
Teel

Tim Kings Project Manager

Mr. Tim Kings has served as Project Manager for the building of the TEEL. Mr. Kings represented the owner's interest throughout construction. This magnificent yacht surely wouldn't have become a reality absent of Mr. King's ability to coordinate the designers, equipment suppliers and the builder. The owner had a strong vision of perfection for this yacht. However, the project needed to be managed to the strict business standards that were also reflective of the owner.

Mr. Kings came to this project with a unique background that made him such an able negotiator among the disparate parties required to bring TEEL together. Whether it required balancing all the designers who contributed to the effort or conveying a concept to a tradesman on the floor, Mr. Kings was able to draw on a part of his professional background to pull the pieces together at the end of the day.

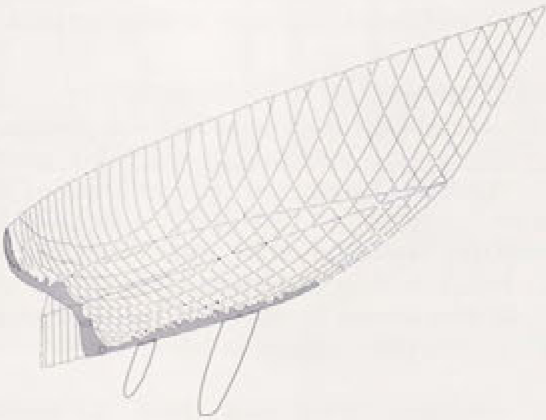
Tim grew up in Pensacola Florida with a great fondness for sailing high performance catamarans and a respect for the structured life that goes with a Navy town. He literally worked his way up from the shop floor when it comes to building large composite yachts. He learned the various shop floor trades working at Gary Carlin's Kiwi Boat Works in the late 70's. His artistic flair was rewarded when he started their in-house design office where he produced hundreds of detail design drawings that made Ron Holland's ocean racers a reality. Mr. Kings would latter hone his design craft in Holland's design office in Ireland.

Always interested in seeing the transformation from drafting table to sailing yacht, Mr. Kings took a job in mainland China that was nothing more than a leap in self confidence. At a yard that produced crudely manufactured FRP fishing boats, Mr. King was able to show the workers how to build a fine yacht, learning the Chinese language as he went. This led him to his dream of building his own design in Taiwan under his detailed, on site supervision. Many Macintosh 45s are happily cruising the globe today.

For Teel, Mr. Kings reported to the owner daily on the status of every little detail of the building process. For an owner who's pleasure is as much the process as the product, Mr. Kings frequent video tapes and tight project management made the experience of building TEEL as rewarding as sailing her.

TEEL: *Driven by Technology*

by Eric Greene



The creation of a beautiful yacht can be compared to the birth of a beautiful child. At conception, optimism fills the air, and the prospect of endless potential is overwhelming. Throughout the gestation period, the realities of bringing a new creation into the world begin to sink in. Preparation and planning go forth at an ever-increasing pace. Both the human birthing process and the period just prior to a yacht's launch are times when physical and mental efforts reach a crescendo.

Today, more than ever, we are faced with choices that will shape future generations. Where marriages were once determined by geography and tradition, greater flexibility is available in today's international society. Likewise, early boatbuilding relied on traditional designs and construction methods largely dictated by local geography. Today, when a magnificent yacht is created, choices about design and construction span the globe.

The development of a large yacht involves many critical decisions along the way. If the project is carried out with vision, a creation that embodies both beauty and function will be launched. This is the story of TEEL.

All great yachts are the product of the process, as much as the materials and skill that go into their creation. The design process painstakingly blends the requirements of form and function through a complex series of systems that must perform together under sail just as a well-rehearsed orchestra does on opening night. Naval architects are trained to understand that an iterative design process is required to ensure that interrelated form, space, function and performance parameters are optimized. This is sometimes visualized as a design spiral, where certain design parameters are revisited to create a refined set of specifications. TEEL is an excellent example of the evolutionary design process that means the difference between sailing away from the dock without looking back or constant refinement and modification after launch.

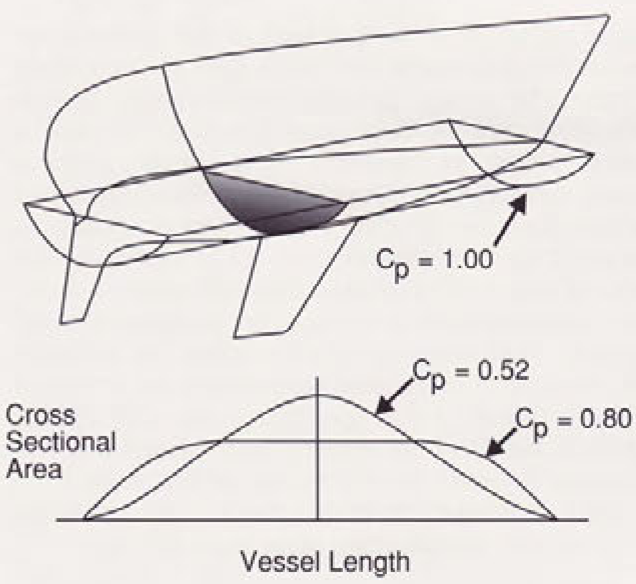
TEEL's predecessor was a Little Harbor 62 that was meticulously re-outfitted by her owner. All the systems on board were optimized with the best available equipment to ensure smooth operation.

This effort created a yacht that was self-sufficient anywhere in the world and could be enjoyed without the fear of equipment failure. The experience with the Little Harbor 62 provided the blueprint for the creation of a Ted Hood designed sailing platform built with state-of-the-art materials and equipment.

Ted Hood Design Group

Ted Hood is certainly the quintessential yachtsman - designing, building and racing his own boats since he was 11. The Hood Design Group was founded in 1959 when he designed and built the first ROBIN. It demonstrated that a shallow draft, wide-beam, deep-centerboard hull could be extremely competitive. A by-product of this design is excellent load-carrying ability and a comfortable motion in heavy seas.

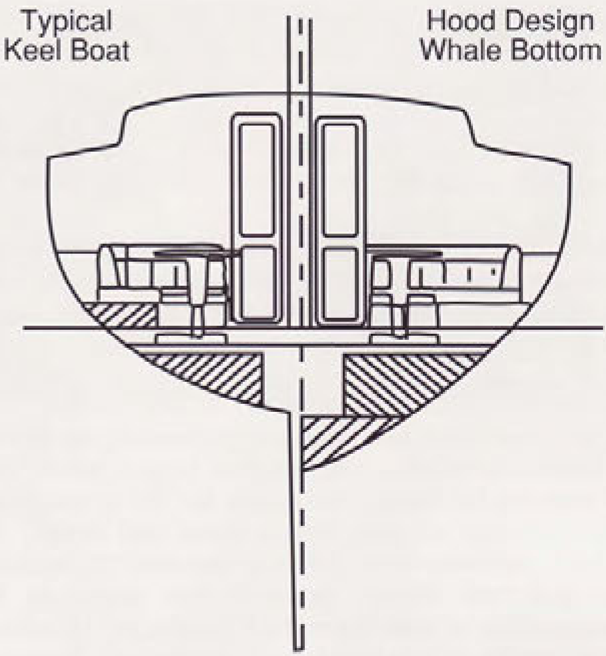
Hood has designed everything from 12-meter America's Cup yachts (NEFERTITI - 1962 and INDEPENDENCE - 1977) to the single-handed, nonstop, 'round-the-world record holder AMERICAN PROMISE. The hull form that was once unbeatable on the race course has been transformed into an oceangoing home. Hood's moderate to heavy displacement designs can accommodate a lot of cruising gear, yet still perform as predicted. This represents a departure from the high prismatic coefficient (Cp) hull shapes that took over the racing scene in the 1970s.



Prismatic coefficient (Cp) is a measure of how fine the ends of a hull are in relationship to the midship section. Light, high Cp sailboats will have fuller bow and stern sections and shallower hull forms, which are fast when in racing trim. The diagram to the left illustrates that Cp is a percentage of the volume a hull occupies as compared with the shape created by extending the midship section the length of the waterline. The lower plot shows how volume distribution differs between high and low prismatic coefficient hull forms.

Hood's low Cp designs have deep hull forms that use large deadrise angles to create room for low internal ballast. Full centerboards provide lift for upwind sailing. This arrangement creates a very large boat that is extremely shoal draft for her size.

> *"The heavy displacement boat gives us the opportunity to build in much more living space, much more storage space, and much more comfort."*
>
> *Ted Hood*



Whenever a design office takes on a project that represents an increase in yacht size and complexity, much attention is given to performance prediction and systems integration. The commission of TEEL's design effort was certainly such an opportunity for the Ted Hood Design Group. The office has advanced significantly from the time when Ted Hood, acting alone, would commit his thoughts to parchment. The group is now a team of design professionals, led by Chief Designer Ted Fontaine, that uses state-of-the-art computers to execute the complex task of designing today's megayacht.

> *"The good use of space is one of the greatest challenges in yacht design and we have tried over the years to optimize the use of limited space. This fact led to an inquiry from the U.S. Space Agency about designing some interiors for astronauts!"*
>
> *Ted Hood*

Hood notes that, as with the J boats at the turn of the last century, we are once again looking at sailing yachts of 100 feet and more. With the advent of hydraulic sail-handling equipment, a crew of five, not 20, can sail this size yacht. These boats offer owners more room for entertaining, greater privacy and increased sailing and motoring speeds.

The TEEL project came to the Hood design office with a very specific set of requirements that included:

- Mechanical and operational integrity of the yacht
- Complete privacy for the owner's party whether at rest or underway
- Performance and comfort at sea
- Shoal draft (around 7' 6")
- A nice sheer, transom and bow
- 6' 6" headroom throughout, including the engine room
- Complete, detailed design package

And so the stage was set for a no-compromise yacht that would embody many forms during its design evolution. Beauty and function were to be melded, with an eye for the practical. The Ted Hood Design Group was the first of many players in a design partnership that blended the talents of the industry's finest minds.

Andrew Winch Design

As the concept designer for the TEEL project, Andrew Winch brought the most "mega-yacht" experience to the table. He has combined a formal training in interior design with his lifelong experience as an offshore sailor to become one of the most sought after designers in an elite community. His seven year apprenticeship with Jon Bannenberg as Project Manager for such yachts as ACHARNE and GARUDA exposed him to the often conflicting requirements of large sailing yachts.

Winch's office has worked on 15 sailing yachts over 100 feet, but none has been as demanding as TEEL. His involvement with the project began when the boat was an 82 footer, for which he did a complete design package working from a Hood hull shape. At his first meeting with TEEL's owners, it became clear that the design process was going to be maximized in a boat that had grown to 105 feet. Winch recalls a husband that wanted to preserve the sailing experience of a 60 footer and a wife who enjoyed the layout of their 80 foot motoryacht for privacy and entertaining.

> *"(My challenge is to create) a glove around how they will live afloat"*
>
> *Andrew Winch*

The owner, his captain, Andrew Winch and Ted Fontaine made up the initial brain trust that hashed out countless alternatives to a design challenge unique to this size sailing craft. The Hood people insisted on a low profile with excellent visibility for the helmsman. The owners wanted distinct flow patterns for guests and crew for efficiency and to maximize the experience for all.

The resulting sailing cockpit with hard top and soft side panels allows for an enjoyable sailing experience without the associated fatigue from excessive wind and sun. The experience is carried below to the salon, with its large wraparound windows. Winch designed the styling above the sheer line with the same standard of proportional elegance that Hood used for the hull form, albeit with a more contemporary flair.

The sailing cockpit aft is designed to be a "family" cockpit, where young children can play in a protected area while sailing or at anchor. This cockpit has direct, private access to the owner's staterooms.

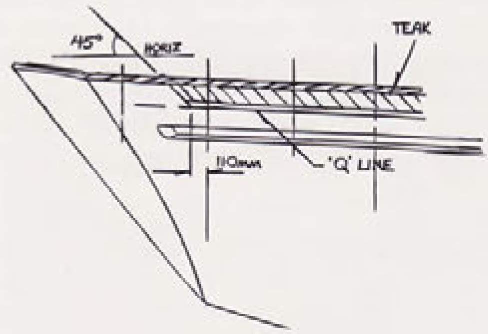
Complete utilization of space is an underlying design objective of the project. Evidence of this is the seating area created on the foredeck when the large tender is launched. The crew has their own cockpit aft of this area to afford them a good vantage point when underway, without the need to crowd the owner and his party.

The function and comfort of the crew factored into the layout below decks, as well. Each cabin has its own entertainment center and the crew's mess area has a link to what's going on topsides via closed circuit television. The "flow" of personnel in performance of their duties is reflected in the layout.

According to Winch, even in the early planning stages for TEEL, details such as the owner's preference for working out of his briefcase and providing a location to do this were considered. Handrails needed to be located based on the generous headroom throughout the boat. Built-in stowage for the owner's hats illustrates the specificity of the many details that the design team juggled throughout the process.

Winch observes that building with composites allows him to create more "soft form shapes." He notes that the crew at Trident are extremely dedicated and competent. The finished product reflects their enthusiasm and their ability to communicate with the design team, which is paramount when an owner is pushing the team to do its best.

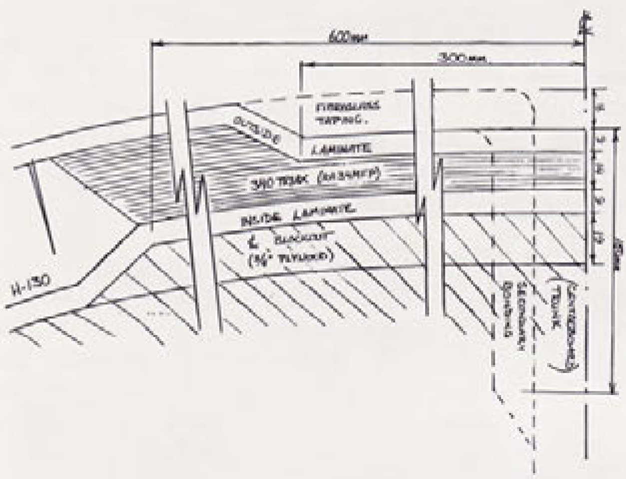
Andrew Winch Designs has recently worked on such diverse projects as the Bauhaus style 140 foot CYCLOS III built at Royal Huisman, the Edwardian style 125 foot HETAIROS from Abeking & Rasmussen and a contemporary 88 foot Tripp boat with cored panel construction for the interior. Winch states that all in his office are sailors, although he currently has five motoryacht projects underway.



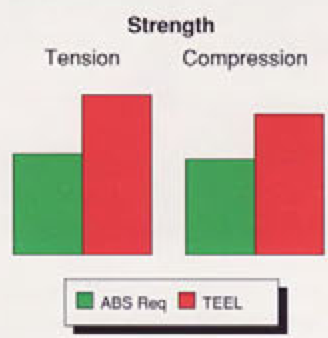
Trident Shipworks

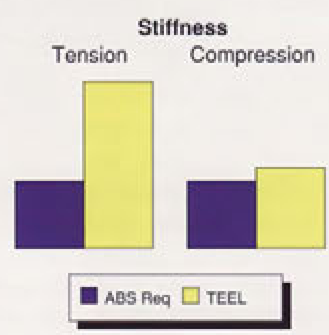
Trident Shipworks is the outgrowth of the Trident Group, which began operations in 1985, but the core personnel have been building advanced composite yachts for over 20 years. People are the most important ingredient in composite yacht construction because so many process variables are involved. Craftsman are responsible for the appearance and strength of a yacht to a higher degree than metal construction.

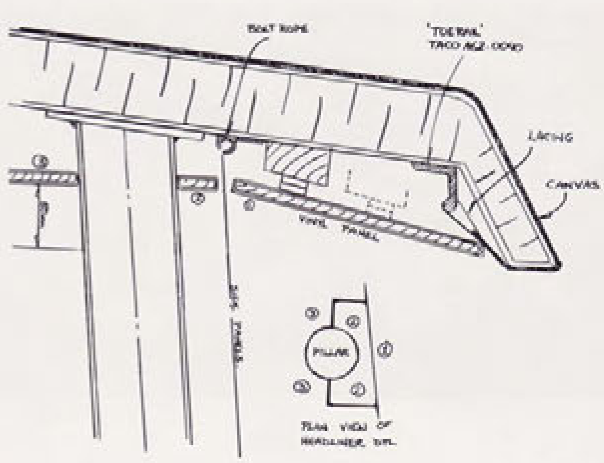
Gary Carlin is one of this country's wizards when it comes to constructing large yachts with advanced composite materials. He and Ron Holland launched their careers with an IOR quarter-tonner in 1973. Carlin went on to build a legacy of high-tech, offshore race yachts at Kiwi Boats that included IMP and KIALOA. In an effort to develop light, stiff and strong hulls, advanced materials and process development earned this yard the reputation for building race winners. Carlin's practical boatbuilding background is blended with the management skills of Steve Nichols to put Trident in a position to create today's complex mega-yachts.



Trident is a yard that does quite a bit of in-house engineering and design work and all their own laminate and process development. The laminate for TEEL was the culmination of two decades worth of building and testing. The requirements for TEEL's hull were for the strongest laminate that could withstand high surface temperatures generated by the black topsides. What evolved was a laminate that was much stronger than that required by the American Bureau of Shipping.







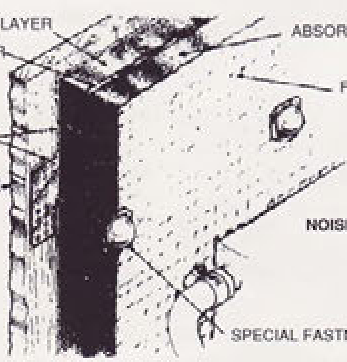
Trident Shipworks is more than just an outstanding composites fabrication shop. A beautiful yacht also reflects the talents of woodworkers, outfitters, plumbers, electricians, machinery specialists and others. Experienced craftspersons of various trades have developed a unique style of working together on closely managed projects.

Joe Smullin

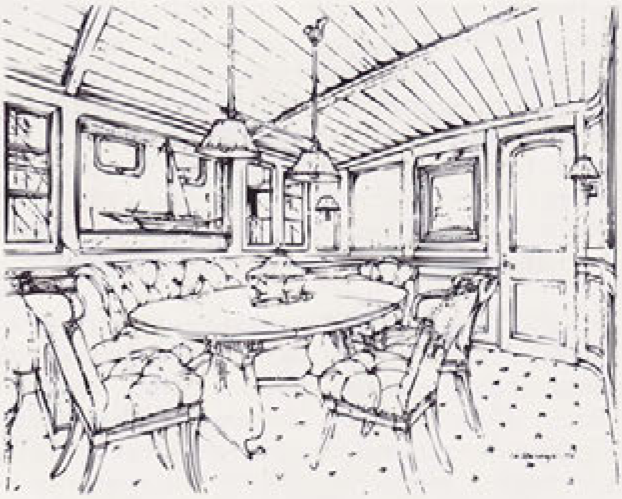
Today's mega-yachts contain engine rooms full of machinery designed to meet the requirements of a floating mini-hotel. Main propulsion systems, generators, air conditioners, and refrigeration systems may be running in various combinations at any given time. Combine this with an owner's requirement for minimum noise and vibration throughout a yacht designed to harness the wind, and the engineering challenges become apparent.

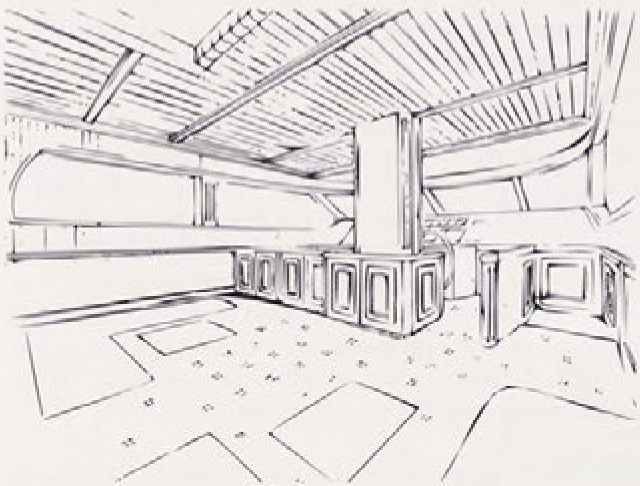
Joe Smullin is an MIT-trained engineer who specializes in creating quiet yachts. Building upon measurement and analysis techniques developed to quiet Navy ships, Smullin has developed a niche specialty that owners and shipyards depend upon to obtain an unseen level of elegance associated with a quiet, vibration-free yacht. Working out of his Marblehead office, he was involved with the TEEL project from the onset as a result of his previous collaborations with the Ted Hood Design Group and Trident Shipworks.

Although expertly trained in the scientific rigors of noise and vibration design principles, data acquisition and analysis, Smullin's biggest asset is his empirical knowledge gained from almost 25 years experience with yachts. Smullin began his career at a defense contractor who had little interest in small specialty projects, such as yachts. He started J & A Enterprises in 1980 to concentrate on the yacht work that he found so interesting.



The TEEL project presented some unique challenges for even an experienced noise control engineer. Although the composite hull and machinery foundations significantly dampen structure-borne noise, the interior contains little natural sound absorbing elements, such as drapes, thick carpeting or cloth upholstery The extensive use of woods and glass that contribute to the feel of a fine yacht also reflect, rather than absorb, noise. For TEEL, Smullin specified a combination of mass layers and insulation for floors and bulkheads as well as isolation systems for all rotating machinery to achieve performance goals. Although Smullin also does military and commercial work, his true passion remains with yachts, where each boat is a prototype requiring innovative thinking to tackle unique challenges.





David Easton

David Easton is an interior designer who has made a name for himself designing Georgian houses with his 40-person staff based in New York City. His only previous experience with yacht interiors was with the 204 foot Feadship, VIRGINIAN. As with TEEL, Easton first worked with the owner developing a highly personalized home. Easton brings his eye for detail to these nautical projects, just as he has been doing for the past 30 years with land-based domiciles.

Easton approaches his projects holistically, specifying every fixture and piece of trim to provide continuity within a space. He likes to integrate his work into the landscape as well as the lifestyle of his clients. His challenge with TEEL was to work with a non-rectilinear, moving platform with multifunctional living spaces.

TEEL's interior of anigre and teak lumber is crafted in a very traditional style to give the feel of a true yacht. Easton's choice of moldings and fixtures were based on TEEL's requirements and his work with the client's shoreside projects. He typically does much research and sketching before the feel for a space is finalized.

> *"I will never force clients to live up to the house, rather than in it."*
>
> *David Easton*

Working with boatbuilders is a far cry from his Manhattan office. He does, however, have an appreciation for fine craftsmen and the myriad of materials unique to marine construction. One can sense the fascination he has with composite construction that can liberate a designer from his straightedge and T-square.

Easton takes advantage of numerous on-site meetings to sketch last minute details or suggest a seating or lighting arrangement that he feels will fit his client's lifestyle. His mission is to make the onboard experience equally enjoyable for the non-sailing guests.

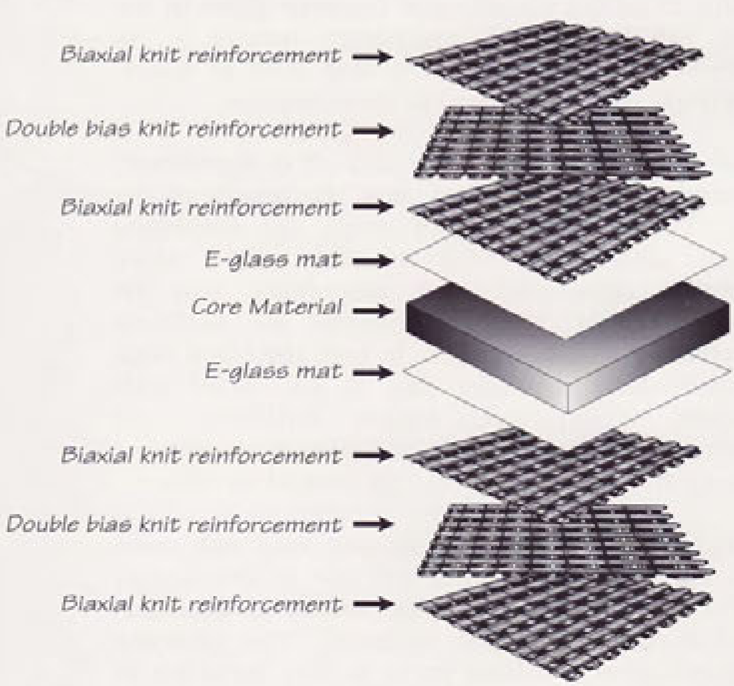
David Easton certainly has a unique role in the synthesis of TEEL. While engineers and builders figure out how to make things work, Easton stands guard as the "style police" to influence how a space will feel.

Composite Construction

Construction with composite material involves the integration of a reinforcement material, such as glass, carbon or Kevlar fibers, with a resin matrix that cures from a liquid to a solid state. Complex geometries with selectively located reinforcement can be created through the lamination process. The concept of combining two materials with different mechanical properties to create a superior structural system dates back to the days of straw and mud huts. Concrete reinforced with steel rebar is a common example of composite construction in use today.

A type of resin matrix composite known as fiberglass reinforced plastic (FRP) has been used in the marine industry since World War II. The boatbuilding industry really took off with FRP in the 1960s when polyester resins and E-glass reinforcement products became commercially available in large quantities. Early boatbuilders recognized the following advantages of FRP construction:

- Production costs are greatly reduced when more than one part are made from the same mold;
- Composites will not corrode in a marine environment;
- Hulls are extremely tough and can withstand much abuse.



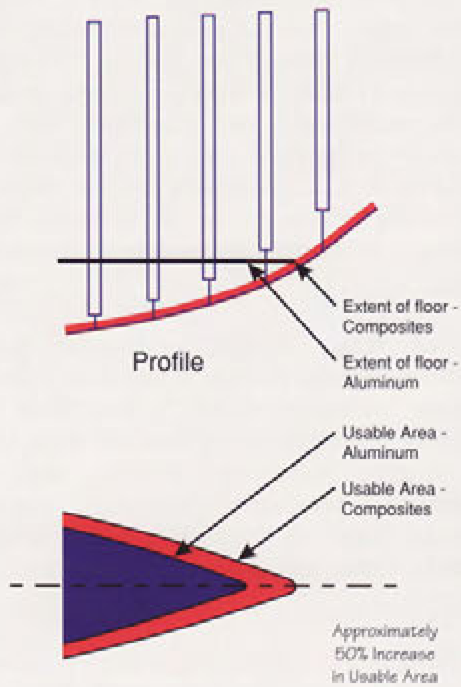
The composites industry has changed greatly in the United States since the early days of solid laminates, which by today's standards are considered to be overbuilt to compensate for lack of knowledge about material performance. Composite materials are now engineered into sandwich constructions for applications as diverse as advanced fighter aircraft and modular shipping containers. With the recent loss of many Department of Defense sponsored composite material programs, competitive recreational applications now serve as the test bed for new materials and construction techniques.

In this country, most construction of boats under 50 feet in length is with composite materials. Construction of vessels from 50 to 200 feet is done either with composites or with aluminum, steel or wood, depending upon design requirements and the owner's specifications. As hull forms get larger, flat plate construction becomes more reasonable. However, as our understanding of composite material performance and construction methods improve, vessels the size of the Navy's 185 foot minehunter are now being built with composites.

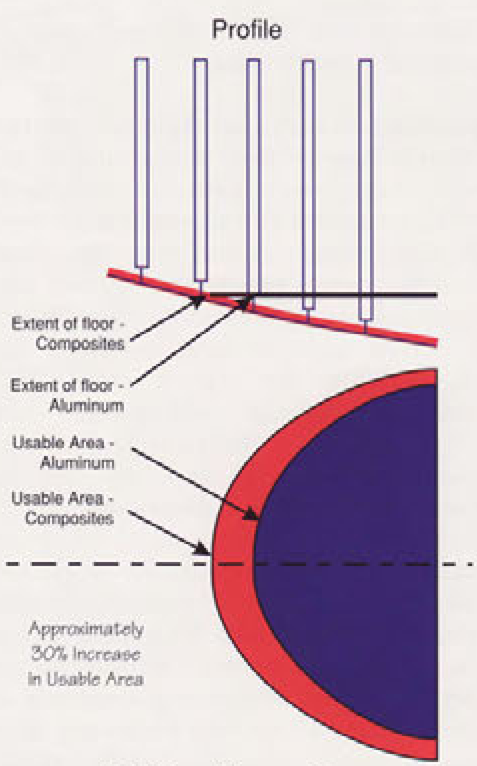
For a sailing yacht that is 115 feet long, the owner can choose either composite or aluminum construction, to be expertly crafted at one of a handful of shipyards throughout the world. Aside from some of the better known advantages of composites, such as reduced maintenance, several other features become apparent when undertaking a project of TEEL's magnitude.

One advantage of composites that is not often recognized is the amount of usable space gained with sandwich rather than framed construction. For a boat such as TEEL, the thickness of the sandwich hull is about 2 5/8", as compared to a frame 5 3/4" deep that would be needed for aluminum construction. This represents a 5% volume increase and a 6% increase in usable cabin sole area throughout the vessel. It also means that equipment can be located lower in the hull. For TEEL, it makes 6"6" headroom in the engine room possible.

Near the bow and stern of the boat, the cabin sole forms a fairly small angle to the hull. In the bow region, aluminum frames are also made deeper to resist slamming loads. These geometric factors combine to produce even more dramatic gains in the crew's cabin and aft machinery spaces. As illustrated, an additional 50% and 30% of space, respectively, can be realized in these regions.



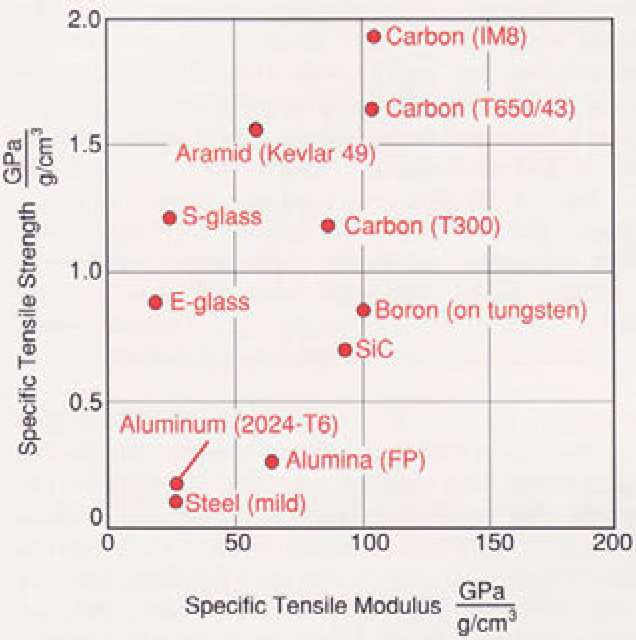
Crew's Quarters



Aft Machinery Space

The gain in usable space fore and aft is significant, translating into several feet over the length of the boat. This sometimes can mean the difference between adding an extra cabin or not. More important, equipment and machinery can be arranged much more efficiently to facilitate inspection and maintenance. In fact, the clean bilge and underdeck structure that is associated with composite construction makes outfitting and maintenance of mechanical and electrical systems far easier than with an intricately framed structure.

Although 5% added usable volume may not seem like a lot, it plays a significant role in the design process. When one design parameter is changed, related variables are also affected. The ultimate configuration of a sailing yacht is very sensitive to the volume issue because the overall size is influenced and so is the center of gravity. If a boat



is made even slightly larger to accommodate the same amount of furnishings and equipment, weights and costs escalate exponentially. Additionally, if the interior can be lowered only a few inches, less ballast and sail area will be required to gain equal sailing performance.

Composite materials are used extensively in the aircraft industry because on a pound-for-pound basis, these materials offer better strength and stiffness than metals. The plot at left illustrates that for epoxy resin laminates measured in the direction of the fibers. The materials at the top are stronger and the materials toward the right are stiffer.

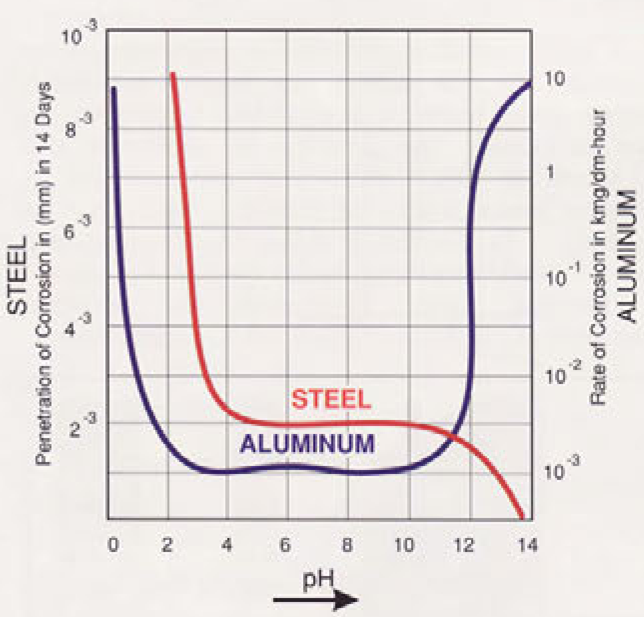
Direction is a very important concept with composites because, unlike metals, a composite laminate will show different mechanical properties in different directions. As designers better understand the complex loading on a structure such as a large sailing yacht, these directional properties of composites can be better exploited. Experienced builders can place reinforcements in areas of high loads in orientations best suited to resist anticipated load paths. The result is an optimized structure that is more closely engineered for its mission than would be possible with metal plates of discrete thicknesses.

Another basic advantage available with composite construction is the ability to create sandwich laminates that have strong skins laminated to lightweight cores. The principle is similar to the steel I-beam, in which material is concentrated in the flanges away from the center. This type of configuration is extremely efficient for resisting hydrostatic and slamming loads caused by waves. The following table illustrates the relative effectiveness of sandwich versus solid constructions.

	t	2t	4t
Relative Stiffness	100%	700%	3700%
Relative Strength	100%	350%	925%
Relative Weight	100%	103%	106%

Today's yachts incorporate complex geometric surfaces to achieve performance and styling objectives. These surfaces are often called upon to be load bearing elements. Because a composite laminate is created by the builder to conform to complex shapes, a stronger product can be produced with fewer stress concentrations. Stress concentrations are local areas that are subject to loads much higher than the overall structure, and thus more susceptible to failure. A classic example of this is the rectangular hatch opening in large ships. Square corners can lead to stresses that are 10 times greater than a similar opening with rounded corners. In every right-angle weldment, there exists some elevated level of stress. By contrast, composite elements are joined with reinforcements that are rounded into a corner.

The builder may also realize other advantages during the construction of a composite yacht. Although more time may be required to produce the hull shell, the outfitting crew is presented with a much cleaner interior to work with. This means that fitting furniture, electrical and heating, venting and air conditioning (HVAC) systems can be accomplished with less effort in a much cleaner fashion.



The performance advantages of a composite yacht are most obvious to the owner over the life of the vessel. Maintenance requirements are often cited as a major advantage. The nemesis of all blue-water yachtsmen is corrosion.

> *"Where exposure to environments which may induce excessive corrosion cannot be avoided, suitable coatings, tapes, sacrificial anodes, impressed-current systems or other corrosion preventive measures are to be employed."*
>
> *ABS Rules for Aluminum Vessels*

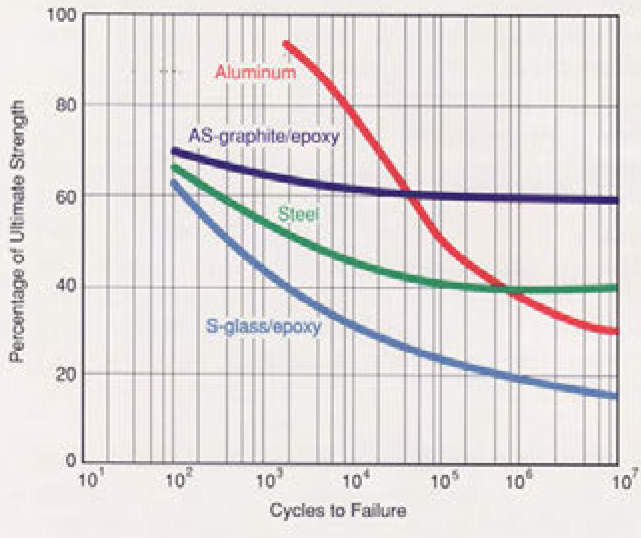
Crevice corrosion in wet spaces, faying surfaces between aluminum and other materials and maintenance of coating systems on intricately framed aluminum structures are constant concerns for owners and captains of aluminum yachts. By contrast, TEEL's geometrically clean bilges are designed to be easily maintained for decades to come.

Electrolysis is an ever-increasing problem as more complex electrical systems are installed on yachts and marinas become "hot" from other vessels. Because TEEL's hull structure is nonconductive, the effects of electrolysis are minimized and grounding

One of the biggest fears of an offshore sailor is the possibility of colliding with a shipping container or other large, semi-submerged flotsam while surfing along at night. A hull's ability to withstand such a collision is called impact resistance. Although no universally accepted method exists for evaluating the strength of ship structures subjected to this phenomenon, we do know a lot about the difference between a framed aluminum hull and one built with sandwich composites.

Because the frame spacing on an aluminum hull is much closer than that with sandwich composites, the impact on the aluminum hull is absorbed by excessive deformation of the frame. Aluminum frames are very stiff, so failure occurs if deformations are too big. In contrast, sandwich composite panels span much greater distances and therefore can deflect much more before failing. Additionally, the PVC core material can absorb a lot of energy during impact or slamming.

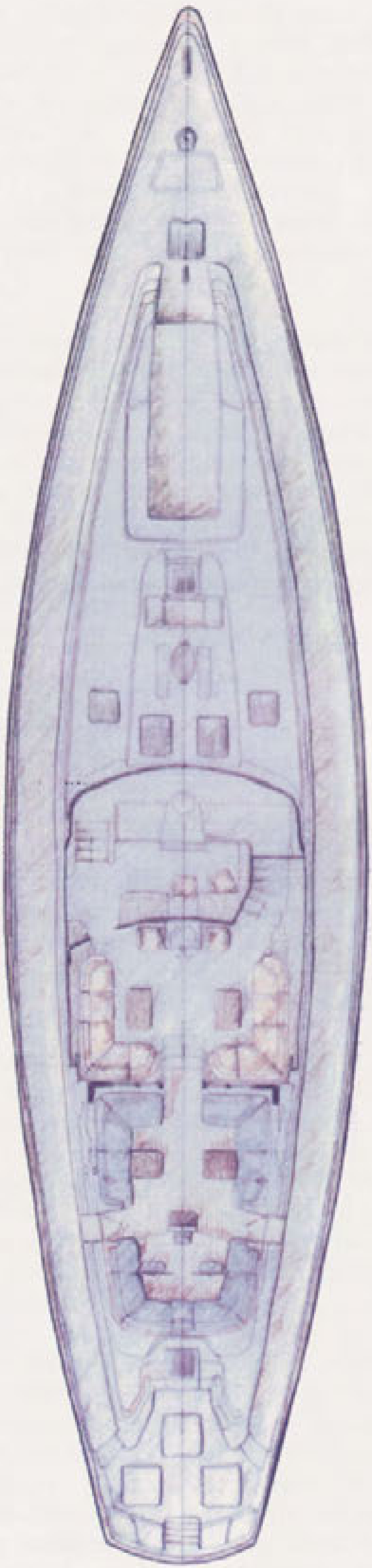
> *"If I went on the rocks, I'd rather be in a glass boat."*
> *Ted Hood*



Another issue critical to the yacht's structural designer is fatigue resistance of the hull. This is a measure of how the hull material responds to loads that happen on a repetitive basis. As one can imagine, sailing in waves can produce alternating repetitive stresses throughout the life of the vessel. Data such as that presented at left are useful to understand how much reduction in stength can be expected over time. The materials with the flatter curves are more desirable.

A yacht of TEEL's magnitude should afford the highest level of comfort for her guests. Minimal noise and vibration while motoring, sailing or at anchor can be achieved when composite materials are used for all structural elements. Composites are excellent insulators, making a boat comfortable and quiet, while eliminating harmful condensation. Composites act to dampen noise and vibration that eminate from rotating machinery.

The technical arguments for composite construction are certainly compelling. From a stylist's standpoint, more design latitude is possible because composites can be formed into almost any geometric shape. Although repair is somewhat easier than for aluminum hulls, more attention is required at the time of consturction of composite hulls because of the increased number of fabrication variables. In the final analysis, the finished product is ultimately a reflection of the quality of the workers who bring an excellent design to fruition.



An Idea Becomes a Design

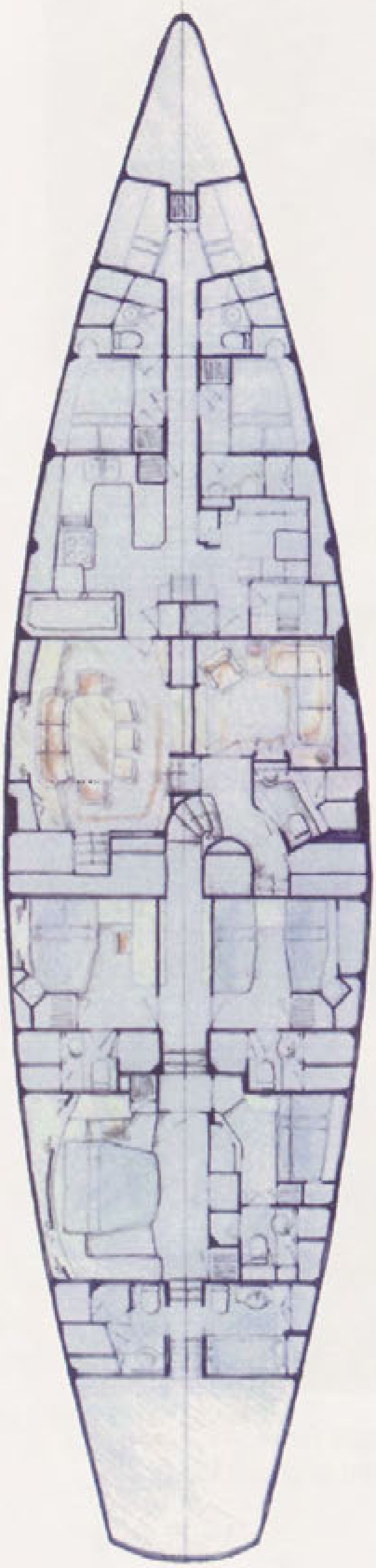
TEEL started as a concept with no preconceived size or layout. Her owner just wanted to go sailing worldwide with family and friends. The design team was established and so were some broad objectives: no cruising destination should be beyond her reach; her lines and detailing must exude traditional elegance while her styling and layout reflect a contemporary use of space and materials; and every aspect of her construction will represent an improvement of what's been done before.

It is no surprise that a boat such as TEEL was commissioned by a New Englander. Self-sufficient, rooted in tradition, tinkering with new solutions to age-old problems, rugged with tremendous character.....these are images that describe both the seaman and fine ships that are New England born and bred. TEEL is the 21st century reincarnation of all the New England built clipper ships and fishing boats that have plied the fierce North Atlantic. With a different mission, TEEL shares a proud maritime heritage with her ancestors. Although her towering carbon fiber spar will be flying sails built from space-age polymers, her sleek black hull and wood ladened interior will hark back to the ships who have sailed these waters before her.

Frostbiting Interclub dinghies in the icy waters of Boston's south shore is a good way to gain respect for the sea. Working one's way from a Pearson 20 to a Bermuda 40, Hinkley 48, 50 and finally a Hood Little Harbor 62 demonstrates an appreciation for sailboats that can stand up to bad weather. In fact, TEEL's owner loves to sail in adverse weather (a prerequisite for all New England sailors) and requires a boat that can face up to the elements.

As the Little Harbor 62 was being re-outfitted from stem to stern, it became apparent that a custom yacht was needed to cover additional territory and carry family and guests in comfort. The concept for a new boat started as an 80 footer in 1987. By 1988, the design had grown to 96 feet, for which Ted Hood Design Group put together 45 drawings and a 400 page specification book.

With new arrivals to the family, a stateroom was added, stretching the boat to 105 feet. To overcome the inherent duality of sail and motor yachts, a flybridge-type sailing cockpit over the main saloon was briefly considered with a 135 foot design in the style of the recently launched Perini-Navis. It soon



became apparent that a vessel this size would control her master by virtue of her size and complexity and the attendant crew. The Hood people also felt that this high a cabin would deviate too much from the traditional hull form they had developed.

By 1991, thinking had swung back around to the belief that design goals could be met in an 87 foot boat. This grew again to 105 feet; then construction finally began on a 108 foot hull at Trident. Frames were half up when a third generator in the engine room became a priority. The boat was stretched to 115 feet and construction proceeded, albeit without the third generator.

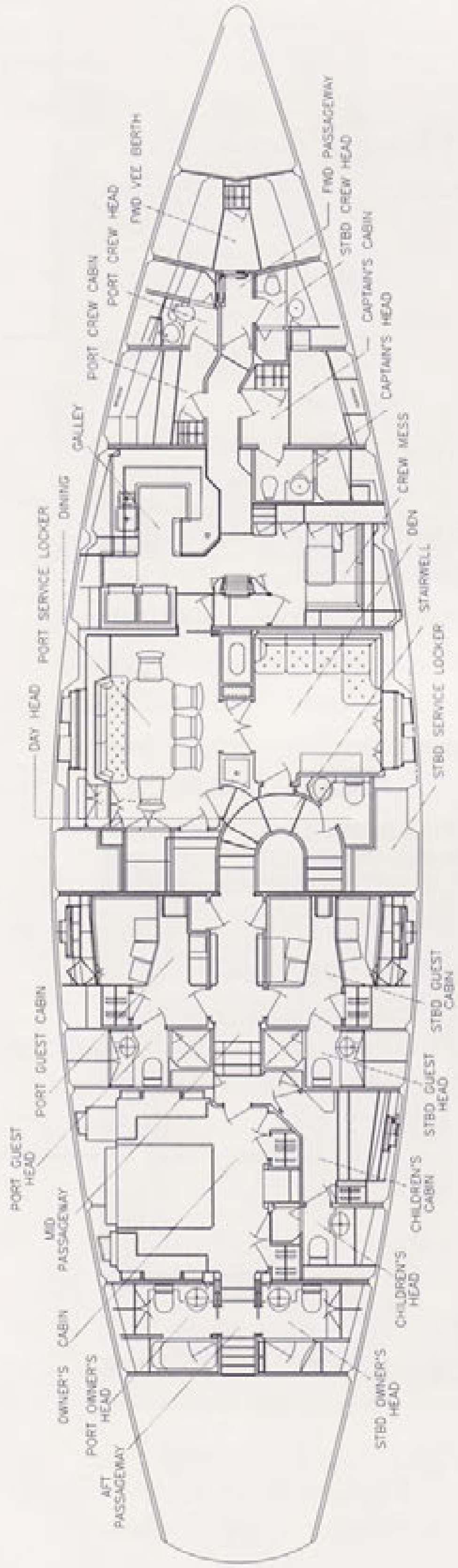
To some, commissioning all these various designs would appear to burden the project with design fees and hinder any preconceived construction timeline. But TEEL is a different type of yacht. Her owner shares a designer's fascination with how something as complex as a 115 foot sailing yacht can come together with symphonic fluidity. What are the mechanics to make such a complex machine operate gracefully without flaw? He was content to build it many times on paper before the first shipwright touched a piece of framing timber. TEEL's creed is thus one of patience and perfection - a hallmark that has stayed with her to this day.

TEEL's deck is lifted for final placement after several dry runs where flanges were built to guarantee a close fit. TEEL's hard top is seen off to the left.

The entire crew gather for a group photo at Christmas time. All involved personnel at Trident, including management and stockroom workers, are pictured here.

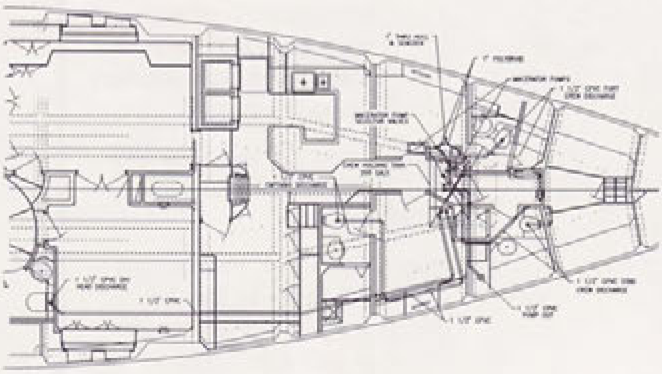
TEEL Specifications

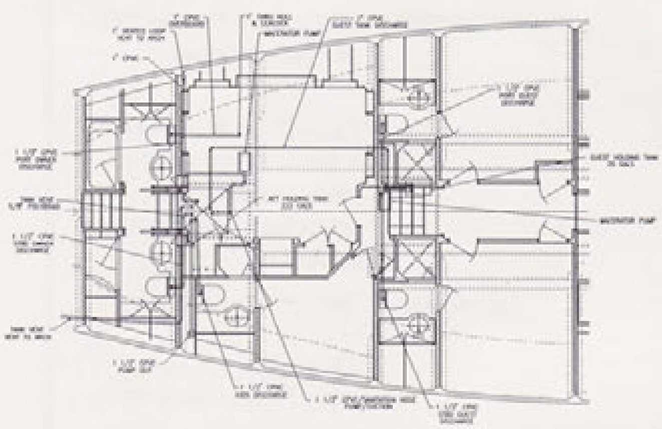
Naval Architecture:	Ted Hood Design Group
Styling:	Andrew Winch Design
Interior Design:	David Easton
Classification:	ABS Americas
Builder:	Trident Shipworks
Hull Construction:	Kevlar Hybrid/Epoxy
Mast Builder:	Omohundro
Mast Construction:	Carbon Fiber/Furling
Sailmaker:	North
Sail Construction:	Spectra
Length Overall:	114.61 feet
Waterline Length:	88.70 feet
Maximum Beam:	27.60 feet
Draft (board up):	7.60 feet
Draft (board down):	19.91 feet
Displacement (light):	400,000 pounds
Displacement (loaded):	428,764 pounds
Ballast:	125,000 pounds
Sail Area (working):	6480 $feet^2$
Sail Area (total):	13,850 $feet^2$
Mast Height above Water:	143 feet
Maximum Speed (power):	12.48 knots
Cruising Speed (power):	11.00 knots
Cruising Range:	2500 nautical miles
Fuel Capacity:	4485 gallons
Water Capacity:	2288 gallons



TEEL Arrangement

Sailing Cockpit:	Dual steering stations - port and starboard, with unobstructed view over copious seating forward. A permanent hard top and removable side curtains provide protection from wind and sun.
Aft Cockpit:	A private area has direct access to the owner's staterooms via an aft companionway. A lounging area is provided in this sheltered space.
Main Salon:	The main salon features wraparound tinted glass that affords excellent visibility, even when seated. A protected helm station is located forward with all navigation instruments.
Library:	As a spiral staircase works its way below, a library is located just past the day head. This room has a traditional, yet warm feel.
Dining Area:	Continuing down the stairway, the formal dining area is located on the port side of the vessel. Built-in seating is situated forward of a hide-away office space.
Galley:	Located forward, the galley features restaurant grade appliances.
Engine Room:	The engine room is a spacious area with full headroom throughout. Access to main engines and generators is arranged to perform periodic maintenance with ease.





TEEL Accommodations

Owner: A full width stateroom features a king size bed and private "his" and "hers" bathrooms with tub/showers. Seperate access to private deck aft is provided.

Children: One twin stateroom with upper and lower berths; head with private shower.

Guests: One double stateroom with private head and shower.

One stateroom with twin lower berths and a "pull-down" upper berth; private shower and head.

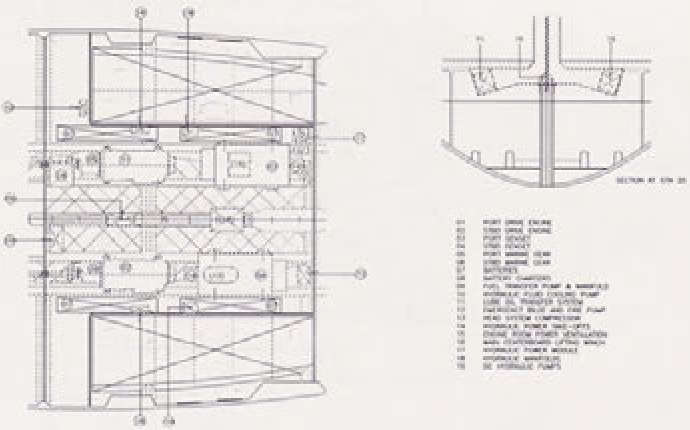
Crew: One captain's double cabin with private head and shower.

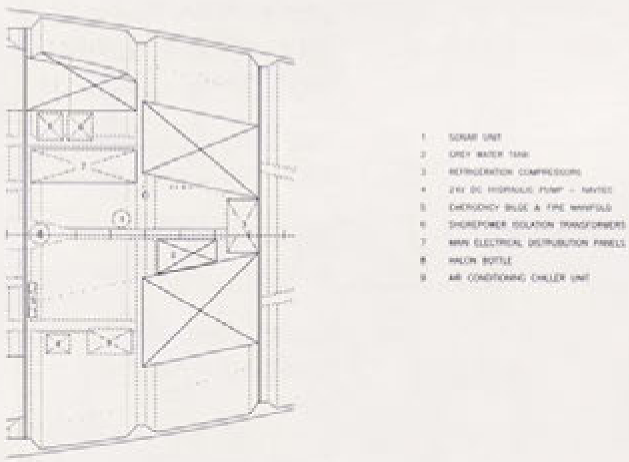
Two twin cabins, each with head and shower.

Crew dinette with entertainment center.

Laundry facilities with full-size washer and dryer.

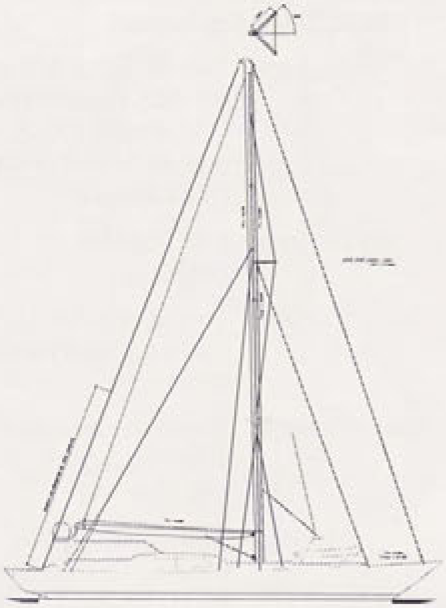
Direct access to foredeck.

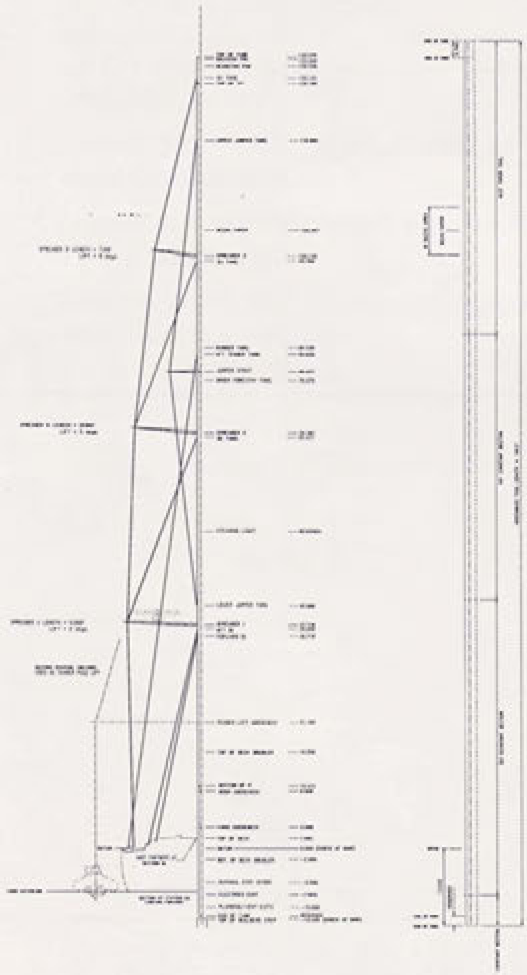




TEEL Main Machinery

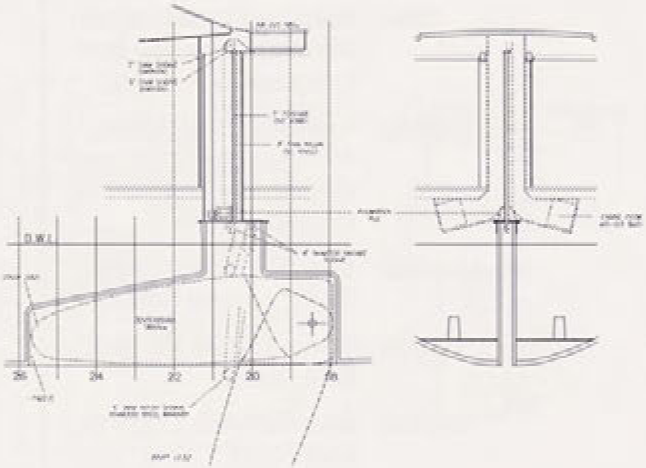
Main Engines:	Two (2) Lugger 6125/HE/BT diesels producing 425 BHP @ 2300 RPM from Alaska Diesel Electric
Gear Box:	Two (2) Twin Disc MG 510 3.10:1 reduction gears
Shafting:	Two (2) 4" Hundested VP-6FR-H4 316 SS varible pitch hydraulic shafts with Thordon bearings from Pacific Marine
Shaft Seals:	Manebar Deep Sea
Controls:	Micro Commander 585 series, electrical actuators
Propellers:	Two (2) Ni Al bronze, 4-bladed, 39" variable pitch Hundested propellers with Spur line cutters
Generators:	Two (2) Northern Lights M 4276 T 60 kW generators driven by John Deere 4045 TF 001 deisels @ 1800 RPMs from Alaska Deisel Electric
Monitoring System:	RGM Model 700
Steering:	Custom SS wheels from Brooks with two (2) Jastram 220 VAC, 5 HP hydraulic power units (primary & back-up) and Jastram controls using Edson sheaves and Thordon bearings
Bow Thruster:	7-bladed, 16 L HT Hydra Thrust 16 L 16" ID x 84" tunnel from Hydra Power Systems

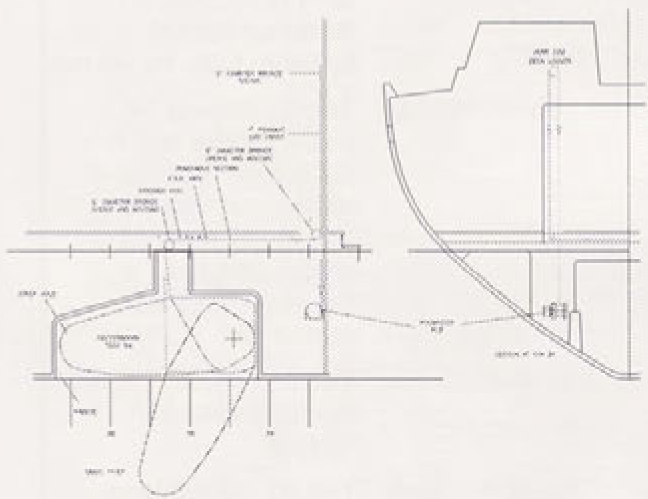




TEEL Sailing Systems

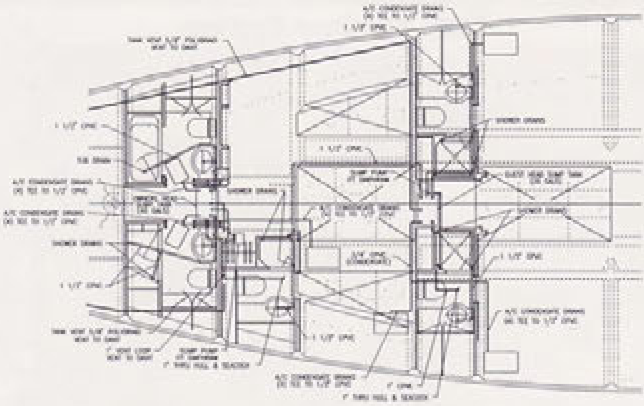
Spar:	Autoclave cured, carbon fiber/epoxy section from Omohundro
Rigging:	Nitronic 50 rod (nickle chromium molybdenum) ranging from 1.4" to 2.5" from Riggarnna
Mainsail:	Spectra®/Norlam 490 TX-12 oz from North
Genoa:	Spectra® 490 TX-10 oz from North
Staysail:	Spectra® 490 TX-10 oz from North
Furling Gear:	One (1) Reckman headstay hydraulic furler for -115 rod; one (1) Reckman staysail hydraulic furler for -48 rod
Sheet Winches:	Two (2) Seaway 16 genoa captive reel; two (2) Seaway 16 staysail captive reel; one (1) Seaway 16 mainsail captive reel; one (1) Seaway 16 outhaul captive reel
Halyard Winches:	Two (2) Lewmar 700 ST; two (2) Barient 737 halyard
Sailing Adjusters:	Two (2) -60 backstay; one (1) -48 vang; two (2) -60 fwd intermediate; two (2) -22 halyard hydraulic adjusters, all from Navtec
Running Rigging:	3/4" Spectra®

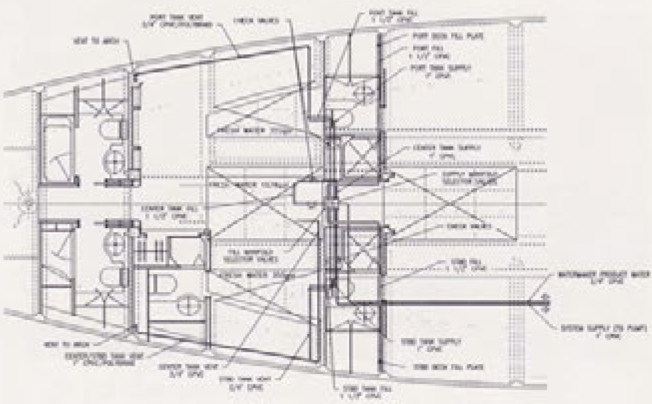


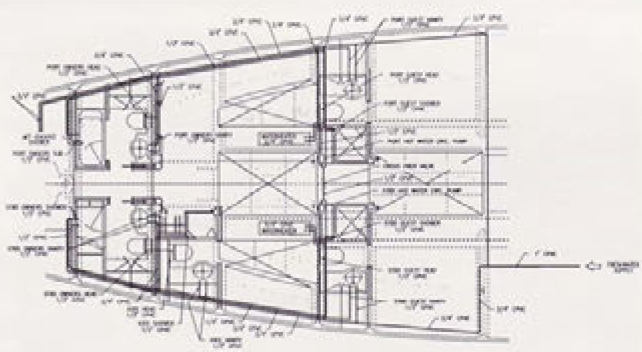


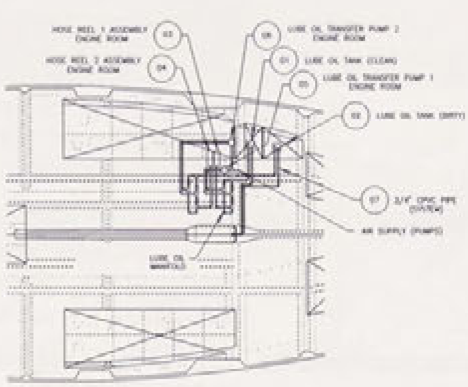
TEEL Deck Equipment

Anchors:	Two (2) Baldt 300 pound SS ABS approved; one (1) Fortress FX125 storm anchor; one (1) Fortress FX37 anchor
Windlasses:	Two (2) Maxwell VWC 10000
Ground Tackle:	Two (2) 300-foot lengths of hot galvanized 5/8" chain
Deck Stowage:	Numerous stowage lockers integrally molded into coaming
Tender:	Novurania MX 530 deluxe, 12.75 feet with 40 hp Yamaha outboard
Dinghy:	Novurania MX 400 deluxe, 17.5 feet, 9 person with 115 hp Yamaha outboard
Launch Stowage:	Custom SS davits by Nautical Structures
Blocks and Tracks:	Harken ball bearing assemblies
Centerboard Adjustment:	Two (2) PL2-12-7-1 hydraulic adjusters from Pullmaster









TEEL Plumbing Systems

Bilge Water:	Ten (10) Rule 3700 HD 3700 gph pumps with float switches; two (2) Par electric; Pacer 200 gpm self-priming emergency centrifugal pump; 5 hp gas emergency pump and ten (10) 1.5" bronze thruhulls
Gray Water:	Two (2) Jabbsco macerator pumps; three (3) Par diaphragm pumps; seven (7) Kracor plastic holding tanks and three (3) integral holding tanks; four (4) 1" bronze thruhulls
Black Water:	Seven (7) Microphor toilets; two (2) Royal Flush toilets; nine (9) Jabbsco macerator pumps; three (3) Par diaphragm pumps and three (3) integral holding tanks
Potable Water:	Two (2) Grundfos Jetstar JS-7, 3/4 hp pumps; 36 gal Amtrol vertical accumulator tank; Cuno 25 micron filter
Watermaker:	Sea Recovery SRC-15-M3-SW0 4000 gal/day
Water Heaters:	Two (2) Allcraft 45 gal; two (2) Allcraft 12 gal, 240 VAC
Fuel System:	Two (2) 240 VAC pumps with hand pump back-up; Oberdorfer 990RH-M46 fuel transfer pump; SS tube or Aeroquip FC234 hose
Lube Oil System:	Two (2) Balcrank pneumatic transfer pumps with reel hoses
Halon System:	Custom by Bonnel

TEEL Navigation and Communication

Electronics installed by Maritech, Stamford, CT

GPS:	Three (3) Trimble Navtrac 200-D controls
Radar:	Two (2) Furuno FRC 1411 MK 3
Autopilot:	C. Plath Navipilot V 4658 AA Digital autopilot and two (2) Navipilot V 4658 AD waterproof remotes
Sailing Instruments:	Brooks & Gatehouse Hercules 690 Race Pack including wind, speed, heading, rudder angle, air temperature, barometric pressure and fifteen (15) displays
Depth Sounders:	Two (2) Furuno FCR-1411/Mark 3
Sonar:	Furuno CH 18
Compasses:	Anschutz Kiel Gyrostar 110 gyro compass and two (2) Sunto 6.5" magnetic compasses
Satcom:	Two (2) Scientific Atlanta Maristar M 9821
Single Sideband:	Stephens Sea 330i
VHF:	Two (2) Icom IC-M 125; one (1) Icom IC-M 57; two (2) Icom IC-M7
UHF:	Four (4) Motorola Radius P 50 handhelds
Cellular Phone:	Three (3) Motorola S 2998 A Nautilus units
Telephone/Intercom:	Twenty six (26) station Panasonic KX-T 7030
Facsimile:	Brother Intellifax 980 M
Loud Hailer:	Raytheon 420
Weatherfax:	Furono FAX 210
Computers:	IBM 6387 with DOCSEA marine documentation system and (2) Macintosh Centris 650
Entertainment:	Eleven (11) Sony TVs with VCRs; seven (7) independent sound systems and (26) pairs of speakers

TEEL Electrical Systems

Ship's AC System:	Primary distribution from engine room via 600 VAC Square-D distribution boxes with wiring to ABYC standards using 105° C insulation and terminating in duplex outlets; DIN style terminal strips, where possible
Ship's DC System:	Eight (8) Prevailer 8D gell cell type batteries for house use and six (6) Prevailer 8D gell cell type batteries for engine and generator start; four (4) 600 A Guest selector switches; two (2) Ratelco 25 A / 24 VDC bank chargers and two (2) 100 A / 24 VDC chargers; Vanner 120 to 240 V inverter/charger
Shore Power:	Two (2) independent 100 amp/ 3 phase services using Helionetics frequency converter and two (2) 45 KVA/3 P Transpac isolation transformers

TEEL Safety Systems

Life Rafts:	Two (2) eight-person ocean life rafts by Givens; emergency dinghy equiped with survival equipment
Personnel Protection:	A combination of (48) SOLAS, Child SOLAS, inflatable and ski type PFDs; (2) throwable man overboard devices; (12) harnesses
EPIRBs:	Three (3) floating beacons by Litton with survival equipment
Medical:	Fully equiped medical locker; combination defibrillator monitor/pacemaker; air splints
Fire Fighting Equipment:	Engine room halon system; numerous dry chemical extinguishers; fire hoses throughout the vessel
Mechanical Systems:	Entire vessel equiped with redundant systems

Creating a Terrapin-Tough Shell for TEEL

Composite yacht construction at Trident adheres to the singular goal of producing state-of-the-art hull structures. Clients come to the yard understanding this and with a trust in the convictions of craftsmen eager to optimize their creation. However, some of the finest work that went into TEEL will never go to sea. In fact, this work was totally destroyed. The wooden plug that so precisely defines the shape of the hull does not form an integral part of the hull as with aluminum vessels. Rather, it is broken apart after the hull is completely laminated.

Trident uses longitudinal wood battens over transverse frames to define a shape that is smaller than the finished hull by a dimension precisely matching the total thickness of the hull. Areas of increased reinforcement require special detail in the hull plug. For TEEL, Trident carried the primary hull laminate inboard in way of the mast to create a strong attachment point for the shrouds. This type of detail requires extensive forethought about the overall hull structure and anticipated loads. In today's world of high-tech manufacturing, this is called "concurrent engineering." This form of concurrent engineering is usually associated with today's high-tech manufacturing rather than traditional shipbuilding.

The framed shape is then "skinned" with wood veneer merely to provide a solid surface for the start of the hull lamination process. Thus the "wooden yacht" that is the creation of master shipwrights using a computer aided design is destined to be a sacraficial sculptural form.

Once the project is turned over to the laminating crew, a different set of shipbuilding talents are called in to play. These highly skilled professionals share the skills of composite fabricators in the aerospace and transportation industries. Craftsmen must also be chemists; shipfitters need to cut and handle textiles; and everyone takes on the added responsibility of quality control engineer.

Unlike metal plate or wood timbers, the materials that went into TEEL's construction have no inherent mechanical properties until the shipbuilder "processes" them. In fact, a major ingredient starts out as a liquid! When properly cured, however, the combination of resin and reinforcement will create a highly optimized structure whose performance is proportional to the expertise of the design and fabrication crews.

The lamination process proceeds according to a precise schedule under the guidance of Greg "Pancho" McLaughlin to ensure that orientation, resin content, thicknesses, consolidation, and ambient conditions are all ideal to produce the strongest possible part. Unidirectional reinforcements of carbon fiber and other materials are strategically placed in areas of high stress.

Thermoset resins, such as epoxy, cure by an exothermic process, which by definition, produces heat. If a laminate get too thick, this heat can build up and damage the part. Experience with the exact resin formulation being used is paramount.

Most builders will make test panels prior to hull construction. For TEEL, this process was quite extensive. Twelve laminate variations were tested by Structural Composites of Melbourne, Florida. Testing involved conventional ASTM 3-point bending methods and a special hydrodynamic shock load performed on 5-foot by 3-foot panels. This grueling exercise was unable to break the Kevlar-toughened panels that ultimately went into TEEL's hull structure.

The tough laminate also had to meet the cosmetic requirements so crucial to a yacht with black topsides. Epoxy laminates typically continue to cure or "post cure" over time as heat is applied to them. Post curing causes the resin to shrink, which has the effect of highlighting the reinforcement material in a phenomena known as "print-through." Trident's Gary Carlin takes pride in having engineered a resin system with good strength properties that has been post cured to the point where future print-through will not be a problem. He boasts at having done this without creating a resin formulation that is toxic to his workers.

After the hull was completely laminated, it was moved out of the construction building and into the Florida sun for an extended post cure period. Once turned upright, the sheer volume of TEEL's hull form became apparent. While the hull was being crafted at one end of the shop, the design team experimented nearby with a number of full-size interior mock-ups to achieve that perfect functional form.

On her back, TEEL very much resembled the whale body that Ted Hood saw when he conceptualized this hull shape. With her bilge to the floor, however, a three-story floating microcosm begins to unfold.

Bob Myers is shown installing the aft intermediate chainplate through a carbon fiber deck beam. Note that the deck is still upside down at this time.

It's an all-hands affair to install the 36 foot long main propulsion shafts. The shafts are hollow, toughened steel with epoxy coating in way of bearings. Hundested supplied the entire shafting system, which contained integral propeller pitch control.

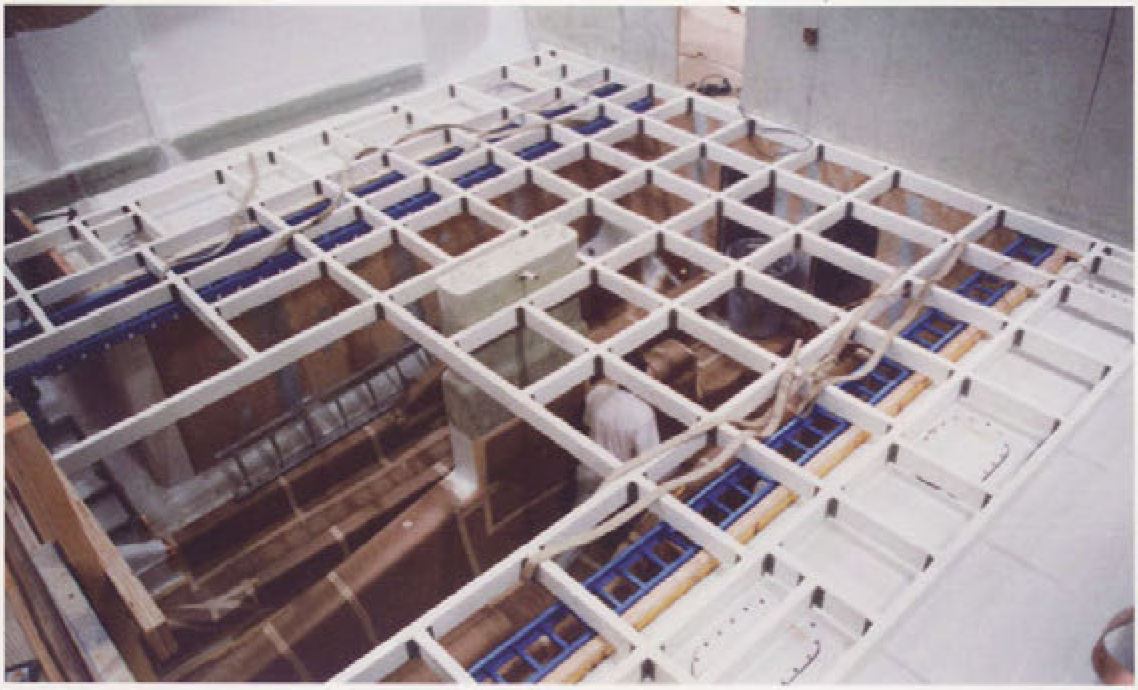
Carpenter Ron Wiren works on French doors that seperate the den and dining areas.

Master carpenter Terry Berton scribes the handrail for the main companionway. Berton was responsible for the fabrication of all the custom joinery that distinguishes TEEL's interior.

Technicians from Technoglass, Switzerland fit custom Nomex form built to fit the shape of TEEL's pilothouse. From this a custom bent laminated chemical tempered glass 19mm thick was fabricated and shipped to Tampa, Florida.

Prepreg reinforcement material is carefully laid in place for TEEL's spreaders. All mast structure was fabricated at Omohundro using aerospace technology.

The labyrinth of flooring structure is built using pultruded shapes and FRP angle brackets. Thick rubber gasketing isolates floorboards from the support structure.



Workers prepare top of fuel tank for final attachment. Note the areas on the top that are left uncoated to permit bonding to the baffle structure.

The port side, custom stainless steel propeller shaft strut receives final fairing to improve hydrodynamic flow.

TEEL's forward and aft centerboards were custom molded by Trident. The composite boards contain internal lead to ensure smooth lowering. Hydraulic winches and Kevlar penants are used to lift each centerboard.

Windlasses by Maxwell Winches of Costa Mesa, California are readied for installation.

Ken Stanley's finish crew apply coatings to TEEL's furniture during all stages of construction. Finishes were choosen for both beauty and durability.

This sink and vanity for the master bath are typical of the custom furniture and fixtures produced for TEEL. The handpainted design inside the sink is designed to evoke the feeling of wood shavings found in a shipwright's shop.

Tom Broschart (right) discusses project details with Tim Kings in the project management office built adjacent to TEEL. Broschart was responsible for TEEL's mechanical and electrical systems.

Kathy Phillips prepares TEEL's transom for the gold leaf lettering she applied.

Final fairing of TEEL's bottom takes place before the application of Copper Clad anti-foaling paint.

TEEL's carbon fiber/epoxy spar towers 140 feet above the water. Her roller-furling mainsail stows cleanly inside the custom mast section. Hydraulic controls for the furling gear permits easy adjustment of mainsail size to suit wind conditions.

Roger Emery, TEEL's master builder, readies the engineer's control station for builder's sea trials. Emery served as Trident's project director with involvement in the myriad of day-to-day details that are inherent with a project this complex.

TEEL stretches her legs during builder's sea trials in Tampa Bay.

TEEL's cockpit is covered by a hard top designed to offer guests protection from the elements while enjoying the full experience of sailing on a high performance yacht.

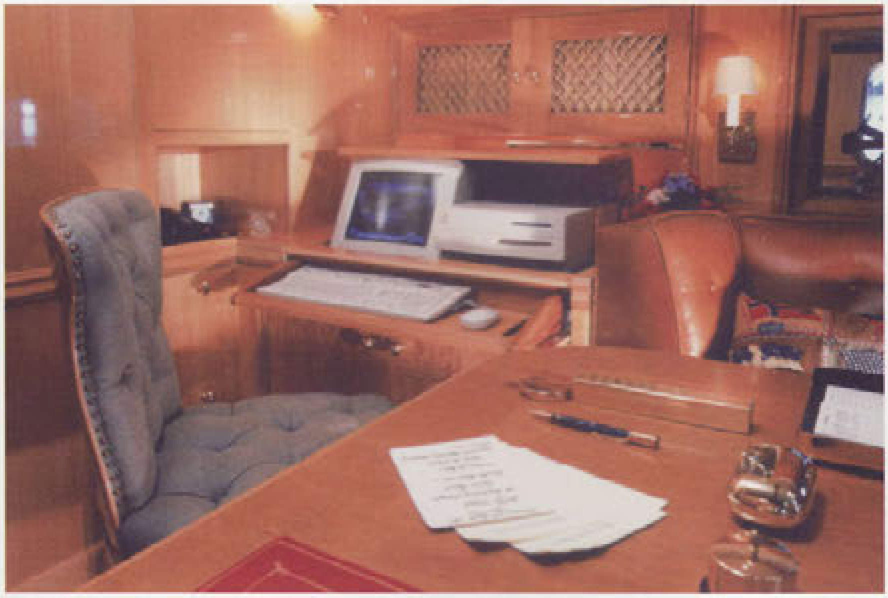
TEEL's powerful double head rig consists of two high-tech Spectra sails from North that are extremely light for their strength.

A forward crew's cockpit has access to sailing controls and a private companionway to the crew's quarters below.

Control of TEEL's powerful mainsail illustrates the on-deck simplicity made possible by underdeck hydraulic reel winches.

Large windows in TEEL's main salon convey the thrill of sailing below decks.

TEEL's captain takes the helm during builder's trials. Note the excellent visibility and overhead ports to view sail trim.



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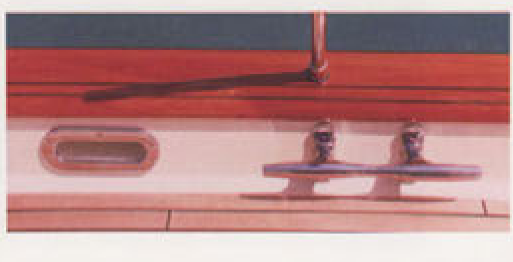

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