PHILOSOPHY

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***** GENERAL PHILOSOPHY *****

A Yacht Building company's philosophy is very often described in simple expressions and slogans like: ***High quality, high performance, high technology, safe, state of the art, etc***. The problem is that these are words and slogans everybody uses the good as well as the bad yards. In order to find out a yards real philosophy and the way the yard lives up to this philosophy in real life one must go much more in detail into the yards thinking, ideas and real actions. This is an attempt to explain at least a part of what represents the foundation of Baltic Yachts philosophy.

Since the start of Baltic Yachts, 1973, our main goal has been to build the best possible sailing yachts combining safe easy handling performance cruising as well as high performance racing.

In order to achieve the performance and handling characteristic goals we decided to use designs that were light to medium displacement types. A heavy type design would not have had the performance we were aiming for; it would also have put us in direct competition with the strongest brands on the market at that time. On the other hand a super light displacement design would not have had the capability to carry the interior and equipment needed in order to achieve comfortable cruising characteristics.

A light to medium displacement philosophy, with comfortable cruising interior, puts pressure on the builder to reduce construction weight in order to reach the weight savings required without sacrificing strength and safety. Hence it becomes essential to use high tech building methods and material. A very positive spin-off from this is that high tech materials/construction give a higher general quality and much better durability.

1 LIGHT VERSUS HEAVY DISPLACEMENT DESIGNS

There have always existed two completely different opinions on which type of boat, light or heavy, that gives the best sailing, handling and safety characteristics for long distance cruising.

With regard to performance we believe that it is fair to say that the vast majority of sailors today are of the opinion that the lighter boats are superior.

The opinions on which type of boat is better as for cruising comfort, handling and safety concerns are much more evenly divided between light and heavy boat supporters. We would claim, however, that the sailors who favour light-medium types of cruising boat have grown in numbers. This is probably because a large number of cruising sailors have gained a lot of positive experience using these types of boat for "World Cruising" during these years. At least we can claim that we have many clients that have been doing "World Cruising" in recent years and their feedback is as positive as can be, also in the context of comfort, handling and safety.

In Yacht design and Yacht construction the same rules apply as with a lot of other things in life. No matter which philosophy you select, heavy or light, it will not guarantee a good product. You can build relatively good yachts with both philosophies but unfortunately you can also get very bad results with both systems. There are a lot of "smaller" decisions that must be made and that will influence the result. Also the final result is very much up to the building quality and commitment to details and capability to tailor-make layouts and equipment to suit the individual client. However, when designing/building a new yacht the project starts with the decision, light or heavy, and we are convinced that a moderate light displacement boat is the best decision for a safe, comfortable cruising boat as well as for the all-round racing boat.

However, when you are building a light displacement yacht with the comfortable accommodation, a Baltic offers and sometimes with high standard equipment, one has to be very realistic when calculating and deciding the displacement for a new design. It is easy to put a lot of promising numbers on paper but if, in reality, these figures are not reached, these theoretical equations are then of no value and the result is a boat with low stability and an insufficient sail area for its displacement. In other words, on a yacht that is supposed to have very comfortable interior and sometimes a lot of equipment one cannot carry the "light displacement idea" to extremes.

What are the main differences between medium-light displacement yachts and heavier types of design?

1.1 HULL SHAPE

LIGHT-MEDIUM DISPLACEMENT HULL

Lighter displacements give the possibility to design a hull with very straight, fair shapes. This will result in the following advantages:

- Less resistance, higher speed potentials

- Straight, fair lines make the hull less asymmetric when the hull is heeling hence better directional stability (tracking capability) plus much less tendency to "roll" down-wind.

- In hard down-wind conditions the hull will "lift" out of the waves easier due to the fuller shape plus the light mass of the boat; the boat will also surf easily maintaining directional stability and control. Waves will not "roll over" from the stern as much as with heavier designs. If the speed increases too much it is always possible to run with reduced sail area. Even in a gale situation running on bare pole with lines out as "brakes" the light displacement yacht will "lift out of the waves" and stay drier.

- Close-hauled, the hull will "lift" out of the waves resulting in less spray over the deck. less pounding into waves, more comfortable in heavy weather.

HEAVY DISPLACEMENT HULL

Heavy displacement for a given length is achieved by giving the hull a deeper and generally "rounder" shape and this will result in a few negative characteristics:

- More volume with a "round", curved shape will have lower speed potential.

- A more curved shape will result in a hull that becomes more asymmetric when heeled. This will result in some windward helm during up-wind conditions. Every boat has this tendency but the "rounder" the shape, the more of this tendency.

- A hull shape with a more asymmetrical shape, when heeled, has a strong tendency to create heavy "rolling" downwind. When the boat is heeling to one side the hull tends to go to the other side (due to an asymmetrical shape). This is prevented with heavy steering compensation. The course is corrected and the boat heels to the other side steering itself in the other direction, again compensating with the rudder, rolling over to the other side etc. etc. As a result, not a very comfortable and safe ride. Some of the old I.O.R. light- displacement boats also had similar problems due to their pinched in sterns.

- In hard downwind conditions running with the seas the heavy boats will often not have enough speed to keep away from the waves and will get waves coming over the boat. Also, at a certain stage, when a wave is catching you, you will lose steering power due to the fact that the speed of the water is almost the same or the same as the boat speed with an increased possibility for knock-downs hence safety risks.

- More water spray over the boat in upwind conditions.

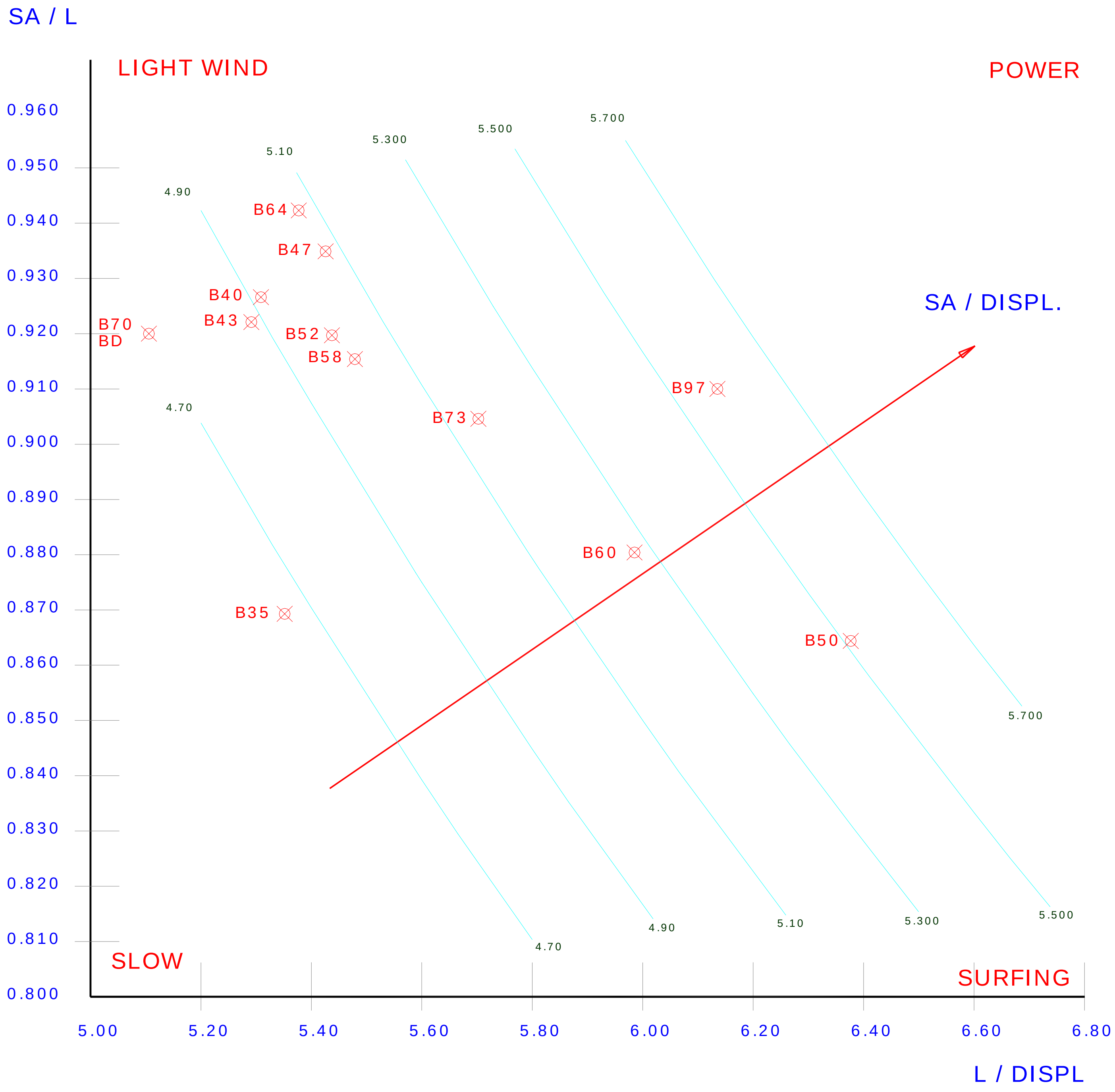
In general, lighter boats are considered to pound more into waves due to very flat forefoot hull shapes. This is not correct. Light boats do not necessarily need to be extremely flat; all our new models have relatively moderate shapes. In fact, the first designers that developed "flat forefoot hull shapes" did it because they had bad experiences of the deep v-shape pounding heavily into the waves with the flat side and believed it should be possible to develop a shape with smoother wave handling. Later the forefoot on some I.O.R. hulls became extremely flat for rating reasons. Our opinion, today, is that the extreme in any direction is never the optimum.

1.2 RIG SAIL PLAN

The relationship of sail area/displacement should be close to the same on the light as the heavy displacement boat in order to have approximately the same level of performance. This means that the heavy displacement boat ends up with a lot more sail area hence being more difficult to handle. Otherwise one must accept a lower performance level. A "light" boat often has a different relationship of head sail/mainsail than a "heavy" boat. Very simplified it can be stated that head sails represent the "low gear" giving power and the mainsail "high gear" giving speed. A heavy boat needs a large genoa in order to get enough power. A lighter boat can have a smaller head sail. This often results in

lighter boats having their mast further forward with a small, high aspect fore triangle and a large mainsail. This is an "easier-to-handle" type of rig;
the boat will be better balanced in a "eased out" situation due to the fact that the sail forces are more forward.

PERFORMANCE CHART



$SA/L = \sqrt{RSAT} \;/\; DWL$

$L/DISPL = DWL \;/\; \sqrt[3]{(DISPL / 1025)}$

$SA/DISPL = \sqrt{RSAT} \;/\; \sqrt[3]{(DISPL / 1025)}$

2 SOME OF THE BASICS ON FIBER REINFORCED PLASTICS

In the world of yachting you often here expressions like: High-tech laminates, Computer analyzed laminates, Aramid laminates, Carbon laminates etc. etc. These expressions are mostly used as marketing gadgets and very few boatyards and even fewer clients know the real technical values and differences between these materials and methods. When looking at the yachts being built in the world today, it is surprising to find that the level of technology used is generally very low. Most boatyards are using basically the same materials and methods that were used almost 20 years ago.

Since the materials and methods used for a laminate are the main factors influencing the final properties, let us just examine some of the basic facts of these different materials/methods.

An FRP (Fiber Reinforced Plastic) laminate has two main ingredients: Fibers and Resin.

Fibers
The fibers in a laminate are there to take most of the loads the laminate is exposed to. Fibers are the "Load carrying members "of a laminate.

Resins
The resin in a laminate is to create a bond among the fibers; in other words, glue the fibers together and keep them in column when they are under load.

2.1 TYPES OF FIBERS

E-glass. This is the most commonly used fiber today. It is made from molten glass, spun into individual fibers. E-glass has basically good strength values as virgin fibers but loses a lot of its strength when it is processed, sized and woven. Our experience shows that E-glass enjoys maximum advantage when it is in unidirectional form due to less handling and manipulation in the manufacturing process. The cost of E-glass is relatively low.

S-glass is a high quality glass fiber developed originally for more high technical purposes. The filament fibers of this glass are approx. half those of E-glass. S-glass has significantly higher strength properties than E-glass but is also normally more expensive.

Aramid is a synthetic fiber and has very good tensile strength and low stretching, very good impact resistance and low density. Aramid is known on the market under brand names such as Kevlar and Twaron. Aramid is relatively expensive.

Carbon fiber is made of graphite fibers. Excellent stiffness, high tensile and compressive strength. Light. Costly.

The above fibers are available in different configurations:
-Chopped strand mat (short fibers arrayed in random directions). This mat is available only in E-glass and has very low structural value in larger yachts.
-Woven Roving. Made from continuous strands of fibers, woven in two orthogonal directions. These types of Roving are available in all of the above fiber types. Strong and easy to use at relatively low costs.
-Unidirectional are roving where the majority of the fibers run in one direction. The result is a material with very pronounced directional properties. This enables the builder to orientated more fibers in the direction of maximum stress or just plainly reinforce high loaded areas of a laminate. A hull laminate can be built up of only unidirectional by running the different layers in different directions. Unidirectional give better laminate properties than any of the other configurations. In terms of minimum thickness, strength to weight ratio and fiber to resin ratio, they outperform every other configuration. They are however most difficult to handle and demand high-level know-how from the builder.

2.2 TYPES OF RESINS

Orthophthalic Polyester is still the most commonly used resin in the boat building industry. This Polyester is relatively inexpensive and easy to use and control during the production process. The strength values of this resin are mediocre. The negative aspects of this resin are low water resistance (risk for blistering/osmosis) and poor elongation to break (stretch characteristics)

Isophthalic Polyester is higher in quality than Ortho-Polyester. Strength values are higher. Elongation to break (stretch) is several times higher than for Ortho-Polyester. It has much better standards of water resistance hence less risk for blistering. The best available Isophtalic resins today have strength and durability properties on the same level as Epoxy. However, proper curing is essential in order to reach optimum strength.

Vinylester is higher priced than Polyester, but still relatively easy to work with. Elongation to break (stretch) is excellent hence this resin gives the final laminate excellent strength properties. Relatively good water resistance. The curing process is relatively sensitive to curing temperature. he only sure way of reaching the potential strength values of vinylester is to Post Cure (cure under high temp.) the laminate; therwise final values could be only mediocre.

Epoxy is a very high performance resin. The elongation capability is better than for any of the other alternatives. Epoxy also has better adhesion properties and will maintain its properties better over a certain time (more durable). Very high water resistance hence no risk for blistering/osmosis. The curing time for an Epoxy laminate can vary, using different hardeners, from 1/2 hour to 9 hours, hence giving ample time for using vacuum bagging methods on relatively large laminates. Epoxy is the most expensive resin and very difficult to work with but with the correct know-how and proper handling, it produces superior results in comparison to the other alternatives.

Pre-Preg Laminates. This is giving the best type of laminates. The fibers are pre-impregnated with an Epoxy resin and are "dry" in room temperature. The laminates are cured under vacuum and at high temperature (85 Centigrade). The pre-preg laminate gives the best strength values also the best resin ratio control plus an optimized fiber orientation (straight fibers).

From the above, we can understand that there is a variety of different materials with different properties that can be combined in a laminate. Below are some of the properties for high grade unidirectional, virgin fiber's, and resin types.

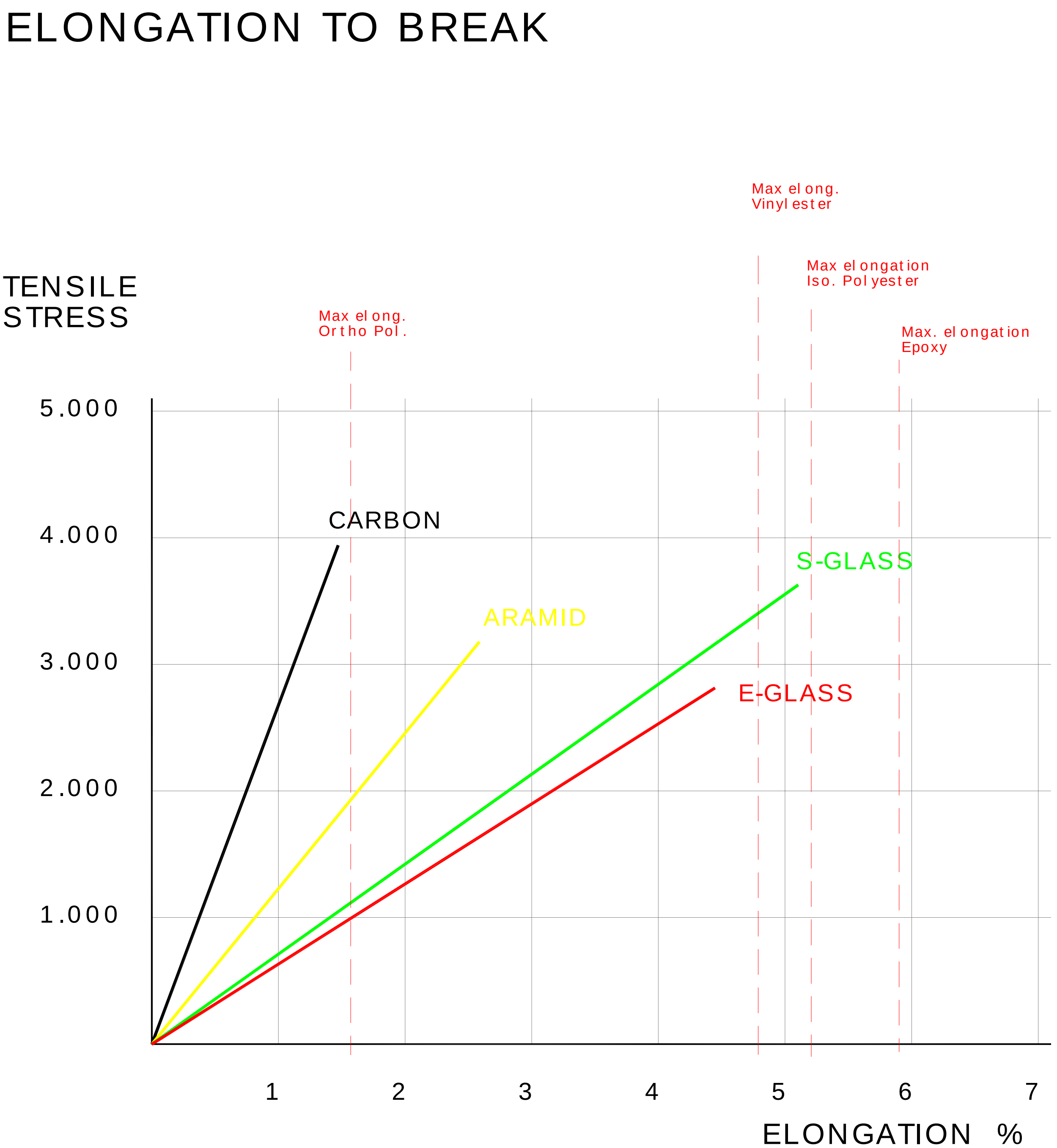
2.3 TABLE OF PROPERTIES FOR FIBERS AND RESINS

In virgin form

	Tensile Strength N/mm^2	**Tensile Modulus** KN/mm^2	**Elongation to break** (%)	**Density** g/cm^3
FIBERS				
E-glass	3400	73	4.8	2.55
S-glass	4600	88	5.4	5.50
Kevlar	2800	100	2.7	1.67
Carbon fiber	3400	230	1.5	1.75
RESINS				
Ortho Polyester	50	4.6	1.6	1.20
Iso Polyester	74	3.5	5.0	1.14
Vinylester	78	3.5	4.9	1.12
Epoxy	76	3.2	5.7	1.09

Fig. 1 Let us take the properties of the materials presented in Fig. 1 and present them in another form in order to try to understand how they work together or against each other when mixed together in a laminate. See Fig. 2.

Fig. 2 In the above schematic picture we can see that a laminate where E-glass is used as fiber and Ortho-Polyester



as resin will break at a point where only approx. 1/3 of the strength potential of E-glass is used. The laminate would start to fail at an elongation of 1.6% which is the maximum elongation of Ortho-Polyester. The laminate fails due to polyester failing, not fiber failing.

If, instead of Ortho-Polyester, we used Epoxy (fibbers would still be E-glass) we would basically increase the strength three times. Not because Epoxy is that much stronger than Polyester but Epoxy has a maximum elongation which exceeds E-glass hence uses all of the E-glass strength potentials.

The resin in a FRP laminate should transfer loads from fiber to fiber. The fibers are the load carrying members in the laminate and the job of the resin is to basically glue the fibers together and keep them in column when they are under load. It is therefore important that the resin has a high level of adhesion to the fibers but equally important that it has enough elasticity (elongation to break). It should be noticed that in order to take full advantage, of the strength potentials in the fibers, the resin should be able to deform (elongate without breaking) to at least the same extent as the fibers. In other words the elongation capability of the resin has a great influence on the strength of the laminate.

Let us take a look at how the properties and strength values of different laminates change during a period of 10 years normal use. Different tests have been made and they all give approximately the same result. Fig.3 shows the reduction in strength for laminates, using different types of resin, during this 10 years period. Again, the Ortho-Polyester, used by over 90 percent of boat builders, shows by far the largest reduction of properties.

3 REDUCTION OF STRENGTH

DUE TO WATER PENETRATION AND STRESS CYCLING DURING 10 YEARS OF AVERAGE USE.

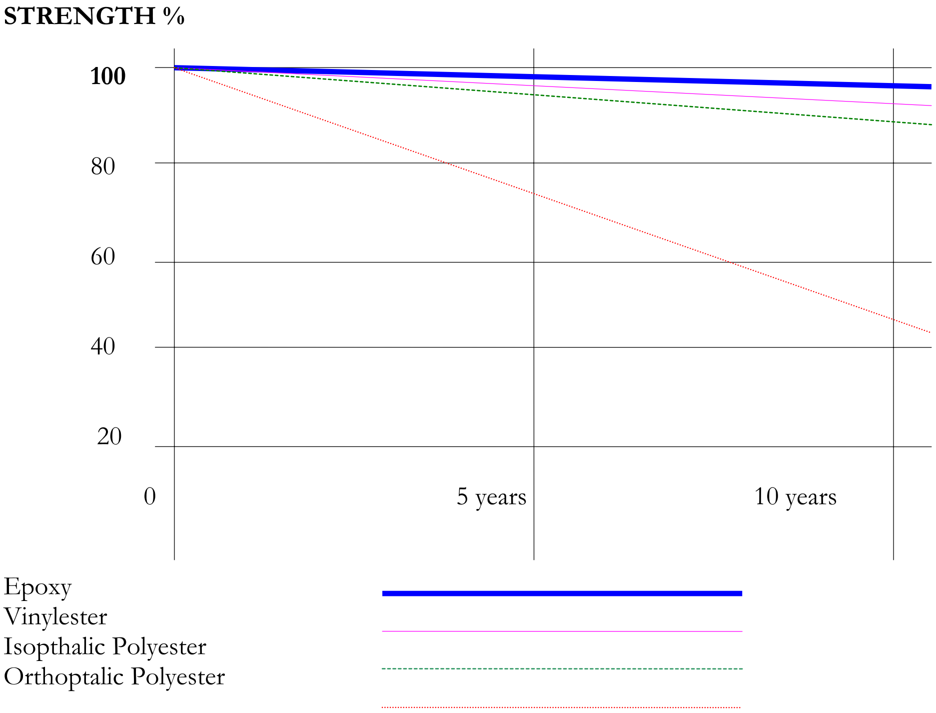
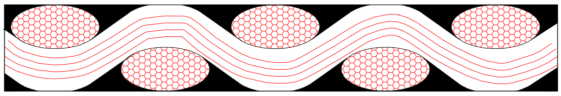


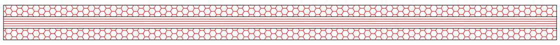
Fig. 3 The above curves represent average laminates during 10 years of average use. It cannot be claimed that every yacht built with Ortho-Polyester will lose 50 % of its strength during 10 years. There are things, other than the resin, that will influence the reduction of the laminate properties , such as which fibers are used, humidity in laminating facilities, quality of work, quality of maintenance etc. However, tests clearly show that there are very distinct differences between the resins.

Improving the laminate by using unidirectional roving in combination with sandwich construction will improve the retention of the strength properties of the laminate due to increased panel stiffness and a lower resin ratio; hence less stress on the resin and more stress on the fibers. This will improve the quality of the laminate substantially. Let us look at some of the reasons why.

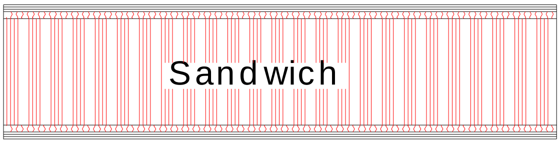
Woven roving laminate



Unidirectional laminate



Unidirectional sandwich laminate



As can be seen from these very schematic pictures the "Woven roving" laminate has a lot of "weak spots". The fibers in the laminate are not straight but "curve around" inside the laminate. This means that when load is applied to the laminate the resin must stretch a lot before the fibers start to take the loads. This creates a laminate that flexes much and a high risk of microscopic cracks in the resin. These microscopic cracks will allow water to penetrate into the laminate and substantially increase the risk of osmosis.

In the "Unidirectional laminate" all fibers run in the directions of the loads and the fibers will immediately take the load. There are no "weak points". The only disadvantage, in some applications, is that unidirectional laminates do not build up thickness in the same way as woven roving do.

The "Sandwich-unidirectional-laminate uses the very good properties of the unidirectional fiber and uses the sandwich material to build up thickness. The panel stiffness of a laminate is dependent on the cube of its thickness hence a sandwich laminate will have much greater panel stiffness and hence less flexing than a single skin laminate. This prolongs the life of the laminate, preventing stress cracks hence better resistance against water penetrating into the laminate.

Experience and testing show that the retention of strength of a laminate will decrease dramatically with increased panel flexing. The more one allows a panel to flex the faster its properties will decline. This applies especially to the very brittle Ortho- Polyester.

Most boatyards today use Ortho-Polyester in combination with E-glass woven roving and chopped strand mat. From an engineering point of view this combination represents a relatively low quality and low cost laminate. Some yards using this method are yards with a high quality image and a good reputation.

At Baltic Yachts we have used, since the beginning in 1973, unidirectional fibers in combination with sandwich construction. Through the years we have developed our laminating systems and today the minimum requirement for a hull laminate is Iso-Polyester. Some of our standard boats like the Baltic 64 have vacuum-bagged Epoxy laminate using Ck57 End-Grain-Balsa as sandwich material and a hybrid roving Kevlar/glass unidirectional as basic fibers in the laminate. We strongly believe that a sensible high tech laminate will be stronger, lighter and last longer hence increasing the life and second hand value of a yacht and making the yacht a good investment for the owner.

The above information is not claimed to cover and clarify all the "mysticism" involved in different materials and laminating systems and some of the ideas and explanations are slightly simplified for clarity. However, it clearly shows the benefit of using laminating techniques and materials that are far above average in boat-building of today.

3.1 BALTIC LAMINATE

Since the beginning in 1973, Baltic have used the sandwich construction in combination with unidirectional fiber laminates in hulls and decks.

Today all laminates are still sandwich construction, for strength, stiffness, lightness and insulation. Most unidirectional used at Baltic are a special Kevlar/glass roving. Minimum requirement for resin is a high quality Isopthalic (for any application, even interior moulds). Our medium size yachts are today mostly in Epoxy vacuum bagged laminates and most of the custom Custom project laminates are in Pre-Preg using extensively Carbon, Aramid, S-glass fibers. As an example can be mentioned that all the three Mega Yachts (147, 141, 152) are in full Pre-Preg laminates not only hulls and decks but also most part of the interior.

THE BALTIC LAMINATING APPROACH IS A TECHNICAL REALITY AND NOT A MARKETING GADGET.

4 SOME BASIC MATHEMATICS OF YACHT DESIGN

Developing a new model always requires close co-operation between the Naval Architect and ourselves.

In order to achieve the performance characteristics that we are looking for on our boats some of the main performance parameters like SAIL AREA/DISPLACEMENT, SAIL AREA/LENGTH, LENGTH/DISPLACEMENT, BALLAST/DISPLACEMENT etc. are virtually given and should stay close to certain given numbers.

It is often claimed (mostly by competitors) that as an example using a high-tech laminate cannot save enough weight to justify the "numbers" in our specifications. We often hear comments like "it is impossible that they can be 2.000 kgs lighter than ours by using high-tech hull laminates because our total hull weight is below 2.000 kgs". This comment is correct if you take an existing design and just switch from conservative to high tech laminate. However let us move the decision process (conservative contra high tech), in time, to where, in our opinion, those things should be decided namely, when the design is still only a design study/proposal in a designer's computer.

If at that stage we decide to use a laminate (just as an example) that would save 500 kgs, the following mathematical process would take place.

1. If we stay with a given BALLAST/DISPLACEMENT ratio we can reduce the keel by approx. 430 kgs.

2. At this stage weight saving is approx. 930 kgs.

3. For a given SAIL AREA/DISPLACEMENT we can, at this stage reduce sail area/mastheight resulting in reduced loads on shrouds, mast, chainplates, winches, deck fittings etc.; hence without reducing safety standards or functions we can go down in dimensions and therefore save weight.

4. With this additional weight saving we can complete the "mathematical circle" and go back to point 1. realizing that we can reduce the ballast again and do another "mathematical circle". etc.

Consequently the decision to use a high-tech method and save 500 kgs in the laminate will result in a total weight saving exceeding 1.000 kgs.

It should also be noted that the laminate is only a small part of the total weight of a boat hence "weight saving mathematics" should not be concentrated/focused only on laminates.

5 DETAILS

5.1 MAST & RIGGING

On all models (except Baltic 35) 3-spreader masts (sometimes even 4-spreader) are used. Some of the reasons:

1. A 3-spreader rig can safely be bent more and has much better sail tuning and trimming capabilities than a 2-spreader rig. Hence a full draft mainsail, giving a lot of power in light wind, can be flattened out enough for heavy wind conditions.

2. Smaller mast section, hence less wind resistance and nicer looking.

3. Genoas can be sheeted in at a smaller angle, hence better pointing capability.

A cruising sailor might ask what all this has to do with him. Our opinion is that a bendable but safe, 3-spreader rig with its better sail-trim possibilities allows better sail-trim especially in heavy wind conditions; hence sailing will be faster, more comfortable and fun. In heavy wind conditions going upwind, a mainsail that can be flattened out will make you go fast and high with less of a heeling angle. A mainsail that is too full and cannot be flattened out will make your boat heel over, not point very well and go slowly.

Standing rigging on all Baltic Yachts is rod-rigging. The reason for this is that it is stronger; smaller diameters can be used (in comparison to wire) hence less windage; rod rigging stretches much less which allows you better mast-tuning and adds a lot of safety to your rig.

5.2 RUDDERS / STEERING

Baltic Yachts have always favoured balanced spade rudders with a very direct ratio between steering wheel and rudder. The more direct a steering system is the more emphasis will be put on having a perfectly balanced rudder. However when properly executed the final result will be a steering that can be handled with almost finger-tip control, in most conditions, and where small movements on the wheel will immediately result in course changes. This not only enables a very effective steering for racing but is also an important factor for making the life for the cruising sailor more comfortable. Just imagine a down-wind situation where the boat is rolling and there is a lot of steering required. With normal "none-direct- ratios" the helmsman will work very hard turning the wheel from side to side and still always be too late while using a lot of energy. On the other hand, with the direct steering the boat will react immediately on the helmsman's reactions and with much smaller wheel movements the boat can be steered on a much more effective "track" and with less energy input from the helmsman.

Today, Baltics have All-Composite rudders including composite rudder stocks. During the last years Baltic Yachts has developed a method of making composite rudder stocks using special moulds and techniques in order to develop a very light, strong and durable construction. The techniques basically allow us to make the rudder posts in one curing process having the laminate exposed to, vacuum, pressure and heat all at the same time. When this system was developed carbon was not permitted according to the IMS rule, so the system was developed based on S-glass/Epoxy laminates.

The result is a rudder shaft that, in comparison to an optimized aluminum rudder post is less than half the weight, has higher breaking strength (the shaft was calculated based on bending being the critical factor), can be connected more easily to the rudder blade (same material), will not fatigue at the same pace as a metal shaft and will not have any corrosion.

With carbon permitted in IMS rudder shafts of today, the same tools and methods can be also used for making carbon rudder posts.

All rudders have self aligning roller bearings for minimum friction.

5.3 TEAK DECKS

When we established Baltic Yachts in 1973, the common way of building a teak deck was to bed the teak down in a flexible compound, mostly the same used in between the teak stripes as caulking material. At that time there were many problems with teak coming loose from the FRP decks resulting in expensive warranty problems for yards and/or maintenance problems for the owners. Also the flexible connection between teak and FRP resulted in the teak not adding much strength and stiffness to the deck, only weight.

We decided, right from the beginning to develop a better way of doing our teak decks. Instead of bedding down the teak in flexible caulking material we bedded it down in Epoxy resin. This gave a much better connection between teak and FRP dramatically reducing the risk for the teak to "disconnect". In addition, since the connection was rigid, the teak added strength and stiffness to the deck; hence the basic deck laminate in some cases could even be reduced and compensate to some extent for the teak weight.

The track records show that we made the right decisions and subsequently a lot of yards have followed us and started to use the same system.

Later we eliminated screws and plugs completely by using vacuum bagging methods to apply the teak decks.

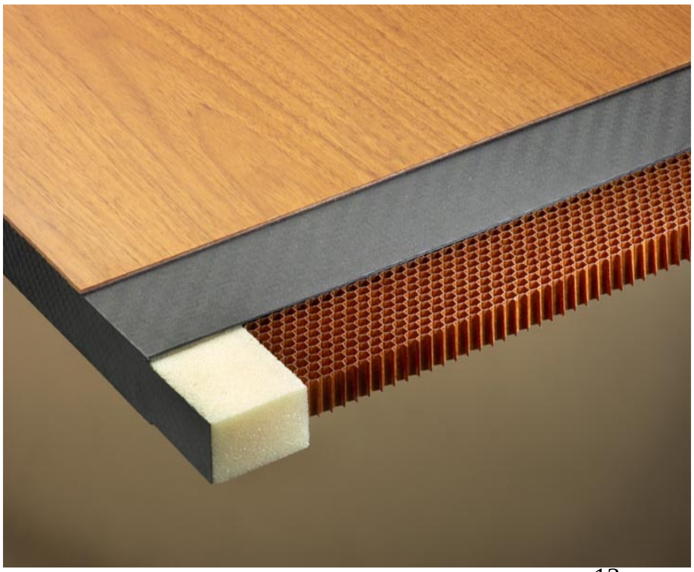
All this in combination with our pretentious way of selecting and cutting teak has resulted in teak decks second to none.

5.4 INTERIOR

The joinery work on a Baltic speaks for itself and must be seen; especially selected and matched teak is put together and finished in the best possible way with several layers of varnish, sanded between each layer and polished to a satin finish.

The interior is also a structural part of the yacht. Wherever a bulkhead or a cabinet meets the hull or the deck they are connected to the hull/deck by means of a tabbing laminate and adds strength and stiffness to the hull and deck. The interior is installed into the hull, when the hull is still in the moulds. On the standard models (built in moulds) the hull stays in the moulds for weeks with the interior installed allowing the laminates to cure (some laminates will be postcured).
The main structural bulkheads are in FRP sandwich construction and only covered with teak veneer for aesthetically purposes.

On the Custom projects we do work with a variety of styles. Today we are building interior in “Baltic style” plus covering a styling spectra from totally modern to classic. We can with our in-house designers do any type of styling plus that we are also working with outside stylists and interior designers. On many projects we have used extremely lightweight interior systems building all panels from lightweight Carbon/nomex with just a thin layer of veneer on visible surfaces.
Below are samples of some of the interiors and interior details we have made.



Example of an interior panel made with Pre-Preg Carbon laminates on a Nomex sandwich and visible surface surface covered with a thin Teak veneer.

Very light, strong and durable.

BALTIC 78 with salon in a typical Baltic styling.

BALTIC 70 "Classic". Classic styling (by Bill Dixon). Mahogany wood.

BALTIC 56-01 modern style (by judel/vrolijk &co)

6 FLEXIBILITY

We have specialized in tailor making our yachts in order to meet the requirements and needs of the clients as much as possible. This has resulted in a situation where we do no longer build yachts in stock. It would be impossible since two yachts will never be completely identical. We make individual interior and deck layouts in addition to individual equipment specifications. We basically work very closely with each client trying to create individual yachts and allowing the client to develop "his yacht" based on personal requirements and taste.

Apart from flexibility in interior and deck layouts we sometimes make for example, different types of keels. Some clients sail in areas with very shallow waters, others race in deep waters etc.; as a result we end up discussing the maximum allowed draft with the client. Based on that we come up with what we consider to be optimum solutions/suggestions. We have ended up with deep fin keels, reduced draft wing keels, keel-center- boarders, etc.

This high degree of flexibility makes our business very individual and personal and that is exactly how we like it.

7 IN-HOUSE DESIGN

In order to be able to do all the individual layouts and all the individual construction drawings, and so forth, we had to become "Computerized" at a very early stage. We have our own CAD systems and work also very closely together with the R & J Design office (located on our premises) equipped with the most modern computers and software for this purpose.

With the increasing Custom business and also because the standard models have become more and more tailor made there has been an increasing need to produce layouts, drawings, weight estimates, prices, performance studies, etc. for prospective projects. These layouts and calculations must be produced in a fairly short times and with a good accuracy hence well developed computer software are the only way to enable us to live up to this standard.
Many years of designing layouts in the computer have given R&J Design a large library of CAD designed details that can be implemented into layouts hence speeding up the design process and this helps in speeding things up.

On the weight and price calculation side we have through the years developed a program that gives good weight and cost numbers for a given size of a yacht. Example calculation can be seen below.

ID: WP60.XLS

PRICE & WEIGHT CALCULATION   *BALTIC YACHTS Ltd*

OBJECT: Prel. Calc. 60 FT   **DATE :** 23.11.2000 PG

LOA :	18,670	**m**
LWL :	16,020	**m**
BEAM :	4,990	**m**
DEPTH	2,040	**m (Hull at ST5)**
SIZE FACTOR :	176,565	

	WEIGHTS	**GLASS / KEVLAR ISOPTHALIC POLYESTER**	**GLASS / KEVLAR EPOXY VACUUM**	**CARBON / KEVLAR EPOXY VACUUM**	**CARBON / KEVLAR PRE-PREG**	**SELECTED VALUES**
10	**HULL**	3 082	2 680	2 144	1 865	
11	**KEEL**	7 646	7 200	6 353	5 823	
20	**DECK**	1 346	1 131	905	778	
	DECK FITTINGS	506	506	506	506	
	WINCHES	182	182	182	182	
	TEAK DECK	318	318	318	318	
30	**INTERIOR**	2 036	2 036	1 629	1 303	
40	**ENGINE**	538	538	538	538	
50	**PLUMBING**	549	549	549	549	
60	**ELECTRICITY**	820	820	820	820	
70	**MAST & RIGGING**	854	854	854	854	
80	**STEERING**	136	136	136	136	
90	**EQUIPMENT**	191	191	191	191	
WEIGHT (EXCL. KEEL)		10 559	9 942	8 773	8 042	0
WEIGHT (INCL. KEEL)		18 206	17 142	15 126	13 865	0
BALLAST RATIO		42 %	42 %	42 %	42 %	

	MATERIAL & HOURS	GLASS / KEVLAR ISOPTHALIC POLYESTER	GLASS / KEVLAR EPOXY VACUUM	CARBON / KEVLAR EPOXY VACUUM	CARBON / KEVLAR PRE-PREG	SELECTED VALUES
10	HULL	201 644	268 859	336 073	403 288	
		2 131	2 665	3 065	3 678	
	BOTTOM PAINT	12 137	12 137	12 137	12 137	
		197	197	197	197	
	HULL PAINTING	13 030	13 030	13 030	13 030	
		552	552	552	552	
11	KEEL	109 574	109 574	109 574	109 574	
		47	47	47	47	
20	DECK	160 035	213 379	266 724	320 069	
		1 300	1 674	1 925	2 310	
	DECK FITTINGS	151 012	151 012	151 012	151 012	
		659	659	659	659	
	WINCHES	132 008	132 008	132 008	132 008	
	TEAK DECK	34 436	34 436	34 436	34 436	
		418	418	418	418	
30	INTERIOR	280 371	311 523	389 404	467 285	
		5 702	6 054	6 962	8 703	
40	ENGINE	117 959	117 959	117 959	117 959	
		159	159	159	159	
50	PLUMBING	92 438	92 438	92 438	92 438	
		584	584	584	584	
60	ELECTRICITY	69 126	69 126	69 126	69 126	
		926	926	926	926	
70	MAST & RIGGING	408 163	408 163	408 163	408 163	
		136	136	136	136	
80	STEERING	59 949	59 949	59 949	59 949	
		71	71	71	71	
90	EQUIPMENT	21 001	21 001	21 001	21 001	
		1 233	1 233	1 233	1 233	
99	MISC	23 524	23 524	23 524	23 524	
MATERIAL COST :		1 886 407	2 038 119	2 236 559	2 435 000	0
BUILDING HOUR .		14 115	15 375	16 934	19 673	0

The above shows the result of a weight and price calculation for a prospective project. The base for the program is what we call a size factor. This size factor is actually a volume calculated from a few length, beam and height values of the projected hull in question.
Based on years of experience we have built up curves for material costs and building hours and transferred these curves into mathematical formulas in our program. The program calculates values for 4 different technology levels.
The numbers are based on what we call a **Baltic Standard Specification.** If the project has variations from this "Standard Specifications" these variations must be considered separately. However this program gives us very fast a base to start from.
This program allows us to make weight and price calculations within a very short time. It also allows us to see the differences between the four different technology levels with regards to both price and weight hence presents a very good base for evaluation. A mixture of all four technologies can be selected (selected values).
Based on these preliminary numbers and preliminary designs and drawings made a performance study will/can be made. In the performance study the alternatives (technology levels) can be run against each other will give the client another tool to evaluate which alternative fits his needs and priorities.

When the project get a full go ahead we get into more detailed weight calculation where we list every item on the yacht, its weight and its center of gravity position. By the end of this process we have a very accurate weight estimate of the project. This weight estimate is followed up and modified during the building process. Following is the first page of a weight estimate as an example.

Weight and center of gravity calculation (according to deck & interior Mark T 6-22-00)

BALTIC 147
Version: 03.09.00 Updated weights on request from R&P
Version: 12.09.00 Updated weights
R. Kasslin

STD PRO INSTALLATION

X=0 at sta 5, fwd positive
Y=0 at DWL, above positive
Z=0 at CL, stb side positive

	pcs	*a`weight* kg	*Tot. weight* kg	*Center of gravity* x	y
HULL MATERIALS					
Weight of hull, deck, structoral interior			0,00		
including painting	1,0(	22000,0(	22000,0(	-2,70	0,60
HULL STRUCTURES					
Interior laminate to hull/deck	1,00	250,00	250,00	-6,48	0,55
Lazarette deviders	1,00	150,00	150,00	-19,80	0,69
V1/D1 chainplates	2,00	40,00	80,00	0,68	1,81
Aft chainplate	1,00	15,00	15,00	-22,30	0,93
Headstay chainplate	1,00	20,00	20,00	19,5(	1,00
IFS chainplate	1,00	20,00	20,00	14,18	0,34
Anchor box reinforcements	1,00	170,00	170,00	15,1(	0,48
FWD thruster box	1,00	40,00	40,00	14,0(	0,00
AFT thruster box	1,00	40,00	40,00	-16,1(	0,14
BALLAST					
Keel (lead)	1,00	54230,00	54230,00	-0,86	-4,85
Cylinder	1,00	630,00	630,00	-0,6(	0,80
Keel locking cylinders	2,00	70,00	140,00	0,6{	1,00
Hydraulic power pack			0,00		
S.S. Bearing parts			0,00		
RUDDER					
Rudder foil	1,00	30,00	28,00	-17,50	-1,81
Rudder shaft	1,00	110,00	110,00	-17,20	-0,73
Bearings, housing and laminate	2,00	15,00	30,00	-17,05	0,63
STEERING					
Wheel	2,00	6,00	12,00	-10,15	2,75
Pedestal	2,00	15,00	30,00	-9,75	2,70
Quadrant	2,00	13,00	26,00	-17,50	0,25
Cables	2,00	5,00	10,00	-13,8(	1,20
Sheaves	8,00	3,00	24,00	-13,8(	1,20
Tiller	1,00	15,00	15,00	-17,90	2,00
Autopilot cylinders	2,00	10,00	20,00	-17,60	0,28
Hydraulic motor	1,00	15,00	15,00	-17,60	0,28
HULL EXTRAS			0,00		
Margin % :		5,00	3905,25		
		HWT	82010,25	-1,45	-3,19
DECK					
Deck laminate included in hull			0,00		
Fillers/paint included in hull			0,00		
Deck beams included in hull			0,00		
Mainsheet targa beam incl. in SPT	1,0(	0,0(	0,0(	0,0(	0,00

The above is just an example from a weight calculation and is only the first page out of normally 7–15 pages. During the production process there are always some changes of equipment that will influence the numbers also real numbers might vary some from calculated ones. This weight calculation is updated accordingly.

Another valuable check that we do is actually scaling the whole boat in various stages of production. We have sensors under the corners of the cradle and can take the weight measurements when required. This will also give the location of the center of gravity. With all these weight and CG numbers, both preliminary and more final ones, we communicate with however is the naval Architect for the project enabling him to make more accurate designs hence a boat floating closer to it intended lines and therefore performing closer to the expected.

People have asked us why we have developed these systems. Most yards relay on Yacht Designers for things like this. We have a slightly different way of looking at this issue. It is our opinion that:

- No designer no matter how good he is can do accurate weight calculations for different yards. Every yard has their own ways of doing things resulting in different final weights.
- A good yard must be able to give the naval architect proper weight numbers.
- Most of our projects are very weight sensitive hence follow up is essential for a good product.
- We simply reduce the gap between the estimated and real numbers hence produce a better product.
- We need to be able to give our potential customer proposals with alternative within a reasonable short time. The more outside capacity that you need in order to put these packages together the less time effective you will be.

We have no intention of becoming also Naval Architects but we do believe that there must be a very good and close cooperation between the yard and the Architect. And we believe that our capability to do these calculations and our follow up of the same, with continuing corrections and upgrades gives a very valuable input to the projects and enable us to give the naval architects more accurate number hence improving the end result.

8 DESIGN, STYLING, LAYOUTS

One of our very important strategies from the beginning was to be able to do our own interior design and exterior styling. We felt and still feel that a good company should have products designed and styled in such a way that the products can be recognized by the public. The only way to achieve this was to create a factory design team which we did.

It is fair to say that our design team has been and is one of the most progressive in the world. We have made interior styling and layouts that later have set trends for the rest of the yachting world: For example, the center double berth aft cabin that was first seen on our Baltic 51 and is now used in a large number of our competitors' designs.

When it comes to styling we have always told ourselves that a Baltic should be recognized on its looks and therefore the basic styling must be maintained. This does not mean that styling cannot be developed. We have certainly changed during the years. Looking at the latest design we have created and comparing it to our first boat, over 20 years ago, the difference is so dramatic that the two designs look as if they were worlds apart. Nevertheless there have been similarities in design and the design development over the years and the different models follow a strategic design plan.

9 CUSTOM DIVISION

We have, since 1973, built 31 custom yachts in sizes ranging from 38 to 152 FT L.O.A. The custom boats have been an addition to the business and have also increased our knowledge and possibilities to develop new methods and materials in a way that would not have been possible with only serial production. Also the custom yachts have given us the possibilities to work together with owners, designers, consultants, etc. that we perhaps otherwise would not have worked with hence providing us with additional input and challenges.

10 FINALLY

There is a perception that all Baltics are just big racing machines. It is true that Baltics have taken their fair share of silver. But not seeing a Baltic as a strong, beautiful cruising yacht is, quite simple, a mistake. We feel that light, stiff and fast are relevant to the cruising family as they are to most competitive ocean racer.

The Baltic "philosophy" has been described many times by the world's sailing press. But your mental picture of a Baltic hard-on-the-wind in a strong breeze is about 95 percent of what a Baltic really is - light, stiff and fast. You can see how easily a Baltic develops power. Responsive, quick and agile are terms used to describe a thoroughbred. They describe a Baltic perfectly.

Once you have experienced a Baltic by sailing one, light, stiff and fast become memorable words. Every Baltic ever made was designed for exhilarating performance. And lasting value. Whether out for an afternoon sail, a distance race, or a circumnavigation, every Baltic is made to go for it.

Did it ever strike you how you know a Baltic is a Baltic even from a considerable distance? The powerful, fast look. The distinctive style. Every detail complete. A Baltic is a serious yacht and a statement about its owner.

There are two components of Baltic that you might not see as quickly.
First is the Finnish craftsmanship that's in every facet of Baltic. From the materials specifications on the engine beds to the tiniest detail of cabinetry, its apparent. At Baltic, craftsmanship goes beyond company philosophy. It's tradition and a part of our heritage. Since our beginnings in 1973, the word quality has changed a lot, but Finnish craftsmanship has only
been refined by the advent of new technologies.

Technology is a key word in the Baltic story because light, stiff and fast is what keeps Baltic Yachts in the forefront of the industry. Our commitment to learning and using technology to refine Baltic's structural integrity, beauty and longevity is unparalleled. It can be said without boasting that Baltic is responsible for many of the high-tech materials and processes that have changed the way boats are built today. What is often proclaimed as new technology, we have quietly used for years.

French Mate's chapter on Baltic in "The World's Best Sailboats" summarizes the Baltic philosophy in 1986, as it does today, except that we have moved light years ahead. When you think of Baltic, if you remember light, stiff and fast, we'll be very happy. That is the philosophy that we at Baltic are dedicated to.

For more than twenty years we have set goals of keeping ourselves among the most progressive yacht builders in the world. It is never an easy task. It demands constant research into new methods and materials. It demands working with the best designers. It demands keeping ahead of our fellow competitors with ideas. Most of all it demands our ability to maintain good contacts with our clients obtaining feedback from them and being able to use that feedback positively in the development of our products and the strategies of our company.

Update 4.4.2006