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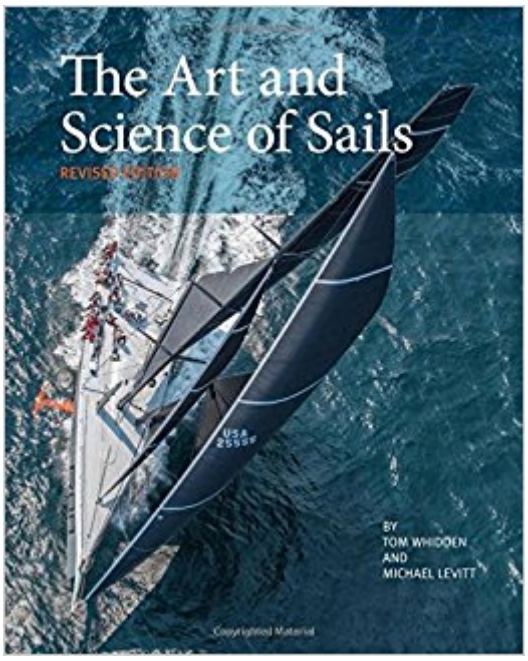
The Art And Science Of Sails



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Synopsis

This is not your parents' Art and Science of Sails, written by Tom Whidden and Michael Levitt and published in 1990 by St. Martin's Press. The first edition sold more than 20,000 copies. The Second Revised Edition 2016 -- now in its second printing -- is published by North Sails Group, LLC and written by the same duo. What a difference 25 years makes! Today there are one-piece sails made over a 3D mold in the shape they will assume in the wind. Sail plans have radically evolved to fractional rigs, fat-head mains, and non-overlapping jibs. That is true for racing boats as well as cruising. Thus, ninety percent of the text is new, as are almost all of the more than 100 photographs and technical illustrations. The authors focus on circulation as they did in the first edition, but now come at it from a different direction. And for the first time anywhere, they attempt to quantify its effects. Where the wind speeds up and why as it passes over a sail plan, and where it slows down and why. Circulation theory is familiar to aerodynamicists for at least 100 years and is argued about by sailors at least since 1973, when the late Arvel Gentry loosed his theories on the sailing world. Gentry was an aerodynamicist at Boeing by day and a sailor on the weekends. And the theories used to explain why airplanes fly were at odds with the theories of why sailboats sail to weather and what the slot actually does. Whidden, CEO of North Marine Group, which includes North Sails, and Levitt, who has written 14 books, utilize explanations like circulation to answer such diverse questions as: â ¢ Why fractional rigs, fat-head mains, and non-overlapping jibs have come to predominate. â ¢ Why and how leech twist can be a sail-trimmer's best friend. â ¢ Why a yacht designer positions the mast, keel, and rudder to create some weather helm. â ¢ Why the safe-leeward position is advantageous relative to the entire fleet, not just to the boat you tacked beneath and forward of. â ¢ Why a mainsail's efficiency is improved with added upper roach, beyond the value of the extra area. â ¢ Why the miracle of upwind sailing is not that there is so much lift but so little drag. â ¢ Why, when sailing upwind, the main is always trimmed to a tighter angle than the jib. â ¢ What a polar diagram tells us or why tacking downwind is almost always faster than sailing directly to a mark.There is also an in-depth look at the wonders of material utilizationâ •not just materials. Indeed there have been no new fibers accepted into sailmaking for over 20 years. It is how they are used that makes the difference. In the last three chapters, the authors drill down on mainsails, headsails, and downwind asymmetric and symmetric spinnakers. And in this edition for the first time they address downwind aerodynamics. The book celebrates the complexity and beauty of sails in words and pictures and of the whole rarefied sport of sailing.

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Customer Reviews

The Art and Science of Sails Revised Edition (2016), by Tom Whidden and Michael Levitt is a perfect addition to any sailorâ ™s library of knowledge. If youâ ™re feeling slow, youâ ™ll know where to go. (Sailing World, January 13, 2017)The subject of sails and sailmaking can be quite complex but in this terrific revised edition of The Art and Science of Sails authors Tom Whidden and Michael Levitt have done a superb job distilling the complexities into a narrative that we can all understand. From the intricacies of how wind and water conspire to propel a boat forward to some of the more mundane aspects of sails, this book covers it all and in great detail. I cannot recommend it highly enough to anyone who wants to know more about that very important part of a sailboat, namely the sails. Twenty six years ago the original The Art and Science of Sails was published and it was a ground breaking book... Who would have guessed back then that the America’s Cup would be raced in flying boats with solid sails? One of the most interesting chapters of the book is The Science of Sails; how indeed can a flimsy curved surface propel a boat almost directly into the wind? It seems unfathomable but it’s true, and Whidden and Levitt walk the reader step by step through the various stages of, as they put it â œflying a flat plate,â • to a complete understanding of aerodynamic theory. They then take this theory and explain how it translates into designing and engineering sails. There is significant ink given to 3DL and 3Di sailmaking and for good reason. Building membrane sails on a full size mold completely revolutionized the industry, and these days it’s not only the racers that want this kind of technology, increasingly cruisers are also seeking it out. By being able to precisely lay fibers along the anticipated load lines in a sail

meant that sails could be built lighter and stronger for the same stretch resistance. Incorporating exotic fibers such as carbon and vectran into sailmaking further advanced things and now blending different fibers into the same sail with each doing their own part all found their roots with 3DL.I urge you to read the whole book cover to cover like I did. Sailors around the world spend an inordinate amount of money on sails and without being disparaging many have no real clue how to use them. I can almost guarantee that your skills as a sailor will be vastly improved once you have read this book. (Brian Hancock, Owner of Great Circle Sails and author of Maximum Sail Power Sail Magazine's Sailfeed, November 17, 2016)This book is the second iteration of the Art and Science of Sails written by a wonderful sailing journalist Michael Levitt and Tom Whidden, a distinguished North Sails veteran. I took it on wanting to understand more about what drove those boats we raced and how we could squeeze one more ounce of speed. The sport has changed dramatically and this book is a solid portrayal of the journey and change in approach, technology, vision and design. In essence it sets the record straight for many of us who were possibly too close to the forest to see the real evolution and its rapid pace of change. Whidden's personal story is intriguing. I loved the approach, the setting of a baseline, the linkages to Hood and North and the contrasts of their inherent strengths, the working through the materials and the technical meat of the book in the transitioning from as they put it â œfrom aerodynamic theory to practice.â • It's often said one of the things that separate great books, especially ones that deal with topics that are technical in nature, from the pack is a style that truly engages and teaches... Simply said this is a must book for your sailing library. (John Kerr, John Kerr is the managing Partner at AD ASTRA Media publishing Canadian Yachting. Canadian Yachting, 10/23/2016)Twenty-Five years ago, these authors published the first version of this book. As they note, in the quarter-century, there has been many amazing advances in sail design and construction. Published by North Sails, this book is stuffed with full of theory and discussion of how sails work. It has sections on theory, materials, design, use of sails, as well as the use of computers in sail design and manufacture. There are also distinct chapters on headsails and mainsails. There are also substantial chapters on the advances that North Sails has made since the late 1980s, specifically 3DL and 3Di sails. It absolutely benefits from the personal knowledge of the authors, and their involvement with North Sails. This book is clearly written for people who are interested in the cutting-edge sail design and manufacture techniques, specifically as applied to racing sailboats. It does not address square rigs at all. It is beautifully printed, and is filled with really interesting diagrams and photos that illuminate the text. This is highly recommended for racers, and also for anybody who is interested in how sails work, and modern sailmaking. It is suitable for all levels of experience. (The Nautical Mind, 10/12/2016)Tom Whidden

and Michael Levitt's legendary reference work on the art and science of sails has received a complete and well-researched update. (Seahorse Magazine, 10/2016)Tom Whidden and Michael Levitt's book is a clear, reliable guide to getting the most out of your sails, an essential component to good seamanship whether you're cruising or racing. (John Rousmaniere, Author of "The Annapolis Book of Seamanship")A fascinating look at the science and history that has led us to today's highly technical world of sailmaking. The book does a wonderful job of explaining the physics behind both trimming of sails and state-of-the-art sailmaking. (Bora Gulari, Two-time Moth World Champion and U.S. Sailing Rolex Yachtsman of the Year)Christmas is drawing near, and with it the question: what gifts should I give? This year, Boote Exclusiv recommends three booksâ | And for the development of sailors, The Art and Science of Sails beckons. North Sails chief executive Tom Whidden shares insider knowledge in 182 pages. (Boote Exclusiv)There is much to learn here for me and my Volvo Ocean Race team. This book is a must read for anybody looking to improve their sail trimming and sailing. (Ian Walker, Skipper of Abu Dhabi, winner of the 2014-15 Volvo Ocean Race and a two time Olympic Silver Medalist.)

Tom Whidden is CEO of North Technology Group, owner of North Sails, Southern Spars, Future Fibres, and Edgewater Powerboats. North Sails and Southern Spars are the largest in their respective marine sectors. He is also one of the world's most experienced sailors and sailboat racers. Tom Whidden is also author of Championship Tactics,by Tom Whidden, Gary Jobson, and Adam Loory,St. Martin’s Press. 1990, ISBN 0312042787.The Art & Science of Sails (First Edition)by Tom Whidden and Michael Levitt,St. Martin’s Press, 1990. ISBN 10: 0312044178Michael Levitt is a journalist, sailor and author of 14 books includingHerding Tigers: The North Sails Story,by Michael Levitt,North Sails Group, LLC, 2009, ISBN 978-0-615-28649.Ted Hood Through Hand and Eye,by Ted Hood and Michael Levitt,Mystic Seaport, 2006, ISBN 0-939511-14-2.The North Sails Storyby Michael Levitt,Fabio Ratti Editoria,1999 ISBN 10: 0615286496.The America’s Cupâ •the History of Sailing’s GreatestCompetition in the Twentieth Centuryby Dennis Conner and Michael Levitt,St. Martin’s Press, 1998, ISBN 0-312-18567-7.The Official Record of West McLaren Mercedes Haymarket SpecialistPublications Ltd Publishing 1998 ISBN 9780860249580.The Official Record of West McLaren Mercedes, Haymarket SpecialistPublications Ltd 1997 ISBN 10 0860249573Around the World in 79 Days,by Cam Lewis and Michael Levitt, 1996, Delta ISBN 0-385-31326-8.

Excellent book by respected author.

This book is worth reading because the insights from an industry leader, including pictures and graphics from proprietary processes, and the explanations of what sail constructions work best for which application are very interesting. I was struck with guilt in thinking back on a few after-regatta sail loft parties and stumbling against a rack, knocking a half finished sail on the floor, and grinding chicken wing bones and beer into the weave before wiping and reshelving it. To the millionaire who got two fewer crisp tacks than he should have from his Farr 40 headsail, that was me and I'm sorry.There are three problems with this book. First it suffers from the self promotion problems which have been described plenty well by other reviewers. The tradeoff is the book is beautifully made and illustrated, far richer than you'd expect for the price. Second it is not perfectly edited, so sometimes it says windward when it means leeward, sometimes the caption contradicts the text, etc. It's not surprising when a sailor is confident or sloppy, but a professional writer helped on this and should have made it better.The third problem is the big one, which is that all the techniques and reasoning in this book are based on an aerodynamic theory - circulation - which the book treats as proven but which is not. I suggest that theory is incorrect and, if you don't trust it, fully half the book becomes suspect. Someone needs to present a sailor's retort to the swirling tyranny of circulation and here is as good a place as any, even if I'm not the spokesperson the case deserves. (there are solid technical papers debunking circulation if that's what you seek). I am a racing sailor who has made his own sails, who has read enough about sail flow over the ages to know theories come and go, and who has education including at the hands of North Sails, the firm behind this book. I'm not an expert in aerodynamics, but neither are the experts in aerodynamics. That's why after 100 years of flight and millenia of sailing, someone just figured out jetliner winglets a decade ago, even though jibs have been slammed down to the foredeck to clean up airflow at the foil edge since before the real Private Ryan got saved. Circulation is the gospel of a man named Arvel Gentry who did pioneering work with sails and was right about some things, both about flow and about the larger-than-imagined effect of the mast. This is why, for a short period, he was consulted by top sailing teams. The authors have decided Gentry was right about everything, including circulation, but he was not. This is why he wasn't consulted by top sailing teams for longer. Gentry is smart and cranky, and people find it difficult and unpleasant to argue with him. That doesn't make him always right.The case for circulation is circumstantial, in that it goes along the lines of 'how else would you explain XYZ' rather than 'here's proof of circulation' in much the same way people assert it would have been hard for Shakespeare to write all those plays, but they don't have a note from the real author. Here are their arguments and what's wrong with each.The authors state that boats go faster than the wind - thus a magical force like circulation must be at play. This would make sense if boats

went faster than the wind dead downwind but they don't, they only do it at an angle. At an angle, the sail is a tool for gathering energy and if the boat is small and sleek it can go faster than the windspeed, just as if the sun were shining at 100 lumens and you had a lot of solar panels hooked to a small bulb you could power it sufficiently to make it shine at more than 100 lumens. Gather energy, concentrate it, use it. Not too hard.The authors state that boats sail toward the wind, which must be due either to circulation or a miracle. Again, if they sailed directly toward the wind this would make sense, but again they sail at an angle. There is a possibility other than circulation or miracles - and it's hanging under your boat gathering barnacles. If circulation made a boat go upwind by its action on the sails, you wouldn't need a keel but anyone who's forgot to drop the centerboard on their 420 after rounding the leeward mark knows you do. If you take a child's yellow triangular block and put one leg against the binding of the complete works of Shakespeare (laying flat on a table) and push a finger toward the binding, perpendicular to it, so it meets the hypoteneuse of the block, the block will slide along the binding even though the force (finger) is going right at the binding. This is upwind sailing. The block is the sail, the book is the keel, your finger is the wind. The block is like so many unhappy high school students and finds the first folio impenetrable but has to yield to the force somehow, so it slides sideways. If you keep angling your finger closer to parallel to the hypoteneuse of the block, this will keep working until you get pretty close to parallel. That's luffing into the wind, that's the edge of the 'no go' zone into which one cannot sail upwind.The authors state that vortices start (the air twirls) when high pressure air drops off the back of the sail (agreed) and the little virtual air wheel those twirls form spins an enourmous opposite-rotating air wheel which envelops the entire sail in a pattern of 'circulation' which travels toward the bow on the windward side, around the front of the sail, toward the stern on the leeward side, and back around the leech of the sail to the windward side again where it just keeps circling the sail this way. A monkey would understand how crazy this is, look out the window of an airplane while you're flying, do you think air is traveling from the BACK of the plane toward the FRONT of the plane on the under side of the wing? How in the world would it overcome 500mph of headwind and even if it did, wouldn't it just create a horrific mess of turbulence? The idea of circulation on a sailboat would mean that air is coming from the back of the boat and crossing all the air which is entering and filling the sail from windward, somehow without either flow (toward the sail or 90 degrees against that flow) being stopped by the other. That's mad.The authors state that circulation is the key which led sailmakers to realize, contrary to popular thinking, that fractional rigs and 100% jibs (small headsails in other words) are actually more effective than big ones. Well, no. Small headsails are effective because of three things - first large headsails put too much power and

heeling force in front of the mast for optimal boat design, second the point of a headsail is to organize and blow wind over the back of the mainsail so that it stays attached better and doesn't allow damaging turbulence and drag, and that's only helpful down where the mainsail is really long, and third because it often pays to ease one's main and if the jib is right there a few inches from it you close the slot and make a honking mess when you try to let the main out. The jib is not some upper section of a magical peanut shaped circulation machine, it's effective because a) it's not preceded by a mast and b) it turns the main into something akin to a 'blown flap' on an aircraft, in other words a lift creating device which is resistant to stall. It doesn't have to be big to do these jobs. Small jibs weren't discovered by North post-Arvel Gentry, just look at a Snipe, Star, or Etchells. Gargantuan headsails were pushed by the sailing industry and boat designers until everyone had one (yours truly knows this as well as anyone as a J/24 bowman, suffering a genoa raking over his face for so long on every tack it was almost a relief when the clew finally assaulted his ankles). Then like any good fashion industry they found it was time to make them passe and sell everyone something 'new' which could actually be seen in any sepia'd old photo of a Herreshoff - a jib.To arguments such as this, Gentry says the reason circulation makes no sense is that aerodynamics are not intuitive. i.e. you're just not sophisticated enough to get it. Could be, we have to be open to that, but it sounds a lot to me like the modern artist who says if you think her spray painted dog sh*t isn't art you're just not sophisticated enough to get it. I might not be, but it might also be what it looks (and smells) like.Now you might be thinking, well if they're using these theories to design sails and boats, and they're getting good results, mustn't they be on to something? Well no, because even the most ardent supporters of circulation say things like 'circulation theory is an incomplete theory in that it cannot be used to predict effects without the application of a designed variable assuming circulation'. This is why the text features no 'smoke tunnel' or other actual tests of sails showing circulation - there aren't any. They show some computer simulations they made on the assumption of circulation which seem to indicate circulation because they were written to do so. If I write down that there is a God, I can later 'find' my note and cite it as proof of God's existence. That's as heartwarming to me as circulation must be to Arvel Gentry but far short of a miracle.Gentry is a clever guy and North has some good sails, it's not as if none of the effects they cite exist, they're just misinterpreting them. Air slows on the windward side as it meets the sail, we all agree on that. It's quick on the leeward side because we have to make it that way to get it to stay attached. High pressure exists around the mast because the mast is an obstacle, and some of the air which meets that high pressure goes around the mast to the leeward side. If you take those things together - slower speed on windward, fast on leeward, air going from windward to leeward

around the front - you can almost picture this sort of oval of flow, three things going on in the vicinity of a sail which Arvel Gentry misinterpreted as one greater event, an event which would make him the discoverer of that event. But it’s like they said in the movie, sometimes i sing and dance around my house in my underwear, it doesn’t make me Madonna.

This book is not bad, but not great. About half of it is a sales pitch for North sails (all my boats have Norths and I like their product but it got a bit tedious.) Most of the science they talk about in the book applies to big boats, not dinghies, and even then it’s mostly jib/main sloop rigged boats, nothing about cat rigged boats, or sailing downwind without a spinnaker. It was interesting but probably not worth the price. I’d wait for paperback.

I found the explanation of the aerodynamics of sails was cursory- obligatory nods to the pioneers without explanations that a human or even a fair engineer could understand. The rest was a poorly disguised advertisement for the black magic of North Sails.A few zippy photos, though.

Mostly name dropping, aerodynamic terminology dropping, tecno-babble and sales pitch, little real (correct) information on sail aerodynamics or science. Literally tens of misleading or outright incorrect statements, making one feel sorry for the writers. Sadly, this will book will be read as the absolute truth and last word about the science of sails, completely ignoring the real, scientific community who has been publishing on the subject since 1960ies and earlier, in conferences like the RINA, Chesapeake, HISWA, HPYD or INNOVSAIL. A little better on sail/rig trim, some good notions but few and far between, by no means systematic or covering the whole subject. The best part is the anecdotal reading about Lowell North and Ted Hood which begins the book. Lots of nice photos.

Infuriating! Graphs with no labels on either the ordinate or the abscissa. Graphs with quantities having no units. Units mangled. If I did that in college I never would have graduated. In addition, the book practically reads like a commercial for North Sails. This COULD have been a great book; instead it is utterly frustrating to read. As a longtime sailor with a Ph.D. in physics, I have a genuine interest in the details of how sails really work, and how they can be made to work best. Sadly, the irritating lapses on multiple graphs are a real turn-off.

The scholarly depth and range makes it a wonderfully interesting read. As a racer (Farr 30, C&C

115) and cruiser (Jeanneau 42DS) I find the lessons tangible and easily implemented. This book exceeded my expectations.

The original edition of The Art and Science of Sails by Tom Whidden and Mike Levitt was an outstanding book when it first came out but a lot has changed in the world of sails and sailmaking. This new edition is absolutely fantastic. The authors have done a fabulous job updating it and the book includes all the very latest on sail design and engineering from the America's Cup and Volvo Ocean Race to sails for the average weekend warrior. If you want to know all you need to know about this very important part of your boat, your sails, I highly recommend that you get a copy of The Art and Science of Sails and read it cover to cover. I did.

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