National Defence
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A-CR-CCP-613/PF-001

ROYAL CANADIAN SEA CADETS

CAN*SAIL* LEVEL 3–6 TECHNICAL PACKAGE

(ENGLISH)

Issued on Authority of the Chief of the Defence Staff

Canada

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(ENGLISH)

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LIST OF EFFECTIVE PAGES

Insert latest changed pages and dispose of superseded pages in accordance with applicable orders.

NOTE

The portion of the text affected by the latest change is indicated by a black vertical line in the margin of the page. Changes to illustrations are indicated by miniature pointing hands or black vertical lines.

Dates of issue for original and changed pages are:

Original	0	2013-06-01	Ch	3	
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Cover	0	Page	0
Title	0	A	0

Contact Officer: Staff Officer Sea Cadet Program Development

FOREWORD AND PREFACE

1. **Issuing Authority.** This Technical Package A-CR-CCP-613/PF-001 was developed under the authority of the Director Cadets and Junior Canadian Rangers (D Cdts & JCR), and issued on the authority of the Chief of Defence Staff.

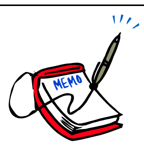
2. **Development.** Development of this Technical Package was in accordance with the performance oriented concept of training outlined in the Canadian Forces Individual Training and Education System A-P9-050 Series, *Manual of Individual Training and Education*, with modifications to meet the needs of the Canadian Cadet Organizations (CCO).

3. **Purpose of the Technical Package.** Following the first season of the implementation of Sail Canada's *CANSail Dinghy Program* and new instructor tools, feedback coming from the field identified the need for technical packages to augment the existing Instructor Packages developed by Sail Canada in support of the program. Incorporating a variety references and resources, this Technical Pack is intended to give detailed descriptions, information and video links for the various skills covered in the *CANSail Program*.

It should be noted that not all of the information included in this package needs to be passed along to the sailors. This package is intended to give the instructor the necessary background information to fully understand the skills being taught and some fundamental coaching tips. When using this package, the instructor should refer back to the applicable CAN*Sail* Rubric to ensure they assess the skills IAW the standard.

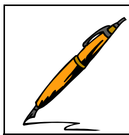
Note. This technical package focuses on CAN*Sail* skills in a doublehanded sailboat.

4. **Use of the Technical Package.** Throughout this technical package, a series of information boxes are used to highlight information; they include:



Note to the Instructor.

Key information to pass along to sailors.



Refer to the following CF regulations and policies.

	Points of interest or special instructions the instructor should pass along to sailors.

5. Suggested Changes. Suggested changes to this document should be forwarded by e-mail to sea.dev@cadets.gc.ca or to National Defence Headquarters (NDHQ) Attention: Staff Officer Sea Cadet Program Development.

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PREPARE FOR SAILING

PHYSICAL LITERACY

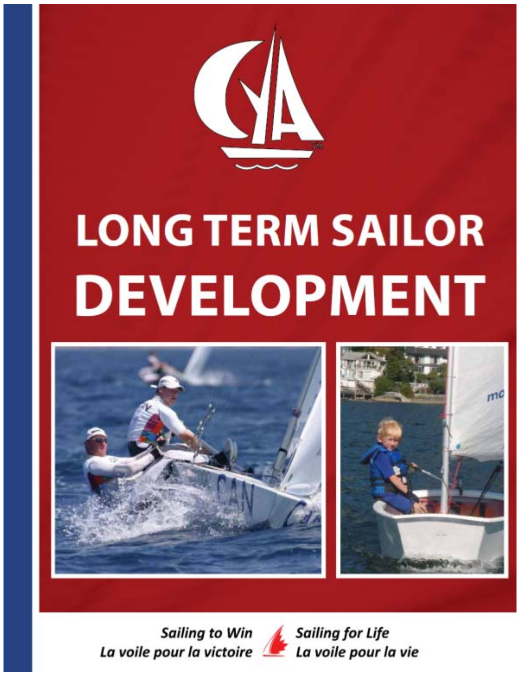
The information in the Physical Literacy section was introduced during *Sail Canada CANSail 2* training. Instructors should review hydration and nutrition requirements for sport, and build warm-up activities that promote endurance and flexibility into their daily training routine.

LONG TERM SAILOR DEVELOPMENT (CANS*AIL* 3–6)

Sail Canada (SC) has designed all CAN*Sail* curricula around the Long Term Sailor Development (LTSD) framework. In addition, all SC events adhere to recommendations and guidelines for training and competition as set out in the LTSD.

What does this mean for you as an instructor? It means that the lessons that you provide for sailors are designed for their developmental age. Developmental age refers to a sailor's stage of development, as opposed to how old he or she might be.

It's important that all CAN*Sail* instructors understand the LTSD, and how it relates to CAN*Sail* programming. In order to do this, you must take the online LTSD module. You can do this during your CAN*Sail* Fundamental Course, or on your own time. Below is a link to access the online LTSD module on the Sail Canada website.



Scan for LTSD Online Module
Or go to http://www.sailing.ca

The LTSD framework provides recommendations for on water training, dry-land, training, physical training, equipment, and competition.

NUTRITION (CAN*SAIL* 3–6)

What goes into a body has a significant impact on energy and performance levels later. Sailing is essentially an endurance sport however it also involves frequent anaerobic movements, which presents unique dietary and hydration requirements. To further complicate things, sailing takes place far from land so it is necessary for sailors to plan ahead.

BREAKFAST

Breakfast is the most important meal of the day because it jump-starts the body's metabolism. Sailors should avoid greasy food, and instead consume whole simple foods, which are high in carbohydrates and moderate in protein. For example: whole grain cereal, boiled egg or yoghurt, a banana and orange juice. This meal provides the body with essential nutrients, and the simple foods will be easily digested giving the body energy shortly after consumption.

MIDMORNING SNACK

In the middle of the morning, metabolic and energy rates begin to decrease. To counteract this and keep energy levels high, sailors should have a snack containing both complex carbohydrates (whole grains) and a small amount of protein. Snacks may include cereal / granola bars or low-acid fruits. Due to the nature of sailing, the snack break will likely be brief and offer limited time for digestion so snacks should be large enough to provide energy but small enough that the sailor can continue practicing without feeling full.

Bananas are often given as a mid-practice snack because of their high levels of potassium and ease of transportation; however this practice can actually hinder performance. Bananas are dense and slowly digested which makes them ideal as part of a pre-practice meal however should be avoided within one hour of activity.

LUNCH

Sailing is unique because it is one of the few sports where athletes train all day, and require a lunch break in the middle of training. With this in mind, a mid-practice lunch requires the same characteristics as a pre-practice breakfast. The meal should consist of lean protein, complex carbohydrates (whole grains), low-acid fruits and vegetables. Once off the water, the meal should be consumed as quickly as possible to allow ample time for digestion and energy replacement prior to the afternoon practice.

MIDAFTERNOON SNACK

Just as in the morning, metabolic and energy rates begin to decrease in the middle of the afternoon. This decrease tends to be more apparent because wind speeds are often higher in the afternoon. Snacks may include cereal / granola bars or low-acid fruits.

SUPPER

After a long day of the water supper needs to replace electrolytes and nutrients lost due to sweat and promote muscle recovery. The meal should be high in lean protein (fish or lean pork), moderate in complex carbohydrates (brown rice or whole grain pasta) and include high iron vegetables (spinach, bell peppers and broccoli). To promote muscle recovery, this meal should be consumed as quickly after practice as possible.

COACHES CORNER—NUTRITION

Sailors often consume meals prepared at home, or at a cafeteria, which gives coaches very little power over the types of food their athletes consume. Instructors can however influence the decisions their sailors make by using a self-reporting technique.

Through informal conversation, instructors can ask sailors to report their energy levels and muscle fatigue / recovery. By discussing the impacts that fatty or complex foods can have on performance, and highlighting when proper eating habits have a positive impact on self-reported energy levels, instructors can instill the benefits of making sound food-related decisions.

HYDRATION (CAN*SAIL* 3–6)

The importance of daily water intake is frequently emphasized in sports and nutrition and healthy living articles. Outside of exercise, the following table can be used as a reference for daily water intake.

Body Mass		Litres
50 kg (110 lbs.)	x 0.036 L	1.8
60 kg (132 lbs.)	x 0.036 L	2.2
70 kg (154 lbs.)	x 0.036 L	2.5
80 kg (176 lbs.)	x 0.036 L	2.9

Due to the length of time spent on the water and subsequent exposure to environmental conditions, dehydration is common in sailing. Even mild dehydration can impair skill and judgment on the water so strategies to minimize dehydration should be introduced to sailors during their introduction to the sport. Appropriate education can help sailors identify their individual needs in specific weather conditions and racing / training scenarios. Sailors should be encouraged to keep a water bottle in their sailboat or in the coach boat. Sports drinks are the ideal choice as they also provide fuel to help maintain blood glucose levels during racing. Extreme heat and environmental conditions may also warrant the use of sports drinks with higher levels of electrolytes.

The following is a recommended hydration routine for a full day practice:

- 500mL (one cup) of water immediately after getting out of bed.
- 500mL of water consumed over the span of one hour, starting with breakfast and continuing until the beginning of practice.
- 250mL of water during each practice break (not to exceed 1250mL per hour).
- 500mL of water or sports drink consumed over the span of a one hour lunch break.

Sports drinks contain fructose, fructose syrup, high fructose corn syrup or crystalline fructose, or sugar as the first ingredient on the ingredients list.

If "clean" sports drink is not available, water can be made to taste better by adding a pinch of salt, ensuring it is chilled or by adding real lime, lemon, orange, ginger root, peppermint leaves or other herbs.

Note. Water should be the main fluid source for the entire day; clean sports drinks should be consumed in moderation.

- 250mL of water or sports drink during each practice break (not to exceed 1250mL per hour).
- 500mL of water or sports drink consumed over the span of a one hour supper break.
- 250mL of water consumed in the last hour before bed.

The most important information in the recommendations above is the routine, not the quantities. Sailors should adjust amounts based on physical size, the amount they sweat and the practice intensity.

Thirst is an early warning sign of dehydration. Sailors should consume enough water / sports drink to avoid thirst, and not enough to give abdominal discomfort / bloating.

Sports drinks are designed to replace salt and electrolyte loss as the result of sweating. Based on wind speed and practice intensity sports drinks are not typically required in the morning practices, however gain importance as the practice day progresses.

COACHES CORNER—HYDRATION

Instructors, especially when coaching basic levels can easily overlook the hydration requirements of sailors. Drinking fluids while on the water is something that should be instilled at the beginning of a sailor's career to ensure it becomes habitual. Failure to do so will result in diminished performance on the water and increase the likelihood of missing time on the water, or leaving the sport entirely. When transitioning between drills, be sure to allow for a short rest and hydration break.

WARM-UP ACTIVITIES (CAN*SAIL* 3–6)

WARM-UP

Sailing in Canada often occurs in cool climate and even cooler water temperatures, making it very important to warm up the body before exercising. Sailing involves a number of awkward movements, so it is important to stretch before heading out on the water. When muscles and ligaments are cool, they can be slow moving and tight, making it important to adequately warm up muscles before stretching.

Warm up activities for sailing should focus on getting the entire body moving and engage the cardiovascular system for 5–7 minutes. After a full body warm-up, a bottom-to-top stretching activity with emphasis on hips, trunk and upper body will help prevent injury and promote optimum performance.

> Depending on the length of lunch break, it likely will not be necessary to complete a warm-up activity prior to going on the water in the afternoon. A brief stretching routine however should be conducted immediately after the morning session, and before the afternoon session.

COOL DOWN

Sailors typically come off the water wet, which drastically increases the speed that muscles cool down after practice and competition. For this reason, it is important to conduct a cool down stretching session as soon as possible once off the water. Stretching will increase blood flow in tired muscles; reducing cramping and promote muscle recovery.

COACHES CORNER—WARM-UP AND COOL DOWN ACTIVITIES

Warm-up and cool down activities can be used to promote teamwork and provide leadership opportunities within the group. Build these activities into part of the daily practice routine, and assign a "Team Leader" to facilitate the daily morning activity and cool down sessions.

> Need warm-up activities ideas? Try this:
> http://www.aisnsw.edu.au/Services/PL/PDHPESecondary/Documents/minor games booklet.pdf
>
> *Note. Retrieved February 2013.*

MENTAL FITNESS

GOAL SETTING (CAN*SAIL* 3–6)

As sailors become invested in the sport of sailing, identifying areas of improvement and setting goals will give them a point of training focus and ultimately increase performance.

Goal. A goal is an aim an individual or group works toward; an object of ambition / effort.

SELF ASSESSMENT

When goal setting, it is important to self reflect and identify areas for improvement. This can be done individually, with a sailing partner or coach. When self-assessing, sailing can be broken down into several skill sets, for example:

- tacking;
- gybing;
- upwind performance;
- downwind performance;
- heading up;
- bearing away;
- stopping / holding position; and
- accelerating.

If a sailor has identified tacking as an area of improvement they should break the skill down further to identify exactly what area of the skill requires focus, for example:

- tacking:
  - course control,
  - tiller exchange,
  - foot work,
  - sail trim; and
  - roll and heel control.

SHORT-TERM AND LONG-TERM GOALS

Short-term goals are those that can be met in a short amount of time and are often set to achieve long-term goals. By setting achievable short-term goals, individuals can measure their progress in the pursuit of their long-term goals.

For example, if an individual's long-term goal is to run 5 km by the end of the year, their short-term goal could be to run 2 km within 2 months.

INDIVIDUAL GOALS

The purpose of setting individual goals is to strive towards personal achievement. Individual goals should be based on personal performance and not on the performance of others. They should be designed to increase personal skill, ability or physical condition.

DEVELOPING GOALS

Goals should be set with a specific purpose in mind. They should be achievable and measurable, allowing individuals to track progress.

Use the mnemonic SMART to remember the factors involved in the development of goals.

There are several factors to take into consideration when developing goals. These include:

Specific. Ensure the aim of the goal is clearly set out and defined.

Measurable. Ensure the goal has defined and measurable standards to work toward.

Achievable. Ensure the goal is realistic and can be met.

Relevant. Ensure the goal is worthwhile.

Timed. Ensure there is a set time frame in which to achieve the goal.

COACHES CORNER—GOAL SETTING

Due to the nature of the sport, some sailors may go 9–10 months between the end of one season and the beginning of the next. To ensure accurate self-reflection, it is important to conduct several cobweb sails with the sailors before facilitating a goal-setting session. While facilitating a goal setting session, it is important for sailors to be honest with themselves regarding sailing skills.

Once goal-setting is complete, sail instructors should review the goals of the entire group and use this information to adjust the training schedule accordingly. This will allow the instructor to focus on the self-reported weakest areas of the group, and give the individual sailors momentum towards achieving their goals.

Unlike other athletes who tend to train several times a week, sailors typically train 4–6 days a week during peak season. For this reason, it is important for coaching staff and sailors to re-evaluate their goals frequently during the season, to determine which goals have been achieved, which are still relevant and add new goals as the sailors improve.

Refer to Attachment A for a sample goal-setting template.

SAILING LOG (CAN*SAIL* 3–6)

SAILING LOG

It is a common practice for successful sailors to maintain a sailing log. The sailing log is used to track day to day rig settings and overall sailing performance. Sailors can use this information as a point of reference for rigging, and as a method for tracking goal progress.

COACHES CORNER—SAILING LOG

When a sailor begins uses a sailing log, the day to day entries will likely be generic. As the sailors make progress with their goals, rigging and tuning abilities and overall feel for the boat type, the information captured will become more valuable.

Coaching staff should work with the sailors when completing their sailing logs to assist them with capturing useful information, highlight progress made towards achieving goals, identifying potential areas for improvement and how variances in rake, rig tension and sail controls impact sailboat performance.

Refer to Attachment B for a sample sailing log template.

PREPARE FOR SAILING

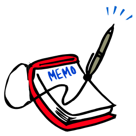
WEATHER (CANSAIL 4)

TYPES OF CLOUD FORMATIONS

Clouds are classified into two categories based on how they are formed—cumulus and stratus.

Cumulus. Formed when small areas of rising air cool to their saturation point. Cumulus clouds appear as a clumpy, "puffy" cloud which are formed in rising air currents. Cumulus clouds are evidence of unstable air conditions.

Stratus. These appear "spread out" and in sheets or horizontal layers. Stratus clouds are formed when a layer of moist air is cooled below its saturation point.



The terms cumulus and stratus are used in most cloud names. In most cases, the height of a cloud will be the prefix (beginning element of a word) and the type will be the suffix (the end element of a word).

Cloud names come from Latin. Some common words are:

- cirro = high,
- alto = middle,
- nimbus = rain,
- cirrus = curl,
- stratus (as a prefix) = low,
- stratus (as a suffix) = layer, and
- cumulus = pile.

Clouds can also be classified according to height. When identifying cloud height, the height of the base of the cloud is used.

Cirrus. High, thin, wispy clouds blown by high winds into long streamers. Cirrus clouds usually move across the sky from west to east. They generally indicate pleasant weather.

Figure 1   Cirrus Cloud

Note. From "Victoria Weather", by UVic, 2007, *School-Based Weather Station Network*. Retrieved November 1, 2007, from http://www.victoriaweather.ca/clouds

Stratus. These clouds appear as low, dull, grey sheets that completely cover the sky (resembling fog). During the day, the sun cannot be seen. They can produce drizzle or very light rain or snow. When deep clouds are above, then rain or snow can be heavier.

Figure 2 Stratus Cloud

Note. From "Victoria Weather", by UVic, 2007, *School-Based Weather Station Network*. Retrieved November 1, 2007, from http://www.victoriaweather.ca/clouds

Cumulus. These clouds are large, individual puffy clouds. They resemble cauliflower or cotton balls; the bottoms often appear dark and flat. They can often be seen on a warm day. When these clouds are in the sky one can expect fair weather, unless they begin to extend upwards.

Figure 3 Cumulus Cloud

Note. From "Victoria Weather", by UVic, 2007, *School-Based Weather Station Network*. Retrieved November 1, 2007, from http://www.victoriaweather.ca/clouds

Cumulonimbus. These clouds are very dark at the bottom. They extend into the atmosphere and have flattened tops. When cumulonimbus clouds are in the sky, one can predict thunderstorms and windy, rainy conditions.

Figure 4 Cumulonimbus Cloud

Note. From *Wild About Weather* (p. 88) by E. Brotak, 2004, New York, NY: Lark Books, A Division of Sterling Publishing Co., Inc. Copyright 2004 by Ed Brotak.

COACHES CORNER—WEATHER

The sky provides a wealth of knowledge which can be used by sailors and instructors to predict upcoming changes in the weather. With practice, reading the clouds can even be used to anticipate upcoming gusts, lulls and wind shifts on the race course. Instructors should use local weather and cloud formations as they occur to discuss impacts with their sailors.

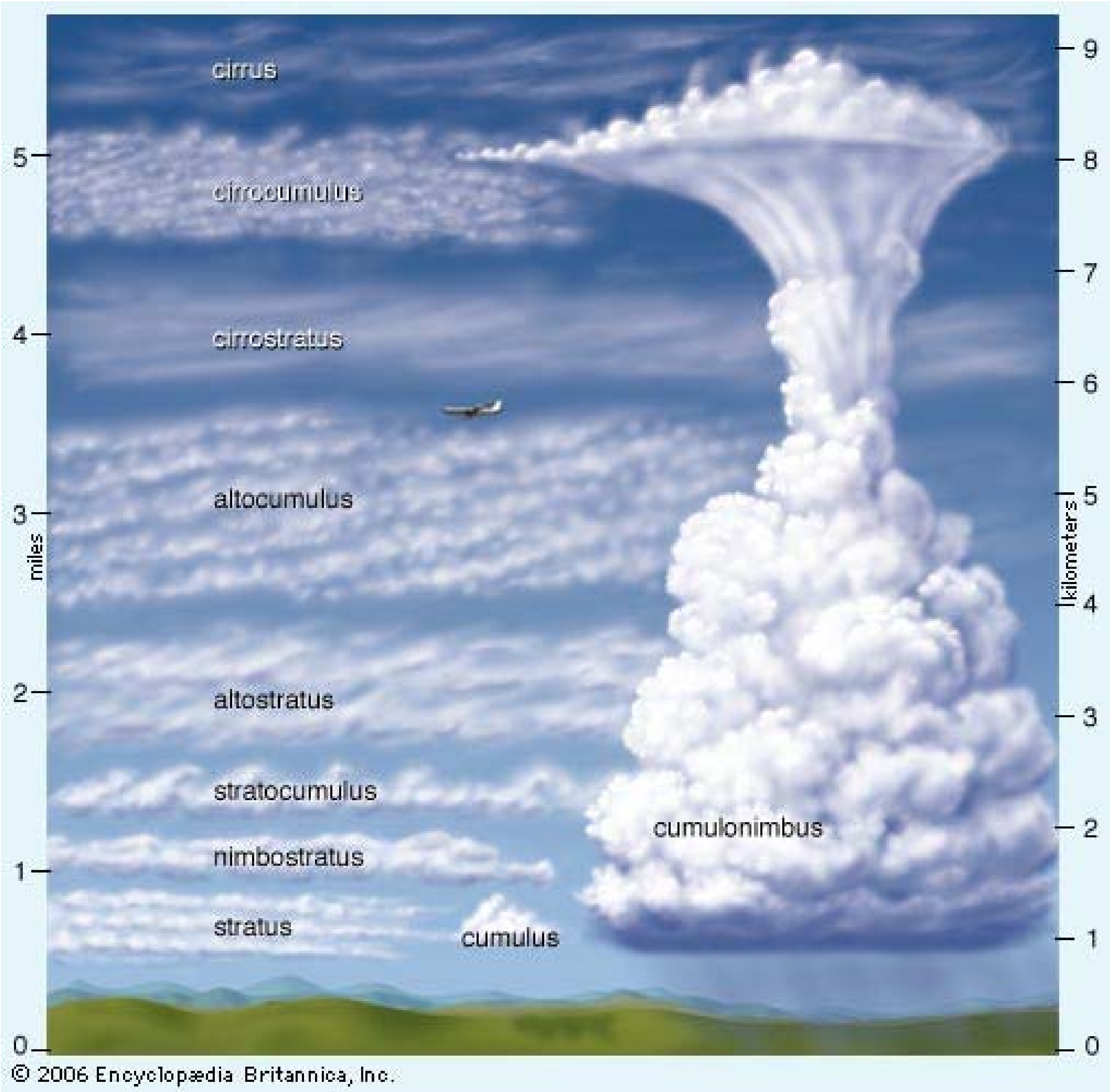
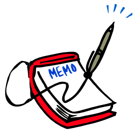


Figure 5 Common Types of Clouds

Note. From "Cumulus Cloud", by Encyclopaedia Britannica, Inc, 2006*, Encyclopaedia Britannica Online*, Copyright 2006 by Encyclopaedia Britannica, Inc. Retrieved, November 21, 2007, from http://cache.eb.com/eb/image?id=93302&rendTypeId=34

HIGH CLOUDS	
Cirrus	Normally an indicator of fair weather.
Cirrocumulus	Expect precipitation in a day or two.
Cirrostratus	Predict fair weather.
MIDDLE CLOUDS	
Altocumulus	Normally seen before fair or bad weather. Have little value as an indicator of future weather developments.
Altostratus	Expect precipitation in 24 hours or less.
LOW CLOUDS	
Stratocumulus	Snow or showers are possible and can be heavy.
Nimbostratus	Expect rain or snow.
Stratus	Expect drizzle, light rain or snow.
CLOUDS OF VERTICAL DEVELOPMENT	
Cumulus	Expect fair weather, unless they begin to extend upwards.
Cumulonimbus	Expect thunderstorms and showery conditions.

RIGGING



The information in this section can be applied to all types of sailboats; however it is tailored for use on a C420.

PREPARE A BOAT FOR RIGGING (CAN*SAIL* 3–6)

INSPECTING AND MAINTAINING ALL STANDING AND RUNNING RIGGING

Experienced sailors will inspect and maintain all of the standing and running rigging of a sailboat regularly to prevent breakdowns. While sailing, if a part of the standing rigging fails, the mast will likely fall causing damage or injury and failure of the running rigging usually results in the inability to properly control sails.

Inspecting and Maintaining Standing Rigging

Standing rigging is used to keep the mast of a sailboat upright and rigid. Standing rigging is assembled using a variety of parts, which may include:

- through-bolts,
- shackles,
- rivets,
- tangs,
- shrouds / forestay,
- crimped ends,
- swaged ends,
- link plates, and
- turnbuckles.

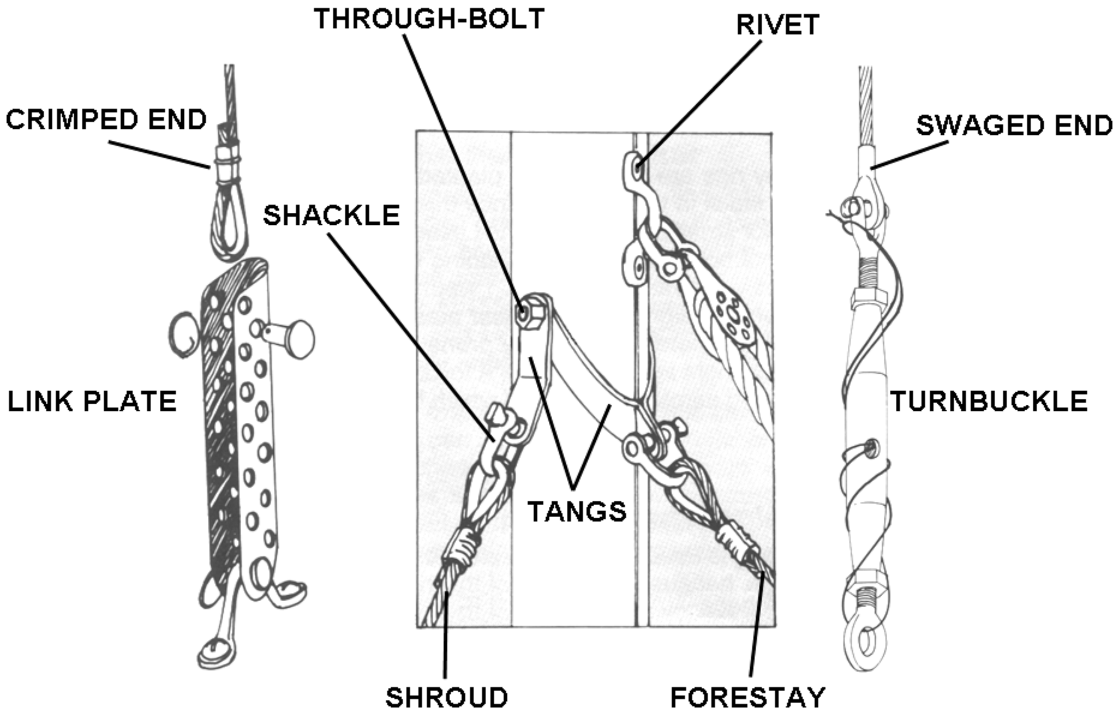


Figure 6 Standing Rigging

Note. From *Advanced Sailing Skills Manual* (p. 38), by S. Donaldson, 2001, Kingston, ON: Canadian Yachting Association. Copyright 2001 by Canadian Yachting Association.

When inspecting the standing rigging, experienced sailors inspect all of the parts looking for corrosion, frayed or broken wire strands, small cracks and loose fasteners (through-bolts and rivets). Replacing worn parts is relatively inexpensive and will help to prevent the standing rigging from failing while sailing.

Inspecting and Maintaining Running Rigging

The running rigging (control lines) of a sailboat consists of any line used to adjust or trim a sail. These lines are rigged through a series of fairleads or block and tackle (as illustrated in Figures 2 and 3) providing a mechanical advantage.

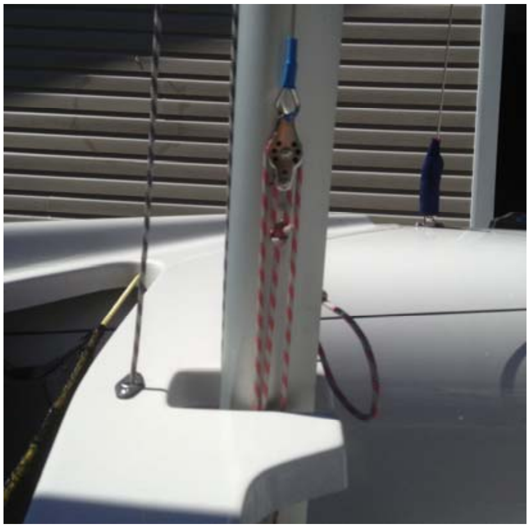


Figure 7 Block and Tackle

Figure 8 Cascade Tackle

When inspecting the running rigging, experienced sailors inspect all of the parts looking for cracked or broken blocks and fairleads, and frayed or worn line. Replacing parts can be costly; however, neglecting to do so will likely result in a failure of the running rigging while sailing.

	Frayed line can often be fixed by re-whipping or re-burning the end.

STEP A MAST AND ATTACH RIGGING

Stepping the mast of a sloop rigged dinghy is usually a two person operation due to the height and weight of the rig. Stepping a mast is an important skill that is used at the beginning of each season, when performing maintenance and moving a sailboat to another location.

	Prior to stepping a mast, ensure all required equipment is on hand.

	Prior to stepping a mast it is important to ensure that no overhead power lines are present. If power lines are present move the sailboat to another location.

STEPPING A MAST

1. Place the mast on or beside the sailboat with the forestay on top. Avoid placing the mast directly on the ground; use blocks of scrap wood to elevate the mast if available.

2. Check for tangles in the shrouds, forestay, control lines and trapeze wires, if equipped.

3. Inspect the standing and running rigging on the mast and replace parts as required.

4. Attach spreaders, if required, and ensure all of the rigging is in front of the spreaders except for the main halyard and trapeze wires (if attached).

5. Wrap rigging tape / electrical tape around the ends of spreaders to secure clevis pins and split rings.

6. Wrap rigging tape / electrical tape around any other split rings, shackles or potentially sharp sections of the mast that cannot be reached once the mast is stepped.

7. Remove clevis pins and split rings from the link plates and place on the hull once the mast is upright.

	Refer to the *Baseline Settings Section*, for information pertaining to the placement of the mast step pin.

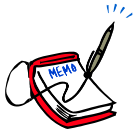
8. Elevate the mast to vertical and place the foot of the mast in the mast step. Technique for this will vary depending on the height and weight of the mast and the location of the mast step.

9. Attach the shrouds, forestay and trapeze wires.

ATTACHING ALL STANDING AND RUNNING RIGGING

1. Inspect the standing and running rigging on the hull and replace parts as required.
2. Attach the boom to the mast.
3. Attach the boom vang to the boom.
4. Attach the mainsheet.

5. Attach all remaining standing and running rigging.



The steps for attaching standing and running rigging will vary depending on the sailboat class.

COACHES CORNER—RIGGING

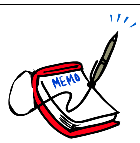
The first time a sailor steps a mast and attaches all of the standing and running rigging, it is a huge learning curve because it teaches them where everything is attached to the mast, hull, and how to run lines in a way that prevents tangles and fouls.

Due to the complexity of this process, coaching staff will need to supervise this lesson very closely to ensure various components are rigged properly. If possible, have a fully rigged sailboat close by, which the sailors can use as a point of reference.

MAST RAKE AND STANDING RIGGING TENSION

MAST RAKE

When the mast is raked forward or aft, it moves the position of the mainsail and jib sail, which affects the position of the centre of the sails—Centre of Effort (CE) in relation to the pivot point of the sailboat—Centre of Lateral Resistance (CLR). It also affects the distance between the leech of the jib and the luff of the mainsail (slot), which affects pointing ability and how much the helm can play the mainsheet before it starts to backwind.



The sailors will learn more about CE and CLR in future training. The emphasis in *CANSail Level 3* is highlighting that mast rake has an impact on pointing and performance.

Forward Mast Rake. Induces lee helm by placing the driving forces of the sails ahead of the pivot point of the sailboat and increases downwind sail power. Typically undesired because of a massive reduction in pointing ability and the tendency for the boat to bear away onto a run if the helm loses control of the tiller.

Zero Mast Rake. Mast is straight up and down. The rig is powerful because the sails are as tall as possible, and there is (typically) a lot of overlap in the slot; however pointing ability is low.

Aft Mast Rake. Induces weather helm by placing the driving forces of the sails behind the pivot point of the sailboat and promotes pointing ability.

On most dinghy sailboats, sailors will always have the mast raked aft. In light wind or when the wind is high but the water is still relatively flat, the mast is raked significantly relatively far aft to promote pointing ability. When the wind speed increases, the mast is raked forward (but still aft of vertical) to increase sail power and the sailboat's ability to punch through waves.

MAST RAKE AND STANDING RIGGING TENSION

On C420s the mast is supported by the luff wire in the jib. The forestay is generally left slack when sailing and is only used to hold the mast up when the boat is not rigged for sailing. Once the shrouds are fixed, increasing tension on the jib halyard does several things to the rig:

1. it straightens the rake, pulling the mast forward, and
2. it pulls against the shrouds and increases rig tension, mast bend and affects mainsail power by reducing draft (camber).

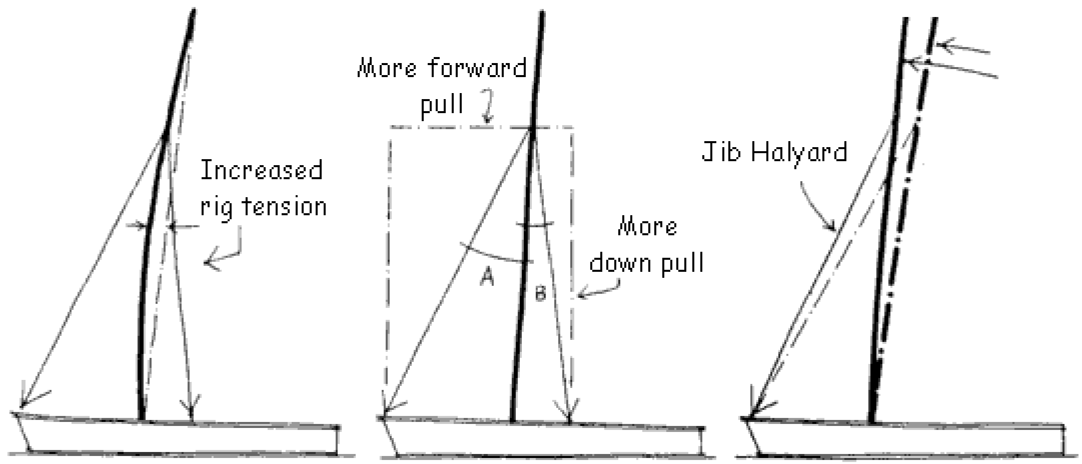


Figure 9 Effect of Jib Halyard on Mast Rake and Shroud Tension

Note. From "Harken", 2008, *Harken: International Laser Deck Layout,* Copyright 2008 by Harken. Retrieved March 10, 2010, from http://www.harken.com/images/470-deck-lg.gif

BASELINE SETTINGS

Sail manufactures for one design sailboats (eg, Opti, Laser, C420) typically publish tuning guides online with the recommended base line settings for mast rake, rig tension and sail controls based on the wind and wave conditions. Using a tuning guide, long measuring tape and tension gauge, sailors are able to take the guess-work out of tuning their rig, by using the recommended settings and following the correct sequence:

The following link is a tuning guide for the 2003-cut, North Sail C420 Sails:

http://www.club420.org/PAGES/Library/tuningGuide.htm

Note. Retrieved February 2013.

1. **Mast Step.** If applicable, measure the location of the mast step pin and ensure it is the recommended distance from the transom. The correct fore-and-aft location of the pin allows sailors to easily attain the desired rake / tension combination.

Note. The mast step pin location typically only needs to be adjusted when there is a change in the manufacturer's sail shape.

2. **Check the forecast.** Because wind speeds often increase late in the morning or early in the afternoon, it can be difficult to anticipate the wind speed while rigging in the morning. It is important to set the rig tension and mast rake based on the forecasted wind and wave conditions, but be prepared to adjust if the forecast does not materialize.

3. **Tension the rig.** Using the jib halyard and tension gauge set the rig tension based on forecast and numbers recommended in the tune guide. To be consistent, always place the tension gauge on the shrouds at approximately the same height (eye level).

Figure 10 Tension Gauge

4. **Check the rake.** Attach a long measuring tape to the main halyard, and hoist the tape to the top of the mast. As directed in the tuning guide, measure the distance from the top of the mast to the transom.

Figure 11 Measure the Rake

5. **Adjust as required.** If the correct rig tension does not give the correct mast rake, it is necessary to adjust the shrouds at the link plates. Remove the tension from the rig, adjust the shrouds and repeat Steps 3 and 4 as required.

6. **Keep a sailing log.** Keep a sailing log and record the baseline settings for the day, including rig tension, mast rake and hole number on the link plates. Sailors can use this information to compare sailboat performance based on settings used, and take the guesswork out of determining pin location in the link plates.

COACHES CORNER—BASELINE SETTINGS

Through *CANSail* 3 and 4 training, the emphasis is on getting a sailboat up to speed and keeping the sailboat moving as quickly as possible while maneuvering; however if a boat isn't rigged right, it won't sail right.

If sailors have the appropriate baseline settings before heading on the water, their sailboat has the right combination of sail power and pointing ability for the wind conditions, allowing them to focus on improving their boat handling skills. Sailors will need extra time while rigging to set their boat up with the appropriate baseline settings, however with practice the process will become faster.

Coaching staff should provide a lot of supervision during the first week of sail training, and as the sailors improve, gradually let the sailors set the rake and mast tension without assistance.

The following video can be used to illustrate the importance of vigilance while rigging:

Rigging tips by Sarah Ayton & Saskia Clark

http://www.youtube.com/watch?v=uXo9wehqB_w&list=UUcdzDFzQJtS6cSzXd4suX5A&index=8&feature=plcp

Note. Retrieved February 2013.

SET SAIL CONTROLS

DRAFT AND LEECH TWIST (CAN*SAIL* 3)

DRAFT

Draft. The curvature or camber of a sail.

The wind does not push on the sails to make a boat move. Instead, wind flows around the sails similar to the way air flows around an airplane wing. In a sense, sailors are constantly trying to bend the wind around their sails. Sail makers help give a sail a curved three-dimensional shape by sewing together panels which are tapered on the top and bottom.

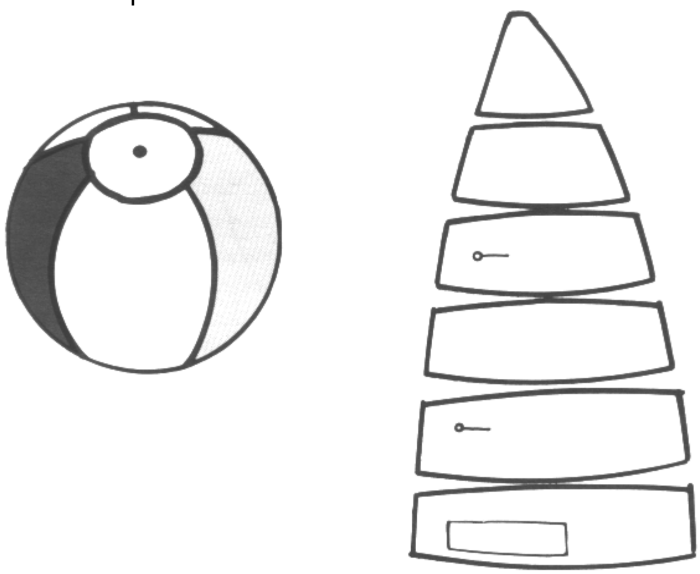


Figure 12 Draft

Note. From *Advanced Sailing Skills Manual* (p. 52), by S. Donaldson, 2001, Kingston, ON: Canadian Yachting Association. Copyright 2001 by Canadian Yachting Association.

When sailing on different points of sail and in different conditions, sailors can add or reduce draft by adjusting sail controls for more sail power or greater pointing ability. For example, loosening the outhaul will move the clew closer to the tack, increasing draft and making the sail fuller. This gives the sail more power but less pointing ability. Tensioning the outhaul will move the clew further away from the tack, reducing the draft or flattening the sail. This gives the sail less power but greater pointing ability.

LEECH TWIST

A leech with a lot of twist is often referred to as being “open” and a leech with little twist is often referred to as being “closed”.

Sail shape is also affected by the amount of twist in the sail. In battens sails, the leech has the tendency to fall away to leeward. The luff and foot of the mainsail are firmly supported by the mast and boom. The leech is unsupported, resulting in the leech falling away to leeward or being more open. As wind speed increases the amount of twist will automatically increase; sailors use a variety of sail controls to add or reduce twist based on the point of sail and conditions.

Figure 13 Twist

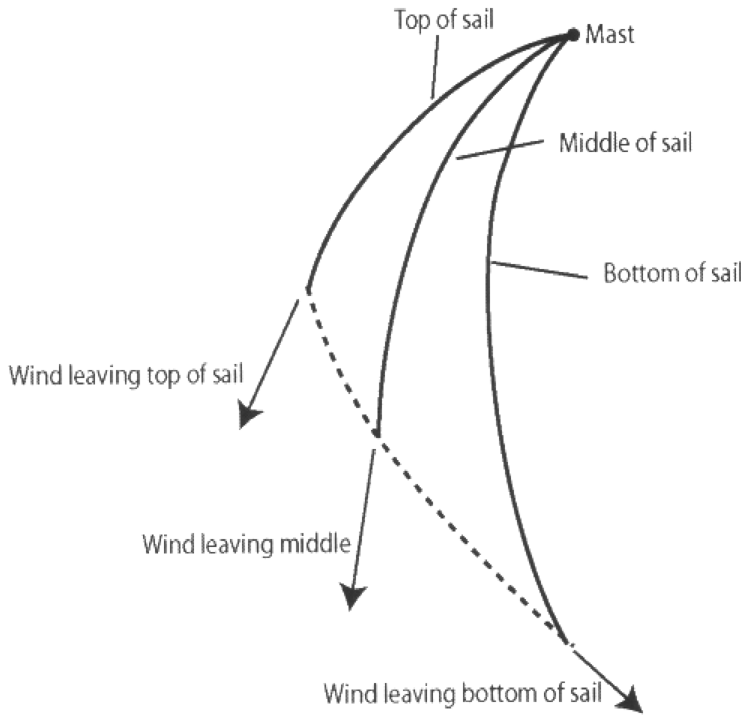


Figure 14 Sectional Aerial View of a Sail

Note. From CYA *Bronze Sail Answer Key* (p. 28), by Canadian Yachting Association, 2005, Kingston, ON: Canadian Yachting Association. Copyright 2005 by Canadian Yachting Association.

Leech tension or twist is controlled primarily by the mainsheet, boom vang, and traveller / bridle. A sail with insufficient leech tension may open up and have too much twist resulting in a loss of power and pointing ability. A sail with too much leech tension may close and have too little twist, curving the leech too far to windward causing the sail to stall.

Stall. Disturbed airflow at the back of the sail, which results in the leech tell tale (leech fly) hooking around the leeward side of the sail. A stalled sail is generally caused by over-sheeting, too much draft or excessive leech tension.

SAIL CONTROLS (CAN*SAIL* 3)

SAIL SHAPE FOR VARIOUS WIND AND WAVE CONDITIONS

Sail controls are used to increase, decrease and move draft location in different conditions and on different points of sail. These adjustments are performed to promote airflow and increase sail forgiveness in light air and choppy wave conditions, to maximize sail power as the wind speed increases and to control heel in heavy air when the helm and crew are unable to keep the sailboat flat.

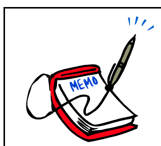
The approximate wind speeds for each wind condition are:

Light air. 4–8 knots (5–9 km / h).
Medium air. 8–14 knots (9–16 km / h).
Heavy air. 14–20 knots (16–23 km / h).

CONDITION	SAIL SHAPE	OUTHAUL	CUNNINGHAM	TRAVELLER
Light Air	Maximum fullness.	Eased to the point of slight vertical wrinkles along the foot then slightly tensioned.	Eased.	Windward or centred.
Medium Air	Moderate fullness.	Almost fully tensioned to prevent the leech twisting to windward in the lower part of the sail.	Tensioned slightly.	Windward.
Heavy Air	Flat.	Tight.	Tight.	Leeward.
Choppy Water	Some fullness.	Eased slightly.	Eased.	Centred or just to leeward.

CONDITION	BRIDLE	MAINSHEET	BOOM VANG	SLOT
Light Air	Lowered slightly.	Eased to promote twist and slightly tensioned as the wind speed increases.	Eased.	Open to promote airflow around mainsail.
Medium Air	Lowered halfway.	Maximum tension to reduce twist and maximize power.	Moderate tension, but not enough to induce mast bend.	Progressively closed to increase power as wind increases.
Heavy Air	Lowered.	Tight but eased in the gusts.	Tight and eased to increase twist as the sailboat becomes overpowered.	Progressively opened to maintain boat balance.
Choppy Water	Raised.	Eased to promote twist.	Moderate tension to allow for slightly more twist.	Open to promote airflow around mainsail.

In very light air (0–4 knots [0–5 km / h]) the sails are flat with an open leech and an open slot.



Sailors will receive additional information regarding slot in future CAN*Sail* training.

To reduce draft and promote airflow in light air, sails should be de-powered beginning at the foot by tensioning the outhaul to reduce draft in the lower section of the mainsail and by moving the jib fairleads aft to open the slot. To reduce draft to control heel in heavy air, sails should be de-powered from the top down, by easing the boom vang and tensioning the Cunningham to increase twist and reduce heel.

In addition to performing sail adjustments for different conditions, it is also necessary to perform sail adjustments for the different points of sail. These adjustments are made to reduce sail power and increase pointing ability while sailing upwind and to increase sail power while sailing downwind. The amount of draft increased or reduced on each point of sail varies depending on conditions. For example, too much draft while running in light air will result in poor airflow and reduced sail power. Too much draft while running in heavy air will result in too much sail power, possibly causing a death roll.

Death roll. Capsizing as a result of uncontrolled side-to-side rolling while running.

SAIL CONTROL	CLOSE HAULED	REACHING	RUNNING
Outhaul	Tight.	Tight.	Eased.
Cunningham	Minimal unless overpowered.	Minimal unless overpowered.	Eased.
Traveller	Centred.	Centred.	Centred.
Boom Vang	Set for proper leech control.	Set for proper leech control. Eased if overpowered.	Eased to avoid closing the leech, but enough tension to prevent the boom from rising much higher than parallel to the water.
Mainsheet	Tight.	Eased.	Eased.

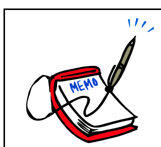
Prior to bearing away onto a reach or run, the boom vang should be eased while sailing upwind to de-power the upper sections of the sail. This will avoid placing too much stress on the upper sections of the mast and will reduce the chance of death rolling. All other sail and centreboard / daggerboard adjustments can be made once the sailboat is heading downwind. When preparing to head up onto a close hauled course, all sail and centreboard adjustments can be made prior to altering course, except for the boom vang, which should be tensioned once the sailboat is heading back upwind.

COACHES CORNER—SAIL CONTROLS

The sail controls lesson is typically taught on a light wind morning when the sails are hanging limp from the mast. The result is the instructor tightening and easing control lines without actually showing sailors what their sails should actually look like in the various conditions.

When teaching the effects of sail controls on sail shape, capsize a sailboat on the dolly and support the mast with a chair, buoy, box etc. Have the sailors stand near the top of the mast (on the leech side) and place a small (light) ball in the sail. Adjust the various sail controls to illustrate the effects of the various sail controls, but do not dwell on sail shape for the various conditions.

Use experiential learning and work with the sailors everyday to assist them in finding the ideal shape. As they practice setting sail shape in a variety of conditions, they will become increasingly more proficient; requiring less guidance.



Never pass a fault. Even if the objectives for a day do not involve sail shape, take the time to ensure the rig and sails are tuned properly for the conditions. If the boat is not set up correctly (under- or over-powered) it will have a negative effect on the sailor's ability to sail the boat at maximum potential.

LEECH TWIST (CAN*SAIL* 4)

When sailors adjust leech twist (leech profile) they are adjusting the overall efficiency of the airfoil, however they are also adjusting the amount of heeling power generated by the sail. The force generated by the foils, combined with the force generated by the sails results in the formation of a lever (arm), which creates heeling force on the sailboat. A twisted sail has most of its draft in the lower section of the sail and spills air from the upper section of the sail resulting in a short lever generated by the sails and foils. A sail with a tight leech has more draft in the middle and upper section of the sail, resulting in a longer lever generated by the sails and foils; this means the higher the draft in the sails, the more heeling force will be applied to the sailboat.

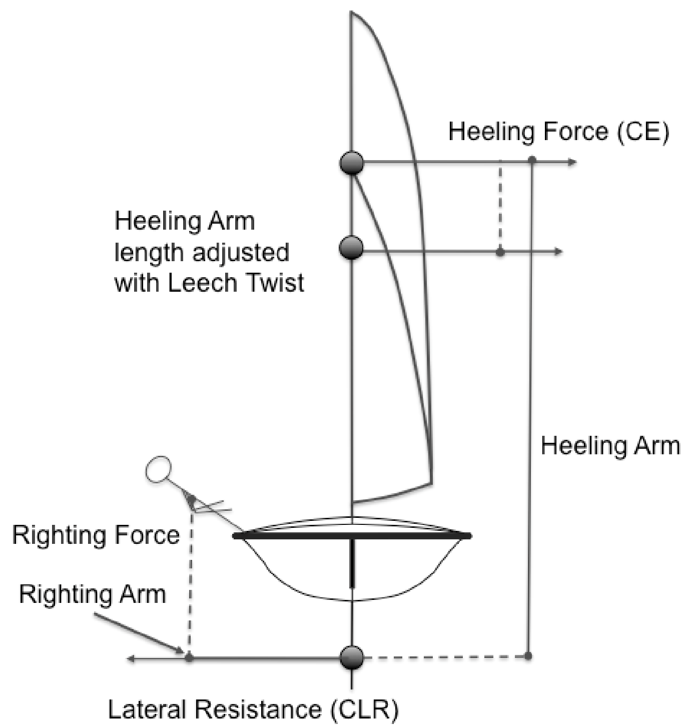


Figure 15 Heeling Arm

By using bridle / traveler height and boom vang and mainsheet tension, sailors adjust the shape of the leech to promote airflow and control heel simultaneously.

DOWNWIND AND REACHING

When sailing downwind, leech profile is controlled by the boom vang (vang). A tight vang increases sail power (relative to wind speed), but increases potential heel. A loose vang, decreases sail power, increases leech twist, and decreases potential heel. When sailing downwind, and settled into proper sitting positions, the helm tensions the vang to keep the leech tell tale flying 2/3 of the time. If the boat becomes over powered, the vang is eased to reduce sail power and control heel.

A boom vang is often referred to as a kicking strap or “kicker”.

UPWIND

Upwind leech profile control is slightly more complicated than downwind because of the sheeting angle of the sails and side forces placed on the rig, the effects of mainsheet and bridle / traveler height and the influence the Cunningham have on a full-battened sail. Once sailors have a basic understanding of how the sail control systems interact, they be able to set upwind leech profile to maximize sail power and control heel angle.

Vang Sheeting

This section will focus on leech control using a bridle. If sailing a boat with a traveller system, a traveller car pulled to windward opens the leech, and a car lowered towards the centreline closes the leech profile.

Setting up the baseline leech profile in a light-moderate breeze involves the mainsheet, bridle and boom vang. When the bridle is high, the boom can be centrelined without simultaneously being pulled down (closing the leech profile). When the bridle is lowered, as the boom is centrelined, it is also pulled down, closing the leech. When setting the leech profile:

1. the helm centerlines the boom;
2. the bridle height is set so that as the helm centerlines the boom, it adjusts the leech profile so that the leech tell tale is flying 2/3 of the time; and
3. the helm eases the mainsheet tension slightly until the leech tell tale is flying 100% of the time and sets vang tension to keep the boom at this height.

By incorporating bridle and vang tension, the helm is able to set maximun desired twist with the vang, and play the mainsheet up and down to adjust leech profile and sail power in gusts and lulls and minimize the amount the in and out sheeting angle. Helms must constantly be aware of bridle height and mainsheet tension, to avoid over tensioning the leech, resulting in a stall.

Figure 16 High Bridle Height with Open Leech

Figure 17 Medium Bridle Height with Leech Twist Reduced

Figure 18 Low Bridle Height with Closed Leech

Leech Profile in a Building Breeze

While sailing upwind a stiff leech promotes pointing ability and gives the sailboat weather helm, which helps to drive the sailboat upwind; this makes it important for performance to maintain a tight leech profile (relative to wind speed) as long as possible when sailing in a building breeze.

As wind speed increases, the added pressure in the sail will cause the leech to fall away (twist), requiring the helm to compensate by lowering the bridle and re-tensioning the vang to re-set leech profile.

When wind increases, the added pressure in the sail flattens the luff by pushing draft in the sail aft, causing the leech to become rounded and hook to windward; this increases the likelihood of a stall and decreases pointing ability. As the shape of the mainsail luff deteriorates and the leech becomes rounded, increasing halyard, vang, Cunningham tension, and lowering the bridle re-sets the sail shape by pulling the draft forward and tensioning the leech.

Depowering for Performance

In addition to controlling luff tension, the Cunningham also affects the shape of the leech on sails fitted with full length battens (C420 Head Batten). When tensioned, the luff is pulled forward, which as a result pushes back against the aft end of the batten. The tension flares the upper leech of the sail to leeward, without adding draft to the rest of the sail.

When sailing downwind increasing leech twist decreases sail power by spilling air over the top corner of the sail. However when sailing upwind, an open leech has the tendency to flap like a flag, which creates drag (heeling force). The result is a sail shape which is poor for performance, and does little to control heel.

When the wind builds to the point that the helm must ease more than one armful of sheet to maintain a flat sailboat in the gusts, sailors should begin depowering their sails. When depowering to control heel angle, the sail controls should be tightened; however. and easing the vang and raising bridle height should be delayed as long as possible. Cunningham tension combined with the head batten will decrease sail power by flaring the top of the leech to leeward, but with a rigidity that will not flap and create drag.

Figure 19 Bladed Mainsail with Bridle Low and Boom Vang and Outhaul Tight

Depowering for Survival Conditions

Survival conditions refer to conditions where the sailboat will likely capsize unless sailed below optimal performance; the term does not imply danger.

A capsized or severely heeled sailboat will not do well in a race situation, thus the term “survival conditions” refers to conditions where greater importance is placed surviving the race without mishap, than sailing at maximum speed.

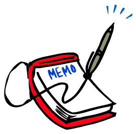
When maximum tension in the sail controls is not enough to maintain heel angle, twist can be reintroduced to reduce heel, however at the expense of sail power because of the drag created by a flapping upper leech.

When depowering for survival conditions, the bridal and boom vang are gradually raised until the helm can maintain the heel angle by easing no more than one armful in gusts. To compensate for added drag, the outhaul can be eased slightly. This will decrease pointing ability, however in doing so it adds sail power to the lower section of the sail and has little impact on the heeling power of the sails.

Figure 20   Mainsail Shape for Survival Conditions with Medium Bridle Height with Cunningham, Boom Vang and Outhaul Tight

COACHES CORNER—BASELINE SETTINGS AND TUNING

Sailors were introduced to rig tuning and the use of sail controls as part of CAN*Sail* 3 and should be becoming more proficient at setting their sailboats up for the conditions. Use experiential learning and work with the sailors everyday to assist them in finding the ideal shape, while focusing on how boom vang tension, mainsheet tension and bridle height affect pointing ability and boat speed.



Never pass a fault. Even if the objectives for a day do not involve sail shape, take the time to ensure the rig and sails are tuned properly for the conditions. If the boat is not set up correctly (under- or over-powered) it will have a negative effect on the sailor's ability to sail the boat at maximum potential.

SAIL THEORY

SLOT (CAN*SAIL* 5)

The information in this section is not assessed IAW CAN*Sail Level 5*, however is included in the Chutes and Wires Level 1 Curriculum.

SLOT

The presence of a jib can increase the power of a sailboat by more than the relative increase of sail area, because a slot is created between the jib and mainsail. The slot is the tapered or funnel-like opening between the jib leech and mainsail luff. The slot causes air to deflect into the opening and compress between the jib leech and mainsail luff. This compression results in an acceleration of air velocity on the leeward side of the mainsail creating an increase of sail power.

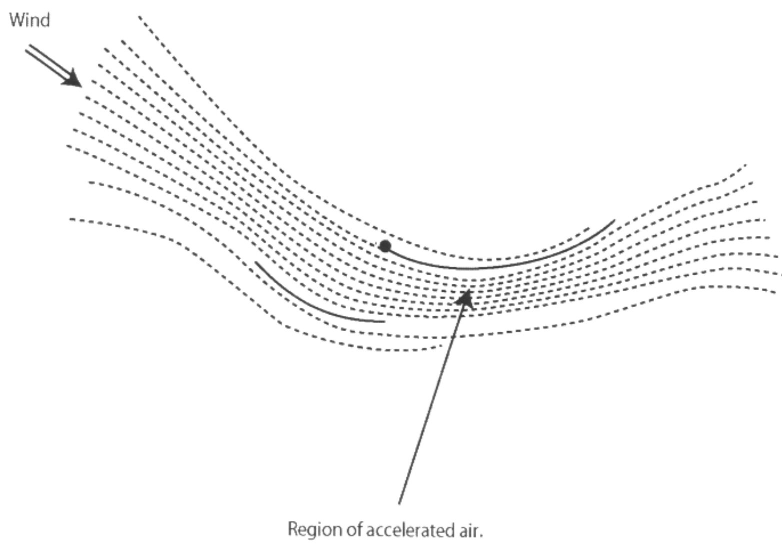


Figure 21 Slot

Note. From CYA *Bronze Sail Answer Key* (p. 18), by Canadian Yachting Association, 2005 Kingston, ON: Canadian Yachting Association. Copyright 2005 by Canadian Yachting Association.

The combination of the mainsail and jib results in greater pointing ability and sail power than that of a single sail of the same size and draft.

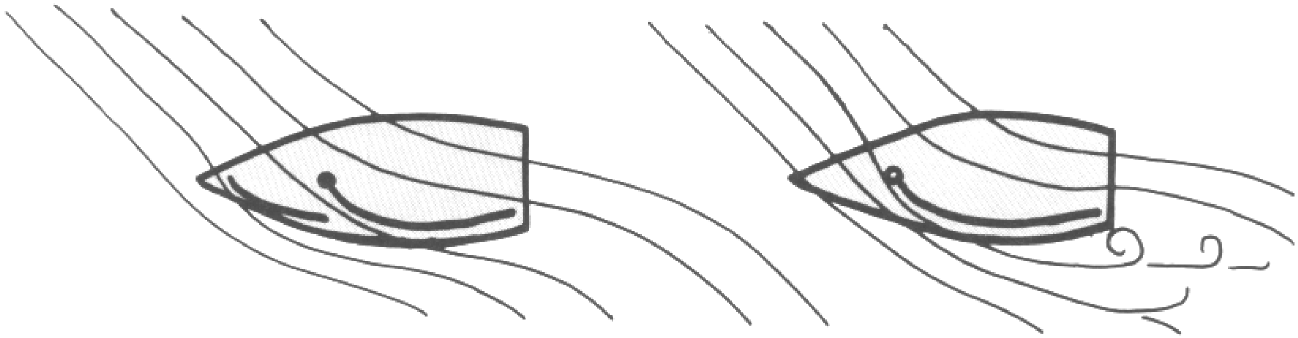


Figure 22 Sloop Rigged Sailboat Versus Cat Rigged Sailboat

Note. From *Advanced Sailing Skills Manual* (p. 47), by S. Donaldson, 2001, Kingston, ON: Canadian Yachting Association. Copyright 2001 by Canadian Yachting Association.

If the slot is choked or too narrow (closed), the air flowing off the jib leech will backwind the mainsail causing its luff to bulge to windward indicating poor airflow, which reduces sail power and pointing ability.

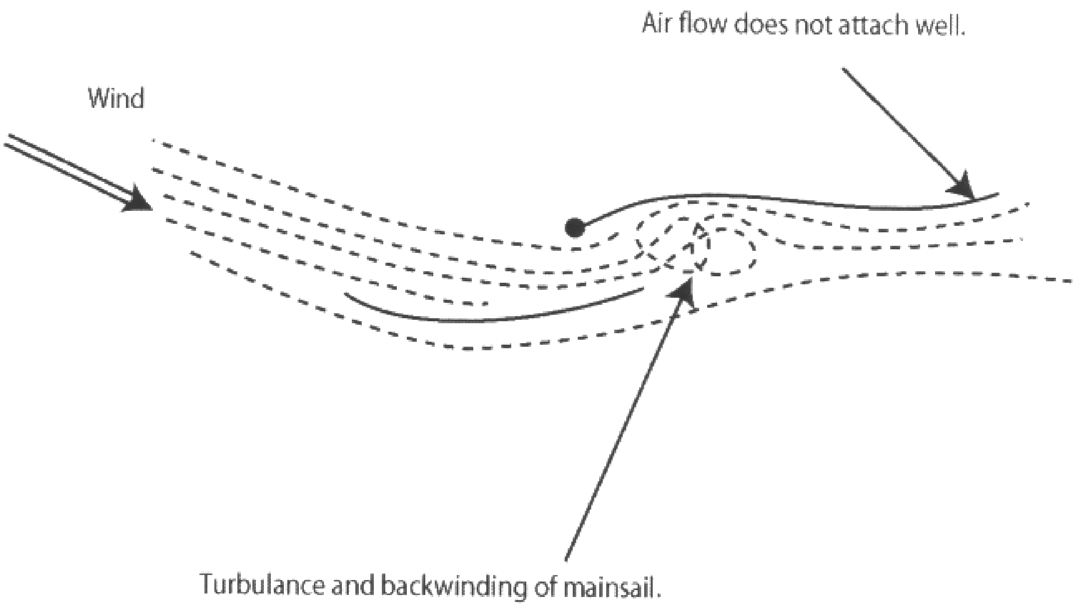


Figure 23 Choked Slot

Note. From CYA *Bronze Sail Answer Key* (p. 18), by Canadian Yachting Association, 2005 Kingston, ON: Canadian Yachting Association. Copyright 2005 by Canadian Yachting Association.

Adjusting the slot is often referred to as “setting the slot”.

SETTING THE SLOT IN VARIOUS CONDITIONS AND POINTS OF SAIL

When sailing on different points of sail and in different conditions, sailors can open or close the slot by adjusting Cunningham / main halyard tension, sail trim and moving the jib fairlead position. Opening the slot decreases sail power and increases pointing ability. Closing the slot increases sail power and decreases pointing ability.

Setting the slot has the same basic Flatter vs Fuller principle as normal sail adjustments. When setting the slot for light and strong winds, the slot is opened and when setting the slot for medium wind and waves, the slot is closed (not to the point of being choked). When pointing, the slot is generally more open and when sailing on a reach and downwind, pointing is no longer a factor so the slot is closed for increased sail power. When setting the slot, sail shape should be adjusted according to the conditions and the jib should be sheeted according to the wind direction. According to the point of sail, the slot should then be set using the jib fairleads (or windward sheeting if sailing a boat without adjustable fairleads) and by mainsail trim. If both the jib and mainsail cannot be properly trimmed at the same time, this is an indication that the slot is choked and sail shape adjustments need to be made.

Particularly in sailboats that do not have fairleads that adjust inboard / outboard, mast rake has a significant effect on slot. Raking the mast aft will reduce the overlap between the jib leech and mainsail luff, opening the slot. Raking the mast forward will increase the overlap and close the slot.

For most popular one-design sailing dinghies, sail makers publish tuning guides with recommended mast butt positioning, mast rake and shroud tension for a range of wind and wave conditions.

When sailing on a reach with a spinnaker, a slot is also created between the leech of the spinnaker and the luff of the mainsail. The presence of the spinnaker deflects more wind around the leeward side of the mainsail. This requires the main sheet to be sheeted in more than if sailing with a jib only. When reaching with a spinnaker, to avoid choking the slot, all three sails should be set so that their leeches are parallel relative to the centreline of the hull. If the spinnaker is trimmed so hard (due to the point of sail) that the mainsail is consistently back-winded, this is an indication that the sailboat is pointing too high for the spinnaker and would sail more efficiently without it, or the helm should bear away so that the spinnaker sheets can be eased and the slot opened.

ADJUSTING THE SLOT

When sailors set the mainsail leech profile, they take into account wind speed, wave height and desired performance (power vs pointing). A properly set jib leech (slot) is roughly parallel to the mainsail leech; as such the slot is set according to wind and wave height, desired performance AND mainsail set up. To further complicate this task, the slot is reset every time the crew trims the jib sail.

When sailing in light and moderate conditions the crew must constantly adjust the slot in each puff and lull to promote maximum sail power and reduce the likelihood of a stall. As wind speed increases, the slot is set for the predominant conditions and the crew focuses on maintaining boat balance.

Some sailboat designs, such as the C420, do not have adjustable fairleads. In these cases the slot is adjusted by windward sheeting. This design has some limitations in the adjustability of the slot, however does provide the benefit of allowing the crew to adjust the slot with the windward sheet while allowing them to leave the leeward sheet cleated—providing a stable jib luff for the helm to drive the boat towards when sailing upwind.

Figures 24 and 25 C420 Jib Without Windward Sheeting & C420 Jib With Excessive Windward Sheeting

Figure 26   C420 Jib With Correct Windward Sheeting

Halyard / Cunningham Tension

Adjusting the tension of the mainsail luff can open and close the slot by moving the draft forward and aft. The slot can be closed by tensioning the main halyard / Cunningham, which pulls the draft of the mainsail forward closing the opening between the jib leech and the mainsail luff.

Sail Trim

The size of the slot is maintained by proper mainsail and jib trim. The slot is often too open or choked as a result of under or over trimming. The position of the mainsail can also be adjusted by the traveller / bridle. The helm can open the slot without reducing twist by moving the traveller to windward or by raising the bridle.

Jib Fairlead Position Forward / Inboard

Moving the jib fairlead is the most common method of adjusting the slot for different points of sail and conditions. Moving the jib fairlead position modifies the direction of force applied by the jib sheet resulting in more tension on the jib foot or leech. Moving the jib fairlead forward applies more tension to the leech and less to the foot. This reduces leech twist, increases the draft and closes the slot. Moving the jib fairlead forward increases sail power and decreases pointing ability.

Some sailboat designs have fairleads that adjust inboard / outboard allowing the slot to be adjusted without affecting the shape of the jib sail. Moving the fairlead position inboard will affect the slot in the same manner as moving the fairlead position forward.

Fairlead Position Aft / Outboard

Moving the jib fairlead aft will apply more tension to the foot and less to the leech. This increases twist, decreases the draft and opens the slot. Moving the jib fairlead aft decreases sail power and improves pointing ability.

Moving the fairlead position outboard will affect the slot in the same manner as moving the fairlead position aft.

AIRFLOW (CAN*SAIL* 6)

AIRFLOW AROUND A SAIL

Foil. A structure with curved surfaces, (eg, an airplane wing) designed to give lift.

Sails are a group of force producing shapes called foils. When a sail is operating as a foil, the movement of the air around the foil causes a difference in pressure on either side of the sail. The higher velocity of air flowing over the leeward side of the sail creates an area of low pressure. The lower velocity of the air on the windward side of the sail results in higher pressure.

When sailing on a run, the air pushes directly on the sail rather than flowing around.

The difference in pressure on either side of the sail causes the following:

- The airflow moving toward the windward side of the sail is drawn (bent) to the leeward side of the sail, resulting in an increase in air velocity over the leeward side of the sail (as illustrated in Figure 27).

Airflow that is drawn to the leeward side of the sail is often referred to as upwash.

Diffusion. A net transport of molecules from a region of higher concentration to one of lower concentration by random molecular motion.

- The diffusion of air caused by the difference in pressure on either side of the sail, results in the creation of sail forces. Sail forces act at right angles to the surface of the sail along the leeward side; these forces are strongest at the luff of the sail and weaken as airflow continues to the leech (as illustrated in Figure 28).

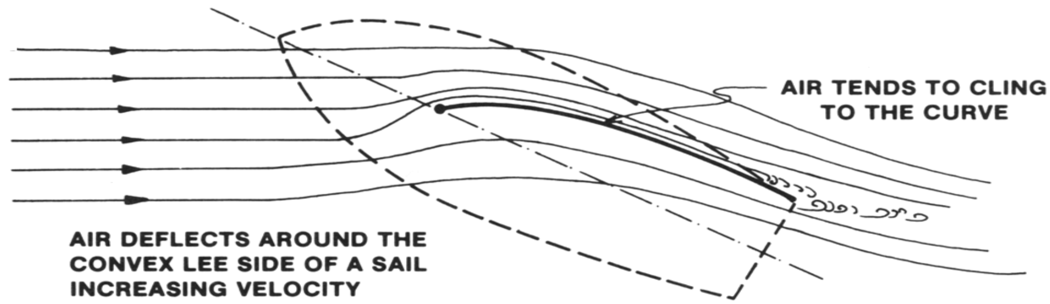


Figure 27 Upwash

Note. From *Advanced Sailing Skills* (p. 102), by D. Griffin, 1989, Gloucester, ON: Canadian Yachting Association. Copyright 2003 by Canadian Yachting Association.

When sailing on a close hauled course, a sailboat experiences more leeway than on other points of sail, because the sails are pulled in close to the sailboat's centre line, which transfers more sail force into leeward force. As the sails are eased, a greater amount of force is transferred forward which reduces heel; however, has a tendency to lower the bow.

The airflow along the surface of a sail will occur in one of two states:

- laminar (smooth) flow, or
- turbulent (disturbed) flow.

Air will follow the curvature of the sail until it breaks away as disturbed air. The duration air follows the curvature of the sail depends on the sail shape and the wind conditions. Sail controls are adjusted to promote airflow in light air and to increase sail power as wind speed increases. The force produced by smooth flowing air is dramatically larger than that produced by disturbed flow.

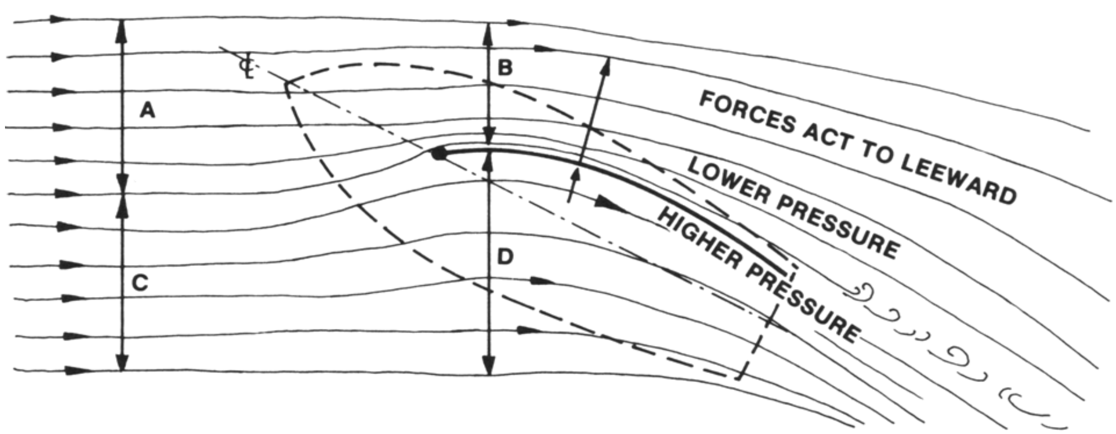


Figure 28 Airflow Around the Sail

Note. From *Advanced Sailing Skills* (p. 103), by D. Griffin, 1989, Gloucester, ON: Canadian Yachting Association. Copyright 2003 by Canadian Yachting Association.

DIFFERENCES BETWEEN MAINSAILS AND JIB SAILS

Sails are not trimmed so that their chords are parallel to the apparent wind direction. To establish upwash around the leeward side of the sail, the angle of the sail relative to the wind direction, or angle of attack, is set based on the type of sail and its shape.

Angle of Attack. The angle of the sail relative to the apparent wind direction.

Chord. The imaginary straight line joining the trailing edge and the center of curvature of the leading edge of the cross-section of an airfoil.

Camber. The depth between the chord and the bend in the airfoil (draft).

The same airflow principles apply to both the mainsail and jib, however because of the difference in sail shape and the mainsail's interaction with the mast, setting up the angle of attack (sail trim) for the two sails must be looked at differently. The mast creates turbulence around the luff of the mainsail, however because of the large chord or draft in the mainsail, laminar airflow is established aft of the mast (and luff) and power is generated. The large camber of the mainsail promotes airflow, which gives sailors flexibly when setting the angle of attack relative to the jib / spinnaker.

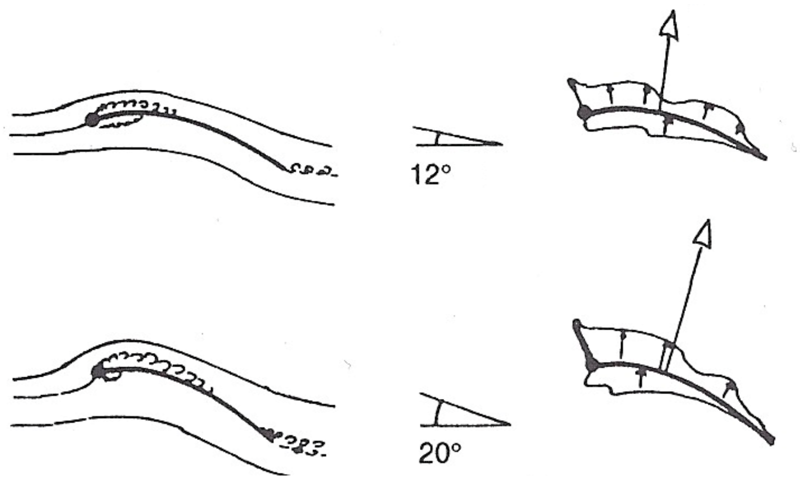


Figure 29 Mainsail Airflow

Note. From *High Performance Sailing* (p. 193), by F. Bethwaite, 1993, London, UK: Adlard Coles Nautical. Copyright 1996 by Frank Bethwaite.

The jib is forward of the mast, and has a very sharp luff allowing laminar airflow to be established directly at the luff. The sharp luff results in a sail with a small camber which does not promote airflow as well as the mainsail, resulting in a narrow angle of attack. The small camber and narrow angle of attack makes trimming very sensitive and is susceptible to over- and under-trimming resulting in detached airflow, this is referred to as knife-edge separation.

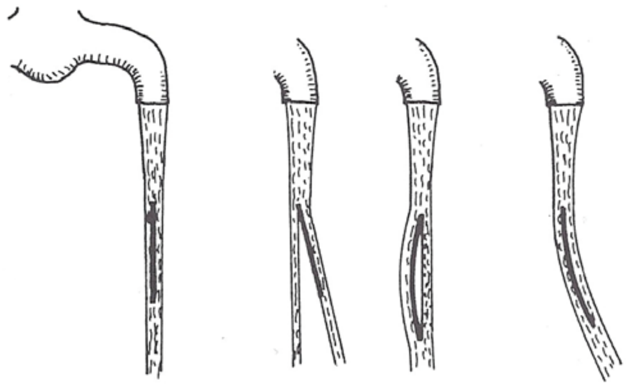


Figure 30 Knife-Edge Separation

Note. From *High Performance Sailing* (p. 197), by F. Bethwaite, 1993, London, UK: Adlard Coles Nautical. Copyright 1996 by Frank Bethwaite.

The margin of trimming error on the jib cannot be changed, however the preferred angle of attack is directly related to the fullness of the sail which is primarily adjusted by fairlead positioning. Particularly when sailing upwind, this sensitivity has advantages because the jib can be cleated, allowing the skipper to steer using the ticklers as a guide, and therefore sailing as close to the wind as possible at all times.

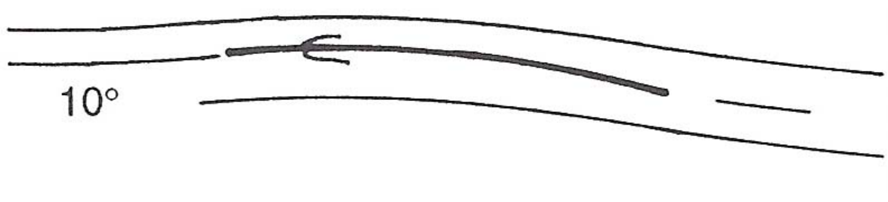


Figure 31 Angle of Attack for a Flat Jib

Note. From *High Performance Sailing* (p. 197), by F. Bethwaite, 1993, London, UK: Adlard Coles Nautical. Copyright 1996 by Frank Bethwaite.

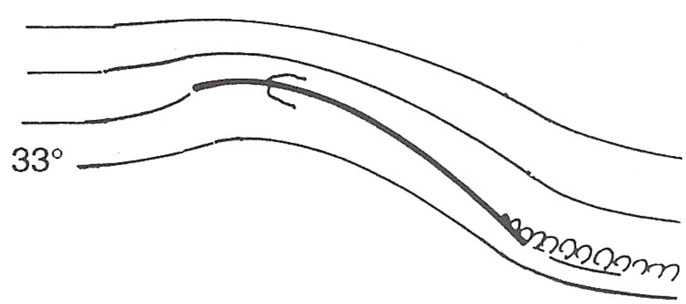


Figure 32 Angle of Attack for a Full Jib

Note. From *High Performance Sailing* (p. 198), by F. Bethwaite, 1993, London, UK: Adlard Coles Nautical. Copyright 1996 by Frank Bethwaite.

FORCES (CAN*SAIL* 6)

FORCES

When sails are trimmed, the sideways pressure of the sails creates leeway. As the sailboat moves, water flows around the centreboard (or daggerboard) creating lateral resistance which counteracts the sideways force of the sails. The combination of the force generated by the sails and the lateral resistance generated by the centreboard interact to propel a sailboat forward.

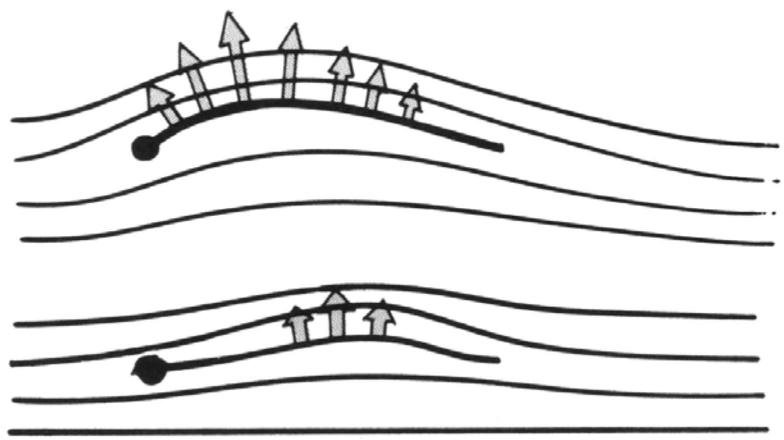


Figure 33 Forces Acting on a Sail

Note. From *Advanced Sailing Skills* (p. 46), by S. Donaldson, 1992, Gloucester, ON: Canadian Yachting Association. Copyright 1992 by Canadian Yachting Association.

As wind flows over a sail, the many forces acting on the sail combine into a resultant force, which is located at the point of maximum draft.

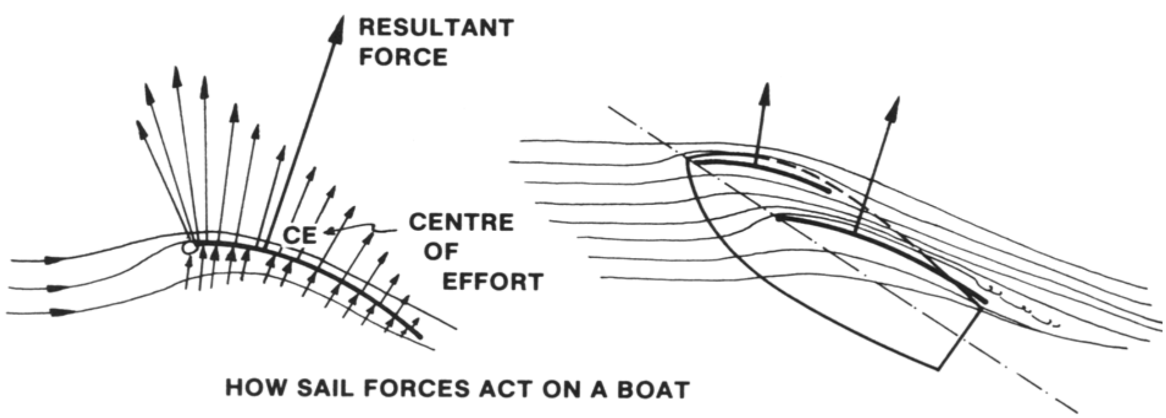


Figure 34 Resultant Force

Note. From *Advanced Sailing Skills* (p. 105), by D. Griffin, 1989, Gloucester, ON: Canadian Yachting Association. Copyright 2003 by Canadian Yachting Association.

The resultant force can be divided into its component forces.

Component forces. Geometric representation of the individual components which make up the resultant. Component forces are aligned at right angles to each other starting from the tail of the resultant force.

The resultant force of a sail is divided into a heeling component and a driving component. The driving component of the force is directed forward while the heeling component of the force is directed leeward (as illustrated in Figure 35).

Centre of effort (CE). The effective application point for all sail forces acting together as a single unified force.

For sailboats with more than one sail, the forces that act at the points of maximum draft of the mainsail and jib sail are combined into a single force located at the CE, which can then be divided into component forces.

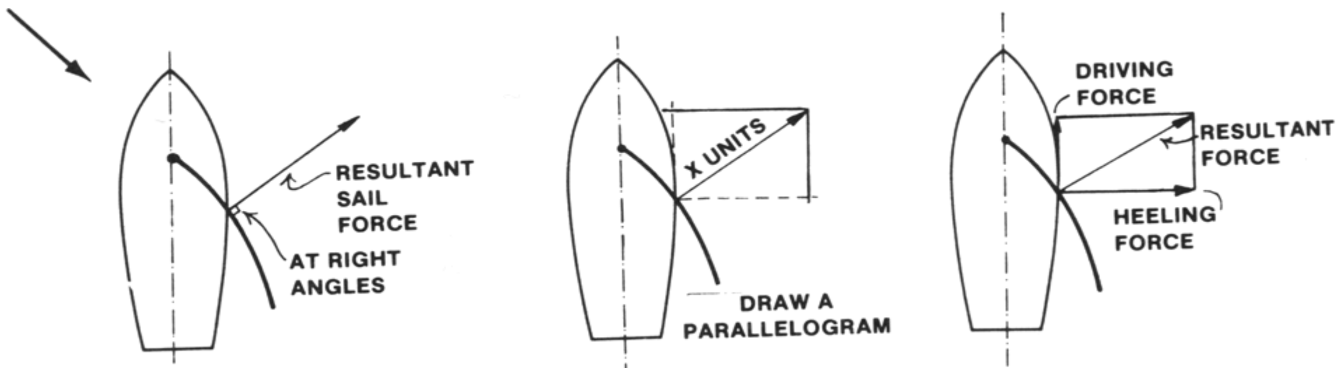


Figure 35 Component Forces

Note. From *Advanced Sailing Skills* (p. 96), by D. Griffin, 1989, Gloucester, ON: Canadian Yachting Association. Copyright 2003 by Canadian Yachting Association.

Centre of lateral resistance (CLR). A position where the combination of the side forces produced by the centreboard / daggerboard, rudder, and wetted hull area act as a single force.

When sails are trimmed, the heeling force of the sails creates leeway. As the sailboat moves, water flows around the centreboard, wetted area of the hull and rudder, creating lateral resistance. This counteracts the sideways force of the sails, reducing leeward and enabling the sailboat to move forward. Once the heeling component of sail force is counteracted by the lateral resistance, the remaining sail force becomes the driving force, which propels the sailboat forward.

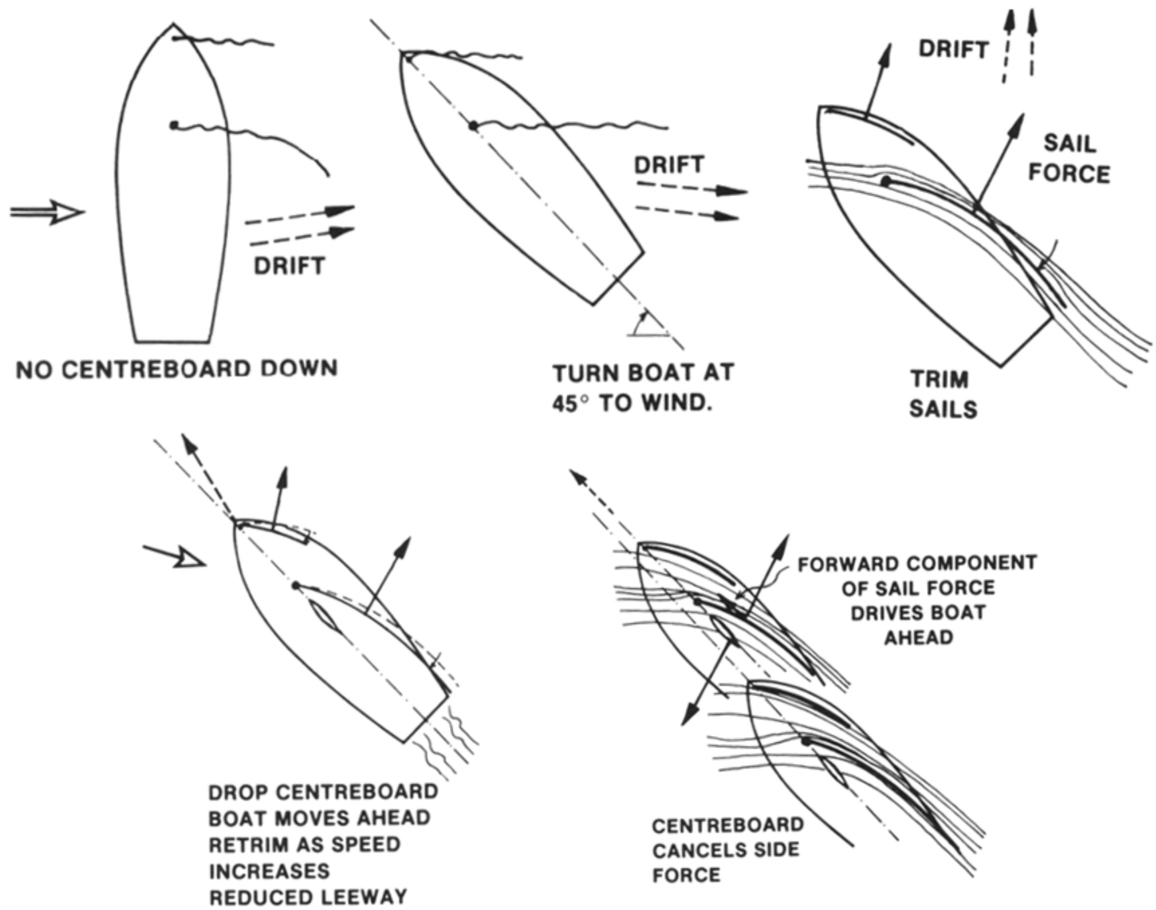


Figure 36   Forward Component of CE Moves Sailboat Forward

Note. From *Advanced Sailing Skills* (p. 99), by D. Griffin, 1989, Gloucester, ON: Canadian Yachting Association. Copyright 2003 by Canadian Yachting Association.

The amount of driving force component at the CE determines the speed of the sailboat. The amount of driving component varies with the point of sail.

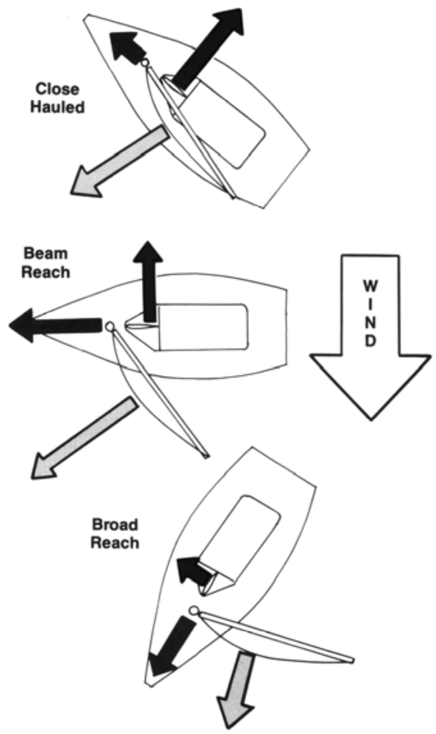


Figure 37 Driving Force Varies With Point of Sail

Note. From *Advanced Sailing Skills* (p. 51), by S. Donaldson, 1992, Gloucester, ON: Canadian Yachting Association. Copyright 1992 by Canadian Yachting Association.

When sailing upwind, heeling forces are directed sideways, however as a sailboat bears away and the resultant force swings forward so does the heeling force. These forward forces cause the mast to tilt forward and drive the bow lower into the water. When sailing upwind, crew weight is generally slightly forward of amidships and is moved aft to maintain boat trim as the sailboat bears away onto lower points of sail.

CENTRE OF EFFORT AND CENTRE OF LATERAL RESISTANCE (CAN*SAIL* 6)

Understanding how sail forces and lateral resistance forces of a sailboat interact is required when establishing neutral helm, and when creating or correcting lee helm and weather helm. Adjusting helm with the forces created by the sailboat enable the helm and crew to maintain a straight course and turn the sailboat with minimal use of the rudder.

Lee helm. The tendency for a sailboat to bear away if the tiller is released.
Weather helm. The tendency for a sailboat to head up if the tiller is released.
Neutral helm. The tendency for a sailboat to track straight ahead if the tiller is released.

CENTRE OF EFFORT

Point of maximum draft. The deepest part of the draft in a sail.

The (Centre of Effort) CE can be thought of as a point on a line that connects the point of maximum draft of both the mainsail and jib sail. The CE's location along the line is equal to the ratio of force developed by the mainsail and jib sail (eg, if the mainsail produced all of the sail force then the CE would be located at the end of the line over the mainsail's point of maximum draft. If the mainsail produced half of the sail force then the CE would be in the centre of the line). Due to the large(r) area of the mainsail, adjustments to the mainsail have a greater effect on the position of the CE than adjustments to the jib sail.

CENTRE OF LATERAL RESISTANCE

The Centre of Lateral Resistance (CLR) can be thought of as the point that connects the points of force of the centreboard (daggerboard), rudder and wetted hull area. The CLR's location is equal to the ratio of force developed between the centreboard, wetted hull area and rudder. Due to the depth of the centreboard and rudder, adjustments to the centreboard and rudder have a greater effect on the position of the CLR than forward and aft crew adjustments.

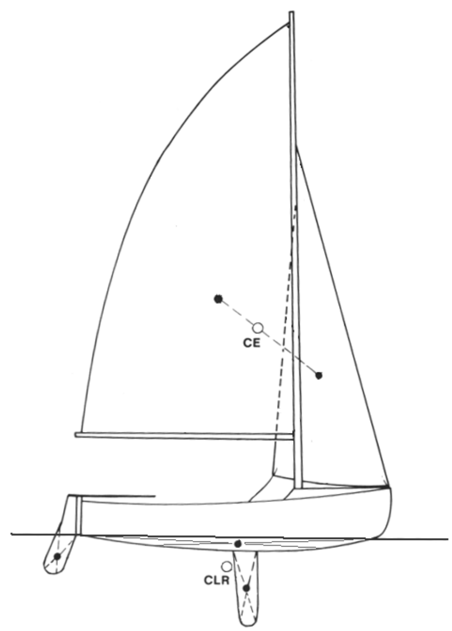


Figure 38 Position of CE and CLR

Note. From *Advanced Sailing Skills* (p. 110), by D. Griffin, 1989, Gloucester, ON: Canadian Yachting Association. Copyright 2003 by Canadian Yachting Association.

The CE and CLR move in relation to changes in the location and the amount of force on their components. The CE and CLR are centres of opposing force that act through a central balance point, establishing neutral helm. When the component forces of the CE and CLR are not balanced, weather helm or lee helm is created causing the sailboat to head up or bear away.

SAIL TRIM

When sailing in a straight line the sails should be trimmed so that the leeches are parallel and their resultant forces are driving in the same direction. When heading up and bearing away, the helm and crew can reduce the amount of rudder required by moving the CE by trimming one sail slightly more or less than the other.

When bearing away, lee helm is created by moving the CE ahead of the CLR. This is done by easing the mainsail slightly faster than the jib sail.

When heading up, weather helm is created by moving the CE behind the CLR. This is done by trimming the mainsail slightly faster than the jib sail.

When sailing in a straight line, the helm and crew work together to adjust for shifts using the sails to help steer the boat. While sailing upwind, fine adjustments to the mainsheet provide enough movement in the CE to compensate for headers and lifters. When sailing downwind, the mainsheet is also effective however, the spinnaker (if flown) has a dramatic effect on helm.

MAST RAKE

Mast rake. The fore and aft position of the top of the mast in reference to the vertical. If a mast is exactly vertical, the mast has no rake, if the mast tip is aft of vertical the mast has aft rake.

When the mast is raked forward or aft, it moves the position of the mainsail and jib sail, which affects the position of the CE in relation to the CLR.

Raking the mast slightly aft:

- creates weather helm;
- increases helm sensitivity; and
- causes the sailboat to head up into the wind and luff if the skipper loses control of the helm.

Raking the mast straight up and down when sailing downwind establishes neutral helm and is beneficial because it maximizes the height of the sails, enabling them to catch more wind.

Raking the mast forward creates lee helm and is potentially dangerous because it causes the sailboat to bear away from the wind if the skipper loses control of the helm.

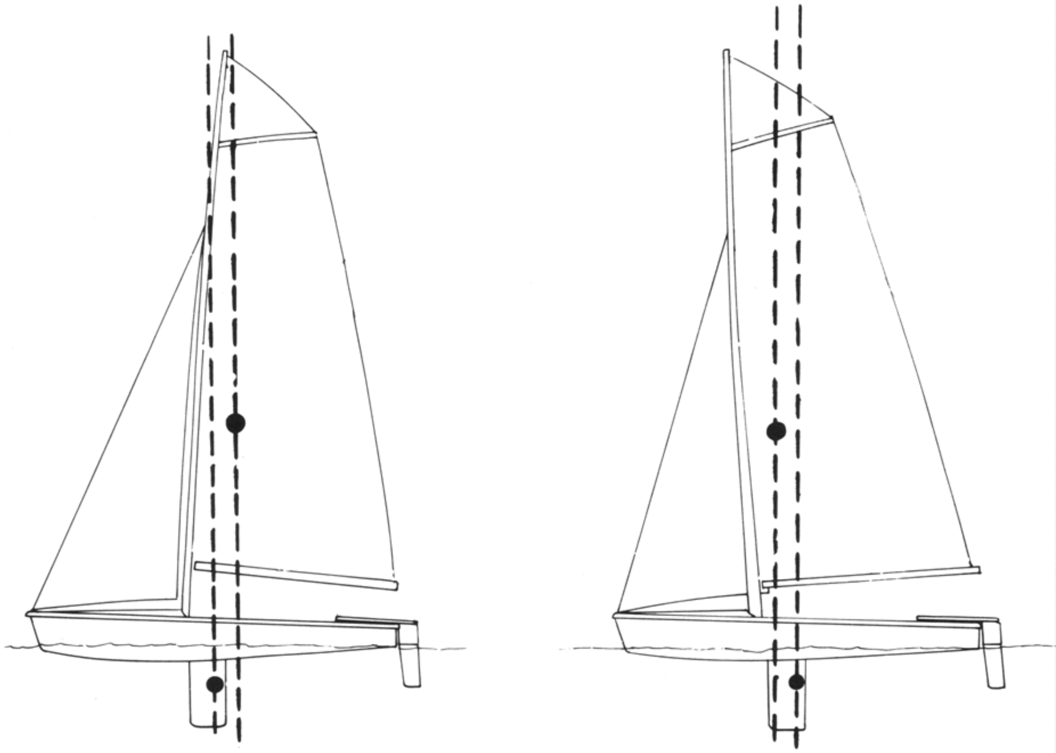


Figure 39   Mast Rake Adjusting CE and CLR

Note: From *Advanced Sailing Skills* (p. 41), by S. Donaldson, 1992, Gloucester, ON: Canadian Yachting Association. Copyright 1992 by Canadian Yachting Association.

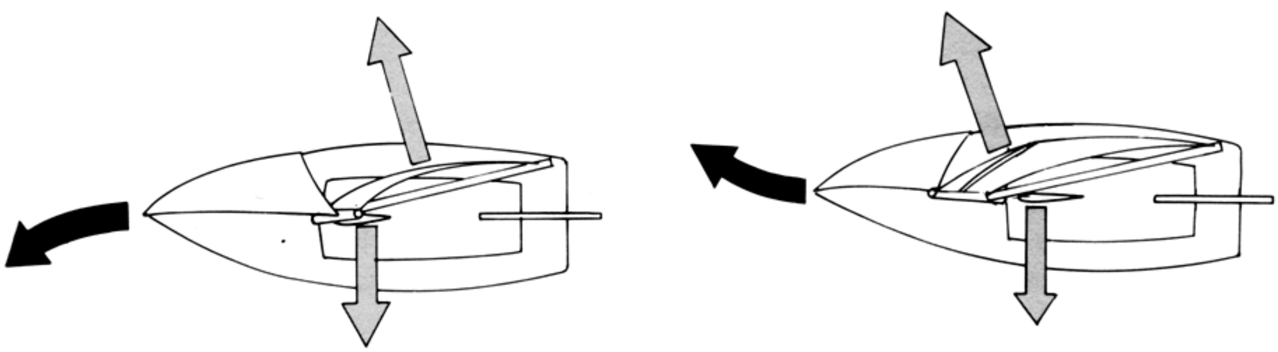


Figure 40   Helm Caused by Mast Rake

Note: From *Advanced Sailing Skills* (p. 41), by S. Donaldson, 1992, Gloucester, ON: Canadian Yachting Association. Copyright 1992 by Canadian Yachting Association.

MAST BUTT

The position of the mast butt can have a dramatic effect on CE because is dictates the physical location of the mast and sails. In a sailboat without adjustable rake (eg, Opti's) moving the mast butt position forward moves the CE forward and vive versa. In a sailboat that is typically raked aft (eg, 420 or 470), adjusting the mast butt position has the opposite effect on CE. Moving the mast butt position forward, also moves the mast head aft, resulting in the CE also being moved aft causing weather helm. Moving the mast butt position aft, moves the mast head forward, resulting in the CE also being moved forward causing lee helm.

Many sailors use the recommended mast butt position in their class rigging / tuning guide. If attempting to find a specific mast rake / rig tension combination, adjusting the mast butt location by even one hole, can have significant impact on the position of the top of the mast.

WEIGHT DISTRIBUTION

When crew weight is shifted aft, the wetted surface of the hull is increased aft and decreased forward, moving the CLR aft. Moving the CLR aft of the CE creates lee helm causing the sailboat to bear away.

The opposite occurs by shifting the crew weight forward. Moving the CLR forward of the CE creates weather helm, causing the sailboat to head up.

	To avoid bow plow and stern drag, it is important not to sit too far forward or aft.

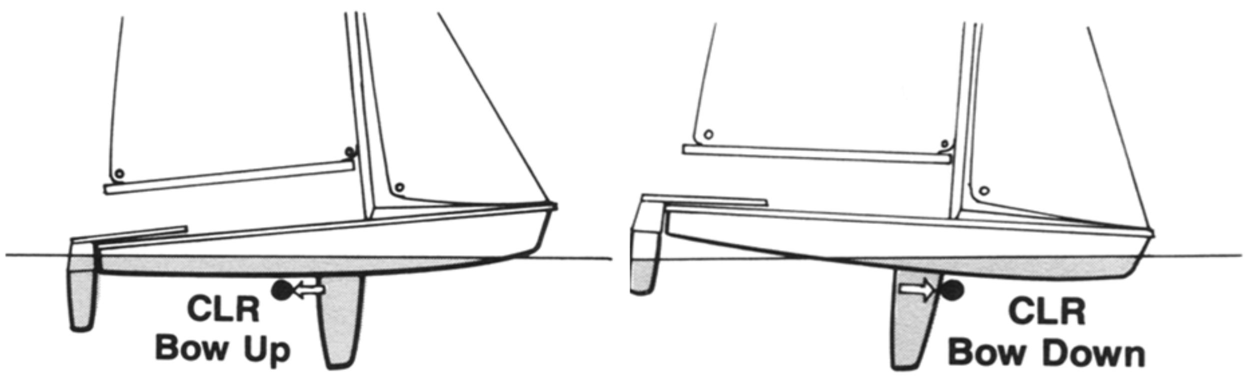


Figure 41 Crew Weight Fore and Aft

Note: From *Advanced Sailing Skills* (p. 64), by S. Donaldson, 1992, Gloucester, ON: Canadian Yachting Association. Copyright 1992 by Canadian Yachting Association.

CENTREBOARD / DAGGERBOARD ADJUSTMENT

When the centreboard is raised, the CLR moves aft, creating lee helm due to the following:

- Raising the centreboard decreases the amount of wetted surface in the water and decreases the amount of lateral resistance, due to the increased ratio of rudder and wetted surface of the hull acting on the CLR.
- The wetted surface of the centreboard is shifted aft.

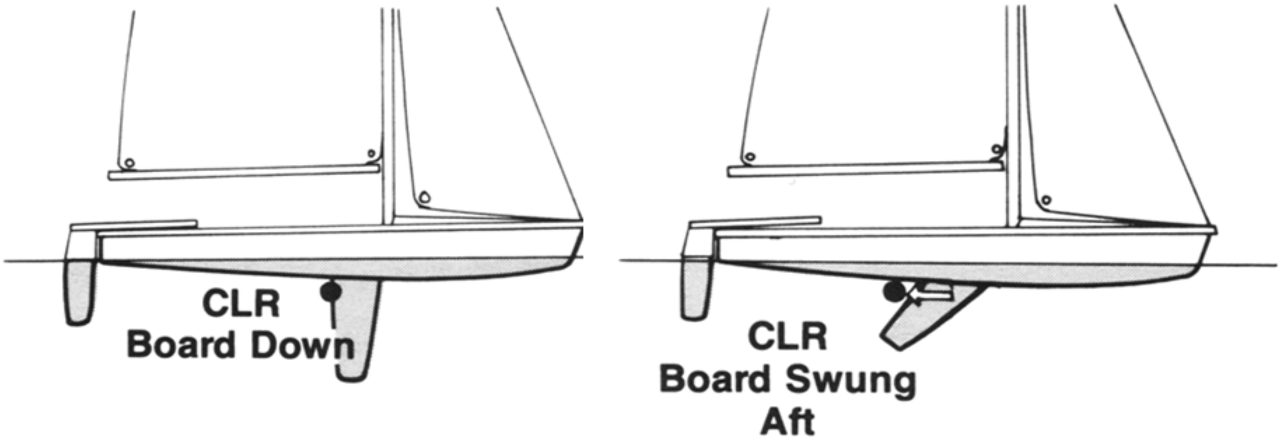


Figure 42 Moving CLR by Adjusting Centreboard

Note: From *Advanced Sailing Skills* (p. 64), by S. Donaldson, 1992, Gloucester, ON: Canadian Yachting Association. Copyright 1992 by Canadian Yachting Association.

Raising the daggerboard moves the CLR aft, creating lee helm. This is caused by a decrease in the amount of wetted surface in the water and a decrease in the amount of lateral resistance, due to the increased ratio of rudder and wetted surface of the hull acting on the CLR.

HEEL

In addition to asymmetric water flow around the hull, heeling affects helm by shifting the position of the sails to windward and leeward, creating lee helm and weather helm. When the sailboat is heeled to leeward, the sails are moved to leeward. The shift in the CE to leeward causes the sailboat to experience weather helm due to the applied yawing force.

The opposite occurs by heeling the sailboat to windward. When the sailboat is heeled to windward, the yawing force causes lee helm, causing the sailboat to bear away.

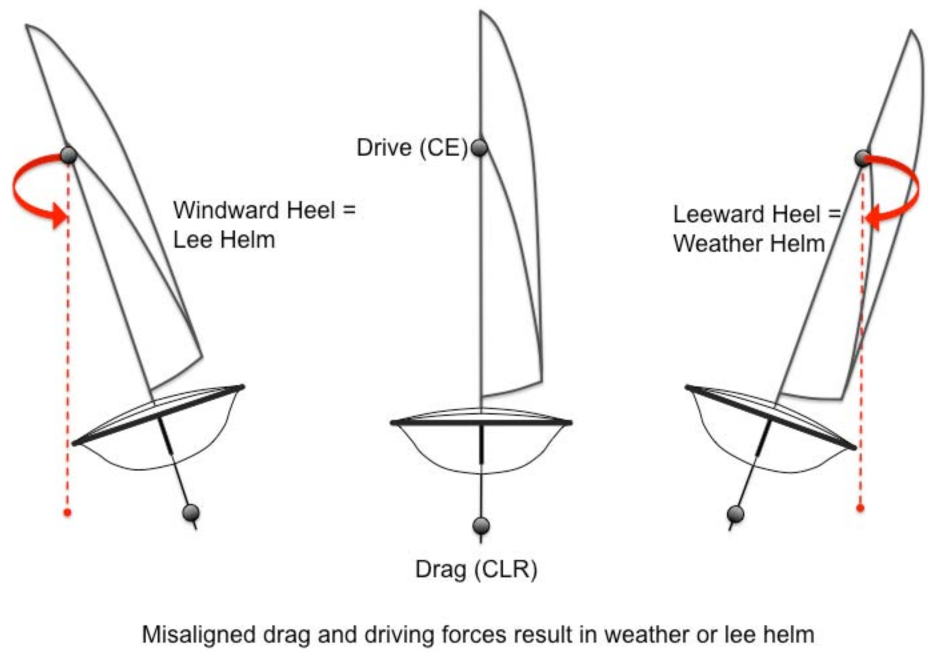


Figure 43 Crew Weight Windward and Leeward

Note. From *Advanced Sailing Skills* (p. 111), by D. Griffin, 1989, Gloucester, ON: Canadian Yachting Association. Copyright 2003 by Canadian Yachting Association.

COACHES CORNER—SAIL THEORY

One of the most difficult topics to teach in sailing is theory. Not because the information is too complex, but because the timing of when to introduce theory is important. Introducing knowledge too early or out of context can confuse (or not assist) sailors, however well timed introduction of knowledge can be translated into better performance on the water.

Theory can be easily taught in a traditional lecture format, however making the link between theory and on-water application for sailors can be difficult. By using experiential learning, theory introduced as part of a brief or debrief can be used to help sailors trouble-shoot issues encountered on the water. For example:

- **A crew continuously plays the leeward jib sheet while sailing upwind?** Discuss airflow and camber differences between the mainsail and jib sail, and why changing the angle of attack of the jib sail makes steering difficult for the helm.
- **A helm continuously drags their crew through the water while on trapeze?** Discuss driving, heeling and resultant forces, and how trimming the mainsail tight can provide enough heel force on the rig to keep the crew on trapeze.
- **Sailors not keeping their boats flat?** Discuss how heel effects neutral, weather and lee helm.

BOAT HANDLING AND BOAT SPEED

The following video can be used to illustrate a several boat handling skills in a variety of conditions:

420 to the Max

http://www.youtube.com/watch?v=ErcZk7nuzU4

Note 1. Retrieved June 2013.

Note 2. This video is an instructional video for the i420 not the C420. As such there will be some techniques that will not apply to the C420 or will require some variation.

TACKING AND GYBING

ROLL TACKING (CAN*SAIL* 3–6)

When a sailboat tacks, boat speed can be greatly reduced by luffing sails, rudder drag and disturbed flow around the foils. By incorporating a roll to windward in the tack, the sails are pumped onto the new leeward side, which reduces the amount of time spent luffing.

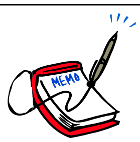
When a sailboat is heeled to leeward and the sails are drawing (full), the resistance in the rig can be used to fan both the sails and foils, which helps the sailboat accelerate out of the tack. Combining a windward roll, with a pump to flatten the sailboat is referred to as a “roll tack”, and greatly reduces the amount of speed lost while tacking.

Drawing. When a sail is full and generating power.

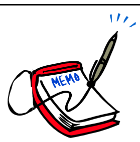
Helm Skills	Crew Skills
Communicate tack with partner.	Confirm tack with sailing partner.
Perform shoulder check (to windward) for other boats and sight line coming out of the tack.	Crew releases windward sheet tension and counts into the tack.
Helm trims mainsail in tight and hikes hard to enter tack with a flat boat.	Crew hikes hard while holding the leeward jib sheet in the aft hand, and the trapeze puck in the forward hand (if rigged)
Helm gently heads up by guiding the tiller into the tack.	
As front 1/3 of main luffs and jib begins to back, helm rolls boat to windward by leaning shoulders outboard and tucking feet against the buoyancy tank under their torso.	Crew places full weight on the trapeze puck and rolls the boat to windward.
As mainsail fills, helm eases mainsheet 5–7cm, and adjusts their hand on the tiller extension in preparation of switching sides.	Just as the (backed) jib sail fills, crew releases the (new) windward sheet, and grasps the new leeward sheet.

In light air, helm holds the windward roll and does not switch sides until the sails begin to draw.	In light air, crew releases the trapeze puck and immediately trims jib to leeward and does not switch sides until the sails begin to draw.
In moderate air (sails draw more quickly), the helm switches sides as soon as the mainsail fills.	In moderate air, crew releases the trapeze puck and graps the new leeward sheet with same hand.
Helm crosses the boat with aft foot first (facing forward) and punches tiller extension to other side of the boat.	Crew crosses boat and trims new jib sheet to bring jib to new leeward side.
Helm sits and straightens boat.	Crew sits and trims jib.
Helm pumps boat flat to accelerate out of the tack, and trims mainsail all of the way in.	Crew pumps boat flat with helm.
Helm switches tiller by reaching back to extension with mainsheet hand to hold both main and tiller extension in mainsheet hand. Then old tiller hand reaches around to take mainsheet. Finally, the tiller extension is flipped over the helm’s shoulder so that it is in their lap.	Crew sets slot with windward sheet.

COACHES CORNER—ROLL TACKING



The information provided in this section provides a full skill breakdown of roll tacking. In the context of assessing CAN*Sail* Level 3 skills, the focus is on incorporating heel and roll in the manoeuvre.



The following video can be used to illustrate light air roll tacking:

C420 Roll Tack Tack Training Session

http://www.youtube.com/watch?v=lHcmeJPjZOs&feature=youtu.be

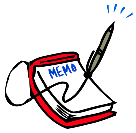
Note. Retrieved June 2013.

The following video can be used to illustrate moderate air roll tacking:

420 Kinsale, Tacking

http://www.youtube.com/watch?v=S0DgKqAHO_M

Note. Retrieved June 2013.



The following video can be used to illustrate C420 Tiller Management during a tack:

Tack2

http://www.youtube.com/watch?v=RwSU8Y8zwkg

Note. Retrieved June 2013.

Roll tacking involves a complex series of movements, which are gradually refined over the course of CAN*Sail* training.

- **Tiller control.** The focus when tacking is maintaining flow around the rudder. If the tiller is moved too quickly or too far leeward, the flow around the rudder blade will become disturbed and create drag. If the rudder is turned slowly, the water flow will bend around the blade and remain smooth.

  When entering a tack, the helm should ease their grip on the tiller extension which will allow them to feel the quality of flow around the blade. The rate of turn should be slow at first, and increase as the bow crosses through irons.

- **When to roll.** It is common for novice sailors to (attempt) rolling to windward while there is still leeward pressure in the sails. This will disturb flow around the sails, and the resulting lee helm will ruin the turn. Sailors should keep their eyes out of the boat, and watch the main sail and jib sail luffs and roll when they begin to back.

- **When to switch / flatten.** For a roll tack to be effective there must be power in the sails and flow (resistance) around the foils. Switching too early results in the centreboard / daggerboard (foil) being "sloshed" through the water; creating significant drag. Switching too late results in heeling force being generated by the sails, which will bury the new leeward gunwale in the water.

  Based on helm / crew chemistry, one person should "call the switch" by focusing on when and how quickly the sails fill. For the flatten to be effective, the helm and crew must switch sides at the same time.

  How hard to pump. Pumping the boat hard in moderate to high winds is obvious, however it can be difficult to gauge in light wind. When pumping the sailboat, sailors should focus on how much resistance they feel from the foils. The emphasis is on pumping slow enough that they do not disturb flow around the foils. When switching sides, sailors should immediately sit on the new windward side rolling their shoulders outboard with force relative to the resistance felt on the foils.

ROLL GYBING (CAN*SAIL* 3–6)

When a sailboat gybes, there is a massive change in direction of the forces applied to the rig, centreboard / dagger board and rudder. When a sailboat is moving fast (relative to the wind speed), the loads placed on the rig are lower than when the sailboat slows down. Focusing on maintaining maximum boat speed by incorporating sail trim and windward heel in the entrance of the gybe, reduces the loads placed on the mainsail, therefore making gybing easier, and reducing the likelihood that the boat will round up when exiting the manoeuvre.

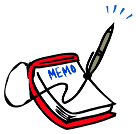
Roll gybing is typically performed when gybing reach-to-reach. Roll gybing is not performed when sailing on a run, because the sailboat is already heading downwind.

Rounding up. The uncontrolled turn into the wind that occurs if the rudder stalls.

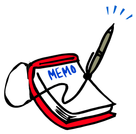
Helm Skills	Crew Skills
Shoulder check and communicate gybe with partner.	Confirm gybe with sailing partner.
Perform shoulder check (to leeward) under boom for other boats and sight line coming out of the gybe.	
Lower the foil if the crew is sitting on the windward gunwale.	Crew lowers the foil if sitting inboard.
Clear mainsheet, in preparation of easing all of the way out.	Crew grasps both jib sheets and prepares to heel to windward.
Induce lee helm by healing to windward, and by easing the mainsheet to match the rate of turn.	Crew heels the boat windward and eases jib sheet to match the rate of turn.
Gently guides the rudder into the gybe, while focusing on maintaining boat speed.	
As heeling forces on the rig are reduced, the helm sits up straight and pre-gybe the tiller extension so that it is on the other side of the mainsheet. Helm tucks feet against the buoyancy tank under their torso.	Crew continues heeling the boat to windward, and grasps the windward trapeze puck.
As the top battens on the mainsail begin to flick, helm uses their shoulders to roll the boat to windward. Grab mainsheet and uses it to gybe the boom.	In a doublehanded boat, crew watches for the top battens on the main to flick, and then gybes the main using the boom vang—remains as far outboard as possible to assist with rolling to windward.
Cross boat with aft foot first (facing forward).	Crew crosses boat and trims new jib sheet.
Sit and straighten boat after gybing.	Crew sits and trims jib.
Helm pumps mainsheet to pop the head batten, and pumps the boat flat to accelerate out of the gybe.	Crew pumps boat flat with helm.
Helm switches tiller by reaching back to extension with mainsheet hand to hold both main and tiller extension in mainsheet hand. Then old tiller hand reaches around to take mainsheet. Finally, the tiller extension is flipped over the helm's shoulder so that it is in their lap.	
Lowers the foil for point of sail.	

The crew will maintain a lookout throughout the gybe.

COACHES CORNER—GYBING (CAN*SAIL* 3–6)



The information provided in this section provides a full skill breakdown of roll gybing. In the context of assessing CAN*Sail Level 3* skills, the focus is on incorporating heel and roll in the manoeuvre.



The following video can be used to illustrate light air roll gybing:

420 sailing

http://www.youtube.com/watch?v=DOSNa3YA_AU&feature=related

Note 1. Retrieved June 2013.
Note 2. Although the spinnaker is used, the same sail trim, weight / heel and tiller control techniques apply with, or without the use of a spinnaker.

The following video can be used to illustrate C420 Tiller Management during a gybe:

Gybe.mov

http://www.youtube.com/watch?v=6Biz6MV9cDc

Note. Retrieved June 2013.

Like tacking, roll gybing involves a complex series of movements, which are gradually refined over the course of CANSail training.

- **Eyes out of boat.** When roll gybing, the transition between heeling to windward for lee helm, setting up to switch sides, and rolling the boat to windward happens very quickly. The execution of these three stages in the gybe can make the difference between a smooth roll gybe and slam gybe.

- **Commit to the gybe.** Particularly when sailing in heavy wind, crews can hesitate before swinging the boom. When sailing on a low angle, the boat will slow down and cause the mainsail to load up making it more difficult to swing the boom and increases the shock load when the mainsail fills on the other side. The helm and crew should be in constant communication during the gybe, so that they are both ready to switch sides when the main leech flickers and the jib clew begins to sag.

  Tiller control. When a boat turns too quickly through a gybe, there is a sudden side-to-side change in forces on the rudder blade; this can disturb flow around the blade so much that flow around the rudder stalls, causing the boat to round up as the boat exits the gybe.

  When entering a gybe, the helm should ease their grip on the tiller extension which will allow them to feel the quality of flow around the blade. The helm should concentrate on heeling the boat to windward, and keeping the tiller as close to the centreline as possible, without slowing the turn. The less the rudder loads up when entering the gybe, the less likely it will stall and cause a round up when exiting the gybe.

- **Pumping the boat.** Pumping the boat when exiting a tack is primarily done to assist with accelerating. Pumping the boat while gybing provides some acceleration, however is primarily done to stop the boat from turning, and to keep the boom from dragging in the water. The emphasis is on pumping slow enough that they do not disturb flow around the foils; but fast enough to prevent a round up.

DOUBLE TACKING (CAN*SAIL* 4)

DOUBLE TACKING

Double tacking involves combining two tacks together into one fluid manoeuvre. When sailing upwind it can be used when avoiding a covering boat, and when slightly low on a lay line as a means to quickly gain distance to windward, without sacrificing boat speed or head way.

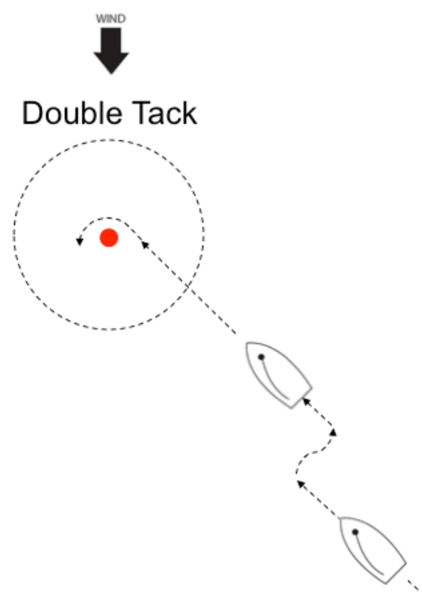


Figure 44 Double Tacking onto a Lay Line

When performing a double tack, it involves the same steps as a roll tack, however when exiting the first tack, the helm and crew must smoothly transition into a second tack by immediately initiating a second turn with the tiller, sails and crew weight.

	Depending on wind speed, it may be necessary for the helm to “power up” by momentarily exiting the first tack on a close reach before heading up into the second tack.

Due to the nature of when and where a double tack is typically performed, a huge emphasis is placed on smooth steering and crew weight to ensure the sailboat does not stall (stop), particularly on a crowded lay line next to a mark. This is accomplished by the helm guiding the tiller into the turns (to maintain smooth flow around the rudder blade) and coordinated movements in the sailboat to maintain flow around the sails and foils.

When the Canadian Sailing Team Head Coach and Director of High Performance was asked what the goal of CAN*Sail* should be, the answer was:

"For the athletes to be able to complete six consecutive tacks without losing speed."

COACHES CORNER—DOUBLE TACKS

Double tacking while sailing upwind is a complex maneuver, which may only be appropriate once every several races. For this reason it is necessary not only to teach the skill of how, but also coach the situational awareness of when a double tack can be used.

The double tack should be introduced in a series of open drills (eg, double tacking on the whistle) to allow the helms and crews the opportunity to practice the skill while focusing on communication, coordination and maintaining boat speed. The double tack should then be consolidated into their sailing skills repertoire by having them sail on small closed drills where they will be able to use the skill in the context of sailing upwind in a fleet setting and when fetching a mark.

DOUBLE GYBING (CAN*SAIL* 4)

DOUBLE GYBING

Like double tacking, double gybing (aka rodeo gybe) involves combining two gybes together into one fluid manoeuvre. When sailing downwind it can be used when avoiding an attacking boat to windward and when slightly high on a downwind lay line as a means to quickly gain distance to leeward, without sacrificing boat speed or head way.

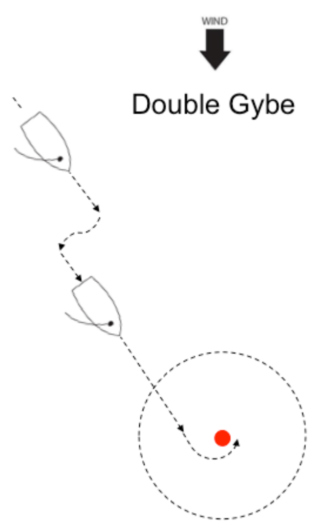


Figure 45 Double Gybing onto a Lay Line

When performing a double gybe, it involves the same steps as a gybe, however when exiting the first gybe, the helm and crew must smoothly transition into a second gybe by immediately initiating a second turn with the tiller, sails and crew weight.

Due to the nature of when and where a double gybe is typically performed, a huge emphasis is placed on smooth steering and crew weight to ensure the sailboat does not stall (stop), particularly on a crowded lay line next to a mark. This is accomplished by the helm guiding the tiller into the turns (so to maintain smooth flow around the rudder blade) and coordinated movements in the sailboat to maintain flow around the sails and foils.

COACHES CORNER—DOUBLE GYBES (CAN*SAIL* 4)

Double gybing is particularly interesting because the potential loss of boat speed is not as significant (although a stall is still a risk), however the risk of capsizing is greatly increased. When a sailboat slows down there is more pressure applied on the rig, which increases the total shock load caused by the mainsail gybing. Although stalling the boat when double gybing is not as common as during a double tack, stalling during a double gybe does greatly increase the likelihood of a capsize.

The double gybe should be introduced in a series of open drills (eg, double gybing on the whistle) to allow the helms and crews the opportunity to practice the skill while focusing on communication, coordination and maintaining boat speed. The double gybe should then be consolidated into their sailing skills repertoire by having them sail on small closed drills where they will be able to use the skill in the context of sailing downwind in a fleet setting and when fetching a mark.

LEEWAY AND FOIL ADJUSTMENTS

LEEWAY (CAN*SAIL* 3)

When sails are trimmed, the sideways pressure of the sails creates leeway. As the sailboat moves, water flows around the centreboard / daggerboard (foil) creating lateral resistance (lift) which counteracts the sideways force of the sails. The combination of the force generated by the sails and the lateral resistance generated by the foil interact to propel a sailboat forward.

Leeway. Side slipping motion of a sailboat, most evident on a close hauled course. Leeway is the difference between the course steered and the course made good.

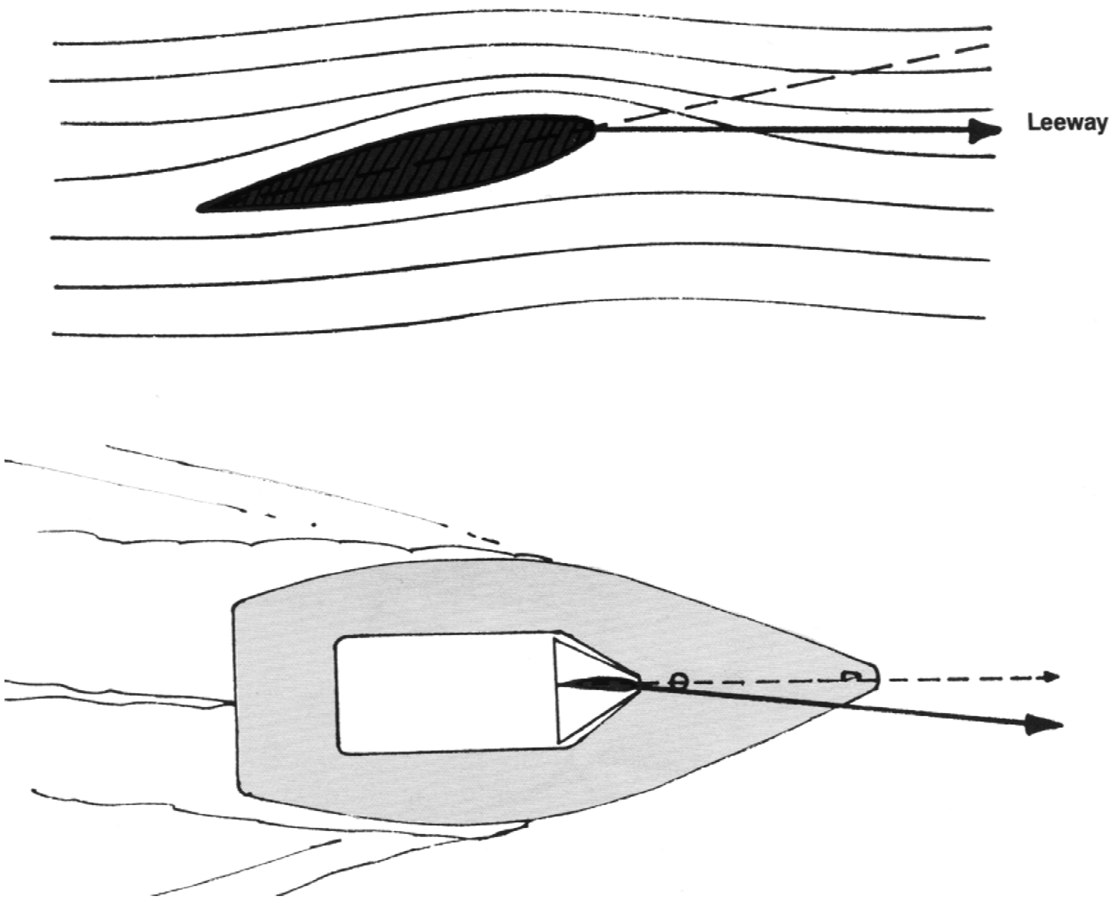


Figure 46 Leeway

Note: From *Advanced Sailing Skills* (p. 49), by S. Donaldson, 1992, Gloucester, ON: Canadian Yachting Association. Copyright 1992 by Canadian Yachting Association.

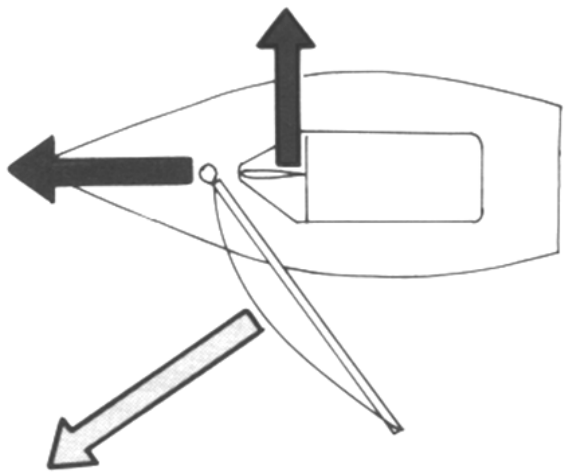


Figure 47 Combination of Sail Forces and Lateral Resistance Forces

Note: From *Advanced Sailing Skills* (p. 51), by S. Donaldson, 1992, Gloucester, ON: Canadian Yachting Association. Copyright 1992 by Canadian Yachting Association.

When sailing on a close hauled course, a sailboat experiences more leeway than on other points of sail, because the sails are pulled in close to the sailboat's centre line, which transfers more sail force into leeward force. As the sails are eased, a greater amount of force is transferred forward.

FOILS (CAN*SAIL* 3)

When a sailboat bears away from the wind and leeway is reduced, the depth of the foil are raised to reduce drag and balance the helm. When the sailboat was rigged, the mast was raked slightly aft creating weather helm. When reaching and sailing downwind, the foil is adjusted to move the pivot point of the boat slightly aft, which balances the helm.

After bearing away and settling into downwind positions, the helm should be the person to adjust the foil. With the sailboat balanced and sail correctly trimmed, the helm eases their grip on the tiller extension and uses feedback from the tiller to determine if the helm is balanced, has weather helm or lee helm.

- **Tiller pulls to leeward.** The sailboat has weather helm—the foil should be trimmed up.
- **Tiller pulls to windward.** The sailboat has lee helm—the foil should be trimmed down.
- **Tiller stays centre lined.** The helm is neutral—the foil is at the correct depth.

COACHES CORNER—LEEWAY AND FOIL ADJUSTMENTS

The negative affects of leeway while sailing upwind are far more significant than the drag created by a foil in the incorrect position downwind. For this reason, it is of the upmost importance for both the helm and crew to ensure the foil is at maximum depth while sailing upwind.

When bearing away from a close-hauled course, the focus should be on maintaining a fast boat, and performing sail adjustments. Once the helm and crew are settled into the downwind mode, the helm should balance the helm by raising the foil.

When preparing to head up, the helm should lower the foil to maximum depth and ensure the pennant is cleated while the crew makes sail control adjustments. Once the foil is down, the helm can then start heading up.

When practicing heading up and bearing away, sailors should focus on executing adjustments in the correct sequence; with practice, they will become more accurate with how high to raise the foil.

BALANCE

EASE, HIKE, TRIM (CAN*SAIL* 3–6)

A flat boat is a fast boat because the centerboard / daggerboard (foil) is at its maximum depth (when sailing upwind), and the sails are as tall as possible.

When a helm and crew sail a heeled boat straight, the forces and flow coming from both the sails and foil will be turbulent, and the rudder will be needed to counteract the resultant weather / lee helm.

When a sailboat enters a gust it is hit by a sudden increase in wind speed and resulting pressure in the sails (heel potential). A sailboat entering a gust has the potential to accelerate and reach a higher top end speed, however if the boat is allowed to heel, the sailboat will experience increased leeway and drag ultimately slowing the boat down.

By watching the water, sailors are able to anticipate gusts and maintain a steady heel angle by employing the "ease, hike, trim" technique:

1. **Ease.** As the sailboat enters the gust, the helm eases the mainsheet 3–5cm to reduce the impact of the gust on the rig (varies depending on the power of the gust).

2. **Hike.** As the sailboat enters the gusts, the helm and especially the crew hike hard to prevent the sailboat from heeling.

If minor sheet adjustments and hiking are not enough to keep the sailboat flat in gusts, the helm can also repower by heading up slightly.

3. **Trim.** As the sailboat accelerates the heeling effects of the rig decrease. As this happens, the helm trims the mainsail back in to promote maximum boat speed.

BOAT TRIM (CAN*SAIL* 3–6)

When a sailboat passes through the water its movement creates dynamic stability, which actually raises the boat higher in the water. When sailing in light wind, the sharp corners of the transom dig into the water creating drag. Sailors can tell if the sailboat is experiencing "stern drag" by listening for bubbles and by looking for smooth water flow coming from the back of the boat. The result of sitting forward in the sailboat is the bow / stem being pushed down into the water. At low wind speed this is acceptable because the pointed edge of the bow creates less drag than the stern. The bow angle is maintained so that the knuckle (corner) of the bow is submerged by 5–7cm in flat water.

As the wind and boat speed builds, the resulting dynamic support raises the sailboat in the water. As well, the added forward pressure in the rig will tilt forward (as well as leeward) pushing the bow further into the water. To counteract "bow plough", the helm and crew move aft as the wind builds; when the water is flat, they move aft enough to maintain boat trim by keeping the knuckle of the bow submerged by 2–3cm.

Figure 48 Knuckle

UPWIND

When setting boat trim, the helm and crew move into position for the predominant conditions. When sailing upwind, the crew must then react to upcoming gusts, lulls and waves by incorporating both heel and fore and aft position; the adjustments small enough that they can be made by moving the torso fore and aft without changing the seated position. When watching experienced sailors going upwind into a gust, they maintain heel and angle and prevent bow plough by hiking hard, and simultaneously shifting their torso aft of their centre mass. When sailing into a lull, they prevent stern drag by moving inboard and shifting their torso forward. The helm hikes as required to maintain heel angle, and can assist with boat trim, however their focus should be on steering by the jib tell tales and keeping the boat moving fast.

In addition to maintaining heel angle and boat trim for changes in wind speed, the helm and crew also use their weight to adjust for wind shifts. By moving their torso slightly to windward and leeward, crews are able to make small course adjustments without the use of the rudder.

DOWNWIND

Novice sailors have a tendency to move far aft when sailing downwind, which is likely caused by watching sailors in high performance dinghies which require a lot of crew weight in the back of the boat. Sailing downwind in displacement conditions (planing) does require the helm and crew to sit slightly aft of the upwind position, however the overall boat trim is actually the same.

When the sailboat is heading downwind, the pressure on the sails will push the rig more forward than side-to-side, which will push the bow down; this requires the helm and crew to maintain boat trim with the knuckle of the bow slightly submerged. When the wind increases (and dynamic stability), it is possible for the helm and crew to sit further and further aft, reducing the amount of bow in the water. The water behind the stern should be smooth and relatively flat. If there is a noticeable rise in water behind the stern (rooster tail), this is referred to as “digging a hole”, as is an indication of downwind stern drag.


Figure 49 Rooster Tail


Figure 50 Smooth Exit

Adjusting crew weight to promote surfing and planing will be taught as a part of CAN*Sail* Level 4.

WAVES

Sailing in waves poses a particular challenge for maintaining boat trim because the bow will constantly want to rise and fall, and at times bury into the face of an oncoming wave. The bow of a boat bouncing through the waves slows the boat down significantly by creating drag in each wave, and further slows the boat by rocking the rig back and forth, thus disturbing airflow. With practice, crews are able "to keep the boat in phase", which is the action of keeping the bow level in the waves.

When sailing upwind, the crew moves their torso aft as the bow approaches the trough of the wave to raise it above the upcoming crest. Just prior to the bow cresting the wave, the crew adjusts forward so that the knuckle of the bow is submerged by 2–3cm, therefore giving the bow a punch through the crest of the wave, and prevent it from bouncing off the top of the wave. When the boat is in phase with the waves, the bow will neither bury in the troughs, or slam into / jump off of the crests; instead it will barely rise and fall as the crew works their weight fore and aft.

When sailing downwind, the same technique applies however it is slowed down because the sailboat is travelling in the same direction as the waves. As the wave approaches from behind, the crew and helm lean forward to raise the stern, and shift aft as the wave overtakes them to prevent the bow from burying into the face of the crest.

COACHES CORNER—BOAT TRIM

Maintaining boat trim, heel angle and using small amounts of heel to assist with minor course changes are skills that require keen observation skills. The helm and crew must watch and listen for bubbles at the stern, for turbulent water at the stern, bow plough, jib tell tales, gusts, lulls, headers, lifters and waves. Based on those observations, the helm and crew must react accordingly by positioning their body relative to the predominant conditions, and reacting to changes in an effort to keep the boat sailing as fast as possible.

Kinetically, maintaining boat balance is a simple skill, however it is a complex skill when incorporating all of the sensory inputs required to keep a sailboat flat and trimmed relative to wind and wave conditions.

Coaching boat trim off can be accomplished using a technique called shaping. The shaping technique begins with demonstrating the complete skill, and breaking it down into simple skills and gradually combining them until they are able to demonstrate the entire complex skill. Using the shaping technique, boat trim and balance can be taught in several stages:

1. **Boat trim for predominant conditions and constant heel angle.** Have the sailors set up boat trim for the predominant conditions, and maintain a flat boat by keeping their eyes outside of the boat and hiking as required.

2. **Boat trim for predominant conditions and heel to alter course.** While maintaining boat trim, have the sailors react to headers and lifters by altering course using slight amounts of crew weight.

3. **Maintain boat trim and heel angle in flat water.** Once sailors are comfortable with combining heel control, heel to assist with steering and boat trim; have them maintain proper boat trim (in flat water) in gusts and lulls by adjusting fore and aft.

4. **Sail in Phase.** Once sailors are comfortable with heel and boat trim in flat water, have them combine all of these skills to keep their sailboat in phase with the waves.

MARK ROUNDINGS (CAN*SAIL* 3)

When heading up or bearing away around a windward, leeward or reach mark, how the sailboat enters and exits the mark rounding has an impact on boat speed, acceleration and position relative to the rest of the fleet.

LEEWARD MARK ROUNDINGS

The steps to heading up around a leeward mark are as follows:

1. Crew will call the distance to the leeward mark.

2. When close, the helm will lower the centreboard / dagger board, and the crew will tighten the Cunningham and outhaul.

3. The helm will say, “Heading up.”

4. The crew will reply, “Ready.”

5. Helm and crew will minimize distance lost to leeward by using a “wide / tight” tactical rounding.

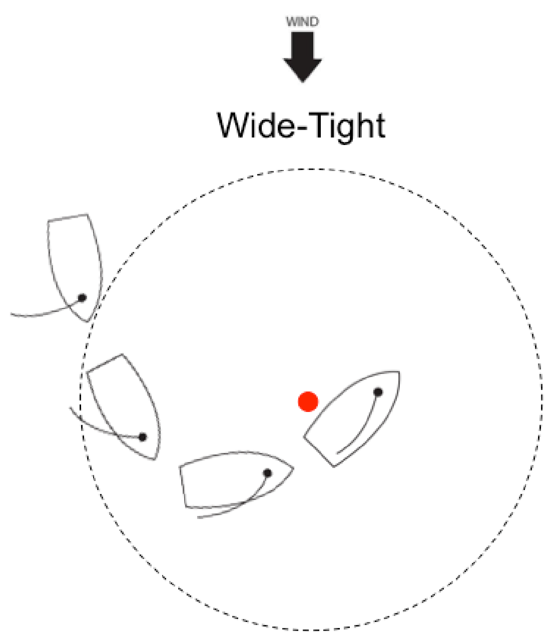


Figure 51 Wide / Tight Leeward Mark Rounding

6. Helm and crew will use sail trim, heel and minimal tiller movements to maximize boat speed and head up around the mark with a wide entrance and tight exit.

7. Helm and crew will allow the sailboat to heel while approaching close hauled, and pump the boat flat to accelerate out of the manoeuvre.

8. Crew will tension the boom vang.

9. Helm and crew will settle into upwind sailing positions.

WINDWARD MARK ROUNDING—DOWNWIND LEG

The steps to bearing away around a windward mark onto a downwind leg are as follows:

1. Crew will call the distance to the windward mark.

2. When close, the crew will ease the boom vang.

3. The helm will say, “Bearing away.”

4. The crew will reply, “Ready.”

5. Helm and crew will minimize extra distance sailed to windward by using a “wide / tight” tactical rounding.

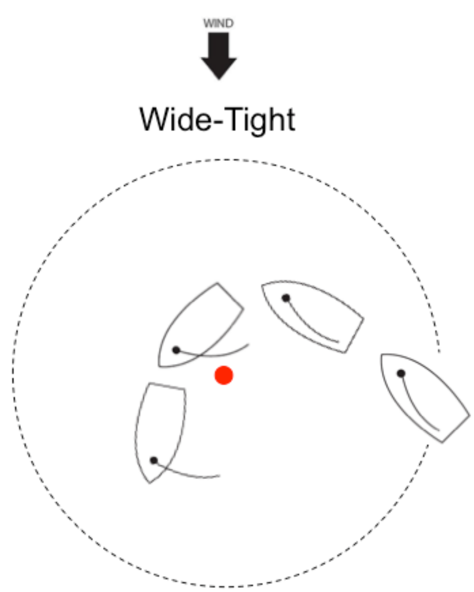


Figure 52 Wide / Tight Windward Mark Rounding

6. Helm and crew will use sail trim, heel and minimal tiller movements to maximize boat speed and bear off around the mark with a wide entrance and tight exit.

7. The crew will move inboard to maintain boat balance as required.

8. When on the desired heading, the helm will raise the centreboard / dagger board, and the crew will ease the Cunningham and outhaul.

9. Helm and crew will settle into downwind sailing positions.

WINDWARD MARK ROUNDING—REACH LEG

The steps to bearing away around a windward mark onto a reach leg are as follows:

1. Crew will call the distance to the windward mark.

2. When close, the crew will ease the boom vang.

3. The helm will say, “Bearing away.”

4. The crew will reply, “Ready.”

5. Helm and crew will maximize acceleration and limit the number of sailboats to windward by using a “tight / wide” tactical rounding.

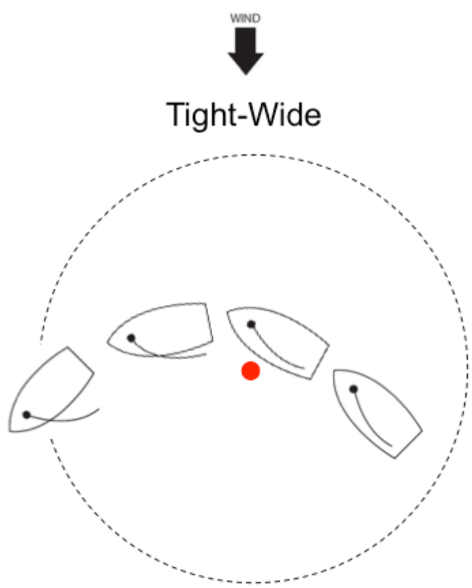


Figure 53 Tight / Wide Windward Mark Rounding

6. Helm and crew will use sail trim, heel and minimal tiller movements to maximize boat speed and bear off around the mark with a tight entrance and wide (high) exit.

7. The crew will move inboard to maintain boat balance as required.

8. When on the desired heading, the helm will raise the centreboard / dagger board, and the crew will ease the Cunningham and outhaul.

9. Helm and crew will settle into reaching sailing positions.

COACHES CORNER—MARK ROUNDINGS

The following video can be used to illustrate windward mark roundings:

Windward Mark Roundings

http://www.youtube.com/watch?v=Z882qWUoIcU&feature=youtu.be

Note. Retrieved June 2013.

The following video can be used to illustrate leeward mark roundings:

Leeward Mark Roundings

http://www.youtube.com/watch?v=Eb2xJ9b4u08&feature=youtu.be

Note. Retrieved June 2013.

In a race setting, mark roundings are critical moments in a race where many places are often lost and gained. One of the main causes for poor mark roundings is poor planning during the mark rounding which results in sloppy maneuvering and poor boat speed.

The focus on CAN*Sail* Level 3 mark rounding training should be on route planning and maintaining maximum boat speed through maneuvering and sail control adjustments. By focusing on developing strong mark rounding routines, sailors will be better equipped for incorporating tactics and strategy during future training.

MARK ROUNDINGS (CAN*SAIL* 4–6)

When sailing, the fleet separates on the legs but typically compresses at the mark rounding's. This makes boat handling and boat speed very important for maximizing places gained and minimizing potential loses. Based on strategic considerations (eg, wind velocity and current) it may also be beneficial to tack / gybe immediately after exiting the mark, or continue sailing. The task of performing a fast, strategically smart mark rounding, requires route planning and communication between the helm and crew during the preceding leg and approach to the mark.

If starboard tack is favoured upwind, port tack is likely the favoured tack down wind.

LEEWARD MARK ROUNDINGS

The steps to heading up around a leeward mark are as follows:

1. Based on the location of the fleet, wind direction, wind speed on each side of the course, current and anticipated wind shifts, crew will determine and communicate how soon the boat will tack following the mark rounding.

2. Crew calls the distance to the leeward mark.

3. When close, the helm lowers the centreboard / dagger board, and the crew tensions the Cunningham and outhaul.

4. The helm says, "Heading up."

5. The crew replies, "Ready."

6. Helm and crew minimize distance lost to leeward by using a "wide / tight" tactical rounding.

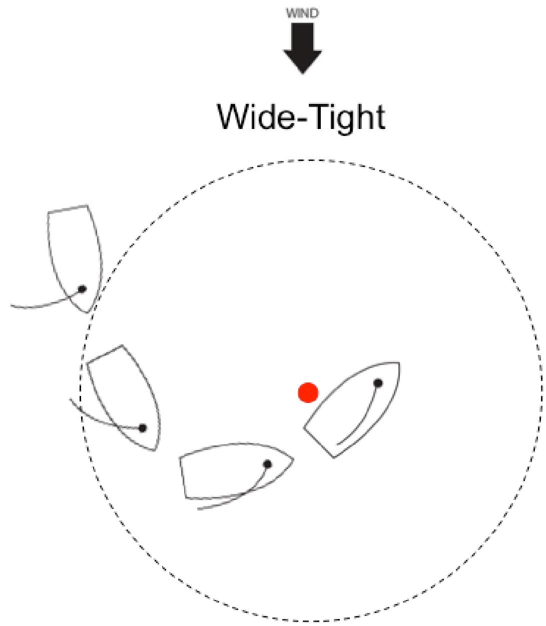


Figure 54 Wide / Tight Leeward Mark Rounding

7. Helm and crew use sail trim, heel and minimal tiller movements to maximize boat speed and head up around the mark with a wide entrance and tight exit.

8. Helm and crew allow the sailboat to heel while approaching close hauled, and pump the boat flat to accelerate out of the manoeuvre.

9. Crew tensions the vang.

10. The helm and crew tack or continue sailing.

> Even if starboard tack is favoured, it is usually beneficial to continue sailing a short distance away from the leeward mark to avoid the wind shadows from boats still sailing downwind.

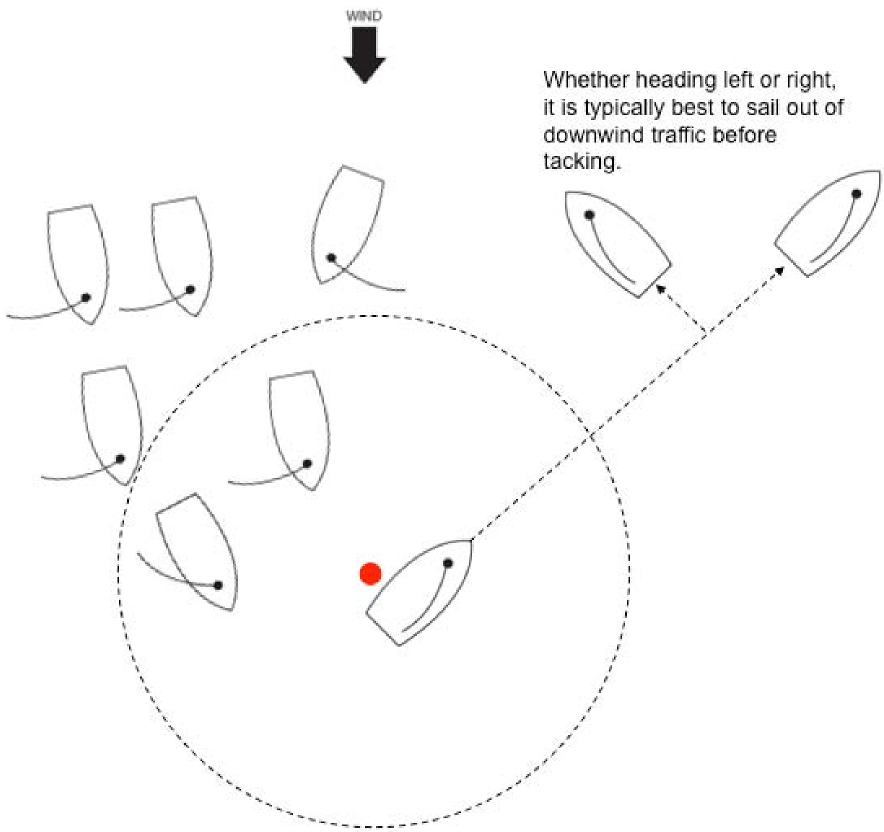


Figure 55 Leeward Mark Rounding

11. Helm and crew settle into upwind sailing positions.

WINDWARD MARK ROUNDING—BEAR AWAY SET

Based on the location of the fleet, wind direction, wind speed on each side of the course, current and anticipated wind shifts, crew will determine and communicate if the mark rounding will be a bear away or gybe set.

The steps to performing a bear away set around a windward mark onto a downwind leg are as follows:

1. Crew will identify a strategic advantage to sail on a starboard tack and communicates a bear away set.

2. Crew calls the distance to the windward mark.

3. When close, the helm / crew eases the vang.

4. The helm says, “Bearing away.”

5. The crew replies, “Ready.”

6. Helm and crew minimize extra distance sailed to windward by using a "wide / tight" tactical rounding.

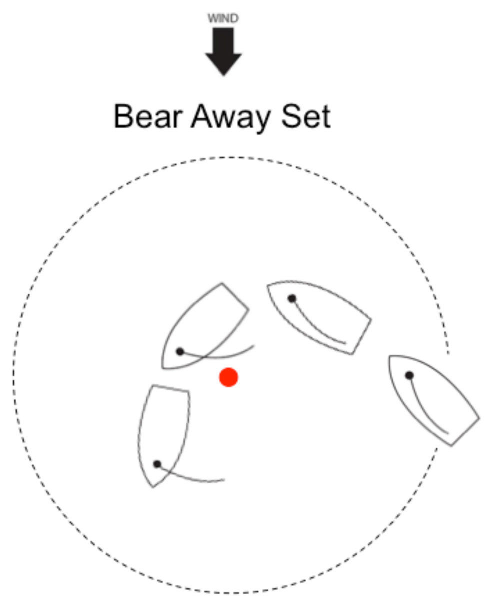


Figure 56 Bear Away Set

7. Helm and crew use sail trim, heel and minimal tiller movements to maximize boat speed and bear off around the mark with a wide entrance and tight exit.

8. The crew moves inboard to maintain boat balance as required.

9. When on the desired heading, the helm raises the centreboard / dagger board, and the crew eases the Cunningham and outhaul.

10. Helm and crew settle into downwind sailing positions.

WINDWARD MARK ROUNDING—GYBE SET

Based on the location of the fleet, wind direction, wind speed on each side of the course, current and anticipated wind shifts, crew will determine and communicate if the mark rounding will be a bear away or gybe set.

The steps to performing a gybe set around a windward mark onto a downwind leg are as follows:

1. Crew identifies a strategic advantage to sail on a port tack and communicates a gybe set.

2. Crew calls the distance to the windward mark.

3. When close, the helm / crew eases the vang.

4. The helm says, “Bearing away.”

5. The crew replies, “Ready.”

6. Helm and crew minimize extra distance sailed to windward by using a “wide / tight” tactical rounding.

7. Helm and crew use sail trim, heel and minimal tiller movements to maximize boat speed and bear off around the mark and roll immediately into a gybe.

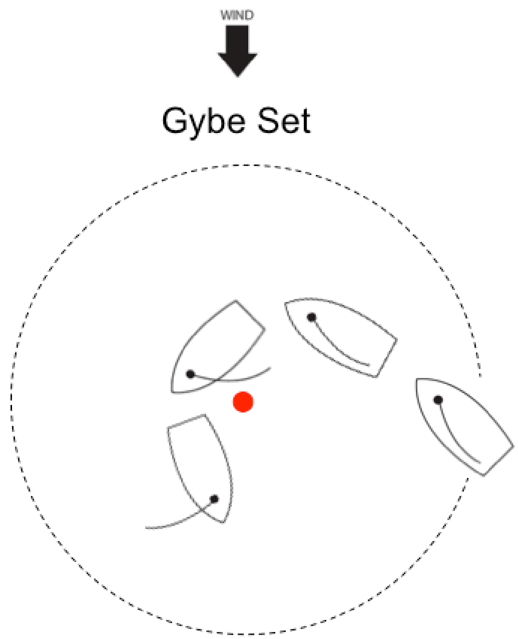


Figure 57 Gybe Set

8. When on the desired heading, the helm raises the centreboard / dagger board, and the crew eases the Cunningham and outhaul.

9. Helm and crew settle into downwind sailing positions.

COACHES CORNER—MARK ROUNDINGS

In a race setting, mark roundings are critical moments in a race where many places are often lost and gained. One of the main causes for poor mark roundings is poor planning during the mark rounding which results in sloppy maneuvering and poor boat speed.

The focus on mark rounding training should be on route planning and exiting the rounding based on strategic considerations for the next leg while maintaining maximum boat speed through maneuvering and sail control adjustments. By focusing on developing strong mark rounding routines and planning for the next leg before the mark rounding, sailors will be better equipped for incorporate tactics and strategy as they progress.

APPARENT WIND

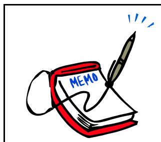
APPARENT WIND (CAN*SAIL* 4)

The wind direction observed on a flag (true wind) is not the wind direction felt on a moving sailboat. The wind created by the movement of the boat is called boat wind and is always in the opposite direction of movement. True wind and boat wind combine to create apparent wind (the wind felt when sailing).

True wind. The wind speed and direction felt by a motionless observer.

Boat wind. The bow-to-stern air flow caused by a sailboat's forward progress.

Apparent wind. The wind speed and direction felt on board a moving sailboat.



True wind, boat wind and apparent wind can be geometrically represented by arrows (vectors). The length of the arrow represents magnitude (speed) and the orientation of the arrow represents direction.

Boat wind is drawn along the sailboat's centre line with the tip of the arrow pointing aft. True wind is drawn with the tip of the arrow touching the tail of the boat wind. Apparent wind is drawn with the tip of the arrow touching the tip of the boat wind arrow and the tail of the arrow touching the tail of the true wind arrow.

The vector diagrams used in this section are intended for illustration purposes only; sailors are not expected to draw vectors.

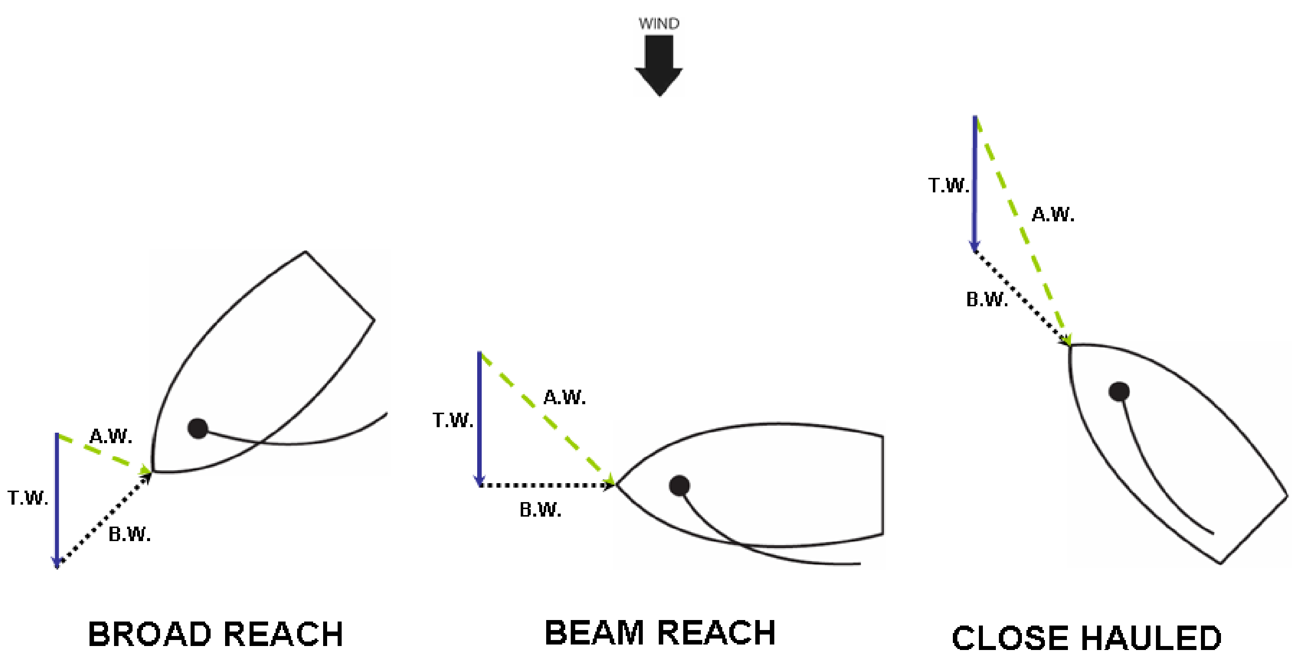


Figure 58   True Wind, Boat Wind and Apparent Wind

Vectors for a sailboat on a run illustrate the true wind and boat wind acting in opposing directions. The opposing forces cancel each other out which makes a run the slowest point of sail.

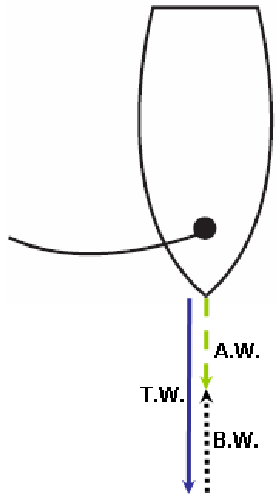


Figure 59 Sailboat on a Run

Velocity header. A shift forward in the apparent wind angle. Velocity headers are usually caused by sailing into a lull or by surfing down the face of a wave.

Velocity lift. A shift aft in the apparent wind angle. Velocity lifters are generally caused by sailing into a gust or by sailing up the face of a wave.

When there is a change in the magnitude of the true wind or boat wind, the apparent wind will shift direction as follows:

- The apparent wind is shifted forward when:
  - o the boat wind increases, or
  - o the true wind decreases.

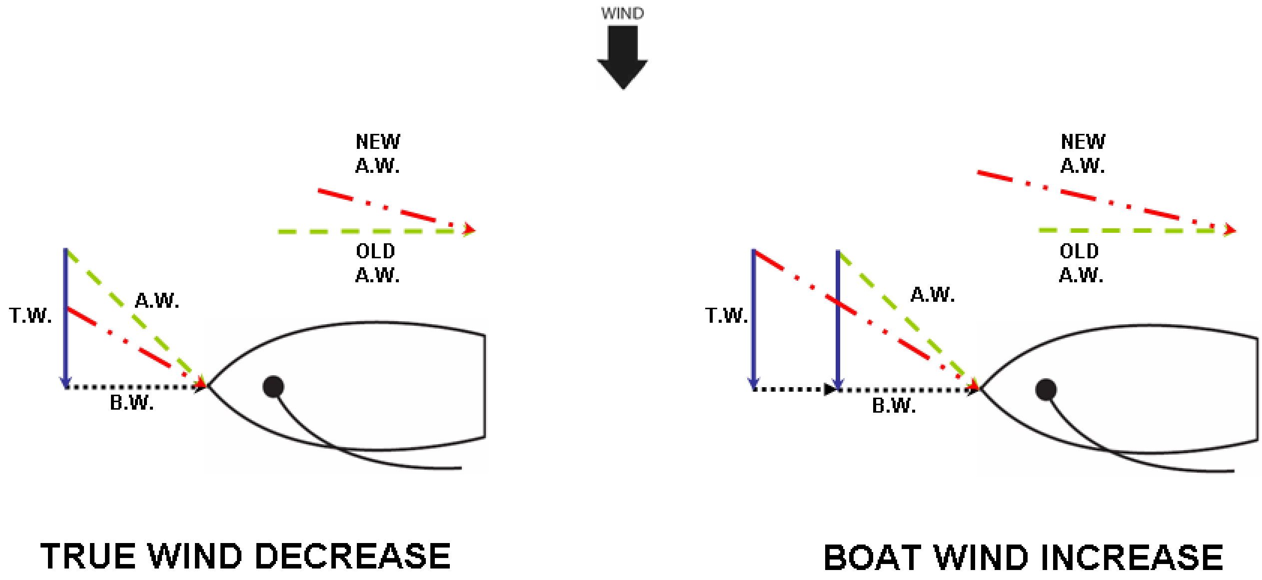


Figure 60 Velocity Header

- The apparent wind is shifted aft when:

  - o the boat wind decreases, or
  - o the true wind increases.

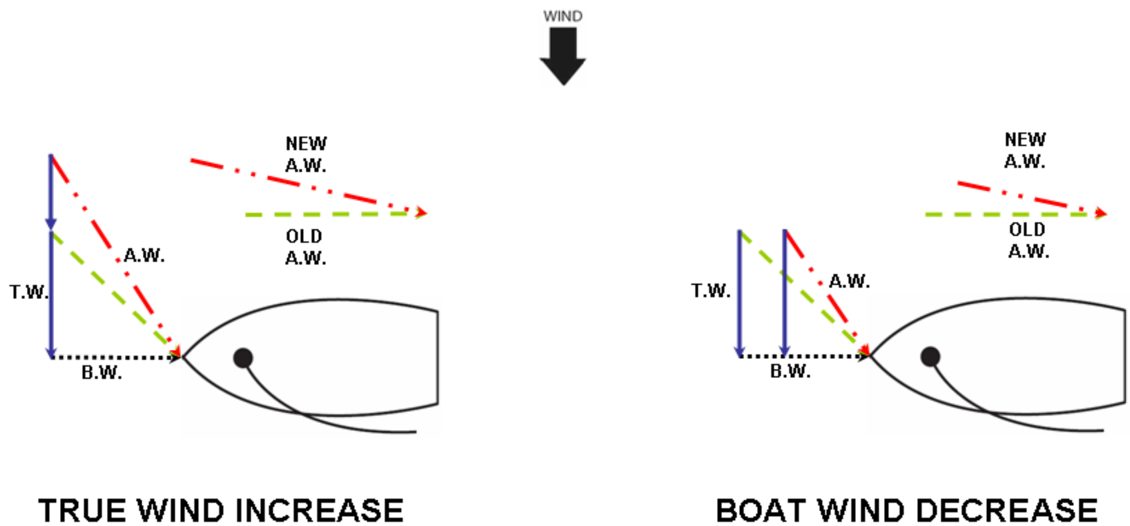


Figure 61 Velocity Lifter

When sailing on a run, a change in magnitude of true wind or boat wind will result in an increase or decrease of apparent wind, but will not affect apparent wind direction.

When the apparent wind is shifted forward (velocity header), the sailboat's crew will need to perform the following actions to maintain boat speed and sail trim:

- sheet in the mainsail and jib sail; and / or

- bear away the sailboat.

When the apparent wind is shifted aft (a velocity lifter), the sailboat's crew will need to perform the following actions to maintain boat speed and sail trim:

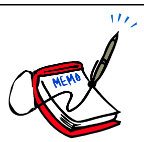
- ease out the mainsail and jib sail; and / or
- head up the sailboat.

When the amount of apparent wind changes, the sailboat's crew will have to shift crew weight to maintain balance.

COACHES CORNER—APPARENT WIND (CAN*SAIL* 4)

Vector diagrams are very useful when explaining how apparent wind works, however can be confusing when explaining how changes in the true wind and apparent wind affect the way we sail.

Although unaware of its presence, sailors have been sailing by the apparent wind since their first time stepping into a boat. Applying this new information brings the changes of wind direction when sailing into a gust, lull or wave to the sailors attention so that they can react accordingly with course adjustment or sail trim.



Although of zero practical sailing application, use a coach boat and large flag to illustrate apparent wind shifts.

1. Start by drifting with the bow pointed (and flag blowing) downwind.
2. Slowly accelerate forward until the boat wind cancels out the true wind and the flag hangs limp.
3. Continue accelerating until the flag blows straight back.
4. Drift with the bow pointed (and flag blowing) 90^{o} to the wind.
5. Moderately increase speed to illustrate a velocity header.
6. Decrease speed to illustrate a velocity lift.

PLANING AND SURFING

PLANING (CAN*SAIL* 4)

INITIATING A PLANE

Most sailboat designs are capable of planing on a beam reach and broad reach in moderate wind conditions. Some sailboat designs are capable of planing on a close reach in strong wind conditions. In patchy wind conditions a gust is usually required to help initiate a plane.

The following can be done to initiate a plane:

1. **Set up the sailboat for planing.** The helm and crew use sail controls to increase power to the sails by tensioning the vang and easing the Cunningham slightly. If reaching, the outhaul is eased to create power in the bottom third of the sail. If sailing upwind, the outhaul is kept relatively tight to maintain upwind sail shape.

2. **Catch a gust.** Watch for overtaking gusts and position the sailboat leeward of them:

   a. if sailing a deep angle, power up in a gust by heading up slightly; and
   b. if attempting to plane upwind, power up in a gust by bearing off slightly.

3. **Pump.** The helm and crew shift weight aft and the helm pumps the mainsail as the sailboat catches a gust. This increase in sail force will help the sailboat accelerate, promoting the sailboat to plane.

> **Pumping.** The act of sheeting in and out very fast, causing a momentary increase in sail force.

4. **Sheet in rapidly.** As a sailboat accelerates in a gust, the boat wind will increase causing the apparent wind to shift forward. The sails are sheeted in quickly to prevent luffing and a loss of drive.

5. **Shift crew weight aft.** As the sailboat begins to plane, shift crew weight aft to help to keep the bow up and distribute weight over the aft section of the hull. Shift crew weight forward when coming off a plane to reduce transom drag.

6. **Maintain the plane.** Depending on point of sail, the helm heads up or bears away to keep the boat powered up. The helm and crew use waves and changes in wind speed as opportunities to pump the sails to keep the boat moving as quickly as possible.

> IAW the *International Sailing Federation (ISAF) the Racing Rules of Sailing*, when racing a sailboat's crew may pull the sheet and the guy controlling any sail in order to initiate surfing or planing, but only once for each wave or gust of wind.

SURFING (CAN*SAIL* 4)

Surfing is a temporary increase in boat speed caused by sailing down the face of a wave. On the downhill slope of an overtaking wave, a sailboat will increase speed due to the momentum of the wave and gravity acting on the hull. Sailors can combine sail and boat trim to promote surfing and significantly improve downwind progress.

INITIATE SURFING

The following actions can be taken to initiate surfing:

1. **Catch a wave.** The helm watches for large overtaking waves and positions the sailboat leeward of them. The helm and crew work together using crew weight to head up in troughs and bear away as the stern begins to lift and the sailboat accelerates.

2. **Pump.** The helm and crew shift weight aft and the helm pumps the mainsail as the sailboat catches a wave. This increase in sail force will help the sailboat accelerate, promoting the sailboat to surf.

3. **Sheet in rapidly.** As a sailboat accelerates on a wave, the boat wind will increase causing the apparent wind to shift forward. The sails should be sheeted in quickly to prevent luffing and a loss of drive.

4. **Maintain the surf.** If the wave begins to overtake the boat, the helm and crew use crew weight to head up slightly to stay on the wave as long as possible.

5. **Catch the next wave.** Once a wave is lost, the helm and crew should immediately shift their weight forward and set up for catching another wave.

> When sailing downwind in heavy air and waves there is potential that the sailboat will sail faster than the waves. This presents the risk of burying the bow in the face of waves as the sailboat sails into them.
>
> When sailing in heavy air and waves, the attention of the helm and crew must be forward, allowing the helm to head up slightly so that the boat sails over the wave on an angle and not directly into the face.

COACHES CORNER—PLANING AND SURFING (CAN*SAIL* 4)

The sudden increase in boat speed that comes with surfing and planing is an incredibly exhilarating experience. Most experienced sailors can vividly remember their first time planing or surfing and can also typically remember the spectacular capsize that shortly followed.

Planing and surfing greatly increases the amount of water flow around the rudder blade, making it much more sensitive to movement (touchy). If helms have limited experience sailing in heavy air, they will have to make adjustments to the way and amount they steer.

The first time planing / surfing conditions present themselves during the season, set a relatively long off-set windward leeward requiring only one gybe on the downwind leg. The sailors will experience many thrills, and likely just as many spills until they learn to adjust their steering for the speed. As sailors grow more comfortable sailing in heavy air / wavy conditions, reconfigure the course to allow for more practice tacking and gybing.

MODES

HIGH AND LOW MODES (CAN*SAIL* 5)

UPWIND

When sailors are proficient at sailing upwind and downwind, they learn to sail the boat within different modes. For example, while sailing close hauled it is possible to adjusting heading slightly within that range to achieve greater pointing or increases speed depending on the situational circumstances.

High (Point) Mode. High (Pointing) Mode is a fine angle between sailing close hauled and pinching, and is very effective in flat water, immediately after a start, when trying to establish a clear lane to windward and when fetching a mark.

To effectively sail in high mode, the helm and crew must communicate and ensure the sailboat is moving fast. Using crew weight (and tiller if required) the helm and crew slowly head up until the windward jib luff telltale begins to “float” around 45 degrees up in the air. Wind speed and waves have a significant impact on how long high mode can be maintained; when the helm and crew feel the sailboat beginning to slow, crew weight (and tiller if required) is used to bear off to regain power.

Due to the risk of stalling and increased leeway, some sailors consider sailing in high mode to be pinching, while others consider a sailboat to be pinching when the jib luff telltale begins to flicker. Regardless of where high mode ends and pinching beings, sailing above normal close hauled will impede upwind progress and cannot be maintained for extended periods of time.

As the course adjustment between normal close hauled and high mode is so fine, the helm and crew should be able to steer between modes with crew weight while hiking.

Low Mode (Footing or Bow Down). Low mode is a fine angle slightly below close hauled and is very effective for powering the boat up. Due to the increase in speed it can be tempting for sailors to maintain this mode for extended periods of time, however by sailing a lower angle it typically does not result in faster time to an upwind mark. Sailing bow down is most effectively used for establishing a clear lane from a windward boat, when powering up after sailing in high mode or when closing the distance between “you” and an attacking port tack boat.

To sail in low mode, the helm and crew bear off slightly so that both jib luff telltales are flying straight back; if the leeward telltale drops, then the boat is sailing too low. Once sailing in low mode is no longer required, the helm and crew head up to a normal close hauled groove.

DOWNWIND

High Mode. Sailing in high mode while downwind is very similar to low mode while sailing upwind. It is a very effective way to power up, although it should not be maintained for extended periods of time because it results in sailing a further distance to the mark.

	Sailing on a high angle is often referred to as sailing a "hot angle". Heading up for pressure / power is often referred to as "heating up".

To sail in high mode, the helm and crew head up, while feeling for pressure in the sheets and sensing an increase in boat speed. Particularly when sailing in planing conditions, sailors use high mode to initiate a plane, and bear away as the apparent wind shifts forward.

Low Mode. The lower a sailboat sails, the more impact boat wind has on pressure in the sails and overall boat speed. However if the sailboat is surfing or planing, sailing in low mode is a very effective way of maximizing downwind distance gained.

To sail in low mode, the helm and crew bear away, while feeling for pressure in the sheets and sensing a decrease in boat speed. When the helm and crew sense a decrease in boat speed, they work together to head back up for power.

As the sailing angles are not as fine as sailing close hauled, the helm and crew communicate constantly about approaching changes in wind, waves and pressure in the sails. The information exchanged in this communications allows sailors to heat up when pressure is light and soak low in pressure to maximize downwind gains.

	Sailing in low mode in a gust, or while planing / surfing is often referred to as "soaking" or "soaking low".

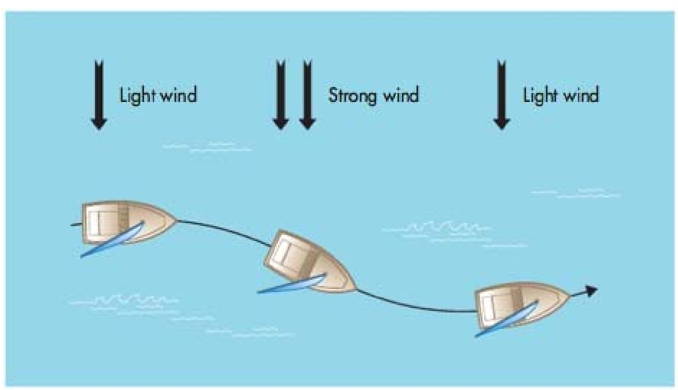


Figure 62 Soaking Low in a Gust

Note. From *Be Your Own Sailing Coach* (p. 171), by Emmett, J. 2008, West Sussex, UK: John Wiley & Sons Ltd. Copyright 2008 by John Wiley & Sons Ltd.

DOWN-SPEED SAILING

DOWN-SPEED SAILING (FROM MAXIMUM SPEED)

DOWN-SPEED SAILING—UPWIND

Upwind down-speed sailing is primarily used when allowing a port or starboard tack boat to cross without significant course changes and when approaching a windward mark in traffic. Upwind down-speed sailing is unique, because of the risk of increased leeway. The following techniques can be employed:

1. **Pinch.** The helm heads up slightly until the windward jib tickler (luff tell tale) begins to lift up and flutter slightly. Pinching increases leeway so it should only be used for short periods of time.

2. **Bow Down.** The crew shifts forward to intentionally trim the bow down. Shifting aft to drag the stern has a similar effect, however it also induces lee helm which will reduce the sailboat's pointing ability.

3. **Sail Trim.** Mainsail trim has a significant impact on the sailboat's pointing ability, therefore it is important for the helm and crew to discuss how much they need to reduce speed. When slowing down upwind, the jib should be eased first, allowing the helm to keep the mainsail in tight and maintain most of their pointing ability. If slowing down a significant amount, the helm must play the mainsail in and out to keep the bow close to the wind.

DOWN-SPEED SAILING—DOWNWIND

Down-speed sailing is commonly used when approaching a leeward mark in traffic and when sailing for clear air.

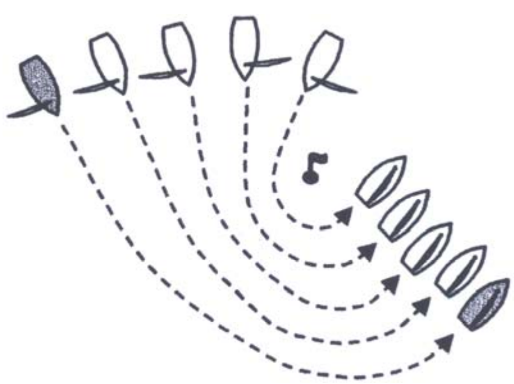


Figure 63 Pinwheel

Note. From *North U: Performance racing tactics* (p. 258), by Gladestone, B., 2007, Madison, CT: North U.

1. **Over-trimming.** Over-trimming the mainsail to cause a stall is the fastest way to slow a sailboat down when sailing downwind. The helm must be careful not to head up, or flow will be re-established around the sail, causing the sailboat to suddenly heel. If stalling the mainsail is not enough, the crew can over-trim the jib sail, however communication is important because this may cause the sailboat to bear away until counteracted by the rudder.

2. **Stern Drag.** The helm and crew shift aft to drag the stern. Very effective at slowing the boat, however the helm and crew must remember to shift forward when it is time to sail at maximum speed again.

3. **Over-steering.** The helm intentionally heads up and bears away with abrupt tiller movements from side-to-side. The rudder blade will induce drag, and the s-shaped course will increase the total distance sailed, therefore increasing the distance from nearby sailboats.

DOWN-SPEED SAILING—REACHING

Down-speed sailing when reaching incorporates techniques used for both upwind and downwind sailing. How the techniques are selected vary depending on how high or low the reaching angle is and the wind speed.

1. **Sail Trim.** Depending on the point of sail, sails can be luffed or over-trimmed to slow the boat down. If sailing on a broad reach stalling the sails by over trimming is most effective. Stalling the sails when on a close reach or beam reach in heavy winds will cause the boat to heel, making luffing the sails more appropriate. The helm and crew need to communicate constantly to determine the wind and angle and appropriate sail trim adjustments.

2. **Stern Drag.** The helm and crew shift aft to drag the stern. Very effective at slowing the boat, however the helm and crew must remember to shift forward when it is time to sail at maximum speed again.

3. **Over-steering.** The helm intentionally heads up and bears away with abrupt tiller movements from side-to-side. The rudder blade will induce drag, and the s-shaped course will increase the total distance sailed, therefore increasing the distance from nearby sailboats. When reaching, heading up or bearing away may actually cause the boat to accelerate slightly because of changing pressure in the sails. The helm and crew should not match sail trim to wind direction, and allow the sails to luff and stall as the sailboat turns.

COACHES CORNER—DOWN-SPEED SAILING

Throughout their training sailors have consistently been coached to sail their boats as fast as possible, so sailing lower than maximum speed will likely be counter-intuitive at this point in their training. When racing in a high-traffic fleet setting, down-speed sailing skills are invaluable, however easily forgotten in the heat of the moment. To build down-speed sailing skills into a sailor's repertoire of go-to skills, they should be incorporated into training as much as possible. For example, control positions, at the beginning of drills and soft skills coached when approaching mark roundings.

BACKWARDS SAILING

BACKWARDS SAILING (CAN*SAIL* 3)

Sailing backwards is most often performed when leaving a dock or mooring, and for short periods of time while manoeuvring before the start of a race.

The following are the steps to sail backwards:

1. The helm will say, "Prepare to luff up."
2. The crew will reply, "Ready."
3. The helm will say, "Luffing."
4. The helm will push the tiller toward the mainsail, causing the sailboat to turn toward the wind.
5. The helm and crew will ease the sheets until they luff.
6. The crew will move inboard to maintain boat balance.
7. When the sailboat reaches head to wind, the crew will back the mainsail to stop the boat and hold it as the sailboat begins to sail backwards. The crew should back the mainsail onto the tack they plan on accelerating away from (back to the port side to accelerate away on starboard tack).
8. As the sailboat accelerates backwards, the helm will steer, keeping the bow head to wind.
9. The helm and crew will shift weight forward to prevent the transom from digging into the water.

When sailing backwards the steering is opposite from steering forward.

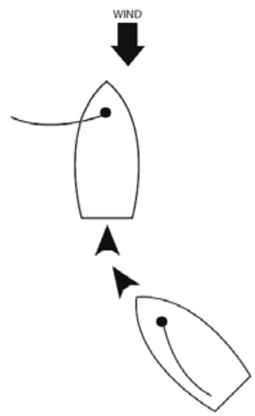


Figure 64   Sailing Backwards

Maintaining Course Control

Steering a straight line while sailing backwards can be difficult because the forces on the rudder are opposite than when sailing forward. This can result in the helm losing control or “over-steering”. If the helm accidently bears away, the sailboat should stop and return to head to wind to resume course.

The helm should always remain seated while sailing backwards to avoid being hit by the boom should the crew lose control of the mainsail.

Accelerating Forward

The following are the steps to change direction from backwards to forward:

1. The helm will say, "Prepare to bear away."
2. The crew will reply, "Ready."
3. The helm will say, "Bearing away."
4. The helm will guide the tiller in the desired direction, bearing away onto a close reach.
5. The skipper and crew will shift weight aft to the normal sitting position.
6. As the boat bears away, the crew will pump the mainsail (with the boom) to pop the head batten to leeward.
7. The skipper and crew will sheet in the sails.
8. As the sailboat begins moving forward, the sailors will heel the sailboat to head up to close hauled, and pump the sailboat flat to accelerate.

COACHES CORNER—BACKWARDS SAILING (CAN*SAIL* 3)

Sailing backwards and smoothly transitioning to a luff or accelerating away is an invaluable skill that has multiple applications but in particular on the start line. For sailors to use it on a busy line, they must become comfortable with performing the skill over long(er) distances where they have room to master the skill without the fear of losing control and hitting other sailboats luffing close by.

- **Head to Wind.** If the bow is not pointed head to wind, backing the mainsail will turn the boat instead of propelling the sailboat backwards. Before backing the mainsail, the crew should watch for the mainsail and jib sail to luff down the centre of the boat.

- **Tiller.** Tiller control when sailing backwards can be a challenge for helms because it requires a light touch when changing directions, but a firm hand when moving backwards. When a sailboat moves backwards, the flow around the rudder blade is against the hydrodynamic profile of the foil; this will give it the tendency to abruptly jam if turned far away from centreline. For a helm to effectively sail backwards they must have a firm grip on the tiller to prevent the sailboat from suddenly bearing away

  When changing directions from sailing forward to backwards or vice versa there will be a moment of slack flow around the rudder blade. By keeping a light touch on the tiller when changing directions, the helm will be able to feel when the flow around the rudder blade changes; therefore telling them how to adjust their steering.

- **Boat Balance.** When a sailboat begins sailing backwards, the transom will have a tendency to dig into the water and raise the bow; giving the sailboat the tendency to bear away and wash to come over the back of the transom and swamp the cockpit. As the crew backwinds the mainsail, it is important for the helm and crew to shift forward to maintain boat trim.

STOPPING AND STARTING FROM BETWEEN TWO MARKS

IDENTIFY A TRANSIT

When stopping and starting on a line between two marks it is easier to know where the sailboat is in relation to the marks when luffing right next to them. However on a long or crowded line it is often difficult to see both marks, which can result in luffing below or above the line.

To help avoid being below or above the line, sailors use landmarks called transits. Sailors luff at one end of the line, and look straight down the line to pick out a unique feature on land such as a tree, building or rock to serve as a landmark. Sailors will then sail to the other end of the line and identify a transit on other side (if present). When stopping on a line between two marks, the crew uses the transits to identify where the sailboat is in relation to the line, and whether the boat needs to move further up or downwind.

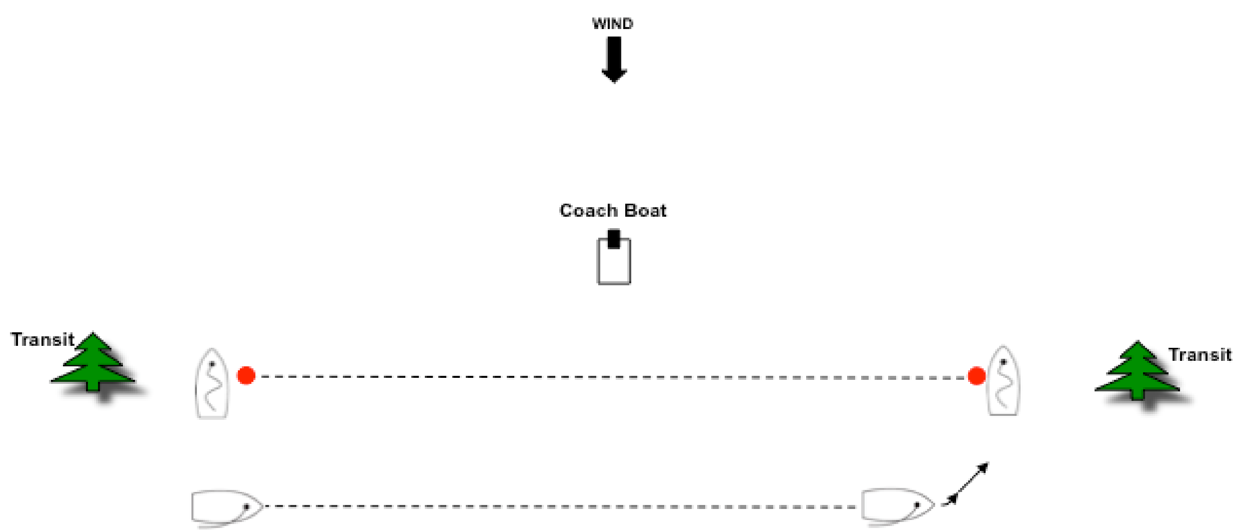


Figure 65 Transit

STOP A SAILBOAT BETWEEN TWO MARKS

Stopping between two marks is slightly more difficult than stopping at a mooring or control position because it can be difficult to gauge whether or not the sail boat is above, below or on the line (between the marks), and because of the traffic associated with stopping in a fleet setting.

1. **The Approach.** The sailboat will typically approach the line on a reach from either a port or starboard tack. Sailors will sail at top speed initially and use down-speed sailing techniques

when close to where they will stop.

2. **Selecting a place to stop.** If stopping between two marks in traffic, the crew will look for a hole in the line up to turn into. The crew will communicate the place to stop, while the helm concentrates on boat speed and boats to leeward. The hole should be large enough that the sailboat will have enough room to bear away onto a close reach to assist with accelerating.

3. **Stop between the two marks:**

   a. The helm will say, "Prepare to luff up."

   b. The crew will reply, "Ready."

   c. The helm will say, "Luffing."

   d. The helm will push the tiller toward the mainsail, causing the sailboat to turn toward the wind.

   e. The helm and crew will ease the sheets until they luff.

   f. The crew will move inboard to maintain boat balance.

   g. The crew communicates the distance to the line.

   h. As the bow reaches the line, the helm will point the bow head to wind, and the crew will back the mainsail to stop the boat. The crew backs the mainsail onto the tack they plan on accelerating away from (back to the port side to accelerate away on starboard tack).

   i. Once stopped, the crew will pump the mainsail (with the boom) to pop the head batten to leeward.

   j. When the sailboat comes to a complete stop, the helm will skull the rudder, to bear the sailboat away slightly so it does not become stuck in irons.

4. **Hold Position.** If the boat simply luffs, it will bear away to beam reach and drift downwind. The crew trims the jib sail to 25%, and the helm pumps the mainsheet to keep the bow pointed upwind.

STARTING FROM BETWEEN TWO MARKS

The Bear Away

While luffing between two marks, the helm and crew maintain a lookout for boats who have stopped to leeward. If space permits, the helm and crew will bear away onto a close reach to allow for faster acceleration away from the line. In the seconds prior to accelerating, the sailboat will bear away by:

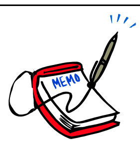
1. the helm standing and backing the mainsail to port;
2. the crew trimming the jib hard and heeling the sailboat to windward;
3. the helm using the rudder as a brake, by moving the tiller as far to port as possible; and
4. as the bow turns down from the wind, the helm and crew release their sails, flatten the boat and the helm pumps the mainsheet to pop the head batten.

Accelerating Forward

The following are the steps to accelerating from between two marks:

1. The crew will call the distance to the line.
2. Based on personal preferences, the helm or crew will count into trimming in the sails.
3. The skipper and crew will sheet in the sails to 90%.
4. As the sailboat begins moving forward, the sailors will heel the sailboat to head up to close hauled.
5. The helm and crew will trim the sails in to 100% and pump the sailboat flat to accelerate.

COACHES CORNER—STOPPING AND STARTING FROM BETWEEN TWO MARKS



The following video can be used to illustrate various down-speed maneuvers:

Raising The Sail 420 Advanced Racing Clinic 2009

http://youtu.be/diuV3-4KYVU?t=1m23s

Note. Retrieved June 2013.

Stopping, holding position and accelerating from between two marks can be stressful because it is typically done while sailing in a fleet setting; creating traffic, noise of luffing sails, and sailboats attempting to stop in a crowded area.

When introducing these skills, course sizes must be large enough and fleet sizes small enough to minimize stress and allow sailors to focus on developing boat-handling skills. Tailor the length of the line and size of the fleet to the wind strength, wave height and skill level of the sailors. With practice, sailors will become more comfortable performing these skills in traffic.

START LINE BOAT HANDLING (CAN*SAIL* 4)

START LINE BOAT HANDLING

The luff start is the most common starting style for dinghy sailboats. Based on the favoured end and first beat strategy, sailboats typically begin luffing on the start line between 2 minutes and 30 seconds prior to the gun.

> During the pre-start it can be tempting for sailors to simply luff near one end of the line. This is understandable because it conserves energy, however it has the potential to disengage both the mind and body.
>
> Between 4 and 2 minutes in a starting sequence countdown, many boats will sail back and forth between the boat-end and pin-end. This keeps muscles, heart and lungs active, while engaging the mind into current wind and wave conditions and activity of the rest of the fleet.

Stopping

When creeping down the line looking for a spot, crews ease their jib to 50% giving the helms full control of boat speed. When stopping, the helms round up quickly with maximum tiller and blow the mainsheet to shoot the bow into the wind, and maximize (stopping) drag from the luffing sails.

As the jib clew luffs inside the shrouds, the crew backs the mainsail to kill forward momentum, leaving just enough energy in the boat to allow the helm to fall down until the jib luffs in line with the leeward shroud. The crew then pumps the boom to ensure the head batten is popped to leeward.

> The longer sailors can control their boat in a luff on a start line, the more likely they are able to start at the favoured end with clear air.

Holding

Once stopped the crew trims the jib to 25-50% (depending on wind speed). The helm stands up and holds the boom (or upper mainsheet block) in their left hand while holding the tiller behind their back with their right hand. Holding the boom or close to the top block gives the helm a great feeling for how much power is in the sail and by standing it easier to watch for boats coming from windward. The helm plays the tiller and mainsail in and out to keep the nose high but not enough to give the boat forward drive.

> Some helms prefer to hold position while sitting and playing the mainsheet from the mainsheet block. Sailors should be encouraged to try a number of different styles and determine which they prefer.

While holding, the helm's focus is on bow height and boats to windward, while the crew calls distance to the line, boats to leeward and timing on the start.

30 seconds before the start, the helm rotates their body so that their shoulders are back inside the boat and switches back to holding the tiller and mainsheet in the normal position in anticipation of the start.

Acceleration

When bearing away to close reach (or lower) in anticipation for the start, the crew pulls the jib sheet in to 100% with zero main to avoid sailing forward. In doing so the jib is pulling the bow down via drag, but because the boat isn't moving forward, there is no flow around the sail.

If pulling the bow down 25–30 seconds prior to the start, the jib can then be allowed to luff at 25% until the helm and crew begin trimming for acceleration at 10–6 seconds to the start (depending on distance from the line, wind speed and wave height).

Bearing away to a close reach luff with the jib trimmed to 25% and the helm ready to trim the mainsail is often refered to as the “ready position”.

If bearing off as part of the acceleration process (eg, the helm and crew are late bearing off), the fully sheeted jib sail will be stalled requiring the crew to ease the jib 2-3 inches (more in light air, less in heavy) to bag out the jib and encourage flow.

The act of easing and retrimming a sail to encourage flow is sometimes referred to as “burping the sail”.

The helm and crew heel the sailboat to leeward to head up to close hauled while trimming the sails all of the way in, and pumping the sailboat flat to accelerate.

COACHES CORNER—STOPPING AND STARTING FROM BETWEEN TWO MARKS (CAN*SAIL* 4)

The following video can be used to illustrate a fleet start:

420 Starts RNSYS May 2008

http://www.youtube.com/watch?v=1wDT7A7fGdA

Note. Retrieved June 2013.

When building first beat and starting strategy into stopping, holding and acceleration boat handling skills, course sizes must be large enough and fleet sizes small enough to minimize stress and allow sailors to practice the skills in a positive environment. Tailor the length of the line and size of the fleet to the wind strength, wave height and skill level of the sailors. With practice, sailors will become more comfortable performing these skills in traffic.

DOUBLE TACKING ON A START LINE

DOWN-SPEED DOUBLE TACKING

DOUBLE TACKING

When on a start line and a hole opens up to windward a down-speed double tack can be used to crab sideways without advancing upwind (above the line), or sacrificing depth (drifting back from the line). A down-speed double tack involves combining two tacks together into one fluid manoeuvre, without the benefit of boat speed and flow around the foils.

The more a boat is heeled the faster it turns while at the same time, the less likely is it to establish flow around the foils—the ability to sail forward. When the sails are trimmed opposite (max in and max out at the same time) the rig will pivot and the imbalance in the sails will greatly reduce its ability to create forward drive.

1. When initiating the turn, the main is max out and the jib is max in to pull the bow down.

2. Once onto a close reach a slight leeward heel is introduced (only slight to avoid leeway), the jib is trimmed max off and main is trimmed quickly to 90% to turn the boat. As the bow reaches close hauled, the main trimmed tight to 100%. The helm is aggressive with the tiller and skulls if needed.

3. As the bow crosses the wind, the jib comes in max on the new leeward side, there is a huge roll to windward to kick the stern around and the main is max eased.

4. As soon as the bow is down onto a close reach, the tiller goes hard to leeward, jib is max off, main is 90-100% and the bow is forced through the wind again.

5. During this manoeuvre a little forward energy will be created, so there is a huge windward roll, with sails fully eased. The crew backs the main to prevent the boat from edging forward and then pumps the boom to set up the head batten.

Depending on wind speed, it may be necessary for the helm to “power up” by momentarily exiting the first tack on a close reach before heading up into the second tack.

COACHES CORNER—DOUBLE TACKS

The following video can be used to illustrate down-speed double tacking:

Down-Speed Double Tack Training

http://www.youtube.com/watch?v=fxEVtUmmVHg&feature=youtu.be

Note. Retrieved June 2013.

Even more so than a double tack executed while sailing at maximum speed, a down-speed double tack requires significant communication and coordinated movements between the helm and crew. Sailors will likely need several attempts at creating an effective communication system before they can begin to focus on the mechanics of the manouvre; when executed correctly it is an invaluable tool on a crowded line.

TACTICS, STRATEGY AND THE *RACING RULES OF SAILING*

There are very few publications which combine information pertaining to rigging, fundamental sail theory, boat handling skills, and regatta preparation into one package. However, the sailing community has dedicated significant amounts of resources to developing publications related to tactics, strategy and the application of the Racing Rules of Sailing to on-water situations.

For that reason, this section intentionally provides only basic information with the intention that coaching staff will use additional references to assist with instructing upwind, downwind and reaching tactics and strategy (as required for each CANSail Level)

Some recommended references include:

C1-256 ISBN 1-898660-30-1 Merricks, J., & Walker, I. (1996). *High performance racing.* West Sussex, UK: Fernhurst Books.

C1-275 ISBN 0-9675890-X Gladestone, B. (2007). North U: Performance racing tactics (sixth edition). Madison, CT: North U.

C1-292 ISBN 978-1904-47512-5 Houghton, D., & Campbell, F. (2005). *Wind strategy.* West Sussex, UK: John Wiley & Sons Ltd.

STRATEGY

UPWIND STRATEGY (CAN*SAIL* 3)

CLEAR AIR

When sailing in a fleet, sailboats can be heavily influenced by the sailboats around them. When air flows around a sail, it leaves the leech as turbulent / disturbed air. Disturbed air has a negative impact on boats sailing to leeward.

Covering

When sailing upwind, sailors use the distributed air coming from their sails to their advantage by covering the boats to leeward. Windward boats can intentionally put themselves in a covering situation by tacking windward and slightly forward of leeward boats.

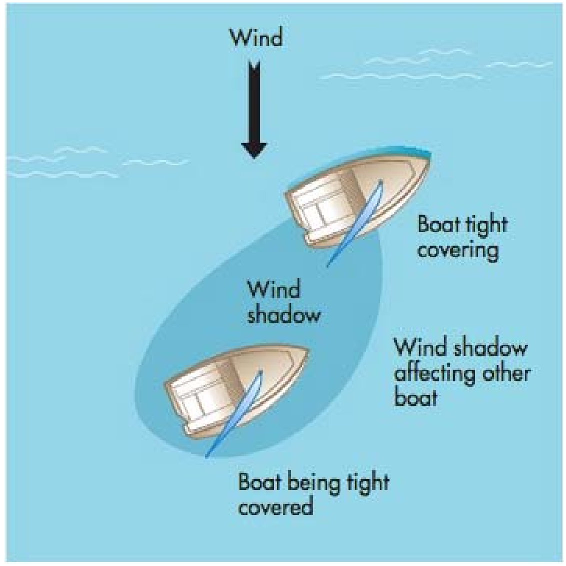


Figure 66 Upwind Cover

Note. From *Be Your Own Sailing Coach* (p. 77), by Emmett, J. 2008, West Sussex, UK: John Wiley & Sons Ltd. Copyright 2008 by John Wiley & Sons Ltd.

Tacking Away From a Cover

When sailing behind over boats, it is important to avoid being covered as much as possible. This can be confusing because when a sailboat is covered, it is not necessarily being blocked from the true wind, instead it is being covered by receiving the exhaust coming off of the sails from the sailboat to windward.

Sailors can tell if they are being covered by using the tell tale located on the windward shroud (or wind indicator located on the mast). If the windward tell tale is blowing back from the same direction as the windward boat (aligned), the leeward sailboat is being covered. Unless approaching the windward mark or an obstruction, the normal defence against a covering boat is to tack away for clear air.

Upwind Lanes

When sailboats are sailing close together in a fleet, it is important to sail in a clean lane. A lane refers to the area of clear air coming from in front of the windward hip (back corner) of a nearby upwind boat. When preparing to tack, it is important to perform a shoulder check to look for windward boats, and ensure the sailboat will be in a clean lane when exiting the tack.

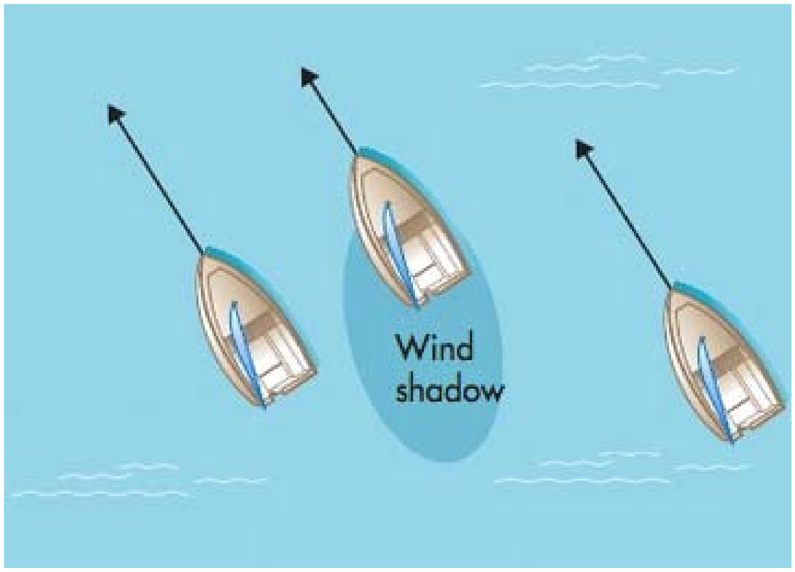


Figure 67 Upwind Lane

Note. From *Be Your Own Sailing Coach* (p. 80), by Emmett, J. 2008, West Sussex, UK: John Wiley & Sons Ltd. Copyright 2008 by John Wiley & Sons Ltd.

UPWIND LAYLINES

A lay line is an imaginary line extending from a mark, where a sailboat can fetch the mark on its given course. When sailing upwind, a starboard tack boat is on the lay line if it is able to sail directly to the mark without tacking or bearing away onto a close reach. Changes in wind direction and speed generally make it a good idea to sail close to the middle of the course, or slightly to the left or right (based on prominent conditions), and avoid the lay lines until close to the windward mark. This will reduce the likelihood of accidently sailing too far (as the result of a shift) or being slowed by a lull that does not impact the rest of the fleet. Sailors can gauge the lay line by using the same technique used to sight their tacks; shoulder check when approaching the mark and tack when slightly above 90^{o}.

When a sailor goes far to the right or left side of the course, this is commonly referred to as “no-man’s land” or “banging the corners”

DOWNWIND STRATEGY (CAN*SAIL* 3)

CLEAR AIR

When sailing upwind, the sailboats in the front have the ability to impact the performance of the sailboats behind them, however downwind is an opportunity for the trailing boats to make gains on the race leaders.

Blanketing

When sailing downwind, sailors position their sailboats so their sails block the wind from the sailboats to leeward of them. When reaching and running, the direction of turbulent air coming from the windward boat is based on their point of sail. If the sailboat is reaching, the majority of exhaust will come from their leech, however if they are running, the exhaust will primarily come from in front of their sailboats.

Downwind sailboats can defend against attacking upwind boats by heading up away from the blanket, or by gybing for clear air.

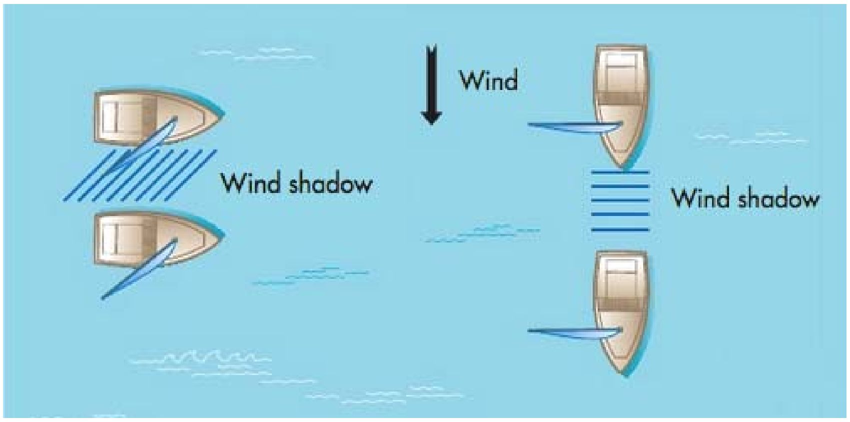


Figure 68 Blanketing

Note. From *Be Your Own Sailing Coach* (p. 88), by Emmett, J. 2008, West Sussex, UK: John Wiley & Sons Ltd. Copyright 2008 by John Wiley & Sons Ltd.

DOWNWIND LAYLINE

Sailing directly downwind tends to be very slow, which results in sailboats on a downwind leg gybing several times on the way to the leeward mark. This results in downwind lay lines which are similar in angle to upwind lay lines. The helm and crew should communicate when approaching the leeward mark to ensure when they gybe for the mark, that they will exit the gybe on a fast (similar) angle to the wind.

COACHES CORNER—STRATEGY (CAN*SAIL* 3)

CAN*Sail* Level 3 introduces some skills which are applicable to racing however have application whenever sailing around other boats. When basic sailors first learn they can influence the boats around them, they have a tendency to sail out of their way to do so, and lose sight of sailing around the course as quickly as possible.

When introducing basic sailing tactics and strategy it is important for basic sailors to understand that they are to be incorporated into finding the fastest way around the course, and not become a distraction.

Tactics and strategy will progressively be elaborated on during future CAN*Sail* training.

WIND SHIFTS, TIDE AND CURRENT

WIND SHIFTS (CAN*SAIL* 4)

WIND TERMINOLOGY AND TYPES OF WIND SHIFTS

Backing. Wind direction shifts in a counter-clockwise direction.

Veering. Wind direction shifts in a clockwise direction.

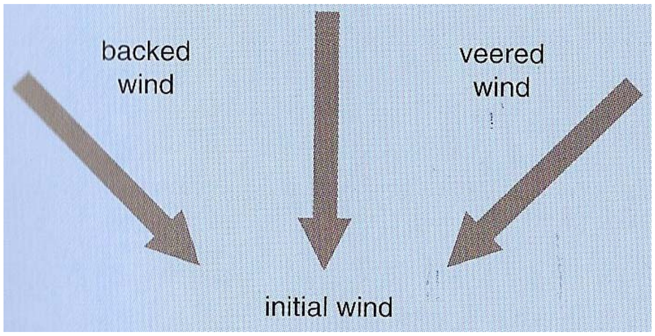


Figure 69 Backing and Veering

Note. From *Wind Strategy* (p. 11), by Houghton, D., & Campbell, 2005, West Sussex, UK: John Wiley & Sons Ltd. Copyright 2005 by David Houghton and Fiona Campbell.

Geographic Shift. A shift in direction or speed caused by land or an object.

Persistent Shift. The wind moves in one direction either very quickly (eg, the passage of a front) or progressively (eg, a sea breeze gradually trending to the right over the course of the afternoon).

Oscillating Shift. The wind slowly shifts back and forth around an average wind direction. These types of shifts usually last from 1–10 minutes.

REACTING TO WIND SHIFTS WHILE SAILING UPWIND

As sailors gain experience sailing in shifty conditions they will soon be able to sail in phase with wind shifts, allowing them to decrease the total distance required to be sailed by sailing on the favoured (lifted) tack.

Dinghy sailing on short courses places particular emphasis on reading oscillating shifts and geographic shifts.

- **Oscillating shifts.** Oscillating wind shifts are very useful to dinghy sailors on a short course because the side-to-side swing of wind direction allows them to consistently sail on the lifted tack up wind. Depending on the conditions, gusts and lulls may consistently result in the wind backing or veering.

  When sailing into a header, sailors can maximize the potential gain of the shift by sailing on the headed tack long enough for the wind direction to stabilize (typically 5–10 seconds) and then tack onto the lifted tack.

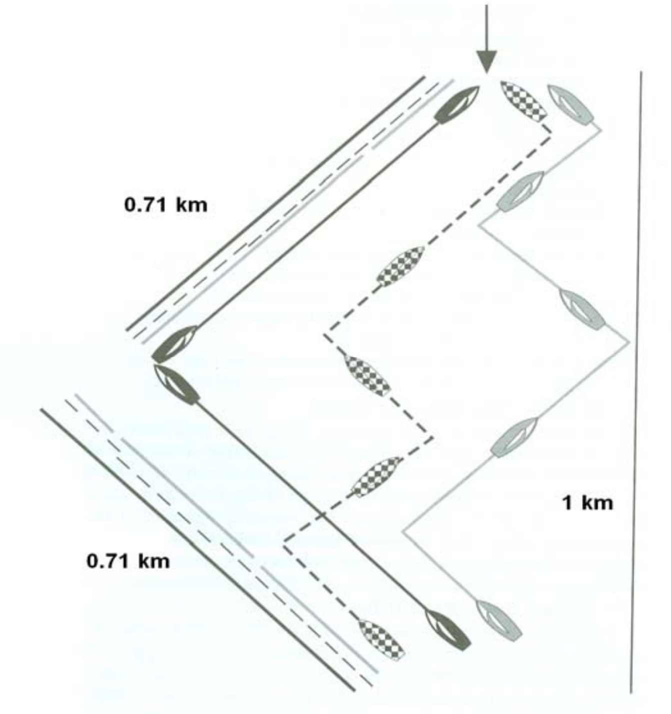


Figure 70 Upwind Sailing Distance

Note. From *North U: Performance racing tactics* (p. 58), by Gladestone, B., 2007, Madison, CT: North U.

- **Geographic shifts.** Geographic shifts are predictable wind shifts, which are caused by shoreline features, local topography (hills, valleys, cliffs, islands etc) and human-made features such as large shoreline parking lots and industrial compounds (areas likely to be hotter than the surrounding land) and large buildings or bridges.

  Sailors maximize gains from geographic shifts by sailing towards the shift. For example, if the wind is expected to back (shift left), approaching the shift on a starboard tack allows sailors to tack into the shift and sail on the lifted port tack as long as the geographic shift is present. Geographic shifts can be anticipated by sailing around the local area and becoming familiar with how local features affect wind direction.

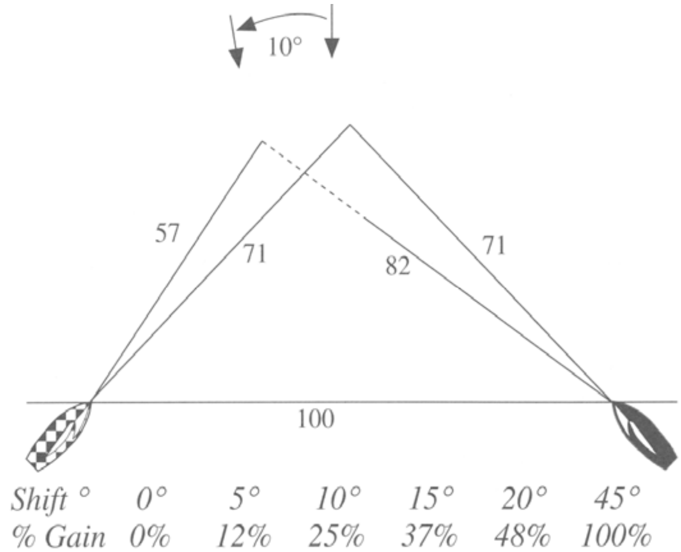


Figure 71 Wind Shift Impact

Note. From *North U: Performance racing tactics* (p. 87), by Gladestone, B., 2007, Madison, CT: North U.

REACTING TO WIND SHIFTS WHILE SAILING DOWNWIND

Reacting to wind shifts while sailing downwind is similar to sailing upwind, however because the sailboats are sailing away from the wind, wind shifts occur less frequently and are more difficult to detect. When sailing downwind it is important for the helm to look over the windward hip of the sailboat to identify gusts, lulls and shifts as they approach from behind.

Unless in drifting conditions, sailing on a run is very slow so sailboats tend to gybe back and forth from broad reach to broad reach (or lee to lee in cat rigged sailboats). By sailing on angles downwind sailors must also sail the favoured tack as much as possible to maximize distance gained on the leeward mark. This is accomplished by sailing on a favoured (headed) tack. As a rule of thumb, if starboard is the favoured tack upwind, port tack will be the favoured tack while sailing downwind.

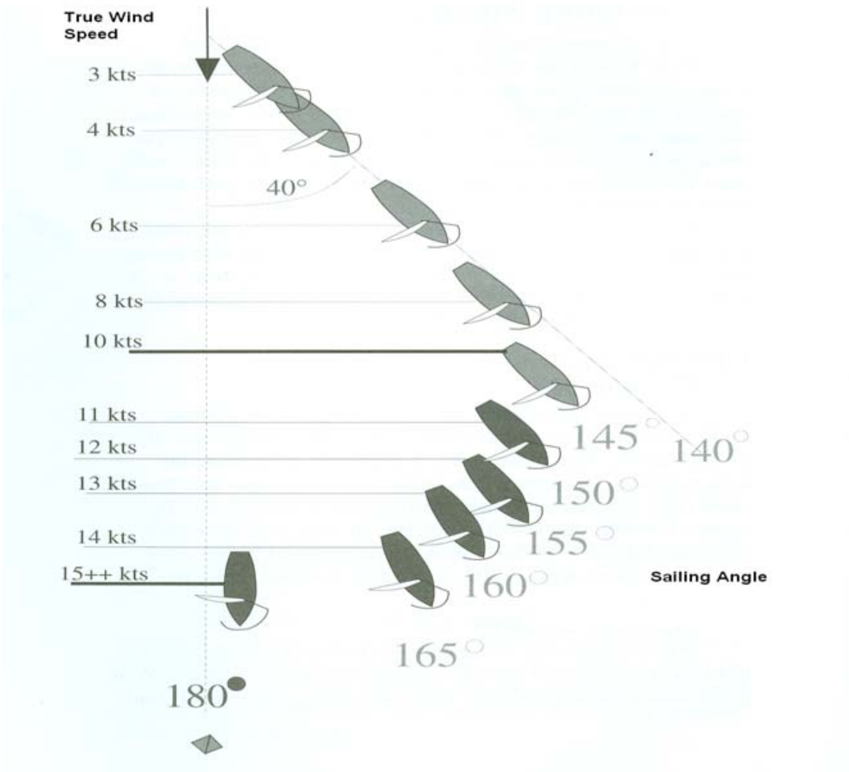


Figure 72 Downwind Sailing Angle

Note. From *North U: Performance racing tactics* (p. 135), by Gladestone, B., 2007, Madison, CT: North U.

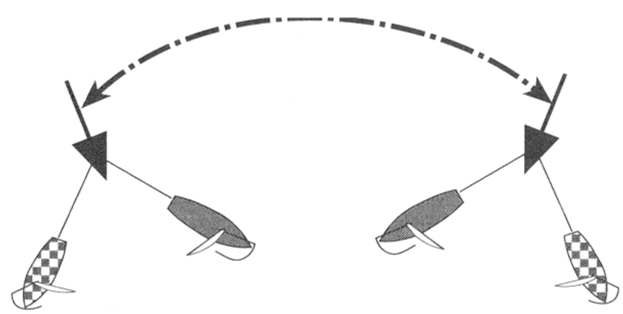


Figure 73 Oscillating Shifts

Note. From *North U: Performance racing tactics* (p. 138), by Gladestone, B., 2007, Madison, CT: North U.

TIDE AND CURRENT (CAN*SAIL* 4)

TIDE AND CURRENT TERMINOLOGY

Tidal range. The difference between low tide and high tide.

Tidal current. The horizontal movement of water due to the difference in the height of water caused by the tide.

Height of tide. The vertical distance between the surface of the sea and chart datum. The total depth of water is found by adding the height of tide to the charted depth. In the case of some ports which are not navigable at low water and where vessels rest on keel blocks or mattresses during low tide, the heights of the tide are measured from keel blocks or mattresses.

Flood current. A tidal current that generally flows toward the shore, or in the direction of the tide progression. Also called flood, flood current or ingoing stream.

Ebb current. A tidal current that generally flows seaward, or in the opposite direction to the tide progression. Also called ebb, ebb current or outgoing stream.

Eddy. The swirling of a fluid and the reverse current created when the fluid flows past an obstacle. The moving fluid creates a space devoid of downstream-flowing fluid on the downstream side of the object.

STRENGTH AND DIRECTION

The strength and direction of tides and currents are influenced by a variety of factors such as the moon, air and water temperatures, water depth, wind velocity and weather patterns. Understanding how these factors influence current can assist in predicting current strength and direction.

Current

In rivers and lakes, currents are produced by the downhill flow of water toward the sea, tides, and prevailing wind. The appearance of the water's surface can provide important clues about the direction and strength of currents. In areas where wind and current are moving together, the waves tend to flatten out and look smooth but where wind and current are opposed, the water becomes choppy with short, steep waves. In general, maximum current speed is reached three hours before and after high tide. Slack water or no current occurs at high and low tide before the current direction changes.

The frictional drag of wind moving over water will cause the water to move creating waves and subsequently current. In an open sea a 10 knot breeze will result in the development of a 1 knot current below the waves over the course of a 10 hour period. At first this current will flow directly downwind, but will gradually shift to the right in the North Hemisphere. In enclosed waters, a sustained wind will cause the water to "build up" at the leeward end, resulting in the development of a back flow current if the wind suddenly drops. This back flow current may develop as a surface current or deep current based on the contour of the sea bottom and water temperature.

SHORELINE EFFECTS

The shape of the shoreline and water depth can have a significant impact on current direction and speed. As a general rule of thumb, current can be expected to be slow in shallow areas, fast in deep areas and fastest when funnelling through narrow areas such as channels or between the shoreline and an island. Currents can be expected to eddy in areas such as obstacles, bays, inlets and downstream of islands.

> Local currents can be observed at the surface by looking at the water flowing around stationary objects such as channel markers, moored buoys and dock pillars.

REACTING TO CURRENT WHILE SAILING

The most difficult part about sailing in current is identifying where, when and how strong it will flow. This is typically done prior to going sailing by studying tidal information, gathering local knowledge and through personal observation.

2008-06-23 (Monday)			← search date
Time	Height		
ADT	(m)	(ft)	← ADT - our time zone m - metres, ft - feet
04:26	**13.6**	44.6	← 4:26 am HIGH TIDE measuring: 13.6 m, 44.6 ft
10:51	**1.9**	6.2	← 10:51 am LOW TIDE
16:50	**13.2**	43.3	← 4:50 pm 2nd HIGH TIDE measuring: 13.2 m, 43.3 ft
23:07	**2.3**	7.5	← 11:07 pm - 2nd LOW TIDE

Figure 74 Tide Table

Note. From Official Website of the Bay of Fundy, *Tides*. Retrieved July 12, 2011, from http://www.bayoffundytourism.com/tides/chart/

By knowing what direction the current is flowing and where the flow is fastest, sailors can reduce losses when sailing against the current (by avoiding it), and maximize gains when sailing with the current (by sailing into it).

COACHES CORNER—STRATEGY (CAN*SAIL* 4)

Developing a strategy and reacting to changes in conditions is a complex decision making process involving any number of factors. As sailors become more aware of wind direction, wind speed, shifts and current in the local area; incorporate environmental factors into informal discussions with sailors and discuss how these factors affect upwind and downwind strategies.

At first, a sailor's strategy will primarily be reactive to changes in the conditions. However with practice, decisions on where to sail will become more deliberate (proactive), resulting in increased gains and better performance sailing around the course.

Tactics and strategy will progressively be elaborated on during future CAN*Sail* training.

STRATEGY—GRADIENT AND THERMAL WIIND (CAN*SAIL* 5)

GRADIENT WIND AND FRICTIONAL DRAG

Air moves around the world in response to heating by the sun and the rotation of the Earth. Air moves primarily because the sun heats the earth unevenly in a complex pattern determined by the day-night cycle, latitude, and cloud cover. As well, there are different heat absorbing qualities for bare rock, forested land, water, open fields, city pavement, and so forth. Heat from the sun causes variation in the pressure of the air which tends to flow from areas of high pressure toward regions where the pressure is lower. However, because of Earth's rotation, it flows in spirals inwards. Viewed from overhead, the wind spirals counter-clockwise around a northern hemisphere low pressure system. This means that the wind direction can vary depending on whether the low pressure system is approaching or departing and whether it is passing to the north or the south. It also means that the wind direction will change considerably as a low pressure system travels through the area. In addition, warm, less dense air rises while cold, more dense air sinks. Both vertical and horizontal air movements can create winds suitable for sailing.

Due to the rotation of the Earth and friction, wind will flow around the outside of the high or low pressure areas. Wind strengths are directly related to the difference between high and low air pressure areas; the larger the difference (gradient), the stronger the winds.

- **Low pressure area.** A low or an L (shown on weather maps) is a region of air where the pressure is lowest in relation to the surrounding area. Lows are associated with stronger winds and rising air. This rising air expands and cools and cannot hold as much water as lower warmer air, resulting in condensation and cloud formation.

In most cases, low pressure systems are created by the collision of warm and cool air masses moving in different directions. Their interaction gives rise, not only to a spiral wind pattern, but to fronts where the warm moist air and cool dry air masses meet.

> A low pressure system will always be followed by a high pressure system and vice versa.

- **High pressure area.** A high or an H (shown on weather maps) is a region where the air pressure is highest in relation to the surrounding area.

- An area of high pressure is a section of air that is sinking. As the air sinks, it warms, allowing it to hold more water. Highs are often associated with fair weather. However, a high pressure area does not necessarily mean warmer weather and can bring cold, fog or frost.

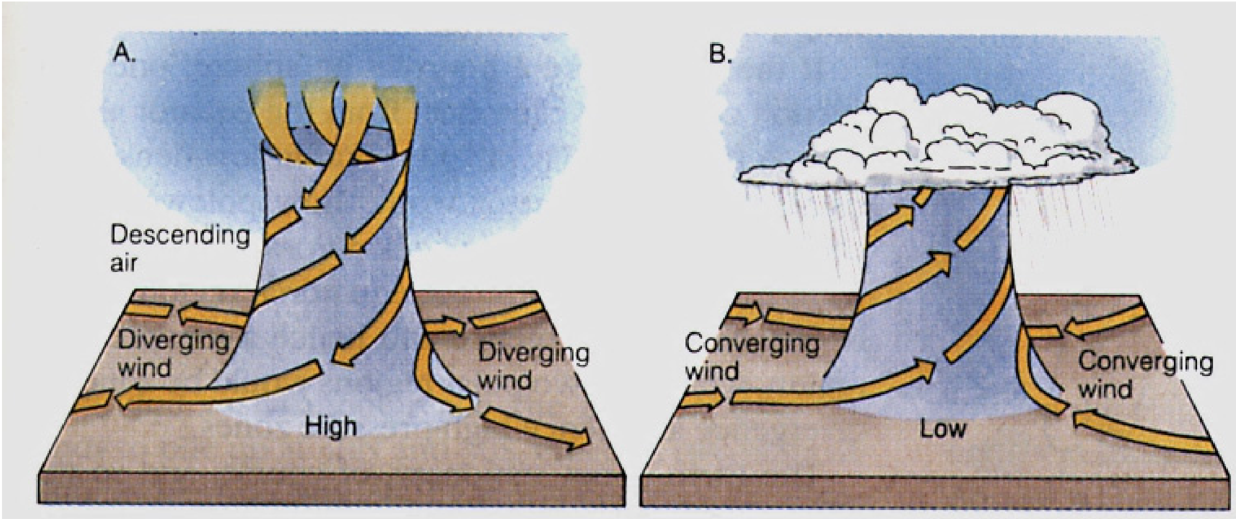


Figure 75 Air Pressure

Note. From "Atmospheric Circulation", by The University of Florida, *Earth Sciences Sector*, Copyright 2000 by Dr. David Hodell and Ray G. Thomas. Retrieved November 19, 2007, from http://ess.geology.ufl.edu/ess/Notes/AtmosphericCirculation/convdiv.jpeg

Gradient Wind

Air circulating around high and low pressure areas will band together into layers of equal pressure, which are reflected in weather maps by Isobars. In each band of air or Isobar air travels parallel to the bar. This air is called Gradient Wind. In the Northern Hemisphere gradient wind flows clockwise in high pressure and counter-clockwise in low pressure; this is reversed in the Southern Hemisphere.

When plotting courses offshore, skilled sailors study weather maps and position their boats so that when they pass through a pressure system they will be on the side which will have them sailing downwind instead of tacking back and forth upwind.

➔	Detailed weather maps can be found at *Weather forecast.com*: http://www.weather-forecast.com/maps/Canada

Inshore and coastal sailors sail most often by thermal winds called Sea and Land Breezes, which are local breezes, caused by the daily heating and cooling of land and the thermal differences between land and water. Understanding how the two types of wind interact can help sailors predict the behavior of thermal breezes in relation to the velocity of the prevailing gradient wind.

Frictional Drag

Gradient Wind flowing at a height of 500 m or greater flows freely without influence from the surface below. Surface winds (below 500 m) interact with the contour and texture of the land and water below. Wave height, trees and topography all influence the direction of the wind; this is most important when in an area where the wind transitions from a rough area onto a smooth one (over land onto water) and vice versa. In the Northern Hemisphere, frictional drag causes the wind to back. Wind traveling over a relatively smooth surface, such as water, will be backed by 5–10 degrees, whereas wind traveling over a forested area can be backed by as much as 40 degrees.

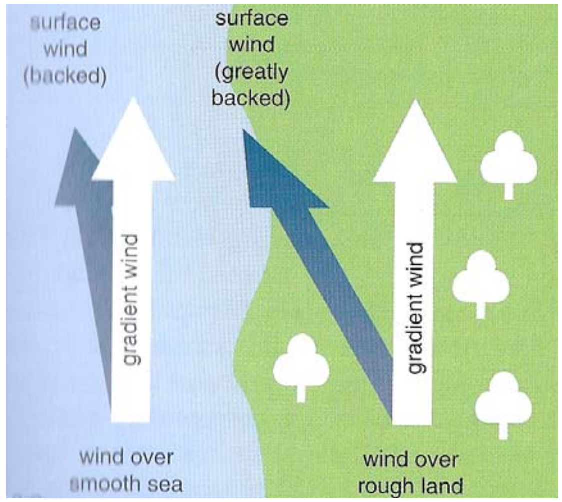


Figure 76 Frictional Drag

Note. From *Wind Strategy* (p. 11), by Houghton, D., & Campbell, 2005, West Sussex, UK: John Wiley & Sons Ltd. Copyright 2005 by David Houghton and Fiona Campbell

Frictional drag only applies to surfaces that wind can travel over without interruption. Objects that obstruct air flow such as a tall building or mountain create local shifts called Geographic Shifts.

THE CAUSES AND EFFECTS OF SEA BREEZE AND LAND BREEZE

Thermal winds are caused by the heating effect of the sun shining on land; this in turn warms the air near the surface of the ground. The warmed surface air rises; when it reaches about 1200 m above the earth it forms a small white billowy cloud called a cumulus cloud as it condenses and cools. Cooler air from nearby surface areas flow in to take its place. This is part of a convection or thermal cycle.

Sea Breeze

When there is a body of water nearby, cooler air from above the water surface will flow toward shore to replace the warm air that is rising inland. This is known as a sea breeze. Despite the name, sea breezes are common on fresh water lakes and sea coasts. On sunny days in late spring and summer, they are often as dependable as clockwork—starting at a particular time in the late morning and dying off in late afternoon.

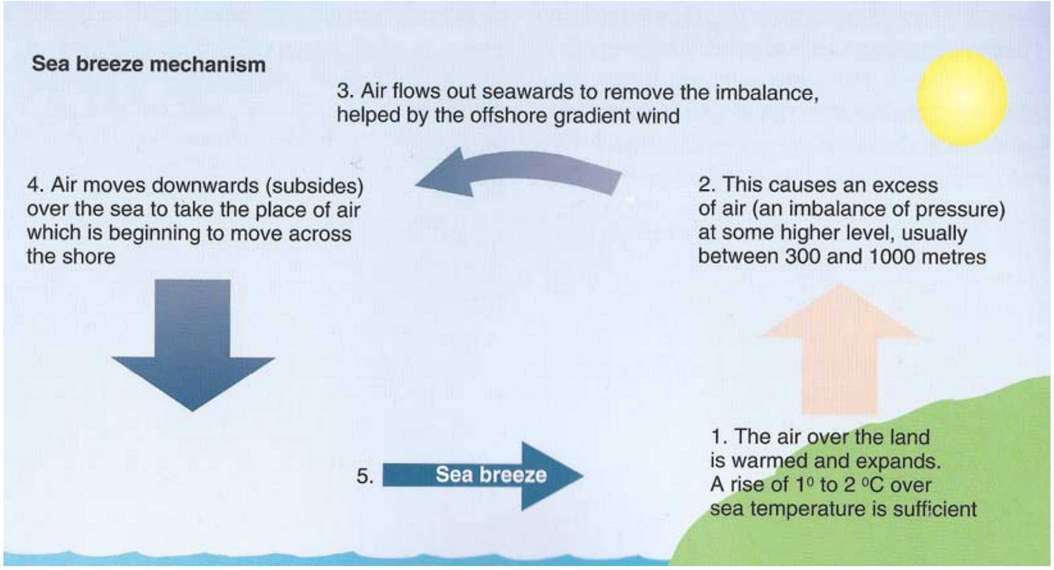


Figure 77 Sea Breeze

Note. From *Wind Strategy* (p. 27), by Houghton, D., & Campbell, 2005, West Sussex, UK: John Wiley & Sons Ltd. Copyright 2005 by David Houghton and Fiona Campbell

Although the presence of a sea breeze is very dependable during the spring and summer, the overall velocity of the sea breeze is determined by it's interaction with the gradient wind. The Sea Breeze is a low-lying layer of wind which does not extend high into the atmosphere and therefore the development of a sea breeze is actually helped by an offshore gradient wind because it helps cycle the warm rising air back out to sea faster. When the gradient breeze is an onshore wind (in the same direction as the sea breeze) warm rising air is held against the shore and often results in a lighter sea breeze.

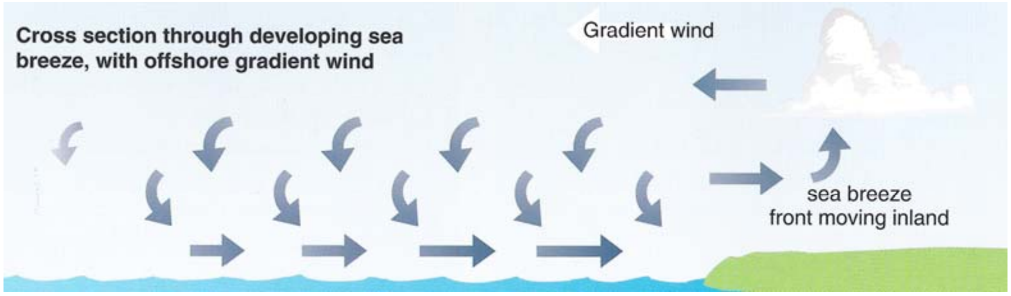


Figure 78 Sea Breeze with offshore Gradient Wind

Note. From *Wind Strategy* (p. 27), by Houghton, D., & Campbell, 2005, West Sussex, UK: John Wiley & Sons Ltd. Copyright 2005 by David Houghton and Fiona Campbell

Land Breeze

At night, the same process often happens in reverse, when the rapidly cooling land becomes colder than the water. This is called a land breeze, because the wind blows from the land. Land breezes interact in similar ways as a sea breeze with the development being aided by an onshore gradient wind and hindered by an offshore gradient wind.

When the gradient wind reaches a velocity of 25 knots or higher, it will impact the local thermal cycles and impede or prevent the development of sea and land breezes.

COACHES CORNER—GRADIENT AND THERMAL WIND (CAN*SAIL* 5)

Particularly during the summer, thermal cycles become predictable. When arriving at a sailing venue, experienced sailors immediately turn their attention to the water and sky to observe not only the immediate wind conditions, but also observable conditions to windward and leeward, as well as cloud formations overhead. With practice sailors learn to compare forecasted conditions to actual, and use local cues to anticipate the timing and strength of developing thermal wind or if gradient wind will be predominate for the day. Instructors should use forecasted and observed weather, to discuss rig settings and strategy with their sailors.

THE *RACING RULES OF SAILING*

The sport of sailing is governed by the *Racing Rules of Sailing*, which are governed and updated every three years by the International Sailing Federation (ISAF). Over the course of CAN*Sail* training, sailors are exposed to the rules from most of the major sections. The rules covered each CANSail Level are as follows:

- CANSail 3 include Parts 1, 2A and 2B.
- CANSail 4 include Parts 1, 2C and 2D.
- CANSail 5 & 6 involve applying the racing rules of sailing during sail training and in competition.

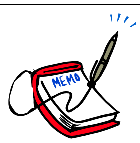
The *Racing Rules of Sailing* can be purchased in hard copy from *Sail Canada,* downloaded as application (app) on a Smartphone or Tablets or viewed as a Pdf. from the following link: http://www.sailing.org/documents/racing-rules.php

Note. Retrieved February 2013.

COACHES CORNER—THE *RACING RULES OF SAILING*

Understanding how to apply the *Racing Rules of Sailing* is an invaluable skill, which will be used by sailors throughout their training and racing careers. When sailors become confident with their sailing skills the *Racing Rules of Sailing* should be introduced to give them exposure to applying them while sailing around a course; introducing them too early can cause them to become a distraction.

While training, situations on the course will inevitably arise where rules are broken. Coaches should make note of these infractions and discuss them during debriefs so that the entire class can learn from the incident. As sailors become more familiar with the rules, the better they will become at applying them on the water.



Be sure to ask the sailor's permission before using them as an example during the debrief.

PREPARE A SAILBOAT FOR TRANSPORT

DERIGGING (CAN*SAIL* 3)

DE-RIGGING THE STANDING AND RUNNING RIGGING

The steps for de-rigging the standing and running rigging vary depending on the class of sailboat. The following steps will be tailored towards de-rigging a C420.

De-Rigging the Running Rigging

When de-rigging the running rigging, many sailors begin at the stern and work their way forward. Once the sailboat is completely disassembled, each component of the running rigging is lashed to the hull or mast or coiled and stored separately. Attention to detail and seamanship when lashing / coiling the running rigging prevents tangles and lost lines. This makes re-assembling the sailboat fast and easy. The lines should be stored neatly and taut, but not so taut that strain is placed on blocks and cleats. Making the lines too tight places unnecessary strain on rigging components resulting in loose rivets and stretched line.

Detaching the Boom

1. Detach the main halyard from the outhaul and place down the aft end of the boom.
2. De-rig the mainsheet.
3. Detach the boom vang.
4. Disassemble the gooseneck.

Once detached, the boom vang is secured to the mast and the mainsheet coiled and stored. The outhaul is secured to the boom by lashing it around the spar. To prevent damage while storing, some sailors also use a nylon cable tie to secure the boom block(s).

Detaching the Boom Vang

1. Remove the tailing line from the centreboard housing and pull it out of the block at the end of the boom vang purchase. Wrap the tailing line around the pain bar (traveller bar).

2. Once the boom vang is detached from the boom, attach the main halyard to the top of the boom vang and pull the main halyard taut and secure, removing all slack from the boom vang.

DE-STEPPING THE MAST

De-stepping the mast of a sloop rigged dinghy is usually a two-person operation due to the height and weight of the rig. De-stepping a mast is an important skill that is used at the end of each season, when performing maintenance and moving a sailboat to another location.

	Prior to de-stepping a mast, it is important to ensure that overhead power lines are not present. If power lines are present, move the sailboat to another location.

1. Ensure all components of the standing and running rigging have been de-rigged and are secured.

2. Remove rigging tape / electrical tape from the shroud adjusters (if required).

3. Grasp the mast and detach the shrouds and forestay. Remove clevis pins and split rings from the shroud adjusters and place on the hull.

4. Once ready to de-step the mast, one person uses the forestay to control the rate of descent; the other person holds onto the mast; walking backward hand over hand as the mast is lowered. Once the mast has been lowered approximately halfway, the person holding the forestay grasps the bottom of the mast, the mast is lifted out of the mast step and is lowered the rest of the way. Technique for this varies depending on the height and weight of the mast and the location of the mast step.

5. Place the mast on or beside the sailboat with the forestay on top. Avoid placing the mast directly on the ground; use blocks of scrap wood, plastic chairs or milk crates to elevate the mast.

6. Reattach the clevis pins and split rings to the shroud adjusters and secure the shroud adjusters to the shrouds.

7. Inspect the standing and running rigging and replace parts as required.

8. If required, remove rigging tape / electrical tape and detach spreaders.

9. Check for tangles in the shrouds, forestay and control lines and trapeze wires (if attached).

10. Secure standing and running rigging to the mast using nylon cable ties or rigging tape / electrical tape.

PEPARE THE HULL

When storing or preparing a dinghy sailboat for transport, it is important to remove as much of the standing and running rigging as possible.

When a dinghy sailboat is stored outside, there is always a risk that it will be vandalized or that parts will be stolen. A bare hull with all of the equipment removed does not present an appealing target to potential vandals or thieves and will likely be left alone.

When a dinghy sailboat is being transported there is a possibility that equipment left attached to the hull may flap in the wind and become damaged. Equipment left attached to hull may also come loose and be lost or may damage a following vehicle. Pull the slack out of the bridle and wrap it, the centreboard pennants and boom vang trailing line around the pain bar. Remove the buoyancy tank plugs and (if available) place a cover over the hull to protect it from damage while underway.

PREPARE EQUIPMENT FOR TRANSPORT

Inspect the sails for any damage, and ensure the sails and sail bags are clearly labelled with the club / CSTC name. The tiller extension should be secured to the tiller to prevent damage to the universal elbow and the rudder blade should be in a foil bag or wrapped in a blanket to protect the gel coat.

SECURE FOR TRANSPORT (CAN*SAIL* 3)

SECURE THE HULL

When preparing to transport a dinghy, it is necessary to ensure it is secured properly to the trailer. Securing the sailboat helps prevent damage to the fibreglass and hull fittings caused by shifting. Securing the sailboat also ensures the sailboat remains on the trailer; preventing damage, injury or death caused by the sailboat falling off of the trailer.

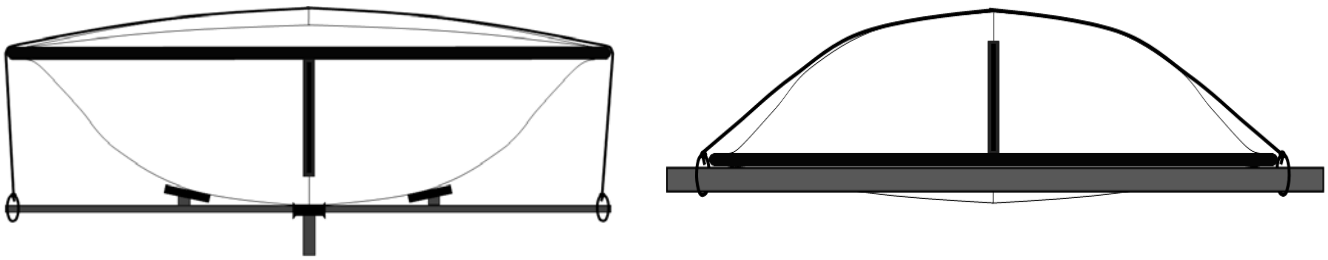


Figure 79   Dinghy Sailboats Loaded on Trailers

Ideally dinghies are secured to trailers using tie-down ratchet straps, however line can be used if ratchet straps are not available. If using ratchet straps, the gel coat must be protected from the metal bracket using a sponge, carpet or other type of padding.

The following are the steps to secure a dinghy sailboat to a trailer:

1. Ensure the sailboat is sitting firmly on the rollers / bunks. If the sailboat is laid upside down on the trailer, ensure the sailboat is not resting on any hull fittings or fragile sections of fibreglass.

2. Inspect the sailboat from bow to stern and ensure all applicable equipment has been removed from the hull.

3. Attach the standing ends of the tie-down straps to the trailer. The standing end of the tie-down strap should be attached as close to the gunwale of the sailboat as possible. This helps prevent the sailboat from slipping side to side while the trailer is in motion. A minimum of two tie-down straps should be used: one to secure the bow and one at the stern.

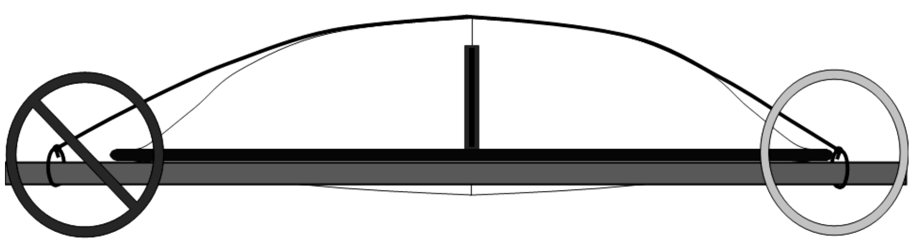


Figure 80   Tie-Down Strap Position

➔	The standing end of a tie-down strap should be secured to the driver's side of the trailer, placing the working end of the strap on the passenger's side. Sailboats sometimes shift while in transit, requiring the driver of the towing vehicle to pull over and tighten the tie-

down straps.

By attaching the working end of the tie-down straps on the passenger's side of the trailer, the driver is able to tighten the tie-down straps on the shoulder of the road and away from the flow of traffic.

4. Pass the tie-down straps over the hull and attach the working ends to the trailer. If using ratchet straps, protect the gel coat by placing a piece of carpet or other soft material between the hull and the ratchet.

5. Pull the straps tight so that the sailboat does not shift.

SECURE THE SPARS

The methods for securing the spars will vary depending on the type and design of the trailer. If towing a single boat trailer (and the boat is right-side-up), the mast is typically laid across the hull length wise, with padding used to protect the gel coat on the transom and deck. The mast is typically secured to the hull using lashing around the hull at the bow and stern areas in such a way that it cannot move from side-to-side or fore-and aft.

Most multi-boat trailers are designed to accommodate mast and boom storage. To prevent damage and tangles, padding should be used to separate the spars while stored on the rack. Spars should be lashed to the trailer in such a way that they cannot move from side-to-side or fore-and-aft.

COACHES CORNER—PREPARE A SAILBOAT FOR TRANSPORT (CAN*SAIL* 3)

Due to the complexity of this process, coaching staff will need to supervise this lesson very closely to ensure various components are secured properly. If possible, have a de-rigged and secured sailboat close by, which the sailors can use as a point of reference.

PREPARE FOR A REGATTA (CAN*SAIL* 4–6)

When preparing for a regatta there are four main elements, which must be addressed to ensure a positive and fun event.

- Body,
- Boat,
- Venue, and
- Mind.

Both body and boat maintenance are discussed in the physical literacy and seamanship sections. In accordance with the CAN*Sail Level 5* checklist, sailors must participate in a training camp or regatta at a new sailing venue. As it is assumed for CAN*Sail Level 4* that sailors will participate in a local regatta (at their normal sailing venue) this section will focus on preparing the mind for a regatta.

BODY

FITNESS REQUIREMENTS

Sheeting

Sheeting is a component of sailing that involves all crewmembers on board a dinghy sailboat. Sheeting engages a variety of arm and upper body muscles which include the forearms, biceps, triceps, shoulders, trapezius and upper back. Muscle movements range from rapid sheeting during maneuvering, quick bursts during pumping and extended periods of static tension while holding sheets on one point of sail.

Sheeting abilities can be increased by weight training of the applicable areas, combined with a pre-competition / sailing routine that loosens the joints and promotes muscle relaxation.

Hiking

Hiking is the most physically demanding component of dinghy sailing. Because dinghies do not have a weighted keel, essentially all of the righting force must be generated by crew weight. To increase the length of the righting arm, sailors hook their feet under straps located near the bottom of the boat and extend their weight outboard engaging the quadriceps, calves, hip flexors, abdominals and lower back muscles for extended periods of time; often followed by short rapid bursts of movement required for tacking, gybing and other boat handling maneuvers. Hiking is particularly demanding because of the nature of muscle contractions. When the body is fully extended from the hiking straps, the legs and core are engaged in static contractions or tension. When muscles are held in constant tension, blood vessels and flow are restricted in those areas resulting in muscle fatigue and pain.

The adage “No pain, no gain” cannot be ignored in the context of hiking and hiking fitness. Sports research in a variety of sailboat classes’ show that there is a direct link between hiking efficiency and overall competition performance. Sailors who are able to hike for the entire race tend to place better then those who cannot. Hiking performance / endurance can be increased by cardiovascular fitness and muscle strengthening of the legs and core. In order for the fitness training to be effective, static tension must be incorporated into the fitness plan so that the muscles can become accustomed to performing with semi-inhibited blood flow.

Trapeze (If Applicable)

Trapezing is more effective then hiking because it increases the length of the righting arm and is easier to maintain proper form for longer periods of time. Trapezing incorporates balance, static tension, short rapid bursts during maneuvering and spinnaker work and increased strength (sheeting) requirements because of the larger sails that generally come with trapeze rigged sailboats. Trapezing engages the quadriceps, calves, hip flexors and abdominals, lower back muscles, forearms, biceps, triceps, shoulders, trapezius and upper back while extending and coming in off of trapeze. Because of the large sail sizes, sheeting muscles must also be included as a physical requirement of trapeze.

Trapeze abilities can be increased by flexibility and stability exercises (to increase balance), weight training (to increase sheeting strength) the applicable areas, and interval training (to increase body efficiency during rapid body movements). These exercises should be combined with a pre-competition / sailing routine that loosens the joints and promotes muscle relaxation.

Refer to the following reference for additional information on off-season training:

C1-274 ISBN 0-906754-94-1 Beggs, A., Derbyshire, J., & Whitmore, J. (1993). *Mental and physical: Fitness for sailing*. West Sussex, UK: Ferhurst books.

ON-WATER PREPARATION

Racing can take place in cold, damp, windy conditions where postponements before and in-between races can cause the muscles to cool, however when a race starts, sailors expect their bodies to work at maximum efficiency. For this reason performing on-the-water warm-ups in between races will ensure the body is prepared to meet the demands of competition. The objective being to:

1. raise the body temperature, and
2. stretch the body parts used during the race.

Raise the Body Temperature

Traditional methods for raising body temperature while in the confined space of a dinghy sailboat therefore some non-traditional methods are required which will vary based on the layout and size of the sailboat. Some body raising activities include:

- Gentle punching, becoming vigorous to the quad and calf muscles.
- Calf raises; raise the heel off of the bottom of the boat and transferring weight onto the balls of the feet.
- Gentle bicycling movements while seated or lying on the back.
- Elbow and arm circling.
- Push-ups, using the transom for support.

Stretch The Body Parts Used During The Race

Stretching the muscles used during the race is one of the best ways to prevent sport-related injury. Special attention should be paid to arms and legs because these body parts can become very tight when cold and are susceptible to cramping during long upwind legs. Some important stretches include:

- lower back,
- quadriceps and hip flexor,
- hamstring,
- chest and biceps,
- bottom,

If the temperature is particularly cold, or if there has been a long period of time in between the ashore stretching session and the anticipated Warning Signal, take additional measures to raise body temperature before the Warning Signal. Most dinghy races begin with a demanding upwind leg so starting with warm muscles will help ensure the body is ready to work at maximums efficiency.

MIND

Just as important as preparing the body and boat for a regatta, mental fitness is also required.

Set Performance Goals

Every regatta is a learning experience and although sailors would love to win every event, there can only be one winner so they need to be realistic when setting performance goals. When setting performance goals, consider the following:

- How does my experience level compare to the rest of the fleet?
- What is my experience level at “this” particular venue?
- How much training time have I had to prepare for this event?
- What is the experience and skill level of my sailing partner?

Based on their answers, sailors can then make goals for themselves. If sailing partners have limited racing experience or are new to the sailboat type then aiming for a mid-fleet finish is probably appropriate. If sailing partners already have racing experience and have a lot of time in the boat together then aiming for the front of the fleet may be an appropriate goal.

In addition to overall performance goals, regattas should also be as a great way to improve overall sailing skills (process / immediate goals). Sailing partners should take the time before and after races to discuss what went well and areas where they can improve.

- Having a great upwind day? Perfect. Discuss what is going well so you can keep doing it in the future.

- Having issues with your leeward mark roundings? Talk about ways to improve (eg, route planning or gaining the inside lane) and make that a goal for the next time you go around the course.

Don't Dwell

Sailors, or any athlete for that matter can have the tendency to dwell on mistakes and poor finishes. If you have one bad race, take the time in-between races to evaluate where you went wrong and how to avoid making the same mistake in the future…then shake it off. No sense in blowing your entire regatta because of one OCS or capsize.

Stay Confident

Confidence in your training, preparation and overall sailing skills are the key. Confidence in what you know you can achieve and the unstinting belief that you can maintain that level of ability without faltering up to the end of the race. This is often achieved by a relaxed, but positive attitude towards your sailing. You need to be able to channel aggression where it is required (for instance at the start) and know when to throttle back (approaching the leeward mark). Maintain a calm, straight-thinking attitude when under pressure and control the concentration at the correct level.

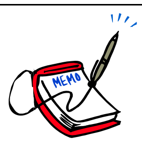
Have Fun

"Believe me, my young friend, there is NOTHING--absolute nothing--half so much worth doing as simply messing about in boats. Simply messing,"

-- The Wind in the Willows

BOAT

Boat maintenance and rigging are discussed in earlier sections of this technical package, however preparing a boat for a regatta at a different location is unique because of the self-reliance and independence required by sailors. Forgetting even small items such as buoyancy tank plugs can be expensive or even impossible to replace when sailing at a new venue.



Refer to the CANSail *5–6 Instructor Package* for information regarding packing lines, foils, sails, hull and gear for a training camp or regatta.

VENUE

When comfortable sailing at a venue it becomes second nature to account for local wind and current effects, however when sailing at a new venue sailors must adapt quickly to current, tide geographic and human-made wind effects, as well as the predominant wind conditions. To reduce the severity of the learning curves, sailors often perform venue research well in advance of a regatta. Venue research allows coaching staff and sailors to adapt training to be venue specific, and provides a list of local wind and current effects to investigate once at the venue itself.

Figure 81 Satellite Image of Halifax Harbour

Note. From *Google Earth 6.1.0.5001.* Port of Halifax 44°37'47.85"N, 63°30'32.85"W, elevation 35m. Retrieved March 26, 2013.

Figure 82 Considerations to Check Upon Arrival

Note. From *Google Earth 6.1.0.5001.* Port of Halifax 44°37'47.85"N, 63°30'32.85"W, elevation 25m. Retrieved March 26, 2013.

When slipping at a new venue it is important to have a checklist of places in the sailing area of interest. In doing so, sailors can be focused on quickly assessing the geographic effects on wind and current and incorporate these factors into overall race strategy.

> A number of websites can be used to find historical wind data taken from weather stations and buoys around Canada. *Windfinder* has information available for many popular sailing venues and has a downloadable app for mobile phones and tablets.
>
> http://www.windfinder.com/windstats/windstatistic_mcnabs_island.htm

Facilities / Logistics

Another consideration upon arrival at a new sailing venue may seem obvious but it is an important aspect to race preparation: that factor is facilities / logistics.

- **How long will I have for meals and where will I be eating?** This will have a huge impact on how much time sailors have to rig.
- **What stores are in the local area?** Knowing where to pick up small things like water, snacks or even electrical tape can save precious minutes while prepping.
- **Where will I be launching?** Slipways or launching areas can have a huge impact on how long it takes to get boats in the water. If launching space is limited, then sailors should be sure to be among the first in line or they can find themselves losing precious sailing time waiting for the boats in front of them.
- **Where can I store my gear?** Dollies, lifejackets, lunches and music players have a habit of going missing during regattas. This is seldom done on purpose but a distracted sailor has been known to pick up the wrong rigging bag by mistake. Sailors and coaches should plan on where they are going to store their gear while on the water.

Anything else? Knowing where the official notice board is, where to find protest forms, where to sign out PFDs, harnesses, request spare parts or even where to find a hose to clean off salt water are all things that take time to figure out. It is important for sailors and coaches to walk around and familiarize themselves with the facilities.

COACHES CORNER—PREPARE FOR A REGATTA (CAN*SAIL* 4–6)

As coaches with racing experience, it can be difficult for some to stay focused on the end goal of participating in locally held fun regattas. As with all CAN*Sail* training the end goal is to have sailors participate in a local regatta as a way to experience competition in the sport in a fun and supportive environment.

While sailors participate in the event, have the sailors focus less on the results and more on the accomplishments they achieve while sailing, for example a clean start, strategically strong upwind or good downwind boat speed.

First time regatta coach? Label EVERYTHING!

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GLOSSARY

Angle of Attack. The angle of the sail relative to the apparent wind direction.

Apparent wind. The wind speed and direction felt on board a moving sailboat.

Automatic bailer. A device in the bottom of the cockpit that allows water to drain out when the sailboat is moving forward.

Backing. Wind direction shifts in a counter-clockwise direction.

Batten. Stiff wood or plastic strip used to support the trailing edge of a sail.

Batten pocket. Slots sewn in the leech where battens are inserted to maintain the proper shape of the mainsail.

Beam reach. Sailing a course approximately 90 degrees to the wind.

Broad reach. Sailing with the wind coming over one corner of the stern.

Boat wind. The bow-to-stern air flow caused by a sailboat's forward progress.

Bolt rope. Rope sewn along the luff and the foot of a mainsail which slips into a groove in the spars.

Boom vang. Tackle leading downward from the boom which controls the mainsail shape by adjusting the tension on the trailing edge. Boom vang tension will also prevent the boom from slipping off the gooseneck.

Boom. Horizontal spar at the bottom of the mainsail.

Bow. Front of the sailboat.

Bowline. Makes a non-slip loop in the end of a line. Used to tie the painter to a bow ring, for attaching sheets and halyards to sails, and for many other purposes.

Camber. The depth between the chord and the bend in the airfoil (draft).

Centreboard. A blade of wood, fibreglass or metal fixed to the sailboat that pivots through a slot in the bottom of the sailboat to prevent sideslipping while sailing. It is similar in function to a daggerboard.

Centre of effort (CE). The effective application point for all sail forces acting together as a single unified force.

Centre of lateral resistance (CLR). A position where the combination of the side forces produced by the centreboard / daggerboard, rudder, and wetted hull area act as a single force.

Chainplate. Anchorage point on the hull for a shroud or stay.

Chord. The imaginary straight line joining the trailing edge and the center of curvature of the leading edge of the cross-section of an airfoil.

Cirrus. High, thin, wispy clouds blown by high winds into long streamers. Cirrus clouds usually move across the sky from west to east. They generally indicate pleasant weather.

Cleats. Fittings that grip and hold lines.

Clew. Lower, aft corner of a sail.

Close hauled. Sailing as close to the wind as possible with sails filling to approach an upwind destination.

Close reach. Sailing on a point of sail above a beam reach (90 degrees to the wind), but lower than the close hauled position.

Component forces. Geometric representation of the individual components which make up the resultant. Component forces are aligned at right angles to each other starting from the tail of the resultant force.

Cringle. Reinforced ring on the corners of a sail to which a line is attached.

Cumulonimbus. These clouds are very dark at the bottom. They extend into the atmosphere and have flattened tops. When cumulonimbus clouds are in the sky, one can predict thunderstorms and windy, rainy conditions.

Cumulus. These clouds are large, individual puffy clouds. They resemble cauliflower or cotton balls; the bottoms often appear dark and flat. They can often be seen on a warm day. When these clouds are in the sky one can expect fair weather, unless they begin to extend upwards.

Daggerboard. A blade of wood, fibreglass or metal that extends and retracts vertically through a slot in the bottom of the sailboat to prevent sideslipping while sailing. It is similar in function to a centreboard.

Diamonds. A rigging arrangement used to support the lower mast on some sailboats. The diamond wires lead from the mast base, over short struts and back to the mast near the top of the forestay.

Double Gybe (Rodeo Gybe). Combines two gybe together into one fluid manoeuvre

Double Tack. Combines two tacks together into one fluid manoeuvre.

Draft. The curvature or camber of a sail.

Drawing. When a sail is full and generating power.

Ebb current. A tidal current that generally flows seaward, or in the opposite direction to the tide progression. Also called ebb, ebb current or outgoing stream.

Eddy. The swirling of a fluid and the reverse current created when the fluid flows past an obstacle. The moving fluid creates a space devoid of downstream-flowing fluid on the downstream side of the object.

Fairlead. Ring or U-shaped fitting which guides a control line and helps prevent tangles.

Figure eight. Used as a 'stopper knot' to prevent a line from slipping through a block or fairlead.

Figure eight through a bight (racing knot). A bight passed through a grommet or cringle, which is secured in place by the standing end of the line with a figure eight knot. A low profile knot which is ideal for securing halyards.

Flood current. A tidal current that generally flows toward the shore, or in the direction of the tide progression. Also called flood, flood current or ingoing stream.

Fog. A thick cloud of water near the Earth's surface. Fog reduces visibility making it difficult to navigate.

Foil. A structure with curved surfaces, (eg, an airplane wing) designed to give lift.

Foot. Lower edge of a sail.

Goal. A goal is an aim an individual or group works toward; an object of ambition / effort.

Geographic hazards. Naturally occurring obstructions that pose a safety concern to a vessel.

Geographic Shift. A shift in direction or speed caused by land or an object.

Gooseneck. Attachment used to connect the boom to the mast.

Gust (synonym—puff). An abrupt increase in wind speed, which appears on the water's surface as dark, rippled patches.

Hanks. Metal or plastic fitting used to secure the jib sail to the forestay.

Head. Upper corner of a sail.

Head batten / power batten. A stiff wood or plastic strip used to support the upper section of a sail.

Header. Forces the sailboat to bear off or trim sails. Typically comes down from the front of the bow, windward jib telltales (ticklers) begin to wave erratically.

Heat-related illness. The condition of having an abnormally high body temperature. This is caused by prolonged exposure to extreme heat or heavy exertions in a hot environment, both of which can occur when sailing.

Heel. The leaning sideways caused by pressure in the sails, or placement of crew weight.

Heeling Arm. The heeling lever created by the relationship between the centre of effort and centre of lateral resistance.

Heeling Force. The magnitude of heeling power generated by the sails.

Height of tide. The vertical distance between the surface of the sea and chart datum. The total depth of water is found by adding the height of tide to the charted depth. In the case of some ports which are not navigable at low water and where vessels rest on keel blocks or mattresses during low tide, the heights of the tide are measured from keel blocks or mattresses.

Hiking strap. Foot straps which enable the skipper and crew to lean back further without falling overboard.

Hounds. Attachment area on the mast for the shrouds and forestay.

Hull. Main shell or body of the sailboat.

Hypothermia. The condition of having an abnormally low body temperature. This is caused by exposure to cold air temperature or cold water, both of which can occur when sailing.

Irons. The bow of the sailboat is pointed directly in the wind and temporarily unable to turn onto either tack.

Jib halyard. Control line used to hoist the jib sail and hold it up.

Jib sail. Small sail set ahead of the mast.

Jib sheet. Line used to control the jib sail. The jib sheet can be pulled in or eased out to trim the jib sail.

Leech. Aft edge of a sail extending from the head to the clew.

Leech Profile. The shape of the leech.

Lee helm. The tendency for a sailboat to want to bear off.

Leeway. Side slipping motion of a sailboat.

Link Plate. A perforated metal plate or short length of channel that is used to attach the lower end of a shroud or stay to the chainplates mounted on the hull.

Lift. Allows the sailboat to head up or ease sails. Typically comes down from the windward side of the bow, leeward jib telltales (ticklers) begin to wave erratically.

Line squalls. A sudden and short-lived gust of wind. Line squalls can be identified by a fast approaching line of dark water.

Luff. Forward edge of a sail extending from the head to the tack.

Luff. To cause a sail to flutter by heading up or easing the sheet.

Luff up. To head up, causing the sails to flutter.

Lull (synonym—hole). An abrupt decrease in wind speed, which appears on the water's surface as a smooth or glassy area.

Main halyard. Control line used to hoist the mainsail and hold it up.

Mainsail. Large sail set behind the mast.

Mainsheet. Line used to control the mainsail. The mainsheet can be pulled in or eased out to trim the mainsail.

Mast. Vertical spar that holds up the sails.

Mast rake. The fore and aft position of the top of the mast in reference to the vertical. If a mast is exactly vertical, the mast has no rake, if the mast tip is aft of vertical the mast has aft rake.

Navigational hazards. Man-made obstructions that pose a safety concern to a vessel.

Neutral helm. The tendency for a sailboat to want to go straight.

Oscillating Shift. The wind slowly shifts back and forth around an average wind direction. These types of shifts usually last from 1–10 minutes.

Outhaul. Control line that attaches the clew of the mainsail to the boom and tensions the bottom of the mainsail.

Persistent Shift. The wind moves in one direction either very quickly (eg, the passage of a front) or progressively (eg, a sea breeze gradually trending to the right over the course of the afternoon).

Port tack. Sailing with the boom on the starboard side.

Point of maximum draft. The deepest part of the draft in a sail.

Reef knot. Used to join two lines of the same diameter and type (eg, manila, polypropylene, etc.)

Rudder. Hinged blade mounted to the outside, flat section of the stern, used for steering.

Righting Arm. The righting lever created by the relationship between the centre of effort and centre of righting mass.

Righting Force. The magnitude of righting power generated by the centre of righting mass.

Rounding up. The uncontrolled turn into the wind that occurs if the rudder stalls.

Running free. Sailing directly away from the wind.

Sailing by the lee. Sailing on a point of sail above a run with the wind on the same side as the boom.

Skull. To pump the rudder as a way to turn the sailboat when it is not making way.

Slot. The tapered or funnel-like opening between the jib leech and mainsail luff. The slot causes air to deflect into the opening and compress between the jib leech and mainsail luff. This compression results in an acceleration of air velocity on the leeward side of the mainsail creating an increase of sail power.

Spreader. Short struts projecting from the sides of a mast that are used to increase the shroud angles or add support to the middle of the rig.

Stall. Disturbed airflow at the back of the sail, which results in the leech tell tale (leech fly) hooking around the leeward side of the sail. A stalled sail is generally caused by over-sheeting, too much draft or excessive leech tension.

Starboard tack. Sailing with the boom on the port side.

Stern. Back of the sailboat.

Stratus. These clouds appear as low, dull, grey sheets that completely cover the sky (resembling fog). During the day, the sun cannot be seen. They can produce drizzle or very light rain or snow. When deep clouds are above, then rain or snow can be heavier.

Tack. Lower, forward corner of a sail.

Tack. The side of the sailboat opposite the boom.

Tangs. Short metal strip with a hole at each end used to link the upper end fitting of a shroud or stay to the mast.

Tidal current. The horizontal movement of water due to the difference in the height of water caused by the tide.

Tidal range. The difference between low tide and high tide.

Thwart. Supports the top of the centreboard housing and provides a seat.

Tiller extension. Handle attached to the end of the tiller which allows the helm to sit further ahead and outboard to help stabilize the sailboat.

Tiller. Handle attached to the top of the rudder which is used to steer the sailboat.

Transom. Flat portion of the hull that spans the stern of the sailboat.

Traveller. A track or rope bridle used to control the side-to-side position of where the mainsheet or other control attaches to the hull.

True wind. The wind speed and direction felt by a motionless observer.

Veering. Wind direction shifts in a clockwise direction.

Velocity header. A shift forward in the apparent wind angle. Velocity headers are usually caused by sailing into a lull or by surfing down the face of a wave.

Velocity lift. A shift aft in the apparent wind angle. Velocity lifters are generally caused by sailing into a gust or by sailing up the face of a wave.

Weather hazard. A meteorological event which poses a safety concern to a vessel.

Weather helm. The tendency for a sailboat to want to head up.

SAILING GOALS

Name:________________________________ **Time Period:**___________________________

Recently achieved goals:

1.____

2.____

3.____

4.____

Sample:

Goals	Comments
Long Term Goal Improve upwind performance.	Duration: (eg, Before the end of season regatta).
Supporting Short term goal Properly maintain upwind boat trim.	Measure for success: (eg, Achieving proper upwind boat trim in all conditions without assistance from coaching staff).

Goals	Comments
Long Term Goal	
Supporting short term goal	
Supporting short term goal	
Supporting short term goal	
Long Term Goal	
Supporting short term goal	
Supporting short term goal	
Supporting short term goal	

Next review date:_______________________________

SAILING LOG

Date:		**Wind Speed:**	
Location:		**Water Conditions:**	
Mast Rake:		**Rig / Jib Halyard Tension:**	
Main Halyard Tension:			

	Upwind	Downwind	Reaching	Comments
Cunningham				
Outhaul				
Boom Vang				
Bridle Height				
Jib fairleads / windward sheeting				
Foil Height				
General Comments:				

Date:		**Wind Speed:**	
Location:		**Water Conditions:**	
Mast Rake:		**Rig / Jib Halyard Tension:**	
Main Halyard Tension:			

	Upwind	Downwind	Reaching	Comments
Cunningham				
Outhaul				
Boom Vang				
Bridle Height				
Jib fairleads / windward sheeting				
Foil Height				
General Comments:				