very bad, dangerous or even life threatening situation. Sailing into a rock, loosing the rig, etc. are perfect examples of this type of situation.

Third, the skipper is unwilling to take whatever action is necessary to rectify the situation because he is afraid of the danger of that action. He simply "hopes for the best." In some cases the required action will be extreme, but in foresight it is still preferable to the doom faced on the existing course. Note that I said "in

foresight." What matters is that the skipper perceives that doom is certain.

The best example is a boat heading for rocks in high winds. The only way to avoid the rocks is by gybing, but this action will bring the boat even closer to the rocks before sailing clear. The skipper must make an immediate choice between the certainty of hitting the rocks in three minutes, or gybing and with the potential of hitting the rocks immediately or hopefully sailing clear. But the skipper faces emotional inertia. He is unable to make the choice to gybe, so sails on to his doom on the rocks.

I've included this concept because if one is aware of the concept of emotional inertia, he will be able to avoid it. When facing this type of dilemma, the skipper should think for a moment "this must be that emotional inertia problem. I should snap out of it and do something!"

I have faced the rocks dilemma twice in my sailing career. The first time I was unwilling to gybe and ran on the rocks. After developing the theory of emotional inertia, the second time I was aware of the dilemma and did an immediate gybe and sailed clear.

As one becomes more skilled, the starting point for emotional inertia moves further out on the scale, but it is still in effect. Here are two examples of highly skilled sailing experts. I believe that they faced it in what can only be described as the most extreme circumstances.

I believe that Derek Hatfield faced emotional inertia approaching Cape Horn, as described in the book "Sea Of Dreams," by Adam Mayers:

As dawn broke on Friday, March 7, Hatfield saw a red light winking ahead to his right, about two and a half miles away. He had been at the helm for almost twenty-four hours and was so exhausted he could barely think, so he was not able to comprehend immediately what his eyes were telling him. As the realization sank in, fear squeezed the breath from his lungs. He would later say this moment was the most terrifying in his life. "It still makes me shiver thinking about it," he says.

Hatfield knew he was looking at the glow of a lighthouse. But if this was the Horn, the lighthouse should be on his left, not his right. If it was the Horn, it meant he was driving towards assured destruction, for to the left there could only be the jagged shards of volcanic rock. Driven by hurricane force winds, he would be dead very quickly, joining the thousands of others who had perished here.

… Over the next fifteen to twenty minutes, the red circle of light drew closer as Spirit of Canada surfed barepoled towards its fate. The light transfixed Hatfield, and he wondered whether these were his last moments on earth. He tried to change course and sail towards the light in the hope that as he got closer he would be able to see it more clearly and manoeuvre around it. But try as he might, he couldn't do it. This wind and wave combination was such that as he altered his course the waves threatened to capsize his boat. When collision seemed certain, the light slip by and receded into the night. … He had passed the Diego Ramirez Islands, a small chain of rocky outcrops … thirty miles west of the horn.

I believe that Pete Goss was facing emotional inertia, as described in his fantastic book "Close to the Wind."

An hour later the wind suddenly increased… up to forty knots… I would never be able to reduce sail in time – the boat was on edge and it would be too much to

ask the autopilot. …The front two thirds of the boat was out of the water, the bow was up and she was touching twenty-seven knots as the gusts swept in from nowhere….What a prat! I was trapped by my own stupidity. She was over canvassed and yet there was no way I could put the boat back on autopilot so that I could go forward and reduce sail. All I could do was helm and hope for the best. (Note that I had written the "hope for the best" line in my emotional inertia theory prior to reading Goss's account.) **…whatever happened now I must keep clear of the runner – the rig was going to go for sure.**

A few hours later Goss's boat did a Chinese gybe and broached, pinning the mast to the water. Luckily the rig survived, but the spinnaker was destroyed. Continuing the story: **I was determined to make the most of the experience. As the last tatter of spinnaker disappeared into the hatch - £4,500 down the drain, I decided I wouldn't be so stupid again.**

Given the very high probability of loosing the rig under these conditions (certain doom), it might have been better to take some other action while reducing sail in a somewhat orderly manner, but Goss "hoped for the best."

I can only think of a person being led to the firing squad. Any action, any action at all, is preferable to this certain doom. Contrary to what the movies show, there is no dignity in being shot. When we are alone on a boat, we don't even need to consider how an action might look to others.

I believe that the problem is less likely on crewed boats because at least one member of the crew will step up to make the necessary suggestion and lead to a decision. It is the type of situation where the singlehander should slap himself across the face and "snap out of it!"

Sleep

Sleep is one of the most discussed topics in singlehanding. Most of us can stay awake 24 or 36 hours on a short voyage, but for anything longer, sleep is a necessity.

For the beginning singlehander, going below decks itself can be a challenge. We have grown accustomed to driving a car, where we don't take our eyes off the road for more than 3 seconds. How could we possibly sleep while the boat continues to move?

I suggest that the new singlehander practice during short afternoon trips, when there is really no reason at all. He or she should go below for 5 minutes at a time to perform a specific task, like checking the charts, making coffee or practicing knots. They must resist the urge to stick his head on deck for at least 5 minutes. After a few days of this, the time below deck can be increased to 20 minutes while they cook an entire meal – and eat it. I suggest that they do not use any electronic monitoring during this period. Turn off the radar, AIS or SeaMe. It takes a person time to become accustomed to sailing on faith alone for 20 minutes, but it must be done. Electronic monitoring aids are just that – aids. They must not become crutches and must not supplant the skipper's instincts.

One piece of advice is that if the skipper can hear the motor of a ship, he should look around. Whales may be able to hear ships 50 miles away. Humans can only hear ships ½ mile away.

Once the skipper has become accustomed to 20 minutes below, a duration when he could have run into any number of floating debris, the idea of spending an hour or more without looking around becomes less stressful. At this point the electronics can be reactivated. It has long been held that it will take 20 minutes for a ship to cross the horizon and hit a sailboat. So this is as long as one should sail on faith alone.

Approaches to sleep:

It is well known that a person can not "store" sleep in a bank to use at a later date. However, it is highly advisable to get the most sleep possible for two nights before a voyage so that the singlehander is well rested as he leaves the dock. Studies have shown that athletic performance is determined more by the sleep taken two days, rather than one day, in advance of the event. Based on this, I make sure to get at least two very good nights of sleep before any voyage. This means that I will not drink any alcohol for these days (alcohol keeps me awake); I get to bed early (I am a "lark" type sleeper); and I will even take a sleeping pill so that I sleep soundly all through the night. I make sure that my boat is fully prepared two days in advance to reduce stress and definitely avoid the pre-race parties that most sailors attend.

I know that adrenalin will stop me from sleeping for the first night when I will probably be in a high traffic area anyway. Starting the voyage well rested ensures that missing one night of sleep is not debilitating.

Once underway, a common method of keeping watch is to get out of the bunk every 20-30 minutes and take a quick look around the horizon and at the compass, then go back to sleep again. The idea is to get back to the bunk before being completely awake, so that it is easy to fall back into deep sleep. This is much like a normal person waking in the middle of the night to urinate, then climbing back into bed and back to sleep. With this technique, the skipper is not intending to work the boat at all, simply check for hazards. I use this technique and Derek Hatfield used it in the 2002 Around Alone; he set an alarm twenty minutes. He would wake up, check around the boat and go back to sleep for another twenty minutes. After a few days he found the alarm unnecessary.

I use three tips to make this technique workable. First, I find that getting out of, and back into, a sleeping bag in my cramped bunk below deck is too much of an effort. It takes too long and has a tendency to bring me fully awake. I have set up a sitting hammock in the cockpit, made from a sail bag. This is a very comfortable place for me to sleep, facing backwards with my head against the main hatchway and my bum just slightly above the cockpit sole. In this position I barely need to move to look all around the horizon. I can also reach the autopilot and all three sheets to make small adjustments if necessary. Modern singlehanded racing boats have built cockpit houses to cover the skipper next to the hatchway for the same purpose. I have taken voyages of up to five days sleeping only in my hammock.

Second, I have a small kitchen alarm clipped to my harness. It is important that the alarm automatically resets to twenty minutes after each activation. If it takes concentration to reset the alarm, once again it wakes me too much.

Third, eliminate electronics that might wake me unnecessarily. The ocean is a really big place. I don't care if a ship passes 20 miles away or even 5 miles away. I only want to know if a ship is passing less than 1 mile away. Radar and AIS alarms should be set for the skipper's own level of comfort. This also refers to the autopilot "wind shift alarm". My autopilot has a built in 15º wind shift alarm that can not be adjusted. I have found this to be too tight a range. On a gusty run, the wind will shift back and forth by 15º many times overnight. All of these electronic alarms will not only wake the skipper,

but keep him nervously on-guard, waiting for the next alarm. This problem led to hallucinations during the 2006 Singlehanded Transpac. I have disconnected the wind shift alarm altogether.

Polyphasic sleep:

Dr. Claudio Stampi is considered the world's greatest expert on "Polyphasic Sleep" for singlehanded sailors. Through his "Chronobiology Research Institute" He has lectured many times on this topic and his methodology is often used by top performing racers. The two basic ideas behind this technique are reducing the total time sleeping each day from a normal 8 hours to 5 hours or less, and to sleep in short naps with productive time in-between each nap. (NOTE: It is important that the skipper read this entire section, including the rebuttal to Stampi's techniques. Hallucinations are a wonderful thing!)

Here is an exerpt from "MacAuthur is caught not napping." The Sunday Times, January 20, 2005:

THE ocean never sleeps and nor does Ellen MacArthur. At least, that is how it seems during her race to become the fastest sailor to circumnavigate the world single-handed. … Sleep represents something of a Catch-22; she knows that she must sleep in order to achieve the mental and physical condition to keep making good time but that each time she does, she is losing time.

MacArthur wears a monitoring device on her arm and the data is sent to Boston to be analysed by Claudio Stampi, the chrono-biologist with whom she has worked for the past five years.

From the start, on November 30, until January 12, she averaged 5.54 hours sleep a day. But from January 6 to the 12th, MacArthur averaged just 3.9 hours. "Under normal circumstances this would already represent quite a sacrificed sleep allowance in comparison to the two-week transatlantic race in 2000, where Ellen averaged 4.2 hours per day," Stampi said. "But this low sleep quota will have an even more dramatic impact on someone who is particularly fatigued having been at sea for 50 days."

MacArthur's sleep patterns are usually feverish, mostly divided into ten or 20 minutes, but napping is one of her strategies. According to Stampi, for the 94 days of the Vendée Globe in 2000-01, MacArthur averaged 5.7 hours sleep a day, divided into nine naps. "When you have to go from an average of 7½ hours a day to Ellen's average of 5½," Stampi said, "we have seen from many experiments that it is actually better to divide those fewer hours into multiple naps." …

Another of Stampi's suggestions is the "Sunday Strategy; that is the strategy of once a week, declaring a different day – like a vacation day, or half-day", Stampi said. "That is both psychologically as well as from a sleep perspective. Sleep seems to be extremely plastic. One day is enough to put you back to a very good level.

"Ellen, from a sleep physiology perspective, is a normal person. Where she is exceptional is in her drive and discipline. You will never find a day without sleep with Ellen. Not every sailor can do that. Some will stay a day, two, sometimes three, without sleep at all. The benefits of even a short nap are disproportionate to the duration."

According to Adam Mayers in "Sea of Dreams," Brad Van Liew used this technique in the 2002 Around Alone. Brad had taken part in a sleep study at Harvard University Medical School, where he learned that he could operate in the eightieth percentile of alertness with just 4 ½ hours of sleep. During the race he had a 45 minute sleep every four hours.

Dr. Stampi teaches sailors how to perform best on minimal sleep. The secret is learning how to power-nap (pulling an Einstein) His research was done by base testing cognitive performance with a normal eight hour sleep. Then he had subjects shift to three-hour routines. A month later, the group that had one long sleep of 3 hours showed a 30 percent loss in cognitive performance. The group that divided its sleep between nighttime and short naps showed a 25 percent drop. But the polyphasic group, which slept exclusively in short naps, showed only a 12 percent drop.

Stampi divides sleep into REM (important for memory and learning) and non-REM (restores energy). Non-REM sleep itself has four stages: one, light slumber; two, the onset of real sleep, (heart rate and breathing slow); three and four, deep (slow-brainwave) sleep that is most restorative.

Sleepers follow a 90 minute cycle through these stages with REM between each cycle. Under this theory, the body needs slow-wave sleep first and achieves this in the first three hours. If only four hours of sleep are possible, the body will still achieve 95% of slow-wave sleep while missing most of the REM and stage-two sleep.

This suggests that slow-wave sleep is the most critical. That sleep is more valuable at the beginning of the sleep cycle than at the end. So if a singlehander takes more naps he is recharging more efficiently than he would be with a single longer sleep.

Stampi notes that a skipper must nap wisely by tailoring times and lengths to the body's particular requirements. For example sleep peaks normally occur in mid-afternoon and early morning, but it is not desirable to sleep in the early evening. This made scientific sense: Humans tend to feel sleep pressure at those times.

His research showed that afternoon naps had the most valuable slow-wave sleep, important for recharging the body. Sailors should try to get at least some of their quota then. The skipper should try to get his body "in phase" and cycle accordingly, so that no time is wasted simply laying in the bunk with eyes wide open.

According to the testing, there are two types of people: morning people, or "larks," and evening people, or "owls." Larks are good at taking short naps but are not as efficient at night, and prefer a regular routine. Owls appear to cope better with irregular schedules, but prefer longer naps. For example, Ellen MacArthur is a lark and tends to spend 60 percent of her sleep in naps of less than an hour. Mike Golding, on the other hand, is an owl. Only 23 percent of his sleep time was devoted to naps of less than an hour. But both sleep about the same amount while racing, between 4.5 and 5.5 hours on average.

An excellent video on Claudio Stampi and polyphasic sleep is available on Youtube.com. Search for "Polyphasic sleep study"

It is difficult to jump into polyphasic sleep on the first day of a long voyage. Here are some techniques for adapting to a polyphasic sleeping schedule, adapted from www.sleepingschedules.com:

- Determine a personal circadian cycle, i.e. when the body wants to sleep and when it wants to be active. Every person has his own, individual circadian rhythm with peaks and dips in alertness, when they normally fall asleep and when they normally wake. It forms the basis of sleep times in the polyphasic system. As mentioned above,

most people are designated as Larks and Owls.

- Staged transition: Some have found that staging the transition over three to nine days helps with success adapting. Start with one (shorter than usual) core sleep at night and one afternoon nap. Move to two sleeps at night separated by a task, along with the afternoon nap. Increase to three sleeps, etc, depending on Lark or Owl status.

- "Core Sleep" is the one longer sleep each 24-hours. Most researchers suggest that this be when the skipper normally goes to sleep. For example, I (a lark) normally go to bed at 10pm, and can fall asleep in just a few minutes.

- Use an alarm to wake up. The skipper should never sleep past the alarm.

- Turn on a bright light to activate the body when waking. This simulates morning. Get out of the bunk immediately. Do not stay in the bunk and daydream, even if awake.

- Do not attempt to sleep between 6pm and 8pm. Stampi refers to this as the "forbidden zone." He suggests that our ancient ancestors used this period to ensure safety before sleeping, so it is instinctive that we not sleep during this period.

- Avoid caffeine before scheduled sleep. It is important not to miss a sleep period if it will lead to reduced performance later.

The polyphasic approach does have critics. The US military has studied fatigue countermeasures: **Each individual nap should be long enough to provide at least 45 continuous minutes of sleep, although longer naps (2 hours) are better. In general, the shorter each individual nap is, the more frequent the naps should be. The objective remains to acquire a daily total of 8 hours of sleep.**

The Canadian Marine Pilot's trainer's handbook: **Under extreme circumstances where sleep cannot be achieved continuously, research on napping shows that 10- to 20-minute naps at regular intervals during the day can help relieve some of the sleep deprivation and thus maintain minimum levels of performance for several days. However, researchers caution that levels of performance achieved using short naps to temporarily replace normal sleep, are always well below that achieved when fully rested.**

Dr. Piotr Wozniak has studied the subject and does not believe it is possible to perform adequately using these techniques. An excellent counter view is expressed in a video on Youtube.com. Search for: "Polyphasic Sleep Experiment," where the best line is "I can't tell if I've been getting sleep or not. I don't know. I might be. I've got memory gaps. I want some pancakes."

The following is excerpted from http://ftp.supermemo.com/articles/polyphasic.htm **The theory behind the polyphasic sleep is that with some effort, we can entrain our brain to sleep along the ancient polyphasic cycle and gain lots of waking time on the way, mostly by shedding the lesser important stages of sleep.**

EEG measurements indicate that humans are basically biphasic. There is a single powerful drive to sleep during the night, and a single dip in alertness in the middle of the day. The cycle can be prodded and shifted slightly on a daily basis. The degree of the shift requires a precise timing of the phase-shifting stimulus. In other words, with a

stimulus such as light, physical activity, or social interaction, we can move the period of maximum sleepiness slightly. Although the precise measurements speak of the possible shift of up to 3 hours in a single day with a single strong stimulus, it is hard, in practice, to shift one's circadian rhythm by more than 1 hour per day.

An increasing portion of the population use the alarm clock to do the job that should naturally by done by sunlight. This is not a healthy solution and is usually forced by our electrically-lit lifestyle with evening TV, evening reading, evening Internet, evening partying, etc. The well-defined effects of natural sleep affecting stimuli on sleep patterns lead to an instant conclusion: the claim that humans can adapt to any sleeping pattern is false. A sudden shift in the schedule, as in shift work, may lead to a catastrophic disruption of sleep control mechanisms.

It appears that polyphasic sleep encounters the precisely same problems as seen in jet lag or shift-work. The human body clock is not adapted to sleeping in patterns other than monophasic or biphasic sleep. In other words, the only known healthy alternatives are: (1) a single 6-8 hours sleep block in the night, or (2) a night sleep of 5-7 hours combined with a 15-90 min. siesta nap.

Through sleep deprivation, polyphasic sleepers can increase the number of naps during the day to three. However, the pattern of one night sleep and three daily naps in highly unstable and can be maintained only with a never-ending degree of sleep deprivation.
The above findings lead to a conclusion that it is not possible to maintain a polyphasic sleep schedule and retain high alertness and/or creativity!
The answer to the question "to sleep or not to sleep polyphasically" will depend on your goals and your chosen criteria. You may want to sleep polyphasically if you want to maximize the frequency of a waking activity (e.g. monitoring the instruments and the horizon in solo yacht racing). Yet you will definitely not want to sleep polyphasically if: you want to maximize creative output, alertness or health. Only when approaching substantial sleep deprivation can polyphasic schedule be superior to biphasic schedule in that respect.

Stampi's methods are primarily targeted at minimizing sleep deprivation. When speaking about Ellen MacArthur, he puts his research in a nutshell: "What Ellen is doing is finding the best compromise between her need to sleep and her need to be awake all the time". Stampi has shown that polyphasic sleep can improve cognitive performance in conditions of sleep deprivation as compared with monophasic sleep: Individuals sleeping for 30 minutes every four hours, for a daily total of only 3 hours of sleep, performed better and were more alert, compared to when they had 3 hours of uninterrupted sleep. In other words, under conditions of dramatic sleep reduction, it is more efficient to recharge the sleep "battery" more often.

With the above rebuttals in mind, it appears that sleeping in short naps spaced throughout the day is superior to a single sleep of just 3 hours but is

still far less than ideal. A polyphasic sleeping schedule was the best compromise between a need to sleep and a need to be awake. But it is nothing more than that. Given that the very reason a singlehander would use this method is to ensure that the boat remains in control, short naps are what he would want and need anyway. Under stressed conditions, he is unlikely to get 3 straight hours of sleep in any case.

Space Filler: Here is a poem about my first long distance race, singlehanded against crewed boats. I was on my Tanzer 22 "Foolish Laughter" on Lac Deschene and the Ottawa River. I was given two mementos for this race: the first for hitting three different rocks; the second for being "the keenest sailor in the race."

The Foolish 50 Miles with apologies to Robert Service

There are strange things done 'neath the moon and sun
By the men who ply the waves.
Leaving wives at home they face the foam
That will blow them to their graves.

Lac Deschene has seen keen men
But the keenest it ever did see
Was the stalwart Captain of Foolish Laughter.
I know him, for that man is me.

It was the ninth month of ought one,
the day the fateful race started.
I said to the wife "Oh, it'll be fun"
As I kissed her and happily parted.

With a promise of rain I raised genny and main
And headed out of the harbour.
But the wind came up fast and struck hard at the mast
As I moved from port tack to the starboard.

"Shorten sail!" yelled the Captain, "Aye Aye!" said the Mate
"We will do whatever we can!"
But the die had been cast when the crew rushed the mast.
For the entire crew was only one man.

The genny was doused and a reef in the main
When I first grounded on that lee shore.
The impact was that of a slow moving train,
And who knew that I'd do it twice more.

I raised centre board up and the boat spun around
When I hit hard rock like a shot.
With the meter destroyed how fast could I go?
I could no longer measure a knot.

A long beat up river, under storm jib and main
I settled down to my course
I had just poured black coffee, when it started to rain.
Oh Lord, could it get any worse.

I raised number one on the down river run.
At surfing the T doesn't fail.
The sky grew quite dark when I rounded S Mark
And then came the crack of the hail.

The wind gusted up to 48 knots
And my heel reached 60 degrees.
The jib came down fast, main sheet out to the last
As I waited for much calmer seas.

Beating up the North shore, could I take any more
Of the wind and the cold and the hail?
I poured my next cup, taking time to look up
And my gaff hook slipped over the rail.

Many men have faced grief upon Blueberry Reef
And I was to join that fine crowd.
It was more like a shudder, kicking c-board and rudder
The boat moaned, but not really out loud.

Up river again as the darkness it came.
I passed boats loaded with crew.
"A great adventure!" I shouted, they laughed in return.
I still had so much left to do.

Should I have chosen to stop when the genny went "POP"
And parted two feet from the head?
I touched ground once more as I neared the South shore
Seeking shelter from the gusts that I dread.

Pure joy made me shiver racing back down that river
And the moon and the stars did appear.
It was 10:59 when I crossed the end line,
And put away all of my fear.

So what's to become of this brave, naive man.
Will my days be happy ever after?
If you come near the lake bend an ear to the West.
On a clear night in a 10 knot breeze,
You can just make out the sound,
Of Foolish Laughter.

Ch. 3: Boat design, selection and setup

What boat to look for:

The best boat for singlehanding is the one that the skipper already owns. Owning a boat is 80% of the way to singlehanding so in owning a boat, any boat, the skipper has taken the first large step. There is a boat for every budget; the Cal 20 "Black Feathers" was purchased for just $1,000, but completed the Singlehanded Transpac. The first, last and only criteria for the beginner is to get a boat and get out on the water. Unfortunately, it is virtually impossible to be a singlehander without owning a boat. No one is going to lend a boat to be taken out alone.

The worst boat is the one that will be purchased "next year." I know of too many wannabees who spend their time searching for the perfect boat, but never get out on the water. I've had many conversations with these dreamers, asking me what boat they should buy, doing months of research on one boat, then another. It seems they can name every design and model, but they never pull away from the dock. Until they does so, they are only pretenders. But the moment they get out on the water, they become a singlehanded sailor. Here is my decree: If a person misses even one season for lack of a boat, he is a dreamer, not a sailor.

When searching for a boat, the singlehander has a terrific advantage over the crewed boat owner. It seems that the most modern boats, those built within the past five years and thus the most expensive, are the least suitable for singlehanding. Older fiberglass boats, built twenty to thirty years ago, by their nature have the design features that are best suited to singlehanding.

The key features to seek out are:

1. Helm: Tiller rather than a wheel. A tiller is almost a requirement for singlehanding, for several reasons. First, a tiller is designed to be used while sitting; a wheel is designed to be used while standing. There will be times when the singlehander is at the helm for hours on end. The ability to sit is paramount. Second, it is easy to control a tiller between the knees while standing or under the leg while sitting. These are necessary when pulling sheets during a tack or when raising a halyard. Third, a tiller can be operated from the front or side, while a wheel is designed to be used from behind. It takes gymnastic abilities to extricate oneself from behind modern wheels that stretch from rail to rail. The singlehander must be able to move around the cockpit very quickly to control lines. A tiller is required regardless of the size of the boat. Even the most modern Class 40 and Open 60 designs include a tiller.
   Fourth, a wind vane works better with a tiller than a wheel. Friction is greatly reduced and the force from the wind vane is more directly transmitted to the rudder stock. Finally, a tiller opens up more space in the cockpit and eliminates all the cables and quadrants below deck which are subject to wear and breakage and take up useful space. At anchor the tiller can be raised to the vertical leaving the whole cockpit free.

2. Cockpit: Small rather than large. The singlehander must be able to control all of the major lines while at the tiller, even if this means stretching forward with the tiller between his knees. Modern racing boats have massive cockpits designed to hold six or eight crewmembers, with winches on the cabin top ten or fifteen feet away from the tiller. These are wholly unsuitable. Older style cockpits are compact and crowded with just two crew. These are the best choice.

3. Mast: Strong and secure. When things go wrong, a singlehander will put far more stress on the mast than a crewed boat. The boat will broach more often and there will be times

when the spinnaker is dragging in the water. These events are common and must not break the mast. Modern boats have spindly masts that snap under the slightest pressure.

4. A single backstay without running backstays. Runners add complexity at the very moment - while tacking or gybing, that the skipper needs simplicity. A runner can only be allowed if it will not get in the way during a tack or gybe, even if it is entirely ignored, and if using the runner incorrectly will not cause damage to the sails or mast. At night, in high winds and tight waters, adding two extra lines to a tack or gybe is insane. Modern boat designs seem to add an unending number of control lines. For the singlehander, the fewer lines the better.

5. Below deck: Simplicity is best. An amusing feature of modern boat designs is having two heads, even on boats less than 40'. It is thought that there must be a head for the owner's family, along with a separate head for their guests. Obviously only one head is required for the singlehander. A two burner stove is ideal, rather than a big galley. A small navigation station with minimal instruments is better than something designed like the Starship Enterprise. Once again, the singlehander prefers a simple boat. This is in contrast to the modern complex boat designs, so by its very nature will be less expensive than a comparable crewed boat.

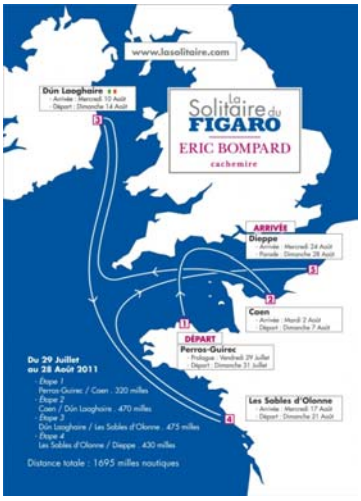
6. A key reason why autopilots burn a significant amount of power is that some boat designs are hard to steer. The sad truth is that some boats are too heavy and have poorly designed, or unbalanced rudders. One should carefully assess the suitability of a particular boat for long-distance singlehanding before buying it, and a big part of this is the hull/rudder/steering systems. Avoid the full keel, barn-door ruddered bruiser that weighs as much as an island.

Singlehanding makes up a tiny amount of the total sailboat market. There are very few boats designed specifically for the singlehander, and all have been designed for racers and none for cruisers. Two types, the Mini 6.50 and the Class 40, are both considered extreme racing machines and are at either end of the boat spectrum that I am covering in this book, so I will not examine them in detail. In addition, nearly all of the Minis and Class 40s are custom builds.

Figaro Bénéteau II

Only one dedicated singlehanded design is being built in production quantities: the Figaro Bénéteau II, designed by Marc Lombard specifically for the Figaro racing series. At 10.15 metres (33') this falls in the middle of my coverage range of 20'-40'. It is reasonable priced new and there is an active market for used boats and there are even a number of boats available to lease for a single racing season (www.classefigarobeneteau.com). Thus it is worth looking at in more detail. The reader should understand that this is a serious racing boat designed to cross oceans. However, given that the lessons learned from racing any type of vehicle (car or bicycle) are later transferred to non-racers, it is interesting to examine what design decisions were made with this model.

"La Solitaire du Figaro" (www.lasolitaire.com) is a well developed series of singlehanded races taking place over four weeks in July and August each year. The races run between various ports in France, with longer legs to Ireland and back. This is a true open ocean event. The Bay of Biscay is considered to have some of the roughest waters in the North Atlantic.



This is a "one design" event, open only to the Figaro II. This boat was specifically designed for this series of races. Many of the world's best known single-handed skippers enter the series, but it is also open to amateurs, thus I consider it to be a good representation of the keen sailor's abilities.

The only formalized singlehanded school that I am aware of is the Artemis Offshore Academy, which uses the Figaro II to train sailors. John Thorn provided the following description:

The Artemis Offshore Academy is a UK training programme of excellence for British short-handed sailors, providing a structure to bring talented sailors up through the ranks. Designed to help them win major offshore solo and short-handed races in the future, the ultimate goal is to put a British sailor in a strong position to win the Vendée Globe in 2016 or 2020.

The Academy offers a unique Scholarship to race on the Figaro circuit each year with a fully funded campaign. In a natural progression to the top of the sailing world the sailors will then most likely move into IMOCA 60 racing.

The Academy has a Development Squad of eight members as well as two Associate members. The Development Squad sailors are selected at the selections trials held once a year at the Weymouth and Portland National Sailing Academy. The Associate members are sailors who already have funded campaigns but wish to train alongside the Academy. The training programme is run from November to April in La Grande Motte (France) at the prestigious Figaro training the Centre D'Entrainment Méditerranéen (CEM). The race programme includes official and unofficial Classe Figaro events in France and RORC races in the UK.

Unfortunately, the Artemis school is only available to selected members and is not open to paying students.

Our interest is not in the race series, but in the boat itself. I had a long discussion with designer Marc Lombard (www.marclombard.com) about his baby. In particular, I asked him to compare how he designed it to be a singlehanded boat versus a crewed boat of the same size. I also spoke with skipper Murray Danforth, perhaps the only North American Figaro II owner. Most recently I spoke with Charles Darbyshire, Technical Director of the Artemis Offshore Academy, which trains singlehanded sailors in the UK. He commented "These people train like Olympic athletes, much more than an amateur."

Marc explained that the design team met with a group of highly skilled skippers of the older Figaro model to ask for their requirements for the race series. Naturally there were differing opinions on every aspect of the boat. In many cases the majority ruled, but in others the team had to rely on their own expertise in meeting conflicting desires.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Final boat cost played a significant role in the design. The Figaro II is intended to be within the price range of the average sailor, and not solely for sponsored professionals. With a length of 10.1 metres, the beam was established at 3.4 metres to control costs.

The boat had to meet a basic minimum weight of three tonnes empty, to meet Category A requirements for open water stability. The final design came in at 3,050 kg. There are 240 litre water ballast tanks on each side for upwind power. The designers were not allowed to use larger tanks because stability would be threatened if the boat was sailed with a crew of six in other races. (Note that the much smaller Mini 650s have up to 450 litres of water ballast.)

For upwind sailing, the water ballast can be transferred from side to side via gravity in about 15 seconds. It is controlled by levers in the cockpit. The process is to open the valves and allow the water to drop, then close the valves again, just before tacking. The ballast is not so great as to overly tip the boat during this process. If the tanks are empty, a pump can fill them in about four minutes. A scoop drops below the boat for this purpose, or to empty the tanks.

Marc explained that with the Figaro II, upwind is where the difference between skilled and unskilled sailors becomes apparent. The boat responds quickly to changes in sail trim. To excel, the skipper must have a strong theoretical knowledge and a lot of practice in differing conditions. The twin rudders provide control regardless of boat heal while beating windward.

The boat has a single backstay, without runners. This was requested by the skippers to avoid tangling with the sails. The mainsail is a traditional shape without the large headboards more recently popular. The mainsail will slide past the backstay in higher winds. In lighter wind, the backstay can be eased to allow the main to pass under. Marc mentioned other recent boat designs with no backstay. The single backstay allows the fractional, double spreader mast and main to be adjusted as necessary for optimal trim in upwind racing.

The mainsail is a large 36 m² with two standard reef points. The fractional foresail is only 28 m². Marc described this as desirable for fewer headsail changes, a benefit to singlehanders.

The cockpit was designed so that all the major controls can be accessed by the skipper while at the helm. The jib sheets cross over the cockpit to the windward side of the boat, allowing him to make adjustments while seated.

For downwind racing, the hull has a wide, flat stern with twin rudders. This was a particular requirement to singlehanding as the boat will often be run by autopilot. The design allows a skipper to launch and gybe a spinnaker in 30 knots of wind with the pilot in full control. The hull shape is incredibly stable in these conditions. Marc explained that downwind, the boat becomes more stable the faster it goes. He commented that the twin rudder design will stop any broach in its early stages. Broaches are very rare in the races, even when the boats are pushed to their limits. As a user, Murray Danforth confirmed this stability. He commented that the rudders really dig into the water and grip it very tightly. A narrow hull with single rudder would be much less stable. Watch the video at: http://tinyurl.com/33npp7 for a great view of sailing in 55 knots wind. Note in particular 1) the skipper's light hand on the tiller; 2) how the autopilot is able to hold course when he is on the bow; 3) the stern view showing the twin rudders grip on the water.

There was debate between the skippers over the choice between symmetrical and asymmetrical spinnaker. In the end, majority ruled and the symmetrical chute was chosen. According to Marc, the Figaro is a tactical race where skippers

want a complete range of options in their route. Symmetrical spinnakers allow for much deeper sailing, and thus more routing options.

I asked Charles Darbyshire how they train his students performs a spinnaker gybe in 30 knots of wind. This is something that they practice extensively. His first answer was "very quickly." They use twin sheets and guys and twin fore guys (pole downhauls). Most important, they have no wasted movements. Charles contrasted them against an expert crew on a Mumm 30: The singlehanded skipper only makes one trip to the bow and one trip back to the cockpit. He performs all the necessary tasks during this one trip, grabbing lines along the way fore and aft. They gybe the main first, then move forward to gybe the pole. The entire process is described fully in Chapter 7.

Charles pointed out that the spinnaker design for the Figaro II is much more stable than another performance boat of similar size. A key to gybing is completing the entire maneuver while at the fastest point of sail, while surfing down a wave when the pressure on the spinnaker is least. Problems will occur if the skipper is delayed past this brief window of opportunity.

An NKE autopilot package is normal for the boat, but the skippers can install any brand as desired. The autopilot controls are normally mounted next to the main hatchway, but again this is up to the individual. Most skippers use a remote control for all of the autopilot functions, including gybing from the foredeck. Charles noted that the performance settings of each racing boat are set individually, after many hours of personalized testing. The racers even change the gain settings for upwind and downwind legs of a race to get the maximum performance.

Multi-hulls

A quick note to say that multi-hulls require a skill set that it well beyond the scope of this book and, I believe, well beyond the abilities of all but the most experienced singlehanders. The issue is that cat's and tri's have a nasty tendency to flip. Once overturned, there is no way to bring them back upright. Multi-hulls are constantly sailed on the razor's edge. It takes an experienced helmsman to keep them under control. An autopilot cannot reliability perform this role, but singlehanding relies on an autopilot. So there is a necessary contradiction.

Several years ago a major transatlantic race was held with mono-hulls and multi-hulls. Although the weather was typical for the race, 40% of the multi-hulls capsized and required rescue. To me it is puzzling that one would enter a race with a 40% (or even 5%) chance that they will need rescue.

As I have mentioned elsewhere, self sufficiency is the bedrock of singlehanded sailing. The skipper should be able to get himself to port under all but the most extreme circumstances. I don't believe that an extra strong blast of wind is sufficient reason to require rescue.

Insurance:

Five years ago, as I was preparing for the Singlehanded Transpac, I contacted my insurance broker about the trip. This company, which is promoted by my yacht club, claimed to be specialists in marine insurance. They rightfully requested my sailing resume and, as expected, it showed my extensive singlehanded experience. However, not only did they refuse to insure my race, they doubled my normal premiums because I singlehand my boat so much. It was obvious that they had no understanding of me or of singlehanding in general. I was appalled and dropped them immediately with severe prejudice.

Clearly, insurance is one of the major problems facing singlehanders. There are many companies that claim to be marine specialists, but very few have any understanding of singlehanding. It is not that we face extra risks, but that we face different risks that can be managed appropriately.

It is a sad fact that only a very few underwriters are willing to look at singlehanded boats anywhere in the world. This is a significant problem for the brokers. I spoke with a large marine insurance underwriter. They were willing to take on singlehanders for coastal sailing with strict conditions, but not offshore racers. They said that there was simply not enough data for them to make good a good judgement on insurable risks.

Fastnet Marine Insurance, in the U.K., is one of the world leaders in obtaining insurance for singlehanded sailors and in particular racers. Fastnet is a broker, as such they seek out coverage on a policy by policy basis from insurance underwriters who provide the actual coverage. They are willing to attempt to find coverage for singlehanders located anywhere in the world, but they are only able to do so if the Insurance underwriters are licensed to in that location. As such, they have struggled with yachts in the U.S. because there are only a few underwriters able to provide this coverage.
I posed a number of direct questions to Richard Power, their Director of Business Development.

The role of the insurance broker is to develop a proper relationship between the sailor and the insurance company. Like a marriage guidance counselor, the best way to do this is by ensuring that both parties are aware of "material facts" before they enter the relationship. From the insurance company's point of view, sailing or racing the boat singlehanded would definitely fall under the heading of material fact.

The singlehander is approaching any insurance company with a significant handicap. His hobby is certainly difficult and might even be considered illegal. Without advance planning, the skipper's negotiating position is virtually nil.

There is some level of truth to the idea that an insurance company will try to avoid paying out on large claims. The role of the insurance broker is to make this as difficult as possible - before the accident occurs.

Thus, it would be unwise for a sailor to simply announce to the company that he was a singlehander, without significant further qualification in terms of how he is managing the special circumstances. The skipper should list both his experience and the changes made to the boat particular to ensuring a claims free singlehanded passage. The list should include:

- Watch keeping equipment: AIS, radar, Sea-me, etc.
- Redundancy in autopilot equipment.
- Knowledge of unpowered self steering methods, (like in this book..)
- Strength of the mast; renewed standing rigging, etc. (mast breakage is a major cost to insurance companies).

Insurance companies have clauses particular to marine insurance, and these have special significance to the singlehander. These are fundamental requirements, placed on the shoulders of the skipper, which should be considered paramount:

> "You will exercise reasonable care to make the Vessel Seaworthy at the start of this policy, and you will exercise reasonable care throughout the period of insurance to make and keep the Vessel in a Seaworthy condition" (Allianz Yachting and Boating).

What is "seaworthy" on a crewed boat is obviously different from what is seaworthy to a singlehander. The skipper needs to ensure that his is a seaworthy singlehanded boat. Some insurers

could legitimately state that keeping the vessel in a "seaworthy condition" includes making sure that she is properly manned and that a lookout is maintained at all times. To have any level of success, the skipper must put forth a valid counter argument with his application.

Some policies have strict limitations on singlehanded voyages:

> "You are covered for singlehanded passages not exceeding 24 hours but not otherwise, providing the Vessel is suitably equipped." (Navigators & General Yacht & Motorboat policy)
>
> "The Vessel must only be sailed between the hours of sunrise and sunset local time and only for a cumulative total of 50 nautical miles per day unless she is manned by two people of adequate physical strength at least one of whom is competent to be in command. (Yachtsure 10/95 policy)

But for all yacht insurance policy wordings, the Insurers would not expect the yacht to be sailed, let alone raced, singlehandedly, unless they had agreed to this in advance.

The experience or inexperience of the sailor would be reflected in the policy price. Richard emphasized that they would try to avoid punitive pricing by gathering as much detail about the yacht preparations as possible. He would use this information to negotiate the best possible terms with the insurers. Skippers with relatively little experience will be asked to provide extensive detail on proper yacht preparation, taking expert advice, taking courses, etc. Richard commented that inexperience is not necessarily reflected in insurance pricing as long as the requested details are forthcoming.

In terms of pricing, singlehanders can expect to pay more than a similar crewed yacht - up to 50% higher premiums. For example, a Figaro II, would be insured in the region of £1,250 to £1,500 for a year's coverage, including the SORC series and full racing risks.

However, it is with the deductable that the real differences appear. The skipper should expect a significantly increased deductable on actual damages when sailing singlehanded. Richard suggested that SORC entries should expect to pay a deductable of approximately 1% - 1.5% of the value of the yacht, compared to ½ % or even less for a fully crewed yacht. There would not be much difference in this deductable for singlehanded cruisers versus racers, given that the type of singlehanded sailing being done (i.e. cruising or racing) is specifically endorsed to the policy.

Richard emphasized that singlehanded cruisers do not face the same risks as racers, and are able to negotiate better rates. I asked if he would be able to provide insurance for "an extended cruise to many exotic ports around the world?" Richard replied that as long as the skipper installed appropriate self steering gear and other necessary equipment, and he maintained that gear throughout the voyage, coverage would not be a problem. If any breakdowns occurred, the skipper would be responsible to carry out repairs at the earliest opportunity – certainly he would not set off on any voyage over 24-hours without full operation.

The more boat preparation and the greater detail available, the better the broker is able to negotiate terms with the underwriter. For example, having the most modern watch keeping equipment on board will be a factor in their discussions.

Insurance underwriters are adverse to skippers with a bad claims history. I would suggest from this that skippers should limit claims to the truly serious amounts, certainly amounts greater than the deductable. It is better to eat a few thousand Euros now than have insurance refused later.

As the most possible extreme in singlehanded sailing, I asked Richard to look at the Global Ocean Race for Class 40 yachts. Fastnet is looking to be a key supplier of insurance to these skippers. Obviously as a round-the-world race this is not indicative of what most singlehanders will require, but it does point toward the type of questions that should be considered by every one of us. The six page questionnaire included:

- Detail any accidents/claims/losses.
- Did the losses take place whilst racing?
- List all offshore voyages over 1000nm, for each year, over the past 10 years; fully crewed, short handed, singlehanded.
- List all offshore races over 1000nm, for each year, over the past 10 years; fully crewed, short handed, singlehanded.
- Include any information about your yachting experience which may affect potential insurer's judgement about your application.
- Detail your plans/programme for the yacht over the next 12 months, including refit work, trials, qualification voyages and races, sponsor entertainment days, etc. Include the locations and indicate which voyages/races will be singlehanded, double handed, etc.
- Provide material and builder of the main components: hull, mast, rigging, rudders, engine.

Fastnet hopes that they will not need to refuse anyone because of inexperience. They are working to demonstrate to the underwriters that Class 40 is a capable offshore boat. Additionally, they want to prove that the safety procedures adopted and enforced by the race organizers lead to insurable risks for all entrants.

Pricing for a round-the-world race will reflect the additional risks of total loss from a relatively minor event that would necessitate abandoning the boat. For example, a boat stricken in the English Channel can be towed to port. The same boat in the Southern Ocean is a write off; the cost or even the possibility of salvage is unrealistic. Richard suggested that premiums will be in the range of 3% to 4% of the boat's total value, or 2-3 times the normal rate.

On the other extreme, I asked Richard to look at Mini 650 racers. He commented that they have not been able to find any UK underwriter to cover them. He knows of only one company, in France, that will provide this coverage. So Fastnet is not sourcing insurance for the Minis. "We have to draw the line somewhere."

Boat Setup

Jack lines:
I start with jack lines because I consider them to be the most important item on my boat. As a serious singlehander, I alone am responsible for my life. I sail in the North Pacific, where the water temperature is never above 12°C. If I become detached from the boat more than a few hundred yards from shore, I'm dead. It's that simple.

Jack lines should be made from strong, flat webbing. Do not use a rope line or tubular webbing because it will roll under foot. The jack lines must be mounted so that the singlehander can walk from the bow to the stern without unclipping the harness. It is completely unacceptable to use jack lines which require unclipping when passing the shrouds or sheets. On my boat the shrouds are slightly inboard, so I run the jack lines outside of the shrouds and jib sheet, but inside the lifelines.

The jack lines can run very close to the bow. However they must stop well short of the stern, such that the skipper will not drag even an inch behind the boat. It is simply impossible to pull oneself back up a line with a boat moving at 5 knots. Add the length of the tether to the back of the jack lines to see the total length. Then either shorten the tether or shorten the jack lines.

Because jack lines are such a vital piece of equipment, I suggest leaving them permanently mounted on the boat. Do not remove them when returning to the dock, because the temptation will be to not replace them the next sunny sailing day. Nylon jack lines will deteriorate in the sun, so they should be purchased annually.

The Pacific International Yachting Association has set these standards for Jack-lines on crewed boats:

Jack-lines with a minimum breaking strength of 4,500 pounds (2040 kg) shall be fitted each side from cockpit to bow such that crew can clip on before leaving the cockpit. Jack-lines shall be attached to fittings equal to the full strength of the attached jack-line."

"Safety snap-on line and harness for each crew member. The recommended assembly shall be ready for use, all components attached. Load-bearing components, including attachment fittings, shall withstand a static load of at least 700 kilograms (1540 lbs.) The safety line shall attach to the harness at chest level and the harness shall support the upper back."

Falling overboard is obviously a rare occurrence. I posted a request for experiences on the Petit Bateau forum, and these are the responses I received. These responses are from different skippers, thus may be conflicting:

- **In 1999, Harvey Schlasky and a crew member sailed in the Double-Handed Farallones Race out of San Francisco. They had rigged jack lines from pulpit to push pit, i.e., the entire length of the boat. When knocked over, the crew member was thrown across the boat and dragged alongside it. He was able to climb back on board. Unfortunately Schlasky's tether slid to the end of the jack lines, so he was dragged behind the boat and perished.**

- **In this year's OSTAR I got washed overboard whilst changing headsails. I was hanging over the upper guardrail - bashing against the hull as we continued at 5 knots under main in around 25 knots of wind. I have a second shorter lifeline on my harness & used this to attach myself under the lower guardrail to the jackstay, before releasing the longer one, & slipped back on board - very quickly! I did have the benefit that a Contessa 32 has low freeboard.**

- **I was washed overboard in a very bad storm on Ostar '76 about 1000 miles west of the Scillies. I was hove to with a storm jib and fully reefed main. My wind speed indicator (analogue in those days of course) had been on the stops at it's limit of 60knots for most of the night. I was sitting in the cockpit in the early hours, having decided to remove all sail and run under bare poles. I was trying to work out the best way of going about it when a breaking wave knocked down my 32ft Pioneer 10. She had been coping with the huge waves until the breaking one arrived. I was washed straight over the side as she capsized and when I eventually surfaced, I was very relieved to find my harness was still attached and in one piece. The next problem was to get back on board. I was over the port (lee) side with my**

lifeline attached to it's anchorage point on the cockpit sole. One option was to work my way round to the stern and use the Aries to climb back aboard but I didn't fancy that as it meant detaching myself from the lifeline. While pondering the problem, the solution presented itself because the next big wave rolled the boat. I was able to wait for the next wave and when the boat rolled towards me, I grabbed a stanchion base and get a leg on to the boat, then as it rolled upright I slid in under the guard rail.

I was lucky to be able to get back aboard and two things made it possible 1) the boat was not moving forward as the sails were trashed by the capsize and she had been hove to. 2) because of the huge waves and the boat being broadside on to them she was rolling heavily. The strange thing is that in a flatter sea, I would have had much greater difficulty getting back aboard.

If a singlehander goes over the side with the boat under way with any forward speed and the boat is being controlled by a windvane or autopilot, it would be nigh on impossible to get back on board unless he has a means of bringing the boat head to wind. With a windvane such as an Aries, one could arrange to have control lines over the stern and bring her head to wind. I can't think of a way to do it under electronic autopilot. It is a nightmare scenario to imagine being over the side and being towed along by boat doing 6 or 7 knots.

- **I have been involved in several man overboard trials. It may seem illogical but it is much easier getting back on a moving boat than a stationary one – unless that is you are unfortunate enough to fall over to windward. There are two reasons for this. 1. the freeboard is less as the boat is heeled towards you. 2. As you are towed on your lifeline your body is on or near the water's surface. Once, when being towed at about 5 knots, I was able to hook an arm and a leg over the rail and roll in under the guard wires.**

  For the AZAB 75 and OSTAR 76 (also in a Pioneer 10) I rigged weighted lines, one each side from about midships to the stern so that when deployed they would hang about 2 feet below the surface. These were held on deck by some light twine, the theory being that I could reach the line in the water, yank it to break the twine and have a loop in the water to help me step (delicately) back on board. Luckily I never tested it. Andrew Bray, EDITOR, Yachting World

Tether: A tether should use proper, strong carabiners like those used by mountain climbers or properly made for sailing harnesses. The skipper must be able to clip and unclip the tether quickly with one hand, for two reasons:

First, if it requires two hands, there will be many times when the skipper forgoes clipping on simply because one hand is busy on the tiller or holding a sheet. I will repeat this sentiment several times in the book. A singlehander is just as likely to fall off the boat on a stormy day with high winds when he is being extra careful as he is on a nice

day when nothing significant is happening, but is just off guard for a fraction of a second. It is on one of those nice days when he might just skip clipping on if it is the least bit difficult. Human nature is such that people will avoid "unnecessary" work unless it is made as simple as possible.

Second, the skipper must be able to unclip with just one hand in situations where the other hand is busy. For example, if the tether gets caught on a cleat in the middle of a spinnaker gybe. It is much easier, and in the end probably safer, to unclip rather than leave the spinnaker pole swinging across the boat. I am not so unrealistic to think that the tether must be worn every second of every voyage. The easier it is to clip on and clip off, the more likely that the skipper will wear it more of the time.

Some boaters insist on locking carabiners. I have no problem with this concept as long as they can be quickly and easily fastened and unfastened blindly with one hand. In nine years of running all over my boat dragging my tether, I have never had a carabiner detach from the jack lines or my harness, so I don't feel that a locking mechanism is necessary. I have heard of situations where the jack line runs parallel to a sheet and the carabiner runs onto the sheet. My suggestion is to move the jack line to a new position where this can not happen.

Some races insist on a quick release mechanism for the clip. I disagree with this concept. First, I have never seen a quick release mechanism that can be easily fastened with one hand. If this can't be done, it won't be used for the reasons mentioned above. Second, I can not imagine the circumstances were I would want to be detached from the boat. Even if I am thrown overboard and dragging injured beside the boat, this is a much better situation than watching the boat sail away. I can see the safety advantage of a quick release on a crewed boat, but not singlehanding.

The tether must be long enough so that the skipper can move from rail to rail without unclipping during normal tacking or gybing. After a tack, it will be necessary to unclip from the leeward jack line and clip to the windward jack line in order to walk up the windward side of the boat.

A solution to this is to use two tethers – one on each side of the boat. Both tethers must still be long enough to reach across the boat. After each tack and when settled on the new course, the skipper can just clip onto the windward tether.

A different configuration is to skip the jack lines and use a longer tether fastened to the centre of the deck aft of the mast. This tether must be long enough to reach both the bow and stern, but once again not allow the user to drag behind the boat. This system will only work if the mainsheet and traveler are on the transom, so that the skipper need not unclip for every tack.

Hand rails A single-hander must be able to work his way to the bow, even under very rough conditions. But the distance from the mast to the bow is very much a no-mans land. On a typical boat there is nothing solid to hold on the foredeck. Lifelines are not sturdy and do not provide a stable grip. In fact it is very common for singlehanders to avoid the bow during a storm, leaving a jib that is too large for the wind.

A set of hand rails mounted on the foredeck will solve this problem. I've mounted hand rails along the toe rails on both sides of the boat. I can crawl to the bow under any rough conditions to change the jib for a storm jib.

Lines in General:
Crewed sailing boats have made tremendous advancements with tuning all aspects of the mast and sails. This has led to an incredible number of control lines mounted around the boat. With a full crew, it is possible to handle these lines, but a singlehander must concentrate on only the key lines that will create the most significant change. Lines that only offer incremental advantages should be avoided – the skipper does not have the time or energy to manage them all. A small number of lines will provide 95% of the control possible from a significantly greater number. The singlehander should accept this 95% and disregard the remainder.

Lines are also a threat to the safety of the sailor so the number and length of lines should be reduced as much as possible. Especially at night, lines are likely to be everywhere around the boat. It is impossible to eliminate the lines but it is possible to make them manageable. The only way is to store the lines in exactly the same place every time.

Halyards
It is commonly thought that all of the halyards should be lead to the cockpit. This is certainly true for the jib and spinnaker, but not necessary for the mainsail.

The main halyard can be left on the mast because it is usually the first sail to raise and the last to drop. On most sailing days the singlehander will only raise and lower the main one time. As well the skipper will likely be at the main halyard when the motor is running and the boat is flat on the water. The main is probably the most physically difficult sail to raise in terms of weight so we don't want to add extra turning points that require extra effort. Even in the worst possible weather, it is still safe to take the few steps from the cockpit to the mast to put in a reef. When reefing the main, the skipper must be at the mast to tie it up anyway. Having the main halyard right next to the reefing line on the mast is very convenient. It makes it possible to drop the main and tighten the reef lines from one position.

One problem with having the main halyard on the side of the mast is the difficulty of reefing in a heavy wind when the halyard is on the leeward side. It is an awkward position if the boat is listing 45° while attempting to handle the halyard from the bottom side. In these cases I just tack so that I'm on the top again.

The jib and spinnaker halyards are used in tandem and are used several times for each trip, so they should be lead to the cockpit. The halyard clutches should be mounted in a spot where they can be reached with the tiller between the legs, even if it is a stretch. The day will come when a really beautiful spinnaker run turns into something stronger than the autohelm can handle - or it will have quit altogether. The skipper must be able to drop the spinnaker while steering the boat. Since the spinnaker drop requires both hands, steering with the knees is necessary. The singlehander should make these measurements at the dock by stand in the cockpit with the tiller between his knees. How far he can reach is the limit of where the jib and spinnaker halyard clutches should be mounted.

Storage of the halyards of a raised sail is an important consideration for both convenience and safety. The best way to store halyards is in a rope bag positioned directly under the halyard clutch. This serves two purposes: first, it stores the halyard safely out from underfoot. It is not possible to trip on a halyard tucked inside a bag. Second it allows the halyard to run free when the

sail is dropped. The skipper should not have to worry about the halyard jamming during a drop.

Line must not be coiled inside a rope bag. The coil will tangle on itself inside the bag. Rather, the line should be shoved into the bag starting with the bitter end. Simply shove the line into the bottom of the bag, one handful at a time until the entire line is inside. This puts the end of the line at the bottom and the entire line will come out in the correct order.

Because halyards are always stored in their bag in the same place on every voyage, the skipper will instinctively learn to avoid them in the dark. Even if he does catch a halyard on his foot, he will know exactly how to shed it in the dark because he will have done it dozens of time in the light.

Winches:
Self tailing, two speed winches are vital to the singlehander. A significant amount of sheeting will be performed with one hand and it will be impossible to put the entire weight of the body into cranking, as is normal with a crew. Spend the money to purchase a good set of winches. They are used more than any other mechanical device on the boat, so they must work well. Also keep the winches well greased. This will have a significant impact on their performance.

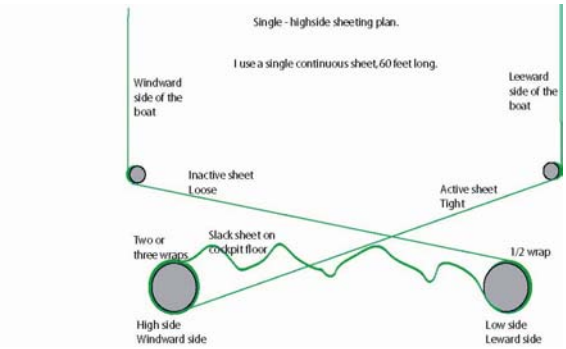
Sheets:
Virtually all sailing is done sitting on the windward (high) side of the boat. As well, the bulk of maneuvering the boat is done by hand, rather than with an autohelm. So set up the sheets to operate from the windward side while maintaining one hand on the tiller.

Jib sheet winches should be mounted just in front of the normal, high side, seating position, where they can be operated easily with one hand while the other remains on the tiller. Most winches come with a strong intended mounting direction, i.e. they are designed to mount in a particular direction. On a normal boat with winches on the leeward side, the winch would be aimed forward. However, on a singlehanded boat, the sheet will be coming up from the leeward side to the windward side. So the winch must be aimed toward the leeward side. (The installation manual for the winches will indicate the strong direction.)

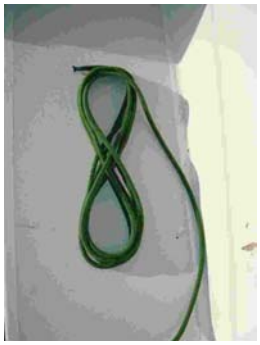
A permanent turning block on the leeward side of the boat is required to bring the jib sheet from the leeward side to the windward side. Thus, when sailing on a starboard tack, the jib sheet will run down the port side of the boat to a turning block, and then up to a winch on the starboard side next to the skipper. It is very handy if the turning block has a locking mechanism in place that will allow the sheet to be locked even if it is removed from the winch. There will be times when the winch is needed for other purposes, such as for the spinnaker sheet.

Sheets are used continuously on any voyage, even the shortest. A new pile of sheet is formed with every tack. These piles are never neat and get in the way of any activity in the cockpit. A very easy method to reduce the length of lose line in the cockpit is to use a single, continuous sheet. This is rarely seen on boats but is incredibly practical. It will eliminate virtually the entire sheet piled in the cockpit. A single, continuous sheet will be longer than one normal sheet, but much shorter than two sheets.

To create a continuous sheet, start with one end tied to the clew of the jib. Run the sheet backwards through the blocks on the leeward side of the boat, around the windward winch with three wraps, around the leeward winch, through the blocks on the windward side of the boat and tie the remaining end to the sail clew.



It is very important that the sheets have no twists prior to starting this process, using the method described above. It is also important to wrap the sheet three times around the windward winch and one time around the leeward winch. This puts the exactly correct number of twists into the line. Thus the line laying in the cockpit will remain twist free during the sailing trip.



(Most sailors coil their lines in an 0 shape. This actually puts one twist in the line for each loop of the 0. It is better to coil heavy lines in an 8 shape. This is the natural way that lines want to fall, and does not add any twists. The first time, hang the jib sheets from the mast to remove all twists. Then, coil them in an 8 shape thereafter.)

It will take practice to become accustomed to the continuous sheet method. But once mastered it is clearly the better approach.

Spinnaker sheets

Because of the potential for trouble, it is even more important that the spinnaker sheet be run back to the singlehander sitting at the tiller. It may be possible to run the spinnaker sheet directly from the spinnaker sheet block, across the boat to the jib sheet winch on the windward side of the boat. My boat has a second set of winches on the cabin top. I use these winches for the spinnaker sheet and guy during the launch. After the spinnaker is raised, I move the sheet back to the jib winch on the windward side and take my position at the tiller. I leave the guy on the cabin top winch. When singlehanding the guy is used much less than the sheet and is rarely needed in emergencies. (In fact in most cases having the guy slightly out of reach stops me from using it in emergencies, which is the best thing.)

Cleats

Another tripping threat is hardware, in particular cleats. These should be moved away from the main walking areas. A cleat that is directly underneath the lifelines is less likely to trip than a cleat inboard by just a couple of inches. Other hardware should be grouped to create avoidable areas, rather than scattered randomly around the deck. Leave open paths from the deck to the cockpit when mounting hardware. After just a few days on the water the skipper will intuitively learn to follow the open paths.

Clutches

As boats have become more complicated with a greater number of lines, the number of rope clutches has grown significantly. Some sailors have spread these clutches across the deck in an attempt to keep the lines neat. But this takes up the entire deck space, leaving no room to walk. It is very important that adequate walking space be left on both sides of the boat and on the cabin top. It would be virtually impossible to walk on top of lines with the boat healed at thirty degrees. The lines will roll under foot. In conjunction with the earlier comments about reducing the number of control lines, clutches must be interspaced and overlapped to reduce the overall footprint and leave a significant amount of walking space.

Tweaker Lines (Twing Lines)

Tweaker lines are small diameter lines that run along the spinnaker sheet at the widest point on the boat. They are used to pull the sheet and guy into the boat and add control. They are invaluable

to the singlehander because they can control the sheet and guy when the spinnaker pole downhaul is released for gybing in higher winds. I use them often.

Sails:
Singlehanding causes significantly greater wear to sails than crewed sailing. The key reason being that there are many times where a sail will be left to flog for extended periods while something more important or perhaps even critically dangerous, is sorted out. For example, I was entering a narrow channel hoping to keep the spinnaker up from a run to a beam reach with the winds blowing at 20 knots. Both the sheet and guy got away and the chute was streaming from the mast straight out the side. For at least two minutes it was impossible to turn downwind without running into the rocks. Only after passing the channel marker was I able to turn, activate the autohelm and douse the sail. The spinnaker was flapping wildly during this time and undoubtedly suffered extensive wear. A crew would have pulled the chute down immediately but it was impossible alone.

In other cases, the mainsail will be flogging wildly while it is reefed in 40 knot winds or the genoa will be smashed into a ball and shoved below deck when 10 knot winds suddenly gust up to 20. Neatness and proper sail packing takes a distant second place to safety when the skipper is on a bucking, wet foredeck in these situations.

High tech, Mylar or Kevlar sails are fantastic if properly handled by a crew but will crack and break under the flogging conditions typical to a singlehander. Watching a $5,000 sail split in his hands will bring tears to any sailor's eyes.

These plastic sails are also nearly impossible to repair. Mylar kits are available to mend small splits, but once patches are being applied over older patches, it can be assumed that the sail has finished its life. Experience has shown that extensive singlehanding will destroy these sails beyond use in one or two years. The trouble with high tech sails is that they go from practically perfect to completely useless in an instant. There is no middle ground lasting years or even months when they are still workable.

Unless the singlehander has money to burn, standard Dacron sails will be the only possible choice. Although Dacron will not hold its airfoil shape past the first few seasons, at least it will still be workable for many years. Dacron sails are also very simple to repair with a sewing machine, an awl, or even a needle and thread on the high seas. The expense of a few trips to the sail loft for repairs will convince the singlehander to learn these skills.

With Dacron, it is even possible to unstitch old repairs and start fresh. This will be necessary at key stress points, such as batten pockets which will split open under flogging conditions. (Specialty sewing machines are available for sails at a reasonable price, but even cheaper are old sewing machines from the 1960s. These have metal gears necessary for sail repair. Modern machines with plastic gears are useless.)

An awl with fine waxed thread is excellent for hand sewing. It is much better than standard needle and thread for repairs in the middle of a

sail because it is worked mainly from one side. It will also push through multiple layers of sail cloth at seams and edges. www.speedystitcher.com

Mainsail: The main must have at least two and preferably three reef points. The first reef point will be used very often. The second reef point a few times a year and the third reef point once every year or two. It is impossible to predict the weather or the winds. A day that starts with a nice breeze can turn into a nice gale at any moment with little warning. A singlehander must be prepared to deal with these changes in a seamanlike manner. This means properly reducing the main and jib. It would be irresponsible to leave the dock without the ability to reduce sail to meet any wind conditions.

Lazy Jacks: One of the greatest difficulties in singlehanding is raising, lowering and reefing the mainsail and boom. The main will flop around wildly until it is completely raised and the boom will bang violently inside the cockpit. A topping lift from the top of the mast to the end of the boom will stop damage from the boom, but it does not help in managing the sail.

An additional problem is in neatly folding the mainsail for storage on top of the boom. I've watched this to be a challenge for a crew of four. It borders on impossible for a singlehander.
Lazy Jacks solve both of these problems. These are a network of lines that run from a single point well up the mast to multiple points on both sides of the boom. Lazy Jacks should be designed to be pulled away from the boom and secured on the mast when the boat is underway. They are known to get tangled with the mainsail battens. Some larger boats use fabric covers around the boom to hold the sail. These are a problem because it is very difficult to work with reef lines while reaching under the fabric.

Jib and Genoa: The key to the fore sail is that it must go up and come down easily from the cockpit. This usually means that hanks are preferable to a sail foil.

When raising the jib on a foil, even with a pre feed, is likely to jam and the singlehander must rush to the bow, release the sail and rush back again to pull on the halyard. When dropping the jib a foil will not let it fall to the deck on its own. Hanks solve both of these problems. Hanks rarely jam on the way up and will quickly drop by at least a few feet when the halyard is released on the way down. It is very simple for the singlehander to grab armfuls of genoa and pull the sail down onto the deck when using hanks.

In my experience Wichard hanks are preferable to piston hanks. The piston type requires two hands to hank on or off – one hand to pull the piston and one hand to move position the hank on the forestay. This can be dangerous or even impossible when crouched in a bouncing pulpit. Wichard hanks can be easily clipped on or off with one hand while the other is holding on to the boat. The small ends of a piston hank are impossible to grab with gloved hands – not an issue with Wichard hanks, and the piston hanks will seize with salt, again not an issue with Wichard hanks.

Wichard hanks have a drawback for boats using an asymmetrical spinnaker. If the jib is still raised, the spinnaker sheet may get caught in Wichard hanks as the spinnaker is gybed. This is a known problem on Mini 6.50 boats. This is

only a problem with asymmetrical spinnakers, not with symmetrical chutes.

Regardless of the type used, hanks on all sails should be positioned in the same direction so that the singlehander knows, even in the dark, which direction is used to hank-on or hank-off a sail. On my boat all sails: the genoa, jib and storm jib all hank on from port to starboard.

A handy device is to run a line up the forestay, woven between just a few of the hanks to the head of the sail. This line is run through a block on the deck and back to the cockpit. When the halyard is released, the skipper can pull this line to pull down the foresail.

Although rarely seen, reef points on the fore sail are a good idea. These are common on the Mini 6.50s. Changing head sails is difficult and exhausting. It is unlikely that a singlehander will want to reduce from a #1 to a #2 for a slight increase in wind strength. But such changes would be common for a crewed boat. It is more likely that a singlehander will drive the #1 past its suggested wind range or will jump to a #3 before its required wind strength. Putting reef points three feet up from the bottom of the genoa will solve this problem by making the jump to a #2 sail size much easier. The same practice holds for the move from a #3 to a #4.

The tack position on a reefed foresail should not be at deck level. The entire foot of the reefed sail should be at least six inches above the deck. Otherwise water will collect in the bundle of material at the foot of the reefed sail. A short line should be used from the tack of the sail to the boat. In addition, small drain holes with proper grommets should be positioned along the sail a few inches below the reef points.

I do believe that a singlehander should use the largest sails designed for the boat. Some have suggested that we not use a genoa but stick with a jib for ease of tacking. I want my boat to sail as fast as it is designed, so rather than sacrifice speed, I have learned how to use the designed sails.

Roller furling sails are a great convenience for the cruising singlehander. The key advantage being that it is very easy to reduce sail from as much as a Genoa to a tiny handkerchief with just the pull on a line. Obviously they completely eliminate the problem of dropping and bagging the foresail. I know of several round-the-world singlehanders who have used roller furling sails very successfully. Their key disadvantage is the only real reason they are not used half rolled by racers: roller furling sails are cut for their fully extended position. They lose their aerodynamic shape and wing effect the moment they are rolled.

Larger boats have used two roller furling sails to eliminate the sail shape issue. A second forestay is positioned a few feet back from the head stay. Of course every new solution offers its own problems. The largest head sail must be tacked through the relatively small gap between the two forestays. This is not an issue on long voyages but will be inconvenient in short tacking situations. As well, sailors go to great lengths to reduce weight up the mast. It is not appealing to leave a large sail, permanently mounted all the way up to the top of the mast. This is a very significant amount of weight that must be counterbalanced at the keel.

This problem is corrected if the entire rolled sail, including its foil, stay and roller, can be dropped to the deck as one complete unit. This is an incredibly neat and efficient way to store a sail on deck.

A self tacking jib is a real convenience for the singlehander. Many modern racing boats use a larger mainsail with a jib, rather than a genoa. Self tacking jibs slide from side to side during tacking and require no effort at all. Only when sailing on a reach is any adjustment made to the jib sheet.

Positioning of the autopilot: It must be possible to operate the autopilot from the tiller position. During a typical sail there will be many times when the autopilot is turned on and off, even for a few seconds. Some of these times will be very rushed so it must be within convenient reach. For example at the start of a race the skipper will be hand steering, but may need to rush to the bow for a few seconds to skirt the jib. Using the autopilot for just a 10 second spurt is very typical, even in a cruising situation where the skipper just needs to find his coffee cup. Autopilots are covered in detail elsewhere.

Spinnaker Socks

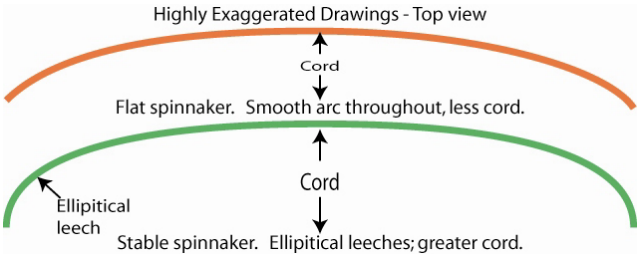
I am not a fan of spinnaker socks. In the first case, they are just not necessary on 20'-40' boats. If the skipper follows the detailed instructions set out in Chapter 7, she will never get into trouble with a spinnaker in any wind conditions. On the other hand, there are several drawbacks to socks. The most obvious is the extra lines and sock itself are prone to fouling at the top of the mast. Second, a singlehander should do everything possible to reduce weight up the mast. A bunched up sock is a lot of weight and wind resistance. The third, and worst, issue is that the skipper must move to the bow to work the sock. It is easy to imagine using a sock on a nice sunny day with a moderate breeze. But what happens when the wind increases to 20 knots against a current, and the waves are a choppy 4' high. Is this the time for a sailor to be standing on the bow with her arms above her head? It is very easy to drop the chute directly into the cockpit under these conditions, but difficult to use a sock. The boat is better off without it.

Spinnaker Net

A spinnaker net is used to stop wraps around the forestay. Nets are usually home-made from light webbing material, with sail hanks to connect to the forestay. The net is stretched between the forestay and mast. The biggest problem with nets is that they become a tangled mess when stored below deck. They should be tied in a nice bundle before storage. Another issue is that the net is in the way of the spinnaker pole uphaul during a gybe. My net has a very light bungee cord to connect to the mast. (The white line visible in the photo.) This bungee cord allows the net to be pushed out of the way by the uphaul during the gybe. It defeats the purpose of the net if it must be disconnected from the mast in order to gybe.

Spinnaker Design:

The Figaro II uses spinnakers that are designed to be "stable" for singlehanded sailing. I contacted Rick McBride with Leitch McBride Custom Sailmakers in Sidney, British Columbia. They



have a strong reputation with the local racing community. Rick explained the differences between a stable and a flat spinnaker. The skipper should keep in mind that all spinnakers act like a wing, with air flow from the luff to the leech, even when sailing deep downwind.

A stable spinnaker is designed to be used with minimal attention to sail trim. It will fly even as the apparent wind oscillates back and forth in normal conditions. A flat spinnaker requires constant trimming or it will collapse. A stable spinnaker will have greater cord depth. This allows the boat to sail higher or lower without the sail stalling. It will also have a more elliptical leach allowing the luff to fold over on itself without collapsing. A flat sail will collapse if the leading edge folds over at all.

Like the wings in a jet airplane, a flat spinnaker will be faster, but more prone to stalling or collapsing than a stable spinnaker designed for singlehanding. There is a trade off between speed and stability that will depend on how much the skipper is able to work the sheets over hours at a time. The above drawings are highly exaggerated. In reality a stable spinnaker will have a cord depth only a few percent greater than a flat chute.

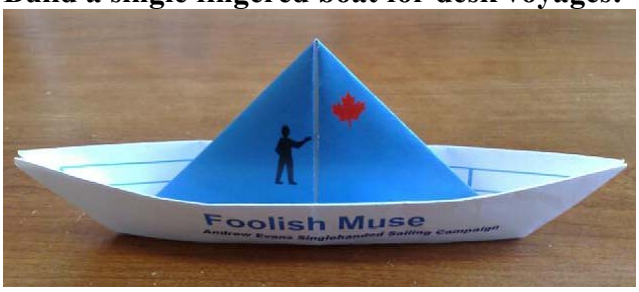
Miscellaneous items:
The key idea to boat setup is that those things that are used minute to minute are positioned within reach of the singlehander sitting at the tiller. Items that are used less often require the singlehander to stand up in the cockpit; and items that are normally used just once per trip require the singlehander to leave the cockpit.

Over time I have added many convenience items to the boat. For example, I have a coffee cup holder right next to the tiller. If I am hand steering for several hours, it is nice to know that my coffee is within reach. I've also added a holder for my GPS unit, so that I don't drop it in the cockpit or overboard (which I've done.)

I have attached cloth bags just inside the main hatch for items that I am likely to use only once each trip. I can put sunglasses, sunscreen, a spare knife, gloves and my GPS when not in use inside these bags that can be accessed just by stepping to the hatch.

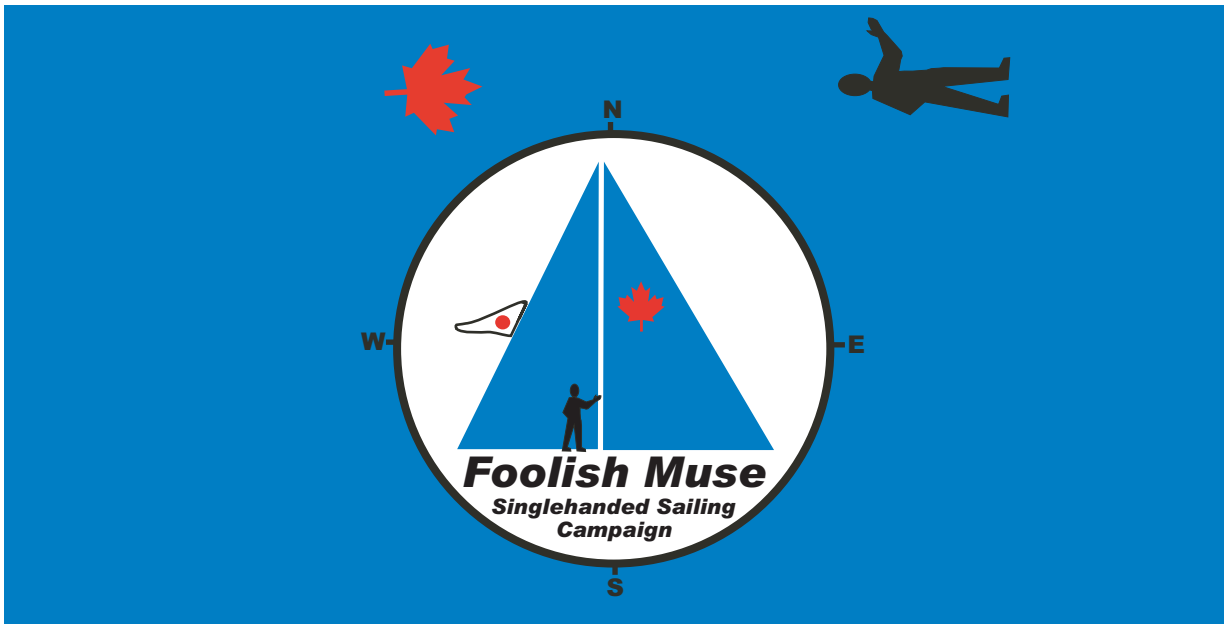
The singlehander should think about what he uses during a voyage, and find his own way to store it appropriately.

Build a single fingered boat for desk voyages:



Print the next two pages back-to-back. (The * mark should be approximately even on both sides of the paper.)
See the instructions at: http://tinyurl.com/52yrm
Set a course for office adventure.

*


N
W
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Foolish Muse
Singlehanded Sailing
Campaign

Foolish Muse

Andrew Evans Singlehanded Sailing Campaign

And now nothing more.
I want to be alone
with my essential sea.
I don't want to speak for a long time,
Silence! I want to learn,
I want to know if I exist.

Ch. 4: Power systems

Electricity is the greatest cause of frustration to every singlehanded sailor. Electrical problems will lead to more voyage cancellations than any other issue and electrical problems will cause the skipper to spend more time in uncomfortable twisted positions below chart tables than anything else. Here are some quotes from highly experienced singlehander Jeanne Socrates' blog over just eight days:

- **Managed to short across circuit while testing AP drive motor ...40A fuse blown - no spare...!**
- **Went to use multimeter to check fuse - 'dead as a Dodo'...! Battery gone - no spare**
- **Used heatshrink butt joint to bypass fuse and join wires together - there's another 40A fuse in same circuit so protected still... Discovered instruments now permanently on - despite switch at chart table - seems I damaged relay in blowing circuit**
- **About to see if I can find out what the problem is with my ship's VHF radio - confirmed yesterday as not transmitting. Means getting (with difficulty!) to behind the instrument panel yet again..... grrr! Maybe I'll be able to see why my SSB radio has lost its GPS input while I'm back there..... and have another go at fixing the lost connection between the same VHF radio and the AIS unit...**
- **"In for a penny, in for a pound" ... I delved deeper and removed the Pactor modem and HF/SSB radio front to see if I could restore the missing GPS input to the radio - another loose connection dealt with ... YES - success!**
- **Lat/long/UTC - all displayed again... I felt I deserved the dark chocolate I rewarded myself with later, after my meal!!**

Jeanne has circumnavigated alone twice and is on her third trip. She has faced these types of problems since I met her 5 years ago. The problems listed above were encountered on a two year old boat with completely new electronics. She has had numerous professionals working on her boat and has become nothing less than an expert herself. There is only one answer. If a boat contains electronics, they will go wrong – without question.

So the singlehander faces two options: first is to attend university for four years to receive a degree in electronics engineering; second is to drastically reduce the amount of electronics on board. I prefer the second option.

I AM A SAIL BOAT. I NEED ONLY WIND TO MOVE MY MASTER SAFELY AND COMFORTABLY TO ANY PORT IN THE WORLD.

This should be engraved on a bronze plaque and mounted inside every singlehanders boat. I love sailing. I want to spend my weekends sailing, not searching out fuses or looking for lose wires. And when I undertake a long offshore voyage, I do not want to be stopped by something that takes four years of university to understand.

Before leaving the dock, a singlehander must ensure that the boat can be sailed safely to its destination even with a complete power failure. A power failure will occur – depend on it.

Modern civilization teaches us that electronics are the source of all safety, comfort and happiness. (Take away any teenager's cell phone to prove my point.) By modern I mean just the last ten years. Two decades ago no sailor would leave port without knowing how to use a compass and sextant. Today a chart plotting GPS

tells us where we are, what heading to the nearest port and the location of every rock in-between. Just four decades ago, the famous singlehander Bernard Moitessier undertook the Golden Globe Race without even a radio. He communicated through passing ships to the race headquarters using signal flags. Today, how many skippers would even notice if they passed a boat signaling one of the distress messages.

I have rambled on for a page and a half to make one point: Electronics is bad. It will break. Luckily, it is not necessary for the prepared singlehander. The chapter on sailing techniques explains how to sail with no autohelm or wind vane. A singlehander is not prepared to leave the dock until he understands these techniques.

However, I am not so naive to think that we can't use electronics to make our lives easier. The first thing a singlehander should do is reduce the amount of electronics on the boat so that inconvenience is limited in the event of a complete power failure. The skipper should seek out and eliminate any electronic gadgets on the boat that can be done just as effectively manually.

The second step is to cut power consumption on necessary items simply by turning them off. In her famous Vendee Globe race, Ellen MacArthur commented that she was spending eight hours a day using a computer and internet connection to research the weather. I was studying weather forecasting at the time, and asked her what she was researching in eight hours that could not be done in a half hour. She answered, "nothing". The simple reason is that the boat was sailing itself perfectly without her constant input. She was just spending time. But she was also wasting power.

The singlehander should use a computer as necessary, but no more so. If it takes a half hour, then don't spend one hour or eight hours. Turn the computer off and read a book.

Sailors have a bad habit of leaving instruments running for the entire voyage, for example by leaving the GPS chart plotter running 24 hours a day in open water. Why? Every boat has a mechanical compass. The GPS should be activated for a few minutes every four hours just to check the course. After that, it should be turned off again and the mechanical compass used. Another good example is collision avoidance equipment. The radar, AIS, Sea-Me or CARD should only be used when the skipper is below deck. They should not be used when the skipper is on deck day or night, except in thick fog. The skipper has eyes; he should use them and not waste more valuable power.
In particular, the display screens on electronic devices can burn an inordinate amount of power. At the very least, the display screens should be put into sleep mode when not in active use.

As a third step, stay in DC. Nearly all electronics in the world are designed to function in DC power. Those that are intended for home use have added a built in AC adapter that converts the power from AC to DC before it enters the unit. (The AC to DC inverter is the small black box commonly found on the end of a power cord.) There is a very significant power loss in moving from AC to DC. So all electronics should be run directly from the boat battery using a DC to DC converter that converts the standard 12V to whatever is required for the instrument.

Power Budget:

Planning a power budget is tricky because there are several uncontrollable variables. The basis is that the skipper should calculate all of the power requirements for his boat. A simple spread sheet is the best way to tackle this issue. I've attached a sheet from the Pacific Cup.

Virtually all of the power usage figures are available from the users' manual or web site for each piece of equipment. For example, a quick look at the Raymarine web site indicates that the

Electrical Budget Worksheet (adapted from Pacific Cup)

1 Calculate your DC Loads:

Lighting	Amps	Hours	AH/Day
Running Lights			0.0
Masthead Tricolor Light			0.0
Anchor Light			0.0
Strobe Light			0.0
Spreader Lights			0.0
Cabin Light (small)			0.0
Cabing Light (big incandescent)			0.0
Cabing Light (flourescent)			0.0
Instrument Lights			0.0
Handheld Spot Light			0.0
Other			0.0
	Lighting AH		**0.0**

Galley	Amps	Hours	AH/Day
Refrigeration			0.0
Prop Solenoid			0.0
Other			0.0
	Galley AH		**0.0**

Electronics	Amps	Hours	AH/Day
Autopilot			0.0
VHF (receive)			0.0
VHF (transmit)			0.0
SSB (receive)			0.0
SSB (transmit)			0.0
SSB Digital controller			0.0
GPS			0.0
Instruments			0.0
Weather fax receiver			0.0
Radar (standby)			0.0
Radar (transmit)			0.0
AIS			0.0
Energy Monitors			0.0
Stereo			0.0
Computer (screen off)			0.0
Computer (screen on)			0.0
Computer (serial adapter)			0.0
Other			0.0
	Electronics AH		**0.0**

Plumbing	Amps	Hours	AH/Day
Fresh Water Pump			0.0
Calculate using average water consumption.			
Bilge Pump(s)			0.0
This should be zero unless the boat leaks.			
Other			0.0
	Plumbing AH		**0.0**

		Watts	Hrs/day	AH/Day
	Inverter			
	Microwave			0.0
	Chargers (nicad)			0.0
	Other			0.0
		Inverter AH		**0.0**
	All values assume inverter efficiency = 85%.			
	Power factor may mess up this estimate.			
	Gross Energy Consumption AH/Day			**0.0**
2	Alternative Energy Sources			
	Device	Amps	Hrs/day	AH/day
	Solar, avg			0.0
	Assumes one large panel.			
	Wind, avg			0.0
	Assumes AIR Marine wind turbine in good location.			
	Water, avg.			0.0
	Contribution of AES AH/Day			**0.0**
3	Net Energy Consumption, AH/Day			**0.0**
4	Desired Hours Between Charging			
5	Range of Battery Use			
	For example, from 50-85% state of charge.			
6	Recommended Battery Capacity			
7	Alternator Output, Amps			
	Target would be 25% flooded, 40% gel, of capacity.			
8	Charge Efficiency Factor			**0.85**
	Gels = 95%, flooded cells = 85%			
9	Minimum Minutes to Charge			
	Assumes alternator runs at full output.			

model AIS 250 has power requirements listed at 200mA. But, when building the spreadsheet the skipper must remember that some equipment only works in conjunction with others. For example, the AIS 250 is designed to work with a multifunction display which consumes another 250mA.

The greatest risk in power consumption calculations is with the auto pilot because this is by far the leading user of power. An error here has one hundred times the consequences of an error in the running lights. The problem being that the pilots' consumption is directly related to weather conditions which are difficult to predict when building the system. For example, the B&G T2 hydraulic pump has a power consumption range from 5 Amps to 22.5 Amps. Actual power consumption within this range will depend on the pilot responsiveness required for the direction of sail (running downwind requires greater power) and the wind/wave conditions (A choppy sea will consume much more power than flat water.)

Power Generation:

Given everything mentioned above, the single best method of meeting power requirements is to cut power requirements. Reducing power requirements will reduce cost, reduce problems and reduce the risk of abandoning a voyage. Reduce, reduce, reduce, reduce. It's easy to remember and it works. After meeting a large part of the power requirement by eliminating it, the singlehander can take the next step and determine which method of power generation is best for his boat and his sailing.

Watts, kilowatts, hours: Power is discussed in terms of Watts or kilowatts or kilowatt hours. Power (in Watts) is equal to Volts x Amps. Since we are almost always dealing with 12 Volts, we can often ignore the aspect of Amps and just work directly with Power.

The "Watt" is the instantaneous measure. For example a solar panel with a 40 Watt output could power a 40 Watt light bulb (assuming no losses). A kilowatt is equal to 1,000 Watts. A kilowatt-hour is a constant stream of one kilowatt for one hour. A solar panel with a 40 Watt output would require 25 hours of sunshine to generate 1 kilowatt hour of power. A battery that stores 1 kilowatt hour of usable power would light ten 100 Watt light bulbs for one hour. For most batteries, only about 50% of listed capacity is actually "usable" if one expects a reasonable battery life.

Examples:

- My boat has 130W of solar panels. During a sunny day at sea I can plan that they will receive usable sunlight for 9 hours. 130 x 9 = 1,170Wh or approximately 1.2 kWh.
- An auto pilot requires 5W under easy conditions and 22W under difficult conditions. We might assume an average of 8W during our voyage. Over a day this is 24 x 8 = 192Wh. However this could be as high as 22 x 24 = 528Wh over an entire day of rough seas.
- A Sea-Me Radar reflector is listed as using 150mA. This is 0.15A, so 0.15A x 12V = 1.8W. Running the Sea-Me for 6 hours while sleeping will require 1.8 x 6 ≈ 11Wh.

Batteries: First, it is impossible to "force" power in to a battery. A battery draws power in, just like sucking it up a straw. Power can not be forced in any faster than the battery wants to draw. A deeply drained battery will draw power in quickly. A battery that is nearing capacity will draw power in slowly.

Power will flow in any direction, from the highest to the lowest. So the only way to charge a battery is to supply power at a higher voltage than what the battery contains. So, for example, a solar panel may be called "12 Volt", but this is the nominal value. In fact it will supply more than 12V. This is necessary because in order to

charge a 12V battery, the solar panel must supply a greater voltage.

Because a drained battery draws power much more quickly than a battery near capacity, it is rarely worthwhile attempting to fill a lead-acid, GEL or AGM battery all the way to capacity while at sea. The battery will fill from 50% to 80% much more quickly than it will fill from 80% to 90% or 90% to 95%. That is, it will take much longer, even in the same sunshine, to get the battery from 80% to 90%, than it will take to get it from 50% to 80%. Many skippers will plug into shore power over extended periods to get their batteries up to 100%, but only charge to 80% while at sea. It is a more efficient approach. As will be indicated later, lithium batteries operate differently.

Much of the information below is sourced from:
http://www.windsun.com/Batteries/Battery_FAQ.htm

Internal resistance is the issue. Slower charging and discharging rates are more efficient. A battery rated at 180 amp-hours over 6 hours might be rated at 220 AH at the 20-hour rate, and 260 AH at the 48-hour rate. Much of this loss of efficiency is due to higher internal resistance at higher amperage rates - internal resistance is not a constant - kind of like "the more you push, the more it pushes back".

Starting batteries are commonly used to start and run engines that need a very large current for a very short time. They have a large number of thin plates for maximum surface area. The plates are composed of a lead "sponge", similar in appearance to a very fine foam sponge. This gives a large surface area, but if deep cycled, this sponge will be consumed and fall to the bottom of the cells. Automotive batteries will generally fail after 30-150 deep cycles if deep cycled, while they may last for thousands of cycles in normal starting use (2-5% discharge).

Deep cycle batteries are designed to be discharged down as much as 80% time after time, and have much thicker plates. The major difference between a true deep cycle battery and others is that the plates are solid lead plates - not sponge. This gives less surface area, thus less "instant" power like starting batteries need. Although these an be cycled down to 20% charge, the best lifespan vs cost method is to keep the average cycle at about 50% discharge.

Marine batteries are usually a hybrid, and fall between the starting and deep-cycle models. In the hybrid, the plates may be composed of Lead sponge, but it is coarser and heavier than that used in starting batteries. It is often hard to tell what is in a "marine" battery, but most are a hybrid. Starting batteries are usually rated at "CCA", or cold cranking amps, or "MCA", Marine cranking amps - the same as "CA". Any battery with the capacity shown in CA or MCA may or may not be a true deep-cycle battery.

Plate thickness (of the Positive plate) matters because of a factor called "positive grid corrosion". This ranks among the top reasons for battery failure. The positive (+) plate gets eaten away gradually over time, so eventually there is nothing left - it all falls to the bottom as sediment. Thicker plates are directly related to longer life, so other things being equal, the battery with the thickest plates will last the longest.

Automotive batteries typically have plates about .040". The typical golf cart will have plates that are around .07 to .11" thick. While plate thickness is not the only factor in how many deep cycles a battery can take before it dies, it is the most important one.

There are several types and technologies for batteries: The major construction types are flooded (wet), gelled, and AGM (Absorbed Glass Mat). AGM batteries are also sometimes called "starved electrolyte" or "dry", because the fiberglass mat is only 95% saturated with Sulfuric acid and there is no excess liquid.

Flooded may be standard, with removable caps, or the so-called "maintenance free" (that means they are designed to die one week after the warranty runs out). All gelled are sealed and are "valve regulated", which means that a tiny valve keeps a slight positive pressure. Nearly all AGM batteries are sealed valve regulated (commonly referred to as "VRLA" - Valve Regulated Lead-Acid).

Flooded: 6V golf cart batteries: What? Golf cart batteries on a boat? Yes, this is what I use. I have a pair of Trojan, 240 Amp Hour, 6 Volt golf cart batteries installed in series to produce 12V. These are standard flooded lead acid batteries that must be checked and refilled periodically. I use these for a few reasons, first they have a very deep cycle, meaning that they provide a steady stream of power for a long time, exactly what I need to run an autopilot for hours or days on end. And they have a high cycle life, i.e. they can be deeply discharged many times before replacement. Think about what they were built for, to run a golf cart through 18 holes, several times in succession before they are recharged overnight. The golf course does not want to replace these batteries every three months. Second, they are the least expensive of any type of battery for the amount of power they supply and they are readily available, from any battery shop. (I notice that West Marine is selling the exact same battery under the name “SeaVolt”). Golf cart batteries are not optimized to provide “cranking” power required to start an engine, however they will not be damaged when used for this. These batteries can spill very dangerous acid, so must be properly secured in the boat to survive even a complete knockdown.

My own experience has shown that they are a good choice; on the return trip to Hawaii, they twice ran my autohelm and electronics through several days of completely overcast conditions without a blip. I have recently replaced my batteries after constant use over five years. The cost of replacing the pair was just over $300. This is why I would recommend golf cart batteries over any other type of standard lead acid battery.

Gel batteries have added a silica gel to the liquid to stop it from sloshing around or spilling. They are sealed so never need refilling. However, there are several disadvantages. One is that they must be charged at a slower rate to prevent excess gas from damaging the cells. They cannot be fast charged on a conventional automotive charger or they may be permanently damaged. This is not usually a problem with solar electric systems, but if an auxiliary generator or inverter bulk charger is used, current must be limited to the manufacturers’ specifications.

AGM (absorbed glass mat) batteries infuse the electrolyte into a fibre mat between the plates. These have the non-spillable benefits benefit of a gel battery, without the limitations on charging. However, AGMs cost 2 to 3 times as much as a flooded battery with the same capacity.

A battery "cycle" is one complete discharge and recharge cycle. It is usually considered to be discharging from 100% to 20%, and then back to 100%. However, there are often ratings for other depth of discharge cycles, the most common ones are 10%, 20%, and 50%. The buyer must be careful when looking at ratings that list how many cycles a battery is rated for unless it also states how far down it is being discharged. For example, most golf cart batteries are rated for about 550 cycles to 50% discharge - which equates to about 2 years.

Battery life is directly related to how deep the battery is cycled each time. If a battery is discharged to 50% every day, it will last about twice as long as if it is cycled to 80% DOD. If cycled only 10% DOD, it will last about 5 times as long as one cycled to 50%. This does not mean it cannot go to 80% once in a while. It's just that when designing a system with some idea of the loads, an average DOD of around 50% should be considered optimum. Also, there is an

upper limit - a battery that is continually cycled 5% or less will usually not last as long as one cycled down 10%. This happens because at very shallow cycles, the Lead Dioxide tends to build up in clumps on the the positive plates rather in an even film.

Lithium Batteries: Bruce Schwab, who has sailed his Open 60 around the world twice, has studied battery power extensively and made these comments on the new lithium batteries. A full discussion is available on Youtube.com: Search for "Bruce Schwab talks about Lithium marine batteries":

No, they're not for everyone…but that's only because they cost a lot up front. The good news is that they are relatively new to the marine market, so the prices will come down eventually. However, here is a big point: over the life of the batteries they may actually cost LESS per cycle or per kWh used than lead/gel/agm. How can that be? This is because lithium batteries can be used for 2000-3000 cycles at 80% DOD (Depth of Discharge) levels. Compare that to the typical <400 cycles of an AGM battery at only 50% DOD.

Furthermore, as noted above the last 20% or so of the lead/gel/agm capacity is rarely available while sailing, because it simply takes too long to charge them all the way up. With a good lithium system they can absorb charge at an enormous rate. How fast?

Up to "3C" continuous, which means three times the Ah capacity, in amps? For example; if you had a 360Ah Genasun lithium system you could charge it at 900A+ (!) up to 90-95% of capacity. In reality, no one on a boat will charge that fast (you would blow any normal fuses, anyway) but the point is that the batteries can take it.

So, at "normal" fast charging rates, you can get to 95%+ of capacity before the voltage goes up and the current is reduced by the alternator regulator. What does this mean? It means that a full 75%+ of the lithium capacity is "useable" and in the fast recharging range, compared to only 30-35% of lead/gel/agm.

Ok, so you've done your power budget and you came up with an average consumption of 10A/hr (at 12V). So you'd like 240Ah @ 12V of useable power for 24hrs, so that you only have to charge once per day. If you have a lead/gel/agm you would need a roughly 720Ah bank to get 252Ah (35%) of useable capacity to reach your 24hr target. That size of lead battery would weigh as much as 500 lbs, and the expected life would be 250-500 cycles at 50% DOD.

With a good lithium system of 360Ah capacity (1/2 of the lead), you would have 270Ah of useable capacity at the very conservative 75% capacity use. The system would weigh about 123 lbs and have a cycle life of 2000-3000 cycles at 75-80% DOD. That is about ¼ of the weight, and 4 to 6 times the cycle life.

Using a Victron Telecom 180Ah telecom as an example, four of them (for the 720Ah) would cost roughly $2350. A Genasun LiFePO4

(Lithium Iron Phosphate) 360Ah x 12V system retails for $7700. So that's 4 to 6 times the cycle life and ¼ of the weight for about 3.28 times the price. And we haven't mentioned the possible fuel savings from faster recharging (depending on how much charging power you can pull out of your engine/generator), and the reduction of amps actually used due to less voltage drop with lithium.

The BMS modules (circuitry on top of the battery) do several things; they measure the voltage and temperature of the cells and send the info to the BMS master. The BMS master then tells the modules when to shunt off a little energy (when needed) to balance the cells with each other. Once a bank is in balance the corrections are very very small, so very little energy is lost.

The better BMS's do balancing full-time, whenever there is a voltage difference and either charging or discharging. Some simpler ones only shunt/balance at a set voltage point.

Oh, that reminds me…did I mention the reduced voltage drop and the greater amps in/out efficiency? Or the lack of "Peukert's Effect" with lithium (the loss of capacity under high loads exhibited with lead)?

Creating Power

Solar Panels: Here is a bold statement: Solar panels are the best method of generating power – no question. Any other method should be selected only if solar panels will not work. Solar panels are the first choice because they are the simplest possible solution. No moving parts, nothing to break, nothing to wear out, nothing to fix – ever. I've used my solar panels for five years without giving a thought to even the slightest bit of maintenance. They just keep working. About the only thing that should be done is an annual current test to ensure none of the connections are broken and the panels are still providing maximum power. A solar panel system only has three parts, the panels, a charge controller and the batteries. That's it.

Solar panels can be added as required for particular voyages. I have 40 watts permanently mounted on the boat to meet all of my normal requirements fifty weeks a year. I add another 50 watts on a mat for my annual offshore trip, and another 40 watts hanging off the transom for longer voyages. With 130 watts Foolish Muse had no problem sailing to Hawaii and back.

This system is not optimally mounted. The wind generator and radar cast a significant shadow across the solar panels. In a knockdown the entire framework would be destroyed.

I believe that for simplicity, the best option is to have the panels mounted flat on the boat. Other systems are mounted on a moveable frame that allows the panels to be aimed more directly at the sun. This will generate more power, particularly in the morning and evening. However, it does move away from my concept of maximum simplicity. If the boat has sufficient solar panels, aiming them at the sun will only add a small amount of extra charging. Keep in

mind that we are only trying to get to 80%, so the extra effort to get to 100% is rarely worth the effort. Rigid and flexible panels are available, however rigid panels supply much more power so are recommended. It is certainly possible to use several panels to meet the contours of the boat deck. I use a series of panels, each measuring 13" x 5", across the stern of the boat. This fits the curve very closely.

Solar panels must be mounted where they have a clear view of the sky. A shadow covering 1/3 of the panel reduces its output to zero. Even a small shadow reduces output significantly. For this reason the best mounting location is on the stern or transom of the boat, behind any shadow from the mainsail or mast. A panel mounted on the cabin top will be partially shaded all of the time.

With a solar panel system, a Charge Controller is required. A charge controller limits the rate at which current is added to batteries to increase the longevity of the batteries. A "Maximum Power Point Tracker" MPPT controller further optimizes the charging to provide the optimum voltage when the batteries are drained, for example after a long night of use.

Wind Generator:

Wind generators have become increasingly popular over the past decade. The have become more robust and much quieter. Noise has always been a complaint against wind generators and noise reduction has been an area of significant research. This in itself is a reason to closely examine later models. Prices for typical units run in the $800 to $1,200 range.

Of course to function, the wind generator must be in an apparent wind. So, all else equal, they will generate much more power sailing up wind than down wind. For example, if sailing upwind in 5 knots of true wind to produce 10 knots apparent, the generator will output about 40 watts of power. However, if sailing downwind in the same 5 knots true and 2 knots apparent, the generator will not produce any power at all. It has a startup requirement of 5 knots. In researching wind generators I've found a huge range in power output. In 10 knots of wind speed, rated power outputs range from 10 to 50 Watts. The skipper is encouraged to research this carefully. It appears that the modern designs produce significantly more power than older models.

A key consideration is in mounting the unit well away from any operational area on the boat. I have seen the photo of an offshore sailor who was seriously cut by the wind generator blade while reaching over the transom. The wings on a typical generator will be 46" or 120 cm across. They take up a significant amount of room so must be mounted well above the transom of the boat. Of course the higher up it is mounted; the higher is the weight and resistance on the boat. In a broach, the wind generator will be the very first piece of equipment to break. They are built for air, not water.

I have also found that many generator companies are no longer in existence. It takes little investment to start one of these companies on the boutique level, so there is no guarantee of longevity.

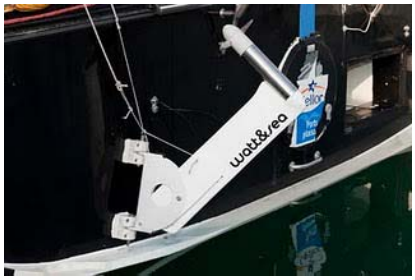
A few better known brands are:
AirBreeze: www.airbreeze.com
Ampair: www.ampair.com
KISS: www.kissenergy.com and svhotwire.com

Water Generator:

There are three types of water generators, fixed, towed and a hybrid. The fixed units are bolted directly to the transom and hang below. The towed units are mounted on the stern rail and towed behind the boat on a long line. The hybrid units are towed on a short shaft. The significance of all water generators is that they

only depend on boat speed, and not on relative wind speed. As such, they are just as efficient moving up or down wind. This is very important on extended downwind voyages – our greatest wish. Any type of water generator will create drag. This is not as important for cruisers, but obviously significant for racers. The significance of the drag will be greater for smaller boats, i.e. a 20' boat will notice much more drag than a 40' boat. Of course as described above, these should only be left in the water for the time necessary to bring the batteries up to 80% - the most efficient charging period.

Fixed: Fixed type generators have recently appeared on the scene. They bolt directly to the transom of the boat and extend into the water below.



They can be swung up when not in use. These are being used in the big Open 60 singlehanded races. The Watt & Sea model specifications indicate that it can produce an astounding 500 Watts of power when traveling at just 8 knots. There is some drag slowing the boat, but the rational is that it is less than the drag of carrying 300 litres of fuel required to produce the same power with a generator on a very long voyage. This unit sells for the equally astounding price of $6,650 for the basic unit. The racing version is more. Obviously it is aimed at the serious market.

Here are some comments Mike Hennessey made on the Sailing Anarchy forum:

The cruising version is about $6,500 USD and the racing version is about $18,000 USD. The difference between the two versions is that the racing has variable pitch blades that feather the blades based on boat speed (e.g. drag minimization) while the curising version has fixed blades. The race version is also 1 kilo lighter than the cruising version.

A good number of Class 40's have either installed or are going to install the units. Several installed them for the Route du Rhum. In the US, the Atlantic Cup organizers are encouraging participants to install the units, in keeping with their goal for a green regatta. The Class 40's have all been going with the cruising version since the drag that is dealt with by the variable pitch control starts to become a real issue at over 12 knots of boats speed, and in a Class 40 the best way to deal with that is to simply pivot the generator out of the water and wait for slower boat speeds to charge. The Class 40's tend to average 9 knots or so, which makes this a viable choice for Class 40's.

The amp budget for my boat is in the range of 200 amps a day. For an IMOCA 60 it is not going to be that much more, just what is used to cant the keel. The problem with a 5 amp device is that it just is not going to make that much difference for the drag penalty you pay. And I am still going to need to haul heavy deisel fuel around, or a genset, or a fuel cell. I frankly have a similar issue with solar panels - I just don't have enough space on the deck to have enough panels to produce enough power that would make me fossil fuel independent.

The Watt & Sea unit can do that. 4 to 5 hours of deployment a day and I pay for my entire amp budget. Sunny days or shady. And while it won't help in really light conditions, I can basically

count on it any time the boat is going more than 4 to 5 knots.

Towed: For a true towed generator, there is nothing but a propeller and shaft at the end of a 30 metre line. The line is connected to a generator on the stern rail. Thus the propeller and line both rotate all the way up to the rail. This type of unit will generate about 12 Watts of power for every 1 knot of boat speed. However, to me it seems that towing a 30 metre rope behind the boat is a lot like towing a drogue, designed to slow the boat. There have also been instances of towed units being eaten by sharks and the rope is prone to foul in bouncing seas.

Hybrid: The hybrid water generator is made up of a ridged shaft and propeller, approximately 8' long, fixed to a generator on the rail. The shaft is gimbaled to move with the water. The propeller has a "diving plane" or wing to keep the propeller below the water. The unit I looked at was rated for 72 Watts of power at 5 knots of boat speed. These units claim 30% less drag than the towed line generators.

Water generator units often advertise that they can be mounted vertically with a larger propeller to capture wind power. However the spec sheets show that this gives poor generating performance compared to a dedicated, modern wind generator.

Fixed: Watt & Sea: www.wattandsea.com
Towed: Ampair: www.ampair.com
Hybrid: Duogen: www.duogen.co.uk

Power Cells: Power cells are a new technology to the sailing world. Just a few years ago they shut down when tilted, as when sailing to windward, making them unusable. However this problem has been corrected. Power cells are now being used by top racers in Trans-Atlantic and round-the-world voyages.

Power cells use a simple chemical reaction to produce electricity. Methanol mixes with oxygen passing through a membrane to release electrons – thus electricity. A simple, quiet pump is the only mechanical aspect of the device. The methanol is used up in the process. The only byproducts are water and carbon dioxide (the same amount of CO_2 as a person breathing) so the unit can be used in the cabin.

A typical power cell will produce about 1.1 kilowatt hours per litre of fuel, making it about 24% less efficient than a gas generator. Power cells often have automatic on/off functions to ensure the batteries are always charged. This can lead to problems if used in conjunction with a solar panel system, so it is recommended that they be operated manually.

Power cells are also considerably more expensive and use more expensive fuel than a generator. However, the mechanical simplicity, reliability and low noise make them a good choice for sailing in well developed areas where the fuel is readily available. This would not be advisable for cruising to the far flung tropical islands of the world.

Generators: Small, portable gasoline or diesel generators have a longer history in sailing. They are more efficient than a fuel cell, producing 1.5

kilowatt hours per litre of fuel for a small model and gasoline or diesel is readily available worldwide. As a full, working engine, generators are mechanically complex with many parts that can wear or break. Generators produce dangerous carbon monoxide so must not be used inside the cabin. Generators claim to be quite, but I would not want to be sleeping next to a running unit. Generators are known to have problems when tilted or in very rough seas. The oil systems are not able to maintain pressure, shutting them down.

Yacht Engine: Using the yacht engine is a common method of generating power. Racers using generators or the yacht engine speak of running the motor for one hour every eight hours of sailing. Personally, I find this concept unappealing. If I had wanted a motor running, I'd have bought a cigarette boat and forget all about the canvas overhead.

However, those who do use the yacht engine have worked out methods of increasing the efficiency of the charging process. Richard Lett, sailing Velocity Girl, made these comments (interspaced with notes from two time circumnavigator Bruce Schwab):

Most, almost all stock alternators are sourced from the automotive industry. They are designed to recharge a starter battery after starting and to run lights etc. whilst the engine is running. All easy stuff requiring no great charging abilities, just a low constant power drain. Almost the opposite of what a yacht needs having run batteries to 50% so and requiring as quick a recharge as possible.

In a car, the engine and batteries work together. On a yacht they work separately. This is where the voltage comes in; car alternators don't need high voltage to push in a charge, because batteries are always being charged as the engine is running. A car battery will only ever be at around 80% charge MAXIMUM, because it doesn't matter and the car alternator doesn't have the high voltage output to fill them any further. It just doesn't matter to a car.

Now on a yacht what we want are batteries as near their potential capacity as possible. When a battery is flat any alternator will do because the resistance to charge in the battery is low, as the battery fills the resistance to filling increases (your 6th pint never goes down as quick as the first!). It is the voltage that provides the push. That is why overhead power cables run at really high voltages because the power (amps) has to be pushed for many miles around a country or across a continent.

So car alternators do not have the voltage to charges batteries once they get to around 70%. Why would a car alternator manufacturer go to the expense of building a high voltage alternator when it is not required by the industry?

Resistance gets really high as batteries get above 70% or so. Dedicated charging alternators, such as Balmar are built with high voltage regulators to keep pushing the amps into the batteries, or you can buy an after market regulator to improve the performance of your basic car type alternator. These still will not fully charge your batteries, they will get them to 80% and will charge at a higher rate for a lot longer than the car type.

(Note from Bruce Schwab: **Almost any alternator can output a high voltage if properly regulated with an external regulator. However, the alternator may not hold up very well under heavy load and long use. Even the well known Balmar brand has a reputation for overheating and not putting out their "rated" amps. There are several brands that I prefer including Amptech, Ample Power and American Power**.)

When you read about multi stage chargers all they are doing is varying the voltage of the alternator. They do this when you have the time and luxury to charge batteries over many hours, like leaving on charge in the garage overnight. They cycle between high and low voltage to deal with bulk, trickle and maintenance phases. When at sea racing, you don't have time for all that. What you do is leave batteries to run all the way down, whack charge as quick as you can until batteries get to around 80% charge, you will see charge rate drop from around 80amps to around 20 amps. Because even a high volt alternator cannot pack charge in quickly to a nearly full battery that is seriously resisting being charged. Quit trying to charge once the charge rate drops and turn the engine off, stop wasting fuel and making a noise, you are wasting your efforts.

Use the battery monitor to tell when battery voltage has dropped close to 12v. Start charging. Watch the battery monitor and see the charge rate start really high and drop as the battery fills, then decide when to stop. For me charging starts around 90 amps, once I see the charge rate drop to around 25 amps, I stop. I don't even need to check, I just know the battery is around 80% full.

(Note from Bruce Schwab: **If you use your engine as the generator, the more you can load it up the more fuel efficient it will be. On the Open 60 "OceanPlanet" the 29hp engine had a 130A x 24V alternator (the same as 260A x 12V!). The battery bank was 360Ah x 24V (same as 720Ah x 12V) of Geltech batteries. With this system even if there was no sun for the solar panels, I could get by on one hour of charging per day. On good sun days in the South Atlantic I sometimes went 3 days before needing to charge with the engine. Having a cutoff switch for the alternator regulator (or a "low power" mode) is essential with such a big alternator on a small engine.)**

When in marina I leave the boat charging on a shore powered multi stage charger, so I start every voyage with 100% full batteries. They will never get above 80% again until back on the shore charger. Once you know this, live with it, charge when necessary, sail for the rest of the time and enjoy the peace of knowing you are doing all that is possible whilst afloat.

Good quality batteries matter, AGM batteries, for example, can take most if not all the charge an alternator can provide. Cheaper lead acid types can be damaged if too many amps are thrown at them, so a powerful alternator and efficient charging systems are wasted. So if you want to keep charge time to a minimum, a combination of high amp output and full charge acceptance is what you want.

Batteries are one part of equation. For offshore I suggest around 300 amps worth - once unplugged from shore power and charging from the engine you will only recharge to around 80% (technical reasons for this, but true whatever claims are made unless you want to run engine for long periods of time). This means that you are running between 50% and 80% of charge which is @100 amps (on a 300 amp bank) at 5 amp per hour this gives you up to 20 hrs between charges, or two 60amp top ups per 24 hrs, which is a fairy relaxed and stress free schedule.

The alternator needs to deliver its amps at high voltage to push all that power into the battery. This is where most factory fitted alternators come up short. They only deliver their amps at around 13.7 or so Vs so when they sense resistance from the battery as it fills up they start to reduce output, significantly. You can be running engine (at whatever revs) and alternator is only giving you less than 10amps, you may as well not bother, unless you like the sound of the engine. The solution is either one of the Adverc systems that regulate the output of your existing alternator to more than 14 Vs or you buy a marine specific Alternator like the Balmar that is designed to charge at higher volts. The higher the voltage of the Alternator the more charge you get in before the alternator is defeated by the resistance.

Next like many I have a clever battery monitor (only they are not as clever as they think). It is meant to count all the amps in and out. But after a few days it is wrong and not so helpful. However the good news is the Volt meter and Amp meter work very well and can be used as follows. Run all systems until your Volt reading is close to 12 V's which means batteries are low, then run engine, Alternator will push out nearly its whole potential and drop to below 20amps when battery reaches close to 80% charge, then you should stop. You may have added around 60amps in that first hour, quit, enjoy the peace. Extra hours waste fuel, don't provide much extra amps, charging twice a day for an hour on a low battery is very economical and will provide you with around 120 amps per day or an average of 5 amps per hour. For one more hours charging you can get up to 8 amps per hour, or you can shut something down. Re the amp reading on the battery monitor, you can use it to see when your alternator performance has fallen of a cliff and shut the engine down - this means battery is up to 80% charge and the last 20% could take all day, and isn't worth the effort. It is because of the last 20% that shore based chargers (however clever and however many stages) take all night to complete the charge.

Regarding engine speed - most pulleys are about 2 to 1 ratio, so double engine speed to know what alternator is running at. Between 1000 - 1400 should be optimal for most.

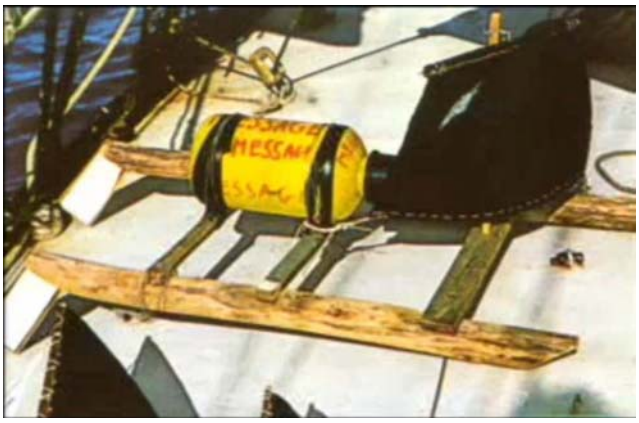
Regarding belts, any alternator over 100 amps need 2 V belts or a one of the newer serpentine belts. 2 belts are never quite the same length and can be a real problem to set up. The new serpentine belts don't slip and can handle huge outputs. I had new pulleys made for engine and alternator at J Class Marine (Shamrock) for £80. And they work a treat.

(Roy Hadland made this comment: As a marine engineer I often use pulleys with two, three or even four belts. We specify that they must be matched when we place the order. The company will ship matched belts that are exactly the same length. Any local store should be able to do the same if asked.)

Regarding smart chargers for engine - don't waste your money - OK if you are cruising and only have engine to charge batteries, you can leave engine on all evening, night or day to handle the full battery charge; if racing - just go for the hour charge on a low battery, accept you are running on 80% until you get back home - to charge quickly you only need good batteries, a high Voltage Alternator and patience to wait until batteries are low to run the engine.

I run a Balmar 120 alternator, which still only provides 95 amps to a flat battery in the real world, but it does top it up very quick - as an aside at that output it gets very hot - to keep everything happy make sure engine bay is well ventilated to dissipate heat - also you need to start engine at 1400 or so revs, as when the alternator kicks in after a minute or so of starting, if you are on tick over it may stall your engine! I have fitted a switch to disable alternator if I need full engine power at any time, they 120 amp can draw up to 20% from my 20 HP Lombardini.

My initial premise with this section was that the best method of managing power is to reduce power requirements. After this, solar panels should be the primary method of generating power because of simplicity and reliability. They offer the greatest benefit with none of the disadvantages of mechanical systems. I will stick with these ideas and leave it up to the skipper to select a secondary source of power, if one is necessary at all.



Two methods Bernard Moitessier used to communicate while single-handing around the world.

By Tony Sheridan

Single-Handed Racing Appeals to Victoria Sailor

"I find racing with a crew boring," Andrew Evans told me soon after he returned from finishing first in division and second overall in the Single-handed TransPac race from San Francisco to Kauai.

As a white-water kayaker, Evans became intrigued with solo sailing. "It's being completely responsible for everything yourself," he explained. He started sailing a Tanzer 22 on the Ottawa River several years ago, and then he decided he wanted to compete in the Bermuda single-handed race -- that meant a bigger and faster boat. After a lot of research he chose an Olson 30. "They have a good record in single-handed races, they are reasonably priced, and I got good feedback from people who had raced them." He bought his Olson 30, *Foolish Muse*, five years ago, began to learn how to handle her on his own, and was soon competing in single-handed races up to 100 miles long. A change in his business career led to a move to Victoria, so he changed his goal from racing to Bermuda to racing alone to Hawaii.

For the past two years, Evans has raced *Foolish Muse* in just about every local long-distance race on his own, except for Swiftsure, as the rules require a minimum crew of two. "By sailing in all sorts of conditions, I've really got to know the boat," he said. "Recently, a friend told me I wear the boat like a glove. That's the best compliment I could have." Soon after racing in this year's Swiftsure, Evans set sail out

***Foolish Muse* heads for the Golden Gate Bridge soon after the start. This photo, courtesy of *Latitude 38*, was presented to Evans as part of his trophy.**

into the Pacific to complete his 400-mile qualifying solo sail for the TransPac. "I sailed into a really big storm, though I don't how strong the wind was or how big the waves." Was he scared? "No, I have so much confidence in the boat." *Foolish Muse* has a cross beam to stiffen the boat and a double spreader to improve her seaworthiness.

After trailing *Foolish Muse* to San Francisco, Evans had a brief time to sail and tune his boat before the start on June 24. The weather report for race day was unusual, showing no wind on the southerly route that leads to the trade winds that were favoured in past races. The great circle route was recommended as the best option, with the challenge being the transition between the coastal system of southeasters into the northeast trades.

The race started off at the Corinthian Yacht Club. "I crept across the line in about three knots of wind, but as soon as we got out into the bay the winds shot up to 20 knots then dropped to about seven knots after passing under the Golden Gate Bridge." On the third day of the race the weather systems changed and the lead boats were becalmed in the transition area between two systems. Evans opted to sail into the high pressure and was able to ghost southwards for two days to pick up the trades, a move that put him up with three leaders, all much larger boats, and left the rest of the fleet becalmed for another 24 hours.

After a week of tricky sailing in changeable weather, with little more than three hours sleep in 24, Evans was able to relax a bit as the trades swept him towards the finish. He increased his sleep to about six hours a day, but it did not ward off hallucinations, commonly experienced by most single-handers.

Top: Evans learns how to handle *Foolish Muse* in tough conditions by Brotchie Ledge.
Photo by Andrew Madding

Bottom: Evans repairing a tear in his genny a few days out off San Francisco.
Photo by Andrew Evans

"Once I came up on deck to see three guys on the foredeck and I had the impression I was sailing on a river in Germany!" Evans forced himself to analyze his situation and return to reality.

With only 250 miles to go, the boom broke and Evans had to drop the main. Fortunately, the wind was between 15 and 25 knots and he was able to maintain enough speed, sailing under genny alone, to retain his hold on second-place overall and finish over 13 hours, on corrected time, ahead of the second boat in his division.

And what's the future for this 45-year-old single-handed sailor? "I hope to enter the Global Ocean Challenge next year." Starting in Europe (host port yet to be identified), this single-handed race for 40- and 50-footers heads to Cape Town, South Africa; Tauranga, New Zealand; Ilhabela, Brazil; Charleston, US, and back to Europe. Evans's first hurdle is to find a sponsor: not an easy task for a Canadian sailor. ■

Ch. 5: Self Steering Systems

Shock Cord sailing –for every singlehander:

I put this first because it is vital for every singlehander, and if I left it until last most readers would just skim over it and not learn these techniques. This information is important because it is guaranteed that at some point the autopilot will fail or the windvane will break. Neither of these pitfalls is an excuse to stop sailing. I find it ridiculous that a significant voyage (such as a major Trans Atlantic race costing hundreds of thousands of dollars) would be halted because of autopilot failure or wind vane breakage. These techniques work perfectly well, are virtually idiot proof and only require five dollars worth of materials.

As a second consideration, many crewed boat racing rules insist that boats not use any type of autopilot or windvane. Hand steering a boat by the compass at three in the morning is extremely difficult, even on a fully crewed boat. The techniques described below would not contravene any racing rules because they work solely by making use of the wind on the sails and nothing more.

Although these techniques were developed many years ago for full keel boats, I have tested them and found that they work perfectly well on modern, fin-keel boats. My Olson 30 is considered to be especially twitchy. If the techniques work on my boat, they are likely to work most anywhere else.

I have placed a video of these techniques up on Youtube.com. Search for "Foolish Muse self steering" or go to:
http://tinyurl.com/4tfr2ah

Upwind steering: Beating into the wind is the easiest. Simply by lashing the tiller in place and making some minor adjustments to sail trim, the boat will continue on its course with only slight variation. It is amusing that in most races, the singlehander will be eating on upwind legs when the boat can steer itself, while crewed boats eat on downwind legs when the boat is flat.

I recommend against purchasing the store-bought tiller locking devices. They are certainly more expensive and they do not work nearly as well as my own tiller line that takes about 5 minutes to create.

Tiller Line System – for Beating
This quick "tiller line" method is appropriate for short term use when beating into the wind, but will fail in a significant wind shift or change in wind speed. The approach is taking a length of line about 3' shorter than the beam of the boat at tiller point. Add 1' of surgical tubing or shock cord to each end of the line. Surgical tubing is considered better than shock cord because it stretches more consistently as it is extended out. Then add some sort of hook or carabiner at each end. Attach this to the toe rail or a cleat on each side of the boat, about 1' back from the tip of the tiller. It should take a little tension to wrap the line one time around the tiller and more tension to wrap the cord

around the tiller twice.
To use this device, sail the boat by hand until it is beating perfectly into the wind. The sails should be trimmed perfectly with the telltales flying. Wrap the tiller line one time around the tip of the tiller. (Two times in higher winds or even three times in very high wind if necessary.) The tiller line should have enough grip to hold the tiller without slipping. Make sure that the tiller line is holding the tiller exactly in the same position as hand steering. This will take some adjustment because the stretch of the tubing will let the tiller drop. The beauty of using a stretchy tiller line is that

it allows for small adjustments by pulling on the line, without removing it from the tiller.

Let go of the tiller and watch. Most likely the boat will round up slowly. When hand steering, there is a normal tendency to have more weather helm than necessary, even if the skipper has read my previous advice about eliminating pressure on the helm. When the boat rounds up, ease the mainsheet slightly - just an inch at a time. It is the mainsail that is pulling the boat up. As the mainsheet is eased, at some point the tiller line will do its job and the boat will sail perfectly on its own.

This system works because the tiller, held slightly to windward, is trying to steer the boat down. Every time the boat sails down, the mainsail catches the wind and tries to pull the boat back up again. When the boat heads up the mainsail will luff and will stop pulling the boat upwards and the tiller will steer the boat down again. The boat will be sailing an elongated S shape through the water, sailing up and down again. With just a bit of adjustment this S shape will be eliminated and the boat will be sailing perfectly straight. A variation of 5° on either side of straight would be very well done. The singlehander should make tiny adjustments to jib and mainsail trim and tiller position until the perfect combination is achieved.

The important part of this technique is DO NOT tighten the main sheet when the sail luffs. It is normal when hand steering to tighten the main sheet when the mainsail luffs. This would be a very standard reaction. But when using the tiller line, if the skipper tightens the main sheet, he will be pulling the boat up past the point where the tiller line has control. He will be pulling the boat up past its normal beating position. The skipper must let the mainsail luff until the boat falls down again and the mainsail catches. It requires self control to allow the mainsail to luff, but it is important.

The tiller line system works best in consistent, moderate winds. When using the tiller line, as with hand steering, changes to the tiller position will be required with changes in wind strength. The tiller must be pulled to windward as winds increase and dropped to leeward as winds drop. Otherwise the boat will quickly sail off in the wrong direction. Such changes are easily done by slipping the tiller line's position over the tiller.

Long Line System – for Running

While the singlehander is hand steering downwind, it is even possible to gybe a spinnaker by running long lines from the tiller, to turning blocks on the toe rail on each side of the boat, up to the foredeck. In moderate winds, the skipper will be able to walk to the foredeck and gybe the chute. Any steering adjustments are made simply by grabbing the "long lines" on the foredeck. To do this the skipper must pay close attention to the boat direction as it can change very quickly. This means less concentration on the gybe actions. This will not work in high winds where the boat can round up in an instant.

Storm Jib System

The tiller line system described above only works when beating into the wind. On a reach the boat would just round up, so a more elaborate system is needed. The "storm jib" system will work from beating close hauled to a broad reach of around 120º true. It will work past this point but becomes less reliable. Additionally, the storm jib system is a long term solution. It can be used for hours or days on end in any conditions. Singlehander Tony Skidmore used this method as his sole means of self steering on a 17,000 mile voyage in a 24 foot sloop.

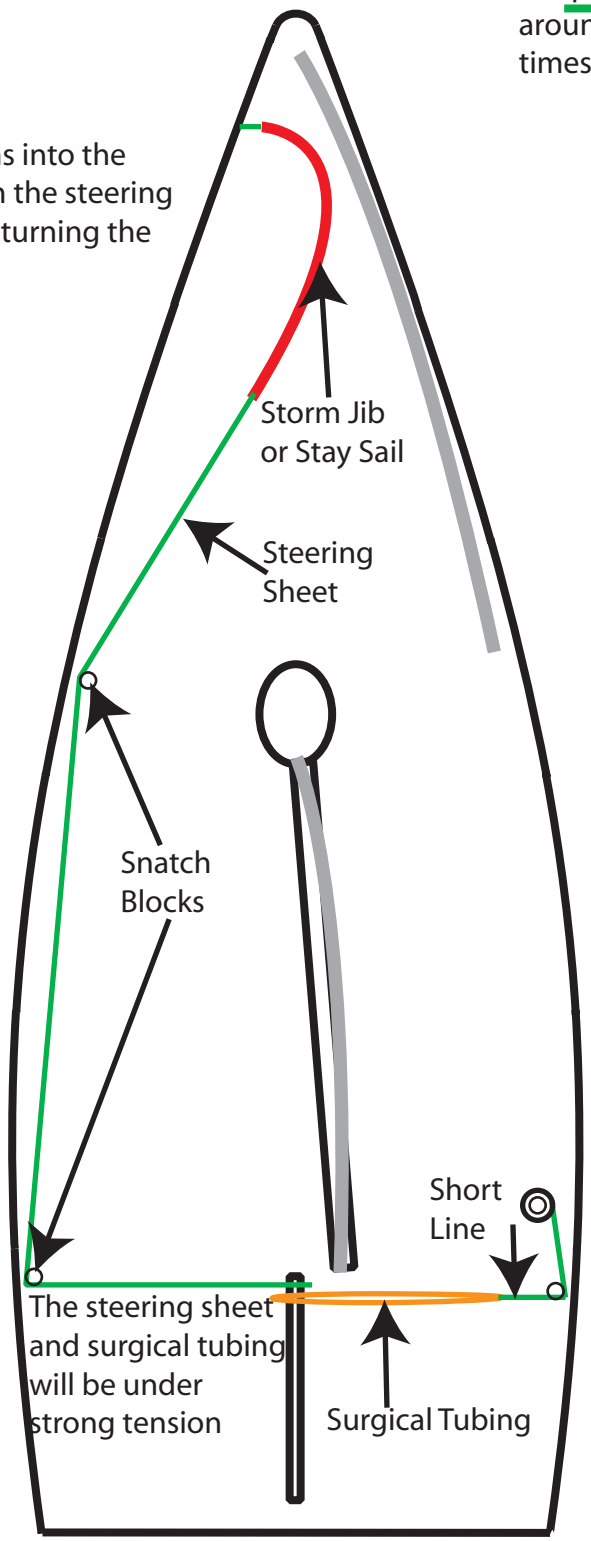
The storm jib system only requires a few feet of surgical tubing, a storm jib (or stay sail) and two snatch blocks. The normal jib/genoa and mainsail are used to drive the boat at speed.

Storm Jib System

Steering is achieved by changing the position of the jib and mainsails.

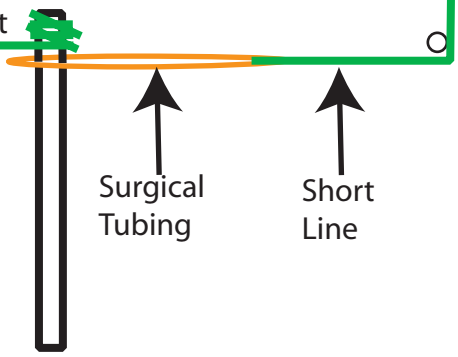
As the boat turns away from the wind, tension on the steering sheet decreases, turning the boat to windward

As the boat turns into the wind, tension on the steering sheet increases, turning the boat to leeward

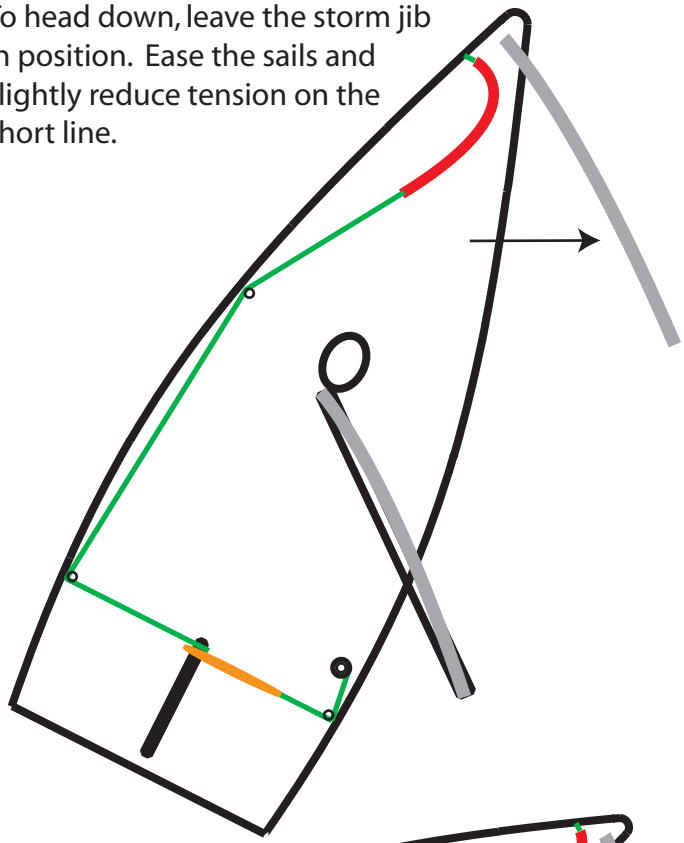


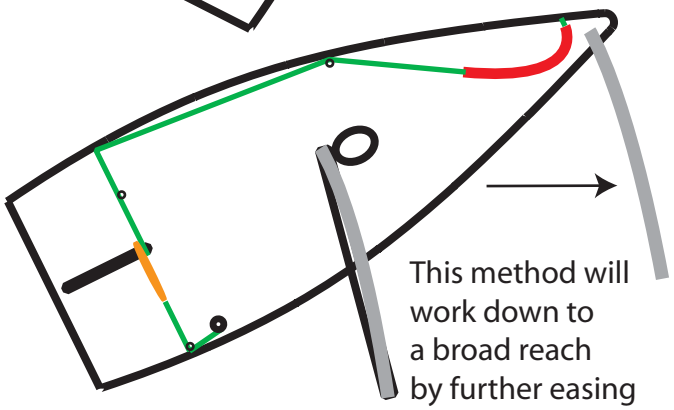
Use the winch to tension the short line and tubing

Wrap the storm jib sheet around the tiller a few times and over itself.



To head down, leave the storm jib in position. Ease the sails and slightly reduce tension on the short line.





This method will work down to a broad reach by further easing the sails

The following steps must all be completed for the system to work, but I have included them in this order only for clarity. It will take 5 minutes to set up the boat to use this method. During this setup time, use the simple "tiller line" steering method to beat into the wind. After setting up, lay-off to a beam reach for the best use of the "storm jib" system.

Tie 3' of surgical tubing into a loop and attach a short line. Run this line through a turning block on the leeward side of the boat even with the tip of the tiller and around the leeward winch. Slip the surgical tubing over the tip of the tiller. It should be tight enough that it pulls strongly on the tiller. The line on the winch is used to adjust the tension of the tubing.

Take a storm jib or stay sail and attach the tack to the toe rail or bow cleat on the windward side of the boat, just a foot or two back from the bow. Use a spinnaker halyard to raise the storm jib tight. Run a small line, such as a spinnaker sheet, from the clew of the storm jib to a block on the windward toe rail near the shrouds. Run the sheet back through another block on the windward toe rail even with the tip of the tiller. Pull tight on the sheet and wrap it around the tiller just in front of the surgical tubing. I find that wrapping the sheet over itself two or three times will hold it in place securely. The tension on the sheet on the windward side of the boat should offset the tension of the tubing on the leeward side.

The storm jib will be parallel with the boat centre. As the boat sails downwards, wind pressure on the storm jib is reduced and the surgical tubing pulls the tiller down, bringing the boat back up. As the boat sails up, wind pressure on the storm jib increases, and the sheet pulls the tiller up, sailing the boat back down again. Use the line from the tubing to the winch to adjust the tension of the tubing. Use the sheet and the forward block position to adjust the tension of the storm jib.

On the first attempt, pull on the tiller and ease the main sheet and jib sheet to drop to a beam reach. IMPORTANT: The storm jib is only used to keep the boat sailing in a straight line. It is the jib and mainsail that determine the direction of the boat. Thus the jib and main must be properly trimmed for a beam reach. The storm jib will not override the basic sail trim. On the first attempt, ease the jib sheet and main sheet well past the normal sailing position. Tighten them slowly until the boat starts to head up. Then ease them again. With small adjustments the boat can be steered with amazing accuracy.

To change course, under normal conditions it is not necessary to adjust the storm jib or the tubing. The boat direction will change simply by adjusting the sail trim in or out. Pull the sails nearly all the way in to head up to a close reach. Ease the sails out to lay-off to a broad reach. I have found this method works well down to 120º true. At 130º true the system will still work, but the boat will swing through wider variation.

The storm jib and tubing tension will require adjustment if there is a significant change in wind strength. Under high winds two loops of surgical tubing can be used to increase tension.

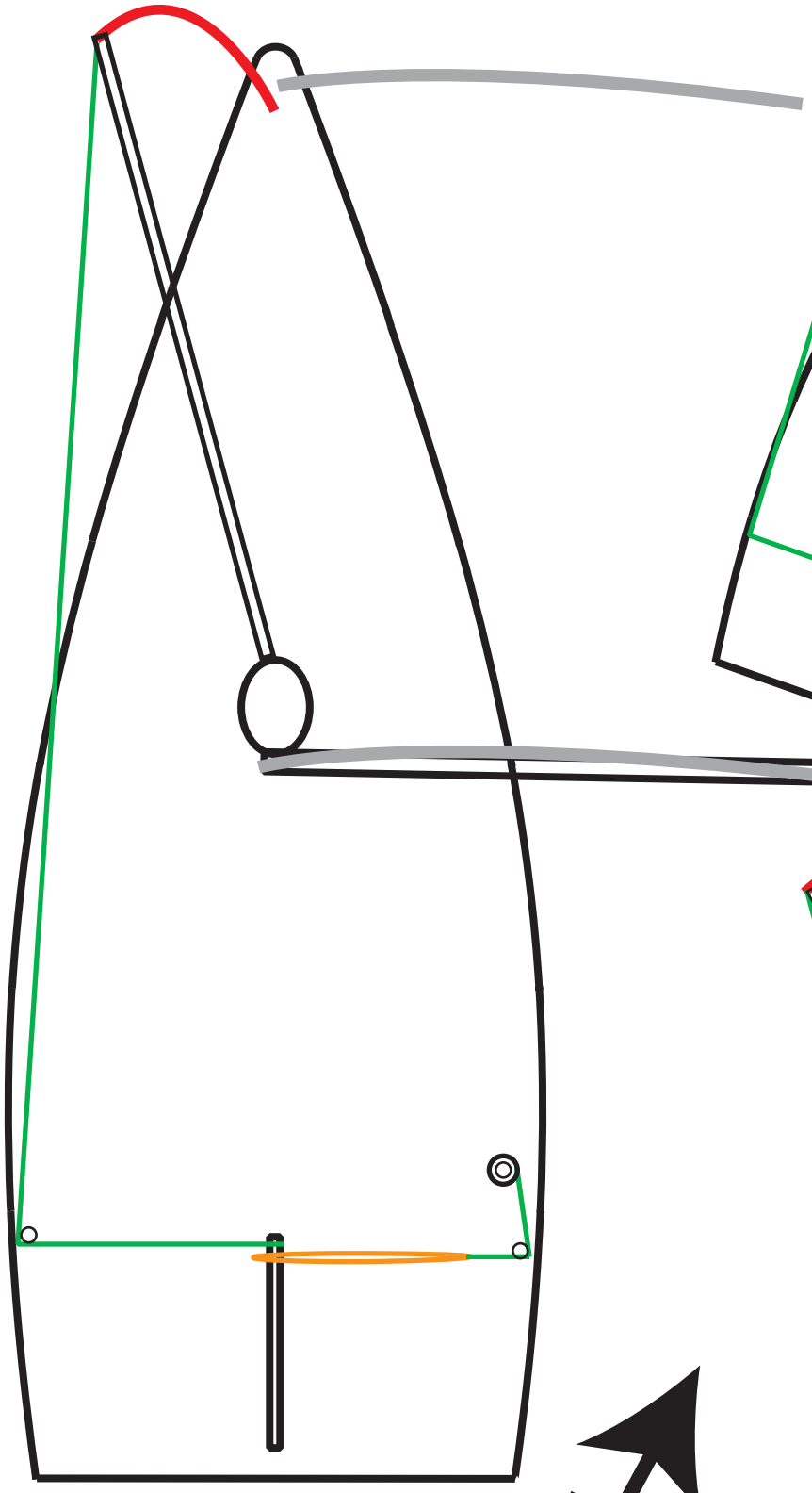
The storm jib method works amazingly well in all conditions and will hold a course better than most human drivers. It does not require any power and certainly does not have the noise of an autopilot. Even those boats with the most advanced electronic systems should consider using the storm jib method in open water.

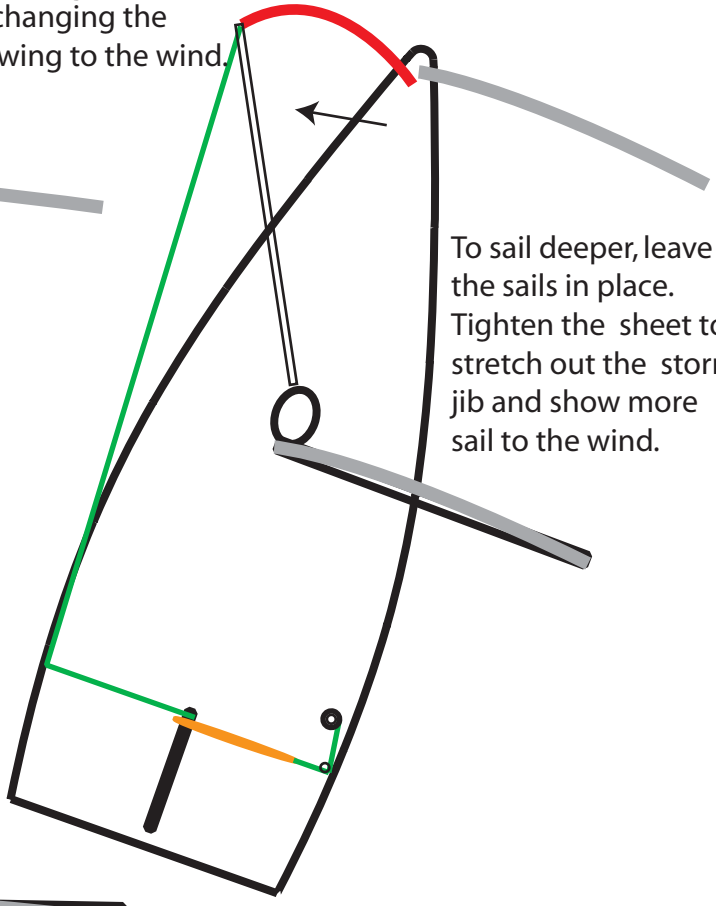
Downwind – Poled Out Jib System

The "storm jib" system will operate effectively down to a broad reach. After this point, we move to the "poled out jib" system. This will operate all the way down to a dead run at 180º but it is most effective at 145º.

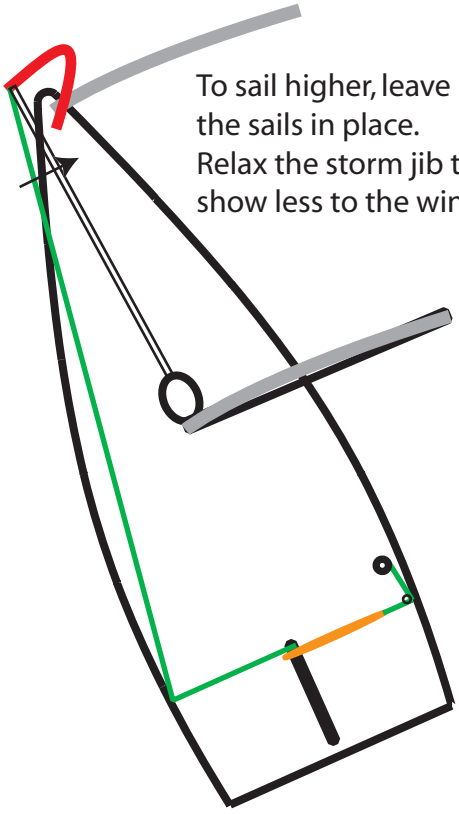
Poled Out Jib System

Steering is achieved by changing the amount of storm jib showing to the wind.





To sail deeper, leave the sails in place. Tighten the sheet to stretch out the storm jib and show more sail to the wind.



To sail higher, leave the sails in place. Relax the storm jib to show less to the wind.

This method will only work sailing downwind with a genoa, not with a spinnaker. A poled out jib (or poled out storm jib in high winds) is used the steer the boat.

Setup in the cockpit is the same as the previous system. The surgical tubing and tension line is setup exactly the same on the leeward side of the boat, although it may require more tension.

A jib is raised on the forestay along with the genoa. The genoa will be on the leeward side and the jib on the windward side of the boat. The skipper must interweave the sail hanks to ensure that both sails are raised to their full tension. It is probable that the jib is shorter than the genoa so two halyards will be needed to raise both sails simultaneously.
The spinnaker pole or whisker pole is used to pole the jib out very far forward on the windward side of the boat. The pole will only be a foot or two back from the forestay and the jib will fly well in front of the boat.

A sheet is run from the clew of the jib back to a snatch block (or spinnaker sheet block) on the toe rail on the windward side, even with the tip of the tiller. The sheet is wrapped around the tip of the tiller, in front of the tubing. Even in moderate winds, the sheet will be under significant tension. It will require strength to wrap it around the tiller and the surgical tubing must have sufficient tension to hold the tiller in the centre of the boat. Under high winds two loops of surgical tubing can be used to increase tension.

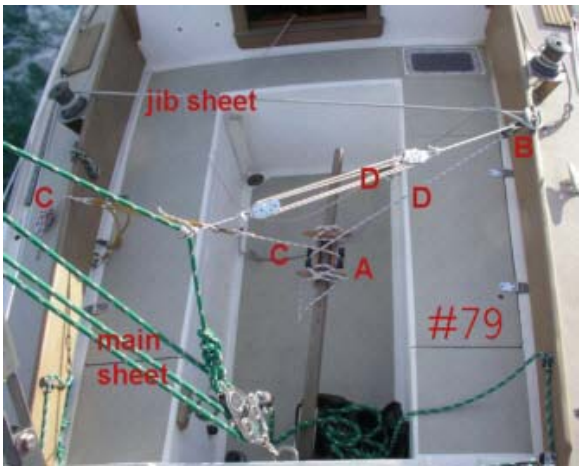
In use, as the boat heads up the poled out jib catches more wind, pulling the tiller to windward and heading the boat down. As the boat drops down, the poled out jib sheds wind, allowing the tubing to pull the tiller down and head the boat up again.

Of course the sails must be properly trimmed for the desired heading. However, with this system the poled out jib is used to adjust the boat heading. If the pole is pulled back about 3' from the forestay, the boat will drop down to sail between 170º and 180º. In this case the genoa will be completely blanketed by the mainsail so the boat could be sailed with no genoa at all. As the boat nears 180º, the poled out jib will collapse allowing the boat to head up.

If the pole is eased to about 1' from the forestay, the boat will head up to sail between 135º and 145º. In this case the genoa will fill and the boat will sail at optimum speed.
The entire range of control of the poled out jib is very small, about three feet in total. Very small adjustments to the jib sheet will change the heading.

In light to moderate winds it is best to use a poled out jib. In strong winds a poled out storm jib should be used. I have found it is unwise to use a storm jib in light or moderate winds. The reason is that the storm jib must be stretched out completely to have the desired effect on steering. Having it completely stretched out will allow it to continue to have pull even if the boat is at 180º, risking an accidental gybe.

Sheet to Tiller systems: Other methods of self steering have been developed using either the jib or the main as the force for the steering power, rather than a storm jib as described above, with the same surgical tubing on the opposite side. These systems require a few more blocks and lines, but not a storm jib. In one such system, a line is connected to the mainsheet midway between the traveler and the boom, run out to a block on the toe rail and back to the tiller, with surgical tubing to provide opposing force. An excellent description with photographs is provided on "Augustine – A Pearson Ariel Page" located at http://solopublications.com/sailariq.htm



The benefit of this system is that the skipper need not shift a storm jib from side to side with each tack. The disadvantage of the systems is that the large sails are very powerful and must be carefully balanced.

For greatest efficiency, any self steering system should not require either the jib or main to luff in order for the boat to fall back into the wind. Obviously allowing a sail to luff slows the boat down considerably. The benefit of the storm jib systems is that the storm jib, used only for steering, luffs. This does not slow the boat.

Autopilot or Wind Vane (Note that I use the generic term "autopilot" because the often used term "autohelm" is a trademark of Raymarine)

This is a longstanding debate among singlehanders. But in reality, the choice has already been made; it is just up to the skipper to determine what type of sailing he will do and what type of boat he will do it on. Then the choice becomes obvious.

Personally, I have a preference for an electronic autopilot system, for several reasons:

Although I dream of long ocean passages, in reality 51 weeks a year my sailing is made up of 3-5 hour trips within 20 miles of my home club. This leads to maneuvering in relatively tight waters, i.e. leaving the harbor and raising the sail under motor power, tacking out of the bay and up the strait, returning home and gybing down the strait with all of the maneuvers reversed, dropping the sails and returning to my slip. Each of these steps requires precise boat control and steering. I estimate that on a typical fun sail, I would adjust the autopilot 30-40 times, even more during a race. An autopilot is ideal for this type of day-to-day sailing. It activates immediately, adjusts with the push of a button and provides rapid response. A windvane can not offer this level of flexibility.

However, for long passages, the windvane can easily become the preferred solution. For example, once into open water on a large lake or wide strait, it may be three hours between tacks. On the open ocean it may actually be several days between course changes. In these cases the immediate flexibility of the autopilot is overwhelmed by the mechanical simplicity and directional reliability of the windvane. Losing a minute or two during a tack is unimportant if only done a few times each day. If heading in one particular wind direction for several hours at a time, a windvane can hold that direction very accurately without limit, with no power draw or noise. An autopilot has a constant power draw and the unremitting hum becomes extremely annoying. The singlehander will learn to despise the sound of his autopilot below decks. After several days it can lead to insanity.

The decision process is also influenced by the type of boat being sailed. I sail on an "ultralight" that will surf very easily with the wind. In these situations the boat takes off down a wave at nearly the same speed as the wind. To operate, a windvane must have a reasonable apparent wind passing over the boat. If my boat starts to surf, there is virtually no apparent wind and the windvane will lose

its grip. This is the reason why modern, ocean going racing boats always use an electronic autopilot. They all surf and a windvane simply will not work.

On the other hand, a heavy cruising boat will rarely pick up and surf down a wave. It will always have apparent wind, regardless of the point of sail. A windvane will be effective all the time.

As a further consideration, autopilots are rated depending on the weight of the boat. If conditions are very rough and winds are very strong, an autopilot will be overtaxed in steering a heavy boat. A windvane is set up for the size of the boat and simply does not consider displacement as a factor.

Thus the choice between autopilot and windvane is already made for the singlehander. It depends solely on the type of boat and the type of sailing to be done. If the majority of sailing is active maneuvering within a few hours of the home port, an autopilot is by far the better choice. If planning a long ocean voyage, the autopilot is preferable only for light racing boats. The windvane is the choice for cruising yachts. Most long distance sailors do not make a choice –they take both a wind vane and autopilot. The autopilot is used when motoring and in light down wind or beam reach conditions. It is also useful during sail changes, tacking or gybing. Otherwise, the wind vane silently does all the work.

Tony Gooch is one of my great heroes. In 2002, Tony left the Royal Victoria Yacht Club on a solo, non-stop circumnavigation. During his trip he did an in-depth comparison between windvane and autopilot. Below is an article written by Tony and published in Cruising World Magazine in January 2004.

Albert Takes on Otto

Offshore Sailing by Tony Gooch.

In 1995, my wife, Coryn, and I sold the Arpège 29 we'd sailed for 16 years, during which time we'd crossed the Atlantic and Pacific oceans. In her place, we bought a 42-foot German-built aluminum sloop, named her Taonui, and proceeded to log more thousands of miles. Then in September 2002, I set off on my attempt to sail solo, non-stop around the world, starting and finishing in British Columbia. On that voyage, which I intended to complete as quickly as I prudently could, I planned to make extensive use of an autopilot.

Based on my experience two years earlier on a solo voyage from Cape Town, South Africa, to England via Cape Horn, I felt that a good, powerful autopilot would do a better job than a windvane, particularly when running before the westerlies in the Southern Ocean. With this in mind, I upgraded Taonui's Simrad autopilot drive unit to the manufacturer's HDL2000L model. To drive it, I installed the latest Simrad. AP22 and J300X control units, and I also added the necessary electronics to enable the AP22 to steer a course relative to a chosen apparent-wind direction.

When we bought Taonui, she had a Monitor windvane that had already seen 30,000 sea miles. Taonui has a long keel, a keel-hung rudder, and tiller steering, and this windvane, which we affectionately called Albert, did a fine job of keeping a steady course in all manner of seas and winds. I

have a great regard for Albert, but without wanting to seem disloyal after many thousands of miles, I felt that the upgraded Simrad autopilot, nicknamed Otto, achieved longer daily runs.

The force of wave action on the hull and changes in the apparent wind will cause a windvane to steer a course that weaves from side-to-side. In theory, because it's set to follow a chosen compass heading, an autopilot steers a dead-straight course. I even installed a new RFC 35 fluxgate compass that would give the control unit more accurate information. In fact, of course, the actual track steered by the autopilot also weaves from side-to-side. A soft key on the new Simrad control unit allows you to view the actual course (as distinct from the chosen course), and I was surprised at the amount of yawing it displayed. In the early days of singlehanded ocean racing, the boats were steered by windvanes, but as the yachts became longer and faster and able to accelerate more quickly, the changes in the apparent wind became too rapid for a windvane to handle. Today, these racing machines regularly hit sustained speeds of 20 to 30 knots and need sophisticated electric/hydraulic autopilots acting directly on their rudderstocks.

Taonui is 42 feet long and displaces about 15 tons, fully-loaded with her full bilges and deep, long keel, she's a very comfortable offshore cruiser, and Albert can certainly handle any speeds she's likely to achieve, even "surfing" downwind in a Southern Ocean gale. Albert follows the apparent wind. If I set the sails for maximum speed for the wind that's blowing, Albert will keep Taonui sailing at her fastest speed for that wind. The wind rarely blows steadily from exactly the same direction; it always oscillates five to 10 degrees, and of course, it's subject to actual shifts in direction. None of which troubles Albert. Otto follows a chosen compass heading. He doesn't know about wind shifts, and when they do occur, the boat will be sailing at less than its maximum speed. I felt that when wind oscillations are small, these probably wouldn't have a big effect, but a 10-degree wind shift would certainly result in a loss of speed, which, if I were asleep, would go unnoticed until the change in the boat's motion woke me.

Under the influence of the wind and waves, both Albert and Otto deviate from side to side of the desired or, in Otto's case, the selected course. Albert's deviations are wider, but he delivers a higher speed. The objective when passage making is to maximize the number of miles made good toward a selected point.

So which system is better?

The Contest

On a six-month nonstop circumnavigation, I had plenty of time and opportunity to compare the performances of the two steering systems. I ran tests in which I would set Taonui on a steady course relative to the wind, with first the windvane (Albert) steering for an hour, then with

Otto the autopilot at the helm for an hour.

If the wind strength or direction changed, I abandoned the test and started again. I wanted to see which steering system yielded the most miles made good in an hour in as near as possible the same wind and sea conditions. If the wind was between 38 and 85 degrees apparent, I set the autopilot to steer a course relative to the apparent wind. The autopilot can't steer off the readout of the apparent wind if it's aft of the beam, so with the apparent wind between 90 and 180 degrees, I had the autopilot steer a compass course. I tracked Taonui's performance by GPS, and to get a readout of miles made good to two decimal places, I set a course to a waypoint that was less than 100 miles away. Before I started the clock running, I would trim the sails for maximum speed, then not touch them for the two hours of the test.

Observations

Although the autopilot steers a straighter course, in most of the tests, the windvane yielded more miles made good. The windvane reads the small oscillations in the apparent wind and adjusts the course to keep the sails driving at maximum efficiency. With the wind aft of the beam, the autopilot tries to steer a compass course, and the changes in the apparent wind result in the sails performing at less than maximum efficiency. The differences are small, but over a long passage, they do add up: If my average speed for the circumnavigation had been 5-percent slower, I would have taken 186 days instead of the actual 177 days.

With the wind forward of the beam and the autopilot steering to a set apparent-wind angle, there wasn't much to choose between the autopilot and the windvane, though it was clear that the windvane yielded more miles made good at the smaller apparent-wind angles. If the wind was between 85 and 95 degrees apparent, it was better to set the autopilot on a fixed compass course, and with this, the autopilot yielded more miles made good than the windvane.

I also ran a number of tests, which aren't recorded here, in which I sailed on a close reach and close-hauled with Otto steering a compass course. The autopilot's inability to "read" the wind reduced the speed and miles made good, when compared to those achieved by the windvane, by about a third. The reason for this is that a windvane acts like a helmsman and keeps the sails performing at maximum efficiency by following the wind as it oscillates and/or as the boat rides up and over the waves. The autopilot tries to force a fixed course, and the sails are inevitably luffing or over trimmed relative to the changing wind.

Bottom Line

Boats up to about 30 feet can be steered by an autopilot that connects directly to the tiller, and some models of light-performance autopilots can be connected to the hub of a steering wheel. These units are adequate for motoring, but they’re not strong enough for

extensive use offshore. Ocean-going boats longer than 30 or 32 feet will typically have an electric or hydraulic linear-drive ram connected to the rudderstock below decks. This requires fitting a strong mounting base, running electrical cables, and mounting control units cost of Taonui's upgraded Simrad system was $4,300, not including taxes. Installation cost only $450 because the mounting place was built when the boat was constructed and we could use much of the old wiring. To fabricate and install a mounting base, run wiring, and fit the autopilot components would take 25 to 30 man-hours and cost roughly $1,500 to $2,000, for a total cost of around $6,000. By contrast, a new Monitor windvane costs $3,500 to $3,800, depending on whether the boat has wheel or tiller steering, you can fit it on the stern of almost any sailboat, and it's a do-it-yourself installation. An autopilot draws a current of 3 to 5 amps, which on most boats is generated by the engine-driven alternator. Most windvanes are reasonably bulletproof in construction, but if something does fail, they're relatively easy to repair. The sacrificial tube between the pendulum strut and the water vane is designed to break in the event of a collision or excessive load. It's easy to replace.
I had only one such breakage on this trip. During 110,000 miles of sailing, Albert's only other breakages were; a worn out bushing, a compression fitting on the actuator shaft, which as an easy fix on a drill press and the loss of the water vane. Before my first circumnavigation, I replaced the pendulum and every three or four years I've replaced the turning blocks for the control lines. In contrast, a couple of years ago, a hydraulic seal broke on my old Simrad, and I had to return it to the factory for repair. Since then, I've carried a spare drive unit (costing $2,150). An autopilot's electronic control units are usually trouble free, but if they do fail, they're black boxes. Aesthetically, a windvane is more pleasing. It makes no noise, requires no feeding, and works in harmony with the wind and the waves. An autopilot makes a noise, requires the running of an engine or generator to supply its energy, and uses force to overcome the pressure of the wind and the waves. Based on the tests I ran, a windvane delivers more miles made good. On a long passage, this is what it's all about.

Having said all this, I would always carry both an autopilot and a windvane, if for no other reason than an autopilot is needed when motoring. For shorthanded sailing, it's essential to have two independent self-steering systems in case one fails. But, if I could have only one, I'd choose a windvane for offshore passage making.

Using a wind vane

A wind vane is really only useful in ocean sailing where you expect to be on the same point of sail for hours or days. A wind vane should be thought of as a device to hold a course relative to the wind, rather than as means of steering the boat or of changing course, so it is not used for tacking or gybing. Before the wind vane is engaged the boat

should be set on the desired course relative to the wind and the sails should be set so the boat is balanced and will steer itself with only a little pressure on the tiller. The most common mistake in using a wind vane is carrying too much mainsail which causes the boat to round up into the wind.

Section 4 of the Manual for the Monitor Self-steering System sets out the best practices for using a wind vane on various points of sail. This excellent manual can be downloaded at http://www.selfsteer.com/pdfs/MonitorManual.pdf

A wind vane works best and will out perform an autopilot when sailing with the wind forward of the mast in any wind strength. On a beam reach an autopilot will outperform a wind vane especially in light winds. In heavy winds 20 + knots, a wind vane will outperform an autopilot on a beam reach. In light winds aft of the mast an autopilot yields higher speed and distance made good. As the wind strengthens above 12 knots true the wind vane is superior. Of course, if the wind shifts the wind vane follows the wind and speed is maintained. Under autopilot the boat stays on a constant compass course (unless driven by a wind direction sensor) and the boat speed drops.

Using a windvane small (say 5 degree) course changes can be made by changing the angle of the vane and the set of the sails. For greater course changes it is best to disengage the vane from the tiller, steer the boat onto the new course, adjust the sails as needed, make sure that the boat is balanced and that there is little pressure needed on the tiller to maintain course, then set the angle of the windvane so that it vertical and then re-connect the lines from the windvane to the tiller. After this watch the boat's performance and make small adjustments as needed. To emphasize an earlier comment, a windvane can't be used to steer the boat, i.e. change course. It is a device to maintain a chosen course relative to the wind.

Autopilots:
There are several well known manufacturers of autopilot systems. Some are more prevalent in Europe and some in North America and they range in price. I will not attempt to compare the systems. However I will make these general statements which should be held as gospel truth.

First, every system will break. There is no question about this. So, just as important as the initial purchase is the location of repair service. I am especially lucky that the Raymarine service centre is exactly half way between my home and my office – and I walk to work! A singlehander will not be interested in waiting three or four weeks for service when his autopilot breaks during racing season. A two day turnaround is invaluable. Before a purchase is made, carefully search through the manufacturers' web site to find a local service centre. A quick phone call will confirm whether service is actually performed on site or if they are going to ship it off to the other side of the world. I also know from experience that it is a good idea to develop a personal relationship with the repair technician. It is nice if he knows you well enough to hand over a completely new unit rather than wait while he is busy working on commercial systems costing many times the price of a small boat autopilot.

Second, every system will communicate with common instruments from other manufacturers via a common protocol such as NMEA. While this is true, it is significantly less than optimal. This will be noticed when the autopilot does not react as quickly as expected with a wind shift or when a cross wave swings the boat around. Each manufacturer has developed their own communications protocol and each system works best within itself. I recommend

against mixing instruments from different manufacturers.

Third, every system proudly advertises its "hard over time", i.e. the time it takes for the ram to move from inner to outer limit. This is a useless criteria. I don't care how fast the ram will move. Other than while tacking, an autopilot will never need to move more than a few inches during even the worst wave conditions. Infinitely more important is that it move intelligently. There is nothing more frustrating than watching the tiller stuck in the wrong position, and waiting for the autopilot to figure out what to do. Before making a purchase, current users should be questioned about how an autopilot reacts during a broaching situation, how long it takes to settle on a new tack, how it sets a course when activated, etc.

Fourth, no system will work perfectly right out of the box. It can take many hours of testing and adjustment to refine the reactions of the autopilot to the boat and water conditions. All systems have a level of intelligence that "learns" the conditions, but significant changes must be dialed in by the skipper before the learning can occur.

Fifth: Other electronics can impact the auto pilot or vice versa. It is well known that a Single Side Band radio uses a tremendous amount of power when transmitting. Even VHF radios use significant power. It is important that any radio wires be kept well away from auto pilot wires. They should be run on opposite sides of the boat as much as possible. This interference can run in both directions; with the auto pilot disturbing the radio, or the radio disturbing the auto pilot. I have even seen instances where the auto pilot only interfered with the radio on one frequency band.

Sixth, sail-trim, sail-trim, sail-trim. Nothing is more important. No autopilot can override poor sail trim. Even a small adjustment to trim will have a significant impact on pilot operation, especially with the spinnaker where things can go bad very quickly.

Tacking and Gybing using an autopilot:

Personally, I find that tacking with the autopilot is much slower and less accurate than tacking manually, using my knees to control the tiller while I sheet in. As well, I pause half way through a tack to pull the jib sheet back (as described in the chapter on Sailing Techniques). And even further I find that the autopilot does not settle on the new tack as quickly as I would like. During a tack the autopilot swings the boat over 90º. I find that it can not do this as accurately as I would like. For these reasons, I do not use the autopilot to tack. I can do it much better myself. However, I know several singlehanders who do use their autopilots to tack very successfully. It is up to each skipper to make his own decision on this.

I do use the autopilot to gybe. In this case the boat swing is only 30º or 40º and the pilot has no trouble handling this correction. (The gybing process is described in the chapter on Sailing Techniques.)

Remote Control:

A remote control is invaluable on long voyages. It enables the skipper to move about the boat to enjoy the sunshine at the bow, or to sleep below while retaining control of the autopilot. A particular annoyance is sleeping during shifty winds. The wind shift alarm will sound every time the wind changes by 15º. A remote transmitter will allow the skipper to react just by lifting his arm, not getting out of the bunk.

The remote transmitter also has a safety aspect. Most autopilot systems will turn the boat into the wind or through the wind if the

skipper falls overboard while wearing the remote. Of course it would be incredibly stupid to rely on this instead of wearing a harness. In a heavy sea, a boat that heaves-too 30 metres away might as well be 30 miles away.

But, remotes also have significant drawbacks and must be researched. There are two problems that commonly arise. First, is the radio range longer than the boat, or will a walk to the bow trigger the man-overboard safety protocols? Second, will weak batteries, or turning the remote off to replace batteries, also trigger the man-overboard protocols? The wireless receiver for the remote must be mounted near the centre of the boat and away from significant metal objects like an engine. Third, remotes don't like to be immersed in water. If one does get drenched and becomes inoperable it may be possible to take it apart, rinse it in fresh water and dry it with the heat of the engine. This method worked when the remote on Rain Drop sat submerged in a cockpit full of water for two minutes.

There are many debates about who makes the "best" autopilot. Based on my observations, there is no clear cut winner. I have seen bitter complaints made about every system. Without making any judgments, here are the major manufacturers of autopilots:

- Raymarine, Based in the U.S. and popular in North America (raymarine.com)
- Navico, The world's largest marine electronics company, which owns B&G and Simrad. (navico.com)
    - B&G, Based in the U.K. and popular in Europe. (bandg.com)
    - Simrad, (Simrad-yachting.com)
- NKE, Based in France and very popular in Europe. (nke-marine-electronics.com)
- Garmin, based in the U.S. Relatively new to the auto pilot market. (Garmin.com)
- Coursemaster, Based in Australia (coursemaster.com)

Wind Vanes:

Wind vane steering systems are also manufactured by several companies. In making a purchase the key issue is that they unit be built to manage the size and weight of the boat. Wind vanes will obviously not face the electronic failures of autopilots, but they are still subject to breakage. Luckily, most units are built so that key breakable parts are simple to replace while underway. Experience has shown which parts are most likely to break and singlehanders are advised to carry several spares.

With wind vanes, one only hears of catastrophic failures under the most severe conditions where the boat has rolled or another component, such as the boom, mast or a large solar panel, has dropped on the wind vane.

Note that the components of a wind vane can also form the basis of an emergency rudder system. Most races will accept a wind vane to meet emergency rudder requirements.

Scanmar has an off the shelf attachment for their Monitor wind vane. The "M•RUD" essentially attaches a small, spare rudder to the regular wind vane mounting tubes that are already installed on the boat. Robin Davie used this system to sail some 2,300 miles in the Around Alone. It can be used to steer by hand, with the wind vane itself or with an auto pilot. The emergency rudder is smaller than would be required to steer the boat aggressively so it might be necessary to reduce sail, but it will get the skipper back to port. It

is important to install and test the emergency rudder system before leaving on a voyage.

The Scanmar website www.selfsteer.com discussed the three keys to successful wind vane steering:

The Boat

As different as sail boats are in appearance, rigging, size, speed, performance, etc., it is obvious that the properties of the yacht will influence the performance of the vane gear. Any characteristic that contributes to balance and makes it easy to trim the boat to stay on course helps the performance of the vane gear. Any characteristic that makes it easy to steer the boat back on course after a deviation is positive. Thus moderate size (30'-55'), moderate displacement, moderate keel, reasonable rudder response and an easily balanced sail plan are some important contributing factors.

The Operator

Top windvane performance requires a balanced boat. Although true for autopilots also, vane gears are especially affected by gross errors in choice and trim of sails. An inexperienced skipper can smother the performance of the best vane gear.

Balancing the boat for self-steering involves setting things up so that the boat has a tendency to stay on the desired point of sail. If a wave or a change in the strength of wind takes the boat off course the balance trim should produce a tendency for the boat to return to course by itself. Through years of experience we have found that the common mistake by first time vane sailors is to over-canvas and over-sheet. The sailors that get the fastest and best results are those that have spent some time trying to balance their boat for self-steering without a vane gear prior to getting one.

Although a good vane gear can be quite forgiving the best performance will be achieved when the vane is only asked to make small corrections to keep a well balanced boat on track. Usually, the new vane sailor will find that a bit of experience leads to great improvements. The vane actually teaches you a lot about sailing and trimming your boat.

The Points of Sail

The particular point of sail is of importance to the performance of a vane gear. Most boats can be trimmed to self-steer by themselves when going hard to weather. Consequently, most vane gears will work well when beating. Running or reaching are trickier. When the boat is moving downwind its own speed forward causes a loss of apparent wind, which weakens the signals from the air vane sensor. In light winds they can become outright erratic as the air vane gets affected more by the boat's rolling, than by the wind.

A reach can be difficult if the wind varies a lot in strength. A hard puff can induce a lot of weather helm. A temporary lull can cause a lot of lee helm. In either case it may require quite a bit of rudder to keep

the boat from rounding up or bearing off.

As stated, some boats are easier to balance to overcome these problems. The operator can do a lot to minimize them also. The myth that vane gears do not steer downwind is simply not true provided they are reasonably designed, engineered and operated.

Without making any judgments, here are some manufacturers of wind vane systems:

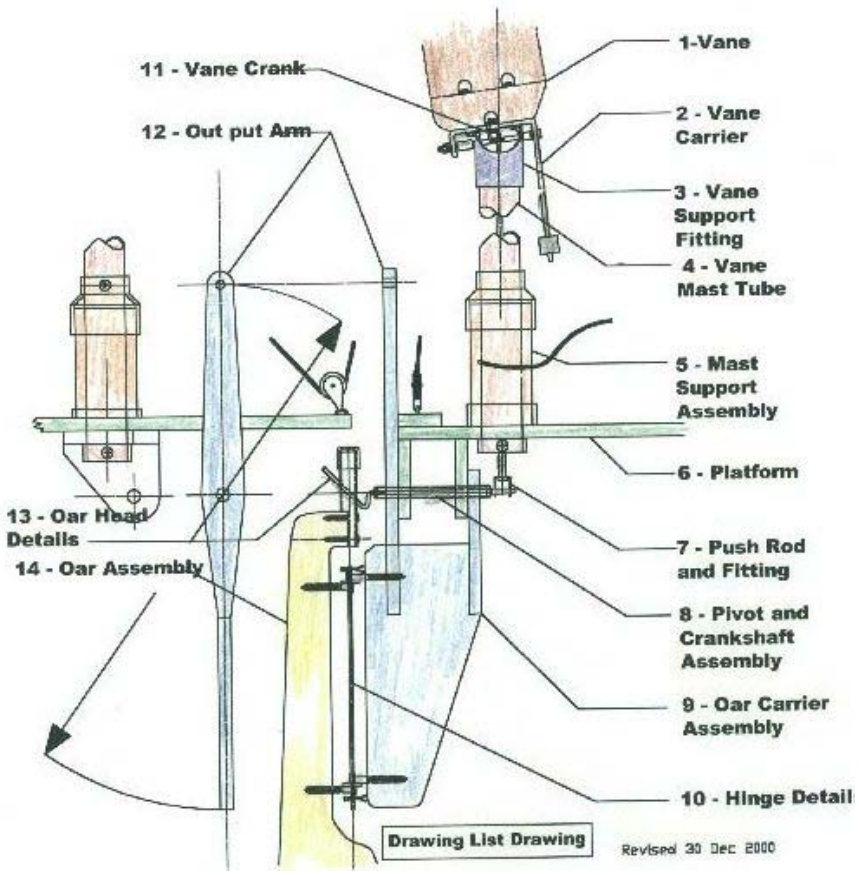
- Monitor, made in the U.S. by Scanmar. Perhaps the best known system worldwide (selfsteer.com)
- Voyager, based in Canada. (voyagerwindvanes.com)
- Aries, based in Denmark. (selfsteer.dk)
- Hyrdovane, based in Canada. (hydrovane.com)

This is obviously a common approach. An online forum is also available for any discussions concerning wind vanes: http://www.cruisenews.net.

Homemade wind vane:

An entire group has sprung up to develop and build wind vanes at home. The site's founder Walt Murray passed away in 2006, but the site can be down-loaded as a zip file from: http://tinyurl.com/4mvxpg6 Numerous designs are presented with highly detailed plans and precise building descriptions. Most of these could be built by any handyman with a decent workshop.

Looking around my yacht club, I can see several boats fitted with homemade wind vanes.



Chapter 6: Leaving the dock and returning

Leaving the dock singlehanded is one of the trickier maneuvers because of tight quarters with other boats, low motoring speeds that limit turning ability, and wind that wants to push the boat in the wrong direction.

As a first step, the skipper should determine the prevailing wind direction at the dock and trade with someone else to get the best possible slip for a singlehander. There is a considerable length of time between when letting go of the final dock line and when the boat starts moving that it will be at the mercy of the wind. If the wind is strong, he does not want to be pushed into another boat that is docked just a few feet away. It is best if the prevailing winds will push the boat into the dock. The skipper can set up fenders to eliminate damage. But he can't protect a neighbour's boat if pushed into it. For those rare instances when the wind is coming from another direction, and if the wind is so strong that there is not sufficient time to motor out of the slip, he should just ask another boater to hold the bow until underway. We need not worry about asking; boaters will offer their help many more times than we will ever need it. This is probably the most social time of being a singlehander.

Once the boat is moving, a singlehander will not have any help in fending off other boats, so this must be done right. When leaving the dock a boat will be moving at very low speed for the first 15 seconds, so the skipper needs to figure out how well the boat maneuvers at low speed. With an outboard motor, the boat can probably make a very sharp turn if backing out, but not moving forwards. With an inboard motor the opposite might be true. The whole concept of prop walk must be considered. The difference is determined by the way the water rushes past the rudder. A singlehander wants to tie up the boat (bow in or stern in) so that the greatest low speed maneuverability is for when he are pulling out, because this will be the lowest speed. There will generally be higher speed when is pulling back into the slip, because there is more room between rows of boats than between individual boats in slips.

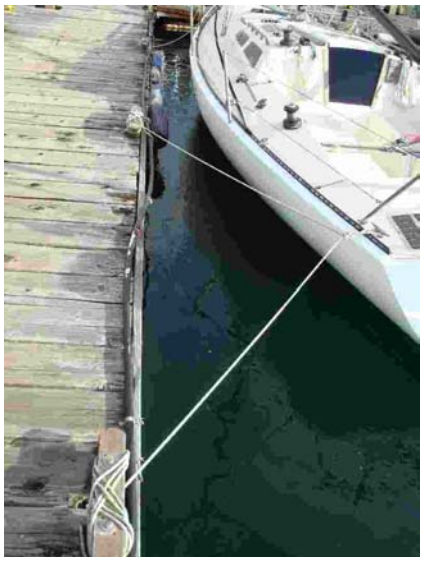
Like most sailors, a singlehander returns to the same slip on the same dock every day. Perhaps only a few times a year does he use a different dock. So it makes sense to set up the slip perfectly for his boat. He will be using that slip at least 95% of the time, so he can take the time to make it really perfect.

Most sailors hang fenders on the side of the boat, take those fenders in every time they leave the dock and set them out again as they return. It makes more sense to hang the fenders permanently on the dock. The skipper should determine the best placement for the fenders, making sure to think of the worst possible wind conditions. Set up the fenders so that the boat is protected from the worst. This way, he can have absolute confidence and he will have less trouble sleeping. Also make sure to think about how he will be coming into the slip under the worst possible conditions. If the wind is blowing, will he be forced to slam into the slip faster than he would prefer? If he thinks about this in advance, it is very easy to position the fenders for greatest protection. He only needs fenders on the dock side. If he follows the steps properly, he should not need fenders on the other side, to protect against other boats.

Again, most sailors keep their docking lines on the boat, pull them off the dock when they leave and run them back to the dock when they return. It is better to tie the lines permanently to the dock and drop them off the boat as he departs. The key reason for this is that the skipper can have them fitted exactly to hold the boat in the best position. He will never need to make adjustment to the length of the line and will know that they are perfectly set.

As well, he doesn't need to worry about spring lines. He just needs one line, set in a V, for the

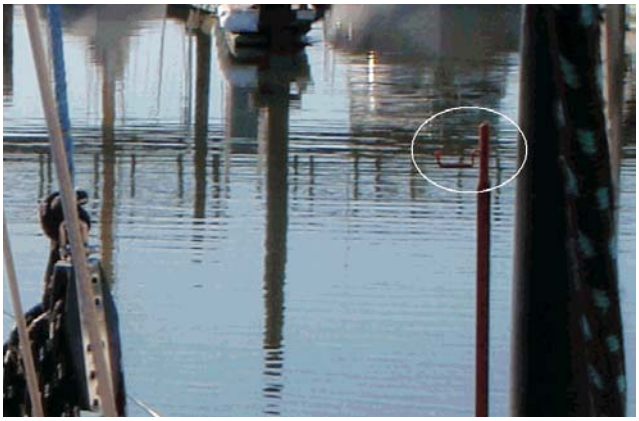
bow and another for the stern. The top of the V is tied to two points on the dock, about ten feet apart. The point of the V is a loop, just big enough to slip over the cleat on the boat. A loop about 6" across is probably the right size. When setting up the V lines, make sure they hold the boat in the correct position, where it won't bash the dock in front and won't hit the neighbour's boat. Adjust the length of the stern V line so that it will stop the boat before it hits the dock. The skipper will be grabbing the stern V line as he returns to dock. Next, set the length of the bow V line such that if the wind is pushing the boat forward or backward, the tension on both V lines is the same. We don't want one V line holding the boat. I know for a fact that this method will hold a boat very securely in all conditions. Our docks have seen 40 knots of wind and my boat has not slipped its lines.



As the skipper leaves the dock, he should remove the loop from the bow cleat and toss the line neatly on the dock. Then walk back to the stern cleat and remove the loop, pulling strongly on the stern V line to start moving. Then he should toss the line on the dock and put the boat in gear. This is the easiest way to get the boat moving up to maneuverable speed.

When returning to the dock, the skipper should use a boathook to snag the stern line off the dock as he passes by, and slip it over the stern cleat. The line should be just the right length that when secure to the stern cleat, he will know that the boat will stop exactly where he wants it. He wants to be able to slip it on and forget it because he will be busy at bow cleat. Once again, use the boathook to grab the line and slip the loop over the bow cleat.

Another singlehander has installed a hook on a piling at the entrance to the slip. He drapes the dock lines over the hook when pulling away. To make it convenient when returning.



Sails on and ready to go

An important consideration to singlehanding is that the skipper must always be prepared with an instant backup plan for operating the boat. He must never leave the dock under motor power without at least one sail hanked on and ready to raise at a moment's notice. This could be the main or jib, it does not matter which, so long as he can raise that sail in less than 15 seconds. Likewise, when returning to the slip he should never pack away all of the sails until he is tied up at the dock.

Experience has proven, time and time again, that the motor is the single most unreliable piece of equipment on a sailboat. I can guarantee that the motor will quit at absolutely the worst possible moment. The singlehander must be prepared for this. Think about it now, what would be the worst possible moment for the motor to quit? My motor quit when I was returning to the dock in 20 knots of wind and less than 50 feet from the rock breakwater. The list of things that can go wrong with the motor is endless, but here are a few of the reasons my 2-stroke outboard has

quit at terrible moments: dirty spark plug, bad oil/gas mixture, small hole in the rubber fuel line allowing air in, rope in the propeller, out of gas, gas tank tilted on its side, cracked fuel line connector. After the first edition of this book, I was motoring inside the harbour in 15 knots of wind. When I shifted from reverse to forward, the motor bracket broke off the transom, dropping my 5hp outboard into the water. Luckily I had a safety line in place. I immediately raised my jib and sailed out of the harbour, dragging the motor behind.

When the motor quits, DO NOT attempt to restart it. There is a reason that it quit and it will take more than 30 seconds to figure it out. When the motor quits, if outside the docks, the first thought must be to raise a sail immediately and regain control of the boat. Once there is a sail up and drawing, the skipper can take all the time in the world to work on the motor. This is the reason why a singlehander must never leave the slip or return to the slip without a sail hanked on and ready to raise. I have watched inexperienced sailors pulling frantically on their starter cord as they drift into rocks. They would have been much better to raise a sail and regain control.

When the motor quits inside the docks, the skipper might not have the room needed to raise sail and gain speed. This is where he will gain a new understanding of how boat hulls are built. The boat hull is a lot stronger than most think. Most sailors think of fiberglass boats the same way as they think of metal cars. But this is wrong. A car will have a permanent dent for every small contact. A fiberglass boat is much stronger and much more forgiving than metal A few years ago I motored into a dock far too fast because a strong wind was pushing from behind. I chose the lesser of two evils and deliberately ran my boat into the dock rather than hit another boat. My bow broke a wooden 4x4 in half, but there was nothing more than a scratch in the gel coat on my boat. So, when the motor quits and the skipper can't raise sail, he shouldn't be afraid to run the boat into a wooden dock, either on the bow or on the side. I've done both several times and do not have any lasting scars. It is emotionally difficult the first time, but after a while I've learned to shrug it off.

Running a boat into other boats takes a lot more nerve, but it will happen, so be prepared. First, what can the skipper do to slow down? He is probably going very slowly in any case. Can he turn into the wind until almost stopped? When he hits another boat, it is not the initial contact that causes most damage. It is one boat sliding along another where the lifelines, push pits and pulpits get caught or the masts and shrouds get tangled. The key is to stop the boat from moving after the initial contact. He should grab the rails or lifelines on the other boat and hang on until things settle down. Tie the boats together so there is no movement. Only after he has got the motion stopped can he make better decisions about solving the initial problem. I will warn that although the singlehander knows that fiberglass is strong and forgiving, the owner of the other boat does not. He is still thinking of his boat like a car, so he might get excited over what we consider to be run-of-the-mill.

If the boat is moving towards a collision, the skipper should not try to stop it using his own brute strength. I'm not saying this because I'm worried about his safety. I'm saying this because I know that it won't work. A 10,000 lb boat at 4 knots has a lot of inertia. No one has the strength to stop it from going where it wants to go. I've proven that even a wooden 4x4 doesn't have the strength. Fortunately, an entire wooden dock does have the strength so this is really the only choice.

With a full crew on board, we have four other sailors who can fend a off of rocks or boats. But singlehanders do not have this ability, so they should not try to do what they can't do. Just live with what they can do and be thankful for insurance.

Anchoring: The idea is to do as much as possible from the cockpit where the skipper has full control of the boat, only moving to the bow at the last possible moment. Under sail in light winds, or if using a motor, the skipper should turn the boat into the wind and release the halyard to drop the foresail or put the motor into neutral, then walk to the bow and release the anchor while the boat drifts backwards. In stronger wind conditions, it is better to heave-too. When the boat has nearly stopped, the anchor can be dropped. This will mean sailing past the desired anchor position and turning back to heave-too. After the anchor is dropped, the boat will swing around into the wind.

Another method is to bring the anchor and chain back to the cockpit to drop over the side. This can get messy with a dirty/rusty anchor. It is necessary to bring the entire anchor and chain back, or else the chain will scrape along the boat rail.

The singlehander must remember to keep the boat under control at all times, especially in a tight anchorage. The best way to keep the boat under control is to have the sails actively working, even if hove-too. A sailor has no control over a boat that is drifting. Only with wind in the sails can the boat be maneuvered.

Mooring buoys

Attach a ten foot line to the mooring buoy with a 4" ring and pickup float on the end. Use a boat hook to grab the pickup line as the boat passes by. A mooring line from the bow of the boat should be run outside the lifelines, all the way back to the cockpit. At the end of the mooring line, a carabiner can be easily clipped to the ring. Once the boat has settled, the mooring line can be hauled in to the bow and the carabiner replaced with a strong line.

Climbing the mast

There are a myriad of ways to a singlehander to climb the mast, but three have proven to be more successful than any others. Mastclimber; Ascender and Grigri; Mast Steps.

Mastclimber: Manufactured by ATN Inc. the Mastclimber is a combination of bosun's chair and climbing system that allows a user to climb up a single halyard. A foot strap system is used to so that the skipper pushes up with both legs to advance up the halyard about 1' per push. A one-way jammer on the bosun's chair and another jammer on the foot strap are used to advance securely up the mast. A complete description and video is available at atninc.com.

The user should not allow the two jammers to come together as they literally can jam and need to be pushed apart. They should be kept separate. This can become an issue when descending quickly. It might be better to use two halyards – one for each jammer. A second problem when descending is in dropping the feet too far. This makes it difficult to stand up enough necessary to release the bosun's chair jammer to proceed. So the user must raise the feet back up a few inches. The best aspects of the Mastclimber are the comfort of sitting in a bosun's chair and the ability to work well above the mast head.

Ascender and Grigri: The beauty of this system is that it allows for rapid descent. It is just as fast when ascending but much faster descending as the two jammers used with the Mastclimber or with two mountain climbing ascenders. The singlehander should visit a reputable mounting climbing shop to purchase an

Ascender, a Grigri and a harness. It is necessary to make a foot harness using strong webbing material and strong thread. The skipper must learn how to use this gear from a qualified expert. I prefer to use two halyards (one for the ascender and one for the Grigri) however it is possible using only one halyard if necessary. In this case the climber must keep the ascender and Grigri from connecting, in which case they will bind up. Of course the halyards must be very well secured with everything available. I use both the halyard clutches and winches. I use a two-foot harness that I made myself, very similar to that shown for the Mastclimber product. A padded mountain climbing harness is recommended. When climbing, the feet can be spread around the mast, as shown in the photo below.

To descend, the user can slide the ascender well down its halyard, step out of the foot straps and pull the Grigri handle and rappel to the deck quickly and under control.

Both of the above methods can be used at the dock or underway. The static line (for the ascender) must be kept very tight, but when underway the user will still swing away from the mast. Thus, I find it better to sail with only a jib, and to drop the mainsail altogether. This allows me to wrap a safety line, and my arms, around the mast. The singlehander should wear his normal harness with a much shorter tether strung around the mast. This extra line will keep him from swinging wildly away from the mast in a strong gust of wind. It will be necessary to disconnect to pass the spreaders. It will also stop him from falling past the spreaders if the climbing gear fails. I find it very helpful to wrap one arm around the mast when pulling up on the Grigri.

Blake's Hitch

There are several knots available to replace the mechanical climbing devices. The best known is the Prusik Loop. However, I find that it binds when holding my weight. A better method is "Blake's Hitch". It does not bind or roll over on itself under weight. A pair of lines tied in this way can be used to climb a pair of halyards. One is tied to the climbing harness and the other to the foot straps. http://tinyurl.com/lzq8jm

During the 2002 Around Alone, UK skipper Emma Richards had an extreme adventure at the top of her 80 foot mast after her main halyard parted at the mast head. Here is an excerpt from thedailysail.com, November 8, 2002:

She set off up the mast at 8:30am GMT in 10 knots of wind. But by the time she was at the mast head, the wind had built to 25 knots and the mast was swinging back and forth, 20 feet either way. Making the repair became a seemingly impossible task in these conditions. Emma, however, showed her true mettle by completing the repair successfully and after four and a

half hours, set foot back on the deck of Pindar at 12:52 pm GMT.

Commenting on the trip up the rig Emma commented: "It was horrible, just horrible – the most terrifying experience of my life. I went up the mast with a fairly steady breeze of 10 knots, but by

the time I'd reached the top, this has built to 25 knots, with the wind constantly shifting direction. The mast was swinging back and forth, as much as 20-feet either side. I was blown upside down in my climbing harness, back to front and thrown all over the place. I am bruised all over from being pounded against the mast – all up my arms, all along my ribs and my legs are totally battered. My head smashed against the mast a few times, so thank god I was wearing a crash helmet. I was so scared, it is definitely the hardest thing I've ever had to do in my life, let alone my sailing career. It was a total horror-show."

Mast Steps: Mast steps are common on cruising boats but are considered to add unacceptable weight and wind resistance to racers. Steps are undoubtedly the fastest way up and down the mast. Of course a safety harness is a must.

Fixed, folding or removable mast steps are available. The newest folding models are manufactured from a nylon / glass fibre.

Jeanne Socrates' Nereida uses folding steps near the working areas at the base of the mast, and fixed steps further up.

Simplicity and ease of use are the greatest benefits of mast steps. Going up the mast with mounting climbing gear is not something I would do for fun. Here is an excerpt from Dave Abbott, referencing the adventures chronicled at maxingout.com:

Why do I consider mast steps to be essential cruising gear on our cat?

1. Mast steps keep me honest: Sailing offshore isn't a place where you should ever live in denial. When you don't pay attention to what is happening on your yacht and around your yacht, you have set your course for denial, and denial comes before disaster.

Mast steps keep me honest about what is happening to my rigging. Every time that I prepare to sail offshore, I climb the mast and inspect every piece of rigging. Because of my due diligence in making rigging inspections, I made it all the way around with world without any rigging disasters.

When I reached Bora Bora, I climbed my mast and found two diamond stays that had broken wire strands and needed replacement. During our five

year sojourn in the South Pacific, New Zealand and Australia, I discovered and replaced diamond stays that had one or two broken strands of wire. In Turkey, I climbed the mast and discovered a broken wire strand on an upper diamond stay. When I reached Gibralter, I discovered that my head stay had several broken wire strands, and I replaced my head stay. The only pieces of rigging that I didn't replace during our eleven year circumnavigation was our cap shrouds. They are still alive and well fourteen years later.

My mast steps made it easy to inspect the rig before every offshore passage. Every time I looked at those mast steps, I felt guilty of neglecting my rig until I climbed to the top of the mast and verified that everything was in order. There's no doubt about it. My mast steps kept me honest.

2. My mast steps kept me safe: I always wanted to have a crow's nest on board Exit Only. But it was too expensive, and the diamond stays made designing one a real challenge. On the other hand, my lower spreaders were at an excellent height and functioned nicely as a makeshift crow's nest. My son would zip up those mast steps and have a look all around as we sailed through passes, into atolls, and among the coral heads of Fiji, the Tuamotus, Suvarov, the Bahamas, the Caribbean, the Great Barrier Reef, and many other destinations around the world.

Having someone up the mast pushes the odds in your favor when you are sailing to coral destinations. Mast steps make it easy to do what you should do - go aloft and have a look around.

Folding the headsail: When using hanks, it is easy to fold the jib/genoa for storage after a sail. Leave the sail hanked onto the forestay. Starting from the clew (back corner) of the sail, flake it back and forth while moving forward until the the sail is laid out in a neat, narrow line.

Starting from the back again, fold the sail over three or four times until it is in a neat pack. (Do not attempt to flake the sail with the exact same folds every time as this will cause wear creases.) Remove the hanks from the forestay and insert the sail into a bag from the back first. In this position, the skipper knows that he can dump the sail on the deck and the hanks will be neatly ready to clip onto the forestay once again. In high winds, most of the sail can be kept in the bag until it is completely hanked on.

Next Page:
The picture on the next page was taken at the start of the Singlehanded Transpac, passing under the Golden Gate Bridge in San Francisco. I sent the picture to the solar panel company, and they put me in their calendar.

july 2007

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Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
July 1 Canada Day	2	3	4 Independence Day	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31	August 1	2	3	4

Chapter 7: Sailing Techniques

With this book I'm assuming that the reader has a basic understanding of how to sail a boat and the terminology used in this sport. I will concentrate on those sailing skills particular to singlehanding. I have developed these techniques through trial and error (many, many errors), after years on the water and hundreds of sailing trips. I have always looked for two criteria in these techniques: the least chance of an error or accident happening; the fastest and most efficient means of achieving the goal.

Understanding sail trim

The first premise is that the sails and the rudder on a boat, when working in combination, are highly effective brakes, designed to slow the boat down or stop it completely. Only if the sails and rudder are perfectly trimmed will the boat sail as it is designed. The vast majority of recreational skippers sail with one foot on the brake. The one thing an educated skipper learns is how to take his foot off the brake. Doing so will increase sailing speed, reduce work effort and increase overall enjoyment.

The most obvious brake is the rudder. This brake is applied every time the rudder is turned, even a little bit. A professional racer told me that they prefer 2º of weather helm. I smiled when replying that 2º is far too much, 1½º is better. "Weather helm" is pressure pulling the tiller downwards, attempting to point the boat upwards. "Lee helm" is pressure pulling the tiller upwards, attempting to point the boat down.

The hand on the tiller should be as light as the hand of a lover during Chopin's finest waltz. It is used to guide with mere thought. Any pressure should be nothing more than the blush that arises from whispered sweet nothings. Like the lovers hand, the tiller should be little more than floating.

Pressure on the tiller should be the absolute minimum required to sail in the desired direction. The skipper must be always conscious of the amount of pressure on the tiller. The only way to sail with speed is too eliminate this pressure. When hand steering, it is very simple for the skipper to feel the amount of pressure. A celebrity sailor once commented that she preferred a wheel because she was not strong enough to sail with a tiller. My immediate reaction is that if steering with a tiller takes more strength than a middle aged woman can easily manage, then she is doing it wrong. Using a tiller takes no strength at all. If done properly, a two year old child would have enough strength - I can't make it any clearer.

When sailing with the auto pilot, the singlehander should stand forward and actually look at the tiller. Just how far from centre is it? With an auto pilot it would be very easy to allow it to expend effort untenable with manual sailing. By watching the tiller the skipper can quickly judge the amount of pressure. The tiller should not be more than a few degrees off centre.

Sail trim is more important for a singlehander than for a crewed boat because bad sail trim will create extra work (and excess wear and power consumption) on any autopilot or will simply overwhelm any wind vane or storm jib steering system.

The only way for the singlehander to control pressure on the tiller is with proper sail trim. Sails that are trimmed too tightly are incredibly slow. Weather helm comes from too much pressure on the mainsail or on the trailing edge of a large genoa. Lee helm comes commonly from too much spinnaker, or more rarely from too much genoa.

To reduce weather helm the singlehander should reduce sail behind the mast or increase sail at the front of the mast. Proper sail balance is the key. Most commonly, weather helm is reduced by easing the main sheet. As winds build this may

mean easing the main sheet until the mainsail is just short of flogging. It is very normal to sail with a reverse bulge in the front third of the mainsail, caused by the wind from the genoa through the slot between the genoa and the main. The trailing edge of the genoa can also cause weather helm. Easing the genoa sheet will reduce this problem. Weather helm would also exist in the ridiculous situation of using a large main with a storm jib or no jib at all in moderate wind conditions. As mentioned previously, sail balance is the key.

Lee helm can occur on a deep run, with the spinnaker pole pulled well back and perpendicular to the wind. To reduce lee helm the singlehander should reduce sail at the front of the boat or increase sail at the rear of the boat. If possible, easing the spinnaker sheet will reduce lee helm. If winds are strong, it may not be possible to ease the sheet enough without flogging the spinnaker. To retain maximum speed a better solution may be to tighten the main sheet and pull the main in a few feet. I.e. tightening the main sheet to increase weather helm will counteract the lee helm caused by too much spinnaker.

The best reference book on sail trim that I've found is published by North Sails. The "North University Sail Trim" book is specifically designed for racing. The advice it gives is a must for any sailor and particularly for a singlehander. But a skipper should not just blindly follow the book's directions. Rather it should be used as a starting point for the skipper's own experiments.

Even today, after years of sailing and many trips, I still experiment with sail trim. Just yesterday I learned the effect of pulling the spinnaker pole down by six inches on a beam reach in 12 knots of wind. What did it do to my sail shape and, most importantly what did it do to boat speed?

Every skipper should try new things every time he leaves the dock. What happens if the backstay is tightened by two inches in 10 knots of wind? What happens if it is tightened two more inches? While the North University book is excellent, it can only provide the general advice that is applicable to all boats. It can not provide the specific advice needed for one specific 24 year old boat with eight year old sails. This can only be discovered by experimentation. I'll give a hint right now: tightening the back stay by the first two inches will increase speed; tightening it by two more inches will reduce speed! (At least on my boat.)

The skipper should always keep one eye on the knot meter. I consider the knot meter to be the most important piece of electronic equipment on the boat, because it is the only thing that will indicate if the boat is being well sailed. A skipper who is new to this concept will be amazed by the change in boat speed just by easing the main sheet one inch, or by what happens to boat speed if the outhaul is pulled slightly tighter.

When watching boat speed, it is better to think in terms of percentage rather than absolute value. A half knot speed increase may seem insignificant until it is understood that this represents 8% for a boat traveling at 6 knots. Think about cars on a highway. One car traveling at 100kph would seem darned slow to another car traveling at 108kph. Even better, think about NASCAR racing. In a typical 300 mile race the first two cars will finish 1/3 second apart. This is just 0.02%, but is a difference of $35,000 in winnings! A typical sailor will not concern himself with 0.02%, but 8% is huge. Keep one eye on the knot meter and constantly experiment with sail trim.

Sailing upwind

Upwind sailing is where a singlehander faces his greatest disadvantage for the simple reason that he lacks weight on the rail. Most club racing boats are designed to have 1,000 lbs of crew on the rail. Weight on the rail keeps the boat level

which shows more sail to the wind. But more importantly, a level boat means the keel is pointing straight down, so the "wing effect" of the keel is at its maximum. The keel helps to keep the boat pointing upwind. The impact of this is dramatic. In races with a 20 knot breeze, I've fallen off the course by 30 yards over a run of just 150 yards when compared to other boats. It's bloody depressing.

The "wing effect" is that the keel provides lift to the boat, pushing it to windward, just like the wing on an airplane pushes the plane upwards. Actually, the keel does not lift the boat to windward, but rather stops it from drifting further to leeward. Although a keel is symmetrical, unlike the wing on an airplane, the fact that the boat is slipping slightly to leeward gives the difference in water speed on both sides of the keel that are needed for lift. In an ideal world, the keel will be pointing straight down, giving the maximum lift. In the singlehanders world, the keel is tilted at a 45º angle, providing virtually no lift at all.

The amount of heal is deceptive. To the skipper's eye, it may look as if he is not heeling any more than other boats. But even a 15% difference in heal will have a dramatic impact on leeway. New boaters incorrectly think that a boat that is heeled is action packed and fast. Just the opposite it true. A boat that is flat is much faster than a boat that is over heeled. They are designed that way.

On purposely designed singlehanded boats, major steps are taken to reduce heal by adding massive water ballast tanks to each side of the boat or a swinging keel that is pulled to windward. In addition, large dagger boards are often added. These dagger board wings point straight down when the boat is healed. The wing effect more than offsets the extra drag from the dagger boards themselves. For the typical boat, these additions are not available, so the singlehander must move to more conventional means of leveling the boat.

In the short term, sail twist is the singlehanders best friend. Mainsail twist is added by keeping the traveler high while easing the main sheet. Thus the top of the sail is twisted away, spilling a large amount of winds. In the same manner, jib twist is added by keeping the jib lead forward while easing the jib sheet. For best sail balance both the main and jib should be twisted the same amount. Twisting one without the other will add pressure to the helm. Twisting the sails is the fastest way to reduce boat heel.

Twist, evenly spread between the main and jib.

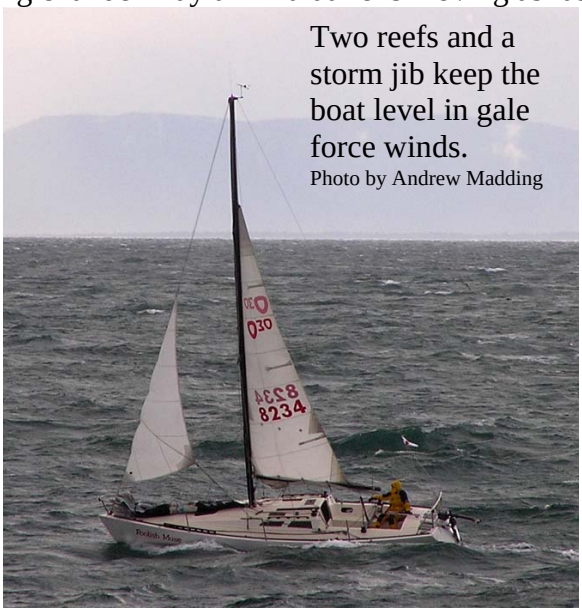
Tension on the luff and foot of the mainsail and jib performs the same function as the gears on a car. First gear on a car (more power but less speed) is attained by having a loose sail luff and foot with a large bulge in the sail. This setting is useful when accelerating after a tack or in choppy water conditions where the boat is constantly attempting to regain speed off of each wave.

Fourth gear in a car (more speed but less power) is attained by having a very tight luff and foot on the sail. This is appropriate after full boat speed has been attained in smooth water. A tight luff and foot is also used to shed excess wind, once again to reduce boat heel. In high winds it is normal to have the foot of the sail very tight, even if the sail is reefed. To do this I'll remove the mainsail outhaul from the bottom clew and connect it to the reef point clew and pull hard to flatten the sail as much as possible.

Second and third gears are the sail positions in between first and fourth. I find it useful to think of my sail settings in terms of gears. If I say to myself "first gear," I know exactly where my settings should be.

With a highly skilled crew it is common for the sail luff tension, adjusted with the backstay and foot tension, adjusted with the outhaul on the main and car on the jib, to be worked constantly while sailing. But a singlehander is unlikely to be constantly making adjustments to luff and foot tension after each tack or between waves. A singlehander is more likely to look at the general water conditions over the next half hour and adjust the luff and foot tension accordingly. It would be extremely taxing and nearly impossible for a singlehander to adjust the backstay tension before and after each tack. This is commonly done on crewed boats.

In the long run, the negative effect of heel is so great as to override the impact of shortening sail. So a singlehander will shorten from a genoa to a jib or reef the main much earlier than a crewed boat. Without other boats to compare, a singlehander may think that he is moving as fast as possible. But in a group, the skipper will quickly realize how much leeway he is suffering without a crew on the rail. In typical races, the only step to take is reducing sail and bringing the boat back upright. Reducing sail will often increase the VMG (velocity made good) to the next waypoint.



Two reefs and a storm jib keep the boat level in gale force winds.
Photo by Andrew Madding

In high, gusting winds, reducing sail will not reduce speed at all. This situation arises if a boat is sailing on the edge of control, where it is swinging back and forth with varying amounts of heel. It is just as fast and certainly more controllable to reduce sail to the point where the amount of heel is stable, rather than varying wildly.

In upwind sailing there are only two issues that the skipper must monitor; the heel of the boat and the amount of weather helm on the tiller. If both of these are under control, the boat is sailing as fast as possible.

Changing foresails

Whether swapping a genoa for a jib or vice versa, the key is preplanning. Changing sails will require at least 5 minutes of clear water on the new tack. The single most important consideration is to reduce the amount of time with no foresail flying to an absolute minimum. These are the steps to follow:

1. On the existing course, lower the foresail just an inch to relieve pressure on the tack shackle.
2. Unroll the new sail on the windward side of the foredeck.
3. Disconnect the lazy sheet (the sheet not under pressure) from the clew of the existing foresail and connect it to the new foresail.
4. Hank on the new foresail below the bottom hank of the existing foresail.
5. Remove the tack of the existing foresail from the shackle and insert the tack of the new foresail. (The existing foresail may ride up a bit.)
6. Pull in the lazy sheet so the new headsail is about ¾ back on the windward side of the boat. Don't make it so tight that the sail can't be raised easily.

7. Press the buttons on the auto pilot to initiate an auto tack. Make sure the auto tack will take the boat at least 10º beyond the new close hauled position.
8. As soon as the auto tack is started, pop the halyard clutch and move to the foredeck. The sail will fall to the deck as the boat swings through the wind. Pull it down quickly.
9. Immediately unhank the existing sail, disconnect the halyard and connect it to the new sail. Leave the old sail on the (now) windward side of the deck.
10. Move back to the cockpit and raise the new headsail.
11. Winch in the new headsail and bring the boat back up to top speed. Have a drink of water and relax. This is exhausting work.
12. Only after the boat is sailing at full speed with the new headsail on the new tack should the old headsail be retrieved.
13. Don't forget to connect the (new) lazy sheet to the new headsail, or get quite a surprise 10 minutes later during the next tack.

Using this procedure, the boat should be without a foresail for less than 45 seconds. In most races, 45 seconds is an eternity. The singlehander should practice and time himself. I do!

Reefing the mainsail: As with changing fore sails, the key consideration in reefing is to shorten the duration of having no main flying as much as possible.

I do not use any type of jiffy reefing system on my 30' boat. It is simply not necessary and would slow the reefing process considerably. The steps I follow in reefing are these:

1. Release the mainsheet completely, allowing the main to flog.
2. At the mast, lower the main halyard sufficiently to connect the reef tack to the hook and pull the halyard tight again.
3. Still at the mast, pull the reef line hard to bring the back of the boom up to the sail at the reef point.
4. Back in the cockpit, pull the mainsheet hard to bring the sail back in.
   (The first four steps of this process should be complete in less than 30 seconds, thus the mainsail is not working for only 30 seconds.)
5. If the reef line does not apply sufficient tension on the main, the outhaul should be used to flatten the sail further.
6. Only after the boat is sailing back up to speed should the intermediate reef lines be tied to straighten the sail. These do not give any strength to the reefed sail, they simply help to keep the sail in a bundle.

Jiffy reefing systems: Very few sailors are satisfied with a single line jiffy reefing system whereby a single line pulls both the reef tack and the reef clew down to the boom. It appears that this is too much work effort for a single line and is difficult to tighten completely, even with a winch.

However, dual line systems have been successful. With this type of system, a reef line at the end of the boom runs up through the reef clew, back down to the end of the boom, forward along the boom exiting at the gooseneck, down the to the deck and back to the cockpit. A second line at the front of the boom runs up through the reef tack, back down to the deck and back to the cockpit. A boat with three reef points will have six lines running back to the deck, each with its own rope clutch. The main halyard must also be controlled from this point, requiring a seventh rope clutch. Because all of these lines run back to the cockpit, it is likely that they must be winched tight, rather than pulled by hand. This is a lot of extra effort and time. It is faster to perform these jobs at the mast by hand.

I find that crewed boats rarely reef and never practice the reefing process. So a singlehander

who regularly reefs his mainsail should be able to do so much faster than a crewed boat.

Reefing the foresail: As with changing a foresail, the reefing process is easiest to do while tacking. The steps are:

1. Move the lazy sheet up to the reefed clew position on the sail.
2. Press the autotack button on the helm.
3. Release the active sheet.
4. As the boat swings through the tack, drop the halyard just past the reefed position.
5. On the new course, walk to the bow and pull the sail down to the reefed position.
6. Back in the cockpit, raise the halyard tight.
7. Sheet in the shortened foresail.
8. Once sailing on course, walk to the foredeck to move the remaining sheet and bundle the foot of the foresail with reef lines.

Tacking

The easiest way to tack is with a self tacking jib. However, if the boat is not equipped with this convenience, it takes quite a bit of practice to become proficient at tacking a normal jib or genoa.

With a crewed boat, tacking through the wind usually consists of turning past close hauled and allowing the jib to fly out past the lifelines. Then winching hard to bring the jib back in as the boat is steered up to close hauled. This is the best way to bring the boat back up to speed as quickly as possible. The exact opposite approach is taken when singlehanding. This is because of the difficulty of winching in the sail with one hand while steering a proper course with the other.

I prefer not to use the auto tack setting on the auto pilot. I find that it performs the maneuver very slowly and that it does not settle down to the new close hauled course for an extended period. I am able to perform the tack much quicker and more accurately manually.

Keeping in mind that we are sheeting to the high side of the boat, the steps to a perfect singlehanded tack are:

1. Ensure that the lazy sheet is laying ½ wrap around the unused winch.
2. Remove the active sheet from the cleat of the self tailing winch, but leave two wraps on the winch.
3. Start the turn.
4. Just as the jib is back winded, remove the wraps from the winch and release the sail.
5. Pause the turn just 20º past head to wind. Use a knee to control the tiller. This pause should only last a few seconds and not long enough to lose speed.
6. Moving across the cockpit, grab the lazy sheet and pull fast and hard. The plan is to ensure the sail is inside the lifelines. That is the only measurement of success; if the sail is completely inside the lifelines.
7. Using the knee, control the tiller to drop the boat down to close hauled.
8. Sit down with the tiller in the leeward hand.
9. With the winch handle in the windward hand, winch the remainder of the sheet. It may be necessary to steer with the tiller under the knee and use both arms to drive the winch.
10. Get the boat under control and at best possible speed on the new tack.
11. If unsuccessful at keeping the sail inside the lifelines, there are two possible approaches.
    a. If racing, activate the auto pilot and walk to the fore deck to skirt the sail.
    b. If cruising, ease the jib sheet and turn head to wind. Winch in the sail as it flops inside the lifeline, then bear away to fill the sail.

    Ken, who has singlehanded a J80 for many years and has just moved to a much larger J105 notes that he does not need to use his knees to steer through the tack process. He just releases the helm (a tiller on his J80 and a wheel on his J105), allowing the normal weather helm to pull the boat up through the wind. Only after moving the jib across the

boat does he need to manually adjust the helm onto the new course.

Ken has a small block on the clew of the jib on his J80. The jib sheet runs from the forward end of the jib car, through the block and back down to the jib car then back to the cockpit. With this 2-to-1 purchase Ken rarely needs to winch in his jib – pulling is enough to sheet in all the way.

The above steps are far easier with a small jib than with a large genoa. However the steps are the same for both. With a genoa, the pause at the top of the turn will be longer as more sail must be pulled backward.

Singlehanded tacking requires extensive practice to master. Each boat will have its own required timing for each step, changing with each wind level. Only with hundreds or thousands of practice tacks will it become second nature.

The Symmetrical Spinnaker

There is absolutely no reason why a singlehander should not use a spinnaker as aggressively as a fully crewed boat. One of the greatest compliments I've ever received was after a very high wind race. The skipper of another boat said "We weren't going to raise the chute until one of the crew pointed out that you had." I've been asked under what conditions I'll raise a chute, and the answer I gave was if I'd do it with a crew, I'll do it alone.

I also know that a singlehander can raise or douse a spinnaker every bit as fast as a fully crewed boat. A singlehander should raise the chute just seconds after rounding a windward mark, and should douse just seconds before the leeward mark. This is why I advise against spinnaker socks. They are unnecessary and cause delays. Likewise raising or dousing into the forward hatch works with a crewed boat, because there is someone up there to do it. A singlehander would have to run to the foredeck, douse, then run back to the cockpit to turn the boat. Any steps that cause a delay should be eliminated. I have worked out a process that is failure proof in any conditions, extremely fast and gives me total control of the sail and the boat at all times.

I also recommend that the spinnaker sheets be tied to the clews using a simple bowline knot. Quick release shackles are common on large crewed boats, allowing the guy to be released from the foredeck, but a singlehander will not be on the foredeck. Any other type of clip is prone to releasing on its own. A bowline has never failed me.

Using the method described below will not put undue strain on the auto steering system. It is more important that the skipper concentrate on raising and trimming the chute than worry about the tiller. However, if he doesn't follow these steps the auto steering system will be challenged beyond its limits. Activate the auto pilot with ¾ of maximum responsiveness.

1. Packing the chute is vital. This is the leading cause of later problems. Start at the head and run the right hand down the green tape on the starboard side of the sail. It is important to use the right hand on the green tape.

2. Start at the head again and run the left hand down the red tape on the port side of the sail. Now the skipper knows that there are no twists in the sail.

3. Push the sail into the sail bag with the green tape on the right and red tape on the left, and leave the three corners on top of the pile.

4. The best launching position is from the lifelines, just at the forward end of the cockpit. The skipper wants to be able to work with the sail while standing in the cockpit. Clip the sail bag to the lifelines, making sure that the red and green corners are facing the correct direction, depending on

whether it is being launched from the port or starboard side of the boat.

I keep harping on the red and green sides, and the left hand or right hand, and the port and starboard side of the boat because these concepts are vital to success. If a singlehander follows these directions consistently, he will never worry about lines crossing each other as the sail is raised, creating an hourglass.

5. Run the spinnaker sheet through the leeward block to the aft corner of the spinnaker. Wrap the sheet around the winch, but leave at least 10' of slack. DO NOT tighten the sheet. Some may think that this will give better control of the chute. In fact, all it does is drive the boat up as soon as the chute is raised – a very bad thing. Leave at least 10' of slack in the sheet.

6. Run the guy around the bow, through the pole and to the forward corner of the spinnaker. Raise the pole uphaul to the appropriate height. In moderate or strong winds, snug the downhaul and pull the pole about 3'-6' back from the forestay.

7. Tie a slip knot about 3' from the end of the sheet and guy. This will stop the sheets from running out when they are released – a common occurrence.

8. Clip the halyard to the head of the spinnaker.

9. Sail down to about 145º off the wind. Slacken the jib sheet so that the jib is properly trimmed for this sailing angle. A tight jib will cause backwind onto the spinnaker and lead to a twist. Slacken the main sheet but do not ease the main onto the spreaders or shrouds. A halyard will get caught between the main and the spreaders.

10. Pull the guy so that the forward corner of the chute is ¾ of the way to the bow. It may be necessary to pull the sail out of the bag by hand. This is the reason to have the sail bag next to the cockpit.

11. Raise the halyard quickly, without letting the sail drop into the water. At some point it may be necessary to pull the jib sheet in by hand to clear the chute out from under the jib sheet.

12. Immediately pull the guy to bring the chute out around the bow. 3'-6' of the chute will be showing and it will start to fill. This is where we will find out if the skipper forgot to snug the downhaul. Pull the sheet so that the sail fills completely. At this point the chute is up and under control, sailing at 145º off the wind. If this is the intended direction, ease the downhaul, pull the guy and ease the sheet until the pole is back to the proper position.

13. It is not necessary to rush to drop the jib down to the deck, but the jib halyard should be eased by a few feet to allow the top of the spinnaker to fill. Only when completely settled should the skipper worry about dropping the jib altogether.

14. Grab the jib halyard and release the jib halyard clutch. Holding onto the jib halyard, move to the foredeck and pull the jib down to the deck.

The entire process of raising the chute should take less than one minute. There is no reason that it should be any slower than an average crewed boat. The only difference being that the singlehander had to sail deeper than may be desired to get it done. Back in the cockpit, now is the time to turn to the desired sailing course and trim the chute accordingly. The auto pilot may be overstressed if sailing a high angle into strong winds. It is better to take the tiller in hand (or under leg) while trimming the sheet and guy if heading up.

Spinnaker trim is both a matter of speed and safety. An improperly trimmed spinnaker is both slow and dangerous. Dangerous? Yes, an improperly trimmed spinnaker will want to drive the boat either up or down. The process is very different from a crewed boat.

The first step is to ease the sheet until the forward edge of the chute starts to curl, then pull back on the sheet just a few inches. Leave the sheet in place. On a crewed boat, one position is "sheet trimmer" who constantly adjusts the sheet to keep it slightly tight. The assumption is that the helmsman is working independently of the spinnaker to keep the boat on course. The complete opposite is true for the singlehander. The auto pilot has limits in steering. If the boat rounds up by 10º over a normal wave and the sheet is tightened, this will drive the boat up further – very quickly. The spinnaker sheet should be loose enough such that it will curl over on itself if the boat rounds up, and uncurl as the boat comes down again. This is an automatic method for dumping wind. Under good conditions, even with a high wind, the boat will sail itself while the skipper enjoys dinner and a coffee.

It is often thought that in high winds, it is safer to hide much of the spinnaker behind the mainsail. This is a mistake that can lead to serious broaches. We must always go back to the initial concept that sail trim is vital. If the spinnaker pole is well forward, the sail trim assumes that the boat is on a reach rather than a run, and the spinnaker will pull the boat up into a broach. An autopilot or wind vane can not overcome this pressure. A much safer approach is to switch down to a smaller spinnaker and pull the pole back to its proper position, perpendicular to the wind. In this position the spinnaker is properly trimmed for the wind direction.

It is important that the skipper have control over the sheet, guy and downhaul from the standard helm position. This will require leading the sheet across the cockpit to the windward jib winch. I usually do this after the chute is up and the jib is down, when I'm moving onto the correct course.

Gybing the Spinnaker:

Since the first edition of this book, I have done extensive research and practice on gybing, arriving at methodology completely new to me. I originally contacted the Artemis Offshore Academy (see chapter 3) with the simple question. "How do you gybe in 30 knots of wind?" The answer I received was a complete surprise. I call it the "main-first method."

Crewed boats gybe the spinnaker and mainsail simultaneously. Obviously the singlehander cannot do so. For the past seven years I have always moved to the foredeck and gybed the spinnaker before hurrying back to the cockpit to gybe the main. It is during this middle period that the boat is in its most precarious position. The main-first method was taught to me over the telephone by Charles Darbyshire and Nigel King, both of the Artemis Offshore Academy.

As a first step, the singlehander must learn how his boat handles without a spinnaker pole. This is best done in moderate, 10-15 knot winds. Launch the chute as normal with the pole, and steer down to 150º apparent. Then move to the foredeck and disconnect the pole and allow it to drop away from the guy. The boat should then be gybed back and forth, numerous times, without allowing the spinnaker to collapse or wrap itself around the forestay. If the boat is sailed too high the spinnaker will fold over on itself. If the boat is sailed too low, the spinnaker will wrap. Nigel said that the key is to "learn to keep the boat underneath the spinnaker."

During this pole less practice, the skipper will learn that the windward sheet should be eased, such that the clew of the spinnaker is just a few feet back from the forestay and allowing the boat to sail higher. Likewise the leeward sheet should be pulled in, bringing the leeward clew back about half way. The skipper should practice

using both tweaker (or twing) lines to control the chute. What happens if one is pulled tight; if both are pulled tight? Also during this stage the skipper will learn that if the boat is sailed at 180 apparent, the spinnaker will wrap around the forestay – to be avoided.

Luckily, without the work of gybing the pole, it is very easy to practice a few dozen gybes simply by changing direction and swinging the main back and forth. The key is to learn the positioning of the spinnaker that will allow it to fly without wrapping.

The main-first gybing method is that the mainsail is gybed before the spinnaker. (See diagrams on the next page.) With the practice obtained above, the singlehander will be confident in his ability to sail the boat without the traditional pole on the windward side. Following are the exact steps for moderate winds;

1. Clip the safety harness on the current leeward side of the boat.
2. Sail fairly deep, down to 160 apparent.
3. Pull both tweaker lines down as far as the lifelines.
4. Release the spinnaker pole downhaul.
5. Pull the guy to bring the pole back about 2/3.
6. Ease the sheet so that the clew of the spinnaker is about 2 feet from the forestay.
7. Push the buttons on the autopilot to steer down to 180 and gybe the mainsail by hand. (With the spinnaker up, the boat should be sailing sufficiently fast that there is light pressure on the main.)
8. Immediately push the autopilot again to steer the boat up to 160 on the new heading. When the boat has settled on the new heading, move further up to 145 apparent. (My autopilot has a tendency to overshoot, which is why I use a two-stage process to get to 145.)
9. Move to the foredeck on the new windward side of the boat.
10. Facing forwards, grab the sheet in the windward hand.
11. Use the mast-side hand to remove the pole from the mast.
12. Connect the sheet to the pole and disconnect the old guy from the pole.
13. Slide the pole up the new guy to the clew.
14. Attach the pole to the mast.
15. Return to the cockpit, tighten the downhaul and trim the chute as appropriate.

It is important to remember that if the boat is sailed too high without the pole, the spinnaker will fold over on itself. If the boat is sailed too low, the spinnaker will wrap. (I speak from experience on this and Nigel confirmed it.)

Although there are a large number of instructions in writing, the entire process should take about 30 seconds. The only way to get good at this is to practice, practice, practice. A keen singlehander will sail out and gybe ten times – just for fun! I have done just that since learning the new main-first method.

Gybing in Higher Winds: The excitement of this maneuver builds as the winds grow. In 20 knots winds, the tweaker lines must be pulled right down to the deck before releasing the downhaul. The pole should be allowed to float, hanging only from the uphaul.

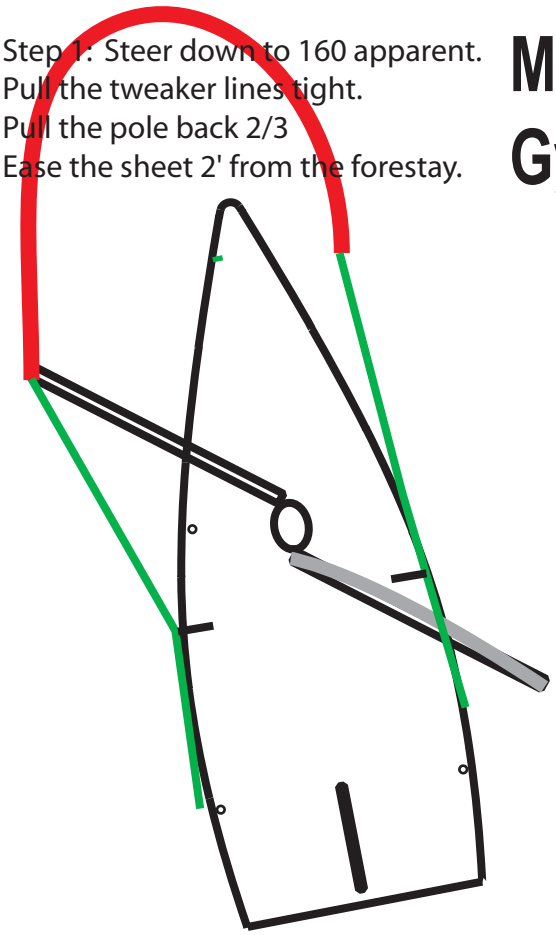
Nigel described that in 30 knots winds, he will steer by hand during the gybe because his autopilot cannot reliably change course without rounding up. Only after settling on the new course will he reactivate the autopilot and move to the foredeck.

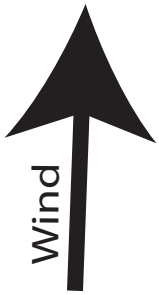
Dousing the Chute: Dousing rarely leads to problems if done properly.

1. Before taking any steps, examine the three corners of the sails to ensure none of the lines are caught or tangled to prevent the douse.
2. In moderate or heavy winds, sail down to 145º. In light winds it is possible to sail higher.

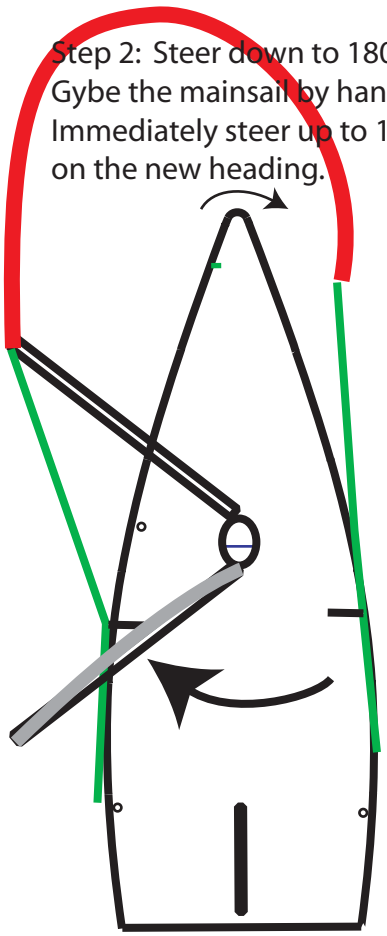
Main-first Gybing Method

Step 1: Steer down to 160 apparent.
Pull the tweaker lines tight.
Pull the pole back 2/3
Ease the sheet 2' from the forestay.

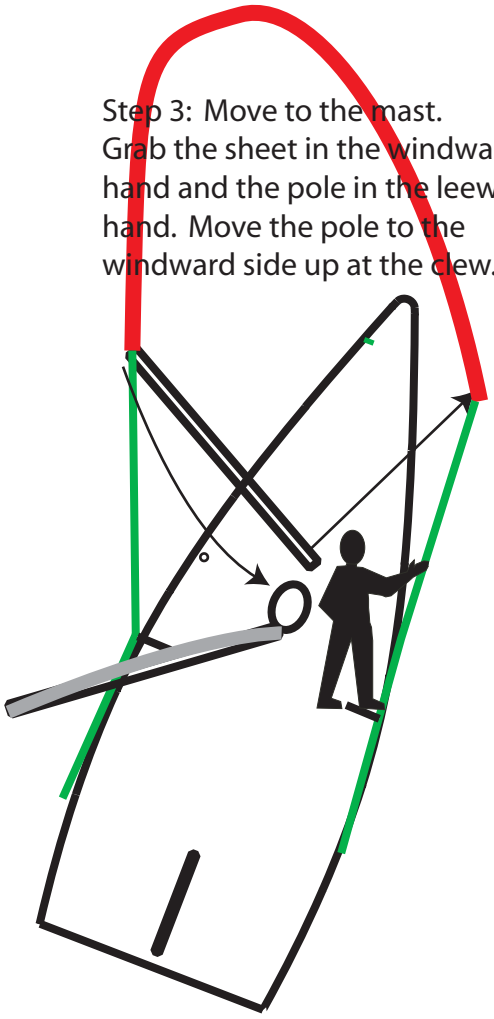


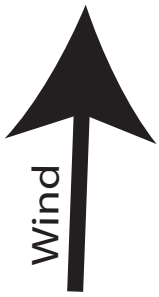


Step 2: Steer down to 180.
Gybe the mainsail by hand.
Immediately steer up to 160
on the new heading.

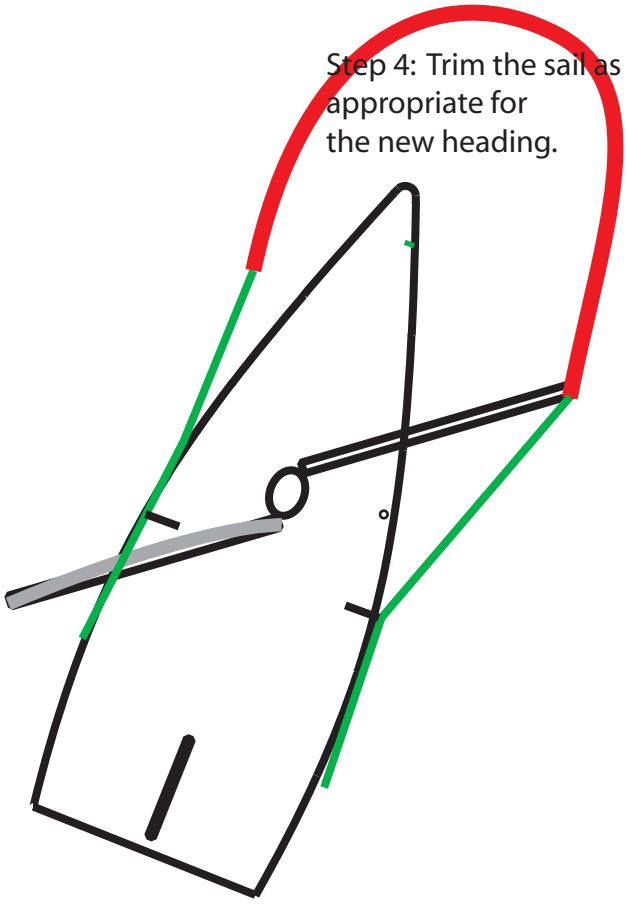


Step 3: Move to the mast.
Grab the sheet in the windward
hand and the pole in the leeward
hand. Move the pole to the
windward side up at the clew..





Step 4: Trim the sail as
appropriate for
the new heading.



3. Raise the jib, leaving the jib sheet moderately slack.
4. Make sure that the guy and halyard are free to run – they will run very quickly. Tie a slipknot at the end of the guy.
5. Stand at the front of the cockpit facing forward.
6. Uncleat the guy, but leave it wrapped on the winch.
7. Reach under the boom and over the lifelines and grab the tight sheet in the leeward hand.
8. Flip the guy off of the winch and let go. It will run out extremely fast.
9. Pull in on the sheet, beneath the boom. Grab as much of the foot of the spinnaker as possible in just a few seconds. It is not necessary to grab the entire foot. Even just the corner will do in high winds.
10. Release the halyard clutch and let the halyard fly.
11. In a hand-over-hand motion, immediately pull the entire sail into the cockpit or dump it down the hatch. If pulled quickly enough the sail will not get wet. It is best not to pull frantically, just quickly and steadily. There is time.
12. Turn to the desired course and trim the jib.
13. Only after attaining speed on the new course should the pole be stored.

Very high winds: At some point, it becomes uncomfortable for a singlehander to gybe the chute. The wind level and sea state where this happens will increase as experience is gained. However the wind level at which a spinnaker is flown will also increase with experience. When this level has been exceeded, the best approach is to douse the spinnaker, tie the sheets and halyard together and pull them around the boat, reattach them to the spinnaker (or preferably to another spinnaker that is properly packed), and raise the spinnaker on the other side.

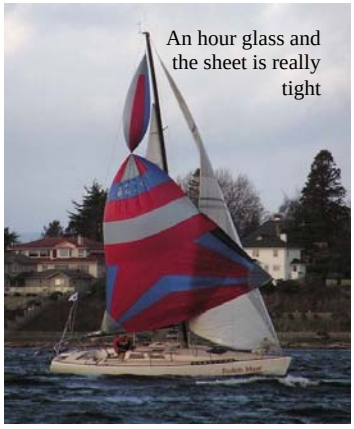
When things go bad.

The challenge of flying a spinnaker is that things can and will go bad very quickly. Fortunately there is a remedy for every situation and nothing has proven to be fatal to this skipper or boat. One overriding technique is DO NOT RELEASE THE GUY until you want to bring the spinnaker down.

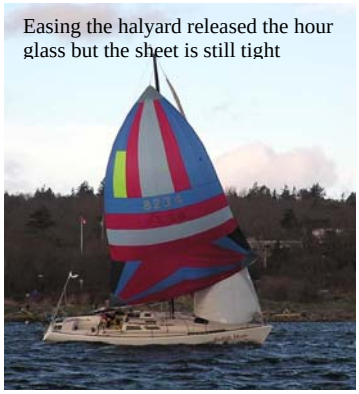
Releasing the guy will almost always cause greater problems. Think of the spinnaker exactly the same as any other sail. If a gust of wind hits the main, the first reaction is the release the sheet. Likewise, if a gust hits the spinnaker, release the sheet. Think of the guy as a permanent attachment, just like the tack on the main or jib.

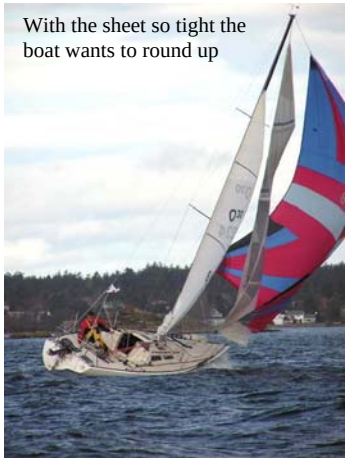
Problem: Spinnaker goes up with an hour glass: The only real remedy is to lower the halyard by 4'. Often this will solve the problem as the halyard itself caused the twist and will allow it to untwist.

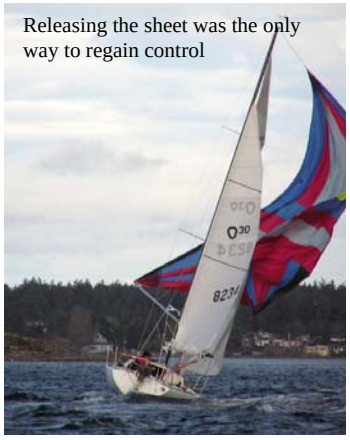
The only other possible solution is


An hour glass and the sheet is really tight

Great series of photos by Andrew Madding


Easing the halyard released the hour glass but the sheet is still tight


With the sheet so tight the boat wants to round up


Releasing the sheet was the only way to regain control

to pull down on the middle of the foot of the chute. If this does not solve the problem, nothing else will work. Pulling on the sheet or guy, or pulling on the corners will not do it. It is a waste of time to keep trying. The faster solution is to drop the spinnaker into the cockpit, undue the hourglass even if this requires disconnecting the sheets, and raise it again from the cockpit. If the spinnaker was properly packed and raised as described earlier, it will not go up with an hourglass. Two minutes of preparation during the beat to windward is worth ten minutes of struggle while watching the fleet sail away.

Problem: Boat rounds up immediately on raising the chute: This is caused by having the sheet too tight. The solution is to immediately release the sheet by 10'-20'. Do not release the guy in this situation. With the knowledge given on launching the chute, this problem should not happen. But skippers continue to believe that they have more control over the spinnaker if the sheet is tight. Like a teenaged child, it is impossible to gain control by holding too tight. Only by letting go can you hope to have some influence over its behavior.

Problem: Gust of wind causes the boat to heel: Once again, simply release the sheet by 10'. There is no problem with having the spinnaker flapping in the wind for a few seconds.

Problem: Spinnaker wraps around the forestay and jib halyard: This is a major problem that is often not solvable quickly. Do not release the sheet or guy. Sail downwind at about 145º. Release the spinnaker halyard and move to the bow to pull the chute and sheets down to the deck. It may be possible and necessary to unwrap it once or twice by hand, sufficiently to pull it down. However do not attempt to unwrap it completely while it is still up and you are at the bow. It is unwise to have the spinnaker suddenly fill when standing at the bow, a long way from the boat controls. Climbing back to the cockpit when the boat is heeled at 65º is more fun than most skippers want.

Problem: On dousing, the spinnaker comes in behind the mainsail and above the boom. This will occur if attempting to douse the chute in higher winds at a high angle. When the guy is released, the spinnaker drives back behind the mainsail. No one is strong enough to hold the sheet in front of the boom. It will not be possible to clear the mess before dousing. Simply continue to douse from behind the main. Afterwards, disconnect all the lines. This problem would have been averted by sailing down to 145º before dousing, but sometimes this is not possible.

Problem: In high winds the spinnaker simply gets away. Sometimes the pressure on the guy is so strong that it runs out from the skipper's hands, often causing a rope burn. This is why it is very important to have slip knots at the end of the sheet and guy. Let the guy run out all the way to the slipknot. Grab the sheet and release the halyard to douse the chute as much as normal. (Note that a knife should be mounted in the cockpit to cut the sheet, as a last resort.)

Problem, No slipknot on the sheet and the spinnaker is attached only at the top of the mast by the halyard, with the sheet and guy flapping wildly one hundred feet away from the side of the boat. Do not release the halyard until the situation is under control. If the halyard is released, the chute will fall in the water well behind the boat. This is a major cause of mast breakage. Even if the mast does not break it will take ten minutes to drag the spinnaker back on board – I've done it. The only possible strategy is to sail down in an attempt to cover the chute behind the main. Use any means possible (such as a boat hook) to snag one of the flapping sheets and pull it into the cockpit. Release the halyard and douse the chute.

All of the above problems become especially interesting if sailing directly towards a rocky

shoreline with just two minutes until impact. The key to singlehanding is the ability to very thoughtfully, but very quickly, consider all of the options and arrive at the best possible solution. But this is why we took up singlehanding in the first place. We have more fun and face more challenges flying a spinnaker than any other aspect of singlehanding. The only important thing is to laugh at all of the problems and at ourselves. It we can't do this, we should take up basket weaving. As mentioned elsewhere, I know – absolutely, that something will go wrong every time I go sailing. But I have never once had a bad day sailing.

Tweakers – Use them properly

Tweaker lines are invaluable for spinnaker control. In high winds, the spinnaker pole should be tightened down hard to flatten the luff and the sheet side tweaker must be kept lose. This allows the spinnaker leach to twist off, dumping excess wind. The skippers should think of the spinnaker just like the jib or main. In high winds let the sail twist. If the sheet tweaker is tight, the boat will start rocking and rolling – a very bad situation.

Gybing without the Pole

Once the skipper has learned to gybe using the main-first method, it becomes obvious that gybing the pole is not necessary at all for short term situations. I use this technique often when I need to get around a mark or around a small island. Simply ease the sheet until the clew is 2-3 feet from the forestay. Then harden down on the sheet side tweaker line. Swing the boat and gybe the main and continue to sail in the new direction. It does take a little more attention so that the chute does not collapse on itself, but I have sailed for as long as 15 minutes with the wind up to 135 apparent. There is no loss of speed and it is much easier than gybing the chute twice in short order to round a mark.

Asymmetrical spinnaker

Ken has singlehanded a J80 for many years and has recently bought a J105. He has perfected raising an asymmetrical spinnaker after being taught by past J80 World Champion Kerry Klingler. The key is to NOT pull the tack forward until the halyard is completely raised. There are two reasons for this. First the tack is very likely to catch on fittings as it is pulled forward. Second, we don't want the sail to fill until the halyard is raised completely and the boat is under control. The steps are:

1. Extend the pole.
2. Ensure that the sheet is sufficiently loose that the spinnaker will not fill – even when the tack is pulled forward.
3. Raise the halyard completely. The chute will be in a long column shielded by the main.
4. Pull the tack line to bring the tack completely forward.
5. Trim the sheet to fill the sail.

Dousing an Asymmetrical:

1. Release the tack.
2. Gather the entire foot of the chute.
3. Release the halyard and pull the chute into the bag in the companionway.

Ken commented that by gathering the entire foot of the sail, everything was kept in good order and did not require sorting for the next launch.

Ken's J80 came with a spinnaker sock but it was difficult to use. The sock was hauled down from the mast, while the main resistance was well forward from the end of the pole. The difference in angle made it difficult to pull down. On his new J105, the sock pulls down to the end of the pole, so the effort is directly in line with the sail, making it much easier to douse.

Extreme winds:

At some point, the winds become too high to fly a spinnaker at all and just a mainsail and jib are in use. In such winds, gybing is a special challenge. If the main is not sheeted in the swinging main will break the boom or the gooseneck. If the main is sheeted but the gybe is not completed immediately, the wind will catch the main and drive the boat upwards into the path of an oncoming freighter at midnight. (Yes,

this has happened to me.) In very high winds the singlehander has a time frame of just seconds to pull in the main, complete the gybe and release the main.

The solution is to completely ignore the jib and concentrate solely on the main. When heading downwind, the jib will not cause any problems if it is back winded. The steps to an extreme wind gybe are:

1. The overriding priority is to complete these steps within a matter of seconds. Any delay will have dire consequences.
2. Head down as far as possible.
3. Sheet in the main as far as possible. It must be within 20º of centre.
4. Immediately gybe to 170º on the new course.
5. Immediately release the main sheet and let it ease as slow as is controllable by hand. Do not let it slam back against the spreaders.
6. Wrap of the jib sheet around the lazy winch.
7. Release the jib sheet of the back winded jib and pull on the newly active jib sheet. The jib will fall easily fall into place in front of the mainsail.
8. Steer to the proper course and trim the sails.

Heaving-too

Heaving-too is a vital skill for the singlehander, but shockingly is little known and little used. I had a discussion with the singlehanded skipper of an Open 40 who had faced an extremely dangerous storm and a lee shore. I asked if he had considered heaving-too and allowing the storm to pass. He replied that he had never practiced heaving-too and did not know if it could be done with his boat. I was fairly amazed with his response that he did not know how to perform the most basic and possibly the most crucial of sailing skills.

On the other hand, my friend Jeanne Socrates has sailed around the world twice. She makes it a practice to heave-too whenever the winds reach storm conditions. She finds this a very comfortable way to wait for better weather.

There are many instances where heaving-too is vital:

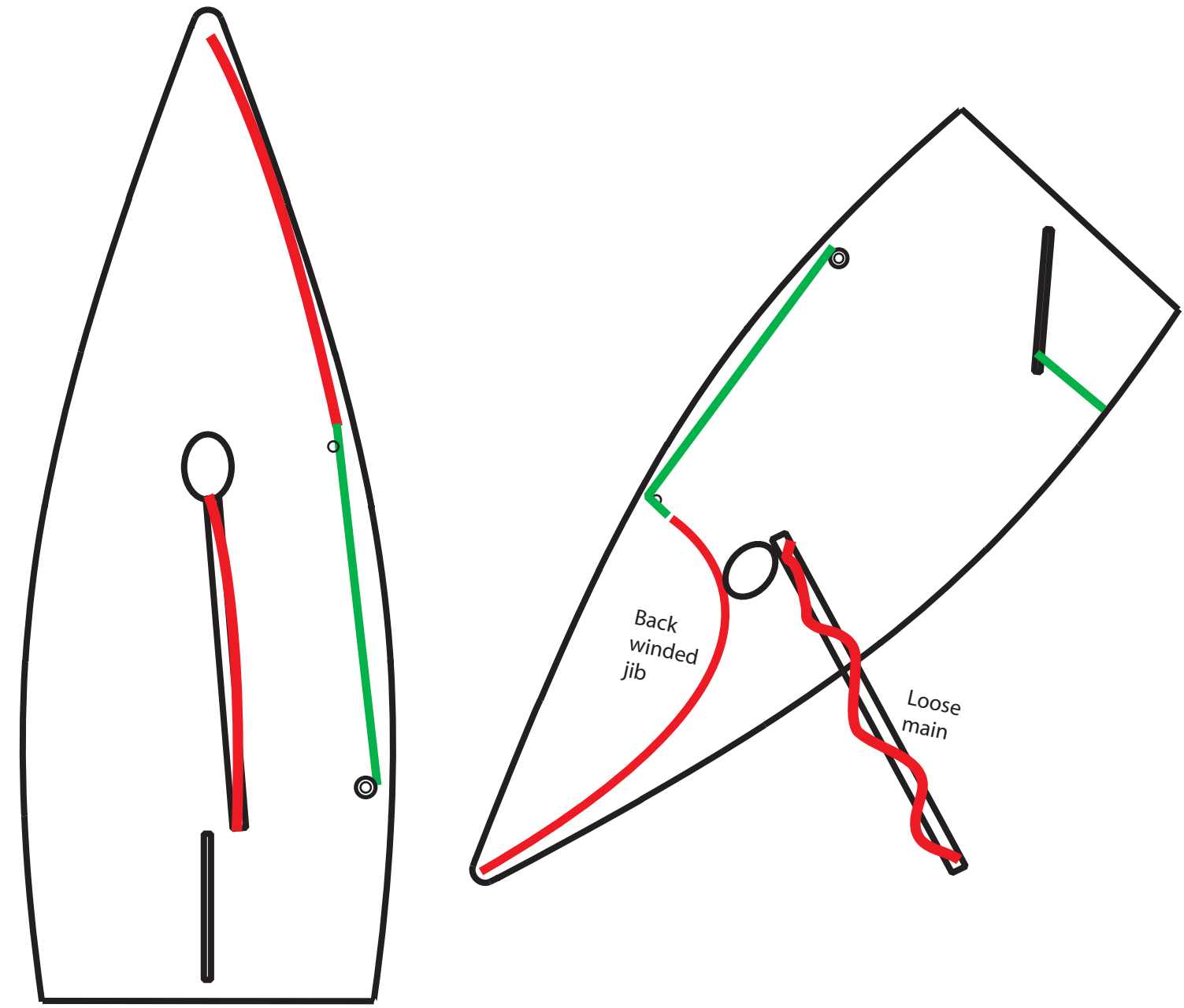
- When nearing the dock without an auto pilot, heaving-too allows the skipper to calmly and safely drop the sails, mount fenders, start the motor, etc. (It is especially impressive to stop the boat just 20 yards from the harbour, calmly ready the boat to dock and then motor in.) I used this method every single time I returned to dock for the two years that I singlehanded before having an auto pilot.
- In cases when the motor fails at a crucial moment, heaving-too gives the singlehander all the time necessary to check the gas tank, check the fuel lines or even remove and check the spark plugs. I have done all of these just outside the harbour entrance.
- Heaving-too is an excellent way to drop the jib and have it fall on the deck rather than in the water even if the singlehander has an auto pilot. This is because the jib is sitting, back winded, directly above the foredeck.
- Heaving-too is just a great way to take a nice break on a very windy day, especially for the rookie singlehander. After a long period of exertion, it can be used just to take the time to sip a coffee or have a sandwich. In open waters, it can even be used to safely have a sleep.
- Heaving-too works better in high wind conditions. It does not work if there is no wind, but the boat can just drift.

Each type of boat will behave differently when heaving too. For example some boats will require a slight pressure on the main sail, while others will heave too with the main completely lose or dropped. And each boat will behave differently with different sail combinations. For example my boat will hold its position better with the genoa than with the jib.

Heaving-too is very simple. On a typical modern sloop it can be done with just a short line or using the auto pilot. In a hove-too position, the fore sail is tight but back winded, the

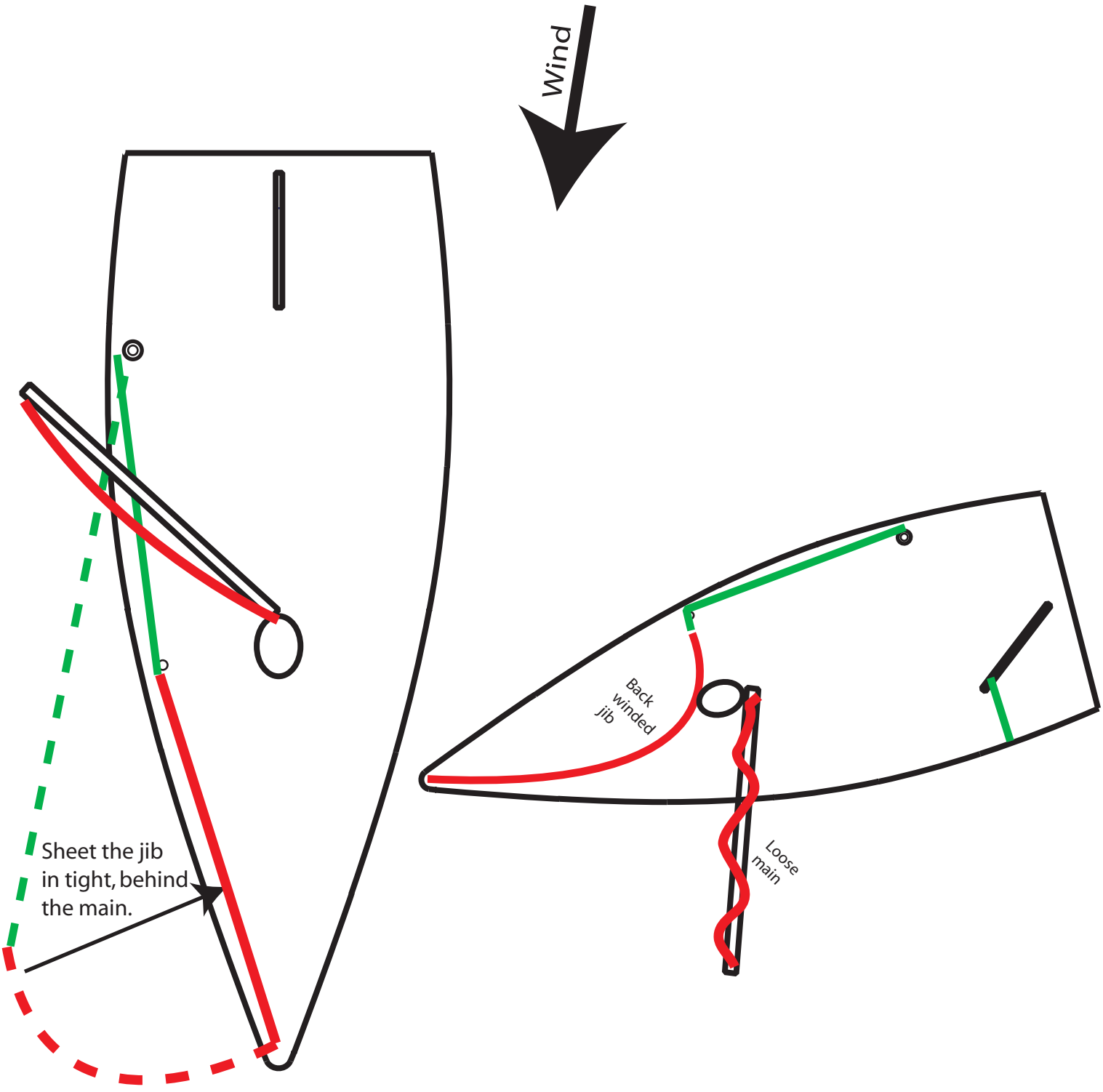
Heaving Too from a Beat

Tack through the wind but do not release the jib sheet. After the tack, release the main sheet completely and tie tiller to the leeward side of the boat.



Heaving Too from a Run

Steer deep down wind. Sheet in the jib tight, shielded by the main. Gybe through the wind but do not release the jib sheet. After the gybe, release the main sheet completely and tie the tiller to the leeward side of the boat.



mainsail is loose to flogging, and the tiller is tied to the leeward rail.

Here are the steps to heave-too from a beat or close reach:

1. Sail as normal on a tight beat with the jib and main sheeted in completely. The boat should be pointed in the heading directly opposite to the heading desired in the hove-too position. I.e. if the skipper wants to be pointing due West, he should be sailing due East.
2. Tack the boat through the wind, but DO NOT release the jib sheet. This will back wind the jib against the mast and shrouds.
3. Immediately after the boat has past head to wind, release the main sheet completely. The mainsail will fall against the newly leeward shroud. Even in high winds the main will only flog gently. The boat will fall off the wind past the close hauled heading.
4. Push the tiller to the newly leeward rail and tie it in place.
5. The boat will settle in a heading directly opposite the original heading, on a beam reach.
6. If desired, for an extended stay the mainsail can be dropped to the deck.

Here are the steps to heave-too from a broad reach or run:

1. Drop the spinnaker and raise the jib or Genoa.
2. Sail down to 160º off the wind so the jib is shielded by the main.
3. Sheet in on the jib until it is tight.
4. Gybe the boat but do not release the jib sheet.
5. Remember when gybing to sheet the main all the way in, turn the boat and then release the main sheet on the leeward side.
6. Allow the boat to head up to a beam reach with the back winded jib on the windward side.
7. Push the tiller to the leeward rail and tie it in place.

The action of the boat is that the back winded jib is trying to push the boat down while the rudder is trying to push the boat up. They will counteract each other perfectly. The boat will continue to move at a very slow speed, perhaps ½ knot. Different fore sails will have a different result. For example, my boat is nearly dead in the water when hove-too with my 155% genoa. But my boat moves at ½ knot when hove-too with my 100% jib.

Note that the mainsail and tiller can be used to adjust the boat heading when hove-too. Pulling in the main sheet to give wind pressure on the mainsail will aim the boat more upwind to a close reach, suitable in large waves. Moving the tiller towards the centre will drop the boat to a broader reach. The skipper should choose the most comfortable boat direction and make adjustments accordingly.

The singlehander should practice heaving-too to determine how the boat will react with each fore sail. Stopping the boat may require easing the jib sheet or changing the tiller position slightly.

Follow the steps below to start sailing again:

1. Untie the tiller and take it in hand or activate the auto pilot.
2. Release the tight jib sheet.
3. Trim the newly active jib sheet.
4. Trim the main sheet.

The boat will start sailing again on a beam reach with perfect control.

If dropping sails to enter a harbour, follow these steps. They can be done calmly and slowly regardless of the wind conditions:

1. Heave too.
2. Drop the mainsail and secure it to the deck or boom.
3. Tie the fenders to the boat rails.
4. Start the motor, but keep it out of gear.
5. Release the jib halyard. The jib will fall neatly on the fore deck. It may require some pulling to get the jib completely down.
6. Release the tiller.
7. Put the motor in gear and enter the harbour with a smile.

Chapter 8: Racing – get into it

Racing is the best way to learn to sail a boat well. It has been said that one year of racing is worth ten years of cruising. I believe that the difference is even greater. The reason is that in racing, the boats are forced to take a route that is often uncomfortable and in worse weather than they would cruise. As well, in racing each skipper will be comparing himself to all of the other boats – it's just human nature to want to do well. Sailing poorly is the equivalent to driving a car with the emergency brake on. It is just inefficient. Sailing well is like driving a tuned car. Racing is the best way to learn to sail well.

Most regions have a limited number of singlehanded races, so there is no choice but to race singlehanded against fully crewed boats. I race every week – year round. All but one or two of these races are against crewed boats. Over the last four years I've raced at least 200 times against fully crewed boats. I win few of these races, but I gain valuable experience every time.

For all of the reasons listed above and for the various issues listed below, a singlehanded boat will not be as fast as a crewed boat. The only way to overcome this is for the singlehander to sail more intelligently than any other boat on the race course. The tips given below will assist in this endeavor.

Handicap adjustment for singlehanding against crewed boats

After racing for a full season, I found that I was very consistently racing bow on bow with another club boat that was rated at 13 seconds slower than me. At the annual club race meeting, I asked for, and was given a 13 second per mile PHRF handicap adjustment for singlehanding. Over the three years since that time I've found this to be quite fair. On corrected time I tend to do well on light wind days, horribly on strong wind days, and finish in the middle of the pack on moderate wind days. This is as fair as it can be. The tactics discussed below will provide an explanation of why a handicap adjustment is appropriate for the singlehander – it is either impossible or unsafe to sail as fast as a well trained crewed boat – but only 13 seconds per mile worth! Any more and the skipper is just not sailing well.

"Distance races" are ideal for the singlehander. These distance races might be just 5-7 miles long on weeknights or 15-25 miles long on weekends. A typical course will be around a nearby island or navigation buoys with only one or two spinnaker runs. It may be necessary to request that weekly distance races are undertaken. It is common knowledge that fewer boats are racing round-the-buoys races. Distance races are a great opportunity to refresh the racing scene for all boats, not just singlehanders. Most club distance races are a more casual affair than round-the-buoys races, with less aggression by all. It is time to get off the merry-go-round.

Normal round-the-buoys racing is an extra challenge for the singlehander because of the need to keep clear of other boats at the rounding marks. This will probably mean sailing 50 yards away from the windward mark before raising the spinnaker, and dropping the spinnaker 50 yards before the leeward mark. Obviously this is a huge racing disadvantage. But as a singlehander, there is an extra responsibility to keep clear of other racing boats. There are times to be aggressive and times to give way, even if it is not required by the rules. The best advice is to remember that a singlehander is probably not going to win the race anyway, so if a skipper is generous with the rules, others are much more likely to be generous the next time. For example, I would never head a boat up into the committee boat at a starting line, because I know that next week the position will be reversed and I'll hope for the same consideration.

It is important to let other racers know that the boat is singlehanding. While it is unreasonable to expect any extra consideration (they will often

give it anyway) it becomes a factor during tricky maneuvers. For example, in high winds I will often hail a nearby boat to "keep an eye out" while I am raising a spinnaker just in case my boat rounds up sharply.

I've never hit another boat while racing singlehanded, but I've done so twice with a crew. I believe that a singlehander is much more aware of his surroundings than a crewed boat because he will never assume that someone else is watching – there is no one else! It would be ridiculous to drive a car while asking the passengers to look for children crossing the road. In the same vein the singlehander is responsible for driving the boat and looking for hazards on the water. In retrospect it actually seems safer this way.

Flying the Number 1 pennant, (a red dot on a white background) is the best way to remind other boats that you are singlehanding. When asked, I remind people that the number 1 pennant is the universally unknown symbol of the singlehanded sailor.

The starting line

Against crewed boats: The starting line is the one place where a singlehander can gain a significant advantage. The overriding philosophy at the line is "not to be in first place across the line – but to be in first place one minute later." This philosophy will keep the singlehander out of trouble, out of other boat's way and will give him a great start a majority of the time. This philosophy has worked so well for me that I've been complimented on having many good starts.

The singlehander should arrive at the start line at least five minutes before the first warning gun. Take a good look at the line and figure out where all the other boats are going to be at the start. Most often in club races all of the boats will be crowding the committee boat end or the pin end, depending on the wind. So the first tactic will be to avoid that end of the line completely. Why? There three key reasons: first because there will be lots of jostling and calls to "head up" in the crowd. A singlehander has enough on his mind and does not want to get involved in this type of jockeying for the one top position. Second, because only one boat is going to be first across the line and in club racing this is as much a matter of luck as skill. All of the other boats will be sucking bad wind behind the first boat. Third, we know that in high winds, the singlehanded boat will have significantly more leeway than crewed racers. So the singlehander does not want to be sailing just slightly to windward of any other boats. He will drift down onto them, and need to drop behind to avoid a collision.

So a singlehander who avoids the crowd has, with this one tactic, put himself into clear air and probably into second place 100 yards after the start. I can't say how many times I've used this tactic with success. I'm all alone, in clear air and sailing a full speed at the gun on the so called "unfavoured end" of the line while I watch 10 boats shouting at each other and sucking bad wind at the favoured end of the line.

It is truly amazing to watch this phenomenon on downwind race starts where the boat that was first across the line in the crowd has his wind killed by the spinnakers of all the other boats behind him. Only on rare occasions should a singlehander get mixed in with the crowd at the start.

Another tactic that I've use well is to follow the others at the committee boat end, but just slightly behind, and then tack immediately after the start. All of the other boats on the line can't tack onto port until the lead boat tacks, and he might not want to. Once again, I'm in clear air at full speed just moments after the start. It is difficult to foresee every starting tactic but it remains the best advice to stay away from the pack.

Another example is in upwind starts of handicapped races, where the biggest boat takes

a position anywhere near the pack and soon moves into the lead. All of the other boats are stuck in his bad air. It is smarter to be well away from the pack in these situations. Remember, the singlehander does not want to be in first place across the line, he wants to be in first place one minute later.

So, before the warning gun the singlehander has figured out where the crowd will be and where he will be. Now is the opportunity to determine how to get there. As a first step, he should pick a route to take on the final run to the line. The goal is to hit the line at the gun and at full speed. Perhaps the best choice is to run all the way down the line from the committee boat to the pin. Or perhaps the better choice is to run from 100 yards behind the line, up at a 45º angle. There have even been times when I've used a port start at the pin end because I knew all the others would be on starboard on the boat end.

It may be possible to find a crab pot, a small buoy or a house on shore to use as a starting point for the final run. As a general thought the starting point for the final run should be slightly less than 1 minute from the start.

Next, figure out how to get to that starting point. In most cases the singlehander will sail up to the starting point at a moderate speed. For example, if the final run will be from the committee boat down the line to the pin, the starting point will be the committee boat. How to get to the committee boat will probably be on a direct line extension of the starting line. If the starting point is 100 yards back of the line, the skipper might choose to get to the starting point by sailing from the line downwards. I'll call this the warm up.

Next, use a stopwatch to time exactly how long it will take to get to the chosen starting point including both the warm up and the final run to the line. It is important to be as precise as possible in this timing and include the time it takes to make the turn from the warm up to the final run.

For example, I've chosen to start at the pin end. I know that the other racers will start at the committee boat end and they will probably come up from 45º below the line, so before the gun the line will be completely clear and I can run down the line easily. My warm up will be to sail away from the committee boat for one minute, then gybe and sail back passing just below the committee boat and then run the line to the pin end. To prepare for this, I time the entire sequence before the first warning gun. I click my stopwatch as I pass the committee boat, sail for exactly 1 minute and gybe and then sail back toward the committee boat and down the line. I stop the stopwatch just as I head up at the pin. In a typical club race I've found that I sail out for 1 minute, back for 1 minute and 15 seconds, and then 45 seconds down the line to the pin. I've done these measurements so many times that I really don't need to do them before every race if I arrive late.

If done reasonably well, this timing sequence will put the singlehander exactly on the line at the gun. The amazing part is that most other racers will not be doing this type of timing; they will simply be guessing on their final run to the line and more often than not will be wrong. By taking this simple extra step of timing the starting sequence, the singlehander will have a very significant advantage over the other boats. A singlehander must use his mind to make up for the many speed disadvantages faced in racing.

Against singlehanded boats: The opposite approach is used at the start. Very few sailors do more than one singlehanded race each year. Because of this they tend to be rather shy in the normal congestion at the starting line. In a crewed race these same skippers would be pushing their way to the best possible starting position, but in a singlehanded race they float around nearly aimlessly.

An experienced singlehanded skipper who is confident in his abilities can take advantage of their timidity. He should use the same level of aggression at the start as he would in any crewed race, by moving to the best possible position at the favored end of the line. The skipper who uses this tactic will be well ahead of every other boat in the fleet.

I have used this approach in every singlehanded race I have ever entered, and it has never proven wrong. Perhaps this will not be the case if I am able to enter the Figaro solo series, but it is certainly the situation with normal club racing.

Rounding the windward mark

For the singlehander, rounding the windward mark requires extra attention because this is a key point where boats congregate. Unfortunately there is little that can be done to improve the situation without causing great distress to other crewed boats, which will not pay off in the long run. The overriding goal at a mark is seeking out clear water where the autopilot can be engaged and the spinnaker raised. Nothing is more frustrating than being pinned into a crowded position watching other boats raise their spinnakers.

Most crewed boats will enter the mark zone wide, with the plan to turn tight around the mark. For the singlehander, the best strategy is to enter the mark zone tight with the idea of sailing wide after the mark. Although it may be legally permissible to force other boats wide as well, this will defeat the purpose of the maneuver because the singlehander won't get the clear water that he wants. The idea of this tactic is to create clear water to activate the autopilot and raise the spinnaker without danger of collision with other boats. Often the best strategy is to duck behind other boats allowing them to lead around the mark but gaining clear water instead. Similar to the starting line strategy, the singlehander will forgo fighting for the best possible position at the mark in favour of gaining a good position one minute later.

If the boat is properly set up, and if the skipper is prepared, it should not take any longer for the singlehander to raise a chute than a crewed boat. But this requires that he have the clear space necessary to do it. So, even if he is first to the mark, the singlehander should sail wide because following boats will quickly envelop him.

The amount of clear water required to raise the spinnaker depends entirely on the wind conditions. In light winds there is very little risk of a massive roundup when raising the chute, so only a small amount of clear water is needed.

In moderate winds, the danger of a round up increases significantly with the inexperience of the singlehander. I will repeat the instructions I gave earlier to make sure that the spinnaker sheet has significant slack to that the chute does not fill when first raised. The chute should only fill when the skipper consciously trims the sheet with the intention of having the spinnaker fill. Obviously this will only be done when the skipper is confident that it is safe to do so.

In heavy winds the risk of an accident with the spinnaker is significant. The singlehander must seek out a considerable amount of clear water, as much as 50 yards, before raising the chute. The singlehander should sail wide around the windward mark to get this needed space. Other racers will almost certainly be sailing tight around the windward mark, attempting to get the best line to the next mark.

It is a tactical risk for the singlehander to mount the spinnaker pole before rounding the windward mark. In attempting to sail as close to the mark as possible, the skipper may misjudge and undercut, or a crowd at the mark may force the singlehander below the mark. In either case, the singlehander is forced into rapid turns to get back on course and back around the mark. These

turns are impossible with the spinnaker pole in place.

It is also wise for the singlehander to consider gybing with jib and main only, before mounting the spinnaker pole and raising the chute. This is appropriate in heavy winds where the single-hander might not want to gybe once the spinnaker is up. Sacrificing one minute after rounding the mark is preferable to sailing a longer stretch without the spinnaker later in the leg.

Leeward mark
A singlehander need not give any water at the leeward mark. He should be able to douse the spinnaker and round the mark every bit as fast as a crewed boat. There are a couple of conditions. First, he must ensure that the spinnaker halyard and guy are ready to run without any snags. If they do not run freely, he will not get the chute down by the mark.

A singlehander will not be able to do a windward takedown common to crewed boats because he can not get the pole down before the mark. He must douse the chute beneath the boom into the main hatch, and leave the pole up, thus staying on the same tack, until after he has cleared the mark and stabilized his position on the upwind leg. Only once he is at full speed on the windward leg should he drop the pole. Naturally he will not be able to tack until the pole is down.

Some singlehanders launch and douse from the foredeck. This is much slower than from the cockpit because it must be done far ahead of the mark, leaving the boat with only a small headsail in the final boat lengths before the mark. I usually leave my chute up until the very last moment on a downwind leg. This is not possible if dousing to the foredeck because the skipper must give himself time to return to the cockpit.

When boats meet: Of course the singlehander must adhere to the same port/starboard or windward/leeward rules when boats are crossing. Because the skipper is alone, fully crewed boat will often assume that they have not been seen and shout "STARBOARD" more than they would for other crewed boats. The singlehander should acknowledge that they have been seen by shouting "I'VE GOT YOU" or "NO PROBLEM" in return, or else the crewed boat will just keep shouting. I've found that just a hand wave is not enough to acknowledge a shout.

Space Filler: Moby Dick

Sometimes in life, a coincidence is so profound as to provide positive proof of the hand of some superior sentience. Such an event occurred as I enjoyed the light winds and sunshine of Cadboro Bay. It was a wonderful day when I set out singlehanded, as is my want, for an afternoon cruise. My Olson 30, Foolish Muse, is a racing boat but on that day I was prepared for a stress free bask with coffee in one hand, a salami sandwich in the other and the tiller beneath my knee.

On such days I will normally be found with an MP3 player hanging from my neck. I have grown to love classic audio books, those books that are far too long and much too boring to actually read, but quite entertaining when presented by a pleasant voice with a British accent. Seafaring titles such as Carroll's "The Hunting of the Snark," London's "The Sea Wolf," and Barrow's "Eventful History of the Mutiny and Piratical Seizure of H.M.S. Bounty," are among my favorites. On this day I was determined to finish the final chapters of Melville's "Moby Dick, or the Whale." Melville's tome, all 135 chapters, took nearly 22 hours over numerous trips to complete. But a slow beat was the perfect setting to complete this task.

Chapters 133 and 134 of the book provided a nail-bighting build-up towards the climax. They gave the details of days one and two of the final chase of the white leviathan during which

Ahab's favorite crewmember was lost, his ivory leg was splintered and boat was smashed.

The event which shapes this story occurred exactly half way through the climatic chapter 135. As we are all familiar, the great white whale was exacting his final and deadly revenge on the Pequod and its crew. On my little craft I heard a familiar Pfffffffft, normally associated with a seal surfacing for a leisurely breath of fresh air. But today the sound was louder than I had become accustomed - so loud as to penetrate my ear buds. Thirty seconds later the Pfffffffft returned. This caught my attention. And in another thirty seconds my own whale, gray – not white, surfaced only 40 feet from my starboard bow. At the very moment of my gray whale sighting, the white whale of my hearing was breaking the back of the Pequod.

One of two Blue Whales, traveling together, that I saw while singlehanding about 50 miles off the coast of Vancouver Island.

What an unbelievable way to complete this book. While my whale was benignly enjoying the same sunshine as I, the final lines of the book wound down with Ismael clinging to a makeshift casket/lifebuoy.

I have sailed some 3,000 hours over the past 8 years. While each and every one of those hours has been incredibly enjoyable, a few, just a very-very few, have proven to be life changing. The short interval from 1:30 to 2:30 on that afternoon is a time period that I will remember until the day that I follow the Pequod into the beyond.

Chapt. 8B - Maintaining a Winning Attitude for the Duration of a Long Distance Singlehanded Race

(This chapter was written on the bases of a separate psychological study performed in 2012)

One hundred years ago the marathon was considered a survival race. Early Olympic film shows wobbly legged men collapsing at the finish line in a state of advanced delirium. Just finishing was considered remarkable. A century later and hundreds of thousands of average people run marathons all over the world with dozens of high-level, potential winners in every race. The most popular books on running concentrate on how to win rather than merely finish.[i]

Long distance, singlehanded sailboat racing appears to be stuck in the mindset of the early marathon runners; that finishing is enough to be remarkable. Until now, all academic studies on the subject have concentrated solely on coping with the numerous stresses of the sport, such as lack of sleep, hallucinations, solitude, etc.[ii] Even the most popular books on the great singlehanded races have barely touched the concept of winning, keeping their attention on the survival aspects of the voyage.[iii] One of the most often repeated statements in singlehanded racing is "In order to win, you first have to finish."[iv] While this is obviously true, it reveals the mindset of the sport, even at the highest level.

The time has come to move beyond the notion of simply finishing the race. Competitive singlehanded sailors need to understand and master the concepts that will take them from the finish line to the top of the podium. There are many schools where one can learn to sail a boat fast, even while singlehanded[v], but it is apparent that no one has studied the mental/psychological requirements necessary to win a Transatlantic or Transpacific race. This paper attempts to fill the void and move racing to the next level of competition.

There are no sports realistically comparable to long distance, singlehanded racing. A typical event will last two weeks, non-stop 24-hours a day, in complete isolation other than intermittent radio chat. The skippers eat, sleep, perform bodily functions, read, chat on the radio, and yes – even sail their boat, all while racing. The closest comparable is the Iditarod[vi] dog sled race in Alaska: A single person in isolation (although they meet up at each leg-end); a very difficult and unpredictable environment; the dogs are doing the physical work with the musher driving. The results of a personality study on the Iditarod mushers are presented later in this paper.

Much of this work is based on a psychological study completed by seven of twenty-three racers in the 2012 Singlehanded Transpac[vii]; a biannual race from San Francisco to Kauai, Hawaii. This is considered the preeminent singlehanded race in North America. The study participants completed pre-race, post-race and twice daily questionnaires on "maintaining an aggressive/winning attitude for the duration of a long distance singlehanded race." (See Appendix 1).

It is important to note that the twice-daily reports were completed before their radio check-in. That is, the racers' feelings in the reports were based only on the perception of their own performance in isolation, not as compared to other racers reported positions.

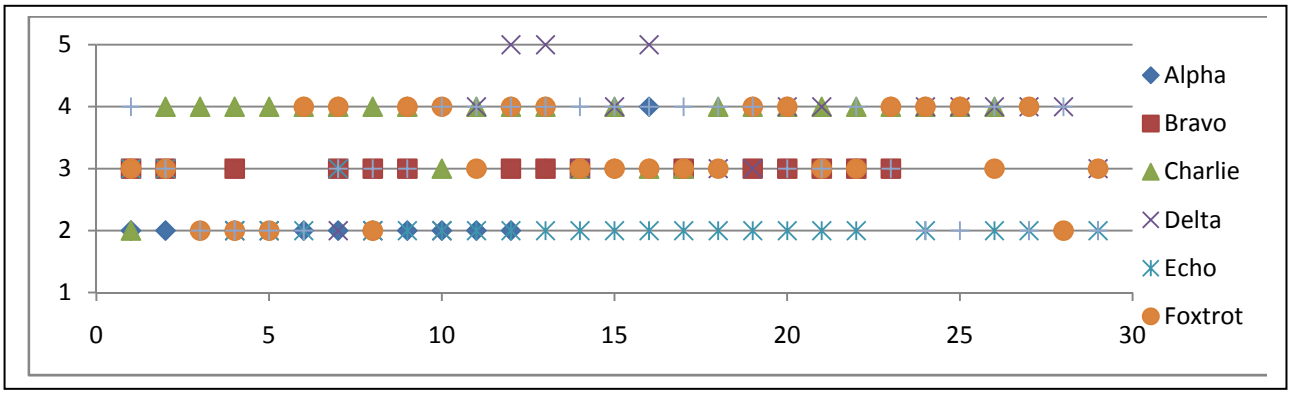
As a point of comparison, boats in the Vic-Maui, a biannual crewed race from Victoria, Canada, to Hawaii agreed to undertake a similar study. The basic difference between the singlehanded and crewed versions is the reference to "you" in the singlehanded race and "on deck crew" in the crewed race. For example: "what percentage of time did you feel energetic?" versus: "what percentage of time did the on deck crew feel energetic?"

Also this work is based on the knowledge of the author, with approximately 900 afternoon singlehanded sails including 250 races and the 2006 Singlehanded Transpac.[viii] During the 2006 race, the author placed 2nd overall, missing 1st place by less than 2½ hours or 0.1 knots of average boat speed. I am in full knowledge that the reasons for this 0.1 knot failure was not lack of sailing skill but was completely because of the psychological factors that accepted my sailing at significantly less than full potential speed. This study was initiated in an attempt to understand and correct this 0.1 knot speed differential.

The most important point:
The line "In order to win, you first have to finish," is the most dangerous statement in this sport. I have never heard a team entering the Super Bowl say, "In order to win we will block a little softer so we don't get injured." I have never heard a runner entering the Olympic 100 metre dash say that she was going to slow down so she won't pull a muscle. I never heard Mohammed Ali say that he was going to take it easy so that he could last the entire 12 rounds. Every top athlete in every sport knows that the only way to win is to leave everything they have, and more, out on the field of play. The line should read:

"In order to win, you have to sail harder than every other boat on the water."

The study proves this to be true. Question 8 of the twice daily survey was: Compared to normal afternoon races or cruises near your home club, have you sailed: (1) very conservatively, (2) conservatively, (3) the same, (4) aggressively, (5) very aggressively. The results are presented here:



The average scores for each racer, from highest to lowest, along with their relative finish race ranking:

Charlie	3.8	1
Delta	3.5	7
Foxtrot	3.2	2
Golf	3.2	3
Bravo	3.0	5
Alpha	2.4	4
Echo	2.1	6

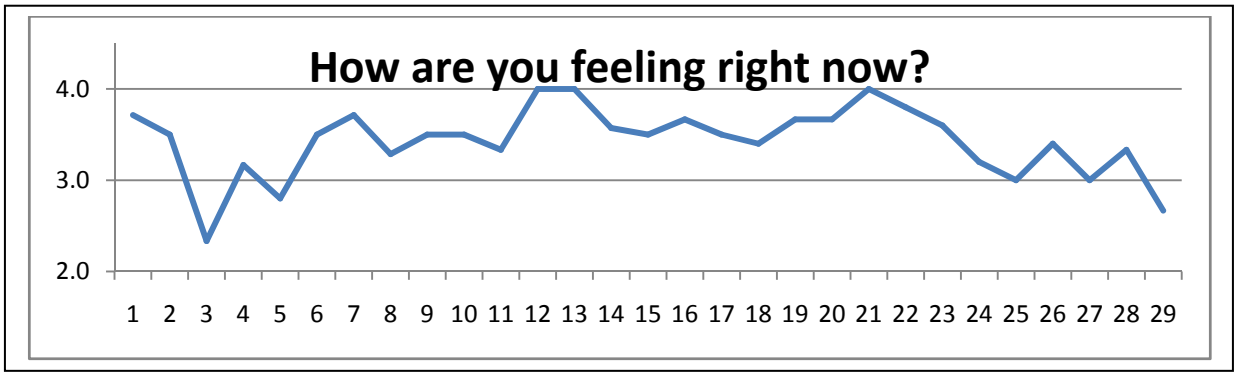
We can see that, there is a medium 43% correlation between reported aggressive sailing and finish ranking, reading 1,7,2,3,5,4,6.[ix] If we remove the outlier boat Delta from the calculation, the reported results are an astounding 86% correlation, reading 1,2,3,5,4,6. (Delta's result is interpreted below.)

This correlation was the most significant finding of the study and leads to the most important recommendation that can be made to any singlehander entering a race: A skipper's final ranking is directly correlated to how aggressively he feels that he sails when compared to a normal afternoon race or cruise. A skipper who feels that he sails more aggressively, more consistently than any other boat in the race, has the greatest chance of winning.

It is interesting to note that the level of aggressive sailing is not being judged by an independent third party, but by the skippers themselves. What an inexperienced skipper reports as "aggressive" might be considered "neutral" or "conservative" by a very experienced skipper. But this did not change the correlation results for the race. It is the skipper's own perception of his sailing that proved important.

Referring in particular to boat Charlie, the overall race winner out of 23 boats: the graph shows a very consistent reading of "Aggressively" with only two drops down to "the same" after the first day of the race. While other boats had peaks into "Aggressively" and even "Very Aggressively," they had greater variability of reported results during the race with a large number of results in "the same" or "conservatively" categories.

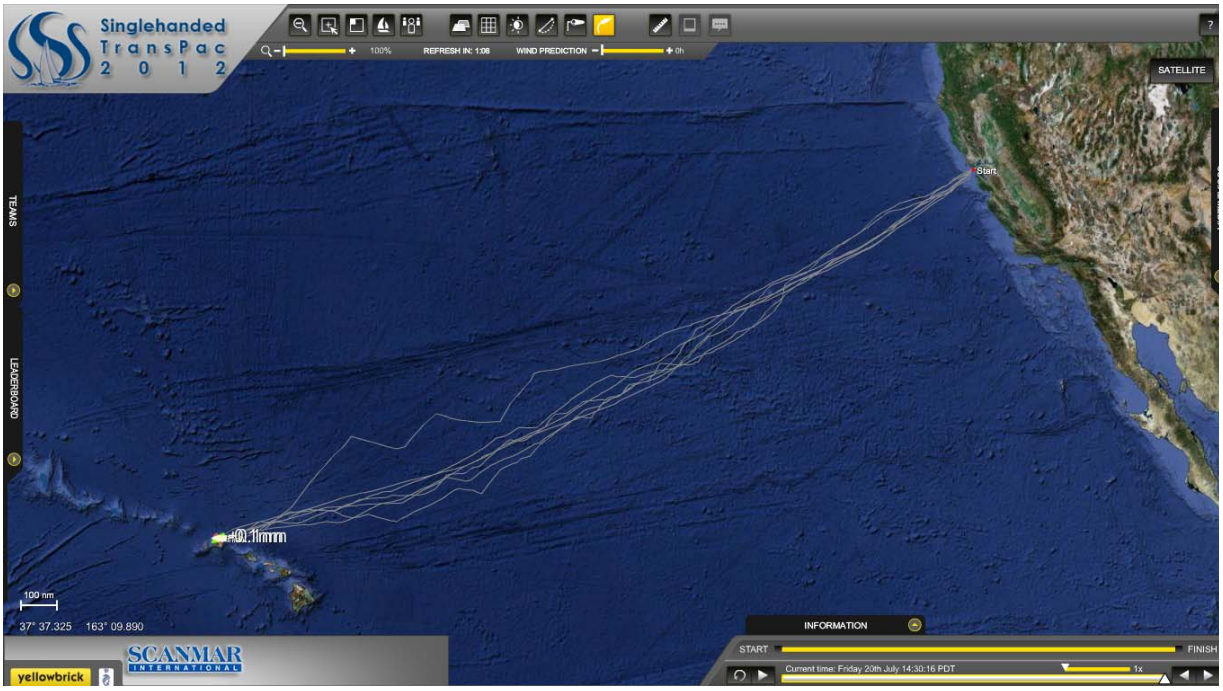
Question #1 of the survey was "How are you feeling right now, in terms of pushing hard for the highest possible speed: nervous(1), cautious(2), neutral(3), assertive(4), aggressive(5)?" This graph shows the average responses for all seven racers every 12 hours:



There is a large dip at the 36 hour point when exhaustion is kicking in, then levels climb through mid-race and drop towards the end as racers understand their final positioning. Of note is the good 50% correlation between this question and Question 8 on how aggressively each skipper sailed over the previous 12 hours.

As a check on Q8 about sailing aggressively, Q9 was "Did you push beyond your comfort limit: no, once, several times, many times". Overall there was only an 18% correlation between the two questions. Thus sailing aggressively does not mean sailing beyond the skippers' comfort zone.

Chart 1



It is important to understand, as seen in the chart above, that the race result was independent of the course taken by the skipper. That is, as long as the skipper did not make a significant mistake in routing, the course chosen was much less important than sailing aggressively in the final race results. This might be taken to indicate that excess time spent on weather forecasting and course routing is wasted.

It should also be noted that each boats' potential speed, as measured by its handicap rating, did not appear to impact on final race ranking. Looking at all 23 competitors in the race, there was a negative 11% correlation between handicap rating and race ranking. It is often thought that the weather during a particular race favours fast boats or slow boats, but this was not the case with the 2012 SH Transpac.

Boat Delta: In Chart 1, boat Delta is the southernmost track when nearing Hawaii. A record of the course heading of each boat, taken every 12 hours of the entire race, gives the following Standard Deviations, measured in degrees:

Charlie	15°
Foxtrot	15°
Golf	10°
Alpha	23°
Bravo	13°
Echo	9°
Delta	22°

(Boat Alpha, the northernmost track when nearing Hawaii, has an asymmetrical spinnaker thus by necessity takes a very zig/zag course in the directly downwind trade winds. So Alpha should be ignored in comparing course deviation.)

It can be seen that boat Delta has a much higher standard deviation in course heading when compared to the other symmetrically rigged boats (8° greater than the average). Thus Delta sailed a much longer distance than the other boats. This might be a reason why Delta ranked poorly in spite of a high "aggressive" sailing report in survey question 8.

Comparing with The Iditarod

The Iditarod is an annual dog sled race from Anchorage to Nome, Alaska. Running for 1,112 miles the race typically takes under two week to complete, about the same length as the Singlehanded Transpac. The Iditarod trail is through a landscape of spruce forests, tundra, over hills and mountain passes and across rivers. Most of the trail is through widely separated towns, villages and small settlements. Although the racers can see people all along the route and there are numerous stopping points, it is a solitary adventure, much like long distance singlehanded sailing. Given that the dogs are doing the work (like the sails on a boat) and the musher is along for the ride (like a singlehanded skipper) the Iditarod is perhaps the closest comparable sport to long distance racing from our point of view.

An extensive study on the personality profiles of twenty-four Iditarod racers was performed during the 1988 and 1989 races[x]. This was a standard "16PF"[xi] multiple choice personality questionnaire used to measure sixteen fundamental traits of human personality. The test was completed by each musher a few weeks before the race began. After the race, the results were broken into groups by how each finished in the race: 1-10, 11-20, 21-30.

The 1st-10th place finishers showed by a wide margin the highest score of all groups for the aggressive Factor E. Factor E ranges from 1-"Submissive" to 10-"Dominant". The top 10 finishers scored an average of 9, compared to the 5 scored by racers 11th-20th, and 4 scored by racers 21st-30th. I believe that this is an overwhelming match with the results of the singlehanded study discussed above; the direct correlation between aggressive sailing and finish rank. Thus not only must a sailor be more aggressive during the race, he must have a more aggressive personality in general.

The top ten finishers also had a very high score of 8 for Factor F which is a ranking of 1-"Sober" to 10-"Enthusiastic". Racers 11th-20th ranked 5 and racers 21st-30th ranked 4 on this scale.

Of Factor H, a ranking of 1-"Shy" to 10-"Bold", the top ten finishers scored 8.5, compared to 5 for racers 11th-20th and 4 for racers 21st-30th.

Perhaps surprisingly on Factor Q3, a ranking of 1-"Group Oriented" to 10-"Self-sufficient", the top ten racers ranked 3, which is far more group oriented than the others: 8 for both 11th-20th and 21st-30th. The Iditarod is a race with checkpoints including mandatory rest stops and supply restocking. Perhaps during these periods, being team oriented is significantly more valuable than being self-sufficient. This might be a cue for round-the-world singlehanded sailors, such as the Global-Ocean race, where teamwork and cooperation during stop-over's are an important part of winning.

It is interesting to note that all the Iditarod mushers, regardless of their final placing, rates as being extremely "cool, reserved" versus the opposite of "warm, outgoing". It would seem that this is a trait necessary to even enter the race. I would agree that this compares well with singlehanded sailors.

Experience

Returning to the Singlehanded Transpac study, among the pre-race questions were three that attempted to measure experience:

"How many times have you sailed singlehanded in the past two years; 1-5, 6-20, 21-40, 41-70, 70+?"

"How many times have you raced or cruised to Hawaii on crewed boats?"

"How many times have you flown a spinnaker while singlehanded in 15-20, 20-25, 25+ knots of wind?"

The answers are presented below, in order of finish.

	Times SH	To Hawaii	15-20 knots	20-25 knots	25+ knots
Charlie	1-5	14	Many times	A few times	Once
Foxtrot	41-70	0	A few times	A few times	Once
Golf	6-20	2	A few times	Once	Never
Alpha	6-20	1	A few times	A few times	Never
Bravo	1-5	19	Many times	Many times	A few times
Echo	6-20	1	Never	Never	Never
Delta	41-70	0	Many times	A few times	Never

It is apparent that there is no correlation at all between race ranking and experience when measured on one particular criterion, although when looking at all the items together there is a general feeling that the more experience the better.

Is winning important? I was told several times during this study that skippers are racing only for the experience, rather than the podium. That they are simply making a checkmark on their bucket list. The study itself refutes this point. In the pre-race questions 4 of the 7 respondents indicated a desire to "Hopefully Win" and 2 wished to "Finish Respectfully". Only 1 skipper wished to "Just Finish".

Another often held idea is that skippers use their first entry into the race as a learning experience or practice for future success. Of the participants, boat Bravo had sailed the race 11 times previously and Delta had sailed it one other time. This was the first Singlehanded Transpac for the other 5 boats. All but Echo answered a strong "Yes" to the question "Do you have the financial resources and vacation time to do this race several times over the coming years, if you desired: Yes, Possibly, Difficult, No?" Even the skippers themselves might be thinking of their first attempt at the Transpac as a practice. But the race records have proven this to be a false hope. Looking at the history of all Singlehanded Transpac races, 75% of skippers only complete the race one time. The Mini Transat race has an even higher attrition rate where 90% only complete the race one time. In spite of skippers wishes, it is apparent that the financial and effort requirements of doing the race are too high for repeats

Thus we are left with the idea that (to quote from beer commercials) this is the skippers' one shot at glory, his one shot to grab the brass ring. While simple completion of the race will be talked of at the yacht club

bar for several years, winning the race will be a point of pride for the skipper for the rest of his or her life. At the very least, the skipper will want to finish the race knowing that he tried his absolute best; that he left everything he had out on the water and that he could not have possibly have done better.

Confidence:
Question 14 was "How confident are you that the boat can finish the race with no significant breakage?" There was a medium 41% correlation between the responses and those to question 8 on sailing aggressively.

The open ocean is a lonely place for a singlehanded sailor. He has no one to rely on but himself if any of the many things that can go wrong does. In this edition of the SH Transpac, one racer was rescued by a passing ship when he reported a life threatening case of blood poisoning. In previous races masts have been broken, a rudder lost, a boat hull has cracked and a storm led to a rescue on the return trip.

These are very typical events in the life of a singlehander and all are perfectly valid reasons why a rookie might have some worries. Regrettably, given the requirement for aggressive sailing in winning, any lack of confidence in the boat must be overcome before race start.

Boat Echo provides one extreme on the proof of this thread. Echo had the lowest level of confidence in his boat; the lowest number of times when he pushed beyond his comfort limit; and reported the lowest aggressive sailing rating. This led to Echo placing 2nd last among the group and an overall dissatisfaction with his racing performance. He reported that he "stopped racing and started enjoying" the trip after just the first couple of days. In the prerace survey, Echo reported that he singlehanded 6-20 times in the previous two years and had never flown a spinnaker singlehanded in over 15 knots of wind.

On the other extreme, Delta had the highest confidence in his boat and the second highest aggressive report. Delta had sailed singlehanded 41-70 times in the previous two years and flown the chute many times in 15-20 knots and a few times in 20+ knots.

Confidence can only be gained on the water in challenging conditions. Singlehanded sailing in 10 knot winds will teach a skipper to sail fast. But only sailing in 20, 25 or 30 knots will give the skipper confidence. Race winner Charlie reported, "I had the chute up 24 hours a day for ten straight days. Rode out every squall (maybe 15 of them?) with the chute up." Charlie had gained his confidence in 14 previous trips to Hawaii, albeit with crew. He had a clear understanding of what a boat can handle and he pushed it to the limit. Charlie was only in the middle of the confidence ranking but was at the top of the aggressive ranking. This shows that he pushed beyond even his own confidence level. This is what it takes to win a race – having high confidence and pushing beyond it anyway.

Self-Sponsorship:
All but a very few transoceanic singlehanded skippers are amateur. However many (particularly in Transatlantic races) do gain some level of sponsorship from corporations to help offset expenses. None the less, there is no question that each skipper has invested a very large amount of his own money and an even larger amount of work effort in getting to the starting line. Thus the skipper himself or perhaps his

wife might be considered his sponsor. So in addition to the concept of making a checkmark on his own bucket list, each skipper must also consider the demands of the sponsor (even if that sponsor is himself). Will his sponsor be happy with anything less than an absolute, full effort? At the end of the race, can each skipper face his sponsor and say, "I gave it everything I had. I could not possibly have done any better."

The survey participants spent an average of about $20,000 to complete the Transpac. This works out to $9.43 per nautical mile or $65 an hour, 24-hours a day, sleeping and awake, sailing, cooking, reading. Each skipper must ask, "Based on the amount of money it is costing, will my sponsor be happy with my effort over the past day, the past hour, the past ten minutes? Perhaps each singlehanded skipper should post a big sign in the cockpit **"$9.43 per Nautical Mile**"

The disconnect:

I was watching video of the Volvo Ocean Race, considered the highest level of crewed long distance racing, and noticed a huge disconnect with singlehanded racing: In every VOR video there was a crewman hunched over the grinder. Every thirty seconds or so, this crewman would grind the sheets in or out making small adjustments to sail trim to increase boat speed. When significant events, such as broaches, occurred the crewman would immediately jump up from his fallen position and get back on the grinder.[xii] I asked a VOR crewman how he was able to maintain his motivation to stand at the grinder many hours a day. He replied that if he didn't do it, there were a thousand other sailors at the next stopover waiting to take his place.

On the other hand, video of the Vendee Globe, considered to be the highest level of singlehanded long distance racing, shows the complete opposite. Videos show the skipper sitting at the nav-station below deck or gazing off into the distance at the scenery. During her famous 2000-2001 Vendee Globe race, Ellen MacArthur blogged that she was spending 8 hours a day at her nav-station, forecasting weather. I sent her an e-mail asking what she was doing in 8 hours that could not be done in ½ hour? She replied "nothing". (MacArthur placed 2nd in the race and later set a world record for singlehanded circumnavigation.) It appears that sitting at the nav-station was considered to be acceptable sailing. Another sailor friend, Bruce Schwab, circumnavigated in the 2002 Around Alone and 2004 Vendee Globe races. When asked if he helmed the boat, he replied that he did so for short periods, but then went below to "get back to racing."

The question becomes obvious: If constant attention to sail trim is not important for boat speed, the Volvo Ocean Racers could significantly reduce cost and weight by cutting their crew size by half. On the other hand, if constant attention to sail trim is important, why are singlehanded sailors ignoring it? Why are singlehanders relying on the autopilot to perform the same functions as the entire on-deck crew?

Skippers must understand that the autopilot steers the boat, it does not sail the boat. The most advanced autopilots have functions that enable them to learn and adapt to wave movements, but no autopilot has any understanding of boat speed. The autopilot does not know that the wind has dropped by 1 knot and boat speed has fallen by ½ knot, or that wind speed has increased by 1 knot and VMG has fallen by ¼ knot. The autopilot does not know that chop has increased so the boat is slowing by ½ knot with each

wave and that it takes a 30 seconds to get back up to full speed. If set according to wind angle, the autopilot does not understand that a 10° shift in wind direction adds 1% to distance travelled. The autopilot does not know that surfing a wave is a good thing or that turning down a few degrees in choppy water will increase VMG. And if set according to compass direction, the autopilot does not understand that a 5° wind shift can decrease boat speed by 10% or more.

It is very easy to study and test these conditions. During an afternoon with normal fluctuations of wind speed and direction, a skipper can set the autopilot, trim the sails and watch boat speed rise and fall. For example, a skipper might know from her polars[xiii] that maximum boat speed is 5.5 knots when beating into 8 knots of true wind, so she hand steers to the correct wind angle, sets her sail trim perfectly, gets her speed up to 5.5 and sets the autopilot by apparent wind angle. The first thing she notices is that boat speed drops down to 5.3 with no changes to wind conditions – this is just a normal fluctuation, but it represents ½ day extra on a trip to Hawaii. She then notices that if the true wind speed fluctuates within a normal range and drops to 6, the boat speed falls dramatically to 4 knots. This is a 25% decrease in boat speed and represents an extra 3 days on a trip to Hawaii. Then she sees that if the wind picks up to 10, the boat heals over and the GPS notes that her Velocity Made Good (VMG) drops by half a knot because the boat is making extra leeway. As well, she notices that the autopilot has pushed the tiller to windward, adding extra braking power to the rudder.

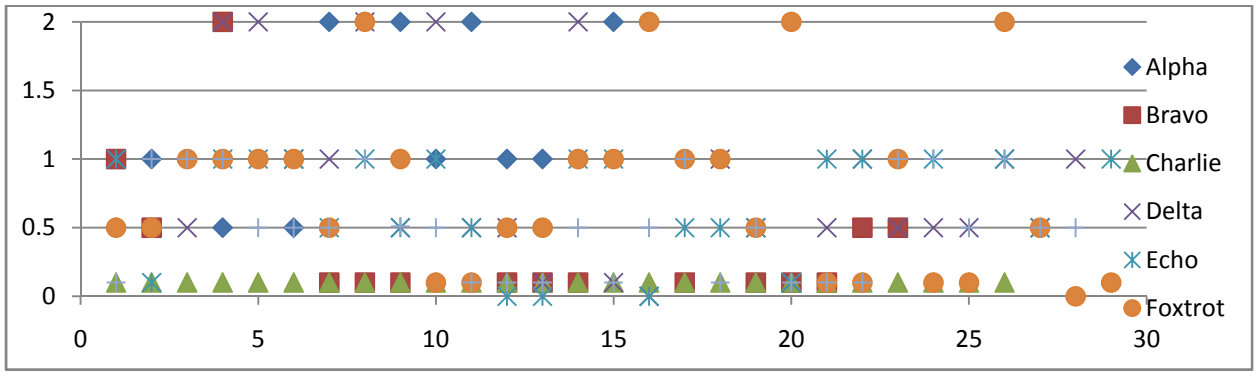
After watching the autopilot perform for a half hour, the skipper takes matters into her own hands. Once again she steers up to 5.5 in 8 knots of wind. Every time she notices a small wave ahead, she heads down a little to build power and keeps her speed steady. If she was really energetic she might also work the backstay to maintain power. Of course every time her boat speed changes, the apparent wind speed also changes and she makes tiny adjustments to sail trim to keep boat speed up at the highest level. When the wind speed drops to 6, she watches the telltales and sails down by 4° to keep boat speed at 5. (She knows from her polars that the boat can beat into 8 knots about 4° closer than it can beat into 6 knots. Rather than allowing the autopilot to pinch, she has gained an extra knot of speed.) When the wind increases to 10, she eases her main and jib sheets by a few inches to add twist and maintain the optimum boat heal, but can now head up by 2° and increase boat speed to 6. This also serves to reduce pressure on the tiller and she maintains the light touch that ensures no braking and maximum speed.

Heading back home, she turns downwind and launches the spinnaker. From the polars, she knows that the boat can travel at 5.5 at the optimum wind angle of 140° in 8 knots so she sets her autopilot and watches. The only way she can allow the autopilot to sail the boat is by trimming the spinnaker sheet until the chute does not collapse with a normal, small wind shift. But this means that for the 90% of the time that the wind is not shifting or gusting, the sheet is too tight. This in turn means that the boat is sailing slower than possible. So our intrepid skipper is never able to reach the polar boat speed of 5.5. She only gets up to 5.2. But she continues to watch. When the wind drops to 6, boat speed drops to 4. But then the wind gusts to 10, the first thing that happens is the boat rounds up in a broach. Of course it will – the massive spinnaker is trimmed for a higher point of sail and the boat will always head up to where the sail is trimmed. After regaining control (which takes a couple of minutes) her boat speed rises to 6 which seems good until another boat passes by sailing 8° further downwind.

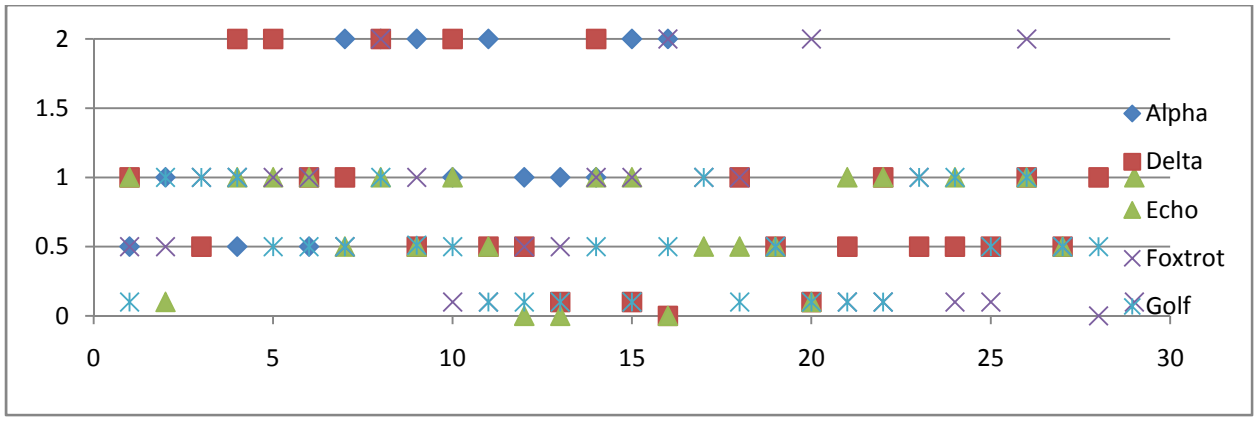
Once again taking the tiller and sheet into her own hands, she gets up to 5.5 boat speed at 140° in 8 knots. Every time the chute starts to curl she trims by a few inches, and then eases when the luff tightens again, keeping her speed exactly at 5.5 When the wind drops to 6 she heads up by 5° according to the optimum heading on the polars and only drops to 4.7. When the wind gusts up to 10, she eases the sheet to dump wind and maintains complete control. Then she heads down by 7° and increases speed to 6.2.

All of the above figures are based on the polar diagrams and experience with my own boat. This is a very accurate description of a typical afternoon on the water. Wind speed fluctuations of 1 or 2 knots and wind shifts of 10° transpire every few minutes under normal conditions. These examples show that even if the boat is sailing perfectly, the skipper who sets the autopilot and goes below is giving up a very significant amount of boat speed, boat control and VMG to the skipper who is actively involved in sailing the boat. In addition, boat polar diagrams work on the assumption that sails are trimmed perfectly. Every change in wind speed does not simply require a change in boat direction, but also a change in sail trim. Any experienced skipper knows the joy of watching boat speed rise by half a knot just because the main sheet has been eased by 3".

The facts about boat speed are clear, even to the racers themselves. Perhaps the most telling question of the survey was:" If you had been in the perfect racing frame of mind and had sailed as fast as possible with your abilities while you were awake, could you have increased your 12 hour average speed by: 0 knots, 0.1 knots, 0.5 knots, 1 knot, 2 knots?"



From the overall chart, it can be seen that boats Bravo and Charlie (the race winner) consistently show a potential speed increase of only 0.1 knots. Bravo has sailed this race 13 times and Charlie has sailed to Hawaii in crewed races 16 times. But removing them from the study to show the less experienced skippers is more revealing:



The vast majority of less experienced reports indicate potential speed increase of .5 knots or 1 knot, with significant numbers at 2 knots. (Note that boat Delta reported the second highest average potential speed increase of 0.9 knots, second only to Alpha's 1.3. Alpha is a much faster boat with handicap rating of -123, compared to the average of 141. Delta's 0.9, along with its wide variation of course might indicate a general dissatisfaction with course selection and speed achieved.)

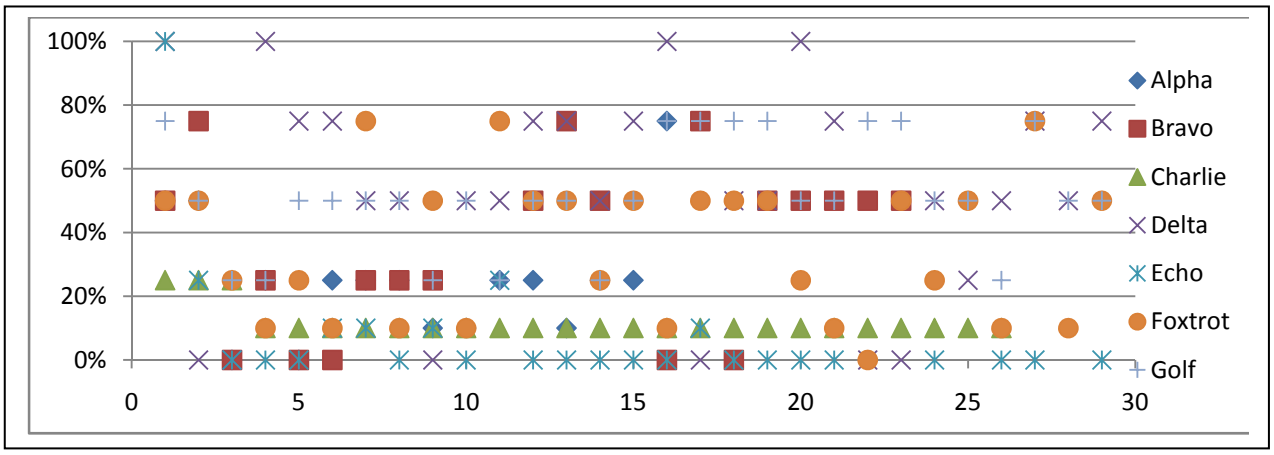
Do these numbers make a difference? The Mini Transat has the greatest number of entrants with 75 competitors in two boat classes. An examination of the results of the past four races shows that an increase in speed by just over 0.2 knots would improve the average placement by 10 positions. Is it worth the extra effort of 0.2 knots of boat speed to move from 17th to 7th? Most racers would think so.

We should also look at what the above potential speed increases would have meant to each boat in miles, time reduction and final ranking (assuming that each boat had met his potential speed in isolation), when compared to all 23 boats in the Transpac.

Boat	Miles	Time Reduction	Change from potential speed increase
Charlie	31	4 hrs saved.	Actual 1st overall
Foxtrot	266	33 hrs saved.	Moved from 7th to 1st overall
Golf	173	22 hrs saved.	Moved from 10th to 2nd overall
Alpha	222	29 hrs saved.	Moved from 13th to 7th overall
Bravo	66	9 hrs saved.	Moved from 14th to 12th overall
Echo	200	27 hrs saved.	Moved from 17th to 8th overall
Delta	268	38 hrs saved.	Moved from 18th to 6th overall

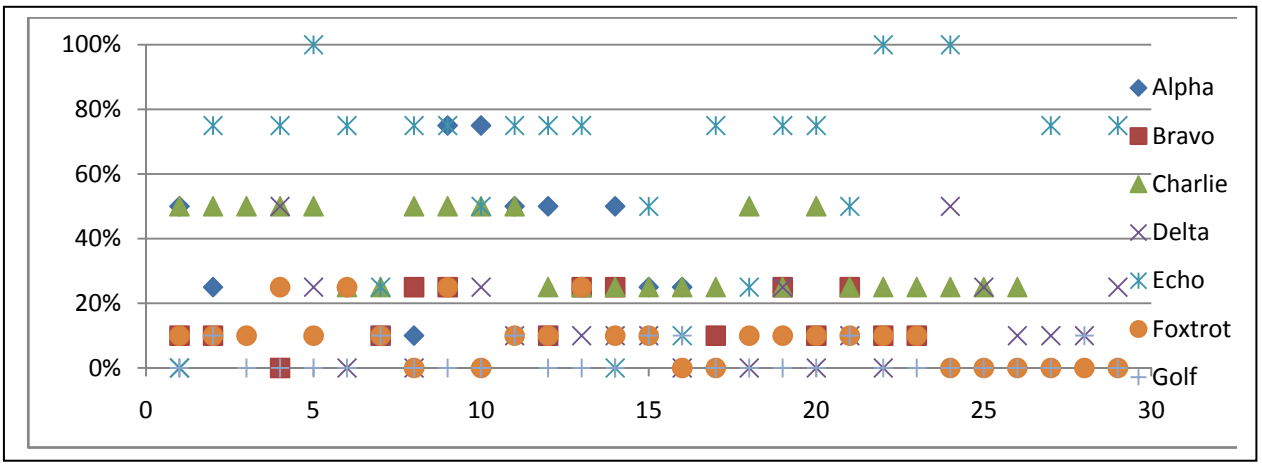
In the Vic-Maui crewed race, skippers reported that they would not be able to increase their speed at all, other than during a few boat damage situations. That is, every boat in the Vic-Maui was reported to be racing at 100% of potential for nearly the entire race. I believe, and my own extensive experience racing against crewed boats shows, that there is no reason why a singlehander should be sailing at anything less than the boat's full potential, at least while the skipper is awake.

A significant question in the survey was: "What percentage of awake time were you in "the zone" of sailing, able to concentrate on trimming, helming, etc. and not get distracted by other things? 10%, 25%, 50%, 75%, 100%?" A graph of responses is presented here:



Two results jump out. The vast majority of responses indicate that the racer was in "the zone" of sailing 50% or less of their awake time. The average rating amongst all skippers was 35%. The highest average was 66% and the lowest was 8%. Also notable are the wide swings within each skipper's results, jumping up and down by significant amounts in-between each report. This returns us to the earlier question of by how much could each racer have improved his average speed if he had been in "the zone" for an extra 25% or 50% of their time on the water? .

The opposite behaviour was also studied with the question "What percentage of awake time did you relax/read/watch movies/radio chat or just chill out?



It is abundantly clear from the survey results and from my own experience that there is a very strong tendency to let the autopilot "sail" the boat, rather than just "steer" the boat.

Given the percentage of time in the zone of sailing and the percentage of time relaxing, the question of each skippers satisfaction with their performance comes to fore. Question 2 asked "How satisfied are you with your performance over the past 12 hours: very disappointed(1), disappointed(2), neutral(3), satisfied(4), very satisfied(5)? The twice daily results are averaged below, together with the race ranking:

Charlie	1	3.35
Foxtrot	2	3.07
Golf	3	3.34
Alpha	4	3.79
Bravo	5	2.87
Echo	6	2.88
Delta	7	3.21

Boat Alpha had the highest satisfaction rating at 3.79, even though he placed 13th overall in the race. Even the race winner, Charlie, was only slightly higher than "neutral" about his performance over the duration of the race. Not one racer even reached the point of "satisfied" on average. The results show only a mild 30% correlation between performance satisfaction and final results. It appears that the skippers are reasonable but not excellent judges of their own performance.

More importantly, it shows that the mindset of the race acknowledges "neutral" as acceptable. This race is costing the skippers on the order of $9.43 for every passing mile, but not one of them drove himself or his boat hard enough to be "satisfied" with his performance. Perhaps if the racers had been in the zone of sailing for longer periods, had hit their potential speed more often and had relaxed a little less, they would have been more satisfied with their performance.

Having completed some 250 afternoon and evening races singlehanded, there were very few in which I was not satisfied with my performance even though I have rarely won. After each race I would know if I tried my best, and would analyze my performance for the next time. This is the type of strategy that should be undertaken after each 12 hour reporting period of a long distance race. Each skipper should make a decision on his level of satisfaction and adjust his performance over the next period accordingly. In the post race report, Golf commented "I compared what I was doing/seeing with my ideal of what should be done & then analyzed the gaps."

The next question, #3, was "How do you feel about the coming 12 hours: highly motivated, determined, relaxed, discouraged, dejected" Did the response to this pan out in the next 12 hours? The vast majority of responses to Q3 were "Determined". However there was a 38% correlation between Q3 and the following 12 hour period response to Q2. This is a medium correlation level on this type of question. It appears to some extent the skippers did adjust performance. However, there was no correlation at all between each skippers' responses to Q3 and their final race ranking.

Much of this paper has promoted the idea that a boat should be actively sailed to reach its potential speed. I believe this would be true even for the race winner; Charlie. Even though he only reported a potential for 0.1 knots of extra speed, one wonders if his laissez faire approach would have held if he had faced a competitor 100 metres away, i.e. if another skipper in an identical boat had been stuck on his starboard bow. Would Charlie have sailed that little bit harder to get away from the mystery boat? 0.1 knots is a significant distance when measured over 15 days.

Energy & Lethargy:

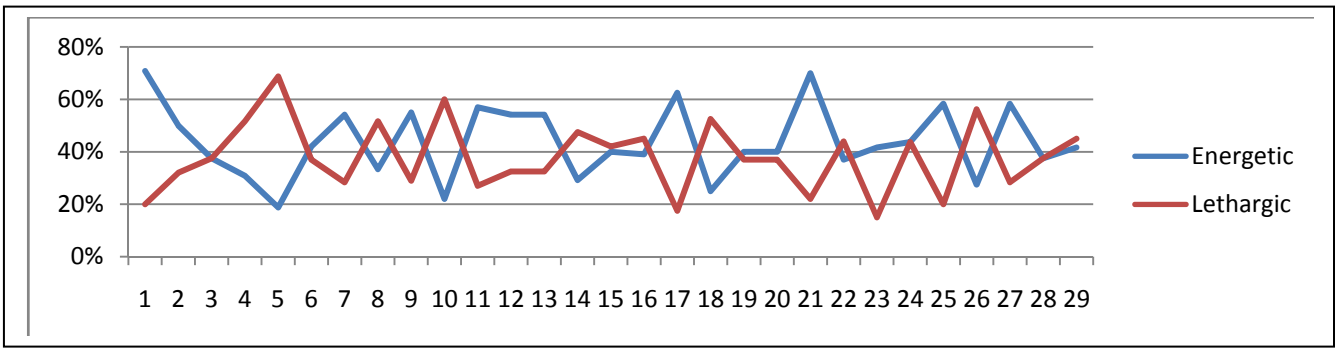
Surprising to first time long distance singlehanded racers it just how boring it can be. Once the initial euphoria of starting the race has past, the skipper faces the experience of having only his own company for days on end. This is probably the first time in his life with a total lack of someone to talk with. It is "small talk" that makes life bearable for the social human animal. When this boredom is added to the general lack of sleep prevalent in all singlehanded races and the heat of the tropical sun, it becomes a self-perpetuating cycle of energy drain and lethargy.

Lethargy is not the same thing as "tired" although they are related. Tired can be cured with sleep and we understand that lack of sleep is integral to singlehanded sailing.[xiv] It is also very possible to be tired and energetic at the same time, if necessity pushes the skipper to activity. In his first circumnavigation, Derek Hatfield was well past exhaustion nearing Cape Horn; "He had been at the helm for almost twenty-four hours and was so exhausted he could barely think…"[xv] But just a short time afterwards Hatfield pitch-poled and had enough of an adrenalin boost, lasting over several hours, to detach the broken mast and rigging and motor into the islands, all while fighting against forty foot waves.

Lethargy is better defined as being lazy, sluggish or indifferent. Lethargy is what a man feels when he lays on the chesterfield on a Saturday afternoon watching NASCAR on TV and is too much of a sloth to get a beer from the fridge, so he asks his wife. The problem is not lack of sleep, it is lack of motivation.

Lethargy is an absolute killer of boat speed because it pulls the skipper away from the tiller and sheets for long periods of time. Every time a skipper watches the telltales flutter, but knows that the situation will correct itself in 30 seconds or a minute, he is experiencing lethargy. Even worse, lethargy is what tells the skipper that he should go and read a book in the shade of the mainsail, rather than sit in the hot sun in the cockpit.

The study asked "What percentage of time feel energetic?" and "What percentage of time did you feel lethargic?" This graph presents the average results (with the boat Golf removed to be explained below).

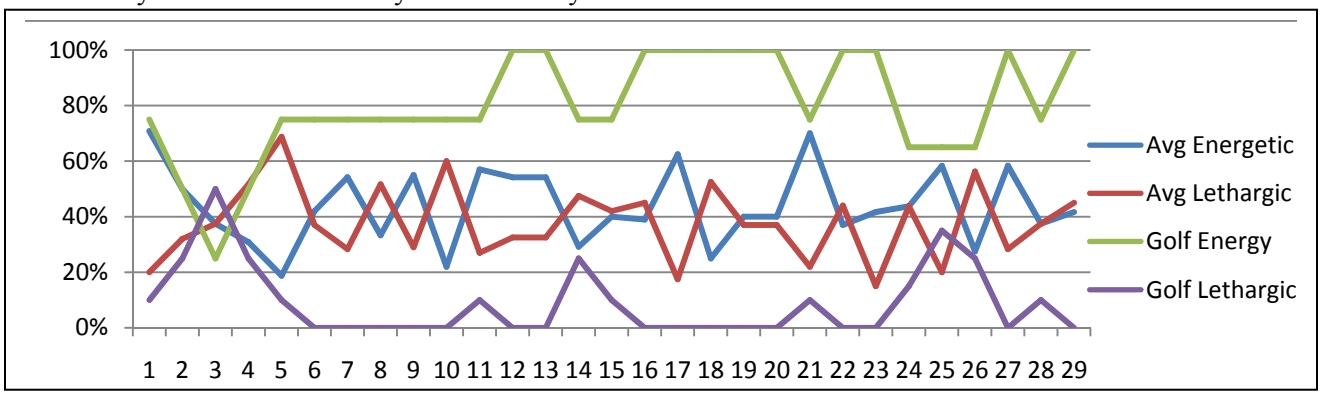


In this graph of the average results, the odd numbers on the bottom represent the evening reports covering the previous daytime. The even numbers on the bottom represent the morning reports, covering the previous nighttimes.

Moving from the left on the graph, first noticeable is the decrease in energy during the first three days of the race when skippers are facing rough weather and are operating on adrenalin, thus getting very little sleep and draining energy rapidly. Next is the clear decrease in energy and increase in lethargy each night, as noted by the up/down swings of the two lines. The peak at point 17 represents the evening report at the time when the largest number of boats is nearing or has just passed the mid-way distance of the race and boat Alpha is arriving at the finish. The energy level is evenly spread between 50%, 75% and 100%. At point 21, four of the five boats left in the race reported 75% energy. The other boat reported 50% energy. This was the most consistently high energy level in the race.

Energy level has a medium (32%)[xvi] correlation with sailing aggressively when all data points are compared. This jumps to 43% if Charlie is ignored. Charlie reported the highest level of aggressive sailing. However he noted: "Heavy boat that doesn't surf is relatively easy to keep at full speed - a .1 change in boat speed for a non surfing boat is quite a bit. I also noted from discussions with others that very few people had full sail area 24x7 (full main, big jenny, then chute). Lots of folks mentioned reefing in day 2 and 3 - and taking down the chute for hours each day if not all night. I had the chute up 24 hours a day for ten straight days. Rode out every squall (maybe 15 of them?) with the chute up (though takes specific squall strategy to make this work). Basically I had all the same sails up as I would if fully crewed. Also my autopilot with gyro helms better than most of my typical PacCup crew. The boat was set-up to sail near full speed without my being at the helm - and the reduced crew weight made her faster than in a crewed race in many conditions." So it appears that Charlie was able to sail very aggressively without a high energy level.

Improving Energy: The skipper of Golf reported the highest energy and lowest lethargy levels by a wide margin. Before the race and as a part of the study, Golf's skipper was instructed in three techniques for improving energy. This graph is a comparison between Golf and the other racers. Clearly he was showing far more energy and far less lethargy than any other racer. This result is a very significant part of the study and should be clearly understood by all future racers.



Golf was instructed in a program of: iron supplements; nuts and moderate exercise:

Iron:[xvii] Iron is an essential component of proteins involved in oxygen transport. A deficiency of iron limits oxygen delivery to cells, resulting in fatigue, poor work performance, and decreased immunity. Almost two-thirds of iron in the body is found in haemoglobin, the protein in red blood cells that carries

oxygen to tissues. Golf took off-the-shelf multivitamins with iron for the three weeks prior to and during the race.

Nuts:[xviii] Nuts are loaded with protein, a great source of energy, but it tends to work more slowly than carbohydrates. Protein does not provide a quick energy fix, but it keeps us going for the long haul.

Another nutrient found in nuts is coenzyme CoQ10. This is a nutrient that helps our cells produce energy. It is also an antioxidant, which means that it protects our cells from damage caused by oxidative stress. Our bodies produce some CoQ10 naturally, but the amount decreases with age.

Nuts also contain Omega 3 fatty acids, a category of unsaturated fats which provide energy to the muscles and organs. They also store energy for the body and help lower LDL, the so-called "bad" cholesterol. Nuts are one of the best sources of this class of fatty acids.

Golf ate a cup of cashews, almonds and peanuts daily as his snack food.

Moderate Exercise:[xix] Exercise will help to increase energy levels in both the long and short term. In the short term doing a little exercise helps greatly by getting the blood pumping around the system and the oxygen flowing. If a racer is feeling lethargic then chances are that the system is static and not pumping that blood around. Jumping around a bit to 'kick start' the body back into action and start to feel vigorous again.

I have found a very significant immediate energy boost simply by walking in place in the cockpit for just ten minutes and only lifting my feet by a few inches. The goal is to get blood moving to the brain, without exhausting the body. Thus moderate exercise is more appropriate to the long distance singlehander than vigorous exercise. Golf reported increased energy from daily running in place in the cabin while holding onto the ceiling grab rails.

Another natural energy supplement, but not tested during this study is Ginseng Root: [xx] A Mayo Clinic-led study found that high doses of the herb American ginseng over two months reduced cancer-related fatigue in patients,. At four weeks, the pure ginseng provided only a slight improvement in fatigue symptoms. However, at eight weeks, ginseng offered cancer patients significant improvement in general exhaustion — feelings of being "pooped," "worn out," "fatigued," "sluggish," "run-down," or "tired" — compared to the placebo group. "After eight weeks, we saw a 20-point improvement in fatigue in cancer patients, measured on a 100-point, standardized fatigue scale," Dr. Barton says. The herb had no apparent side effects, she says.

I believe that the lethargy experienced during a long distance race is comparable to that felt by a cancer patient, so the Mayo Clinic study into the benefits of ginseng are appropriate for singlehanders. Ginseng is the active ingredient in the energy boosting drink Cheetah Power Surge that promises rapid energy with "no caffeine and no caffeine crash."[xxi]

Carnitine[xxii], also not a part of this study: "Patients taking chemotherapy drugs can deplete levels of carnitine, a natural substance in the body. Scientists at the Urbino Hospital in Italy found that a pineapple-

flavored drink containing a compound called levocarnitine, which the body converts into carnitine, helped most patients recover from their fatigue within a week." Carnitine is also available in energy boosting drinks.

In the crewed Vic-Maui race, the skippers reported that their on-deck crew was operating 100% energetically for most of the reports, with the occasional dip down to the 75% energy level. This is obviously substantially higher than the reports for the singlehanded race and may be a key reason that there was no room for speed improvement in the Vic-Maui boats. Clearly energy is important to racing and any steps a skipper can take to improve energy will not only improve his speed, but will also substantially improve his emotional state during the race.

Mindfulness:

The current state of the art in the psychology of athletic performance enhancement is based on the concept of "Mindfulness". In brief, mindfulness is a condition where the athlete is able to engage in a present-moment focus on the task at hand for extended periods without distraction from extraneous factors. It does not attempt to block these extraneous factors. Rather it allows them to pass through the athlete's mind with no effect. That is, they are simply passing events no more important than a bird flying overhead. If a sailor can allow a seagull to fly past with no impact on his concentration, can he allow any other thoughts to also fly past with no distraction?

We should consider driving a car for long distances, perhaps an eight hour trip of steady driving with just one bathroom break. For the length of this trip we are able to concentrate on keeping a vehicle in between the white lines that are only one metre on either side, while we are driving at 100kph with other cars driving in the opposite direction just two metres away. Somehow thousands of drivers, in particular long-haul truck drivers, perform this act of mindfulness every day.

During this eight hour trip a thousand thoughts pass through our mind: "Do I need to move money into the chequing account to make the mortgage payment; my arm aches; I've got to fix that leaky gutter." Each of these thoughts passes and is considered briefly before being shunted elsewhere. Our mind has given itself the ability to complete an incredibly complex task, driving at 100kph, with many thoughts passing harmlessly and not impacting the necessary concentration. At any moment we can react immediately to a deer running across the highway.

However, once in a while a more significant thought enters the mind: "Is my wife having an affair? She seems to be on the phone every night and has been spending a lot of time at the yacht club. What is she doing right now?" It is during these periods when we do not have the solution within our own consciousness that the world seems to pass by without notice. All of our concentration is focused on the issue and not on driving. These are the times when we hit a deer or drift across the white line into oncoming traffic. This is also the reason that talking on a cell phone is so dangerous; it allows extraneous factors to become the 'present-moment focus' instead of remaining engaged in the act of driving. Distracted driving is virtually tied with alcohol and speed as the leading cause of traffic death. One can imagine how difficult it would be for a golfer to hit the perfect shot if someone in the crowd shouted, "Your wife is having an affair!"

In some activities, mindfulness must be taken to the extreme. For example in professional golf the athlete must be absolutely perfect for the 10 seconds up to and including the swing. A golfer who is 99.9% perfect would never reach the professional ranks. On the other hand, in professional truck driving, engineers have designed roads and vehicles to allow for a significantly lower threshold of acceptability. How much more mindful would drivers need to be if the highways were two metres narrower?

In the same way, mindfulness also refers to attention to the present moment rather than allowing the mind to wander into the past or future. Returning to our roadway example, five minutes ago the driver needed to cross the centre line while passing a group of cyclists. Likewise the weather forecast calls for heavy rain this afternoon and he will need to be more cautious. The driver's awareness of these past and future situations does not cause him to drive off the road now. His mindfulness of the current situation keeps him driving safely for every moment of the trip.

Thankfully, in singlehanded sailing the threshold of required mindfulness is even lower than for driving. Technology in autopilots enables us to completely ignore sailing altogether. We can actually go to sleep while the boat continues to sail. But this is a two edged sword. In high performance racing, technology has become the problem rather than the solution. In allowing us to walk away from the tiller, it has allowed us to walk away from all the aspects of sailing that make the boat go fast.

An interesting comparison can be made with the America's Cup World Series. The level of concentration required by the entire crew in those short duration races equals that of professional golf. For example, if a crewman were to fumble pulling in the jib sheet because he was distracted by his wife's affair, his boat would fall behind by just one boat length – enough to lose the race. Even at the highest level, long distance singlehanded sailing does not require the mindfulness of a golfer about to make the perfect swing or an ACWS crewman in mid-tack. It would be more accurate to say that a long distance singlehanded sailor is very well served with the mindfulness of a truck driver. All he needs is stay within the white lines (i.e. keep the inside and outside telltales flying with each change in wind direction) while he adjusts his foot on the gas pedal for every hill and valley (i.e. trim or ease the sheets with each change in wind strength). Thankfully the singlehander is not likely to cause an accident and death even if he does ignore the telltales completely.

Mindfulness-Acceptance-Commitment (MAC) approach: In earlier years, sports psychologists considered that optimum performance would be obtained by the avoidance of destructive thoughts; that is negative thoughts or emotions should be controlled, eliminated or replaced. This was based on studies that showed high performance athletes are less anxious, more confident and experience fewer negative thoughts. What followed was the assumption that interventions should work to replace negative thoughts with positive thoughts. Unfortunately, subsequent studies did not show that a reduction in negative thought consistently resulted in enhanced performance. In fact they showed that the suppression of one negative thought actually resulted in a triggering process whereby the athlete actively searched for signs of negative cognitive activity and then brought these to the forefront where it could subsequently be suppressed. I.e. the mind was being trained to seek out and destroy negative thoughts, but this only ended in more seeking and thus more finding of negative thoughts. The result was that rather than concentrating

on the important task at hand (swinging a golf club), the athlete's mind was more concerned with the seeking/destroying process. Further difficulty arose from the tendency of people to connect these internal negative thoughts with the behaviour with which they were connected. For example if negative thoughts were summoned during practice sessions, an athlete would avoid practicing in order to avoid the negative thoughts.

The current proposal is to advocate the acceptance, rather than suppression, of these destructive thoughts. Internal thoughts are viewed as naturally occurring events that regularly come and go in normal experience. Mindful based techniques emphasize the development of non-judgmental attention to all of these thoughts. That is, all thoughts are noticed but not evaluated as being good or bad, right or wrong. This allows the thoughts to pass without impacting on performance. To give an extreme example, the thought "my wife is having an affair" has the same value level as "I need to moving money from savings to chequing to make this month's mortgage payment" and "I need to fix the gutter." I.e. they all have no value at all. None of them are good or bad. None of them are right or wrong. Thoughts remain simply thoughts – words in our heads. Our present-moment focus, then, can more easily be trained on our actions: sailing the boat.

Of course it is not only thoughts from outside the race that can lead to distraction. A hundred considerations within the race itself can lead to the same negative effect. "I'm hungry; this seat is damned uncomfortable; Jim has gotten way ahead and I'll never be able to catch him; I screwed up on my weather forecast and went too far south; I'm worried about the squalls tonight." Each of these might distract a skipper and take his mind off of the key goal of sailing fast. But the skipper who practices the concepts of mindfulness will let each current issue pass by without any value judgement, and will concentrate on the here and now, rather than dwell on past mistakes or future worries.

Emotional flare-ups are common in long distance singlehanding. Racers report intense crying jags lasting several hours during which real or imagined external and internal factors take control of the mind.[xxiii] This is exactly the type of situation where mindfulness can be of benefit. The skipper can learn to allow the thought "I miss my wife" to pass by with the same non-value attachment as the seagull flying overhead.

Once we have accepted the premise of this paper, that it is better to actively sail the boat rather than letting the autopilot do all the work, the ideas behind mindfulness allow the singlehander to stay at the helm or on the sheets for longer periods. If the skipper is able to maintain the level of mindfulness of a long-haul trucker, with his eyes on the telltales and his hands on the sheets or tiller, he will be able to sail much faster than the skipper who allows himself to be constantly distracted.

I am not proposing that singlehanders hand steer for the entire race. I am suggesting that skippers share the load with the autopilot for as long as possible, in the same way that the pit-crew shares the load with the helmsman on a crewed boat. There are times when allowing the autopilot to steer while working the sheets would be most beneficial. There are other times when hand steering would add the greatest speed.

Competition

One of the most common maxims in sailing is that a race occurs any time two boats are in sight, moving in the same direction. Every skipper has a natural inclination to show that he is as good as, or better than the skipper in the next boat. In almost any sport, racers are told to train against a partner because it will set up the natural competitive instinct of every human being. Unfortunately, the corollary is that no race occurs when there is no other boat.

A significant problem in long distance sailing is the lack of any competitor in sight. After the first few hours of the race, each boat is on a seemingly empty ocean with nothing on the horizon but seagulls. The fact that each boat is taking a different route to the finish, and that each boat is racing with a different handicap rating, add to the problem. It is exceedingly difficult to maintain a competitive attitude in these circumstances. Twice daily position reports, with latitudes and longitudes hand written on a pad or plotted on a chart, do not offer a level of incentive to racers.

The feeling is that on a crewed boat, energetic crewmates will push each other to higher performance with different crewmates taking the encouraging role at different times and no crewman wanting to be seen as slacking. This would be another reason why crewed boats in the study were energetic nearly 100% of the time and could not add to their average speed by being in the perfect racing frame of mind. They are already in that frame of mind.

Racers can take several steps to increase the feeling of active racing and thus keep themselves at the highest level of performance.

First, while seated in the cockpit with a hand on the tiller or on the sheets, skippers must keep a constant eye on the knot meter. It is very easy for speed to drop by ½ or 1 knot with no audible change in water passing by the boat. Speed drops at this level are a constant part of sailing, even with an autopilot. Skippers must watch the knot meter and make the immediate corrections to sail trim and heading to maintain top speed. A few minutes here and there with the speed at one knot below optimum can quickly add up.

Second, each skipper must have a copy of her boat's polars on hand and must push to sail to the polars. These graphs represent the best possible speed for each boat design and will give the skipper immediate feedback on her sailing ability.

Third, sail to the best possible speed of the moment. I find it best to watch the knot meter looking for spikes of speed, and then sail to match these spikes. For example if while sailing at 5.9 I notice a spike to 6.2, I will do everything possible to regain and retain this level. I say to myself, "if I can reach 6.2 once, why can't I do it continuously?"

Racing against reports Most races allow for only twice daily reporting of positions. It is vitally important for every skipper to record all of the competitors' positions so that he has a ready reference to how he is doing. Nothing could be more disappointing than to lose a race by a small amount only

because the skipper did not even know how close he was. Such a record might not be useful to close a 10 hour gap, but it would certainly be useful to discover a 1 hour gap that could be overtaken.

Handicap racing provides the extra challenge in that the closest competitor's boat might be a day or two in front or behind. The final result is only known when the corrected time is taken. For example in the SH Transpac, the overall ranking for 3rd and 4th place was a difference of 2½ hours on corrected time, or 0.1 knots. However the handicap ratings were such that the 3rd place boat finished 2½ days after the 4th place boat. I have developed a spread sheet methodology that takes the handicap rating into account and allows each boat to know their standing at any point in the race.

The calculation:

- At each report of the race, take the actual miles sailed towards the finish line by each boat up to that point in the race. This can be done by subtracting the total race length from the Distance to Finish. (We are only concerned with each boat's speed toward the finish, not any extra miles they cover to gain a weather advantage.)
- Take all of these numbers and average the result for all the boats. Set this average mileage as a "Standard Race".
- Divide the actual distance travelled towards the finish line by the actual time of the race to find the Actual Speed of each boat on the race to date.
- Based on their Actual Speed, calculate each boat's corrected finish time for the Standard Race.
    - Use the normal Time-On-Distance formula to calculate each boat's Corrected Time for the Standard Race.
      The time-on-distance formula is: TA =(Standard Race Length x PHRF)/ 60
      Actual Time – TA = Corrected Time
      At this point we have the Corrected Time for each boat in the Standard Race.
- Divide the Actual distance traveled by each boat by its Corrected Time. This gives the Corrected Speed for each boat.
- Multiple the Actual Hours since the start of the race by each boat's Corrected Speed. This will give a Corrected Distance traveled by each boat.
- Compare the Corrected Distance for each boat to determine the relative placing of each boat at any point in the race. This should give a fairly good indication of how many corrected miles sits in between each boat in the race.

The above calculation is long, but it can easily be set up in a spread sheet before the race and only the DTF figures need be entered at each report. The spread sheet will instantly output the result.

Race against herself. Top level marathon runners use this method when competitors are out of view[xxiv]. Each runner knows their own potential speed (like the polars of a boat) and uses a stopwatch to pass mile-markers on the race at a specific rate. They can break a race down to individual miles of running and work to match their best possible performance for each mile. A singlehander can use the Man Over Board feature on their GPS and a stopwatch to help with this process by setting up a continuous series of 20 minute races. The skipper pushes the MOB button and takes one of two approaches: She can watch for a specific distance to pass, two nautical miles might be appropriate, and time the duration of her race. Or she can sail for a set period, such as 20 minutes, and watch the distance covered. She must

immediately write the result down on a white board in the cockpit. This is important to provide a challenging visual competitor. After she does this once, she immediately does it again, and then again, and again, and again continuously. Ideally, the distance or time differences for each race segment will be very close to each other. One should think of short around-the-buoys races where competitors are only separated by a boat length or two.

Each past race segment represents a new competitor against whom she is racing in the current segment. If she betters the last race segment, she wins that little race. If she does not match the last segment, she loses the race and must try harder the next time. She should do a series of nine of these race segments over three hours before taking a break. Each segment represents a new competitor's boat on her course, so she must write down every segment result on the white board. After nine segments in the morning, she can take a sanity break to get something to eat, before starting the process again for her afternoon race series.

She should look at each three hour period as an intense set of races, just like a set of round-the-buoy races at her yacht club. And she should dedicate the same level of concentration and intensity to it.

Two considerations are important. The distance or duration of each race segment must be sufficiently short that it does not allow the skipper to leave the tiller and do other functions, like get a coffee. These periods are intended to be intense, short duration races where the skipper concentrates solely on boat speed. However they should be long enough that normal fluctuations in wind do not impact the performance over the entire duration of the race. Inside each segment she can watch the knot meter to try to match her highest speed, but knowing that more important than staying at 6.2 is cutting down the time needed to cover 2 nautical miles.

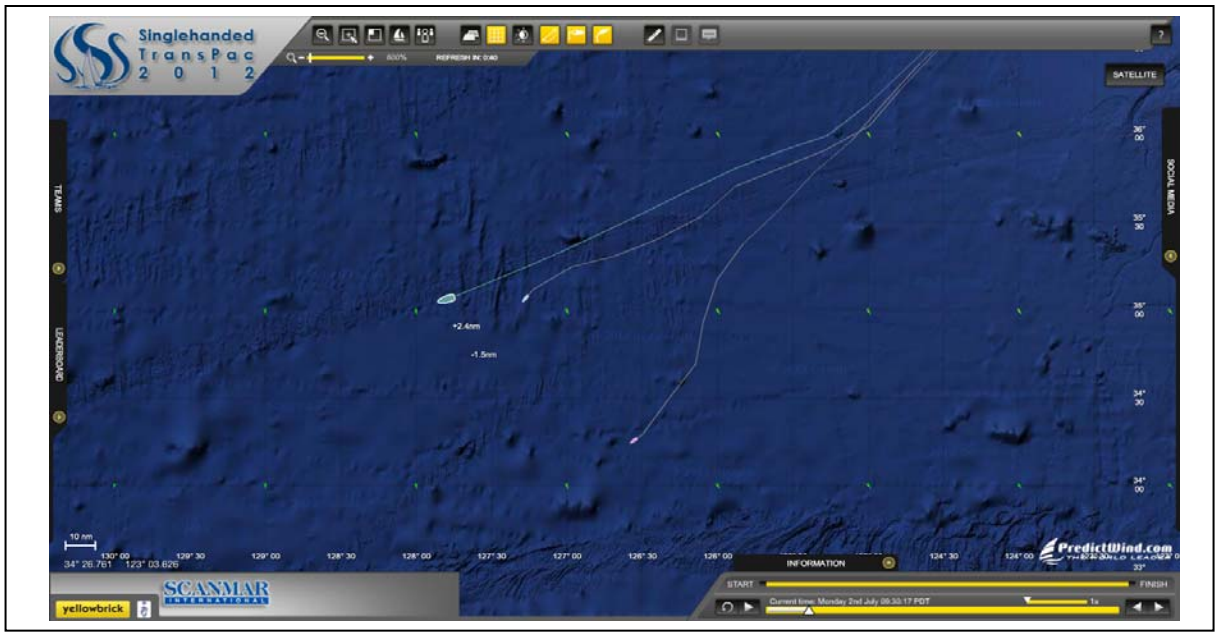
Sea and wind conditions might change over the entire three-hour race period, but they will not change sufficiently from one segment to the next to nullify the comparison.

Also the skipper should not make any course changes during the three hour race series. This idea is to cover the greatest possible distance on a particular point of sail. A runner would not include a flat and a hill within a 1 mile measurement. Likewise a sailor should not include any course changes. A course change would slow the boat and the race result would not be measurable against the other segments.

Autopilots: the weakest link in the chain

There is a second reason why sailors must understand the need for non-reliance on the autopilot; because it is the least reliable piece of equipment on the boat. In some cases, the autopilot cannot handle the wind/wave conditions facing the boat. This was the situation facing the boat Hotel in the Transpac. Quoting from the logs. "I was so exhausted last night I let the boat go way south in exchange for 3 hours of solid sleep. On my planned heading, the autopilot kept rounding up every time a gust or big wave hit, which meant no sleep"

This change in direction to head south cost Hotel 40 nautical miles in distance to finish compared to India and 27 nautical miles compared to Juliette over the next 14 hours. (See course chart below) All three boats were in close proximity and facing the same weather conditions before Hotel headed southward. In other situations, the entire electrical system fails. Boat Kilo reported "With no solar power and fully



depleting my batteries in the first two, I was left to hand steer with no other real alternative if I wanted to keep racing. I hand steered 60 out of 72 hours for a 20 hour/ day average over 3 days. I hit my mental and physical breaking point a few times, dropping both sails and collapsing in the cockpit.

It is difficult to imagine how a marathon runner could expect to win if he decided to stop running and rest on the park bench for a couple of minutes. The solution to this situation is amazingly simple and well known, requiring nothing more than a $3 piece of surgical tubing.[xxv] While this emergency self steering system is not claiming to be as fast as an autopilot, it is a lot faster than dropping sails and sitting adrift.

In other situations: "Wind! Finally it decided to show up! 18-22 knots. Boat speed averaging in mid to upper 8′s all night, recklessly over-canvassed. Autopilot could not keep up and would begin oscillating the boat horribly." And: "Autopilot was too slow to drive with spinnaker in moderate seas and 20 knots of breeze. I remember being below, feeling a roundup coming and sticking my head out to look at the autopilot and yell: "You got that?" Much of the time, the answer was no." And: "When one of the squalls passes the wind speed picks up and the boat wants to round up and the auto pilot can't handle so I jump on to hand steer again." And "The autopilot is leaving a bit to be desired with the spinnaker up. So far, I figure that I'm about 20% faster than the pilot on average. That really hurts when it comes to standings in the race." My own experience is very much the same. It is a known fact that all auto pilots have limits when a boat is being pushed to its maximum. Competitive racers must accept that there will be many hours when they must steer with one hand and keep the other on the sheet. The speed of the boat must be determined only by what the boat, sails and skipper can handle, not by the autopilot – the weakest link in the chain.

Included in the pre-race questions was, "Are you confident that you can handle a significant event, such as breaking the mast half way up?" Three racers answered Very Confident, three answered Confident and one answered Neutral. So it was surprising to see that the skippers were prepared to manage the very rare and traumatic event of breaking a mast, but seemed not at all prepared to manage the very common problem of electrical system or autopilot failure.

Skippers must understand the overwhelming requirement that in order to win, they must keep moving towards the finish line. Small equipment failures are a normal part of racing and every skipper must be able to handle them without slowing.

Comfort

If one was to design a method of torture; sitting on a hard piece of plastic, covered in 40-grit sand paper, sixteen hours a day in soaking wet pants, would be an effective starting point. Round-the-world singlehanded racers are known to install very comfortable executive chairs reminiscent of Captain Kirk inside the cabin. This only encourages the skipper to spend more time out of the cockpit and away from actually sailing the boat. It is very rare for anyone to make even the smallest adaptation to the cockpit to allow for comfortable seating hours on end. Professional race cars install ergonomic seats designed specifically for each driver in a race that lasts only three hours. But singlehanded sailors are expected to sit on a section of ridged, stippled plastic for the duration of a transoceanic race. The sheer pain of it will drive even the hardiest skipper away from the tiller after a few hours.

If we accept that effective racing includes actually sailing the boat for extended periods, then skippers must take steps to improve cockpit comfort for long duration sitting. Such seating must be comfortable on the bum, provide proper back support, allow for the movement necessary to sail the boat and have sufficient drainage to remove water immediately. Homemade solutions include cutting the legs off of a plastic deck chair and adding wooden cross slats with carpeting on the bottom. Another solution is a bean bag chair using closed cell foam pellets and lawn chair fabric. West Marine offers a Go-Anywhere seat that seems to provide back support.

Conclusion

This has been the first in-depth study done specifically on the psychological factors required to win a long distance singlehanded sailboat race. The study showed a very strong correlation between sailing aggressively and final race ranking. This result was backed up with a study from the Iditarod dog sled race showing that the most aggressive mushers had a better finish than those less aggressive.

The study also showed that typical singlehanded skippers are "in the zone" of sailing only a third of the time of crewed boats in a similar race. I believe that by increasing their time "in the zone" and active involvement in sailing the boat in order to achieve small increases in average speed, skippers can significantly improve their final result. Records prove that even an incremental increase in average boat speed can improve race ranking by as much as ten positions.

[i] Eg. "Iron War: Dave Scott, Mark Allen, & the Greatest Race Ever Run"; Matt Fitzgerald, 2011, Velopres. Marathon, The Ultimate Training Guide; Hal Higdon, 1999, St. Martin's Press

[ii] Eg. "Medical and psychological problems in the 1972 singlehanded transatlantic yacht race" Glin Bennet, The Lancet, 1973.
"Stress and Coping in Single-Handed Round-The-World Ocean Sailing"; Neil J.V. Weston, et al, University of Portsmouth, UK, Journal of Applied Sport Psychology, 21-2009
"Voluntary Solitude: Studies of men in a singlehanded Transatlantic sailing race", H.E. Lewis, J.M. Harris, D.H. Lewis, C. De
Monchhaux, The Lancet 1, 1964

[iii] Eg. "Taking on the World – A sailors extraordinary solo race around the globe" Ellen MacArthur, International Marine/ Ragged Mountain Press, 2004
"Sea of Dreams" Adam Mayers, McClelland & Stewart, 2006
"The Strange Last Voyage of Donald Crowhurst", Nicholas Tomalin, Ron Hall, International Marine/Ragged Mountain Press, 2003

[iv] www.Gitana-Team.com, Gate Hopping in the Deep South, 2008

[v] www.ArtimusOffshoreAcademy.com

[vi] http://iditarod.com

[vii] www.singlehandedtranspac.com

[viii] "Thoughts, Tips, Techniques & Tactics for Singlehanded Sailing" Andrew Evans, Self e-published 2010

[ix] A correlation of 0.5 might be regarded as strong in social science situations (e.g. where the measures are based on 5-point Likert scales)
wiki.answers.com/Q/Would_a_0.5_correlation_be_considered_weak_modest_strong_or_very_weak

[x] Personality profiles of Iditarod mushers as compared by finish group. GO Dean, NM Dean, A Turner. Arctic Sports Medicine / Human Performance Labgoratory, University of Alaska, Anchorage, 1989.

[xi] http://en.wikipedia.org/wiki/16PF_Questionnaire

[xii] www.youtube.com: "Telefonica Big Wave Crashes, Volvo Ocean Race 201-2012

[xiii] Boat polars: A graph produced for a particular boat showing the maximum possible speed for every wind angle, wind speed and sail combination assuming all other conditions are optimum.
See http://www.pro-charter.com/english/polar.htm

[xiv] Op Cit Evans, pg 2-10

[xv] Sea of Dreams, Adam Mayers, McClelland & Stewart, 2006

[xvi] It becomes challenging to measure the correlation between two data sets that are both based on reported opinions. A 50% correlation would be considered weak in a strict mathematical comparison, but is considered stronger in social science situations.

[xvii] U.S. National Institutes of Health, Office of Dietary Supplements, Dietary Supplement Fact Sheet

[xviii] http://www.workingwellness.com/fitness-&-excercise/nuts-to-increase-energy.php

[xix] http://www.healthguidance.org/entry/16197/1/Fighting-Lethargy.html

[xx] http://www.mayoclinic.org/news2012-rst/6907.html
[xxi] http://www.cheetahpowersurge.com/

[xxii] http://www.prescriptiondrug-info.com/drug_details.asp?title=Levocarnitine&ad=true
http://health.groups.yahoo.com/group/experimentalandunconventional/message/460

[xxiii] Op Cit Evans, pg 2-1

[xxiv] The Lore of Running – 4th Edition, Timothy Noakes, Human Kinetics, 2002

[xxv] Op Cit Evans, Chapter 5

Chapter 9: See and Be Seen

Navigation:

There are numerous reference books on navigation. I will concentrate on the only aspect of navigation that is of particular challenge to the singlehander – navigating in tight quarters. The singlehanded sailor should own a hand-held, chart plotting GPS.

Experience has shown that it is very difficult for a singlehander to refer to paper charts when sailing, or even motoring, in tight channels or shoal littered waters. It is extremely difficult to follow a position with one finger on the chart and the other hand on the tiller, especially during tacks. These tasks are easy on a crewed boat, but nearly impossible for the singlehander. If rain is added, then the chart will be kept below deck where the skipper can't see it at all.

A flush mounted, chart-plotting GPS is suitable only if it is clearly visible from the tiller.

A hand held, chart-plotting GPS is the best solution. It allows the skipper to follow his position precisely relative to any navigation hazards. The skipper can hold it in his hand and closely examine the location of buoys or rocks ahead.

The major caveat is that the GPS should be zoomed-in to clearly show all hazards. Some units do not show all hazards when they are zoomed-out. I know of one boat that ran on a rock that was not shown in the macro view on his GPS. After hitting the rock he selected a micro view and the rock was clearly marked.

With the advent of I-Phone type devices, chart plotting GPS units have become less expensive and more readily available.

Maintaining a Lookout

The International Regulations for Preventing Collisions at Sea, Rule 5, state:

- Every vessel shall at all times maintain a proper look-out by sight and hearing as well as by all available means appropriate in the prevailing circumstances and conditions so as to make a full appraisal of the situation and of the risk of collision.

Obviously, it is impossible for a singlehander to abide by the letter of this rule. This is a significant controversy in the sailing community:

Troubled Waters: Bernard Hayman,
For 19 of the 35 years that I worked for the magazine Yachting World, I was a member of the UK Safety of Navigation Committee. During those 19 years I never met a single professional mariner be he a shipmaster; a pilot; member of the Nautical Institute; of Trinity House; the RNLI; or what is now the Marine Safety Agency who did not consider that long distance single handed sailing was unlawful. Thus I am dismayed to see a singlehanded Trans-atlantic event promoted by the RIN. Of course I am aware that single-handed events exist but by what right do these 'adventurers' claim that Rule 5 the requirement to keep a proper lookout need not apply to them. If anyone can offer a valid reason why Rule 5 should be rewritten, I should be interested to hear it. Until it is rewritten it is like any other rule in COLREG and should be obeyed. The RYA summed up the situation in its comment: 'This is the most important Rule. If it is not observed, the rest of the Rules might as well not exist'.

Even if we recognize that a singlehander can not live within the letter of the rule, is it possible to live within the spirit:

Reply by Michael Richey:
My good friend Bernard Hayman's memory on this occasion seems a bit selective. I too served on that Committee for many years and was far from aware of being isolated in holding that single-handed sailing could be compatible with the Collision Regulations. Rule 5 ('Every vessel shall at all times maintain a proper look- out...') is entirely concerned with the risk of collision so that in the (hypothetical) situation where no such risk exists, it can have no application. From this it is not a long way to saying that where the risk of collision is small, some relaxation of vigilance can be accepted. As one of the authors (Cockcroft) of A Guide to the Collision Regulations put it, no one would admonish a ship's master experiencing continuous fog in the North Pacific Ocean over several days for failing to sound his whistle every two minutes throughout the 24 hours. In other words safety at sea is the criterion and the Regulations should be applied with common sense. The views of the International Association of Institutes of Navigation, incidentally, as submitted to the International Maritime Organisation on this matter and IMO's comments on them are printed in the Journal for January 1979.

Whether we live within the spirit or the letter, we are the only ones who will suffer in any case:

On the Lookout: Dag Pike
Bernard Hayman in his letter (above) is concerned about single handers flouting the Colregs by not keeping a lookout all the time. The Colregs are flouted by virtually every vessel at sea, particularly small craft. It may be navigation lights not meeting requirements, not sounding fog signals, simply keeping out of the way of larger ships etc. In this radar-governed world, when did you last hear a ship sounding fog signals? Most people, including single handers get away with it and I could be cynical in saying that the Colregs are not there to govern our behaviour at sea but are only so that there is someone to blame when things do go wrong. In the current lawyers paradise where we need to sue someone when an accident happens, the Colregs perform a vital role. In the practical world, I see no problem with single handers keeping the level of lookout they feel comfortable with. After all, they will be the ones to suffer if a collision occurs.

Two recent encounters between singlehanded boat and ship come to mind:

Jessica Watson: In the 2009 run-up to her round the world voyage aboard the 10.4 metre sloop "Ella's Pink Lady," the Australian 16 year old laid her head down for a moment and struck the 225 metre bulk carrier Silver Yang. The mast was destroyed and Jessica motored back to port.

(Note: The IMO reported, June 2010: The Australian Transport Safety Bureau said the Chinese crew of the bulk carrier Silver Yang did not offer any form of assistance to the skipper of the Australian registered singlehanded yacht Ella's Pink Lady following a collision in September 2009. The report said the Silver Yang's second mate and a seafarer had been on duty on board the ship's bridge but had not seen the yacht until two and a half minutes prior to impact. At first the crew thought the yacht to be a bouy but by the time they realized otherwise, it was too late to avoid a collision.)

Louis Burton: During the 2010 Route du Rhum on his Class 40 boat "Bureau Valleé." At about 5:00am, while sleeping, Louis hit a Portuguese trawler. According to first reports, the trawler had no one on deck and no watch standing. Louis's bow sprit was shattered and a breach in the hull, but forward of his water tight bulkhead. His pulpit, stanchions, lifelines and spinnaker were also destroyed. Louis continued in the race.

In both of these encounters the singlehanded yacht suffered extensive damage while the ship did not report a scratch. Dag Pike's comments above appear to hold true: "after all, they (the singlehander) will be the ones to suffer if a collision occurs." This suffering might be physical, or it might be financial when the lawyers get involved. But I tend to agree that we are the ones who will suffer.

A very good friend of mine recently started a long voyage. I reminded her that if her only goal was to "stay safe," she would not be doing it in the first place. Singlehanded sailing is a necessarily dangerous activity. We do it because the enjoyment we get outweighs the risks.

Obviously a sailor must sleep, even if for 20 minutes at a time. Most singlehanders will also spend a significant amount of time below deck navigating, studying weather charts, cooking, reading and even just to stay out of bad weather. The more comfortable that the boat is below, the longer the singlehander will stay below.

In the open ocean, away from major shipping channels, the chances of hitting another vessel are extremely slim. Unfortunately, most voyages do not cross the open ocean. As I've said elsewhere, while we all dream of crossing the great oceans, ninety-five percent of our trips will be within a few hours or a few days of our home port. This means that ninety-five percent of singlehanding is done in the middle of the most active shipping lanes, mixed in with freighters, cruise ships, tug boats with barges on a quarter mile of cable and fishing boats dragging miles of net. Although we would love to remain purists with only the wind at our backs, the desire to continue living means that we must take precautions.

Technology has lept ahead in the past decade with a number of user friendly mechanisms enabling singlehanders to keep a good watch while below decks and even while sleeping. There are skeptics to every single one of the solutions offered below and their skepticisms are valid. If used in combination, these solutions will provide as close to perfect protection as is technically possible.

Radar offers the ultimate in protection, at the greatest cost and complexity. The least expensive radar systems start at $1,000, not including the many accessories needed to mount the unit and the screen to view the output. The real cost is in power consumption of at least 33 Watts. This can be minimized by only using the radar when below deck and setting the system to activate once every five minutes. Most systems offer collision avoidance and guard zone alarms that ignore ships passing in the distance. Here are excerpts from a 2009 write up on radars from Chuck Husick from www.BoatUS.com website.

Put a radar on your boat and you will be able to "see" through fog, rain and darkness. In the hands of a competent operator radar is a remarkable aid to safe navigation. It can confirm your position relative to landmarks and navigation aids such as buoys and by detecting other waterborne traffic make a great contribution to collision avoidance. Once reserved for large yachts and ships, today's radar products are available at prices and sizes

suitable for use on boats as small as 18 feet. Even the least costly radars provide quite complete operational capabilities, including on screen display of the range and bearing of targets. Electrical power consumption is modest and well within the capability of virtually any boat equipped with an engine. The ultimate value of a radar rests with the user's ability to understand and properly use the information on the screen.

Choosing radar requires evaluation of a number of performance specifications. The maximum range specification and transmitter power rating are often quoted as meaningful measures of the suitability of radar for a particular boat. Although of interest, they are not particularly appropriate measures on which to base a selection.

Radar energy, like the energy emitted from the VHF transceiver, travels in a generally straight line. Horizontally directed radar energy is soon well above the curved surface of the earth and can illuminate only those objects tall enough to protrude above the radar horizon. Regardless of the size of the vessel it is most often used to scan for targets not more than about 6 miles distant and will frequently be operated at ranges of less than 2 miles. Choosing a radar on the basis of maximum range is not a good idea.

Radar transmitter power is defined as Peak Pulse Power. Although manufacturers typically provide increasing power levels in their longer range and most costly sets, a modest amount of power is usually sufficient for the relatively short ranges most often used. Two kW transmitters can provide excellent results. For most recreational boats, transmitter power becomes important only in very heavy rain conditions. Rain reflects and absorbs radar energy. The reflection is useful in showing us the location and shape of rain showers. The absorption of radar energy can prevent a radar from portraying targets it would normally detect. Higher transmitter power can be valuable in such cases, however there are some tropical downpour conditions that can absorb all of the energy of even the most powerful ship radar sets.

The size of the radar antenna plays a key role in determining the overall performance of radar. Marine radars use the same antenna for both transmission and reception. The transmitter energy is carefully focused, much like the light from a well designed searchlight. However, unlike a searchlight, where the desired pattern of projected light is usually circular, the energy from the radar must illuminate a relatively wide vertical swath to ensure that the target area is well covered as the boat rolls and pitches in the sea. At the same time, a narrow horizontal beam is needed to allow objects close to one another in azimuth to be seen as separate targets and not as a single blob. Typical vertical beam angles are ±12.5 degrees. Horizontal beam angles, which are largely determined by the length of the antenna range from about 2.4 degrees for the smallest antennas to 0.75 degree for antennas about 10 feet in length. Even the smallest antennas will provide useful target information at the

relatively short ranges most often used by small craft.

The radar antenna, transmitter and receiver are usually packaged as a single unit, enclosed in either a radome or in a housing with a rotating, bar-like antenna mounted on its top surface. The smallest radome housed units are less than 12 inches in diameter and weigh less than 10 pounds, making them practical for installation on even quite small boats. The antenna should be mounted at a height that places it at least two feet above and four to five feet from the head of anyone on board and in a position where crew members will usually be at least five feet from the antenna. Mounting the antenna more than about 22 feet above the water will not make a worthwhile contribution to maximum range operation and can degrade the radar's ability to show important close-in targets. A radar mounting pole that places the radar about eight feet above the deck works well.

The power of pleasure boat radar transmitters ranges from about 2 kW to as much as 50 kW sets used on large yachts (with the exception of the new solid state continuous wave sets where average power may be as low as one-tenth of a watt). All of these power ratings are peak power. The transmitter delivers its power in extremely short pulses, usually on the order of 0.07 to 0.7 millionths of a second long. Pulses repeat at rates between 1000 and 3000 per second. The average power consumption of most radar sets is quite low, with small boat radar usually consuming less than 50 watts of 12 volt power. Providing this amount of power is rarely a problem, even on boats under sail with no engine or generator set operating. Solid-state, CW radar sets typically consume less than 20 watts, excluding the display screen unit.

Broadband Radar: Is the trademark of a new technology developed by Navico and sold under the Simrad, Lowrance and Northstar brand names. Here is a summary of information presented on the company websites:

Conventional pulse radar uses a magnetron to generate a pulsed microwave signal that is transmitted from the rotating radar antenna. This burst of microwave energy is reflected off any target that it hits and returns to the radar, with the time it takes determining the range and bearing. This type of radar transmission is, in layman's terms like shouting loudly in one direction and then listening to see if you hear an echo, turning and then repeating.

Broadband Radar uses a different type of technology that allows the radar to send out a continuous radar signal, with a changing tone or frequency, at a very much lower power and at the same time listen for the change in that signal. This is like continuously whispering and listening at the same time for the echo and is made possible by the radar using two antennas, one to transmit and another to receive.

The change in the tone of the transmitted radar signal determines the time taken for the signal to reach the target and return. This time determines the range and the bearing.

There is a distinct advantage in sending out a much lower-power signal. The distortion in a

normal radar transmission, which can be likened to a shout, gets distorted at very close ranges. This is often referred to as "main bang" interference and appears on the screen as a sunburst in the centre of the display. At very short ranges this noise covers up any close-in targets, making the radar ineffective at short distances. Many types of conventional radar suppress this pulse and hide the noise; but this again hides any short-range targets, thereby effectively blinding the radar to nearby targets.

With the Broadband Radar emitting only low levels of energy the noise and distortion is just not there, with the result that there is no distortion in the centre of the screen and therefore no need for any suppression. The benefit of this is that close-up targets are not lost or hidden, and the radar is able to show approaching targets until they are just a few feet from the transmitter. This short-range performance has never before been seen in leisure marine radar.

Conventional radars emit a pulse, and this pulse varies in length depending on the range. The length of the pulse determines the ability of conventional radar to distinguish between close targets on a similar bearing, and generally this can be down to 90ft at short ranges and up to 500ft at longer ranges. However the Broadband Radar, using its continuously transmitted signal, is not only able to see targets as close as 6ft from the dome on the shortest scale but can also separate targets just 30ft apart on the scales used for general navigation.

Further evidence of this short-range performance can be seen from the ability of broadband radar to go beyond the conventional minimum range of 1/8th to 1/32nd of a mile. Broadband radar allows the user to display at just 400ft, 300ft and 200ft, with range rings of only 100ft, for superb target resolution and differentiation.

According to the websites, broadband radar uses significantly less power than traditional systems, 17 Watts in active mode and 1.6W in standby. As well, "instant on" means that the user need not wait 2-3 minutes of warm-up time from other systems.

AIS, Automatic Identification System, is the newest technology and is becoming very popular with single-handers. A full AIS system transmits information about a vessel's name, position, course and speed. It allows a skipper to identify nearby ships, and then to hail them by name if necessary. Systems can be configured to detect potential collisions.

Jeanne Socrates used her AIS extensively on two circumnavigations. She often uses her VHF radio to hail ships entering into her comfort zone and has been known to yell into the radio if they do not change course appropriately.

The ISAF Offshore Racing Rules require that from January 2010, an AIS transponder must be carried for Cat 2 races and above. The International Maritime Organization's "International Convention for the Safety of Life at Sea" (SOLAS) requires AIS to be fitted aboard international voyaging ships with gross tonnage of 300 or more tons, and all passenger ships regardless of size. It is estimated that more

than 40,000 ships currently carry AIS class A equipment. In 2007, the new Class B AIS standard was introduced which enabled a new generation of low cost AIS transceivers. This has triggered multiple additional national mandates affecting hundreds of thousands of vessels.

Class B AIS systems are most appropriate for sailboats. They transmit at 2 W and are not required to have an integrated display: They can be connected to most display systems which the received messages will be displayed in lists or overlaid on charts. The Class B type standard requires integrated GPS and certain LED indicators. Class B equipment receives all types of AIS messages.

AIS systems are available with either Receive Only or Transmit/Receive functions. The Receive Only systems will receive data from other vessels nearby. The Transmit/ Receive systems will also transmit the sailor's information to other vessels every 30 seconds. Typical power usage is about 2A during the receive phase and up to 6A during transmission. The receive-only systems are considerably less expensive, in the $600 range.

I posed a question about the usefulness of AIS on the Singlehanded Transpac website. Here are some of the replies:

- **I was personally far less than impressed. I used it during my sea-trials and qualifier, and some of the delivery home, but I don't even think I used it during my Transpac at all. There are so many vessels out there that don't even transmit that it's not even funny. It gives you a false sense of security. It seemed like when I did use it in a place with lots of traffic, (like SF Bay, or just offshore near the shipping lanes), it picked up a majority of freight ships, but nowhere near all of them. This is strictly my opinion.**

- **From my experience using both, AIS works well offshore and alerts you to shipping traffic beyond the range of the radar, including localized stuff the radar does not see due to squalls. The radar works well for picking up things that aren't running AIS - other small boats and warships, for example. I really like running both, the AIS continuously and the radar on a 5 minute guard zone mode - the radar wakes up every 5 minutes, scans for a minute, and if nothing is found it goes back to sleep.**

- **I loved my AIS! In fact, it worked too well. I used a splitter which shared the whip on the masthead with the VHF. This configuration gave me targets 80 miles out! I would spot them, want to talk, but our CPA was three hours.**

- **I loved my AIS! And it seemed that my little 25 foot Folkboat was a freighter magnet during the Transpac...compared with others in the fleet...we saw a ton of shipping and my little standalone Nasa Marine AIS unit was spot on...a false sense of security or not--it helped me sleep better at night.**

- **But even if just one ship in 2200 miles happens to find your boat while you're sleeping, wouldn't you want to know about it, and better yet, wouldn't you want the ship to "see" you? You can forget about them seeing your radar reflector until it's too late, if at all.**

- **AIS came in handy for one ship that was insisting on running us over until I called them by name. They then said "yeah, we see you and have you on radar. clear astern.**

Nigel Sly from Manchester made this comment:
Most sail boats use a Class B transceiver. Many commercial vessels using Class A filter out Class B signals when in harbours to cut down on the number of targets, but then forget to reset the filters when back at sea.

I'm in the habit of calling up commercial vessels and ask if they have my AIS signal. If not, I ask them to check if they have filtered out Class B, many have.

Something to bear in mind. I am a skipper on Maersk Anchor handling tugs and know that this can happen.

Active Radar Reflector: The SeaMe (www.sea-me.co.uk) is the most popular active radar reflector system. Another brands is the Echomax Active XS (www.echomax.co.uk) (Note that several other brands have disappeared from this market: Ocean Sentry, Seahawk, Activ'Echo, Tron ARR and Rasmus.) These units perform two functions. First, they "actively" reflect back a radar signal to the passing ship that sent it. I.e. they electronically amplify the radar signal, making a small sailboat look much bigger to the ship. Second, they beep to alert the singlehander that he has been hit by a radar signal.

Here is a brief excerpt from Capt. Phil Gallman, Ph.D. and his website theradarreflectorsite.org. Gallman has done extensive research on radar reflectors for sailors and has published a book on the subject, available his website.

**What should I look for in an RTE (radar target enhancer)?
First, you want adequate RCS (radar cross section). The IMO recommends 7.5 m^2. Much larger than this becomes impractical for smaller vessels. I suggest in my book that if your sailing is restricted to benign conditions in protected waters a smaller RCS may be adequate. Equally important to magnitude of RCS is how RCS varies with aspect, or orientation of the unit relative to the radar. First, the RTE must provide a good response at large enough elevation angle so that you are visible when heeled at the maximum angle of heel you expect to encounter (depending on your vessel type and sailing environment). Second, there should be no gaps in coverage, i.e. regions in azimuth and elevation where the RCS is extremely small, so that you will never encounter the situation in which you are invisible right up to point of collision. Finally, even though the RCS can vary as the orientation changes as your vessel rolls, yaws, and pitches in a seaway, the variation is not so severe that detection becomes intermittent. Intermittent detection is hard for a human operator to handle and may keep your vessel from being detected at all.**

Active radar reflectors are very popular with singlehanded offshore racers, mainly because of the low power draw. Several blogs reference their use. When being struck by radar, they use up to 350 mA of power. When in standby, they use as low as 35mA. I use the SeaMe unit when sailing. My only testimony is that I'm still alive, so I assume it works.

IMPORTANT: Active reflectors and Broadband radar: Note that active radar reflectors, like the SeaMe and the CARD do not work with broadband radar. They do not reflect any signal back to the originating radar station. This is important as use of broadband systems increases.

The CARD and MER-VEILLE brands of radar receiver have fallen out of favour of late. These notify the skipper that he has been hit by a radar signal, but do not reflect back to the passing ship. With the advancements in active reflectors and AIS, we are seeing less of the these methods. John Hayward on the Valiant 40 Dream Chaser made this comment about the CARD: **I have a CARD system on Dream Chaser. In the 2008 Transpac I ran it a lot and it never once went off even when large ships that the AIS picked up were visible. In the 2010 Transpac I turned it on several times when I picked up traffic on the radar or the AIS and still nothing. I have picked up signals in the harbor with it but I don't think it's worth the power consumption (low as it is) while singlehanding.**

Flashlight: Every singlehander should carry a really big flashlight in the cockpit. A sailboat is nearly invisible at night. A sailboat with a spotlight shining on the sails is impossible to miss. I find this method very effective when sailing in congested waters, surrounded by tugboats and fishing boats. Their radar systems are designed to hit targets in the distance, not two boat lengths away. A flashlight on the sails is the best approach in a crowded channel.

Passive Radar Reflector: Capt. Gallman has also done a detailed comparison of passive radar reflectors. The entire study is available in his book and excerpted on his website.

There are many designs available. In brief, the popular tubular shape, such as the Mobri S-4, provides a strong cross section when vertical, but there is virtually no response when tilted past a few degrees, as on a normal sailboat. The least expensive octahedral reflectors, such as the Davis Echomaster (www.davisnet.com) provided a strong response at some ranges, particularly at large elevation angles. Gallman recommends that these units be rigidly mounted as the common practice of hanging them from the spreaders with a line allows them to flop around, producing an intermittent response. One of the most expensive units, the Tri-Lens, (www.tri-lens.com) produced the best overall reflection in all directions and at heal angles up to 50°.

A Testament to the Centerboard Sonar (from a letter I wrote to 48 North magazine.)

I can personally speak to the incredible technological advancement of the centerboard sonar. My Tanzer 22, Foolish Laughter, was equipped with this marvel of advanced engineering and I made use of it numerous times while sailing in Ottawa. In fact, on the very day of my boat launch, my wife and I used the CBS to discover that we were getting too close to the Quebec side of the river. (I think it could sense the maple syrup.) A simple gybe got us back into navigable waters with nary a scratch. Three months later, while singlehanding in the club's 50-mile race, I used the CBS on three occasions.

But my greatest testament is when the CBS actually saved my life! I was returning to the club after a nice day sail when a massive thunder squall came up. As could be expected, my outboard chose this moment to die and I could

not enter the harbor in such high winds. I dropped the genoa and aimed east above the rapids that sit between the club and the Quebec side. With only the mainsail up I was not able to tack into the wind, so I traveled much further than planned. I was halfway across the river when the CBS alarm sounded. I raced to the bow and threw out my anchor and a full ten feet of rode. Thanks to my strong belief that Poseidon cares for foolish sailors, the anchor stuck fast under a rock. Under strong winds and even stronger current, the boat swung to sit a mere six feet above the start of a 100 yard stretch of rapids.

There were no tow facilities on the river, so I dialed 911 and a half hour later the fire department sent out their rescue RIB. But they - were only equipped to rescue people, not boats, so my beloved was left in the most treacherous part of the river. I found a volunteer to tow my boat, but he would not go anywhere near the rapids. It was quite amusing to ask the fire department to put me back on board. They had to seek permission from several levels of command before they agreed. Once the boat was ashore, the local media showed up and asked if I'd be willing to take the boat out again, just for pictures.

It is based on this adventure that I started a Coast Guard Auxiliary at the club. We applied for a grant from provincial lottery funds for a rescue RIB, complete with twin 250hp outboards and a launch ramp. So, it may be said that the centerboard sonar save both my life and perhaps many, many lives in the future.

Chapter 10: Managing Bad Weather

Under some circumstances there will simply be too much weather, for too long, for the singlehander to manage. A boat need not be south of Cape Horn to face these conditions, they can be found on a simple return trip from Hawaii in the height of summer.

Here is the log from Skip Allen's return to California aboard "Wildflower", a Wylie Custom 27, just after winning the 2008 Singlehanded Transpac. Skip's log is an incredibly well written adventure story, and could be enjoyed for that reason alone. But I am presenting this as a real opportunity for learning. The reader should pay specific attention to:

- Skips long sailing experience.
- His positions on the chart, sailing direction and wind direction.
- The long range forecasts that he was working with.
- His physical and mental condition.
- The boat's condition. The hatch boards.
- Communication with friends and with the coast guard, in particular via SSB.

His words should be considered as a significant lesson for anyone taking up this sport.

On Saturday, 8/23, 10 days after leaving Hanalei, we were halfway home to Santa Cruz with 1190 miles to go. We had passed the Pacific High, and were running in the Westerlies at latitude 38-38 x longitude 147 -17. So far, the passage had been going well, my sixth return passage from Hawaii aboard Wildflower. But an ominous note on the thrice daily weather fax charts was the notation "GALE" between our position and the Pacific Coast.

I began to plan for this possible gale by increasing latitude, slowing down, and closely monitoring projected GRIB files out to 144 hours. It appeared from all forecasts that we needed to slow down for at least 48 hours to let the gale ahead abate. However, it is against my instincts to slow a boat down, and so with difficulty I reefed the main and dropped the jib in 8 knots of wind, reducing speed to a sedate 3.5 knots in smooth seas.

On Wednesday, 8/27, the morning GRIB file showed the area of most wind ahead was between 124 and 128 degrees, with no weather abatement until at least Monday, 9/1 earliest. Dwight Odom on Na Na, 450 miles ahead, had reported gusts of 42.5 knots from the north between latitude 127-128 and having to run off under storm jib 80 miles. Na Na reported 20 foot seas the previous night near 37 x 124-30. I hoped that Wildflower, by being at the latitude 40 degrees, would allow us to run off 180 miles to the latitude of Santa Cruz, should conditions worsen.

On Friday, 8/29, at sunset near 40N x 130W, conditions began to rapidly deteriorate. I changed to the #4 (75% short hoist) and storm staysail, dropping the main completely.

The following day, Saturday, 8/30, with Santa Cruz 365 miles on a bearing of 095 T, we were having to run off due south (180 T) in winds 30-35 knots. By 15:30, the sail combination proved too much, and I dropped the #4, flying the storm staysail (39 sq. feet) and towing a 30" diameter metal hooped drogue. It was uncomfortable, windy, and rolly that night, with the cockpit filling about every five minutes, and the boat being knocked down to 70 degrees at least half a dozen times. Wildflower's shallow cockpit and

oversize drains allowed full drainage in about 90 seconds, and this was not a problem.

The electric Auto Helm 1000+ tiller pilot was doing an amazing job steering, as it was being continuously drenched, even submerged. The Sail-O-Mat windvane was useless preventing or correcting breaking wave induced broaches and I retracted its oar to avoid fouling the drogue rode.

On Sunday, 8/31, the wind was steady 30-35, with higher gusts and a confused wave train from the NW, N, and NE. At 09:15 I winched in the drogue to change from a hi-tech spinnaker sheet to stretchy nylon anchor line. Unfortunately, I found the drogue had split, and was no longer effective. I deployed my spare drogue, but without a metal hoop, it would periodically collapse astern in a breaking crest. I think a series drogue is the best available. But really, anything will work as a drogue, including a tire, milk crates, or anchor and chain.

(With my drogue, I was still going 4-6 knots under bare poles. With no drogue, I was surfing faster, 6-10 knots. Taking off on a breaking wave with no one on deck is a recipe for a roll over as the boat could easily get sideways and broach. I believe my use of a drogue was justified in slowing the speed and keeping the stern aligned with the oncoming waves. The amount of water coming over the stern was manageable and not a significant problem. There was no water getting below, as my hatch boards were bullet proof. Had a breaking sea come over the side of the boat, things would have become more serious.)

At noon, it looked like the gale was lessening. I left the safety of the cabin, and with two safety harnesses affixed to the windward rail, began to hand steer eastward on a reach with the #4. It was mogul sailing at its best, having to radically bear away to avoid hissing 8-12' breaking crests on the top of 15-30 foot seas.

At sunset I again went below with the Auto Helm tiller pilot continuing to steer nicely under #4 jib. Not long after, the wind came on to blow from the NNW, and the seas began to build further. That night I stayed suited up below with full foulies, headlamp, and harness, ready to dash out the hatch and take the tiller if the autopilot failed and we subsequently rounded up. In addition, I dropped the storm staysail, as we were running too fast at 6-9 knots. Under bare poles DDW, the speed was better at 5-7 knots.

What followed ultimately played into the following day's events. During the long night, my third in this particular gale, breaking crests would poop the boat about every five minutes, filling the cockpit and surging against the companionway hatch boards. Even though I had gone to lengths for many years to insure fire hose watertight integrity of the companionway hatch, I found the power of the breaking wave crests slamming the boat would cause water to forcefully spray around the edges of the hatch boards and into the cabin.

During the long wait for daylight, I had more than enough time to ponder what might happen if the autopilot was damaged or was washed off its mount. I had two spare tiller pilots. But it

would take several minutes, exposed in the cockpit, on my knees, to hook up a replacement in the cockpit, on a dark night, when the boat was being periodically knocked down and the cockpit swept.

In addition, I pondered the fate of the Daisy that had been lost in this spring's Lightship Race, presumably crushed and sunk by a large breaking wave. I also reminded myself I was responsible for not only my own life, but was also a family care giver at home.

There was no doubt that if Wildflower tiller pilot was lost that we would round up and be at the mercy of these breaking waves, some of which I estimated to be in the vicinity of 25-35 feet, and as big as I hadn't seen since the '79 Fastnet Race storm on IMP.

The anxiety and stress of this night, with the whine of the wind in the rigging, the wave crests slamming into the hatch boards, and the 70 degree knockdowns that would launch me across the cabin, created serious doubts that we could continue this for another night, much less the 3-4 days the conditions were expected to continue.

The boat was fine, and had suffered no serious damage. My physical health was OK, but I could see with minimum sleep that my decision making could be beginning to be compromised

At 0715 the following morning, Monday, 9/1, I Sat phoned my long time sailing friend, ham radio contact, router, navigator and weatherman, Joe Buck in Redondo Beach. Joe and I had maintained two per day ham radio schedule since leaving Hanalei, and he had instant internet access to all forecast weather and wave charts. I explained the current situation to Joe: that I'd had a difficult night, and wasn't sure I could safely continue. Joe's weather info had the highest wind and wave overhead on my current drift southward continuing for at least another three days, with continuing gale force winds and 18-22' significant wave height.

I asked Joe for help in some difficult decision making I had to do. First, would he phone San Francisco Coast Guard Search and Rescue (SAR), and query what the protocol was for asking for assistance, all the while making sure the Coast Guard understood I was not in trouble and was not asking for help at this time. (Coast Guard NMC Pt. Reyes, Kodiak, and Hono were not answering my radio calls on their published 4, 6, 8, and 12 mg frequencies, both simplex and duplex.)

Joe called back an hour later (08:30) on ham radio 40 meters and said that Lt. Saxon at SAR reported no military assets within 200 miles or 20 hours, that Wildflower was 200 miles beyond helicopter range, but that there was an inbound container ship "Toronto" coming in my direction at an undetermined distance.

Joe helped me to understand if the boat were lost, I would likely be lost also. But if that I left Wildflower in advance, that only the boat would be lost. I told Joe of my hesitation of putting my life in the hands of a possibly foreign crew on a big commercial ship during a transfer off Wildflower in these conditions, especially at night. We agreed that a decision had to

be arrived at soon, before 11:30, and before Toronto passed by.

I spent the next hour, sitting on the cabin sole on my life raft, debating whether to ask for assistance in leaving my beloved Wildflower. “Fleur” was my home, consort, and magic carpet that I had built 34 years ago. I cried, pounded my fist, looked out through the hatch numerous times at the passing wave mountains, remembered all the good times I had shared with Wildflower. And came to a decision.

I was three days/nights in the gale. Except for a few hours, I was below decks, much the safest place to be. "Sleep" was not possible given the conditions, though I dozed in a half awake state for many hours. Despite wearing earplugs, and a watch cap pulled over my eyes, the whine of the wind in the rigging, the hissing and crunching of the waves as they came aboard, the motion of the boat, and the worry, anticipation, and feeling of helplessness precluded any sound sleep: I was dressed and ready to immediately take the deck in the event of calamity or loss of steering if the autopilot was swept overboard.

This led to exhaustion, a state I was familiar with from my many miles of singlehanding. I knew that both intelligent decision making and physical stamina was compromised by exhaustion. It was important to me to monitor my mental and physical well being, knowing I was deteriorating because of exhaustion. I was likely to be called upon to perform some self rescue, and I wanted to be in the best possible condition to successfully pull that off if/when the time came.

At 11:15 I called Joe back and told him to again call Lt. Saxon at SAR and inform her that I was asking for assistance. Joe called back and informed me that Toronto was 5-6 hours away, and that SAR needed to hear from me directly as to my request.

At 12:00, like a gopher popping out of its hole, I slid the hatch open to get a clear Satphone signal, and called SAR. Lt. Saxon already knew my details and position, and only asked “What are you requesting?” I replied, “I am asking for assistance to be removed from my boat.”

We kept the conversation short and to the point, due to my exposure topsides with the Satphone. She said the MSC Toronto would be requested to divert, that I was NOT to trigger the EPIRB, but that I was to take the EPIRB with me when I left Wildflower. Contrary to published reports, at no time did I call “PAN PAN,” and no com schedule was kept with the Coast Guard, although I did check in with Joe every 30 minutes on ham radio.

Lt. Saxon also said that if I left my boat, she would be considered “derelict” and a hazard to navigation. I assured her I would not leave my boat floating or derelict.

An hour later, at 1300, Wildflower AIS alarm rang. MSC Toronto was showing 30 miles away, and closing at 23.4 knots from the south west. I had to do some fast planning.

But with no idea how the transfer would be made (jump, swim, climb, hoist?) I didn't know what I could pack into my bag, bags, or backpack. I decided on my documents, wallet, passport,

laptop, camera, cell phone and sat phone, logbook, EPIRB and a change of clothes and shoes. All this I bagged into waterproof bags. And in a moment of whimsy, decided to try and offload the two Single Handed Transpac perpetual trophies, as they had 30 year historical value to our Race.

At eight miles, the captain of the MSC Toronto rang on the VHF. He spoke perfect English, and as I had a visual, directed him to alter 20 degrees to starboard to intercept. He explained his ship was over 1,000 feet long, that he would lay her parallel to the waves and make a lee at a forward speed of Slow Ahead (6 knots).

The captain also explained that I would board his ship from a rope ladder that led to the pilot's door, on the aft starboard side.

I asked if he could slow to a speed between 3-4 knots, and he willingly agreed to try.

At five miles, a sharp eyed lookout on MSC Toronto sighted Wildflower ahead. But the ship's radar did not register my boat until 2.5 miles in these conditions.

At 1415, one of the world's biggest container ships was bearing down on Wildflower, less than five boat lengths (125 feet) dead ahead, the huge bulb bow extending 20 feet and making a five foot breaking wave. With my heart in my throat, I motored down the starboard side of a gigantic black wall, made a U turn, and pulled alongside the pilot's door and rope ladder.

The crew threw a heaving line, and in the next five minutes we transferred three bags, including the perpetual trophies. Knowing I was next, I jumped below decks, said a final quick goodbye, and pulled the already disconnected hose off the engine salt water intake thru hull.

Back on deck, I reached for the bottom rung of the Jacob's Ladder, which was alternately at head height, or 10 feet out of reach, depending on the ship's roll. I grabbed hold, jumped, and did a pull up onto the ladder, and climbed up, wearing a 15 pound backpack with my most valuable possessions and EPIRB.

At 1429, on Monday, 9/1, at position 35-17 x 126-38, the MSC Toronto resumed its voyage to Long Beach, leaving Wildflower alone to bang and scrape her way down the aft quarter of the ship and disappear under the stern. I watched, but could barely see through my tears.

Four hours and 100 miles SE of where I left Wildflower I was on the bridge of MSC Toronto watching the anemometer True Wind Speed graph continuing to register 32-35 knots. From 140 feet off the water, the swells below still looked impressive, and the ship was rolling enough to send spray above the top containers on the forward part of the ship

For the next 24 hours aboard MSC Toronto (1065' LOA, too wide for Panama) I was treated with the utmost kindness and compassion by Capt. Ivo Hruza and his crew of 24. We stood watch together, ate together, told stories, viewed family photo albums, discussed the world situation, toured the ship and engine room (12 cylinder, 93,360 horsepower diesel). By the time we came down the Santa Barbara Channel, ahead

of schedule, and docked at Long Beach, I felt a part of this happy crew of 6 nationalities. I could not have been assisted by a better or more professionally manned ship.

On Tuesday afternoon, after clearing customs and immigration aboard, I shook hands with each and every crew member. And descended the gangway alone, to meet Joe, sister Marilee, and begin New Beginnings.

I will never forget Wildflower. She took a beating in this gale. She never let me down, and took me to amazing places, where we met wonderful people and made new friends.

In this time of loss, a most wonderful thing is happening: many loved ones, friends, interested parties, and people I've never met are closing a circle of love around the mourning and celebration of Wildflower.

Treasure Each Day,
Skip Allen 9/3/08

There are several excellent books available on sailing in heavy weather. The most often quoted book is Adlard Coles' "Heavy Weather Sailing", first published in 1967.

In 1999, Steve & Linda Dashew published their authoritative book "Surviving the Storm, Coastal & Offshore Tactics". I will refer the reader to these books for the greatest guidance.

However singlehanding does present its own challenges in heavy weather because there is no one else to take watch. Every book written on the great singlehanded races contains long chapters about the fight against storms. They all tell the story of spending 24, 36, 48 or more hours at the helm. Here is an excerpt from Derek Lundy's famous book "Godforsaken Sea" published in 1998 about the BOC Challenge:

The wryly laconic Australian David Adams, with his fifty-foot boat "True Blue", was sailing right up with the big boats and leading class two as he sailed his boat like a big dingy.

"I'm absolutely stuffed," he reported to race headquarters. "Been twenty-four hours at the wheel in 40 to 60 knots. Had four knockdowns, with the mast in the water. Once we went down a wave like that, on our ears. It's just survival out here, not racing."

He later wrote: "In a huge storm when you're running on sheer adrenalin, it's enough to get through the next half-hour alive and bugger the race." "People often asked how I managed to hand-steer for hours and even days through these storms," he wrote. "Fear is a great motivator. I thought if I stopped steering I would die. Simple as that. So I kept steering."

What are the key considerations for a singlehander in bad weather? The skipper should know that bad weather does not just mean a single gust of wind or one bad wave. The books tell heroic stories about how the skipper had to cut away the mast after the boat rolled, but the books never talk about the wave conditions after the first roll. We need to remember that after the boat rolled, the weather did not suddenly turn calm. The winds are still blowing at 60 knots and the waves are still 30 feet high. The immediate repairs that are done must be done in these extreme conditions. So the following points are vital:

- Carry a second hatch board that is much stronger than the day to day set. Perhaps a

piece of ¾" plywood, tightly fitted with gaskets would be appropriate. Keep the hatch boards closed and locked, and the boat well sealed at all times. Although the main hatch might only be four square feet in actual size, the skipper should envision a 25 foot wave crashing over the stern, directly into the hatchway. How much force does this wave carry and how much force will the hatch boards withstand? As well, it is guaranteed that the boat will broach beyond anything the skipper has experienced.

If the boat fills with water, it will destroy all of the electronic systems on board, most likely including the autopilot computer and the radio system. It is not difficult to imagine what it would be like to bail out the boat with water up to the bunks, at the same moment that all of the lines are detached and dragging overboard, at the same moment that the boom has broken at the gooseneck and the mainsail is bashing around.

On a crewed boat, the skipper will be yelling "Brenda, you go below and bail like hell. Kayla and Leslie, you grab the lines and pull the mast back on board before it smashes the hull. Donna, try to get the radio working and notify the coast guard of our position. Anna, you get a bandage on Debby's head and get her in a bunk. I'll do everything I can to keep our stern to the waves." An awful (and I use that term deliberately) lot will happen in a severe knockdown. A crewed boat is pushed to its limits and will have bar room stories for years. It is impossible to quantify the impact of the same situation to a singlehander.

- Make sure EVERYTHING below is well secured. Absolutely every book about a singlehander in a storm describes how their supplies and tools flew around the cabin and were broken or lost during a knockdown. After pitch poling and breaking his mast at Cape Horn, Derek Hatfield used a Leatherman pocket knife to detach all of the rigging and release the mast before it smashed a hole in the boat. This was because all of the tools, including a bolt cutter, were lost somewhere inside the boat. Before a voyage, a singlehander should imagine what would happen if Poseidon picked up the boat by its keel and shook it. This is exactly what a storm can do. The boat should be equipped with internal straps to secure all tools and supplies in place, whether that be on the cabin floor or in a locker.

Here is an excerpt from Jeanne Socrates' log, just after a knockdown while rounding Cape Horn. www.SVNereida.com:

We were well heeled, and there were plenty of big seas...and suddenly, near 2.30pm, while I was fortunately leaning against a wall in the head, all hell let loose - and everything that could move was re-located to the star-board side of the cabin.... Water was pouring in from under the sliding hatch and there was chaos everywhere.

A photo taken by Jeanne Socrates' of Nereidas's cabin, after a knockdown nearing Cape Horn.

Slowly we righted and soon after I looked to see what damage there was - clearly there was some - no instruments, for a start!.. but I could not budge the hatch to open it - try as might...! I had to climb out of the aft cabin hatch to access the cockpit - which I'd already seen enough of to realize

the boom was broken in half and the canopy/dodger over the companionway was missing, along with its framework ..... There was safety glass everywhere. I soon realized why the hatch wouldn't slide open - the halyard bag full of heavy wet lines, was lying on top and was soon removed along with several lines lying loose... Going down below, I noticed the perspex hatch was cracked in half vertically - a worry if we should ever get pooped. Next, I got the instruments working - a connection in the aft cabin had been hit by flying/sliding objects... In brief, I didn't know where to start... Tried to clear up a bit on deck - not much I could achieve there... down below - impossible to clear up wet things (all pillows and bedding were sopping wet at their end.. still beam on to oncoming seas... not good.)

- How difficult will it be to cook during a storm? A couple of thermos's of coffee and a thermos of hot stew cooked before the storm, will be necessities. The skipper can not send a designated "cook" below to whip up a hot meal. Many snacks and bottles of water should be kept in the cockpit, within reach from the helm.

- The storm sails should be readily available. Most sailors never face a real blow. Many will not leave the dock above 25 knots. Their storm sails are neatly tucked in the bow of the boat, still in the bags. I know from experience that crawling to the bow in heavy weather is nigh on impossible. The storm sails should always be stored near the main hatch, and should be lashed on deck if bad weather is approaching.

- What would happen in the highly likely circumstances of the self-steering system being destroyed? Skip Allen reported that his wind vane was damaged beyond repair. He abandoned Wildflower partly because of his fear of loosing the auto pilot as well. The singlehander should think about this before the voyage. What will he do if it occurs. This is not a reason to abandon a voyage, but it is a reason to pre-think. Is the skipper equipped, mentally and physically, to spend 24 or 48 hours at the helm?

- How will the singlehander sleep during the storm? I have a "sitting hammock" in my cockpit with my back to the main hatch. I can sleep quite comfortably within reach of the auto pilot, tiller and sheets. Has the boat been setup to sleep on the floorboards, the lowest and most stable position on the boat?

The books about heavy weather were written for crewed boats. But in a crewed boat, all of the above considerations are not nearly as important. The crew can rotate at the helm and in their secure bunks. They have assigned tasks to cook, bail the boat and work the lines. A singlehander does not have these luxuries.

Drogues:

Perhaps the greatest invention to assist the singlehander in storm conditions is the Jordan Series Drogue. The Dashews have dedicated more than 50 pages of their book to the topic of drogues. It is clearly of importance during extreme situations:

If you cannot control your vessel in the existing conditions (whether due to wind and sea state or a steering-related mechanical problem), the use of a sea anchor or drogue may provide the only way to increase security. It is safe to say that in moderate storm conditions, where risks are low that a breaking sea will cause a capsize, slowing down is an excellent means of getting some rest.

If you are heading into the seas at speed, then the speed of the wave added to boat speed increases impact. On the other hand, when you are running with the sea, the speed of the boat is subtracted from wave speed. Consider that the impact energy of a wave is a function of its velocity squared, you can see how reducing this relative impact speed, even a modest amount, has a big effect on the energy absorbed. You can infer from this that the faster you go downwind, the less problem the waves will be. This is how it works in the real world.

While there are many variables, the one thing we can agree on is that being beam-on to the seas – or even at a 60 degree angle – is far more dangerous than having one or the other ends of the boat pointed into the waves.

However, we would like you to keep in mind that in many situations there comes a time when it is safer to have the boat moving – with the rudder under control so you can work the waves – than to be passively tied to some form of sea anchor or drogue.

Based on this, there is some agreement amongst sailors that it is better to use a drogue from the stern that slows, but does not stop, the boat.

The other method is to deploy a sea anchor from the bow of the boat. This is essentially a single, large parachute. These were considered very useful for older style, long keel boats with attached rudders. These boats would maintain a steady position relative to the sea anchor, without swinging from side to side. Modern, fin keel boats will tend to yaw (swing back and forth), sometimes violently if held from the bow. This is because of the wind pressure on the bow of the boat, but all of the holding power provided by the keel and rudder towards the stern.

A drogue from the stern performs two functions: First, it slows the boat, particularly important during wild surfs down a steep wave. As the Dashews intimated, a boat only maintains control if there is water flowing past the rudder. Thus the idea is not to stop the boat dead, but just to slow it down to a manageable speed.

Skip Allen discussed that his drogue reduced boat speed by just one or two knots, but this was enough for him to wait out the storm below, rather than at the helm. Skip's electronic auto pilot was able to keep the boat on course under these conditions.

Second, the drogue keeps the stern of the boat at right angles to the waves, particularly breaking waves. A boat that shifts off of right angles in a breaking wave will broach, possibly roll or even pitch pole.

A Jordan Series Drogue is made from 100 to 150 small fabric cones (each about 6" across) connected to a long line (300 feet of line would be appropriate). (Photos below by Dave Pelissier) The drogue will be dragged behind the boat, stretching well behind any breaking waves. These units are available complete in the range of $1,200 - $2,000 or at lower prices for do-it-yourself kits. I have spoken to several singlehanders who have sewn their own drogues.

The drogue is attached to the boat with a V shaped bridle off the transom. The legs of the V can be adjusted to swing the drogue towards one side of the boat if necessary when the waves are not running at right angles to the wind.

Extensive information is available at http://www.jordanseriesdrogue.com. The following was written by the inventor, Don Jordan, who passed away in 2008.

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

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

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

1. To protect a yacht in a hurricane, an outside force must be applied from a drag device. No design changes to the boat and no storm tactics on the part of the skipper can result in a significant reduction in risk.

2. The drag device must be a drogue, i.e. the boat must be tethered from the stern. (I have found this to be the most difficult concept to get across)

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

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

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

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

boat attachments.

7. The strength of the drogue and the number of drag elements must be adjusted to be compatible with the displacement of the specific yacht.

8. With a proper drogue, a yacht and crew can survive a storm of the severity of the Fastnet or 1998 Sydney-Hobart storm with no serious storm damage or crew injuries

A series drogue has significant advantages over the large drogue model. First, there is not one single breaking point of the drogue cones. It would have no effect if a few of the cones ripped, and because the pressure on each cone is quite small, the changes of a rip are very low. Second, it is not necessary to deploy the entire drogue. A smaller section can be deployed in lesser conditions. (To do this, the cones could be connected in sections of 40 cones followed by 20' of clear line, then 40 more cones, etc.)

Launching and Retrieval:

A series drogue is fairly simple to launch and extremely difficult to retrieve. To launch, the drogue is flaked down with the bridle end at the bottom of the bag and the bridle legs fastened securely to the corners of the transom. The weight is at the top of the bag. The weight is dropped overboard and the drogue fed out slowly. The weight will pull the drogue down and away from the boat, eliminating fouling. Eventually the drogue will catch the water and secure the boat.

Because of the significant resistance given by the 100 – 150 cones, it is very difficult to retrieve a series drogue. (Most large single piece drogues include a collapse mechanism that eliminates their drag.) Some skippers have even been known to cut a series drogue loose and abandon them in frustration. At best it will take a half hour of significant effort to retrieve the drogue on a large winch.

First, prior to launch the skipper should affix a single line to the apex of the bridle. This can be winched in to bring the main drogue line up to the boat. All winching should be done not from the stern, but from the cabin top. This brings the drogue up into the cockpit. A pair of "drogue retrieval lines will be used, of proper diameter for the winch. It creates a mechanical advantage to tie a pair of snatch blocks to the mast and run the retrieval lines from the winch, through the snatch blocks back to the drogue itself (see attached drawing). Once the drogue line is on board, the most efficient method is to attach the retrieval line to the drogue with a rolling hitch. This is easy to tie and remove. The drogue is then winched in towards the mast until the rolling hitch is up on the cabin top. At this point the second retrieval line, from the other winch, is tied to the drogue and winched in. Then the first retrieval line will be slack, so it can be moved and tied further down the drogue, and so on. Depending on sea conditions, this can take about 20 to 30 minutes. A diagram is provided on the next page.

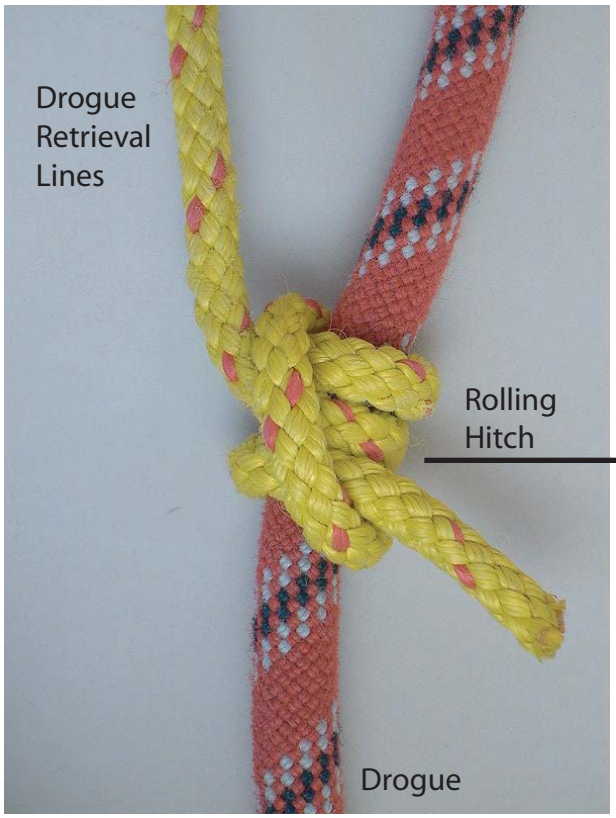
Drogues and singlehanders:

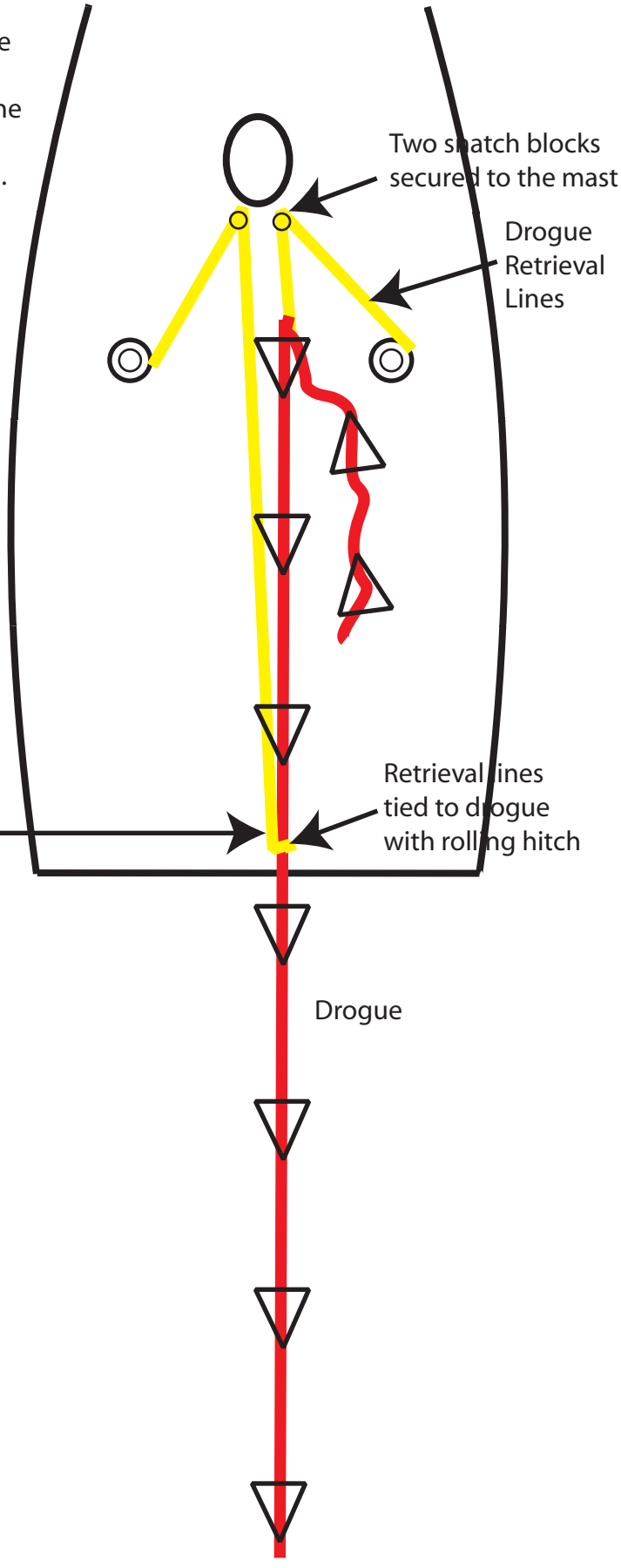
From the "Drag Device Data Base" web site at http://www.dddb.com

"Swift Cloud", Brooke cutter, LOA 37' x 6 Tons. In June 2002 Swift Cloud left New Zealand for Rarotonga and ran into a Force 10 storm. Her singlehanded owner deployed a homemade series drogue consisting of 30 cones, each 10 inches in diameter. "At 45 knots the drogue held Swift Cloud stern to, but an angle of about 20 degrees to the wind. At 60 knots she was taking wind and sea dead astern. "The ride was a little like being on a bungee – I could feel her accelerate as a sea approached, but as she went up

Drogue Retrieval

To retrieve the drogue, use a pair of "retrieval lines" through a pair of snatch blocks at the mast, to the cabin top winches. Tie the retrieval lines to the drogue using a rolling hitch at the transom. Winch the line in to the cabin top. Then connect the second retrieval line at the transom and winch it in. Then move the first retrieval line to the transom and winch it in, and so on.





the face of the sea the forward movement would slow and then reverse." The stern of the yacht took a beating, however, water coming in through the companionway "as though from a shower nozzle." The self-steering gear was carried away when a weld failed, "but the boat was kept well under control." Swift Cloud was tethered to the series drogue for 60 hours during which time she drifted in circle of about 20 miles radius.

From the Jessica Watson website at www.JessicaWatson.com.au. Jessica, who complete her singlehanded circumnavigation at age 16, used a parachute drogue nearing the Bass Strait towards the end of her voyage in 2010. She proved that a drogue is not the answer to every problem and still requires vigilance:

And last night things sure got interesting. I put the drogue (a parachute like thing that you trail behind the boat to slow you down in really big seas) out to stop us losing too much ground and to stop us being knocked down. The wind gusted at 55 knots and the sea was (and still is!) a total, gigantic mess, with 8-12 meter swells. Although the wind is easing now, the sea's still rising.

Riding out the weather with the drogue out was a lot like my first gale in Ella's Pink Lady because of the new motion and all the new noises. It didn't make for the most relaxing night as I played around with the bridle to try and get us sitting at the right angle to the waves. Then when I did put my head down for a bit of sleep we were knocked down again when the lashing came off the tiller and a big wave caught us on the side.

As a further thought on the topic: Jeanne Socrates launched a series drogue to retain control after Nereida's knockdown, suffering severe damage near Cape Horn. A local fishing boat arrived to take her in tow:

"When I retrieved my series drogue, my suspicions were confirmed ... Looks as though the fishing vessel, when approaching and circling us in the night, cut the line with its prop - of 125 cones, only six are now there with a very reduced length of line... and no chain, of course...!"

This only proves my continuing view that the singlehander must be prepared for the worst possible things to go wrong at the worst possible moment, even if they have taken the best possible precautions.

Through all of the above discussion about drogues, it must be remembered that they only allow the boat to sail down wind. They can not help the skipper to fight his way up wind. In 2007-2008, Glen Wakefield attempted a westward circumnavigation (the wrong way against the wind) on his Choey Lee designed Offshore 40 "Kim Chow". When sailing in the roaring 40s, Glen would reduce sail to a triple reefed main and "hankee yankee" and then even further to just the hankee yankee as winds increased. This sail is just 8 square feet and is only used to hold the bow into the wind. Thus by doing so he is able keep the boat in a safe position to the waves, climbing up them at a 45º angle. During these conditions, Glen's forward progress was reduced to single digit miles per day, even falling back some days.

Damage:

It is guaranteed that damage will occur during short sails on sunny afternoons and during long voyages with calms and storms. Things will break – important things. The key to being a successful singlehander, and perhaps the great joy in what we do, is in how we handle these

situations. My great disappointment is singlehanders who are forced to abandon their voyage or call for help for something that should be repairable. My greatest respect goes to those who solve their problems and continue with their voyage.

Here are some postings from the 2008 Singlehanded Transpac logs:

- **July 27: Ruben Gabriel (sailing the Pearson Electra 22 "Sparky") flies his spinnaker and hand steers from the am to the pm check-in, then puts up the twins at night. He's done this daily from the first day he was downwind. Today he decided to take a break and put up twin head sails during the day. In the early afternoon he hoisted and reefed his mainsail (in addition to the twins) to increase his speed. At about 11:45am, pacific time there was a gust of wind, he rounded up, and the mast broke 2 to 3 feet above the boom gooseneck. Fortunately there were no holes in the boat or in Ruben. It took him several hours to retrieve the mast and rigging from the water.**

  After spending time bobbing around, he's managed to use the bottom portion of the mast and the lower shrouds, forestay, and a halyard on the stern to jury rig a new mast. Using his jib, he's able to steer a steady course going between 1.8 and 3.5 knots.

  He said the mess on his boat is unbelievable and is doing his best to clean it up. He's tired, but now with the new rig he's feeling better.

July 29: Today was the launch of phase two of his new jury rig. He topped his current rig by opening up the mangled, squished portion of the piece of mast he was using for phase one, and inserting the twisted, crooked, piece of what's left of a spinnaker pole. He then ran a jib halyard up the pole.

The successful phase two is now 8 to 9 feet tall running twin headsails. While talking to him on the phone tonight, he hit the downside of a swell at 6.6 knots! His speed is ranging from 3.5 to 5.5 knots.

July 28: With the hope of increasing his speed, tomorrow he plans to replace the current jury rig with the larger portion of his mast which is approximately 12 feet high. He's feeling better and his spirits are high.

August 2: The last couple of days have been full of ups and downs. Thursday there was very little wind which provided the opportunity to deploy Operation Sparky Phase 3. He began using the top portion of his mast, which was about 12 feet tall (much larger than Phase 2), and attempted with all of his strength and ingenuity to re-step it. After agonizing and struggling for hours in trying to get it up and secured, he realized that he needed to make it a little shorter. So he removed 2 feet from the bottom and, after blood, sweat, and tears he successfully secure it. Now he can use his existing lower shrouds, forestay, and a halyard for the backstay. In addition, he now has running halyards. The plan (once there

is wind) is to continue using his twin headsails and fly an asymmetrical spinnaker. The rig is also much more stable.

August 8: Sparky finished SHTP 08 this morning at just after sunrise (6:34 HST). It was a beautiful morning with misty squalls inshore against Kauai's peaks, and a light offshore breeze. Ruben's jury rig is the top 9 feet of his mast stepped on deck with sails hanked to the shortened headstay. After anchoring in the Bay, Ruben was whisked ashore to a welcoming with Robbie and his family, who had flown in from New Mexico. Not a dry eye in the house. This evening at Tree Ruben will receive his SHTP 08 belt buckle.

- **July 27: At 03:00 Skip Allen (aboard a Wylie Custom 27 "Wildflower") was struck by a particularly strong Squall. He was using two poles to fly his two headsails. A wind gust managed to overpower his Windvane and his boat headed up into the wind. As a consequence I believe his port pole dipped into the ocean causing it to snap in two. Half the pole went flying over head and wrapped in his outer shroud. The other end flew up and smashed his radar dome.....while all this was happening Skip was hit by a flying fish. Now I know I'm having fun!**

Damage during the 2009 Solo Transat,
Collected by Jerry Freeman

- **QII Open 35. Torn main sail, the lowest full length batten had the batten car to mast track removed in error by sail makers' assistant. Point load opened to a hole that eventually ripped full width of sail on day 15, last 6 days sailed with 2 reefs in light conditions. Cost 12 hrs.**

  Spinning Wheel. Open 40. New plastic rudder bearings pintles failed on twin transom rudders in first 3 days, These bearings were fitted prior to start replacing long tested metal bearings that had completed the delivery from Italy with no problem.

- **De Franchsman. Open 30. Old fore hatch fitting failed on front-hinged hatch. Massive water ingress to cabin, floorboards cut to fix over hole. Consequential damage; nothing serious, but all clothing and fresh food wet. Cost; lost four hours repairing and recovering mainly due to reducing speed (down to about 1 or 2 knots) to minimize water ingress during the night. Remember it was a 30-knot beat in the Western Approaches.**

- **Jbellino. J122. Lost all spinnaker gear over the side on day 17, (Grand Banks ice/fog) in heavy running conditions and knock down. Also jib wrapped round forestay and flogged itself so that the vertical battens ripped the sail to shreds. Sail written off. Probable primary cause of this incident was lack of food – low blood sugar – and tiredness. It should have been a normal spi take down but I changed the process and allowed the sail to drag in the water. Wind continued to increase. Boat gybed, sheets and guys tangled round rudder and more. Bad**

decisions at many points through the night. Solution - be aware of effects of low energy and tiredness and try to do minimum to stabilize situation. THEN eat and rest even if for short time. I failed to take this advice.

Pilot failure. New Raymarine Type 1 pilot (ram) failed after 35 hours. Used about 15 hours before race start so I believed that it had passed its failure phase. Problem was an assembly fault.(Rob Craigie)

- **Katie Miller sailing her Figaro 2 BluQube(21 days 19hrs) reports: The radar pole detached and fell into cockpit taking up a lot of space, a hazard. The pole was fitted 2008, radar never used. Cost about 36 hours? Loss of radar caused me to change planned route to avoid the Newfoundland banks and fog. Added extra distance and contrary current**

  Water ingress to cabin caused by poor seal from companionway sliding hatch. Cost about 5 hrs, immersed EPIRB in cabin false alarmed causing distress at home.

  Sail damage caused by loss of top batten. Cost 2 hours.

  Rudder damage (20 cm of tip broken off) caused by collision with unidentified object. Most probably a container judging by shear on rudder. This lead to further more serious water ingress, the source of which could no be found during the race. Later found to be a tear in the rubber gaitor around the rudder stock.

- **Oscar Mead sailing King of Shaves, J105:**
  My first problem was that the cogs in the port side pit winch gave way before lands end, as i made the change to the #4 jib in 25knots of breeze, old cogs just sheered. Having contacted Harken on my arrival home they instantly guessed which winch it was before I told them, so it's a problem they have been dealing with.

  The next real problem was sea talk, having been very happy with the pilot during the first part of the race and impressed at how it was coping it seemed fitting that this should be the next thing to break. It started with the speed instrument up by the 20/20's which began to flicker on and off, finally it turned off completely. Not a problem but the entire sea talk network crashed and the boat instantly rounded up alarms going berserk. I got the boat back on track and used string and the wheel lock to keep her on course, but it wasn't fast, then I began to try and fix sea talk, I made an emergency call to Will Sayer as he knows Raymarine well, he suggested I look for breaks in the yellow sea talk wire, which I had already started. Going up wind in 25 knots with the spray hood and garage unscrewed and in the cockpit , all the headlining on the floor, was a frustrating few hours, but there was to be no sleep till it was fixed or I had some sort of solution. After about four hours it began to get dark, and I hastily re-wired the pilot without sea talk input using only one display,

and with only heading data. This served but it was no where near as fast as wind angle, that defiantly cost me, especially in the light, without the pilot playing the small shifts the boat simply stopped and I would go nowhere for an hour whilst I was asleep.

When the boat got back to the UK the problem proved to be water ingress into the main distribution panel in the wiring box, the panel had shorted and taken down the network, short of a replacement there wasn't any mending it.

However half way through the race and nicely mid Atlantic I found I was unable to charge the batteries at all, I checked all the terminals re did the fittings on the alternator and checked the boost system, all was ok. Finally I narrowed the problem down to the blocking diode in the split charging system, they had completely burned out, a quick rewire and they were removed, problem solved.

Damaged sails was another problem, by the time I reached Newfoundland I had a foot long gash just bellow the third reef, by the time the storm had gone threw, I had a three foot gash along and at least on and a half up, despite my best efforts with Kevlar tape, in the end I had to take the mainsail down three times and gaffa tape it into oblivion and that didn't really work either but I think it helped.

- **Will Sayer on Elmarleen, Delivery to Plymouth: Wind generator started to spin excessively fast and developed a loud rattle as I sailed through the Needles – it was blowing 30 knots. Concerned that the generator was broken I contacted the manufacturer immediately on arrival in Plymouth. I was assured that it was fine and that it had over heated so it went into free spin. This was true but during the race it became apparent that the bearing had also gone resulting in hellish vibration and noise in anything over 15knots. Noise was so great I couldn't sleep in a primary berth. No lost time but incredibly distracting.**

  During the race:
  Day 3: On doing the first maintenance check around the boat since the beginning of the race I noticed that the port lower shroud had the majority of its strands broken at the top swage. A sound repair was required immediately otherwise I would have had to retire from the race. I had no spare lower, but I did have a spare inner forestay which was 6mm dia rather than 7mm. I also had a 6mm sta-lock fitting. I used the 6mm T on the spare inner forestay to attached it to the mast and cut the bottom to length with bolt croppers and used the sta-lock fitting to attached it through the body of the old bottle screw. It meant I could not tension the lower shroud but worked as a replacement for the remaining 20 days.

  Two things to note: the sta-lock fitting unwound and nearly came loose after about a week. This was due to the difficulty in assembling it at

sea. I reassembled it with a whole tube of loktite. The second issue was on inspection in Newport, the backing plate in the mast had cracked as the 6mm T terminal didn't fit the 7mm backing plate. This could have resulted in the loss of my rig mid-Atlantic. Time Lost: 2 hours

Day 4: I am guessing the wind vane rudder (Navik) hit an obstruction. This resulted in the trim tab on the trailing edge of the rudder breaking its lower pintal and being bent horizontal. I had a complete spare rudder paddle assembly which I swapped over two days later when the sea state had calmed down. In the mean time I sailed on using autopilot.

Day 5: Ripped my light weight spinnaker. It caught inside the lower shroud and I continued to pull the halyard. Spinnaker was torn the full length and unusable for the duration of the race.

Day: 10 I am guessing this happened when I was hit by a big wave beam on as I wasn't aware or the true extent of the damage until lifting the boat in Newport. When hand steering I felt the rudder get tight when I pushed it to port. The bearings were brand new and replaced in April but no sign of them being tight was evident before the race. This eased up as the race continued but was replaced with a clonking/knocking noise when the boat rolled. The bearings suddenly felt excessively warn when steering by hand. When lifted the rudder had been bent sideways 3-4 inches (measured at the bottom). This had resulted in the lower bearing breaking loose from the hull and wearing internally and externally excessively.

Other: I fought charging issues the whole way across. The wind generator with its damage bearings appeared to have reduced output and the advanced alternator regulator tripped complaining of high battery temperature or high battery voltage nearly every time I charged. I replaced the alternator regulator at sea with no improvement. Since the race I have learnt it was the Sterling advanced alternator regulator at fault. No time lost.

What can a singlehander learn from these stories? The only important thing is that every part of the boat can break, even those parts that we can't imagine breaking.

The successful outcome of every posting comes from a skipper who had enough ingenuity to come up with a fix. It would be impossible to pre-consider every fix, but it is possible to pre-plan and it is possible to arrive at a solution. We know from many examples that there is virtually no mechanical breakdown that need, necessarily, stop a voyage and require rescue.

Before a voyage, the skipper should spend a good four hours with a pad, walking around and looking at every part of the boat. Then he should think about how to fix that part if it broke at sea. Starting from the bow, walk clockwise, examining anything that could break.

For example, at the bow the following things might possibly break:

- Hitting a log or container smashes the bow at the waterline.
- Forestay breaks at the turnbuckle, any one of three components

- Bow navigation light bulb burns out.

In this brief example, one item is life threatening but extremely rare, one item could stop the boat from sailing and is relatively common, and one item is just a little annoying but happens all the time. I am not asking the skipper to solve every single problem before it happens. I am asking to at least give a moment's thought to every problem so that if it happens, it is not completely unexpected.

There are two considerations: First, because we are only concerned with safely arriving at port, we do not need to be overly concerned with electronics. These are nice to have, but (as we know from the chapter on power) not necessary for a safe voyage. A broken radar will not stop a voyage, a broken forestay might. Second, by starting out with the idea of spending four hours on this assignment, the skipper will know how much time and consideration to spend on each item. This is not just a cursory glance; this is an in depth examination with lots of thinking. By walking around the boat in this way, and by actually thinking about how each part could be repaired if broken, the skipper will have gained enough experience to handle nearly any other problem that might arise.

My father tells the story of how, at age 5, he and his friends set out to build their own boat. Being a cautious group, they built the patches first. They didn't get much further, but at least they were ready for the worst possible disaster.

As my father's son, I developed my own emergency patch when I took a fist sized hole in the side of my Tanzer 22, just above the water-line, on day 1 of the National Championship. For day 2, I bought a corrugated plastic sign from the local hardware store, along with Goop and some metal screws. I glued the sign over the hole and screwed it in place. This worked so well that I took a sign with me to Hawaii - just in case. Corrugated plastic is water proof, bends nicely to the shape of the hull, and glues very quickly.

A commercial emergency patching material is called "Stay Afloat:" www.stayafloatmarine.com It is a petroleum byproduct, waxy putty, that can be jammed into large or small cracks or broken through-hulls to stop leaks immediately. The videos on the web site are impressive. Company President Gary Olson told me that it has been used to fill gashes in the hull up to 18" long and holes up to 3 ½" in diameter. "Basically the more material you have the larger the hole you can plug, and it can be combined with other materials to plug very large holes."

The product does not dry or harden over time. I asked if it would survive a trip to Hawaii. Gary answered "It will last a long time as it does not break down." But it is not designed as a permanent repair; more of a temporary patch to endure the voyage. Any hole should be permanently repaired in port. It does have some adhesive qualities, so perhaps it could be used with my Beware of Dog sign and some screws on a large hole.

In all of the above stories about breakage and damage, I tip my hat to multi-voyage Singlehanded Transpac skipper Synthia Petroka, Race Chair for the 2008 edition. When speaking with Ruben Gabriel aboard Sparky shortly after he dismasted 650 miles from Hawaii. She remarked "You're a singlehanded sailor, so you'll figure it out!"

Chapter 11: Looking after the body

Injuries – First, avoid them

Bernard Moitessier

> "I am a citizen of the most beautiful nation on earth. A nation whose laws are harsh yet simple, a nation that never cheats, which is immense and without borders, where life is lived in the present. In this limitless nation, this nation of wind, light, and peace, there is no other ruler besides the sea."

When sailing with a crew it is easy to become cavalier about running around the boat. If a sailor falls, he has a crew member to pick him up and to take over his responsibilities. Injuries are fairly common on an active boat; broken ribs caused from falling onto a winch, sprained wrists from falling onto the deck and sprained ankles from slipping on lines. While these might not be considered overly serious on a crewed boat, they will probably knock the sailor out of commission for several days, perhaps making it impossible for him to perform any work.

The singlehander can not allow for this level of incapacitation. A relatively simple injury could lead to disastrous results, even during a day sail. For example, imagine jumping from the deck to the cockpit, catching a line and spraining an ankle. This causes the skipper to pass out for just a couple of minutes. This would be disastrous in tight spaces. A personal example, sailing at night into the Juan de Fuca Strait: I was very tired when I stepped from the cabin top onto the ledge of the main hatch. I missed the ledge and fell – half through the hatch and half into the cockpit where I banged my head on the traveler. It took a couple of minutes to regain my bearings. I was lucky that the winds were light. Just a half hour earlier, before the wind died, this would have been a very serious incident as the boat sailed its continued course.

The rules laid down in this section are nothing more than common sense, but common sense alone will keep a sailor alive. These types of accidents are completely avoidable with proper caution. If we can avoid the obvious things, we can reduce the threat of accident by ninety percent. My hope is that after reading this chapter, the singlehander will pause and think for just a quarter of a second, long enough to adjust his behavior a slight bit to eliminate the risk. Perhaps the best way to put it is <u>learn from my mistakes</u>.

The first precaution: Never run anywhere on the boat – walk quickly but deliberately. The singlehander should look down at his feet when walking, not up at the sails or the mast or the rigging. There are dozens of threats to every footfall but almost nothing dangerous overhead.

The second precaution, never jump. Even jumping a short distance from the cabin top to the cockpit is an accident waiting to happen. The singlehander should take deliberate, cautious steps from one level to another. Because the boat is a moving target, the chances of missing a proper footfall are very high. As much as possible he should hold onto something solid at the same time. The old seaman's saying "one hand for the Queen and one hand for yourself" is more than just quaint. It is a rule that in any precarious situation, the sailor should use one hand to keep himself safe and one hand to operate the boat.

The third precaution, keep the working areas of the boat neat – especially at night. A single-hander must take the time to clear the deck of any lines either coiled or loose, either neat or a mess. Any line will roll underfoot. This will be very dangerous on a level boat and even more so on a boat at 30°. At night the sailor will catch his feet on lines virtually every time he moves. Lines are everywhere around the boat. It is impossible to eliminate them but it is possible to make them manageable. The best way is to store the lines in exactly the same place every time. If every line is stored in the same place, the skipper will instinctively know how to avoid them. Even

if he does catch a line on his foot, he will know how to shed it in the dark because he will have done it dozens of time in the light. Halyards should be stuffed into a proper rope bag. Each halyard stuffed into a bag will eliminate 30-60 feet of line in the cockpit. Loose jib sheets can be eliminated by using a single, continuous sheet rather than a pair of sheets. This one step will remove 40 feet of line from the cockpit.

Every danger apparent during the day doubles in intensity at night. Obviously it is dark, making the danger impossible to see. For the most part, the singlehander will be working the boat by experience and feel, rather than by sight. All lines look the same at night. It is impossible to differentiate between a blue halyard, a green jib sheet and a red anchor line. Unless the skipper knows exactly where and how each of these lines is stored and how it will release, pulling into a tight anchorage at midnight would be a dangerous and embarrassing undertaking.

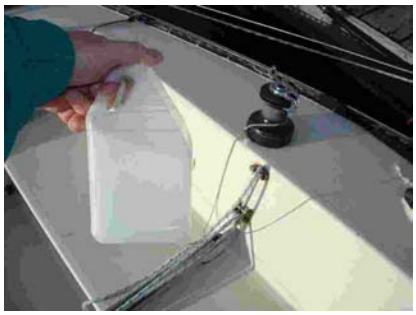
An even greater danger is that at three in the morning the singlehander is extremely tired, blurry eyed and making bad decisions. It is ridiculous to tell the singlehander to get some sleep, the boat must be sailed. The only step that can be taken is to make all of the actions required to sail the boat as robotic as possible. The skipper should not have to "think" at three in the morning – it's just not possible. Every action should be done by instinct, which requires that every piece of running rigging be perfectly stored in the correct place.

Do not store sails on deck in the walking areas. They will be in the way and they will be tripped on. All sails should be stored below deck or secured in designated spaces on deck. I follow the rule that the working areas of my boat, that is the cockpit, cabin top and foredeck, are all kept neat. These are the areas where I will be rushing to perform difficult tasks like gybing a spinnaker. Anything on the deck will either catch my foot or my tether. If the winds are so strong that I can not pack the genoa into a bag, I just shove it down the main hatch in a big pile. I know that my working areas are neat, and if I step into the cabin I know that I'll be stepping onto a disorganized pile of sail and line. If I trip on something on deck and fall off the boat, I'll likely die. If I trip on something in the cabin and fall, I'll land on the bunk. The fact that I know the conditions is what makes the system work. The dangers only come when I don't know what I am stepping on.

Urinating:
I am amazed to watch men urinate off the stern of a boat, with one elbow wrapped around the backstay, holding them self in the other hand. It just seems insane to be in this precarious position, especially for a singlehander. Here is a paragraph from Ronnie Simpson's Singlehanded Transpac adventure, as published on SailingAnarchy.com:

One most memorable instance, when I was on my knees pissing off the transom (still clipped in) and the boat decided to round up. So back up to the helm, board shorts still around my ankles, peeing all over myself and the cockpit, so that I can stop the pilot, dump the sheet, drive down, sheet back in, etc. But that's what single-handing is all about. It's not always pretty, but you get there.

There is a simple solution. Find a 1 litre plastic bottle with a handle, such as a vinegar bottle. Cut the opening a little larger, but leave the handle in place. Tie a cord through the handle with a large loop at the other end.



The singlehander should remain safely in the cockpit. Place the loop over a winch. Hold the vinegar bottle with one hand and hang onto something solid with the other. For a man, just flop yourself into the bottle. For a woman, hold the bottle between your legs. After urinating, toss the bottle overboard while you zip up. The bottle will flush itself in the wake beside the boat. This is a safe solution to the problem.

Bowel Movements:
The singlehander has two advantages over a crewed boat. First, he never need clean the head. Second, he can experience the delight of pooping outdoors, with the whole ocean in view. A simple five gallon bucket is the source of this joy. I have glued a rubber mat to the bottom of the bucket so that it does not slip out from under me – a disaster. I also carry a one gallon pail on a rope to rinse out the larger one. I think it would dislocate my shoulder if I attempted to catch water in the five gallon bucket while traveling at seven knots.

Diaper Rash – not just for babies anymore
For an adult, nothing is worse than a bad case of diaper rash. It is caused by too much moisture, for too long, in the nether regions. I strongly recommend that long distance sailors pay the money for a really good, high quality set of foul weather gear. Once a person has faced diaper rash, $1,000 on foulies will seem a cheap price.

However, in reality nothing can be done to eliminate moisture in the multiple folds of fabric and skin in the groin area. The singlehander is likely to spend days on end sitting in the steady rain on a long voyage.
When his foul weather gear is wet from the outside, there is little chance for moisture from the inside to evaporate, even with the best gear.

Every singlehander should take a trip to the pharmacy and pick up a jar of strong, zinc oxide diaper rash cream. It's messy stuff on a baby, and even more so on a hairy adult. But it should be applied any time that the sailor will be sitting in the rain more than a few hours.

Remember, the whole purpose of this book is for others to learn the lessons that I gained through hard experience. Learn this one first!

Keeping Clean:
Large boats have reasonably sized heads with sinks. Small boats don't. The best alternative is pre-moistened towelettes, such as "Wet Ones". These are stronger than normal baby wipes. They work equally well for wiping off sunscreen and after using the bucket.

Industrial strength paper towels are handy for a quick cleanup after a day in the sun. I use them with water to wash my face and arms in the evening, when sunscreen is no longer necessary.

Medical first aid

There are two key issues facing the singlehanded sailor with regard to medical aid. Most "first aid" is given with the assumption that the patient can be transported to hospital within minutes, or at most a few hours. In a search through nearly every first aid book in the world, the instructions for every serious ailment either start or end with "transport to hospital immediately."

When a sailor is offshore, the assumption must be made that formal medical assistance is 48-hours away at the absolute minimum. More realistically, professional medical assistance is 5-7 days away. I am not exaggerating with this figure and it has been proven out time after time.

Two factors lead to this excessively delayed timeline:

First, if sailing anywhere more than 100 miles offshore, even near populated areas, it must be assumed that it will take between 8 and 24 hours for a rescue vessel to reach the boat.

If a sailor were to issue a mayday by VHF radio, he would have to hope and pray that a ship is passing within 20 miles to pick up the signal. If the sailor were to activate an EPIRB, it would take several hours for the COSPAS-SARSAT to verify the signal (which requires calling the sailors' contact person to verify that the signal is not a false alarm), and activate the emergency response. If the sailor were to attempt communication to the coast guard by Single Side Band radio, - good luck! Experience has shown this to be unreliable at best. (Referring to Skip Allen's return to California from Hawaii, where he tried to contact them: "Coast Guard NMC Pt. Reyes, Kodiak, and Hono were not answering my radio calls on their published 4, 6, 8, and 12 mg frequencies, both simplex and duplex." See the chapter on Bad Weather for more details.)

It is also unlikely that a casual sailor will go to the trouble of installing an SSB for a once-a-year offshore outing. A satphone is the only way for a typical sailor to reliably and immediately contact emergency assistance. But the expense of purchasing/renting and using a satphone means that many trips are done without them.

Second, if the boat is in any type of rough weather, evacuation will be impossible even once a rescue ship has appeared. Here is a brief exert from Glenn Wakefield's account of his singlehanded trip around the world, taken from his website at www.kimchowaroundtheworld.com:

But when he was about 300 miles north-east of the Falkland Islands and 750 miles from Cape Horn – his last big challenge before he turned the corner on the home stretch – a storm battered him, his boat and his dreams. "It didn't look on the weather to be anything more unusual than what I'd already experienced," Wakefield said. "But as it turned out it was."

The boat was rolled by the fierce wind and enormous waves. Wakefield didn't think he'd perish, but said he realized his "capability to carry on was diminished."

"I was unconscious for awhile, I had a gash and was bleeding and the one side of my body was quite badly bruised so I have some nerve damage – nothing that time won't heal and I'm well on my way, but when you put that together with the fact that the life raft was gone, the solar panels were gone, the wind generator was damaged and one hatch was gone, it just led you on a path that wasn't particularly great," Wakefield said. "As it turned out, it was the worst weather they'd had in the Falkland Islands in 25 years."

The Argentine coast guard pegged his situation immediately but getting a 450-foot naval vessel to him quickly was another matter. "It took them two days to get to me and then when they got to me it was so rough they couldn't get to me for 36 hours," Wakefield said. "It was too rough."

I know of several other examples with this length of delay. The simple fact is, any offshore sailor must be prepared to live, and I do mean live, with emergency medical assistance at least 48 hours away under the best conditions, and seven days away under the worst.

The second key issue facing the singlehander is that there is virtually no documentation and absolutely no courses available on "self first aid". We live in a social world where the loner really is by himself. All first aid manuals talk of treating "the patient" as a third person. (For example even the excellent "Doctor on Board" reference book discussed below only refers to

performing the Heimlich maneuver on another person, not on oneself.) All books assume that the injured person will rest after the incident – a liberty not given to the singlehander.

Here are excerpts from the incredible story of Victor Yazykov who performed self surgery during the 1998 Around Alone, taken from www.SFGate.com as written by April Lynch, Chronicle Staff Writer on November 19, 1998:

Early in the race, he injured his right elbow. By November 10, he e-mailed Carlin, the race's on-call and online doctor, that his elbow did not look good.

"It feels like dead," he wrote. "Waiting for your help."

The arm problem grew worse, spreading to Yazykov's hand and making it tough to climb the mast, secure lines or wrestle with the rigging. On November 12, Yazykov wrote, "The pulse in the wrist is OK. . . . All the fingers are moving, but it is still a bit colder and weak."

The next day, Carlin decided that the infection needed emergency surgery. Yazykov, equipped with a few medical supplies, would have to do it on his own. Carlin e-mailed detailed instructions on how to puncture and drain the abscess with the scalpel. Yazykov would have to hold his arm over a mirror to see where the incision would go.

Yazykov got the doctor's e- mail. Then, as the sun went down, his computer link died. He was on his own.

The surgery was makeshift at best. Bungee cords, a bottle of red wine and some chocolate became instant medical supplies for a sailor who had to become an instant surgeon almost entirely on his own.

Holding his arm over the mirror, Yazykov cut into the infected area. As blood and fluid poured out of his arm, the sailor could no longer see the incision in the mirror and did not know where he should press to stop the bleeding. Panic started to set in.

"It didn't take long to do all the doctor's instructions, but the bleeding was too frightening," he wrote. "So I have placed a (bungee) cord above the elbow," in a misguided attempt to stop the bleeding. "Watching as my life drop by drop (is) leaving me," he wrote in an e-mail Saturday.

Cutting off the blood supply to the injured area could have cost Yazykov his arm. "The stakes were very high," Carlin said. "Losing his arm would have been a disaster."

The tourniquet made the sailor's hand and arm go numb. The wound continued to bleed. The cabin was covered with blood. After two hours, Yazykov's arm turned cold and rubbery, and he took the tourniquet off. Slowly, the bleeding eased.

"Blood was all over the cabin floor," he wrote. "The hand was white, cold and rubberlike. . . . I have been losing control. Getting out of power. Will finish later. Bye."

He tried soaking the hand to coax some life back into it. Believing that red wine would help rebuild his blood supply, he drank half a bottle of it. He ate some

chocolate. He took a couple of aspirin. Then he passed out.

When he woke up, Carlin directed him by e-mail to apply direct pressure to the wound, which Yazykov did. He finished the first leg of the race, making it to Cape Town, and is expected to make a full recovery.

Two books will provide the singlehander with both a detailed medical reference and a more useable quick guide to medical emergencies:

International Medical Guide for Ships

Available for free download from the World Health Organization at www.who.int. This 469 page volume should be printed and stored in a binder on the boat for the simple reason that it is the only large reference that actually uses the term "when evacuation is not possible", i.e. it was specifically written for use at sea when help may be days away. The book was written for a ship's designated first aid provider. As such is assumes a basic level of medical competency. This book has an excellent "medicine chest" section that describes in detail exactly what items should be carried in the boats' first aid kit. Perhaps the most important content is the point form "What to do" and "What not to do" instructions for every possible malady.

Dr Laragh Gollogly, editor of the 3rd edition commented: **"Well, the same things happen to people on board a ship that happen on land. And because of the dangerous environment in which they are working a lot of other things that don't happen on land. So you have every gamut of problems you would see in an emergency room, from violent crime, to poisoning, to suicide attempts, to heart attacks, to falls from a height, with the addition of cold water exposure, drunkenness, diabetic crisis...everything you could imagine. And this book covers everything, essentially, it really does."**

The International Sailing Federation specifically notes this book in the Offshore Special Regulations for Cat 0 and Cat 1 races. "In the absence of a national authority's requirement, the latest edition (of the International Medical Guide for Ships) is recommended."

Prior to a voyage, the singlehander should spend a few evenings browsing through the Guide and reading the treatments for the most likely problems.

Doctor on Board: Dr. J. Hauert, 2010
Doctor on Board is a much more practical book for the typical sailor. It is an excellent quick reference guide also recognizing that help may be days away. Most sailors will find it easy to read because it uses normal, day to day terminology with many pictures. The 96 page book covers most of the traumatic injuries that might occur on board. It also has a very concise medications and equipment list for the medical kit.

Courses in remote first aid are available from The Red Cross: "Wilderness and Remote First Aid" www.wfra.ca. An internet search on "remote first aid" will pull up numerous courses from public and private institutions.

On a crewed boat, if one person has an accident the others will be able to take 30 seconds to search the reference books for a resolution. But the singlehander can not. It is very easy to imagine a sailor slicing a major artery on his hand while attempting to cut and release a spinnaker sheet that has jammed when the boat is broaching. Would this be a good time to search through the 489 pages of the International Medical Guide? A singlehander must have read and understood the instructions, at least in the Doctor on Board book (plus the self-Heimlich maneuver), before setting out on a voyage.

Chapter 12: Spiritual Side to Singlehanding

How rare it is that a man can spend time alone with his thoughts. We have always been a social animal, in fact we have been taught from our earliest days the importance of "getting along with others." Those of us who enjoy being alone are thought of as odd, even peculiar. But, speaking as one of those peculiar people, perhaps we are the one who will reach new insights into the universe.

In his best known book "Walden", Thoreau wrote of his voyage of spiritual discovery during a two year stay in a 10' x 15' cabin (about the size of a typical sailboat) on the edge of his home town. Thoreau rhapsodized about the beneficial effects of living solitary and close to nature. He claimed to love being alone, saying "I never found the companion that was so companionable as solitude."

I find it wholesome to be alone the greater part of the time. To be in company, even with the best, is soon wearisome and dissipating. I love to be alone. I never found the companion that was so companionable as solitude.

Society is commonly too cheap. We meet at very short intervals, not having had time to acquire any new value for each other. We meet at meals three times a day, and give each other a new taste of that old musty cheese that we are. We have had to agree on a certain set of rules, called etiquette and politeness, to make this frequent meeting tolerable and that we need not come to open war. We meet at the post-office, and at the sociable, and about the fireside every night; we live thick and are in each other's way, and stumble over one another, and I think that we thus lose some respect for one another. Certainly less frequency would suffice for all important and hearty communications. It would be better if there were but one inhabitant to a square mile, as where I live. The value of a man is not in his skin, that we should touch him.

I have a great deal of company in my house; especially in the morning, when nobody calls. Let me suggest a few comparisons, that some one may convey an idea of my situation. I am no more lonely than the loon in the pond that laughs so loud, or than Walden Pond itself. What company has that lonely lake, I pray? And yet it has not the blue devils, but the blue angels in it, in the azure tint of its waters. The sun is alone, except in thick weather, when there sometimes appear to be two, but one is a mock sun. God is alone – but the devil, he is far from being alone; he sees a great deal of company; he is legion. I am no more lonely than a single mullein or dandelion in a pasture, or a bean leaf, or sorrel, or a horse-fly, or a bumblebee. I am no more lonely than the Mill Brook, or a weathercock, or the north star, or the south wind, or an April shower, or a January thaw, or the first spider in a new house.

As a final thought on Thoreau, I'll go with this quote: "If a man does not keep pace with his companions, perhaps it is because he hears a different drummer. Let him step to the music which he hears, however measured or far away."

A singlehanded sailor is freed from the schackles of socialization. He is freed from the need to maintian polite conversation; the need to say "good morning" and not say "you're a twit". Where else in our life can we get this freedom. Socialization is not a bad thing, but is it really necessary 24-hours a day, every day of our life? For a few hours a week, or a few weeks a year,

can we not get away from all human contact, even away from the potential for human contact?

Buddhism discusses the conceptes of nirvana and enlightment. According to Buddhist texts, Siddhārtha Gautama realized that a meditative state was the right path to awakening. He discovered a path of moderation away from the extremes of self-indulgence and self-mortification. Gautama was seated under a tree - now known as the Bodhi tree, when he vowed never to arise until he had found the truth. After 49 days of meditation he is said to have attained Enlightenment. From that time, Gautama was known to his followers as the Buddha or "Awakened One."

When a man knows the solitude of silence, and feels the joy of quietness, he is then free from fear and he feels the joy of the dharma. Happy is he who lives contented in solitude, is well-versed in the Doctrine and who has realized it. Happy is he who lives in this world free from ill-will, and is benevolent towards all beings. Happy is he who lives in this world free from passion, has overcome sensual enjoyment, and who has attained mastership over the conceit of "I am." This indeed is the highest happiness.

Enlightenment is sometimes described as complete and perfect sanity or awareness of the true nature of the universe. After attainment, it is believed that one is freed from the cycle of birth, suffering, death and rebirth.

Maslow is most famous for his "Hierarchy of Needs". In his theory, Maslow proposes that a man must meet his lower level needs before he can move up to a higher level. In order, from lowest to highest, the needs are: Physiological (food, sleep, etc); Safety (personal, financial, etc); Love (and friendship); Esteem (respect and self-respect); Self-actualization (the realization of one's full potential).

The beauty of singlehanded sailing is that it allows the skipper to pass over the four lower levels and move directly to self-actualization. Once at sea, the physical and safety needs are met by the boat - nothing else is needed. There is no one else to be loved by and no one else to be respected by. The singlehander has love for himself, and esteem for himself – if he did not have these, he would not have set out in the first place. (How can anyone on a crewed boat get past the love and esteem platforms on the hierarchy?) The only thing left for the singlehanded skipper is self actualization. Alone with his thoughts he can realize his full potential, there is nothing and no one to stop him from doing so.

Christianity: The Solitude and Silence of Jesus: Adapted from a sermon by Tom Shepard:

There is great value in seeking silence and solitude in our lives. In this fast paced world – it is not uncommon for most of us to miss tranquil times of quiet. Jesus used silence and solitude quite a bit during His life and ministry. He did not get away by Himself just to get away from people - He wanted to hear that "still small voice" of The Father speak to Him. So – He sought solitude and silence – so that He could hear God's voice clearer.

The scripture tells us: "Jesus was led up by the Spirit into the wilderness to be tempted by the devil.

I would never advise anyone to go out and try to pick a fight with Satan. However, I also believe that there are times when Satan will try to pick a fight with you. Silence and solitude – your quiet time with God – will help you resist.

The second example is right before He goes out and chooses the twelve apostles. "Now it came to pass in those days that He went out to the mountain to pray, and continued all night in prayer to God. And when it was day, He called His disciples to Himself; and from them He chose twelve whom He also named apostles." It is never a bad idea to pray before making major decisions in your life – Jesus did!

Next: You recall the story of John the Baptist: When Jesus heard about the beheading of John, He withdrew from there in a boat to a secluded place by Himself." Jesus sought solitude and silence.

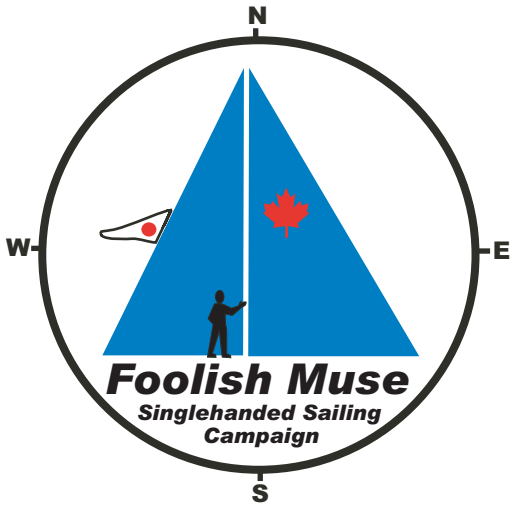
The storms of death will more than likely touch each and every one of our lives, and it is times like those that we may need to seek silence and solitude with our Father in heaven. We need His strength and support as we travel through "the valley of the shadow death."

As the popularity of Jesus increased – so did the demands placed upon Him. "The report went around concerning Him all the more; and great multitudes came together to hear, and to be healed by Him of their infirmities. So He Himself often withdrew into the wilderness and prayed."

Daily demands can drain us. There are times we all need to seek silence and solitude to help us recharge our batteries for the challenges that may lie right around the corner.

None of us know when we are going to die. We really don't know for sure what tomorrow holds. You may be going through good times right now – or hard times. You may be walking through the valley of the shadow of death – or walking on cloud nine. You may have your future all planned out – or you may be living one day at a time. But the most important thing you can do is build a relationship with God.

The best chances that any person has of conversing with God is to place himself in a position to do so; give deep consideration to issues of morality; and then hope that God has a free moment to talk. It happened to me once, for a very brief conversation. But that is all it took. Now that I have actual knowledge of the existence of God, not just faith in His existence, and now that I have received the correct answer to a universal question of morality, there is not much more that I need out of life. In the words of Maslow, I have achieved self-actualization; in the words of Buddha, I have achieved Nirvana; in the words of Christ, I have achieved peace. All of this thanks to singlehanded sailing.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