SOME COMMENTS ON CRUISING BOAT DESIGN AND CONSTRUCTION

Sailing vessels like most anything you buy are available in various levels of quality depending on their intended use. Some are designed for racing, others for recreational sailing on a lake, harbor or coastal; while others are for long distance cruising. These vessels will vary in price because they are built differently. Our objective is to build a boat that will last a life time and is capable of crossing oceans without worry of deterioration or breaking apart in the roughest of seas. To build a boat of this quality requires hundreds and even thousands of skilled man hours and use of the best materials and building methods available. Unless the buyer is a boatbuilder or has extensive offshore sailing experience it will be difficult to determine what separates one boat from another. The buyer may listen to the salesman or read articles (not ads) about the boat and presume what is said or what he read is correct.

Recent boat building technology has been aimed at the lighter, faster vessels with as much living space as possible but at the sacrifice of structural strength and offshore safety. The Sam L. Morse Co. feels that this new technology is excellent but in some cases does not belong as a building method for long distant cruisers. Our intention is to explain the advantages and disadvantage of the methods now being used by other builders and compare these to the methods being used by the Sam L. Morse Company. We hope to enlightened the reader with information they may not have considered before.

HULL DESIGN: There are three issues to be addressed: The underbody hull shape, the transom design and the topsides surface area. Reference: *SEAWORTHINESS The Forgotten Factor by, C.A. Marchaj.*

Hull Shape: There are many different hull shapes, lets separate them into two categories: the racer type and the cruising or offshore type.

Racer Hull Shape: The racer's hull is usually round with a deep fin keel and spade rudder. The advantage here is there is less wetted surface so the boat will sail quicker than other shapes and designs. For the offshore sailor the concern is also one of speed but more importantly, a structurally strong boat with less draft and a keel shape that isn't so vertical, as these vessels will be sailing into unfamiliar waters and the likely hood of a grounding at speed may occur. There is also the possibility that they may hit a container, logs and general large flotsam which is increasing daily. There is even the danger of a collision with large sea life. With a fin keel and spade rudder the grounding or collision will be abrupt and could cause severe damage. When a deep fin keel boat does go hard aground it is more difficult to kedge off because the anchors are set lower than the deck level of the boat thus pulling the stern downward aft, digging the back of the keel deeper into the bottom. The deep, nearly vertical keel and spade rudder will catch fishing nets and may be damaged by even a small log. If damage were to occur at sea it would be nearly impossible to make repairs until a proper boat yard is reached where the vessel could be taken out of the water. This hull shape is difficult to beach for bottom cleaning or repairs and it is no simple matter to stand on the hard without ample support to keep it from falling. If the rudder post is bent and the boat is set out of the water a hole in the ground must be dug so the rudder can be removed from its housing.

An equally important concern is that the fin keel, spade rudder is quick at the helm, meaning it will turn quickly with the slightest movement of the helm. This is important for the racer but the offshore sailor wants a longer keel shape so the boat will track and hold her course for long periods with little work at the helm.

Because the fin keel is deeper with less wetted surface fore and aft of the keel it is difficult to impossible to "heave to" in storm conditions. The ability to "heave to" easily is an important storm strategy for the offshore sailor.

Cruisers Hull Shape: Unlike the racer's hull the cruisers hull will have a wider beam which gives more living space and adds to its "Form Stability". The cruiser will be concerned with a comfortable motion of the boat both at sea and at anchor. The keel should not be as deep or as vertical. It would be better if its shape was more gradual with less draft so it can go into shallower waters with less danger of a grounding. If a grounding does occur the keel will hopefully ride up onto the reef rather than coming to an abrupt stop. The rudder will be supported by a skeg or attached to the transom for protection.

There are two common types of cruising keel shapes, the full *cutaway* keel and full *swept back* keel. In the old days of building offshore vessels a full keel ran the length of the boat from bow to stern and was nearly parallel to the waterline. This shape provided excellent tracking but didn't go to weather too well because there was too much wetted surface forward. This long keel was slow to respond to the helm. The *cutaway* and *swept back* keel shapes are a compromise between the full long keel of the past and the fin keel of today.

The *cutaway* keel has a "dog leg" shape where the keel meets the hull. It is like a swept back keel with a notch forward. The rudder is supported by a skeg or extension to the aft end of the keel. The concern here is how this skeg is attached to the hull. If it is part of the actual hull, built into the mold, it will be strong enough to support the rudder even in a grounding. If it is attached afterward the buyer should look carefully at its construction and method of fastening. The skeg should support the rudder, not the opposite. The abruptness of the notch or angle of the forward cutaway will determine how much damage could occur in a grounding at speed. This will vary with each boat builder. The design of the keel and skeg should have the keel considerably deeper than the skeg so if a grounding did occur the skeg and rudder would not be damaged.

The *swept back* keel used on Sam L. Morse boats is similar to the *cutaway* keel. It has about the same wetted surface forward but without the notch or cutaway. The keel continues sloping back to the stern where the outboard rudder is attached. This keel shape will ride up onto the reef without an abrupt stop. Since the rudder is attached to the end of the *swept back* keel and sets several inches higher than the bottom, it is protected from damage during a grounding or collision. If, by chance, it is damaged it can be removed and repaired in the water. This hull shape will point as high into the wind as any cutaway keel.

Transom or Pointed Stern: There are two basic stern designs, the *Transom* stern is flat while the *Pointed* stern isn't flat. If the shape of the pointed stern is similar to the bow entry it is called a Double Ender.

Pointed Stern: The advocates of the *pointed* stern claims it is safer in a stormy following sea because it will break or split the wave when it hits the stern. There is no doubt that a pointed stern is going to part a short following sea. I say short because that is all it will do is separate a wave that is about 3 feet high. Because the pointed stern extends considerably further aft of the waterline, which gives lift, the stern will bury deeper into the wave before the boat will lift. Now the wave is further over the boat before it will break.

The *pointed* stern will lose a considerable amount of effective waterline length lift because the waterline turns inward toward the centerline eliminating lift in this area. The *pointed* stern has less carrying capacity for the same deck length.

Transom Stern: The *transom* stern is a flat surface at the back of the boat. It has the advantage that it will provide lift sooner in a tall following wave. It uses every bit of its waterline length for lift and has much more carrying capacity for the deck length. Admittedly, the *transom* stern will be subject to slapping in short following seas, this however, is not a danger to the vessel.

Lyle Hess designed his boats to be sea kindly. He accomplished this through the shape of the hull. By adding more reverse curve to the Garboard and widening the transom, the boat has flatter floors and less deadrise. The transom stern boats designed by Lyle Hess will be more comfortable at sea and at anchor than the pointed stern.

Topsides Surface Area: This is the total area exposed to the wind and seas that is above the waterline. This surface area is constantly exposed no matter how strong or how light. Every sailboat ever built has a point where "the exposed surface area exceeds the windward driving forces of the minimum sail area set". An example: If you were caught on a lee shore with the wind increasing in strength and you had your storm sails set so you could drive the boat off the lee shore but she would sail no better than 90 degrees to the wind you would have reached the point where surface area exceeds the driving force of the sails. This problem increases rapidly as the surface area increases or the wind increases. Similarly the driving forces improve as the surface area is less or winds decrease. So it would be best to have a boat with minimum amount of exposed surface area. Boats that are most apparent are split rigs such as ketches with a large cabin. The boat less likely to have a problem would be a sloop or cutter with a flush deck (if the freeboard is not too high).

HULL CONSTRUCTION: There are two ways to have a fiberglass hull constructed, cored or solid fiberglass.

Cored Hulls: The primary purpose for a cored hull is lightness and stiffness. The hull gets a thin layer of fiberglass, about 3/16" depending on the builder. This is followed by about 5/8" of light weight core material, which also varies with the builder. This is all followed by another thin layer of fiberglass, about 1/8". The results is a hull that is about 1" thick, about 5/16" of total fiberglass and 5/8" core material. This hull will be light and hold its shape well because it is stiffer than if it were only 5/16" fiberglass.

This construction method has the disadvantage that it has less impact resistance than a thicker solid fiberglass hull. That is, if the cored hull boat hit a log or any heavy object it may be penetrated easier than if it were the same total thickness in solid fiberglass.

We also know that osmosis now exists in fiberglass boats, which means that water will ingress through the hull. All builders are attempting to use modern materials to retard this from happening but the truth is it still happens only more slowly. What will happen to the core material if it is absorbent? Visit some boat yards and talk to the yard's owner to find out if blistering is more prevalent on cored hulls than solid hulls.

What happens when two different materials, fiberglass and core material, are bonded together. Will they react differently under different temperate conditions? Will they expand and contract differently? Will there be eventual separation? Will the cored hull be as easy to repair as a solid fiberglass hull?

Another concern is the interior furniture is bonded to the inner liner or inner hull which is separated from the outer hull by the core material, will they move differently when under the stress of rough seas over the years of offshore sailing? How do you install a thru-hull fitting in a cored hull for strength on longevity?

These are all questions that most builders will have answers for, but unfortunately, even they don't know the answers until time passes and it is proven otherwise.

Solid Fiberglass Hull: The solid FRP (fiberglass reinforced plastic) hull should be nearly as thick as the cored hull. It will have similar stiffness characteristics but it will be considerably heavier. The additional weight on a cruising vessel will give the boat a better motion in a seaway so this is not a disadvantage but an advantage. The solid thick hull will be stronger with better impact resistance. Because it is a thick, solid hull it will resist moisture ingress longer and there is nothing to hold the moisture. The solid glass hull will have the furniture bonded directly to the hull adding to the total strength. Unlike the cored hull, the thru-hull fittings will pass through and fasten to the solid thick hull.

The solid fiberglass hull is only as strong as the method and materials used for the lay-up. Fiberglass hulls get their strength from the resin saturated fiberglass matt, roving and cloth. Resin by itself has little if any strength, in fact it is brittle. To produce a structurally strong lay-up there should be a layer of matt to absorb and hold the resin and a layer of heavy roving also saturated with resin. The important factor is to remove all excess resins and any air bubbles that may be trapped within these layers. If any excess resin remains it will be a brittle spot. If any air bubbles remain it will react with the moisture as it enters the hull and will expand causing separation and huge blisters. There are many different methods used to remove the excess resins and air bubbles. The Sam L. Morse Co. contracts Crystaliner to build their hulls. Crystaliner has a long standing reputation for building strong offshore vessels such as the Westsail and lifeguard rescue vessels. The hull is laid up entirely by hand; each and every square inch is hand squeegeed of excess resins and air bubbles. This procedure is closely supervised so that each hull receives the same treatment and number of lay-ups.

When you visit a boat yard ask to see the plugs from the holes cut for the thru-hull fittings. The plugs should be of various thickness from different parts of the hull. It should increase in thickness as it gets deeper into the hull. It should be thicker forward to take the pounding when sailing hard to weather; at the location where the chainplates are installed; at the transom and anywhere you would expect impact or additional stresses. Also, look to see that the layers are all of equal thickness. If not that means the excess resins were not uniformly removed. Look for air bubbles or any signs of anything but a solid thick hull with evenly spaced lay-ups, count the number of lay-ups in the different part of the hull.

INTERIOR INSTALLATION: The interior furniture of the boat should add to it structural strength.

Thwart Ship Reinforcement: A thick, properly laid up fiberglass hull will still work or flex in a seaway without additional reinforcements. The submarine would collapse if it were not for the internal bulkheads that strengthen an already strong steel shell. Sailing vessels use bulkheads to strengthen the boat athwart ship.

The most important bulkhead is the one at the mast location. The Rigging and forces of the wind put tremendous compression on the base of the mast. This "pulling down" by the standing rigging adds stress to the hull at the location of the chainplates. The hull wants to pull towards the center of the boat to reduce this stress. This "main" bulkhead prevents it from happening. Additional bulkheads should be located forward to absorb the stress of the pounding seas. Other bulkheads should be located after to prevent the hull from "tweaking" or "twisting" in a seaway. In fact, the more bulkheads a boat has installed the stronger the boat.

In order for the bulkhead to add maximum strength it should be bonded to the hull and deck all the way around and on both sides. The wider the fiberglass bonding or "tabbing" the stronger the join. This wide bonding also distributes the pressure over a wider area. One concern is that the bulkhead should not make direct contact with the hull because it will cause a hard spot where the hull will work on either side of the bulkhead.

The Sam L. Morse Co. installs four completely bonded bulkheads to the Bristol Channel Cutter and two to the Falmouth Cutter. In addition to these full bulkheads there is a half bulkhead further forward and four quarter bulkheads in the center of the interior. Twelve inches of bonding fiberglass material is used on the main bulkhead, and 8" on others. There is a 1" rigid foam strip installed between the bulkheads and the hull to act as a cushioning strip to prevent a hard spot. To further strengthen this installation method, 2" holes are drilled, evenly spaced at about 18" around the circumference of the main bulkhead so when the bonding takes place on both sides of the bulkhead the fiberglass material makes contact through the holes, locking the bond to the bulkhead.

For the bulkheads to provide the maximum strength they must be bonded to the underside of the deck as well as the hull. If a builder has the interior all completed before the deck is set into place it is unlikely the bulkheads will ever be bonded to the deck.

Longitudinal Reinforcement: Equally important to add structural strength to an already strong hull is longitudinal reinforcement. On smaller boats the furniture is bonded to the hull providing this longitudinal strength. On larger boats over 35 feet where there is more space between the pieces of furniture, stringers are bonded to the hull. For our purpose, smaller boats, it is the furniture and how it is bonded to the hull that determines the structural results. At one extreme you will find manufacturers who will use one huge fiberglass liner for the entire interior. It may only make contact with the hull around its circumference and few other places. This gives little if any additional strength to the boat. As the liner is reduced in size and becomes more modular the more contact it has with the hull adding to its strength.

There are two things to consider here. First, is the ability to bond both the outside and inside of the liner to the hull. Is it accessible or is it only bonded to the outside which provides only half the strength? Next, is the gel coat ground away before bonding to the hull? If not the builder is bonding to gel coat which is like gluing to paint. The more bonding material used and larger the area bonded will distributes the strength over a wider area.

The Sam L. Morse Co. does not use liners. We build our interior out of marine plywood in progressive segments so that each piece is individually fitted and bonded to the hull on both sides as well as inside and outside. The only concern with this building method is should the wood become constantly exposed to moisture rot could develop. To prevent this all the wood is sealed before it is installed and after. Most all builders use marine ply for their bulkheads and use the same sealing methods. I hope.

Using marine plywood furniture also permits the builder to make changes to the interior layout for the buyer. This may seem trivial but there aren't two Sam L. Morse Co. boats yet built that are exactly alike. For those who would prefer a liner we have a two part liner for the Falmouth Cutter available and would result in a reduction in price.

DECK CONSTRUCTION AND INSTALLATION: The deck, like the hull should be strong and properly bonded to the hull to last the lifetime of the boat.

Deck Construction: To build a deck out of solid fiberglass would be uncommon because the results would be extremely heavy. So builders use cores in the deck to provide the strength and stiffness required. Most builders use balsa wood as a core material because it is light, inexpensive and simple to use. The major advantage using this light weight core material is less weight. The disadvantage is that the core material is extremely water absorbent if water enters through a bolt or screw hole. This could result in separation and dry or wet rot. Also, it has poor compression strength. That is, if a piece of hardware is through bolted the bolt or its nut could pull through the skin as the core material compresses when the nut is tightened. To prevent this from happening builders use a high compression material at the location where cleats, winches, etc. will be located. Some builders use solid fiberglass and others use plywood. If the buyer knows where he will install the dinghy, life raft or other unexpected hardware they can have the builder install the plywood or additional fiberglass at this location. If there is a need to add something later, a large back up plate must be used to distribute the pressure and even then it will compress in time as the hardware is put under stress.

The Sam L. Morse Co. uses only marine plywood for their core material because it has excellent compression and stiffness characteristics. Double thickness is used at the bitts, mast locations and anywhere excess loads are expected. The results is a structurally stiffer deck where hardware can be installed at any location. The disadvantage is if excessive moisture enters into the plywood core it could also rot. In the 20 year history of the Sam L. Morse Co. there are no reports of a deck having rot or separation. A major reason for this is that plywood is not nearly as moisture absorbent as other core materials. Another disadvantage to the plywood core is it is heavier. That would be of concern to the racer but the little additional weight would have little effect on the boats performance and the additional strength might be appreciated when the weather shows it's worst.

Hull to Deck Joint: The deck adds to the strength of the boat. No matter how strongly the deck is built it is only as strong as the method used to attach it to the hull. There is a big difference between the methods builders use to connect the deck to the hull. Some use an out turning flange, some a vertical connection and others an in turning flange. The out turning flange is usually small or narrow because it would stick out too far beyond the hull if it were wider. The in turning flange is more popular because it adds strength to the sheer line; the wider the flange the stronger the sheer. The problem with this method is it costs more to build the molds because it must be in two parts so the "piece" can be removed. The wider the flange the more surface on which to set the deck so the joint will be stronger. On a wide flange the deck can be through bolted, staggering the bolts so they are not in line. The wide flange provides a larger surface area for the bonding material.

Some boats have a small flange and after the deck is set in place the joint is fiberglassed over. This is an excellent method as long as the flange is wide enough to provide structural support for the deck and the fiberglass bonding is heavy and on both sides.

The Sam L. Morse boats use an in turning flange. The Bristol Channel Cutter uses 3-1/2" flange, the Falmouth Cutter uses a 2-1/2" flange. The deck is first set in place then 1/4" holes are drilled every 5" staggered from side to side. The deck is then raised and cleaned before ample amounts of 3M5200 marine sealant is applied. Then the deck is bolted in place using 1/4" stainless steel bolts, back up washers, lock washers and nuts. In the 20 year history of the company there has never been a leaking deck to hull joint reported.

BALLAST: Most all boat builders are now using lead for their ballast. The controversy is should the ballast be internal or external?

External Ballast: External ballast is when the lead keel is bolted through the hull. There are several concerns with this method. The hull, at the location where the keel will be attached, must be exceptionally strong. Look carefully at how the builder lays up this area and if it will take a hard grounding without damage. The keel bolt material is another concern. Water will eventually reach the keel bolts. This means they will be exposed to oxygen starvation corrosion and electrolysis. If the bolts are made of monel there will be little problems because it is high on the Galvanic Scale. If stainless steel is used it is less noble than many other metals and could act as an anode. Another concern with the keel bolts is there size. If a one inch rod is threaded then the minor diameter of the rod is 3/4" and will have the same strength as a 3/4" rod. Another concern is the method the keel bolts are attached within the ballast. Since lead is soft it is possible that the bolts may work loose after years of stress. In a recent article in Professional Boatbuilder the write talks about keel bolts that loosen and need to be tightened as the boat gets older. His comment was that the nuts don't loosen but everything else compresses and works which requires the nuts to be tightened.

Presuming that all the above is satisfactory and there is a hard grounding with the external ballast. The advantage is that the lead will absorb a lot of the damage but the joint between the hull and the ballast will take the maximum stress. It is possible to break this bond and elongate the keel bolt holes which could let water dribble into the bilge. How many groundings will it take before the ballast must be removed and resealed to the hull?

If the decision is to have an external ballast boat make certain that the keel bolts are all accessible for regular inspection. It would be advisable to look at an older boat you are considering buying to see if there are any signs of water ingress or separation between the ballast and hull. Also visit boatyards that have external ballast boats out of the water. Look for repairs, cracks and water weeping out of the ballast to hull joint.

Internal Ballast: The Sam L. Morse Co. sets the lead ballast inside the hull. The hull is extremely thick throughout but exceptionally so at this location. After the boat is leveled the pre-cast lead ballast, which is shaped to the hull cavity, is set in place. A dam is bonded to the aft end of the ballast to hold the resins that will encapsulate the lead. The ballast cavity is filled with slow curing resin totally covering the lead. This is followed by multiple layers of mat and roving to further strengthen this installation. The ballast will never make contact with any water or moisture for the life time of the boat.

If a hard grounding occurs there will be some gel coat chipped off but the hull is about 1-1/2 thick at the bottom and it would take a considerable amount of time to grind it away. If either an external or internal ballast boat is grounded and continues to set upright it is 99% floating which means it can be kedged off. Boats are lost when they fall over on their side and the damage occurs at the turn of the bilge. In this situation it would be best to have the thickest hull with strong internal strengthening regardless if the ballast in internal or external.

MAST STEP: The mast can be deck stepped or keel stepped.

Deck Stepped Mast: The mast can be set on the deck for two reasons. First, is if it is intended to be raised or lowered for transport or going under low bridges. The other is to provide more room below decks. This method is well accepted in the boat building industry as long as there is a substantial compression post installed to transfer the compression load to the mass of the keel. Make a close inspection of the material used between the two to ensure that it will not compress in time.

Keel Stepped Mast: The keel stepped mast passes through the deck and sets directly on the solid mass of the keel; there is nothing to compress. The advantage is that it is structurally a stronger installation. After all, the mast will stand by itself if all the rigging were removed so it has to be a stronger installation. The disadvantage is that the mast passes through the inside the boat taking up living space.

Some boat builders who build deck stepped masts state that the keel stepped mast will tear off the cabin if the mast is lost during a storm. I would ask this builder if they build their cabins so lightly that this could happen. The mast is an aluminum tube and would break in half before it would ever threaten tearing off the cabin. The Sam L. Morse Co. Bristol Channel Cutter passes the mast through the deck, not the cabin. The deck is reinforced to 2" thick at this location.

MISCELLANEOUS ITEMS TO CONSIDER:

General Quality: When looking for a quality boat there are other factors to consider other than those directly related to structural integrity. These may seem trivial but they reflect the builder's attitude towards quality rather than expense:

- Does the builder use the best quality hardware and materials such as metal ports holes and cowl vents instead of plastic?
- Are the lifeline stanchions double walled for strength?
- Is the cabin sole solid teak or is it a plywood veneer?

- Is the mast tapered at the top to reduce weight and windage? Based on the height of the mast, does it have double spreaders for additional strength?
- Marine heads come in many various types and costs, what is being installed on the boat you are considering?
- This list could go on for pages but take the time to look closely and compare.

Deck Space: Your boat should have wide working decks. This makes it easy to drag sail bags back and forth as well as a safe area for a good foot hold when moving fore and aft. Sam L. Morse Co. has up to 24 inch wide decks on the Bristol Channel Cutter and 20 inch wide decks on the Falmouth Cutter.

Bulwarks: Bulwarks are like a short wall going around the sheer of the boat. They keep your feet and other items from sliding over the side. To be effective they should be tall as possible without looking out of place or disturbing the sheer line and they must drain as quickly as the water comes aboard. Sam L. Morse Co. boats have 7 1/2 inch tall bulwarks with an inch gap underneath for rapid draining.

Dinghy Storage: Surprisingly, buyers rarely consider where they will store a dinghy on deck. The Bristol Channel Cutter and Falmouth Cutter will take a 7' 4" hard dinghy on the foredeck, inverted over the Scuttle Hatch or it can be set in chocks on top of the cabin. If a longer dinghy is needed a 9 foot one can be used on the BCC but it covers the bitts. We are now producing CHERUB a 7' 4" lapstrake rowing and sailing dinghy that fits perfectly on both the BCC and FC.

Interior Insulation: Fiberglass does not have any insulation qualities. Its not uncommon for a boat to "sweat" in warm climates. This "sweating" often results in the growth of mold and algae. This can be a serious problem on a boat if an interior liner where you cannot access. The Sam L. Morse Co. insulates there boats under the coach roof, under the decks and down the side to the waterline. Inside the lockers and bins can be insulated as an option.

Cockpit Size: A large cockpit is great when entertaining or lounging under the sun but it can be hazardous if it can hold too much water if a breaking sea comes aboard. Most importantly is that the companion way have a bridge deck so that any water that goes into the cockpit will not enter into the boat. One cubic foot of water weighs 64 pounds and this can add up quickly in a large cockpit. The cockpit well should be small and equipped with a cover so it can be used for sleeping outside.

Steering Methods: A boat can be steered by a wheel or a tiller. The wheel is usually used on larger boats with large cockpits and tillers on smaller ones. The advantage of the wheel is that there is less strain on the helmsman than the tiller. The disadvantage is that the pedestal and wheel are not removable and are always in the way. The other downside is that there are many working parts that can fail. If it fails it is usually during periods of stress like in a storm. If a boat with a wheel is selected be sure that repairs can be easily made at sea and that there is a tiller back up. There will be less problems with rack and pinion or worm gear designs.

The Sam L. Morse Co. uses a tiller because a wheel would take up too much room. The advantage of the tiller is that it can be removed when sailing with a wind vane, autopilot or while at anchor leaving the entire cockpit open for sleeping or lounging. Since the tiller is directly attached to the rudder the helmsman has a better feel of the performance of the yacht. Also, it is easier to steer the boat in close quarters when picking up a mooring or anchoring. The downside to the tiller is that it swings in a wide arc when hand steering and has a direct load line to the rudder.

Accessibility of the hull: Any vessel that goes offshore should have access to every square inch of the hull. This is not only necessary in case of an emergency but for inspection and cleaning. This is one problem with many boats built with liners, there is no access behind the liner without cutting it out. The Sam L. Morse Co. has access to every square inch of the hull except behind the ice box where there is insulation between the hull and ice box liner.

Engine Access: Equally important is being able to access the engine on both sides, top and bottom in any sea condition. The larger the access area the easier the job will be. It is a bonus if there is a light installed as well. The Sam L. Morse Co. boats engine compartment is so large that a person can crawl inside to access the back of the engine and stern tube without difficulty. The engine access is from inside the boat and repairs can safely be made in any weather.

Lifeline Stanchions: Lifeline stanchions are provided to keep the sailor aboard in rough seas. The sea conditions may be such that the person may be thrown against the lifelines with considerable force. The stanchion and lifelines must be strongly installed and capable of standing up to this force. The Sam L. Morse Co. uses 28" high, double walled stainless steel stanchions with stainless steel lifelines. The stanchion bases are bolted through the deck and top of the bulwarks providing maximum strength.

Water Tank Location: Water tanks are made of stainless steel, fiberglass or polyethylene. They are all good materials and all have some limitations. The stainless steel tanks have problems with electrolysis attacking the welds and after a few years small pin holes dribble water. This can be prevented by using the proper welding rods that match the tank material. Fiberglass tanks will always taste like fiberglass but will not leak and will last a long time. Polyethylene is what most of the marine industry is now using. It is the same material used in bottled water purchased at the local market so it is tasteless. The only disadvantage is that it is a softer material and can ware away if not properly supported during installation. Since baffles cannot be installed in these rotary molded tanks individual tanks can be installed providing the same capacity. This can be a bonus because a diverter valve can be installed between the tanks so either tank can be selected in case questionable water is taken aboard. Regardless of the water tank material, they should be capable of replacement if damaged and there must be an easy access for cleaning the inside.

As mentioned above, water weighs 64 pounds per cubic foot or 8.4 pounds per gallon. There is only one place for water tanks and that is in the center of the boat as low in the bilge as possible so it adds to the yachts ballast. The tanks must be easily removed for accessing keel bolts (if external ballast), repairing leaks and cleaning. They should have an easily accessible inspection plate for cleaning. The Sam L. Morse Co. boats use polyethylene tanks installed over the internal ballast, under the cabin sole, as low as possible and in the center of the boat. They can be quickly and easily accessed by removing a few screws that hold sole cover.

Berths: Most boat builder have a "V" berth forward because it is a simple place to install a double berth without interfering with the rest of the boat's interior. The advantage is that it can be a wide long comfortable berth. The disadvantage is that it is the most uncomfortable berth on the boat when underway or in a rough anchorage. There is more violent movement to the boat forward than any other part of the boat. While at anchor, the sound from the anchor rope, chain and waves slapping against the hull is transferred into this area. By installing a long "V" berth forces the builder to install the chain locker far forward which can effect the safety of the boat in rough conditions. The best location for a berth is amidships in the center of the boat, as low as possible. This is where there is minimum movement. However, it is difficult to build a berth at this location because it is the living area.

Sam L. Morse Co. Bristol Channel Cutter has the double, pull out berth, located amidships on the port side. A single settee berth amidships on the starboard side, a quarter berth on the starboard side aft. Because we are a custom boat builder we can add a single or double berth forward. We can make the starboard single settee into a pull out double or make any necessary changes the owner may want. The Falmouth Cutter has a large quarter berth on port and starboard sides and a double berth forward. If the buyer wanted an outboard engine instead of an inboard the area between the quarter berths could become a huge double.

Head and Showers: A totally enclosed head and shower have the advantage of privacy. The disadvantage is that the space is used for 10 or 15 minutes a day and the rest of the time it takes up valuable space. Many head and shower installations are not properly vented and will not dry out adequately in warmer climates. The Sam L. Morse Co. boats install the head and shower forward. The shower curtains is set around the inside of the scuttle hatch which can be opened during and after showering for maximum ventilation. The head and shower area is also the work bench, hanging lockers, sail locker, chain locker and more so the area serves more than one purpose.

Propane tanks: Most all boat builders today use propane as the primary cooking fuel. If properly installed it should never give an owner any problems. The primary concern is that the tanks be installed so they will vent overboard even with a bad leak. Coast Guard approved installations require that the propane locker be used only for stowing propane tanks and nothing else. The Sam L. Morse Co. boats have the aluminum propane tanks stored in deck boxes located on both sides of the mast. There would be no problem if a buyer wanted kerosene or natural gas installed instead.

Chain storage: Anchor chain is heavy and should <u>never</u> be stored above the waterline or too far forward. The best location for anchor chains is low, near the centerline and as far aft as possible. The Sam L. Morse Co. boats store the chain deep into the bilge far aft. When making a passage 300 feet of chain can be pulled back into the shower sump just forward of the mast and still lead out as normal if needed.

Boom Gallows: It is hard to understand why all boat builders don't use boom gallows. They support the boom when the sails are down. In rough weather the boom can be lashed to the gallows making it impossible for it to come loose and swing across the deck. They provide a perfect place to install an underway sun awning between the dodger and the boom gallows. When

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going offshore an additional chest high lifeline can be tied between the boom gallows knees and the upper or aft lower shrouds. They provide a strong support to grab when coming aboard from the dingy. A fishing reel can be installed on the boom gallows stanchions. An auto pilot bracket can be attached to the boom gallows stanchions. They provide a support when taking celestial sights by leaning elbows over the gallows cross piece. When entering a port the helmsman can sit on the top of the stern rail and rest his arms on the gallows while steering with one foot. It is a place to install a life ring, an outboard engine and the list could go on.

Bowsprit: One of the major concerns for buyers considering the Bristol Channel Cutter and Falmouth cutter is the long bowsprits. The major advantage of the bowsprit, other than adding to the lovely lines, is the increase to the "J" measurement. The longer "J" permits the boat to carry more sail area. It increases the angle of the headstay which makes a longer sheet lead all of which permits the boat to point higher into the wind. This increase in headstay angle also works well with roller furling because the sheet lead is nearly 90 degrees to the headstay. When the head sail is roller reefed the sheet lead does not change leaving a good sail shape.

The downside is that no one wants to go out on the bowsprit in anything but mild weather. There are several ways to solve this problem. The first is a quality roller furling system. With this method only one sail is set on the roller furling headstay and it is used from light to strong winds. As the wind increases the sail area is reduced by rolling it up until there is no sail left. The staysail remains set and provides the necessary drive. Today, roller furling and reefing system are built to high standards and will be trouble free if properly used and maintained. There in no need to go out on the bowsprit. If conditions are real light and a drifter or light weight Genoa is required it can be set aft of the roller furling headstay and raised "free flying". This would require that the tack be connected to the snap shackle on the bowsprit but in such light conditions it would not be a problem. If the snap shackle pin has a line leading back on deck the sail can be released without going out on the bowsprit.

If you are still a purest and want to use a hanked on Yankee sail with a down haul then a <u>close pattern</u> heavy netting can be lashed between the Whisker stays, below the bowsprit, to walk on. Never walk on the bowsprit, instead walk on the netting, straddling the bowsprit. The netting will stretch and the lifeline will be above waist height if a pulpit is installed. In the 20 years we have been building these boats no owner has complained about the bowsprit, probably because they realize the advantages outweigh the disadvantages.

Storage Area: Another important factor on a cruising vessel is the amount to storage space available. Surprisingly, many larger boats have far less storage space than the Sam L. Morse Co. boats. It is advisable to compare the boats you are considering purchasing by counting of the number of lockers and bins and there estimated size or square footage.

Conclusion: I would like to conclude with a few comments about the Lyle Hess designed, Sam L. Morse Co. Built boats for the people who are not familiar with the traditional design and its sailing performance.

- The Bristol Channel Cutter and the Falmouth Cutter have recorded remarkable speeds and passages. There are many recorded passages in excess of 180 nautical miles a day. One such passage was on a Falmouth Cutter "POPEYE" that made 200 nautical miles from noon to noon sailing from Ensenada, Mexico to Cabo San Lucas, Mexico. The Bristol Channel Cutter, "XIPHIAS" sailed 3,200 nautical miles in 22 days for an average speed of over 6 knots. Read about other major accomplishments in the brochure.
- Both boats have remarkable windward sailing ability. They both can point 30 degrees to the apparent wind or 45 degrees on the compass.
- Both vessels are exceedingly seaworthy with proven ocean crossings and are capable of sailing anywhere in the world.
- Because of the design and size of these boats they are delightfully fun for a day sail within the harbor or can be provisioned and cross oceans.
- All the critical systems of the boats are designed for ease of service and maintenance.
- Unlike modern designs today, the proven interior layout does not compromise comfort at sea or at anchor. If the buyer wants to modify the standard interior we can easily meet your needs.
- The Sam L. Morse Co. has been in business for over 20 years building and improving the same two vessels. The two top shipwrights have been building these same boats for over 18 years.

Our goal is and has always been to create a sincere but beautiful offshore cruising vessel. To summarize, a quote by Ferenc Mate from his book, <u>THE WORLDS BEST SAILBOATS</u>. "I might as well start off by telling you that the Bristol Channel Cutter and the Falmouth Cutter are the most beautiful 28 foot and 22 foot sailboats in the world".

We encourage you to visit our factory and meet Dick and Tommy our two long-term shipwrights who will be building your boat for you. Take your time and wander around inside and outside the boats and see, first hand, how we hand craft these fine vessels.