WHY OWN AN ALUMINUM YACHT?

Marine grade aluminum has become the choice structural fabric of modern yacht construction. It doesn't leak, absorb water, delaminate, or deform. It can't rust, and won't spark, or combust. It just sits there. Aluminum yachts are lightweight, strong, corrosion-resistance, and non-flammable. The ease of workability, welding and handling make aluminum hulls economical.

WHY ARE SO MANY YACHTS MADE OF FRP?

Most of today's yachts are made of fiberglass reinforce plastic (FRP). Fiberglass is inexpensive and easily formed and thus, has become the production material of choice. However, composites have other drawbacks. Composite materials are highly flammable, absorb water, delaminate, and will deform.

"Composites assembled by even the best yacht builders can suffer delamination, incomplete cure, resin starvation, water absorptions and heat deformation", according to Michael A. Smith, a contributing editor to "Yachting" and "Boating" magazines in his article Why Aluminum. Experts warn that under the hot tropical sun, a fiberglass boat with a Deep Blue or another dark color hull can lose up to 75% of its strength. Smith wrote that, "According to one classification-society engineer, it's likely that cored-composite yachts built with bottom-of-the-barrel raw materials like E-glass fabric and polyester resin will have water in the core within five years. Even more troublesome is secondary bonding: attachment of bulkheads, stringers, floors and other structural members to the cured hull." Smith's final comment, "Composite fiberglass is floating Russian roulette-do you feel lucky?"

Michael Kasten, N.A. has fun with American's obsession with fiberglass boats in his article Aluminum For Boats, available on his website (kastenmarine.com), in which he shares the notion that, "Among dedicated blue water cruisers in the South Pacific, 50% of the boats are metal; the rest of them are from the United States". The statement, of course, is an exaggeration, but it's not far from the truth

An aluminum yacht is a more capable world cruiser and makes more sense where safety and comfort are primary concerns. You won't find commercial, blue water, ocean going boats or ships made from fiberglass. These vessels are built of steel or aluminum for strength and safety. Blue water yachts range up to 150 ft. and more. For vessels in lengths from 30 ft to 150 ft, aluminum is the material of choice by knowledgeable yachts owners. Besides being lightweight and strong, aluminum can be cut with ordinary carbide tools, is easy to bend and form, and is also easy and quick to weld, which simplifies the construction process, thus reducing cost.

HOW DOES THE WEIGHT OF ALUMINUM COMPARE TO OTHER MATERIALS?

Light Weight. Aluminum weighs about 35% of the weight of steel. As in shown in the following table, the weight of 3/8-inch aluminum plate is comparable to 1/8-inch steel, and is about half the weight of ¼ inch steel plate.

COMPARATIVE WEIGHTS OF STEEL AND ALUMINUM

Thickness	Mild Steel Pounds per Sq. Ft.	5086 H116 Aluminum Pounds per Sq. Ft.
1/8 in.	5.10	1.76
3/16 in.	7.65	2.64
¼ in.	10.20	3.52
3/8 in.	15.30	5.44

The difference in weight means that the aluminum yacht will be able to use smaller engines, reducing fuel consumption, and increasing vessel range. The cost for engine and drive train will also be lower as the demand on that equipment is reduced. The lighter weight also means significant savings in operating costs during the ownership period of the yacht.

HOW STRONG IS ALUMINUM?

Strength. Several knowledgeable authors have written about the strength of aluminum verses steel. Their discussions focus on yachts being designed to the "same standards", such as IMO, ABS, Lloyds or other similar classification societies. They discuss the strength, rigidity or deflection of the structure, the yield point, the flexure or plastic range of the material. For aluminum yachts, structure rigidity is usually the controlling design criteria, resulting in greater overall flexural and tensile strength than would otherwise be necessary.

Steel designs, on the other hand, are developed around the tensile yield point of the material because flexure and rigidity are not limiting factors. The following table from Bruce Roberts-Goodson's book **The Complete Guide to Metal Boats** compares the yield strength, tensile strength and plastic (flexure) range of steel, aluminum and fiberglass. A measure of material rigidity, the elastic modulus, has been added to this table:

COMPARATIVE STRENGTHS OF DIFFERENT MATERIALS

	Steel	Aluminum	Fiberglass
Yield strength	36,000-42,000 PSI	18,000-40,000 PSI	10,000-15,000 PSI
Tensile Strength	60,000-72,000 PSI	23,000-47,000 PSI	15,000-34,000 PSI

Plastic Range	40%	24%	Fair
Elastic Modulus (Rigidity or Stiffing)	30×10^6 PSI	10×10^6 PSI	

The over strength of the aluminum yacht is a favorable consequence of its rigidity-based design. "Scantlings", or hull plate thickness, will be about 1.5 times greater for aluminum versus steel. For example, if a steel yacht were designed to use ¼ inch bottom plate, then an aluminum yacht built to the same strength standard would use 3/8-inch bottom plate.

According to Michael Kasten, in his website article on Strength of Aluminum vs. Strength of Steel, this increase in plate thickness yields about 29% greater strength than the equivalent steel plate and will have a 12.5% higher tensile capability. He concludes, therefore, "… That a boat built in aluminum will be far less easy to dent by running into stuff (roughly 29% higher regional yield strength), and will have a slightly higher resistance to ultimate failure (around 12.5%)."

CAN AN ALUMINUM HULL SURVIVE A HARD GROUNDING?

In catastrophic situations like running aground, the strength of the welded aluminum hull can mean the difference between completely loosing your yacht and being able to recover it. For example, in 1971 Palmer Johnson built Yankee Girl, a Sparkman and Stevens designed IOR racer. After her racing days, while sailing along the southern coast of New England, she ran aground on a rocky shore. She was eventually washed into 18 inches of water by the tides, surf and winds. The problem was, she drew nine feet! After three months of being battered by wind, surf, tides, and waves, she was pulled-off with a large portion of her hull flattened, but she didn't leak! She was towed to a yard in the vicinity, damage removed, new frames and plates installed and eventually sailed away no worse for the wear.

The hull of the aluminum yacht will be more fair because the thicker material resists distortion better during the welding process. Consequently, the hull will require less labor-intensive fairing, and save money in the finishing process.

DOESN'T ALUMINUM CORRODE EASILY?

Corrosion. Today's marine grade aluminum, 5086H116, is virtually corrosion free. Aluminum alloys have trace metals added like chromium, copper, iron, manganese, and magnesium to create alloys for various applications. For marine use, aluminum alloy 5086H116 is recommended. It contains pure aluminum, with 4 to 5 percent of magnesium and no other race metals. 5086H116 provides excellent resistance to salt water, is ductile, and retains its high strength when welded.

First and foremost in corrosion protection is a good painting system. Use of a high build epoxy barrier coat(s) is the preferred system. Experts recommend using between 12 to 16 mils, dry-film paint coverage. This system would be used on interior surfaces as well as exterior surfaces. The interior surfaces can then be sprayed with foam insulation. The exterior can receive several coats of finish linear polyurethane. This rugged finish will protect the epoxy and keep the entire structure safely and securely encapsulated and provide years of corrosion-free durability.

In addition to this primary system, dissimilar metals must be kept electrically isolated with bedding compounds like Sikaflex and 3M 5200, or non-conductive plastic like Delrin, or rubber isolators. All of these systems work together to create a corrosion free environment for aluminum yachts.

Below the waterline, an array of sacrificial zinc anodes must be used to control any stray-current galvanic corrosion. In addition to zinc anode protection, an inexpensive onboard monitoring system can be installed that constantly checks corrosion potential. The majority of aluminum yachts, however, enjoy many decades of trouble-free and corrosion-free use, protected only by zinc anodes.

ALUMINUM YACHTS MAKE SENSE!

In all, aluminum yachts make good sense! If you want a boat that retains and even gains in value, is virtually corrosion free, strong and rigid, non-flammable, cost effective to operate, easily repairable, won’t leak, delaminate, or absorb water, consider an aluminum yacht for your next purchase.