COMPENDIO DI IDRODINAMICA APPLICATA

A surfboard is a device used by man to ride waves.

If you surf however, you know that a surfboard is more than it's physical description. Even if you don't surf you probably have an idea that a surfboard is a very special piece of equipment for a surfer.

"What is a surfboard ?" Surfers questioned included surfer / shapers, professional surfers, casual, recreational, and extreme surfers. Here are some of their replies:

"A surfboard is a tool connecting man and nature used by man to ride waves - a connection between man and nature."

"A surfboard is a device for homo sapiens to ride waves."

"A surfboard is anything you want it to be, even your belly. It's something you ride waves with. It could be an inflatable matt, your torso, a boat, a piece of wood, or a piece of foam."

"A surfboard is a craft - a tool - for accessing pure energy."

"A surfboard is a tool to have fun with. The more fun oriented the surfboard, the more the surfer wants to use it. A tool to happiness."

"A surfboard is a magic carpet. It's a device that taps a pure source of energy and yields a magic moment."

"A surfboard is not only something you ride waves with, it is a portal to a place of fun and solitude."

"A surfboard is a beautiful and marvelous synthesis of ideas and curves that links man with nature."

This simple question can have a wide range of answers. A surfboard is something unique yet similar to surfers both in a physical and metaphysical sense. Neither aspect of a surfboard can be ignored in the design process. A well designed surfboard should provide a transcendental and technical experience to the surfer. A well designed surfboard must be functionally relevant to the surfer and the surfing environment to achieve this goal.

GLOSSARY

Surfboard A device (structural sandwich) used by man to ride waves.

Surfboard Design Arranging or modifying the performance and durability of a surfboard to be functional and relevant to surfers and the waves they ride.

Structural Sandwich An arrangement of materials with a thick, lightweight, low density "core" and a thin, high strength "skin" or facing.

Foam Sandwich Surfboard A functionally relevant shaped blank of polyurethane foam, EPS, or extruded styrofoam "core" with an equally relevant fiberglass reinforced plastic wrapped "skin."

Variables The elements of design describing the components of a surfboard.

Template The outline of the surfboard.

Rocker Dimensional lines along the bottom, top, and rail of the surfboard usually referenced from nose to tail.

Bottom Rocker Dimensional curve following a line along the bottom of a surfboard.

Deck Rocker Dimensional curve following a line along the top of a surfboard. (The area defined by plotting bottom and deck rocker defines the foil or thickness flow of a surfboard from nose to tail.)

Rail Rocker Dimensional curve along the rail of a surfboard. This line follows the outline and the bottom of a surfboard's rail(s). The relationship between a surfboard's bottom rocker and rail rocker helps define the bottom contours of a surboard.

Bottom Contours The nose to tail and rail to rail configuration of the bottom of a surfboard. Bottom contours may be flat, convex, concave, or a combination of these.

Deck Contours The nose to tail and rail to rail configuration of the deck of a surfboard. Deck contours vary from flat to crowned.

Rails Transition area between the bottom and deck of a surfboard.

Rail Profiles Section shape of the rail. Rail profiles vary in configuration and dimension. Configurations includes round, boxy or square, and crowned profiles. Dimensions vary from relatively thin, to medium, to thick and apply to all configurations.

Foil Distribution of volume throughout a surfboard.

Foil (primary) Thickness flow or distribution of volume along the center of a surfboard from nose to tail.

Deck Foil Thickness flow or distribution of volume from side to side or rail to rail of a surfboard. The deck foil also varies from nose to tail.

Rail Foil Thickness flow or distribution of volume along the rail of a surfboard from nose to tail.

Blank Core of the sufboard. From ancient to contemporary surfboards cores have been solid wood, hollow (chambered), hollow (transverse braced), EPS foam, extruded styrofoam, and polyurethane foam.

Stringer Wood, foam, plastic, or reinforced plastic element glued into the center of a blank on a vertical axis. Stringers provide a crucial "I-beam" element to the "core" of a "foam sandwich." They reinforce the ultimate strength of a surfboard by holding the top and bottom "skins" of the "foam sandwich" apart.

Fiberglass Fabrics of various weave, finish, and weight used as the reinforcement in a plastic matrix. When combined with a resin system the resulting composite forms the "skin" of a "foam sandwich" surfboard.

Resin A material, generally a polymer, that has an indefinite and often high molecular weight. Resins are used as the matrix that binds together the reinforcement materials in composites.

Glassing Schedule The arrangement of fabrics and resins included in the "skin" of a "foam sandwich" surfboard.

Curing - Pot Life Time length of time a catalyzed thermosetting resin system retains a viscosity low enough for it to be suitable for processing.

Curing - Post Cure Exposure of cured resin to higher temperatures to improve the mechanical properties of the resin system in the "skin" of a "foam sandwich."

Mechanical Properties The properties of the "core" and "skin" materials that contribute to the ultimate strength and durability of a surfboard. These include bond, compression, flexural, impact, shear, tensile, and thermal strengths. These properties increase and decrease exponentially as a product of the surfboard's design.

Ultimate Strength Measure of the ability of a surfboard to absorb energy. The maximum toughness and durability achieved by a surfboard's "design."

Fatigue The failure of a composite's or a materials's mechanical properties as the result of repeated "stress."

Strength to Weight Ratio The relative relationship between the weight of a surfboard and the ultimate strength of a surfboard. "Custom" surfboard construction allows for the functional and relevant application of foam density, stringer, and glassing schedule. Surfboards may vary from a 4 1/2 pound high performance shortboard to a 20 pound tow in gun, from a light weight performance longboard to a classic heavy weight reproduction of a 50's - 60's era longboard, or may be the moderate and sensible strength and weight of a recreational oriented shortboard, hybrid, or funboard

THE DESIGN PROCESS

Nature and the Design Process

The principles of surfboard design are a vast array of theories of surfers interacting with waves. It's a science, but it's not an exact science. There are few, if any, absolutes. There is no lab or test tank. The lab is nature. Surfer, surfboard, waves, and surfing are the variables.

Design begins in the metaphysical world and transitions into the physical world. It flows from imagination and desire, intuition and reasoning to trial and error, and testing and observation.

Surfing and the surfboard design process began with the imagination and desire of ancient Pacific islanders. The islanders saw waves and visualized themselves riding them. Their intuition and reasoning led them to craft surfboards from trees to glide on swells and breaking waves. Through trial and error - test and observation - they modified and developed their boards to be efficient for their approach to riding waves. Over the centuries this process has repeated itself and will continue to repeat itself as long as man rides waves and interacts with nature.

The surfboard design process begins with identifying the desires, needs, or goals of the end user and his environment (the smorgasbord of surfers and the waves they ride); identifying the variables (dimensions, rockers, bottom contours, deck contours, foils, templates, rails, fins, and more) in a specific technology (surfboard shaping and construction); hypothesizing arrangements of these variables (6' 2" x 18 1/2" x 2 3/8", squash single to double concave, soft crown deck, moderate foil, soft thin round rail) through intuition and reasoning; testing the results of these arrangements (surfing and observation); and bringing new hypothesis into the process based on these tests and any new ideas that may develop (surfers / shapers / designers experiences with existing surfboards, imagination, and observations of events and circumstances outside of surfing.)

Correct use of the design process yields a functional and relevant surfboard. A surfboard is functional and relevant when it is designed for and performs for the surfer and the conditions in which it will be surfed.

Surfer / shaper / designers depend on their imagination and desires; intuition and reasoning; trial and error; and testing and observation to advance surfboard design. They design and shape by arranging dimensions, rockers, bottom contours, deck contours, foils, templates, rails, and fins to best suit individual surfers (their size, skill, and technique) and the specific conditions (size, power, and shape) of the waves they ride.

THE EVOLUTION OF SURFBOARD DESIGN

Intuition and Reasoning in the Evolution of Surfboard Design

Intuition - immediate apprehension, understanding, perception, or knowledge.

Intuitive design - using the imagination or general understanding without the conscious use of reasoning to solve a problem.

Reasoning - drawing conclusions from known or assumed facts.

Inductive design - using particular facts or individual circumstances to reach a general conclusion.

Deductive design - using logic or reasoning to conclude from known facts, existing data, or general principles.

The surfboard design process begins with identifying the desires, needs, or goals of the end user and his environment (the smorgasbord of surfers and the waves they ride); identifying the variables (dimensions, rockers, bottom contours, deck contours, foils, templates, rails, fins, and more) in a specific technology (surfboard shaping and construction); hypothesizing arrangements of these variables (6' 2" x 18 1/2" x 2 3/8", squash single to double concave, soft crown deck, moderate foil, soft thin round rail) through intuition and reasoning; testing the results of these arrangements (surfing and observation); and bringing new hypothesis into the process based on these tests and any new ideas that may develop (surfers / shapers / designers experiences with existing surfboards, imagination, and observations of events and circumstances outside of surfing.)

Surfing and surfboard design began with the imagination and desire of ancient Pacific islanders. Historically surfing was documented in polynesia as long ago as 300 AD. Man sees waves and wants to ride them. Perhaps the ancient Pacific islanders experienced the pleasure of their boats, canoes, or water craft planning on ocean swells while making passage from one island or one location to another. They observe that a long relatively flat and narrow piece of wood glides on swells with a man on its deck as their boats or a canoes did in the open ocean. Craftsmen were assigned the task of selecting wood and with stone ax, granulated coral, and a rough polishing stone shaped the islanders ancient surfboards. Thus surfing, the surfboard, and the shaping process were invented.

The islanders **intuition** led them to understand they could ride waves individually on a device similar to their canoes. Their **reasoning** led them to conclude that a surfboard could be configured similar to their canoes, built from the same trees, with the same tools they used to build their canoes.

Surfing remained the undisturbed passion of the islanders for 1500 years before their interaction with Western Civilization. Fortunately, a couple of hundred years of Puritan Ethics could do no more than reduce the passion before it's renaissance in the early 20th century. Ironically, it was three haoles, Jack London, George Freeth, and Alexander Hume Ford who led the campaign to restore surfing to Hawaii's culture. While London was writing about surfing and Freeth was surfing in front of astonished crowds, Alexander Hume Ford was campaigning on behalf of surfing. Ford presented a "surfing manifesto" to the trustees of Queen Emma's Estate. In 1905 the native Hawaiians began the informal Hui Nalu (surf club), revitalizing native Hawaiian interest in the sport. In 1908 they founded the Hawaiian Outrigger Canoe Club, the first modern club dedicated to the perpetuation of wave-riding. By 1911 when the Hui Nalu was formalized there were as many as one hundred surfboards on the beach at Waikiki.

Although World War II curtailed surfing activity, it exposed tens of thousands of men to Hawaii, the Pacific Ocean, and the Sport of Kings. Surfer / shaper / designers of the post World War II era (1945 - 1955) pioneered and explored an unspoiled California coastline rich with clean point and reef breaks. Perfect trim was surfing's ultimate maneuver. Bob Simmons, Phil Edwards, Reynolds Yater, Skip Frye, and Mike Hynson's **intuition** led them to emulate sea birds trimming on the updraft of wind from the face of groomed ocean swells as they jacked up and broke along these clean points and reefs. Their **reasoning** led them to design surfboards that trimmed on the upward flow of water in the face of these waves.

The foam sandwich surfboard (polyeruthane foam cores and fiberglass reinforced plastic skins) introduced to surfing in the 1950's opened the flood gates to incremental and quantum steps in surfboard design. The cores or "blanks" were extremely easy to tool or "shape." Wrapping the blanks with glass and resin and attaching a fin(s) could be done in a matter of days. Trimming qualities of surfboards improved dramatically. Across the long walls of Malibu and Rincon and the curving bowls of Windansea and Sunset Cliffs surfers found themselves adjusting and readjusting trim to maintain the best possible position in the waves. These adjustments opened the door to bottom turns, cutbacks, and floaters - the advent of "hot dog" surfing. Surfer / shaper / designers desire to combine these trimming and turning approaches to surfing and the simplicity and speed of surfboard construction led to identifying the significance of specific variables and modifying the arrangement of dimensions, outlines, rockers, bottoms, decks, rails, and fins in surfboard design to achieve that feeling surfers were looking for.

Design by **reasoning** (ever more efficient trimming surfboards) ushered in design by **intuition** (the desire to turn surfboards between positions of trim.) Unknown to the surfer / shaper / designers of the era the seed of the shortboard had been planted.

Germination would take another five or six years. Nat Young's performance on his Bob McTavish designed surfboard named "Sam" at the 1966 World Titles in San Diego was a fantastic display of powerful turns combined with tight trim and graceful nose riding. In Australia, California, and Hawaii George Greenough, Wayne Lynch, Mike Diffenderfer, Michael Peterson, Dick Brewer, Michael Cundith, Josh Bradbury and a whole crew of (r)evolutionary surfer / shaper / designers were visualizing and implementing new approaches to surfing and surfboard design.

By 1967 the idea of replacing the straight line trimming approach to surfing with high speed direction changes and awesome acceleration in and out of the most critical parts of waves was the new approach to surfing. This remains the **primary goal of surfboard design** to this day.

The inevitable growth of the surfing population in California and Hawaii and the development of surfing in Australia, South Africa, Japan, and South America and the increase in disposable income and leisure lifestyle of the affluent "industrialized" cultures of the world allowed this ever increasing surfing population to make surfing the priority in their lives. Day in and day out, season to season, year in and year out surfers were riding a greater variety of waves.

Greater numbers of surfers, riding an ever expanding variety of waves, on an evolving variety of surfboards are a feast for surfboard design. Intuition and reasoning join to fulfill the imagination and desire of surfers to improve their surfing and their surfboards and explore new realms of surfing. Arrangement after arrangement of the fundamental variables are tested, observed, and evaluated. Does it work ? Can it be improved ? Should it be modified ? What should be modified ? To what extent should it be modified ? Should it be completely redesigned ?

Certainly, variables of surfboard design were identified and applied to ancient surfboards. Dimensions, templates, bottom and top contours, and rails were designed to glide on waves. Additional variables were identified and applied in the 1930's as the surfer / shaper / designers of that era improved the ancient designs. Rocker and fins were applied and surfers turned and trimmed their boards across the open face of breaking waves. The relative ease in shaping balsa and foam boards of the 40's and 50's set the table for shapers to identify and modify the variables that existed in all surfboards - ancient to contemporary.

Today, surfer / shaper / designers depend on their **intuition** and **reasoning** to advance surfboard design. They design and shape by arranging dimensions, rockers, bottom contours, deck contours, foils, templates, rails, and fins to best suit individual surfers (their size, skill, and technique) and the specific conditions (size, power, and shape) of the waves they ride.

A surfboard is **functional** and **relevant** when it is designed for the surfer and the conditions in which it will be surfed.

SURFBOARD CLASSES AND DESCRIPTIONS

The Wide Variety of Surfboard Designs

Surfboards at the debut of the 21st century are a variety of devices designed to ride waves. Surfboards are designed for a variety of surfers, approaches to surfing (styles of surfing), and waves. They're built from a variety of materials - polyeurethane blank cores with polyester and fiberglass composite skins to styrofoam blank cores with epoxy, plastic, and fiberglass composite skins; by a variety of methods - custom, hand shaped, hand glassed, "one off" surfboards to molded computer shaped "pop outs."

Whether you're motivated to carve turns, accelerate in and out of the pocket, or pull into barrels; glide in perfect trim (like a seabird on the updraft of a wind groomed swell); cruise through waves with an occassional turn or two; or drop into huge waves today's surfer / shaper / designers can build a surfboard for you.

Reality is what we perceive it to be. One surfer's reality may vary from another's. Functional surfboard design is relative to the needs of each surfer. The wide variety of surfboards at this point in time is the surfboard designer's response to the demographic smorgasbord of surf culture. Surfers educated about surfboard design (shapes and construction) are equiped with the knowledge and understanding to select the correct surfboard(s) to maximize their surfing.

The focus of this document is a description of the variety of surfboard designs currently in use and the design components that make them relevant and functional for the surfer, their surfing, and surfing conditions. These are the features that determine the design of a surfboard.

Surfboards may be grouped into several primary classes:

[Shortboards]

The shortboard is a high performance surfboard that has experienced constant evolution of it's design since the mid 1960's. This design is motivated by the surfer's desire to carve radical maneuvers in, around, and through the pocket of waves. Speed, acceleration, and control are all essential to performing these maneuvers and the introduction of "new" maneuvers or "variations" of existing maneuvers. At times design evolution has been incremental - slight adjustments of rocker, bottom contours, templates, rail profiles, or volume - that over time yield a shortboard remarkably more efficient than a similar previous design. Other times design evolution has been quantum if not revolutionary - introduction of three fins, multiple concaves, staged rocker - features that overnight yield break through performance.

The shortboard is a low volume surfboard that combines the fundamental variables into a surfboard that will perform to the level of skill of the surfer. It works when the rider weights and unweights the board from rail to rail driving off the rails and fins in the face of a wave. This rail to rail action taps into the waves energy and continues to build and hold speed as the rider carves turns off the rail and fins. The length of rail in the water and the time the rider holds the rail in the water will vary from turn to turn depending on the intent of the turn and the demands of the wave. Understanding and the skill to execute based on this fine line of function determines the level of performance. Basically, the shortboard must be kept in perpetual motion. If a surfer fails to keep working the board it will go to sleep on him.

The shortboard can bring great satisfaction and great frustration to the surfer. There is little margin for error in the shaper's execution of this low volume design and equally little margin for error in the surfer's performance. Minor mistakes in design and surfing are exaggerated. However, when the design components are balanced, working together, and matched to the surfer and the conditions the performance is awesome.

Shortboard Components

Core

- Clark Foam close tolerance blank

  • Blank options - 63R, 63H, 64R, and 65R
  • Density - Superlight or Ultralight
  • Stringer - 5/32 " bass or 1/16 + 1/16 " bass T band
  • Blank Rocker - Shaper's preference

Generic Dimensions

- Length: 6' 2"
- Width nose: 11 1/4 "
- Width wide point: 18 1/2 "
- Width tail: 14 "
- Thickness nose: 1 1/4 "
- Thickness wide point: 2 1/4 "
- Thickness tail: 1 1/2 "

Templates

- The outline is often parallel through wide point towards the nose and tail. Maintaining parallel lines towards nose increases potential projection out of turns. Curves (hip) forward of fins (centered on the surfers stance) determines turning radius. Tail configuration further varies the turning radius, projection, and drive features of the design.
- Squash tail - Functional combination of drive and loose, easy to find the rail, and forgiving in tight spots.
- Swallow tail - Maximum drive, similar to squash, reduced tail area with swallow cut really holds the rail in place.
- Round pin tail - Very loose, curve in last 25 % of outline continues all the way through tail.

Rocker

- Shortboard bottom rocker is either "continuous curve" or "staged" rocker.
- Continuous curve rocker is a bottom curve with no flat spots that still flows from greater curves in the nose and entry of the surfboard to lesser curves in the mid and tail sections of the board. These smooth and continuous curves allow a surfboard to turn with relative (to length, template, and bottom contours) ease, yet develop speed, and project well out of turns.
- Staged rocker is a bottom curve that is relatively flat through the mid section of the surfboard with accelerated curves in the entry and tail sections of the board. The staged curves rocker is a radical extension of continuous rocker where the rocker in the mid section of a surfboard has been "flattened" to dial up the speed and projection of a shortboard out of it's turns. The extent that these flat and accelerated curves transition into each other is critical to the successful application of this design. Smooth transitions allow the board to maximize performance and prevent the board from pushing water - bogging and slowing down. Poor, interrupted transitions will cause the board to drag and lose speed.

Bottom Contours

- Variations of multiple concaves are the most common bottom contours. Concaves are one of the most complicated and contradictory design components included in the modern shortboard. Consideration of other design variables of the board is essential to decisions about the arrangement, depth, and placement of concaves. Imagination and experimentation - trial and error - testing and observation yield efficient multiple concave bottoms.

  Concaves produce lift with laminar flow (channeling water under the board) and surface area (a curved line is longer than a straight line side to side across a surface) as water passes under a surfboard. They produce additional lift when water runs into the aft section of the surfboard's template (where the template turns into the tail and crosses the path of the water flowing towards the tail) and lifts the tail under the surfers back foot. (Try placing the concave side of a spoon under a faucet of flowing water !)

Dealing effectively with lift and drag is key to designing concaves into the bottom of a surfboard. Efficient multiple concaves feed water under a surfboard to the surfer's stance then release water through the fins and tail of a surfboard behind the surfer's back foot. When a surfer weights the rail and bottom of a surfboard he compresses the water, channeling it through the concave array. The rocker, template, rail, and fin arrangement provides this compressed water with an avenue of escape - out through the tail section of the board. This phenomena excentuates the acceleration of the surfboard through it's turns.

- Most concave bottoms will follow a pattern like this: Flat, slight roll, or slight veep in first 12 to 20 inches of entry; shallow single concave increasing in depth to maximum depth about halfway from wide point to rail fins; double concave begins at or near this spot and carries through rail fins; double concave decreases quickly through the fins; double concave transitions to veep in last 6 to 10 inches of tail.

  Looser boards - single concave carries further towards fins before double concave develops. Driver boards - single concave transitions into double concave closer to the wide point.

  The concave array must have it's maximum depth under the surfer, between the wide point and the fins, to achieve maximum results !

Deck Contours

- Deck contours or the side to side configuration of the deck of the shortboard vary from domed to flat. Deck contours are determined by the surfer's size, skill, and technique; the thickness and width of the board; and the rail design.

  Shortboards function by transferring weight from rail to rail. To facilitate rail to rail action boards need to roll from side to side - rail to rail - with ease. As most shortboards have a multiple concave bottom a configuration that does not tip, shapers depend on deck contours to influence the rail to rail action. Deck contours dial up and fine tune volume as it flows out to the rail. Domed or crowned decks carry less volume to the rails. Flatter decks carry more volume to the rails.

- Domed or crowned deck - Less volume towards the rail than in the center of the board will be more sensitive rail to rail.

- Flat or flatter deck - Carries volume out to the rail from the center of the board will be more stable and require more influence from the surfer to transfer weight from rail to rail.

- It's important that shortboards have enough rail volume not to bog when the rail is weighted into the face of a wave. This "correct" volume carries speed while on rail and allows a shortboard to accelerate out of turns.

  An average sized surfer (approximately 5' 9" x 155 lbs) of average skill riding a 6' 2" x 18 1/4" x 2 1/4" surfboard will be right at home with a moderately domed or crowned deck. A large surfer (approximately 6' 0" x 185 lbs) of average skill riding a surfboard with the same dimensions will be more comfortable with a flatter deck.

A light footed surfer will have better results with a crowned deck. A heavy footed surfer will have better results with a flatter deck.

When a surfer's technique uses feet and ankles with quiet hips and upper body a crowned deck is more functional. When a surfer's technique uses hips and upper body a flatter deck is more functional.

Foils

- The foil or distribution of thickness of the shortboard is pretty straight forward. The singular function and low volume nature of the design leaves few options.

- The primary foil, nose to tail along the length of the board, has the thickness concentrated from 12 to 15 inches in front of the wide point to the side fins. The nose and tail are very thin - the nose more so than the tail. The transition from thin nose, to the concentration of foam under the surfer, to the thin tail must be very smooth to maximize the board's performance.

  The primary foil of a typical 6' 2" shortboard, measured from nose to tail:

  • 1 1/4 " at 12 " from nose
  • 2 " at 24 " from nose
  • 2 1/4 " at widepoint
  • 2 1/8 " at 24 " from tail
  • 1 1/2 " at 12 " from tail

- The deck foil, side to side from nose to tail, is more crowned in the nose and transitions to a flatter side to side configuration in the tail. This facilitates a little lower and thinner rail in the nose and entry and a little fuller but not thick rail under the surfer's center of gravity.

- The rail foil, nose to tail along the rail, mimics the primary foil. The flow is a bit more consistent, particularly from the surfers center to the tail. Rail foils should not be taken lightly. A well conceived and executed primary foil is no guarantee that the rail foil will automatically function.

  The rail foil of a typical 6' 2" shortboard, measured from nose to tail:

  • 5/8 " at 12 " from nose
  • 7/8 " at 24 " from nose
  • 1 + " at widepoint
  • 1 - " at 24 " from tail
  • 7/8 " at 12 " from tail

Rails

- The rails of a shortboard transition from thin and round with no edge from nose / entry to widepoint in a manner that allows them to penetrate the face of a wave as the surfer rolls onto and weights the rail. The soft, round, neutral rails in the entry also facilitate easy transition from rail to rail in critical tight areas of the wave. The rail profile is nearly the same but slightly fuller at the widepoint, near the surfer's front foot. Here, the rail must support the weight applied by the surfer to maintain speed while the board is on rail. From the wide point to the tail the rail profile remains nearly the same on the deck side, but begins to shorten the radius and develop an edge on the bottom side of the rail. By the trailing edge of the side fins the rail has no tuck and an extremely hard edge. Through this transition the rail provides leverage and release so the board can accelerate off the rail and out of the turn.

Fins

- Tri fins are the standard shortboard fin arrangement. Removable fins are most common, although glass on fins have excellent properties.

  Set further to the tail a tri fin cluster will provide more apparent drive off the tail, but in the extreme the board is more difficult to roll onto rail. Set further off the tail a tri fin cluster will roll onto rail with greater ease. There is greater responsibility on the surfer to make the board work with a "forward" fin placement. Fin clusters with more toe and cant loosen up a surfboard. Less toe and cant create more drive.

  Most shapers are comfortable with a specific "formula" for fin placement on their designs. Placement is based on the surfboard's dimensions, the intent of the board's design, and the surfer's skill and technique.

- Typical fin specifications:

  • 4 3/8 " base
  • 4 1/2 " depth
  • Side fin template is wide base, medium tip, and medium rake. Center fin template is 1/16 " narrower in base and tip, and has slightly more rake than side fins.
  • Side fins have one sided foil with a bit of two side foil at the base of the leading edge. Center fin has two sided foil. Quality fins have no flat surfaces on foiled sides. They have minimum drag and maximum lift.

- Typical "tail oriented" fin cluster position:

  • Center fin 3 1/4 " from tail
  • Side fins 10 1/2 " from tail
  • Side fins set 1 1/16 " from rail, with 5/32 " toe, and 6 1/2 degrees cant.

- Typical "forward" fin cluster position:

  • Center fin 3 1/2 " from tail
  • Side fins 11 1/4 " from tail
  • Side fins set 1 1/8 " from rail, with 5/32 " toe, and 6 1/2 degrees cant.

Glassing
Glassing Schedule:

• 1 x 4 ounce Bottom
• 2 x 4 ounce Deck with optional 4 ounce butterfly tail patch
• Matte or satin acrylic finish
• Ideal weight - 6 pounds

[Specialty Shortboards]

Groveler shortboard - slightly shorter version of the contemporary shortboard. Designed to ride like a pure shortboard in minimum conditions. Lots of rocker from the widepoint to tail is the key design component. Natural arc of the turn is very tight yet powerful. Requires skilled and fit surfer for optimum results. Can deliver awesome results in small waves.

Step up shortboard - slightly longer version of the contemporary shortboard. Designed to ride like a shortboard in conditions just past the envelope of the pure shortboard.

Semiguns - designed for various types of larger and thicker waves.

Extended shortboard - medium and high volume shortboard designed for bigger and older surfers.

Contemporary "fish" - designed for similar conditions as the "groveler" with a flatter rocker profile and more surface area in the template. This board can glide or trim through small / mushy waves, doesn't require as much input from the surfer, and consequently is easier to ride than a "groveler."

[Big Wave Guns]

A fundamental and simple design. Big wave surfing places brutally clear cut demands on a surfer and surfboard. First and foremost is wave catching and entry followed closely by control getting to and off the bottom of the wave. The design elements of the Big Wave Gun function to meet these requirements.

Big Wave Gun Components

Core

- Clark Foam blank

    • Blank options - 112, 104A, 109B, and 99A
    • Density - Superblue, Supergreen, or Classic
    • Stringer - 1/2 " bass or 1/4 + 1/4 " bass T band
    • Blank Rocker - Shaper's preference

Generic Dimensions

- Length: 10' 0"
- Width nose: 9 3/4 "
- Width wide point: 20 1/4 "
- Width tail: 9 1/2 "
- Thickness nose: 1 1/2 "

- Thickness wide point: 3 1/4 minimum "
- Thickness tail: 1 1/2 "

Templates

- The outline is distinguished by it's wide point and concentration of surface area 6 to 10 inches forward of center. The outline from nose to wide point is relatively straight and designed to eliminate drag paddling into and dropping down the face of huge waves where entry is often challenged by strong winds or rips. The outline from wide point to tail is a very long, minimum curved line. There is a minimum of surface area in the back half of the board. This minimum surface area anchors the board into the face of the powerful waves for which this board is designed. The outline is designed with surface area forward to naturally place the surfer over the long rail line resulting in great projection out of turns. The features of the big wave gun's outline are about control and projection.

- Pin tail - Most functional.

- Swallow tail - Slightly straighter line from fin(s) to end of tail.

Rocker

- Big wave gun bottom rocker is "continuous curve" rocker, a bottom curve with no flat spots that still flows from greater curves in the nose and entry of the surfboard to lesser curves in the mid and tail sections of the board. These smooth and continuous curves allows the big wave gun to glide through the water without "pushing" water in critical conditions, control speed, and project well out of turns.

Bottom Contours

- Functional and simple !!! Big wave guns require a convex bottom configuration. These boards are designed to be functional and effecient in extreme conditions. Vee in the entry transitions to nearly flat or tri plane in the mid section to panel vee in the tail section of the surfboard. The vee in entry can cut through the chop and turbulence of wind blown or riptide surfaces or slice into a glassy surface at the speeds developed dropping into a big wave. The flatter mid section keeps the hull at speed and accelerates the board into the shallow panel vee in the tail. The panel vee in the tail steers the board from rail to rail and holds the board in a line much like the keel of a sailboat transfers the force of the wind into forward motion.

Deck Contours

- Deck contours or the side to side configuration of the deck of the big wave gun are simple and functional. They transition from the high volume thickness in the center and widepoint of the board to the steep / crowned / angular rail profile. They carry the thickness as far to the rail as functionally possible for paddling and stability, then crown into the steep / crowned / angular rails with equally functional reduction in volume so the rails can bite into face of a wave to control the board in high speed drops, turns, and transitions.

Foils

- The foil or distribution of thickness of the big wave gun has a singular function..
- The primary foil, nose to tail along the length of the board, has the thickness developing from 12 to 18 inches behind the nose, gaining thickness through the wide point, then tapering with a strong smooth reduction of volume through the tail. Most of the volume is concentrated at the wide point corresponding to the concentration of surface area in the outline. The forward mass has a pendulum effect pulling the board down the face in take off and down the line out of the turns.

  The primary foil of a typical 10' 0" big wave gun, measured from nose to tail:

  • 1 1/2 " at 12 " from nose
  • 2 3/4 " at 24 " from nose
  • 3 1/4 " at widepoint
  • 2 1/2 " at 24 " from tail
  • 1 1/2 " at 12 " from tail

- The deck foil, side to side from nose to tail, is crowned throughout. This facilitates a lot of volume in the center of the board with easy reduction of volume in the steep / crowned / angular rails.
- The rail foil, nose to tail along the rail, mimics the primary foil. The flow is thin enough leading into the wide point that the surfer has no difficulty getting the rail into the water, yet full enough at the wide point to sustain planing speed on rail. The rail foil tapers from wide point to tail with the same strong smooth reduction of volume as found in the primary foil. As with all surfboards, the rail foil should not be taken lightly. A well conceived and executed primary foil is no guarantee that the rail foil will automatically function.

  The rail foil of a typical 10' 0" big wave gun, measured from nose to tail:

  • 7/8 " at 12 " from nose
  • 1 1/4 " at 24 " from nose
  • 1 1/2 + " at widepoint
  • 1 1/8 " at 24 " from tail
  • 7/8 " at 12 " from tail

Rails

- The rails of a big wave gun are round, neutral, and forgiving in the entry. They transition from this neutral entry rail into a steep, crowned, angular profile in the wide point that tucks softly into the bottom of the board. The rail profile remains the same from the wide point through the tail, but the volume and thickness of the rail reduces with the flow of the primary and rail foil. The rail must support the forces of the surfer and the wave to control and maintain speed while the board is on rail.

From the wide point to the tail the bottom of the rail profile transitions from the soft tucked profile to a hard edge with no radius. At or near the fin(s) the rail has no tuck and an extremely hard edge.

Fin(s)

- Single fins and tri fins are both employed in big wave guns. Both single fin and tri fins benefit from a glassed on arrangement. The fin fering adds to the fin(s) foil and holding power and reduces cavitation.
- Typical single fin specifications:

  • 6 " base
  • 9 " depth
  • Fin set 6 to 8 " from tail depending on the surface area of the tail.
  • Single fin has two sided foil for minimum drag.

- Typical tri fin specifications:

  • Side fins 4 3/8 " base
  • Side fins 4 5/8 " depth
  • Side fins one side foil / leading edge two sided foil.
  • Center fin 4 1/2 " base
  • Center fin 4 3/4 to 5 " depth
  • Center fin two sided foil

- Tri fin cluster position:

  • Center fin 5 " from tail
  • Side fins 15 " from tail
  • Side fins set 1 1/8 " from rail, with 5/32 " toe, and 5 1/2 degrees cant.

Glassing
Glassing Schedule:

• 2 x 6 ounce Bottom / Resin rich lamination
• 2 x 6 ounce Deck / Resin rich lamination
• Matte or satin acrylic finish
• Ideal weight - 10 to 12 pounds

[Hybrids]

Is this where the evolution of surfboard design is leading the largest slices of surf culture's demographic pie ? Why shouldn't surfers of all skills have a well designed surfboard - a surfboard that will maximize their surfing experience. Hybrid design varies with the surfer, the approach they take to surfing, and the waves they intend to ride. Borrowing components from modern shortboards and integrating them into a longer surfboard with significant surface area, hybrids combine the thrill of carve and glide.

Hybrid Components

Core

- Clark Foam close tolerance blank

  • Blank options - 74R, 711R, and 84R
  • Density - Superblue or Supergreen
  • Stringer - 3/16 " bass or 1/8 + 1/8 " bass T band
  • Blank Rocker - Shaper's preference

Generic Dimensions

- Length: 7' 4"
- Width nose: 13 1/2 "
- Width wide point: 20 1/2 "
- Width tail: 14 1/4 "
- Thickness nose: 1 3/8 "
- Thickness wide point: 2 3/4 "
- Thickness tail: 1 5/8 "

Templates

- The outline is a clean continuous curve. The wide point is well in front of center to carry surface area out towards the nose. Surfers are comfortable in trim and turning the board in long arcs from this forward area. The outline in the tail is borrowed from the shortboard. The turning radius off the tail varies with the intent of the surfer and the demands of the wave from tighter to longer arcs. Tail configuration further varies the turning radius, projection, and drive features of the design.
- Squash tail - Functional combination of drive and loose, easy to find the rail, and forgiving in tight spots.
- Round pin tail - Very loose and forgiving - transitions and rotates from rail to rail with ease.

Rocker

- Hybrids bottom rocker is "continuous curve rocker." This is a bottom curve with no flat spots that still flows from greater curves in the nose and entry of the surfboard to lesser curves in the mid and tail sections of the board. These smooth and continuous curves allow a surfboard to turn with relative ease, yet develop speed, and project well out of turns.

Bottom Contours

- Hybrids have very simple bottoms. They flow from slight vee or roll entry to shallow tri plane wide point to panel vee with soft transition on the center of the vee. (A sharp vee can be tracky and unforgiving.)

Deck Contours

- Deck contours or the side to side configuration of the deck of hybrids is a soft crown, thicker in the middle and thinner towards the rails. These moderate to high volume boards are much easier to control when the volume is reduced towards the rails.

Foils

- The foil or distribution of thickness of the hybrid is balanced from nose to tail.

- The primary foil, nose to tail along the length of the board, has the thickness concentrated from 12 to 15 inches behind the nose through the wide point to 15 to 18 inches from the tail. The nose and tail are thinner - the nose more so than the tail. The transition from thinner nose, to the concentration of foam from the wide point to the fin area, to the thinner tail must be very smooth to maximize the board's performance.

  The primary foil of a typical 7' 4" hybrid, measured from nose to tail:

  • 1 3/8 " at 12 " from nose
  • 2 1/4 " at 24 " from nose
  • 2 3/4 " at widepoint
  • 2 3/8 " at 24 " from tail
  • 1 5/8 " at 12 " from tail

- The deck foil, side to side from nose to tail, is moderately crowned throughout.

- The rail foil, nose to tail along the rail, mimics the primary foil. The flow is a bit more consistent, particularly from the wide point to the tail. Rail foils should not be taken lightly. A well conceived and executed primary foil is no guarantee that the rail foil will automatically function.

  The rail foil of a typical 7' 4" hybrid, measured from nose to tail:

  • 5/8 " at 12 " from nose
  • 1 " at 24 " from nose
  • 1 1/4 " at widepoint
  • 1 1/8 " at 24 " from tail
  • 7/8 " at 12 " from tail

Rails

- The rails of a hybrid are borrowed from the modern shortboard. They transition from thin and round with no edge from nose / entry to widepoint in a manner that allows them to penetrate the face of a wave as the surfer rolls onto the rail. The soft, round, neutral rails in the entry also facilitate easy transition from rail to rail in critical tight areas of a wave. The rail profile is nearly the same but slightly fuller at the widepoint. From the wide point to the tail the rail profile remains nearly the same on the deck side, but begins to shorten the radius and develop an edge on the bottom side of the rail. By the trailing edge of the side fins the rail has no tuck and an extremely hard edge. Through this transition the rail provides leverage and release so the board can accelerate off the rail and out of the turn. The profile of a hybrid rail is usually a bit lower or more crowned on the top of the rail than the profile of a shortboard rail.

Fins

- Hybrids may have one of two fin arrangements: a tri fin cluster or a single fin with rail bites.

  A hybrid with a tri fin cluster will drive off the rail and tail much like a shortboard, and hold a high line in trim. A hybrid with a single fin / rail bite arrangement will have a "ball bering" flow from rail to rail, and hold a neutral line in a critical section of a wave. The single fin / rail bite arrangement is a more "forgiving" board.

- Typical tri fin specifications:

  • 4 7/16 " base
  • 4 9/16 " depth
  • Side fin template is wide base, medium tip, and medium rake.
  • Side fins have one sided foil with a bit of two side foil at the base of the leading edge. Center fin has two sided foil. Quality fins have no flat surfaces on foiled sides. They have minimum drag and maximum lift.

- Typical tri fin cluster position:

  • Center fin 3 1/2 " from tail
  • Side fins 11 3/4 " from tail
  • Side fins set 1 1/16 " from rail, with 5/32 " toe, and 5 1/2 degrees cant.

- Typical single fin / rail bite specifications:

  • Center fin 7 1/2" cutaway
  • Rail bite 3 3/4 " base
  • Rail bite 3 5/8 " depth
  • Center single fin has two sided foil cutaway at trailing edge base.
  • Side fins have one sided foil with a bit of two side foil at the base of the leading edge.

- Typical single fin / rail bite fin cluster position:

  • Center fin 6 1/2 " from tail
  • Side fins 13 " from tail
  • Side fins set 1 1/16 " from rail, with 5/32 " toe, and 5 1/2 degrees cant.

Glassing
Glassing Schedule:

• 1 x 6 ounce Bottom
• 1 x 6 ounce and 1 x 4 ounce Deck
• Matte or satin acrylic finish
• Ideal weight - 8 pounds

[Longboards]

Glide like a seabird on the updraft of a wind groomed swell.

ROCKER

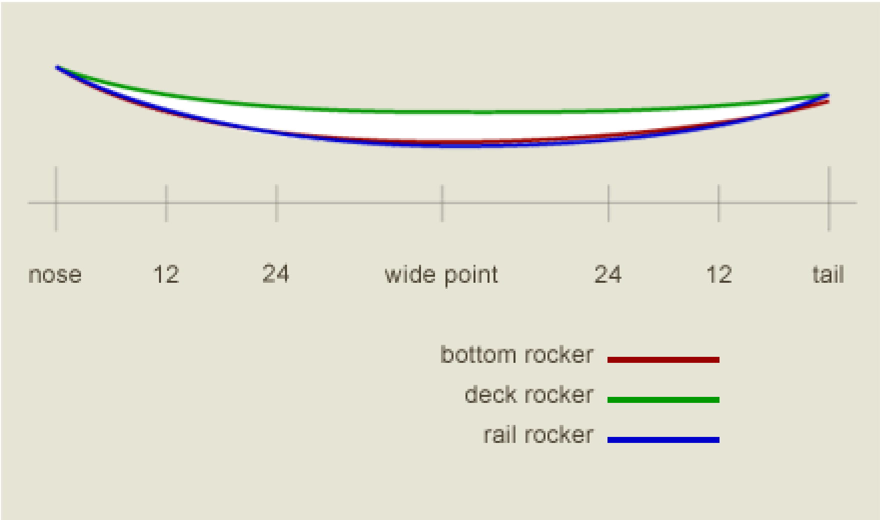
Is it Magic ?

Rocker is a dimensional curve along the bottom, top, and rail of the surfboard usually referenced from nose to tail.

Bottom Rocker - Dimensional curve following a straight line along the bottom of a surfboard. Bottom rocker is the backbone or foundation of a well designed surfboard.

Deck Rocker - Dimensional curve following a straight line along the top of a surfboard. The area defined by plotting bottom and deck rocker defines the foil or thickness flow of a surfboard from nose to tail.

Rail Rocker - Dimensional curve along the rail of a surfboard. This line follows the outline and the bottom of a surfboard's rail(s). The relationship between a surfboard's bottom rocker and rail rocker helps define the bottom contours of a surfboard



Rocker is an extremely significant variable in the design of a surfboard. Bottom rocker is (generally) the first design element a shaper puts into a surboard. Once the bottom rocker is established the shaper will proceed to add bottom contours and foil the board from nose to tail and side to side, ALL in relation to the bottom rocker. It's essential that these additional variables compliment the bottom rocker of the board. If these design variables are not in sync, they risk working against each other.

A well designed bottom rocker, functional - relevant - and well executed, is the foundation of a "magic" board.

There are three primary varieties of rocker evident in surfboard design: (1) "Continuous" curves, (2) "Staged" curves, and (3) a "hybrid" combination of both. All these bottom rockers may be applied to most surfboard design - shortboards, specialty shortboards, semiguns, guns, tow boards, hybrids, funboards, and longboards - as shapers design the performance characteristics into a surfboard. However, you could make a strong argument that each of these bottom rockers is generally better suited to some designs than others.

Continuous Curves Rocker is a bottom curve with no flat spots that still flows from greater curves in the nose and entry of the surfboard to lesser curves in the mid and tail sections of the board. These smooth and continuous curves allow a surfboard to turn with relative (to length, template, and bottom contours) ease, yet develop speed, and project well out of turns.

When applied to shortboards, specialty shortboards, semiguns, and guns this type of rocker allows a surfboard to transfer from rail to rail, turn in a variety of arcs (turning radius), and drive out of the turns with a variety of projection. Shapers may dial up or down these performance features by varying the degree of these curves. A relatively greater continuous rocker pattern will have a tighter turning radius and less projection out of a turn - a relatively flatter continuous rocker pattern will have a longer turning radius and more projection out of a turn.

When applied to funboards, hybrids, and longboards continuous curves rocker allows a surfboard to glide or trim at speed and turn. Shapers may dial up or down these performance features (just as they do in other types of surfboard designs) by varying the curves. Hybrids will have rocker patterns similar to shortboards designed to turn and accelerate when the opportunity presents itself yet glide and trim through waves with less energy and power. Funboards and longboards will have rocker patterns that are flatter throughout, particularly in the nose. They are still characterized by slow arching continuous curves with no flat areas. The flatter nose and forward rocker of longboards is the trimming area of the board. The greater rocker curves in the aft section of longboards is the turning area of the board.

Staged Curves Rocker is a bottom curve that is relatively flat through the mid section of the surboard with accelerated curves in the entry and tail sections of the board. The staged curves rocker is a radical extension of continuous rocker where the rocker in the mid section of a surfboard has been "flattened" to dial up the speed and projection of a shortboard out of it's turns. The extent that these flat and accelerated curves transition into each other is critical to the successful application of this design. Smooth transitions allow the board to maximize performance and prevent the board from pushing water - bogging and slowing down. Poor, interrupted transitions will cause the board to drag and lose speed.

Staged curves rockers are applied primarily to shortboards, specialty shortboards, and semiguns. Decreasing the curve and extending these relative flatter curves of the mid section yield greater speed and projection and longer arcs out of the turns. Increasing the curve and shortening the flatter mid section yields less projection, tighter turning radius, and shorter arcs out of the turns, without loss of speed. (Surfers with the skill to ride these boards will be able to generate and maintain speed no matter what the natural arc or turning radius of the board.) Shapers apply these principles to maximize a boards performance in a variety of conditions.

Hybrid Combination Rocker is a bottom curve that draws on the relevant features of continuous curves rocker and staged curves rocker. These rocker patterns are applied primarily to the wide variety of hybrid surfboard designs. To accomplish the varied goals of these designs shapers will combine the smooth even curves of the continuous curves rocker and the flatter curves of the mid section of staged curves rocker to maximize performance. Hybrid combo rocker may be configured to carve and accelerate through turns in critical waves and hold speed and power to transition through flatter and less powerful waves.

BOTTOM CONTOURS

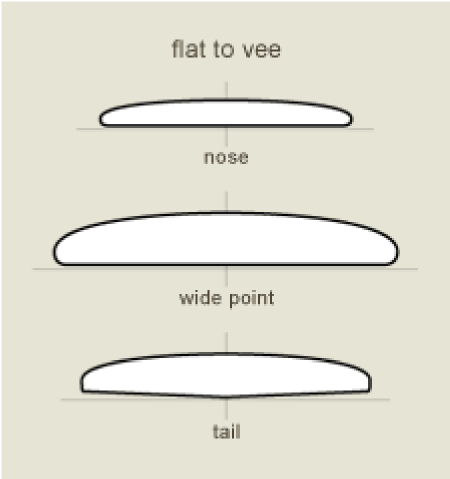
The Bottom of the Board

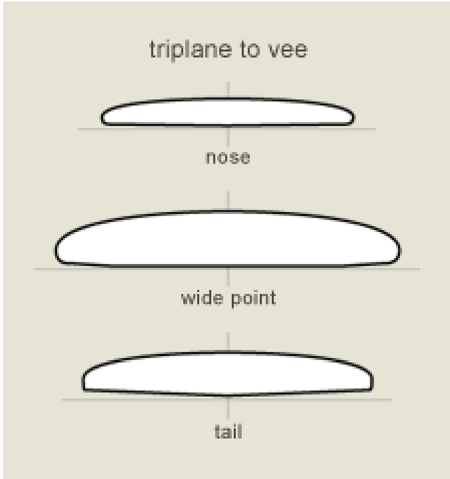
There are several bottom contour configurations found in contemporary surfboard design. They may be divided into three primary groups: flat, convex, and concave. All may be applied to any type of surfboard, although most are relevant to specific types of boards.

Flat is flat. Some shapers employ a flat bottom nose to tail in their designs, but a flat bottom is hard pressed to add any performance features to a surfboard - shortboard, hybrid, gun, or longboard. Flat provides no lateral stability, lift, or leverage. Bottom contours with flat areas combined with other contours are common. Combined with vee, tri planes, soft round surfaces, and concaves flat bottom contours move away from their safe, neutral, vanilla features and help develop acceleration, speed, and control.

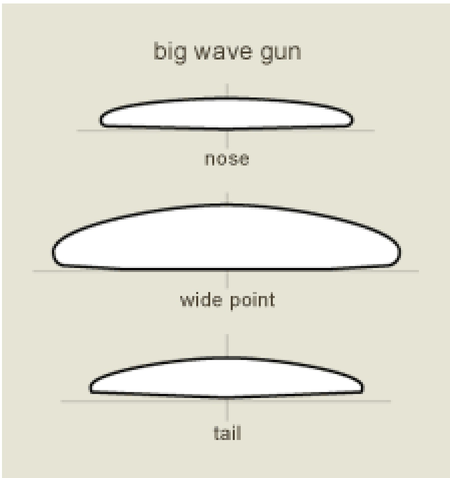
Convex bottom contours are any combination of flats and curves that descend below the rail line of the surfboard. Convex bottoms may also be described as "displacement hulls." These designs provide great lateral stability and control, smooth transitions from rail to rail, and are very forgiving. They handle well at a full range of speeds. They are truly essential to big wave guns, hybrids, and longboards. And, they are functional, although somewhat conservative, in shortboards and specialty shortboards.

The following illustrations show two convex bottom configurations. **Flat to vee** is very simple and common to shortboards, hybrids, and longboards. The flat entry is fast enough and forgiving enough for surfers of all skills. The depth and length of the vee is varied to determine turning radius and provide control at higher speeds or in critical sections. When employed in hybrids and longboards, surfboards with lots of surface area and volume, the vee helps manage and control the boards' mass. **Tri plane to vee** is also a very simple bottom, and arguably a more versatile and effecient configuration than flat to vee. The displacement in front of the vee is faster than flat, as it planes in the face of a wave with less wet surface; it's very forgiving as it lifts the forward rails out of the water in critical sections; and it initiates turns with less effort as the surfer leads the surfboard onto rail or from rail to rail.

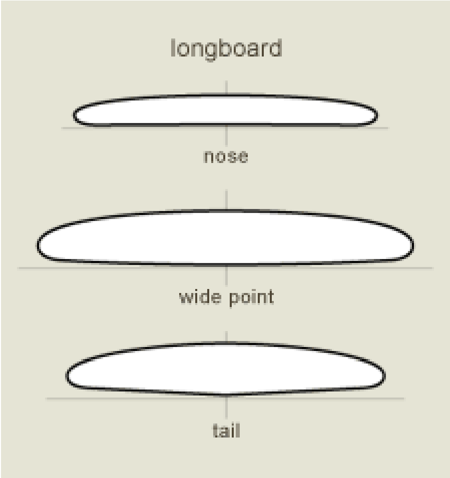




Big wave guns require a convex bottom configuration. These boards are designed to be functional and effecient in extreme conditions. **Vee** in the entry transitions to nearly **flat or tri plane** in the mid section to **panel vee** in the tail section of the surfboard. The vee in entry can cut through the chop and turbulence of wind blown or riptide surfaces or slice into a glassy surface at the speeds developed dropping into a big wave. The flatter mid section keeps the hull at speed and accelerates the board into the shallow panel vee in the tail. The panel vee in the tail steers the board from rail to rail and holds the board in a line much like the keel of a sailboat transfers the force of the wind into forward motion.



Traditional longboards, reproductions of the classic surfboards of the '50s and '60s, have a convex bottom configuration. The longboard bottom design is a displacement hull, blending nearly flat entry with soft round bellied mid and tail sections. These boards are designed to glide, trim, and roll from side to side to turn and adjust trim. These convex features hold the board firmly in the face of a wave.



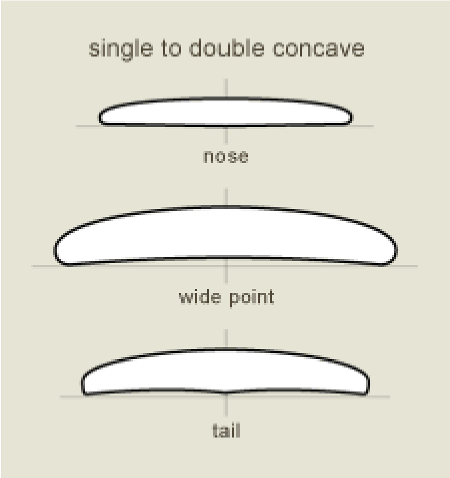
Concave bottom contours are any combination of curves that ascend above the rail line "into" the surfboard. Variations of single to double concaves are the primary bottom contour configurations in the modern shortboard. Concaves are one of the most complicated and contradictory design components included in a shortboard. Consideration of other design variables of the board is essential to decisions about the arrangement, depth, and placement of concaves. Imagination and experimentation - trial and error - testing and observation yield efficient multiple concave bottoms.

Concaves produce lift with laminar flow (channeling water under the board) and surface area (a curved line is longer than a straight line side to side across a surface) as water passes under a surfboard. They produce additional lift when water runs into the aft section of the surfboard's template (where the template turns into the tail and crosses the path of the water flowing towards the tail) and lifts the tail under the surfers back foot. (Try placing the concave side of a spoon under a faucet of flowing water !)

Dealing effectively with lift and drag is key to designing concaves into the bottom of a surfboard. Efficient multiple concaves feed water under a surfboard to the surfer's stance then release water through the fins and tail of a surfboard behind the surfer's back foot. When a surfer weights the rail and bottom of a surfboard he compresses the water, channeling it through the concave array. The rocker, template, rail, and fin arrangement provides this compressed water with an avenue of escape - out through the tail section of the board. This phenomena excentuates the acceleration of the surfboard through it's turns. Tuning each variable and their interaction with the other variables determines the performance characteristics of the surfboard.

Most concave bottoms will follow a pattern like this: Flat, slight roll, or slight veep in first 12 to 20 inches of entry; shallow single concave increasing in depth to maximum depth about halfway from wide point to rail fins; double concave begins at or near this spot and carries through rail fins; double concave decreases quickly through the fins; double concave transitions to vee in last 6 to 10 inches of tail.

Looser boards - single concave carries further towards fins before double concave develops. Drivier boards - double concave carries further into the board from the tail. Holding the template and rocker constant, concave arrays dominated by single concave will favor very tight turning radius. Concave arrays dominated by double concave will favor greater projection out of turns.



TEMPLATES

The Outline of the Surfboard

Overview

The outline of a surfboard is the distribution and configuration of the surface area of the surfboard. This layout is referred to as the plan shape or the template of the surfboard.

Outlines are often referenced by the configuration of specific elements of the surfboard: the tail (roundtail, roundpin, pintail, squash tail, the relative width of the surfboard (narrow board, wide board, narrow nose with wide tail, full nose with tear drop tail.)

These descriptions state the obvious identifying features of a surfboard's plan shape or template, descriptions that are useful for discussion and the design of the surfboard's outline. These features are design variables that surfers, shapers, and designers use to create, modify, and tune (dial up or down) specific performance features in a surfboard.

Outlines may also be referenced by **the overall distribution and configuration of the surface area of the surfboard.** Considering the surfboard's outline from this perspective has significant impact on the design process and the performance of the surfboard.

This perspective focuses on the fundamental and essential effect of the overall view of the outline on the design goals of the surfboard. Specific elements of the outline (nose and tail configurtions and width throughout) are incorporated into the design to further develop and tune the surfboard's outline. The logic is to begin with a fudamental design goal, basic, relevent, and essential, then tune that fundamental design with specific elements.

Distinct overall outline configurations include dominantly "parallel" outlines, dominantly "continuous curve" outlines, and "hybrid" outlines (where parallel and continuous curves are integrated to mix and match their effects on the performance of the surfboard.) These overall outline descriptions, like the specific elements of the outline, are important design variables used to create, modify, and tune the performance of the surfboard.

Surfers, foamsmiths, and designers may prefer either of these approches or perspectives (or others) to initiate outline design. Arguably, though, initiating the outline's design with relevant choices about performance based on the overall distribution and configuration of surface area then tuning the outline with specific elements ultimately yields a superior surfboard.

Overall Distribution and Configuration of Surface Area

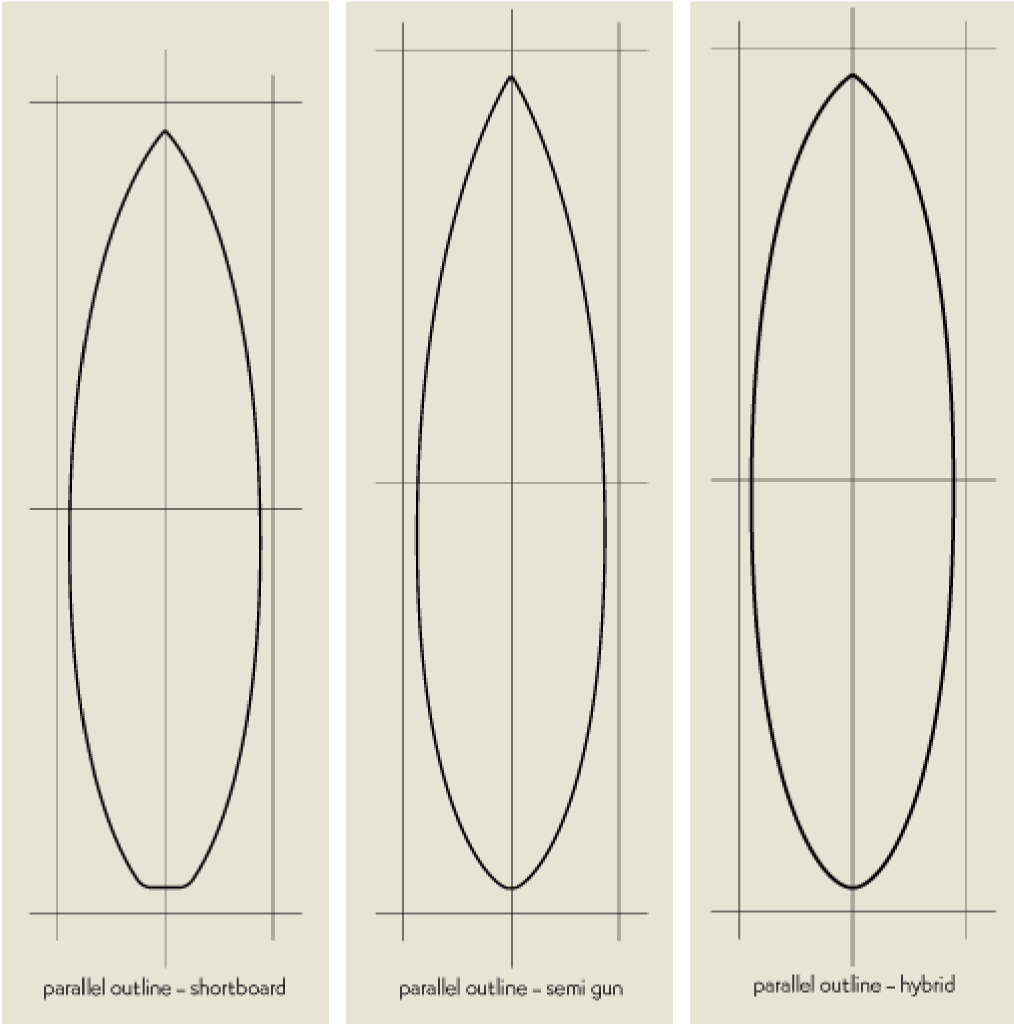
Parallel outlines feature elongated nearly straight curves in the plan shape or template of the surfboard. They are common to all classes of surfboards and are most functional when modified and matched with areas of continuous curve strategically integrated into the outline.

A parallel shortboard, semi gun, tow board, hybrid, or longboard outline will have strong nearly straight curves in the template running "parallel" to the center line of the surfboard. These parallel lines dominate most of the length of the surfboard. They extend surface area further into the nose and tail of the surfboard. They can be very effective in creating a longer drawn out turn from a shortboard, small semi gun, or tow board when required by surfing conditions. (Adjustments to other design variables are required to keep the most extreme of the parallel outlined boards from being to stiff or not quick in a tight situation.)

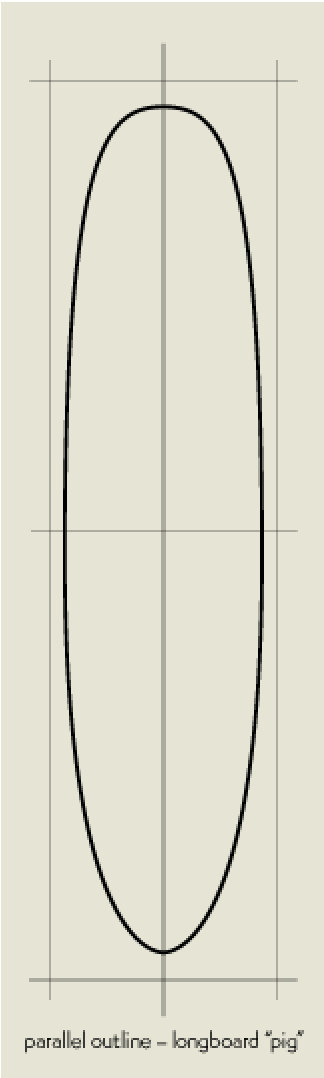
Extreme parallel outlines can be problematic for shortboards. as they may lack the necessary curves required by a shortboard to turn and release in tight and critical as well as flat and soft sections of waves. Strategically placed parallel lines through the widepoint (near the surfer's front foot) towards the fins (just forward of the surfer's rear foot) matched with continuous curves near the rail fins provides the required release and tight radius a shortboard needs to profit from the speed and power provided by those parallel lines. Dominantly parallel outlines may be used in semi guns and hybrids where the length of the surfboard matched with the elongated straight curves yields a long powerful turning radius. The extra length of these surfboards remains an asset when, as with shortboards, the parallel areas of the template are matched with areas of continuous curve. See "hybrid outlines."

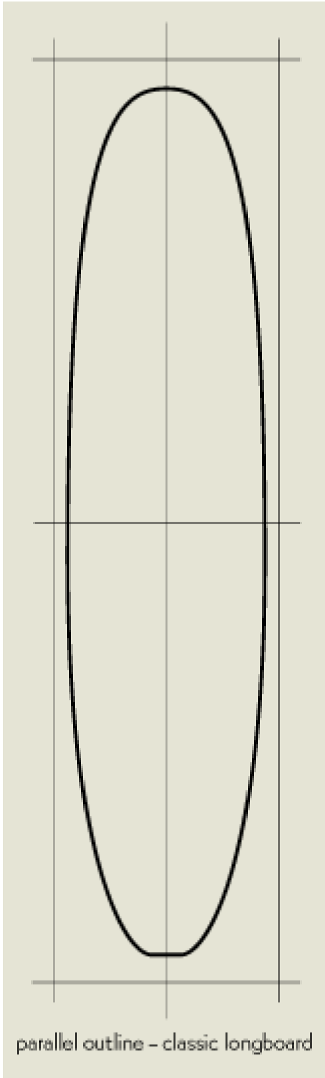
Parallel outlines are very common to longboard templates. Classics, nose riders, and "pigs" have "parallel" lines dominating the nose and widepoint of their outlines. Their dominant parallel lines promote down the line trim and nose riding performing these tasks best when well positioned in the most critical parts of waves. These surfboards are designed for their outstanding trim and nose riding, not to be mistaken with a design priority of turning or carving a tight powerful radius.

Contemporary and performance longboards have strong parallel lines in the widepoint and midsection of their outlines carrying to a lesser degree into the nose and tail than they do in "old school" longboards. The shorter parallel lines matched with smooth sweeping curves into the nose and tail of the "new school" longboards creates an outline that has a unique combination of trim, nose riding, and turning potential.



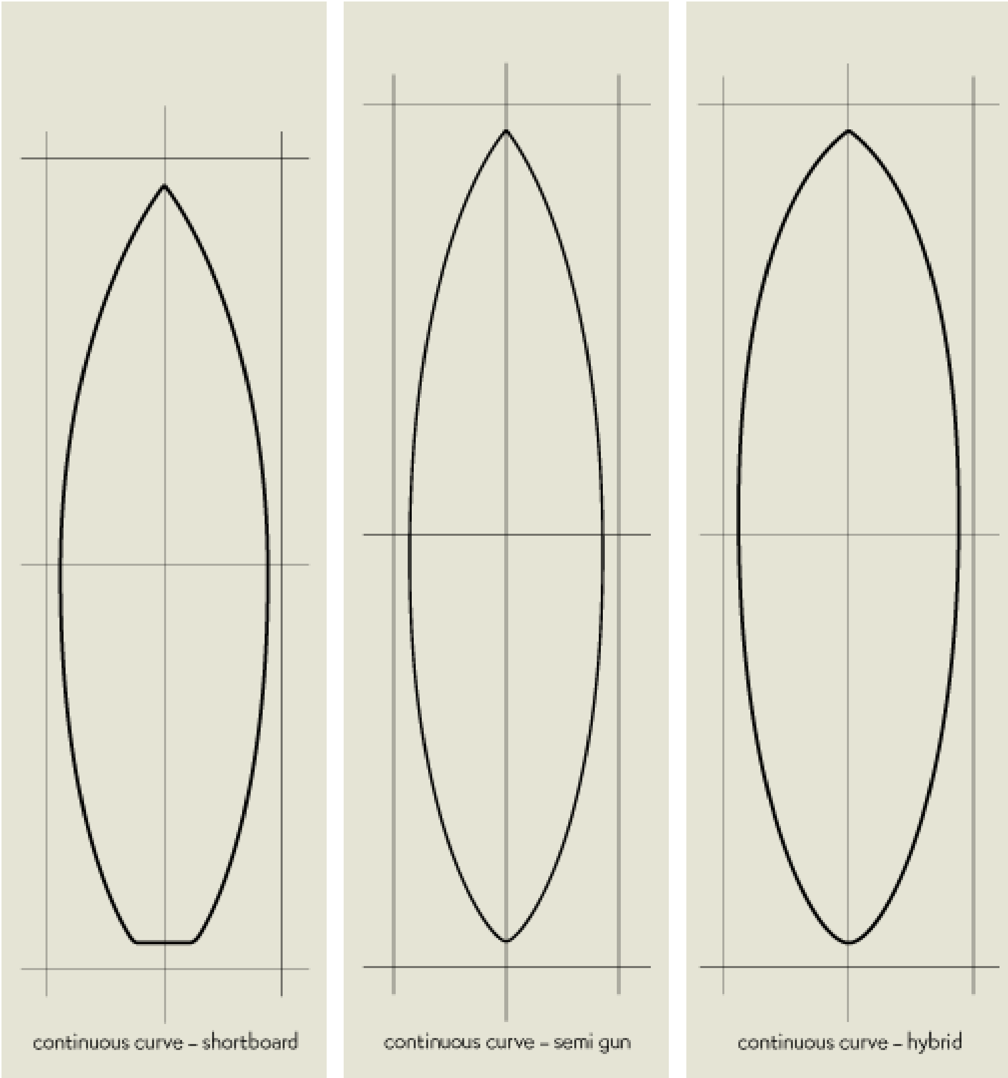
Illustrations of three parallel outlines, applied to shortboards, semiguns, and hybrids. Note the strong, parallel, nearly straight, curves carrying from the widepoint towards the nose and tail in each of the designs.





Illustrations of two parrallel outlines, applied to a "pig" and a "classic" longboard. Note the dominant parallel curves in the nose and widepoint of the "pig" with the smooth curves in the tail, and the even more dominant parrallel curves throughout the "classic."

Continuous curve outlines feature smooth, geometric (nearly elliptical), constant curves in the plan shape or template. They are common to longer shortboards, semi guns, and hybrids where one of the fundamental design goals is an easier tighter turning radius turn from a surfboard whose extra length would otherwise result in the surfboard¹s performance being relatively "stiff." Another common use of a continuous curve outline is matching it with a flatter more relaxed rocker profile in an average shortboards and hybrids. (When a flatter rocker profile is essential to the design goals of the surfboard or the preference of the surfer.) The curved outline matched with flatter rocker yields a surfboard that maintains acceleration and drive out of the turns and can still carve a very tight radius turn.



Illustrations of three continuous curve outlines, applied to shortboards, semiguns, and hybrids. Note the smooth, continuous curves throughout.

"Hybrid" outlines feature combinations of strong parallel lines and smooth continuous curves in the distribution and configuration of the surface area of the surfboard. They are common to all classes of surfboards. (Shortboards, semi guns, big wave guns, tow boards, hybrids, funboards, and longboards.) Typically, these outlines have parallel lines in the widepoint of the surfboard carrying forward towards the nose and aft towards the hips and tail. An elongated continuous curve carries the plan shape or template into the nose and a shorter curve or "hip" carries the outline into the fins and tail. This curve or "hip" may continue through the tail or straighten into the tail depending on the prefered performance goal of the surfer, shaper, designer. Matching various types of curves in the surfboard's outline arguably yields a very versatile and functional outline. This is the expected result of using the most functional and relevent curves as an appropriate response to the performance requirements and the other design variables (rocker, bottom contours, foil, rails, and fins) of a surfboard. (The performance requirements of the surfboard are a product of the skill of the surfer, the range of conditions it will be used in, and the intent of the surfboard's design.)

Outlines Referenced by the Configuration of Specific Elements

All these specific tail configurations may be applied to paralle, continuous curve, and "hybrid" outlines. Surfers, shapers, and designers should chose the most appropriate combinations to render the outline relevent to the design goals and intended use of the surfboard.

Roundtails

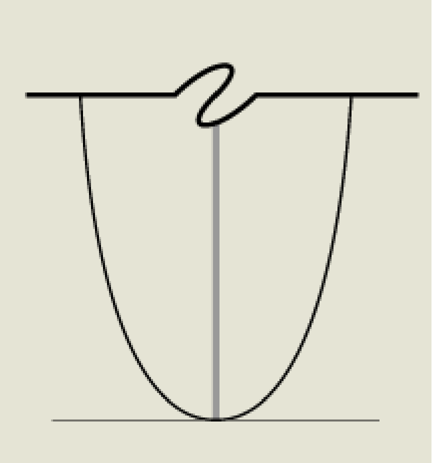
Tail template with the most surface area of the "round" and "pin" family. A full, elliptical line flowing without interuption from the area near the fins to the center of the tail (and not ending in a point !) of the surfboard. Common to small wave boards where the design and performance preference is to maintain significant surface area without the "corner" typical to squash and swallow tails. A roundtails will release a bit easier off the top of a wave than a squash or swallow, but will not be as easy to "square off" a turn in mid face or off the bottom of a wave.

Roundpin tails

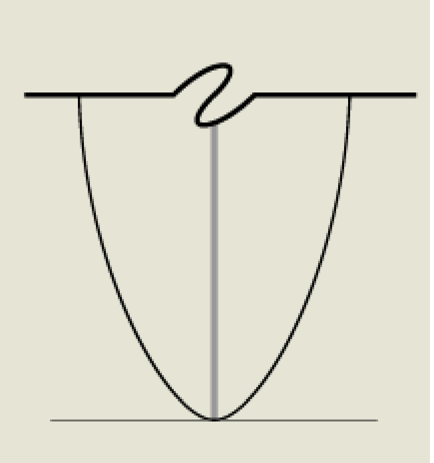
The most versatile tail template in the "round" and "pin" family. Moderate reduction in surface area of the tail with a similar elliptical curve flowing from the area near the fins to the center of the tail (may or may not end in a soft point !) of the surfboard. The smooth curves and the reduced surface area allow this tail template to maintain more control than the roundtail when performing critical maneuvers. The roundpin template is common to a wide variety of shortboards, semi guns, hybrids, and longboards.

Pintails

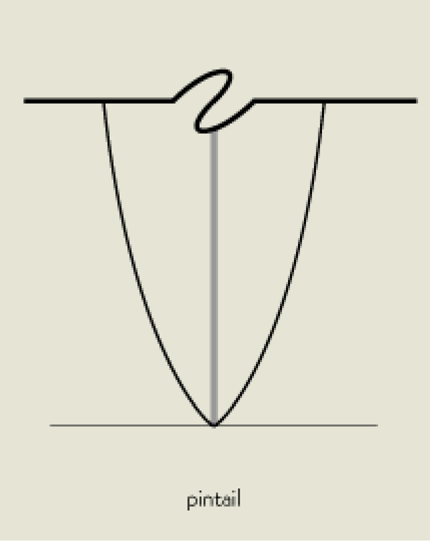
The most dramatic and the rarest member of the "round" and "pin" family. The pintail is based on the same elliptical lines of the other tail templates in the family with the curve reduced to nearly straight. Absolutely minimizes the surface area in the tail of the surfboard's outline. A great tail design where control is the primary design consideration, used almost exclusively by shapers and designers for large semi guns and big wave guns.



round tail



roundpin tail

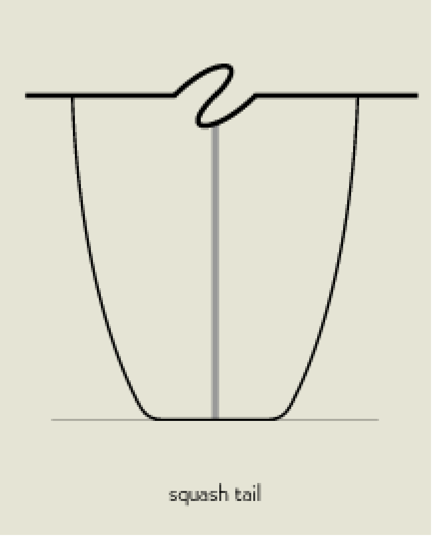


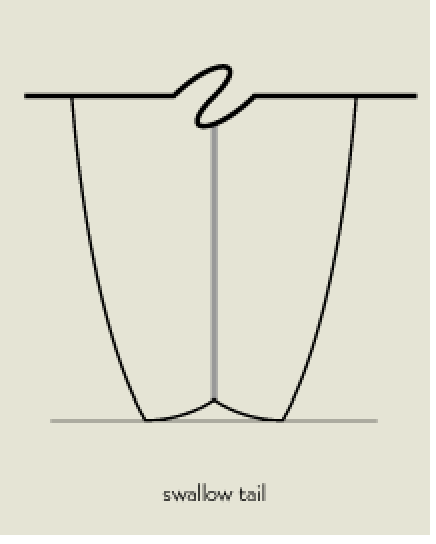
Squash tails

The most common tail template for shortboards, hybrids, and longboards. The squash tail combines maximum surface area (provides lift and generates speed) with a soft squared corner (for control.) The curves leading into the corner may be continuous or parallel. A continuous curve leading into the corner will have some of the smooth feel associated with the roundtail and the roundpin tail. A parallel curve leading into the corner will provide some extra drive and acceleration out of the turns.

Swallow tails

The swallow tail shares it's fundamentals with the squash tail. The layout of the swallow tail maximizes surface area, from rail to rail or side to side, in short and mid range shortboards then reduces the surface area between the corners with a cut out area that provides a great deal of control into and out of turns. Swallow tails are also common to step up shortboards and semi guns with narrower tails. The narrow tail with the cutaway between the corners provides maximum control in critical performance situation. (The width between the corners and the depth of the cut out can be manipulated to increase or decrease surface area thus balancing the effects of lift and control.)





VOLUME THEORY

What's the right volume ?

Virtually all the design variables involved in the shaping of a surfboard are dependent on the surfer, the waves he intends to ride, and how he intends to ride these waves. The volume or displacement of a shape is no exception. The volume of a surfboard is a product of it's overall length, and varied width and thickness.

First consideration is the height and weight of the surfer. Obviously a larger surfer requires more volume than a smaller surfer. Further, powerful surfers require more volume than light footed surfers as they will load their boards with greater apparent weight as they weight and un-weight their boards' rails.

Next consideration is the speed, power, and size of the waves the surfer intends to ride. At low speed in a gutless small wave most surfers can control a bit more volume. In a fast powerful wave most surfers require adequete volume to catch the wave, but not too much volume to keep the board in the water at speed. Varying the distribution of volume is a huge asset in all conditions, but it's critical and essential in a fast and powerful wave.

Last consideration is how the surfer intends to ride waves. The more demanding and critical the maneuvers a surfer wants to perform, the less tolerance there is in varying from correct volume. The less critical simpler maneuvers a surfer may want to perform allow more tolerance in varying from ideal volume. It's important to note, however, that more precise volume will enhance any surfer's experience in the surf.

These factors considered, there remains the most basic theory of volume which applies to all situations. If you've got too much volume in your board you'll probably go real fast as you'll always be planing around on top of the water. But, you'll lack control because you simply won't be able to get enough board in the water through your turns. If you don't have enough volume in your board you'll always be able to sink a rail for control through turns, but the rails will overload and you won't have any speed coming out of your turns. If, however, you've got a correct amount of volume well distributed in your board you'll be able to weight and un-weight the rails of your board controlling and generating speed out of your turns.

GENERATING SPEED AND POWER

Boards that find the power source in waves

Today's surfboards are the result of decades of surfing, shaping, and design. They generate and control speed and power in waves from two to thirty feet. They provide recreational joy and professional competence to a wide spectrum of surfers. Through a combination of intuitive ideas and deductive reasoning they have evolved into the variety of fine tuned boards available today. It's up to the surfer's and shaper's imagination and logic where the surfboard will go from here.

Surfboard design is a simple combination of variables. These variables may seem overwhelming to some. They are anything but overwhelming, once you identify and become familiar with them. Generally, these variables include the template, rocker, foil (thickness flow), bottom contours, rails, fins and their placement, and the "glassing" of the board. Some of these variables are more significant than others, but the single, most significant, and often overlooked variable is the synthesis of all the variables. All the design variables and elements must work with each other to achieve optimum results.

Without motors, paddles, sails, or any other external source of energy, speed and power - the essential components of high performance surfing - are achieved with the board's design, the surfer's board management, and the waves. The one element that makes surfing a reality is the wave. Without waves, there is no surfing.

Surfers, shapers, and designers recognized from the outset of the sport that boards developed more speed and power in bigger and or better waves. Such waves through size and or quality provide the resource to the design equation that makes boards fast and responsive and allows them to accelerate and turn on demand.

It took decades to recognize that even the smallest waves had "critical" sections or areas within that also generate speed and power. Over those many years the primary design goal of a surfboard was rarely to fit easily into these "critical" areas where they could tap into the greatest potential energy available in a wave. The surfboard was a high volume, maximum surface area, relatively flat planning device. They were so bulky and awkward they fit into the tight contours of the critical sections with great difficulty. Generally, these boards, even with the advent of polyurethane foam cores and resin/fiberlass skins, shortboards, and tri fins (Thank you, Simon) were unable to access the greatest energy source of most waves.

It's often necessary to look beyond as well as push the limits of the fundamental variables of surfboard design to achieve quantum leaps in performance surfing. Further work within the variables is essential for fine tuning these quantum steps. Thus intuitive ideas and deductive reasoning contribute to surfboard design.

Shorter boards with reduced surface area and increased rocker find themselves forced comfortably into the critical sections of waves. In these critical sections, where water moves at it's greatest speed and power up the face of the wave, bottom contours and rails pour energy into boards. The more powerful the wave and the better the board fits into the waves power, the greater the potential for a surfer to generate speed and power into his surfing. This realization and the fine tuning of the design variables of contemporary surfboards are responsible for the current high level of performance surfing.

Unfortunately, the low volume, minimum surface area, more rockered surfboard presented surfers, shapers, and designers a new problem to overcome. These "glass slippers" sped out of the critical sections of waves and quickly and often bled off their speed and power. Subtle increases in surface area and thickness and moderation and evolution of rocker and bottom contours yields a surfboard that still taps into the energy of the critical sections of a wave and maintains the speed and power through the less critical sections of a wave.

Surfers who chose to ride boards with templates and rockers that fit easily into the critical sections of waves, and have sufficient surface area and volume, achieve the fastest and most powerful surfing you will see.