

MICHAEL HALSBAND

The pioneer of high-performance surfing integrated the flex patterns of his fin and board over 40 years ago—something the rest of the surf world is still trying to do.

George Greenough, Byron Bay, Australia

George picks up the phone. “I’m just in from the garden,” he says, and I ask if this is a good time to talk. “Well,” he says, “what do you want to know?” His answers come quick, off the top of his head—50 or more years of practical, applied knowledge readily accessible.

CHRISTIAN I was thinking of the sketch that Bob McTavish did of you pointing out the characteristics of a yellow fin’s tail fin, and just what a straightforward and natural place it is to look for inspiration.

GEORGE Everything I’ve learned has all come from fish. I had a look at a lot of fish and that’s where I learned about flex

SOUN

and everything. It’s the same thing as designing and modifying swim fins. You look at different types of fish and how they perform in the water—you look at that performance for what you’re looking to get either out of a craft or a swim fin.

CHRISTIAN It’s an intriguing concept because it seems the answer is right there, but then, of course, to replicate what you see in nature is another thing. Where should people be looking in terms of the development of fin designs—materials, templates, foils?

GEORGE As far as materials go—look at carbon fiber. There are about 20 different types of carbon fiber available. The standard one everyone uses is the T-300. I’ve used a T-700 that’s got 30 percent higher tensile strength and 30 percent longer fiber elongation than T-300, and it’s slightly stiffer. So all your little things have to be changed if you’re using it, depending on what you want the material to do. If you look at a Thruster fin, it’s a low-aspect fin; it can be made out of anything—it doesn’t have to be a very strong material—[but different materials begin to make sense] when you’re getting these narrow, high-aspect fins that are highly loaded at times, like windsurfing fins when you’re jumping and landing sideways, all this kind of stuff where you’re using a completely different fin design for high speeds.

CHRISTIAN There are a lot of technical considerations.

GEORGE It’s not technical necessarily. To start with, what do you want to put the fin on and what do you want it to do? Then you start looking at materials to get the optimum performance. Plain old ordinary fiberglass makes very, very good fins, you know? You make the same fin out of carbon, it could be too stiff and not work as well, or it could be too thin and change the foil ratio.

I can make a very educated guess at what works. If you and I were on a racing team and rode 500cc Grand Prix bikes, what I would probably want my bike to feel and what you would want to feel would probably be

DINGS IV

A Fin Study with 11 Professors of the Craft

COMPILED BY CHRISTIAN BEAMISH AND DEVON HOWARD ■ PRINCIPAL PHOTOGRAPHY BY DEVON HOWARD

different...it's all up to the individual operator of the craft, and [getting back to surfing] that has to do with the flow ratio of the fin and that will change all that aspect—in how much it flexes, in how much it bends off.

You've got the whole variable of what's going on with the board and how the person rides it...there's no one thing that suits everybody.

CHRISTIAN And there are craftsmen here and there—you're certainly one of them—who are tinkering in the woodshop on their own design ideas.

GEORGE You don't necessarily have to have a woodshop; you can be tinkering anywhere with it, you know? You can be living in the back of a car and take your fin out and tune it, or buy a slightly bigger fin and cut it and reshape it to whatever you want—I've done that before. I want a new flexi-fin. I just go down and there's a longboard fin that looks pretty close to what I want, take it back, put a new outline on it, reshape the outline, and redo the foil. Then you've got a new fin and it was mostly shaped for you.

That's what I do with swim fins; I reshape. Most of the time I can't find a swim fin that I like out of a box. I reshape fins. I get them tuned to exactly what I want them to do—the push I want for when I want to accelerate to catch a wave versus the cruising. You've got to have a fin that's efficient in both realms.

CHRISTIAN None of your work has been done on a CAD machine, has it?

GEORGE No, I don't know much about it. Look, I've got a computer here to use, but it's a headache.

CHRISTIAN Would you say your technical work is led by intuition and observation?

GEORGE Basically, it's what I want to feel. I go out there, and if I've got a new board or something and it feels like it's pushing—the fin's too big, or too flat a foil, I modify it. And that's the hard thing. Let's say I did something for one of the current hero surfers, is the guy going to be

able to relate to me as a mechanic? If a surfer's not doing it himself, he's got to interpret what's happening with his equipment to a person that functions as a mechanic. But this is way up on the high end of surfing; no one ever bothers with this, basically.

You can pretty well see [the characteristics of a board] and you can feel it, but if you want to get real technical about it, which I do sometimes, I'll use a dial micrometer and a weight if I'm tuning the flex of a board; that will give me a curve on a piece of paper. I'll look at the curve and go, "Well, the curve's got a bump in it here, the board's too stiff in this one area, and I'll take a little off until I get that parabolic, accelerating curve right to the end of the tail. Same thing with the fin. They both have to work together—the flexible fin has to work with the tail of the board.

CHRISTIAN What kind of surfing craft is catching your interest these days?

GEORGE Well, I windsurf, so I've got a big spoon with a flexible tail that I use a windsurfing rig on. I mat surf almost all the time.

CHRISTIAN And that's finless surfing.

GEORGE That's it. And you adjust the air pressure. It's a real interesting thing because it's an infinitely variable shape. Same thing with a spoon—remember with a spoon you've got variable rocker. Same with the windsurfing spoon. It's 7'3" x 18 1/8".

CHRISTIAN Powered by a big sail, I'd imagine.

GEORGE No, not a very big sail. I design my own sails based off aircraft wings. They're a double surface and a variable leading edge, so the sail changes shape according to the loading. The leading edge will change shape—a very thick leading edge, like what they use on aerobatic planes at low speeds, to a thinner leading edge when you want to penetrate at higher speeds.

CHRISTIAN That's like fin dynamics, too.



Gerr with the magic 6½" fin cut from a panel of carbon fiber Greenough supplied in the early '90s. In everything from five-fin Bonzers to 9'0" widowmakers, the fin has been "the one."

GEORGE It's just like tuning a race car; you're looking for that one-tenth of one second more speed. The difference between getting it right and not getting it right can mean, OK, you need 60 feet of projection out of a bottom turn to get around a really big section. Fifty-nine feet won't do the job, and if you're not quite right, you don't quite make it and you straighten out and get pummeled. If everything was just right, you might just slip around the corner where you can pull in. There's the difference between getting it 95 percent of the way there and getting it 99 percent—there can be that foot of difference. In a contest, that could cost someone ten grand.

Most of the fin systems are non adjustable. So, if I've got a board and something doesn't feel quite right, I can't move the fins, I don't have the option. At least the Red Ex box you can move the fin back and forth about half an inch. [Fin systems] are fine for traveling, and fine for interchanging fins, but if that thing happens to be a quarter-inch too far forward or too far back, it's not going to feel quite right, and you're never going to know.

Brad Gerlach, Leucadia, California

From amateur phenom and ASP performer throughout the '80s and early '90s to his current place in the top ranks of the tow-in cadre, Gerlach has always pursued his surfing with commitment and a willingness to experiment with his equipment.

DEVON What has been the most surprising or unexpected discovery you've made regarding fins?

GERR George [Greenough] piqued my interest in 1991. Then I met up with Curtis Hesslegrave in 1995 and he taught me all kinds of shit too. What George really taught me was about flex patterns and what a fin does. He'd take one out and say, "This one I laid up 90 degrees, so it doesn't bend in the tip, it just twists in the back. This one I laid up at a 45-degree angle," that one bent at the tip and doesn't twist. And then he goes, "This one over here is a 70/30 ratio," and on and on with the math. So that was the biggest thing, the light went off in my head. Then, on top of that—and this is key—he said, "You can have this stuff going on with these fins, but it's how they're

attached to the surfboard that's really important. Because if they're bending around on the foam, if they're not solidly attached, you won't get a true read or feel of what the fin is doing." If it isn't attached to the surfboard, à la some of the fin systems out there, it's just going to bend from the base, and you can get flex in the tip, but you're going to get a totally different personality coming off of the board; basically, you'll have delay.

DEVON Most of the guys on tour have glass-on fins, do you think that's a good thing?

GERR They're getting more drive out of their boards with the glass-on fins. The fins on certain systems were too flexy, and they weren't getting the kind of resistance that a powerful surfer needs. The fact is the sport isn't sophisticated enough yet. But when it gets further along, let's say when it's the U.S. versus Brazil in the World Cup [of surfing] final...don't you think all these people are going to focus on the highest possible performance they can get? Only when people come together collectively for a common goal—like winning—will [performance advancements] happen. I don't know if George or Curtis have said this, but there's too much private enterprise and commerce involved with surfboards.

DEVON It seems, from what you're saying, that people still aren't giving the fin enough credit for performance.

GERR No, they're not there yet. The application to the surfboard is not there. If you get a surfboard are you going to take it over to Curtis Hesslegrave and have him foil [your fins]? That would be the best thing you could do right now. It's not going to happen unless Andy Irons says, "Hey, Curtis, I'll pay you 'x' amount of money to foil the fins on all my boards." It takes a guy who's really proactive and opportunistic to do that.

DEVON Slater's kind of done that.

GERR Well, he has and he hasn't. He's been trying to make FCS work and he gets paid a lot of money for that. I know he fiddles around and has his theories, but he's the one guy who: (a) could afford it and (b) really make an impact. We all got to make money; Slater doesn't seem to have a problem in that area. But it does come down to motivation.

DEVON I'll probably leave that one out....

GERR You don't have to leave that one out. I'm not afraid of Kelly saying something to me. It's true. All of us, as surfers, have a certain responsibility to endorse the products that we believe in. Because that's what we're doing when we put our face and name to a product, we're telling people "I use this product because I believe in it." A lot of people look to him and say, "What do you think, Kelly? Is this really the way to go?" He's a major, major influence. He may totally believe in the system he uses, but I can tell you right now, and this is totally arguable, a lot of times I can see his fins flexing too much for how much power he has. I understand what flex does to a surfer. I'm lucky enough to have talked with Hesslegrave and

Greenough, so I watch Kelly surf and here's what's so amazing about him: He's probably the best surfer in history at recovery....

It's OK to say this kind of stuff. I wish the sport was more objective, and people weren't afraid. I'm talking constructive criticism here. If you look at all the sports, they get up there on the sports channels and say, "No, that wasn't a good call," and they're not worried about a guy coming and finding them somewhere and punching the guy. Just say it. It's healthy for the sport to have checks and balances, it keeps people on their toes. Here's a question: Why are Mick Fanning and Joel Parkinson—who are in my opinion both better than Kelly, faster and more progressive—using glass-ons? I guarantee you that either one of those guys could go to a fin system company and make a lot more money than you and I make in one deal. But they're not. And why are they not? Because they don't believe in it.

DEVON What about the fin that you got from Greenough?

GERR George gave me that [carbon fiber] panel in 1993, and I got Mark Thomson to cut it out. We drew it from a fin template that I thought looked pretty good. I had some five-fin Bonzers, and I rode them with the fin. I was also playing around with widowmaker-type boards, and I tried the fin in those. I remembered what GG had said about the lay-up and the flex in the tip, so we made sure to cut the fin out [of the panel] at a 45-degree angle in relation to the weave of the cloth. The difference in performance between the regular glass fin that I modeled the carbon fin from and the GG fin was night and day.

I still remember being in the '94 Kirra pro, and I got a wave before the horn. The board was a 6'6" [five-fin Bonzer], which is kind of big for head-high Kirra, and I got a 9.5 without getting tubed. The board just had this incredible drive and sweet spot on it. I had it in Hawaii, and I got this one—not quite at Backdoor and not quite OTW—and I pulled into this tube late, and I was pumping inside this barrel, and it got to this point where I couldn't see. It was like a chandelier in there and I shut my eyes just waiting for the big whollup, and the board took me out of the tube, basically. It just kept going, it didn't get sucked up the face, and I think that was a testimony to the five-fin Bonzer, and also the fact that the fin was so responsive and good. Then in '97-'98, I started surfing Todos with Taylor Knox and Mike Parsons, and I got Doc [Lausch] to make me boards with small side fins like widowmakers, and I used that 6½" fin in the back of a 9'0" and a 9'6", and my board responded really well.

DEVON Not to be a pessimist, but it seems like we're still pretty far from getting our fins dialed in.

GERR The first thing you need to have is a strong fin-box application to the surfboard that has integrity. The second thing is to have superior materials in our fins.



Curtis Hesslegrave and Bill Bahne drawing foils. In the shop (right) inputting computer-generated designs. Curtis works with NACA (National Advisory Committee for Aeronautics) source codes to produce ever more precise fins.

The third thing you need is an expert like Hesslegrave to shape and foil the fin. And the fourth is to be able to test it with someone like Parko or Fanning.

DEVON That's not happening yet.

GERR Because it's mostly been about commerce. It's commerce driven instead of performance driven.

Bill Bahne & Curtis Hesslegrave Encinitas, California

Bill Bahne, the inventor of the production fin box (a design so simple and efficient that it has changed little since its early '60s inception), brought fin designer Curtis Hesslegrave back on board, and the two share their thoughts on computer modeling and the evolution of the "technically cambered foil" for surfboard fins.

BILL We do a lot of our production overseas, but our key stuff is done here. If you want a real fast turnaround time on design work, it has to be done here. All of our custom stuff is done here. A lot of design has been overlooked. What we're doing here is that Curtis is actively involved in the fine-tuned high technology. I think we've taken boards to a point that we've got to start extracting every bit of energy that's given to us and using it right. That's the only way you can get anywhere farther.

A lot of people say, "Well, it's just a fin." You've got your retro guys with their longboards and "bigger is better, uglier has got to be cool because that's the way it was in the '50s and '60s," but that's taking design work backward. We do different kinds of foils like hand foils and machine-shaped foils. And we develop a lot of our foils in resin transfer molds with different layers of glass over core-mat material. A typical hand foil is not as aerodynamically correct.

CHRISTIAN Curtis, you're credited with coming up with the "Vector" foil. Was that your work?

CURTIS It's inappropriate to use that term. That is a trademark term for a cambered foil.

CHRISTIAN Are cambered foils where your fin development has taken you?

CURTIS I introduced cambered foils into Thruster fins. Technically cambered fins we did initially with tow-in fins, and we did it in 1999. Then we went on to work with Laird and Derek Doerner and Gerry Lopez.

CHRISTIAN Were you able to bring lessons from the kinds of velocities that those guys were experiencing back to standard surfing fins?

CURTIS Here's how the sequence went: We were working with John Carper at the time and Peter Mel was riding for John, and it seemed to me that tow-in was a very good candidate for a highly technical fin. So we made some fins for Peter, and I focused in on what speed they were going when they let go of the rope (40 mph, plus or minus) and compared that to what we had done almost ten years earlier with speed fins for windsurfing—we set the world speed record for sail with Pascual Macca in 1990—and then I applied the technology we'd used for that. It was a huge breakthrough [for tow-in equipment].

CHRISTIAN Were those foils designed to channel or mitigate all that speed? At 40 mph, you don't need more speed; you need to control the speed you have.

CURTIS What you don't want to do is slow down. And you want the foil to bite solidly and cleanly and be as efficient as it can be so that you don't slow down. So it's the same goal in paddle-in surfing: You want the fin to be extremely efficient and have as little drag as possible. And you want it to do the job that you want done on that wave.

CHRISTIAN What does "efficient" mean?

CURTIS Foils produce power. How that power is produced depends on the type of foil you have. If you have a single-fin foil, that's a symmetrical foil when it's going dead ahead at zero degree angle of attack, it's not producing power—it's just cleaving the water. So you want it to be as efficient as it can be just splitting the water. As soon as you put [the fin] on an angle you start to produce power on the side you're angling toward, so the inside of the fin starts to suck itself into the wave, and the water just rushes past the other side and that provides hold. Extrapolate that [principle] out to all maneuvers, all turns, etc., and you're producing power all the time.

The foils opened up the tow world and it came directly from the speed [windsurf] work. 1986 was the advent of proper technical foils, and I initially worked with Chuck Stahl who had a computer program that provided me output of foils. Then, I was introduced to a guy who was a senior scientist at the NASA wind





It's all about the flow—Rusty interprets four-fin dynamics. “I think quads are insane,” he said. “I have fond memories of some I built in '80-'82.”

tunnels in Palo Alto—the guy’s name was Ray Hicks. He kind of mentored me and gave me copies of what’s known as the NACA source codes. This program [pointing to a laptop screen, the words “NACA Generator” in the upper left-hand corner] has the source codes in it, and a guy made it for me in 1993. Now, this models all foils. We’d conceived of foiling surfboard fins as early as 1990, but it took until 2000 or 2001 to turn them into a product for surfing that was commercially available.

We’ve got a C & C machine like the surfboard-shaping machine; we just make fins on this one. We’ve moved from learning how to do this kind of work using templates and hand foiling to doing it completely in the computer and then writing the programs that have a machine make the entire fin.

Rusty Preisendorfer, San Diego, California

With an impressive team of surfers in his stable focusing on all aspects of wave riding from cutting-edge performance to the outer limits of giant surf, Rusty has not shied from any element of material or design in search of improving surfboard characteristics.

DEVON A few years ago you were very excited about Vector fins. What was it about them that had you so jazzed?

RUSTY I saw a lot of modern performance surfing evolving around fin failure. Why learn how to do tail slides if you could have a board that could do carving figure-eight turns as tight as you wanted? Curtis [Hesslegrave] talked to me about some fins he was making for some of the tow-in guys—specifically Laird [Hamilton]—that had “inner foils.” I had worked in the past with fins that had various degrees of curve on the inside. I always found them to be loose, but the downside was a lack of speed. Curtis explained that these newer cambered foils actually had a slight concave on the inside. Imagine looking down on a fish as it swims through the water—that’s how a cross section of one of these foils would look.

So I took some of them to Fiji in March 2000. The results were mind blowing. The foils with the deeper concaves were insanely fast right out of the gate and seemed to have no top-end limits. They also held power through cutbacks like no other fin I’ve felt. I called Curtis from Fiji and ordered more. These first fins were made out of G10, which is a dense, pre-preg fiberglass panel, primarily used for circuit boards, pressed to exacting standards.

DEVON Has there been a process of fine-tuning the Vectors?

RUSTY I felt that the Vector’s [inside] concave did not need to run all the way up to the tip. The geometry of the concave was making the tips too rigid and tracky. Most of the power comes from the bottom half of the fin. Finesse comes from the tips—control, adjustments, launch, spring, spill, and more are the things an experienced surfer feels and manages with the tips. I had Curtis and Vince [Longo, of Future Fins] work on a gradual fade out of the concave going toward the tip. It was magic.

DEVON Have any of the recent advancements in fin foils directly impacted your surfboard designs?

RUSTY I believe that having more efficient fins is allowing me to make the hulls more dynamic. The net effect is surfboards that are looser and faster. At the moment, I’m getting incredible feedback on EPS/epoxy quads with fins that have graduated cambered foils and progressive cant. Sounds like a mouthful, but with today’s improved surfboard-specific EPS foam and epoxies, I can build a very light, strong surfboard with great flex characteristics. Marry this construction with advanced fin technology, and you are looking at a quantum leap in board performance.

DEVON You always talk a lot about flex. How important is it?

RUSTY It is so crucial. Not just the amount of flex, but the quality of the flex. Where is the fin bending? Base-to-tip flex? Torsional flex? How quick does it rebound? Lighter surfers in smaller, weaker surf will usually benefit from a fin with softer flex. Softer fins will help the board to feel looser. It will help to initiate turns but isn't necessarily a dynamic solution. Soft, as in "bendy," plastic helps start a turn, but there isn't a lot of return. You may find yourself double pumping to try and keep your rail set or struggling to project to where you want to go. Another symptom of a fin that is too soft is that it will wash out on turns, especially on cutbacks or coming off the top. Coming off the top you should be able to accelerate. A soft fin will slip a little and throw your timing off. A quality glass or composite fin may have a firm base but a "softer tip," and what you should be looking for is a crisp rebound on that flex. A fin that is soft, generally speaking, spills a lot of the power you put into a turn and slows reaction time out of the turn.

Larger surfers in more powerful surf will be happier with a more rigid fin. However, too rigid is no good. A turn is a complex thing that takes everything working in harmony to maximize the return on effort. A good hull will have certain flex attributes, and it should be married to a fin with complementary qualities. As you load the board in a turn, so too should the fins be storing energy. As you follow through on your arc and start to unweight, the power of the wave and your energy being returned should flow together. You should feel a launch out of the board and the fins that should be seamless.

DEVON Most of the touring pros today use glass-on fins for their competition boards, but the average, everyday surfers predominately use removable fin systems. Which do you prefer?

RUSTY With the pros there are several considerations. One is feel related, and most will tell you this is the most important thing. Another is structural or maintenance. Box failure can be devastating and difficult to repair, especially on the road. Glass-ons, on the other hand, are usually not that difficult to reinforce or reattach. A lot of pros simply feel that glass-ons add something—however difficult to articulate—to the board's performance. There is also an ongoing dialogue about the effect of having roving or a fillet at the base of the fins. Many competitive surfers feel that the radius at the base of a glass-on fin adds some intangible element of flow, or that the fins being glassed-on creates a "oneness" in terms of how the sum of the parts is greater than the whole.

Personally, I think a lot is lost in the inability to fine tune performance by changing out fins. Years ago, a visiting pro who was in town for a major tour event got a new board and I could tell he really liked the hull, but the fins weren't quite right. We cut those suckers

off and glassed them back on four different times in four days before he finally declared they were right, and he ended up getting a good result in the contest.

DEVON A lot of today's fin science seems to be coming from the big-wave world, mostly tow-in surfing. What about big-wave paddle-in fins? Is there much happening in the way of advancement there?

RUSTY Since the early days of the tri-fin, I have felt that for longer boards, narrower tails, and bigger, more powerful surf, having a bigger back fin and smaller front fins is the go. If you start with small-wave boards, most surfers will benefit from having larger front fins that create a lot of lift and less fin aft. As I design boards for surf that is starting to get into the double-overhead range, at some point I recommend a transition into a more dominant back fin. The really big paddle-in boards, I usually go with what Flea calls the "cock and balls" setup. Big fins in big waves help maintain control through surface chop. That has been traditional thinking. Taller fins have a lot of frontal area, which translates into drag.

I really think we will be seeing more quads ridden in bigger surf—especially when surface conditions are reasonably clean. They are faster, more maneuverable, and hold better. At high speeds, well designed foils are more efficient, which will allow for even less depth and area and result in less overall drag.

DEVON Speaking of four-fin boards, what are your thoughts on their recent comeback? Is it fashion or function?

RUSTY I think quads are insane. Some of my team guys started asking for them about 18 months ago. I've been riding them almost exclusively for the last year and a half. I'm just coming off a good Indo boat trip where half the boards on the boat were EPS/epoxy quads with Vector-style cambered fins. Everyone was psyched. They work great in slop. They work great in perfect waves. They are fast and carry well through the flats, they hold on a steep face, and they accelerate through turns, especially cutbacks. Will we see one being ridden in a WCT? Someday. But for now, the average guy should look seriously at having a go on one. They are just too user-friendly to pass by.

Jim Robertson, Encinitas, California

In 2001, Robertson purchased and redesigned the Lokbox fin system. For well over 15 years, he has repaired, polished, hot coated, and finned thousands of boards for Moonlight Glassing, Tom Eberly, and others. Robertson is also known for four-fin, semi-gun ripping at Swami's and Black's.

DEVON To your way of thinking, is the Thruster cluster still the best setup for contemporary surfing?

JIM Well, that's tough to claim, but if you take a look in the shops around Southern California these days, you see a huge diversification going on with stock surfboards, especially with quads. It's happening in other places as well



Jim Robertson and the Turbo fin setup: “We’re still experimenting with angles and positions—proper flex is key—but one thing we definitely know is that they go really good on wide-tailed fish boards.”

like Europe and Australia. So, I wouldn't be surprised to see the quad thing start replacing the Thruster for many people. Nathan Fletcher rode all quads at Pipe last year—and his surfing is at the forefront of cutting edge. And look at Cory Lopez; he's on one of the latest mag covers boosting a pretty ridiculous air. He's riding a fish on a wave with some power, too. I'm sure he could have good results on a shortboard quad setup as well.

DEVON In the mid-'80s and on up to just a few years ago, quads remained alive among only a very small number of obscure proponents. So why do you think they are making such a huge comeback?

JIM I think it's because the quad is a very relevant and amazing design. When combining proper board outlines, fin templates and positioning, they can go just about anywhere a Thruster can. With two fins on the rail, they love to ride up on the wall and carry speed. This speed comes partly from the hull design, but it's mostly due to the tremendous amount of drive created by the quad's fin placement. Having two fins close to the rail creates more drive—by simply having more surface area of fin on the rail—thus, more speed as you fall down the face

and engage the rail. When riding a highline or bottom-turning on a Thruster, only one side fin is truly getting that maximum drive effect, and the trailing center fin is only partially engaged in the water. The quad has the side and the trailing fin near the rail, so both are fully engaged. I think it's this sensation of great speed that is one of the easiest explanations for their current popularity. They're also a versatile fin setup. They work in giant waves for tow and paddle-in boards, and they especially excel in our average, crappy everyday waves because they skate through the flats well and go rail-to-rail with ease. It's hard to deny the relevance of something that's that fun. And, it's exciting to think we've only just scratched the surface of revisiting the quad. I definitely don't see it going away again like it did years ago.

DEVON Guys like Jeff Clark and Anthony Tashnick are reportedly riding paddle-in quad guns at Mav's. What kind of feedback have you heard from those involved with the big-wave quad movement?

JIM The quad gun has been tested and used extensively at places like Maverick's, Dungeons, Todos, and even Pipe. But I doubt there is any one man that has tested the quad

gun design in huge surf more than Jeff Clark. He's been riding and building them for many, many years, and testing them with his team guys like Grant Washburn, among others. They ride them as big as you can paddle in out there and then switch to the tow boards when it's maxing. A lot of their tow boards are quads now, too.

DEVON What's the feedback on why quads work so well for a paddle-in gun?

JIM Jeff says that the outside bowl at Maverick's has such incredible suction up the face at the peak that Thrusters tend to want to go straight down and come off the bottom—thanks to that center fin aligned with the stringer. Thrusters almost fight you when you try to pull them up off the bottom and up onto the face. This can result in the lip landing on your head. Quads reportedly don't have this problem as much because all four fins are toed-in and all are placed closer to the rail. This allows the surfer to enter into his bottom turn when he needs to, rather than when the board allows him to. The quad setup also allows a big board to go rail-to-rail easier than traditional Thruster guns, and two fins on the rail gives more drive—or what some call lift—to more effectively help redirect the rail of a bigger board.

DEVON What are your thoughts on flex?

JIM A few years back, Damien Hobgood convinced me of the importance of flex when he described free-falling out of the lip at Pipe on a triple-overhead face. He was using the RPF (Rusty Performance Flex) four-ounce fiberglass fins. As he free-fell and landed mid-face, he felt the fins flex and drift for a split second, then flex back and reconnect. At first, I wasn't sure this was such a good thing until he said that if the fins were stiff when he landed, he would have just gotten pitched off the board. But they gave him that split-second moment of recovery so he could stay on the board, and as they flexed back he was shot out of the tube. I think flex is a largely overlooked aspect of board performance that should be explored further. With fin systems it's real easy to do that.

DEVON What role do you see fins playing in the progression of surfing?

JIM A large one. I think some surfers are beginning to understand fins more and more and are now more able to apply what they've learned to their boards. To me, that's some serious progression right there. Also, the fin system market is getting more and more competitive, which will keep all of us fin guys striving to find that holy grail of fins—the one that works for everyone. Until that happens, though, the real advancement will be when the average surfer learns what works for them on a particular board and when and where they should use it. The pros will always get the latest and greatest in design advancements, and feedback from that will trickle back to us more average-level surfers so we can all constantly push our surfing closer and closer to their level.

Chuck Ames, Goleta, California

Ames got his start in fin manufacturing after he bought a fin business operating out of a water tower in a bean field in Oxnard in 1979. Working with Al Merrick and in close proximity to the Campbell Bros., as well as Greg Liddel and George Greenough, Chuck has developed an eclectic and wide-ranging fin catalog that reflects the evolution of the performance shortboard and classic longboard.

CHRISTIAN Would you consider most of your designs to be the result of field-testing, or did you work out the mathematics?

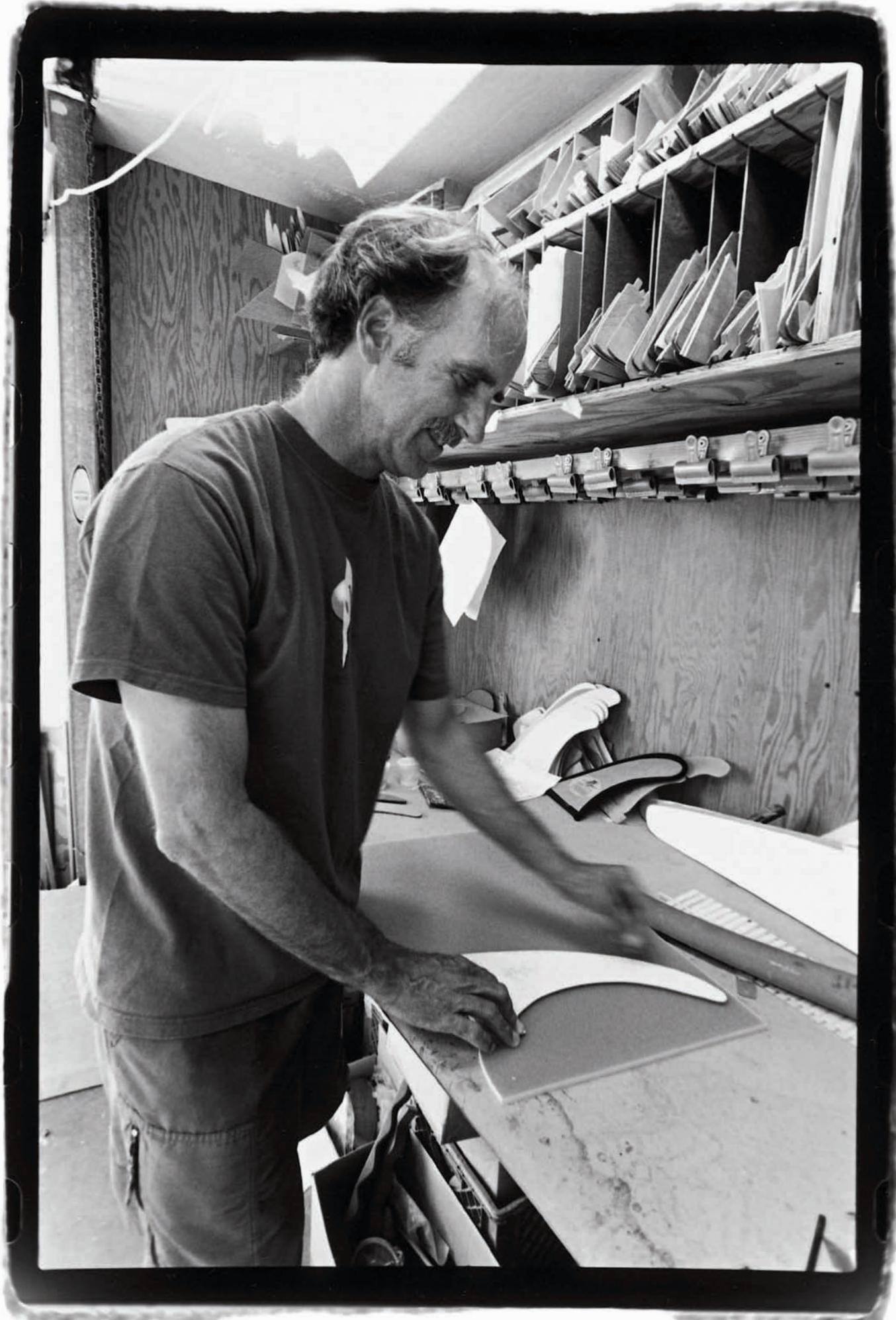
CHUCK We worked out the math in a relative way. We knew something and then pushed that benchmark. We measured area—even volume as far as displacement. The area of a fin became very important, and the aspect ratio [the height versus width] and the rake, too. The more you rake a fin, the wider it is, the more area it has, and it becomes a lower-aspect-ratio fin. So the most efficient, fast fins, as with airplane wing design, are really high-aspect-ratio fins, which are just little knives that stick out, but they don't provide a whole lot of stability. Windsurfing got to higher- and higher-aspect-ratio fins, and that was a really cool thing. We were breaking speed records—windsurfing for a while was the highest-powered craft with a sail on it, faster than a boat. So to do that with the fins I was shaping was really cool. I learned a lot about where foils should be placed on a fin, and thicknesses, and subtle changes in area. Mathematically, we did those equations and had a lot of charts with those analyses on them, but bottom line, pretty much it was all trial and error. There's a book called *The Theory of Wing Sections*, where we drew a lot of our foils in windsurfing from what was published in the late '40s. [The book] is basically a bunch of aerodynamic equations that came out of the military.

CHRISTIAN So you did end up studying math.

CHUCK Oh, yeah, the foil sections are called NACA foil sections, and we referred to those. There are about three or four of them that are totally applicable, and, still, to this day, I base a lot of my foils on those foils. They're just timeless equations. They work. They describe different components of lift—you can have a really fat leading edge that will be slow, but you can go vertical on takeoff. If you have a really surface-piercing, fast leading edge, you're not going to get a whole lot of lift without a whole lot of thrust.

CHRISTIAN How did you determine that a sharp leading edge and flat surfaces actually produce drag?

CHUCK It goes back to Malcolm Campbell or Simon Anderson—those are the guys who started putting fins at angles in the mainstream. I'm sure there are predecessors to that, but somehow they figured that if they tilted the fins and toed them in, turns became easier. Again, it's trial and error—it's form and function. The early Thrusters had all kinds of positioning issues, people



didn't really know. For about a year there, there were all kinds of three-fin configurations until it standardized. It's amazing how quickly it standardized. Twin-fins helped all that. Really, we learned tilt and toe-in from twin-fins. People saw MR redirecting on a dime, with power, and you could never do that on a single-fin.

CHRISTIAN Coming up to the present day, what is Resin Transfer Molding?

CHUCK It's a way of making a fin without grinding it out of sheet stock, which is where we've been from the beginning of fin manufacturing. You use a mold to make the fin: You insert material, let it cure, open mold, and cycle again. With RTM, you're cutting out a bunch of glass and setting it up to fit in the mold. Or whatever kind of material you want to put in the mold—that's the cool thing with RTM. You have repeatability, which is a really big thing, and you have glass weave orientation, which affects the flex of the fin. You can have carbon fiber or regular glass or core-mat that keeps the fin really light. Any fin company has ultra-light, RTM fins. The unbroken fibers of RTM fins make for a whole different way to approach flex and twist.

CHRISTIAN Do you have production outside of your factory in Goleta?

CHUCK Yes. Most of our production is outside of our factory. I think a fin made overseas is a different kind of conversation than boards made overseas. The technology and the cost of making a fin is totally prohibitive to be in production in the U.S. Overseas, they have a bunch of employees with really nice machine shop setups, and these are pretty state-of-the-art facilities making our fins for us. I had up to 25 employees between '95 and '97, and we still needed more machines—the cost was becoming astronomical.

CHRISTIAN Does overseas production become an issue in terms of design progression? Do you have to order up big production runs?

CHUCK Our deal is that we're in really tight with a few manufacturers overseas and have been for a long time, so they're working for us. They're looking to us for what's the next thing, and they're open to listening. We go over there and show them setups. We make the molds for our RTM fins and send them over there. We don't buy anything that they have over there for the open market—it's my entire product. Unfortunately, I don't own the factories over there, so it's not proprietary information, and it gets filtered out to any other company that might come along.

CHRISTIAN So someone could simply copy a design?

CHUCK Pretty much. But you could say that with IBM computers, you know? You have to have a huge background to be able to come in off of dry land and duplicate it. I get frustrated with how long it takes to develop products. These RTM fins for instance: I've been working on



(above) Got flex? A fin designer's work, while generally more subtle than the board shaper's, has a profound impact on performance. Chuck Ames (facing page) in the library.

them, have known that they could be great fins, and it just took much longer to evolve than I ever hoped for. I have a million ideas for the next fin; unfortunately, I'm constricted by time.

CHRISTIAN With as radical as surfers are getting these days, it's hard to imagine surfing going further, but it's always gone further.

CHUCK Exactly, so it's really cool to just keep going along, and keep pushing those people along. Same thing with the tow-ins. I've loved making those tow-in fins, and we've got to use GIO material [epoxy laminate] because we're getting into the higher speeds and higher loads. That material lends toward a more precision foil. Materials and craftsmanship are the number one elements that make these guys surf at higher levels.

The conversation turns to hulls and flex fins.

CHRISTIAN Greg Liddle recommends sanding the hull with wet and dry sandpaper after you've ridden it for a while.

CHUCK Do you know why he says that?

CHRISTIAN No. I've reached the limit of my hydrodynamic knowledge.

CHUCK It's so you get better laminar flow; you get better water adhesion to the surface of your board and less turbulence. They really worry about that in aircraft wings. A wet-sanded board is probably a better finish than a highly polished board. You just want the water to attach to the surface of whatever it is [fins or surfboard bottom] so it's not creating turbulence. Turbulence is drag. Any time you introduce air under there you're slowing yourself down.



Michael Durante and Andy Dovell at the Surf Hardware offices in Sydney. The H2 is the result of well over 100 combinations of fin templates and foils that were boiled down to what worked for the broadest range of surfers.

Michael Durante and Andy Dovell, Sydney, Australia

Durante and Dovell are two designers who have been involved in what may well be the most extensive and methodical study of fin dynamics to date. The result of their efforts (along with an extensive team of co-designers) is the futuristic-looking H2, which shares a similar profile with the Canard airplane wing that shaper Rich Pavel incorporated into his Canard quad-fin setup in the 1980s.

CHRISTIAN What have the past couple of years' worth of testing and design produced?

MICHAEL A lot of the research that went into the H2 was about water flow, how the fin interacts with the water. The research and development that we're focusing on now has a lot to do with the flex of the fin.

CHRISTIAN Is experimenting with flex characteristics the next step after working out your template and foil?

MICHAEL Yeah, that's right. There are two parts of fin design that we focus on: One is the purely hydrodynamic aspects of the foil, and the second is the other handling characteristics of the fin, which are dictated by the outline, and

all the different angles that the fin sits on the board. But further to that is this Pandora's box of flex.

CHRISTIAN How has your controlled tank testing of fins connected to the trial-and-error process of field-testing?

MICHAEL I suppose the most penetrating truths really do come out of the field-testing. We do it in a way that is absolutely blind testing. We'll take a set of fins down to the beach, and we have a baseline fin that we're referencing everything off. We have a number of surfers that go out and have no idea what they're riding. We videotape them and interview them after they come in, and that's when you start to see [what's working]. If there's a range of surfers that are saying the same thing about one fin, you can really see there's some truth in that. The ultimate truth is when you can marry up the feedback with what you're seeing in the tank—you're marrying up the science and the field-testing.

The discussion continues with Andy Dovell, an American emigrant to Australia with a background in America's Cup racing design, as well as advanced degrees in mechanical engineering and naval architecture.

CHRISTIAN Andy, in designing surfboard fins do you have a radically different set of criteria you work with compared to sailboat keels?

ANDY Yeah, you do. With the yacht, you can include a lot of high-performance components, in other words, aspects of design that will produce something that's very fast, regardless of how it handles. With surfboards you still have the same elements, you're still trying to create a design that has less drag, which creates more speed, which gives the surfer more freedom to make choices. The balance between something that potentially is very fast and something that handles well is totally skewed with surfboard design. [Surfboards] must handle well, and you're willing to give away a lot of potential performance in the name of handling characteristics.

CHRISTIAN Is the tank testing something you observe, or do you have instruments that do the calculating?

ANDY We run visual experiments, which are flow visualization techniques that are the equivalent of injecting smoke into a wind tunnel. In water, you inject a very fine stream of either dye or bubbles upstream of the fin, and you can watch the globular flows. And if you want to know about what's happening right on the surface of the fin, you can use other techniques that involve the smearing of certain chemicals on the fin. We did a lot of that and it proved a lot about laminar separation and turbulence reattachment of flow. But the numbers are what really matter.

CHRISTIAN Numbers?

ANDY The instruments are very sensitive, so we get lift, drag, roll moment, pitching moment—the lot. We use real fins, so the flex characteristics are there. The testing is quasi-static, because the testing is at set angles of attack. Now, when you talk about the flex characteristics of a fin, yes, we're taking them into account. But in terms of the handling characteristics, that's something you can't measure—you just go out and surf.

CHRISTIAN The H2 is an intriguing design because it looks like a jet airplane wing with its elliptical outline.

ANDY You intuitively have a reasonable feel for aerodynamics. So what you do is take the right and left fin and put them tab-to-tab so they create a total wing—you'll see that with most fins you wouldn't want to go flying in that plane. They're just so swept it doesn't make any sense. Planes have the same problems [as fins]. Think about a plane where all that matters is efficiency—a 747. The plane that has to have the most efficiency—forget handling characteristics—is human-powered aircraft. They have incredibly long wings, or a glider for that matter. Then you compare that to a fighter jet. Mind you, he's got an ultimate source of power, but, nonetheless, the aerodynamics need to be such that he can jam the thing around much the same as you do in surfing. His wings are very swept back. How can we make a better fin? Reduce drag. That continues to be the goal: to drop drag

off and maintain the handling characteristics that you want. The art form comes in with the fact that everyone wants a different kind of fin—that's why we have so many fins out there. Everybody has a different idea of what makes good handling characteristics.

Skip Frye and Larry Gephart, San Diego, California

Perennial San Diego surfers, Frye and Gephart are craftsmen of the highest order.

DEVON What's the latest project you have been collaborating on?

SKIP Last year we dialed in a wing project. They were little wings—little fins—that we put on to the board's rails, right above the fins. That was the most fun I've had since shortboards happened that one year—'68—when everybody did everything.

DEVON Where did the idea stem from?

SKIP It's something that Larry and the other Cliffs guys did back in the '70s. We just revisited it.

LARRY Remember the Ben Aipa stingers with that wing in the front of the fin? That was the first one I ever saw. And then we were starting, just adding wings on the boards we had, because the board had already been shaped and glassed. We just stuck them, moving them around and reshaping them. Stevie [Lis] used with play with that, too.

DEVON What does a wing-fin do for a board's performance?

SKIP To me, it adds a little more plane, and you can get a tighter turn on a big fish. When Geppy added little keels on the bottom of the wings—or what we now call Ls, for L-fins—man, it was like having radial tires on a sports car compared to regular ones. It looks like a mini side fin extended out from the rail. It just gives you more leverage and torque, a tighter turning arc.

LARRY Yeah, it adds to the board's fin efficiency and gives you that extra ten degrees, or maybe even 15 degrees, angle of attack. The Ls are 18" apart, which is pretty spread out. So, suddenly, you have all this leverage. It's an incredible feeling to go super fast on a wide-tail board and have it hold in so well and turn with ease.

SKIP The board I first had with 'em was a single-wing, but before I could even dial that one, Geppy was like one step ahead already. He had one with two wings. I was like, "Whoa!" He asked me to try it. So I did, and I just freaked out, man. After about four waves I just shoved it back to him and said, "You'd better hide this thing, man." [Richard] Kenvin's got that board now.

DEVON Are you just putting these wing-fins on fish boards?

LARRY Yeah, Skippy's got the perfect fleet. So we could make little changes from one board to another, get one board tuned in to where we'd all agree that that one was feeling the best, and then move on to another type of wing and L-fin variation.



JEFF DIVINE

Larry Gephart's work in marine ply (above) and other woods, sets the bar for handcrafted fins. Skip Frye (facing page) with Gephart keels and "wings," meant to bring the fish into tighter turns. Does it work? Skip tried it and said, "I just freaked out, man."

SKIP We're doing them on the long fish—the 6'9".

LARRY ...with three different boards, and a board without wings that we all rotated around. We've had some really fun sessions with Andrew Kidman, Skip, Kenvin, and myself. The thing about the wings is that they add planing ability to the board. They add grab. They make a hip for easier turning. They do all kinds of stuff. You can even feel that your board paddles better, because they are made of a type of composite foam that floats. They add positive buoyancy to the tail of the board, which is one of the similar reasons I use wood for the regular fins I make. You should never use materials on a surfboard that don't float. If your board breaks into a hundred pieces, it should all be able to wash back to shore. That's why I don't like these fin systems with boxes that sink in water and have metal parts. That makes no sense to me.

DEVON Do you see these wing-fins catching on with mainstream popularity?

SKIP Nah, probably not. It got to be such a thing that everybody wanted Geppy to put wings on their boards. We thought about maybe even marketing these things, you know. Making a little kit where you could stick them on, but...

LARRY It's too much hassle. I would have to be putting them on for everyone. I just want to make the fins and go surfing. So, we'll see what eventually happens with the L-fins. Who knows?

DEVON Aside from this L-fin project, what's the most surprising or unexpected thing you've seen with fins in all your years of surfing?

LARRY For me the biggest trip I ever had was when I was a kid, I saw Skip come down to the beach with a bag of fins and a 4-1 file. He's sitting right there on the sand shaping his

fins, and I was just going, "Does that make it different?" Huh? I'd never ever thought of it before. So as far as the biggest surprise of the whole thing was that instant when I got mentally involved in thinking what a difference fins could make. It was like, duh. [laughs.]

SKIP For me it goes back to Greenough and flex. I was exposed to that through reading Australian magazines. Then there were McTavish and Young's discoveries with Greenough's fins, then seeing Nat's performance on one at OB in '66. I was probably one of the first guys in our area to start cutting down my fin like theirs on my first homemade board, which was the mother of the [G&S] Frye models. What I got from that experience in those late '60s years, and still do to this day, even, is that most surfers are still way over-finned. For me, my evolution is still shrinking in size.

DEVON Larry, all the fins you shape are made of wood. Is that for looks, or is there something more to it?

LARRY Well, I already mentioned float is one major factor. You should never add things that don't float. Beyond that factor, it is the flex. When you lay up the wood, you can control the grain orientation, and then you can alter flex by foiling them certain ways. [Wood] is biomimetic [mimics the character of a living organism]: It's wood; it's got these grains; it flows; it's so strong; it's opinionated; it's got a memory; it knows what it wants to be; you can lay it up according to the grain.

Fiberglass is a homogenous material, it doesn't really have an opinion about which way it flexes, and it doesn't have as much memory about the way it's supposed to flex. But wood is pretty opinionated, it bends in a certain way, it's really strong but flexes—plywood especially when you start changing the directions of the grain. Now here's a quarter-inch piece of plywood, Mr. Karate, let me see you break this in half. There is nothing as good as wood, there just isn't. It's wood.

DEVON What about foil?

LARRY A thicker foil I think is more efficient. It allows you to have a smaller fin because it is efficient, so you gain speed there—there's a weird trade-off, right? At a certain stage, if you are trading fins around you might find that sometimes a little thicker foil is more efficient [with] a shorter fin. So now you have a speed increase because your fins are one inch [shorter], but you lost a little bit of speed 'cuz the water's wrapping.

There's a lot more going on than people realize. And it's hard to tell unless you take an old favorite board, and you really know the board and then start changing the fins up. And that's what's good about the fleet with the wings, you don't know where you're at unless you have a constant, you need a baseline and then you can make subtle changes, and then you learn what the subtle change means. Learning something that absolutely doesn't work is just as important as [learning what does]. ✨





**The Surfer's Journal PDF Archives
Copyright The Surfer's Journal 2015
All rights reserved**

The use of this PDF is strictly for personal use and enjoyment.

**If you are interested in purchasing the right to reprint this article,
you can do one at a time directly from our
website www.surfersjournal.com or in large quantities
by calling The Surfer's Journal at 949-361-0331.
You can also email us at customerservice@surfersjournal.com.**

Thanks, and enjoy!