Welcome

Dear Students, Alumni, and Friends,

In the March 09 issue of The Masthead, our lead story announced the new ABYC sponsored tuition grant program designed to help new yacht design students to partly defray tuition costs during the current economic downturn in order to encourage them to start preparing now for employment opportunities that will come as the economy recovers.

For readers who missed this article in the March issue, we have re-printed highlights of the grant program and other cost saving measures that are available to students on page six of this issue.

Norm
Norman Nudelman, Editor
nnudelman@westlawn.edu

Westlawn Offers Interior Design Reference to the Public

Westlawn is offering its textbook *Interior Design Methods for Yacht Design and the Boat Building Industry*, by Lisa C. Hix, for sale to the marine industry and general public for the first time. This unique book is the only reference of its kind, covering all aspects of boat interior design and human-factors engineering (ergonomics). It is the closest thing there is to an *Architectural Graphic Standards* for boat interior design. Specifically prepared as a textbook for Westlawn’s intensive Yacht & Boat Design Program, and also used as the text for Westlawn’s continuing education course in boat interior design, *Interior Design Methods for Yacht Design and the Boat Building Industry* provides detailed technical information not available from any other source.

Heavily illustrated, with numerous drawings and photos on nearly every page, *Interior Design Methods for Yacht Design and the Boat Building Industry* will answer almost any question a designer, builder, surveyor, crew member, or serious boater may have about the accommodations and arrangements required for safe, comfortable, and efficient crew and passenger spaces. Though focused on boats (vessels under 200 feet or 60 meters), the information is equally valuable for efficient and comfortable accommodations on commercial vessels of all sizes.

Author Lisa Hix brings years of practical experience as an industrial design consultant to bear in her clear and comprehensive coverage of the subject matter. Ms. Hix has a degree in industrial design from the Rhode Island School of Design and a diploma from the Yacht Design Institute. She has been a staff...
designer and project manager for production boatbuilding companies’ design teams, where she has worked from concept through tooling and prototyping to sea trials. She has done design consulting and illustrations for boatbuilders, naval architects, and marine equipment manufacturers. Ms. Hix has also served as a lighting-fixture designer for a major manufacturer, and as a lighting consultant for residential and commercial spaces. With experience including sailing and motoring many types of boats as well as sailing transatlantic, she has gathered first-hand, real-world functional information on human-factors engineering aboard boats.

Since its founding in 1930, Westlawn’s policy has been to provide its textbooks solely to students actively enrolled in Westlawn courses. In response to continued requests for a reference on boat interior design, however—and recognizing that there is no other comparable reference source available to the boating industry—Westlawn Institute has decided to make Interior Design Methods for Yacht Design and the Boat Building Industry available to all.

The idea here is to know the functional space requirements so you can come up with many arrangements of the interior elements. Each arrangement can be looked at for its positive aspects and its drawbacks. The interior space can be visualized and the visual design elements can be refined. A functional layout and the visual aspects build off each other. There is a lot of trying an idea, changing and checking again for functionality.

The interior elements interface with the deck, machinery, and the support structures; basically all the parts of the boat. These interfaces are also areas of trying ideas, changing and checking for the impact. A well functioning interior is one of the aspects that will bring pleasure to the boat owners as they go about their everyday tasks.

An Excerpt From Chapter 2

Space Planning for the Yacht Interior

After we identify which activities we would like our yacht design to support, we need to look at the space required to do the activities. There is a certain amount of space needed for the human body and for its movements. Equipment and furniture need to be located to support the body and facilitate activities.

Paying attention to the human factors when designing a boat affects many aspects of boating life. It is easier to get through rough weather conditions when the body can perform the necessary tasks with a minimum of effort and stress. Everyday activities will be made easier to perform and the spaces will feel less cramped. With many functions having to fit into small spaces, compromises often have to be made based on the priorities of safety and functionality.

We will look at the body sizes and the range of motion of our target population. The size requirements of each function provides a basis for designing each interior element. Activity flow and operational sequence diagramming provide a basis for arranging and interfacing the interior elements.

Looking at each functional area in detail will give a better understanding of the requirements. Choices on how much space to give to a particular function can be based on the priority of importance, spatial requirements and overall balance.
Westlawn’s Fourth Annual Mystic Meet
Meet the Faculty! Explore Mystic Seaport! - July 25, 2009

Time for our fourth annual Mystic Meet! This is your chance to meet your instructor: Dave, Stu, and Norm, to see Westlawn’s Mystic office, and to explore Mystic Seaport Museum. Attend Mystic Seaport’s Antique and Classic Boat Rendezvous, also being held at Mystic Seaport July 25-26. Don’t Miss It! Bring your spouse, bring a friend. There’s plenty to see and plenty to do. RSVP SOON! to pschulte@westlawn.edu. Alumni are welcome too!

Bring your boat-design drawings and your questions. We’ll spread them out and answer questions and give critiques for all, one-on-one, right on the spot.

SCHEDULE:
Here’s the schedule (Event order and times may change slightly.)

July 24 (Friday):
Check into your hotel in Mystic, CT.

July 25 (Saturday):
8:30 – 9:15 AM
• Coffee at the Westlawn office
• Free Westlawn T-shirts and caps for all
• Free passes to Mystic Seaport for the weekend
9:30 AM – 10:30 AM
Guided behind-the-scenes tour of The Charles W. Morgan – the oldest whaling ship in the world. She’s hauled out and under restoration. This is a unique opportunity to see this kind of construction from the inside.
10:45 AM - 12:30 PM
• At Westlawn office. Seminar on planing hull design, by Westlawn director Dave Gerr. This will be in depth and detailed, with plenty of examples of real boats with problems and examples of boats that ran well. Prepare to take notes and answer questions as well as ask them.
12:45 PM – 2:15 PM
Lunch for all, compliments of Westlawn. Join your instructors and fellow students for bite to eat at the Seamans Inn, at Mystic Seaport. (Cash bar.)
2:15 - 5:30 PM
• At Westlawn office. Jeremy Wurmfeld—Westlawn alumnus, partner in Persak and Wurmfeld, Naval Architects—(see page 15 of this newsletter) will give a one-hour talk on the changing role of the boat designer and the practical implications for modern design practices.
• Group-participation, one-on-one critique and review of drawings, questions and answers. Stump the faculty—ask any questions you can think off. See if you can come up with one we can’t answer. (Only questions about boat design count!)
6:30 or 7:00 PM:
On your own. Get together with whoever you want to for dinner.
• Or . . .
Answer the post on the Westlawn Forum to meet with other students and Westlawn faculty for dinner. If we get enough people, we’ll arrange dinner reservations in advance. (This is pay your own way.)

July 26 (Sunday):
On your own to explore Mystic Seaport and Mystic Aquarium. These are huge facilities in beautiful settings. There’s a tremendous amount to learn at Mystic Seaport alone. It would take you several days to take it all in—if not more.

PLEASE RSVP BY JULY 12:
Email Patti Schulte, pschulte@westlawn.edu, to let us know you’ll be coming. Be sure to include your name and student ID number:
In the subject line of the email type: “Attending the Mystic Meet – YOUR STUDENT ID NO.” If you are an alumnus type “Attending the Mystic Meet – ALUMNUS”. If you are a prospective student, type “Attending the Mystic Meet – PROSPECTIVE STUDENT”.
Let us know if your spouse or a friend is coming too, so we can arrange for additional Seaport passes.

Full information on the Mystic Meet can be found on the Westlawn Internet Forum...or by contacting Patti Schulte at pschulte@westlawn.edu.

ATTENTION PROSPECTIVE STUDENTS:
If you are seriously interested in preparing for a career in boat and yacht design, this would be a great opportunity to meet and talk with Westlawn faculty and students, see how student’s design work is critiqued by instructors, and enjoy the wonders of the Mystic Seaport Museum.
The Dragon was designed early last century by Johan Anker. Dibley Marine's job was in the management of putting her together with modern sailing systems. This is another roll for a boat designer in a long list of rolls.

Kevin Dibley

Kevin Dibley of Dibley Marine is a Westlawn alumnus. www.dibleymarine.com

The newly launched Classic Dragon, Alla (NZL-15), finished a credible 3rd in the 2009 New Zealand Dragon National Championships. Owner/skipper, Alex Kirichuk, received the Brown and Stone Trophy for best performing “Classic Dragon” for this result. NZL-15, an all wooden Dragon, was skippered by Alex, and crewed by Simon Kidd of Doyle Sailmakers, and Kevin Dibley. This was the first time NZL-15 sailed and the crew were still tuning her up to the last race. The Regatta was won by Scott Palmer and his crew of Fraser Beer and Phil Allen in their GRP Dragon Yankee Doodle Dandee. Past National Champion, John Webber and his crew of Frans & Sam de Court teamed up on Matuku to take a hard fought for 2nd place. With the World Championships in Elbourne in 2011, the New Zealand International Dragon Association has seen this regatta as a platform to build up the local Dragon fleet. Alex Kirichuk, who brought in NZL-15 from the Ukrainian yard of Lagoon Royal, has a further two dragons underway and hopes to have them sent to NZ to be finished off in the very near future.

Dibley Marine managed the refitting of NZL-15 with a team which included Phil Bish Boatbuilders, Simon Kidd of Doyle Sailmakers, John Bennett of Sparloft and Grant Blewitt of Harken. NZL-15 and the Nationals, was sponsored by John St Clair Brown of Waiwera Water, and Alex Kirichuk of Corinthian Vodka. John also kindly put up the crew of NZL-15 on his 16 meter power cat for the duration of the regatta.

A Little History
The Dragon was designed in Norway by Johan Anker in 1929. The original design had two berths and was well suited for cruising in Anker’s home waters. The boat quickly became popular and within a decade it spread all over Europe. In 1937 the Gold Cup was presented to the class by the Clyde Yacht Club Association. This became a principal championships in the class and a prestigious trophy in the competitive yachting world.
Winner! - 2009 J-24 Worlds

Westlawn student Alfredo Rovere, the bowman on the winning Brazilian boat, Bruschetta, reported this account of their victory in the 2009 J-24 World Championships at Annapolis, Maryland, April 30 through May 8. The J-24 was designed by Westlawn Alumnus Rodney Johnstone.

The story began at the end of February 2009, when we decide to participate in the Worlds with the same team that won the 2006/2007 Worlds and the Pan-American Games 2007. We were working together since 2005 and we separated after the PAN.

With few days for training, we were in the water as much as possible since we had to fly to Annapolis on April 24th. On the 26th, we received the brand new J-24 built by Paolo Boido at his boatyard J-Boats Italy. After two days setting up all the equipment, we went to the water for two days of training. We felt comfortable with the boat and with the new sails from Santa Cruz Sails. We used an aramid genoa that was allowed by the new rule.

After the measurement during April 30th and May 1st, we were back on the water for a last day of practice before the Worlds starts on May 4th. Rain, low temperature, and winds of 10 to 15 knots were the conditions for day one. Two races were sailed and at the end of the day we were leading after a 6th place in race one and a 1st place in the second race.

On the second day there was of no wind at all and consequently no race. Day three also had very light winds and the RC decided to start with maybe less than 6 knots of wind which was dying during the race. We did a 47th and also took a penalty of 20% that gave us a 63rd on race three and 14th in the overall result.

Day four came with another horrible weather forecast. More light wind for J-24 fleet. We never feel good in this conditions. We knew that we couldn’t make any mistakes if we wanted to be back in the game. Only one race could be sailed and we finished 11th. With that result, we were in 110th overall. The worst result could be throw out after the 5th race, so we knew that as soon as the 5th race started, we would be leading the championship again with 18 points.

Day five had three races scheduled and, as usual, light winds again... Race five we started close to Casale and Milev. Pereira did a great start and pulled to the top three at the first mark. Chris Larsson, Milev and our boat rounded the mark between 15th and 20th, and Andrea Casale was around the 40s. Pereira finished in 2nd, Larsson did a 3rd, Milev 12th, we did a 16th, and Andrea Casale was out of the game with his 2nd bad result.

Continued on Pg. 6
2009 J-24 Worlds (Continued)

For race six, the wind was still light, and the Argentineans did another great start and won the race easily. In 3rd place was Chris Larsson and his team, we crossed the line in 4th with Rossi Milev in 5th. After six races the title was still there, and four teams had a good chances of win.

1 Chris Larsson 36 pts, 2 Bruschetta 38 pts, 3 Rossi Milev 38 pts, 4 Matias Pereira 42 pts

The seventh and last race started and a few second after the signal we saw Larsson and Milev far behind. We had a very good start and we were sailing to the left side of the course and ten boat lengths to leeward of the Argentineans, so we decided to tack and try a cross with them. As soon as they crossed us, they tacked and made us tack again to the left side, that was just were we wanted to go. The shift came from the left and we rounded the weather mark in 1st place, the Argentineans were 7th, Larsson between 20th and 25th and Milev was in the 40s. With this situation, we just sailed conservatively to the finish line. We crossed in the 3rd place and that was enough to win our third J-24 World title, and become the first non American team to win a J-24 Worlds in the US.

Final result:
1 Bruschetta
2 Chris Larsson
3 Matias Pereira
4 Rossi Milev
5 Anthony Kouton

I want to thank all the people who trusted in us and especially all my crew mates of the Bruschetta Sailing team, Mauricio Santa Cruz (helmsman), Daniel Santiago (trimmer), Alexandre Saldanha (tactician) and Paolo Boido (pit).

Regards,
Alfredo Rovere (bowman)

WESTLAWN DRIVES DOWN EDUCATION COSTS!
A Recap from the March 09 Masthead

Westlawn has instituted a number of measures designed to help students cope with education costs and encourage them to keep studying during today’s economic conditions. These measures include controlling tuition costs and finding ways for students to obtain otherwise expensive design software at little or no cost.

**ABYC Grants For New Enrollments in Westlawn Courses**
The American Boat & Yacht Council (ABYC) has generously sponsored a new-student grant program to help with tuition costs for enrollment in Westlawn’s two entry-level boat design courses, Module 1 or Elements of Technical Boat Design. The grants are available to all, but only until all funds are expended.

**Westlawn is now offering a ZERO-INTEREST TUITION PAYMENT PLAN** for all four modules of our professional diploma program in yacht and boat design as well as for our one-module short course, Elements of Technical Boat Design. In addition, Westlawn continues to offer students two low interest options for financing for the four-module professional Yacht & Boat Design Program and for Elements of Technical Boat Design.

**Free Student AutoCad and Deep Discounts on Other Essential Software**
Westlawn has arranged for active Westlawn students to download AutoCad online directly from Autodesk, an enormous savings of $3,999.

Westlawn has also arranged with DRS C3 Advanced Technology Center for deep student discounts on the Orca3D hull modeling plug-in software for Rhino, plus Rhino if needed, with savings over the full commercial prices range from $2,907 to $3,804 depending on the package.

For students who prefer alternate hull fairing programs we have arranged for special student pricing on New Wave Systems ProSurf. Students may download the free 3-surface version of MaxSurf, as well as get student discounts on more complete versions of MaxSurf.

More information on these cost saving measures as reported in the March 09 issue of The Masthead. [CLICK HERE](#) to read the full article.
LIFE ON THE OCEAN WAVE - A kids point of view.
By Cheree Bowdidge

In Part 1 Cheree tells of the adventures of the Bowdidge family during the first part of their 11 years of adventure aboard Inflight, their 42-ft. cruising catamaran. (To read Part 1 Click Here to go to the March 09 issue of the masthead.)

Now, Join Cheree and Natasha and their Mom and Dad, Mark and Debbie as they explore Malaysia and Singapore.

The best thing I liked about Indonesia was the smell of spices and smoke from wood fires, and the incense that burned on shore. We could smell the smoke burning miles away from shore, and when we pulled in for anchorage, we could hear the Indonesians singing and hear their bells from their temples. It was so amazing! The reefs in Indonesia were really something to see when we went snorkelling, but surprisingly we saw hardly any fish, starfish or shells compared to Australian reefs. Sailing through Indonesian waters, we couldn’t understand why all the fishing boats kept trying to cut across our bows, even to the point where one fishing boat was desperately trying to cut across our yacht under crank power alone. Obviously, his motor had stopped working. It wasn’t until we were halfway through Indonesia that we were told the Indonesian fisherman believe bad luck is caused by evil spirits and, to rid their boat of evil spirits, they cut across the bow of another boat in order to dump the evil spirits onto the other boat. I remember thinking it was strange how the Indonesians got so excited when they saw us. It was when we passed them on their boats, they’d run out on deck and wave and scream hellos, jumping up down from excitement as if they had never seen a white person before.

Going ashore, though, was even funnier. Every time we went ashore, EVERYONE in the village would follow us every step of the way! But the most interesting and fun part about Indonesia is the markets. Fruit, veggies, unfortunately plucked live chickens and FISH, the smell of fish was so overpowering! Everywhere we went, people would follow us around trying to sell what they had.

I had my shifts at the wheel too. I drove the boat, took fixes on the chart and filled in the log. Dad slept in the cockpit close to me so if I needed him, he’d be there. I’d spend nights watching the compass and stars, but one time I remember, it was about sunset and it was my shift at the wheel. The seas were pretty average, and there were coconuts floating on the surface of the water going past us. I never used to avoid them, but Dad came out and told me to steer around them from now on. About half an hour after he told me that, I saw what looked like a large palm trunk ahead, so doing what dad told me, I steered a little around it. When we got closer, I saw it wasn’t a palm trunk, but a large
Life on the Ocean Wave Part 2 (continued)

steel ball with pointed spikes coming out of it. I got a closer look at it from the edge of the hull as we drove past. I wasn’t quite sure what it was but after watching enough 007 movies, I knew it must have been a sea mine! There’s nothing else that matched the description. I called Dad, and after seeing it, Dad called Singapore radio and gave the position of which we saw. About 12 hours later a navy ship passed us heading towards it. From that point on, I knew to steer around anything I saw in the water!

When we were going past Singapore, I expected it to be almost exactly like Indonesia, but I was very wrong. Indonesia seemed to me like a country built on superstition and tradition, Malaysia and Singapore however, was more industrialised. I mean, our first day in Singapore and my 15-year-old sister was taking the wheel and steering our yacht through a channel filled with hundreds of huge ships going everywhere. We felt like a bug amongst a flock of birds ready to be squashed! We dodged in front and behind these massive ships and navy destroyers. It was really exciting!

It was unlike anything I ever expected. The smog was so thick we could barely see in front of the boat. We had to literally maze our way through manmade islands, old rusted ships, and houses of sticks built on the water. I still remember the smells of Singapore! The manmade ‘islands’ had huge smoke towers going so far up into the sky. There was about five towers per ‘island,’ with so much black smoke everywhere!!! Our first night in Singapore, I remember we had to find our way through the night with a spotlight because the channel was filled with houses built out on the water. One night we got so close to one particular house built on the water that my Dad had a conversation with him as we passed! One thing I miss: It’s the sounds of the Muslim prayers sung through loudspeakers over Johor Bahru. The sounds, the smells, the people, the amazing electrical storms, this adventure is truly one thing that will stick with me forever!

When it was time to come back from Malaysia and Singapore, I was excited about coming home. I was looking forward to trying life on shore. I guess back then, as exciting as life on a yacht was, I was too young to remember life on land, and I felt like maybe I was missing out on something. However, now living back on shore, I’ll always reminisce and miss my old life! Coming home to Australia on our boat was also half of the adventure in itself. There were so many good times. One particular time we went ashore on an Indonesian island to see the komodo dragons! We searched and searched and then finally, as we walked around the spit of the island, we came face to face with a huge komodo dragon hiding behind an enormous boulder. It was so unexpected that everyone screamed, including the dragon, and we all ran in different directions!

One night when I took the wheel for my 2-hour shift, I was so excited. There was a storm raging around us and I loved sailing through storms
and squalls...as scary as they can be! I remember the lighting would seem to strike only a few feet from the side of the hull, so close it was almost as if I could reach out and touch it! The thunder would literally shake the boat! Out of all our years living on our yacht, we were never struck by lighting. When the storms approached, huge water-sprouts would appear. I actually thought they were tornadoes until my parents explained it to me! I remembered sitting on the deck and watching three huge water-sprouts surrounding us, it was scary considering all I could think about was one hitting us or sailing into one. The flying fish would leap out of the water and hit the deck in the night squalls, and we would have around 20 or more fish per day on our deck! Then the squalls would blow over, and the skies would clear revealing nothing but the stars and the moon above us.

It's funny you know, but some might think it's lonely at night, the dim glow of the compass light, the stars above, the ocean horizon reaching forever, while the family sleeps. Nothing but the icy night, and only you awake to steer the yacht, but I never felt alone. In fact, it was like a world of its own. I was only 12 going onto 13 years old and to me it was so beautiful and peaceful. I'd love to go back and maybe one day I will.

The best part about coming home to Australian waters was the way it happened. I remember it was my shift, around 5 AM, and everyone was asleep. I had decided that since we were so close that maybe I could pick up reception on the radio. So, when I put on my disk-man and searched for a radio station, the first song I picked up was “This is Australia” by Mark Callaghan. I remembered it was so beautiful because just when the song came on, the sun started to rise, I remember the sky seemed so 3D. The clouds were streaked with pink and yellow, it was magic. After all the sunrises I'd seen my whole life whilst living on the boat, that one looked more incredible than anything I had ever seen.

Although it’s unknown where the future will lead me, like the sea, it’s ever changing. It has endless horizons and many adventures, for you never know what the wind and tide will bring in. There’s one thing I know for sure, I'd love to go back to the sea...to “a life on the ocean wave”

Natasha is presently pursuing her bachelor's degree in geological oceanography and I'm beginning my bachelor of science in marine archaeology
Re: Dave Gerr's Tech article High Strength Marine Metals Part 1 – Stainless Steel Published on the March 09 Issue of The Masthead:

On March 15, 2009, David Treadway wrote:

Greetings,

Would you please verify that I am understanding this section of your article correctly. Under the heading Stainless Welding Concerns you reference two situations regarding welding on rudders. Both involving stainless in an oxygen deprived area. Does the same concern apply to any welded stainless underwater? i.e. A powerboat rudder where the welds are not contained in a core.

In reading the entire piece I believe that all welded stainless used below the waterline should be low carbon or special alloys. Am I on the right track here?

On a side note, what about the practice of turning down and welding up sections of shafts worn or pitted under bearings?

Thank you,
David Treadway

Dave Gerr's response

David:

Good question. It's a bit of a conundrum. All stainless welds below the waterline are potentially subject to pitting corrosion or weld cracking. 302 and 304 stainless are virtually guaranteed to experience severe pitting or cracking. 316L and 317L are much more resistant to such pitting, but still not 100% immune to it. For this reason, my recommendation is never have a weld at a high-strength underwater fitting. I recommend you never "strengthen" rudder stock with a welded on stainless pipe sleeve for this reason—regardless of alloy. (In addition, there's also the question of how to be sure that the alloy really is 316L or 317L.)

There are some cases, however, where high-strength welds are unavoidable on underwater stainless. This might be for a custom welded stainless propeller strut, for example. I would prefer silicon bronze on wood or fiberglass hulls, or integral welded mild steel on steel hulls, or integral welded aluminum struts on aluminum hulls. Still, if you are going to use welded stainless for such an application, then you must be extra careful that the alloy really is 316L or 317L, that the welding has been expertly done, and that the struts are designed with a large margin of safety so that the stresses in the struts (particularly at the welds) are low.

Turning down and welding up worn or pitted shafts is a cost-saving approach. It work if properly done—if the welding alloy is correct, the shaft alloy is correct, and there's good quality control. It will not have the longevity of new shaft of the proper alloy.

Cheers,
Dave

Re: Marine Metals—Part 1 (March 09 issue of The Masthead)

On March 15, 2009 Jonathan Klopman wrote:

I had a couple of comments about your article on stainless steel-

Precise identification of stainless alloys requires a trip to you local metallurgist. They can run a sample through a gas chromatograph/mass spectrometer to tell you the precise percentage of alloying elements and whether the sample meets “spec” for that given alloy. However, there are some identification techniques, while not exacting, that can be used in the field. In the case of 316, the alloying element that allows it to resist pitting corrosion is 1.5% molybdenum. There is a simple spot test that you can use to test for molybdenum content on the surface of the metal. This is a fairly simple "go, no go" gauge to tell you whether or not the part could possibly be 316 For example, a local rail manufacturer received a
load of stainless tubing that they thought was supposed to be 316, but showed signs of surface corrosion. My test confirmed that the tubing was in fact 316; however, my gut feeling is that the postproduction cleaning of the tube was lacking. My point here is that a little bit of careful inspection prevented a potential row between the shop and the distributor. There are reagents for spot testing almost any alloy in the field. However, chemicals are not cheap and they do not all have a good shelf life. I do think that any decent fabricator would do well to look into this technology in order to provide quality assurance for the materials they push through the shop.

The whole issue of weld failure with carbon containing stainless can be a sticky one. More precisely, the problem occurs as the weldment cools. The chromium carbide forms in the heat affected zone outside of the weld bead, hence the term “carbide precipitation”. The condition can be corrected if the part is reheated and cooled in a controlled manner. However, this step is impractical for most fabricators (in order for the chromium carbides go back into solution, the part would need to be heated to 2000°F). The chromium depleted areas in the heat affected zone can lead to pitting corrosion. However, is more common to find these areas suffer from cracking. The problem is especially dramatic if the weldment is used in an application where it is loaded in tension- say chainplates. Pitting, in general, tends to be a degenerative and gradual failure mode. Cracking that one sees as a result of carbide precipitation and/or chloride induced stress corrosion cracking is far more serious. You can probably see, the problems in failure modes often involve overlapping issues (high carbon weld, tension load, exposure to chlorides, etc.). As you pointed out, the simple answer is to source low-carbon grade stainless. You did mention 321 (347 contains tantalum and is used for the same applications in welding). In practice, I think it might be fairly difficult in for the average fabricator to find either of these grades through their local distributor.

The super austenitic 22 – 13 – 5 stainless steels (Aquamet 22, Aqualoy 22, and Nitronic 50 are trade names for essentially the same alloy) have become more and more common. It might be worth noting that these alloys gain their superior strength through cold working- rolling or drawing the material. This is one reason why you typically see it in the form of rod stock (shafting down to rigging) less than 3” in diameter and why don’t see big plates of Aquamet 22. The point here is knowing something about the specific alloy may help you in specing out parts or designs.

The last point I want to make was in regards to 17-4. This is a precipitation hardened alloy that, as you mentioned exhibits remarkable tensile strength. One very common application for this alloy is when it is sold as “Aquamet 17” shafting for commercial boats. As noted above, Aquamet 22 simply is not available in larger shaft sizes. In commercial applications, where work boats are constantly moving, this does not present much of an issue. However, this alloy does not hold up well in pleasure boat use in marine applications. Aquamet 17 will pit badly if it is left to sit and collect marine growth. Some boat manufacturers may use Aquamet 17 for shafting (especially if the builder is geared more towards providing boats for freshwater use). The lesson here is not to assume that the shafting is Aquamet 22.

You’d mention the use of 17–4 for rigging applications. Aside from its potential corrosion issues in immersion applications noted above, 17-4 has proven to be extremely susceptible to stress corrosion cracking. This has led to some dramatic failures of high load fittings. As a result, I would be extremely reluctant to recommend using this grade for rigging fittings or keel bolts.

Jonathan Klopman
Marine Surveyor, NAMS-CMS IAMI-CMI

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Dave Gerr’s response
Jonathan:

Thanks for your comments on stainless steel for use in marine applications. They are very helpful.

You are correct that there are some tests to identify stainless alloys. They are not widely used or well known, but one of the best sources for such test equipment is:

Koslow Scientific Company
172 Walkers Lane
Englewood, N.J. 07631
Tel: 201-541-9100
Email: info@koslow.com
Web: www.koslow.com

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We Get Mail (Continued from Pg. 11)

They offer an assortment of testing kits and equipment on their website, that should match any normal need, particularly for surveyors and investigators involved in cases requiring identification of metals and alloys. Koslow's Stainless Steel Inspector's Kit 1499 would serve to identify 304 vs 316 and determine L (low carbon) or not.

Yes, indeed, the problem of carbide precipitation resulting during the welding of stainless steel can be corrected by annealing (heating). As you noted, this is not a process easily available to most marine fabricators, and annealing must be done correctly or it can result in other problems.

17-4 stainless should never be used for fastenings underwater and never, ever for keel bolts. It's acceptable (as Aquamet 17) for propeller shafts, but is not my first choice, particularly for vessels that won't get regular use. It's always a 3rd or 4th choice here. 17-4 is found in some lightweight, high-strength rigging components. Because of it's very high strength, it saves weight, but your point about potential stress cracking is important. Such fittings should be designed to work at low stress (for this alloy) and inspected regularly.

Cheers,
Dave

On Mar 16, 2009, Kenneth Rorison wrote:


Good afternoon:

Not all wooden boats have their max-beam at midships.

The reference face of the frame should be determined by the aft face of the frame forward of max-beam and the forward face of the frame aft of max-beam.

Regards,
Kenneth W. Rorison

Dave Gerr's response

Kenneth:

You are correct. Some boats have their maximum beam aft of midships (often between station 5.2 and 5.8), which complicates things slightly. My short explanation of the proper location for the reference face of frames, in the March 2009 issue of The Masthead, was to make readers familiar with the principle involved. To be more precise, however, the so-called "midships" location for determining whether the reference face of the frame is to be either the forward or the aft face of the frame should be taken as the section of the boat with maximum beam. This may be at the exact midships of the DWL or it may be slightly aft of midships.

Cheers,
Dave

Your comments and questions are welcome. Space permitting, we will print them in the next issue of The Masthead. Address your comments and questions to Letters to the Editor and email them to: nnudelman@westlawn.edu.
Know It All Contest Solution of the March 2009 Question  
Calculating the Bending Moment for Fin Keel Structural Design  
By Dave Gerr, © 2009 Dave Gerr

The question from the March 2009 issue was:
You are working on the design of a fin-keel sailboat, and need to start the structural design of the fin keel and its attachment to the hull. The fin keel is of welded mild-steel plate with internal steel framing, and the ballast bulb at the bottom is of lead as pictured in the drawing (right).

Your calculations indicated the steel fin will weigh 1,594 pounds, and the torpedo/bulb is cast of solid lead of 7.17 cubic feet in volume. The lead contains 4% antimony, for a density of 702 lb. per cu.ft., giving a total bulb weight of 4,960 lb.

Referring to the drawing of this keel on the right, showing the geometry and the location of the center of gravity of the steel fin and the ballast bulb, what is the maximum bending moment on the fin keel, and where does the maximum bending moment occur?

Nearly a dozen solutions to the fin-keel bending moment question were submitted, a few by well-known designers. None used the correct method or had the right answer. Here’s the correct procedure:

In order to find the bending moment, first you have to find the location of the combined center of gravity (CG) of the total keel weight—bulb and fin. You can do this using a weight table (next page), or—for a simple two-weight configuration—you can locate it graphically as shown on the drawing. For the fin keel in our Know It All question, you’ll find the total weight is 6,554 pounds, with the center of gravity located 7.8 feet down from the fin keel attachment, and 3.42 feet aft of the center of the keel attachment to the hull.

The design condition for the bending moment on a fin keel (the condition of greatest stress) is with the boat heeled over on its beam ends (90 degrees) and the fin out of the water, exactly horizontal. A fin keel like this is a cantilever, but critically—on most keels it is not in pure
bending. Because the center of gravity isn’t vertically in line with the attachment to the hull, this keel is experiencing combined twisting and bending. (See the drawing below, Combined Forces on a Fin Keel.) All too often, this combined twisting and bending is overlooked. It increases the stress. The formula for determining the combined moment (the equivalent effective bending moment) is:

\[ CM = \frac{BM}{2} + \sqrt{\left(\frac{BM}{2}\right)^2 + TM^2} \]

Where:
CM = Combined twisting and bending moment, ft.lb.
BM = Bending moment, ft.lb.
BM = Keel weight, lb. x distance to the bottom of the hull, ft.
TM = Twisting moment, ft.lb.
TM = Keel weight, lb. x distance aft (or forward) of the center of attachment, ft.

For our Know It All fin-keel question we get:

BM = 6,554 lb. x 7.80 ft. = 51,121 ft.lb.
TM = 6,554 lb. x 3.42 ft. = 22,415 ft.lb.

\[ CM = \frac{51,121 \text{ ft.lb.}}{2} + \sqrt{\left(\frac{51,121 \text{ ft.lb.}}{2}\right)^2 + (22,415 \text{ ft.lb.})^2} \]

CM = 59,557 ft.lb.

The maximum effective bending moment on the fin keel is thus 59,557 ft.lb., and occurs right at the attachment of the fin to the hull bottom. For the structural calculations—with the material strength in psi (pounds per square inch)—we need to use inch pounds, which is:

59,557 ft.lb. x 12 in./ft. = 714,864 in.lb.

The Incorrect Bending Arm
A number of answers were submitted which located the combined center of gravity for the fin keel properly, but then essentially measured the straight-line distance from the combined CG to the center of the keel attachment to the hull, and used that distance as the bending arm. The distance works out to 8.51 feet in this problem. (See drawing previous page.) Using it yields a bending moment of 55,774 ft.lb. This is closer to the accurate answer of 59,557 ft.lb., but the method isn’t correct and still understates the actual combined twisting and bending moment.

The Real Center of Attachment
For the purposes of this question, the center of the attachment to the hull was taken as the fore-n-aft center of the fin keel at the hull. This is a reasonable approximation but is not strictly accurate. In fact, the effective center of attachment is the centroid of the fin-keel’s structural section area at the hull bottom. For an airfoil section the centroid would fall somewhat forward of the center of fore-n-aft length. This increases the length of the twisting arm and so further increases the total combined bending moment.

To solve this properly for a fin keel, you need to draw the proposed fin keel section at the hull, find the centroid of that section, and use that location as the fore-n-aft center of the keel attachment. One quick and accurate method of doing this is in AutoCAD, employing the Region Tool and then the Mass Properties Tool.

The drawing shows a generalized structural section through our Know It All question’s welded mild-steel fin keel at the hull. You can see the centroid is 3 inches or 0.25 feet forward of center of the fore-n-aft length. Using this, the twisting arm increases to 3.67 feet, and the twisting moment increases to 24,053 ft.lb. Entering this in the formula for combined bending moment yields a CM of 60,659 ft.lb.

Don’t forget to design fin keels using the combined twisting and bending moment. Failing to do this will result in using a lower bending moment than is correct and thus a reduced factor of safety.

### Weight Arm Aft Mom Aft Arm Down Mom Down

<table>
<thead>
<tr>
<th>Item</th>
<th>Weight lb</th>
<th>Arm Aft ft</th>
<th>Mom Aft ft.lb</th>
<th>Arm Down ft</th>
<th>Mom Down ft.lb</th>
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<tr>
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<td>1,594</td>
<td>1.29</td>
<td>2,059</td>
<td>4.06</td>
<td>6,476</td>
</tr>
<tr>
<td>Lead Bulb</td>
<td>4,960</td>
<td>4.10</td>
<td>20,356</td>
<td>9.00</td>
<td>44,640</td>
</tr>
<tr>
<td>SUM</td>
<td>6,554</td>
<td>3.42</td>
<td>22,415</td>
<td>7.80</td>
<td>51,116</td>
</tr>
</tbody>
</table>

Note: The sum or resultant arm aft or arm down is the sum of the moment divided by the sum of weights.

See page 22 for this issue’s Know It All question.
Jeremy Wurmfeld currently runs his own design firm, PERSAK & WURMFELD, with partner Carl Persak. Both well under 40, they have set the ambitious mission for their firm to “lead the next generation of yacht design.” Wurmfeld explains, “For us, that means actively listening, communicating and collaborating with clients and providing exemplary customer service throughout the design and construction process.” Persak added that it also means “utilizing the latest in cutting edge design technologies.” P&W offers a complete scope of services, ranging from conceptual design through engineering and construction oversight. The firm services a diverse range of clients large and small, from private individuals to large boat builders and other naval architecture firms in the US and abroad. P&W vigorously pursues clients’ goals with a balance of creative and practical design.

Persak & Wurmfeld is the only full-service yacht design and naval architecture firm headquartered in Brooklyn, NY, where both partners live with their families. Carl and Jeremy give back to their community through Brooklyn Boatworks, an after-school program that teaches leadership and environmental conversation through boat building and sailing.

Initially schooled as a traditional architect, Jeremy’s post graduate experience brought him to the Eastern Caribbean (by sailboat) where he joined a prominent firm in the U.S. Virgin Islands designing residential and commercial projects. His sailing roots and the clear water one block from his office in St. John inspired Jeremy to turn to sailing and yacht design as a profession. A licensed captain, he skippered several charter and private yachts throughout the Eastern Caribbean before deciding to study yacht design at the Westlawn Institute of Marine Technology.

While at Westlawn, Jeremy started working for Sparkman & Stephens in New York City where he designed a broad range of vessels for an international group of clients and boat builders. One of his first S&S projects was named "Boat of the Year" by Cruising World. Jeremy is also an avid racing sailor who took part in many local, national, and international campaigns. He spent two seasons aboard the AC winning 12 meter, Intrepid, and then joined the Etchells class leading his own campaign at the American Yacht Club.

Jeremy met Carl while they were both working at Sparkman & Stephens. Carl holds both a bachelor and masters from Webb Institute in Glen Cove, NY, and is a New York State professional engineer (PE). In addition to his seven years with S&S, Carl has also worked with Michael Peters Yacht Design in Sarasota, FL, and the Elliot Bay Group in Seattle, WA. Carl has an extensive background in commercial and pleasure yacht design, engineering, and construction management.

Recent P&W projects include:

Design of e Sailing Yachts line (Click Here). The success of the e33 daysailer has led e Sailing Yachts to engage P&W in designing three new models for the e Sailing Yachts line: the e24 ideal club racer; the e27 compact family daysailer and the e44 performance cruiser. All feature the trademark eSailing Yachts combination of easy performance, elegant and ergonomic design and spacious cockpits.

Jeremy’s innovative designs caught the eye of America's Cup Winner, Robbie Doyle of Doyle Sails. Jeremy went on to design the e33 performance daysailers, and Jeremy and Robbie consequently co-founded e Sailing Yachts in 2006. The e33 was named by Sail Magazine's “Best Boat” for excellence in deck design. Persak & Wurmfeld is now designing the e24, the e27 and the e44 for e Sailing Yachts.
144' Motor Yacht Design This P&W designed motor yacht will be the largest member of a production line of a Florida shipyard. She will feature six state-rooms, a tri-deck layout and a long waterline to boost performance and sea keeping qualities. The design challenge was to marry an existing design aesthetic with an improved performance envelope.

35' Motor Yacht Design P&W designed a new custom motor yacht design for a private client to be used primarily as a day boat for excursions off the coasts of Massachusetts and Florida for activities such as cruising and whale watching. This design is being considered for a production building venture. As a result, the design and inherent details are considerate of those building methods and processes. The vessel is to have a high level of finish, but easily maintained. The dimensions and weight of the vessel will allow it to be transported via trailer.

105' Sailing Yacht Refit To accomplish this total refit, P&W improved the profile aesthetics by simplifying the house side geometry, lowering cockpit coamings, and relocating air intakes. The social cockpit and helm station arrangements were reconfigured for better ergonomics and functionality. P&W also engineered a transom stair with a hydraulically operated swim platform that folds flush to the original transom.

102' Power Yacht Refit P&W updated a challenging late 90’s exterior styling and arrangement on this 102’ mega yacht. In addition they engineered a new transom structure with spacious storage solutions and new arrangements of the fore and aft decks. P&W also re-designed the fly bridge, adding a Jacuzzi, wet bar, grill, and innovative sliding hardtop. The new design modernized all mechanical, electrical, electronics and piping systems and corrected various running, performance, stability and spray issues.

Lifting Keel Design P&W recently designed a truly unique lifting keel for an e33 daysailer that can be replicated on much larger vessels as well. P&W’s goal was to solve the common problem of lifting keels while they are raised or lowered: that they become unstable, bang against the hull and scratch the foil. Their unique design features a torpedo-shaped lead bulb attached to the end of a carbon fiber foil. When lowered in the sailing position this special keel draws 6'- 6". The foil has vertical leading and trailing edges to allow the keel to lift 30" to a 4’ draft for motoring and mooring in shallow water. The system is hydraulically controlled and operated from the cockpit mounted panel. The innovative design allows the keel to remain totally stable in all positions.

Commercial Design and Engineering P&W have completed several commercial and engineering projects for wide variety of clients, including the Panama Canal Authority, US Steam Lines, the New York State Office of Parks Marine Services, ELCO Electric Launch, and as a subcontractor to other naval architecture firms around the world.

Jeremy Wurmfeld will be a guest speaker at Westlawn’s Mystic Meet at our Mystic CT campus on July 25. His topic is—The changing role of the boat designer and the practical implications for modern design practices.

To learn more about Persak & Wurmfeld, click here to visit their website.

Persak & Wurmfeld’s design offices are located at: 68 Jay Street, Unit 411—Brooklyn, NY 11201
Phone: 718 222 4401, Email: design@persakwurmfeld.com
Web: www.persakwurmfeld.com
ABYC Announces First in a Summer Series of Webinars “Hot Docks, Hot Boats & Electric Shock Drowning”

Based on positive feedback from a webinar that was held in April, the American Boat & Yacht Council (ABYC) will be offering a summer series of webinars aimed at sharing safety-related, technical topics of importance to professionals in the marine industry. This first summer webinar is titled “Hot Docks, Hot Boats & Electric Shock Drowning,” and it will be held on Thursday, June 18, 2009 from 2:00 – 3:30 p.m. ET.

This is a safety issue that everyone, especially on-water officers should know about. By attending this webinar, participants will learn what is a “hot dock” or a “hot boat” and how can you establish which is putting potentially deadly AC current into the water? How can this possibly result in an Electric Shock Drowning? What is an Electric Shock Drowning? Attendees will receive an alert to allow interested parties to submit comments to the U.S. Environmental Protection Agency, encouraging them to deny the petition to increase ethanol blend levels in gasoline to E15. Erin McGinn, MRAA executive director, said that they will take firm action to prevent this from happening.

Kevin Ritz, ABYC’s Pacific Northwest Regional Representative will be presenting this webinar. Kevin is also the co-owner of Cruising Essentials, LLC in Scappoose, OR. Kevin is an ABYC Certified Master Technician and is ABYC Certified in Electrical, Corrosion and ABYC Standards.

The webinar is directed toward on-water law enforcement officers, administrators, insurance personnel, surveyors, technicians and other interested parties. The cost is $49. Space is limited and registration is required. Registration information can be found on the ABYC website, www.abycinc.org.

EPA Seeks Comments on Ethanol Increase

The Environmental Protection Agency has called for comments on a proposal by Growth Energy and 54 other ethanol manufacturers to increase the allowable ethanol content of gasoline from 10 percent to 15 percent (to E15). E10 (10% ethanol) is currently in use as part of the EPA's renewable fuels standard. In March, Growth Energy the other ethanol manufacturers submitted a petition for a waiver to allow ethanol blends of 15 percent. Both the National Marine Manufacturers Association and the Marine Retailers Association of America oppose the petition on grounds that Ethanol in gasoline has been shown to damage marine engines, fuel-handling systems, fuel tanks, and pollution control and safety equipment.

Ed Lofgren, president of 3M Marine Services and chairman of the MRAA, told Soundings that the biggest repair costs for his customers have been fuel related, and these fuel problems have been exacerbated by ethanol in the last few years. Ethanol supporters are trying to circumvent the Clean Air Act process and get an administrative action declaring that E15 is the same as E10, according to the NMMA. Matthew Dunn, NMMA legislative director, said that they will take firm action to prevent this from happening.

The National Marine Manufacturers Association has set up an online action alert to allow interested parties to submit comments to the U.S. Environmental Protection Agency, encouraging them to deny the petition to increase ethanol blend levels in gasoline to E15. Unfortunately the comment period, ended May 21—before the publication date of the June 09 masthead.

New Jersey Law Now Requires Safety Certificate

As of June 1, 2009, ALL power vessel operators, REGARDLESS OF AGE, will be required to pass a boating safety course approved by the state’s marine police. Even if you don’t own a boat, but operate boats in NJ waters belonging to your friends or relatives, you must still possess a boat safety certificate.

For more information, go to: www.njboatsafety.com

New York Drops Luxury Tax Proposal

New York lawmakers have decided not to impose the 5% tax on boats costing over $200,000, which was included in Gov. David Paterson’s original budget proposal.

The NMMA, along with the New York Marine Trades Association and other allies worked to have this proposal eliminated from the budget. Hundreds of letters and e-mails were sent to the governor warning of the consequences such a tax could have on the marine industry, the NMMA said.

"The impact of the proposed tax would hit New York marine dealers most immediately. About 38 percent of their sales are of boats 30-39 feet long, most of which retail for more than $200,000," the NMMA said in a letter to the governor. Loss of even 20 percent of these sales to neighboring states, or to decisions to not purchase a vessel rather than pay the tax, could lead to even greater layoffs than already experienced in the New York market.

David Dickerson, NMMA director of state government relations, said in a statement "We're pleased that the legislature and the governor realized that this boat tax would not only fail to bring in revenue, but would significantly damage many marine businesses."

Source: Soundings Trade Only Today April 06, 2009

New Jersey Law Now Requires Safety Certificate

As of June 1, 2009, ALL power vessel operators, REGARDLESS OF AGE, will be required to pass a boating safety course approved by the state’s marine police. Even if you don’t own a boat, but operate boats in NJ waters belonging to your friends or relatives, you must still possess a boat safety certificate.

For more information, go to: www.njboatsafety.com

Source: Soundings Trade Only Today
Maine Marine Trade Association Hosts a Series of ABYC Certifications Series in 2009

In response to the need for regional training, the American Boat & Yacht Council (ABYC) and the Maine Marine Trades Association (MMTA) have joined forces to offer a series of ABYC Certification courses at the Marine Systems Training Center (MSTC) in Thomaston, Maine. By sponsoring the ABYC Certifications, the MMTA can offer these courses often at reduced pricing for State marine professionals, and with substantial savings in travel expenses.

The MMTA recently sponsored the ABYC Diesel Engine & Support Systems Certification at the end of March, and the following courses have been scheduled thus far for the rest of the year. These courses will also be held at the MSTC in Thomaston, ME:

- September 8 – 11, 2009, Marine Corrosion Certification
- December 1 – 4, 2009, Marine Systems Certification

Minda McVetty, Director of the Marine Systems Training Center commented. “We are delighted to have this association with ABYC which enables us to offer their highly sought after courses and certifications at a location in closer proximity to so many yards and builders in Maine and other states. We look forward to bringing more ABYC courses here and to furthering this great collaboration.”

ABYC offers technical training courses that progress from basic to advanced, and includes eight workforce certification courses for marine technicians and professionals. Mike New, ABYC’s Education Director, said, “ABYC was honored to be contacted about our On-Site training program by the TYIS and USDDC. ABYC has taught our certification courses all around the world including Australia, England, South Africa and Canada, and we are thrilled to have moved into this geographic region of the world. Taiwan has been producing recreational craft for over 30 years now, and we feel that by hosting two ABYC Certification courses, the Taiwan boatbuilding community is recognizing the importance of building safe, better quality boats using ABYC standards.”

Local technicians from the Ocean Alexander Yacht Company’s yard in Taiwan (Alexander Marine), as well as the TaShing Yacht Building facility were in attendance. Other members of the TYIA or USDDC also attended.

ABYC offers technical training courses that progress from basic to advanced, and includes eight workforce certification courses for marine technicians and professionals. To schedule an On-Site course, or to receive more information on customized training programs, both state-side and around the globe, contact Michael New at (410) 990-4460, ext. 31, or via email at mnew@abycinc.org. For a listing of regularly scheduled ABYC Certification courses and other training programs, please visit www.abycinc.org.

Source: American Boat and Yacht Council

April, 14 2009

NMMA Plans to Launch Online Boat Show Component

The National Marine Manufacturers Association is planning a boat show website so that consumers can preview products.

The Web site, www.BoatShows.com, is being launched later this year as a means for lead generation to dealers.

Carl Blackwell, NMMA vice president of marketing and communications stated, “Given current economic conditions, now more than ever we need to create a unique opportunity for boat dealers to help them sell more boats — period.

Providing the additional ability to generate leads before, during and after the show is a real advantage for dealers who exhibit at NMMA shows.”

Boat dealers who exhibit at NMMA shows will be able to feature their current inventory, new and used, on the national Web site, www.BoatShows.com, helping generate sales leads year-round.

Source: Trade Only Today May 07, 2009

ABYC Takes Certification Courses to Taiwan

Upon the request of the Taiwan Yacht Industry Association (TYIA) and the United Ship Design & Development Center (USDDC), the American Boat & Yacht Council (ABYC) held two ABYC Certification courses in Kaohsiung, Taiwan. ABYC conducted the four-day Electrical Certification course on May 12 – 15, 2009 and the four-day ABYC Marine Systems Certification course May 18 – 21, 2009 as part of the ABYC On-Site training program. Both courses were taught by ABYC Instructor Mickey Smith, and were held at the USDDC office, in Kaohsiung, Taiwan.

Source: American Boat and Yacht Council
Last issue we examined stainless steel. We saw what alloys are appropriate for marine use and what stainless steel's weak points are. Here, we'll take a look at copper and nickel alloys suitable for applications on boats. Though frequently (not always) somewhat more expensive than stainless steels, copper- and nickel-based alloys have much to recommend them.

**Bronze**

It's really a shame that stainless has become the "standard" metal for so many marine fittings recently. It wasn't always so. Unlike stainless, good-quality marine bronze doesn't suffer from pitting, crevice corrosion, or weld corrosion cracking. Many bronzes are as strong as stainless, and bronze can be more easily cast and worked into complex shapes than stainless. Even better, bronze is more ductile (it stretches and gives more) which provides an additional margin of strength and safety—more energy absorbed before failure.

Perhaps the most important question is: What's the difference between bronze and brass? Once, this was relatively simple—brasses were of copper alloyed with zinc, and bronzes were of copper alloyed with tin, with very little or no zinc at all. Either brass or bronze could have a variety of other elements stirred in to adjust strength, elongation, and machineability. Over the past several hundred years or so, "new" varieties of bronzes have been developed. The old standard bronzes are usually called "tin bronzes." Now, these may also have phosphorus added and so are sometimes called "phosphor bronzes." The alternatives are "aluminum bronzes," which have 5 to 8 percent aluminum, while "silicon bronze" has . . . you'll never guess . . . silicon added.

Keel bolts, for lead keels on fiberglass or wooden hulls, shouldn't be of stainless. Such bolts are (as we saw last issue) in exactly the worst environment for stainless underwater—in stagnant water (when any water gets in and it will). I once had a young engineer at a major keel manufacturer
solemnly explain that bronze wasn’t strong enough for keel bolts?! I managed not to laugh. Not only does bronze have nearly the same tensile strength as stainless, but bronze’s corrosion resistance is infinitely superior in this application. Bronze keel bolts are the standard and have been for over 150 years.

The best known silicon bronze is probably Everdur, a trademark bronze generally of 95% or higher copper, with about 3% silicon, and 1% manganese. Silicon bronze (Everdur) is about my all-around favorite marine metal. The top pick for most marine screws and bolts, it has a tensile strength of 90,000 psi in hard temper and 55,000 psi in soft temper. It’ll never corrode (unless you’re foolish enough to fasten it directly to steel or aluminum, where it will cause corrosion in the aluminum or steel). It can be cast, welded, rolled, bent and otherwise formed without harm. If I had my way, every fitting on a boat would be made from silicon bronze. (Of course, this is on fiberglass or wood/wood-epoxy hulls. Aluminum or steel boats should use proper marine stainless to minimize galvanic corrosion.) A silicon bronze rudder stock will simply never fail from corrosion.

If you don’t like polishing bronze deck hardware (and don’t want to just let it “go green,” which is harmless) get it chrome plated. Now that’s Bristol fashion! (This must be proper, marine-grade, high-quality chrome plating. Careful preparation over 2 or 3 nickel base coats, and multiple chrome coats are required. Cheap chrome plating will peel off and look awful in a very short time.) Phosphor and aluminum bronzes are also exceptional for almost all marine applications.

**Cast Bronzes and Zinc**

There’s a bit of a conundrum when it comes to casting bronze. Though, say, true silicon bronze can be cast successfully, it is more difficult to cast cleanly with defined edges as well as more difficult to machine after casting. Adding zinc greatly improves bronze’s castability. The question is, are such “bronzes” really bronze or are they brass. There doesn’t seem to be a clear delineation on this, but copper alloys with less than 15% zinc are unlikely to suffer from dezincification. The lower the zinc content the better. Generally, alloys of copper, with less than 6% zinc content can be considered bronzes and immune from dezincification. Some of these alloys, however, are called brasses. A good example is 115 Red, C83600 Cast Leaded Red Brass. Its composition is 85% copper, 5% tin, 5% lead, and 5% zinc. Though called a brass, with such low zinc content, it’s effectively a bronze. 115 Red is a good alloy for casting many marine fittings.

**Nickel Aluminum Bronze**

Both bronze (including so-called manganese bronze) and stainless steel are used for propellers. Such bronzes are the low-cost approach for propellers that aren’t highly loaded. Stainless propellers are high strength and can have thin blades, which are ideally suited for high-speed, high-stress applications. Such stainless propellers, however, can suffer from the same pitting and crevice corrosion that all stainless steels can experience in saltwater. Nickel aluminum bronze is the answer for high strength plus high corrosion resistance in props. NiBrAl is about
80% copper, 9% aluminum, and 5% nickel. Tensile strength is 90,000 psi, with tensile yield of 40,000 psi.

Fake Bronze That’s Really Brass
As we’ve seen, where bronze is copper alloyed with tin (or silicon, or phosphorus, or aluminum) brasses are copper alloyed primarily with zinc. Most brasses should not be used for structural purposes on a boat. The reason is that the zinc is so far apart from the copper on the galvanic scale that the brass will suffer from severe corrosion called dezincification. The zinc will literally dissolve away leaving a brittle spongy mass with no strength at all. Brass can and does make fine interior hardware and low-strength deck fitting, however.

There are some brasses which masquerade as bronzes, however. The four most common of these fakers are manganese bronze, Tobin bronze, commercial bronze, and naval brass. Manganese bronze is a complete misnomer (though it is the correct name for some unknown reason). In fact, manganese bronze is 58% copper and 39% zinc (with 0.8% manganese)—a true brass. Tobin bronze is 60% copper, 39.2% zinc, and 0.7% tin, a true brass again. Commercial bronze is 90% copper and 10% zinc—too much zinc to be a true bronze, but—in this case, at under 15% zinc—moderately resistant to dezincification. Naval brass is at least properly named as a brass. It is 60% copper and 37.5% zinc. Because it has the word “naval” in it, however, there’s a tendency to think it can be used for marine applications underwater. It shouldn’t be. It should be limited to use on deck and in the interior.

Interestingly, manganese bronze, Tobin bronze, and commercial bronze are widely employed for not only fittings like cleats, and chocks, and portlights, but even for propellers and struts. The reasons is that they are strong (initially), easy to cast, and easy to machine. In fact, they give adequate service on deck and excellent service in the interior, but are potential problems below the waterline. When used for propellers or propeller struts—which is surprisingly common—care must be taken to protect these manganese-, Tobin- or commercial-bronze (really brass) fittings with zinc anodes. These anodes have to be inspected and renewed regularly. Proper silicon bronze is much better. The best propeller material, as we’ve seen, is nickel aluminum bronze, usually called NiBrAl or nibral.

A common comment regarding bronze is that it’s difficult to find. Two sources of bronze in all shapes and in plates are: Atlas Metal [www.atlasmetal.com](http://www.atlasmetal.com) Anchor Bronze & Metals, Inc. [www.anchormetals.com](http://www.anchormetals.com)
Sources for bronze fasteners are: Jamestown Distributors [www.jamestowndistributors.com](http://www.jamestowndistributors.com) Aarons Silicon Bronze Fasteners [www.aaronsiliconbronzefasteners.com](http://www.aaronsiliconbronzefasteners.com) Bristol Bronze [www.bristolbronze.com](http://www.bristolbronze.com)

Monel
The real king of all marine metals is Monel. It’s drawback is higher cost, but whether it’s fuel or water tanks, keel bolts, fasteners, or custom hardware, no other metal provides the combination of high strength and corrosion resistance that Monel offers. Monel is nickel and copper alloyed with other elements. Monel 400 is 63% nickel, 28% to 34% copper, 2.5% iron max., 2% manganese max., 0.024% sulfur max.,

<table>
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<th>Mn</th>
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<td>27.0</td>
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<td>0.50</td>
<td>0.50</td>
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<td>0.015</td>
<td>2.30</td>
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<td>Bal</td>
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<tr>
<td>Inconel 625</td>
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Values are percentages
0.3% carbon max., and 0.5% silicon max. Tensile strength is 80,000 psi, and tensile yield strength 35,000 psi. Monel K-500 has a somewhat different chemical composition with incredibly high strength: 100,000 psi tensile strength and 70,000 psi tensile yield strength. Monel is also the best keel bolt material. Though silicon bronze is excellent, Monel is better still. Interestingly—and somewhat counterintuitively—Monel is the ideal keel-bolt material for cast-iron keels—highest strength, high corrosion resistance, and galvanically compatible with the cast iron.

**Copper-Nickel**
A lesser known metal is copper nickel. Obviously, this is primarily copper alloyed with nickel. Copper-nickel CA-706 is 90% copper and 10% nickel, with a tensile strength of 40,000 psi or 55,000 psi in one-quarter hard. CA-715 is 70% copper and 30% nickel, with a tensile strength of 45,000 psi. The very special characteristic of copper-nickel is that it’s non-fouling without any bottom paint. Yes, almost completely and virtually forever. A few workboats have been fabricated with all copper-nickel hulls. Though their initial cost is very high, the payback—over several years of operation—is in savings from no haul-outs or bottom painting, as well as increased fuel economy from always having a clean bottom. Still, that’s not the primary use for copper nickel. It’s most common application is in keel coolers for boats with dry exhaust. It also makes excellent sea strainers.

**Inconel and Hastalloy C**
The least know of the nickel-based alloys are Inconel and Hastalloy C. These alloys are so corrosion resistant they can withstand acid at boiling temperatures. You wouldn’t think there was call for such materials on boats, but there is in one specific use—exhaust piping. Though stainless (316L or 317L) can be used for custom dry exhaust risers and exhaust pipes, nothing beats the corrosion resistance of Inconel and Hastalloy C for this purpose. These metals are also very strong with tensile strengths from 80,000 psi to 130,000 psi depending the alloy. If you are specifying custom dry exhaust risers, Inconel and Hastalloy C—though pricy—are worth every penny.

**Steel and Aluminum**
We haven’t discussed steel and aluminum in these two articles. Steel is certainly high strength, but it is far too prone to rust and corrosion for use in most marine hardware or fittings. Aluminum—proper marine aluminum—is widely used for all sorts of hardware and fittings, from window frames, to sail tracks, to cleats, to spars, and much more. Aluminum—compared to stainless, bronze, Monel—however, is both weaker and softer. It’s thus not a high-strength metal. Of course, both steel and aluminum make excellent boat hulls. We’ll take a look at them in a future article.

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**Who Will Be The June 2009 Know It All Winner?**

Want to see how much you know? Want to show everyone else how much you know? The first three people to submit the correct answer to the following question will win a Westlawn tee shirt and cap, and will also receive a Know It All certificate. The answer and winners to be published in the next issue of *The Masthead.*

*Breezy* is a classic 48-foot motorcruiser, with a light grey hull, white decks and superstructure. The large main cabin on deck aft has a comfortable main saloon, a dining area, and a large fully equipped galley. The “galley-up” configuration works well for *Breezy*’s owners, who prepare gourmet meals, and routinely entertain six to eight guests for lunch or dinner parties on cruises of a few hours on the Chesapeake. Visibility out of the main cabin is excellent through large windows all around and large sliding glass doors leading to the aft cockpit. The cabin is 15’ – 6” long fore-n-aft and 12’ wide. Headroom is a generous 6’ – 8”.

*Breezy* has three separate air/conditioning units. The forward cabins belowdeck and the aft main cabin on deck are each on separate, split, direct-expansion A/C units. The pilothouse between these two areas has its own dedicated small A/C unit. Though the pilothouse and forward A/C units are up to the job. The A/C unit for the main aft cabin can’t keep up on warm days. How much air/conditioning capacity would you recommend for this cabin, and what notes or special comments (if any) would you make about its installation?

Email you answer to Norm Nudelman at: nnudelman@westlawn.edu
Write “June 2009 Know It All” in the subject line.
The first three correct responders will be the winners.
Essential Continuing Education
For Marine Surveyors, Boatbuilders, and Small-Craft Designers

**Elements of Technical Boat Design** (Course No: Elements)
A comprehensive introduction to the fundamental concepts in yacht and boat design for marine professionals. Note: Graduates of Elements may continue on to complete the full Professional Westlawn Yacht & Boat Design Program, receiving credit for all the subjects passed in the Elements course. (Elements was formerly called Yacht Design Lite.)
[Click here for a detailed syllabus](#).

**Interior Design Methods for Yacht Design and the Boat-building Industry—NEWLY UPDATED** (Course No. ID201C)
This design-thesis challenge course** meets a critical need within the marine industry for detailed, updated instruction on the disciplines of ergonomics and interior design.
Among key design issues cited are physical access, storage, stairway and lighting design, berth, galley, dining, and head layouts. What distinguishes the accompanying text from others is that the author never loses sight of physical imperatives—wave motion, heeling, drainage, ventilation and vessel structure—as factors in determining a boat’s interior spaces.
*This course is designed for the mature learner. Students study the Westlawn text (the only one of its kind on this subject) and then complete an extensive design-thesis challenge exam to graduate. (Strong manual drafting or 2D CAD skills are required.) For more information on how the design-thesis challenge method of study works, email us at info@westlawn.edu

**IMPORTANT NOTE:** The course textbook *Interior Design Methods for Yacht Design and the Boat Building Industry*, by Lisa C. Hix is supplied at no extra charge to students enrolling in this course. However, Students who already have a copy of this book will be given a $100.00 tuition discount when enrolling in this course.

**CLICK HERE** for more information Westlawn Continuing education courses.

**ABYC Courses and Schedule for 2009**
The ABYC Education Department has been providing industry certifications, training, high school and college curriculum, and industry seminars for over twenty years. They are providing the marine industry with the skilled workers required to build and maintain modern small craft of all types.

ABYC is currently scheduling on-site factory training for 2009. Please call ABYC for custom tailored, flat rate, instruction by top industry trainers at your facility (410-990-4460, Ext. 31).

The Marine Technician Certification Program developed by ABYC with "NOCTI Certification"* has proven to be the industry standard. ABYC continues to provide the highest quality marine education and training throughout the country and throughout the year.
For course dates and descriptions [Click Here](#) or see listing on Masthead Page 24.

*NOCTI (National Occupational Competency Testing Institute) is a regular provider of the assessments on which many certifying bodies depend for measures of applicants’ standards-based knowledge and skills. Certificates benefit employers by showing that applicants have acquired specific skills. The status of having a certified staff can lead to higher sales and customer satisfaction.
Training Links & Events Schedules

Training Links - For Current In-Class ABYC Courses

To register for an ABYC Education Program, click on the event name you would like to attend.

<table>
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<tr>
<th>DATE</th>
<th>EVENT NAME (CLICK FOR DETAILS)</th>
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<tr>
<td>Jun 03, 09 - Jun 05, 09</td>
<td>SC400 Standards Certification Course, - St. Pete, FL</td>
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<td>Jul 13, 09 - Jul 15, 09</td>
<td>**MMTA On-Site Train The Trainer - High School Educators</td>
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<td>Jul 28, 09 - Jul 30, 09</td>
<td>SC400 - ABYC Standards Certification Class, Toronto, Canada</td>
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<td>SC400 - ABYC Standards Certification - Annapolis, MD</td>
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<td>EL400 - Electrical Certification Course - Philadelphia, PA</td>
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<td>EL400 - Electrical Certification Course, Annapolis, Maryland</td>
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FOR MORE ABYC COURSES & DATES  CLICK HERE

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**Announcement**

WE’VE CHANGED OUR EMAIL ADDRESSES. PLEASE MAKE A NOTE IN YOUR CONTACT LIST.

In order to work efficiently with other colleges and schools and to better serve our students, Westlawn has changed its email to our .edu domain—westlawn.edu. .EDU is the top level domain for educational institutions.

The new Westlawn e-mail addresses are:

- General information: info@westlawn.edu
- Dave Gerr, director: dgerr@westlawn.edu
- Norm Nudelman, provost: nnudelman@westlawn.edu
- Stu Waring, senior instructor: swaring@westlawn.edu
- Patti Schulte, student services coordinator: pschulte@westlawn.edu

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Training Links for Westlawn Distance Study

Click on Topic for more information:

- **Professional Yacht & Boat Design, 4-Module Program**
- **Elements of Technical Boat Design** (Formerly Yacht Design Lite)
- **Continuing Education**
- **Applications & Enrollment**

All Westlawn Courses are nationally accredited by the Accrediting Commission of the DETC

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**2009 NMMA Boat shows**

**Toronto In-Water Boat Show - 2009**
September 17 - 20, 2009
Ontario Place
Toronto, Ontario
[www.torontoinwaterboatshow.com](http://www.torontoinwaterboatshow.com)

**Norwalk International In-Water Boat Show 2009**
September 24 - 27, 2009
Norwalk Cove Marina
Norwalk, Connecticut
[www.boatshownorwalk.com](http://www.boatshownorwalk.com)

**Liberty Boat Show - 2009**
October 1 - 4, 2009
Liberty Landing Marina at Liberty State Park
Jersey City, New Jersey
[www.libertyboatshow.com](http://www.libertyboatshow.com)

**24th Nashville Boat & Sportshow**
January 6-10, 2010
Nashville Convention Center
Nashville, Tennessee
[www.nashvilleboatshow.com](http://www.nashvilleboatshow.com)

CLICK HERE for a Complete Listing of NMMA Boat Shows

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**IBEX**
International Boatbuilders’ Exhibition & Conference
October 12-14
Miami Beach Convention Center, Miami Beach Florida
2009 Conference & Training Programme

WARSHIP 2009
June 2009, London, UK
http://www.rina.org.uk/warship2009

ICCAS: INTERNATIONAL CONFERENCE ON COMPUTER APPLICATIONS IN SHIPBUILDING
1-3 September 2009, Shanghai, China
http://www.rina.org.uk/ICCAS

INTERNATIONAL SYMPOSIUM ON SHIPBUILDING TECHNOLOGY
September 2009, Osaka, Japan
http://www.rina.org.uk/ISST2009

HISTORIC SHIPS
October 2009, London, UK

ICSOT: ICE CLASS SHIPS
October 2009, Busan, Korea
http://www.rina.org.uk/ICSOT2009

INTERNATIONAL CONFERENCE ON SHIP AND OFFSHORE TECHNOLOGY
December 2009, Kharagpur, India
http://www.rina.org.uk/icsotindia2009
www.rina.org.uk/events

If you would like to receive any further information on any RINA event then please contact the events department: 10 upper Belgrave street, London, SW1X 8BQ.
Tel: 44 (0)20 7235 4622, Fax: 44 (0)20 7259 5912, email: conference@rina.org.uk

Westlawn students are eligible for student membership and Westlawn graduates are eligible for graduate membership in RINA. See Westlawn forum for details.

Integrity 55 — Bradley M. Collett, Westlawn Alumnus
Tracks on the Water — My Life in Yacht Design
Westlawn Alumnus Robert Harris Publishes His Autobiography

After a more than five decades in boat design, Robert Harris (one of Westlawn’s many influential graduates) has written of his life’s work. An important pioneer in multihulls, he also designed many successful monohulls, custom and production.

This is a great read by a designer who has seen a lot and done a lot. It offer much food for thought regarding both technical aspects of design and the realities of small-craft naval architecture as a living.

Books can be ordered for $25.50 U.S., in an international postal money order or bank note drawn to U.S. funds. Send to:

Robert Harris
795 Sawyers Lane
Vancouver BC V5Z 3Z8
Canada